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ADVERTISEMENT.

This work is the twelfth of a series of papers intended to illustrate the collections of Natural History and Ethnology belonging to the United States and constituting the National Museum, of which the Smithsonian Institution was placed in charge by the act of Congress of August 10, 1846.

It has been prepared at the request of the Institution, and printed by authority of the honorable Secretary of the Interior.

JOSEPH HENRY,

Secretary of the Smithsonian Institution.

SMITHSONIAN INSTITUTION,

Washington, May, 1878.

CONTRIBUTIONS

TO

NORTH AMERICAN ICHTHYOLOGY.

BASED PRIMARILY ON THE

COLLECTIONS OF THE UNITED STATES NATIONAL MUSEUM.

III.

A.—On the Distribution of the Fishes of the Alleghany Region of South Carolina, Georgia, and Tennessee, with Descriptions of New or Little Known Species.

BY

DAVID S. JORDAN

AND

ALEMBERT W. BRAYTON.

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CONTRIBUTIONS

TO

NORTH AMERICAN ICHTHYOLOGY.

No. 3.

A.

ON THE DISTRIBUTION OF THE FISHES OF THE ALLEGHANY REGION OF SOUTH CAROLINA, GEORGIA, AND TENNESSEE, WITH DESCRIPTIONS OF NEW OR LITTLE KNOWN SPECIES.

By David S. Jordan and Alembert W. Brayton.

This paper is based primarily on the collections made by the present writers, assisted by Mr. C. H. Gilbert, and a party of students from Butler University, during the past summer (1877), in various streams of South Carolina, Georgia, and Tennessee. For the purpose of a more complete discussion of questions of geographical distribution, the authors have brought together, with their own observations, those previously made on the fish-faunæ of the same streams by other writers, especially the observations on the fishes of the Tennessee Basin by Professor Agassiz;* those on the fishes of the basins of the Santee† (Catawba), Tennessee,‡ and Cumberland,‖ by Professor Cope, and on the fishes of the Cumberland, Tennessee, Alabama, and Altamaha

* Notice of a Collection of Fishes from the Southern Bend of the Tennessee River, in the State of Alabama. By L. Agassiz. < American Journal Sci. Arts, 1854, pp. 297–308 and 353–365.

† Partial Synopsis of the Fishes of North Carolina. By E. D. Cope. < Proc. Am. Philos. Soc. Phila. 1870, pp. 448–495.

‡ On the distribution of Fresh-water Fishes in the Alleghany Region of South-western Virginia. By E. D. Cope, A. M. < Journal Acad. Nat. Sci. Phila. new series, vol. vi, part iii, January, 1869, pp. 207–247.

‖ On some Etheostomine Perch from Tennessee and North Carolina. By E. D. Cope. < Proc. Am. Philos. Soc. 1870, pp. 261–270.

basins by Professor Jordan.* The purpose of this paper is to give a *résumé* of all that is certainly known in regard to the ichthyology of the seven hydrographic basins embraced in its scope, viz, the Santee, Savannah, Altamaha, Chattahoochee, Alabama, Tennessee, and Cumberland. For purposes of comparison, a table of distribution of species is added, which includes, in addition, what is known of the fish-faunæ of the James, Roanoke, Neuse, Great Pedee, and Ohio.

The following is a classified list of the streams which have been examined in each water-basin included in this paper, with a word or two suggestive of the character of each stream. The collections in every case were made by one or both of the present writers, unless otherwise stated.

LIST OF STREAMS EXAMINED.

I.—SANTEE BASIN.

1. Catawba River and tributaries in North Carolina. (Cope, 1869.)
2. Ennoree River, near Chick Springs, S. C. (Deep, muddy, and rapid.)
3. Reedy River, at Greenville Court-House, S. C. (Muddy.)
4. Saluda River, at Farr's Mills, west of Greenville. (Clear and rapid; a fine seining-ground.)

II.—SAVANNAH BASIN.

1. Tugaloo River, Habersham County, Ga., just below mouth of Panther. (Clear, broad rapids.)
2. Panther Creek, north of Toccoa City, Ga. (Clear mountain-stream.)
3. Toccoa Creek, below Toccoa Falls, Ga. (Clear, cold mountain-stream; contains little besides *Hydrophlox rubricroceus*.)
4. Toxaway and Chatuga Rivers and tributaries about the foot of Whiteside Mountain. (Clear mountain-streams, abounding in Trout.)

III.—ALTAMAHA BASIN.

1. Oconee River, at Sulphur Springs and Fuller's Mills, Hall County, Georgia. (Clear.)
2. Ocmulgee River, Reed's Fish-pond, south of Atlanta, Ga. (Headwaters; clear.)
3. Ocmulgee River, South Fork, Flat Rock, De Kalb County, Georgia. (Partly clear; a small falls, and a deep basin worn in granite rock; a fine stream for seining.)

* A Partial Synopsis of the Fishes of Upper Georgia; with Supplementary Papers on Fishes of Tennessee, Kentucky and Indiana. By David Starr Jordan, M. D., Ph. D < Annals N. Y. Lyceum Nat. Hist. vol. xi, 1877, pp. 307–377.

4. Ocmulgee River, Macon, Ga. (Collection of Dr. T. H. Bean and other members of the United States Fish Commission.)

IV.—CHATTAHOOCHEE BASIN.

1. Chattahoochee River at Shallow Ford, northwest of Gainesville, Ga. (Broad, shallow, rapid; water moderately clear.)
2. Suwannee Creek, near Suwannee, Gwinnett County, Ga. (Deep, muddy, and very cold. Contains chiefly *Codoma eurystoma*.)
3. Peach Tree Creek, just north of Atlanta. (Deep and muddy.)
4. Nancy's Creek, northwest of Atlanta. (Clear and rapid.)
5. Flint River, in Taylor County. (Collection of Dr. Hugh M. Neisler in United States National Museum.)

V.—ALABAMA BASIN.

A.—Etowah River.

1. Pettis Creek, near Cartersville, Ga. (Clear, rocky.)
2. Silver Creek, near Rome, Ga. (Clear, rapid; a fine stream for collecting.)
3. Dyke's Creek and Pond, near Rome, Ga. (Clear and cold.)

B.—Oostanaula River.

4. Rocky Creek, near Floyd Springs, Ga. (A fine, clear stream.)
5. John's Creek, near Floyd Springs. (Clear.)
6. Lovejoy's Creek, near Floyd Springs. (A small sandy stream, full of fishes.)
7. Big Armuchee Creek, above Rome. (Clear.)
8. Big Dry Creek, near Rome. (A succession of weedy rock-pools.)
9. Little Dry Creek, near Rome. (Like the preceding.)
10. Waters's Creek, above Rome. (Muddy and rocky.)
11. Lavender Creek, in Texas Valley, Ga. (A small clear stream.)

C.—Coosa River.

12. Beech Creek, near Rome. (Muddy.)
13. Horse-leg Creek, near Rome. (Rocky, clear.)
14. Little Cedar Creek, at Cave Spring, Ga. (A fine, clear, cold stream. One of the best for the collection of fishes. Abounds in *Xenisma stelliferum*, *Hydrophlox chrosomus*, *Codoma callistia*, and other beautiful species.)

D.—Alabama River, near Montgomery, Ala. (Collection of Dr. Bean and others, 1876.)

VI.—TENNESSEE BASIN.

A.—Upper Course.

1. Clinch River, tributaries in Southwestern Virginia. (Cope, 1868.)
2. Powell's River, near Cumberland Gap. (Clear.)
3. Indian Creek, near Cumberland Gap. (Clear.)
4. Station Creek, near Cumberland Gap. (Clear.)
5. Holston River, various tributaries in Southwestern Virginia. (Cope, 1868.)
6. French Broad River, at Newport, Tenn. (Rather deep and muddy.)
7. French Broad River, about Warm Springs, N. C., Asheville, N. C., and elsewhere.) (Cope, 1869.) (Rapid, rocky, and generally clear.)
8. Big Pigeon River, at Cliffton, Tenn. (Rather clear.)
9. Swannanoa River, at foot of Black Mountain. (Clear, cold mountain-stream, with trout.)

B.—Lower Course.

10. Chickamauga River, at Ringgold, Ga. (Rather clear and very rocky.)
11. Tributaries of Tennessee River, about Huntsville, Ala. (Agassiz; Newman's collection, 1853.)
12. Tributaries of Tennessee River, about Florence, Ala. (Storer, 1845.)
13. Elk River and tributaries, at Estill Springs, Tenn. (Clear, rocky, and cold.)

VII.—CUMBERLAND BASIN.

1. Round-Stone River, Rock Castle County, Kentucky. (Clear.)
2. Rock Castle River, Livingston, Ky. (Clear and rocky.)
3. Big Laurel River, Laurel County, Kentucky. (Clear.)
4. Cumberland River, about Pineville, Ky. (Clear, rocky.)
5. Yellow Creek, near Cumberland Gap. (Rather muddy.)
6. South Fork of Cumberland River, in Tennessee. (Cope, 1869.)
7. Cumberland River and tributaries, near Nashville. (Winchell, 1876.)
8. Stone River, Murfreesboro', Tenn. (Clear and rocky.)

It will be noticed that almost without exception the above mentioned localities are in the mountainous or upland parts of the different water-basins. Of the fishes inhabiting distinctively the lowland courses of most of the streams, little is yet definitely known.

The Santee, Savannah, Altamaha, and Chattahoochee have been examined only in that part of their course which flows over metamorphic rocks. The three western streams have been studied chiefly in the limestone regions. The lithological character of the bed of a stream has a certain influence on its fish-fauna, as will be seen hereafter. Generally limestone streams are richer in species than those with granitic bottoms.

The types of the new species described below are deposited in the United States National Museum at Washington, and in the Museum of Butler University, Indianapolis, Indiana.

I.—SANTEE BASIN.

Thirty-nine species are ascertained to occur in the headwaters of the Santee River, thirty-three having been obtained by Professor Cope in the Catawba River in North Carolina, and thirty by the present writers in the Saluda and Ennoree in South Carolina. Of these thirty nine species, ten are not as yet known from any other hydrographic basin. These are: *Alvordius crassus*, *Nothonotus thalassinus*, *Ceratichthys labrosus*, *Ceratichthys zanemus*, *Codoma pyrrhomelas*, *Codoma chloristia*, *Photogenis niveus*, *Alburnops chlorocephalus*, *Alburnops saludanus*, and *Myxostoma album*. The apparent absence of *Luxilus cornutus* in the Great Pedee, Santee, Savannah, Altamaha, and Chattahoochee Basins is remarkable, as that species is abundant in the tributaries of the Neuse on the east and the Alabama on the west, as in all streams northward to Minnesota and New England.

The species most abundant as to individuals, in the Saluda at least, is probably *Notropis photogenis*. Next to this come *Codoma pyrrhomelas* and *Ceratichthys biguttatus*. Of the *Catostomidæ*, *Myxostoma cervinum* seems to be the predominant species; of the *Siluridæ*, *Amiurus brunneus*, and of the *Centrarchidæ*, *Lepiopomus auritus*. The chief food-fishes at Greenville, S. C., are the "Mud Cats" (*Amiurus brunneus* and *platycephalus*), the "Fine-scaled Sucker" (*Catostomus commersoni*), the Eel (*Anguilla vulgaris*), the "Spotted Sucker" (*Minytrema melanops*), the "Perch" (*Lepiopomus auritus*), the "War-mouth Perch" (*Chænobryttus viridis*), the "Jack" (*Esox reticulatus*), and the "Jump Rocks" (*Myxostoma cervinum*).

ETHEOSTOMATIDÆ.

Genus ALVORDIUS *Girard.*

1. ALVORDIUS CRASSUS, *sp. nov.*

Etheostoma maculatum var. COPE, Proc. Am. Philos. Soc. 1870, 261, 262, and 449. (Not *Hadropterus maculatus* Girard.)

A species bearing considerable resemblance to *A. aspro*, but less distinctly marked and more heavily built, the form being less graceful than that of the other members of the genus. Body considerably compressed, the depth $4\frac{1}{2}$ times in length to origin of caudal (as in all cases in this paper). Head comparatively short, $3\frac{4}{5}$ in length; the snout medium, not acuminate as in *A. phoxocephalus*, nor especially obtuse. Eye moderate, as long as snout, 4 in head. Mouth rather small for the genus, nearly horizontal, the upper jaw but little the longer: upper jaw not projectile: maxillary reaching anterior margin of eye.

Cheeks naked: opercles with a few scales above: back and breast naked: middle line of belly in some specimens naked: in others with enlarged plates. Scales on the body rather larger than usual, about 7–55–7.

Fins moderately developed: dorsal XII–I, 10, varying to XI–I, 11; an increase in the number of the spines, as usual, accompanying a decrease in the number of soft rays, a rule apparently not hitherto noticed, and perhaps not of general application. The two dorsal fins are well separated, the first being longer than the second, but considerably lower.

Anal fin shorter, but higher than second dorsal, II, 9; the two spines well developed. Caudal fin deeply lunate, almost furcate. Pectorals and ventrals large, their tips about equal.

Coloration rather plain. General hue olivaceous; the back marked with darker, as in the other species of the genus. Sides with a series of dark olive, rounded blotches, connected along the lateral line by a narrow, dark band; a dark streak forward, and one downward from the eye. First dorsal with a dark spot in front, and another on its last rays. Second dorsal, caudal, and pectorals barred with dark spots. Anal and ventrals uncolored.

Length of longest specimens observed, 3 inches.

Habitat.—Saluda, Ennoree, and Reedy Rivers, in rapid water, especially abundant in the Saluda at Farr's Mills. Also recorded by Cope from the Catawba.

Genus BOLEOSOMA *DeKay.*

2. Boleosoma maculaticeps *Cope.*

Boleosoma maculaticeps Cope (1870), Proc. Am. Philos. Soc. 269 and 450. (Catawba R.)—Jordan & Copeland (1876), Check List (Bull. Buffalo Soc. Nat. Hist.), 163. (Name only.)
Arlina maculaticeps Jordan (1877), Bull. U. S. Nat. Mus. x, 15. (Name only.)
Boleosoma olmstedi Jordan (1877), Ann. N. Y. Lyc. Nat. Hist. 368. (Ocmulgee River.)

A single specimen taken in the Saluda River at Farr's Mills answers closely to Professor Cope's description. The upper part of the cheeks have, however, a few scattering scales. This species is a true *Boleosoma*. Although the type of *Boleosoma* has but a single anal spine and *B. effulgens* and *B. maculaticeps* have two anal spines, the essential character of those spines is the same in both cases, and the genus *Arlina*, based on *B. effulgens*, is a synonym of *Boleosoma*. In *Boleosoma*, the spines are all weak and flexible, and those of the anal especially so. In most or all of the other genera of *Etheostomatidæ*, the anal spines are stiff and long, and, with scarcely an exception, the first spine is the longer of the two. In the species of *Boleosoma*, with *two* anal spines, the two spines are unequal, the second the longer, both extremely slender and flexible; not at all "spine"-like, except that they are not inarticulate. This feeble condition of the spines seems to constitute the chief generic character of *Boleosoma*.

Two of the species provisionally referred by Professor Jordan (Bull. U. S. Nat. Mus. x) to "*Arlina*", viz, *Arlina stigmæa* Jor. and *A. atripinnis* Jor., have the anal spines well developed, as usual in *Etheostomatidæ*. These two species and their congeners apparently constitute a distinct genus, differing from *Diplesium* in the toothed vomer and from *Nothonotus* in the protractile upper jaw. For this genus, the name of *Ulocentra* (Jordan) has been suggested (Man. Vert. ed. 2d, p. 223), in allusion to the development of the spines.

Genus NOTHONOTUS *Agassiz.*

3. Nothonotus thalassinus, *sp. nov.*

A handsome species, differing from the others now referred to this genus in the entire nakedness of the head.

Body rather stout, the depth about 5 times in the length, compressed behind, the back somewhat arched. Head large, 4 in length, the snout rather blunt and convex in profile; a pretty decided angle

opposite the eye. Eyes large, high up, longer than the muzzle, 3½ in head: interorbital space rather narrow, the eye having some upward range. Mouth moderate, slightly oblique, the maxillary reaching to orbit. Upper jaw slightly longer than the lower, not protractile. Head entirely naked, both cheeks and opercles being destitute of scales.

Scales large, 5–43–5. Belly scaled: throat naked: neck anteriorly naked, but scaly in front of the dorsal: lateral line complete.

Fins all large: D, X–I, 10, or IX–I, 11, the membrane of the first dorsal continued to the base of the second: longest dorsal spine a little over half the length of the head, scarcely shorter than the soft rays; the base of the spinous dorsal a little longer than that of the soft dorsal. Anal II, 8, rather smaller than second dorsal, the first spine longer and larger than the second. Caudal fin deeply lunate, almost forked. Pectoral and ventral fins large; the former reaching nearly to the vent, the latter somewhat shorter.

Color, in spirits: Olive, closely mottled and tessellated above with dark green; this color extending down the sides, forming six or eight irregular dark green bars. Head dark green; a dark green line downward from eye and another forward. Fins in males nearly plain, the spinous dorsal with a black edge; females with all the fins except the ventrals closely barred or speckled with dark green. Two pale orange spots at the base of the caudal.

Life-colors: The colors of a male specimen in life are as follows: Body dark olive and blotched above: sides with nine dark blue-green vertical bars, the five next the last most distinct, and reaching down nearly to the anal. Spinous dorsal reddish at base, then with a broad black band, the uppermost third being of a bright ferruginous orange-red: second dorsal blackish at base, reddish above: caudal with two orange blotches at base, black mesially, pale orange externally. Anal fin of a brilliant blue-green color at base, pale at tip. Pectorals barred, the middle of the fin grass-green. Ventrals dusky mesially, with a green shade. Opercular region more or less grass-green: streaks about eye blackish-green.

Length of largest specimens taken, 2½ inches.

Habitat.—Very abundant in all the streams seined, especially so in the rocky shoals of Reedy River in the city of Greenville.

This handsome little fish may be easily known from its congeners by the smooth head, and by the general greenness of its coloration, which resembles somewhat that of the species of *Diplesium*.

Genus ETHEOSTOMA *Rafinesque.*

4. ETHEOSTOMA FLABELLARE *Raf.*

(*Catonotus flabellatus* Auct.)

Three specimens doubtfully referred to this species were obtained by Professer Cope in the Catawba River.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

5. MICROPTERUS PALLIDUS (*Rafinesque*) *Gill & Jordan.*

Professor Cope obtained this species in the Catawba. We collected none in the Saluda or Ennoree, but we were told that "Trout", as the species of *Micropterus* are universally called in the South, are frequently taken there.

Genus CHÆNOBRYTTUS *Gill.*

6. CHÆNOBRYTTUS VIRIDIS (*Cuv. & Val.*) *Jordan.*

The War-mouth Perch occurs in abundance in the Saluda, and apparently in all the South Atlantic streams. Cope says that it is exceedingly common in all the streams of Eastern North Carolina, and that it is known as the Red-eyed Bream on the Catawba. This species is very closely related to *C. gulosus*, differing chiefly in the color and in the somewhat less robust form. It may be only a variety.

Genus LEPIOPOMUS *Rafinesque.*

7. LEPIOPOMUS AURITUS (*Linnæus*) *Raf.*

All my specimens of this species from the Saluda have a dusky blotch or bar at the base of the soft dorsal, a feature of coloration not shown by my Northern specimens. This is a widely diffused species, and, like most such, is quite variable.

Genus EUPOMOTIS *Gill & Jordan.*

8. EUPOMOTIS AUREUS (*Walbaum*) *Gill & Jordan.*

Professor Cope obtained this species in Catawba River. We have never collected it in the Southern States. It is probably chiefly confined to the lowland regions.

ESOCIDÆ.

Genus ESOX *Linnæus.*

9. ESOX RETICULATUS *Le Sueur.*

Very common. We are unable to distinguish the Southern form (*phaleratus* Say, *affinis* Holbrook) as even varietally distinct from the Northern *reticulatus.*

10. ESOX RAVENELI *Holbrook.*

Obtained by Professor Cope in the Catawba. Its specific distinction from *E. americanus* Gmelin appears questionable.

SALMONIDÆ.

Genus SALVELINUS *Richardson.*

11. SALVELINUS FONTINALIS (*Mitchill*) *Gill & Jordan.*

This species was found by Professor Cope in the headwaters of the Catawba River.

CYPRINIDÆ.

Genus CAMPOSTOMA *Agassiz.*

12. CAMPOSTOMA ANOMALUM (*Raf.*) *Ag.*

Subspecies *prolixum* (Storer) Jor.

A few specimens from Saluda River. Also in the Catawba (Cope).

Genus HYBOGNATHUS *Agassiz.*

13. HYBOGNATHUS ARGYRITIS *Girard.*

A few specimens were obtained in Saluda River, not distinguishable from others from Ohio River and others (types of *H. osmerinus* Cope) from New Jersey. Professor Cope found it abundant in Catawba River.

Genus ALBURNOPS *Girard.*

14. ALBURNOPS SALUDANUS, *sp. nov.*

Hybopsis amarus, "variety from the Catawba," COPE (1870), Proc. Am. Philos. Soc. 460.

A species belonging to "*Hybopsis*, Group A", of Cope, which is equi-

valent to the subgeneric section of *Alburnops* or "*Hybopsis*", called *Hudsonius* by Girard.

Body elongate, but compared with its immediate relatives, *hudsonius*, *amarus*, and *storerianus*, short and thick; moderately compressed, the depth $4\frac{2}{5}$ in length: caudal peduncle shortened, $4\frac{3}{5}$ in length: head large, 4 times in length, relatively heavy and gibbous forward, the snout rounded in profile, as in *A. hudsonius*. Eye large, rather wider than interorbital space, about equal to snout, $3\frac{1}{4}$ in head.

Mouth moderate, subinferior, the maxillary not reaching to eye.

Scales large, thin, and loose, 5–39–3, about twelve in front of the dorsal fin. Lateral line somewhat decurved in front.

Fins moderately developed. Dorsal beginning in advance of ventrals, I, 8; its first ray nearer snout than caudal. Anal I, 8, rather small. Pectorals not reaching to ventrals, the latter not to vent.

Color clear olivaceous, nearly white, like the rest of the group, some specimens showing a faint plumbeous lateral line.

Teeth 1, 4–4, 1, two or three of the principal row obtuse, not hooked; only one or two of the teeth usually showing a masticatory face.

Habitat.—Abundant in Saluda River, where it reaches a length of about four inches. Also obtained by Professor Cope from the Catawba.

The peculiar characters of this species have been noticed by Professor Cope, who, however, was disposed to consider it a variety of *H. amarus*. It differs from our specimens of what we consider to be the latter species (from Ocmulgee River) in the smaller eye, the thicker head, shorter, deeper body, more decurved front, and shorter caudal peduncle. In *amarus*, the eye is 3 in head, the head $4\frac{3}{4}$ in length, and the caudal peduncle $3\frac{4}{5}$.

We have been disposed to unite, under the generic name *Luxilus*, a large number of species forming a series the extremes of which bear little resemblance to each other or to the means, but which form a chain so unbroken that it is difficult to draw any generic lines among them. That this group may ultimately be broken up into natural genera is very probable, but the groups thus far proposed have not received very satisfactory definition.

These species agree (*a*) in the absence of any special modification, either of mouth, fins, or alimentary canal; (*b*) in the dentition, the teeth being in one or two rows, always *four* in the principal row of the raptorial type, and some or all of them provided with a grinding surface; often, and in some species always, one edge of the masticatory

surface is more or less crenate, especially in young individuals; (*c*) the anal fin is always short, containing from seven to nine rays; (*d*) the dorsal fin is never inserted very far behind the ventrals; (*e*) the lateral line is developed and continuous.

The species differ much among themselves in size, nuptial dress, and general appearance, notably in the squamation, the scales of the typical species of *Luxilus* being closely imbricated and much higher than long, while in the group called *Hudsonius* the two dimensions of the scales are nearly equal. The scales themselves, in *Hudsonius*, are thin and loosely imbricated. Within certain limits, the position of the dorsal varies also. In *Hudsonius*, its first ray is in advance of the insertion of the ventrals; in *Luxilus* and *Alburnops*, usually directly opposite; in *Photogenis* and *Hydrophlox*, distinctly posterior. The form of the mouth varies largely: in *L. coccogenis*, it is wide and oblique, the lower jaw projecting. In the typical species of *Alburnops* and *Hudsonius*, the mouth is small and more or less inferior.

The species may be provisionally grouped as follows, under five groups, four of which may be considered as distinct genera. Those species whose position is doubtful are indicated by a mark of interrogation:—

A.—LUXILUS *Rafinesque.* (Scales very closely imbricated, much deeper than long: teeth 2, 4–4, 2, entire: dorsal fin inserted directly opposite ventrals: mouth terminal: size large: nuptial dress peculiar; type *Cyprinus cornutus* Mit.)

cornutus Mit. — *coccogenis* Cope.
selene Jor.

B.—PHOTOGENIS *Cope.* (Scales pretty closely imbricated, deeper than long: teeth 1, 4–4, 1, more or less crenate (rarely one-rowed?): dorsal fin behind ventrals, always with a black spot on the last rays behind: males in spring tuberculate, the lower fins and the tips of the vertical fins filled with satin-white pigment in spring: mouth terminal, the upper jaw longest: size medium; type *P. spilopterus* Cope = *Cyprinella analostana*).

analostanus Girard. — *niveus* Cope.
galacturus Cope. — *iris* Cope (?).
leucopus J. & B.

C.—HYDROPHLOX *Jordan.* (Scales less closely imbricated, somewhat deeper than long; teeth usually 2, 4–4, 2, often more or less crenate: dorsal fin distinctly behind ventrals, unspotted: breeding-dress peculiar, the males almost always red: mouth terminal,

oblique, the upper jaw usually slightly the longer: size very small; type *Hybopsis rubricroceus* Cope.)

roseus Jordan.
rubricroccus Cope.
lutipinnis J. & B.
chiliticus Cope.
chalybæus Cope.
chrosomus Jor.
xænocephalus Jor.
plumbeolus Cope.
birrittatus Cope.
lacertosus Cope.

D.—ALBURNOPS *Girard.* (Scales rather loosely imbricated: teeth 4–4, or 1, 4–4, 1: dorsal fin inserted over ventrals, unspotted: sexes alike: mouth more or less inferior, horizontal or oblique: size small; type *Alburnops blennius* Grd.)

microstomus Raf.
volucellus Cope.
spectrunculus Cope.
procne Cope.
stramineus Cope.
tuditanus Cope (?).
missuriensis Cope.
scylla Cope.
timpanogensis Cope.
chlorocephalus Cope.
frctensis Cope.
nubilus Forbes.
blennius Grd.
shumardi Grd.
illecebrosus Grd.

E.—HUDSONIUS *Girard.* (Scales thin and loosely imbricated: teeth 1, 4–4, 1 or 2, the grinding surface often distorted: dorsal inserted in advance of ventrals: colors silvery: sexes alike: mouth inferior: body elongate, the head comparatively short: size medium; type *Clupea hudsonia* Clinton.)

saludanus J. & B.
hudsonius Clinton.
amarus Girard.
storerianus Kirtland.

We have substituted the name *Alburnops* Grd. for the earlier name *Hybopsis*, as we think that the latter genus was founded on a species of *Ceratichthys*.

15. ALBURNOPS CHLOROCEPHALUS (*Cope*) *J. & B.*

Hybopsis chlorocephalus COPE (1870), Proc. Am. Philos. Soc. 461.

This beautiful little fish is abundant in the clear rapid waters of the Saluda. It resembles *H. rubricroccus*, but is smaller and stouter-bodied, with smaller mouth. The scales in front of the dorsal are fewer (about 16) in number. The teeth are 1, 4–4, 1 (2, 4–4, 2, in *rubricroceus*). The male specimens are profusely tuberculate on the snout and ante-dorsal region. Professor Cope found this species abundant in the clear waters of the tributaries of the Catawba.

Genus PHOTOGENIS *Cope.*

16. PHOTOGENIS NIVEUS (*Cope*) *J. & B.*

Hybopsis niveus COPE (1870), Proc. Am. Philos. Soc. 461.

A very pale species, related to *Photogenis analostanus* and *P. galacturus*, rather than to the species of "*Hybopsis*", to which genus Professor Cope referred it. My specimens are all very white, with a narrow bluish stripe along the caudal peduncle, which sometimes forms a faint spot at base of caudal. In male specimens, the snout and ante-dorsal region are covered with small tubercles. In males, the dorsal fin is considerably elevated. In color, the dorsal fin is largely dusky on the last rays, the most of the fin somewhat creamy-tinted. The tip of the dorsal fin and the tips of the caudal are filled with milk-white pigment, as in the related species. The anal fin is entirely milky. The teeth are 1, 4–4, 1, provided with a narrow masticatory surface.

Photogenis niveus is abundant in the Saluda River. It was first discovered by Professor Cope in the Catawba River.

17. PHOTOGENIS ANALOSTANUS (*Girard*) *Jordan.*

We did not find this species in the Saluda, although Professor Cope states that it is abundant in the Catawba. It is perhaps possible that Professor Cope mistook our *Codoma chloristia*, a species which resembles it very much, except in dentition, for the true *analostanus*. The "*Cyprinella analostana*" has been a stumbling-block in the classification of these fishes, as to the masticatory surface of *Luxilus* it adds the crenations of *Cyprinella*. We are inclined to think that *Cyprinella* should be restricted to those species whose teeth are without grinding surfaces and are permanently crenate. The relations of *Luxilus analostanus*, *spilopterus*, *galacturus*, *leucopus*, and *niveus* are much more intimately with the species of *Codoma* than with *Luxilus*, but the development of grinding surfaces on the teeth renders it necessary to refer them to the latter genus, unless *Photogenis* be admitted as a distinct genus.

Genus CODOMA *Girard.*

(Subgenus EROGALA *Jordan.*)

Photogenis JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 335. (Not of Cope, whose type, *P. spilopterus*, proves to be a species closely related to *L. analostanus*, if not identical with it.)

Examination of a large number of specimens supposed to be *Photogenis spilopterus*, from Saint Joseph's River, in Northern Indiana, Professor

Cope's original locality, has convinced us that the *spilopterus*, the type of the genus *Photogenis*, does not belong to the group of colored species for which Professor Jordan lately adopted the latter name. The genus *Photogenis* (Jordan) being thus left without a name, that of *Erogala* has been suggested (ἦρ, spring-time; γάλα, milk, in allusion to the milk-white pigment with which the male fishes are ornamented in the nuptial season).

Codoma Grd. differs from *Erogala* in the form of the head, which is short, blunt, and rounded, as in *Pimephales*. We do not now think that the two are distinct as genera, and prefer to consider *Erogala* as a subgenus of *Codoma*.

The type of *Erogala* is *Photogenis stigmaturus* Jordan. This subgenus is remarkable for its geographical distribution. All of the species thus far known belong to the Southern States, and each of the Southern river-basins probably has from two to four species of the genus; not a single species, so far as known, being common to two different river-basins.

The distribution of the species of *Erogala* is as follows:—

Santee Basin: *pyrrhomelas* Cope.
chloristia J. & B.
Savannah Basin: none known.
Altamaha Basin: *xœnura* Jor.
callisema Jor.
Chattahoochee Basin: *eurystoma* Jor.
Flint River: *formosa* Putn.
Alabama Basin: *callistia* Jor.
trichroistia J. & G.
cœrulea Jor.
stigmatura Jor.

Farther west their place is taken by the species of *Cyprinella* having serrated teeth, and farther north by the species of *Luxilus*, section *Photogenis*, having teeth with developed grinding surfaces.

The species of *Codoma* are remarkable for their exquisite coloration, most of them being adorned with bright red in addition to the milky pigment. The black dorsal spot is present in all the species.

18. Codoma chloristia, *sp. nov.*

Body short and deep, strongly compressed, the form elliptical, resembling that of *C. pyrrhomelas*, but rather deeper, the depth of adults being 3¾ to 4 in length. Head rather small and pointed, 4¼ in length.

Eye moderate, less than snout, 4 in head. Mouth rather small, quite oblique, the maxillary not attaining the line of the orbit, the upper jaw projecting beyond the lower, especially in spring males. The head and mouth considerably resemble those parts in *P. analostanus*.

Scales much deeper than long, very closely and smoothly imbricated, more or less dark-edged above. 5–37–3. Lateral line decurved.

Fins moderately developed: dorsal distinctly behind ventrals, its first ray about midway between nostrils and the base of the caudal. Dorsal 1, 8. Anal 1, 8.

Nuptial tubercles in the male greatly developed, covering rather sparsely the top of the head and the region anterior to the dorsal. In addition, similar tubercles cover the caudal peduncle and the whole sides of the body, except the space below the lateral line and in front of the ventrals. The tubercles on the body are considerably smaller than those on the head, and smaller than in *xænura* or *pyrrhomelas*, but they cover a much larger area than in any of the latter species of the genus. Chin tuberculate.

Teeth 1, 4–4, 1, entire, without masticatory surface.

Coloration, in life: General color a dark steel-blue, a very distinct blue stripe along each side of the caudal peduncle, as in *C. cærulea*, but fainter: sides of body with fine steely-purple lustre: back clear green: head clear brownish: iris white: cheeks of a pale violet color: lower part of sides becoming rather abruptly milky-white: dorsal fin with the usual large black spot on the last rays well developed, and the usual milk-white pigment in the tips: lower part of the dorsal fin with pigment of a fine clear green color, somewhat as in *analostanus*, but unusually bright: caudal fin chiefly dusky, its tips milky and the base somewhat so; the middle of the fin has a slight reddish tinge: anal fin entirely milky, a faint dusky spot on its last rays, resembling that on the dorsal: ventral fins milky.

Female and young specimens are more slender, and the bright colors are usually wanting or obscured.

Size small; length of largest specimens less than three inches.

In form, this species resembles *C. pyrrhomelas*, but the short anal (eight rays instead of ten) will always distinguish the species. The coloration of the male is different, being much less brilliant, although perhaps more delicate. *C. chloristia* resembles in color *C. cærulea* most, but the latter species has a much more slender form.

Habitat.—Abundant in the clear waters of Saluda River, with *C.*

pyrrhomelas, *Photogenis niveus*, *Alburnops chlorocephalus*, and other handsome species.

19. Codoma pyrrhomelas (*Cope*) *Jor.*

Photogenis pyrrhomelas Cope (1870), Proc. Am. Philos. Soc. Phila. 463.

This species, the most ornate of the genus, and one of the most brilliant of *Cyprinidæ*, is extremely abundant in the clear rapid waters of the Saluda and its tributaries. The general color of the males is dark steel-blue above, with the scales darker-edged, the belly abruptly milky-white. The head is pale reddish; the snout, the tip of lower jaw, and the iris above and below are scarlet; the dorsal fin is dusky at base, has a large black spot on the last rays, is red in front, and broadly milk-white at tip. The tips of the caudal fin are milk-white; next to this comes a dusky crescent; a wide bright scarlet crescent lies inside of the black and extends into the two lobes of the fin. The base of the fin is pale.

The top of the head and the region in front of the dorsal are covered with small pale tubercles. The sides of the caudal peduncle are provided with rather larger tubercles, arranged in rows along the series of scales.

This is the most abundant fish in the waters of Catawba River, according to Professor Cope.

Genus NOTROPIS *Rafinesque.*

(*Minnilus* Rafinesque; *Alburnellus* Girard.)

20. Notropis photogenis (*Cope*) *Jordan.*

Squalius photogenis Cope (1864) Proc. Ac. Nat. Sc. 280.
Photogenis leucops Cope (1866), Trans. Am. Phil. Soc. 379, and elsewhere.

My specimens differ considerably from the typical forms of this species, but correspond to Professor Cope's "var. *a a a a a*" from the Catawba. It is the most abundant species in the Saluda waters, especially in more sluggish tributaries. Two forms, perhaps varieties, perhaps different sexes, occur, the one pale, with deep, compressed body; the other darker, with the scales dark-edged and the body much more elongate. It is difficult to distinguish the latter form from *N. telescopus* (Cope). The pale form has the head above and under jaw covered with small pointed tubercles.

Genus GILA *Baird & Girard.*

(Subgenus CLINOSTOMUS *Girard.*)

21. GILA VANDOISULA (*Cuv. & Val.*) *Jor.*

Leuciscus vandoisulus C. & V. (1844), Hist. Nat. Poiss. xvii, 317.
Clinostomus affinis GIRARD (1856), Proc. Ac. Nat. Sc. 212.

This species is common in the Saluda waters, as in the Catawba, Yadkin, and other Southern streams. It seems to prefer still, or even muddy waters, as we found it more abundant in the Reedy River than in either Saluda or Ennoree. Our specimens were greenish or bluish in color, the back mottled with scales of a different hue, as usual in this genus. In the males, the region behind the head and above the pectorals and extending backward to the anal are of a bright rosy-red, brightest just behind the head. There is no distinct dark lateral band. None of our specimens were noticed to be tuberculate. The characters distinguishing this species from the more northerly *Gila* (*Clinostomus*) *funduloides* have been well given by Professor Cope (Journ. Ac. Nat. Sci. Phila. 1868, 228).

Genus NOTEMIGONUS *Rafinesque.*

22. NOTEMIGONUS AMERICANUS (*Linn.*) *Jordan.*

Notemigonus ischanus JORDAN (1877), Ann. Lyc. Nat. Hist. p. 364.

This is the true *Cyprinus americanus* of Linnæus, as has been elsewhere shown. We obtained but a single specimen in the Reedy River. Professor Cope found it abundant in the sluggish waters of the Catawba. The long anal, more compressed body, larger eye, and peculiar breeding colors distinguish this species from the Northern and Western *N. chrysoleucus.*

Genus CERATICHTHYS *Baird.*

23. CERATICHTHYS ZANEMUS, *sp. nov.*

A small, peculiar species, allied to *C. labrosus* (Cope), but apparently differing in the longer barbel, smaller scales, and in the coloration.

Body long and slender, not much compressed, the depth about $4\frac{1}{4}$ ($5\frac{1}{2}$ in young) in length. Head rather long, narrow, and pointed, $4\frac{1}{4}$ in length, very slender in young specimens, stouter in adults: snout decurved in profile, with an angle in front of the nostrils. Eye moderate,

rather shorter than the long muzzle, placed nearly midway in head, about $3\frac{1}{3}$ in head.

Mouth rather large, inferior, the lips much thickened, Sucker-like; upper jaw extremely protractile; the lower with a conspicuous internal fringe of papillæ.

Barbels extremely long, probably longer than in any other of our Cyprinoids; their length $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye.

Scales moderate, pretty closely imbricated, 5–40–3; 15 or 16 in front of dorsal. Lateral line continuous, slightly deflected forward.

Fins rather small, high, and short. Dorsal 1, 8, originating slightly behind the base of the ventrals, as in *C. labrosus* and *C. monachus*. Anal 1, 7. Caudal deeply forked, its peduncle long and slender.

Coloration, in spirits, quite pale; a small, round, black spot at base of caudal: dorsal scales dark-edged: some dark points along caudal peduncle, forming a dark streak: muzzle punctate. Large specimens with a large dark patch on the last rays of dorsal, as in *C. monachus* and the species of *Codoma:* base of dorsal fin with dark points. Cheeks and opercles silvery.

In the spring, the male fishes are profusely tuberculate on the head and neck, and the fins are flushed with crimson. Teeth 1, 4–4, 1, hooked, without masticatory surface.

The largest specimens taken were nearly three inches long, but most were less than two.

This species is abundant in Saluda River. It appears to be distinct from *C. labrosus*, that species having larger scales and some other points of difference. *C. labrosus*, *monachus*, and *zanemus* differ from their congeners in the backward position of the dorsal and in the greater development of the lips.

24. Ceratichthys labrosus *Cope.*

Ceratichthys labrosus Cope (1870), Proc. Am. Philos. Soc. 458.

Professor Cope found this species not uncommon in the upper waters of the Catawba. We did not find it in the Saluda or the Ennoree.

25. Ceratichthys hypsinotus *Cope.*

Ceratichthys hypsinotus Cope (1870), Proc. Am. Philos. Soc. 458.

This species is not uncommon in the Saluda. Breeding males are violet-tinted, and the fins are quite red. The head is more or less rosy and tuberculate above. This species has a very small barbel, and might easily be taken for a *Hydrophlox* of the *rubricroceus* type.

26. CERATICHTHYS BIGUTTATUS (*Kirt.*) *Baird.*

The common Horned Chub is very abundant in all the tributaries of the Saluda.

Genus SEMOTILUS *Rafinesque.*

27. SEMOTILUS CORPORALIS (*Mit.*) *Putn.*

This common species occurs in the tributaries of the Saluda.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

(*Moxostoma* and *Teretulus* Raf.; *Ptychostomus* Ag.)

28. MYXOSTOMA CERVINUM *Cope.*

Teretulus cervinus COPE (1868), Journ. Ac. Nat. Sc. Phila. 235.
Ptychostomus cervinus COPE (1870), Proc. Am. Philos. Soc. 478.

This little Sucker is exceedingly abundant in the Saluda, Reedy, and Ennoree. It abounds in rapids and rocky shoals, and is popularly known as "Jump-rocks", from its habit of leaping from the water. It is not much valued, except by negroes, small boys, and naturalists. The black outer margin of the dorsal is a characteristic color-mark.

29. MYXOSTOMA PAPILLOSUM (*Cope*) *Jor.*

Ptychostomus papillosus COPE (1870), Proc. Am. Philos. Soc. 470.

A few specimens of this peculiar species were taken in Saluda River. Professor Cope found it abundant in the Catawba and Yadkin Rivers.

30. MYXOSTOMA VELATUM (*Cope*) *Jordan.*

Ptychostomus collapsus COPE (1870), Proc. Am. Philos. Soc. 471.

We obtained no specimens of this widely diffused species in any of the Southern rivers. Professor Cope found it in the Neuse, Yadkin, and Catawba.

31. MYXOSTOMA COREGONUS (*Cope*) *J. & B.*

Ptychostomus coregonus COPE (1870), Proc. Am. Phil. Soc. 472.

The "Blue Mullet" was found very abundant in the Catawba and Yadkin Rivers. We did not take it in the Saluda.

32. MYXOSTOMA ALBUM (*Cope*) *J. & B.*

Ptychostomus albus COPE (1870), Proc. Am. Phil. Soc. 472.

The species—the "White Mullet"—was found by Professor Cope in the Catawba River only. We obtained no specimens from the Saluda, which is perhaps due to the fact that our collections were not made during the season of the migrations.

Genus ERIMYZON *Jordan.*

(*Moxostoma* Agassiz, but not of Raf.)

33. ERIMYZON SUCETTA (*Lac.*) *Jordan.*

Cyprinus sucetta LACÉPÈDE.
Cyprinus oblongus MITCHILL.

This species is moderately abundant in the Saluda River. Professor Cope found neither this species, nor the next, in the Catawba.

Genus MINYTREMA *Jordan.*

34. MINYTREMA MELANOPS (*Raf.*) *Jor.*

Catostomus melanops RAFINESQUE, KIRTLAND, etc.
Moxostoma victoriæ GIRARD.
Erimyzon melanops JORDAN.

This widely diffused species is abundant in the mill-ponds, etc., of the Saluda River, and is known as the Striped Sucker. It is considerably valued as a food-fish. Many specimens were taken at Bannister's Mills, on the Ennoree, the proprietor of the mill, Mr. Bannister, having kindly drawn off the water from his pond, in order to enable us better to examine its fishes. Our specimens seem to be precisely like the ordinary *melanops* from the Ohio River and the Great Lakes.

Genus CATOSTOMUS *Le Sueur.*

35. CATOSTOMUS COMMERSONI (*Lac.*) *Jor.*

The Fine-scaled Sucker is common in the Saluda, as in nearly every stream east of the Rocky Mountains. It is especially abundant in mill-ponds.

SILURIDÆ.

Genus AMIURUS *Rafinesque.*

36. AMIURUS BRUNNEUS *Jordan.*

Amiurus platycephalus COPE (1870), Proc. Am. Philos. Soc. 485. (Not *Pimelodus platycephalus* Grd.)
Amiurus brunneus JORDAN (1870), Ann. Lyc. Nat. Hist. 366.

This is the common cat-fish of the Saluda, and is known as the Mud Cat. Adult specimens reach a length of about 18 inches, and bear little resemblance to the young, from which the species was first described. The adults are extremely elongate, nearly terete behind, with flat, thin, broad heads. In color, they are of a more or less clear yellowish-green, more distinctly green than is any other species. The name "*brunneus*" only applies well to the young. The species may be known from the related *A. platycephalus* by the more elongate form, the shorter anal fin (16 to 18 rays instead of 20), and by the mouth, which is somewhat inferior, the lower jaw being much the shorter, while in *A. platycephalus* the jaws are equal. The color is also different in the two species. *A. platycephalus* is yellowish, dark above, and more or less marbled on the sides with darker, resembling, in that respect, *A. marmoratus.* In *A. brunneus*, the caudal fin is usually unequal, the upper lobe being the longer, and the rudimentary caudal rays are unusually numerous. A specimen nearly a foot long had the alimentary canal four times the length of the body, and filled with *Podostemon ceratophyllum.* The stomach contained eight adult males of *Codoma pyrrhomelas.*

As Professor Cope counted 17 anal rays in his "*platycephalus*", it is likely that he had this species instead of Girard's, which has pretty uniformly 20 or 21 rays. Both *Amiurus brunneus* and *platycephalus* are valued as food.

37. AMIURUS PLATYCEPHALUS (*Girard*) *Gill.*

Pimelodus platycephalus GIRARD (1859), Proc. Ac. Nat. Sci. Phila. 160.

Many specimens of this species were taken in Bannister's mill-pond, on the Ennoree. The fishermen confound it with the preceding under the name of Mud Cat, but the species may be readily distinguished by the characters given above.

A "Blue Cat" is said to occur in the Saluda, but we obtained no specimens.

Genus NOTURUS *Rafinesque.*

38. NOTURUS INSIGNIS (*Richardson*) *Gill & Jor.*

Noturus marginatus BAIRD.

This species is abundant in the rock-pools of Reedy River. It probably occurs in all the Atlantic streams as far north as Pennsylvania.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

39. ANGUILLA VULGARIS *Fleming.*

The common Eel is abundant in all the streams of the Southern States thus far explored.

LEPIDOSTEIDÆ.

Genus LEPIDOSTEUS *Lacépède.*

40. LEPIDOSTEUS OSSEUS (*L.*) *Ag.*

This fish is said to occur in the Saluda, but we obtained no specimens.

II.—WATER-BASIN OF THE SAVANNAH RIVER.

Fifteen species are ascertained to occur in the water-basin of the Savannah. Of these, two species are recorded from specimens in the United States National Museum; one on the authority of Professor Agassiz, the others from our collections in the Tugaloo River and in Toccoa Creek. None of these species are peculiar to the Savannah Basin. The common *Cyprinidæ* are all of Tennessee River types; the others are either species of general distribution, or else are shared with other Southern streams.

In seining the Tugaloo River, two rather unexpected features were made manifest: first, the very small number of small fishes, both *Cyprinidæ* and *Etheostomatidæ* inhabiting the river. There seem to be very few species present, and these few are represented by very few individuals. Although the islands below the mouth of Panther Creek furnish a most excellent seining-ground, yet our fishing was a series of "water-hauls". A single draw of the seine in the Saluda or the Etowah would often yield more species and more individuals than were secured in the Tugaloo in a whole day.

The second peculiarity of the Tugaloo fauna is that its characteristic fishes are all of types abundant in the Tennessee River, but not known from any other of the Atlantic streams. Of these may be mentioned *Photogenis galacturus*, *Luxilus coccogenis*, *Hydrophlox rubricroceus*, and *Catostomus nigricans*. The close proximity of the sources of the Tugaloo and the Little Tennessee, War Woman Creek and Little Tennessee River rising on opposite sides of Rabun Gap, and of the Tallulah and the Hiawassee, may perhaps help to explain this anomaly of distribution.

ETHEOSTOMATIDÆ.

Genus HADROPTERUS *Agassiz.*

1. Hadropterus nigrofasciatus *Ag.*

A single large specimen was taken in Toccoa Creek, near Toccoa Falls.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

2. Micropterus salmoides (*Lac.*) *Gill.*

(Var. *salmoides.*)

The small-mouthed Black Bass or "Trout" of the Southern streams (*i. e.*, Savannah, Altamaha, Chattahoochee, Alabama) differs so constantly from Northern representatives of the same species that the two forms may be taken as geographical varieties of one species, and it is probably worth while to distinguish each by name. The *Labrus salmoides* of Lacépède was collected by Bose near Charleston, S. C. It was therefore presumably the Southern variety, which should be designated as var. *salmoides*. The oldest name known to apply to the Northern form is that of *Bodianus achigan* Raf. The Northern form may therefore be designated as *Micropterus salmoides* var. *achigan*, whenever it is deemed desirable to call attention to these variations.

The body is appreciably longer and slenderer in var. *salmoides* than in var. *achigan*, the head being about $3\frac{1}{4}$ in length instead of about $2\frac{3}{4}$. The anal rays in *salmoides* are usually 10 instead of 11; the dorsal formula X, I, 12, instead of X, I, 13. The scales are larger in *salmoides*, there being about 70 in the lateral line instead of 77. The coloration of *salmoides* is uniformly unlike that of *achigan*. The lower part of the sides

is marked by pretty regular lines of dark olive-green spots along the series of scales. The lower fins are usually more or less red, and the black, yellow, and white coloration of the caudal fin, so conspicuous in young specimens of the Northern form—in the Western States, at least—is not noticeable in the Southern variety.

This species is abundant in the tributaries of the Savannah, where it is known as the "Trout".

Genus XENOTIS *Jordan.*

3. XENOTIS SANGUINOLENTUS (*Agassiz*) *Jordan.*

JORDAN (1877), Ann. Lyc. Nat. Hist. 318.

A single specimen of this beautiful fish is in the National Museum from Augusta, Ga. It is identical with my specimens from the Etowah, mentioned in the paper above cited, but it is possibly not the species to which Agassiz gave the name of *sanguinolentus*. The species of the genus *Xenotis* are extremely difficult either to define or to recognize.

CYPRINODONTIDÆ.

Genus ZYGONECTES *Agassiz.*

4. ZYGONECTES NOTTII *Agassiz.*

A "*Zygonectes guttatus*" is recorded by Professor Agassiz from the Savannah near Augusta. Professor Putnam informs me, from the examination of the type-specimens, that the species is identical with *Z. nottii* Ag.

SALMONIDÆ.

Genus SALVELINUS *Richardson.*

5. SALVELINUS FONTINALIS (*Mitch.*) *Gill & Jor.*

The common Brook Trout is very abundant in the clear tributaries of the Chatuga and Toxaway Rivers, at the foot of the Blue Ridge. This is very near the southern limit of the species, although it is said to occur in certain tributaries of the Upper Chattahoochee, farther west.

CYPRINIDÆ.

Genus LUXILUS *Rafinesque.*

6. LUXILUS COCCOGENIS (*Cope*) *Jordan.*

This beautiful species is common in the Tugaloo. The numerous specimens were all pale, and showed only traces of the distinctive red markings.

Genus PHOTOGENIS *Cope.*

7. Photogenis galacturus (*Cope*) *J. & B.*

Hypsilepis galacturus Cope (1870), Proc. Ac. Nat. Sc. 160

The most abundant fish in the Tugaloo. Our specimens were very pale and dull colored, but they are not otherwise different from specimens of *P. galacturus* from the Tennessee and Cumberland Rivers.

Genus HYDROPHLOX *Jordan.*

8. Hydrophlox rubricroceus (*Cope*) *J. & B.*

Hybopsis rubricroceus Cope (1868), Journ. Ac. Nat. Sc. 231.

This surpassingly beautiful little fish abounds in the rock-pools of the smaller tributaries of the Tugaloo. In Toccoa Creek, it is very abundant, far outnumbering all other species. We obtained many specimens from the pool at the foot of Toccoa Falls.

The life-colors are as follows: Dark steel-blue; a dark lateral band of coaly punctulations, which is usually distinct on the anterior half of body, and passes through the eye around the snout. All the fins of a rich clear red; the dorsal rather crimson, the caudal pink, the lower fins full bright scarlet. Head all pale scarlet-red, the lower jaw flushed, as if bloody, a lustrous streak along the sides, below which is a distinct silvery lustre. Eyes silvery, somewhat flushed with red. In high coloration, the entire body becomes more or less red. This red pigment becomes more evident when a fish is first placed in alcohol. First ray of dorsal dusky on anterior edge.

Top of head and whole ante-dorsal region in males dusted with fine white tubercles.

Female specimens are pale olivaceous or silvery.

Teeth 2, 4–4, 2, with masticatory surface, the edge of which is usually crenate.

This species and the preceding were hitherto known only from the headwaters of the Tennessee River.

Genus CERATICHTHYS *Baird.*

9. Ceratichthys rubrifrons *Jordan.*

Nocomis rubrifrons Jordan (1877), Ann. N. Y. Lyceum Nat. Hist. 330.

A few specimens of this species were taken. They were brighter in color than the original types from the Ocmulgee. The muzzle was in the males bright red, and the fins somewhat rosy.

This species is related to *C. hypsinotus* (Cope), but has a less elevated dorsal region and longer barbels.

10. CERATICHTHYS BIGUTTATUS (*Kirtland*) *Girard.*

The "Horny Head" is abundant in all the small streams falling into the Tugaloo. It furnishes much harmless sport for the amateur anglers who yearly visit the beautiful Tallulah region.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

11. MYXOSTOMA CERVINUM (*Cope*) *Jor.*

The little "Jump Rocks" occurs in some abundance in the Tugaloo and its tributaries.

Genus CATOSTOMUS *Le Sueur.*

(*Hylomyzon* Agassiz.)

12. CATOSTOMUS NIGRICANS *Le S.*

The Hog-sucker occurs in rapid waters of the Tugaloo and Toccoa. It is not known to occur in any other of the Atlantic streams south of the Potomac.

SILURIDÆ.

Genus AMIURUS *Rafinesque.*

13. AMIURUS PLATYCEPHALUS (*Girard*) *Gill.*

The original types of this species in the Smithsonian Institution were from a tributary of the Savannah at Anderson, S. C.

Genus ICHTHÆLURUS *Rafinesque.*

14. ICHTHÆLURUS PUNCTATUS (*Raf.*) *Jor.*

The common "Channel Cat" is found in some abundance in the Tugaloo River.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

15. ANGUILLA VULGARIS *Fleming.*

The common Eel is an inhabitant of the waters of the Tugaloo.

III.—WATER-BASIN OF THE ALTAMAHA RIVER.

Twenty-three species are known to occur in the water-basin of the Altamaha, exclusive of the Shad (*Alosa sapidissima*), which ascends all the Southern rivers until prevented by the dams Of these twenty-three, four are known only from the Oconee and Ocmulgee, viz, *Nothonotus inscriptus*, *Hydrophlox lutipinnis*, *Codoma callisema*, and *Codoma xænura*. The others are chiefly species of general distribution. Five species were obtained by the writers in the headwaters of the Oconee River, viz, *Nothonotus inscriptus*, *Micropterus salmoides*, *Hydrophlox lutipinnis*, *Ceratichthys rubrifrons*, and *Ceratichthys biguttatus*. The other species mentioned below are from the Ocmulgee.

ETHEOSTOMATIDÆ.

Genus HADROPTERUS *Agassiz.*

1. HADROPTERUS NIGROFASCIATUS *Agassiz.*

Taken at the Flat Shoals in the South Fork of the Ocmulgee.

Genus BOLEOSOMA *DeKay.*

2. BOLEOSOMA MACULATICEPS *Cope.*

A specimen, apparently of this species, from the Ocmulgee River at Macon, Ga.

Genus NOTHONOTUS *Agassiz.*

3. NOTHONOTUS INSCRIPTUS, *sp. nov.*

Body rather stout and deep, pretty strongly compressed behind, less so anteriorly: depth $4\frac{3}{4}$ in length: caudal peduncle rather deep.

Head large, $4\frac{3}{4}$ in length, rather obtuse, the profile quite gibbous: a considerable angle formed opposite the eyes, which are high up and rather close together.

Eye about equal to snout, $3\frac{1}{2}$ in head. Mouth moderate, slightly oblique, the maxillary reaching eye, the upper jaw the longer. Cheeks and opercles entirely scaleless, as in *N. thalassinus*. Region in front of dorsal scaly: breast naked. Belly covered with ordinary scales. Scales rather large, closely imbricated, the lateral line continuous and nearly straight. Scales 5–46–5.

Fins well developed. The spinous dorsal larger than the soft dorsal,

which is somewhat larger than the anal; the two dorsal fins connected by membrane. Dorsal XI–I, 11. Anal II, 8.

Dorsal spines a little more than half the length of head. Pectorals and ventrals well developed.

Color, in spirits: Olive, with an orange spot on on each scale, these forming continuous lines along the rows of scales. These lines are quite conspicuous, as in *Xenisma catenatum*. Three dark blotches across the back: one in front of dorsal, forming a black spot on the anterior dorsal spines; one between the two dorsal fins, forming a similar black spot on the last part of the spinous dorsal; and one on the caudal peduncle, behind the second dorsal.

Sides with about six irregular dark olive blotches just below the lateral line. Second dorsal, caudal, and pectoral extensively dusky-shaded. Anal unicolor. Head dusky above, a dark line downward, and one forward from eye.

A female specimen taken lacked the lines of orange spots, and it was more distinctly blotched on the sides. In life, the male specimen had the entire anal fin, the cheeks, opercles, and a bar below the eye bright blue. The extreme edge of the spinous dorsal was blackish; below this bright orange red, and a dusky bar at the base. The colored lines of spots were ferruginous, or scarlet-red, rather than orange.

Length 2½ inches.

Two specimens only were taken, in the upper waters of the Oconee River, at Sulphur Springs, in Hall County, Georgia.

This is one of the most beautiful of this interesting genus. In the smooth head, it resembles *N. thalassinus*, and differs from the others known. The entirely dissimilar coloration separates it at once from *N. thalassinus*.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

4. MICROPTERUS SALMOIDES (*Lac.*) *Gill.*

Var. *salmoides.*

Abundant in the Oconee and Ocmulgee.

Genus CHÆNOBRYTTUS *Gill.*

5. CHÆNOBRYTTUS VIRIDIS (*C. & V.*) *Jordan.*

The "War-mouth Perch" is abundant in the Ocmulgee.

Genus LEPIOPOMUS *Rafinesque.*

6. LEPIOPOMUS AURITUS (*L.*) *Raf.*

Common in the Ocmulgee River.

Genus CENTRARCHUS *Cuvier & Valenciennes.*

7. CENTRARCHUS MACROPTERUS (*Lacépède*) *Jordan.*

Several specimens of the large-finned *Centrarchus* are in the United States National Museum, from the Ocmulgee River, near Macon, Ga. The characters distinguishing this species from *C. irideus* are given in Bulletin No. 10 of the National Museum, p. 31.

ESOCIDÆ.

Genus ESOX *Linnæus.*

8. ESOX RETICULATUS *Le Sueur.*

Found in the Ocmulgee River.

CYPRINIDÆ.

Genus ALBURNOPS *Girard.*

(Subgenus HUDSONIUS *Grd.*)

9. ALBURNOPS AMARUS (*Grd.*) *Jordan.*

Hybopsis hudsonius var. *amarus* JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 362.

Very abundant in the South Fork of the Ocmulgee. This is possibly not Girard's *amarus*, but at present I think that it is. *Leuciscus spirlingulus* C. & V. seems to be *A. hudsonius*.

Genus HYDROPHLOX *Jordan.*

10. HYDROPHLOX LUTIPINNIS, *sp. nov.*

A brilliantly colored little fish allied to *H. rubricroceus*.

Body stout and rather strongly compressed, the depth $4\frac{1}{4}$ in length, the dorsal region somewhat elevated, the outline of the back sloping each way from the base of the dorsal fin.

Head short and rather deep, 4 to $4\frac{1}{4}$ in length, broad and flattish

above, the muzzle moderately rounded. Eye rather large, nearly as long as the muzzle, 3½ to 3¾ in head.

Mouth large, quite oblique, the maxillary reaching to orbit, the mandible included.

Scales medium, 6–40–3, rather closely imbricated, about 21 in front of the dorsal. Dorsal nearer caudal than muzzle, distinctly behind the ventrals. Dorsal I, 8. Anal I, 8. Pectorals not reaching nearly to ventrals, the latter not to vent.

Color, in spirits: Clear olive; a dark, burnished, plumbeous lateral band, which extends through the eye and up the caudal fin: whole body bright crimson: fins yellow.

Colors, in life: Clear olive above, with very intense green dorsal and vertebral lines; an intense metallic blackish band along sides; below this the sides bright silvery, in the males bright, clear red, the color of red berries; the whole body more or less flushed with red, the belly especially bright: iris crimson.

Fins all bright golden-yellow: silvery space below eye strongly marked: tip of lower jaw black.

Teeth 2, 4–4, 2, with masticatory surface developed.

Length 2½ to 3 inches.

This species is extremely abundant in the headwaters of the Oconee, in clear rapid streams. It is one of the most brilliant of the genus.

Hydrophlox lutipinnis is deeper-bodied than *H. rubricroceus*. It has also a smaller mouth and different coloration, especially of the fins. From *A. chlorocephalus*, it differs in the larger mouth, larger size, and smaller scales: the pectoral and ventral fins are also usually shorter. The teeth, also, are 2, 4, instead of 1, 4.

Genus CODOMA *Girard.*

11. CODOMA XÆNURA *Jordan.*

Minnilus (Photogenis) xænurus JORDAN (1877), Proc. Ac. Nat. Sc. Phila. 79.

This beautiful fish is the most abundant species in the rapids of the Ocmulgee at Flat Shoals.

12. CODOMA CALLISEMA *Jordan.*

Episema calliscma JORDAN (1877), Ann. Lyc. Nat. Hist. 363.

This species, one of the most elegant of the genus, is very abundant in the South Fork of the Ocmulgee. It differs from the other species of

the genus in the presence of a single row of teeth and in the more anterior position of the dorsal, which is scarcely at all posterior to the ventrals. It is, however, rather a *Codoma* than an *Episema*.

Genus NOTEMIGONUS *Rafinesque.*

13. NOTEMIGONUS AMERICANUS (*L.*) *Jor.*

Notemigonus ischanus JORDAN (1877), Ann. Lyc. Nat. Hist. 364.

Very abundant everywhere in the Ocmulgee in still or deep waters. Adult specimens have the lower fins yellow, tipped with scarlet.

Genus CERATICHTHYS *Baird.*

14. CERATICHTHYS RUBRIFRONS *Jordan.*

Nocomis rubrifrons JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 330.

This handsome little fish was first described from the Ocmulgee River, where it is abundant. It is also common in the Oconee.

15. CERATICHTHYS BIGUTTATUS (*Kirt.*) *Girard.*

Abundant in the Oconee; not noticed in the Ocmulgee.

Genus SEMOTILUS *Rafinesque.*

16. SEMOTILUS CORPORALIS (*Mit.*) *Putnam.*

From a small brook, tributary to the Ocmulgee. In the South, this species is almost confined to the smaller creeks and spring runs.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

17. MYXOSTOMA CERVINUM (*Cope*) *Jordan.*

The little "Jump Rocks" is very abundant at the Flat Shoals of the Ocmulgee.

18. MYXOSTOMA PAPILLOSUM (*Cope*) *Jordan.*

Common in the Ocmulgee.

Genus ERIMYZON *Jordan.*

19. ERIMYZON SUCETTA (*Lac.*) *Jordan.*

From the Ocmulgee.

SILURIDÆ.

Genus ICHTHÆLURUS *Rafinesque.*

20. ICHTHÆLURUS PUNCTATUS (*Rafinesque*) *Jordan.*

Very common in the Ocmulgee.

Genus AMIURUS *Rafinesque.*

21. AMIURUS MARMORATUS (*Holbrook*) *Jordan.*

A single specimen is in the National Museum, collected by Dr. Holbrook in the Altamaha River. The species occurs in abundance in the streams and sloughs of Southern Illinois.

