SOME NOTEWORTHY EXTRA-EUROPEAN CYPRINIDS

By THEODORE GILL

In a former article on "The Family of Cyprinids and the Carp as its Type," were considered a few of the characters which serve to differentiate the Cyprinids from other fishes and which have been used to subdivide the family itself into minor groups. Furthermore, those species which bear names that have been transferred in America to other species were briefly noticed and illustrated. In the present article are introduced a few of the innumerable host occurring in America and other countries, which are conspicuous for various reasons.

American Cyprinids

In North America about 250 species of Cyprinids occur and almost all belong to genera or at least sub-genera unknown to Europe or Asia. The genus *Barbus,* so numerously represented in the old world, has not a single representative in the new, nor are any of the related ones represented. The genus that replaces it, so far as numbers go (and so far only), is *Notropis,* which includes about two-fifths of the American Cyprinids—over one hundred species; it belongs to the group called Leuciscinæ. The genus *Leuciscus* (*Squalius* of most European ichthyologists), as understood by Jordan and his disciples, is represented by about twenty-five species, the closely related *Rutilus* (*Leuciscus* of European ichthyologists) by four species, and *Abramis* by two. All the other American Cyprinids belong to genera peculiar to the "nearctic" or "arctamerican" region, but most of them belong to the group (*Leuciscinæ*) to which the bulk of the European Cyprinids do. Others have been referred to another ill-defined group (*"Chondrostominæ"*) typified by European fishes. Still others (*"Mylopharodontinæ"*) are closely related to the *Leuciscinæ* but have been differentiated from them on account of the preponderance of blunt or molar pharyngeal teeth. Better defined are three groups peculiar to America—the so-called *"Campostominæ," "Exoglossinæ"* and *"Plagopterinæ."* The systematic value of all these groups, however, remains to be discovered, and can only be realized after a thorough study of their anatomy.

Two of the characteristics of the American cyprinoid fauna are noteworthy: (1) The specialized character of the aggregate of

species, and (2) the comparative relations of the species to the old world faunas.

The isolation of America's cyprinoid fauna affords one of the many arguments against the association of all the northern faunas into one great realm or region variously designated as the triarctic, holarctic, and periarctic.

The American Cyprinids may be segregated under two geographical divisions, one including the species of the Atlantic slope as well as of the Mississippi Valley, and the other those of the Pacific slope. The former are the most characteristically American, the latter most nearly related to old world forms. It has long been maintained by botanists—by many at least—that there is a striking analogy on the one hand between the types of eastern America and eastern Asia, and on the other between those of western America and western Europe. Some features of the fish faunas might seem to support such a contention, but a more critical consideration of the evidence leads to a different conclusion. The fauna of Europe extends eastward into Asia and the resemblance between the fish faunas of western America and Europe is simply due to that fact and to the approximation of the two continents toward the north.

Another noteworthy circumstance is the large size which many of the Cyprinids of the Pacific slope attain, in this respect rivaling old world species, and contrasting with those of the cismontane regions. On the other hand, almost all of the numerous Cyprinids, not only of the streams of the Atlantic slope, but of the great Mississippi Valley, are of small size, only a couple of species under ordinary circumstances reaching a length of a foot. The large Cyprinids of Europe are to some extent replaced by the Catosomids (suckers) of America.

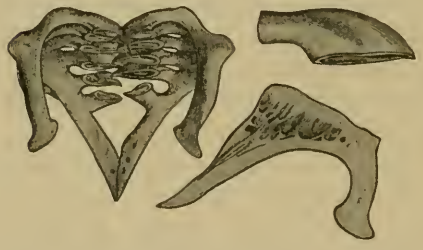

FIG. 36.—Pharyngeal bones and teeth of *Chondrostoma nasus*. After Heckel.

In more detail, none of the American species have three rows of pharyngeal teeth as most of the old world forms have. Further, a rather striking feature is the reduction in the number of pharyngeal teeth in the main row; the European species generally have five (in very few less) while most of the American species have only four. The Chondrostomines of Europe have mostly six or

even seven, while the American representatives, with one exception (*Orthodon microlepidotus*) have only four or five.

Still another interesting coincidence is the development of barbels. The majority of the old world Cyprinids have two pairs of well developed supramaxillary barbels, while not one of the indigenous American species has as many and when barbels are developed in a single pair they are usually very small and even may be said to be obsolete.

The great majority of the American Cyprinids, as already indicated, belong to the same great group (Leuciscines) as the majority of the European, and have the same kind of lips, pharyngeal teeth, alimentary canal, and dorsal and ventral fins. No distinction can be maintained between them and the Abramidines or breams. Indeed so little difference is manifest between them that an eminent ichthyologist on one occasion mistook for a variety of the American bream or common shiner (*Abramis* or *Notemigonus chrysoleucas*) a fish which he afterwards ascertained to be an escaped individual of the English Rudd. This case gives an example of the closeness of observation which is requisite to properly determine the species of the family.

Only a few of the more common or otherwise noteworthy species can be noticed here.

First some of the eastern Leuciscines may be considered.

Atlantic and Gulf Slope Cyprinids

The most characteristic American genus, so far at least as number of species goes, is one now generally named *Notropis* and comprising a large number of species (about a hundred) mostly confounded under the general designation of minnows. In common with a number of other American genera it has a main row of only four teeth on each pharyngeal bone, and sometimes only those four, but in most of the species there is a second row of one or two teeth; most of these are of the "prehensile" or "hooked" type (Greifzähne Heckel called them), and have either a very narrow grinding surface or none at all; the jaws have thin lips and no barbels, and the scales are rather large. Such is the "genus" as recognized by Jordan and Evermann, but their arrangement must be regarded as only provisional. They admit a number of sections or subgenera—a dozen—and several are worthy of notice.

The typical section—*Notropis* proper—has scales loosely imbricated and of regular form, and the teeth are in two rows (2, 4—

4, 2) and sharp-edged or without grinding surfaces. More than a score of species are recognized by Jordan and Evermann. The type and best known is the *Notropis atherinoides,* "the largest and

FIG. 37.—*Notropis atherinoides.* After Agassiz.

handsomest species" of the section; it occasionally attains a length of six inches and is "abundant in lakes, quiet places and river channels" in the Great Lake basin as well as in the Ohio and Mississippi valleys.

FIG. 38.—*Notropis cornutus,* female. After Baird.

FIG. 39.—*Notropis cornutus,* male. After Agassiz.

Another and one of the best marked sections has been designated as *Luxilus.* It is distinguished by the high and closely imbricated scales so that the exposed portions are unusually narrow in propor-

tion to their height; a second row of pharyngeal teeth is developed and most of the teeth have narrow grinding surfaces. The species (about four) are comparatively large and the largest and best known is the *Notropis cornutus.*

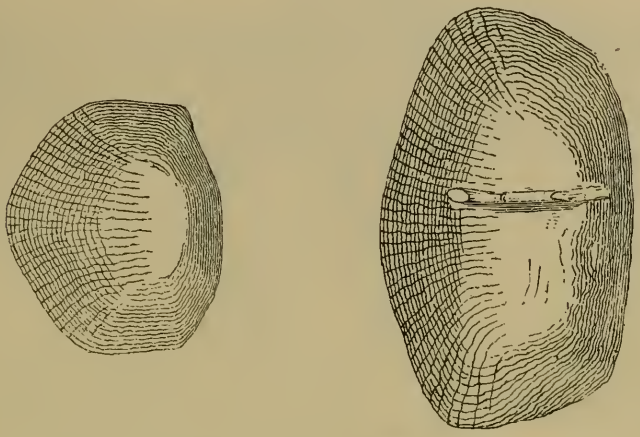

FIG. 40.—Scales of *Notropis cornutus.* After Baird.

The *Notropis cornutus* is most generally known as the redfin; other names shared with other fishes are dace and shiner. It is one of the largest of its genus, reaching a length of five to eight inches, and is one of the most abundant wherever found. It is often a companion of the common shiner (*Abramis—Notemigonus—chrysoleucas*). The color is steel-blue above, but in the spring the males become conspicuous for their gay attire, red or rosy lower fins, and tuberculated head; it is allusion to these tubercles, reminding one or horns, that the name *cornutus* involves. It is frequently caught by the angler for small fishes.

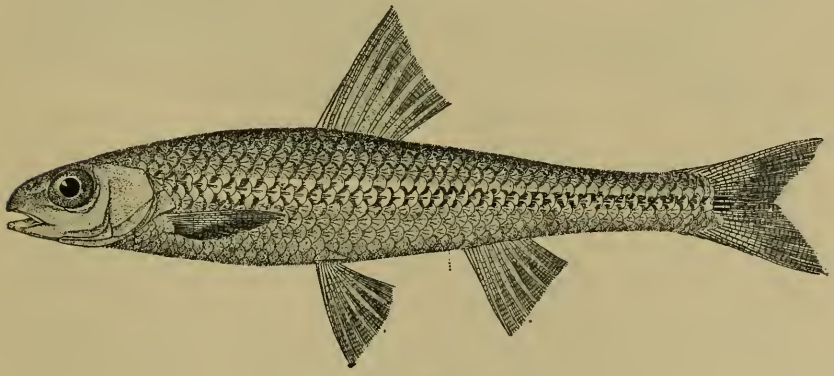

FIG. 41.—*Notropis hudsonius.*

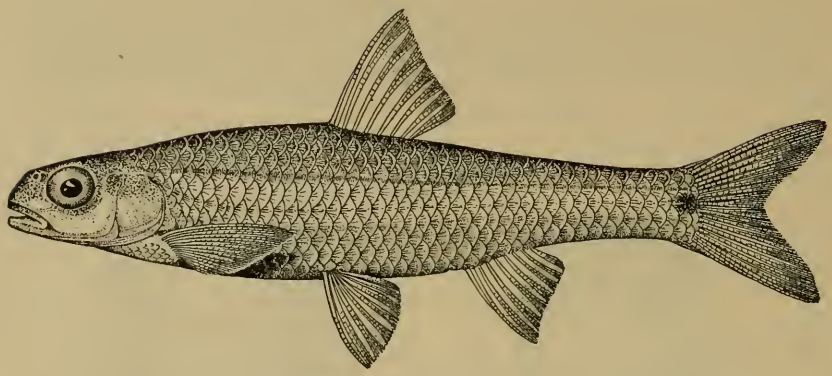

FIG. 42.—*Notropis hudsonius.* After Jordan and Evermann.

A third section (*Hudsonius*) includes fishes with large and normally formed scales, which are regularly imbricated; pharyngeal teeth, besides the main row (four), are generally existent to the number of one or rarely two in a second, but there is considerable variation in this respect (1, 4—4, 0 or 1, 4—4, 1 or 1, 4—4, 2 or 2, 4—4, 1). About a dozen species are known, the most notable being the *Notropis hudsonius* which has received such names as spawneater and spot-tail, and shares with many others those of minnow and shiner. It reaches a maximum length of six inches. While especially "abundant in the Great Lakes, and not rare east of the Alleghany Mountains," it also extends westward to Dakota and southward to South Carolina. It is known to many as "the choice live bait of the St. Lawrence angler," and fishermen along the Hudson commemorate, in a name they have given to it (spawneater), the belief that it is especially injurious to the spawn of more valued fishes.

Most of the numerous other species of *Notropis,* confounded under the general name of minnows, are much smaller than those mentioned.

Another interesting American Cyprinid, related to *Notropis* but "one of the most remarkable of our little minnows," is the *Ericymba buccata,* which nevertheless appears to have no distinctive vernacular name and is merely one of the host confounded under the designation of minnow. The species is distinguished from all others by the porous or cavernous condition of many of the head bones, especially the lower jaw, interopercular and suborbital bones, and the swollen appearance of the tunnels or channels perforated by the pores. It is to this condition that the name *Ericymba* refers, it being derived

from the Greek intensive particle ἐρι and the noun κύμβη, cavity. The species is pretty wide spread in the country watered by the northern and eastern affluents of the Mississippi and extends northward into Michigan and southward into West Florida, and where

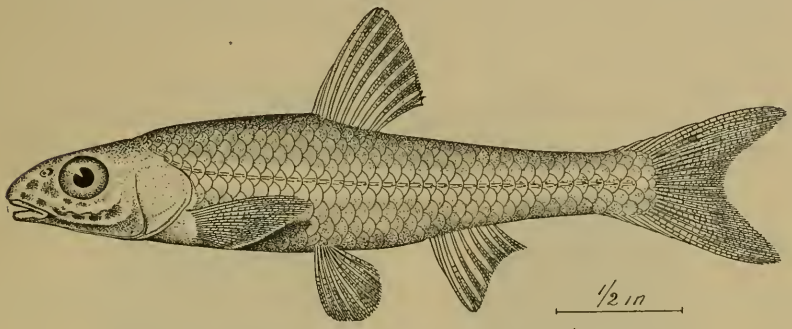

FIG. 43.—*Ericymba buccata.* After Jordan and Evermann.

it does occur, is tolerably common and "locally very abundant." It rarely attains a length of five inches.