22. AMIURUS BRUNNEUS *Jordan.*

Very abundant in the Ocmulgee, from which river it was first described.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

23. ANGUILLA VULGARIS *Fleming.*

Eels occur in all the larger tributaries of the Oconee and Ocmulgee.

IV.—WATER BASIN OF THE CHATTAHOOCHEE RIVER.

Our collections in the Chattahoochee Basin have been rather unsatisfactory, as only twenty-one species have been obtained. Of these, three seem to be characteristic of the river, and have not yet been obtained elsewhere: *Semotilus thoreauianus*, *Photogenis leucopus*, and *Codoma eurystoma*. The other species taken are found also either in the Altamaha or Alabama, or both.

The Chattahoochee is noteworthy as being, so far as is at present known, the easternmost limit in the Southern States of the Rock Bass (*Ambloplites rupestris*) and the Red Horse (*Myxostoma duquesnii*), as the westernmost limit of the range of the "Green Cat" (*Amiurus brunneus*), the War-mouth Perch (*Chænobryttus viridis*), and the "Jump Rocks" (*Myxostoma cervinum*). It is also the westernmost of the series of rivers—Great Pedee, Santee, Savannah, Altamaha, and Chattahoochee—in which *Luxilus cornutus* does not occur.

Four of the species here mentioned were collected several years ago by Dr. Hugh M. Neisler at some point in Georgia, the record of the locality not certainly preserved, but supposed to be Flint River, and are now in the Museum of the Smithsonian Institution. These are *Campostoma anomalum*, *Semotilus thoreauianus*, *Codoma formosa* ("*grandipinnis*"), and *Aphododerus sayanus* ("*Asternotremia mesotrema*").

ETHEOSTOMATIDÆ.

Genus HADROPTERUS *Agassiz.*

1. HADROPTERUS NIGROFASCIATUS *Agassiz.*

Abundant at the Shallow Ford of the Chattahoochee near Gainesville, Ga.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

2. MICROPTERUS PALLIDUS (*Raf.*) *G. & J.*

Not very abundant.

3. MICROPTERUS SALMOIDES (*Lac.*) *Gill.*

Very common.

Genus AMBLOPLITES *Rafinesque.*

4. AMBLOPLITES RUPESTRIS (*Raf.*) *Gill.*

Abundant.

Genus LEPIOPOMUS *Rafinesque.*

5. LEPIOPOMUS PALLIDUS (*Mit.*) *G. & J.*

(*Ichthelis incisor* Holbrook.)

A few specimens taken in Peach Tree Creek near Atlanta.

6. LEPIOPOMUS AURITUS (*L.*) *Raf.*

Abundant at the Shallow Ford of the Chattahoochee. My specimens are more elongate than those from the Saluda, and they differ somewhat in coloration and squamation. The dark blotches at the base of the dorsal are wanting. I am not, however, disposed to consider them as specifically distinct.

APHODODERIDÆ.

Genus APHODODERUS *Le Sueur.*

7. APHODODERUS SAYANUS (*Gill*) *DeK.*

The specimen described in Bulletin No. 10, U. S. Nat. Mus., as *Asternotremia mesotrema* Jor., doubtless belongs to this species. The "genus" *Asternotremia* is probably an immature stage of *Aphododerus.*

CYPRINIDÆ.

Genus PHOTOGENIS *Cope.*

8. PHOTOGENIS LEUCOPUS, *sp. nov.*

A slender, rather plain species, closely resembling *Photogenis niveus* from the Saluda.

Body elongate, compressed, tapering toward the snout and the long caudal peduncle. Depth 4⅓ in length. Head moderate, 4½ in length, larger than in *P. niveus*, rather pointed, wide on top. Snout rather long and somewhat pointed. Mouth large, quite oblique, the intermaxillaries on the level of the pupil: upper jaw slightly longest. Eye moderate, rather less than snout, 3½ in head. Scales moderate, rather closely imbricated, but less so than in *P. analostanus*, 6–39–3.

Fins moderate, D. I, 8, A. I, 8, the dorsal evidently behind the ventrals. Pectorals not reaching nearly to ventrals, the latter not quite to vent. Neither dorsal nor anal specially elevated.

Teeth 1, 4–4, 1, hooked, with narrow grinding surfaces and usually somewhat crenate.

Color olivaceous, the sides bright silvery: a rather inconspicuous dark blotch on last rays of dorsal, as in related species. A round black spot, nearly as large as eye, at base of caudal, precisely as in *Codoma eurystoma.* In life, the coloration is pale; the dorsal fin is chiefly of a clear yellowish-green color, as though yellowish pigment were mixed with white; the upper part is of a pale ferrugineous-red and the extreme tip milky-white. The caudal fin is ferrugineous, with milk-white tips. The lower fins, especially the ventrals, are milk-white. The snout in males is tuberculate, and very minute prickles occur on the sides of the caudal peduncle. Length 3½ to 4 inches.

Very abundant in the Chattahoochee River at the Shallow Ford; not noticed elsewhere.

Compared with *P. niveus*, *P. leucopus* has a different form, the dorsal region is less elevated, and the nuchal region less depressed. The mouth is larger, the maxillary extending to nearly opposite the eye, instead of falling short. The eye is larger and the mouth is less inferior in *P. leucopus*. The coloration is somewhat different.

Photogenis leucopus also resembles *Codoma eurystoma*, but that species has a heavier head, larger eye, stouter body, and different dentition and coloration.

Genus CODOMA *Girard.*

9. Codoma eurystoma *Jordan.*

Photogenis eurystomus Jordan (1877), Ann. Lyc. Nat. Hist. 356.

This is the most abundant Cyprinoid in the tributaries of the Chattahoochee River. It frequents especially the cold streams, but does not seem to be adverse to mud. In Suwannee Creek, a deep, cold, muddy stream flowing through the woods, this was almost the only species obtained.

Its life-colors are as follows: General color of *Luxilus cornutus* on body, but the sides with considerable coppery lustre. Dorsal fin with a sharp, black, horizontal bar about half-way up. In young fishes, this bar is red. The fin above is somewhat milky; below, it is pale. There is a small, but distinct, round, black, caudal spot. The caudal fin is chiefly of a rather dull ferruginous red. The base of the fin is pale, the tips rather milky. The anal fin is unmarked. There are gilt lines along the back and sides. A dark humeral bar is usually present, and the upper edge of the pectoral fin is largely black.

The teeth of this species are usually 1, 4–4, 1, as at first described, but we have found several individuals 1, 4–4, 2. This species resembles somewhat *Photogenis leucopus*, but it is stouter every way, with deeper body, larger head, and much larger eye.

10. Codoma formosa (*Putnam*) *Jordan.*

(*Alburnus formosus* Putnam, *Leuciscus hypsclopterus* Günther, *Photogenis grandipinnis* Jordan.)

The typical specimens of *P. grandipinnis* are supposed to have been collected in Flint River. *Leuciscus hypsclopterus* of Günther is doubtless the same species. We follow Günther in identifying *Alburnus formosus* Putnam as the same, although there is little in the very imperfect original description to warrant it.

Genus CAMPOSTOMA *Agassiz.*

11. CAMPOSTOMA ANOMALUM (*Raf.*) *Ag.*

Specimens in Dr. Neisler's collection, supposed to have been taken in the Flint River, in Taylor County, Georgia.

Genus SEMOTILUS *Rafinesque.*

12. SEMOTILUS THOREAUIANUS *Jordan.*

The types are in Dr. Neisler's collection, probably from Flint River.

Genus CERATICHTHYS *Baird.*

13. CERATICHTHYS BIGUTTATUS (*Kirtland*) *Girard.*

Very abundant in the Chattahoochee.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

14. MYXOSTOMA DUQUESNII (*Le Sueur*) *Jordan.*

A species which we are unable to distinguish from the common "Red Horse" of the Ohio is abundant in the Chattahoochee.

15. MYXOSTOMA CERVINUM *Cope.*

A few specimens taken in the Shallow Ford.

Genus ERIMYZON *Jordan.*

16. ERIMYZON SUCETTA (*Lac.*) *Jor.*

From Peach Tree Creek near Atlanta.

SILURIDÆ.

Genus ICHTHÆLURUS *Rafinesque.*

17. ICHTHÆLURUS PUNCTATUS (*Raf.*) *Jor.*

The Channel Cat is exceedingly abundant in the Chattahoochee.

Genus AMIURUS *Rafinesque.*

18. AMIURUS BRUNNEUS *Jordan.*

This is the most abundant edible fish in the Chattahoochee. We secured upwards of forty large specimens in two hours' seining at the Shallow Ford. It grows to the length of about 18 inches, and is much valued as food. It is usually known as the Mud Cat.

Genus NOTURUS *Rafinesque.*

19. NOTURUS LEPTACANTHUS *Jordan.*

Noturus leptacanthus JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 352.

This species was originally described from a single specimen taken in Silver Creek, a tributary of the Etowah. A second specimen, similar to the first, was taken by us at the Shallow Ford during the past summer, and since then a third, at the same locality as the first. In color, this species is of a rich pale transparent brown, very slightly mottled with darker.

LEPIDOSTEIDÆ.

Genus LEPIDOSTEUS *Lacépède.*

20. LEPIDOSTEUS OSSEUS (*L.*) *Ag.*

Taken at the Shallow Ford.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

21. ANGUILLA VULGARIS *Fleming.*

Eels, of course, abound in the Chattahoochee.

V.—WATER-BASIN OF THE ALABAMA RIVER.

The fish-fauna of the Alabama River is now better known than that of any other of the Southern streams. Fifty-five species are now known as inhabitants of that river and of its great tributaries, the Etowah, Oostanaula, and Coosa. A slight examination of any suitable tributary of the Alabama is sufficient to show that it is much richer in species than are any of the rivers lying to the eastward of it.

Of these fifty-six species, thirteen are as yet only known from the

Alabama Basin. These are: *Xenisma stelliferum*, *Zygonectes guttatus*, *Zygonectes hieroglyphicus*, *Hydrophlox xænocephalus*, *Hydrophlox chrosomus*, *Codoma callistia*, *Codoma trichroistia*, *Codoma cærulea*, *Codoma stigmatura*, *Notropis stilbius*, *Phenacobius catostomus*, *Catostomus nigricans etoranus*, and *Myxostoma euryops*. I exclude from this enumeration one or two species recorded from the Black Warrior River, as it is likely that the fauna of that stream will prove, in part at least, different.

Certain common Northern or Western types, apparently absent in the streams hitherto noticed, make their appearance in the waters of the Alabama. Among these are *Luxilus cornutus*, *Notemigonus chrysoleucus*, *Chænobryttus gulosus*, *Hyodon*, *Phenacobius*, etc.

ETHEOSTOMATIDÆ.

Genus PERCINA *Haldeman.*

1. PERCINA CAPRODES (*Raf.*) *Grd.*

Abundant: precisely like Northern specimens.

Genus HADROPTERUS *Agassiz.*

2. HADROPTERUS NIGROFASCIATUS *Agassiz.*

Abundant: first described from near Mobile.

Genus ULOCENTRA *Jordan.*

3. ULOCENTRA STIGMÆA *Jordan.*

Boleosoma stigmæa JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 311.

Common in clear water. This species also occurs in the streams of Louisiana.

Genus BOLEICHTHYS *Girard.*

4. BOLEICHTHYS ELEGANS *Girard.*

Abundant in clear, weedy ponds. This may not be identical with Girard's species, which was originally described from Texas.

PERCIDÆ.

Genus STIZOSTETHIUM *Rafinesque.*

5. STIZOSTETHIUM SALMONEUM *Rafinesque.*

In the river-channels of the Oostanaula. We have had no opportunity to examine specimens, and we are not sure that the Alabama fish is the original *salmoneum*.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

6. MICROPTERUS PALLIDUS (*Raf.*) *G. & J.*

Abundant.

7. MICROPTERUS SALMOIDES (*Lac.*) *Gill.*
(Var. *salmoides.*)

Abundant, but less so than the preceding. The two species are known indiscriminately as "Trout".

Genus CHÆNOBRYTTUS *Gill.*

8. CHÆNOBRYTTUS GULOSUS (*C. & V.*) *Gill.*

From the Alabama River at Montgomery.

Genus AMBLOPLITES *Rafinesque.*

9. AMBLOPLITES RUPESTRIS (*Raf.*) *Gill.*

From the Etowah and Oostanaula; rather common.

Genus LEPIOPOMUS *Rafinesque.*

10. LEPIOPOMUS PALLIDUS (*Mit.*) *G. & J.*

Abundant in the Etowah and Oostanaula.

11. LEPIOPOMUS OBSCURUS (*Agassiz*) *Jor.*

Not rare in the Etowah and Oostanaula.

Genus XENOTIS *Jordan.*

12. XENOTIS INSCRIPTUS (*Agassiz*) *Jor.*

From the Oostanaula.

13. XENOTIS SANGUINOLENTUS (*Agassiz*) *Jor.*

Very abundant in the Etowah and Oostanaula.

Genus EUPOMOTIS *Gill & Jordan.*

14. EUPOMOTIS PALLIDUS (*Agassiz*) *G. & J.*

Specimens from the Alabama River near Montgomery. This species and the three preceding were first described from the Tennessee River in Alabama.

Genus CENTRARCHUS *Cuvier & Valenciennes.*

15. CENTRARCHUS IRIDEUS (*Lac.*) *C. & V.*

Specimens from Alabama River, at Montgomery, similar to others from the Neuse and from about Charleston. This species has been found by Prof. S. A. Forbes in Southern Illinois.

Genus POMOXYS *Rafinesque.*

16. POMOXYS NIGROMACULATUS (*Le S.*) *Girard.*

Specimens from the Alabama River at Montgomery.

17. POMOXYS ANNULARIS *Raf.*

From Round Lake near Montgomery.

SCIÆNIDÆ.

Genus HAPLOIDONOTUS *Rafinesque.*

18. HAPLOIDONOTUS GRUNNIENS *Rafinesque.*

Abundant in the Oostanaula.

COTTIDÆ.

Genus POTAMOCOTTUS *Gill.*

19. POTAMOCOTTUS MERIDIONALIS (*Girard*) *Gill.*

Potamocottus carolinæ GILL (1861), Proc. Bost. Soc. Nat. Hist.
Potamocottus zopherus JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 320.

Exceedingly abundant in all the clear and cold tributaries of the Etowah, Oostanaula, and Coosa. Many specimens from the cold waters of the Cave Spring Creek. We are unable to satisfactorily distinguish the forms called *zopherus*, *carolinæ*, and *meridionalis*, and, believing them specifically identical, we unite them under the oldest name.

APHODODERIDÆ.

Genus APHODODERUS *Le Sueur.*

(*Aphredoderus* Le S.; *Sternotremia* Nelson.)

20. APHODODERUS SAYANUS (*Gilliams*) *DeKay.*

Specimens from Alabama River near Montgomery. The fish described by Professor Jordan from Flint River, under the name of *Asternotremia mesotrema*, is undoubtedly a variation of this species.

CYPRINODONTIDÆ.

Genus XENISMA *Jordan.*

21. XENISMA STELLIFERUM *Jordan.*

Xenisma stellifera JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 322.

This most exquisitely colored fish is very abundant in all the clear tributaries of the Etowah, Oostanaula, and Coosa. It prefers cold waters, and ascends the "spring-runs" to their fountain-heads.

Genus ZYGONECTES *Agassiz.*

22. ZYGONECTES NOTTII *Agassiz.*

Many specimens in the Museum of the Academy of Natural Sciences of Philadelphia, from near Mobile. This and the next belong to the group of short-bodied species called *Micristius* by Professor Gill.

23. ZYGONECTES GUTTATUS *Agassiz.*

Recorded by Professor Agassiz from near Mobile.

24. ZYGONECTES HIEROGLYPHICUS *Agassiz.*

Recorded by Professor Agassiz from near Mobile. We have never seen either this or the preceding, and doubt if any one will ever recognize them from the published descriptions.

ESOCIDÆ.

Genus ESOX *Linnæus.*

25. ESOX RETICULATUS *Le Sueur.*

Abundant in tributaries of the Etowah.

26. ESOX RAVENELI *Holbrook.*

A few specimens in the United States National Museum from the Alabama River.

HYODONTIDÆ.

Genus HYODON *Le Sueur.*

27. HYODON SELENOPS *Jordan & Bean.*

Hyodon selenops JORDAN & BEAN (1877), Bulletin U. S. Nat. Mus. x. 65.

A single specimen in the National Museum from the Alabama River at Montgomery.

DOROSOMATIDÆ.

Genus DOROSOMA *Rafinesque.*

28. Dorosoma cepedianum (*Lac.*) *Gill.*

(Var. *heterurum* Raf.)

Specimens in the United States National Museum from Round Lake at Montgomery, Ala.

CYPRINIDÆ.

Genus CAMPOSTOMA *Agassiz.*

29. Campostoma anomalum (*Raf.*) *Ag.*

Var. *prolixum* (Storer).

Abundant in the Etowah and Oostanaula.

Genus LUXILUS *Rafinesque.*

30. Luxilus cornutus (*Mit.*) *Jor.*

Very abundant in all the tributaries of the Etowah, Oostanaula, and Coosa Rivers.

My specimens do not obviously differ from those from New York and the Northwest.

Genus HYDROPHLOX *Jordan*

31. Hydrophlox chrosomus *Jordan.*

Hybopsis chrosomus Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 333.

Very abundant in the clear tributaries of the Oostanaula, Coosa, and Etowah. In Cedar Creek, at Cave Spring, it is the commonest species occurring in the clear, cold waters, with *Codoma callistia* and *Xenisma stelliferum*. None of our *Cyprinidæ* excel *Hydrophlox chrosomus* in delicacy of coloration. It is of a clear hyaline-green above; clear silvery below: a scarlet band straight from upper edge of opercle to caudal: dorsal, anal, and caudal each with a scarlet bar. In this species, the mouth is rather less terminal than is usual in the group called *Hydrophlox*.

32. Hydrophlox xænocephalus *Jordan.*

Hybopsis xænocephalus Jordan (1877), Ann. Lyc. Nat. Hist. 334.

With the preceding, but rather less common. This species bears some resemblance to the young of *Codoma callistia*.

Genus CODOMA *Girard.*

33. Codoma stigmatura *Jordan.*

Photogenis stigmaturus Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 337.

This elegant species is very abundant in the tributaries of the Etowah, Oostanaula, and Coosa. In those streams which are neither very clear and cold nor very muddy, it is usually the most abundant species.

34. Codoma callistia *Jordan.*

Photogenis callistius Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 337.

A large, ornate species, more brilliantly colored than the preceding, but less graceful in form. Female specimens are dull dark olive, with the dorsal fin brick-red. This species occurs with the preceding, but is rather less abundant.

35. Codoma trichroistia *Jordan & Gilbert, sp. nov.*

A small, slender species, graceful in form and elegant in coloration. It is most nearly related to *C. callistia*, but may be readily distinguished.

Body rather slender, considerably compressed, the depth $4\frac{1}{4}$ in length. Head rather slender and pointed, $4\frac{1}{8}$ in length. Eye of moderate size, $3\frac{1}{3}$ in head. Mouth quite large, very oblique, the maxillary extending to opposite the anterior margin of the eye, and the premaxillaries being on a level with the middle of the pupil, the mouth thus being similar to that of the species of *Notropis*. In *C. callistia*, the mouth is much more inferior, nearly horizontal; the maxillaries do not extend to the eye, and the *premaxillaries are entirely below the level of the orbit.*

Scales rather closely imbricated, 6–42–3; lateral line considerably decurved, usually with an abrupt angulation between pectorals and ventrals; 18 or 19 scales before dorsal fin (15 or 16 in *C. callistia*).

Fins moderately developed: dorsal well behind ventrals, rather nearer caudal than muzzle. Dorsal I, 7. Anal I, 9. Pectorals falling somewhat short of ventrals; the latter reaching beyond vent nearly to base of anal.

Color: Bright steel-blue above: sides bright silvery; in males, more or less milky. A large black spot at base of caudal, precisely as in *C. callistia*, not nearly so distinct as in *C. stigmatura*. Head silvery; above bluish. Dorsal fin with a broad, dusky, horizontal band at base; the membrane of the last rays above jet-black, blacker than in the other species; the tip of the fin milk-white. The rest of the dorsal fin, espe-

cially the anterior part, is of a bright pale vermillion-red. The caudal fin is chiefly rosy, the tips milk-white. The anal is milky, with a decided flush of rose-color. The ventrals are milky.

Female specimens are duller, but the black fin-markings and the caudal spot are similar in all. In the female of *C. callistia*, the dorsal markings are obliterated.

In the males, in spring, the head and anterior dorsal region are rather sparsely tuberculate. The caudal peduncle and the space below the lateral line as far forward as the ventrals are covered with similar tubercles.

Teeth 1, 4–4, 1, of the usual type, hooked and sharp-edged. Maximum length $2\frac{3}{4}$ inches. *C. callistia* reaches a length of 4 inches.

Codoma trichroistia is very abundant in the clear tributaries of the Etowah and Oostanaula. Specimens were taken by Messrs. Jordan and Gilbert in 1876, but the species was at first confounded by us with *C. callistia*, which it much resembles in coloration. The entirely different mouth will distinguish the two species at once.

36. Erogala cærulea *Jordan.*

Photogenis cæruleus Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 338.

This most delicate and graceful fish has thus far been only found in the Oostanaula River and its tributary, Rocky Creek. It prefers clear waters.

37. Codoma formosa (*Putnam*) *Jordan.*

The typical specimens of *Alburnus formosus* Putnam and of *Leuciscus hypselopterus* Günther were obtained from near Mobile. The species therefore belongs to the fauna of the Alabama Basin. Günther's description applies well to "*Photogenis grandipinnis* Jor.", and *Alburnus formosus* is probably the same.

The following is an analysis of the characters of the species of the subgenus *Erogala* at present known:—

Section I. Anal fin elongate, its rays I, 10, or I, 11: teeth 1, 4–4, 1.

a. Dorsal fin entirely posterior to ventrals, its rays, in males, longer than head, reaching nearly to the base of the caudal: body short, much compressed: back elevated; depth 4 in length: head $4\frac{1}{4}$: mouth large, very oblique, the jaws equal: black dorsal blotch very distinct: a distinct black caudal spot: coloration and tubercles unknown: size small; length $2\frac{1}{2}$ inches. ..... formosa, 1.

aa. Dorsal fin slightly posterior to ventrals, its longest rays, in males, shorter than the head, and not reaching nearly to base of caudal: caudal peduncle tuberculate: fins with much red: size medium; length $3\frac{1}{4}$ inches.

b. Body deep, compressed; depth 3½ to 3¾ in length: fins all greatly elevated; the height of the dorsal five-sixths the length of the head: muzzle, anterior part of dorsal fin, and a broad crescent in the middle of the caudal fin bright scarlet: posterior margin of caudal blackish; no black spot at base of caudal ..... PYRRHOMELAS, 2.

bb. Body more elongate, less compressed, its depth 4 to 4¼ in length: fins all rather low, the longest dorsal ray scarcely ⅔ length of head: dorsal, anal, and caudal fins chiefly bright crimson: no definite dark margin to caudal: a faint black caudal spot ..... XÆNURA, 3.

Section II. Anal fin short, its rays I, 8, or I, 9.

* Teeth one-rowed, 4–4. Dorsal fin scarcely at all posterior to ventrals, its first ray nearer snout than base of caudal: body elongate, compressed: mouth smallish, oblique, rather inferior: dorsal fin greatly elevated, the longest ray, in males, longer than the head: black dorsal blotch well marked: dorsal, anal, and caudal fins chiefly of a bright ferruginous-orange; a blue streak along sides: size small; length 2¾ inches ... CALLISEMA, 4.

** Teeth two-rowed, I, 4–4, I (often I, 4–4, 2, in *C. eurystoma*).

c. Black markings of the dorsal fin not in the form of a horizontal bar across the fin.

d. Adult males without red markings on the fins.

e. No distinct black or dark blue spot at base of caudal: body short and deep, strongly compressed: fins not greatly elevated, the dorsal largely of a bright lustrous pale green: black dorsal markings distinct: a bluish streak along sides: males with the whole body tuberculate, except the space anterior to the ventrals and below the lateral line: head pointed: mouth oblique, the upper jaw projecting: size small; length 3 inches ..... CHLORISTIA, 5.

ee. A rather faint dark blue caudal spot, preceded by a very distinct lateral band of clear blue: sides chiefly blue and silvery: fins clear yellow, the black markings obscure: body slender: mouth small: fins not greatly elevated: size small; length 2¾ inches ..... CÆRULEA, 6.

eee. A large, very conspicuous jet-black spot at base of caudal: body elongate, moderately compressed: color pale olivaceous or bluish: sides silvery: fin-markings rather obscure: fins rather low: mouth oblique, the lower jaw the shorter: scales large; size large: length 4 inches.. STIGMATURA, 7.

dd. Adult males with the vertical fins chiefly red: a well-marked black caudal spot, less distinct than in *C. stigmatura*.

f. Mouth large, quite oblique, the jaws about equal, the maxillary reaching to opposite the eye *and the premaxillaries anteriorly* on the level of the pupil: body slender, compressed: dorsal fin dusky at base, jet-black on last rays, the fin otherwise, as well as the anal and caudal pale vermillion: caudal peduncle tuberculate: dorsal markings usually distinct in both sexes: size small; length 2¾ inches ..... TRICHROISTIA, 8.

ff. Mouth nearly horizontal, overlapped by the heavy snout, the maxillary not reaching to the eye, and the *premaxillaries anteriorly* below the level of the orbit: dorsal fin dusky at the base and on the last rays, the greater part of the fin, as well as of the caudal, bright carmine: coloration of body quite dark, blue in males, olive in females: dorsal markings obscure in the latter: body stout, not greatly compressed, the back somewhat elevated: size large; length 4 inches ..... CALLISTIA, 9.

cc. Black markings of the dorsal fin in the form of a horizontal bar across the fin midway: body stout and deep, not greatly compressed: head heavy: mouth large, oblique, with equal jaws: eye very large; a small but distinct black caudal spot: fins with pale red: teeth sometimes 1, 4–4, 2: size large; length 4 inches: appearance of *Luxilus* ..... EURYSTOMA, 10.

Genus NOTROPIS *Rafinesque.*

38. Notropis lirus *Jordan.*

Nototropis lirus Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 342.

Common in tributaries of the Etowah, Oostanaula, and Coosa in still, deep waters. This species is not, by any means, a typical member of the genus. In form, coloration, squamation, and nuptial tubercles, it resembles the species of *Lythrurus*, from which it is technically separated by the want of masticatory surface on the teeth. *Notropis matutinus* approaches it in the small size of its scales.

39. Notropis stilbius *Jordan.*

Nototropis stilbius Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 343.

Abundant in the water-basin of the Alabama. The species of this genus greatly need revision.

Genus NOTEMIGONUS *Rafinesque.*

40. Notemigonus chrysoleucus (*Mit.*) *Jor.*

(*Stilbe americana* of most writers; not *Cyprinus americanus* Linnæus, which is a Southeastern species—*Notemigonus ischanus* Jor.)

This familiar species is very abundant in bayous and weedy streams in the basin of the Alabama.

Genus PHENACOBIUS *Cope.*

41. Phenacobius catostomus *Jordan.*

Phenacobius catostomus Jordan (1877), Ann. Lyc. Nat. Hist. N. Y. 332.

This strongly marked species was found in abundance in two clear streams, Silver Creek and Cedar Creek, tributaries respectively to the Etowah and the Coosa. This is a much stouter species than *P. uranops* Cope; it has less developed lips and is in various other ways dissimilar.

Genus CERATICHTHYS *Baird.*

42. Ceratichthys winchelli (*Girard*) *Jordan.*

Hybopsis winchelli Girard (1856), Proc. Ac. Nat. Sc. Phila. 1856, 211.
Ceratichthys hyalinus Cope (1868), Journ. Ac. Nat. Sc. Phila. 1868, 236.

Very common in the Alabama Basin. *C. biguttatus* was not obtained by us in any of the tributaries of the Alabama. It seems, however, to have been described by Girard, from the Black Warrior, under the name of *Nocomis bellicus.*

Genus SEMOTILUS *Rafinesque.*

43. SEMOTILUS CORPORALIS (*Mit.*) *Putnam.*

Common in the smaller streams.

Genus RHINICHTHYS *Agassiz.*

44. RHINICHTHYS OBTUSUS *Agassiz.*

Very common in the spring-runs tributary to the Etowah and Oostanaula.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

45. MYXOSTOMA MACROLEPIDOTUM DUQUESNII (*Le S.*) *Jordan.*

The "Red Horse" is common in the Etowah and Oostanaula. Var. *lachrymale* (Cope) also occurs.

46. MYXOSTOMA EURYOPS *Jordan.*

Myxostoma euryops JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 348.

From Lovejoy's Creek, a tributary of the Oostanaula. The type-specimen of this singular species still remains unique.

Genus CATOSTOMUS *Le Sueur.*

47. CATOSTOMUS NIGRICANS ETOWANUS *Jordan.*

Catostomus nigricans var. *etowanus* JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y.

The Hog Mullet, or Crawl-a-bottom, is very abundant in all rapid streams in the Alabama Basin. The characters separating var. *etowanus* from *nigricans* seem to be pretty constant. I do not, however, think them distinct species.

Genus ERIMYZON *Jordan.*

48. ERIMYZON SUCETTA (*Lac.*) *Jordan.*

This species, known locally as the May Sucker, is abundant in the water-basin of the Alabama.

Genus MINYTREMA *Jordan.*

49. MINYTREMA MELANOPS *Jordan.*

The "Sand Sucker" is abundant in the waters of the Alabama.

Genus CARPIODES *Rafinesque.*

50. CARPIODES CYPRINUS (*Le S.*) *Ag.*

A single specimen from Round Lake near Montgomery, Ala., apparently identical with Pennsylvania examples.

Genus BUBALICHTHYS *Agassiz.*

51. BUBALICHTHYS (TAURUS) *Agassiz.*

Recorded by Professor Agassiz from the Alabama. Other species of "Buffalo Fish" doubtless occur in the Alabama, but the species have never been studied.

SILURIDÆ.

Genus ICHTHÆLURUS *Rafinesque.*

52. ICHTHÆLURUS PUNCTATUS (*Raf.*) *Jor.*

Abundant in the basin of the Alabama.

Genus AMIURUS *Rafinesque.*

53. AMIURUS NATALIS ANTONIENSIS (*Grd.*) *Jor.*

Abundant in muddy tributaries of the Etowah and Coosa.

Genus NOTURUS *Rafinesque.*

54. NOTURUS LEPTACANTHUS *Jordan.*

Two specimens, taken in Silver Creek, and a third specimen, from the Chattahoochee, are all that are at present known of this curious little species.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

55. ANGUILLA VULGARIS *Fleming.*

Abundant.

LEPIDOSTEIDÆ.

Genus LEPIDOSTEUS *Lacépède.*

56. LEPIDOSTEUS OSSEUS (*L.*) *Ag.*

From the Oostanaula; probably common.

VI.—WATER-BASIN OF THE TENNESSEE RIVER.

The fish-fauna of the Tennessee River has been pretty fully studied, especially as to its *Cyprinidæ*. Thirty-seven species were obtained by Professor Cope in the French Broad, thirty-four in the Holston, and twenty-five by Professor Jordan in tributaries of the Clinch and French Broad, making in all some sixty different species known to inhabit the upper waters of the Tennessee. In the lower course of the river, thirty-four species are recorded by Professor Agassiz from the Tennessee River at Huntsville, Ala.; twenty species were obtained by the writers from the Chickamauga River at Ringgold, Ga., and seventeen species from Elk River at Estill Springs in Tennessee. About sixty-eight species are therefore known to occur in the lower course of the river. In all, eighty-two different species are *known* to inhabit the waters of the Tennessee. To this number many species of large fishes inhabiting the Ohio at the mouth of the Tennessee might, with certainty, be added; but it is not the province of this paper to record guesses. Forty-six species are therefore *certainly* common to the upper and lower courses of the Tennessee River.

The species at present known in the Tennessee Basin, only from the upper course,—the Clinch, Holston, and French Broad Rivers,—are the following:—

Hadropterus aurantiacus.
Diplesium simoterum.
Nothonotus zonalis.
Nothonotus vulneratus.
Nothonotus rufilineatus.
Etheostoma flabellare.
Salvelinus fontinalis.
Alburnops spectrunculus.
Hydrophlox rubricroceus.
Hydrophlox lacertosus.
Episema leucioda.
Notropis micropteryx.
Notropis atherinoides.
Hemitremia vittata.
Placopharynx carinatus.
Noturus eleutherus.

In all, sixteen species.

From the lower course of the river only, the following are known:—

("Etheostoma") cinerea.
("Etheostoma") tessellata.
Pœcilichthys jessiæ.
Chænobryttus gulosus.
Lepiopomus obscurus.
(Lepiopomus) bombifrons.
Eupomotis pallidus.
Xenotis inscriptus.
Esox (crassus).
Hyodon selenops.
Pomolobus chrysochloris.
Dorosoma cepedianum heterurum.
Notropis lirus.
Phoxinus flammeus.

Gila estor.
Quassilabia lacera.
Carpiodes bison.
Bubalichthys urus.
Amia calva.
Acipenser maculosus.

In all, twenty species.

Increased knowledge will considerably modify these lists. It is probable that the sixteen species in the first list, with the probable exceptions of *Noturus eleutherus* and *Salvelinus fontinalis*, will be found to inhabit the lower part of the river-basin, if sought for in suitable localities. It is likely that the tributaries of the Tennessee having their source in the Cumberland Mountains in Alabama have the same fish-fauna as similar streams rising in the Cumberland Mountains in Virginia.

About twelve species are at present known only from the Tennessee River and its tributaries. These are:—

Hadropterus aurantiacus.
(Etheostoma) cinerea.
(Etheostoma) tessellata.
Nothonotus vulneratus.
Nothonotus rufilineatus.
Pœcilichthys jessiæ.
(Lepiopomus) bombifrons.
Alburnops spectrunculus.
Hydrophlox lacertosus.
Phoxinus flammeus.
Episema leucioda.
Ceratichthys monachus.

As we go from the Alabama to the Tennessee, we note an increased resemblance in the fish-fauna to that of the Ohio and Upper Mississippi region. The following are some of the Northern or Western types added:—

Diplesium, *Etheostoma*, *Pœcilichthys*, *Labidesthes*, *Zygonectes* (proper), *Episema*, *Hemitremia*, *Chrosomus*, *Phoxinus*, *Placopharynx*, *Quassilabia*.

COTTIDÆ.

Genus POTAMOCOTTUS *Gill.*

1. Potamocottus meridionalis (*Girard*) *Gill.*

From Chickamauga River. Also a single specimen from the Cave Spring at Cumberland Gap. Abundant in the French Broad River (*Cope*) and in the Holston.

ETHEOSTOMATIDÆ.

Genus PERCINA *Haldeman.*

2. Percina caprodes (*Raf.*) *Grd.*

Generally abundant in clear streams.

Genus ALVORDIUS *Girard.*

3. ALVORDIUS MACULATUS *Girard.*

(*? Alvordius maculatus* Grd.; *Hadropterus maculatus* Grd.; *Ethcostoma blennioides* Agassiz, etc.; *Alvordius aspro* Cope & Jor.)

From the Clinch and French Broad Rivers. Also abundant in the Chickamauga at Ringgold.

Genus HADROPTERUS *Agassiz.*

4. HADROPTERUS AURANTIACUS (*Cope*) *Jordan.*

French Broad River (*Cope*).

Genus DIPLESIUM *Rafinesque.*

5. DIPLESIUM BLENNIOIDES (*Raf.*) *Jor.*

Holston and French Broad Rivers. Also from Chickamauga River. Described by Professor Agassiz from Huntsville, Alabama, under the name of *Hyostoma newmani.*

6. DIPLESIUM SIMOTERUM (*Cope*) *Copeland.*

From the Clinch and Holston Rivers.

Genus BOLEOSOMA *DeKay.*

7. BOLEOSOMA MACULATUM *Agassiz.*

(*B. brevipinne* Cope.)

Abundant in the Holston River.

Genus NOTHONOTUS *Agassiz.*

8. NOTHONOTUS ZONALIS (*Cope*) *Jordan.*

Holston and French Broad Rivers (*Cope*).

9. NOTHONOTUS VULNERATUS (*Cope*) *Jor.*

French Broad River at Warm Springs.

10. NOTHONOTUS RUFILINEATUS (*Cope*) *Jor.*

French Broad River. We have not examined this species and the preceding. One or both of them may perhaps belong to *Pœcilichthys.*

Genus PŒCILICHTHYS *Agassiz.*

11. Pœcilichthys jessiæ *Jor. & Brayt.*

Jordan, Man. Vert. E. U. S. ed. 2d, 1878, 227.

Body fusiform, rather deep and compressed, the depth 5 to 5½ in length, the form of the body similar to that of *P. spectabilis.*

Head rather large, moderately pointed, 4 in length. Mouth rather large, terminal, the upper jaw slightly longest, not protractile. Eye pretty large, high up, 3½ in head, about equal to snout.

Cheeks naked, scaly above: opercles scaly: throat naked: neck above scaly: scales medium, 6–45 to 50–7. Lateral line incomplete, but extending farther than in *P. variatus* and *P. spectabilis*, on about 35 scales, or nearly to the end of the second dorsal.

Fins moderate. Dorsal, XII—about 12. Anal II, 9.

Color, in spirits, olivaceous, with about nine squarish, bar-like blotches along the sides, and about five dark cross-blotches on the back. Dorsal and caudal fins faintly barred.

In life, the fish is chestnut-colored above, and the squares on the sides are bright dark blue: the fins are mottled with chestnut. A dark yellow or orange band across the dorsal. Second dorsal and anal with dark and golden specklings.

Several specimens, each about two inches long, taken in Chickamauga River at Ringgold. The specimens are certainly not fully grown, and the coloration of the adult male is doubtless much more brilliant. It will be at once distinguished from *P. variatus* and *P. spectabilis* by the scaliness of the upper part of the cheeks, by the greater development of the lateral line, the more numerous dorsal spines, and the coloration. This species is named for Mrs. Jessie D. Brayton.

Genus ETHEOSTOMA *Rafinesque.*

12. Etheostoma flabellare *Rafinesque.*

Abundant in the upper waters of the Tennessee in clear rapid streams.

Genus ? ———.

13. (Etheostoma) cinerea *Storer.*

Described from Florence, Ala. The description has reference chiefly to the coloration. Neither this species nor the next have been recognized by any author subsequent to their description.

14. (Etheostoma) tessellata *Storer.*

From the Tennessee River at Florence, Ala.

PERCIDÆ.

Genus STIZOSTETHIUM *Rafinesque.*

15. STIZOSTETHIUM VITREUM (*Cuv. & Val.*) *Jor. & Copel.*

Found by Professor Cope in the French Broad.

16. STIZOSTETHIUM SALMONEUM *Raf.*

Species of this genus occur throughout the Tennessee Basin. Professor Cope ascribes this species and the preceding to the French Broad. As we have seen no specimen, we follow his identifications.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

17. MICROPTERUS PALLIDUS (*Raf.*) *Gill & Jordan.*

Not uncommon in the Tennessee Basin.

18. MICROPTERUS SALMOIDES (*Lac.*) *Gill.*

Very common in the Tennessee River.

Genus AMBLOPLITES *Rafinesque.*

19. AMBLOPLITES RUPESTRIS (*Raf.*) *Gill.*

Common in the Tennessee Basin.

Genus CHÆNOBRYTTUS *Gill.*

20. CHÆNOBRYTTUS GULOSUS (*C. & V.*) *Gill.*

Lower Tennessee River; probably common.

Genus LEPIOPOMUS *Rafinesque.*

21. LEPIOPOMUS PALLIDUS (*Mitch.*) *Gill & Jor.*

Very common in the Tennessee Basin.

22. LEPIOPOMUS OBSCURUS (*Agassiz*) *Jordan.*

Described by Professor Agassiz from Huntsville, Ala.

23. (LEPIOPOMUS) BOMBIFRONS (*Agassiz*).

Only the type-specimens of this species are yet known. They were

from Huntsville, Ala. We are unable to decide, from the description and a MS. drawing kindly forwarded by Professor Bliss, whether this species is a *Lepiopomus* or a *Xenotis*.

Genus XENOTIS *Jordan.*

24. XENOTIS SANGUINOLENTUS (*Agassiz*) *Jordan.*

Originally described from the Tennessee River at Huntsville. We have seen no specimens from that locality, and are unable to decide whether Agassiz's species is the one to which we have applied the name *sanguinolentus*, or whether it be one of the forms of the Northern *X. megalotis*.

25. XENOTIS INSCRIPTUS (*Agassiz*) *Jor.*

Originally described from the Tennessee River at Huntsville. Also found by Professor Cope in the upper waters of the same river.

Genus EUPOMOTIS *Gill & Jordan.*

26. EUPOMOTIS PALLIDUS (*Agassiz*) *G. & J.*

Originally described from Huntsville, Ala.

Genus XYSTROPLITES *Jordan.*

27. XYSTROPLITES NOTATUS (*Agassiz*).

Originally described from Huntsville, and later found by Professor Cope in the upper waters of the Tennessee. This species may be a *Eupomotis* instead of a *Xystroplites*. It much resembles the Texan *Xystroplites heros* B. & C.

SCIÆNIDÆ.

Genus HAPLOIDONOTUS *Rafinesque.*

28. HAPLOIDONOTUS GRUNNIENS *Raf.*

Abundant in the Tennessee Basin. The form called by Professor Agassiz *Amblodon concinnus* needs re-examination before it can be admitted as a species.

ATHERINIDÆ.

Genus LABIDESTHES *Cope.*

29. LABIDESTHES SICCULUS *Cope.*

Found by Professor Cope in Coal Creek, a tributary of the Clinch River.

CYPRINODONTIDÆ.

Genus XENISMA *Jordan.*

30. XENISMA CATENATUM (*Storer*) *Jordan.*

Originally described from Florence, Ala. It is abundant in the Elk, Clinch, and Holston in clear waters.

Genus ZYGONECTES *Agassiz.*

31. ZYGONECTES NOTATUS (*Raf.*) *Jor.*

Described by Dr. Storer from Florence, Ala., under the name of *Pœcilia olivacea.* This species prefers still, deep waters.

ESOCIDÆ.

Genus ESOX *Linnæus.*

32. ESOX (CRASSUS *Agassiz*).

A species is recorded by Professor Agassiz under the name of *Esox crassus.* The description is insufficient and the species is at present unrecognized.

HYODONTIDÆ.

Genus HYODON *Le Sueur.*

33. HYODON SELENOPS *Jordan & Bean.*

The original type of this species came from the Tennessee River at Chattanooga. *Hyodon tergisus* doubtless also occurs in the lower course of the river.

CLUPEIDÆ.

Genus POMOLOBUS *Rafinesque.*

34. POMOLOBUS CHRYSOCHLORIS *Raf.*

Abundant in the channel of the Lower Tennessee.

DOROSOMATIDÆ.

Genus DOROSOMA *Rafinesque.*

35. DOROSOMA CEPEDIANUM HETERURUM (*Raf.*) *Jor.*

The "Gizzard Shad" is abundant in the Lower Tennessee.

SALMONIDÆ.

Genus SALVELINUS *Richardson.*

36. SALVELINUS FONTINALIS (*Mitchill*) *Gill & Jor.*

This species occurs in abundance in Swannanoa River, at the foot of Black Mountain, and in all clear tributaries of the French Broad in Western North Carolina. In Southwestern Virginia, it occurs in certain tributaries of the Holston. In Rabun County, in Northeastern Georgia, it abounds in the headwaters of the Little Tennessee. Professor Cope states, on the authority of Dr. Hardy, of Asheville, that it "occurs in the headwaters of the Chattahoochee, on the south slope of the Alleghanies, in Georgia".

CYPRINIDÆ.

Genus CAMPOSTOMA *Agassiz.*

37. CAMPOSTOMA ANOMALUM (*Raf.*) *Ag.*

Var. *prolixum* Storer.

Everywhere abundant. In the clear pools of the Swannanoa River, at the foot of Black Mountain, this fish is extremely abundant, and the large specimens are brilliantly colored, so that they appear to be luminous or phosphorescent as one looks down on them through the crystal water.

Genus HYBORHYNCHUS *Agassiz.*

38. HYBORHYNCHUS NOTATUS (*Raf.*) *Agassiz.*

Numerous specimens from the Chickamauga River. These are narrower-headed than the common Western form (*H. superciliosus* Cope) and want the barbel, which is usually distinct on the latter. It is not improbable that we have two distinct species.

Genus LUXILUS *Rafinesque.*

39. LUXILUS CORNUTUS (*Mitch.*) *Jor.*

Abundant in every stream examined.

40. LUXILUS COCCOGENIS (*Cope*) *Jor.*

Abundant in every stream examined.

Genus PHOTOGENIS *Cope.*

41. PHOTOGENIS GALACTURUS (*Cope*) *Jor.*

Abundant in every stream examined.

Genus HYDROPHLOX *Jordan.*

42. HYDROPHLOX RUBRICROCEUS (*Cope*) *Jor.*

Described by Professor Cope from tributaries of the Holston. It prefers boisterous mountain-streams.

43. HYDROPHLOX LACERTOSUS (*Cope*) *Jor.*

Described from the Holston.

Genus ALBURNOPS *Girard.*

44. ALBURNOPS MICROSTOMUS (*Raf.*) *Jor.*

Minnilus microstomus RAF.
Hybopsis longiceps COPE.

Obtained by Professor Cope in tributaries of Clinch River.

45. ALBURNOPS SPECTRUNCULUS (*Cope*) *Jor.*

Obtained by Professor Cope in the Holston and French Broad.

Genus EPISEMA *Cope & Jordan.*

46. EPISEMA LEUCIODA *Cope.*

Found by Professor Cope in the Holston and French Broad.

Genus NOTROPIS *Rafinesque.*

(*Notropis et Minnilus* Raf.; *Alburnellus* Girard.)

47. NOTROPIS ATHERINOIDES *Raf.*

From tributaries of Clinch River.

48. NOTROPIS MICROPTERYX (*Cope*) *Jor.*

From tributaries of the Holston and Clinch.

49. NOTROPIS PHOTOGENIS (*Cope*) *Jor.*

(*Squalius photogenis* Cope; *Photogenis leucops* Cope.)

Abundant in the French Broad River.

50. NOTROPIS TELESCOPUS (*Cope*) *Jor.*

Holston and French Broad Rivers (*Cope*). Also abundant in Elk River. If our specimens are correctly identified, this is a true *Notropis*. We find it not easily distinguishable from *N. photogenis*.

51. NOTROPIS LIRUS *Jordan.*

This little species abounds in both the Elk and the Chickamauga.

Genus HEMITREMIA *Cope.*

52. HEMITREMIA VITTATA *Cope.*

Described from the Holston River near Knoxville.

Genus CHROSOMUS *Rafinesque.*

53. CHROSOMUS ERYTHROGASTER *Raf.*

Recorded by Professor Agassiz from Huntsville, Ala. We have seen no specimens from the Tennessee River.

Genus PHOXINUS *Rafinesque.*

54. PHOXINUS FLAMMEUS *Jordan & Gilbert.*

Jordan, Man. Vert. E. U. S. ed. 2d, p. 303.

A very distinct species, resembling "*Gila*" *margarita* (Cope), but with the short lateral line of *P. neogæus* Cope.

Body stout, rather more slender and more compressed than in *P. neogæus*, the form being nearly that of *G. margarita*. Depth 4 in length, about equal to the length of the head.

Head short and deep, smaller than in *neogæus*, the upper outline rounded, the muzzle quite blunt and rather short. Eye rather large, $3\frac{1}{3}$ in head, longer than snout. Mouth small, oblique, the lower jaw projecting, the intermaxillary in front on the level of the pupil, and the maxillary extending to opposite the front of the orbit.

Scales much larger than in *P. neogæus*, but still quite small, in appear-

ance similar to those of the species of *Gila;* dorsal and ventral regions scaled; 7–43–5. Lateral line short, decurved, not reaching to base of ventrals, on only 14 scales.

Teeth 2, 4–5, 2, as in *P. neogæus*, without masticatory surface.

Fins small: dorsal well behind ventrals: pectorals reaching nearly to ventrals, the latter to vent. D. I, 8, A. I, 8; the latter fin rather high.

Coloration that of the species of *Clinostomus*, especially *C. margarita* (which species, having the lateral line wanting on the last three to eight scales, might perhaps with propriety be referred to *Phoxinus*).

Back dark, the scales profusely punctate: a dusky band formed of dark specks along the sides: cheeks pearly: space below lateral line silvery; in the type-specimen flushed with rich scarlet-red.

Length of type 2½ inches.

A single specimen taken in Elk River, at Estill Springs, in company with *Gila estor*, which species it much resembles in color. *Phoxinus flammeus* bears the same relation to *P. neogæus* that *Gila estor* does to the small-scaled *Gila elongata*.

Genus GILA *Baird & Girard.*

(Subgenus CLINOSTOMUS *Girard.*)

55. GILA ESTOR *Jordan & Brayton.*

Jordan, Man. Vert. ed. 2d, p. 300.

A large and handsome species, related to *G. elongata* and *G. proriger*, but well distinguished from both.

Body elliptical-elongate, rather deep and compressed; the caudal peduncle long. Greatest depth 4¼ in length. Head very long and large, 3⅔ in length; flattish above, but not wide. Mouth exceedingly large, very oblique, the premaxillaries anteriorly on the level of the pupil, the maxillary extending to opposite the middle of the orbit, and the length of the gape of the mouth a little more than half the length of the head. Lower jaw decidedly the longer.

Eye quite large, less than snout, 4 in head.

Scales small, but large for the genus, their outlines well defined, especially above, 8–50–5. Lateral line strongly decurved; about 23 scales on the back anterior to the dorsal fin.

Fins high. Dorsal I, 8, well behind ventrals, its first ray nearer the caudal than the snout. Anal I, 8, short and high. Pectorals falling just short of ventrals, the latter just short of vent.

Teeth 2, 4–5, 2.

Color dark olive above, with a bluish lustre, many scales darker, as is usual in this genus. Sides somewhat silvery. No dark lateral band. A broad shade of deep rose color along the sides, below which most of the belly is bright crimson, the red colors brightest anteriorly.

Length of largest specimens about 4 inches. Numerous specimens from the Elk River at Estill Springs, and from Stone River at Murfreesboro'. This striking species resembles most *G. elongata* and *G. proriger*. Both those species have much smaller scales (70 to 75 in the lateral line in *elongata*, 60 to 65 in *proriger*). The coloration is likewise different, the two latter species having a dusky band along the sides, the anterior half of which in *elongata* is red in spring. *G. elongata* is much more elongate, as is also *G. proriger*. The mouth appears largest in *G. estor*. The distinction between *G. proriger* and *G. elongata* is perhaps questionable.

Genus NOTEMIGONUS *Rafinesque.*

56. Notemigonus chrysoleucus (*Mit.*) *Jor.*

Common in still waters in the Tennessee Basin.

Genus PHENACOBIUS *Cope.*

57. Phenacobius uranops *Cope.*

Rather common in the Elk and Chickamauga Rivers. A few specimens from the French Broad. Originally described from the Holston in Virginia.

Genus RHINICHTHYS *Agassiz.*

58. Rhinichthys obtusus *Agassiz.*

(*Rhinichthys lunatus* Cope.)

This species is abundant in all clear rocky brooks and in outlets of springs.

Genus CERATICHTHYS *Baird.*

59. Ceratichthys monachus *Cope.*

Abundant in Chickamauga River. Originally described from the Holston.

60. Ceratichthys dissimilis (*Kirt.*) *Cope.*

Obtained in Elk River.

61. CERATICHTHYS WINCHELLI (*Girard*) *Jordan.*

(*Ceratichthys hyalinus* Cope.)

Everywhere abundant in Tennessee River. This is probably *Hybopsis gracilis* Ag., the original type of the genus *Hybopsis.* In that case, it will be necessary to substitute the specific name *gracilis* for *winchelli.*

62. CERATICHTHYS BIGUTTATUS (*Kirtland*) *Girard.*

Everywhere very abundant.

Genus SEMOTILUS *Rafinesque.*

63. SEMOTILUS CORPORALIS (*Mit.*) *Putn.*

Tributaries of the Clinch and French Broad; chiefly in small mountain-streams.

CATOSTOMIDÆ.

Genus QUASSILABIA *Jordan & Brayton.*

64. QUASSILABIA LACERA *Jordan & Brayton.*

Lagochila lacera JORDAN & BRAYTON (1877), Proc. Ac. Nat. Sc. Phila.

Two specimens of this singular fish were taken in the Chickamauga River at Ringgold and one specimen in Elk River at Estill Springs. In the Chickamauga, we were told that it is quite common, and that it is much valued for food. It is usually known as the "Hare-lip" or "Split-mouth Sucker". We have lately received a fine specimen taken in the Scioto River, Ohio, by Mr. J. H. Klippart, where it is well known to the fishermen under the name of "May Sucker".

Genus MYXOSTOMA *Rafinesque.*

65. MYXOSTOMA VELATUM (*Cope*) *Jor.*

(*Ptychostomus collapsus* Cope.)

Obtained by Professor Cope in Clinch River, and by us in the Chickamauga.

66. MYXOSTOMA MACROLEPIDOTUM DUQUESNII (*Le S.*) *Jor.*

From the Holston, Clinch, French Broad, and Chickamauga. Probably generally abundant.

Genus PLACOPHARYNX *Cope.*

67. PLACOPHARYNX CARINATUS *Cope.*

This large species is the common "Red Horse" of the French Broad. It much resembles the preceding, but has a much larger mouth and lips, besides the different dentition.

Genus ERIMYZON *Jordan.*

68. ERIMYZON SUCETTA (*Lac.*) *Jor.*

Obtained in Clinch River.

Genus MINYTREMA *Jordan.*

69. MINYTREMA MELANOPS (*Raf.*) *Jor.*

Obtained by Professor Agassiz at Huntsville, Ala.

Genus CATOSTOMUS *Le Sueur.*

70. CATOSTOMUS NIGRICANS *Le S.*

Very abundant throughout the Tennessee Basin.

71. CATOSTOMUS COMMERSONI (*Lac.*) *Jor.*

Generally abundant.

Genus CARPIODES *Rafinesque.*

72. CARPIODES BISON *Agassiz.*

Lower Tennessee River (*Cope.*) The *Bubalichthyinæ* of the Tennessee River are as yet unstudied.

Genus BUBALICHTHYS *Agassiz.*

73. BUBALICHTHYS URUS *Agassiz.*

Recorded by Professor Agassiz from the Tennessee River.

SILURIDÆ.

Genus ICHTHÆLURUS *Rafinesque.*

74. ICHTHÆLURUS PUNCTATUS (*Raf.*) *Jor.*

Very abundant in the Tennessee River.

Genus AMIURUS *Rafinesque.*

75. AMIURUS NATALIS (*Le S.*) *Gill.*

Var. *eupreus* (*Raf.*).

Rather abundant in Tennessee River. Other species of this genus are doubtless common; but they have not been distinguished.

Genus PELODICHTHYS *Rafinesque.*

76. PELODICHTHYS OLIVARIS (*Raf.*) *Gill & Jor.*

Abundant in the channels of the larger streams. Several specimens from the French Broad.

This species probably occurs in the channels of all the streams mentioned in this paper; but, from its habits, it is not easily taken with a small net.

Genus NOTURUS *Rafinesque.*

77. NOTURUS ELEUTHERUS *Jordan.*

Noturus eleutherus JORDAN (1877), Ann. Lyc. Nat. Hist. N. Y. 372.

The type-specimen of this species was from Big Pigeon River, in Cocke County, Tennessee, near its junction with the French Broad. Many other specimens have since been obtained in Tar River, North Carolina.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

78. ANGUILLA VULGARIS *Fleming.*

Eels occur in Tennessee River, though rather less abundantly than in the streams farther south.

AMIIDÆ.

Genus AMIA *Linnæus.*

79. AMIA CALVA *L.*

Recorded by Professor Agassiz from Huntsville, Ala.

LEPIDOSTEIDÆ.

Genus LEPIDOSTEUS *Lacépède.*

80. LEPIDOSTEUS OSSEUS (*L.*) *Ag.*

Generally abundant.

81. LEPIDOSTEUS PLATYSTOMUS *Raf.*

From Huntsville, Ala. (*Agassiz*).

ACIPENSERIDÆ.

Genus ACIPENSER *Agassiz.*

82. ACIPENSER MACULOSUS *Le Sueur.*

Huntsville, Ala. (*Agassiz*).

83. ACIPENSER RUBICUNDUS *Le Sueur.*

From Huntsville, Ala. (*Agassiz*).

POLYODONTIDÆ.

Genus POLYODON *Lacépède.*

84. POLYODON FOLIUM "*Lac.*"

Abundant in the river-channels.

VII.—WATER-BASIN OF CUMBERLAND RIVER.

Sixty-five species are known to occur in the waters of the Cumberland River. Of these, forty-seven have been obtained in the lower course of the river, *i. e.*, in the vicinity of Nashville, by Professor Winchell, and in Stone River, at Murfreesboro', by the present writers. In the upper course of the stream, thirty-three species have been obtained by Professor Cope in the South Fork of the Cumberland in Tennessee and by Professor Jordan at the Falls and in the Rock Castle, Round Stone, Big Laurel, and other tributaries in Kentucky. Only fifteen species are, therefore, *known* to be common to both the upper and lower courses of the stream. The actual differences between the upper and lower faunæ are, however, probably very small, if similar streams are compared. The differences really existing are probably chiefly due to the fact that the large fishes inhabiting the lower part of the river are unable to ascend above the falls of the Cumberland.

Comparing the Cumberland River with the Tennessee, the disappear-

ance of one or two Southern types will be noticed, as will be the appearance of certain forms abundant in the basin of the Ohio. Of these latter may be noticed *Pœcilichthys variatus*, *Apomotis*, *Lythrurus*, and *Pimephales*. But two species, both Darters, are at present known only from the Cumberland River. These are *Ulocentra atripinnis* and *Nothonotus sanguifluus*.

The National Museum is indebted to the kindness of Professor Winchell for the following interesting—

List of Fishes of Nashville, as given by a Fisherman, Daniel A. Birchett, to A. Winchell.

"PERCH TRIBE."

Sun Perch.
Coon Perch.
White Perch.
Black Perch.
Red Perch.
Speckled Perch.
Brama Perch.
Bass or Rock Bass.

"TROUT TRIBE."

White Trout.
Black Trout.

"SUCKER TRIBE."

White Sucker.
Spotted Sucker.
Hog Sucker.
Red Horse, creeks and river.
Black Horse.
Carp, creeks and river.
Mullet.

"BUFFALO TRIBE."

White Buffalo.
Blue Buffalo.

"CAT TRIBE."

Yellow Cat.
Blue Cat.
Nigger-lip Cat.
Chisel-head Cat.
Kerkin Cat.
Shovel-bill Cat.

"MINNOW TRIBE."

Silver Side.
Stone Toter.
Horny Head.
White Roach.
Creek Mullet.
Steel Back.

MISCELLANEOUS.

Thunder Head.
Drum.
Jack.
Chover.
White Chover.
Gizzard Shad.
Skip Jack.
Tooth Herring.
Sand Pike.
Pike.
Top Water (several species).
Gar.
Sturgeon.
Eel.
Lamprey Eel.

COTTIDÆ.

Genus POTAMOCOTTUS *Gill.*

1. POTAMOCOTTUS MERIDIONALIS (*Grd.*) *Gill.*

From Cumberland River at Nashville.

ETHEOSTOMATIDÆ.

Genus PERCINA *Haldeman.*

2. PERCINA CAPRODES (*Raf.*) *Grd.*

Abundant.

Genus ALVORDIUS *Girard.*

3. ALVORDIUS MACULATUS (*Girard*) *Cope & Jordan.*

From the Rock Castle and Cumberland at various points.

4. ALVORDIUS PHOXOCEPHALUS (*Nelson*) *Cope & Jordan.*

From the Cumberland River at Nashville. Specimens of this interesting species are in the National Museum from Marais du Cygne, Kansas. I have others from the Wabash River. Nelson's types were from Illinois River.

Genus DIPLESIUM *Rafinesque.*

5. DIPLESIUM BLENNIOIDES (*Raf.*) *Jor.*

South Fork of the Cumberland River (*Cope*). Also from Cumberland and Stone Rivers.

6. DIPLESIUM SIMOTERUM (*Cope*) *Copeland.*

From the Rock Castle River at Livingston, Ky.

Genus ULOCENTRA *Jordan.*

7. ULOCENTRA ATRIPINNIS *Jordan.*

Arlina atripinnis JORDAN (1877), Bulletin X, U. S. Nat. Museum, 10.

The type of this species was collected in the Cumberland River at Nashville by Professor Winchell.

Genus NOTHONOTUS *Agassiz.*

8. Nothonotus camurus (*Cope*) *Jor.*

Professor Cope's types were from the South Fork of the Cumberland. We have seen others from White River in Indiana, and from Mahoning River and other streams in Ohio. This species is not identical with *Nothonotus maculatus* Ag. (*Etheostoma maculata* Kirt.), as has been supposed.

Nothonotus maculatus has a pointed instead of rounded snout; its jaws are equal; its mouth is larger, the body is more compressed, and its dorsal fin more elevated, the soft rays when depressed reaching to the caudal.

Specimens in the National Museum, collected in Mahoning River by Professors Baird and Kirtland, show the following characters:—

Body moderately elongated, very deep, strongly compressed, the depth $4\frac{2}{3}$ in length. Head 4 in length, the jaws equal, the mouth large. Eye $4\frac{1}{3}$ in head. Spinous dorsal with a long base, larger than soft dorsal, the spines high, the two fins slightly connected. Soft dorsal elevated, the longest rays when depressed reaching base of caudal, the caudal peduncle very short and deep. Caudal fin short and rounded. Anal somewhat smaller than second dorsal. Pectorals and ventrals moderate.

Scales not large, 58 to 60 in the lateral line, which is continuous: cheeks naked: opercles scaly.

Fin-rays: Dorsal XII–13; A. II, 8.

An elaborate colored drawing of a male fish in life colors, in the Smithsonian Institution, shows the following features of coloration. As we have never seen this species in life, we cannot vouch for their accuracy:—

Back olive; belly becoming yellowish. Sides and back profusely speckled with carmine-red, the blotches rather less than the size of the eye, not round, nor arranged in rows.

Dorsal fin with a dull red stripe at base, a brown interval, then a bright red stripe, finally margined with white. Second dorsal dull brown at base, then a broad red stripe; a broad marginal band of white. Caudal similarly tricolor, chiefly crimson, with a broad dusky band at base and a wide white band at the tip. Anal chiefly crimson, with a terminal band of white. Pectorals and ventrals nearly plain. Head olivaceous.

9. NOTHONOTUS SANGUIFLUUS (*Cope*) *Jor.*

From the South Fork of the Cumberland in Tennessee (*Cope*).

Genus BOLEOSOMA *DeKay.*

10. BOLEOSOMA MACULATUM *Ag.*

From the Rock Castle River.

Genus PŒCILICHTHYS *Agassiz.*

11. PŒCILICHTHYS VARIATUS (*Kirt.*) *Ag.*

From the South Fork of the Cumberland River (*Cope*).

Genus ETHEOSTOMA *Rafinesque.*

12. ETHEOSTOMA FLABELLARE *Raf.*

Abundant in the mountain tributaries of the Cumberland.

PERCIDÆ.

Genus STIZOSTETHIUM *Rafinesque.*

13. STIZOSTETHIUM SALMONEUM *Raf.*

One or two small specimens from the Rock Castle River.

CENTRARCHIDÆ.

Genus MICROPTERUS *Lacépède.*

14. MICROPTERUS PALLIDUS (*Raf.*) *G. & J.*

The "White Trout", as this species is often called, is common in the Cumberland. It is said that this species and the next were not found above the falls until introduced.