The interest of this genus is in the fact that it repeats in the family of Cyprinids a characteristic which is manifest in isolated genera of a number of other families, but notably in the fresh-water Percids (as in *Acerina* or *Cernua*) and Cichlids (as in the *Trematocara* of Lake Tanganyika). It will be an interesting study for future naturalists to investigate the correlation between this structural feature

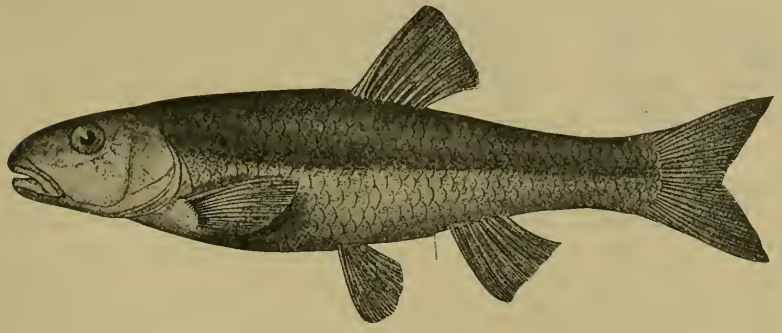

FIG. 44.—Horny Head, *Hybopsis kentuckiensis.* After Goode.

and habits and to ascertain whether the analogous structures are adaptive to identical or different conditions. Cope evidently assigned too much relative importance to the character by giving to it subfamily rank and isolating the genus from all others.

Closely related to *Notropis* is the genus *Hybopsis* which includes nearly a score (seventeen) of species. Like *Notropis* it has a principal row of four pharyngeal teeth, and in some a single tooth represents a second row, but sometimes there is none (4—4 or 1, 4—4, 1 or 1, 4—4, 0), and the teeth are essentially like those of *Notropis;* it differs from the kindred genus by the development of a barbel at the end of each maxillary bone.

The best known species is the *Hybopsis kentuckiensis,* popularly known as the horny-head, jerker, river chub, and Indian chub. It ranges from "Pennsylvania to Wyoming and Alabama, on both

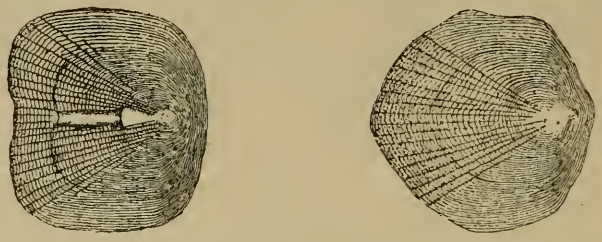

FIG. 45.—Scales of *Semotilus atromaculatus.* After Baird.

sides of the Alleghanies" and is "everywhere abundant in the larger streams, seldom ascending small brooks." It rarely attains a length of nine inches.

The genus containing the largest eastern American species is named *Semotilus* and differs from *Leuciscus* mainly in the fact that there is a little skinny flap called a barbel—and a very little one it is—near the hinder end of each upper jaw or supramaxillary bone, and the dorsal fin is a little farther back; the pharyngeal teeth of one side are also reduced in number (2, 5—4, 2).

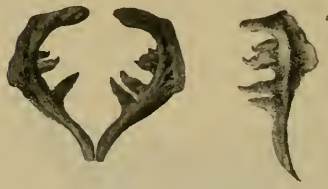

FIG. 46.—Pharyngeal bones and teeth of *Semotilus.* After Baird.

There are two very distinct species (*S. atromaculatus* and *S. corporalis*), mostly designated as chubs in the eastern states, but also known as dace and by various other names. A third more southern form (*S. thoreauianus*) is scarcely distinguishable from the *S. atromaculatus.*

The fish generally called chub or, more specifically, silver chub, in the eastern states or New England and the Middle States, is a fish also named corporal, windfish, and fall-fish. Besides these, other English names given to Cyprinids have been misplaced upon

it, as cheven or chivin (an English synonym of chub), dace, and roach. Its scientific name is *Semotilus corporalis.* It is by far the largest of the Eastern American Cyprinids and sometimes reaches the length of eighteen or even twenty inches, although one twelve inches long is regarded as a good sized fish. It prefers clear

FIG. 47.—*Semotilus corporalis,* young. After Fowler.

swift streams and affords considerable sport to the angler. When young it has quite a different appearance from the adult, being marked with a distinct lateral band and the form of the head is also different.

A related species distinguished by the black spot at the base of the dorsal is the *Semotilus atromaculatus,* known as the creek chub

FIG. 48.—*Semotilus atromaculatus.* After Baird.

or horned dace. This has been closely observed in the spawning season by Professor Reighard, but no complete record of his observations has been published.

Both of these "chubs" are rather omnivorous feeders. They catch small fishes that come in the way, and also crawfishes, but depend mainly on insects and entomostraceous crustaceans as well as worms. A further considerable percentage of the food consists of filamentous algæ and vegetable debris.

Considerable difference of opinion prevails as to the gustatory quality of the chub. The opinion of Thoreau—"it is a soft fish, and tastes like brown paper salted"—has been often quoted. In

opposition to this the fish commissioner of Canada (E. F. Prince) declares (1905)[1] that "Thoreau was very far astray" and that the fish's "flesh is white," though "not quite as white as the whitefish, and of a delicate flavour, the bones being far less troublesome"

FIG. 49.—*Semotilus corporalis.* After Storer.

than those of "its near allies, the suckers." Prince had "known it (wittingly or unwittingly) served up as whitefish at sportsmen's clubs," and in Canada it is frequently called whitefish.

Another type related to *Leuciscus* and still more to *Semotilus* has been named *Platygobio* to commemorate one of the chief distinctions, the broad flattish head; the teeth are biserial but in reduced number (2, 4—4, 2) and have narrowed grinding surfaces; maxillary barbels are well developed. Three species are known and the best known is the *Platygobio gracilis,* designated as the flathead

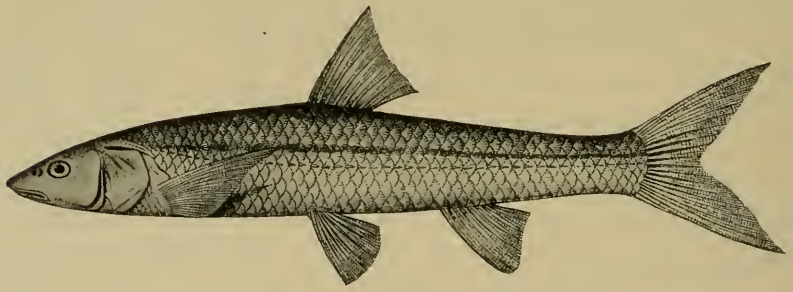

FIG. 50.—*Platygobio gracilis.* After Gill.

chub. Its range is from the east slope of the Rocky Mountains to the Saskatchewan River, and it is "abundant in river channels as far south as Kansas City, not ascending to springs." It attains a length of a foot.

[1] Twenty-seventh An. Rep. Dep't Marine and Fish.—Fisheries, p. lxxviii.

FIG. 51.—Pharyngeal bones, teeth, and scales of *Platygobio gracilis*. After Gill.

The shiner of many parts of the United States (*Abramis*—or *Notemigonus—chrysoleucas*) is most nearly related to the common bream of Europe, but instead of bearing that name, has had forced on it those of the English roach and dace. It is one of the commonest of the American Cyprinids and reaches a larger size than most of the others—often as much as six inches and occasionally, it is claimed, even a foot in length.[1] It affects mostly grassy or reedy waters and is generally to be found in mill-ponds. It is often angled for and readily takes a hook baited with an ordinary earthworm.

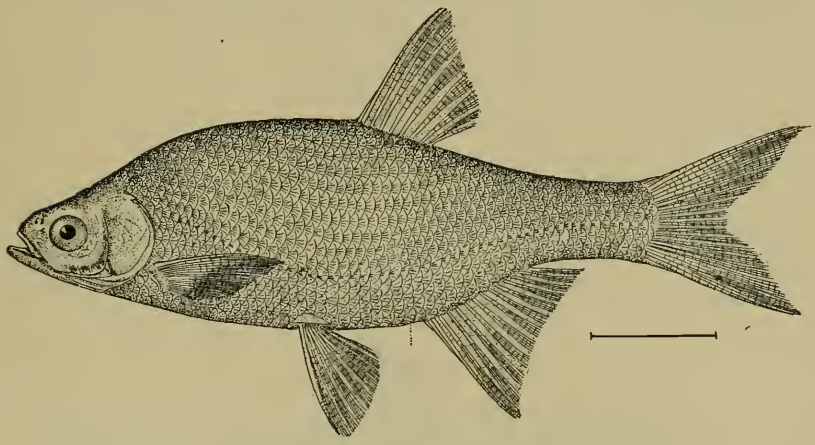

FIG. 52.—*Abramis chrysoleucas*. After Goode.

By Storer "it is said to be a delicate fish for the table," but it is really scarcely, if any, better than any other Cyprinid of the same size. It was more aptly said by him to be "the best bait" for pickerel in Massachusetts. It is not likely, indeed, that the pickerel exercises choice, but simply that, because of its size, abundance and facility of obtainment, it is the most used.

[1] The largest of thousands the present writer has caught or seen was barely ten inches long.

Dace is a name given in the United States to many different Cyprinids, but in the vicinity of Washington and many other places it is applied to the species of *Rhinichthys,* another genus peculiar to America and not very nearly related to any other. The name is

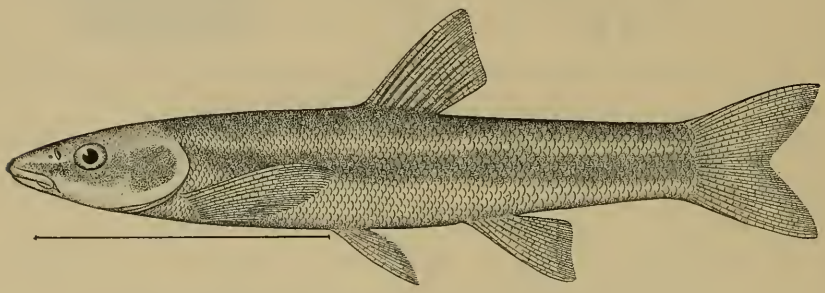

FIG. 53.—*Rhinichthys dulcis.* After Jordan and Evermann.

often extended into black-nosed dace. The few species are distinguished by a projecting snout, inferior mouth, dark color, and generally a darker longitudinal lateral stripe on each side; in the breeding season, however, the males assume a brilliant dress, becoming more or less suffused with crimson. They are active little fishes, preferring clear running streams, and are much used for bait for larger fishes. They prepare a nest of stones for the reception of the eggs, which is taken charge of by the male.

Data respecting the habits of *Rhinichthys atronasus* are given by C. N. Holder in Harper's *New Monthly Magazine* for December, 1883 (Vol. 68, pp. 100–103, under the typographical misnomer *Rhynchichthys abronasus*), and by C. C. Abbott in 1884 in "A

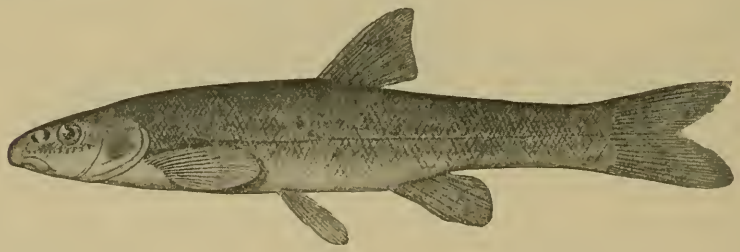

FIG. 54.—*Rhinichthys atronasus.* After Storer.

Naturalist's Rambles about Home" (pp. 419, 420). This is a small species about three inches long. A larger one, about five inches long, has a more prominent snout and was therefore named by the old ichthyologists *R. nasutus,* but a still older name—*cataractæ*—has

been revived by recent authors for the species. The latter name was given because the type specimens were found about Niagara Falls; its favorite resorts are also indicated by the name, for it largely resorts to rapids and swift running streams.