15. MICROPTERUS SALMOIDES (*Lac.*) *Gill.*

The "Black Trout" occurs with the preceding, and is still more abundant.

Genus AMBLOPLITES *Rafinesque.*

16. AMBLOPLITES RUPESTRIS (*Raf.*) *Gill.*

Everywhere abundant.

Genus APOMOTIS *Rafinesque.*

17. APOMOTIS CYANELLUS (*Raf.*) *Jor.*

Abundant in the Cumberland River at Nashville.

Genus LEPIOPOMUS *Rafinesque.*

18. LEPIOPOMUS PALLIDUS (*Mit.*) *Gill & Jordan.*

Very abundant in the Cumberland.

19. LEPIOPOMUS OBSCURUS (*Agassiz*) *Jor.*

Collected by Professor Winchell in the Cumberland River at Nashville.

Genus XENOTIS *Jordan.*

20. XENOTIS MEGALOTIS (*Raf.*) *Jor.*

Abundant in the Cumberland River.

Genus POMOXYS *Rafinesque.*

21. POMOXYS NIGROMACULATUS (*Le S.*) *Grd.*

Collected by Professor Winchell at Nashville.

22. POMOXYS ANNULARIS *Raf.*

From the Cumberland at Nashville.

SCIÆNIDÆ.

Genus HAPLOIDONOTUS *Rafinesque.*

23. HAPLOIDONOTUS GRUNNIENS *Raf.*

Abundant in the river-channel.

ATHERINIDÆ.

Genus LABIDESTHES *Cope.*

24. LABIDESTHES SICCULUS *Cope.*

Abundant in Stone River at Murfreesboro'. This interesting species was named by Rafinesque in 1832 *Zonargyra virescens.* This latter name was, however, not accompanied by a description, and therefore cannot be employed.

CYPRINODONTIDÆ.

Genus XENISMA *Jordan.*

25. XENISMA CATENATUM (*Storer*) *Jordan.*

Collected by Professor Winchell in streams about Nashville

Genus ZYGONECTES *Agassiz.*

26. ZYGONECTES NOTATUS (*Raf.*) *Jor.*

From Cumberland and Stone Rivers. Rafinesque's original specimens were from the Cumberland at Williamsburg.

HYODONTIDÆ.

Genus HYODON *Le Sueur.*

27. HYODON TERGISUS *Le Sueur.*

Abundant in the Cumberland.

28. HYODON SELENOPS *Jordan & Bean.*

Two or three specimens in the National Museum from Cumberland River.

CLUPEIDÆ.

Genus POMOLOBUS *Rafinesque.*

29. POMOLOBUS CHRYSOCHLORIS *Rafinesque.*

Abundant in the Lower Cumberland.

DOROSOMATIDÆ.

Genus DOROSOMA *Rafinesque.*

30. DOROSOMA CEPEDIANUM HETERURUM (*Raf.*) *Jor.*

Abundant in the Lower Cumberland.

CYPRINIDÆ.

Genus CAMPOSTOMA *Agassiz.*

31. CAMPOSTOMA ANOMALUM (*Raf.*) *Ag.*

Abundant.

Genus PIMEPHALES *Rafinesque.*

32. PIMEPHALES PROMELAS *Rafinesque.*

Collected by Professor Winchell in tributaries of the Cumberland.

Genus HYBORHYNCHUS *Agassiz.*

33. HYBORHYNCHUS NOTATUS (*Raf.*) *Ag.*

Abundant everywhere in the Cumberland.

Genus LUXILUS *Rafinesque.*

34. LUXILUS CORNUTUS (*Mit.*) *Jordan.*

Exceedingly abundant everywhere.

Genus PHOTOGENIS *Cope.*

35. PHOTOGENIS GALACTURUS (*Cope*) *Jor.*

Very abundant everywhere in the Cumberland. Some specimens from Nashville have the caudal fin pale red. This species does not seem to occur in the Ohio. The quotations from that river were founded on erroneous identifications.

36. PHOTOGENIS ANALOSTANUS (*Grd.*) *Jor.*

From the Cumberland at Nashville.

Genus ALBURNOPS *Girard.*

37. ALBURNOPS MICROSTOMUS (*Raf.*) *Jor.*

From the South Fork of the Cumberland (*Cope*).

Genus LYTHRURUS *Jordan.*

38. LYTHRURUS ARDENS (*Cope*) *Jor.*

Very abundant everywhere in Cumberland River. One of the most charcteristic species, as it apparently does not occur either in the Kentucky or the Tennessee.

Genus NOTROPIS *Rafinesque.*

39. NOTROPIS ATHERINOIDES (*Raf.*) *Jor.*

Very abundant in the Rock Castle and other upper tributaries of the Cumberland.

40. NOTROPIS MICROPTERYX (*Cope*) *Jor.*

Abundant in the Rock Castle.

41. NOTROPIS TELESCOPUS (*Cope*) *Jor.*

Stone River at Murfreesboro'.

Genus HEMITREMIA *Cope.*

42. HEMITREMIA VITTATA *Cope.*

Abundant in Big Laurel River in Laurel County, Kentucky.

Genus GILA *Baird & Girard.*

43. GILA ESTOR *Jordan & Brayton.*

Several specimens from Stone River at Murfreesboro'.

Genus CHROSOMUS *Agassiz.*

44. CHROSOMUS ERYTHROGASTER *Ag.*

From the tributaries of the Rock Castle.

Genus NOTEMIGONUS *Rafinesque*

45. NOTEMIGONUS CHRYSOLEUCUS (*Mit.*) *Jor.*

Common in sluggish waters.

Genus PHENACOBIUS *Cope.*

46. PHENACOBIUS URANOPS *Cope.*

Taken in Rock Castle River.

Genus CERATICHTHYS *Baird.*

47. CERATICHTHYS DISSIMILIS (*Kirtland*) *Cope.*

From Cumberland River at Nashville.

48. CERATICHTHYS AMBLOPS (*Raf.*) *Grd.*

From Cumberland River at Nashville.

49. CERATICHTHYS BIGUTTATUS (*Kirt.*) *Grd.*

Everywhere abundant.

Genus SEMOTILUS *Rafinesque.*

50. SEMOTILUS CORPORALIS (*Mit.*) *Put.*

From Rock Castle River.

CATOSTOMIDÆ.

Genus MYXOSTOMA *Rafinesque.*

51. MYXOSTOMA MACROLEPIDOTUM DUQUESNII (*Le S.*) *Jor.*

Common in the Cumberland.

Genus ERIMYZON *Jordan.*

52. ERIMYZON SUCETTA (*Lac.*) *Jor.*

From the Cumberland at Nashville and from the Rock Castle.

Genus MINYTREMA *Jordan.*

53. MINYTREMA MELANOPS (*Raf.*) *Jor.*

From the Cumberland at Nashville.

Genus CATOSTOMUS *Le Sueur.*

54. CATOSTOMUS NIGRICANS *Le S.*

Common in the Cumberland.

55. CATOSTOMUS COMMERSONI (*Lac.*) *Jor.*

Very common in the Cumberland.

Genus CYCLEPTUS *Rafinesque.*

56. CYCLEPTUS ELONGATUS (*Le S.*) *Ag.*

From the Cumberland at Nashville. This species is known as "Black Horse", "Gourd-seed Sucker", and "Missouri Sucker".

Genus CARPIODES *Rafinesque.*

57. CARPIODES CUTISANSERINUS *Cope.*

From the Cumberland River at Nashville.

SILURIDÆ.

Genus ICHTHÆLURUS *Rafinesque.*

58. ICHTHÆLURUS PUNCTATUS (*Raf.*) *Jor.*

Very abundant.

Genus AMIURUS *Rafinesque.*

59. AMIURUS NATALIS (*Le S.*) *Gill.*

Collected at Nashville by Professor Winchell.

60. AMIURUS NIGRICANS (*Le S.*) *Gill*

From the Falls of the Cumberland.

Genus PELODICHTHYS *Rafinesque.*

61. PELODICHTHYS OLIVARIS (*Raf.*) *Gill & Jor.*

From the Rock Castle at Livingston, and from the Cumberland below the Falls.

ANGUILLIDÆ.

Genus ANGUILLA *Thunberg.*

62. ANGUILLA VULGARIS *Fleming.*

Common in the Cumberland. A very large specimen taken in the Rock Castle at the mouth of Round Stone River.

LEPIDOSTEIDÆ.

Genus LEPIDOSTEUS *Lacépède.*

63. LEPIDOSTEUS OSSEUS (*L.*) *Ag.*

From the Cumberland at Nashville.

POLYODONTIDÆ.

Genus POLYODON *Lacépède.*

64. POLYODON FOLIUM "*Lac.*"

From the Cumberland River.

RECAPITULATION.

The following table shows the distribution of the species in the seven river-basins especially treated in this paper. For purposes of comparison, I have introduced the results of Professor Cope's explorations in the Roanoke, James, Neuse, and Great Pedee, of Prof. Forbes and Mr. Nelson in the Illinois, and of myself and others in the Ohio. A few unverified species have been introduced, but all doubtful quotations and, in general, all "guesswork" have been excluded.

Table showing the Distribution of the Species in the Different River-Basins.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Lota lacustris, (Walb.) Gill												+	+	N.
Potamocottus meridionalis, (Grd.) Gill	+								+	+	+	+		
Potamocottus bairdii, (Grd.) Gill												+	+	N.
Pleurolepis asprellus, Jor.*									+				+	
Pleurolepis ellucidus, (Baird) Ag												+		
Ioa vitrea, (Cope) Jor			+											
Percina caprodes, (Raf.) Grd									+	+	+		+	NE.
Percina manitou, Jor												+		NW.
Alvordius maculatus, Grd	+									+	+	+	+	
Alvordius macrocephalus, Cope												+		
Alvordius phoxocephalus, (Nels.) C. & J											+	+	+	W.
Alvordius crassus, J. & B			+		+									
Alvordius nevisensis, Cope			+											
Ericosma evides, J. & C												+		
Rheocrypta copelandi, Jor												+		
Hadropterus aurantiacus, (Cope) Jor										+				
Hadropterus nigrofasciatus, Ag						+	+	+						
Hadropterus tessellatus, Jor												+		
Imostoma shumardii, (Grd.) Jor												+	+	SW.
Ulocentra atripinnis, Jor											+			
Ulocentra stigmæa, Jor									+					SW.
Diplesium blennioides, (Raf.) Jor	+									+	+	+		NW.
Diplesium simoterum, (Cope) Copel										+	+			
Boleosoma maculaticeps, Cope			+		+		+							
Boleosoma olmstedi, (Stor.) Ag	+									+				NE.
Boleosoma maculatum, Ag										+	+	+	+	NW.
Boleosoma æsopus, Cope												+		
Nothonotus zonalis, (Cope) Jor												+		
Nothonotus maculatus, (Kirt.) Ag												+		
Nothonotus camurus, (Cope) Jor											+			
Nothonotus sanguifluus, (Cope) Jor											+			
Nothonotus vulneratus, (Cope) Jor										+				
Nothonotus thalassinus, J. & B					+									
Nothonotus inscriptus, J. & B							+							
Nothonotus rufilineatus, (Cope) Jor										+				
Pœcilichthys variatus, (Kirt.) Ag											+	+	+	NW.
Pœcilichthys spectabilis, Ag												+	+	NW.

*Just received from Montgomery, Ala.

Table showing the Distribution of the Species in the Different River-Basins—Continued.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Pœcilichthys jessiæ, J. & B.	..	..	..	..	..	..	..	..	..	+	..	..	..	
(Etheostoma) tessellata, Stor.	..	..	..	..	..	..	..	..	..	+	..	..	..	
(Etheostoma) cinerea, Stor.	..	..	..	..	..	..	..	..	..	+	..	..	..	
Etheostoma squamiceps, Jor.	..	..	..	..	..	..	..	..	..	..	..	+	..	
Etheostoma flabellare, Raf.	+	+	..	..	+	..	..	..	..	+	+	+	..	
Etheostoma lineolatum, (Ag.) Jor.	..	..	..	..	..	..	..	..	..	..	..	..	+	N.
Boleichthys cos, Jor. & Copel.	..	..	..	..	..	..	..	..	..	..	..	+	+	N.
Boleichthys elegans, Grd.	..	..	..	..	..	..	..	..	+	..	..	..	+	SW.
Vaillantia camura, (Forbes) Jor.	..	..	..	..	..	..	..	..	..	..	..	..	+	
Microperca punctulata, Putn.	..	..	..	..	..	..	..	..	..	..	..	+	+	N.
Perca americana, Schranck	..	..	+	..	..	..	..	..	..	..	..	..	+	NE.
Stizostethium vitreum, (Mit.) J. & C.	..	..	..	..	..	..	..	..	..	+	..	..	+	NE.
Stizostethium salmoneum, Raf.	..	..	..	..	..	..	..	..	+	+	+	+	+	
Stizostethium canadense, (Smith) Jor.	..	..	..	..	..	..	..	..	..	..	..	+	+	N.
Roccus chrysops, (Raf.) Gill	..	..	..	..	..	..	..	..	..	..	..	+	+	N.
Morone interrupta, Gill	..	..	..	..	..	..	..	..	..	..	..	+	+	SW.
Micropterus pallidus, (Raf.) G. & J.	+	..	+	+	+	..	..	+	+	+	+	+	+	
Micropterus salmoides, (Lac.) Gill	..	..	..	..	..	..	+	+	+	+	+	+	+	
Acantharchus pomotis, (Baird) Gill	..	..	+	..	..	..	..	..	..	..	..	..	..	
Ambloplites rupestris, (Raf.) Gill	+	..	..	..	..	..	..	+	+	+	+	+	+	
Ambloplites cavifrons, Cope	..	+	..	..	..	..	..	..	..	..	..	..	..	
Chænobryttus gulosus, (C. & V.) Gill	..	..	..	..	..	..	..	..	+	+	+	+	+	SW.
Chænobryttus viridis, (C. & V.) Jor.	+	+	+	+	+	..	+	..	..	..	..	..	..	SE.
Apomotis cyanellus, (Raf.) C. & J.	..	..	..	..	..	..	..	..	..	..	+	+	+	W.
Lepiopomus pallidus, (Mit.) G. & J.	..	..	..	+	..	..	..	+	+	+	+	+	+	
Lepiopomus obscurus, (Ag.) Jor.	..	..	..	..	..	..	..	..	+	+	+	..	..	
Lepiopomus ischyrus, J. & N.	..	..	..	..	..	..	..	..	..	..	..	..	+	
Lepiopomus auritus, (L.) Raf.	+	+	+	+	+	..	+	+	..	..	..	..	..	SE.
Lepiopomus macrochirus, Raf.	..	..	..	..	..	..	..	..	..	..	..	+	+	
Lepiopomus anagallinus, Cope	..	..	..	..	..	..	..	..	..	..	..	+	..	W.
(Lepiopomus) bombifrons, Ag.	..	..	..	..	..	..	..	..	..	..	..	..	..	
Xenotis megalotis, (Raf.) Jor.	..	..	..	..	..	..	..	..	..	..	+	+	+	N.
Xenotis aureolus, Jor.	..	..	..	..	..	..	..	..	..	..	..	+	+	
Xenotis lythrochloris, Jor.	..	..	..	..	..	..	..	..	..	..	..	+	..	
Xenotis inscriptus, (Ag.) Jor.	..	..	..	..	..	..	..	..	+	+	..	+	..	
Xenotis peltastes, (Cope) Jor.	..	..	..	..	..	..	..	..	..	..	..	..	+	N.
Xenotis sanguinolentus, (Ag.) Jor.	..	..	..	..	..	+	..	..	+	+	..	..	..	
(Xystroplites) notatus, Ag.	..	..	..	..	..	..	..	..	..	+	..	..	..	
Eupomotis pallidus, (Ag.) G. & J.	..	..	..	..	..	..	..	..	+	+	..	+	..	
Eupomotis aureus, (Walb.) G. & J.	+	..	+	+	+	..	..	..	..	..	..	..	+	NE.
Enneacanthus pinniger, G. & J.	..	..	+	..	..	..	..	..	..	..	..	..	..	
Enneacanthus margarotis, Gill & Jor.	+	..	+	..	..	..	..	..	..	..	..	..	..	
Hemioplites simulans, Cope	+	..	..	..	..	..	..	..	..	..	..	..	..	
Centrarchus irideus, (Lac.) C. & V.	..	..	+	..	..	..	..	..	+	..	..	+	..	S.
Centrarchus macropterus, (Lac.) Jor.	..	..	..	..	..	..	+	..	..	..	..	..	..	
Pomoxys nigromaculatus, (Le S.) Grd.	+	..	+	..	..	..	..	..	+	..	+	+	+	
Pomoxys annularis, Raf.	..	..	+	..	..	..	..	..	+	+	+	+	+	
Haploidonotus grunniens, Raf.	..	..	..	..	..	..	..	..	+	+	+	+	+	N.
Aphododerus sayanus, (Gilliams) DeKay	..	..	+	..	..	..	..	+	+	..	..	+	+	
Eucalia inconstans, (Kirt.) Jor.	..	..	..	..	..	..	..	..	..	..	..	..	+	N.
Labidesthes sicculus, Cope	..	..	..	..	..	..	..	..	..	+	+	+	+	N.

Table showing the Distribution of the Species in the Different River-Basins—Continued.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Fundulus diaphanus, (Le S.) Ag	...	...	...	...	...	...	...	...	...	...	...	...	+	
Xenisma stelliferum, Jor	...	...	...	...	...	...	...	...	+	...	...	...	...	
Xenisma catenatum, (Stor.) Jor	...	...	...	...	...	...	...	...	...	+	+	...	...	
Zygonectes dispar, Ag	...	...	...	...	...	...	...	...	...	...	...	+	+	
Zygonectes nottii, Ag	...	...	...	...	...	+	...	...	+	...	...	...	...	
Zygonectes melanops, Cope	+	...	+	...	...	...	...	...	...	...	...	+	...	
Zygonectes atrilatus, J. & B.*	...	...	+	...	...	...	...	...	...	...	...	...	...	
Zygonectes guttatus, Ag	...	...	...	...	...	...	...	...	+	...	...	...	...	
Zygonectes hieroglyphicus, Ag	...	...	...	...	...	...	...	...	+	...	...	...	...	
Zygonectes notatus, (Raf.) Jor	...	...	...	...	...	...	...	...	...	+	+	+	+	NW.
Melanura limi, (Kirt.) Ag	...	...	...	...	...	...	...	...	...	...	...	+	+	N.
Melanura pygmæa, (DeKay) Baird	+	...	+	...	...	...	...	...	...	...	...	...	...	
Amblyopsis spelæus, DeKay	...	...	...	...	...	...	...	...	...	...	...	+	...	
Typhlichthys subterraneus, Grd	...	...	...	...	...	...	...	...	...	...	...	+	...	
Chologaster agassizi, Putn	...	...	...	...	...	...	...	...	...	...	...	+	...	
Esox reticulatus, Le S	+	...	+	...	+	...	+	...	+	...	...	...	...	NE.
Esox (raveneli, Holbr.)	...	...	+	...	+	...	...	...	+	...	...	...	...	
Esox (crassus, Ag.)	...	...	...	...	...	...	...	...	...	+	...	...	...	
Esox salmoneus, Raf	...	...	...	...	...	...	...	...	...	...	...	+	+	N.
Esox cypho, Cope	...	...	...	...	...	...	...	...	...	...	...	+	+	N.
Esox lucius, L	...	...	...	...	...	...	...	...	...	...	...	...	+	N.
Percopsis guttatus, Ag	...	...	...	...	...	...	...	...	...	...	...	+	+	N.
Salvelinus fontinalis, (Mit.) Gill & Jor	+	+	...	...	+	...	...	...	...	+	...	+	...	N.
Coregonus artedi sisco, Jor	...	...	...	...	...	...	...	...	...	...	...	+	...	
Hyodon tergisus, Le S	...	...	...	...	...	...	...	...	...	...	+	+	+	N.
Hyodon selenops, Jor. & Bean	...	...	...	...	...	...	...	...	+	+	+	...	...	
Dorosoma cepedianum heterurum, (Raf.) Jor	...	...	...	...	...	...	...	...	+	+	+	+	+	
Pomolobus chrysochloris, Raf	...	...	...	...	...	...	...	...	...	+	+	+	+	
Campostoma, anomalum, (Raf.) Ag	+	+	...	...	+	...	...	+	+	+	+	+	+	N.
Hybognathus argyritis, Grd	...	...	+	...	+	...	...	...	...	...	...	+	+	W.
Hybognathus nuchalis, Ag	...	...	...	...	...	...	...	...	...	...	...	+	+	
Pimephales promelas, Raf	...	...	...	...	...	...	...	...	...	...	+	+	+	N.
Hyborhynchus notatus, (Raf.) Ag	...	...	...	...	...	...	...	...	...	+	+	+	+	N.
Hyborhynchus superciliosus, Cope	...	...	...	...	...	...	...	...	...	...	...	+	+	
Ericymba buccata, Cope	...	...	...	...	...	...	...	...	...	...	...	+	...	
Luxilus cornutus, (Mit.) Jor	+	+	+	...	...	...	...	...	+	+	+	+	+	N.
Photogenis galacturus, (Cope) Jor	...	...	...	...	...	+	...	...	...	+	+	...	...	
Photogenis analostanus (Grd.) Jor	+	...	+	+	+	...	...	...	...	...	+	+	+	
Photogenis leucopus J. & B	...	...	...	...	...	...	...	+	...	...	...	...	...	

* *Zygonectes atrilatus*, sp. nov.—A short, thick-set species, related to *Z. melanops* Cope. Body short and stout, compressed, especially posteriorly, the depth about 4 times in the length to base of caudal. Head moderate, 3¾ times in length, moderately broad and flattened above, the mouth of the ordinary sort. Dorsal fin well back, moderately high, of about 8 rays; anal larger than the dorsal, with seven rays: ventral fins quite small, not reaching quite to the anal: pectoral fins small: caudal fin rounded, of the usual form: scales large, in about 30 transverse series.

Coloration dull olive; no stripes nor bars: scales slightly dark-edged: each side with a large jet-black blotch on the sides of the body just above and somewhat in front of the vent: dorsal and anal fins speckled.

Numerous specimens, 1½ to 1¾ inches in length, nearly all females, distended with spawn. In all, the black side-blotch is very distinct. They were taken by Messrs. Brayton and Gilbert, in the Neuse River, near Goldsboro', with *Ioa vitrea*, *Noturus eleutherus*, *Achirus lineatus*, and other interesting species.

Table showing the Distribution of the Species in the Different River-Basins—Continued.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Photogenis niveus, (Cope) Jor	..	..	..	..	+	..	..	..	..	..	..	..	..	
Luxilus coccogenis, (Cope) Jor	..	..	..	..	..	+	..	..	..	+	..	..	..	
Hydrophlox rubricroceus, (Cope) Jor	..	..	..	..	..	+	..	..	..	+	..	..	..	
Alburnops chlorocephalus, (Cope) Jor	..	..	+	..	+	..	..	..	..	..	..	..	..	
Hydrophlox lutipinnis, J. & B	..	..	..	..	..	..	+	..	..	..	..	..	..	
Hydrophlox chiliticus (Cope) Jor	..	..	..	+	..	..	..	..	..	..	..	..	..	
Hydrophlox chrosomus, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Hydrophlox xænocephalus, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Hydrophlox lacertosus, (Cope) Jor	..	..	..	..	..	..	..	..	..	+	..	..	..	
Alburnops spectrunculus, (Cope) Jor	..	..	..	..	..	..	..	..	..	+	..	..	..	
Alburnops stramineus, (Cope) Jor	..	..	..	..	..	..	..	..	..	..	..	+	+	
Alburnops fretensis, (Cope) Jor	..	..	..	..	..	..	..	..	..	..	..	..	+	N.
Alburnops microstomus, (Raf.) Jor	+	+	..	..	..	..	..	..	..	+	+	+	..	
Alburnops saludanus, J. & B	..	..	..	..	+	..	..	..	..	..	..	..	..	
Alburnops amarus, (Grd.) Jor	..	..	+	..	..	..	+	..	..	..	..	..	..	NE.
Notropis dinemus, (Raf.) Jor	..	..	..	..	..	..	..	..	..	+	+	+	+	
Notropis rubellus, (Ag.) Jor	..	..	..	..	..	..	..	..	..	..	..	+	+	N.
Notropis rubrifrons, (Cope) Jor	..	..	..	..	..	..	..	..	..	..	..	+	+	
Notropis micropteryx, (Cope) Jor	..	..	..	..	..	..	..	..	..	+	+	..	..	
Notropis dilectus, (Grd.) Jor	..	..	..	..	..	..	..	..	..	..	..	+	..	W.
Notropis altipinnis, (Cope) Jor	..	..	..	+	..	..	..	..	..	..	..	..	..	
Notropis stilbius, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Notropis telescopus, (Cope) Jor	..	..	..	..	..	..	..	..	..	+	+	..	..	
Notropis photogenis, (Cope) Jor	..	..	+	..	+	..	..	..	..	+	..	+	..	
Notropis matutinus, (Cope) Jor	..	..	+	..	..	..	..	..	..	..	..	..	..	
Notropis lirus, Jor	..	..	..	..	..	..	..	..	+	+	..	..	..	
Lythrurus ardens, (Cope) Jor	..	+	..	..	..	..	..	..	..	..	+	..	..	
Lythrurus diplæmius, (Raf.) Jor	..	..	..	..	..	..	..	..	..	..	..	+	+	
Codoma xænura Jor	..	..	..	..	..	..	+	..	..	..	..	..	..	
Codoma pyrrhomelas (Cope) Jor	..	..	..	..	+	..	..	..	..	..	..	..	..	
Codoma formosa, (Putn.) Jor	..	..	..	..	..	..	..	+	..	..	..	..	..	
Codoma callisema, Jor	..	..	..	..	..	..	+	..	..	..	..	..	..	
Codoma chloristia, J. & B	..	..	..	..	+	..	..	..	..	..	..	..	..	
Codoma cærulea, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Codoma trichroistia, Jor. & Gilbert	..	..	..	..	..	..	..	..	+	..	..	..	..	
Codoma callistia, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Codoma stigmatura, Jor	..	..	..	..	..	..	..	..	+	..	..	..	..	
Codoma eurystoma, Jor	..	..	..	..	..	..	..	+	..	..	..	..	..	
Episema leucioda, Cope	..	..	..	..	..	..	..	..	..	+	..	..	..	
Episema scabriceps, Cope	..	..	..	..	..	..	..	..	..	..	..	+	..	
Episema ariomma, Cope	..	..	..	..	..	..	..	..	..	..	..	+	..	
Hemitremia vittata, Cope	..	..	..	..	..	..	..	..	..	+	+	..	..	
Hemitremia heterodon, Cope	..	..	..	..	..	..	..	..	..	..	..	..	+	
Chrosomus erythrogaster, Raf	+	+	..	..	..	..	..	..	..	+	+	+	+	
Phoxinus neogæus, Cope	..	..	..	..	..	..	..	..	..	..	..	..	+	N.
Phoxinus flammeus, Jor. & Gilbert	..	..	..	..	..	..	..	..	..	+	..	..	..	
Gila elongata, (Kirt.) Jor	..	..	..	..	..	..	..	..	..	..	..	..	+	
Gila proriger, Cope	..	..	..	..	..	..	..	..	..	..	..	+	..	
Gila cstor, J. & B	..	..	..	..	..	..	..	..	..	+	+	..	..	
Gila vandoisula, (C. & V.) Jor	+	+	..	+	+	..	..	..	..	..	..	..	..	
Notemigonus chrysoleucus, (Mit.) Jor	..	..	..	..	..	..	..	..	+	+	+	+	+	N.

Table showing the Distribution of the Species in the Different River-Basins—Continued.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Notemigonus americanus, (L.) Jor			+		+		+							
Phenacobius teretulus, Cope												+		
Phenacobius uranops, Cope										+	+			
Phenacobius scopiferus, (Cope) Jor													+	
Phenacobius catostomus, Jor									+					
Rhinichthys atronasus, (Mit.) Ag	+	+												
Rhinichthys obtusus, Ag									+	+		+	+	
Rhinichthys meleagris, Ag													+	W.
Rhinichthys nasutus, (Ayres) Ag												+		E.
Ceratichthys zanemus, J. & B														
Ceratichthys labrosus, Cope														
Ceratichthys monachus, Cope										+				
Ceratichthys dissimilis, (Kirt.) Grd										+	+	+	+	
Ceratichthys amblops, (Raf.) Grd											+	+		
Ceratichthys winchelli, (Grd.) Jor									+	+				
Ceratichthys rubrifrons, Jor						+	+							
Ceratichthys hypsinotus, Cope				+										
Ceratichthys biguttatus, (Kirt.) Baird	+	+	+	+	+	+	+	+		+	+	+	+	NW.
Semotilus bullaris, (Raf.) Jor	+													
Semotilus corporalis, (Mit.) Put	+		+	+	+		+		+	+	+	+	+	
Semotilus thoreauianus, Jor								+						
Exoglossum maxillilingua, (Le S.) Hald	+	+										+		NE.
Quassilabia lacera, J. & B										+				
Placopharynx carinatus, Cope												+	+	
Myxostoma velatum, (Raf.) Jor			+	+	+					+		+	+	
Myxostoma album, (Cope) Jor					+									
Myxostoma coregonus, (Cope) Jor				+	+									
Myxostoma conus, (Cope) Jor				+										
Myxostoma thalassinum, (Cope) Jor				+										
Myxostoma pidiense, (Cope) Jor				+										
Myxostoma crassilabre, (Cope) Jor			+											
Myxost. macrolepidotum, (Le S.) Jor. et vars			+					+	+	+	+	+	+	
Myxostoma aureolum, (Le S.) Jor												+	+	
Myxostoma anisurum, (Raf.) Jor												+		
Myxostoma cryops, Jor									+					
Myxostoma cervinum, (Cope) Jor	+	+			+	+	+	+						
Myxostoma papillosum, (Cope) Jor					+		+							
Minytrema melanops, (Raf.) Jor									+	+	+	+	+	W.
Erimyzon sucetta, (Lac.) Jor			+		+		+	+	+	+	+	+	+	
Hypentelium nigricans, (Le S.) Jor	+	+				+				+	+	+	+	NW.
Hypentelium etowanum, Jor									+					
Catostomus commersoni, (Lac.) Jor	+	+	+	+	+					+	+	+	+	
Catostomus longirostris, Le S													+	
Cycleptus elongatus, (Le S.) Raf											+	+	+	
Carpiodes difformis, Cope												+	+	
Carpiodes cutisanserinus, Cope											+	+	+	
Carpiodes velifer, (Raf.) Ag												+	+	
Carpiodes cyprinus, (Le S.) Ag									+					NE.
Carpiodes bison, Ag										+		+	+	
Carpiodes carpio, (Raf.) Jor												+	+	
Ichthyobus bubalus, (Raf.) Ag												+	+	
Bubalichthys cyanellus, (Nels.) Jor												+	+	W.

Table showing the Distribution of the Species in the Different River-Basins—Continued.

	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chatt. hoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	General range.
Babalichthys urus, Ag										+		+	+	
Ichthælurus furcatus (C. & V.) Gill		-										+		SW.
Ichthælurus robustus, Jor													+	
Ichthælurus punctatus, (Raf) Jor						+	+	+	+	+	+	+	+	W.
Amiurus albidus, (Le S.) Gill	+		+											
Amiurus niveiventris, Cope			+											
Amiurus nigricans, (Le S.) Gill												+	+	N. & S.
Amiurus natalis, (Le S.) Gill			+						+	+	+	+	+	
Amiurus, catus, (L.) Gill	+	+	+									+	+	
Amiurus xanthocephalus, (Raf.) Gill												+	+	
Amiurus melas, (Raf) J. & C												+	+	W.
Amiurus marmoratus, (Holbr.) Jor							+					+		
Amiurus platycephalus, (Grd.) Gill					+	+								
Amiurus brunneus, Jor				+	+		+	+						
Pelodichthys olivaris, (Raf) G. & J										+	+	+		
Noturus flavus Raf												+	+	N.
Noturus insignis, (Rich.) G. & J	+			+	+							+	-	NE.
Noturus exilis, Nels												+	+	NW.
Noturus leptacanthus, Jor								+	+					
Noturus sialis, Jor												+	+	W.
Noturus miurus, Jor												+	+	
Noturus eleutherus, Jor			+							+				
Anguilla vulgaris, Flem	+	+	+	+	+	+	+	+	+	+	+	+	+	
Amia calva L										+		+	+	
Lepidosteus osseus, (L.) Ag				+	+			+	+	+	+	+	+	
Lepidosteus platystomus, Raf											+	+	+	W.
Litholepis spatula, (Lac.) Jor												+	+	
Scaphirhynchops platyrhynchus, (Raf) Gill												+	+	
Polyodon folium, Auct										+	+	+	+	
Acipenser rubicundus, Le S										+		+	+	
Acipenser maculosus, Le S										+		+	+	
Ammocœtes argenteus, (Kirt.)												+	+	
Ammocœtes niger, (Raf)												+	+	
Ammocœtes hirudo, (Grd.)												+		
Total	35	19	42	24	40	13	24	22	55	84	66	138	117	

From the above table, it will be seen that the number of species inhabiting any one river-basin rapidly increases as we leave the Atlantic streams for those of the Gulf. The following table shows the arrangement of the species from another point of view—omitting reference to the range of the species outside of the thirteen rivers included in this table:

Known only from the—	Species.	Known only from the—	Species.
Ohio	30	Tennessee	16
Alabama	17	Illinois	14

Known only from the—	Species.	Known only from the—	Species.
Santee	10	James	3
Altamaha	7	Cumberland	2
Great Pedee	6	Roanoake	1
Neuse	7	Savannah	0
Chattahoochee	4		

Common to—

	Species.
Ohio and Illinois	39
Cumberland and Tennessee	10
Tennessee, Cumberland, Ohio, and Illinois	10
Cumberland, Ohio, and Illinois	10
Alabama, Tennessee, Cumberland, Ohio, and Illinois	6
James and Neuse	4
Tennessee, Ohio, and Illinois	4
Alabama and Tennessee	3
Savannah and Tennessee	2
Alabama, Tennessee, and Cumberland	2
Great Pedee and Santee	2
Cumberland and Ohio	2

Distribution of Genera.

	Great Lakes.	Connecticut.	Delaware.	Susquehanna.	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	Wisconsin.	Lower Mississippi.
Lota	+	+	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	...
Uranidea	+	+	+	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Potamocottus	+	...	...	...	+	...	...	...	...	...	...	...	+	+	+	+	+	+	+
Tauridea	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Triglopsis	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ammocrypta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Pleurolepis	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	+	+	...	...
Ioa*	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...
Percina	+	...	...	+	...	...	...	...	...	...	...	...	+	+	+	+	+	+	...
Alvordius	+	...	...	+	...	...	+	...	+	...	...	...	...	+	+	+	+	+	...
Ericosma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
Hadropterus	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	+	...	...	...
Imostoma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+	...	...
Rheocrypta	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
Ulocentra	...	...	...	...	...	...	...	...	...	...	...	...	+	...	+	...	...	...	+
Diplesium	+	...	...	...	+	...	...	...	...	...	...	...	...	+	+	+	+	...	...

* Ioa (J. & B.), gen. nov.: type *Poecilichthys vitreus* Cope. This genus is distinguished from *Pleurolepis* by the presence of two anal spines instead of one, and by the greater scaliness of the ventral region. The name is from ἰός, an arrow or dart.

Distribution of Genera—Continued.

	Great Lakes.	Connecticut.	Delaware.	Susquehanna.	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois.	Wisconsin.	Lower Mississippi.
Boleosoma	+	+	+	+	+	...	+	+	+	...	+	...	...	+	+	+	+	+	...
Nothonotus	...	...	...	...	...	...	...	...	+	...	+	...	...	+	+	+	...	...	...
Pœcilichthys	+	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+
Etheostoma	+	...	...	...	+	+	...	...	+	...	...	...	...	+	+	+	...	+	...
Boleichthys	+	+	+	...	...	...	...	...	...	...	...	...	+	...	...	+	+	+	+
Vaillantia*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
Microperca	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	...
Elassoma	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	+
Perca	+	+	+	+	...	...	+	...	...	...	...	...	...	...	...	...	+	+	...
Stizostethium	+	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	...
Micropterus	+	...	...	...	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Ambloplites	+	...	...	...	+	...	...	...	...	...	...	+	+	+	+	+	+	+	+
Acantharchus	...	...	+	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...
Chænobryttus	+	...	...	...	+	+	+	+	+	...	+	...	+	+	+	+	+	+	+
Apomotis	+	...	+	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+
Lepiopomus	+	+	+	+	+	+	+	+	+	...	+	+	+	+	+	+	+	+	+
Xenotis	+	...	...	...	...	...	...	...	...	+	...	...	+	+	+	+	+	+	+
Xystroplites	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Eupomotis	+	+	+	+	+	...	+	+	+	...	...	...	+	+	...	...	+	+	...
Mesogonistius	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Enneacanthus	...	+	+	+	+	...	+	...	...	...	...	...	...	...	...	...	...	...	...
Hemioplites	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Copelandia	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Centrarchus	...	...	...	...	...	...	+	...	...	...	+	...	+	...	...	+	...	...	+
Pomoxys	+	...	+	...	+	...	+	...	...	...	...	...	+	+	+	+	+	+	+
Haploidonctus	+	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	+
Aphododerus	+	...	+	+	...	...	+	...	...	...	...	+	+	...	...	+	+	...	+
Eucalia	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	+	...
Pygosteus	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Labidesthes	+	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	...
Fundulus	+	+	+	+	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+
Xenisma	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	...	...	...	...
Zygonectes	+	...	...	...	+	...	+	...	...	+	...	...	+	+	+	+	+	+	+
Gambusia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Girardinus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Mollienesia	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Melanura	+	+	+	+	+	...	+	...	...	...	...	...	...	...	...	+	+	+	...
Amblyopsis	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
Typhlichthys	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
Chologaster	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
Esox	+	+	+	+	+	...	+	...	+	...	+	...	+	+	+	+	+	+	...
Tetragonopterus	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
Percopsis	+	...	+	...	...	...	...	...	...	...	...	...	...	...	...	+	+	+	...
Salvelinus	+	+	+	+	+	+	...	...	+	+	...	...	...	+	...	+	...	+	...
Cristivomer	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Thymallus	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Coregonus	+	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	+	...
Hyodon	+	...	...	...	...	...	...	...	...	...	...	...	+	+	+	+	+	+	+

* VAILLANTIA (jordan), gen. nov.: type *Boleosoma Camurum* Forbes. This genus differs from *Boleichthys* in having the upper jaw protractile, and the anal spines very feeble. From *Boleosoma*, with which it agrees in these respects, it is distinguished by the incomplete lateral line. It is named for Prof. Léon Vaillaut, of Paris, whose thoroughly excellent monograph of the *Etheostomatidæ* is still the starting-point for all work on that difficult but most interesting group.

Distribution of Genera—Continued.

	Great Lakes.	Connecticut.	Delaware.	Susquehanna.	James.	Roanoke.	Neuse.	Great Pedee.	Santee.	Savannah.	Altamaha.	Chattahoochee.	Alabama.	Tennessee.	Cumberland.	Ohio.	Illinois	Wisconsin.	Lower Mississippi.
Pomolobus	+													+	+	+	+		+
Dorosoma	+												+	+	+	+	+		+
Campostoma	+				+	+			+			+	+	+		+	+	+	+
Hybognathus			+				+		+							+	+		
Pimephales	+													+		+	+	+	
Hyborhynchus	+																		
Luxilus (proper)	+	+	+	+	+	+	+						+	+	+	+	+	+	+
Photogenis	+		+	+	+		+	+	+	+		+		+		+	+	+	
Hydrophlox	+		+					+	+	+	+		+	+	+				
Alburnops	+		+	+	+	+							+	+	+	+	+	+	+
Hudsonius	+		+	+			+		+		+								
Lythrurus	+					+									+	+	+	+	
Cyprinella																+			+
Codoma									+		+	+	+	+					
Notropis	+		+				+	+	+				+	+	+	+	+	+	+
Episema														+		+			+
Phenacobius													+	+	+	+	+		+
Hemitremia		+	+	+										+	+		+	+	
Chrosomus	+			+	+	+								+	+	+	+	+	
Phoxinus	+			+										+			+	+	
Gila	+		+		+	+		+	+						+	+	+	+	
Notemigonus	+	+	+	+			+	+	+		+		+	+	+	+	+	+	+
Rhinichthys	+	+	+	+	+	+							+	+	+	+	+	+	
Ceratichthys	+			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
Semotilus	+	+	+	+	+		+	+	+		+		+	+	+	+	+	+	
Ericymba																+			
Exoglossum				+	+	+										+			
Quassilabia														+		+			
Placopharynx														+			+		
Myxostoma	+		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Minytrema	+								+				+	+	+	+	+	+	+
Erimyzon	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Catostomus	+	+	+	+	+	+	+	+	+					+		+	+	+	
Cycleptus															+	+	+	+	+
Carpiodes	+			+									+	+	+	+	+	+	+
Ichthyobus																+	+	+	+
Bubalichthys													+	+	+	+	+	+	+
Ichthaelurus	+									+	+	+	+	+	+	+	+	+	+
Amiurus	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Pelodichthys														+	+	+	+	+	+
Noturus	+		+	+	+		+	+						+	+	+	+	+	+
Anguilla	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Amia	+													+		+	+	+	+
Lepidosteus	+		+	+				+	+			+	+	+	+	+	+	+	+
Litholepis																	+	+	+
Polyodon														+	+		+	+	+
Acipenser	+													+		+	+	+	+
Scaphirhynchops																	+	+	+
Ammocœtes	+															+	+	+	+
Total	69	21	35	34	32	19	29	19	28	12	19	15	40	59	56	83	63	65	53

CONCLUSIONS.*

In the course of the investigations detailed in this paper, some light has been thrown on the laws which govern the distribution of fresh-water fishes in general. The writer has collated the known facts into a series of general propositions, which, without any pretense to exhaustiveness or to originality, are here briefly stated. It may be premised that some of these propositions are only half truths, to be more completely stated when our knowledge of the subject shall be increased. Most of the statements also refer chiefly to the smaller and non-migratory fishes, especially the *Etheostomatidæ*, *Centrarchidæ*, and *Cyprinidæ*. Our knowledge of the range of the larger *Catostomidæ* and *Siluridæ* is still very meagre.

For the first statement of several of the following propositions, we are indebted to Professor Cope, who has ably discussed the subject of the distribution of fishes in his paper on the Fishes of the Alleghany Region of Southwest Virginia, Journ. Acad. Nat. Sc. Phila. 1868, pp. 239–247.

I. In the case of rivers flowing into the *ocean*, the character of the faunæ of the upper waters, compared one with another, bears no, or very little, relation with the places of discharge. In illustration of this we may note (*a*) the similarity of the faunæ of the Chattahoochee and Altamaha, as compared with the Chattahoochee and Alabama. The faunæ of Wisconsin River and of Red River of the North are very similar.

II. River-basins having a similar discharge into some larger river or lake have a similarity of fauna, due to this fact, and, in general, other things being equal, the nearer together the places of discharge, if in *fresh water*, the greater the similarity. The almost identical faunæ of the Catawba and the Saluda will illustrate this.

III. Parallel rivers tributary to the same stream have, other things being equal, more in common than streams coming from opposite directions. The Wabash and Miami have more in common than either has with the Kentucky.

IV. The higher or the older the water-shed between two streams, the fewer species are common to both. (This matter needs further investigation.)

V. Certain species, not including "species of general distribution", occur on opposite sides of even the highest watersheds. This fact was first noticed by Professor Cope. The occurrence of *Luxilus coccogenis*,

* An abstract of the remaining part of this paper appeared in the American Naturalist for October, 1877 (pp. 607–613). For this part, Professor Jordan is alone responsible.

Hydrophlox rubricroceus, *Photogenis galacturus*, and *Catostomus nigricans*, both in the Tennessee and Savannah, will illustrate this. Neither of the two first-named species are as yet known from any other river-basins.

VI. When the watershed between two streams is a swampy upland instead of a mountain-range, the same species may be found in the headwaters of both, although the species inhabiting the lower courses may be different. In case the one stream flows northward and the other southward, the common fauna will be nearest like that of the northern stream.

In Northern Indiana, the same species are found in the waters of Saint Joseph's, Maumee, Wabash, and Illinois Rivers, although these streams discharge their waters in widely different directions. The swampy watershed between them is often overflowed in the spring, affording to the smaller fishes an easy means of migration.

VII. In any river-basin, many of the species inhabiting small streams are different from those occurring in the river-channels. Among the brook species may be mentioned *Eucalia inconstans*, *Pœcilichthys spectabilis*, *Xenotis lythrochloris*, *Xenisma stelliferum*, *Salvelinus fontinalis*, *Ericymba buccata*, *Semotilus corporalis*, *Chrosomus erythrogaster*, the species of *Rhinichthys*, etc. Of channel species, *Haploidonotus*, *Hyodon*, *Dorosoma*, *Pomolobus*, *Roccus chrysops*, all the "Buffalo-fishes", and the larger *Siluridæ*, *Ichthælurus punctatus*, *Pelodichthys olivaris*, *Amiurus nigricans*, and the like, will serve as examples.

VIII. Many species inhabiting the upper course of a stream are different from those of the lower. This subject has been ably discussed by Professer Cope, but further investigations, especially of the rivers of the Southern States, are very desirable.

IX. This difference between the upper fauna and the lower is due to differences in the character of the river itself, such as climate, condition of water, character of river-bed, supply of food, etc.

X. Hence, if in the same river basin there are two streams flowing into a larger stream, the one near its source, the other near its mouth, if the two streams are similar in all known physical respects, their faunæ will be similar, and if dissimilar, they will have different faunæ. The general identity of the faunæ of Elk River and Powell's River may be noticed in this connection.

XI. Some species of fishes are confined strictly to a single river-basin, while other species, with apparently no better means of diffusion or of defense, are widely distributed, inhabiting many rivers. In illustration of this, the limited range of each of the species of *Codoma* may be com-

pared with the range of *Luxilus cornutus*. In the genus *Ceratichthys*, *C. biguttatus* probably occurs in every stream from the Susquehanna to the Great Salt Lake, while four other species of the same genus, *C. micropogon*, *C. monachus*, *C. zanemus*, and *C. labrosus*, are each, so far as is known, confined to a single river-basin.

XII. In any river-basin, the most abundant species (of small fishes) are usually (*a*) those peculiar to it, or (*b*) those of the widest distribution. In illustration of this, we may notice the abundance of *Codoma pyrrhomelas* and *Notropis photogenis* in the Santee; of *Codoma stigmatura* and *Luxilus cornutus* in the Alabama; of *Codoma eurystoma* and *Ceratichthys biguttatus* in the Chattahoochee; of *Codoma xænura* and *Notemigonus americanus* in the Ocmulgee. To this rule, however, there are many exceptions and modifications.

XIII. In general, the further south any river-basin lies, the more species are peculiar to it, and the greater the differences between its fauna and that of the neighboring streams. In illustration of this, the differences existing between the faunæ of the Alabama and Chattahoochee may be compared with those between the faunæ of the Susquehanna and Delaware. Twelve genera are known to be common to the Chattahoochee and Alabama, and twenty-three to the Susquehanna and Delaware. In the Southern streams, the process of evolution of specific forms seems to have gone on more rapidly. This matter, however, requires further investigation.

XIV. Species of the widest distribution often have breaks in their range which cannot be accounted for by any facts now in our possession. *Luxilus cornutus*, so abundant in all the waters of the North and West, does not occur, so far as is known, in any of the rivers between the Neuse and the Alabama, in both of which streams it is abundant. Various species range over several river-basins and then cease abruptly. *Amiurus brunneus* is abundant from the Santee to the Chattahoochee, in the latter river the most abundant food-fish, while in the very next river-basin, the Alabama, it is unknown.

XV. Many species of wide distribution which are absent in certain streams are there represented by certain other related species, which may be regarded as modified descendants. Thus, in the South Atlantic streams, *Chœnobryttus gulosus* is represented by *Chœnobryttus viridis*, *Notemigonus chrysoleucus* by *Notemigonus americanus*. In the Southwest, *Eupomotis aureus* is represented by *Eupomotis pallidus;* in the West, *Noturus gyrinus* by *Noturus sialis*, *Noturus insignis* by *Noturus*

exilis, *Noturus eleutherus* by *Noturus miurus*, *Melanura pygmæa* by *Melanura limi*.

XVI. Other species under similar circumstances have no such representatives. The case of *Luxilus cornutus* will again illustrate.

XVII. Certain species have been known to extend their geographical range since the opening of the canals. Such are more especially the migratory species of probably marine origin, as *Dorosoma heterura*, *Pomolobus chrysochloris*, and *Anguilla vulgaris*. These species are now abundant in Lake Michigan and Lake Erie, although formerly unknown there. The range of certain *Percidæ* and *Centrarchidæ* has undoubtedly been extended by the same means.

XVIII. The characteristically American forms of fishes are, generally speaking, rare or absent in the waters of New England and of the Pacific slope. This fact has been well stated by Professor Agassiz, who called New England "a zoological island".

About 105 genera of fresh-water fishes occur in the waters of the United States east of the Mississippi River. Of these, about 76 do not occur in New England (exclusive of Lake Champlain, the fauna of which is nearly identical with that of Lake Ontario.) Of these 30 or fewer genera occurring in New England, all but *Salvelinus*, *Coregonus*, *Esox*, *Semotilus*, *Rhinichthys*, and possibly *Amiurus*, are represented by a single species each. From 30 to 35 genera occur in the waters of the Pacific slope.

XIX. The larger the river-basin, the greater its variety of forms, both genera and species. In the little White River at Indianapolis, belonging to the Mississippi basin, 70 species, representing 48 genera, are known to occur—twice as many as inhabit all the rivers of New England.

XX. Other things being equal, a river whose course lies in a region of undisturbed stratified rocks or of glacial drift contains most genera and species.

XXI. Conversely, rivers in regions of igneous or metamorphic rock contain fewest species.

XXII. Sources of streams on opposite sides of a high watershed often have species in common which do not occur in the lower courses of the same rivers. The distribution of several mountain species, as *Salvelinus fontinalis* and *Hydrophlox rubricroceus*, will exemplify this.

XXIII. Certain species have a compact geographical range, occurring in all the rivers within this range, without apparent regard to the direction of their flow. Such are *Lepiopomus obscurus* in the Alabama, Ten-

nessee, and Cumberland, and *Alburnops microstomus* in the James, Roanoke, Kentucky, Cumberland, and Clinch.

XXIV. Certain species have a wide east and west range, without apparent regard to the courses of the rivers, but are bounded on either the north or the south by parallels of latitude.

Eucalia inconstans occurs from Western New York to Kansas and northward, but it is never found southward of a line passing about fifty miles south of Lake Erie. *Percopsis guttatus* has a like range, but its southern boundary is in the Potomac and Ohio. *Lota lacustris* is similarly circumscribed, but ranges farther to the east. The three species of *Lythrurus* have each a belt of latitude: *L. cyanocephalus* belonging to the Great Lakes and Upper Mississippi; *L. diplæmius* to the Ohio and the Potomac; *L. ardens* to the Roanoke, James, and Cumberland. The three species of *Hyodon* are similarly arranged.

XXV. Certain species have a peculiar northern and eastern range, occurring in the waters of the Upper Mississippi, in the headwaters of the Illinois, Wabash, and Scioto, thence through the Great Lakes to New England, thence to South Carolina on the eastern slope of the Alleghanies. Such species are *Eupomotis aureus*, *Perca americana*, and *Amiurus catus*.

XXVI. Certain species have a peculiar northern and western range, occurring in the Middle States and in the Great Lakes, and usually southward in the east to some point in Virginia or North Carolina, ceasing in the same latitude on both sides of the Alleghanies, but extending southwestward through the Mississippi Valley to the Gulf of Mexico. Among these may be mentioned *Luxilus cornutus*, *Notemigonus chrysoleucus*, *Ambloplites rupestris*, *Apomotis cyanellus*. The last-named species, however, scarcely ranges east of the Alleghanies.

XXVII. Certain species have a wide range north and south, either east or west of the Alleghanies, but do not cross that chain. Of these may be mentioned *Lepiopomus auritus*, *Enneacanthus obesus*, *Esox reticulatus*, etc., on the east, and *Haploidonotus grunniens*, *Hyodon tergisus*, *Noturus miurus*, *Noturus sialis*, etc., on the west.

XXVIII. The distribution of fresh-water fishes is dependent (*a*) on fresh-water communication; (*b*) on character of stream, *i. e.*, of water—as to purity, depth, rapidity, vegetable growth, etc.; (*c*) on the character of the river-bed; (*d*) on climate, as determined by latitude and by elevation above the sea; and (*e*) finally on various unknown factors arising from the nature or past history of the species in question, and from the geological history of the rivers.

B.

A SYNOPSIS OF THE FAMILY CATOSTOMIDÆ.

By David S. Jordan.

Class PISCES.

Subclass TELEOSTEI.

Order TELEOCEPHALI.

Suborder EVENTOGNATHI.

Family CATOSTOMIDÆ.

Catostomoidæ Gill. Proc. Acad. Nat. Sc. Phila. v. 13, p. 8, 1861.
Catostomidæ Cope, Proc. Am. Assoc. Adv. Sci. v. 20, p. 332, 1872.
Catostomidæ Jordan, Man. Vert. E. U. S. p. 292, 1876.
Cyprinidæ gen. Rafinesque, Risso, Cuvier, Bonaparte, Girard, Bleeker.
Cyprinidæ subfam. Heckel, Agassiz, Bleeker, Günther.

The family of *Catostomidæ*, or the "Suckers", may be briefly defined as follows:—*Eventognathous* fishes, having the pharyngeal teeth pectiniform, in a single row, closely approximated, very numerous, and compressed at right angles to the direction of the bone, and the intermaxillaries forming but a small part of the upper arch of the mouth, the maxillaries entering into it largely on each side.*

* The following more elaborate diagnosis is given by Professor Gill (Johnson's Universal Cyclopædia, vol. iv, p. 1574):—"The body varies between an elongated subcylindrical and an oblong more or less compressed contour; the scales are of medium or rather large size, cycloid; the lateral line is generally present and decurved, but some-

Early writers on fishes, as well as most foreign ichthyologists, have considered the Suckers as forming a mere tribe or subfamily of the *Cyprinidæ*, which group has been variously denominated *Catostomi*, *Catostomina*, and *Catostominæ*, but the characters above noted, of teeth and mouth, seem to the writer to fully justify their separation as a distinct family. The dorsal fin in *Catostomidæ* is more developed than is usual in American *Cyprinidæ*, although various Old World genera show similar characters. The development of the lips and the great protractility of the mouth are features usually diagnostic, but in the genus *Quassi'abia* the mouth is scarcely protractile, and among our *Cyprinidæ* certain species of *Phenacobius* and *Ceratichthys* have thicker lips than have some of the *Catostomidæ*.

The *Catostomidæ* fall at once into three well-marked subfamilies, first indicated by Professor Gill, and termed by him *Catostominæ*, *Cycleptinæ*, and *Bubalichthyinæ*. These may be characterized as follows:—

Catostominæ.—Body oblong or elongate, subterete or more or less compressed: dorsal fin nearly median, short and subquadrate, with from nine to eighteen developed rays: ventral fins under the dorsal, of nine or ten rays: anal fin high and short, normally of seven rays, nearer the base of the caudal than that of the ventral fins: lips well developed, usually papillose or plicate: gill-rakers little developed. Genera *Quassilabia*, *Placopharynx*, *Myxostoma*, *Erimyzon*, *Minytrema*, *Chasmistes*, *Catostomus*, *Pantosteus*.

Cycleptinæ.—Body elongate, slender: dorsal fin falciform, of about 30 rays, beginning over the interval between the pectoral and ventral fins, and extending as far back as the beginning of the anal fin: ventral fins 10 rayed; anal fin small, of about 7 rays: head extremely small: scales moderate, with the exposed surfaces broad: fontanelle entirely obliter-

times absent; the head is diversiform; the opercular bones normally developed; the nostrils double; the mouth more or less inferior, and provided with fleshy and generally papillose or crenated lips; the upper jaw is formed on the middle by the small and lamelliform intermaxillaries, and on the sides by the supramaxillaries; teeth are wanting in the jaws; the pharyngeal bones are developed in a falciform manner, and provided with a row of numerous comb-like teeth; the branchial apertures are restricted to the sides; branchiostegal rays three on each side; dorsal variable in development; anal posterior, and generally short and high; caudal large, and more or less emarginated; pectoral fins low down, but lateral and with their rays branched; ventral fins abdominal; the intestinal canal is very long; the stomach simple and destitute of pyloric cæca; the air-bladder is large, unprotected by an osseous capsule, and divided by transverse constrictions into two or three regions."

ated by the union of the parietal bones: mouth inferior, with thick papillose lips: gill-rakers moderate, soft. Genus *Cycleptus*.

Bubalichthyinæ.—Body stout, oblong-oval, and compressed. Dorsal fin elongate, beginning more or less in front of the ventral fins, and extending at least as far as the commencement of the anal, its rays 20 to 50 in number, the anterior ones more or less elongate: ventral rays usually 10: anal rays 8 to 12: head stout and heavy: mouth moderate or small, with thin lips: fontanelle open: gill-rakers of anterior arch long, slender, and stiff above, growing smaller downwards. Genera *Carpiodes*, *Bubalichthys*, *Ichthyobus*, *Myxocyprinus*.

As the chief purpose of this paper is to ascertain and make known the proper nomenclature of the valid genera and species of *Catostomidæ*, I shall omit further discussion of family and subfamily characters, and proceed at once to a catalogue of described species, arranged in chronological order, with the date and my identification of each species opposite its name. As is the case in nearly every group of American fishes, the number of nominal species is about three times the number really existing. It will be noticed that the number of species which I have admitted is in most of the Catostomoid genera fewer than has been recognized by previous writers. This seems to me to result not from any peculiar theories as to what constitutes a species, but from the fact that I have had a greater range of specimens of most forms than any previous writer has had. I am confident that in the presence of a still greater amount of material, the characters of several other species will be found to melt away. To indicate which these species are, in default of such material, would, however, be an unprofitable task. In this group, as in so many others, the truth well stated by Dr. Coues* becomes apparent:—"We can only predicate and define species at all from the mere circumstance of *missing links*. 'Species' are the twigs of a tree separated from the parent stems. We name and arrange them arbitrarily, in default of a means of reconstructing the whole tree according to Nature's ramifications."

* Birds of the Northwest, p. 227.

List of Nominal Species of Catostomidæ, with Identifications.

Nominal species.	Date.	Identification.
Cyprinus catostomus Forster	1773	Catostomus longirostris.
"*Le cyprin commersonien*"* Lacépède	1803	Catostomus teres.
Cyprinus sucetta Lacépède	1803	Erimyzon sucetta.
Cyprinus rostratus Tilesius	1813	(Catostomus) rostratus.
Cyprinus teres Mitchill	1814	Catostomus teres.
Cyprinus oblongus Mitchill	1814	Erimyzon sucetta.
Catostomus cyprinus Le Sueur	1817	Carpiodes cyprinus.
Catostomus gibbosus Le Sueur	1817	Erimyzon sucetta.
Catostomus tuberculatus Le Sueur	1817	Erimyzon sucetta.
Catostomus macrolepidotus Le Sueur	1817	Myxostoma macrolepidotum.
Catostomus aureolus Le Sueur	1817	Myxostoma aureolum.
Catostomus communis Le Sueur	1817	Catostomus teres.
Catostomus longirostrum Le Sueur	1817	Catostomus longirostris.
Catostomus nigricans Le Sueur	1817	Catostomus nigricans.
Catostomus maculosus Le Sueur	1817	Catostomus nigricans.
Catostomus elongatus Le Sueur	1817	Cycleptus elongatus.
Catostomus vittatus Le Sueur	1817	Erimyzon sucetta.
Catostomus duquesnii Le Sueur	1817	Myxostoma macrolepidotum duquesni.
Catostomus bostoniensis Le Sueur	1817	Catostomus teres.
Catostomus hudsonius Le Sueur	1817	Catostomus longirostris.
Catostomus bubalus Rafinesque	1818	Ichthyobus bubalus.
Catostomus erythrurus Rafinesque	1818	Myxostoma macrolepidotum duquesni.
Exoglossum macropterum Rafinesque	1818	Catostomus nigricans.
Amblodon niger Rafinesque	1819	Bubalichthys sp.?
Cycleptus nigrescens Rafinesque	1819	Cycleptus elongatus.
Rutilus melanurus Rafinesque	1820	Myxostoma macrolepidotum duquesni.
Catostomus anisurus Rafinesque	1820	Myxostoma anisura.
Catostomus anisopterus Rafinesque	1820	Carpiodes sp.
Catostomus carpio Rafinesque	1820	Carpiodes carpio.
Catostomus velifer Rafinesque	1820	Carpiodes velifer.
Catostomus xanthopus Rafinesque	1820	Catostomus nigricans.
Catostomus melanops Rafinesque	1820	Minytrema melanops.
Catostomus fasciolaris Rafinesque	1820	Erimyzon sucetta.
Catostomus flexuosus Rafinesque	1820	Catostomus teres.
Catostomus megastomus Rafinesque	1820	*A myth.*
Catostomus forsterianus Richardson	1823	Catostomus longirostris.
Catostomus lesueurii Richardson	1823	Myxostoma aureolum.

*This species is quoted by Dr. Günther as "*Cyprinus commersonnii* Lacépède". I have been unable to examine Lacépède's original work, but in the reprints of it, supposed to be literal, I find only the French form, "Le Cyprin Commersonien". Unless Lacépède really bestowed a Latinized specific name on the species, "*commersoni*" or "*commersonianus*" should not claim priority over *teres* of Mitchill.

List of Nominal Species of Catostomidæ, with Identifications—Continued.

Nominal species.	Date.	Identification.
Cyprinus (Catostomus) sucurii Rich.	1836	Myxostoma aureolum ?
Cyprinus (Catostomus) reticulatus Rich.	1836	Catostomus teres.
Catostomus gracilis Kirtland	1838	Catostomus teres.
Labeo elegans DeKay	1842	Erimyzon sucetta.
Labeo esopus DeKay	1842	Erimyzon sucetta.
Catostomus oneida DeKay	1842	Myxostoma macrolepidotum.
Catostomus pallidus DeKay	1842	Catostomus teres.
Labeo elongatus DeKay	1842	Erimyzon sucetta.
Catostomus fasciatus Le Sueur, MSS	1844	Minytrema melanops.
Catostomus planiceps Valenciennes	1844	Catostomus nigricans.
Catostomus carpio Valenciennes	1844	Myxostoma carpio.
Catostomus tilesii Valenciennes	1844	(Catostomus) rostratus.
Sclerognathus cyprinella Valenciennes	1844	Ichthyobus bubalus.
Catostomus forsterianus Agassiz	1850	Catostomus teres.
Catostomus aurora Agassiz	1850	Catostomus longirostris.
Catostomus latipinnis Baird & Girard	1853	Catostomus latipinnis.
Carpiodes urus Agassiz	1854	Bubalichthys urus.
Carpiodes taurus Agassiz	1854	Bubalichthys sp.
Carpiodes bison Agassiz	1854	Carpiodes bison.
Carpiodes vitulus Agassiz	1854	Bubalichthys sp.
Carpiodes vacca Agassiz	1854	Carpiodes cyprinus.
Castotomus congestus Baird & Girard	1854	Myxostoma congestum.
Catostomus clarki Baird & Girard	1854	Catostomus clarki.
Catostomus insignis Baird & Girard	1854	Catostomus insignis
Catostomus plebeius Baird & Girard	1854	Pantosteus plebeius.
Carpiodes tumidus Baird & Girard	1854	Carpiodes cyprinus.
Catostomus occidentalis Ayres	1854	Catostomus occidentalis.
Ichthyobus rauchii Agassiz	1855	Ichthyobus bubalus.
Ichthyobus stolleyi Agassiz	1855	Ichthyobus bubalus.
Moxostoma tenue Agassiz	1855	Erimyzon oblongus.
Carpiodes thompsoni Agassiz	1855	Carpiodes thompsoni.
Bubalichthys niger Agassiz	1855	Bubalichthys urus.
Bubalichthys bubalus Agassiz	1855	Bubalichthys bubalus.
Bubalichthys bonasus Agassiz	1855	Bubalichthys urus.
Catostomus occidentalis Agassiz	1855	Catostomus occidentalis.
Catostomus labiatus Ayres	1855	Catostomus labiatus.
Carpiodes damalis Girard	1856	Carpiodes cyprinus.
Moxostoma claviformis Girard	1856	Erimyzon sucetta.
Moxostoma kennerlyi Girard	1856	Erimyzon sucetta.
Moxostoma victoriæ Girard	1856	Minytrema melanops.
Moxostoma campbelli Girard	1856	Erimyzon sucetta.
Ptychostomus albidus Girard	1856	Myxostoma albidum.
Ptychostomus haydeni Girard	1856	Minytrema melanops.