A characteristic eastern American genus named *Hybognathus* has been referred to the Chondrostomines because it has an elongated alimentary canal (three to ten times as long as the body), but otherwise it is not like the typical members of the group. The jaws are

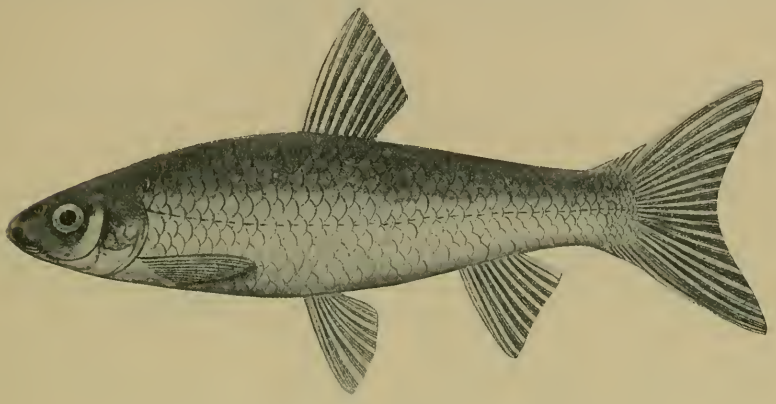

FIG. 55.—*Hybognathus nuchalis.* After Fowler.

sharp-edged and without corneous coverings and the pharyngeal teeth are uniserial (4—4), cultriform, and nearly straight. The gudgeon of the vicinity of Washington is the type of the genus. That type (*Hybognathus nuchalis*) is a fish with large scales, often about six inches long, of an olivaceous green color, with silvery sides and almost translucent. This style of coloration has also gained for it the name of smelt. It is much angled for from the wharves and shore-walls of Washington and is also used for bait.

There are a couple of genera well marked as such, but otherwise possessing no salient external peculiarities that arrest immediate attention, which on closer examination are discovered to have quite exceptional characters; they have been named *Campostoma* and *Exoglossum*. Both of them were set apart many years ago (in 1866) by E. D. Cope as the types of independent sub-families which he named Mesocysti and Cochlobori, but for which those of Campostominæ and Exoglossinæ have been substituted by later American ichthyologists.

The Campostomines, although having a somewhat peculiar physiognomy, present no external features which would lead one to

suspect any great internal differences or that they were very distinct from minnows or chubs. The mouth and mouth parts are normal.

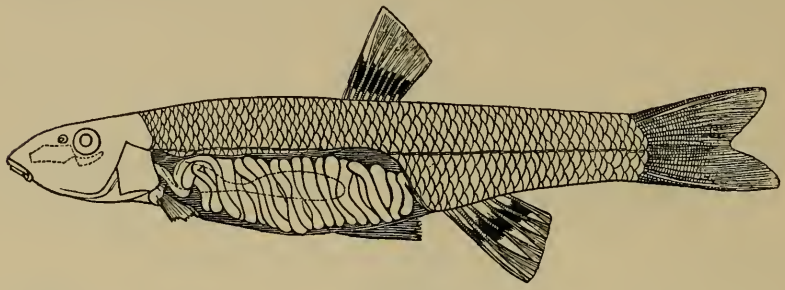

FIG. 56.—*Campostoma anomalum,* showing the air-bladder (in outline) involved in the circumvolutions of the alimentary canal. After Cope.

Dissection, nevertheless, reveals a strange and otherwise unexampled condition of the viscera.

The intestinal canal is extremely elongated and it goes out of its regular course to involve the air-bladder and surround it with many coils, and within these coils are also involved even the gonads (ovaries of the females and spermaries of the males). This arrangement contrasts strongly with that manifest in other Cyprinids and, in fact, in all other teleost fishes, in which the air-bladder (when present) is next to the roof of the abdominal cavity.

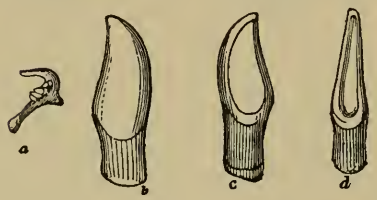

FIG. 57.—Teeth of *Campostoma anomalum.* After Agassiz.

The only genus, *Campostoma,* according to Jordan and Evermann, has four species, fishes of moderate size as American Cyprinids go

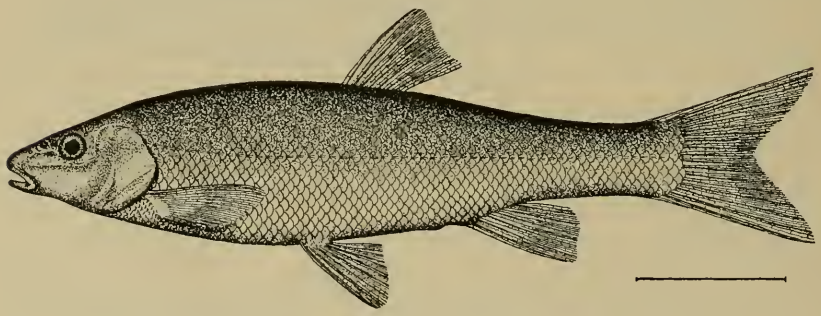

FIG. 58.—*Campostoma anomalum.* After Jordan and Evermann.

(up to about eight inches), and which range from New York to Mexico; in other words they occur in the streams tributary, directly as well as indirectly, to the Mississippi basin, and in those discharging west of it in the Gulf of Mexico, but not in those of the Atlantic seaboard. The best known species is the *Campostoma anomalum* which ranges from central New York to Tennessee, Texas and Wyoming, and was found by Jordan and Evermann to be "everywhere abundant in deep or still places in small streams, running up small brooks to spawn in spring." It brings stones together into a nest and is known popularly as the stone-roller.

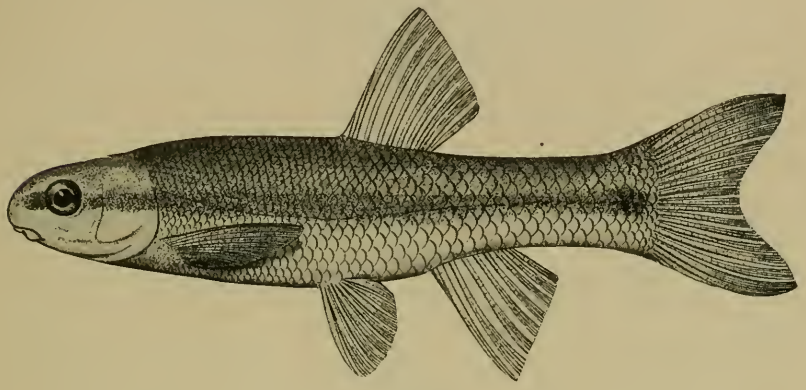

FIG. 59.—Cut-lips Minnow, *Exoglossum maxillingua*. After Fowler.

The Exoglossines, although in general appearance like the ordinary minnows, manifest a certain peculiarity in physiognomy which is soon found to result from the singularly shaped mouth, and especially the structure of the lower jaw. The peculiarity of structure was first recognized by Cope (1866) who correctly described the foremost or principal elements of the lower jaw, "dentary bones, straight and flat, united together throughout their length"; thus modified, they simulate a tongue, and to this the name *Exoglossum* (ἔξω, outside, and γλῶσσα, tongue) alludes. The tongue-like structure, however, has nothing to do with the true tongue unless it be to entail a recession of it backwards. As Cope has stated, "the incompletely defined body which in this family represents the tongue is situated in the back part of the oral cavity, since the glossohyal bone is excluded from its usual place, and is short; its approximation to the interopercle and ceratohyal, with the basihyal and strongly elongate urohyal, defend the lower surface of the head effectually."

The linguiform extension of the lower jaw is utilized for the pur-

pose of scraping shells from the rocks on which they are found. Mollusks form the principal food of the fishes and crushed shells may be almost any time found in the stomach. On account of the

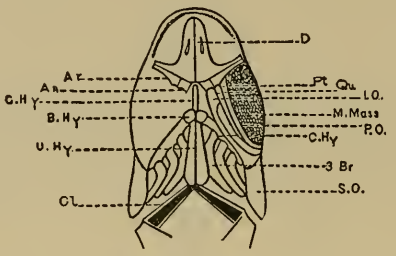

FIG. 60.—*Exoglossum maxillingua*. Lower bones. *An*, Angular; *Ar*, Articular; *B.Hy*, Basihyoid; *3Br*, Branchiostegal rays; *C.Hy*, Ceratohyoid; *Cl*, Clavicle Cœnosteon; *G.Hy*, Glossohyal; *IO*, Interopercular; *M.Mass*, Masseter Muscle; *P.O*, Preopercular; *Pt*, Pterygoid; *Qu*, Quadrate; *S.O*, Subopercular; *U.Hy*, Urohyoid. After Cope.

adaptation and food habits of the type the name Cochlobori (shellfish-eaters) was given to the subfamily by Cope.

The *Exoglossum maxillingua* is the only common and naturally the best known species of the group, and is sufficiently large and conspicuous to have received a number of popular names, such as cut-lips, day chub, nigger chub, and nigger dick, the first, of course,

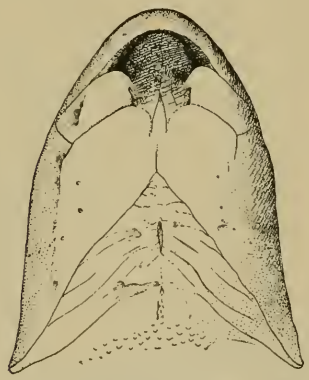

FIG. 61.—Lip of *Exoglossum maxillingua*. After Jordan and Evermann.

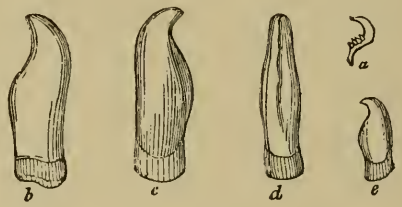

FIG. 62.—Teeth of *Exoglossum*. After Agassiz.

recalling the trenchant lower jaw and the last two the dark color. Its geographical range is from the St. Lawrence basin and Lakes Ontario and Champlain southwards into Virginia. It is, as Jordan

and Evermann remark, "abundant in the basins of the Susquehanna, Hudson, Potomac, James, Roanoke and Kanawha, but not widely distributed." Its ordinary length is about five or six inches.

Another interesting type of very limited distribution is that designated as the Plagopterinæ or Medinæ. These are small fishes distinguished by the structure of the dorsal and ventral fins. The ven-

FIG. 63.—*Plagopterus argentissimus.* After Cope.

tral and the anterior dorsal rays are peculiarly modified. The dorsal has a first spine which is short and slender or rudimentary and this is followed by a large compressed one furrowed behind and closely pressed upon by a smaller third spine. The ventrals are still more modified from the ordinary cyprinoid types: the innermost rays are

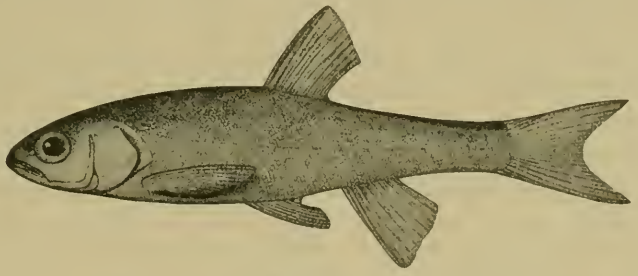

FIG. 64.—*Lepidomeda vittata.* After Cope.

tied to the body by a membrane extending along most of the length of the ray and all are more or less compressed and inarticulate at base, but from their inner edges branched and articulated raylets divaricate, the whole reminding one of a flat chip whose edge has been partly slivered off.

FIG. 65.—*Lepidomeda vittata.* After Cope.

Two of the species have perfectly naked bodies and are very closely related, but nevertheless are distinguished by the presence or absence of barbels and have consequently been referred to different genera—*Meda* and *Plagopterus*.

The longest known species is the *Meda fulgida* which has no barbels. It is a little fish rarely exceeding two inches in length and of a bright silvery color. It was found by C. H. Gilbert and N. B. Scofield (1898) to be "extremely abundant in the upper course of the Rio Verde, near Chino," and occurs elsewhere in Arizona.

Pacific Slope Cyprinids

As already indicated (p. 298), the cyprinoid fauna of the streams and lakes of the Pacific slope has many features in common with that of Europe, and the English angler might recognize, in the objects of his capture, forms that he had been familiar with from youth. He would, probably, even be inclined to call one or more chub, and the chub genus—*Leuciscus*—is represented by a number of species. None of the species, indeed, are closely related and all belong to sections or subgenera peculiar to America, but the differences are so slight as to justify their union in the same genus.

The common "chub" of the San Francisco and Sacramento markets is the sole representative of a peculiar section (*Siboma*) and is conspicuous for the massive appearance of the caudal peduncle from a side view, and to this the name *L. crassicauda* alludes; it is very much compressed and high, squeezed out, as it were, upwards and downwards; the scales are comparatively large and well imbricated (50–56 along the lateral line); the pharyngeal teeth are generally in unequal number on the opposite sides (2, 4—5, 2); the color of the back is brown and of the sides white, but the scales generally are dotted with dark. Its ordinary length is about a foot. It is caught in large quantities and is a staple market fish but chiefly utilized by the Chinese.

Another very common species is the "chub of Utah Lake," or the "great chub" common in the streams of the plateaux and bottoms of the Rocky Mountains—the *Leuciscus lincatus* of recent ichthyology. It is typical of a group of species (*Tigoma*) characterized by small or moderate-sized scales which are less imbricated than usual; the pharyngeal teeth are essentially like those of *Leuciscus crassicauda*. The color is very dark—blackened—and this darkness extends to sides and belly even, especially about the edges of the scales, for the centers are somewhat paler; this arrangement of colors has given rise to the rather misleading scientific name

(*lineatus*) of the species. Otherwise, as Jordan and Evermann add, the species "varies greatly with age and surroundings." It grows

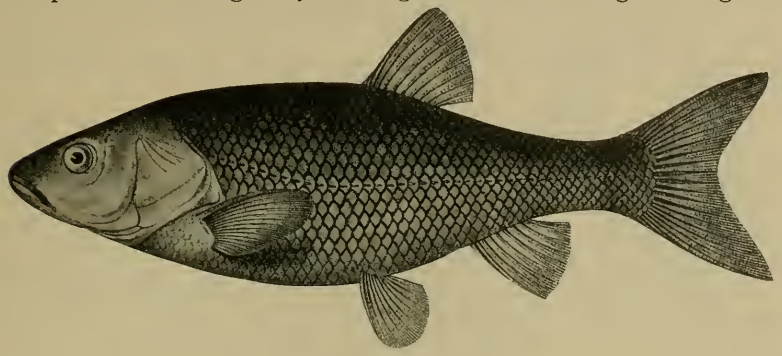

FIG. 66.—Chub of Utah Lake, *Leuciscus lineatus*. After Gill.

to a length of a foot or more—at least to fifteen inches occasionally. According to Jordan (1884) it "is excessively abundant in Utah Lake and, as it ascends the streams to spawn almost simultaneously with the trout (*Salmo mykiss clarkii?*), it is extremely destructive to the young of the latter. It is taken in considerable number in seines, and is sold in the markets of Salt Lake City and other towns.

Rather nearly related to the chubs and daces is a genus whose headquarters are in the Gila river and from this it has derived its name (*Gila*). The physiognomy of the fishes is characteristic, the caudal peduncle being exceptionally slender and elongate; the caudal fin is deeply forked and enlarged by rudimentary or fulcrum-like rays which increase its extent above and below the peduncle; the scales

FIG. 67.—*Gila elegans*. After Girard.

are very small and barely imbricated; the head is broad and the snout prominent; otherwise it is essentially like the chubs and has pharyngeal teeth of the same general type as the *Tigomas* (2, 5—4, 2).

As Jordan (1883) has remarked, "the various species of *Gila* abound in the basin of the Rio Colorado and Rio Gila, and are used as food in New Mexico and Arizona. They reach a length of about eighteen inches."

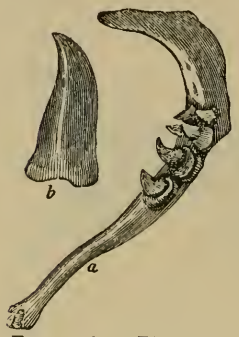

FIG. 68. — Pharyngeal bones and tooth of *Ptychocheilus major*. After Agassiz.

Another of the Leuciscine genera characteristics of Pacific America is that called *Ptychocheilus,* whose species have an appearance somewhat intermediate between chubs and gilas; the head is long, the snout prolonged, and the mouth deeply cleft and almost horizontal, thus somewhat resembling a pike whose name has been usurped for it by some of the inhabitants of its country. In accordance with its large mouth are the pharyngeal bones and teeth, the former elongate, the latter sharp-pointed and sharp-edged. Three species are generally recognized.

The largest of the American Cyprinids belong to the genus *Ptychocheilus,* one inhabiting the Colorado river (*P. lucius*), being locally known as the "salmon," and another (*P. oregonensis*) of Oregon and the Sacramento river being dubbed the "pike" or "squaw fish"; the former sometimes attains a length of five feet and a weight of eighty pounds and the latter is not very much smaller. They are rapacious animals with larger mouths than are possessed by any other American Cyprinids. Both are common

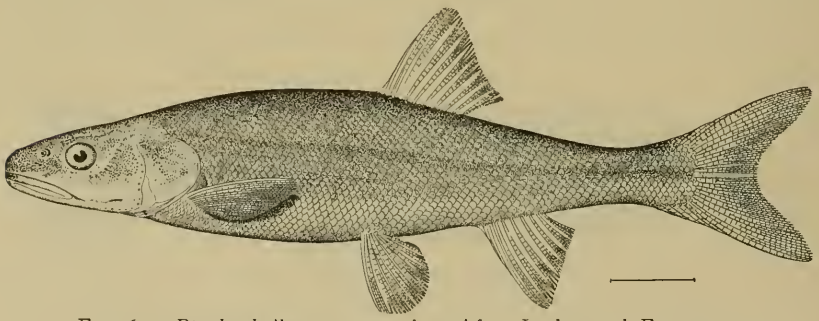

FIG. 69.—*Ptychocheilus oregonensis*. After Jordan and Evermann.

fishes in their respective regions and held in some esteem as marketable fishes. In Oregon, the species of its great river is very highly esteemed by the Indians, and is a rival in their favor of the salmons, and hence has been designated as the squaw-fish, a name which

has indeed come into quite general use. In the Sacramento basin, other names, besides pike, according to Jordan and Evermann, are "chub, pig-mouth, box-head, yellow-belly and chappaul."

A genus of the same general group and having the same form as the preceding is *Pogonichthys,* so named because, unlike all the

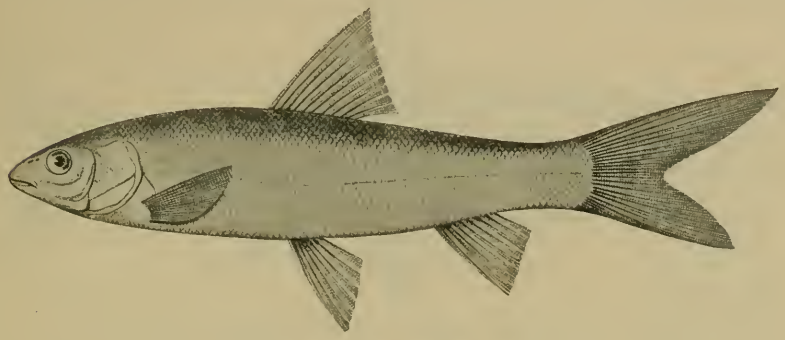

FIG. 70.—*Pogonichthys inæquilobus.* After Girard.

preceding, it has little skinny tags or barbels at the hinder ends of the upper jaw bones (one on each side); another peculiar character, developed in the adults, is a want of symmetry in the forked tail-fin, the upper lobe being much larger than the lower; furthermore, the fulcral or basal caudal rays are unusually developed. The scales are rather large (about 65 in lateral line) and well imbricated. Only one species is now recognized.

The split-tail is the name aptly given to the *Pogonichthys macrolepidotus.* Its ordinary length is about a foot, but some may attain

FIG. 71.—*Mylopharodon conocephalus.*

that of eighteen inches. According to Jordan (1883), it "is very common in the Sacramento, and is brought in considerable numbers to the San Francisco market."

All the preceding species of the Pacific coast have been universally recognized as Leuciscines; a couple of other west coast types resembling them in structure and form, as well as in the short intestinal canal, but differentiated by molariform pharyngeal teeth, have been

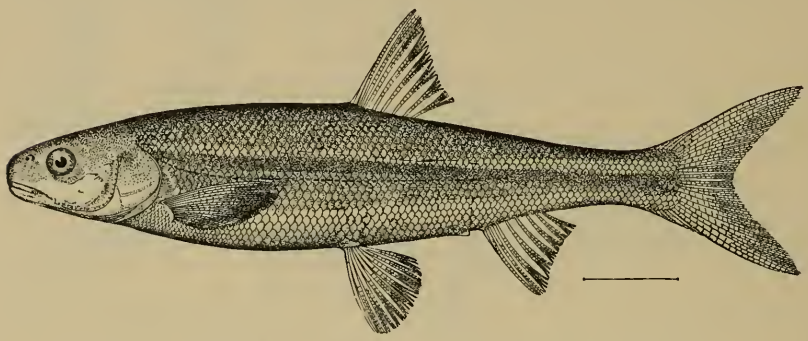

FIG. 72. *Mylocheilus lateralis*. After Jordan and Evermann.

segregated by Jordan and Evermann as the "*Mylopharodontinæ*." Three genera have been established, two of which are noteworthy. Both of them have the teeth in two rows (2, 4—5, 2 or 2, 5—5, 2), and each is represented by a single species.

The *Mylocheilus lateralis* (miscalled *caurinus*) has the upper jaw slightly protractile and a small tag or barbel at the end of each maxillary. According to Jordan (1883), it "abounds from California to Puget Sound in all the streams of Oregon, Washington

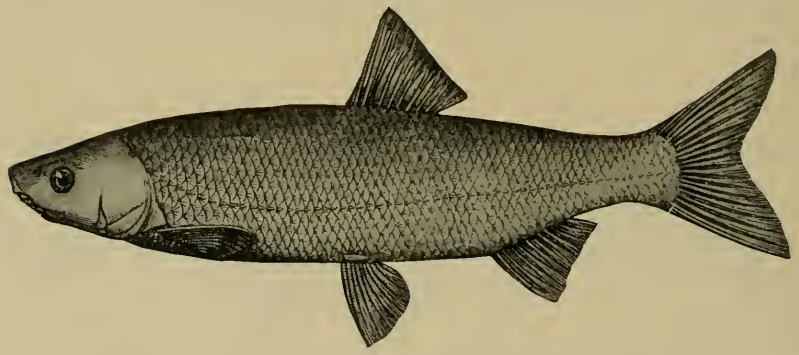

FIG. 73.—*Chondrostoma nasus*. After Heckel and Kner.

and Idaho, and often enters the sea. It reaches the length of little more than a foot." It was formerly little used for food where trout and other fishes abound, but now, according to Jordan and Ever-

mann (1902), "it possesses some importance as a food-fish. At some places in the Columbia basin it is served as 'whitefish' at the hotels, and elsewhere it is peddled over the country as 'trout' or 'fresh-water herring.'" It is also esteemed as an angle-fish. "It takes the hook readily and possesses considerable game qualities. The best bait seems to be salmon spawn, but it will bite at almost anything."

The *Mylopharodon conocephalus* has the upper jaw fixed (not protractile) and is destitute of barbels. It occurs with the socalled pike (*Ptychocheilus oregonensis*) "in the Sacramento and is brought with it into the markets." It reaches a size scarcely less than that of its associate (two to three feet) "but is less plentiful," and does not extend beyond the Sacramento basin.

FIG. 74.—Head from below of *Chondrostoma nasus*. After Kner.

Three other Pacific slope Cyprinids are noteworthy because they belong to a group chiefly represented in the old world (*Chondrostomines*) distinguished by the elongated alimentary canal (which is more than twice as long as the body) and, in the typical forms, by a horny plate investing each jaw.

One of these (*Acrocheilus alutaceus*) has, like the typical Chondrostomines of Eurasia, a horny plate to each jaw which is very

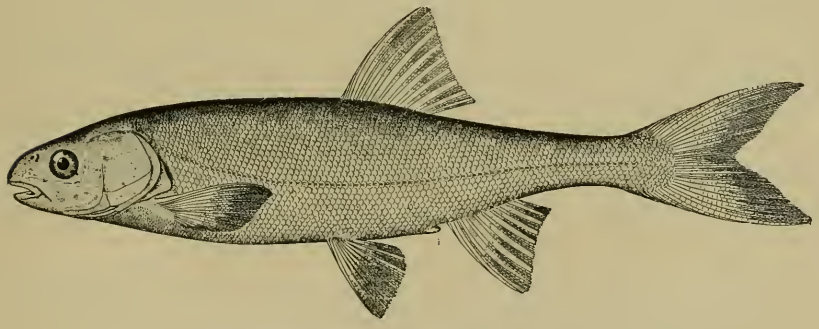

FIG. 75.—*Acrocheilus alutaceus*. After Jordan and Evermann.

conspicuous and sharp-edged. The structure or form of the lips and mouth have suggested the generic name (*ακρος* sharp, *χειλος* lip) as well as the vernacular names of the species (chisel-mouth, hard-mouth and square-mouth). It differs, however, by the reduced

number of pharyngeal teeth (4—5) which are hooked and have broad grinding surfaces.