List of Nominal Species of Catostomidæ, with Identifications—Continued.

Nominal species.	Date.	Identification.
Catostomus (Acomus) guzmanensis Gir.	1856	Catostomus latipinnis.
Catostomus (Acomus) generosus Girard.	1856	Pantosteus generosus.
Catostomus (Acomus) griseus Girard...	1856	Catostomus longirostris.
Catostomus (Acomus) lactarius Girard.	1856	Catostomus longirostris.
Catostomus macrocheilus Girard.....	1856	Catostomus macrochilus.
Catostomus sucklii Girard.....	1856	Catostomus teres.
Catostomus bernardini Girard.....	1856	Catostomus occidentalis.
Catostomus texanus Abbott	1860	Catostomus teres.
Catostomus chloropteron Abbott.....	1860	Catostomus teres.
Carpiodes asiaticus Bleeker.....	1864	Myxocyprinus asiaticus.
Teretulus cervinus Cope.....	1868	Myxostoma cervinum.
Sclerognathus meridionalis Günther ...	1868	Bubalichthys meridionalis.
Placopharynx carinatus Cope.....	1870	Placopharynx carinatus.
Ptychostomus pappillosus Cope.....	1870	Myxostoma papillosum.
Ptychostomus velatus Cope.....	1870	Myxostoma velatum.
Ptychostomus collapsus Cope.....	1870	Myxostoma velatum.
Ptychostomus pidiensis Cope.....	1870	Myxostoma pidiense.
Ptychostomus coregonus Cope.....	1870	Myxostoma coregonus.
Ptychostomus albus Cope.....	1870	Myxostoma album.
Ptychostomus thalassinus Cope.....	1870	Myxostoma thalassinum.
Ptychostomus robustus Cope	1870	Myxostoma macrolepidotum.
Ptychostomus lachrymalis Cope.....	1870	Myx. macrolepidotum lachrymale.
Ptychostomus crassilabris Cope.....	1870	Myxostoma crassilabre.
Ptychostomus breviceps Cope	1870	Myxostoma anisura.
Ptychostomus conus Cope.....	1870	Myxostoma conus.
Carpiodes difformis Cope.....	1870	Carpiodes difformis.
Carpiodes cutisanserinus Cope.....	1870	Carpiodes cutisanserinus.
Carpiodes selene Cope.....	1870	Carpiodes cutisanserinus.
Carpiodes grayi Cope	1870	Carpiodes cyprinus.
Carpiodes nummifer Cope	1870	Carpiodes carpio.
Catostomus discobolus Cope.....	1872	Catostomus discobolus.
Minomus delphinus Cope.....	1872	Pantosteus (plebeius?).
Minomus bardus Cope.....	1872	Pantosteus (plebeius?).
Ptychostomus bucco Cope.....	1872	Myxostoma congestum.
Minomus platyrhynchus Cope	1874	Pantosteus platyrhynchus.
Minomus jarrovii Cope.....	1874	Pantosteus generosus.
Catostomus alticolus Cope.....	1874	Catostomus teres.
Ichthyobus cyanellus Nelson.....	1876	Bubalichthys bubalus.
Pantosteus virescens Cope.....	1876	Pantosteus virescens.
Catostomus fecundum Cope & Yarrow.	1876	Chasmistes fecundus.
Moxostoma trisignatum Cope.....	1876	Catostomus teres.
Ichthyobus ischyrus Nelson	1877	Ichthyobus bubalus.
Bubalichthys altus Nelson.....	1877	Bubalichthys bubalus.

List of Nominal Species of Catostomidæ, with Identifications—Continued.

Nominal species.	Date.	Identification
Myxostoma euryops Jordan	1877	Myxostoma euryops.
Bubalichthys bubalinus Jordan	1877	Bubalichthys bubalus.
Myxostoma pœcilura Jordan	1877	Myxostoma pœcilura.
Lagochila lacera Jordan & Brayton	1877	Quassilabia lacera.
Erimyzon goodei Jordan	1878	Erimyzon goodei.
Catostomus arœopus Jordan	1878	Catostomus arœopus.
Catostomus retropinnis Jordan	1878	Catostomus retropinnis.

ANALYSIS OF GENERA OF CATOSTOMIDÆ.

* Dorsal fin short, subquadrate, with ten to eighteen developed rays: body oblong or elongate: gill-rakers feeble. (*Catostominæ.*)

a. Mouth singular, the upper lip not protractile, greatly enlarged, the lower lip developed as two separate lobes: operculum very short: air-bladder in three parts: scales large: fontanelle well developed: lateral line present: pharyngeal bones and teeth ordinary.....QUASSILABIA, 1.

aa. Mouth normal, the lower lip entire or merely lobed, either tubercular or plicate.

b. Air-bladder in three parts: lateral line continuous: fontanelle present: scales large, subequal.

c. Pharyngeal bones very strong, with the lower teeth much enlarged, subcylindrical and truncate, the teeth of the upper part of the bone small and compressed: mouth large, somewhat oblique, with very thick lips.....PLACOPHARYNX, 2.

cc. Pharyngeal bones moderate, the teeth compressed, gradually larger downwards: mouth moderate or small, the lips usually plicate.

MYXOSTOMA, 3.

bb. Air-bladder in two parts.

d. Lateral line interrupted or wanting: scales large (40 to 50 in the course of the lateral line): lips plicate.

e. Lateral line incomplete, obsolete in the young, becoming developed in the adult, but always more or less interrupted: mouth small, inferior.

MINYTREMA, 4.

ee. Lateral line entirely wanting: mouth somewhat oblique..ERIMYZON, 5.

dd. Lateral line complete and continuous: scales small, 55 to 115 in the course of the lateral line.

f. Fontanelle present.

g. Mouth very large, terminal, oblique: lips thin, nearly smooth.

CHASMISTES, 6.

gg. Mouth inferior, moderate or small, with thick, papillose lips.

CATOSTOMUS, 7.

ff. Fontanelle obliterated by the union of the parietal bones: mouth small, inferior, with thick, papillose lips, the lower jaw provided with a cartilaginous sheath.....PANTOSTEUS, 8.

** Dorsal fin elongate, more or less elevated in front, of about 25 or more developed rays: air bladder in two parts.

† Fontanelle obliterated by the union of the parietal bones: head short and small: body elongate. (*Cycleptinæ.*)

h. Mouth small, inferior, with very thick, papillose lips: scales small, 55 to 60 in the course of the lateral line ..... CYCLEPTUS, 9.

†† Fontanelle well developed: head large: body oblong or ovate: scales large, 35 to 45 in the course of the lateral line. (*Bubalichthyinæ.*)

i. Dorsal rays in moderate number (24 to 33).

j. Mouth comparatively small, inferior, protractile downwards.

k. Pharyngeal bones narrow, with the teeth comparatively thin and weak. CARPIODES, 10.

kk. Pharyngeal bones strong, the teeth comparatively coarse and large, increasing in size downwards ..... BUBALICHTHYS, 11.

jj. Mouth quite large, terminal, protractile forwards: pharyngeal bones and teeth moderate: lips thin, nearly smooth ..... ICHTHYOBUS, 12.

ii. Dorsal fin very long, of about 50 developed rays ..... MYXOCYPRINUS, 13

Genus QUASSILABIA *Jordan & Brayton.*

Lagochila JORDAN & BRAYTON, Proc. Ac. Nat. Sc. Phila. 280. 1877. (Preoccupied in conchology as *Lagochilus.*)

Quassilabia (JORDAN & BRAYTON) JORDAN, Man. Vert. E. U. S. ed. 2d, 401, 1878.

Type, *Lagochila lacera* Jordan & Brayton.

Etymology, *quassus,* broken or torn; *labia,* lip.

Suckers like *Myxostoma* in every respect excepting the structure of the mouth and opercula. Head shortish, conical, with lengthened snout; its length 4½ to 5 times in that of the body, the opercular region being reduced, so that the eye is well backwards: suborbital bones narrow: fontanelle large, widely open. Mouth large, singular in structure, inferior, the upper lip not protractile, greatly prolonged, closely plicate. Lower lip much reduced, divided into two distinct elongate lobes, which are weakly papillose. The split between these lobes extends backwards to the edge of the dentary bones, which are provided with a rather hard, horny plate, as in *Pantosteus.* The lower lip is entirely separated from the upper at the angles by a deep fissure. The skin of the cheeks forms a sort of cloak over this fissure, the crease separating this skin from the mouth extending up on the sides of the muzzle. The crease between the lips extends down on the under side of the head. System of muciferous tubes well developed.

Pharyngeal bones not dissimilar from the usual type in *Myxostoma,* rather weak, with numerous small teeth.

Body elongate, not much compressed, not elevated. Fins moderate, of precisely the type usual in *Myxostoma.*

Scales large, precisely as in *Myxostoma*, the lateral line well developed and nearly straight, with about 45 scales in its course.

Air-bladder in three parts.

Sexual peculiarities unknown; probably little marked.

But a single species of this genus is known. It is a sort of offshoot from the genus *Myxostoma*, but its non-protractile mouth and singular lower lip would seem to indicate some real affinity with the genus *Exoglossum*.

The name *Lagochilus* had been previously applied to a genus of Gasteropods by Blanford, and to a genus of Insects by Loew. As *Lagochila* is substantially the same word, with the same etymology, and as, if written in strict correctness, it would be *Lagochilus* also, its authors have seen fit to substitute the name *Quassilabia*, and thus to forestall all discussion as to whether the name *Lagochila* should be retained. As this substitution was made soon after the original description of the genus, and before the name *Lagochila* had come into any general use, it is to be hoped that it will be accepted by succeeding ichthyologists.

Generic Characterizations.

LAGOCHILA Jordan & Brayton, 1877.—"Similar to *Myxostoma* (*Ptychostomus* Agassiz) except in the structure of the mouth parts. Dorsal fin short; lateral line well developed; scales large, subequal; air-bladder in three parts; fontanelle between parietal bones well developed; pharyngeal bones weak, with numerous small teeth; upper lip not all protractile, greatly enlarged, but attenuated, and singular in form. It consists of two elongated and narrow lobes, separated by a narrow, deep fissure, which extends inward to the edge of the mandible proper, which seems to be armed with a rather hard or almost horny plate, about as in the genus *Pantosteus*. The two lobes of the lip are weakly papillose. The lower lip is entirely separated from the upper at the angles by a deep fissure. Over this fissure the skin of the cheek lies as a sort of cloak; the crease separating this skin from the mouth, extending up on the sides of the muzzle. The fissure between the lips extends down on the skin of the under side of the head. The opercle is extremely short and the eye is entirely in the posterior part of the head."—(JORDAN & BRAYTON, *Proc. Ac. Nat. Sc. Phila.* p. 280, 1877.)

QUASSILABIA Jordan & Brayton, 1878.—"When the name *Lagochila* was first proposed for this genus, its authors were not aware that the masculine form, *Lagochilus*, had been already given to two different genera, to one of Gasteropods by Blanford and to one of Insects by Loew. The words *Lagochila* and *Lagochilus* are identical in etymology and in all except terminations, and many writers would consider them insufficiently distinct, and would hold that the name *Lagochila* should be changed. At present, I am inclined to the contrary opinion; nevertheless, as the matter stands, and as the name *Lagochila* has not yet come into general use, less confusion perhaps will result from renaming the genus, than from any other course. The name *Quassilabia* (Jordan & Brayton) is accordingly suggested as a substitute for *Lagochila*, considered to be preoccupied in conchology. The etymology is *quassus*, broken or torn; *labia*, lip.

The case is precisely like that of the genus of Doves, *Leptoptila* Swainson, lately named *Æchmoptila* by Dr. Cones, on account of the previous *Leptoptilus* of Lesson."—(JORDAN, *Bull. U. S. Geol. Surv. Terr.* vol iv, No. 2, p. 418, 1878.)

ANALYSIS OF SPECIES OF QUASSILABIA.

*Head short, conical, with lengthened snout, the region between the eyes flattened and with prominent mucous ridges: cheeks and lower part of head rather swollen: opercle much reduced, its greatest length scarcely greater than the diameter of the eye: head about 4⅔ in length: eye 4½ in length of head, about 2 in length of the snout, its situation thus quite posterior; length of the top of the head 1⅔ in the distance from the snout to the base of the dorsal. Body rather slender, the form being between that of *Myxostoma cervinum* and *M. macrolepidotum*, the depth 4⅔ in the length. Dorsal fin rather low; its rays I, 12; A. I, 7; V. 9. Scales 5-45-5. Color olive or bluish-brown above; sides and belly silvery; lower fins faintly orange...LACERA, 1.

1. QUASSILABIA LACERA *Jordan & Brayton.*

Hare-lip Sucker. Split-mouth Sucker. May Sucker of the Scioto. Cut-lips.

1877—*Lagochila lacera* JORDAN & BRAYTON, Proc. Ac. Nat. Sc. Phila. 280, 1877.
Lagochila lacera JORDAN, Man. Vert. ed. 2d, 511, 1878.
Quassilabia lacera JORDAN, Man. Vert. ed. 2d, 406, 1878.
Quassilabia lacera JORDAN, Bull. U. S. Geol. Surv. Terr. 418, 1878.

HABITAT.—Tennessee River. Scioto River.

Only three specimens of this singular Sucker are yet known. Two of these were taken by Professor Brayton and myself in the Chickamauga River at Ringgold, Catoosa County, Georgia, and the other in Elk River near Estill Springs, Tennessee. In both these streams, the species was well known to the fishermen, who said that it is one of the most abundant species in those waters, and one of the most highly valued for food. In the Chickamauga, it is known as the Hare-lip or Split-mouth Sucker None of the specimens taken were mature, the largest being but ten inches long, so that its maximum size cannot be given.

Since the above was written, a fine large specimen has been sent to me by J. H. Klippart, Esq., of the Ohio Fish Commission. It was taken in Scioto River near Columbus, in April, 1878. Mr. Klippart informs me that the species is well known to the Scioto fishermen, who call it May Sucker, as it runs up the river in May. That so strongly marked a species has so long escaped the attention of ichthyologists in the State of Ohio is singular.

Specimens in United States National Museum.

Number.	Locality.	Collector.
—	Chickamauga River	D. S. Jordan.

Genus PLACOPHARYNX *Cope.*

Placopharynx Cope, Proc. Am. Philos. Soc. Phila. 467, 1870.

Type, *Placopharynx carinatus* Cope.

Etymology, πλὰξ, a broad surface; φάρυγξ, pharynx.

Suckers like *Myxostoma* in all respects, except that the pharyngeal bones are much more developed, and the teeth reduced in number, those on the lower half of the bone very large, 6 to 10 in number, nearly cylindric in form, being but little compressed, and with a broad, rounded or flattened grinding surface. The forms and positions of these enlarged teeth vary greatly. In a specimen before me, the first tooth is the highest and most compressed, its summit being rounded and then abruptly truncate. The second tooth is notably shorter and thicker, much larger, and rounded on top, the body of the tooth serving as a peduncle for the swollen grinding surface. The third tooth is still shorter and similar in form. The fourth tooth is similar to the first, being much higher than the second and third, and flat on top. The others seem to be irregularly alternated or arranged in pairs, a long one and a short one, the long teeth in all cases being the most truncated, as if their surfaces had been most worn off.

As I have at present no perfect specimens of this genus, nothing but very young specimens, and pharyngeal jaws of adults, I cannot do better than to copy Professor Cope's original description, which seems to be an accurate one. I substitute the generic names used in this paper (*Myxostoma*, etc.) for those used by Professor Cope (*Ptychostomus*, etc.), whenever a difference occurs:—

"Allied to *Myxostoma*. The pharyngeal teeth much reduced in number, only seven on the proximal half of the bone, cylindric in form, with a broad, truncate triturating surface. These play against a broad, crescentic, chitin-like shield on the posterior roof of the pharyngeal cavity. Three divisions of the *vesica natatoria*.

"With a great superficial resemblance to *Myxostoma*, the masticatory apparatus is different from that of any Catostomoid form known to me, and combines peculiarities observed in some forms of true *Cyprinidæ*. The chitin-like shield is found in some of the latter; it is represented in *Catostomus*, *Myxostoma*, and *Carpiodes* by a narrow and very thin pellicle of the same material, frequently interrupted in the middle line."

But one species of the genus is known. It is apparently widely distributed through the Mississippi Valley and the Great Lakes, but its

peculiarities are rarely noticed unless the pharyngeal teeth are exposed. The writer has obtained four sets of the pharyngeal jaws and one entire skeleton, but has seen only two small specimens, collected by Professor Brayton in the Illinois River, and has obtained none in life.

Since the foregoing was written, I have collected numerous large specimens in the French Broad River, North Carolina, where it is the most abundant member of the family, known to all fishermen as the "Red Horse". With a great superficial resemblance to the Northern Red Horse (*Myxostoma macrolepidotum*), *Placopharynx carinatus* differs from all the species of *Myxostoma* in its larger and more oblique mouth and extremely thick lips.

2. PLACOPHARYNX CARINATUS *Cope.*

Big-jawed Sucker.

1870—*Placopharynx carinatus* COPE, Proc. Am. Philos. Soc. Phila. 467, 1870.

Placopharynx carinatus JORDAN, Fishes of Ind. 221, 1875. (Name only.)

Placopharynx carinatus JORDAN, Man. Vert. 296, 1876.

Placopharynx carinatus NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Placopharynx carinatus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)

Placopharynx carinatus JORDAN, Proc. Ac. Nat. Sc. Phila. 72, 1877.

Placopharynx carinatus JORDAN & GILBERT, in Klippart's Rept. 53, 1877. (Name only.)

Placopharynx carinatus KLIPPART, First Report Ohio Fish Commission, 86, 1877.

Placopharynx carinatus JORDAN, Bull. U. S. Nat. Mus. ix, 50, 1877. (Name only.)

Placopharynx carinatus JORDAN, Man. Vert. ed. 2d, 311, 1878.

Placopharynx carinatus JORDAN, Bull. U. S. Geol. Surv. vol. iv, No. 2, p. 417, 1878.

HABITAT.—Mississippi Valley and Upper Great Lakes. Wabash River (*Cope, Jordan*). Scioto River. Ohio River. Detroit River. Illinois River. French Broad River.

The following is Professor Cope's description of this species:—

"The physiognomy and proportions of this sucker are those of the *Pt. erythrurus* or the 'red horse' of the Western Rivers.

"The lips are large and plicate, the anterior pendent like that of the *P. collapsus*, the posterior full like that of *Pt. cervinus*. Muzzle vertically truncate. Length of head in that of body four times; depth of body in same 3.66 times; scales 6—41—5. Radii D. XIV, V. 9, A. 7. Free margin of dorsal straight, not elevated anteriorly. Occipital region more elevated medially than in *Pt. erythrurus*, superior ridges well marked, with a special addition characteristic of this species, and of none other with which I am acquainted. This is a median longitudinal frontal ridge, extending from the fontanelle to between the nasal ridges. Only

the posterior extremity of this ridge appears in some *Ptychostomi*. Orbit longitudinally oval, 4.5 times in length of head, twice in interorbital width. Type, fourteen inches in length.

"Color in alcohol like that of other species, uniform straw or whitish silvery.

"The pharyngeal bones of this species are much stouter than those of other species of its own and greater size, *e. g.*, *Pt. aureolus* of eighteen inches, where they are comparatively slight. The exteroposterior ala is twice as wide as the body inside the teeth is deep, and but for its short base and narrowed tip would do for that of a Semotilus. But while there are seven broad teeth without heel or cusp on the basal half, there are at least forty on the distal half, they becoming more compressed and finally like those of other allied genera. There are fourteen with truncate extremities. The pharyngeal plate has narrow horns directed upwards and forwards, and is thickened medially. It is placed immediately in advance of the opening of the œsophagus. I have but one specimen of this curious species, which I obtained at Lafayette, on the Wabash River, in Indiana."

The writer has in his collection two young specimens obtained in Illinois River by Prof. Brayton, a skeleton of a very large individual found in Scioto River by Dr. J. W. Wheaton, and a pair of pharyngeal bones taken by Dr. G. M. Levette from a fish taken in the Wabash at Terre Haute. I have also seen a pair of pharyngeals and an air-bladder of one taken in Detroit River by Professor Baird, and now in the United States National Museum, and a jaw from "Post-pliocene" deposits near the Falls of the Ohio, found by Dr. John Sloan. The jaws and air-bladder above noticed are the only specimens of this species preserved in the National Museum.

Since the foregoing was written, the writer has obtained numerous living specimens of *Placopharynx carinatus* from the French Broad at Wolf Creek and other localities in North Carolina. From one of these, the following description was taken :—

Body oblong, moderately compressed, heavy at the shoulders: head very large, $3\frac{3}{5}$ in length of the body: eye small, behind the middle of the head: mouth extremely large, the lower jaw oblique when the mouth is closed, the mouth, therefore, protractile forwards as well as downwards: lips very thick, coarsely plicate, the lower lip full and heavy, truncate behind: head above evenly rounded, in my specimens not showing the carination described by Professor Cope: scales 6–45–6: dorsal rays 13; ventral 9: color brassy-green above; lower fins red.

Genus MYXOSTOMA (*Rafinesque*) *Jordan.*

Catostomus sp. Le Sueur, and of all writers till 1855.

Moxostoma Rafinesque, Ichthyologia Ohiensis, 1820, 54. (Proposed as a subgenus for those species of *Catostomus* with eight ventral rays and the caudal lobes unequal: type *C. anisurus* Raf.)

Teretulus Rafinesque, Ichthyologia Ohiensis, 1820, 57. (As a subgenus, to include those species of *Catostomus* with nine ventral rays: no type designated—most of the species recorded belong to the present genus. *C. aureolus* Le Sueur is the species first mentioned, and to this species and its relatives the name *Teretulus* was afterwards restricted by Professor Cope.)

Ptychostomus Agassiz, American Journal of Science and Arts, 1855, p. 203. (No type designated: the species mentioned are *P. aureolus, P. macrolepidotus, P. duquesnii*, and *P. melanops*. *P. aureolus* has been considered the type of the genus.)

Teretulus Cope, Journ. Ac. Nat. Sc. Phila. 1868, 236.

Moxostoma Jordan, Manual of Vertebrates, 1876, 295.

Myxostoma Jordan, Ann. Lyc. Nat. Hist. 1877, 348. (Corrected orthography.)

Etymology, *μύξω*, to suck; *στόμα*, mouth.

Type, *Catostomus anisurus* Rafinesque.

Body more or less elongate, sometimes nearly terete, usually more or less compressed.

Head variously long or short, its length ranging from $3\frac{1}{2}$ to $5\frac{1}{2}$ in that of the body: eye usually rather large, varying from 3 to 6 times in the length of the side of the head, its position high up and median or rather posterior: suborbital bones very narrow, always much longer than broad, their width less than one-fourth that of the fleshy part of the cheek: fontanelle on top of head always well open, the parietal bones not coalescing.

Mouth varying much in size, always inferior in position, the mandible being horizontal or nearly so: lips usually well developed, the form of the lower varying in different sections of the genus, usually with a slight median fissure, but never deeply incised; the lips with transverse plicæ—the folds rarely so broken up as to form papillæ: jaws without conspicuous cartilaginous sheath: muciferous system considerably developed, a chain of tubes along the supraorbital region, a branch of which extends around behind the eye and forwards along the suborbital bones and the lower edge of the preorbital: opercular bones moderately developed, nearly smooth: isthmus broad: gill-rakers weak, moderately long, in length about half the diameter of the eye.

Pharyngeal bones rather weak, much as in *Erimyzon* and *Catostomus*,

the teeth rather coarser, strongly compressed, the lower five or six much stronger than the others, which are rapidly diminished in size upwards, each with a prominent internal cusp.

Scales large, more or less quadrate in form, nearly equal in size over the body, and not specially crowded anywhere, usually about 44 in the lateral line (41 to 56), and about twelve series between dorsal and ventrals. Lateral line well developed, straight or anteriorly decurved.

Fins well developed, the dorsal inserted about midway of the body, its first rays usually rather nearer snout than the caudal, the number of developed rays usually about 13, but varying in different species from 11 to 17: anal fin short and high, usually emarginate in the male fish, probably always with seven developed rays: ventrals inserted nearly under the middle of the dorsal; their number of rays normally 9, occasionally varying to 10; the occurrence of ten ventral rays is probably an accidental individual character, and not a permanent specific one: caudal fin deeply forked, the lobes about equal, except in two species.

Air-bladder with three chambers: skeleton essentially as in *Catostomus*, the vertebræ in *M. carpio* 27–14 (Günther).

Sexual peculiarities little marked, the males in the spawning season with the lower fins reddened, and the anal rays swollen and somewhat tuberculate.

This genus is widely diffused, some of its species occurring in all the waters of the United States east of the Rocky Mountains, excepting those of the New England States. Some of the more aberrant species seem to be quite local; other species are of the widest distribution. The principal species in the genus, although not the technical type, *M. macrolepidotum*, is very widely diffused, and is subject to much variation.

This genus is one readily recognizable by external appearance, its species being known to the fishermen as "*Red Horse*" and "*Mullet*"; those of other genera being called rather "Suckers". Its proper nomenclature has, however, been a subject of considerable uncertainty.

The subgenus *Moxostoma* was originally proposed by Rafinesque to include *C. anisurus* Raf., with the following diagnosis:—"Body oblong, compressed; head compressed, eight abdominal rays; dorsal fin commonly longitudinal; tail commonly unequally forked."

The characters here noticed are either common to several genera, or else merely specific, and the use of the generic name must depend on our identification of the original typical species. By some

process of reasoning not now explainable, Professor Agassiz identified this with the common Chub Sucker of the West, a species which I consider identical with *Cyprinus oblongus* Mitchill. He thus transferred the name *Moxostoma* from the "Red Horse" to the "Chub Sucker" group. Rafinesque's description, however, renders it evident that his fish was one of the Red Horse kind; and as *Moxostoma* is the first generic name applied to species of that group, it must be retained in spite of the incompleteness of the original diagnosis.

Teretulus Rafinesque was proposed three pages later for "an extensive subgenus, to which belong all the following species of Le Sueur: *C. aureolus*, *C. macrolepidotus*, *C. longirostrum*, *C. nigricans*, *C. vittatus*, *C. maculosus*, *C. sucetta*, besides the *C. teres* and *C. oblongus* of Mitchill." To these he adds his own species, *C. melanops*, *C. melanotus* (= *Campostoma*), *C. fasciolaris*, *C. erythrurus*, and *C. flexuosus*. This "*omnium gatherum*" receives the following diagnosis:—"Body elongate cylindrical or somewhat quadrangular, 9 abdominal rays, dorsal fin commonly small, tail equally forked."

A name proposed for a group of this kind, in the opinion of the present writer, should not be set aside, but should be retained for some one or more of the species originally referred to it, and when any writer adopts such a genus, he shall have the right to select any of the species as its type, and the name should be considered thereafter as applying to such typical species only, not to be revived in case such typical species be afterwards found to have had a prior generic name. In case no such type has been selected by any author, then the "principle of exclusion" should be applied, and the name be retained for such species as may be left to the last, on subtracting from the mongrel group the different component genera in chronological order.

In this view, *Teretulus*, having been by Professor Cope, in 1868, restricted to *C. aureolus* Le S. and its affines, these being congeneric with species previously called *Moxostoma*, becomes a synonym of *Moxostoma*, and cannot be used for a distinct genus. The principle of exclusion, if unmodified, would require us to use the name *Teretulus* for those species left on subtracting *Catostomus* proper, *Moxostoma*, *Campostoma*, *Erimyzon*, and *Hypentelium*, *i. e.*, in place of *Minytrema*.

Ptychostomus Agassiz was proposed for this same group, without reference to the two names conferred by Rafinesque. This genus was well characterized by Professor Agassiz on the peculiarities of the scales

and lips, although the species of *Minytrema* was inadvertently included in it. The most important generic feature, the tricellular air bladder, was first noticed by Professor Cope.

I have seen fit to change the orthography of the name from *Moxostoma* to *Myxostoma*, in accordance with its apparent etymology. This change is rather desirable from the fact that it tends to avoid confusion, the name *Moxostoma* having been commonly used in connection with a different genus.

The genus *Myxostoma* contains two well-marked sections, typified respectively by *M. velatum* and *M. macrolepidotum*, and characterized by the form of the mouth and lower lip: that of *M. velata* being as in the genus *Erimyzon;* that of *M. macrolepidotum* being of the character most common in this genus.

Generic Characterizations.

MOXOSTOMA Rafinesque, 1820.—"Body oblong, compressed; head compressed, eight abdominal rays, dorsal fin commonly longitudinal; tail commonly unequally forked."—(*Ichthyologia Ohiensis*, p. 54.)

TERETULUS Rafinesque, 1820.—"Body elongate cylindrical or somewhat quadrangular, 9 abdominal rays, dorsal fins commonly small; tail equally forked. An extensive subgenus, to which belong all the following species of Le Sueur: *C. aureolus*, *C. macrolepidotus*, *C. longirostrum*, *C. nigricans*, *C. vittatus*, *C. maculosus*, *C. sucetta*, besides the *C. teres* and *C. oblongus* of Dr. Mitchill."—(*Ich. Oh.* p. 57.)

PTYCHOSTOMUS Agassiz, 1855.—"In respect to form of body and the structure and position of the fins, this genus does not differ from Catostomus proper, but may be distinguished by the following structural peculiarities. The lips are marked by transverse ridges or folds, and hardly bilobed below; they are not papillated as in Catostomus proper. The generic name of this type is derived from this character of the lips The head is shorter and stouter. The dorsal is longer than it is high, but in the males, it is longer in proportion than in the females. The anal of the male is also broader than that of the female, and its lower margin lobed, while in the female it is trapezoidal and narrow.

"The scales are as large on the anterior as on the posterior region of the body; their vertical diameter about as great as the longitudinal, so that the scales are nearly quadrangular, with rounded edges; the ornamental concentric ridges not longer nor broader upon the posterior than upon the lateral and anterior fields; the radiating furrows few, only one or two in the posterior field and one on each side limiting that field from the lateral fields; those of the anterior field are more numerous, and yet not crowded. Tube of the lateral line arising in the centre of radiation or farther back upon the posterior field.

"The pharyngeals are strong, their entire edge spreading like a wing, and that spreading margin is separated from the symphysis by a deep emargination. The teeth increasing rather rapidly in size from above downwards, are more apart from one

another than in the preceding genera, and arched inward as in Moxostoma, the inner edge of the lower ones square, its inner margin rising into a broad cusp in the middle and upper teeth."—(*American Journ. Sci. Arts*, xix, p. 203.)

TERETULUS Cope, 1868.—"The essential character of this genus is the division of the natatory bladder into three chambers, while Catostomus and all Cyprinidæ, exhibit but two. This feature is accompanied by plicate lips, as Agassiz has indicated, and nine rays to the ventral fin, already pointed out by Rafinesque. The species are the largest scaled of the typical suckers. Le Sueur and Valenciennes have pointed out the generic features in the *P. macrolepidotus;* Prof. Baird informs me that it occurs in *Pt. florealis* Bd., and I find it in *Pt. cervinus* and *Pt. duquesnii*. It no doubt exists also in the *Pt. aureolus*. Other species described by Baird and Girard from the Southwest probably possess it.

"It is difficult to assign a name to this genus. Rafinesque proposes it upon untenable characters, and includes with it species of Moxostoma and Catostomus. Agassiz purged it of these elements, but did not express its essential character, apparently relying on the plicate lips. I have taken the older name, leaving for others the final decision."—(*Journal Acad. Nat. Sci. Phila.* 1868, p. 236.)

PTYCHOSTOMUS Cope, 1870.—"The development of the lips furnish important diagnostic indications in this genus. In those most nearly allied to Moxostoma, the inferior lip resembles that of that genus in being narrower and deeply incised, emarginate posteriorly forming a figure V with the apex forwards, at the same time the superior lip is very thin and often narrow. Such species are shorter, and tend to a great development of dorsal fin. Others of this type are more elongate. Some species of both are distinguished by their very prominent conic muzzle and minute, inferior mouth, reminding one of the Carpiodes. In one species the lips are papillose instead of plicate. In some species, the mouth is very projectile, in others scarcely so at all.

"Rafinesque proposed a genus *Teretulus* on the characteristic peculiarity of nine ventral radii, belonging to most species of this genus. He however included species of two other genera. On this account, Agassiz, in rearranging the suckers, imposed on it the name standing at the head of this article, regarding the plicate lips as a primary character. I think Rafinesque's name is to be rejected, owing to its ill application; the more as I find two species in which there are ten ventral radii. I adopt that of Agassiz, though I showed, when describing the *Pt. cervinus*, that the tricellular natatory bladder was a more distinctive feature. This becomes the more obvious now that I have found a species where the lips are tubercular instead of plicate."—(*Proc. Am. Philos. Soc. Phila.* p. 469.)

MOXOSTOMA Jordan, 1876.—"Dorsal moderate, of 11 to 20 rays: air bladder in three parts: lips usually plicate: lateral line very distinct: pharyngeal teeth numerous and all small, of the usual type, the bones slender" (in comparison with those of *Placopharynx*).—(*Man. Vert. E. U. S.* p. 292.)

MOXOSTOMA Cope & Jordan, 1877.—"Body oblong or elongate, with a short subquadrate dorsal fin of 10 to 17 developed rays: air bladder in three parts: lateral line present: fontanelle present: scales large, subequal: pharyngeal bones not especially enlarged, the teeth of the usual type."—(JORDAN, *Proc. Acad. Nat. Sci. Phila.* 1877, p. 81.)

ANALYSIS OF SPECIES OF MYXOSTOMA.

* Lips distinctly plicate.

† Lower lip full, its posterior edge truncate, not infolded and "Λ-shaped".

a. Species with the body distinctly compressed, the depth 3⅓ to nearly 5 in length.

b. Dorsal fin largely developed, its rays 15 to 18 in number: head rather large, 3⅜ to 4¼ in length, broad above: mouth large, with full lips: eye rather large: body deep, strongly compressed, the back somewhat elevated, the depth about 3¼ in length: dorsal fin high and large, larger than in any other species of the genus, the first ray about as long as the base of the fin: scales 5–43–4, quite large: coloration very pale and silvery, the lower fins white ..... CARPIO, 3.

bb. Dorsal fin moderate, its rays 12 to 14 in number.

c. Scales large, 41 to 50 in the course of the lateral line.

d. Caudal fin normal, the two lobes about equal and similarly colored.

e. Head singular in form, much shortened, the muzzle very abruptly decurved, descending almost perpendicularly in front of the eye: the head wedge-shaped from behind forwards, and less so from below upwards, its sides subvertical and the lower cross-diameter of the head greater than the upper.

f. Eye very large, more than one-third the length of the side of the head (in an individual of six inches in length): lips thin, very faintly plicate: width of head through the opercles greater than the thickness of the body: head 4⅓ in length; depth about the same: dorsal rays 13: scales 6–43–5: body shortish, closely compressed, the back somewhat elevated, and the caudal peduncle unusually long in proportion: color smoky-blue; lower fins white: size probably small ..... EURYOPS, 4.

ee. Head normal in form, not as above.

g. Mouth moderate or large, not very small, nor very much overpassed by the muzzle: lips thick, strongly plicate: body stoutish, varying to moderately elongate: dorsal fin medium, its developed rays 12 to 14, usually 13 in number: scales large, about 6–45–5: lower fins in the adult red or orange.

h. Head comparatively elongate, 4 to 5 in length: mouth large: size very large, reaching a length of two feet or more ..... MACROLEPIDOTUM, 5.

x. Head quite elongate, 4 to 4⅖ in length: back little elevated: body rather elongate, not greatly compressed: scales pretty large, 6–42 to 49–5: back bluish or olive; sides brilliantly silvery, with bright reflections; dorsal fin dusky above; lower fins bright red ..... *duquesnii.*

xx. Head a little shorter, 4⅓ to 4⅜ in length: form of the preceding: scales distinctly smaller, 7 or 8–48 to 50–6: back with much smoky shading ..... *lachrymale.*

*Lips distinctly plicate—Continued.

xxx. Head still shorter and deeper, 4½ to 5 in length, its upper profile concurrent with the curve of the back, which is considerably elevated, the form being thus somewhat elliptical: sides compressed: dorsal rays usually 13: coloration little silvery, the sides reflecting brownish and golden; back smoky, some of the scales dusky at base: scales 6–42 to 50–5.....*macrolepidotum.*

hh. Head comparatively short, low and small, 5 to 5½ in length; back elevated and compressed; depth 8⅓ in length: mouth rather small, more or less overpassed by the snout: coloration bright yellowish-brown, etc., not silvery; lower fins bright red: dorsal rays 13: scales 6–42 to 48–5: size large.

AUREOLUM, 6.

gg. Mouth very small, much overpassed by the conic muzzle: head small, about 5 in length.

i. Body flattish, the back elevated and compressed; depth 3¾: muzzle contracted: scales large, 5–44–5: dorsal rays usually 12: dorsal fin elevated in front, its first soft ray longer than the base of the fin: color silvery, with smoky shading above, some of the scales blackish at their bases; lower fins white; top of head, humeral bar, and dorsal fin dusky.

CRASSILABRE, 7.

ii. Body flattish, the dorsal outline elevated, the form being like that of *M. coregonus:* head small and conic: mouth exceedingly small, the snout far overpassing it, the muzzle being much longer than in *M. crassilabre:* dorsal rays 14: eye large: coloration smoky above, some scales dusky at their bases; sides pale; lower fins white.....CONUS, 8.

dd. Caudal fin with the upper lobe falcate, much longer than the lower, at least in the adult, the lobes similarly colored: dorsal fin short and high, falcate: body compressed; back somewhat elevated; depth 3½ in length: head conic, flattish, 5¼ in length: mouth very small, much as in *aureolum.* D. 12–13, half higher than long: scales 6–46–5.

ANISURA, 9.

ddd. Caudal fin with the lower lobe much longer than the upper and differently colored, the upper lobe in the adult being red, the inferior jet-black, its two lowermost developed rays and their membranes abruptly white (? in both sexes). Body elongate, moderately compressed, somewhat elevated forwards; depth 4⅓ in length: head about the same: mouth medium, the lips full: dorsal rays 13: scales large, 5–44–4: coloration usual, except of the caudal fin; other fins all red, with blackish shadings: size small.....PŒCILURA, 10.

*Lips distinctly plicate—Continued.

cc. Scales very small for the genus, about 9–56–8 in number: body moderately elongate, the depth about 4 in the length.

ee. Head shortish, conic, the snout not much projecting, about 4 in length: eye large: dorsal fin small, with about eleven rays, the last rapidly shortened (characters of mouth unknown, but probably similar to *macrolepidotum* and *pœcilura;* it is said to be "much larger than in *P. congestus*") ..... ALBIDUM, 11.

aa. Species with the body elongate, little compressed, broad, the depth about 5 in length, not very much greater than the thickness.

j. Head very short, roundish above, rather pointed forwards, about 5 in length: cheeks subvertical: mouth rather large, with thick lips, which are strongly plicate, the folds somewhat broken up: eye small: fins very small, the dorsal rays 10 to 12: scales rather large, 6–44 to 49–5: color greenish-brown, a pale blotch on each scale, these forming continuous streaks along the rows of scales: back with more or less distinct brownish cross-blotches; fins brownish, not much red; the dorsal blackish at tip: size smallest: length less than a foot ..... CERVINUM, 12.

†* Lower lip thin, not infolded and "Λ-shaped", forming a narrow, crescent-shaped border around the mandible.

k. Head small, 5 times in length: muzzle prominent, but less so than in *M. coregonus:* mouth moderate: back a little elevated: depth about 3⅛ in length: dorsal rays 12 to 14, its free border often incised: scales 6–45–5: coloration very pale; lower fins white: size large; reaches a weight of four pounds or more ..... ALBUM, 13.

kk. Head stout, as in *M. relatum*, rather long, 4 in length, flattish above, muzzle truncate, not very prominent: mouth moderate: back elevated: dorsal fin long, of 14 or 15 rays: sea-green above; white below; lower fins white ..... THALASSINUM, 14.

††† Lower lip infolded, Λ-shaped when viewed from below, with a distinct median crease, in which the two halves of the lip meet, forming an acute angle: mouth small.

l. Dorsal large, with 16 (15 to 17) developed rays.

m. Body stout, deep, compressed, the back elevated, the depth 3 to 4 in length: head short, heavy, flattish and broad above, thick through the cheeks, 3¾ to 4¼ in length: eye rather large, midway in head, 4 to 5 in its length: muzzle rather prominent, bluntish, overhanging the very small mouth: fins very large: dorsal long and high, its height five-sixths the length of the head: pectorals nearly reaching ventrals: color silvery, smoky above; lower fins red: size large ..... VELATUM, 15.

*Lips distinctly plicate—Continued.

ll. Dorsal moderate, with 12 to 14 developed rays.

n. Head comparatively large, about 4 in length: dorsal rays usually 12.

o. Head short and very wide through the opercles, flat above: body stout, the back somewhat elevated, depth 4 in length: muzzle subtruncate, slightly projecting: scales 6–40–5: olivaceous, silvery below; dorsal fin dusky.

CONGESTUM, 16.

oo. Head rather long, 4½ in length, flattish above: body elongate, more nearly cylindrical, little compressed: muzzle truncate: olivaceous, sometimes with rows of faint spots along the series of scales; dorsal and caudal fins black-edged: size quite small: resembles *M. cervinum*, but the mouth entirely different ..... PIDIENSE, 17.

nn. Head very small, about 5 in length: muzzle conic, much projecting beyond the very small mouth; body broadly fusiform, much compressed, the back elevated and arched: dorsal rays 14: color silvery, with plumbeous shades above; lower fins white: size small ..... COREGONUS, 18.

** Lips full, strongly papillose, much as in the subgenus *Hypentelium*.

p. Body comparatively stout, the dorsal region somewhat elevated and rounded, the depth being about 4 in length, the head about the same: eye rather large, high up and well back, the preorbital space being longer than in the other species: top of head flat: dorsal rays 12 to 14: scales rather large, 6–42–5: lips well developed, deeply incised: color silvery; back with smoky shading; lower fins white: size large, reaches a length of about two feet

PAPILLOSUM, 19.

3. MYXOSTOMA CARPIO (*Valenciennes*) *Jordan.*

Carp Mullet. White Lake Mullet.

1844—*Catostomus carpio* VALENCIENNES, Cuv. et Val. Hist. Nat. des Poiss. xvii, 457, pl. 517.

Catostomus carpio STORER, Synopsis, 426, 1846.

Catostomus carpio GÜNTHER, Cat. Fishes Brit. Mus. vii, 20, 1868.

Ptychostomus carpio COPE, Proc. Am. Philos. Soc. Phila. 476, 1870.

Ptychostomus carpio JORDAN, Fishes of Ind. 221, 1875. (Name only.)

Moxostoma carpio JORDAN, Man. Vert. 296, 1876.

Teretulus carpio NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Teretulus carpio JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Moxostoma carpio JORDAN & GILBERT, in Klippart's Rept. Fish Comm. Ohio, 53, 1877. (Name only.)

Myxostoma carpio JORDAN, Man. Vert. E. U. S. ed. 2d, 312, 1878.

HABITAT.—Great Lake Region and northward. Also in the Ohio River.

This species is apparently not very common, and its distribution is probably chiefly northward. I have obtained but one living specimen, a fine large one, from Lac des Buttes des Morts, in Northeastern Wisconsin. This specimen in life was extremely pale and silvery, its fins having none of the orange coloration common to most of the species. *M. carpio* is related to *M. macrolepidotum*, but the much greater development of the dorsal will always distinguish it.

Specimens in United States National Museum.

Number.	Locality.	Collector.
10793	Cincinnati, Ohio	J. W. Milner.
11214	Alpena, Mich. (Lake Huron)	J. W. Milner.
12270	Cincinnati, Ohio	J. W. Milner.
12271	Cincinnati, Ohio	J. W. Milner.
12293	Cincinnati, Ohio	J. W. Milner.
—	Marietta, Ohio	Prof. Andrews.

4. MYXOSTOMA EURYOPS *Jordan.*

Snub-nosed Sucker.

1876—*Teretulus euryops* JORDAN & COPELAND, Check List, 157. (Name only.)

Myxostoma euryops JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi. 348, 1877.

Myxostoma euryops JORDAN, Man. Vert. ed. 2d, 312, 1878.

HABITAT.—Alabama River.

This species is still known only from the type-specimen obtained in Lovejoy's Creek, a small tributary of Oostanaula River, a few miles north of Rome, Ga. The species is most nearly related to *M. macrolepidotum*, and it is barely possible that the type-specimen is a monstrosity of that species. The peculiarities of the mouth, and the fact that the bones of the head seem to be normally developed, lead me to consider it a distinct species.

5. MYXOSTOMA MACROLEPIDOTUM (*Le Sueur*) *Jordan.*

Common Red Horse. Mullet. White Sucker. Large-scaled Sucker.

a. Subspecies *macrolepidotum.*

1817—*Catostomus macrolepidotus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. i, 94.

Catostomus macrolepidotus DEKAY, New York Fauna, part iv, Fishes, 202, 1842.

Catostomus macrolepidotus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 447, 1844.

Catostomus macrolepidotus STORER, Synopsis, 420, 1846.

Ptychostomus macrolepidotus AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 204, 1855.

Ptychostomus macrolepidotus COPE, Proc. Am. Philos. Soc. Phila. 475, 1870.

Ptychostomus macrolepidotus JORDAN, Fishes of Ind. 221, 1875. (Name only.)

Moxostoma macrolepidotum JORDAN, Man. Vert. 296, 1876.

Teretulus macrolepidotum NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Catostomus macrolepidotus UHLER & LUGGER, Fishes of Maryland, 140, 1876.

Teretulus macrolepidotus JORDAN & COPELAND, Check List; x, 157, 1876. (Name only.)

Moxostoma macrolepidota JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Myxostoma macrolepidota JORDAN, Man. Vert. E. U. S. ed. 2d, 313, 1878.

1842—*Catostomus oncida* DEKAY, New York Fauna, part iv, Fishes, 198.

Catostomus oncida STORER, Synopsis, 425, 1846.

Ptychostomus oncida COPE, Proc. Am. Philos. Soc. Phila. 476, 1870.

1870—*Ptychostomus robustus* COPE, Proc. Am. Philos. Soc. Phila. 473.

Teretulus robustus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

1876—*Ptychostomus congestus* COPE & YARROW, Lieutenant Wheeler's Expl. W. 100th Mer. v, 680, 1876. (Not of Girard.)

HABITAT.—North Carolina to Vermont, and northwestward through the Great Lake Region and the Upper Mississippi—the only form of the species occurring east of the Alleghany Mountains. (Also in Arizona?)

b. Subspecies *lachrymale* (Cope) Jordan.

1870—*Ptychostomus lachrymalis* COPE, Proc. Am. Philos. Soc. Phila. 474.

Teretulus lachrymalis JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Myxostoma duquesnii var. *lachrymalis* JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 349, 1877.

Myxostoma macrolepidota var. *lachrymalis* JORDAN, Man. Vert. ed. 2d, 313, 1878.

HABITAT.—North Carolina to Alabama.

c. Subspecies *duquesnei* (Le Sueur) Jordan.

1817—*Catostomus duquesnii* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 105.

Catostomus duquesnii RAFINESQUE, Ich. Oh. 60, 1820.

Catostomus duquesnii KIRTLAND, Rept. Zool. Ohio, 162, 1838.

Catostomus duquesnii DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus duquesnii CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 458, 1844.

Catostomus duquesnii KIRTLAND, Boston Journ. Nat. Hist. v, 268, 1845.

Catostomus duquesnii STORER, Synopsis, 423, 1846.

Ptychostomus duquesnii AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 204, 1855.

Catostomus duquesnii GÜNTHER, Cat. Fishes Brit. Mus. vii, 18, 1868.

Teretulus duquesnei COPE, Journ. Ac. Nat. Sc. Phila. 236, 1868.

Ptychostomus duquesni COPE, Proc. Am. Philos. Soc. Phila. 476, 1870.

Ptychostomus duquesnei JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.

Moxostoma duquesnii JORDAN, Man. Vert. 295, 1876.

Catostomus duquesnii UHLER & LUGGER, Fishes of Maryland, 139, 1876.

Teretulus duquesnii NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Teretulus duquesnii JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Moxostoma duquesnei JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Myxostoma duquesnii JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 349, 1877.

Myxostoma duquesnii JORDAN, Bull. U. S. Nat. Mus. ix, 37, 1877.

Myxostoma macrolepidota var. *duquesni* JORDAN, Man. Vert. ed. 2d, p. 313, 1878.

1818—*Catostomus erythrurus*, RAFINESQUE, Am. Month. Mag. and Crit. Rev. 354.

Catostomus erythrurus RAFINESQUE, Ich. Oh. 59, 1820.

Catostomus erythrurus KIRTLAND, Rept. Zool. Ohio, 168, 1838.

Ptychostomus erythrurus COPE, Proc. Am. Philos. Soc. Phila. 474, 1870.

Ptychostomus erythrurus JORDAN, Fishes of Ind. 221, 1875. (Name only.)

Teretulus erythrurus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

1820—*Rutilus melanurus* RAFINESQUE, Ich. Oh. 51.

HABITAT.—Ohio Valley. Upper Mississippi River and southward; most abundant from Wisconsin to Georgia.

Examination of a very large series of "Mullet" and "Red Horse" from various parts of the country has led me to the conclusion, at first rather unexpected, that all the various forms included in the above synonymy belong to one widely diffused and somewhat variable species.

The "Mullet" of the lakes and of Eastern Pennsylvania appears generally to differ in the more elevated and compressed body, shorter, deeper head, and brownish or brassy rather than silvery coloration. This represents the general tendency of "var. *macrolepidotum*"; but specimens of "*duquesnei*" can be found which will match the average *macrolepidotum* in each of these respects. The form which I have identified with Professor Cope's *lachrymale* is to some extent intermediate, but has the additional peculiarity of smaller scales. In this respect, however, occasional individuals, both of *duquesnei* and of *macrolepidotum*, can be found which approach it.

The form inhabiting the waters of the eastern and northern parts of the United States is the variety *macrolepidotum*. It is sold commonly as a food-

fish in the winter and spring in the markets of Washington and Philadelphia, as well as in the markets of those cities in the West which are supplied by the fisheries of the Great Lakes. It is probably much more abundant in Lake Erie than *M. aureolum* is, and it has been frequently confounded with the latter species. I once obtained two specimens, each of nearly twelve pounds weight, in the Fox River in Wisconsin.

In the Ohio River and its tributaries, and in the rivers of the Southwest generally, the var. *duquesnii* is the prevailing form. This variety is more delicately colored than the other, the silvery lustre of the scales is more strongly marked, and the red of the fins is rather more vivid. This form, too, is valued somewhat as a food-fish, although the flesh, like that of all the Suckers, is comparatively coarse, tasteless, and full of bones. The variety *duquesnei* is everywhere known by the curious vernacular name of "Red Horse", a name possibly to be accounted for by the color of the fins and the form of the head. This variety also grows to a large size.

The variety *lachrymale* I only know from specimens obtained in Etowah River, Georgia, in company with the variety *duquesnei*. Nothing distinctive was noticed in regard to its habits.

The Red Horse prefer rather deep, clear water, seldom ascending very small streams, and then chiefly in the spawning season—in May—at which time they may be found in great abundance in any rapid of a river or a creek, or below a mill-pond. They are generally caught by nets, traps, or snares, but will frequently bite at a hook baited with a worm.

In the confinement of an aquarium, the Red Horse are not very hardy. Foul water kills them at once.

Synonyms.—The earliest name given to a Red Horse is that of *Catostomus macrolepidotus* Le Sueur. The specific name *macrolepidotus* must therefore be retained for this species. The specific name *oneida*, given by DeKay to an individual from Oneida Lake, New York, doubtless belongs here, as the var. *macrolepidotum* is the only member of this genus known to inhabit that part of New York, and there are no serious discrepancies in the rather poor description.

Ptychostomus robustus Cope may possibly be different; but as its describer has failed to note any distinctive characters which I consider likely to be permanent, I am compelled to refer it here. It is from Yadkin River in North Carolina. A *Ptychostomus congestus* is described by Cope and Yarrow from Arizona. It is probably not Girard's species of

that name, and I am unable to distinguish it from typical *macrolepidotum*, although the mouth is rather small, more like that of *aureolum*.

I have identified certain specimens with Professor Cope's *P. lachrymale* with a little doubt, as the points of differentiation which I notice are not those emphasized by Professor Cope. The original types, which I believe are now lost, were from the Neuse River in North Carolina. In describing this species, Professor Cope remarks, "This species is quite near the last (*P. erythrurus*) and may at some future time be shown to be a local variety of it, but in this case *P. macrolepidotus* must follow also."

The synonyms of var. *duquesnei* may now be noticed. Of these, the only one of importance is that of *Catostomus erythrurus* Rafinesque, recently recognized by Professor Cope as a species distinct from *P. duquesnii*.

The presence of ten ventral rays in *duquesnii*, as contrasted with nine ventral rays in *erythrurus*, is the chief point on which Professor Cope relies to distinguish the two species. He also finds the mouth rather more inferior in *duquesnii*, and the scales rather smaller, 7–48–7, instead of 5–42–4.

In regard to the number of ventral rays, my experience is that in every species of the genus the normal number is *nine*, but that ten-rayed individuals occur in the proportion of about one in twenty in any of the species. I have seen specimens of *duquesnii* with nine rays on one side and ten on the other. I have therefore discarded all consideration of the number of ventral rays as a specific character. In regard to the number of scales in the lateral line, the usual number in most of the species is 43 to 44; but of every species in which I have been enabled to examine a large series of individuals, I have found a range extending from 42 to 49. I have seen ten-rayed specimens of *duquesnei* with large scales, and nine-rayed *erythruri* with small ones. Within the limit of 42 to 50 I therefore do not consider the number of scales as a permanent specific character. The greater prominence of the muzzle in *duquesnei*, as observed by Professor Cope, is perhaps accidental or individual. At all events, it is too uncertain a feature to base a species on.

The *Rutilus melanurus* of Rafinesque is, as I have elsewhere shown, probably a young Red Horse, with a dusky-shaded dorsal and caudal, which that acute, but superficial, observer mistook for a species of Dace.

Specimens in United States National Museum.

Number.	Locality.	Collector.
	Var. *macrolepidotum.*	
7995		
8754	"Probably North Carolina"	
9056		
10631	Potomac River	J. W. Milner.
10682	Potomac River	J. W. Milner.
10689	Potomac River	J. W. Milner.
11106	Potomac River	J. W. Milner.
12316	Potomac River	J. W. Milner.
12317	Potomac River	J. W. Milner.
12318	Potomac River	J. W. Milner.
12319	Potomac River	J. W. Milner.
16755	Ash Creek, Arizona ("*congestus*")	Dr. J. T. Rockrock.
18251	Potomac River	G. B. Goode.
18253	Potomac River	G. B. Goode.
18254	Potomac River	G. B. Goode.
18255	Potomac River	G. B. Goode.
18256	Potomac River	G. B. Goode.
18257	Potomac River	G. B. Goode.
19451	Potomac River	J. W. Milner.
20230	Black River, New York.	S. F. Baird.
20263	Nebraska, Pacific Railroad Survey	Governor Stevens.
20278	"Brooklyn"	J. C. Brevoort.
	Var. *duquesnii.*	
8025	Yellow Creek, Ohio	S. F. Baird.
8526		
10794	Cincinnati, Ohio	J. W. Milner
12268	Cincinnati, Ohio	J. W. Milner.
12269	Cincinnati, Ohio	J. W. Milner.
12272	Cincinnati, Ohio	J. W. Milner.
20040	Cumberland River, Tennessee	A. Winchell.
20075		
20773	Normal, Illinois	S. A. Forbes.

6. MYXOSTOMA AUREOLUM (*Le Sueur*) *Jordan.*

Golden Red Horse. Lake Mullet.

1817—*Catostomus aureolus* LE SUEUR, Journ. Ac. Nat. Sci. Phila. i, 95.

Catostomus aureolus KIRTLAND, Rept. Zool. Ohio, 168, 1838.

Catostomus aureolus KIRTLAND, Boston Journ. Nat. Hist. iii, 349, 1840.

Catostomus aureolus DEKAY, New York Fauna, part iv, Fishes, 201, 1842.

Catostomus aureolus STORER, Synopsis, 420, 1846.

Catostomus aureolus AGASSIZ, Lake Superior, 357, 1850.

Ptychostomus aureolus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 204, 1855.

Ptychostomus aureolus PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Ptychostomus aureolus COPE, Proc. Ac. Nat. Sc. Phila. 285, 1864.

Catostomus aureolus GÜNTHER, Cat. Fishes Brit. Mus. vii, 16, 1868. (In part; description apparently copied and confused.)

Ptychostomus aureolus COPE, Proc. Am. Philos. Soc. Phila. 476, 1870

Moxostoma aureolum JORDAN, Man. Vert. 295, 1876.

Teretulus aureolum NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Teretulus aureolus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Moxostoma aureola JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Myxostoma aureola JORDAN, Man. Vert. E. U. S. ed. 2d, 314, 1878.

1823—*Catostomus lesueurii* RICHARDSON, Franklin's Journal, 772, 1823.

1836—*Cyprinus* (*Catostomus*) *sueurii* RICHARDSON, Faun. Bor.-Am. Fishes, pp. 118, 303, 1836.

Catostomus sueurii CUV. & VAL., Hist. Nat. des Poissons, xvii, 465, 1844.

Catostomus sueuri DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus sueurii STORER, Synopsis, 425, 1846.

Ptychostomus sueurii COPE, Proc. Am. Philos. Soc. Phila. 477, 1870.

Teretulus sueurii JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

1868—*Catostomus macrolepidotus* GÜNTHER, Cat. Fishes Brit. Mus. vii, 18, 1868. (Excl. syn. part. Not of Le Sueur.)

HABITAT.—Great Lake Region, Upper Missouri and Ohio Valleys, and northward.

This species is very closely related to the last, and may possibly be a variety of it, as specimens of var. *macrolepidotum* often occur which are with difficulty distinguished from it. In general, however, the smaller head, smaller mouth, and deeper body of *aureolum* sufficiently distinguish them. This species is less abundant than *macrolepidotum*, and is apparently more northerly in its distribution. It has been well figured by DeKay.

The synonymy of this species needs no special remark. It seems probable that *C. lesueurii* belongs here, although the statement that "the muzzle projects an inch beyond the mouth" in a specimen 19 inches long, if correct, would indicate difference. The name "*le sueurii*" was first given, and afterwards changed to "*sueurii*" on the ground that the article "*le*" is not an integral part of Le Sueur's name.

Specimens in United States National Museum.

Number.	Locality.	Collector.
7756	.....	
8252	Carlisle, Pa	S. F. Baird.
11074	Sandusky, Ohio	J. W. Milner.
11151	Sandusky, Ohio	J. W. Milner.
12267	Cincinnati, Ohio	J. W. Milner.
12294	Cincinnati, Ohio	J. W. Milner.
12446	Écorse, Mich	J. W. Milner.
20272	Root River, Wisconsin	S. F. Baird.

7. MYXOSTOMA CRASSILABRE (*Cope*) *Jordan.*

Thick-lipped Mullet.

1870—*Ptychostomus crassilabris* COPE, Proc. Am. Philos. Soc. Phila. 477, 1870.
Teretulus crassilabris JORDAN & COPELAND, Check List, 157, 1876. (Name only.)
Myxostoma crassilabris JORDAN, Man. Vert. ed. 2d, 314, 1878.

HABITAT.—Neuse River, North Carolina.

This species is known only from Professor Cope's description. It appears to be distinct from *M. aureolum*, which is probably its nearest relative. Nothing has been noted in regard to its habits.

8. MYXOSTOMA CONUS (*Cope*) *Jordan.*

Long-nosed Mullet.

1870—*Ptychostomus conus*, COPE, Proc. Am. Philos. Soc. Phila. 478.
Teretulus conus, JORDAN & COPELAND, Check List, 157, 1876. (Name only.)
Myxostoma conus, JORDAN, Man. Vert. ed. 2d, 314, 1878.

HABITAT.—Yadkin River, North Carolina.

This species is also known only from Professor Cope's account. There appears, however, to be no room for doubt as to its specific distinction. As stated by Professor Cope, "this fish represents the *P. coregonus* in the section with fully-developed lips."

It is taken in large numbers in the Yadkin River, "with *Pt. collapsus*, *Pt. robustus*, etc., but is of less value than they."

9. MYXOSTOMA ANISURA (*Rafinesque*) *Jordan.*

Long-tailed Red Horse.

1820—*Catostomus anisurus* RAFINESQUE, Ichthyologia Ohiensis, 54.
Myxostoma anisura JORDAN, Man. Vert. ed. 2d, 315, 1878.

1870—*Ptychostomus breviceps* COPE, Proc. Am. Philos. Soc. Phila. 478.

Teretulus breviceps JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Moxostoma breviceps JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Myxostoma breviceps JORDAN, Bull. U. S. Nat. Mus. 9, 50, 1877. (Name only.)

HABITAT.—Ohio Valley and Great Lakes.

This species, first described by Rafinesque in 1820, has been entirely lost sight of by succeeding writers, and I, doubting the existence in the Ohio River of a species characterized by the marked inequality of the caudal lobes, have hitherto followed Dr. Kirtland in using the name *anisura* for the fish recently named *collapsus* by Professor Cope. Some specimens lately examined by me from the Ohio River have shown the existence of a fish corresponding very closely to Rafinesque's account, and which really has the inequality of the caudal fin, on which he lays such emphasis, and which suggested the name *anisurus* (unequal-tail). This fish appears to be the same as that to which Professor Cope has given the name of *breviceps*. Professor Cope had, however, but a single specimen, in poor condition, and did not notice the falcation of the caudal, or, more likely, that fin was not preserved intact. I have, some time since, examined Professor Cope's type, preserved in the Museum of the Academy of Natural Sciences, at Philadelphia, and believe it to be identical with *M. anisura* Raf. The form of the head and body and of the mouth are similar in the two, and the dorsal in both is similarly falcate.

This species resembles *aureolum* in every respect, except that the dorsal fin is shorter, and elevated or falcate in front, the free border being deeply incised, and that the caudal fin is similarly elongated, the upper lobe being much the longer and greatly attenuated.

The following are the measurements of three specimens: 10,788, from Sandusky, and 12,267 and 12,294 from Cincinnati. The fractions indicate percentage of the length to the base of the caudal:—

Measurements of three specimens of Myxostoma anisura.

	10788.	12267.	12294.
Length, inches	2¼	8¾	10¼
Depth	.28	.27	.26
Length of head	.18	.17	.18
Width of interorbital area	.08	.....	.....
Length of snout	.07½	.....	.....
Eye	.05	.....	.....
Length of base of dorsal	.15½	.14½	.16
Height of longest ray of dorsal	.22	.22	.23½
Height of last ray of dorsal	.10	.....	.....
Length of upper caudal lobe	.31	.29	.31
Length of lower caudal lobe	.26	.25	.25
Length of middle caudal rays	.13	.....	.....
Dorsal rays	2, 13	2, 12	2, 13
Scales	6-46-5	6-47-5	.....