It is a common fish in places in the "Lower Columbia River and tributaries, as far up as Spokane and Shoshone Falls." It is one of the many foot-long fishes. It is only eaten in lieu of better fishes.

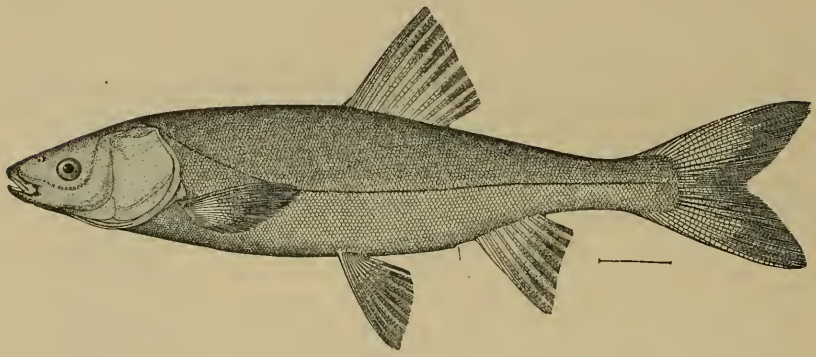

FIG. 76.—*Orthodon microlepidotus*. After Goode.

A second generic type (*Orthodon microlepidotus*) has no horny covering to the jaws, but the lower is sharp-edged and has a knob at its symphysis; in the number of pharyngeal teeth, however, it agrees better with the old world Chondrostomines (6—6 or 6—5); the teeth are lancet-like and nearly straight, and to this peculiarity the generic name refers (*ορθος*, straight, and *οδους*, tooth). The color is dark olivaceous but paler below—dark enough, however, for it to be called, as so many others have been, blackfish in California; of course this is a distinctive name only in its home, but no other has been recorded.

It ranges generally between a foot and a foot and a half in length and its size secures it a place in the markets. "A good many are sent to the market in San Francisco, where they are eaten by the Chinese."

The third of the so-called Chondrostomine fishes (*Lavinia exilicauda*) has no horny plates to the jaws and the lower jaw shuts within the upper. The pharyngeal teeth are uniserial (4—5 or 5—5) and cultriform with broad but shallow grinding surfaces. Like several of its compatriots its caudal fin is reinforced by a number of rudimentary or fulcrate rays procurrent above and below the peduncle. The peduncle is quite slender and it is to that slenderness that the specific name (*exilis*, slender, *cauda*, tail) refers. A foot

is the average length. It is, according to Jordan and Evermann, an inhabitant of the "streams of the Coast Range about San Francisco and Monterey, locally common as far north as Clear Lake." It is caught to some extent for the markets.

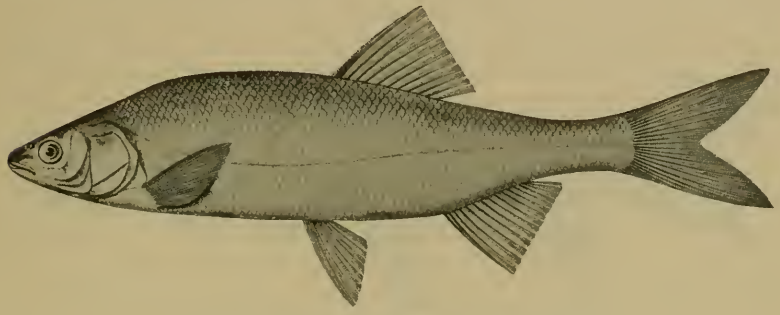

FIG. 77.—*Lavinia exilicauda*. After Girard.

MEXICAN CYPRINIDS

Cyprinids extend far down into Mexico in the streams of the tableland, but in diminishing numbers southwards, and are practically absent from the streams of the lowlands south of the Rio Grande valley. Altogether, about a half hundred (48) species occur in temperate Mexico, of which nearly half (23) are confined to the country and the rest (25) are common to it and southwestern United States. Two score species (40) occur in the valley of the Rio Grande and five in the Colorado river system. Five of the genera (*Xystrosus, Stypodon, Falcula, Aztecula* and *Evarra*) are restricted to Mexico, but are monotypic or represented by only two (*Evarra*) or three species (*Aztecula*). Further details may be found in Seth Meek's monograph on "The Fresh-water Fishes of Mexico" (1904).

NORTHERN ASIATIC CYPRINIDS

The cyprinoid fauna of northern Asia is simply an extension of the European fauna eastward or, more properly, there is a great Eurasiatic realm, extending from the Pacific to the Atlantic ocean and from the Himalaya mountains and isothermal regions northwards, which has a common fish fauna as well as continuous mammal and bird faunas. Many genera extend from one extreme to the other; for instance, *Leuciscus* and *Phoxinus,* the daces and minnows, are as prominent in Japan as in Britain.

The barbel genus (*Barbus*) is represented by at least three species in Palestine and one of them (*Barbus longiceps*) is quite closely related to the common barbel of Europe, but has the head, and especially the snout, more elongate, as the name (*longiceps* or long-

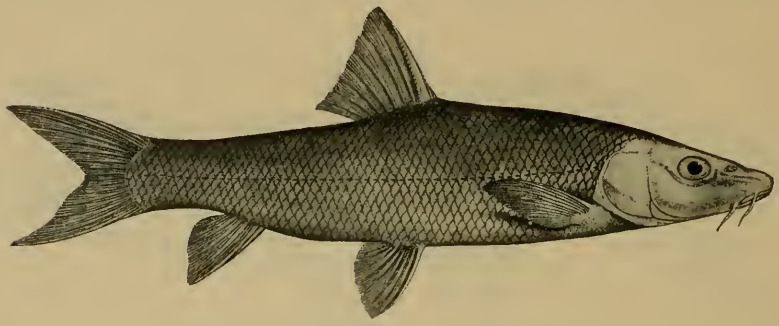

FIG. 78.—*Barbus longiceps.* After Tristram.

headed) indicates. This species is peculiar to the Lake of Galilee and the river Jordan and, according to Tristram (1884), "is one of the most abundant of the many abundant species in the Lake." It is noteworthy, too, that it is also "one of the best kinds for the table."

A peculiar genus (*Capoeta*), related to the barbels, is distinguished by the transverse inferior mouth and by the branches of the

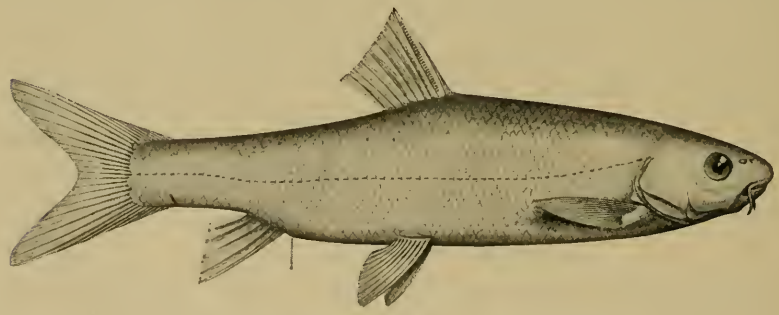

FIG. 79.—*Capoeta fratercula.* After Heckel.

lower bent inwards in front and with the anterior edge invested in a subcorneous sheath. It is richly represented by species from near the confines of Europe to Central Asia, and no less than seven species occur in Palestine. In that holy land one of the species (*Capoeta fratercula*) has become the recipient of exceptional atten-

tion. Tristram tells that "at the Algerian village of Deichûn, near Safed in Galilee, there is a large fountain full of this species. These fish are looked upon by the Arabs as sacred to Mohammed, and they will on no account allow any one to take them. A little to the north of Tripoli also, at the shrine of Sheikh el Bedawi, is a copious spring, with a large basin and streams flowing from it, choked with these fishes, which seem piled up in layers, with hardly space to move. They are an object of veneration, and are always fed by the worshipers. They follow in masses any visitor as he walks by the edge, gaping for food." This Capoeta is called by the Arabs *Semakh nahri* and is esteemed as one of the best fishes of Palestine. Tristram considers that "it is excellent eating, and its flesh is a pale pink colour."

Several of the other species of *Capoeta* (especially *C. damascina, C. syriaca* and *C. socialis*) are very abundant in the Lake of Gennasoret, the Sea of Galilee of the Bible. The *C. damascina* is equally abundant in the lower reaches of the Jordan and, according to Tristram Canon, is "carried down into the Dead Sea in great numbers, and perishes at once, strewing the north shore."

Another of the characteristic and very common fishes, but locally, of Syria, is a small species, a real minnow closely related to the European minnow and dace, but distinguished by the combination of the imperfect lateral line behind, the development of only nine anal rays, and the presence of only one row of pharyngeal teeth. It has been named *Leuciscus libani* as well as *Phoxinellus* and *Pseudo-*

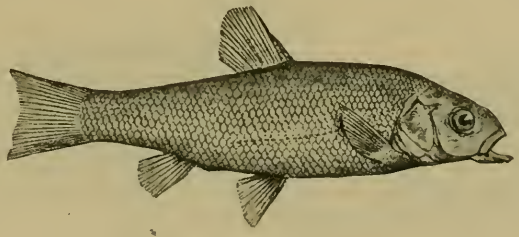

FIG. 80.—*Pseudophoxinus libani.* After Lortet.

phoxinus. It is "generally less than two inches long" and "rarely reaches two and one-half inches in length." It was "discovered by Dr. Lortet in the little lake of Yammûneh, a mountain tarn above Ainâta in Lebanon, well known to visitors to the Cedars from Bealbeck, and 4,800 feet above the sea. These little fishes, apparently the only inhabitants of the lake, at the season when the little streamlets of the tarn are at their fullest, crowd into them, and form an

important article of commerce for the villagers." The inhabitants of the little hamlet of Yammûuneh catch them by thousands of kilograms and sell them in the neighboring villages and convents for eight to ten cents a " battle " which is a measure of about five pounds.

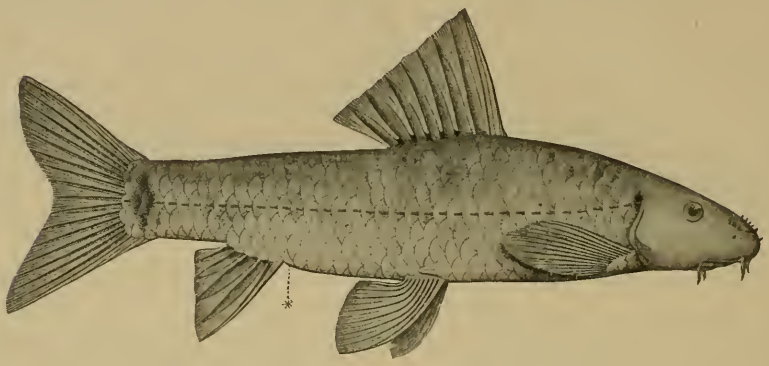

FIG. 81.—*Discognathus lamta,* female. After Heckel.

A characteristic Asiatic genus represented by a number of species is *Discognathus.* It is related to the barbels and, like the typical species of that genus, has two pairs of barbels and three rows of pharyngeal teeth, but the lip is transformed into a subcircular suctorial disk with free margins. The air-bladder is small, especially

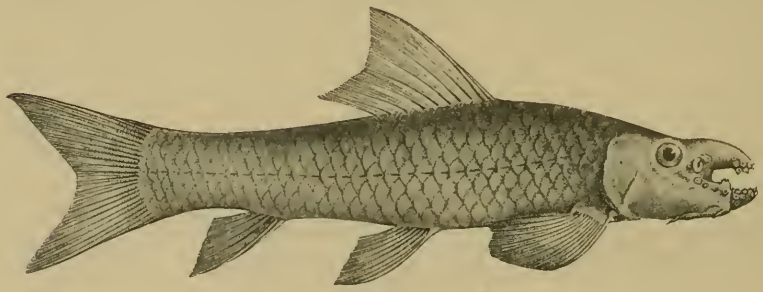

FIG. 82.—*Discognathus lamta,* male. After Day.

its hinder portion. The males of the lamta, in the height of the breeding season, may develop a remarkable subfrontal prominence and this, as well as the snout, is beset with spiniform tubercles. A singular appearance is thus imparted to the head and, as the mouth is inferior and concealed from observation, one might mistake, at first glance, the cleft between the frontal prominence and snout for the mouth. Females have the ordinary barbel-like head and the

contrast between them and males is very striking. The lamta (*Discognathus lamta*) has a wide range in Asia, ranging from Syria into India and still further eastward, and is common in the affluents of the Jordan and the Lake of Gennesaret; it also extends into Abys-

Female. After Heckel. Male. After Day.