It is perhaps barely possible that this fish is the male of *aureolum* at a certain age, but it seems to me decidedly improbable. The resemblance between the two is, however, very strong, and, except for the fins, they could hardly be distinguished.

Specimens in United States National Museum.

Number.	Locality.	Collector.
8505	.....	
10788	Sandusky, Ohio	J. W. Milner.
11105	Cincinnati, Ohio	J. W. Milner.
11107	Cincinnati, Ohio	J. W. Milner.
11108	Cincinnati, Ohio	J. W. Milner.

10. MYXOSTOMA PŒCILURA *Jordan.*

Varicgated-tailed Red Horse.

1877—*Myxostoma pœcilura* JORDAN, Bull. U. S. Nat. Mus. x, 66, 1877.

Myxostoma pœcilura JORDAN, Man. Vert. ed. 2d, 315, 1878.

HABITAT.—Tangipahoa River, Southeastern Louisiana.

This singular species is known only from two specimens in the United States National Museum, recently collected by Mr. Fred. Mather, of the United States Fish Commission. Whether the peculiar form and coloration of the caudal is general or is confined to the male sex is not certain. In any event, it will serve to sharply distinguish this species from all the others now known. In other respects, it most approaches *M. macrolepidotum lachrymale.*

Specimens in United States National Museum.

Number.	Locality.	Collector.
*16928	Tangipahoa River, Louisiana	Fred. Mather.

11. MYXOSTOMA ALBIDUM (*Girard*) *Jordan.*

Small-scaled Red Horse.

1856—*Ptychostomus albidus* GIRARD, Proc. Ac. Nat. Sci. Phila. 172.

Ptychostomus albidus GIRARD, U. S. Mex. Bound. Surv. Ichth. 36, pl. xix, f. 5–8, 1859.

Teretulus albidus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Myxostoma albidum JORDAN, Man. Vert. E. U. S. 315, 1878.

HABITAT.—Rio San Juan, near Monterey, New Leon, in Mexico.

This species is known only from Girard's figure and description. No account of the lips is given, but the mouth is said to be a "great deal larger" than in *M. congestum*. The description is trivial, but the figure, if at all correct, represents a species quite unlike our other members of the genus; the chief character being the much smaller size of the scales, which in the description are merely stated to be "smaller than in *congestus*". The species may possibly belong to some section of the genus other than the one in which it is here placed. The original types, No. 170, U. S. Nat. Museum, from Rio San Juan, near Monterey, New Leon, are no longer to be found.

12. MYXOSTOMA CERVINUM (*Cope*) *Jordan.*

Jump-rocks. Jumping Mullet.

1868—*Teretulus cervinus* COPE, Journ. Ac. Nat. Sci. Phila. 236.

Ptychostomus cervinus COPE, Proc. Am. Philos. Soc. Phila. 478, 1870.

Moxostoma cervinum JORDAN, Man. Vert. 296, 1876.

Teretulus cervinus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Myxostoma cervinum JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 365, 1877.

Myxostoma cervinum JORDAN, Man. Vert. E. U. S. ed. 2d, 315, 1878.

1868—*Catostomus duquesnii* GÜNTHER, Cat. Fishes Brit. Mus. vii, 483. (Not of Le Sueur, nor of p. 18.)

HABITAT.—Rivers of the South Atlantic States, from the James to the Chattahoochee.

This is a strongly marked and very abundant species, the smallest of its genus, and one of the smallest of the *Catostomidæ*. It occurs in the

*Two specimens, types of the species.

greatest abundance in the swift streams of the South, frequenting especially the rapids or "shoals", and often throwing itself from the water in its endeavors to reach some higher rock-pool. It is too small and the flesh spoils too quickly to be much valued for food, but great numbers are caught for "fun" by negroes and boys. The largest specimens which I have seen were taken in the Chattahoochee, and are about ten inches in length; ordinary individuals are four to six inches long.

Specimens in United States National Museum.

Number.	Locality.	Collector.
7633	.....	
8835	.....	
†14994	Catawba River	E. D. Cope.
—	Ocmulgee River	D. S. Jordan.
—	Saluda River	D. S. Jordan.
—	Chattahoochee River	D. S. Jordan.

13. MYXOSTOMA ALBUM (*Cope*) *Jordan.*

White Mullet.

1870—*Ptychostomus albus* COPE, Proc. Am. Philos. Soc. Phila. 472.
Teretulus albus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)
Myxostoma alba JORDAN, Man. Vert. ed. 2d, 316, 1878.

HABITAT.—Catawba and other rivers of Eastern North Carolina.

This species is well marked by the peculiar form of the under lip, which is quite small—a narrow, regular crescent following the boundary of the mandible, not full, as in the species previously noted, nor with the sides folding so as to meet on the middle line, as in the remaining species (excepting *thalassinum*). Specimens from North Carolina in the National Museum correspond well to Professor Cope's description, except that the back is rather more elevated than one would infer from Professor Cope's remarks. The dorsal rays are 12 and 13 instead of 14. The following are the measurements of two of them, 18,535 and 14,943, both from Kinston, N. C.:—

† Types.

Measurements of two specimens of Myxostoma album.

	18535.	14943.
Length, inches	13	11½
Depth (percentage of length to base of caudal)	.32	.30
Length of head	.20	.20
Width of interorbital area	.10	.10
Length of snout	.08½	.....
Diameter of orbit	.04	.....
Length of base of dorsal	.19	.17
Height of dorsal	.22	.18½
Height of last ray of dorsal	.09	.....
Length of outer caudal rays	.24	.....
Length of middle caudal rays	.24	.....
Length of pectorals	.21	.....
Number of dorsal rays	2,13	2,12
Scales	6-45-5	.....

The form is elliptical, not much compressed, but rather elevated, somewhat as in *Erimyzon sucetta*. Head short and stout, bluntish, broad, and rounded above; mouth somewhat inferior; the plicæ of the lips few and rather broken; dorsal fin high, its free border somewhat concave; caudal strongly forked; color lustrous white, with greenish reflections.

This is one of the largest species, reaching the weight of four pounds or more. Professor Cope states that it is much valued as a food-fish by people living in the neighborhood of Catawba River, where it is known as the White Mullet.

Specimens in United States National Museum.

Number.	Locality.	Collector.
10632	North Carolina	G. B. Goode.
14943	Kinston, N. C	G. B. Goode.
14990	North Carolina	G. B. Goode.
18535	Kinston, N. C	J. W. Milner.
19450	North Carolina	G. B. Goode.

14. MYXOSTOMA THALASSINUM (*Cope*) *Jordan.*

Green Mullet.

1870—*Ptychostomus thalassinus* COPE, Proc. Am. Philos. Soc. Phila. 472, 1870.

Teretulus thalassinus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)

Myxostoma thalassina JORDAN, Man. Vert. ed. 2d, 316, 1878.

HABITAT.—Yadkin River.

I have not seen this species. From Professor Cope's description, it would appear to be allied to *M. album*, but distinguishable by the longer head. It is a large species, abundant in the Yadkin River, where it is used for food.

15. MYXOSTOMA VELATUM (*Cope*) *Jordan.*

Small-mouthed Red Horse.

1845—*Catostomus anisurus* KIRTLAND, Boston Journ. Nat. Hist. v, 269 (with plate). (Not of Rafinesque.)

Catostomus anisurus STORER, Synopsis, 424, 1846.

Ptychostomus anisurus JORDAN, Bull. Buffalo Soc. Nat. Hist. 94, 1876. (Name only.)

Moxostoma anisurus JORDAN, Man. Vert. 295, 1876.

Teretulus anisurus NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Teretulus anisurus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)

Moxostoma anisurum JORDAN, Proc. Ac. Nat. Sc. Phila. 72, 1877.

Moxostoma anisurum JORDAN, Proc. Ac. Nat. Sc. Phila. 80, 1877.

Moxostoma anisura JORDAN & GILBERT, in Klippart's Rept. 53, 1877. (Name only.)

Myxostoma anisura JORDAN, Bull. U. S. Nat. Mus. ix, 33, 1877.

1870—*Ptychostomus velatus* COPE, Proc. Am. Philos. Soc. Phila. 471.

Moxostoma velatum JORDAN, Man. Vert. 296, 1876.

Teretulus velatum NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Teretulus velatus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)

Moxostoma velata JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Myxostoma velata JORDAN, Man. Vert. ed. 2d, 317, 1878.

1870—*Ptychostomus collapsus* COPE, Proc. Am. Philos. Soc. Phila. 471.

HABITAT.—Upper Mississippi Valley to Georgia and South Carolina. Neuse, Yadkin, Catawba, Clinch, Youghiogheny and Wabash Rivers (*Cope*). Chickamauga, Ohio Wabash, Illinois, Rock, and Wisconsin Rivers (*Jordan*). Lake Erie (*Jordan*).

This species is one of the most widely distributed species, although it does not seem to be as abundant in individuals as several others. There is considerable variation in form among different specimens, but all the species with long dorsal fin and small Λ-shaped mouth appear to belong to one species, for which the name *velatum* should be retained.

The finding of a species with unequal caudal lobes renders it evident that the identification of Rafinesque's *anisurus* with this species is incorrect. The name next in order is *velatus* Cope. The difference in the size of the eye between *collapsus* Cope and *velatus* Cope appears to be due to difference in age merely. Younger specimens have the eye proportionally larger.

I did not find any specimens of this species in the United States National Museum. The types of *velatus* and *collapsus*, preserved in the Museum of the Academy of Natural Sciences, at Philadelphia, I have examined.

16. MYXOSTOMA CONGESTUM (*Baird & Girard*) *Jordan.*

Gibbous Sucker.

1854—*Catostomus congestus* BAIRD & GIRARD, Proc. Ac. Nat. Sc. Phila. 27.
Ptychostomus congestus GIRARD, Proc. Ac. Nat. Sc. Phila. 172, 1856.
Ptychostomus congestus GIRARD, U. S. Mex. Bound. Surv. Ichth. 36, pl. xxi, f. 5–8, 1859.
Catostomus congestus GÜNTHER, Cat. Fishes Brit. Mus. vii, 19, 1868.
Teretulus congestus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)
Myxostoma congesta JORDAN, Man. Vert. ed. 2d, 317, 1878.
1872—*Ptychostomus bucco* COPE, Hayden's Geol. Surv. Wyoming, 1870, 437.
Teretulus bucco JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

HABITAT.—Kansas to Texas.

The original type of *congestus*, No. 171, from Rio Salado, Texas, collected in 1851 by John H. Clark, seems to have disappeared from the Museum. No description of the mouth has been given, except that it is "very small". The species, therefore, probably has a mouth similar to that of *velatum*, and, if so, is probably identical with the species since described as *P. bucco* by Professor Cope. I have not seen the type of *P. bucco*, and, therefore, can only suggest the probable identity of the two; but, as the matter is likely to remain long unsettled, it seems best provisionally to unite them. "*P. congestus*" Cope & Yarrow is certainly not this species; more likely a form of *M. macrolepidotum*.

17. MYXOSTOMA PIDIENSE (*Cope*) *Jordan.*

Mullet of the Great Pedee.

1870—*Ptychostomus pidiensis* COPE, Proc. Am. Philos. Soc. Phila. 471.
Teretulus pidiensis JORDAN & COPELAND, Check List, 158, 1876. (Name only.)
Myxostoma pidiensis JORDAN, Man. Vert. ed. 2d, 317, 1878.

HABITAT.—Great Pedee River, North Carolina.

This appears to be a slender species, resembling "*P. cervinus* in color, form, and size". Professor Cope obtained it in the Yadkin River. I have not seen it. No specimens are in the National Museum.

18. MYXOSTOMA COREGONUS (*Cope*) *Jordan.*

Blue Mullet.

1870—*Ptychostomus coregonus* COPE, Proc. Am. Philos. Soc. Phila. 472.
Teretulus coregonus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)
Myxostoma coregonus JORDAN, Man. Vert. ed. 2d, 317, 1878.

HABITAT.—Catawba and Yadkin Rivers, North Carolina.

I have not seen this species. Professor Cope states that "it never exceeds a foot in length, and is very abundant in the Catawba and Yadkin Rivers. It is caught with the preceding two species and is used for food, but is the least valued of all the species. It is called at Morganton, Blue Mullet." There are no specimens in the National Museum.

19. MYXOSTOMA PAPILLOSUM (*Cope*) *Jordan.*

Papillose Mullet.

1870—*Ptychostomus pappillosus* COPE, Proc. Am. Philos. Soc. Phila. 470.
Teretulus pappillosus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)
Myxostoma papillosum JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 366, 1877. (Ocmulgee River.)
Myxostoma papillosa JORDAN, Man. Vert. ed. 2d, 318, 1878.

HABITAT.—North Carolina to Georgia.

This species appears to be very abundant in all the streams from the Great Pedee to the Altamaha. In its general character and appearance, it is very similar to the rest of the genus; but the mouth is remarkably different, the lower lip being full, thick, decidedly papillose, strongly incised behind, being very much as in *Catostomus nigricans.*

My specimens do not agree very well with Professor Cope's description; but this is probably due to their greater size. Still, a possibility exists that two species of this type inhabit our South Atlantic States.

The head in my specimens is very large, flattish above, narrowed forwards, and more than one fourth of the length, without caudal. The mouth is very large and inferior. The body is oblong, compressed, heavy forwards; the back moderately elevated. The eye is quite large, high up, and well back. The free border of the dorsal fin is sometimes

convex, sometimes concave. The following are the measurements of two specimens:—

	14989.	18536.
Length, inches	16½	12
Depth (percentage of length)	.29	.27
Head	.26	.24
Width of interorbital area	.10	
Length of snout	.12	
Diameter of orbit	.05	
Length of base of dorsal	.19	
Height of longest ray	.16	.19
Height of last ray	.10	
Dorsal rays	2, 14	2, 10
Scales	6-46-5	

In color, this species is smoky above, the sides silvery, the lower fins white.

Professor Cope says that "they attain one foot in length, and do not exceed one pound in weight". I have specimens a foot and a half long and of three pounds or more weight.

In the Ocmulgee, the species is next to *M. cervinum* the most abundant, and is called the White Mullet, or Sucker. Professor Cope found it quite abundant in the Catawba and the Yadkin Rivers, where it "is highly valued by the inhabitants as an article of food. It is regarded as the best of the Catostomi for that purpose. It is less frequently caught on the hook than some other species, but in the autumn, they come upon the weirs in considerable numbers. The fishermen call it the 'Shiner'."

Specimens in the United States National Museum.

Number.	Locality.	Collector.
14989	Kinston, N. C	J. W. Milner.
18536	Kinston, N. C	J. W. Milner.
18537	Kinston, N. C	J. W. Milner.
18538	Kinston, N. C	J. W. Milner.
18970	Kinston, N. C	J. W. Milner.
20906	Kinston, N. C	J. W. Milner.
—	Ocmulgee River, Ga	D. S. Jordan.

Genus MINYTREMA *Jordan.*

Minytrema JORDAN, Man. Vert. ed. 2d, 318, 1878.

Catostomus, Ptychostomus, Moxostoma, and *Erimyzon* sp., AUTHORS.

Type, *Catostomus melanops* Rafinesque.

Etymology, *μινυς,* reduced; *τρῆμα,* aperture, in allusion to the imperfections of the lateral line.

Species with the form, squamation, and general appearance of *Myxostoma*, but with the air-bladder in two parts, as in *Erimyzon*, and the lateral line imperfect—in the very young entirely obsolete, in half-grown specimens showing as a succession of deepened furrows, in the adult with perfect tubes, but interrupted, these tubes being wanting on some of the scales, especially posteriorly.

Head moderate, rather broad above; mouth moderate, inferior, horizontal, the upper lip well developed, freely protractile, the lower rather small, infolded, Λ-shaped in outline, plicate, with 12 to 20 plicæ on each side; lower jaw without cartilaginous sheath; eye moderate, rather high up, placed about midway of the head. Suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them, the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided, the anterior somewhat deeper than long, often divided into two, sometimes united with the preorbital, which is well developed and much longer than broad. The number and form of these bones, except as to their depth, are not constant in the same species, and do not afford specific characters. Opercular bones well developed, not much rugose. Fontanelle evident, rather large. Gill-rakers rather long, in length about half the diameter of the eye. Isthmus moderate. Pharyngeal bones essentially as in *Myxostoma.*

Body rather elongate, subterete, becoming deep and rather compressed with age. Scales rather large, nearly equal over the body, the radiating furrows not specially marked. Lateral line as above described, interrupted in the adult, but with perfect tubes, imperfect in partly grown specimens, entirely obsolete in the young. Scales in a longitudinal series 44 to 47 in number, 12 to 14 in a transverse series from dorsal to ventrals.

Dorsal fin rather short and high, with about 12 developed rays, beginning rather nearer the snout than the base of the caudal. Pectoral fins moderate, not reaching ventrals, the latter not to vent. Ventrals rather in advance of the middle of the dorsal, their rays normally 9,

rarely 8 or 10. Anal fin high and short, often more or less emarginate in males. Caudal fin moderately forked, the lobes about equal.

Air-bladder with two chambers.

Males in spring with the head covered with many small tubercles.

But one species of this genus seems to be known. It is widely distributed in the waters of the Western and Southern States.

This genus has been recently separated from *Erimyzon*, on account of the peculiarities of the lateral line. The form of the body, the form of the mouth, and the character of the squamation differ considerably in the two genera.

Generic Characterizations.

MINYTREMA Jordan, 1878.—"Young specimens of this species (*melanops*) have no trace of a lateral line, as in *Erimyzon*. Older ones (6 to 8 inches) show a deepening of the furrows along the median series of scales. Adults of 12 to 18 inches show a series of completely developed tubes, which, however, are wanting on some of the scales, especially behind. As *Erimyzon* never shows any traces of the tubes of the lateral line, these peculiarities may be held to indicate generic distinction, and the name *Minytrema* is here proposed for *E. melanops*."—(JORDAN, *Man. Vert.* ed. 2d, 318, 1878.)

ANALYSIS OF SPECIES OF MINYTREMA.

* Body oblong, little compressed; the young nearly terete; the adults deeper-bodied; the dorsal region not elevated: depth about 4 in length, varying from about 3 in adults to 4½ in the young: head not very large, 4½ in length of body (4¼ to 4½), not specially depressed: mucous pores rather strong: eye small, 5 to 6 in head: mouth quite inferior, horizontal, rather small: scales large, firm, regularly and smoothly imbricated, in 46 (44–47) longitudinal series and 13 (12 to 14) transverse series, the scales not crowded forwards: fin-rays usually, dorsal 12,* anal 7, ventrals 9.

Coloration dusky above, with usually a black blotch behind the dorsal fin: each scale along the sides with a small, more or less distinct blackish spot at its base, these spots forming interrupted longitudinal lines along the rows of scales. These lines are usually very distinct, especially in the adult, but young specimens often show them faintly: sides and belly silvery, with a coppery lustre: sexual peculiarities moderately marked; very old males with the head covered with small tubercles in spring: no great changes with age, either in form or coloration: size large; maximum length about 18 inches ..... MELANOPS, 20.

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* As in all cases in the present paper, the *number of developed rays* is here understood, the one, two, or three rudimentary rays not being counted, and the last or double ray of the dorsal and anal being counted as one.

20. MINYTREMA MELANOPS (*Rafinesque*) *Jordan.*

Striped Sucker. Sand Sucker.

1820—*Catostomus melanops* RAFINESQUE, Ich. Oh. 57.

Catostomus melanopsis KIRTLAND, Zool. Ohio, 168, 1838.

Catostomus melanops KIRTLAND, Boston Journ. Nat. Hist. v, 271, 1845.

Catostomus melanops STORER, Synopsis, 424, 1846.

Ptychostomus melanops AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 204, 1855.

Ptychostomus melanops COPE, Proc. Am. Philos. Soc. Phila. 478, 1870.

Erimyzon melanops JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.

Erimyzon melanops JORDAN, Man. Vert. 294, 1876.

Erimyzon melanops NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 48, 1876.

Erimyzon melanops JORDAN & COPELAND, Check List, 157, 1876.

Erimyzon melanops JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 347, 1877.

Minytrema melanops JORDAN, Man. Vert. ed. 2d, 318, 1878.

1844—*Catostomus fasciatus* (LE SUEUR MSS.) CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 449.

Catostomus fasciatus STORER, Synopsis, 426, 1846.

Catostomus fasciatus GÜNTHER, Cat. Fishes Brit. Mus. vii, 19, 1868.

1856—*Moxostoma victoriæ* GIRARD, Proc. Ac. Nat. Sc. Phila. 171.

Moxostoma victoriæ GIRARD, U. S. Mex. Bound. Surv. Ichth. 35, pl. xx, f. 1–3, 1859.

1856—*Ptychostomus haydeni* GIRARD, Proc. Ac. Nat. Sc. Phila. 172.

Ptychostomus haydeni GIRARD, U. S. Pac. R. R. Expl. x, 220, pl. xlix, f. 1–4, 1858.

Teretulus haydeni JORDAN & COPELAND, Check List, 157, 1876.

1877—*Teretulus suecetta* JORDAN & GILBERT, in Klippart's Rept. Fish Commr. Ohio, 53. (Supposed to be *C. suecetta* Lacépède, as it was perhaps in part the *C. suceti* of Cuv. & Val. and of Bosc.)

Erimyzon suecetta JORDAN, Bull. U. S. Nat. Mus. x, 35, 1877.

HABITAT.—Great Lake Region to South Carolina and Texas.

This fish, although a very abundant one in the Mississippi Basin, seems to have been overlooked by most recent writers. Rafinesque described it rather poorly. Dr. Kirtland was able to recognize the fish from Rafinesque's account, and has given a very good description and an indifferent figure. Valenciennes described it fairly, and Agassiz seems to have been acquainted with it, although, deceived by its external appearance, he took it for a *Myxostoma* (*Ptychostomus*). Girard next described and figured it as two species, belonging to two different genera. Professor Cope, for some reason, did not obtain it in any of his collections, and seems to have had much difficulty in identifying Kirtland's account. In 1875, the writer, noticing certain resemblances to *Erimyzon oblongus*, was led to dissect a number of individuals, and found that the

air-bladder in all cases was bicellular, as in the genus *Erimyzon*. At that time he had never seen any specimens with a developed lateral line and then unquestioningly referred the species to *Erimyzon*. Later, Mr. Nelson noticed the occasional partial development of the lateral line, and recently, by the examination of a full series of specimens, the writer has been enabled to trace the stages in its growth.

This fish inhabits all the Western streams and lakes, usually in company with *Erimyzon sucetta*. It is fond of clear sluggish waters, and abounds in ponds and bayous. It is used for food, and is pretty good for a "Sucker", which is not saying much. This species is more than usually tenacious of life, and young specimens are rather interesting as aquarium fishes.

The synonymy of this species needs a few words. It was originally described by Rafinesque as a species with a lateral line. This first description is quite indifferent, but the account of the coloration, and the name, Striped Sucker, enabled Dr. Kirtland readily to identify it, but the latter writer found the "lateral line obsolete". Later, Valenciennes described it under Le Sueur's MSS. name of *fasciatus*, and found a lateral line. As Le Sueur's specimens were from the Wabash, there can be no doubt of their identity with *melanops*. Later, Dr. Girard described and figured Texan specimens without the lateral line under the name of *Moxostoma victoriæ*, and specimens with the lateral line from the Upper Missouri Region as *Ptychostomus haydeni*. The types of neither of these species are preserved, but no distinctions from *melanops* are noticed in either case by the describer, and the range of *melanops* certainly includes the Missouri river and the waters of Texas.

The name *sucetta* has been once or twice employed by me for this species, erroneously, as I am now convinced. I found this species in abundance in South Carolina; and Le Sueur, apparently quoting from Lacépède, says:—"Sides silvery, with brown spots at the base of the scales." Nevertheless, on inspection of Lacépède's description, and especially of the colored figure which he gives from a drawing by Bosc, it becomes evident that the *Cyprinus sucetta* Lacépède is the same as *Cyprinus oblongus* of Mitchill, a species equally abundant in the same waters. Bosc's drawing, although not giving the details of structure minutely, represents the general form and coloration of the body and fins, and this figure can only represent the *Cyprinus oblongus*. As the *Cyprinus sucetta* Lacépède is based entirely on information derived from Bosc, the name must be retained for the species which Bosc had fig-

ured. As for the expression, "brown spots at the base of the scales," if really originating with Bosc, as appears to be the case, it may have arisen from the confusion of *sucetta* with *melanops*, which species inhabits the same waters, or it may simply refer to the obscure duskiness of the bases of the scales, common to both species.

I have examined many specimens of *Minytrema melanops* from the Great Lakes, from various places in the Mississippi Valley, and from the Tennessee, Alabama, Santee, and other Southern rivers, and can find no differences of any importance. Indeed, the species seems to be very little variable for one so widely distributed.

Specimens in the United States National Museum.

Number.	Locality.	Collector.
7694	.....	
7768	.....	
8434	.....	
11050	Sandusky, Ohio.....	J. W. Milner.
11144	Sandusky, Ohio.....	J. W. Milner.
11145	Sandusky, Ohio.....	J. W. Milner.
12449	Sandusky, Ohio	J. W. Milner.
17800	Round Lake, Montgomery, Ala.....	Kumlien & Bean.
17808	Hempstead, Tex.....	Kumlien & Earll.
20275	.....	Dr. Kenners.
—	White River, Indiana.....	D. S. Jordan.
—	Etowah River, Georgia.....	D. S. Jordan.
—	Saluda River, South Carolina.....	D. S. Jordan.

Genus ERIMYZON *Jordan.*

Moxostoma AGASSIZ, Am. Journ. Sc. Arts, 1854, 200. (Not of Rafinesque.)

Erimyzon JORDAN, Bull. Buff. Soc. Nat. Hist. 1876, 95.

Teretulus COPE, Synopsis of Fishes of N. C. 2d ed. Addenda, 1877. (Not of Rafinesque.)

Cyprinus, Catostomus, and *Labeo* sp., EARLY AUTHORS.

Type, *Cyprinus oblongus* Mitchill = *Cyprinus sucetta* Lac.

Etymology, ἐρι, an intensive particle; μύζω, to suck.

Head moderate, rather broad above: mouth moderate, somewhat inferior, the upper lip well developed, freely protractile, the lower moderate, infolded, Λ-shaped in outline, plicate, with 12–20 plicæ on each side: lower jaw without cartilaginous sheath, rather stronger than usual,

and oblique in position when the mouth is closed, the mouth thus similar to that of *Ichthyobus*. Eye moderate, rather high up, placed about midway of the head: suborbital bones considerably developed, not very much narrower than the fleshy portion of the cheek below them, the posterior suborbital concavo-convex, about twice as long as deep, sometimes divided, the anterior somewhat deeper than long, sometimes divided into two, sometimes united with the preorbital bone, which is well developed and much longer than broad. Opercular bones moderately developed, scarcely or not rugose. Fontanelle evident, rather large. Gill-rakers rather long, about half the diameter of the eye in length. Isthmus moderately developed, about the width of the eye.

Pharyngeal bones weak, the teeth quite small, slender, and weak, rapidly diminishing in length upwards, each tooth narrowly compressed, with a cusp on the inner margin of the cutting surface, and some inequalities besides.

Body oblong, rather shortened, heavy forwards and considerably compressed.

Scales rather large, more or less crowded forwards, sometimes showing irregularities of arrangement, the longitudinal radiating furrows much stronger than usual, the scales rather longer than deep, but so imbricated in the adult that the exposed surfaces appear deeper than long.

Lateral line entirely wanting. Scales in the longitudinal series from head to base of caudal 35 to 45 in number; scales in transverse row from base of ventral to dorsal 12 to 18.

Dorsal fin rather short and high, with from 10 to 14 developed rays, the number usually 11 or 12.

Beginning of dorsal fin rather nearer snout than base of caudal. Pectoral fins moderate, not reaching ventrals; the latter not to vent.

Ventrals under a point rather in advance of the middle of dorsal; their rays normally 9, but occasionally 8 or 10.

Anal fin high and short, more or less emarginate or bilobed in adult males; caudal fin moderately forked or merely lunate, its two lobes about equal.

Air-bladder with two chambers.

This genus has a very wide range, one of its two known species probably occurring in all the streams of the United States east of the Rocky Mountains.

The existence of this genus seems to have been first noticed by DeKay, who, however, erroneously supposed it to be identical with the Afri-

can genus *Labeo* of Cuvier and Valenciennes. Its essential character—the absence of the lateral line—was first noticed by Professor Agassiz, who identified its typical species with *Catostomus* (*Moxostoma*) *anisurus* Rafinesque, and therefore erroneously called the genus *Moxostoma*. The application of the name *Moxostoma* to the Red Horse group was pointed out by the present writer in 1876; the name *Erimyzon* being then suggested for the group now under consideration.

The use of the name *Teretulus* for this genus has been lately suggested by Professor Cope, its species being among those enumerated by Rafinesque as composing his "*omnium gatherum*" to which the name *Teretulus* was applied. If we subtract from the original group *Teretulus*, the different component genera in order of time of proposal, the last one left would be *Erimyzon*, or rather *Minytrema*. But the name *Teretulus* has already been restricted by Professor Cope to the Red Horse group, the principal component of Rafinesque's *Teretulus*. In my opinion, it should remain there, although the earlier name *Myxostoma* renders it but a synonym. We cannot afford to reconsider our use of these old collective generic names whenever a new genus is proposed. The "rule of exclusion", if stiffly adhered to, would require the substitution of *Acomus* for *Pantosteus*, inasmuch as a species of the latter genus was referred by Girard to the former. This question is further discussed under *Myxostoma*.

Generic Characterizations.

LABEO DeKay, 1842.—"Dorsal long. No spines nor barbels. Lips fleshy, and frequently crenated."—(DEKAY, *New York Fauna, Fishes*, 192.)

MOXOSTOMA Agassiz, 1855.—"The species of this genus contrast greatly with those of all other genera of the family of Cyprinoids, by the total absence of external openings in the lateral line, visible upon the scales. There is indeed no *row of perforated scales upon the sides of the body*, to mark the main course of the system of tubes pervading the skin in most fishes, and the pores traversing the skin which covers the skull and cheeks, as well as the lower jaw, are so minute as to escape the unarmed eye. In this respect the genus *Moxostoma* differs greatly from all other abdominal fishes in which the lateral line is distinctly marked by a series of tubes traversing a prominent row of scales along the sides, and extending through the mastoids to the forehead, and along the preopercle to the symphysis of the lower jaw. This total absence of a lateral line is compensated by the presence of a few deeper radiating furrows in the posterior field of all the scales.

"The longitudinal diameter of the scales exceeds greatly the transverse, but the scales are imbricated in such a manner that the portion visible externally appears higher than long. The centre of radiation is placed in the middle of the scales; there are no radiating furrows upon the lateral fields, those of the posterior field are fewer and deeper than those of the anterior field; the concentric ornamental ridges of the

posterior field are also much broader and farther apart than those of the lateral and anterior fields. The scales are smaller upon the anterior portion of the body than upon the sides. Another remarkable peculiarity of this genus consists in the great difference there is among the adults in the form of their fins in the several sexes. The young also differ strikingly from the adults both in form and coloration. . . . . The body of Moxostoma is elongated and somewhat compressed, though stouter than that of *Ptychostomus* and *Catostomus* proper. The greatest depth is over the ventrals.

"The head is small; the small mouth opens obliquely forwards and downwards; when open the lower jaw is quite prominent. The lips are small and transversely ridged; the lower one is slightly bilobed. The dorsal is over the ventrals; its length considerably exceeds its height in the males; in the females its dimensions are more nearly equal. The pectorals and ventrals are more pointed and longer in the males than in the females. The lower margin of the anal fin is bilobed in the males, while in the females it is simply emarginated; in both sexes, the anal when bent backwards reaches the caudal.

"The pharyngeal bones have a greater resemblance to those of the genus *Ichthyobus* than to any other of the tribe of Catostomi; the symphysis however is shorter, and the teeth are neither so minute nor so numerous; they increase also more rapidly in size from above downwards, and are more strongly curved inwards, the innermost edge rising into an acute point, which is more prominent in the middle and upper teeth, than in the lower ones."—(AGASSIZ, *Am. Journ. Sci. Arts*, 1855, p. 200.)

MOXOSTOMA Girard, 1856.—"May be circumscribed by characters more natural than the preceding ones. And the most striking of these, it must be conceded, is the absence of that lateral line possessed by almost all fishes. The body is elongated and compressed; the head small; the mouth small also, opening obliquely forwards and downwards. The lips being small and transversally ridged; the inferior one being slightly bilobed. The anterior margin of the dorsal is situated in advance of the insertion of the ventrals. The dorsal fin is either higher than long or else its length is equal to its height, varying somewhat according to the sexes, as well as the anal, which is, however, always deeper than long. The shaft of the pharyngeal bones constitutes a very open curve, the convex margin of which is regular and entire. The teeth themselves are very much compressed, strongly curved inwardly, and much larger inferiorly than superiorly."—(GIRARD, *Proc. Ac. Nat. Sc. Phila.* 1856, p. 171.)

MOXOSTOMA Günther, 1868.—"Scales of moderate size; lateral line none; fins, mouth, gills and pharyngeal teeth, identical with those of *Catostomus* in all essential points."—GÜNTHER, *Cat. Fishes Brit. Mus.* vii, p. 20.)

ERIMYZON Jordan, 1876.—[Name suggested as a substitute for *Moxostoma* Ag., the type of *Moxostoma* Raf. (*Catostomus anisurus* Raf.) not being a member of this genus.]—(JORDAN, *Bull. Buff. Soc. Nat. Hist.* p. 95.)

ERIMYZON Jordan, 1876.—"Dorsal moderate; air-bladder in two parts; no lateral line; lips usually plicate."—(JORDAN, *Man. Vert.* ed. 1st, p. 292.)

ANALYSIS OF SPECIES OF ERIMYZON.

*Body oblong, compressed, becoming gibbous with age, the ante-dorsal region more or less elevated in the adults; the depth 3½ in length, ranging from 2⅔ in adults

to 4 in young: head stout, short, about 4¼ in length (4 to 4½), the interorbital space wide and depressed, the lower parts narrower, so that it is somewhat wedge-shaped downwards: eye not large, 4¾ in head (4½ to 5½): mouth protractile downwards and forwards, the mandible oblique: scales usually closely imbricated and more or less crowded forwards, but often showing various irregularities in arrangement, about 43 (39–45) in a longitudinal series and 15 (14 to 16) in a transverse series between the ventrals and the dorsal. Fin-rays somewhat variable, the dorsal with 11 (10 to 13) developed rays, the anal with 7, and the ventrals with 9 (rarely 8).

Coloration varying with age; never distinct series of black spots along the rows of scales; young with a broad black lateral band bordered above by paler; in some specimens from clear water, this band is of a jet-black color and very distinct; in others, it is duller; later this band becomes broken into a series of blotches, which often assume the form of broad transverse bars; in adult specimens, these bars disappear, and the color is nearly uniform brown, dusky above, paler below, everywhere with a coppery or brassy, never silvery, lustre; the fins are dusky or smoky brown, rarely reddish-tinged: sexual differences strong; the males in spring with usually three large tubercles on each side of the snout, and with the anal fin more or less swollen and emarginate: adult specimens with the back gibbous and the body strongly compressed, in appearance quite unlike the young. Maximum length about 10 inches.....SUCETTA, 21.

** Body oblong, the back more elevated, the body deeper and more compressed than in the preceding, the greatest depth in advance of the dorsal fin being contained about 2¾ times in the length; nape less gibbous than in *sucetta;* head quite small and short, the large eye being almost exactly midway in its length, its length 4½ in that of the body; eye 4¼ in head; interorbital space rather narrow, strongly transversely convex, less than half the length of the head: mouth small, protractile forwards, the lower jaw oblique; lips as in the preceding.

Scales large, much larger and much more uniform in their imbrication than in *E. sucetta;* 36 in a longitudinal series, and about 13 in a transverse series from the ventrals to the dorsal. Dorsal fin high, of 12 developed rays; anal moderate, with 7; ventrals large, with 10. Color dark olivaceous above, each scale along the sides reflecting pale from the strongly ridged middle part; these giving in certain lights the appearance of pale stripes along the rows of scales: fins dusky, especially at their tips.....GOODEI, 22.

21. ERIMYZON SUCETTA (*Lacépède*) *Jordan.*

Chub Sucker. Creek Fish. Mullet.

1803—*Cyprinus sucetta* LACÉPÈDE, Hist. Nat. des Poissons, v, 606, 610.

Catostomus succtta LE SUEUR, Journ. Ac. Nat. Sc. Phila. 109, 1817.

Catostomus succtta DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus suceti CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 466, 1844.

Catostomus suceti STORER, Synopsis, 419, 1846.

Moxostoma sucetta AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 202, 1855.

Moxostoma sucetta PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Erimyzon sucetta JORDAN, Man. Vert. 295, 1876.

Erimyzon sucetta JORDAN & COPELAND, Check List, 157, 1876.

Erimyzon sucetta, JORDAN, Man. Vert. ed. 2d, 319, 1878.

1814—*Cyprinus oblongus* MITCHILL, Lit. & Phil. Trans. New York, 1, 459.

Catostomus oblongus LE SUEUR, Journ. Ac. Nat. Sc. 108, 1817.

Catostomus oblongus THOMPSON, Hist. Vt. 134, 1842. (Synonymy, but not description, which applies to *M. macrolepidotum*.)

Labeo oblongus DEKAY, New York Fauna, part iv, Fishes, 193, 1842.

Catostomus oblongus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 441, 1844.

Catostomus oblongus STORER, Synopsis, 423, 1846.

Moxostoma oblongum AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 203, 1855.

Moxostoma oblongum PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Moxostoma oblongum GILL, Canadian Nat. p. 19, Aug. 1865.

Moxostoma oblongum GÜNTHER, Cat. Fishes Brit. Mus. vii, 21, 1868.

Moxostoma oblongum COPE, Proc. Am. Philos. Soc. Phila. 468, 1870.

Moxostoma oblongum JORDAN, Fishes of Ind. 221, 1875. (Name only.)

Erimyzon oblongus JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876. (Name only; generic diagnosis of *Erimyzon*.)

Erimyzon oblongus JORDAN, Man. Vert. 294, 1876.

Moxostoma oblongum UHLER & LUGGER, Fishes of Maryland, 140, 1876.

Erimyzon oblongus NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 48, 1876.

Erimyzon oblongus JORDAN & COPELAND, Check List, 157, 1876. (Name only.)

Teretulus oblongus JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)

Teretulus oblongus JORDAN & GILBERT, in Klippart's First Report, Ohio Fish Commission, 85, pl. xii, f. 20, 1877.

Erimyzon oblongus JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 346, 1877.

Erimyzon oblongus JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 365, 1877.

Erimyzon oblongus JORDAN, Bull. U. S. Nat. Mus. ix, 36, 1877.

1817—*Catostomus gibbosus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. i, 92.

Catostomus gibbosus STORER, Rept. Ichthy. Mass. 183, 1838.

Labeo gibbosus DEKAY, New York Fauna, part iv, Fishes, 194, 1842.

Catostomus gibbosus STORER, Synopsis, 420, 1846.

Catostomus gibbosus KIRTLAND, Hamilton Smith's Annals of Science.

Catostomus gibbosus STORER, Hist. Fishes Mass. 291, pl. xxii, f. 4, 1867.

1817—*Catostomus tuberculatus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. i, 93.

Catostomus tuberculatus DEKAY, New York Fauna, part iv, Fishes, 199, 1842.

Catostomus tuberculatus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 444, 1844.

Catostomus tuberculatus THOREAU, Week on Concord and Merrimack, 38, 1868.

1817—*Catostomus vittatus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 104.

Catostomus vittatus DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus vittatus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 459, 1844.

Catostomus vittatus STORER, Synopsis, 422, 1846.

1820—*Catostomus fasciolaris* RAFINESQUE, Ich. Oh. 58.

1842—*Labeo elegans* DeKay, New York Fauna, part iv, Fishes, 192.
Catostomus elegans Storer, Synopsis, 425, 1846.
1842—*Labeo esopus* DeKay, New York Fauna, part iv, Fishes, 195.
Catostomus esopus Storer, Synopsis, 425, 1846.
1842—*Labeo elongatus* DeKay, New York Fauna, part iv, Fishes, 394.
1855—*Moxostoma anisurus* Agassiz, Am. Journ. Sc. Arts, 2d series, xix, 202. (Not of Rafinesque.)
1855—*Moxostoma tenue* Agassiz, Am. Journ. Sc. Arts, 2d series, xix, 203.
Moxostoma tenue Putnam, Bull. Mus. Comp. Zool. 10, 1863.
Moxostoma tenue Günther, Cat. Fishes Brit. Mus. vii, 21, 1868.
Erimyzon tenuis Jordan & Copeland, Check List, 157, 1876.
1856—*Moxostoma claviformis* Girard, Proc. Ac. Nat. Sc. Phila. 171.
Moxostoma claviformis Girard, U. S. Pac. R. R. Expl. x, 219, pl. xlviii, f. 5–9, 1858.
Erimyzon claviformis Jordan & Copeland, Check List, 157, 1876.
1856—*Moxostoma kennerlyi* Girard, Proc. Ac. Nat. Sc. Phila. 171.
Moxostoma kennerlyi Girard, U. S. Mex. Bound. Surv. Ichth. 34, pl. xx, f. 7–9, 1859.
1856—*Moxostoma campbelli* Girard, Proc. Ac. Nat. Sc. Phila. 172.
Moxostoma campbelli Girard, U. S. Mex. Bound. Surv. Ichth. 35, pl. xx, f. 4–6, 1859.
Erimyzon campbelli Jordan & Copeland, Check List, 157, 1876.

Habitat.—All waters of the United States east of the Rocky Mountains.

This protean species is, next to *Catostomus teres*, the most abundant and the most widely diffused of our species of Suckers. It occurs in every stream from Maine to Texas, and thrives in all sorts of waters, from the Great Lakes to the smallest ponds and brooks. Its variations in color and form are remarkable; but after the elimination of those which are known to be due to differences of sex, age, and surroundings, I find nothing left on which a difference of species or even a varietal difference may be based. I therefore unite all the nominal species of this genus, with a single exception, under the oldest specific name applied to any of them, *sucetta* of Lacépède.

The name *sucetta* has been passed from author to author for a long time, all the descriptions being based on the notes of Bosc and the account given by Lacépède, no one seeming to have any clear idea of what the original species was. The reasons for identifying *sucetta* with *oblongus* have been already given.

The name *sucetta* was spelled *suceti* by Valenciennes. I see no reason for this change. The derivation of the word is from the French *sucet*, a sucker; and *sucetta* is an agreeable latinization of the barbarous word. The identity of the nominal species *oblongus*, *gibbosus*, *tuberculatus*, *vittatus*, *esopus*, *elongatus*, and *elegans* was conclusively shown by Professor Agassiz. The *fasciolaris* of Rafinesque, as I have shown, is probably this species, which Rafinesque could hardly have overlooked.

Professor Agassiz's *anisurus*, considered by him as the Western representative of *oblongus*, must belong here. Professor Agassiz's *tenuis* from Mobile is not described; but as *sucetta* occurs abundantly in Alabama, it is safe to presume their identity. The type of *Moxostoma claviformis* Girard is now lost. Both figure and description point to the young of *sucetta*. The figure represents the scales rather smaller than usual, but it may not be correct. The types of *Moxostoma kennerlyi* Girard and of *Moxostoma campbelli* Girard, from Texas, have also disappeared; but they too seem to have been based on the young of the present species, and as *sucetta* certainly occurs in Texas, these nominal species must fall into the synonymy.

The Chub Sucker is one of the smallest species, rarely reaching a length of more than a foot. It is tenacious of life, and bites readily at a small hook, but is not much valued for food. The young are rather handsome, the black lateral band being sometimes very distinct. In the aquarium, they act as scavengers. The adult fishes, especially the males, are very dusky in color, and the males in spring are provided with three large tubercles arranged in a triangle on each side of the head. The fins of the adults are usually black, sometimes tinged with red.

Specimens in United States National Museum.

Number.	Locality.	Collector.
144	Sugar Loaf Creek, Arkansas	H. B. Möllhausen.
6860	Nova Scotia	
7638		
7646	Boston, Mass	
7771	Riverhead, L. I	S. F. Baird.
7776		
8280		S. F. Baird.
8376	North Carolina	McNair.
8459	Potomac River	
8497		
8700	Holliston, Mass	
8742	Detroit River	S. F. Baird.
8933	Brimfield	
8975		
9007	Delaware County	
9042		
9082		
9160		
9162	Jackson, Ill	R. Kennicott.

Specimens in United States National Museum—Continued.

Number.	Locality.	Collector.
9166	Abbeville, S. C	
9275		
9446	Aux Plaines River, Illinois	R. Kennicott.
9551	Lake Oconomowoc, Wisconsin	S. F. Baird.
9660		
10631	Potomac River	J. W. Milner.
10814	Sandusky, Ohio	Do.
11033	do	Do.
11034	do	Do.
11035	do	Do.
11199	do	Do.
11200	do	Do.
12441	Halifax, Nova Scotia	Do.
14977	Potomac River	G. B. Goode.
16990	do	J. W. Milner.
16991	do	Do.
16992	do	Do.
16993	do	Do.
16994	do	Do.
17816	Clear Creek, Texas	Kumlien & Earll.
17821	do	Do.
17838	New Bedford, Mass	Thomas.
19158	Aux Plaines River, Illinois	R. Kennicott.
20061	Cedar Swamp, New Jersey	S. F. Baird.
20064	Schuylkill, River	J. H. Richard.
20105	Fox River, Wisconsin	S. F. Baird.
20157	Montgomery, Ala	Kumlien & Maxson.
20231	Riverhead, L. I	S. F. Baird.
20254	Piermont, N. Y	Do.
20269	Sing Sing, N. Y	Do.
20360	Trenton, N. J	C. C. Abbott.
—	Cumberland River	A. Winchell.
—	White River, Indiana	D. S. Jordan.
—	Etowah River, Georgia	Do.
—	Saluda River, South Carolina	Do.

22. ERIMYZON GOODEI, *sp. nov.*

Goode's Sucker.

This species differs from *E. sucetta* in form, in the smaller size of the head, in its greater convexity above, and in the larger size and greater uniformity of the scales, which are not at all crowded or reduced forwards.

The type is a fine specimen, 10¼ inches long, collected by Professor G. Brown Goode in the Saint John's River, Florida. It is numbered 19071 on the Museum Register. I have named the species for my friend, Professor Goode, one of the best of American ichthyologists, to whom we are indebted for the discovery of the species.

Specimens in United States National Museum.

Number.	Locality.	Collector.
19071	Saint John's River, Fla	G. Brown Goode.

Genus CHASMISTES *Jordan.*

Chasmistes JORDAN, Bull. Hayden Geol. Surv. Terr. 417, 1878.

Type, *Catostomus fecundus* Cope & Yarrow.

Etymology, χασμάω, to yawn or gape.

Fishes related to *Catostomus*, having the teeth, scales, and air-bladder as in that genus, but distinguished by the size and position of the mouth, the great development of the mandible, and by the small, smooth lips.

Head disproportionally large, forming more than one-fourth of the length, broad and flattish above; sides of head vertical, slightly directed inwards, the breadth through the cheeks less than the breadth above the eyes; eyes small, high up, rather posterior: mouth exceedingly large, terminal, the lower jaw in the closed mouth being very oblique, placed at an angle of about 45 degrees; the lower jaw very long and strong, its length more than one-third the length of the head, nearly half the length of the head in the adult, its tip when the mouth is closed about on a level with the eye; upper jaw very protractile; upper lip very thin (for a Sucker), and nearly smooth; snout elevated above the rest of the head, notably so when the mouth is closed; lower lip moderate, consisting of a broad flap on each side of the mandible, in front reduced to a narrow rim, the surface of the lip nearly smooth, without evident papillæ: nostrils large; suborbital bones narrow, but rather broader than in *Catostomus;* preorbital unusually large: mucous channels moderately developed; fontanelle very large; isthmus rather narrow: pharyngeal bones and teeth essentially as in *Catostomus.*

Body rather slender, tapering pretty regularly from the shoulders to the tail, but little compressed: caudal peduncle rather stout.

Fins moderate, the dorsal rays about 12, the anal 7: pectorals rather long, not quite reaching ventrals: ventrals reaching vent: anal fin high, reaching caudal: caudal fin rather long, its lobes equal.

Scales moderate, large on the caudal peduncle, much smaller and crowded anteriorly, 60 to 65 in the lateral line, about 18 in a transverse series from dorsal to ventrals.

Sexual peculiarities unknown.

Coloration usual.

Air-bladder in two parts.

Size moderate or rather large.

The single species now included in this genus is known only from Utah Lake. Its describers referred it to the genus *Catostomus*, but made no mention of its singular mouth and lips. The original type of the species is in very bad condition, the mouth being shrunken and distorted, and the bones of the head protruding through the skin, so that the peculiarities of the species are hardly recognizable.*

Generic Characterizations.

CHASMISTES Jordan, 1878.—"This genus is distinguished from *Catostomus* by the very large, terminal mouth, the lower jaw being very strong, oblique, its length about one-third that of the head. The lips are little developed, and are very nearly smooth. The type of the genus is *C. fecundus* Cope & Yarrow."—(JORDAN, *Bull. U. S. Geol. Surv. Terr.* vol. iv, No. 2, p. 417, 1878.)

ANALYSIS OF SPECIES OF CHASMISTES.

* Depth about 5 in length; head $3\frac{3}{8}$; interorbital space broad, $2\frac{1}{4}$ in head; eye 6 to 7 in head; width of the open mouth $3\frac{1}{2}$ in head. Dorsal 12. Anal 7. Scales 9-63-8. Color dusky above, pale below; the scales of the back and sides profusely covered with dark punctulations ..... FECUNDUS, 23.

23. CHASMISTES FECUNDUS (*Cope & Yarrow*) *Jordan.*

Sucker of Utah Lake.

1876—*Catostomus fecundus* COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 678, pl. xxxii, f. 1, 1 *a*.

Catostomus fecundus JORDAN & COPELAND, Check List, 156, 1876.

Chasmistes fecundus JORDAN, Bull. Hayden's Geol. Surv. Terr. vol. iv, No. 2, 417, 1878.

HABITAT.—Utah Lake, Utah, where it is excessively abundant. Not yet noticed elsewhere.

This singular species has been overlooked until quite lately. Dr. Yarrow states that it "is abundant in Utah Lake, and is called Sucker

* In fact, this specimen in its present condition looks to me more like *Catostomus occidentalis*, but the figure published by Cope & Yarrow represents *C. fecundus*. Both species occur in Utah Lake.

by the inhabitants. They run up the rivers to spawn in June; feed on the bottom and eat the spawn of better fish; spawning beds on gravel; bite at hook sometimes; are extremely numerous, and are considered a nuisance by the fishermen, but they meet with a ready sale in winter at an average price of 2½ cents per pound."

Specimens in United States National Museum.

Number.	Locality.	Collector.
12894	Utah Lake, Utah	Yarrow & Henshaw.
20337	Utah Lake, Utah	Dr. H. C. Yarrow. (Many specimens.)
20932	Utah Lake, Utah	Dr. H. C. Yarrow. (Type *Chasmistes.*)
—	Utah Lake, Utah	Dr. H. C. Yarrow. (Types of the species.)

Genus CATOSTOMUS *Le Sueur.*

Catostomus Le Sueur, Journ. Ac. Nat. Sc. Phila. i, 1817, 89. (Equivalent to family *Catostomidæ.*)

Hypentelium Rafinesque, Journ. Ac. Nat. Sc. Phila. i, 1818, 421. (As subgenus of *Exoglossum.*)

Decactylus Rafinesque, Ichthyologia Ohiensis, 1820, 60. (As subgenus of *Catostomus*, including the 10-rayed species.)

Hylomyzon Agassiz, Am. Journ. Sc. Arts, 1855, 205.

Minomus Girard, Proc. Ac. Nat. Sc. Phila. 1856, 173.

Acomus Girard, Proc. Ac. Nat. Sc. Phila. 1856, 173.

Catastomus Gill, Canadian Naturalist, 1865, August.

Decadactylus Jordan, Man. Vert. 2d ed. 1878, 319. (As subgenus.)

Type, *Cyprinus catostomus* Forster, = *Catostomus hudsonius* Le Sueur, = *Catostomus longirostrum* Le Sueur.

Etymology, κατο, low; στόμα, mouth.

Etymology of Synonyms.

Hypentelium: probably ὑπὸ, below; πέντε, five; λοβος, lobe, as the name is said to refer to the 5-lobed lower lip, supposed to distinguish it from the 3-lobed subgenus *Maxillingua;* possibly, however, from ὑπὸ, below; εντελὴς, perfect.

Decactylus: δεκὰς, ten; δάκτυλος, toe, *i. e.*, 10 ventral rays, hence properly *Decadactylus.*

Hylomyzon: ὕλε, mud; μυζάω, to suck.

Acomus and *Minomus* are probably meaningless words, without etymology.

Head more or less elongate, its length ranging from 3½ to 5 times in that of the body, its form varying considerably in the different subgenera. Eye usually rather small, high up and median or more or less pos-

terior in position: suborbital bones narrow, longer than broad, much as in *Myxostoma:* fontanelle always present, usually widely open, in two species reduced to a narrow slit, but never wholly obliterated.

Mouth rather large, always inferior, and sometimes notably so; the upper lip thick, protractile, papillose; the lower lip greatly developed, with a broad free margin, deeply incised behind, so that it forms two lobes, which are often more or less separated: mandible horizontal, short, not one-third the length of the head and not reaching to opposite the eye: lower jaw usually without distinct cartilaginous sheath: opercular apparatus moderately developed, not rugose: pharyngeal bones moderately strong, the teeth shortish, vertically compressed, rapidly diminishing in size upwards, the upper surface of the teeth nearly even, or somewhat cuspidate.

Body oblong or elongate, more or less fusiform, subterete, more or less compressed.

Scales comparatively small, typically much smaller and crowded anteriorly, the number in the lateral line ranging from about 50 to 115, the number in a transverse series between dorsal and ventrals from 15 to 40: lateral line well developed, straightish, somewhat decurved anteriorly.

Fins variously developed: dorsal with its first ray nearly midway of the body, with from 9 to 14 developed rays; anal fin short and high, with probably always 7 developed rays; ventrals inserted under the middle or posterior part of the dorsal, typically with 10 rays, in one subgenus usually 9, the number often subject to variation of one; caudal fin usually deeply forked, the lobes nearly equal.

Sexual peculiarities not much marked, the fins higher in the male and the anal somewhat swollen and tuberculate in the spring: breeding males in some species with a rosy or orange lateral band.

Air-bladder with two chambers. Vertebræ in *C. teres* and *C. nigricans* 45 to 47.

"The *skeleton* in *Catostomus* has been well described by Valenciennes (XVII. p. 433). It is distinguished by the comparative want of solidity, certain bones consisting merely of a network of osseous matter. There is a large and broad fontanelle on the upper surface of the head, separating the parietal bones, and leading directly into the cerebral cavity. The occipital process is, below the anterior vertebræ, enlarged into a bladder-like swelling, which is not solid, but consists of a delicate network only. The prefrontal is advanced to the anterior part of the orbit.

The jaw-bones are very feeble, the intermaxillary being reduced to a thin lamella, which does not descend to the middle of the maxillary. The anterior part of the mandible is horizontal, thin and slightly dilated. The apophyses of the four anterior vertebræ are very strong and long."—(GÜNTHER, *Cat. Fishes Brit. Mus.* vii, 13.)

This genus as at present restricted comprises three well-marked groups, which may be accepted as subgenera, under the names *Catostomus*, *Decadactylus*, and *Hypentelium*. One of these groups, *Hypentelium*, has been usually considered as a distinct genus, on account of the differences in the form of the head and in the squamation. These differences are, however, individually of subordinate value, and should probably be held to designate a subgeneric section, rather than a distinct genus.

The group *Decadactylus* as here given is nearly equivalent to *Minomus* and *Catostomus* of Girard, while our *Catostomus* is Girard's *Acomus*. The type of *Catostomus*, as restricted by Agassiz, prior to Girard being *Cyprinus catostomus* Forster, one of the small-scaled group, the name belongs properly to that group, and *Acomus* is a simple synonym. *Decactylus* Rafinesque was not originally defined in any very tangible way, inasmuch as its author included in it species of *Myxostoma* and *Cycleptus*. As, however, it was intended for 10-rayed species, and as one among those originally placed in it was *C. teres* (as *C. bostoniensis*), the the name *Decactylus* (*Decadactylus*) may be used instead of *Minomus* as a designation for the subgenus to which *C. teres* belongs.

The genus *Catostomus* is, next to *Myxostoma*, the most rich in species. It is much the most widely distributed of the genera of Suckers, some of its members abounding in every river of North America, and one of them being found in Asia.

Generic Characterizations.

"CATOSTOMUS Le Sueur, 1817.

"*Back* with a single fin.

"*Gill-membrane* three-rayed.

"*Head* and *opercula* smooth.

"*Jaws* toothless and retractile.

"*Mouth* beneath the snout; lips plaited, lobed, or carunculated, suitable for sucking.

"*Throat* with pectinated teeth.

"The species which are here described are all possessed of the following general characters:—

"*Body.*—The body in general is elongated and varied in its form.

"*Scales.*—The scales in almost all the species are marked with radiated lines, and fimbriated on their edges; their form more or less rhomboidal or roundish.

"*Gill-covers.*—The gill-covers are large, and composed of three pieces; the anterior piece small in some, as is exemplified in the *C. macrolepidotus*, and in others large, as in the *C. communis*; opening or expansion wide.

"*Nostrils.*—The nostrils are double on each side, and separated by a membrane; the largest aperture near the eyes.

"*Eyes.*—The eyes in general are pretty large, a little oblong, without nictitating membrane: pupil black and roundish: irides yellowish, sometimes brown, as in the *C. gibbosus.*

"*Teeth.*—No *teeth* in the jaws, but those of the throat, on each side, are composed of a range of bones, generally blunt and thick at their summits, placed in a pectinated form, on an osseous, arcuated base, of which they are a component part, and sometimes terminate in a hooked point, as in the *C. maculosus*; these teeth are enveloped in a thick mass of whitish substance, which covers the throat, and supplies the place of a tongue.

"*Mouth.*—The *mouth* is generally lunated; to the palate is attached a membrane.

"*Viscera.*—The *intestinal canal* is very much developed, and it has its origin near the throat; the *stomach*, which is simple, and without plaits and curvatures, being a continuation of this canal, and appears to be confounded with it. The intestines make a number of circumvolutions; in a specimen of the *C. macrolepidotus* of 16 inches in length, they were 3 feet 5 inches in length. The *liver* is deliquescent, and soon passes into oil after exposure to the atmosphere. The *air-bladder* is subcylindrical, and divided, in most species, into two parts; in the *C. macrolepidotus*, it is separated into four parts. I have remarked in the intestines of these fishes river-shells of the genera *Lymnæa*, *Bulimus*, etc., which dwell on aquatic plants and on the rock at the bottom of the rivers; these shells the *Catostomi* are enabled to take with their lips, which are protruded forwards by means of their jaws.

"It is necessary to remark that in all the species which I have examined there is a line which runs from the nape, beneath the eyes, and another along the head, above the eyes, of small orifices, for the passage of mucus, which lines are well defined after the fish is dead and desiccated, but not so conspicuous when recent; these lines Forster improperly terms sutures. I will add that some species, in a dried state, have also a tuberculated appearance on the head, which tubercles are not discernible when the animals are living."—(Le Sueur, *Journ. Ac. Nat. Sc.* i, p. 89.)

Hypentelium Rafinesque, 1818.—"This species [*Exoglossum macropterum*] distinguished by so many secondary characters may be the type of a subgenus, which may be called *Hypentelium*, in reference to the five lobes of the lower jaw. The species with a three-lobed jaw may form then another section under the former name of *Maxillingua.*"—(Rafinesque, *Journ. Acad. Nat. Sc.* p. 420, 1818.)

Catostomus Rafinesque, 1820.—"Body oblong cylindrical, scaly. Vent posterior or nearer to the tail. Head and opercules scaleless and smooth. Mouth beneath the snout, with fleshy, thick or lobed sucking lips. Jaws toothless and retractible. Throat with pectinated teeth. Nostrils double. Gill-cover double or triple. Three branchial rays to the gill membrane. A single dorsal fin commonly opposite to the abdominal fins, which have from eight to ten rays."—(Rafinesque, *Ich. Oh.* p. 53.)

Decactylus Rafinesque, 1820.—"Body nearly cylindrical, abdominal fins with ten

rays; tail equally forked. Besides the two following species (*C. duquesnii; C. elongatus*) the *C. bostoniensis* and *C. hudsonius* must be enumerated here."—(RAFINESQUE, *Ich. Oh.* p. 60.)

HYPENTELIUM Rafinesque, 1820.—"Body pyramidal slightly compressed, with very minute scales. Vent posterior. Head scaleless, nearly square, mouth terminal protruded beneath toothless, jaw shorter with five lobes, the middle one larger, lips very small. Abdominal fins anterior removed from the vent, dorsal fin anterior, opposed to them.

"This genus belongs to the family of the Cyprinidia, and is next to my genus *Exoglossum*, with which I had united it; but this last differs from it by an oblong body, flat head, lower lip trilobe not protruded, abdominal fins and dorsal fin medial, &c. The name expresses the character of the lower lip."—(RAFINESQUE, *Ich. Oh.* p. 68.)

CATOSTOMUS DeKay, 1842.—"Both lips thick, fleshy, and crenated or plaited; the lower lip pendant. Dorsal placed above the ventrals and usually short."—(DEKAY, *New York Fauna, Fishes*, p. 196.)

CATOSTOMUS Heckel, 1843.—"Os inferum; labia carnea, lata, rugosa, suctui apta; cirrhi nulli; præoperculum ante occiput. Pinna dorsalis brevis, rarius elongata; analis brevior, utraque radio osseo nullo. Dentes pharyngei pectiniformes.

$$\begin{array}{l|l} \text{D} : 3 & 8-13-29 \\ \hline \text{A} : 2 & 5-7 \end{array}$$

(Characters of Tribus IV, including *Catostomus*, *Rhytidostomus*, and ♀ *Exoglossum*.)

"Dentes pectiniformes 40 — 40. Os inferum; labia carnea; lata, rugosa ad suctum apta; cirrhi nulli. Pinna dorsalis et analis brevis, illa ante pinnas ventrales incipiens; radius osseus nullus. — Tractus intestinalis $2\frac{1}{2}$—3 long. corp." — (HECKEL, *Fische Syriens*, p. 33.)

CATOSTOMUS Valenciennes, 1844.—"Ils diffèrent des ables [*Leuciscus*], avec lesquels ils ne sont pas sans affinité, par la position de leur bouche et par la forme des lèvres qui la bordent. Ces organes sont assez distincts de ceux des Chondrostomes.

"L'absence des barbillons les éloigne aussi des Labéons [*Labeo*], avec lesquels ils ont d'ailleurs moins de rapports que M. Cuvier ne le supposait quand il a rédigé le Règne Animal. Enfin ils diffèrent de tous ces genres par leurs dents pharyngiennes.

"Par la forme générale de leur corps, ils ressemblent à nos barbeaux [*Barbus*], dont ils ont presque tous la tête alongée, lisse et nue, et le museau un peu proéminent, mais ils n'ont pas leurs barbillons, et la dorsale manque de rayons épineux et dentelés. La bouche est située sous le museau; elle est sans dents, et les lèvres, élargies, lobées, caronculées, mais sans prolonguements filiformes, servent à constituer une sorte de ventouse au moyen de laquelle ces poissons peuvent adherer ou sucer. Les pharyngiens sont grands et arqués, presque en demi-cercle; tout le bord interne est garni de dents comprimées, à couronne striée, un peu plus large que la base; toutes ces dents décroissent regulièrement depuis les inferiéures jusqu'aux supérieures, le nombre en varie selon les espèces; elles forment un peigne sur le corps l'os. Les opercules sont grands; les narines ont chacune, comme à l'ordinaire, deux ouvertures rapprochées; les yeux assez larges, sont elliptiques, et ont l'iris ordinairement jaune; les écailles sont en général petites sur la nuque et près de la tête, et elles vont ensuite en augmentant à mésure qu'on s'en approche de la queue; elles sont plus ou moins rhomboïdales et striées ou frangées.

"Les viscères rappellent ceux des cyprinoïdes en général, mais l'intestin, à cause de ses nombreux replis, a encore plus d'étendue. . . . Le foie se résout bientôt en huile; la vessie aérienne est communément divisé en deux et communique avec le haut de l'œsophage comme dans nos cyprins."—(VALENCIENNES, *Hist. Nat. des Poissons*, xvii, pp. 423–424.)

HYLOMYZON Agassiz, 1855.—"The name of this genus is a mere translation of the vernacular name of its type, the Mud-Sucker of the West, framed in imitation of Petromyzon, but expressing its habits of living in the mud. The body is stout and heavy in front, and tapers off rapidly from the shoulders towards the tail; behind the dorsal it is nearly cylindrical in form.

"The short quadrangular head is broad and flat above, its sides are vertical. The eyes are of moderate size and elliptical in form; the superorbital ridges are elevated above the general level of the head. The mouth is inferior, and encircled by broad fleshy lips which are covered with small grains or papillæ. The lower lip is bilobed. The dorsal is over the ventrals, and nearer the head than the tail; its height and length are nearly equal. The pectorals and ventrals are broad and rounded, the anal fin is slender and reaches the caudal. The scales are largest on the anterior portion of the body. They are slightly longer than high, the ornamental concentric ridges of the posterior field are broader and farther apart than those of the lateral and anterior fields; those of the anterior and posterior fields rather remote, about equal in number. Tubes of the lateral line arising from the centre of radiation.

"The teeth are compressed, so that their sharp edge projects inwards; at the same time they are slightly arched inwards and inserted obliquely upon the pharyngeal bones. They increase gradually in size and thickness from above downwards. The masticating ridge of the teeth is transverse, compressed in the middle and sharp; its upper and lower edges are rounded and more projecting, the inner point, however, more projecting than the outer one."—(AGASSIZ, *Am. Journ. Sci. Arts*, 1855, p. 205.)

CATOSTOMUS Agassiz, 1855.—"I have retained the name of Catostomus for the type to which it was originally applied by Forster. The body is elongated, fusiform and slightly compressed. The snout is short and blunt, and projects but little beyond the mouth, which is inferior. The lower jaw is short and broad. The lips are fleshy and strongly bilobed below; their surface is conspicuously granulated or papillated. The head is considerably longer than high. The dorsal is large and mostly in advance of the ventrals; its length is greater than its height. The anal fin is long and slender, and reaches the caudal. The sexual differences, so conspicuous in the genus Moxostoma and Ptychostomus, are hardly to be noticed in this genus. The other fins are of moderate size, and more or less pointed.

"The scales are much smaller on the anterior than on the posterior portion of the body; nearly quadrangular, with rounded angles, but somewhat longer than high; the ornamental concentric ridges of the posterior field broader than those of the lateral and anterior fields; the radiating furrows more numerous than in Hylomyzon and Ptychostomus, and encroaches upon the lateral fields, where, in some species, they are nearly as numerous as upon the anterior and posterior fields. Tubes of the lateral line wider than in Hylomyzon and Ptychostomus, extending from the centre of radiation to the posterior margin.

"The pharyngeals are stout and compact, the outer margin not so spreading as

in Ptychostomus; the teeth are blunter and larger comparatively than in any other genus of the tribe, increasing more rapidly in size from above downwards, so that those of the middle of the arch are already of the same cast as those of the lower part of the comb; their crown is blunt and the inner edge rises into a blunt cusp."—(AGASSIZ, *Am. Journ. Sc. Arts*, 1855, p. 207.)

MINOMUS Girard, 1856.—"We propose to include under the head of *Minomus*, such species as are characterized by an elongated and fusiform body, a head longer than deep; a dorsal fin either higher than long, or with both dimensions equal. The lips being tuberculated, moderately bilobed. The pharyngeals not expanded laterally, but considerably bent inwardly. The teeth compressed, decidedly bicuspid, but the inner projection more developed than the outer. The scales being nearly of the same size, but slightly smaller anteriorly than posteriorly." (Includes *C. insignis*, *C. plebeius*, and *C. clarkii*.)—(GIRARD, *Proc. Ac. Nat. Sc. Phila.* 1856, p. 173.)

ACOMUS Girard, 1856.—"And then giving the name of *Acomus* to those species in which the head is very elongated, the dorsal higher than long, and the scales much smaller upon the anterior region of the body than upon the posterior. The lips being papillated and very deeply cleft. The pharyngeals are gently arched and not expanded; the teeth compressed and bituberculated, the inner projection conspicuous; the outer one obsolete, though existing." (Includes *C. forsterianus*, *C. aurora*, *C. latipinnis*, *C. guzmaniensis*, *C. generosus*, *C. griseus*, and *C. lactarius*.)—(GIRARD, *Proc. Ac. Nat. Sc. Phila.* 1856, p. 174.)

CATOSTOMUS Girard, 1856.—"The genus *Catostomus*, Le Sueur, would then be restricted to such species in which the head is moderately elongated, the dorsal fin generally longer than high, and the size of the scales less disproportionate anteriorly and posteriorly than in *Acomus*. The lips are papillated and deeply cleft. The pharyngeals provided with a little expansion inferiorly. The teeth are compressed, with the inner projection of the crown alone developed." (Includes *C. hudsonius*, *C. communis*, *C. occidentalis*, *C. labiatus*, *C. macrocheilus*, *C. sucklii*, and *C. bernardini*.)—(GIRARD, *Proc. Ac. Nat. Sc. Phila.* 1856, p. 174.)

CATASTOMUS Gill, 1865.—"Snout long. Lateral line present, nearly straight. Lips papillated."—(GILL, *Canadian Naturalist*, Aug. 1865, p. 19, reprint.)

CATOSTOMUS Günther, 1868.—"Scales of small, moderate or large size. Lateral line present, running along the middle of the tail. Dorsal fin of moderate extent, with not more than about seventeen rays, opposite to the ventrals, without spine. Anal fin very short, but deep. Fins of the males generally more produced than those of the females, and frequently with horny tubercles. Mouth inferior, with the lips more or less thickened and papillose, the lower frequently bilobed. Barbels none. Gill-rakers well developed, soft, the upper lanceolate, the lower quite membranaceous, low folds crossing the bone. Pseudobranchiæ. Pharyngeal bones sickle-shaped, armed with a comb-like series of numerous compressed teeth, the teeth becoming larger and broader towards the lower end of the series."—(GÜNTHER, *Cat. Fishes Brit. Mus.* vii, p. 12.)

CATOSTOMUS Jordan, 1876.—"Air bladder in two parts; lateral line well developed; lips papillose; scales much smaller anteriorly than posteriorly; interorbital space convex; body sub-terete."—(JORDAN, *Man. Vert.* 1876, p. 292.)

HYPENTELIUM Jordan, 1876.—"Air bladder in two parts; lateral line well developed; lips papillose; scales about as large on front part of body as on tail; body

tapering rapidly from shoulders to tail; interorbital space concave; length of head greater than depth of body."—(JORDAN, *Man. Vert.* 1876, p. 292.)

CATOSTOMUS Cope & Jordan, 1877.—"Body oblong or elongate, with a short, subquadrate dorsal fin; air bladder in two parts; lateral line well developed; fontanelle distinct."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 81.)

HYPENTELIUM Jordan, 1878.—"Body oblong or elongate, with a short subqnadrate dorsal; anal rays uniformly 7; mouth normal, the lower lip undivided or deeply lobed; lips tuberculate; lateral line well developed; fontanelle distinct; no mandibulary sheath; scales moderate, not crowded forwards, about equal over the body; body long, and little compressed; head transversely concave between orbits, long and flattened, the physiognomy being therefore peculiar; ventral rays 9."—(JORDAN, *Man. Vert.* ed. 2d, 1878, pp. 309–310.)

CATOSTOMUS Jordan, 1878.—[As in the preceding except] "Scales small, smaller anteriorly and much crowded; head transversely convex between orbits; ventral rays normally 10."—(JORDAN, *Man. Vert.* ed. 2d, 1878, pp. 309–310.)

DECADACTYLUS Jordan, 1878 (as subgenus).—"Lateral line with 60 to 65 scales; snout comparatively short."—(JORDAN, *Man. Vert.* ed. 2d, p. 319.)

CATOSTOMUS Jordan, 1878 (as subgenus).—"Lateral line with about 100 scales; snout much produced."—(JORDAN, *Man. Vert.* ed. 2d, p. 320.)

The three subgenera here recognized are characterized below. The single species of *Hypentelium* is found only eastward of the Rocky Mountains. *Catostomus* and *Decadactylus* each have representatives on both sides of the mountains. It is a curious fact that the Southwestern representatives of each, as a rule, have the upper lip more developed, and with more numerous series of papillæ, than the Eastern ones. In this respect as in others, these Western species approach the genus *Pantosteus*, a group exclusively Western in its distribution.

ANALYSIS OF SPECIES OF CATOSTOMUS.

* Scales moderate; not crowded anteriorly, nearly equal over the body; 48 to 55 in the lateral line; 12 to 15 in a transverse series from dorsal to ventrals: head flattened above, transversely concave between the orbits, the frontal bone thick, broad, and short, the physiognomy being therefore peculiar: ventral rays normally 9: upper lip very thick, strongly papillose, with a broad, free margin, which has upwards of 8 to 10 series of papillæ upon it. Lower lip greatly developed, strongly papillose, considerally incised behind, but less so than in *Catostomus* proper: fontanelle shorter and smaller than in *Decadactylus*: pectoral fins unusually large. (*Hypentelium.*)

x. Depth 4½ to 5 in length; head 4 to 4½; eye rather small, 4½ to 5 in head: color olivaceous; sides with brassy lustre; belly white; back brown, with several dark cross-blotches, irregularly arranged, these becoming obsolete in old individuals; lower fins dull red, with some dusky shading: size large; maximum length about two feet ..... NIGRICANS, 24.

y. Dorsal with 11 developed rays: scales 7-50-5: head rather longer, 4 to 4½ in length: pectoral fins rather longer: colors relatively dull; no distinct whitish stripes along the rows of scales.

nigricans.

yy. Dorsal with 10 developed rays: scales 6-48-5: head rather shorter, 4½ in length: pectoral fins rather shorter: colors brighter; blackish above; belly abruptly white; a pale spot at the base of each scale, these forming conspicuous whitish streaks along the rows of scales ..... *etowanus*.

** Scales small, reduced, and crowded anteriorly more or less; 58 to 72 in the lateral line and about 20 to 25 in a transverse series from the ventrals to the dorsal: snout moderate or rather short. (*Decadactylus*.)

† Upper lip comparatively thin, with but few (2 or 3) rows of papillæ.

a. Dorsal fin with but 10 or 11 developed rays; scales but little reduced in size forwards.

b. Body moderately stout; depth 4⅔ in length; head very small and short, about 5 in length; eye moderate; fins all notably small: scales small, subequal, 9–70–9, larger on the middle of the body than on the caudal peduncle: body with scattered, dusky, nebulous spots ..... CLARKI, 25.

bb. Body rather elongate, subterete, heavy at the shoulders and tapering backwards, the depth about 5 in length; head moderate, about 4¼ in length; mouth comparatively small; lips moderate, the upper narrow, with about two rows of large tubercles: scales little crowded forwards, 58 to 63 in the lateral line, 19 in a cross-series: a series of dusky spots along each row of scales, as in *Minytrema melanops*; the spots sometimes obscure.

INSIGNIS, 26.

aa. Dorsal with 11 to 13 developed rays: scales much reduced and crowded anteriorly.

c. Body moderately stout, varying with age, subterete, heavy at the shoulders, the depth 4 to 4⅔ in length: head rather large and stout, conical, flattish above, its length 4 to 4½ in body (3½ to 4¼ in young); snout moderately prominent, scarcely overpassing the mouth; mouth rather large, the lips strongly papillose, the upper moderate, with two or three rows of papillæ: scales crowded anteriorly, much larger on the sides than below; scales 10–64 to 70–9: coloration olivaceous; males in spring with a faint rosy lateral band; young brownish, more or less mottled, often with about three large confluent lateral blotches, which sometimes form an obscure lateral band.

TERES, 27.

†† Upper lip thick and full, with several (5 to 8) rows of papillæ: scales crowded forwards.

† Fontanelle well developed: lips without evident cartilaginous sheath.

d. Dorsal fin comparatively long, of 12 to 14 rays.

e. Mouth quite large, with very large lips, the upper full and pendent, with 6 to 8 rows of strong papillæ: head large, 4¼ in length, rather narrow, quadrangular, the snout projecting: eye large: dorsal fin much longer than high, its rays about 14: scales 12–72–10: coloration rather dark; a dusky lateral stripe..... MACROCHILUS, 28.

ee. Mouth comparatively small, smaller than in *C. teres;* the upper lip thick, with 5 or 6 rows of papillæ, which are moderately large: head rounded above, 4½ in length, the profile steeper than in *C. teres*, the snout more pointed, the two sides of the head more convergent forwards: eye small: dorsal fin longer than high, its rays 12 to 14: scales 13–72–10.

OCCIDENTALIS, 29.

dd. Dorsal fin short, higher than long, of about 11 developed rays: head 4⅓ in length, rather bluntish: mouth moderate, the labial papillæ largely developed, the upper lip full, with about 5 rows of large but rather sparse papillæ: scales 12–74–10: color dark above; sides clouded with black and yellow... LABIATUS, 30.

†† Fontanelle very small and narrow: both jaws with a weak cartilaginous sheath: body elongate, fusiform, subterete, the greatest depth 4¼ to 4½ in length: head small, conical, 4⅔ in length: mouth quite large, with full, thick lips, the upper very wide and pendent, with about 6 rows of very strong papillæ: lower lip two-lobed, similarly papillose: interorbital space wide, convex: eye elevated, posterior, quite small: fins moderate; dorsal higher than long, with 10, rarely 11, rays: ventral rays 10: scales small, crowded forwards, 10 or 9–70–8: color dark; scales with dark punctulations..... ARÆOPUS, 31.

*** Scales very small, much reduced and crowded anteriorly; 83 to 115 in the lateral line, and 25 to 40 in a transverse series from the ventrals to the dorsal: body and head more or less elongate: sides with a broad rosy or orange lateral band in spring males. (*Catostomus.*)

§ Fontanelle well developed: jaws without evident cartilaginous sheath.

f. Upper lip comparatively thin and narrow, with but few (3 or 4) rows of papillæ.

g. Body shorter than in the next, but still elongated, its greatest depth 4½ to 5 in length: head very large and long-acuminate, the muzzle nearly one-half its length, overhanging the rather large mouth: lips moderate; the upper pendent, with about 3 rows of small papillæ; the lower rather full, similarly papillose: eye nearly median, rather small, 8½ in head: scales small and crowded forwards, closely imbricated, 83 to 87 in

the course of the lateral line and about 28 in a cross-series from dorsal to ventrals: coloration very dark; fins dusky; scales everywhere finely punctate. Size large..TAHOENSIS, 32.

gg. Body elongate, subterete, the depth 4¼ to 4⅔ in length: head quite long and slender, 4¼ to 4⅔ in length, depressed and flattened above, broad at base, but tapering into a long snout, which considerably overhangs the large mouth: lips thick, coarsely tuberculate, the upper lip narrow, with 2 or 3 rows of tubercles: eye rather small, behind the middle of the head: scales very small, much crowded forwards, 95 to 114 in the course of the lateral line, and about 29 (26 to 31) in a cross row from dorsal to ventrals: dorsal rays 10 or 11: males in spring with the head and anal fin profusely tuberculate, the tubercles on the head small; the sides at that season with a broad rosy band: size large; the largest species in the genus.....LONGIROSTRIS, 34.

ff. Upper lip very broad, with several (5 or 6) rows of large papillæ.

i. Body long and slender, subterete, compressed behind, the form essentially that of *C. longirostris*, the depth contained 5½ times in the length: head large, 4 in length of body, the interorbital space broad and flat, 2½ in length of head: eye small, high up and rather posterior: preorbital bone very long and slender, its length about three times its depth: mouth large, precisely as in *C. latipinnis*, the upper lip pendent, very large, with 5 to 8 series of tubercles: dorsal fin not elongated or especially elevated, its rays 11, the beginning of the dorsal much nearer base of caudal than snout: caudal fin long and strongly forked: anal fin long and high, reaching base of caudal: ventrals not reaching vent: caudal peduncle stout and deep, its least depth more than one-third length of head, its length about two-thirds that of head: scales quite small, about as in *longirostris*, the exposed portion not notably lengthened: chest with well-developed scales; scales 16–100–14: coloration dusky brown, a dusky lateral band, pale below, the dark colors extending low; snout quite dark: size large..RETROPINNIS, 35.

ii. Body slender and elongate, the caudal peduncle especially long and very slender, the depth 5¼ in the length: head moderate, 4⅔ in length, rather slender, with prominent snout and rather contracted, inferior mouth; outline of the mouth triangular, the apex forwards; the lips very thick, greatly developed, lower lip incised to the base, its posterior margin extending backwards to opposite the eye: jaws with a slight cartilaginous pellicle: eye small, high up: preorbital bone broad, scarcely twice as long as deep: scales long and low, posteriorly rounded, their horizontal diameter greater than the ver-

tical, 17-98 to 105-17: fins excessively developed, much more elevated in the males than in the females, the free border of the dorsal, in the males at least, deeply incised: in the males, the height of each of the three vertical fins is greater than the length of the head: dorsal rays 13, its beginning rather nearer snout than base of dorsal: caudal fin especially strong, the rudimentary rays at its base unusually developed: least depth of caudal peduncle less than one-third length of head: coloration rather silvery, the males probably rosy and tuberculate in spring..... LATIPINNIS, 36.

§§ Fontanelle almost obliterated, reduced to a narrow slit: each jaw with a well-developed cartilaginous sheath (as in *Pantosteus*).

j. Body subterete, compressed behind, the depth 5 in length: interorbital space 2 in head: head quite short, broad and rounded above, 4¾ in length: eye small, far back and high up, 6 in head: mouth very large, inferior, beneath the projecting snout: upper lip very full, pendent, with about 5 rows of tubercles upon it: lower lip very full, moderately incised, with about 10 rows, a notch separating the upper lip from the lower, each jaw with a slightly curved cartilaginous sheath on its edge, the two parallel with each other and fitting closely together: fins small: dorsal rays 11; caudal little forked: scales 15-90-11, very much reduced forwards and subject to many irregularities: colors dusky: size small.. DISCOBOLUS, 36.

24. CATOSTOMUS NIGRICANS *Le Sueur*.

Hog Sucker. Hog Mullet. Hog Molly. Crawl-a-bottom. Stone Roller. Stone Toter. Stone Lugger. Hammer-head. Mud Sucker.

a. Subspecies *nigricans*.

1817—*Catostomus nigricans* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 102.

Catostomus nigrans (*sic*) KIRTLAND, Rept. Zool. Ohio, 168, 1838.

Catostomus nigricans DEKAY, New York Fauna, part iv, Fishes, 202, 1842.

Catostomus nigricans CUVIER & VALENCIENNES, Hist. Nat. des Poiss. xvii, 453, 1844.

Catostomus nigricans STORER, Synopsis, 421, 1846.

Hylomyzon nigricans AGASSIZ, Am. Journ. Sci. Arts, 2d series, xix, 205, 1855.

Hylomyzon nigricans PUTNAM, Bull. Mus. Comp. Zool. 10, 1865.

Hylomyzon nigricans COPE, Proc. Ac. Nat. Sc. Phila. 285, 1864

Catostomus nigricans COPE, Journ. Ac. Nat. Sc. Phila. 236, 1868.

Catostomus nigricans GÜNTHER, Cat. Fishes Brit. Mus. vii, 17, 1868.

Catostomus nigricans COPE, Proc. Am. Philos. Soc. Phila. 468, 1870.

Hylomyzon nigricans JORDAN, Fishes of Ind. 221, 1875.

Hypentelium nigricans JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.

Hypentelium nigricans JORDAN, Man. Vert. 294, 1876.

Catostomus nigricans UHLER & LUGGER, Fishes of Maryland, 138, 1876

Hypentelium nigricans NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 48, 1876.

Hypentelium nigricans JORDAN & COPELAND, Check List, 156, 1876.

Catostomus nigricans JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 345, 1877.

Hypentelium nigricans JORDAN & GILBERT, in Klippart's Rept. 53, 1876.

Hypentelium nigricans JORDAN, Bull. U. S. Nat. Mus. ix, 34, 1877.

Hypentelium nigricans JORDAN, Man. Vert. ed. 2d, 319, 1878.

1817—*Catostomus maculosus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 103.

Catostomus maculosus DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus maculosus CUVIER & VALENCIENNES, Hist. Nat. des Poiss. xvii, 454, 1844.

Catostomus maculosus STORER, Synopsis, 422, 1846.

Catostomus maculosus UHLER & LUGGER, Fishes of Maryland, 139, 1876.

1817—*Exoglossum macropterum* RAFINESQUE, Journ. Ac. Nat. Sc. Phila. 420.

Hypentelium macropterum RAFINESQUE, Ich. Oh. 68, 1820.

Hypentelium macropterum KIRTLAND, Rept. Zool. Ohio, 168, 1838.

Exoglossum macropterum CUVIER & VALENCIENNES, xvii, 486, 1844.

Exoglossum macropterum STORER, Synopsis, 428, 1846.

1820—*Catostomus xanthopus* RAFINESQUE, Ich. Oh. 57.

1820—*? Catostomus ? megastomus* RAFINESQUE, Ich. Oh. 59. (Most likely mythical.)

1844—*Catostomus planiceps* CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 450, pl. 516.

Catostomus planiceps STORER, Synopsis, 426, 1846.

aa. Subspecies *etowanus*.

1877—*Catostomus nigricans* var. *etowanus* JORDAN, Ann. Lyc. Nat. Hist. N. Y. xi, 345.

HABITAT.—New York and Maryland to North Carolina; west to the Great Plains. Var. *etowanus* in the Alabama River. Most common in the Central Mississippi Basin; not known from the streams of the South Atlantic States, excepting the Savannah River.

This species is one of the most abundant and widely distributed of our Suckers. It abounds in rapids and shoals, especially in the larger streams, and its singular, almost comical form is familiar to every school-boy in the West. Its powerful pectoral fins render it a swifter fish in the water than any others of its family. Its habit is to rest motionless on the bottom, where its mottled colors render it difficult to distinguish from the stones among which it lies. When disturbed, it darts away very quickly, after the manner of the Etheostomoids. They often go in flocks of eight to ten. I have never yet found this species in really muddy water, and when placed in the aquarium it is one of the very first fishes to feel the influence of impure water. In my experience, it is a fish as peculiar to the clear streams as the species of *Etheostoma* or *Uranidea* are. Professor Agassiz speaks of it as the Mud Sucker, and has named it *Hylomyzon*, in allusion to its mud-loving habits. It is fortunate that that name has become a synonym, for it is certainly a misnomer.

This Sucker reaches a length of about 18 inches. It is not much valued

as food, but is often caught by boys with a spear or snare. In company with other species of *Catostomus* and *Myxostoma*, it ascends all our Western streams in April for the purpose of depositing its spawn.

The Southern form, which I have designated as var. *etowanus*, is more intensely colored and differs in some minor respects. It frequents, in great abundance, the clear tributaries of the Etowah, Oostanaula, and Coosa Rivers, in company with *Potamocottus meridionalis* (*zopherus*), a species to which the young of the *Catostomus* bears much resemblance as seen in the water.

The synonymy of this species has been well worked out by Professor Agassiz. The variations in age and appearance have given rise to a number of nominal species, most of which have, however, already been disposed of. The oldest specific name, *nigricans*, has been the one most generally employed. The generic name used depends on whether we consider this species generically distinct from the type of *Catostomus* or not. It would seem—if we may so speak—as if Nature had intended *Hypentelium* for a distinct genus, but not being an expert in generic characters, had failed to provide it with any which can stand our tests. The name *Hylomyzon*, being a simple synonym of *Hypentelium*, of course cannot be used. Rafinesque's account is much inferior to that of Professor Agassiz, and the figure given by him is one of the worst ever published, still his typical species is readily identifiable, and his name for it cannot be set aside.

Specimens in United States National Museum.

Number.	Locality.	Collector.
7644	.....	
8446	Cayuga Lake, New York	
8762	.....	
9061	.....	
9069	.....	
12295	Cincinnati, Ohio	J. W. Milner.
--	Écorse, Mich	J. W. Milner.
15246	Bainbridge, Pa.	T. H. Bean.
20066	Black River, Ohio	S. F. Baird.
20106	Tennessee	Beckwith.
20260	Yellow Creek, Ohio	S. F. Baird.
20270	Root River, Wisconsin	
—	Etowah River, Georgia (types of var. *etowanus*)	D. S. Jordan.
—	White River, Indiana	D. S. Jordan.
—	Savannah River	D. S. Jordan.

25. CATOSTOMUS CLARKI *Baird & Girard.*

Clark's Sucker.

1854—*Catostomus clarkii* Baird & Girard, Proc. Phila. Ac. Nat. Sc. 27.
Catostomus clarkii Agassiz, Am. Journ. Sc. Arts, 2d series, xix, 208, 1855.
Minomus clarkii Girard, Proc. Ac. Nat. Sc. Phila. 173, 1856.
Minomus clarkii Girard, U. S. Mex. Bound. Surv. Ichth. 38, pl. xxii, f. 5–8, 1859.
Catostomus clarkii Jordan & Copeland, Check List, 156, 1876.

Habitat.—Rio Santa Cruz in Arizona.

Nothing is known of this species except from the figure given by Girard and the descriptions published by Baird and Girard. The original types of the species are not to be found in the Museum, and there are no specimens of recent collection which appear to belong to it. It seems, however, to be a valid species, related to *C. insignis*. Its lips have not been figured, hence I can only infer that it belongs to the group with a narrow upper lip.

26. CATOSTOMUS INSIGNIS *Baird & Girard.*

Spotted Sucker.

1854—*Catostomus insignis* Baird & Girard, Proc. Phila. Ac. Nat. Sc. 28, 1854.
Minomus insignis Girard, Proc. Ac. Nat. Sc. Phila. 173, 1856.
Minomus insignis Girard, U. S. Mex. Bound. Surv. Ichth. 37, pl. xxi, f. 1–4, 1859.
Catostomus insigne Cope & Yarrow, Wheeler's Expl. W. 100th Mer. v, Zool. 676, 1876.
Catostomus insignis Jordan & Copeland, Check List, 156, 1876.

Habitat.—Tributaries of the Rio Gila.

The original types of this species, from the Rio San Pedro, are now lost. The specimens collected by Dr. Rothrock in Ash Creek, Arizona, and referred to this species by Professor Cope, undoubtedly belong here. The species is a well-marked one, both as to form and coloration. The genus *Minomus*, of which it was made the type, appears, however, to have no tangible existence.

Specimens in United States National Museum.

Number.	Locality.	Collector.
16756	Ash Creek, Arizona	Dr. J. T. Rothrock.

27. CATOSTOMUS TERES (*Mitchill*) *Le Sueur.*

Common Sucker. White Sucker. Brook Sucker. Fine-scaled Sucker.

1803—*Le Cyprin commersonien* LACÉPÈDE, Hist. Nat. des Poiss. v, 502, 508.

Catostomus commersonii JORDAN, Man. Vert. ed. 2d, 320, 1878.

18——*Cyprinus catostomus* PECK, Mem. Am. Acad. ii, pt. 2, p. 55, pl. 2, f. 4. (Not of Forster.)

1814—*Cyprinus teres* MITCHILL, Lit. and Phil. Trans. New York, i, 458.

Catostomus teres LE SUEUR, Journ. Ac. Nat. Sc. Phila. 108, 1817.

Catostomus teres THOMPSON, Hist. Vt. 134, 1842.

Catostomus teres CUVIER & VALENCIENNES, xii, 468, 1844.

Catostomus teres STORER, Synopsis, 423, 1846.

Catostomus teres AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 208, 1855.

Catostomus teres GÜNTHER, Cat. Fishes Brit. Mus. vii, 15, 1868.

Catostomus teres COPE, Proc. Am. Philos. Soc. Phila. 468, 1870.

Catostomus teres JORDAN, Fishes of Ind. 221, 1875.

Catostomus teres JORDAN, Man. Vert. 293, 1876.

Catostomus teres NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 48, 1876.

Catostomus teres JORDAN & COPELAND, Check List, 156, 1876.

Catostomus teres JORDAN & GILBERT, in Klippart's Rept. 53, 1876.

Catostomus teres JORDAN & GILBERT, in Klippart's First Report Ohio Fish Commission, 84, pl. xii, f. 18–19, 1877.

Catostomus teres JORDAN, Bull. U. S. Nat. Mus. ix, 37, 1877.

1817—*Catostomus communis* LE SUEUR, Journ. Ac. Nat. Sc. Phila. i, 95.

Catostomus communis DEKAY, New York Fauna, part iv, Fishes, 196, 1842.

Catostomus communis CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 426, 1844.

Catostomus communis KIRTLAND, Boston Journ. Nat. Hist. v, 265, 1845.

Catostomus communis STORER, Synopsis, 421, 1846.

Catostomus communis COPE, Journ. Ac. Nat. Sc. Phila. 236, 1868.

Catostomus communis UHLER & LUGGER, Fishes of Maryland, 138, 1876.

1817—*Catostomus bostoniensis* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 106.

Catostomus bostoniensis STORER, Rep^{t}. Ich. Mass. 84, 1838.

Catostomus bostoniensis CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 432, 1844.

Catostomus bostoniensis STORER, Synopsis, 423, 1846.

Catostomus bostoniensis PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Catostomus bostoniensis GILL, Canadian Nat. p. 19, Aug. 1865.

Catostomus bostoniensis STORER, Hist. Fishes Mass. 290, pl. xxii, f. 3, 1867.

Catostomus bostoniensis THOREAU, Week on Concord and Merrimack, 38, 1868.

1820—*Catostomus flexuosus* RAFINESQUE, Ich. Oh. 59.

1823—*Catostomus hudsonius* RICHARDSON, Franklin's Journal, 717, 1823. (Not of Le Sueur.)

Cyprinus (*Catostomus*) *hudsonius* RICHARDSON, Fauna Bor.-Am. Fishes, 112, 1836. (Excl. syn.)

1836—*Cyprinus* (*Catostomus*) *reticulatus* RICHARDSON, Fauna Bor.-Am. Fishes, 303.

1838—*Catostomus gracilis* KIRTLAND, Rept. Zool. Ohio, 168.

1838—*Catostomus nigricans* STORER, Rept. Ich. Mass. 86. (Not of Le Sueur.)

Catostomus nigricans THOMPSON, Hist. Vermont, 135, 1842.

1842—*Catostomus pallidus* DEKAY, New York Fauna, part iv, Fishes, 200.

Catostomus pallidus STORER, Synopsis, 426, 1846.

1844—*Catostomus aureolus* CUVIER & VALENCIENNES, Hist. Nat. des Poiss. xvii, 439. (Not of Le Sueur.)

Catostomus aureolus GÜNTHER, Cat. Fishes Brit. Mus. vii, 16, 1868.

1850—*Catostomus forsterianus* AGASSIZ, Lake Superior, 358.

1855—*Catostomus forsterianus* AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 208.

Acomus forsterianus GIRARD, Proc. Ac. Nat. Sc. Phila. 173, 1856.

1856—*Catostomus sucklii* GIRARD, Proc. Ac. Nat. Sc. Phila. 175.

Catostomus sucklii GIRARD, U. S. Pac. R. R. Expl. x, pl. li, 226, 1858.

Catostomus sucklii COPE, Hayden's Geol. Surv. Wyoming, 1870, 434, 1872.

Catostomus suckleyi JORDAN & COPELAND, Check List, 156, 1876.

1860—? *Catostomus texanus* ABBOTT, Proc. Ac. Nat. Sc. Phila. 473.

? *Catostomus texanus* JORDAN & COPELAND, Check List, 156, 1876.

1860—*Catostomus chloropteron* ABBOTT, Proc. Ac. Nat. Sc. Phila. 473.

Catostomus chloropterum COPE, Proc. Ac. Nat. Sc. Phila. 85, 1865.

Catostomus chloropterus JORDAN & COPELAND, Check List, 156, 1876.

1876—*Catostomus alticolus* COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 677.

Catostomus alticolus JORDAN & COPELAND, Check List, 156, 1876.

1876—*Moxostoma trisignatum* (COPE) COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 679.

Erimyzon trisignatus JORDAN & COPELAND, Check List, 157, 1876.

HABITAT.—All streams from Labrador to Florida and westward to the Rocky Mountains. Everywhere abundant. The most widely distributed of the *Catostomidæ*.

This species is the commonest of all the Suckers in nearly every stream east of the Rocky Mountains. In Canada, in New England, in the Great Lakes, in the Mississippi Valley, in South Carolina, in Georgia, in Alabama, it is everywhere the commonest Sucker, and it certainly occurs in Dakota, Nebraska, Kansas, Colorado, and Texas, though how abundantly I am unable to say.

This species is everywhere the one to which the name of "Sucker" primarily belongs, the other species, though often called "Sucker", as a sort of general term, receiving the special names of Red Horse, Buffalo, Mullet, Chub Sucker, etc.

This species is subject to considerable variations in different waters. In shaded brooks, it is dark-colored and rather slender. In open or muddy waters, it becomes pale. In the Great Lakes, it often reaches a considerable size and a proportional stoutness of body. The adult is usually uniformly colored above. Young fishes 1½ to 3 inches in length are often variegated, and sometimes show three or four lateral dark

blotches, which are sometimes confluent into an irregular dusky band. Such little fishes usually have the lateral line imperfect. On such, the nominal species *Moxostoma trisignatum* was based.

The male fishes in the spring show a more or less distinct pinkish or rosy lateral band. The males and females ascend the small streams in the spring for the purpose of depositing their spawn. The coincidence of their times of migration with that of some of the early settlers of Illinois, who used to come up from New Orleans in the spring, returning in the fall, has given to the natives of that State the slang name of "Suckers", as natives of Michigan were called "Wolverenes"; of Minnesota, "Gophers"; of Wisconsin, "Badgers"; of Indiana, "Hoosiers"; of Ohio, "Buckeyes"; and of Missouri, "Pukes".

I have elsewhere adopted the name "*commersoni*" for this species, inasmuch as there is little doubt that it is the "*Cyprin commersonien*"* of Lacépède, as has long since been noticed by Valenciennes.

Dr. Günther quotes, in the synonymy of *Catostomus teres*, "*Cyprinus commersonnii* Lacépède"; but, on examination of Lacépède's work, I am unable to find that he uses the name *commersoni*, or in fact any classical name whatever for the species, and as priority of date can hardly be claimed for a French name like "*Cyprin commersonien*", I am compelled to fall back on Mitchill's very appropriate name *teres* for the species. The identity of *C. teres* of Mitchill, *C. communis* and *C. bostoniensis* of Le Sueur, *C. reticulatus* of Richardson, *C. gracilis* of Kirtland, and *C. pallidus* of DeKay has been long since shown, and has been generally admitted by late writers. *C. nigricans* of Storer and Thompson, from the Connecticut, is evidently the dusky brook form of this species, and not the true *nigricans* of Le Sueur. It is equally evident that the species called *C. aureolus* by Valenciennes and Günther is the present one and not *Myxostoma aureolum*. Agassiz's *Catostomus forsterianus* is doubtless the common lake form of *C. teres*, as indicated by Dr. Günther. The

* The following is Lacépède's description of his "*Le Cyprin Commersonien*":—

"Onze rayons à la dorsale; huit à la nageoire de l'anus; dix à chaque ventrale; huit ou neuf à chaque pectorale; la nageoire du dos et celle de l'anus quadrilatères; l'anal étroite; l'angle de l'extrémité de cette dernière nageoire très aigu; la caudale en croissant; la ligne latérale droite; la machoire supérieure plus avancée que celle d'en bas; les écailles arrondies et très petites.

"Le commersonien, dont nous publions les premiers la description, et que le savant Commerson a observé, présente un double orifice pour chaque narine; sa tête est dénuée de petites écailles; ses ventrales et ses pectorales sont arrondies à leur extrémité; la dorsale s'élève vers le milieu de la longueur totale de la poisson."

types of *C. sucklii* are lost, but *C. teres* occurs in the Upper Missouri region, and Girard's description hints at no specific difference. *Catostomus chloropteron* Abbott is evidently the same. *Catostomus texanus* Abbott, described from a dried specimen, is less clear, but what there is of specific characterization in the description points to *C. teres*. The dorsal carination is frequently observed in stuffed fishes in which some flesh is left in the back to shrink in drying, leaving the back "carinated".

I have examined several of the types of *Catostomus alticolus* Cope. They are all small fishes, not one-fourth grown, and, as usual in young fishes, the head appears proportionally large. I see, however, no reason for considering them different from *Catostomus teres*. *Moxostoma trisignatum* I have already referred to. The absence of the lateral line is due to their youth, not to their belonging to a different genus. The three large lateral spots, "not seen in any other of the order," are found on young specimens of *Catostomus* generally. I have examined the types of "*Moxostoma trisignatum*", and have found specimens of similar size, similarly colored and without lateral line, from Michigan and from other Western States. I would undertake to match them from any stream in the West. The reference of these specimens to *Moxostoma* (*Erimyzon*) was probably the result of a very hasty examination.

Specimens in United States National Museum.

Number.	Locality.	Collector.
1592	Carlisle, Pa	S. F. Baird.
6239	Maryland	Dr. Kennerly.
6853	Summerville, S. C	
7067	Lake Champlain	S. F. Baird.
7607	Marietta, Ohio	Prof. Andrews.
7677		
7678		
7706		
7707		
7717		
7777		
7781		
8329	Port Huron, Mich	
8409		
8440		
8451		
8489	Racine, Wis	
8501		
8573	Toronto, Canada	

Specimens in United States National Museum—Continued.

Number.	Locality.	Collector.
8664		
8671		
8689		Barry.
8728	Huron River, Michigan	S. F. Baird.
8759		
8834	Oswego, N. Y	
8870	Alabama	
8927		
8984		
9041	Missouri (?)	Barry.
9054		
9059		
9157		
9170		
9182	Pembina, Red River of the North	R. Kennicott.
9195	Aux Plaines River, Illinois	R. Kennicott.
9207	Lake Champlain	
9393	Écorse, Mich	G. Clark.
9404	Abbeville, S. C	
9503	Mississippi Valley	
9646		
9875	Black River	S. F. Baird.
10540	Lake Superior	J. W. Milner.
11146	Sandusky, Ohio	J. W. Milner.
11147	Sandusky, Ohio	J. W. Milner.
11148	Sandusky, Ohio	J. W. Milner.
12320	Potomac River	J. W. Milner.
12915	Twin Lakes, Colorado (*alticolus*)	J. T. Rothrock.
12936	South Hadley Falls, Mass	J. W. Milner.
12937	South Hadley Falls, Mass	J. W. Milner.
12939	South Hadley Falls, Mass	J. W. Milner.
12940	South Hadley Falls, Mass	J. W. Milner.
15356	Bainbridge, Pa	T. H. Bean.
15777	Twin Lakes, Colorado (types of *alticolus*)	J. T. Rothrock.
17099	Arkansas River, Pueblo, Col. (types of *trisignatum*)	C. E. Aiken.
18258	Potomac River	G. B. Goode.
18259	Potomac River	G. B. Goode.
20010	Yellow Creek, Ohio	S. F. Baird.
20057	Brownsville, Tex	
20097	Sing Sing, N. Y	S. F. Baird.
20194 20195	Northern Boundary Survey, Dakota	Dr. Elliott Coues.

Specimens in United States National Museum—Continued.

Number.	Locality.	Collector.
20241	Piermont, N. Y	S. F. Baird.
20238	Madison, Wis	S. F. Baird.
20256		
20262	Quebec, Canada	S. F. Baird.
20266	Fox River, Wisconsin	S. F. Baird.
20267	Sing Sing	S. F. Baird.
20268	Root River, Wisconsin	S. F. Baird.
20316		
20344	Potomac River	Goode & Bean.
20377	Potomac River	House.
20382	Platte Valley, Nebraska	
20454	Wilkesbarre, Pa	L. H. Taylor.
—	Etowah River, Georgia	D. S. Jordan.
—	Saluda River, South Carolina	D. S. Jordan.
20918	Fort Bridger, Wyoming	

28.* CATOSTOMUS MACROCHILUS *Girard.*

Large-lipped Sucker.

1856—*Catostomus macrocheilus* GIRARD, Proc. Ac. Nat. Sc. Phila. 175.
Catostomus macrocheilus GIRARD, U. S. Pac. R. R. Expl. x, 225, 1858.
Catostomus macrochilus GÜNTHER, Cat. Fishes Brit. Mus. vii, 20, 1868.
Catostomus macrochilus JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Columbia River.

Only the original type of this species is known. It is an adult specimen, well preserved. Although this species seems closely related to *C. occidentalis*, I am disposed to consider it distinct, as the mouth is notably larger than in any *occidentalis* which I have seen. The examination of a large series of specimens may, however, render it necessary to unite them.

Specimens in United States National Museum.

Number.	Locality.	Collector.
240	Astoria, Oregon (type *macrochilus*)	Lieut. Trowbridge.

* For 28 (*b*). *Catostomus fecundus* Cope & Yarrow, see Addenda, p. 219.

29. CATOSTOMUS OCCIDENTALIS *Ayres.*

Western Sucker.

1854—*Catostomus occidentalis* AYRES, Proc. Cal. Ac. Nat. Sc. i, 18.

Catostomus occidentalis AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 209, 1855. (Described as a new species.)

Catostomus occidentalis GIRARD, Proc. Ac. Nat. Sc. Phila. 174, 1856.

Catostomus occidentalis GIRARD, U. S. Pac. R. R. Expl. x, 224, 1858.

Catostomus occidentalis GÜNTHER, Cat Fishes Brit. Mus. vii, 17, 1868.

Catostomus occidentalis JORDAN & COPELAND, Check List, 156, 1876. (Name only.)

1856—*? Catostomus bernardini* GIRARD, Proc. Ac. Nat. Sc. Phila. 175.

? Catostomus bernardini GIRARD, U. S. Mex. Bound. Ichth. 40, pl. 23, f. 1–5, 1859.

? Catostomus bernardini GÜNTHER, Cat. Fishes Brit. Mus. v. 7, 17, 1868.

HABITAT.—Streams west of the Rocky Mountains, probably generally distributed.

This species was described almost simultaneously under the same name by Dr. Ayres and Professor Agassiz. Since then it has been little noticed by ichthyologists, and its distribution has remained uncertain. The few specimens in the National Museum indicate, however, a wide distribution. I have here united *Catostomus bernardini* Girard to *C. occidentalis*. The single specimen made the type of *C. bernardini* is lost, so that we can probably never know exactly for what the author intended the name. The size of the dorsal and the form of the mouth as given in Girard's figure indicate a species of *Catostomus* rather than *Pantosteus*, and as I am unable to distinguish it from *C. occidentalis*, I let it fall into the synonymy. The scales of *C. bernardini* as *figured* seem, however, smaller than usual in *C. occidentalis*.

C. occidentalis is apparently related to *C. tercs*, but is distinguished by the form of mouth and by the somewhat smaller scales. The species is "brought to the market in San Francisco, and is said to be quite common in the Sacramento and San Joaquin Rivers."—(GIRARD.)

Specimens in United States National Museum.

Number.	Locality.	Collector.
15527	Green River, Wyoming	Livingston Stone.
20814	McLeod River, California	Livingston Stone.

30. CATOSTOMUS LABIATUS *Ayres.*

Thick-lipped Sucker.

1855—*Catostomus labiatus* AYRES, Proc. Cal. Ac. Nat. Sc. i, 32.
Catostomus labiatus GIRARD, Proc. Ac. Nat. Sc. Phila. 175, 1856.
Catostomus labiatus GIRARD, U. S. Pac. R. R. Expl. x, 224, 1858.
Catostomus labiatus JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Streams of Oregon (Klamath Lake).

I have seen only the specimen from which Girard's description was taken. Like *macrochilus*, this species appears distinct from *occidentalis*, but the examination of a larger series of specimens is necessary to prove it. At present, it appears to differ from *macrochilus* and *occidentalis* in the smaller size of the dorsal fin.

Specimens in United States National Museum.

Number.	Locality.	Collector.
239	Klamath Lake, Oregon	Dr. John S. Newberry.

31. CATOSTOMUS ARÆOPUS *Jordan*, sp. nov.

Hard-headed Sucker.

1878—*Catostomus arœopus* JORDAN, MSS., Wheeler's Report Surv. W. 100th Mer. (*ined.*).

This species represents *C. discobolus* in the section *Decadactylus*. Its very narrow fontanelle and sheathed lips indicate its close relation to *Pantosteus*. The specific name is from αραιὸς, small, thin; οπή, hole or aperture. The typical specimens were from Kern River, California.

Specimens in United States National Museum.

Number.	Locality.	Collector.
17107	Kern River, Cal. (type)	H. W. Henshaw.
17103	Carson River, Nevada	H. W. Henshaw.

32. CATOSTOMUS TAHOENSIS *Gill & Jordan.*

Sucker of Lake Tahoe.

1868—*Acomus generosus* COOPER, Cronise's Nat. Wealth Cal. 495. (Not of Girard.)
1878—*Catostomus tahoensis* GILL & JORDAN, Bull. U. S. Nat. Mus. xi, p. —.

HABITAT.—Lake Tahoe, Nevada.

The Sucker of Lake Tahoe is closely related to *Catostomus longirostris*, but seems to differ constantly in the shorter head and more contracted

body. It is said to be very abundant in Lake Tahoe. "They are caught in nets and sometimes with the hook, but like all this family are rather poor as food" (*Cooper*). *Acomus generosus* of Girard, with which this species has been identified, is a very different species, belonging to a different genus.

Specimens in United States National Museum.

Number.	Locality.	Collector.
5240	Lake Tahoe (types *C. tahoensis*)	J. G. Cooper.
17109	Lake Tahoe	H. W. Henshaw.

33. CATOSTOMUS ROSTRATUS (*Tilesius*) *Jordan.*

Siberian Sucker.

1813—"*Cyprinus rostratus* TILESIUS, Mém. Ac. Sc. St. Pétersbourg, iv, p. 454, tab. 15, figs. 1-2, 1813."

Cyprinus rostratus PALLAS, Zoogr. Rosso-Asiat. iii. 308.

Cyprius rostratus GÜNTHER, Cat. Fishes Brit. Mus. xii, 12, 1868. (As doubtful species of *Catostomus*.)

1844—*Catostomus tilesii* CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 469, 1844.

HABITAT.—Eastern Siberia.

No writer since Tilesius seems to have observed this fish. It is, however, unquestionably a species of *Catostomus*, allied to and perhaps even identical with *C. longirostris*. The following is Tilesius's description of this species, as quoted by Pallas:—

"Descriptio *Cyprini rostrati* Tungusis ad Covymam fluv., Tschukulschan et Jucagiris Onatscha dicti. Tab. XV, Fig. 1-5. (*Der Rüffelkarpfen, Rampkopf.*)

"*Magnitudo* in adultis pedem superat, sed trium spithamarum longitudinem vix attingit. *Caput* osseum longum antico rostro descendente truncatum e quino simile quam ob rem Ruthenis.

"*Koub* dicitur aliis Produst, quoniam os subtus, ut in (*sic*) Cotto cataphracto vel Agono accipenserino, sed rictus oris vel orificium lunatum non amplum sed angustum labiis crassis pinguibus marginatum, labium anterius fornicatum, ambitu semicirculare ossibus labialibus vel mystaceis ad frænum oris descendentibus arcuatis lateraliter lectum, labium posterius minus, rectum, ab anteriori inclusum amplexum papillis numerosissimis granulatum.

"*Oculi* lateralis a rostro remoti operculo posteriori branchiali approximati ovales, iridibus aureis superne angustioribus, pupilla supra centrum posita. *Nares* ad marginem orbitæ anteriorem duplices in sulco profundo ossco. *Operculo branchialia* trilamellata, *lamella anterior* cum ossibus maxillæ superioris conjuncta ellyptica angusta ad orbitæ marginem anteriorem ascendens inferius lamellæ *secundæ* tenerrimæ angustiori orbitam inferiorem formanti imposita, lamina ossea subjacens, operculum

medium formans, subtus plica itshmo juguli adnata, carne tegitur suborbitali. *Lamina posterior* maxima latissima ossea conchæ adinstar fornicata, anterius cum obitæ margine posteriori juncta. *Membrana branchiostega* triradiata inter operculi laminam anteriorem subtus utrinque approximatam coarcta et in isthmo gulæ conjuncta. *Corpus* oblongum erectum microlepidotum, squamis lævibus subtilissime radiato-striatis oblongis, ad caput minoribus versus anum et caudam majoribus imbricatum crassiusculum leviter compressum, ventre-dorsusque convexum. *Linea lateralis* recta versus medium corporis paululum descendens per seriem squamarum postice incisarum expressa versus caudam magis conspicua. *Color* in dorso atro cœruleus nitidus, versus latera subargenteus, subtus albeus. *Pinnæ pectorales* quatuordecim radiatæ, radii medii longissimi, *ventrales* decemradiatæ, radia primo osseo acuminato, *dorsalis* decemradiata et duodecimradiata, radio primo cum adminiculo radicali, ultimo brevissimo ad basin usque fisso, omnibus ad apices quadrifidis, dorsalis pinna ventralibus opposita, analis p. septemradiata, radio primo simplici cum adminiculo radicali, reliquis quadrifidis, tertio longissimo septimo brevissimo. *Caudalis pinna* bifurca lacinia inferior paulo major undecimradiata, superior novemradiata tota pinna viginti radiis suffulta extremis lateralibus cum adminiculo radicali connatis. Radii pennarum ad extremitatis quadrifidi et extremi ad radices duplicati vel ex binis truncis connati, quam ab rem primus dorsalis longitudinaliter ad basin sulcatus est, quod etiam in primo analis et caudalibus extremis fere ex tribus compositis ceruitur. In dorsali et anali pinna radii valde distant, pectorales ventrales et analis pinnæ aureo-rubescentes et ad basin prominentes, pectorales adeo tuberosæ, ventralium radices per membranosam laminam triangularem squamatam obteguntur. Anus caudæ propior. Interna non exploravi. Characteribus cæterum generis cyprinacei ore nimirum edentulo, dentibus post branchialibus, membrana branchiostega triradiata utrinque instructus est. A celeberrimo *Merck* plura specima ex siccata ex Covymæ fluvio allata sunt, quæ nominæ Tschukutschan designata sunt. Annotavit simul idem, 'piscem in Lena et Indigirca ejusque collaterali lapidoso Dogdo fluviis copiosum esse sed propter nationis velocitatem captu difficilem esse et non nisi in cœcis fluminum ramis hamo capi, gregatim et velocissime natare, sapidissimum cæterum, excepto vere, cum, ova spargunt nec aristis impeditum piscem esse, attamen ab accolis Covymæ et Indigircæ (qui caput tantem in deliciis habet, reliqua canibus cedunt) non multum æstimari.'"—(Pallas, *Zoographia Rosso-Asiatica*, pp. 308–310.)

34. CATOSTOMUS LONGIROSTRIS *Le Sueur.*

Long-nosed Sucker. Northern Sucker. Red-sided Sucker.

1773—"*Cyprinus catostomus* Forster, Philos. Trans. lxiii, 155, tab. 6, 1773."
Cyprinus catastomus Schneider, ed. Bloch, 444, 1802.

1817—*Catostomus longirostrum* Le Sueur, Journ. Ac. Nat. Sc. Phila. 102.
Catostomus longirostrum Thompson, Hist. Vt. 135, 1842.
Catostomus longirostris DeKay, New York Fauna, part iv, Fishes, 203, 1842.
Catostomus longirostrum Cuvier & Valenciennes, xvii, 453, 1844.
Catostomus longirostrum Storer, Synopsis, 421, 1846.
Catostomus longirostrum Jordan & Copeland, Check List, 156, 1876.
Catostomus longirostris Jordan & Gilbert, in Klippart's Rept. 53, 1877.

1817—*Catostomus hudsonius* Le Sueur, Journ. Ac. Nat. Sc. Phila. 107.

Catostomus hudsonius CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 459, 1844.

Catostomus hudsonius STORER, Synopsis, 419, 1846.

Catostomus hudsonius AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 208, 1855.

Catostomus hudsonius GÜNTHER, Cat. Fishes Brit. Mus. vii, 13, 1868.

Catostomus hudsonius JORDAN, Man. Vert. 293, 1876.

Catostomus hudsonius NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 48, 1876.

1823—*Catostomus forsterianus* RICHARDSON, Franklin's Journal, 720.

Catostomus forsterianus RICHARDSON, Fauna Bor.-Amer. iii, Fishes, 116, 1836.

Catostomus forsterianus DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus forsterianus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 463, 1844.

Catostomus forsterianus STORER, Synopsis, 419, 1846.

Acomus forsterianus GIRARD, Proc. Ac. Nat. Sc. Phila. 172, 1856.

Catostomus forsterianus PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Catostomus forsterianus JORDAN & COPELAND, Check List, 156, 1876.

1850—*Catostomus aurora* AGASSIZ, Lake Superior, 360, pl. 2, f. 3-4.

Acomus aurora GIRARD, Proc. Ac. Nat. Sc. Phila. 173, 1856.

Catostomus aurora PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

1856—*Acomus griseus* GIRARD, Proc. Ac. Nat. Sc. Phila. 174.

Acomus griseus GIRARD, U. S. Pac. R. R. Expl. x, 222, pl. xlix, 1858.

Catostomus griseus GÜNTHER, Cat. Fishes Brit. Mus. vii, 14, 1868.

Catostomus griseum COPE, Hayden's Geol. Surv. Wyoming, 1870, 434, 1872.

Catostomus griseus JORDAN & COPELAND, Check List, 156, 1876.

1856—*Catostomus lactarius* GIRARD, Proc. Ac. Nat. Sc. Phila. 174.

Acomus lactarius GIRARD, U. S. Pac. R. R. Expl. x, 223, 1858.

Catostomus lactarius JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—New England to Nebraska and north to Alaska and the Arctic Sea. Extremely abundant in British America and along the northern boundaries of the United States, but not found south of 40° north latitude.

This is another of our numerous species which have an extremely wide range of distribution and a considerable range of variation. It has been longer known than any other of the Suckers. The oldest specific name given was that of *catostomus*, which, however, had to be set aside when the generic name *Catostomus* was proposed for it. The next name in order of time is the very appropriate one of *longirostrum* Le Sueur (more properly spelled *longirostris*), given to some specimens from Vermont. Five pages later, the name *hudsonius* was given as a substitute for *catostomus* of Forster. The slight priority of *longirostrum* over *hudsonius*, however, seems to entitle it to preference, although the latter name has been most frequently used. Later, specimens considered by Dr. Günther to be identical with *hudsonius* received from Richardson the name "*forsterianus*", and, still later, the name *forsterianus* was, without evident reason, transferred from this species to *teres* by Professor Agassiz, who

gave to this species the name of *aurora*, in allusion to the red breeding colors of the male. Western specimens were still later described by Girard as two distinct species, *griseus* and *lactarius*, apparently without comparison with the Eastern forms.

The examination of the large series of specimens noticed below, together with others from the Great Lakes and Upper Mississippi, has convinced me that all belong to one species, variable to some degree, but not more so than is *Catostomus teres* and less so than *Erimyzon sucetta*. Some of the Upper Missouri specimens referable to *C. griseus* Grd. have on an average rather smaller scales (95 in the lateral line instead of 100 to 110); but I am unable to distinguish a tangible variety. The original types of *C. lactarius* Girard are not now to be found, but the description indicates no difference from *C. longirostris*.

Specimens in United States National Museum.

Number.	Locality.	Collector.
1054	Lake Superior	J. W. Milner.
2087	Puget's Sound	R. Kennicott.
2563	Platte River, Nebraska	Capt. Simpson.
6709	Youghiogheny River	Prof. Andrews.
7047	Lake Winnipeg	R. Kennicott.
7640		
7993	Nulato, Youcon River, Alaska	W. H. Dall.
8136		
8435		
8437	Essex County, New York	
8802	Quebec	S. F. Baird.
8905	Great Slave Lake	R. Kennicott.
9010	Pole Creek, Nebraska	Lieut. Wood.
9116		
9175		
9522	Saint Michael's, Alaska	Dr. Bannister.
11212	Au Sable River, Michigan	J. W. Milner.
11213	Au Sable River, Michigan	J. W. Milner.
12210	Au Sable River, Michigan	J. W. Milner.
20075	Racine, Wis	
20191	Northern Boundary Survey, Dakota	Dr. Elliott Coues.
20223	Racine, Wis	S. F. Baird.
20235	Lake Superior	J. W. Milner.
20257	(Probably original types of *griseus;* the old number and locality obliterated.)	Bowman.
20282	Platte River, Nebraska	
20689	Great Lakes	

35. CATOSTOMUS RETROPINNIS *Jordan*, sp. nov.

1878—*Catostomus retropinnis* JORDAN, Bull. Hayden's Geol. Surv. Terr. (*incd.*).

This fine species combines the mouth of *C. latipinnis* with the form and general characters of *C. longirostris*. The type is No. 21,197, collected by Dr. Elliott Coues in Milk River, Montana. It is a male specimen 16¾ inches in length. A specimen previously examined from Platte Valley was identified as probably the female of *C. latipinnis*, but the discovery of this large male specimen forbids such a supposition.

Specimens in the United States National Museum.

Number.	Locality.	Collector.
20933	Platte Valley	
21197	Milk River, Montana (type)	Dr. Elliott Coues.

36. CATOSTOMUS LATIPINNIS *Baird & Girard.*

Great-finned Sucker.

1853—*Catostomus latipinnis* BAIRD & GIRARD, in Proc. Ac. Nat. Sc. Phila. vi, 388.
Acomus latipinnis GIRARD, Proc. Ac. Nat. Sc. Phila. 173, 1856.
Acomus latipinnis GIRARD, U. S. Mex. Bound. Surv. Ichth. 39, pl. xxiv, f. 1–6, 1859.
Catostomus latipinnis GÜNTHER, Cat. Fishes Brit. Mus. vii, 14, 1868.
Catostomus latipinnis COPE, Hayden's Geol. Surv. Wyoming, 1870, 434, 1872.
Catostomus latipinnis JORDAN & COPELAND, Check List, 156, 1876.
1856—*Catostomus guzmaniensis* GIRARD, Proc. Ac. Nat. Sc. Phila. 173.
Acomus guzmaniensis GIRARD, U. S. Mex. Bound. Surv. Ichth. 39, pl. xxiii, f. 6–10, 1859.
Catostomus guzmaniensis GÜNTHER, Cat. Fishes Brit. Mus. vii, 15, 1868.
Catostomus guzmaniense COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 679, 1876.
Catostomus guzmaniensis JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Arizona and Sonora. Green River, Wyoming (*Cope*). Probably not abundant.

This species is one of the most strongly marked of our Suckers. The male fish may be known at once by the slender form and excessive development of the fins, and probably in the females the fins are more developed than in the males of any of the related species. The squama-

tion also is peculiar, and the form of the mouth is unlike that of any other species. These features are all well shown in Girard's figure of the species in the Ichthyology of the Mexican Boundary.

The distribution of the species has not been well made out. I have seen but one specimen, an adult male from the Gila region, apparently the one from which Girard's figure was made.

The type of *Catostomus guzmaniensis* cannot be found. The figure was made from a young fish, and the distinctions between it and *latipinnis* are such as often distinguish a young fish from an old one. It is better, therefore, to unite the two than to admit an insufficiently characterized nominal species.

Specimens in United States National Museum.

Number.	Locality.	Collector.
20078	(Type of *latipinnis* undoubtedly, but the locality, Rio San Pedro, tributary of Rio Gila, and old number, 254?, obliterated.)	J. H. Clark.

37. CATOSTOMUS DISCOBOLUS *Cope.*

Large-lipped Sucker.

1872—*Catostomus discobolus* COPE, Hayden's Geol. Surv. Wyo. 1870, 435.

Catostomus discobolus COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 677, 1876.

Catostomus discobolus JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Idaho to Arizona.

This interesting species is a *Pantosteus* in all but the technical character of the open fontanelle, and in this respect it is really intermediate, as the fontanelle, in the adult at least, is reduced to a narrow slit. The characters given in the analysis were taken from the Snake River specimen, 20,475, larger and in better condition than most or all of those examined by Professor Cope. Professor Cope's original types came from Green River in Wyoming.

Specimens in United States National Museum.

Number.	Locality.	Collector.
12914	.....	Newberry.
15783	Zuñi, N. Mex	Yarrow & Henshaw.
15791	Arizona	C. G. Newberry.
20475	Snake River, Idaho	F. V. Hayden.

Genus PANTOSTEUS *Cope.*

Minomus COPE, U. S. Geol. Surv. Wyoming, 1870, 434 (1872). (Not of Girard.)
Pantosteus COPE, Lieut. Wheeler's Expl. W. 100th Mer. v, 673, 1876.
Catostomus, Acomus et Minomus sp. GIRARD.

Type, *Minomus platyrhynchus* Cope.

Etymology, πᾶν, all; ὀστέον, bone (from the closing of the fontanelle by bone).

Head moderate or rather small, 4 to 5 times in length of body, flattish and rather broad above, anteriorly somewhat pointed; eye rather small, usually behind the middle of the head: suborbital bones narrow, as in *Catostomus;* bones of head rather thick, the two parietal bones firmly united, entirely obliterating the fontanelle.

Mouth rather large, entirely inferior; each jaw with a more or less developed cartilaginous sheath, separable in alcohol, essentially as in *Chondrostoma*, *Acrochilus*, and related genera; upper lip broad, papillose, with a rather broad, free margin, and several series of tubercles; lower lip largely developed, with an extensive free margin deeply incised behind, but less so than in *Catostomus.* Pharyngeal bones and teeth essentially as in *Catostomus.* Isthmus quite broad.

Body generally elongate, subterete, and little compressed.

Scales quite small, from 80 to 105 in the course of the lateral line, and 30 to 35 in a cross series between dorsal and ventrals, usually more or less reduced in size and crowded forward, as in *Catostomus;* lateral line well developed, straightish.

Fins generally rather small; first ray of dorsal usually about midway of body, its rays few, 9 to 12 in number; ventrals inserted rather under posterior part of dorsal, their rays 10 or 9; anal short and high, with 7 developed rays; caudal rather shallow, emarginate; pectorals well developed: air-bladder with two chambers.

The characters of *Pantosteus* are essentially those of *Catostomus*, except that the fontanelle is obliterated. The usual scale-formula is interme-

diate between that of *Catostomus* proper and that of the subgenus *Decadactylus*.

The genus was first indicated by Professor Cope in 1874, under the name of *Minomus*, he supposing at the time that *Catostomus insignis*, the type of Girard's *Minomus*, was a species with closed fontanelle. On obtaining specimens of *C. insignis*, it became evident that such was not the case, and the new name *Pantosteus* was proposed for the genus. *Pantosteus* runs very close to *Catostomus*, two species referred to the latter genus (*C. discobolus* and *C. arcopus*) being almost intermediate.

Generic Characterizations.