FIG. 83.—*Discognathus lamta.*

sinia. It rarely grows to more than six to eight inches long. According to Day, it putrifies very rapidly after death, and generally dies almost as soon as removed from water.

PECULIAR UPLAND CYPRINIDS.

In streams of the great mountain regions, the Himalayas and their outliers, isolating India from the rest of Asia, are to be found peculiar fishes which have been combined in a group named (by McClelland) "Schizothoracinæ." The group includes fishes having the same general form as the barbels, and indeed called hill-barbels,

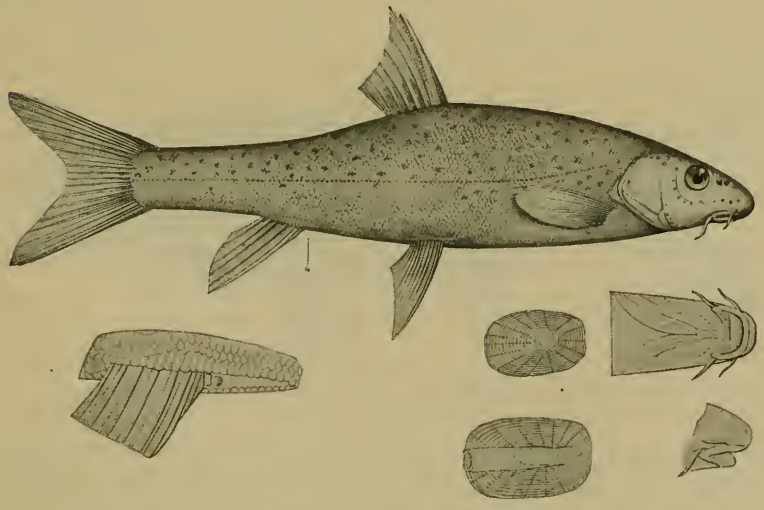

FIG. 84.—*Schizothorax sinnatus.* After Heckel.

but distinguished by a remarkable type of squamation. Above and on each side of the anus and anal fin is a band of enlarged scales differentiated from the others and forming a kind of sheath into which the base of the anal fin is concealed. In other respects there is little difference from the true barbels; there are, as in them, three rows of pharyngeal teeth in the typical forms, but in others there are only two; the number of barbels varies, some species having four, others two, and the remaining none.

About fifty species representing ten or a dozen genera are known, the principal being *Schizothorax,* which contains about a score of species.

Species of this genus are very voracious. J. McClelland (1838) claimed "that it is no uncommon thing to find" one "so overgorged that the tail of its prey remains protruding from the mouth, to be swallowed after that portion which is capable of being received into the capacious stomach is sufficiently digested to admit of the introduction of the remainder." He had seen fishes "so often in this state" that he presumed "they are easier caught in it than in any other."

Some Chinese Cyprinids.

Another type is noteworthy on account of the singularity of appearance as well as the size of the few species. The forehead or interorbital region is high upraised and arched, and consequently the eyes are abnormally low down on the sides. This inferior position of the eyes has given name to the genus (*Hypophthalmichthys*)

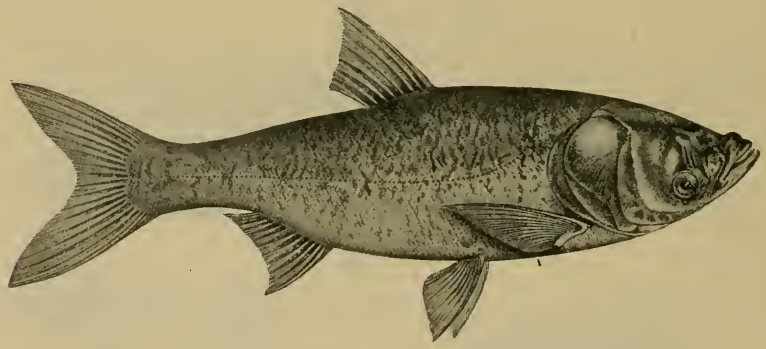

Fig. 85.—*Hypophthalmichthys nobilis.* After Steindachner.

and group or sub-family which it represents (Hypothalmichthyines). Another remarkable peculiarity is the structure of the gill-rakers in association with a peculiar superbranchial shell-like organ which

has been described and illustrated by Boulenger (1901). The genus is represented by about eight species occurring in various waters of Central and Eastern Asia. The largest and best known of these are the Chinese *H. molitrix* and *H. nobilis.*

The *Hypophthalmichthys molitrix* is an inhabitant of China, where it is known as the Lenhi; it sometimes attains a large size—between three and four feet.[1] It is highly esteemed as a food fish, and is the object of a considerable pisciculture, not only in China, but by Chinese beyond the borders of their country. According to Mitsukuri (1905) the Chinese of Formosa import the young, "when nine to ten inches long," from China "in November and December," place them in ponds where they are "abundantly fed," and when they have become a "foot long" they are ready for market. The "fish is cultivated in all parts of Formosa."

FIG. 86.—Pharyngeal bones of *Hypophthalmichthys.* After Steindachner.

The clupeiform Cyprinids typified by the European sichling (*Pelecus cultratus*) are represented by Chinese fishes distinguished from *Pelecus* by the development of three rows of pharyngeal teeth (5 or 4, 4, 2—2, 4, 4 or 5). *Parapelecus argenteus* and *P. machœrius* are species.

JAPANESE CYPRINIDS.

As already indicated, the Cyprinoid fauna of Japan is in its general features essentially similar to that of Britain and the rest of western Europe, that is, it is part of one and the same great "eurasiatic" or "palæarctic" realm, but an entirely distinct subordinate region. The fullest exposition of its character has been given by David S. Jordan and Henry W. Fowler in "a review of the Cyprinoid fishes of Japan," published in 1903 (Proc. U. S. Nat. Mus., XXVI, 811–862). Then thirty-four species representing twenty-one genera were recognized. Most of the genera are monotypic and peculiar to Japan and China, but others are shared with Europe. Cyprinines (*Cyprinus* and *Corassius*), in the persons of the common and Prussian carps, are in both extremes in a state of domestication. The carp "has run into many varieties, distinguished by differences in form, squamation, and development of

[1] According to information communicated to A. Günther (1889) both *H. nobilis* and *H. molitrix* attain equal size, "exceeding a length of four feet."

fins." The Carassius, in the form of the goldfish, is common everywhere; "in its native condition the species is plain dark olivaceous," but domesticated varieties and monstrosities are innumerable. The Gobionines number eight species of five genera; *Gobio,* the Gudgeon genus, though not represented immediately, is represented mediately by several genera (especially by one, *Leucogobio,* with four species, and another, *Abbotina,* with one) differing from each other as well as from *Gobio* by slight differences of the mouth and lips. The Leuciscines are no less than sixteen; *Leuciscus,* the chub genus, has six congeneric relations, and *Phoxinus,* the minnow, one. A characteristic species is that here figured, *Leuciscus phalacrocorax,* whose rather strange name was given because some specimens obtained by Jordan and Fowler were caught by trained cormorants of the genus *Phalacrocorax* in the Tana river. To the Rhodeine subfamily have been referred seven species of four genera, but it is not known whether any exercises the peculiar mode of oviposition

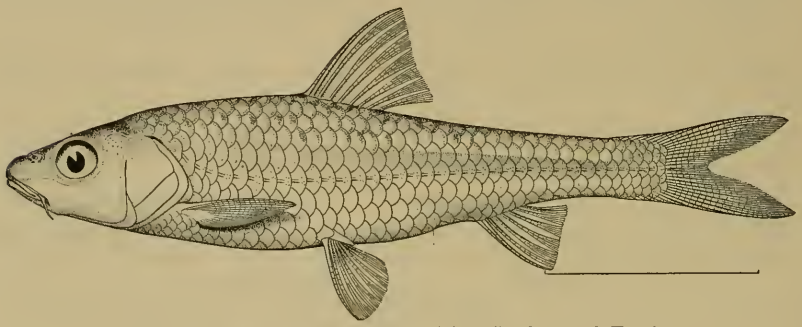

FIG. 87.—*Leucogobio mayedæ.* After Jordan and Fowler.

within the valves of a Unionid as does the bitterling of Germany. It is noteworthy, however, that one of the species, *Pseudoperilampus typus,* has been given a Japanese name (Nigabuna) which conveys the same allusion (bitter carp) as the German name; it rarely attains a length of three inches. Several of the Rhodeines are remarkable for traits of color. Few of the Cyprinids have distinct black markings, the predominant colors being brownish or olivaceous on the back and sides and whitish or silvery below, and consequently the European Leuciscines are collectively designated as whitefish and this has been rendered into the Greek derivative *Leuciscus.* Among the exceptions to the rule are Rhodeines, one of which (*Acheilognathus cyanostigma*) is here illustrated; a black lateral band concurrent with the dorsal outlines is very conspicuous. It is one of the many fishes of the great Japanese lake Biwa. The

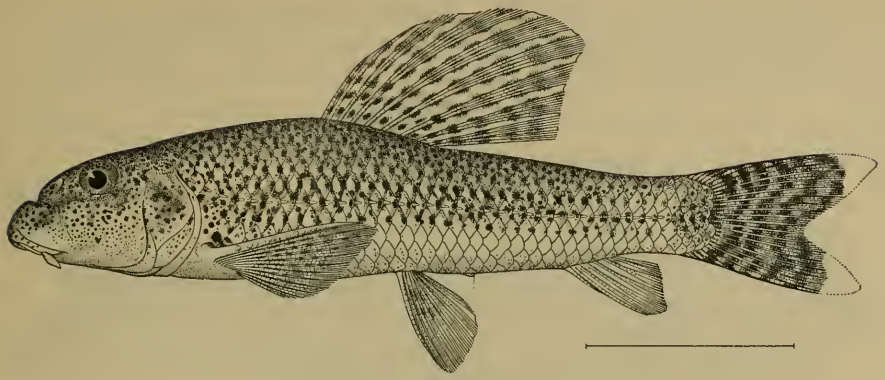

FIG. 88.—*Abbottina psegma*. After Jordan and Fowler.

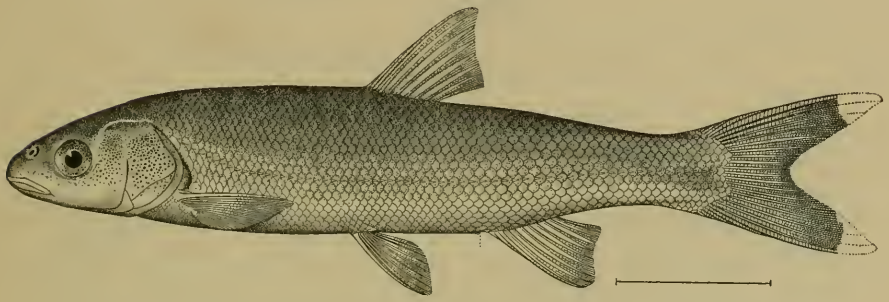

FIG. 89.—*Leuciscus phalacrocorax*. After Jordan and Fowler.

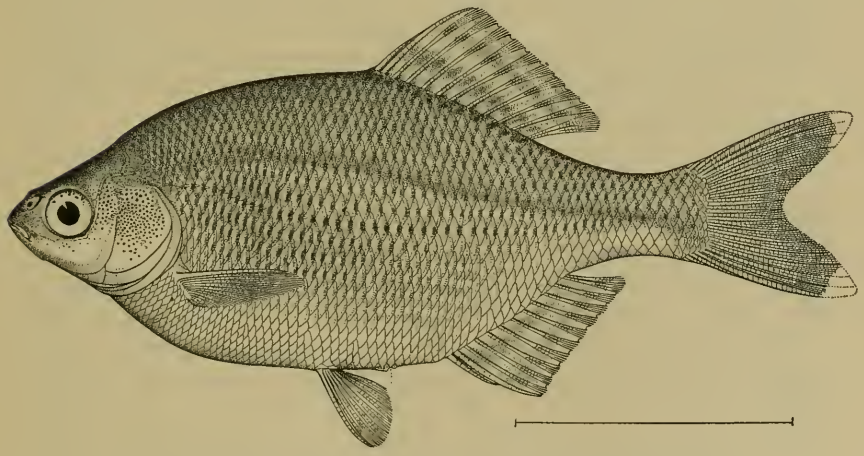

FIG. 90.—*Pseudoperilampus typus*. After Jordan and Fowler.