MINOMUS Cope, 1872.—"I have proposed to adopt as valid (Proc. Amer. Philos. Soc. 1870, 480) seven genera of this family. I will now add an eighth, which embraces species which combine with the characters of *Catostomus* proper, a complete union of the parietal bones, which obliterates the fontanelle so universal among the suckers. The only other exception is seen in *Cycleptus*, Raf., as I have already mentioned. In all the members of the family where I have examined it, this fontanelle is quite open and of no doubtful proportions, and nowhere reduced to the slit so often seen in *Siluridæ*. In searching for the characters of Girard's so-called genera *Minomus* and *Acomus*, I find that the type of the former, *M. insignis*, B. G., presents the character above mentioned. I therefore adopt his name for the new genus, and add two new species, *M. delphinus* and *M. bardus*. Whether his two other species, *M. plebeius* and *M. clarkii*, belong to it is uncertain as yet, but they have the same physiognomy."—(COPE, *Hayden's Geol. Surv. Wyoming for* 1870, p. 434, 1872.)

PANTOSTEUS (Cope) Yarrow, 1876.—"Professor Cope, in 1870, purposed to adopt as valid seven genera of this family; but in 1872, he stated his belief that an eighth should be added, which should embrace species combining the characters of *Catostomus* proper, a complete union of the parietal bones, which obliterates the fontanelle, so universal among the suckers; the only other exception being seen in *Cycleptus*, Raf., as he has already observed. In all the members of the family that he has examined in this regard the fontanelle has been found quite open and of no doubtful proportions, and is nowhere reduced to the slit often seen in the Siluridæ, unless it be in the *Catostomus discobolus*. In searching for the characters of Girard's so-called genera *Minomus* and *Acomus*, he expressed the view that the type of the former, *M. insignis*, Baird & Girard, presents the character in question. This conclusion was based on a specimen sent to the Academy of Natural Sciences from Washington, bearing that name. Having since examined five specimens of the *M. insignis*, obtained by the geologists of this survey, he finds them to be true Catostomi as determined by the presence of the fontanelle. It therefore requires a name, and he proposes for it that of *Pantosteus*. It embraces *P. platyrhynchus*, *P. jarrovii* and *P. virescens* Cope of the present essay and *P. delphinus* and *P. bardus*, Cope, Hayden's Report, *l. c.*"—(YARROW, *Lieut. Wheeler's Expl. W. 100th Mer.* vol. 5, p. 673, 1876.)

PANTOSTEUS Cope & Jordan, 1877.—"Body oblong or elongate, with a short, subquadrate dorsal fin; air bladder in two parts; lateral line well developed; fontanelle obliterated by the union of the parietal bones."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 81.)

ANALYSIS OF SPECIES OF PANTOSTEUS.

* Scales very small, 100 to 105 in the lateral line; 18 above and 16 below, in a cross-series: body elongate, compressed, the caudal peduncle contracted: head short, wide, 5 in length: muzzle obtuse, little projecting; upper lip wide; lower lip full, emarginate; jaws with well developed cartilaginous sheaths: scales much reduced in size forwards: dorsal rays 10; ventral 9: color olive; lower surface yellow ..... VIRESCENS, 38.

** Scales small, 80 to 85 in the course of the lateral line.

† Scales very much reduced and crowded anteriorly: upper lip full, pendent; cartilaginous sheaths on jaws well developed, the commissure transverse and abruptly angulate at the corners of the mouth.

a. Body extremely elongate, the depth 5½ to 7 in length: head 4¾ in length, short and wide, with depressed and expanded muzzle, which considerably overhangs the mouth: isthmus very wide: dorsal rays 11; ventral rays 9: scales 15–86–12: belly and lower fins yellowish, probably red in life ..... PLATYRHYNCHUS, 39.

aa. Body moderately elongate, the depth 4½ to 5 in the length: head rather short, 4⅝ in length, not specially broadened; muzzle not greatly overhanging the mouth: dorsal rays 9 (rarely 10); ventral rays 10 (rarely 9): scales 11 to 14–83 to 87–13 to 15: light brown above, with dusky spots and clouds; males with the chin and fins red, and a crimson lateral band ..... GENEROSUS, 40.

†† Scales subequal over the body, not much reduced forwards: upper lip rather narrow, not pendent; cartilaginous sheath on jaws obsolete (?).

b. Body comparatively stout, the caudal peduncle short and thick, the back somewhat arched, the depth 4½ to 5 in length: head short and wide, flattish above, 4⅝ to 5 in length: scales 14–84–15: dorsal rays 9 to 11; ventral rays 10: blackish above, with one or two dark lateral shades ..... PLEBEIUS, 41.

38. PANTOSTEUS VIRESCENS *Cope.*

Green Sucker.

1876—*Pantosteus virescens* (COPE) COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 675.

Pantosteus virescens JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Arkansas River in Colorado.

Only a single specimen of this species is known, collected by Mr. C. E. Aiken at Pueblo, Colo. The small size of its scales indicates its distinctness from the other species of *Pantosteus*. The greenness of coloration of the typical specimen is probably due to its having been kept in a copper tank.

Specimens in United States National Museum.

Number.	Locality.	Collector.
—	Arkansas River, Pueblo, Colo. (type)	C. E. Aiken.

39. PANTOSTEUS PLATYRHYNCHUS *Cope.*

Flat-headed Sucker.

1874—*Minomus platyrhynchus* COPE, Proc. Am. Philos Soc. Phila. 134.
Pantosteus platyrhynchus COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 673, pl. xxix, f. 3, 3 *a*, 1876.
Pantosteus platyrhynchus JORDAN & COPELAND, Check List, 156, 1876.
Pantosteus platyrhynchus JORDAN, Bull. U. S. Nat. Mus. xi, p. —, 1878.

HABITAT.—Utah Lake and tributaries.

The specimens which I have seen of this species are all small and in poor condition. Their remarkable slenderness is doubtless in part due to their flabbiness. The species as noted by Professor Cope much resembles *Catostomus discobolus.* It is also very similar to *Pantosteus generosus,* but at present I consider it distinct.

Specimens in United States National Museum.

Number.	Locality.	Collector.
12906	Utah Lake	Yarrow & Henshaw.
15163	Utah Lake	Yarrow & Henshaw.

40. PANTOSTEUS GENEROSUS (*Girard*) *Jordan.*

Yarrow's Sucker.

1856—*Catostomus* (*Acomus*) *generosus* GIRARD, Proc. Ac. Nat. Sc. Phila. 174.
Acomus generosus GIRARD, U. S. Pac. R. R. Expl. x, 221, 1858.
Catostomus generosus JORDAN & COPELAND, Check List, 156, 1876.
1874—*Minomus jarrovii* COPE, Proc. Am. Philos. Soc. Phila. 35.
Pantosteus jarrovii COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 674, pl. xxix, 2, 2 *a*, 1876.
Pantosteus yarrowi JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Rio Grande, Colorado Basin, and Great Basin of Utah; very abundant.

This species is the most characteristic and most widely diffused of the Suckers of the Great Basin. It was first described by Girard in 1856, under the name of *Catostomus generosus.* Girard's description, unaccompanied by a figure, was so very loose and irrelevant that it has hitherto remained unidentified. I have, however, had the opportunity of examining Girard's original types, and of comparing them with the types of *Pantosteus jarrovii.* They seem to me to belong to the same species, and I am therefore compelled to substitute the name *generosus*

for that of *jarrovii*. If I had not been able to compare *generosus* with *jarrovii*, I should never have suspected their identity.

Specimens in United States National Museum.

Number.	Locality.	Collector.
256	Cottonwood Creek (types of *generosus*)	Lieut. Beckwith.
5910	Ojo de Gallo, N. Mex	Lieut. Beale.
15802	Zuñi River, New Mexico (types of *jarrovii*)	H. W. Henshaw.
17080	San Ildefonso, N. Mex	Yarrow & Cope.
17095	Mohave Desert, California	Dr. O. Loew.
18009	New Mexico	H. C. Yarrow.
20102	Pacific Railroad Survey, 38°	Lieut. Beckwith.

41. PANTOSTEUS PLEBEIUS (*Baird & Girard*) *Jordan.*

Plain Sucker.

1854—*Catostomus plebeius* BAIRD & GIRARD, Proc. Ac. Nat. Sc. Phila. 28.
Catostomus plebius AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 208, 1855.
Minomus plebeius GIRARD, Proc. Ac. Nat. Sc. Phila. 173, 1856.
Minomus plebeius GIRARD, U. S. Mex. Bound. Surv. Ichth. 38, pl. xxii, f. 1–4, 1859.
Catostomus plebejus GÜNTHER, Cat. Fishes Brit. Mus. vii, 15, 1868.
Catostomus plebejus JORDAN & COPELAND, Check List, 156, 1876.
Pantosteus plebeius JORDAN, Bull. U. S. Nat. Mus. xi, p.—, 1878.
1872—*Minomus delphinus* COPE, Hayden's Geol. Surv. Wyoming, 1870, 435, 1872.
Pantosteus delphinus COPE & YARROW, Lieut. Wheeler's Rept. Expl. W. 100th Mer. vol. 5, 673, 1876.
Pantosteus dolphinus JORDAN & COPELAND, Check List, 156, 1876. (Misprint for *delphinus*.)
1872—*Minomus bardus* COPE, Hayden's Geol. Surv. Wyoming, 1870, 436.
Pantosteus bardus COPE, Lieut. Wheeler's Expl. W. 100th Mer. vol. 5, p. 673, 1876.
Pantosteus bardus JORDAN & COPELAND, Check List, 156, 1876.

HABITAT.—Basin of the Colorado. Lake Guzman.

The types of *Catostomus plebeius* are not to be found, and no specimens referable to the species are in the National Museum. The types of *Pantosteus delphinus* and *P. bardus* I have been unable to examine. The scale-formula and small dorsal fin of *C. plebeius* indicate that it is a species of *Pantosteus*. Assuming that it is so, I find myself unable to draw from the printed descriptions of *plebeius*, *delphinus*, and *bardus* any sort of specific characters. Until such characters are shown, the burden of proof lies with the proposer of those species, and I shall consider them as identical until they are proved to be distinct. In characters of mouth,

scales, and form of body, *Pantosteus plebeius* seems to resemble *Catostomus insignis* and *C. clarkii*, and to diverge from the type of *discobolus*, *generosus*, and *platyrhynchus*.*

* Professor Cope (*in lit.*) dissents from the identification above made, maintaining that *P. delphinus* and *P. bardus* are at least specifically distinct from each other, whatever may be the relation of either to *P. plebeius*. As I have seen none of the three forms in question, I let the above stand as I had written it, and quote the original descriptions of the three nominal species:—

MINOMUS PLEBEIUS Grd.—"Body sub-fusiform, compressed. Head elongate, subconical, forming the fifth of the entire length. Mouth of medium size. Eyes large, subelliptical, their longitudinal diameter being contained about five times in the length of side of head. Dorsal fin subquadrangular, its anterior margin being equidistant between the tip of the snout and the first rudimentary rays of the upper lobe of the caudal. The latter is slightly concave posteriorly, and the lobes rounded off. The base of the anal is contained nearly three times in its height, and when brought backwards its tip extends to the rudimentary rays at the inferior lobe of the caudal fin. The ventrals are inserted under the posterior third of the dorsal; bent backwards, their tip does not reach as far as the anus. The pectorals are of medium development, subovate, posteriorly acute.

"The scales are of medium size, considerably largest on the peduncle of the tail. Twenty-eight to thirty rows from the base of the ventrals to the dorsal fin. About eighty in the lateral line, which is not discernible as far back as the base of the caudal fin.

"The color as preserved in alcohol, is dark brown on the upper regions, faintly mottled with blackish patches. The sides and belly exhibit traces of orange in some of the specimens, in others it is pale yellowish. The fins are unicolor; the dorsal, caudal, and pectorals, blackish brown; the anals and ventrals yellowish."—(GIRARD, *Ich. U. S. and Mex. Boundary Surv.* ——, p. 38, figs. 1–4, plate xxii.)

MINOMUS DELPHINUS Cope.—"The subequal size of the scales of this species would refer it indifferently to the true group Catostomus of Girard, or his group Minomus, which he did not distinguish clearly. The preceding species would enter his Acomus, which is, however, only an undefined group of species, to which, by the way, the type of Catostomus, C. teres, belongs. This species is especially distinguished from those heretofore described by the shortening of the caudal part of the vertebral column, and the consequent posterior position of the dorsal fin. Add to this a short, wide head, and thick body, and its physiognomy is expressed.

"The dorsal outline is arched, the head flat above, but elevated behind, and much depressed on the muzzle. The muzzle is wide and does not project beyond the upper lip, which is appressed to its lower face and bears four rows of warts; its smooth commissural part is narrow. On the lower lip the tubercles advance nearly to the commissure; this lip is deeply emarginate posteriorly; the eye enters the length of the head five times, two and one-half times measuring the muzzle, and twice the interorbital region. Head four and two-thirds times in length to end of caudal basal scales. Scales in thirty longitudinal series, between dorsal and ventral fins; ventrals remark-

Genus CYCLEPTUS *Rafinesque.*

Cycleptus RAFINESQUE, Journal de Physique, de Chimie et d'Histoire Naturelle, Paris, 1819, p. 421.

Rhytidostomus HECKEL, Fische Syriens, Russegger's Reisen, 1842, p. 1023.

Catostomus et Sclerognathus sp. AUCT.

Type, *Cycleptus nigrescens* Rafinesque, = *Catostomus elongatus* Le Sueur.

Etymology, κύκλος, round; λεπτὸς, small. "The name means small, round mouth" (*Rafinesque*).

Head very small, short and slender, its length contained 6 to 7 times in that of the body, its upper surface rounded; eye quite small, nearly median, not very high up, its length 6 to 8 in that of the side of the head; suborbital bones rather small and quite narrow; fontanelle entirely obliterated by the union of the parietal bones.

Mouth small, entirely inferior, overlapped by the projecting snout, the upper lip thick, pendent, covered with 3 to 5 rows of tubercles, the outer quite large, the inner small; lower lip moderate, formed some-

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ably short, extending little more than half way to vent, originating under posterior third of dorsal. Pectorals well separated. Isthmus wide.

"Color above blackish, with a strong inferior marginal shade on the lower part of the sides, and the lighter tint above; a brown spot just above axilla, is cut off from it by a band of the yellow color which covers the belly and head below.

"The only species concerning which any doubt can arise in the nomenclature of this one is *C. bernardini* of Girard. That writer states that the latter possesses 15 D. radii; this, with the ascription of a slender form and other peculiarities, will always separate them. Three species in Professor Hayden's collection without locality. This should be probably a tributary of Green River."—(COPE, *Hayden's Geol. Surv. Terr.* 1872, p. 436.)

MINOMUS BARDUS Cope.—"This species is distinguished by its very short head, and marked coloration, resembling in that respect the *C. guzmaniensis* of Girard; with this species, it has, however, nothing else in common.

"Head wide, muzzle not projecting beyond upper lip; latter not pendent, with narrow, smooth commissure and three or four rows of tubercles. Lower lip deeply incised, tubercular to near inner edge. Eye 5.25 times in length of head, twice in interorbital width. Head five times to end of basal caudal scales. Form stout: body cylindric anteriorly. Dorsal fin nearer end of muzzle than end of caudal scales. Scales of body subequal, in thirty longitudinal rows between dorsal and ventral fins, latter originating beneath hinder border of dorsal, not quite reaching vent. Pectorals well separate; isthmus wide, narrower than in *M. delphinus*. Color blackish above, a broad olive band from upper part of opercular border along upper half of caudal peduncle, and a bread black band below, narrowing to a line along the middle of the peduncle; below, yellowish, a band of the same cutting off a blackish area above the axilla, as in the last species."—(COPE, *Hayden's Geol. Surv. Terr.* 1872, p. 436.)

what as in *Catostomus*, but less full, incised behind; jaws without cartilaginous sheath; muciferous system not greatly developed; opercular apparatus not greatly developed, the operculum smooth and narrow. Isthmus moderate; gill-rakers moderately long, soft; pharyngeal bones strong, the teeth stout, increasing in size downwards, rather wide apart.

Body elongate, moderately compressed, not much elevated, the caudal peduncle long, the greatest depth contained 4 to 6 times in length.

Scales moderate, about equal over the body, not closely imbricated, with wide exposed surfaces, the number in the lateral line from 55 to 60, and about 17 in a transverse series from dorsal to ventrals; edges of scales serrate; lateral line well developed, nearly straight.

Fins rather large; dorsal fin beginning in front of ventrals and ending just before anal, of about 30 rays, strongly falcate in front, the first and second developed rays in length more than half the length of the base of the fin, the rays rapidly shortened to about the eighth, the length of the remaining rays being nearly uniform and all short; caudal fin large, widely forked, the lobes about equal; anal fin quite small, low, of 7 or 8 developed rays, scaly at base; ventrals moderate, with 10 rays; pectorals elongate, somewhat falcate.

Sexual peculiarities somewhat marked; the males in spring with black pigment; the head then covered with small tubercles.

Air-bladder with two chambers, the anterior short, the posterior elongate.

But a single species of this singular genus is as yet known. It is found in the waters of the Mississippi Valley, and, although not a rare fish, it is by no means as generally abundant as are many others of its family.

Generic Characterizations.

CYCLEPTUS Rafinesque, 1819.—"Cycleptus, (abdominal). Différent du genre Catostomus. Deux nageoires dorsales, bouche petite, ronde, au bout du museau; lèvres circulaires. Famille Cyprinidia? *C. nigrescens*, noirâtre; ventre blanchâtre, bouche retroussée; queue fourchée. Parvient à deux pieds de long; très bon à manger, rare dans l'Ohio et le Missouri."—(RAFINESQUE, *Journ. de Phys. etc.* 1819, p. 421.)

CYCLEPTUS Rafinesque, 1820.—"Difference from the foregoing genus [*Catostomus*]—two dorsal fins, mouth round and terminal."—(RAFINESQUE, *Ich. Oh.* p. 6.)

RHYTIDOSTOMUS Heckel, 1842.—"Dentes pectiniformes 60-60. Pinna dorsalis basi elongata; radio tertio vel quarto longissimo. In reliquis cum genere Catostomo congruit."—(HECKEL, *Fische Syriens*, p. 33, or *Russeger's Reisen*, p. 1023.—Species referred to the genus, *Cyprinus catostomus* Forster and *Catostomus elongatus* Le Sueur.)

CYCLEPTUS Agassiz, 1855.—"As in many other instances, Rafinesque has named, but neither defined nor characterised the genus to which I now call attention. He has not

himself even seen the fish upon which the genus is founded, and refers to another genus a species which cannot be separated from this. Moreover, the characteristics of the genus, as given by Rafinesque, are not true to nature. Yet, notwithstanding these objections, I do not feel at liberty to reject his generic name, since it is possible to identify the fish he meant by the vernacular name under which it is known in the West. There is another reason why Rafinesque's description of our western fishes ought to be carefully considered and every possible effort made to identify his genera and species, the fact that he was the first to investigate the fishes of the Ohio and its tributaries upon a large scale, and that notwithstanding the looseness with which he performed the task and the lamentable inaccuracies of his too short descriptions, his works bear almost upon every page the imprint of his keen perception of the natural affinities of species, and their intimate relations to one another; so much so, that even where he has failed to assign his genera any characters by which they may be recognized, yet, when the species upon which they were founded can be identified, we usually find that there are good reasons for considering them as forming distinct genera.

"The trouble with Rafinesque is, that he too often introduced in his works species which he had not always seen himself, and which he referred almost at random among his genera, thus defacing his well characterised groups, or that he went so far as to found genera upon species which he had never seen, overlooking perhaps that he had already described such types under other names.

"The genus *Cycleptus* affords a striking example of all these mistakes combined together. In his remarkable paper upon the genus *Catostomus*, Lesueur describes and figures one species from the Ohio River, under the name of *C. elongatus*, peculiar for its elongated cylindrical body, and for its long dorsal fin beginning half way between the pectorals and ventrals, and extending as far back as the insertion of the anal. The species Rafinesque introduces in his subgenus *Decactylus* among the genuine *Catostomi*, without perceiving that it belongs to his own genus *Cycleptus*. This mistake arises undoubtedly from his belief that in *Cycleptus* there are two dorsals, which indeed he mentions as characteristics of this genus; but this statement is erroneous: the rays of the dorsal are, in fact, enclosed in a continuous membrane, the anterior rays only being much longer than those of the middle and posterior portion of the fin; occasionally these long rays split, and accidentally separate from the following ones, when they seem to form two dorsals.

"The character of this genus, so far as the dorsal is concerned, consists in reality not in its division, but in its great extension along the back, and the elongation of its anterior rays. The anal is very long in proportion to the size of the fish, and inserted far back, so that the length of the abdominal cavity is greater than in the genera *Carpiodes*, *Ichthyobus*, and *Bubalichthys*, with which *Cycleptus* is closely allied by the peculiar form of its dorsal. Again, Rafinesque remarks that the mouth is terminal, round and small. This requires also to be qualified. The mouth appears terminal and round only when the jaws are protruded to their utmost extent; when closed, it is rather crescent-shaped and entirely retracted under the projecting, pointed snout; the lips are covered with numerous projecting papillæ and spread horizontally,—these are moreover, continuous around the angles of the mouth, so that the upper and lower lips are hardly separated by a small fold, and the lower lip is slightly emarginate in the middle, while in other genera of this tribe it is actually bilobed.

"The pharyngeal bones are strong, their anterior surface being flattened and the greatest diameter being the transverse one, as in *Bubalichthys*, and not laterally compressed and thin as in *Carpiodes* and *Ichthyobus*.

"The symphysis is short and its peduncle flat and square, separated from the curved arch by a deep semicircular emargination. The teeth are also stronger and stouter than in *Carpiodes* and *Ichthyobus*, as is also the case in *Bubalichthys*, and they are gradually increasing in size, and relative thickness from the upper part of the arch to the symphysis, but they are much fewer and farther apart than in the latter genus. Their inner edge is transverse, rather blunt, though the middle ridge is somewhat projecting; the lower teeth are so shaped that their inner angle is hardly higher than the outer, while in the middle and upper teeth it is gradually more projecting, and from the middle of the arch upwards forms a prominent point arched outwards.

"The scales are considerably longer than high, with a rather prominent posterior margin; numerous radiating furrows upon the anterior and posterior fields, some across the lateral fields; the concentric ridges of the posterior field are not only broader than those of the other fields, but instead of running parallel to the margin of the scales they are curved in concentric gothic arches between each two radiating furrows. Heckel mentions this genus under the name of *Rhytidostomus*, but Rafinesque's name *Cycleptus* has the priority. Properly it ought to be called *Leptocyclus*, according to its etymology, (see my Nomenclator Zoologicus; Index Universalis, p. 109,) but under this form nobody would recognise it as Rafinesque's name. I shall therefore not urge the change."—(AGASSIZ, *Am. Journ. Sci. Arts*, 1855, p. 197.)

CYCLEPTUS Cope & Jordan, 1877.—"Body much elongated, subcylindrical forwards: dorsal elongate, falciform, of 30 or more rays; fontanelle obliterated by the union of the parietal bones; mouth small, inferior, with papillose lips."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 81.)

ANALYSIS OF SPECIES OF CYCLEPTUS.

* Depth 4 to 5 in length: head 6 to 6½: eye small, 6 to 7 in length of head: longest dorsal rays a little longer than head: pectorals rather longer than head: dorsal rays 30; anal 7 or 8: scales 9-56-7: coloration very dark, the males almost black; size large; length of adult 1½ to 2½ feet ..... ELONGATUS, 42.

42. CYCLEPTUS ELONGATUS (*Le Sueur*) *Agassiz.*

Black Horse. Gourd-seed Sucker. Missouri Sucker. Suckerel.

1817—*Catostomus elongatus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. 103.

Catostomus elongatus RAFINESQUE, Ich. Oh. 60, 1820.

Catostomus elongatus KIRTLAND, Rept. Zool. Ohio, 168, 1838.

Catostomus elongatus DEKAY, New York Fauna, part iv, Fishes, 203, 1842.

Catostomus elongatus CUVIER & VALENCIENNES, Hist. Nat. des Poiss. xvii, 455, 1844.

Catostomus elongatus KIRTLAND, Boston Journ. Nat. Hist. v, 267, 1845.

Catostomus elongatus STORER, Synopsis, 422, 1846.

Cycleptus elongatus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 197, 1855.

Sclerognathus elongatus GÜNTHER, Cat. Fishes Brit. Mus. vii, 23, 1868.

Cycleptus elongatus JORDAN, Fishes of Ind. 222, 1875.
Cycleptus elongatus JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876. (Name only.)
Cycleptus elongatus JORDAN, Man. Vert. 298, 1876.
Cycleptus elongatus NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 50, 1876.
Cycleptus elongatus JORDAN & COPELAND, Check List, 158, 1876. (Name only.)
Cycleptus elongatus JORDAN & GILBERT, in Klippart's Rept. 53, 1876. (Name only.)
Cycleptus elongatus JORDAN, Bull. U. S. Nat. Mus. ix, 38, 1877.
Cycleptus elongatus JORDAN, Man. Vert. ed. 2d, 1878.
1818—*Cycleptus nigrescens* RAFINESQUE, Journal de Physique, 421.
Cycleptus nigrescens RAFINESQUE, Ich. Oh. 61, 1820.

HABITAT.—Mississippi Valley, in all the larger streams.

This species is found in some abundance in the larger streams. At the Falls of the Ohio, it is taken in nets, and meets a ready sale. It is, however, much less abundant than the Buffalo fishes are. From the general use of the name "Missouri Sucker", its abundance in the State of Missouri may be inferred; but, as to the facts in the case, I am not informed. This fish is as sharply distinguished from the other Suckers in its appearance as in its anatomy. The dusky colors and the small size of the head attract attention at once.

But one species is yet known. That being the case, the synonymy of the species needs no discussion, its oldest name being the one in common use.

Specimens in United States National Museum.

Number.	Locality.	Collector.
107	.....	
8673	.....	
10790	Cincinnati, Ohio	J. W. Milner.
12278	.....do	Do.

Genus CARPIODES *Rafinesque.*

Carpiodes RAFINESQUE, Ich. Oh. 56, 1820. (As subgenus of *Catostomus.*)
Sclerognathus VALENCIENNES, Hist. Nat. des Poissons, xvii, 472, 1844.
Type, *Catostomus cyprinus* Le Sueur.
Etymology, Latin *carpio*, a carp; *i. e.*, carp-like.

Head comparatively short and deep, sometimes conic, sometimes blunt, its length ranging from 3½ to 5 in that of the body, its upper surface always rounded; eye moderate, median or anterior in position; suborbital bones well developed, their depth more than half that of

the fleshy portion of the cheek below; fontanelle always present, well developed.

Mouth always small, horizontal and inferior, the mandible less than one-third the length of the head, the lips thin, the upper protractile, narrow, the lower quite narrow, Λ-shaped, or rather ∩-shaped, behind; both lips feebly plicate or nearly smooth, the plicæ often more or less broken up; jaws without cartilaginous sheath; muciferous system moderately developed; opercular apparatus well developed, the subopercle broad, the operculum in the adult more or less rugose; isthmus moderate; pharyngeal bones remarkably thin and laterally compressed, with a shallow furrow along the anterior margin on the inside, and another more central one on the outline of the enlarged surfaces; teeth very small, compressed, nearly equally thin along the whole inner edge of the bone, forming a fine comb-like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point. Gillrakers of anterior arch slender and stiff above, becoming reduced downwards.

Body ovate or oblong, the dorsal outline more or less arched, the ventral outline more nearly straight, the depth from half to one-third the length, the sides compressed; the back notably so, forming a sort of carina; caudal peduncle short and deep; scales large, about equal over the body, their posterior margins slightly serrate; lateral line well developed, nearly straight, with 34 to 41 scales, 12 to 15 scales in a cross-row from dorsal to ventrals; dorsal fin beginning near the middle of the body, somewhat in advance of ventrals, falcate, its anterior rays very much elevated and usually filamentous, their height ranging from $\frac{1}{2}$ to $1\frac{1}{3}$ the length of the base of the fin, the number of developed rays ranging from 23 to 30; caudal fin well forked, the lobes equal; anal fin comparatively long and low, emarginate (in males?), its number of developed rays usually 8; ventrals shortish, with usually 10 rays; pectorals short.

Sexual peculiarities little marked; in some species, at least, the males in spring have the snout minutely tuberculate.

Coloration always plain; pale olivaceous above, white below, but hardly silvery, the fins all partaking of the color of the region to which they belong.

Air-bladder with two chambers.

Size medium or rather large.

This genus was first recognized and defined by Professor Agassiz in

1855. Since then it has been generally received by authors under the same name and with the same limits. It was first briefly outlined by Rafinesque in 1820 under the name of *Carpiodes*, then afterwards by Valenciennes defined more fully under the name of *Sclerognathus*. Both *Carpiodes* and *Sclerognathus* having the same typical species (*Catostomus cyprinus* Le Sueur), the older and preferable name, *Carpiodes*, is the one to be adopted.

The recognition of species in this genus is a matter of extreme difficulty, from their great resemblance to each other in color, size, form, and general appearance. Our knowledge of the species thus far has been almost entirely due to the labors of Professor Cope (A Partial Synopsis of the Fishes of North Carolina", Proc. Am. Philos. Soc. Phila. 1870). I have myself examined specimens agreeing with each of Professor Cope's descriptions, and, with two exception (*Carpiodes selene* and *Carpiodes grayi*), I am disposed to admit all his species. It is true, however, that in every large collection of *Carpiodes* there are specimens disagreeing more or less from the typical forms of each species, and which should, in consistency, be described as distinct species, or else the species which they appear to connect should be united. I have not, however, examined a sufficiently full series of *Carpiodes* to be prepared to accept either of these alternatives. I have, therefore, taken Professor Cope's analysis of the species, and added to it such additional features as I have been able to observe, and I give the whole as our best knowledge at present on the subject, leaving for future study the consideration of the degree of relationship existing between *cyprinus*, *velifer*, and *thompsoni*. The other four species, *carpio*, *bison*, *cutisanserinus*, and *difformis*, seem to be manifestly distinct, unless *difformis* be a monstrous form of *cutisanserinus*.

Species of this genus are found in all the fresh waters of the United States east of the Rocky Mountains. They seldom ascend the small streams, and are taken by means of nets from the larger rivers and lakes. From their resemblance in form to the European Carp (*Cyprinus carpio*), they are popularly known as "Carp". This resemblance has suggested the name of the genus and of two of its species. As food-fishes they are rather indifferent, the flesh being rather coarse and flavorless and full of small bones. The geographical distribution of the species has been little studied. *C. cyprinus* is the common species east of the Alleghanies, and, if "*C. damalis*" and "*C. tumidus*" be the same, in the Upper Missouri region and the Rio Grande also. *C. thompsoni* is the

common Carp of the Great Lakes. *C. carpio* is the most abundant species in the Ohio River, where *C. velifer* and *C. cutisanserinus* also occur in immense numbers.

I am convinced that neither the number of scales nor the number of fin-rays can be relied on to distinguish species in this genus, the entire range of variation being probably found in every species. The height of the anterior rays of the dorsal, although subject to considerable variation with age and wear, seems to be sufficiently constant to divide the species into two groups.

Generic Characterizations.

CARPIODES Rafinesque, 1820.—"Body oblong, somewhat compressed; head compressed, nine abdominal rays, dorsal fin commonly elongate, tail equally forked."—(RAFINESQUE, *Ich. Oh.* p. 56.)

SCLEROGNATHUS Storer, 1846.—"Snout slightly advanced beyond the mouth; the extremity of the mouth is supported, as in the *Catostomi*, by the intermaxillary, which is furnished in front with a well developed, projecting, cartilaginous ethmoid. The upright branch is long, and of a styloid form, while the horizontal is shortened, and is a mere keel, the inferior edge of which serves merely to support the superior angle of the mouth. The remainder of the maxillary arch is formed by a fibrous ligament covered by a thin, undilated lip, reduced to a thin and fleshy protuberance. The upper jaw is a wide, very solid bony piece, under which the upper lip is partly drawn; this bone is concealed by the first two suborbitals, being wider and no less advanced than those of the *Catostomi*. As to its lips, it is a *Leuciscus;* but the osteology of its mouth resembles that of the *Catostomi*. The dorsal is long, like that of the Carps. The head is naked, marked by lines of mucous pores. Pharyngeal teeth comb-like, finer and more equal than those of the *Catostomi*. The air-bladder is divided into two large lobes; the anterior is large and rounded, with a slight depression at its superior face: the second conical, twice as long as the first and followed by two small lobes; the second communicates with the œsophagus by an air-pipe."—(STORER, *Mem. Am. Ac. Arts and Sc.* 1846, p. 427; essentially a translation from Valenciennes's account.)

CARPIODES Agassiz, 1855.—"The body is very high and strongly compressed, the narrow ridge on the back forming the outline in front of the dorsal is very much arched, and regularly continuous downwards with the rather steep profile of the head.

"The head is short, its height and length differ but little. The snout is short and blunt. The small mouth is entirely inferior, and surrounded by narrow thin lips, which are more or less transversely folded. The lower jaw is short and broad. The pharyngeal bones of *Carpiodes* are remarkably thin, compressed laterally, with a shallow furrow along the anterior margin on the side, and another more central one on the outline of the arched surfaces; the teeth are very small, compressed, equally thin along the whole inner edge of the bone, forming a fine comb-like crest of minute serratures; their cutting edge rises above the inner margin into a prominent point.

"The anterior lobe of the long dorsal is slender, its third and fourth rays being prolonged beyond the following ones into long filaments. The lower fins are all pointed,

rather small, and hence different from one another. The ventral ridge of the body is flat. The scales have many narrow, radiating furrows upon the anterior field, and are more deeply marked, in a straight line, across the lateral fields, or limiting the lateral and posterior fields, hardly any upon the anterior field, the waving of the broader concentric ridges producing only a radiated appearance upon that field. Tube of the lateral line straight and simple, arising in advance of the centre of radiation, which is seated in the centre of form of the scales."—(AGASSIZ, *Am. Journ. Sc. Arts*, 1855, p. 189.)

CARPIODES Günther, 1868.—"Distinguished from *Sclerognathus* (*i. e. Bubalichthys* and *Ichthyobus*) by its very thin, compressed pharyngeal bones, which are armed with a comb-like series of nearly equally minute compressed teeth."—(GÜNTHER, *Cat. Fishes Brit. Mus.* vii, p. 24.)

CARPIODES Cope & Jordan, 1877.—"Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present; pharyngeal bones narrow, with the teeth relatively thin and weak; mouth small, inferior, protractile downwards."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 82.)

ANALYSIS OF SPECIES OF CARPIODES.

* Dorsal fin with the anterior rays very much elevated and attenuated, equalling or more usually exceeding the length of the base of the fin.

† Muzzle very abruptly obtuse, almost vertically truncate in front.

a. Muzzle exceedingly blunt, so that the anterior edge of the mandible is in line with the anterior rim of the orbit, and the maxillary reaches to the anterior edge of the pupil: anterior suborbital deeper than long: head 4¼ in length: eye quite large, 3½ to 4 in head: body arched, the depth somewhat less than half the length: first ray of dorsal nearer muzzle than base of caudal: scales 6–35–4: D. 24, A. 8, V. 9..... DIFFORMIS, 43.

aa. Muzzle notably blunt, but less so than in the preceding: anterior edge of the mandible in advance of the orbit, and the maxillary just reaching the line of the lower rim of the orbit: anterior suborbital bone deeper than long (longer than deep, "*selene*"): head 4 times in length: eye smallish, 4½ in head: body arched, the depth about 2½ in length: anterior rays of dorsal about midway between snout and base of caudal: scales 7–37–5: D. 26, A. 8, V. 10..... CUTISANSERINUS, 44.

†† Muzzle conic, projecting, obtusely pointed: end of the mandible reaching to opposite nostrils: anterior suborbital as deep as long: head 3¾ in length: eye moderate, 4 to 4½ in length of head: body arched above, the depth 2¼ to 2½ in length: first ray of dorsal nearer muzzle than base of caudal: scales 7–37–5: D. 26 or 27 ("22", *Cope*) ..... VELIFER, 45.

** Dorsal fin with the anterior rays more or less shortened, their length one-half to two-thirds that of the base of the fin: muzzle more or less conic and projecting.

b. Head long, contained about 3½ times in length to base of caudal: muzzle elongate-conic, so that the eye is nearly median, the middle of the length of the head falling in front of its posterior margin: body not much arched; depth 3 in length: anterior rays of dorsal pretty high, not much shorter than the base of the fin, not thickened at base: lips well developed: eye large, 4½ in head: scales 7–40–5: D. 27, A. 7, V. 10..... BISON, 46.

bb. Head intermediate, its length contained about 4 times ($3\frac{3}{4}$ to $4\frac{1}{3}$) in that of body: anterior rays of dorsal not thickened at base.

c. Body stout, short, the back much arched, the depth $2\frac{1}{3}$ in length: head 4 to $4\frac{1}{4}$ in length, the muzzle moderately pointed: dorsal rays considerably elevated, two-thirds as long as base of fin: eye small, $5\frac{1}{4}$ in head: tip of lower jaw much in advance of nostrils; maxillary reaching line of orbit: anterior suborbital large, deep, roundish: origin of dorsal about midway of body: scales rather closely imbricated, 8–39 to 41–6: D. 27, A. 7, V. 10.

THOMPSONI, 47.

cc. Body elongate, not much elevated, the depth $2\frac{3}{4}$ in length: head $3\frac{3}{4}$ to 4, the muzzle prominent but rather bluntish: front scarcely concave above eyes, the profile forming a somewhat uniform curve: eye small, nearly 6 in head: anterior rays of dorsal moderately elevated, nearly three-fourths the length of the fin, the first ray nearly midway between snout and base of caudal: scales 6–37–5: D. 24 to 27, A. 8, V. 10 ..... CYPRINUS, 48.

bbb. Head comparatively short, its length contained $4\frac{1}{2}$ to 5 times in the length of the body: body more fusiform than in the others, compressed, but not much arched, the depth $2\frac{3}{8}$ to 3 times in the length: anterior rays of dorsal short, notably thickened and osseous at base, the first ray nearer the end of the muzzle than the base of the caudal fin: eye small, anterior, $4\frac{1}{2}$ in head: muzzle short, but projecting much beyond mouth: size largest of the genus.

CARPIO, 49.

43. CARPIODES DIFFORMIS *Cope.*

Deformed Carp Sucker.

1870—*Carpiodes difformis* COPE, Proc. Am. Philos. Soc. Phila. 480.

Carpiodes difformis JORDAN, Man. Vert. 297, 1876.

Carpiodes difformis JORDAN & COPELAND, Check List, 158, 1876.

Carpiodes difformis JORDAN, Proc. Ac. Nat. Sc. Phila. 72, 1877.

Carpiodes difformis JORDAN & GILBERT, in Klippart's First Report Ohio Fish Commission, 86, pl. xiii, f. 21, 1877.

Carpiodes difformis JORDAN, Bull. U. S. Nat. Mus. 9, 50, 1877.

Carpiodes difformis JORDAN, Man. Vert. ed. 2d, 321, 1878.

HABITAT.—Ohio Valley; less common than the other species.

The only specimen which I have seen of this species was from the Wabash River, in which stream Professor Cope's original types were collected. No specimens are in the United States National Museum, which, indeed, at present contains very few of the Carp Suckers or Buffalo-fish.

44. CARPIODES CUTISANSERINUS *Cope.*

Long-finned Carp Sucker. Quillback.

1870—*Carpiodes cutisanserinus* COPE, Proc. Am. Philos. Soc. Phila. 481.

Carpiodes cutisanserinus JORDAN & COPELAND, Check List, 158, 1876.

Carpiodes cutisanserinus JORDAN, Bull. U. S. Nat. Mus. 9, 50, 1877.
Carpiodes cutisanserinus JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Carpiodes cutisanserinus JORDAN, Man. Vert. ed. 2d, 321, 1878.

1870—*Carpiodes selene* COPE, Proc. Am. Philos. Soc. Phila. 481.
Carpiodes selene JORDAN & COPELAND, Check List, 158, 1876.
Carpiodes selene JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Carpiodes selene JORDAN, Man. Vert. ed. 2d, 321, 1878.

1876—*Ichthyobus difformis* NELSON, Bull. No. 1, U. S. Nat. Mus. 49.

HABITAT.—Mississippi Valley; generally abundant.

This species is closely related to *C. velifer*, but differs in the abruptly truncate snout, that of *velifer* being conic. I am unable to recognize *C. selene* as a distinct species at present, the form of the anterior suborbital being the only distinguishing feature of much importance, and that probably not a constant one. *C. cutisanserinus* is as abundant in the Ohio as *C. velifer*, and I have seen many specimens from the Illinois River.

Specimens in United States National Museum.

Number.	Locality.	Collector.
20032	Cumberland River	A. Winchell.
20033	....do	Do.

45. CARPIODES VELIFER (*Rafinesque*) *Agassiz.*

Carp Sucker. Skimback. Quillback. Sailor. Sailing Sucker. Spear-fish.

1820—?? *Catostomus anisopterus* RAFINESQUE, Ich. Oh. 45. (Description at second hand and unrecognizable.)

1820—*Catostomus velifer* RAFINESQUE, Ich. Oh. 56.
Catostomus velifer KIRTLAND, Rep. Zool. Ohio, 168, 1838.
Carpiodes velifer AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 191, 1855.
Carpiodes velifer COPE, Proc. Am. Philos. Soc. Phila. 482, 1870.
Carpiodes velifer JORDAN, Fishes of Ind. 222, 1875.
Carpiodes velifer JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.
Carpiodes velifer JORDAN, Man. Vert. 297, 1876.
Carpiodes velifer JORDAN & Copeland, Check List, 158, 1876.
Ichthyobus velifer NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.
Carpiodes velifer JORDAN & GILBERT, in Klippart's First Report Ohio Fish Commission, 87, 1877.
Carpiodes velifer JORDAN, Bull. U. S. Nat. Mus. ix, 34, 1877.
Carpiodes velifer JORDAN, Man. Vert. ed. 2d, 321, 1878.

1846—*Sclerognathus cyprinus* KIRTLAND, Bost. Journ. Nat. Hist. vol. v, 275. (In part; not of C. & V.)

HABITAT.—Western streams and lakes (Cayuga Lake, New York, to Mississippi River).

This species is quite abundant in the Ohio River, and I have seen specimens not evidently distinguishable, from Lake Erie and from other waters tributary to the Great Lakes. Indiscriminately with *C. cutis-anserinus*, it is known to the fishermen as Quillback, Skimback, etc., the lower-finned species being called rather "Carp". Most of the synonymy above quoted includes several species, the true *velifer* being first distinguished by Professor Cope. Rafinesque's *anisopterus* I bring into the synonymy of this species, simply to refer to it somewhere. It is really unidentifiable. Kirtland's *Sclerognathus cyprinus* refers most to this species, but his figure represents no known fish. The head is too small, and the form, etc., incorrect.

Specimens in United States National Museum.

Number.	Locality.	Collector.
20277	Cayuga Lake, New York	

There are also several other specimens in the collection, but without locality.

46. CARPIODES BISON *Agassiz.*

Long-headed Carp Sucker.

1854—*Carpiodes bison* AGASSIZ, Am. Journ. Sci. Arts, 356.
Carpiodes bison AGASSIZ, Am. Journ. Sci. Arts, 190, 1855.
Carpiodes bison COPE, Proc. Am. Philos Soc. Phila. 483, 1870.
Carpiodes bison JORDAN, Man. Vert. 297, 1876.
Carpiodes bison JORDAN & COPELAND, Check List, 158, 1876.
Ichthyobus bison NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.
Carpiodes bison JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Carpiodes bison JORDAN, Bull. U. S. Nat. Mus. ix, 50, 1877.
Carpiodes bison JORDAN, Man. Vert. ed. 2d, 322, 1878.

HABITAT.—Mississippi Valley (Osage River, *Agassiz;* Mississippi River, Wabash River, Tennessee River, *Cope*).

What the fish is to which Professor Agassiz gave the name "*bison*" cannot be ascertained from the published descriptions. Professor Cope has described the present species under that name, and we accept the

name *bison* on his authority. This species is not generally common in so far as my experience goes. I have, however, seen one or two from the Ohio River. I found no specimens in the National Museum.

47. CARPIODES THOMPSONI *Agassiz.*

Lake Carp.

1842—*Catostomus cyprinus* THOMPSON, Hist. Vt. 133.

1855—*Carpiodes thompsoni* AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 191.

Carpiodes thompsoni COPE, Proc. Ac. Nat. Sc. Phila. 285, 1864.

Carpiodes thompsonii COPE, Proc. Am. Philos. Soc. Phila. 483, 1870.

Carpiodes thompsoni JORDAN, Man. Vert. 297, 1876.

Ichthyobus thompsoni NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.

Carpiodes thompsoni JORDAN & COPELAND, Check List, 158, 1876.

Carpiodes thompsonii JORDAN & GILBERT, in Klippart's Rept. 53, 1876.

Carpiodes thompsoni JORDAN, Man. Vert. ed. 2d, 322, 1878.

HABITAT.—Great Lake region; abundant.

This species occurs in more or less abundance throughout the Great Lake region. It is the shortest and most arched of all the species. Its dorsal fin is about intermediate between that of *velifer* and that of *carpio*. I have examined very many specimens of this species, and I find little variation among them. This fish reaches a length of something over a foot, and is sold by the Lake fishermen as "Carp".

Specimens in United States National Museum.

Number.	Locality.	Collector.
11040	Sandusky, Ohio	J. W. Milner.
11127	do	Do.
11128	do	Do.
11130	do	Do.
11131	do	Do.
11132	do	Do.

48. CARPIODES CYPRINUS (*Le Sueur*) *Agassiz.*

Eastern Carp Sucker. Nebraska Carp Sucker. Rio Grande Carp.

1817—*Catostomus cyprinus* LE SUEUR, Journ. Ac. Nat. Sc. Phila. i, 91.

Labeo cyprinus DEKAY, New York Fauna, part iv, Fishes, 194, 1842.

Sclerognathus cyprinus CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 474, 1844.

Sclerognathus cyprinus STORER, Synopsis, 427, 1846.

Carpiodes cyprinus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 191, 1855.

Carpiodes cyprinus GÜNTHER, Cat. Fishes Brit. Mus. vii, 24, 1868.

Carpiodes cyprinus COPE, Proc. Am. Philos. Soc. Phila. 484, 1870.

Carpiodes cyprinus JORDAN, Fishes of Ind. 202, 1875.

Carpiodes cyprinus JORDAN, Man. Vert. 297, 1876.

Carpiodes cyprinus UHLER & LUGGER, Fishes of Maryland, 140, 1876.

Carpiodes cyprinus JORDAN & COPELAND, Check List, 158, 1876.

Carpiodes cyprinus JORDAN, Man. Vert. ed. 2d, 323, 1878.

1854—*Carpiodes vacca* AGASSIZ, Am. Journ. Sci. Arts, 356.

1854—*Carpiodes tumidus* BAIRD & GIRARD, Proc. Phila. Ac. Nat. Sc. 28.

Ictiobus tumidus GIRARD, U. S. Mex. Bound. Surv. Ich. 34, pl. xxx, f. 1–4, 1859.

Ichthyobus tumidus JORDAN & COPELAND, Check List, 158, 1876.

1856—*Carpiodes damalis* GIRARD, Proc. Ac. Nat. Sc. Phila. 170.

Carpiodes damalis GIRARD, U. S. Pac. R. R. Expl. x, 218, pl. xlviii, f. 1–4, 1858.

Carpiodes damalis COPE, Proc. Ac. Nat. Sc. Phila. 85, 1865.

Carpiodes damalis JORDAN & COPELAND, Check List, 155, 1876.

1870—*Carpiodes grayi* COPE, Proc. Am. Philos. Soc. Phila. 482, 1870.

Carpiodes grayi JORDAN & COPELAND, Check List, 158, 1876.

Carpiodes grayi COPE & YARROW, Wheeler's Expl. W. 100th Mer. v, Zool. 681, 1876.

HABITAT.—New England to Alabama; thence to Mexico and north to the Upper Missouri.

I have elsewhere already united the nominal species *grayi* and *tumidus*, for the following reasons:—Girard's "*Ictiobus tumidus*" is certainly a *Carpiodes*, as is plainly shown by the published figure, the mouth being represented as small and inferior, beneath the projecting snout. I have numerous young specimens of a *Carpiodes* from the Rio Grande, at Brownsville, Texas, the original locality of *Ictiobus tumidus*. But my specimens do not disagree in any important respect from *Carpiodes grayi*, from the same river, nor am I able, on examination of authentic specimens of the latter species, to point out any differences between them and my Brownsville specimens. Therefore, if *tumidus* and *grayi* are really different, the differences have escaped my notice. It is of course possible that my Brownsville specimens, although from the original locality of *tumidus*, may not be that species; but, as the types of *tumidus* have been lost, I do not see how the question can ever be settled.

I am furthermore unable to separate *tumidus* as thus characterized from *damalis* Grd., and the close relationship existing between *damalis* and *cyprinus* has already been noticed by Professor Cope. As I now believe that *cyprinus*, *tumidus*, *damalis*, and *grayi* were all based on members of a single widely diffused species, I unite them in the above synonymy.

This species is the common Carp Sucker of Pennsylvania and the

Middle States. I have no specimens referable to this species from the Great Lakes, nor from the Mississippi or the Ohio. If *cyprinus*, *tumidus*, and *damalis* are identical, however, one of two things must be true. Either *C. cyprinus* really inhabits the whole Mississippi Valley, but has been overlooked or confounded with others, or else we have a very curious anomaly in the distribution of the species, it being an inhabitant of waters of two widely separated areas, having little in common. The former supposition seems the most probable, and I accordingly look for specimens of *C. cyprinus* in the Mississippi Valley.

Specimens in United States National Museum.

Number.	Locality.	Collector.
—	Round Lake, Montgomery, Alabama	Kumlien & Bean.
179	Fort Pierre, Nebr. (types of *C. damalis*)	Dr. Evans.
3550	Republican River	Wood & Hammond.
13012	Rio Grande, New Mexico (*grayi*)	Dr. O. Loew.
15891	Nebraska	
20109	"U. S. Mex. Boundary Survey" (types of *tumidus?*).	
—	Brownsville, Tex	

49. CARPIODES CARPIO (*Rafinesque*) *Jordan.*

Big Carp Sucker. Olive Carp Sucker.

1820—*Catostomus carpio* RAFINESQUE, Ich. Oh. 56.
Carpiodes carpio JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.
Carpiodes carpio JORDAN, Man. Vert. 297, 1876.
Ichthyobus carpio NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.
Carpiodes carpio JORDAN & COPELAND, Check List, 158, 1876.
Carpiodes carpio JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Carpiodes carpio JORDAN, Proc. Ac. Nat. Sc. Phila. 72, 1877.
Carpiodes carpio JORDAN, Bull, U. S. Nat. Mus. ix, 34, 1877.
Carpiodes carpio JORDAN, Man. Vert. ed. 2d, 322, 1878.
1870—*Carpiodes nummifer* COPE, Proc. Am. Philos. Soc. Phila. 484.

HABITAT.—Mississippi Valley. Abundant in the Ohio River.

This is the most abundant species of its genus in the Ohio River and its tributaries. It is the largest species, the most elongate, and has the lowest fin-rays and the smallest head. The peculiar enlargement of the anterior rays of the dorsal I have found to be an excellent diagnostic character. This species has been well described by Professor Cope under the name of *C. nummifer*. There can, however, be but little

doubt that Rafinesque had the same fish in mind as his *C. carpio*, and I have accordingly adopted the latter name.

Specimens in United States National Museum.

Number.	Locality.	Collector.
12291	Ohio River, Cincinnati	J. W. Milner.
12292	.....do	Do.

Genus BUBALICHTHYS *Agassiz.*

Bubalichthys AGASSIZ, Am. Journ. Sci. Arts, 1855, 192.
Sclerognathus GÜNTHER, Cat. Fishes Brit. Mus. vii, p. 22, 1868.
Catostomus et *Carpiodes* sp. of authors.
Type, *Carpiodes urus* Agassiz.
Etymology, *βούβᾰλος*, buffalo; *ἰχθύς*, fish.

Head moderate or rather large, deep and thick, its superior outline rapidly rising, its length about 4 in that of the body: eye moderate, median or rather anterior in position; suborbital bones comparatively narrow; fontanelle always present and widely open.

Mouth moderate or small, more or less inferior, the mandible short, little oblique, or typically quite horizontal, the mandible less than one-third the length of the head, the premaxillaries in the closed mouth below the level of the lower part of the orbit; lips rather thin, thicker than in *Ichthyobus*, the upper protractile, narrow, plicate, the plicæ sometimes broken up into granules; lower lip comparatively full (for a Buffalo-fish), faintly plicate, the plicæ broken up into granules, the lower lip having the general ∩-shaped form seen in *Carpiodes;* jaws without cartilaginous sheath; muciferous system well developed; opercular apparatus well developed, but less so than in *Ichthyobus*, the operculum strongly rugose; isthmus moderate; pharyngeal bones triangular, with large teeth, which increase in size from above downwards; teeth compressed, their grinding edge blunt, slightly arched in the middle, and provided with a little cusp along the inner margin, which is hardly detached from the crown, and does not rise above the surface: gill-rakers of anterior arch slender and stiff above, growing shorter downwards.

Body ovate or oblong, the dorsal outline more or less arched, the sides of the body compressed, the ventral outline curved also, but to a less degree: scales very large, about equal over the body, their posterior

outlines somewhat serrate; lateral line well developed, nearly straight, with 35 to 42 scales, 12 to 14 in a cross-series from ventrals to dorsal; dorsal fin beginning near the middle of the body, somewhat in advance of the ventrals, its anterior rays elevated, their height about equal to half the base of the fin, the number of rays in the dorsal fin ranging from 25 to 32; caudal fin well forked, the lobes about equal, not falcate; anal fin comparatively long and rather low, of 8 or 9 developed rays; ventrals moderate, 10-rayed; pectorals rather short: sexual peculiarities, if any, unknown: coloration dull dark brown, nearly plain, not silvery; fins olivaceous or more or less dusky.

Air-bladder with two chambers.

Size quite large.

In general appearance, the species of *Bubalichthys* bear a considerable resemblance to those of *Carpiodes*. The form is, however, coarser than that of any *Carpiodes*, the dorsal fin is lower, and the coloration is darker and duller. The species reach a larger size than do those of *Carpiodes*, but whether larger or not than the species of *Ichthyobus* I am unable to say. In external appearance, *Bubalichthys* is intermediate between *Carpiodes* and *Ichthyobus*, the one species, *bubalus*, resembling *Carpiodes* most, the other, *urus*, being most like *Ichthyobus*.

Our knowledge of the species of this genus is very incomplete. Many species were named and indicated by Professor Agassiz, but with such fragmentary descriptions that not a single one of them is certainly known by any one. I have, however, been able to identify in specimens from Quincy, Ill., the fishes termed by him *B. bubalus* and *B. niger*, the small-mouthed and the large-mouthed Buffalo. Assuming these two well-separated species as a basis, I have compared with them numerous Buffalo-fishes from various localities, and in all cases I have found them identical with either the one or the other. I have therefore adopted the hypothesis, possible, and perhaps probable, that all of the nominal species of Professor Agassiz were based on the one or the other of these two forms. As to this, I may say that the sole basis of some of these nominal species was the difference in locality. From what we know of the range of other species of *Catostomidæ*, there is nothing antecedently improbable in the same fish being found in the Wabash and Mobile Rivers, or in the Tennessee and Osage. *Myxostoma macrolepidotum*, *Erimyzon oblongus*, *Minytrema melanops*, *Catostomus teres*, and others are known to occur in all four of those streams. The questions of locality may, I think, be safely eliminated from the discussion. The

descriptions published by Professor Agassiz are almost worthless for the distinction of species. It has accordingly seemed best to me, as a temporary arrangement, at least until *more than two* species are shown to occur in our waters, or until some one is able to show from examination of Professor Agassiz's types what he really had in mind, to distribute his nominal species in the synonymy of the two which we know. I have accordingly considered each of Agassiz's species and made it identical with either the small-mouthed or the large-mouthed species, as the description seemed to indicate. A third species, from Central America, which I suppose belongs to this genus, is added from Dr. Günther's description.

Generic Characterizations.

BUBALICHTHYS Agassiz, 1855.—"At the time I vindicated the propriety of restoring some of the genera established by Rafinesque among Cyprinoids, I did not suspect that the genus *Carpiodes*, as I then represented it, still contained two distinct types, though I had noticed that some of the species had the anterior margin of their dorsal greatly prolonged, whilst in others it hardly rises above the middle and posterior of that fin. Having since examined the pharyngeals of all the species of this tribe which I have been able to secure from different parts of the country, I find that those with a high dorsal which constitute the genus *Carpiodes*, have, in addition, very thin flat pharyngeals with extremely minute teeth, whilst those with a low dorsal have triangular pharyngeals with larger teeth, increasing gradually in size and thickness, from the upper margin of the bones towards the symphysis. The difference in form of these bones arises from the circumstance that the slight ridge upon the outer surface of the arch in *Carpiodes* is transformed in this second type into a prominent edge, dividing the outer surface of the arch into a posterior and anterior plane, meeting under an acute angle. This structural homology is satisfactorily traced by the difference of the external appearance of these two planes, the posterior one being full as the posterior half of the flat outer surface of the arch in *Carpiodes*, whilst the anterior plane is coarsely porous, indeed studded with deep pits analogous to the porous character of the anterior half of the outer surface of that bone in *Carpiodes*. The teeth themselves are compressed; their grinding edge is rather blunt, slightly raised in the middle, and provided with a little cusp along the inner margin, which is hardly detached from the crown, and does not rise above its surface, as in *Carpiodes*, *Ichthyobus* and *Cycleptus*.

"In this genus the bulk of the body is not placed so far forwards as in *Carpiodes*, the greatest height being between head and tail. The upper outline of the body is less strongly arched in advance of the dorsal; the head is longer than high, and the snout not more prominent than the mouth. The mouth opens obliquely downwards and forwards, the lower jaw being nearly as long as the upper. The lips are small and granulated. The anterior rays of the dorsal are not separately prolonged beyond the rest of the fin, though its anterior margin is higher than its middle and posterior portion. The lower fins are as in *Carpiodes*.

"The scales have many narrow radiating furrows upon the anterior field, none across the lateral fields, and few upon the posterior fields, converging to the centre of radia-

tion, to which the tubes of the lateral line extend also. For this new genus I propose the name of *Bubalichthys*, intending to recall the name of Buffalo fish, commonly applied to this species. To this genus belong the species I have described as *Carpiodes urus* from the Tennessee River, *C. taurus* from Mobile River, and *C. vitulus* from the Wabash, and also the *Catostomus niger* of Rafinesque and *Catostomus bubalus* of Dr. Kirtland from the Ohio, but not *C. bubalus* Rafinesque, which is the type of the genus *Ichthyobus* described in the following paragraph. I have another new species from the Osage River, sent me by Mr. George Stolley. This shows this type to be widely distributed in our western waters, but thus far it has not been found in the Atlantic states. I have some doubts respecting the nomenclature of these species which are rather difficult to solve. It will be seen upon reference to Rafinesque's Ichthyologia Ohiensis, p. 55 and 56, that he mentions two species of his subgenus *Ichthyobus*, one of which he calls *C. bubalus*, and the other *C. niger;* the second he has not seen himself, but describes it on the authority of Mr. Audubon as 'entirely similar to the common Buffalo fish,' his *C. bubalus*, but 'larger, weighing upwards of fifty pounds.' Dr. Kirtland, on the other hand, describes the *C. bubalus* as the largest species found in the western waters, and adds that the young is nearly elliptical in its outline and is often sold in the market as a distinct species under the name of Buffalo Perch. If there was only one species of Buffalo in those waters the case would be very simple, and the *Catostomus bubalus* and *niger* of Rafinesque, and *C. bubalus* of Dr. Kirtland, should simply be considered as synonymous, but Dr. Rauch of Burlington has sent me fine specimens of this Buffalo Perch, to which the remark of Dr. Kirtland, 'elliptical in its outline,' perfectly applies, and I find that it not only differs specifically but even generically from the broader, high backed, common Buffalo, and being the smaller species, I take it to be Rafinesque's *C. bubalus*, the type of his genus *Ichthyobus*, which is more fully characterised below, whilst the larger species, Rafinesque's *C. niger*, can be no other than Dr. Kirtland's *C. bubalus*, 'the largest species of the western waters.' It seems therefore hardly avoidable to retain the name of *C. niger* or rather *Bubalichthys niger* for the common Buffalo, though Rafinesque, who first named the fish, never saw it, or if he saw it mistook it for his own *bubalus*, and though Dr. Kirtland, who correctly describes and figures it, names it *C. bubalus*, for such is the natural result to which the history of the successive steps in our investigation of these fishes lead. But our difficulties here are not yet at an end. Among the splendid collections I received from Dr. Rauch, I found two perfectly distinct species of *Bubalichthys*, one with a large mouth, and the other with a small mouth, and one of *Ichthyobus*, living together in the Mississippi River, in the neighborhood of Burlington, Iowa; and the next question, probably never to be solved, will be, if they all three occur also in the Ohio, whether Rafinesque's *C. niger* was the big mouthed or the small mouthed *Bubalichthys*. Judging from the figure given by Dr. Kirtland in the Boston Journal of Natural History, vol. v, pl. fig. 2, I believe his *C. bubalus* to be the small mouthed species. I myself have, however, seen only one specimen of the big mouthed species from the Ohio, and that in rather an indifferent state of preservation; for which I am indebted to Prof. Baird, and none of the small mouthed species. Should, however, all three, as is possible, occur in the Ohio as well as the Mississippi, to avoid introducing new names, I will call the big mouthed species *B. niger*, preserving for it Rafinesque's specific name,—the small

mouthed, *B. bubalus*, retaining for it the name which Dr. Kirtland has given it, even though the species of *Ichthyobus* must bear the same specific name, being that originally applied by Rafinesque. It may be that either my *B. vitulus* or my *B. urus* is identical with Dr. Kirtland's *C. bubalus*, but until I can obtain original specimens of this species, this point must remain undecided, as it is impossible for mere descriptions to institute a sufficiently minute comparison. The specimens from Osage River I shall call *B. bonasus*.

"Compared with one another, these species differ as follows: *B. niger*, (the big-mouthed Buffalo) differs from *B. bubalus* (the small-mouthed Buffalo) by its larger mouth, opening more forwards; its more elongated body, the first rays of the dorsal rising immediately above the base of the ventrals, and its anterior lobe being broader, and the anal fin not emarginated; *B. bonasus* differs from *B. bubalus* and from *B. niger* in having the mouth larger than the first and smaller than the second, and from *B. bubalus* by its less emarginated dorsal, which renders its larger lobe broader, anal fin not emarginated, opercle larger. A farther comparison with the Southern species could only be satisfactory, if accompanied by accurate figures."—(AGASSIZ, *Am. Journ. Sc. Arts*, 1855, p. 192.)

SCLEROGNATHUS Günther, 1868.—"Scales of moderate or rather large size. Lateral line running along the middle of the tail. Dorsal fin much elongate, with about 30 or more rays, none of which are spinous. Anal fin short. Mouth small, inferior (*Bubalichthys*) or subterminal (*Sclerognathus*), with the lips more or less thickened. Barbels none. Gill-rakers long, stiff in the upper two-thirds of the first branchial arch, modified into low membranaceous transverse folds in the lower third. Pseudobranchiæ. Pharyngeal bones sickle-shaped, armed with a comb-like series of numerous, compressed teeth, increasing in size downwards."—(GÜNTHER, *Cat. Fishes Brit. Mus.* vii, 22, 1868.)

BUBALICHTHYS Cope & Jordan, 1877.—"Body oblong oval, compressed; dorsal elongate, elevated in front, of 20 or more rays; fontanelle present; pharyngeal bones strong, the teeth comparatively coarse and large, increasing in size downwards; mouth inferior."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 82.)

ANALYSIS OF SPECIES OF BUBALICHTHYS.