Barbel (Barbine) group has a single representative, *Barbus schlegeli* or *Hemibarbus barbus,* which grows to about ten inches in length.

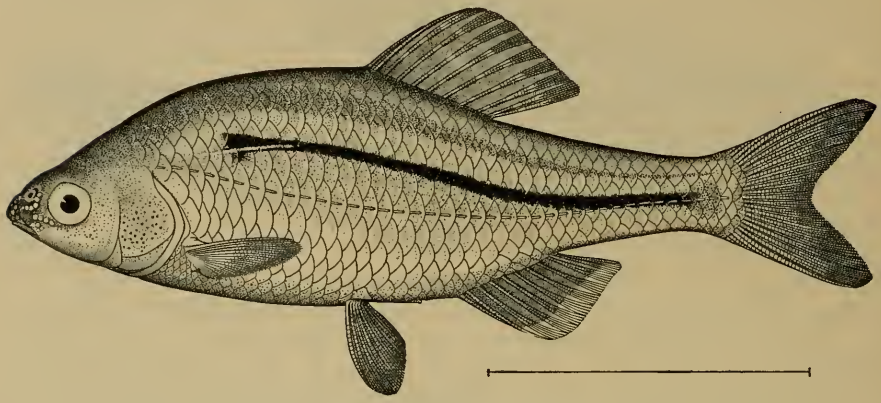

FIG. 91.—*Acheilognathus cyanostigma.* After Jordan and Fowler.

SOUTHERN ASIATIC CYPRINIDS

Asia, south of the Himalayas, the continent east of India, and the great as well as small islands of the Indo-Moluccan archipelago, as well as the Philippine islands, support a very numerous cyprinoid population amounting to some 500 or 600 species. The best known of the regions into which the realm is divided are India and the Dutch islands, the former of which has been most fully illustrated by F. Day and the latter by P. von Bleeker. Day (1889) recognized 185 species belonging to the Indian fauna and Bleeker (1864) 119 species representing the "Indo-Archipelagic" area. The species of Indo-China (Tongking, Annan, Siam, Cochin China, Cambodia and Siam) were given as 57 by Sauvage in 1881. To these many have been added since from all the regions.

India is a favored land of Cyprinids and some of them are fine game fishes. Far above all is the "kingly Mahseer" (*Barbus tor*), but high in the second rank come "the grand Rohu" (*Labeo rohita*), "the sprightly Mirgha" (*Cirrhina mrigala*), and "the massive Catla" (*Catla catla* or *buchanani*), as they are styled by Thomas in "The Rod in India" (1897, p. 196). Smaller species, but at least equally game, are the wide-mouthed Barils which have some superficial resemblance to, and by most English residents are called trout.

The most conspicuous or the most characteristic of the species alone can be now briefly noticed.

The dominant genus of India is that of the barbels (*Barbus*), containing, as it does, according to the views of Day and most recent authors, about a third of its cyprinoid fauna, or seventy species. Only one of them demands consideration here.

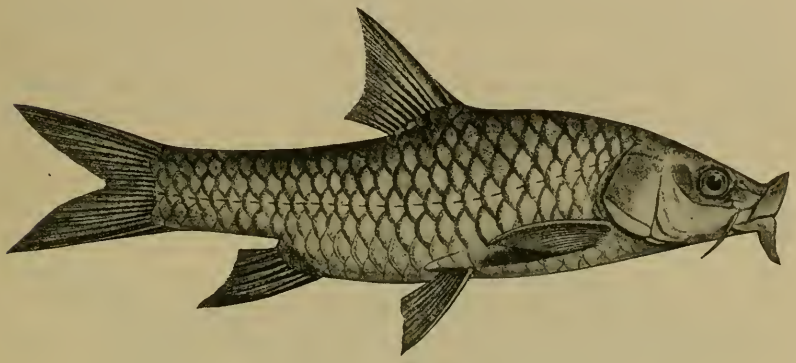

FIG. 92.—*Barbus tor* or *mosal*. After Day.

The Mahseer or Mahsir (*Barbus tor* or *mosal*) is the chief of a small file of species confined to Southern Asia and recognizable by the strong smooth dorsal spine, seven or eight branched anal rays, and the very large scales. The Mahseer itself has twenty-five to twenty-seven scales along the lateral line, two and a half scales between the lateral line and ventral fin, a pointed snout, fleshy lobate lips, and a dorsal spine as long as the head back of the snout. It is the principal fresh-water game fish of India, in which country it is almost everywhere found but, according to Day, it occurs in the "greatest abundance in mountain streams or those which are rocky." It occasionally reaches a very large size, and G. P. Sanderson, the author of "Thirteen years among the wild beasts of India," in a letter published by Thomas, affirmed that he had "no doubt in" his "own mind that they run over 200 or 250 pounds," as he had seen teeth and bones of them far larger than he claimed to have caught; he added that "they are often caught by the natives." The more modest maximum of a hundred pounds is admitted by others. These figures, however, refer to entirely exceptional individuals. An experienced angler quoted in Thomas's work (p. 406) wrote that "in northern India they do not run to any greater size in the rivers of Jhansi and Lullutpore than twelve to fifteen pounds." He thought that "instances of fish caught over ten pounds are rare." Size, however, "depends much on the size of the river in which the mahseer is found."

The mahseer is a carnivorous fish, preying chiefly on smaller representatives of its class. It is angled for with live bait, with the spoon, with flies, with paste, and with parched grain. Instructions for all kinds are given by Thomas in "The Rod in India" in nine chapters and 140 pages devoted especially to the species.

The palatability of the mahseer is a matter respecting which there is some difference of opinion. According to Thomas (p. 23), much depends on the size and condition of the fish. He had "tasted mahseer in such high condition that they were excellent; they were so rich that one could not eat any melted butter or other sauce with them, and so well flavoured that they seemed" to him "to stand between the salmon and the trout for the table." He considered that "the best size for flavour" is about six or seven pounds, or between limits of two and ten pounds. "When less than two pounds they are too bony; when much larger than ten pounds they are apt to be too gross and oily for European tastes, but they are always thought thoroughly edible by your camp."

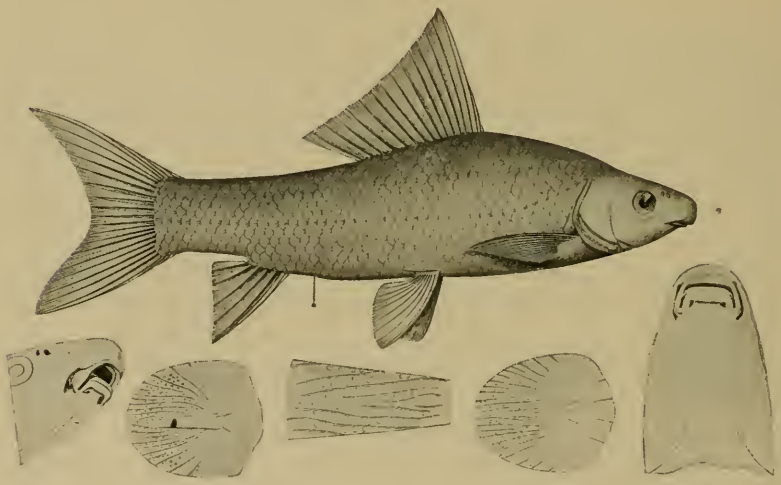

FIG. 93.—*Labeo vulgaris*. After Heckel.

The Indian genus next in importance to *Barbus*, so far as number of species is concerned, is *Labeo*. This essentially agrees with *Barbus* in form and has, like it, three rows of pharyngeal teeth, but the lips are peculiar in that the lateral folds are enlarged and each lip has an internal cross-fold covered by a trenchant corneous but soft and deciduous covering; the snout is smaller, the suborbitals are narrow, and the dorsal is rather long, having twelve to sixteen rays.

Twenty-five Indian species have been referred by Day to this genus, including species with and without barbels, but have been separated by others (especially Bleeker) in several genera. A number of the species attain a large size and some are quite highly esteemed for the table, at least by natives of India.

The largest species, *Labeo gonius,* the goni of Bengal, sometimes reaches a length of five feet and about seventy pounds. Several attain a length of at least three feet, such as the *Labeo calbasu* (Kalbasu of Bengal or kalbans), the *Labeo nandina* (Nandin of

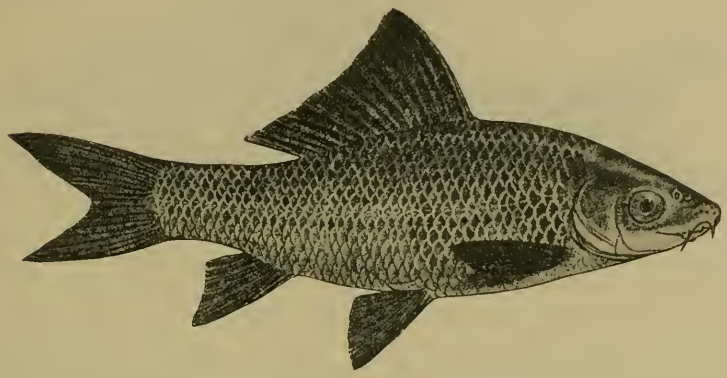

FIG. 94.—*Labeo calbasu.* After Day.

Bengal), the *Labeo rohita* or Rohu, and the *Labeo dyochilus* (Boallo of Hindustan). Others range down from two feet to a few inches in length.

The best known of these, at least from an angler's point of view, is the Rohu. A chapter has been devoted to that species (and incidentally others) by Thomas in "The Rod in India." He asserts (p. 193) that he "never knew any fisherman, however good at mahseer, who had once tried this labeo fishing" with him, who "was not fully converted to it as taxing all his skill in a higher degree than any other fishing, and as showing sport of a superior order."

According to Day, the Rohu "is esteemed excellent as food, propagated with care in ponds in Bengal."

One of the largest of the Indian fishes is known as the catla in Bengal, and scientifically as the *Catla catla* or *buchanani.* It has a carp-like form, but the large head is much more arched between the eyes and backward there are no barbels. The rami of the lower jaw are loosely connected and the dorsal fin is shorter. But the most distinctive characters have to be sought for deeper. The pharyngeal teeth are in three rows, but none are molariform, and the gill-rakers

are especially notable, being setiform and close together, somewhat as in a shad.

The catla, according to Day, "attains at least six feet in length and a weight of 100 pounds; it resides in fresh or brackish water, being found within tidal influence." It ranges throughout India to the Kistna, and eastward through Bengal and Burma to Siam.

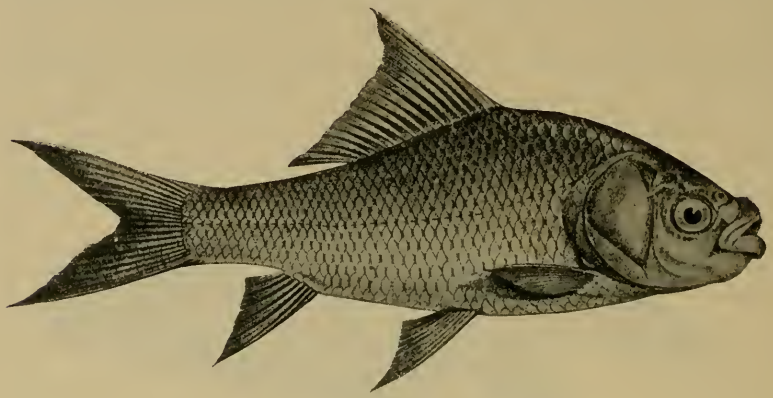

FIG. 95.—*Catla buchanani.* After Day.

Hamilton Buchanan found that "it is a very strong active animal, and often leaps over the seine of the fishermen, on which account, when fishing for the catla, they usually follow the net in canoes and make a noise by shouting and splashing with their paddles." It is said by Thomas to be "very destructive to small fish."

As one of the regular game fishes of India, it is claimed by H. S. Thomas that "one must fish with the bait off the ground, for his mouth would seem to be formed to take bait from above and not off the ground." As bait, "small fish, spoon and phantom" are used to some extent, but "paste is the standard bait."

The "sprightly mirgha" (*Cirrhina mrigala*) is the chief of a genus (*Cirrhina*) generally approximated to catla, but with short gill-rakers, a smaller head with little arched interorbital area, and the lower jaw with a symphysial tubercle. Five Indian and other southeastern Asiatic species have been recognized.

The mirgha, according to Day, is an inhabitant of "rivers and tanks in Bengal, Deccan, Northwest Provinces, Punjab, Sind, Cutch and Burma," and grows to a length of three feet and a weight of some forty pounds. It is considered to be "an excellent species for stocking tanks with," and is also an esteemed angle fish. Thomas records that fishes are "taken with a rod up to 34 pounds in weight."

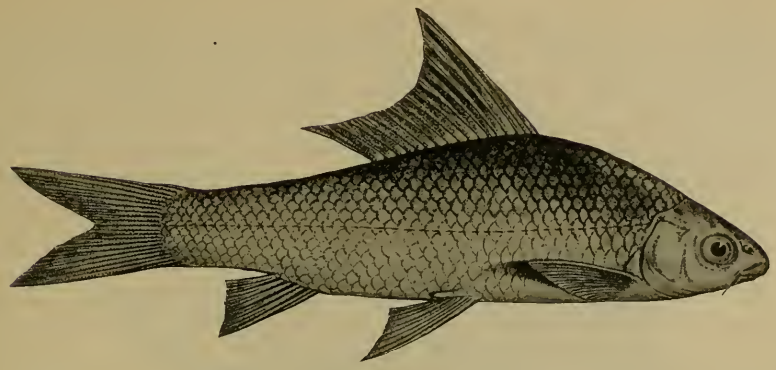

FIG. 96—*Cirrhina mrigala.* After Day.

Another group, designated as the Danionines, has been distinguished because the species differ from all the preceding by the course of the lateral line along the caudal peduncle considerably below its middle instead of along the middle as in most fishes; the anal fin is moderately long, having at least eleven or more branched rays. The fishes are mostly small, but some of one genus (*Barilius*) are noteworthy. They have a fusiform or trout-like form, mouth deeply cleft (the jaws extending backwards under the eyes), and broad sub-orbitals. Fourteen species are recognized by Day as Indian and of these one (*Barilius bola*) is noteworthy as the "Indian

FIG. 97.—*Barilius bola.* After Day.

trout." The misapplication of the name is less glaring than many of the misnomers to be met, for the fish has an outline, mouth, arrangement of fins, and spots not very unlike those of a trout. Of course the likeness is entirely superficial and a little attention reveals the fact that differences innumerable exist. Even the color is quite unlike that of any trout, the spots being rather large, bluish, and in two or more rows.

The bola, according to Day, is a native of "Orissa, Bengal, Northwest Provinces, Assam, and Burma," where it is most at home in "clear streams with stony bed." Its average weight is about three-quarters of a pound, and the maximum near five pounds. Fishes are "taken with the fly, and likewise with small spinning bait; a small phantom is very good bait to use." A hooked fish "will

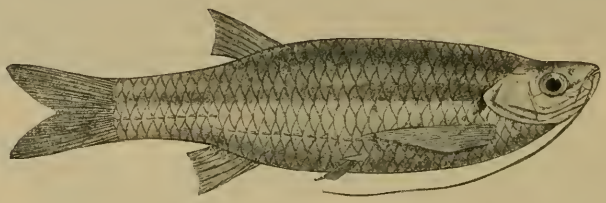

FIG. 98.—*Nuria danrica.* After Day.

jump repeatedly out of the water and dash about in a perfect frenzy and is game to the last."

Another remarkable oriental type is the genus *Nuria,* also a representative of the group *Danioninæ* distinguished by the inferior position behind of the lateral line which runs nearer the lower edge; the dorsal is also farther back and little in advance of the anal. *Nuria* is further distinguished, not only from the other species of Danionines, but from all other Cyprinids, by the very long maxillary barbels which are quite as prolonged as those of an ordinary catfish. The *Nuria danrica* is a fish which "attains five inches in length" and

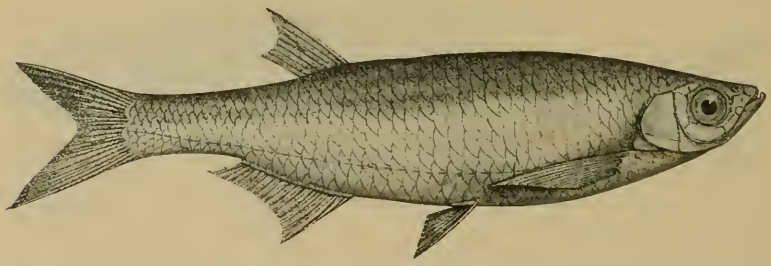

FIG. 99.—*Chela argentea.* After Day.

occurs in India as well as Burma, Ceylon and the Nicobars. It was also found "in a hot stream of 112° Fahr. at Pooree" and likewise "in a hot stream at Cannia in Ceylon."

Another characteristic Indian genus is *Chela,* whose name is latinized from the Hindustanee name *Chilwa,* applied to the principal species. The group is closely related to *Pelecus,* whose type is the

sichling of Germany (*P. cultratus*); indeed, it differs by little more than the course of the lateral line which is moderately and regularly decurved and continuous, while in the sichling it is abruptly deflected behind the base of the pectoral and thence irregularly continuous and parallel with the belly and anal to the caudal. Ten Indian fishes are referred to the genus, all being of small size, relatively to the large fishes already noticed, that is, nine inches or less. The most important of the species is the *Chela argentea,* distinguishable from its fellows by the combination of a moderately long anal fin (with seventeen to nineteen rays) and large scales (forty-three to forty-five along lateral line). It is an inhabitant of the streams and tanks of northern India, and is in many places "a very common fish." It is, according to Thomas, "a delicate fish both to eat and to keep alive, so that it requires care to keep them alive, but, once in, they will live in any pond, and keep its surface alive with rises. They thrive in any still water. In the river they are to be found in the still water." The Chelas generally "are most game fly-takers, springing into the air after the fly. They want striking very quickly, and especially they want the smallest possible fly." Detailed instructions for fishing are given by Thomas.

African Cyprinids

The Cyprinids of tropical and southern Africa are of the same general type as those of India and the prominent genera of the latter region are also the chief ones of Africa. Thus, *Barbus* is represented by one hundred and thirty-three species, *Labeo* by thirty-two, and *Barilius* by sixteen, consequently by more than in India itself, but by many less than in the Indian realm, which also includes Further India and the Indo-Moluccan archipelago. The figures here given are those presented by Boulenger in "A List of the Freshwater Fishes of Africa" (July, 1905). In this list just two hundred species of Cyprinids (including one Cobitid) are attributed to Africa and, with the exception of a *Phoxinellus* and an *Alburnus,* are of or related to warm Asiatic types. Other species, especially of barbels, have been added since.

The genus *Barbus* as here accepted is a *polymorphous* group which will doubtless be ultimately subdivided into various genera and would be now if the classification was brought into harmony with American usage as well as that generally applied to the European species. A prominent African type is that represented by a celebrated species, the bynni of modern Egyptians.

The bynni, or benny, of the Nile (*Barbus bynni*) is the type of a group represented by about fifty species in Africa, having a very strong, smooth dorsal spine, five branched anal rays, and large scales (there are barely three scales between the lateral line and the ventral fin); the snout is very protuberant, and the anterior barbels about as long as the eye.

The bynni was, in the time of the Ptolomies, named *Lepidotus*

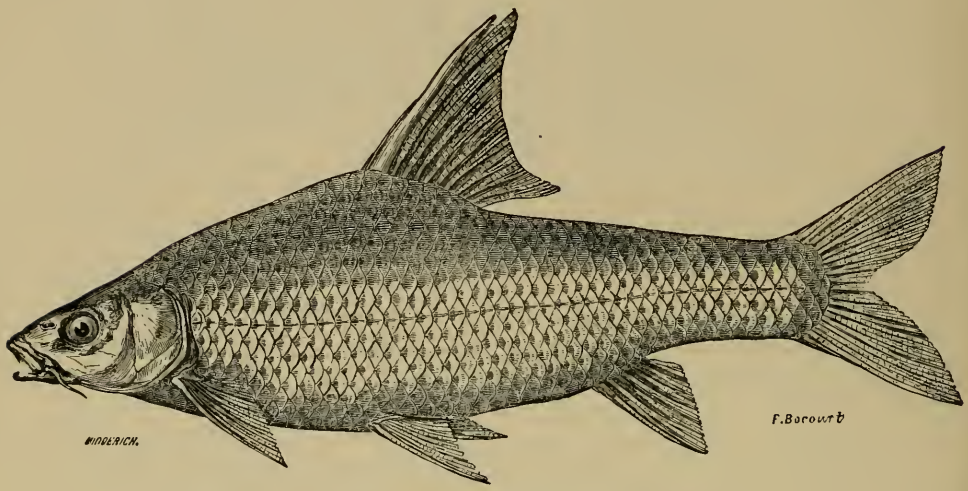

FIG. 100.—*Barbus bynni*. After Geoffroy Saint-Hilaire.

by the Greeks, or at least it has been supposed by E. Geoffroy Saint-Hilaire and others to be the fish so called by Greek writers, especially Strabo and Athenæus; it was the object of veneration of the dwellers along the Nile, and shared this attention with the oxyrhynchus, a mormyroid fish. It is now highly esteemed for its flesh and there is a very ambiguous "proverb" which is intended to express that esteem: "If thou knowest any better than me, do not eat me." It is the special object of fishery at various places, especially Syout and Kené. Commonly it is eighteen or twenty inches long, but not infrequently attains a length of forty inches or even more. It was especially recommended for introduction and acclimation in France by I. Geoffroy Saint-Hilaire.

To give some idea of the extraordinary extent given to the genus *Barbus* by one of the ablest of European ichthyologists another species referred to that genus may be illustrated. It is a large, fine fish of Central Africa and has been named by Dr. Boulenger *Barbus tropidolepis*. By some authors it would be relegated to the genus

Puntius, although not very like any of the other species. Unlike the typical barbels, it has no barbels whatever. It sometimes reaches a length of a meter (40 inches) and may attain a weight of ten or eleven kilograms. It is one of the commonest fishes of Lake Tanganyika and by the natives named M'Biriki. In the spawning season it runs up the rivers discharging into the lake and manifests as much activity as a salmon, leaping up falls five to seven feet high. It especially courses up the river Lu-Fuko, a very rapid stream interrupted by many falls, in great numbers during January to May and

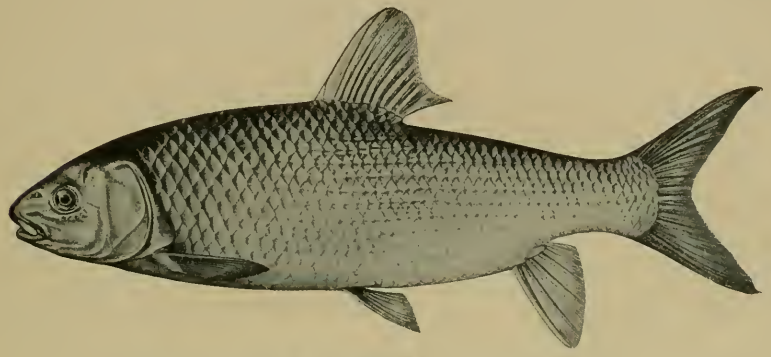

FIG. 101.—*Barbus tropidolepis*. After Boulenger.

remains therein several months. It then gives employment or food to several villages nearby. Large numbers are caught in nets—sometimes as many as seventy at one time. The fish is considered to be " excellent " and, indeed, one of the very best of all the numerous fishes of Lake Tanganyika; it is not fished for, however, in the lake itself.

Three monotypic genera are peculiar to Africa—*Leptocypris, Chelæthiops* and *Neobola*—but they are closely related to Indian genera.

The genus *Chelæthiops* is of special interest on account of the very

FIG. 102.—*Chelæthiops elongatus*. After Boulenger.

backward position of the dorsal fin which is mostly over the hinder half of the anal fin—in fact as far behind as in the pikes and killie-

fishes. In most other respects the genus agrees with *Chela* and *Pelecus* as well as the Danioninæ and apparently belongs to the latter group or subfamily; like them it has the lateral line very low ("très bas") and comparatively near the lower edge of the caudal peduncle. The only known species is the *C. elongatus* of the river Liranga, a tributary of the Congo; a native name is Pondé. It appears to attain a length of little more than two inches ("six centimetres").