* Body considerably elevated and compressed above; the dorsal region subcarinate; belly thicker; depth 2½ to 2¾ in length; axis of body above the ventrals below the lateral line and nearly twice as far from the back as from the belly: head moderate, triangular in outline when viewed from the side, 4 in length: eye equal to snout, 4 to 5 in length of head, much larger than in *B. urus*: mouth quite small, notably smaller and more inferior than in *B. urus*: mandible about equal to eye: dorsal fin elevated in front and rapidly declined, the highest ray reaching much beyond the middle of the fin, the seventh ray about half the length of the third or longest; anal rays rapidly shortened behind, the middle rays much shorter than the first long ones: scales 8–39–6; dorsal, 29; anal, 10; ventrals, 10: coloration paler, the lower fins slightly dusky ..... BUBALUS, 50.

** Body much less elevated and less compressed than in the preceding, the back not at all carinated; axis of body above ventrals about at the lateral line, and but very little farther from the dorsal outline than from the ventral; depth 3 to 3¼ in length: head very stout, strongly transversely convex, thicker, larger, and less pointed

than in the next, about 4 in length: eye about equal to snout, 5½ in head, much smaller than in *B. bubalus:* mouth large, considerably oblique, opening well forwards: mandible longer than eye: dorsal fin lower and less rapidly depressed than in the next, the longest ray scarcely half the length of the base of the fin; anal fin rounded, its rays not rapidly shortened, the middle ones not much shorter than the longest: colors very dark; fins all black: scales 8–41–7; dorsal, 30; anal, 10 ..... URUS, 51.

*** Mouth small, inferior, slightly corrugated: depth 3⅓ to 3¾ in length; head 4 to 4½, not much longer than high: eye rather small, one-fifth of the length of the head and ⅔ that of the snout: suborbitals narrow. Anterior rays not much produced, shorter than the head; caudal forked. Origin of ventral vertically below the fourth dorsal ray. Pectoral fin not extending to ventrals. There are five longitudinal series of scales between the lateral line and the root of the ventral. Coloration uniform. Scales 7–38–7; dorsal 29; anal 10 ..... MERIDIONALIS, 52.

50. BUBALICHTHYS BUBALUS *Agassiz.*

Buffalo-fish. Small-mouthed Buffalo. High-backed Buffalo.

1838—*Catostomus bubalus* KIRTLAND, Rept. Zool. Ohio, 168. (Not of Rafinesque.)
Catostomus bubalus KIRTLAND, Boston Journ. Nat. Hist. v, 266, 1845.
Catostomus bubalus STORER, Synopsis, 424, 1846.
Bubalichthys bubalus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 195, 1855.
Bubalichthys bubalus JORDAN, Fishes of Ind., 222, 1875.
Bubalichthys bubalus JORDAN & COPELAND, Check List, 158, 1876.
Bubalichthys bubalus JORDAN, Proc. Ac. Nat. Sc. Phila. 74, 1877.
Bubalichthys bubalus JORDAN & GILBERT, in Klippart's Rept. 53, 1877.

1854—*?? Carpiodes taurus* AGASSIZ, Am. Journ. Sci. Arts, 355. (Not identifiable.)
?? Bubalichthys taurus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 193, 1855.
?? Bubalichthys taurus JORDAN & COPELAND, Check List, 158, 1876.

1854—*?? Carpiodes vitulus* AGASSIZ, Am. Journ. Sci. Arts, 356. (Not identifiable.)
?? Bubalichthys vitulus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 193, 1855.
?? Bubalichthys vitulus JORDAN & COPELAND, Check List, 158, 1876.
?? Bubalichthys vitulus JORDAN & GILBERT, in Klippart's Rept. 53, 1876.

1868—*Sclerognathus urus* GÜNTHER, Cat. Fishes Brit. Mus. vii, 22.

1876—*Ichthyobus cyanellus* NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49.
Ichthyobus cyanellus JORDAN & COPELAND, Check List, 158, 1876.
Ichthyobus cyanellus JORDAN, Proc. Ac. Nat. Sc. Phila. 73, 1877.
Ichthyobus cyanellus JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Ichthyobus cyanellus JORDAN, Man. Vert. ed. 2d, 323, 1878.

1877—*Bubalichthys altus* NELSON, MSS.
Bubalichthys altus JORDAN, Proc. Ac. Nat. Sc. Phila. 73, 1877.
Bubalichthys altus JORDAN, Man. Vert. ed. 2d, 324, 1878.

1877—*Bubalichthys bubalinus* JORDAN, Bull. U. S. Nat. Mus. ix, 50.
Bubalichthys bubalinus JORDAN, Man. Vert. ed. 2d, 325, 1878.

HABITAT.—Mississippi Valley; abundant in all the larger streams.

This is probably the most generally distributed of the various species known popularly as Buffalo-fish. The question as to its proper nomenclature is even more complicated than that of the next species. It may be that this is the true *bubalus* of Rafinesque, as supposed by Dr. Kirtland. But as that species was the type of the genus *Ictiobus*, the identification of Rafinesque's species with the present one would lead to changes in nomenclature far from desirable. The name *Ichthyobus* would then belong to *Bubalichthys* and the genus *Ichthyobus* would receive a new name. As this can never be proven, it is best to consider Agassiz's identification as correct and that of Dr. Kirtland wrong. The first mention of this species was that of Dr. Kirtland as *Catostomus bubalus*. The name *bubalus*, however, was given through an erroneous identification, and must be passed over. Next come Agassiz's names *taurus* and *vitulus*, both possibly belonging here, but just as likely belonging to *urus*. Both of them, from the exasperating insufficiency and irrelevance of the descriptions, are practically unidentifiable. Next is Agassiz's *bubalus*, noticed below. The next name in order is that of *Ichthyobus cyanellus* Nelson, which was based on this species, as I have ascertained by examination of his type. This is the first tenable name *certainly* belonging to this species, unless we adopt the name *bubalus*. Next comes Nelson's *altus*. A specimen answering Nelson's description in all respects, and as evidently belonging to the species now under consideration, is at present before me. It is a fine *adult* example. Lastly comes my own *bubalinus*, intended merely as a substitute for the name "*bubalus*", not then considered tenable as the specific name of this species, having been given to it originally by an error in identification. The adoption of the name *bubalus* by Agassiz after the knowledge of this error may, however, be considered as a proposal of a new name. The original descriptions of *taurus*, *vitulus*, *cyanellus*, and *altus* are here subjoined.

Carpiodes taurus Agassiz, Am. Journ. Sci. Arts, 1855, p. 355.—"From Mobile River, Alabama. The form of the body is intermediate between that of *C. Cyprinus* and *C. Urus*. The gill-cover has the same form as in *C. Urus*, but it is larger and more strongly arched behind. The hind margin of the scales is waving, owing to a somewhat prominent middle angle. The anterior rays of the dorsal equal in length two-thirds of that of the base of the fin. Anal not lunate behind. The ventrals do not reach to the anal opening. Caudal not so deeply furcate as in *C. Cyprinus*."

Carpiodes vitulus Agassiz, Am. Journ. Sc. Arts, 1855, p. 356.—"From the Wabash River, Indiana. This seems to be a smaller species than the preceding ones. The form of the body resembles that of *C. Taurus*, but the eyes are smaller; the opercle is more broadly rounded behind; the subopercle has its posterior and free border regularly arched above and below, and not emarginate as in *C. Taurus*. The direction of the numerous water-tubes on the head and cheeks also differ. The upper and lower border of the scales are nearly straight. The dorsal does not extend quite so far forward. I am indebted to Col. Richard Owen of New Harmony for this species."

Ichthyobus cyanellus Nelson, Bull. Ills. Mus. Nat. Hist. i, 1877, p. 49.—"Blue Buffalo. A number of specimens of this species are in the state collection, from the Illinois river, and in Prof. Jordan's collection, from the Mississippi at St. Louis. The following is the description, taken from several specimens, measuring from 8 to 9¼ inches in length:—

"Head about 3⅓ in length. Depth 2⅔ to 5–6. Eye 4⅓ to 5½ in head. Dorsal I, 30. Anal I, 8. Ventrals 10. Lat. l. 38. Longitudinal rows 7–5 to 7–6. Body compressed, high. Anteriorly broad, compressed behind. Longest ray reaching 18th ray. Pectorals shorter than ventrals, both shorter than head. Anal scarcely reaching caudal; head very short, high and thick; its thickness ¾ length, depth 1⅓ in length. Mouth quite small, oblique, and overlapped by a slightly projecting snout. Mandible short, 4 in head. Opercle becoming wrinkled with age. Head small, short and thick; muzzle obtuse, conic, not twice the length of eye. Anterior ray of dorsal, in type from Illinois river, slightly nearer snout than base of caudal. In specimens from St, Louis the dorsal is about equidistant. Color above, light steel blue in adults, becoming lighter below. Young lighter with distinct stripes along the rows of scales. Although the species is described from specimens but nine inches long, when full grown it undoubtedly reaches similar dimensions to its congeners."

Bubalichthys altus Nelson, MSS.; Proc. Acad. Nat. Sc. Phila. 1877, 74.—"This specimen is very deep and much compressed. The back is much arched and the profile descends steeply in front to end of snout, not forming an angle with it as in many species of *Ichthyobus*.

"Depth of body, 2½ in length; head, 4 in length; greatest thickness of body, 1⅔ in length of head; depth of head, 1⅓ in its length; width, 1½ in length. Eye, 5½ in head, 2½ in interorbital space, which is but little rounded.

"Lateral line perfectly straight from upper edge of opercle to caudal.

"Scales, 8–35–5. Dorsal I. 25; A. I. 9.

"Color in spirits, dull yellowish olive; fins dusky.

"Type specimen 12 inches long, in Ills. State Museum, from Cairo, Illinois."

51. BUBALICHTHYS URUS *Agassiz.*

Big-mouthed Buffalo. Black Buffalo. Mongrel Buffalo.

1818—?? *Amblodon niger* RAFINESQUE, Journal de Physique Phila. 421. (Entirely unrecognizable.)

?? *Catostomus niger* RAFINESQUE, Ichth. Oh. 56, 1820. (Unrecognizable; more likely *Cycleptus elongatus.*)

Bubalichthys niger AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 195, 1855.

Bubalichthys niger JORDAN, Fishes of Ind. 222, 1875.

Bubalichthys niger JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.

Bubalichthys niger JORDAN, Man. Vert. 298, 1876.

Bubalichthys niger NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 50, 1876.

Bubalichthys niger JORDAN & COPELAND, Check List, 158, 1876.

Bubalichthys niger JORDAN, Proc. Ac. Nat. Sc. Phila. 75, 1877.

Bubalichthys niger JORDAN & GILBERT, in Klippart's Rept. 53, 1876.

Bubalichthys niger JORDAN, Bull. U. S. Nat. Mus. ix, 34, 1877.

Bubalichthys niger JORDAN, Man. Vert. ed. 2d, 323.

1854—*Carpiodes urus* AGASSIZ, Am. Journ. Sc. Arts, 355.

Bubalichthys urus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 193, 1855.

Bubalichthys urus PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.

Bubalichthys urus JORDAN, Fishes of Ind. 222, 1875.

Bubalichthys urus JORDAN & COPELAND, Check List, 158, 1876.

1855—*Bubalichthys bonasus* AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 195.

Bubalichthys bonasus JORDAN & COPELAND, Check List, 158, 1876.

HABITAT.—Mississippi Valley, in the larger streams.

This is an abundant species in the Mississippi and its larger tributaries. It is very distinct from the preceding, almost intermediate between *Bubalichthys bubalus* and *Ichthyobus bubalus.* It may indeed be necessary to unite these two genera on account of this species.

The question of the name which should be borne by this species is a very difficult one. Inasmuch as Rafinesque's *C. niger* was known to him only through the accounts of Mr. Audubon, a gentleman known to have played several practical jokes on the too credulous naturalist, and to have led him thereby to describe and name several impossible animals, and inasmuch as no real description whatever is given by Rafinesque, it seems to me that the name *niger* can be used only on the authority of Agassiz, and not on that of Rafinesque. That being the case, the name

urus of Agassiz, which unquestionably belongs to this species, has a year's priority over *niger*, and is really the first tenable name applied to any species of *Bubalichthys*. The original account given by Rafinesque of his *Catostomus niger* and that by Professor Agassiz of his *Bubalichthys urus* I here append. Agassiz's descriptions of *B. niger* and *B. bonasus* have been previously given under the head of the genus.

Catostomus (*Ictiobus*) *niger* Raf. Ich. Oh. p. 56.—"Entirely black; lateral line straight; I have not seen this fish. Mr. Audubon describes it as a peculiar species found in the Mississippi and the lower part of the Ohio, being entirely similar to the common Buffalo fish, but larger, weighing upwards of fifty pounds, and living in separate schools."

Carpiodes urus Agassiz, Am. Journ. Sci. Arts, 1854, p. 355.—"From the Tennessee River. It grows very large, weighing occasionally from 30 to 40 pounds. The body in this species is not so high as in *C. cyprinus*, nor is it so compressed above; the scales are also not so high, but more angular behind, and the anterior portion of the dorsal is not so elongated. The gill-cover is larger, and the distance from the hind border of the eye to the inferior angle of the subopercle near the base of the pectorals and the distance from the same point to the superior and posterior angle of the opercle, are nearly equal. In *C. cyprinus* the distances differ by nearly one third. The subopercle is not triangular, but its hind border is nearly regularly arched from the upper angle to the posterior angle of the interopercle. The anal has its posterior margin full and not lunate; the caudal is not so deeply furcate as in *C. cyprinus*. The ventrals do not reach the anal. All fins are of a dark color. I am indebted to Dr. Newman for this species."

I found no specimens of *Bubalichthys urus* in the collections of the United States National Museum.

52. BUBALICHTHYS MERIDIONALIS (*Günther*) *Jordan*.

Central American Buffalo.

1868—*Sclerognathus meridionalis* GÜNTHER, Trans. Zool. Soc. p. —.

Sclerognathus meridionalis GÜNTHER, Cat. Fishes Brit. Mus. vii, 23, 1868.

HABITAT.—Rio Usumacinta, Guatemala.

I know nothing of this species except from Günther's description. From its remote locality, it is probably distinct, but the description shows no especial difference from *B. bubalus*, unless it be that the body is slenderer. The following is Dr. Günther's account:—

"D. 29–30. A. 10; lat. l. 38, l. transv. $7\frac{1}{2}$–$7\frac{1}{2}$. Mouth small, inferior,

slightly corrugated. The height of the body is contained thrice and one third or thrice and one fourth in the total length (without caudal), the length of the head four times or four times and a half; head not much longer than high. Eye rather small, one fifth of the length of the head and two thirds of that of the snout; suborbitals narrow. The anterior dorsal rays are not much produced, being shorter than the head. Caudal fin forked. The origin of the ventral fin is vertically below the fourth dorsal ray. Pectoral fin not extending to the ventral. There are five longitudinal series of scales between the lateral line and the root of the ventral. Coloration uniform. Pharyngeal teeth very numerous and small, increasing somewhat in size downwards.

"Rio Usumacinta (Guatemala)."

Genus ICHTHYOBUS *Rafinesque.*

Amblodon RAFINESQUE, Journal de Physique, de Chymie et d'Histoire Naturelle, Paris, 421, 1819. (Part.)

Icliobus RAFINESQUE, Ich. Oh. 1820, p. 55. (As subgenus of *Catostomus.*)

Ichthyobus AGASSIZ, Am. Journ. Sci. Arts, 1855, p. 195.

Type, *Amblodon bubalus* Rafinesque.

Etymology, *ἰχθύς*, fish; *βοῦς*, bull or buffalo; *i. e.*, buffalo-fish.

Head very large and strong, wide and deep, its length $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of the body, its upper surface broad and depressed; eye moderate, wholly anterior in position, the middle of the head being entirely behind it; suborbital bones proportionately narrow; fontanelle large, well open; opercular apparatus largely developed, the subopercuium broad, the operculum broad, strongly furrowed.

Mouth very large for a Sucker, terminal, protractile forwards, the middle of the premaxillaries rather above the line of the middle of the eye, the posterior edge of the maxillary extending about to the line of the nostrils; mandible very strong, oblique, placed at an angle of 45 degrees or more when the mouth is closed, its posterior end extending to beyond opposite the front of the eye, its length a little less than one-third that of the head. Lips very little developed, the upper narrow and smooth, scarcely appreciable, the lower narrow, rather full on the sides, but reduced to a narrow rim in front, entirely destitute both of papillæ and plicæ; jaws without cartilaginous sheath; muciferous system of head well developed; isthmus narrow; pharyngeal bones in form intermediate between those of *Carpiodes* and those of *Bubalichthys*, the outer surface of the arch standing outwards, and presenting a porous

outer margin. The peduncle of the symphysis is much longer proportionally, and more pointed than in *Carpiodes* and *Bubalichthys*. The teeth are very numerous, small, thin and compressed in *Carpiodes*, but the lower ones are gradually larger than the upper ones. Their inner edge is slanting outwards, and not uniformly arched as in *Bubalichthys*, or truncate as in *Cycleptus*, the innermost margin rising somewhat in the shape of a projecting cusp. Gill-rakers of anterior arch long and slender above, becoming shorter downwards.

Body heavy, robust, not especially arched above nor greatly compressed, the form somewhat elliptical, the depth $2\frac{1}{2}$ to $3\frac{1}{2}$ in the length of the body.

Scales large, thick, nearly equal over the body, their posterior edges somewhat serrate, the lateral line well developed, but not as distinct as in *Carpiodes*, slightly decurved anteriorly, the number of scales in its course 36 to 42; 13 to 15 in a transverse series from dorsal to ventrals.

Dorsal fin with an elongate basis, its number of rays 25 to 30, the anterior rays somewhat elevated, their length about half that of the base of the fin; caudal not much forked; anal fin not much elevated, its rays about 9 in number; pectorals and ventrals moderate, the latter with about 10 rays.

Sexual peculiarities, if any, unknown. Coloration dark, not silvery, above dusky olive; lower fins more or less black.

Air-bladder with two chambers.

Size very large.

The claim of this group to generic rank has been questioned by Professor Cope and others. The differences in the pharyngeal teeth are perhaps hardly sufficient to distinguish it from *Carpiodes*, but at present I am inclined to think that the great development of the mandible, which forms a large and terminal mouth, amply sufficient for generic distinction. The relations of the group to *Bubalichthys* are doubtless, in reality, closer. *Ichthyobus* bears much the same relation to *Bubalichthys* that *Chasmistes* does to *Catostomus*, and, so far as the mouth is concerned, but in a greater degree, that *Erimyzon* bears to *Minytrema* and *Placopharynx* to *Myxostoma*. The head of *Ichthyobus* is much larger and stouter, and the whole body more robust and less compressed than in *Carpiodes*. I know from autopsy but a single species of *Ichthyobus*. It has, however, been described under several different names. So far as is known, the genus is confined to the valley of the Mississippi, no species having been recorded from the Great Lakes, or from any streams

east of the Alleghanies. No members of the suborders *Cycleptinæ* and *Bubalichthyinæ* are known from the United States west of the basin of the Rio Grande.

The typical species was first described under the name of *Amblodon*. The genus *Amblodon* of Rafinesque, 1819, is based on the same species as his *Ictiobus* of 1820. The name *Amblodon*, however, was given in allusion to the pharyngeal teeth of *Haploidonotus grunniens*, popularly supposed to be the teeth of the Buffalo-fish, the presence of which teeth was supposed to distinguish *Amblodon* from *Catostomus*. This error was afterwards discovered by Rafinesque, and the name *Amblodon* transferred to the Sciænoid fish. As *Amblodon* of Rafinesque included the present genera *Haploidonotus* and *Ichthyobus*, erroneously confounded, and as on the discovery of this error its author restricted the name to *Haploidonotus*, I think that we are justified in retaining *Ichthyobus* instead of *Amblodon* for the genus of Catostomoids.

Generic Characterizations.

Amblodon Rafinesque, 1819.—"16. Amblodon. (*Abdominal.*) Différent du genre *Catostomus*. Machoire inférieure pavée de dents osseuses serrées arrondies, à couronne plate, inégales.—Les poissons de ce genre, qui abondent dans l'Ohio, le Missouri et le Mississippi, sont distinguées par le nom vulgaire de Buffaloe-Fish (Poisson bouffle) et les François de la Louisiane les nomment Picoueau. Il y en a plusieurs espèces qui parviennent souvent à une très grosse taille. Les deux suivants habitent dans l'Ohio. 1. *A. bubalus*. Brun olivâtre pâle dessous, joues blanchâtres. D. 28, A. 12, P. 16, A. 9, C. 24. L'*A. niger* est entièrement noir; tous deux ont la ligne latérale droite, queue bilobée, tête tronquée, etc. Ils sont très-bons à manger."—(Rafinesque, *Journal de Physique, etc.* p. 421.)

Ictiobus Rafinesque, 1820.—"Body nearly cylindrical. Dorsal fin elongated, abdominal fins with nine rays, tail bilobed, commonly equal."—(Rafinesque, *Ichthyologia Ohiensis*, p. 55.)

Ichthyobus Agassiz, 1855.—"In the form and position of the fins, as well as in the general outline of the body, this genus is very nearly related to *Bubalichthys*, but in the structure of the parts of the head, it is quite dissimilar. The mouth opens directly forwards, and is large and round. The lips are small, smooth and thin; the upper one is not thicker than the intermaxillary itself, and tapers to a narrow edge. At the symphysis of the lower jaw, which is larger than in any other genus of this group, the lower lip is hardly more than a thin membrane connecting its small lateral lobes.

"The eye is small, and the opercular pieces very large.

"The scales have many narrow radiating furrows upon the anterior field; none across the lateral fields, few upon the margin of the posterior field and these not extending to the centre of radiation. Tubes of the lateral line straight and simple, arising nearly in the middle of the posterior field.

"Pharyngeal bones are neither flat as in *Carpiodes* nor triangular as in *Bubalichthys*,

but present an intermediate form; the outer surface of the arch standing outwards and presenting a porous outer margin. The peduncle of the symphysis is much longer proportionally and more pointed than in *Carpiodes* and *Bubalichthys*. The teeth are very numerous, small, thin and compressed as in *Carpiodes*, but the lower ones are gradually larger than the upper ones. Their inner edge is slanting outwards, and not uniformly arched as in *Bubalichthys* or truncate as in *Cycleptus*, the innermost margin rising somewhat in the shape of a projecting cusp."—(AGASSIZ, *Am. Journ. Sc. Arts*, 1855, p. 196.)

ICHTHYOBUS Cope & Jordan, 1877.—"Body oblong oval, compressed; dorsal elevated in front, of 20 or more rays; fontanelle present; pharyngeal bones narrow, with the teeth relatively thin and weak; mouth large, subterminal, protractile forwards."—(JORDAN, *Proc. Ac. Nat. Sc. Phila.* 1877, p. 82.)

ANALYSIS OF SPECIES OF ICHTHYOBUS.

* Body robust, moderately compressed, the outline somewhat elliptical, but the back rather more curved than the belly; depth 2½ to 3½ in length: head very large and thick, 3½ in length of body: opercular apparatus very strong, the operculum itself forming nearly half the length of the head: scales very large: developed rays of the dorsal 27 to 29; anal rays 9; ventrals 10: scales 7-37 to 41-6: coloration dull brownish-olive, not silvery; fins dusky: size very large, reaches a length of nearly three feet and a weight of 20 to 30 pounds ..... BUBALUS, 53.

53. ICHTHYOBUS BUBALUS (*Rafinesque*) *Agassiz.*

Red-mouth Buffalo Fish. Large-mouthed Buffalo.

1818—*Amblodon bubalus* RAFINESQUE, Journal de Physique, 421.
Catostomus bubalus RAFINESQUE, Am. Month. Mag. and Crit. Rev. 354, 1818.
Catostomus bubalus RAFINESQUE, Ich. Oh. 55, 1820.
Ichthyobus bubalus AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 196, 1855.
Ichthyobus bubalus JORDAN, Fishes of Ind. 222, 1875.
Ichthyobus bubalus JORDAN, Bull. Buffalo Soc. Nat. Hist. 95, 1876.
Ichthyobus bubalus JORDAN, Man. Vert. 298, 1876.
Ichthyobus bubalus NELSON, Bull. No. 1, Ills. Mus. Nat. Hist. 49, 1876.
Ichthyobus bubalus JORDAN & COPELAND, Check List, 158, 1876.
Ichthyobus bubalus JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Ichthyobus bubalus JORDAN, Proc. Ac. Nat. Sc. Phila. 72, 1877.
Ichthyobus bubalus JORDAN, Bull. U. S. Nat. Mus. ix, 34, 1877.
Ichthyobus bubalus JORDAN, Man. Vert. ed. 2d, 322.

1844—*Sclerognathus cyprinella* CUVIER & VALENCIENNES, Hist. Nat. des Poissons, xvii, 477, pl. 518.
Sclerognathus cyprinella STORER, Synopsis, 428, 1846.
Ichthyobus cyprinella AGASSIZ, Am. Journ. Sci. Arts, 196, 1855.
Sclerognathus cyprinella GÜNTHER, Cat. Fishes, Brit. Mus. vii, 24, 1868.
Ichthyobus cyprinella JORDAN, Man. Vert. 298, 1876.
Ichthyobus cyprinella JORDAN & COPELAND, Check List, 158, 1876.

1855—*Ichthyobus rauchii* AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 196.

Ichthyobus rauchii PUTNAM, Bull. Mus. Comp. Zool. 10, 1863.
Ichthyobus rauchii JORDAN & COPELAND, Check List, 158, 1876.
Ichthyobus rauchii JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Ichthyobus rauchii JORDAN, Man. Vert. ed. 2d, 323, 1878.

1855—*Ichthyobus stolleyi* AGASSIZ, Am. Journ. Sc. Arts, 2d series, xix, 196.
Ichthyobus stolleyi JORDAN & COPELAND, Check List, 158, 1876.

1877—*Ichthyobus ischyrus* NELSON, MSS.—JORDAN, Proc. Ac. Nat. Sc. Phila. 72.
Ichthyobus ischyrus JORDAN & COPELAND, Check List, 158, 1876.
Ichthyobus ischyrus JORDAN & GILBERT, in Klippart's Rept. 53, 1876.
Ichthyobus ischyrus JORDAN, Man. Vert. ed. 2d, 323, 1878.

HABITAT.—Mississippi Valley; generally abundant in the larger streams.

An examination of a large series of wide-mouthed Buffalo fishes from the Ohio, Wabash, Illinois, and Mississippi Rivers has convinced me, contrary to my previous impressions, that all belong to a single species. It is not absolutely certain what Rafinesque's *Catostomus bubalus* was. It is perhaps as likely to have been a species of *Bubalichthys*, as supposed by Dr. Kirtland, as an *Ichthyobus*. I however follow Professor Agassiz in identifying it with the present species, which is, at the Falls of the Ohio, where Rafinesque's collections were made, probably the most abundant of the Buffalo-fishes. Neither Rafinesque nor Professor Agassiz has, however, recognizably described the species. In my Manual of Vertebrates, in 1876, I gave a short account of *Ichthyobus bubalus*, drawn from two large specimens taken in Wabash River at Lafayette. Besides these, I have numerous smaller specimens, obtained in the Mississippi at Saint Louis. As these differed in the greater compression of the body and higher fins, I have identified them as belonging to *Ichthyobus rauchii* Agassiz, an identification which I still think correct. In 1877, Mr. Nelson described an *Ichthyobus ischyrus*, from Mackinaw Creek, a tributary of the Illinois River, near Peoria. His typical specimen was very stout and deep, and at the time I thought with him that it was probably distinct from *I. bubalus*. Lately I have been enabled to re-examine the type of *I. ischyrus* in the State Museum of Illinois, and to compare it with a numerous series from the same locality. I found it possible to establish an unbroken series among them, connecting the nominal species which I had termed *bubalus*, *rauchii*, and *ischyrus*, the differences separating them being, in my opinion, due either to differences of age or to individual peculiarities. As no description of any importance has been published of *I. stolleyi*, I include it as a synonym of *I. bubalus*. I know nothing whatever concerning it. *Ichthyobus cyanellus* Nelson, as below stated, is a species of

Bubalichthys. The description of *Sclerognathus cyprinella* Valenciennes refers principally to the generic features of these fishes. It agrees fully with *I. bubalus*, except in the number of scales above the lateral line, a difference doubtless due to a difference in the place or the manner of making the count. As no specific characters are known, and as the *Ichthyobus bubalus* doubtless abounds in the Lower as in the Upper Mississippi, I refer *I. cyprinella* to the synonymy of *I. bubalus*, the original type having probably been a young specimen of that species. This species is perhaps the largest of the *Catostomidæ*, reaching a weight of 20 to 30 pounds and a length of more than two feet. The young ("*ischyrus*") are sold in the Illinois markets under the name of Red-mouth Buffalo, the adult being called simply Buffalo. A species which I suppose to be the present one I have seen taken in immense numbers, by means of seines, in the Mississippi River at Burlington, Iowa. The flesh is good, although not first-rate. It is rather coarse, and is full of small bones.

For purposes of comparison I here add the original descriptions of *S. cyprinella*, *I. rauchii*, *I. stolleyi*, and *I. ischyrus*:—

SCLEROGNATHUS CYPRINELLA Valenciennes.—"Rien ce me semble, ne justifie mieux la séparation des sclérognathes du genre des Catostomes que l'espèce dont je vais donner ici la description. Avec une bouche, formée comme celle du *Sclerognathus cyprinus*, nous voyons l'ouverture portée au bout du museau, la lèvre inférieure plus longue que la supérieure, et par conséquent il n'y a plus de possibilité d'employer la bouche pour sucer.

"Ce poisson a le corps assez semblable au précédent [*Sclerognathus cyprinus*]; sa hauteur est trois fois et un tiers dans sa longueur totale; la longueur de la tête y est comprise quatre fois et demie; l'œil est petit, et sur le haut de la joue, le diamètre est contenu cinq fois et un tiers dans la tête, et deux diamètres et demi, donnant la mesure de l'intervalle entre les deux yeux; le dessus du crâne, couvert comme à l'ordinaire, d'une peau nue est moins convexe; les deux lignes de pores sont tracées à leur place ordinaire, et sont sinueuses, comme celles de l'espèce précédente; l'opercule est strié et bombé et est plus grand, ce qui rend le sous-opercule plus petit que dans l'autre sclérognathe. L'on sent les intermaxillaires à l'extrémité supérieure du museau, soutenant un lèvre très mince. L'inférieure est moins épaisse, et le nombre des papilles est moins faible. La dorsale a la même forme que celle de l'autre espèce; mais l'anale est plus pointue; la caudale est échancrée et large.

"D. 33. A. 12, etc.

"Les écailles sont beaucoup plus petites; j'en compte quarante et une le long des côtés; dix au dessus, et sept au dessous de la ligne latérale, qui est étroite et mince.

"La couleur est un doré verdâtre, avec les nageoires plus foncées.

"Notre individu est long de sept pouces; il vient du Lac Pontchartrain."—(VALENCIENNES, *Hist. Nat. des Poiss.* xvii, pp. 477–479.)

ICHTHYOBUS RAUCHII Agassiz.—"Dorsal much higher than in *I. bubalus*, all other fins much larger, and the scales much higher than long; from Burlington, Iowa."

ICHTHYOBUS STOLLEYI Agassiz.—"Body higher than in *Ichthyobus rauchii*, profile steeper, and hence snout blunter, opercular bones larger; fins proportionally of the same size. From Osage River, Missouri."

ICHTHYOBUS ISCHYRUS Nelson.—"This is a very stout and heavily built species: depth 2½ in length; head extremely broad between the eyes and but slightly convex; its length 3⅓ times in length of body; snout short and rounded, opercular apparatus large; depth of head 1⅓ in its length; width of head 1½; eye 6⅔ in head, 1⅔ in snout, 4 in interorbital space; caudal peduncle a little deeper than long; scales 7–37–7, nearly uniform, a little crowded anteriorly, finely punctate; fins all small; dorsal I, 27; anal I, 8, bluish olive above; yellowish below; fins blackish."

Specimens in United States National Museum.

Number.	Locality.	Collector.
20774	Illinois River at Peoria (very large; typical of *bubalus*)	S. A. Forbes.

Genus MYXOCYPRINUS *Gill.*

Myxocyprinus GILL, Johnson's Cyclopædia, p. 1574, 1878.
Carpiodes et Sclerognathus sp. BLEEKER, GÜNTHER.

Type, *Carpiodes asiaticus* Bleeker.

Etymology, *μυξαω*, to suck; *κύπρινος*, a carp.

This genus is known to me only from Dr. Bleeker's description of its typical species. Whether it differs from its relatives, *Ichthyobus*, *Bubalichthys*, etc., in any other character than the obvious one of the great increase in the number of its dorsal rays and the smaller scales, I do not know. In any event, however, its right to independent generic rank is unquestionable.

Generic Characterizations.

MYXOCYPRINUS Gill, 1878.—"*Myxocyprinus* is a name proposed for the *Carpiodes asiaticus* of Bleeker, which is distinguished by the multiradiate dorsal and anal fins (*e. g.* D. 52; A. 13)."—(GILL, *Johnson's Cyclopædia, Appendix*, p 1574.)

54. MYXOCYPRINUS ASIATICUS (*Bleeker*) *Jordan.*

1864—*Carpiodes asiaticus* BLEEKER, Nederl. Tydschr. Dierk. ii, 19.
Sclerognathus asiaticus GÜNTHER, Cat. Fishes Brit. Mus. vii, 23, 1868.

HABITAT.—China.

My only knowledge of this species is from Dr. Bleeker's original description, which I here subjoin:—

"CARPIODES ASIATICUS Blkr.—Carpiod. corpore oblongo compresso, altitudine 2½ fere in ejus longitudine absque, 3½ circiter in longitudine corporis cum pinna caudali,

dorso valde elevato maxime compresso; latitudine corporis 2½ circiter in ejus altitudine; capite obtuso 5 fere in longitudine corporis absque 6 circiter in longitudine corporis cum pinna caudali; oculis in media capitis longitudine sitis, diametro 5 circiter in longitudine capitis, diametris 2⅔ circiter distantibus; linea rostro-dorsali vertice et fronte declivi rectiuscula, rostro valde convexa; naribus orbitæ approximatis, posterioribus valvula claudendis; rostro obtuso truncatiusculo valde carnoso ante rictum prominente; labiis valde carnosis papillatis, inferiore lobis parum productis; osse suborbitali anteriore sat longe ante orbitam sito, scaphæformi, duplo circiter longiore quam alto apice acuto antrorsum spectante; osse suborbitali 2° oblique tetragono æque alto circiter ac longo; ossibus suborbitalibus ceteris gracilibus oculi diametro quadruplo circiter humilioribus; operculo duplo circiter altiore quam lato marginibus posteriore et inferiore convexo; osse scapulari valde brevi et obtuso; ossibus pharyngealibus compressis sat validis altioribus quam latis, dentibus 30 ad 50 compressis corona vulgo unituberculatis; squamis dimidio libero et dimidio basali subradiatim striatis, 50 in linea laterali, 24 in serie transversali absque ventralibus infimis quarum 12 lineam lateralem inter et initium pinnæ dorsalis; squamæ linea laterali postice medio emarginatis; linea lateralis singulis squamis tubulo simplice marginem squamarum liberum attingente notata; pinnis dorsali et anali basis vagina squamosa inclusa, dorsali basi non multo plus que 2 in longitudine totius corporis, longe ante pinnas ventrales incipiente, antice valde elevata corpore vix humiliore, acuta, valde emarginata, medio et postice corpore quadruplo circiter humiliore radio postico radio anali postico subopposito; pinnis pectoralibus rotundales capite longioribus, ventrales non attingentibus; ventralibus acute rotundatis pectoralibus non multo brevioribus, analem non attingentibus; anali corpore minus duplo humiliore, duplo altiore quam basi longa, acutiuscule rotundata non emarginata; caudali profunde emarginata lobis acutis 4⅔ cerciter in longitudiné corporis; colore corpore fuscescente-olivaceo, pinnis fusco vel fusco-violaceo.

"B. 3. D. 4–49. P. 1–17. V. 2–11. A. 3–11 vel 4–10. C. 1–16–1 et lat. brev.

"Hab. China.

"Longitudo speciminis descripti 508'''.

"Rem. La présence de Catostomini dans les eaux de l'Asie orientale est un fait assez curieux. Tilesius déjà en avait fait connaître un représentant, vivant dans le Covyma, dans le Léna, l'Indigirca et le Dogdo, espèce qu'il nomma Cyprinus rostratus, que M. Valenciennes rebaptisa Catostomus Tilesii et qui paraît être un Acomus. Mais cette espèce était jusqu'ici la seule du groupe qu'on savait habiter l'Asie. L'espèce actuelle prouve l'existence dans les fleuves de l'Asie orientale d'une seconde espèce du groupe et elle appartient manifestement au genre dont la Carpiodes cyprinus est le type. Mais elle est remarquable parmi tous les poissons de la division des Ichthyobi (Carpiodes Raf., Cycleptus Raf., Ichthyobus Raf., et Bubalichthys Ag.) par son dos très-élevé et anguleux et par sa très-longue dorsale à plus de 50 rayons. C'est un espèce éminemment distincte qu'on ne pourrait confondre avec aucune des espèces américaines."—(BLEEKER, *Notices sur Quelques Genres et Espèces des Cyprinoïdes de Chine, <Nederlandsch Tijdschrift voor de Dierkunde*, 1864, ii, pp. 19–21.)

ADDENDA.

23. CHASMISTES LIORUS *Jordan, sp. nov.*

Big-mouthed Sucker of Utah Lake.

1878—*Chasmistes fecundus* JORDAN, Bull. Hayden's Geol. Surv. Terr. iv, No. 2, 417. (Not *Catostomus fecundus* Cope & Yarrow.)

Chasmistes fecundus JORDAN, p. 150 of the present work.

Since pages 149–151 of the present work were in press, I have carefully recompared Cope and Yarrow's description and figure of their *Catostomus fecundus*, and my notes on their typical specimens, with the specimens on which the genus *Chasmistes* was based, and I have come to the conclusion, hinted at in the text, that the *Chasmistes* is a species distinct from *C. fecundus*, and thus far undescribed. The specific name *liorus* (λεῖος, smooth; ὄρος, border) is therefore proposed for it, in allusion to the smooth lips.

28 (*b*). CATOSTOMUS FECUNDUS *Cope & Yarrow.*

Sucker of Utah Lake.

1876—*Catostomus fecundus* COPE & YARROW, Zool. Lieut. Wheeler's Expl. W. 100th Mer. 678, plate xxxii, figs. 1, 1 *a*.

Catostomus fecundus JORDAN & COPELAND, Check List, 156, 1876. (Name only. Not *Catostomus fecundus* Jordan, Bull. U. S. Nat. Mus. xi; nor *Chasmistes fecundus* Jordan, Bull. Hayden's Geol. Surv. Terr. iv, No. 2, 417.)

HABITAT.—Utah Lake.

As stated above, I at first identified *Chasmistes liorus* from Utah Lake with this species from the same waters, the two being very similar as to scales and fins, and the form of the mouth and snout in the figure of *C. fecundus* suggesting, though not resembling, the form of those parts in *Chasmistes*. The finding of one of the typical specimens of *Catostomus fecundus* in the National Museum has shown me that it is a true *Catostomus*, and not a *Chasmistes*. I did not ascertain the lip characters of the species while at the Museum, the mouth-parts being in poor condition, and I therefore am not now able to place it in the ana-

lytical key to the species of the genus. If the upper lip is narrow, with few rows of tubercles, it will not be easy to separate *fecundus* from *teres*. If the lip is broad, with many series of tubercles, it will be approximated to *C. occidentalis*, differing, however, in the larger scales (about 60 in the lateral line, instead of 72). I therefore quote the original description, and leave the relations of the species to be finally settled at some future time:—

"It is a true *Catostomus* having the parietal fontanelle well marked and widely open. The head enters in entire length 5 times, the diameter of the orbit 6 times in greatest length of side of head. The insertion of the dorsal fin anteriorly is nearer to the end of the muzzle than insertion of caudal; the ventrals originating below middle of dorsal. The width of the dorsal to ventral enters the entire length to insertion of caudal 6 times.

"Radii: D. 12–13. A. 1–8. P. 7. V. 11. Scales are in 20 longitudinal rows from the insertion of the first dorsal to pectoral, and in 60 transverse rows from branchiæ to insertion of caudal: they are elongate and octagonal, smaller on dorsal region, and larger on ventral. Body elongated, subfusiform. It differs from *C.* (*Acomus*) *generosus*, Gir., in many particulars, as may be seen from the following comparisons.

"Girard's species has no fontanelle; is shorter and narrower; the diameter of orbit enters greatest length of side of head 5 times instead of 6. The anterior insertion of dorsal fin is equidistant between the end of the snout and the insertion of the caudal, while in *C. fecundus*, it is nearer the end of the snout than insertion of caudal. The ventrals in *C. generosus* originate under the posterior third of the dorsal; in *C. fecundus* under the middle third of the dorsal. The radii in *C. generosus* are: D. 10, A 2, 7, P. 16, V. 10, C. 27; in *C. fecundus:* D. 12–13, A. 1, 8, P. 17, V. 11.

"This species is abundant in Utah Lake, and is called 'Sucker' by the settlers. They run well up the rivers to spawn in June; feed on the bottom and *eat spawn* of better fish; spawning beds on gravel; bite at hook sometimes; are extremely numerous, and are considered a nuisance by the fishermen, but they meet with a ready sale in winter, at an average price of 2½ cents a pound."—(COPE & YARROW, *l. c.*)

Specimens in United States National Museum.

Number.	Locality.	Collector.
12894	Utah Lake	Yarrow & Henshaw.
—	do	Do.

BIBLIOGRAPHY.

The following list comprises all the works known to the writer in which new species or genera of *Catostomidæ* are indicated, or in which original descriptions are given of genera or species previously known. In general, I have endeavored to include all papers in which anything of importance was added to or *subtracted from* the sum of our knowledge of these fishes :—

FORSTER (John Reinhold). [Description of *Cyprinus catostomus* Forster.] <Philosophical Transactions, vol. 63, London, 1773.

LACÉPÈDE (Bernard Germain Étienne de la Ville-sur-Illon, *Comte de*). Histoire Naturelle des Poissons par le Citoyen La Cépède, membre de l'Institut national, et Professeur du Muséum de histoire naturelle. Tome premier à cinquième. À Paris, chez Plassan, imprimeur libraire, Rue du Cimetière André-des-Arcs. No. 10. L'an VI de la République, — 1798 [— L'an XI de la République, i. e. 1803].

[Descriptions of Le Cyprin catostome, *Cyprinus catostomus* Forster, Le Cyprin commersonien, and Le Cyprin sucet, *Cyprinus suecta* Lacépède.]

BLOCH (Mark Elieser) *and* **SCHNEIDER** (Johann Gottlob). M. E. Blochii Doctoris Medicinæ Berolinensis, et societatibus literariis multis adscripti, Systema Ichthyologiæ iconibus CX illustratum.—Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit Jo. Gottlob Schneider, Saxo.-Berolini, sumtibus Auctoris impressum et bibliopolio Sanderiano commissum, 1801.

[Description of *Cyprinus catostomus* Forster.]

TILESIUS (—). "Piscium Camtschaticorum descriptiones et icones. <Mém. Ac. Sc. St. Pétersb. I and III, 1810–1811."

[Description and figure of *Cyprinus rostratus*, sp. nov., from Eastern Siberia.]

PALLAS (Petro). Zoographia Rosso Asiatica sistens Omnium Animalium in extenso Imperio Rossico et adjacentibus maribus observatorum, recensionem, domicilia, mores et descriptiones, anatomen atque icones | lucrimorem auctore Petro Pallas, Eq. Aur. Academico Petropolitano. Volumen tertium. Petropoli, in officina Caes. Academiae Scientiarum Impress. MDCCCXI. Edit. MDCCCXXXI.

[Description of *Cyprinus rostratus* quoted from Tilesius.]

MITCHILL (Samuel Latham). The Fishes of New York Described and Arranged. <Transactions of the Literary and Philosophical Society, New York, 1814.

[*Cyprinus teres* and *Cyprinus oblongus*, sp. nov.]

LE SUEUR (Charles A.) A new genus of Fishes, of the Order Abdominales, proposed, under the name of *Catostomus;* and the characters of this genus, with those of its species, indicated. By C. A. Le Sueur. Read September 16, 1817. <Journal of the Academy of Natural Sciences of Philadelphia, vol. i, 1817, pp. 88–96 and 102–111.

[Describes *Catostomus*, gen. nov., and the following new species, most of which are figured:—*C. cyprinus, C. gibbosus, C. tuberculatus, C. macrolepidotus, C. aureolus, C. communis, C. longirostrum, C. nigricans, C. maculosus, C. elongatus, C. vittatus, C. duquesnii, C. bostoniensis*, and *C. hudsonius. C. teres* (Mitch.), *C. oblongus* (Mitch.), and *C. suectta* (Lac.) are also described. This paper is an excellent one, and compares favorably with most that has since been written on this group.]

RAFINESQUE (**Constantine Samuel**). Discoveries in Natural History made during a Journey through the Western Region of the United States by Constantine Samuel Rafinesque Esq. Addressed to Samuel L. Mitchill, President, and other members of the Lyceum of Natural History in a letter dated at Louisville, Falls of the Ohio, 20th July 1818. <American Monthly Magazine and Critical Review, New York, September, 1818.

[Description of *Catostomus bubalus* and *Catostomus erythrurus*, sp. nov., and notice of the discovery of the "Carp" "*Catostomus macropterus*" and the "Sucker" *Catostomus duquesnei*.]

——— Description of three new genera of fluviatile Fish, *Pomoxis*, *Sarchirus* and *Exoglossum*. By C. S. Rafinesque. Read December 1st & 8th. <Journal of the Academy of Natural Sciences of Philadelphia, i, 1818, pp. 417–422.

[Description of *Exoglossum* (*Hypentelium*) *macropterum*; subgenus and species new.]

——— Prodrome de 70 nouveaux Genres d'Animaux découverts dans l'intérieur des États-Unis d'Amérique durant l'année 1818. <Journal de Chymie, de Physique et d'Histoire Naturelle, Paris, June, 1819.

[Description of *Amblodon*, gen. nov., based on the pharyngeals of *Haploidonotus grunniens*, erroneously ascribed to a Buffalo-fish, with the species *A. bubalus* and *A. niger*, sp. nov., and of *Cycleptus nigrescens*, gen. et sp. nov.]

LACÉPÈDE (**Bernard Germain Étienne**). Histoire Naturelle des Poissons, par M. le Comte Lacépède, suite et complément des Œuvres de Buffon. Tome cinquième, avec vingt-trois nouvelles planches en taille-douce. Paris, Rapet, Rue Saint-André-des-Arcs, No. 10, Éditeur du Temple de la Gloire ou les Fastes Militaires de la France, ouvrage in-folio, avec figures, 1819.

[A reprint of Lacépède's work.]

RAFINESQUE (**Constantine Samuel**). Ichthyologia Ohiensis or Natural History of the Fishes Inhabiting the River Ohio and its tributary streams. Preceded by a physical description of the Ohio and its branches by C. S. Rafinesque, Professor of Botany and Natural History in Transylvania University, Author of the Analysis of Nature &c. &c., member of the Literary and Philosophical Society of New York, the Historical Society of New York, the Lyceum of Natural History of New York, the Academy of Sciences of Philadelphia, the American Antiquarian Society, the Royal Institute of Natural Sciences of Naples, the Italian Society of Arts & Sciences, the Medical Societies of Lexington and Cincinnati &c., &c. The art of seeing well, or of distinguishing with accuracy the objects which we perceive is a high faculty of the mind, unfolded in few individuals, and despised by those who can neither acquire it, nor appreciate its results. Lexington, Kentucky, printed for the Author by W. G. Hunt, (price one dollar),—1820. (1 vol. 8vo. 90 pp.)

[Originally printed in the Western Review and Miscellaneous Magazine, Lexington, Kentucky, 1819–20. It contains descriptions of the genera and species of *Catostomi* found in the Ohio River, they being referred to three genera, *Catostomus*, *Cycleptus*, and *Hypentelium*, the genus *Catostomus* being divided into five new subgenera, *Moxostoma*, *Ictiobus*, *Carpiodes*, *Teretulus*, *Eurystomus*, and *Decactylus*.

The following is the arrangement of the species described:—

Genus CATOSTOMUS.
- Subgenus *Moxostoma*.
  - anisurus, sp. nov.
  - anisopterus, sp. nov.
- Subgenus *Ictiobus*.
  - bubalus.
  - niger.
- Subgenus *Carpiodes*.
  - carpio, sp. nov.
  - velifer, sp. nov.
  - xanthopus, sp. nov.
- Subgenus *Teretulus*.
  - melanops, sp. nov.
  - melanotus, sp. nov.
  - fasciolaris, sp. nov.
  - erythrurus.
  - flexuosus, sp. nov.
- Subgenus *Eurystomus*.
  - megastomus, sp. nov.
- Subgenus *Decactylus*.
  - duquesni.

Genus CYCLEPTUS.
- nigrescens.

Genus HYPENTELIUM.
- macropterum.]

RICHARDSON (John). [Franklin's Journal.] 1823.

[Descriptions of *Catostomus forsterianus*, sp. nov., and *Catostomus le sueurii*, sp. nov., and notes on some other species.]

——— Fauna-Boreali-Americana; or the Zoölogy of the Northern Parts of British America, containing descriptions of the objects of Natural History collected on the late Northern Land Expeditions under command of Captain John Franklin, R. N. Part third. The Fish. By John Richardson M. D. F. R. S. F. L. S. member of the Geographical Society of London, and the Wernerian Natural History Society of Edinburgh; Honorary Member of the Natural History Society of Montreal, and Literary and Philosophical Society of Quebec, Foreign Member of the Geographical Society of Paris; and Corresponding Member of the Academy of Natural Sciences of Philadelphia; Surgeon and Naturalist to the Expeditions.—Illustrated by numerous plates.—Published under the authority of the Right Honorable the Secretary of State for Colonial Affairs. London: Richard Bentley, New Burlington St. MDCCCXXXVI.

[Contains notices or descriptions of *Catostomus hudsonius*, *C. forsterianus*, *C. aureolus*, *C. nigricans*, and *C. sueuri*.]

KIRTLAND (Jared Potter). Report on the Zoology of Ohio, by Prof. J. P. Kirtland, M. D. <Second Annual Report on the Geological Survey of the State of Ohio, by W. W. Mather, Principal Geologist, and the several assistants. Columbus: Samuel Medary, Printer to the State. 1838.

[Catalogue of Fishes, pp. 168–170. Notes on species mentioned, pp. 190–197. Nine species referred to *Catostomus* are included, as follows:—*velifer* Raf., *aureolus* Le S., *elongatus* Le S., *Duquesnii* Le S., *erythrurus* Raf., *bubalus* Raf., *gracilis* Kirt., *melanopsis* Raf., *nigrans* Le S., and *Hypentelium macropterum* Raf. "*C. gracilis* Kirt. [sp. nov.] is briefly characterized as distinguished by the minuteness of the scales on the anterior part of the body, and as the scales approach the caudal fin they increase to a medium size" (*l. c.* p. 193).]

STORER (David Humphreys). A Report on the Fishes of Massachusetts. By D. Humphreys Storer, M. D. <Boston Journal of Natural History, vol. ii, 1839, pp. 289–558.

[Descriptions of *Catostomus gibbosus*, *C. tuberculatus*, *C. nigricans*, and *C. bostoniensis*.]

KIRTLAND (Jared Potter). Description of the Fishes of the Ohio River and its Tributaries. By Jared P. Kirtland, Professor of the Theory and Practice of Medicine in the Medical College of Ohio, at Cincinnati. <Boston Journal of Natural History, vols. iii–v, 1840–1844.

[Describes and figures *Catostomus aureolus*, *C. communis*, *C. bubalus*, *C. elongatus*, *C. duquesni*, *C. anisurus*, *C. melanops*, *C. nigricans*, and *Selerognathus cyprinus*.]

——— [Papers on the Fishes of Ohio—in Family Visitor and in Annals of Science. Cleveland, 1840–1846.]

[Descriptions of the species found in the vicinity of Cleveland, with figures, most of them from the same plates as in his "Fishes of the Ohio". *Catostomus gracilis*, sp. nov., also *Catostomus gibbosus*, not described in the previous paper, here described and figured.]

THOMPSON (Zadock). Fishes of Vermont. =Chapter V, (pp. 127–151). <Natural History of Vermont, in History of Vermont, Natural, Civil, & Statistical, by Rev. Zadock Thompson, Burlington, Vermont, 1842.

[Descriptions of *Catostomus cyprinus*, *C. oblongus* (= *M. macrolepidotum*), *C. teres*, *C. nigricans* (= *C. teres*), and *C. longirostrum*.]

CUVIER (Georges Chrétien Léopold Dagobert) *and* **VALENCIENNES** (Achille). Histoire Naturelle des Poissons par M. le B.on Cuvier, Pair de France, Grand Officier de la Légion d'honneur, Conseilleur de l'État et au Conseil royal

CUVIER (G. C. L. D.) *and* **VALENCIENNES (A.)**—Continued.

de l'instruction publique, l'un des quarante de l'Académie française, Associé libre de l'Académie des Belles-Lettres, Secrétaire perpetuelle de celle des Sciences, Membre des Sociétés et Académies royales de Londres, de Berlin, de Pétersbourg, de Stockholm, de Turin, de Gœttingue, des Pays-Bas, de Munich, de Modène, etc.; et par M. A. Valenciennes, Professeur de Zoologie au Muséum d'Histoire naturelle, Membre de l'Académie royale des Sciences de Berlin, de la Société Zoologique de Londres, etc. Tome dix-septième. 1842. (*Cyprinoïdes.*)

[Descriptions of *Catostomus hudsonius, C. forsterianus, C. suceti, C. gibbosus, C. tuberculatus, C. macrolepidotus, C. aureolus, C. communis, C. longirostrum, C. nigricans, C. maculosus, C. elongatus, C. vittatus, C. duquesnii, C. bostoniensis, C. teres, C. oblongus, C. fasciatus* (sp. nov.), *C. planiceps* (sp. nov.), *C. carpio* (sp. nov.), *C. tilesii* (sp. nov.), *Sclerognathus* (gen. nov.) *cyprinus, Sclerognathus cyprinella* (sp. nov.), and *Exoglossum macroptcrum.* This volume was written after the death of Cuvier by Valenciennes.]

DEKAY (James E.) Zoology of New York, or the New York Fauna; comprising detailed descriptions of all the animals hitherto observed within the State of New York, with notices of those occasionally found near its borders, and accompanied by appropriate illustrations. By James E. Dekay. Part IV. Fishes. Albany: printed by W. & A. White & J. Visscher. 1842.

[Descriptions of *Labeo elegans* (sp. nov.), *Labeo oblongus, Labeo cyprinus, Labeo gibbosus, Labeo esopus* (sp. nov.), *Catostomus communis, Catostomus oneida* (sp. nov.), *Catostomus tuberculatus, Catostomus pallidus* (sp. nov.), *Catostomus aureolus Catostomus nigricans, Catostomus macrolepidotus,* with notices of other species. In the Appendix, the name *Labeo elongatus* is suggested as a substitute for *Labeo oblongus*, to prevent confusion with *Labeo oblongus* C. & V.]

HECKEL (Johann Jakob). Abbildungen und Beschreibungen der Fische Syriens nebst einer neuen Classification and Characteristik sämmtlicher Gattungen der Cyprinen von Johann Jakob Heckel, Inspector am K. K. Hof-Naturalienkabinet in Wien, mehr. gelehrt. Gesellsch. Mitglied. Stuttgart, E. Schweizerbart'sche Verlagshandlung. 1843. pp. 109. (=pp. 991–1099, Russegger's Reisen.)

[Contains a classification of the *Cyprinidæ* according to their teeth; our species of *Catostomidæ* being divided between *Catostomus* and *Rhytidostomus*, gen. nov., corresponding to *Catostominæ* and *Cycleptinæ*. No allusion is made to the *Bubalichthyinæ*.]

STORER (David Humphreys). A Synopsis of the Fishes of North America, by David Humphreys Storer, M. D., A. A. S., Vice president of the Boston Society of Natural History; Member of the American Philosophical Society, Corresponding Member of the Academy of Natural Sciences of Philadelphia, etc. Cambridge: Metcalf & Company, Printers to the University. 1846. (Reprinted from Memoirs of the American Academy, ii, 1846.)

[Brief descriptions of 27 nominal species of *Catostomus*, two of *Sclerognathus*, and one referred erroneously to *Exoglossum.*]

AGASSIZ (Louis). Lake Superior: its Physical Character, Vegetation and Animals compared with those of other and similar regions, by Louis Agassiz, with a narrative of the tour by J. Elliott Cabot, and contributions by other scientific gentlemen. Elegantly illustrated. Boston: Gould, Kendall and Lincoln, 59 Washington Street. 1850.

[Descriptions of several species, with notes and remarks; *Catostomus aurora* described as a new species, and the name *C. forsterianus* used in a new sense.]

BAIRD (Spencer Fullerton) *and* **GIRARD (Charles).** Description of new species of Fishes collected by John H. Clark on the U. S. and Mexican Boundary Survey under Lt. Col. Jas. D. Graham. By Spencer F. Baird and Charles Girard. August 30, 1853. <Proceedings of the Academy of Natural Sciences of Philadelphia, vol. 6, pp. 387–390. August, 1853.

[*Catostomus latipinnis*, sp. nov.]

STORER (David Humphreys). A History of the Fishes of Massachusetts. By David Humphreys Storer. <Memoirs of the American Academy of Arts and Sciences (Boston), new series, (1853 to 1867).

[Descriptions and excellent figures of *Catostomus bostoniensis* and *C. gibbosus*.]

AGASSIZ (Louis). Notice of a collection of Fishes from the southern bend of the Tennessee River, in the State of Alabama; by L. Agassiz. <American Journal of Science and Arts, second series, xviii, 1854, pp. 297–308, 353–365.

[Revives the Rafinesquian genera *Carpiodes*, *Ictiobus*, *Cycleptus*, and *Moxostoma*; describes sp. nov. *Carpiodes urus*, *Carpiodes taurus*, *Carpiodes bison*, *Carpiodes vitulus*, and *Carpiodes vacca*, and records *Catostomus communis*, *C. nigricans*, *C. duquesnii*, and *C. melanops* from Huntsville, Ala. The specific descriptions are comparative only, and are not readily identifiable.]

BAIRD (Spencer Fullerton) *and* **GIRARD (Charles).** Description of New Species of Fishes collected in Texas, New Mexico and Sonora by Mr. John H. Clark on the United States and Mexican Boundary Survey and in Texas by Capt. Stewart Van Vliet, U. S. A., by S. F. Baird and Charles Girard. <Proceedings of the Academy of Natural Sciences of Philadelphia, vol. vii, 1854, pp. 24–29.

[Descriptions of *Catostomus congestus*, *C. clarki*, *C. insignis*, and *C. tumidus*, sp. nov.]

AYRES (William O.) Descriptions of two new species of Cyprinoids. By Wm. O. Ayres, M. D. Dec. 11, 1854. <Proceedings of the California Academy of Sciences, vol. i, pp. 18–19, 1854; 2d ed., pp. 17–18, 1873.

[*Catostomus occidentalis*, sp. nov.]

——— Description of a new species of Catostomus. By Wm. O. Ayres, M. D. Feb. 26, 1855. <Proceedings of the California Academy of Sciences, vol. i, pp. 31–32, 1855; 2d ed., pp. 30–32, 1873.

[*Catostomus labiatus*, sp. nov.]

AGASSIZ (Louis). Synopsis of the Ichthyological Fauna of the Pacific Slope of North America, chiefly from the collections made by the U. S. Expl. Exped., under the command of Capt. C. Wilkes, with recent Additions and Comparisons with Eastern types; by L. Agassiz. <American Journal of Science and Arts, 2d series, vol. xix, 1855, pp. 186–231.

[Characterizes very fully the genera, viz:—*Carpiodes* Raf.; *Bubalichthys* Ag., gen. nov.; *Ichthyobus* Raf.; *Cycleptus* Raf.; *Moxostoma* Raf.; *Ptychostomus* Ag., gen. nov.; *Hylomyzon* Ag., gen. nov.; and *Catostomus* Le Sueur. The species of each genus are noticed, and the following new species are very briefly and in most cases unsatisfactorily described:—*Carpiodes thompsoni*, *Bubalichthys bonasus*, *Ichthyobus rauchii*, *Ichthyobus stollcyi*, *Moxostoma tenue*, and *Catostomus occidentalis*.]

GIRARD (Charles). Researches upon the Cyprinoid Fishes inhabiting the fresh waters of the United States of America, west of the Mississippi Valley, from specimens in the Museum of the Smithsonian Institution. By Charles Girard, M. D. <Proceedings of the Academy of Natural Sciences of Philadelphia, 1856, pp. 165–213.

[Twenty-six species enumerated—most of them briefly described. Two new genera are proposed, *Minomus* and *Acomus*, and the following new species are characterized:—*Carpiodes damalis*. *Moxostoma claviformis*, *Moxostoma kennerlii*, *Moxostoma victoriæ*, *Moxostoma campbelli*, *Ptychostomus albidus*, *Ptychostomus haydeni*, *Acomus guzmaniensis*, *Acomus generosus*, *Acomus griseus*, *Acomus lactarius*, *Catostomus macrochilus*, *Catostomus sucklii*, and *Catostomus bernardini*. These descriptions are mostly short and insufficient.]

——— General Report upon the Zoology of the Several Pacific Railroad Routes. =Reports of Explorations and Surveys to Ascertain the most practicable and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War, in 1853–6, according to Acts of

GIRARD (Charles)—Continued.

Congress of March 3, 1853, May 31, 1854, and August 5, 1854. Volume X. Washington, A. O. P. Nicholson, Printer, 1859. (Part 4, Fishes, by Dr. Charles Girard.)

[Descriptions of *Carpiodes damalis, Moxostoma claviformis, Ptychostomus haydeni, Acomus generosus, Acomus griseus, Acomus lactarius, Catostomus occidentalis, Catostomus labiatus. Catostomus macrocheilus,* and *Catostomus sucklii;* all of the species except *Acomus generosus, C. occidentalis, C. labiatus,* and *C macrocheilus* being accompanied by figures.]

——— United States and Mexican Boundary Survey, under the order of Lieut. Col. W. H. Emory, Major First Cavalry and United States Commissioner.—Ichthyology of the Boundary, by Charles Girard, M. D. < United States and Mexican Boundary Survey, vol. ii, part i, 1859.

[Descriptions and figures of *Ictiobus tumidus, Moxostoma kennerlii, Moxostoma victoriæ, Moxostoma campbelli, Ptychostomus congestus, Ptychostomus albidus, Minomus insignis, Minomus plebeius, Minomus clarki, Acomus latipinnis, Acomus guzmaniensis,* and *Catostomus bernardini.*]

BLEEKER (Pieter van). "Conspectus systematis Cyprinorum. <Naturl. Tijdschr. Nederl. Ind. XXI, 1860."

[Systematic arrangement of the genera.]

ABBOTT (Charles Conrad). Descriptions of Four New Species of North American Cyprinidæ, by Charles C. Abbott. <Proceedings of the Academy of Natural Sciences of Philadelphia, 1860, pp. 473–474.

[Describes *Catostomus texanus* and *Catostomus chloropteron.*]

GILL (Theodore Nicholas). On the classification of the EVENTOGNATHI or CYPRINI, a suborder of TELEOCEPHALI, by Theodore Gill. <Proceedings of the Academy of Natural Sciences of Philadelphia, 1861, pp. 6–9.

[Characterizes the suborder *Eventognathi,* equivalent to "the true Cyprinoids of Agassiz, without teeth in the jaws, and with large falciform lower pharyngeal bones". This suborder is divided into four families,—*Homalopteroidæ, Cobitoidæ, Cyprinoidæ,* and *Catastomoidæ;* the latter family being in turn divided into three subfamilies,—*Catastominæ, Cycleptinæ,* and *Bubalichthyinæ.*]

PUTNAM (Frederick Ward). List of the Fishes sent by the Museum to different Institutions, in exchange for other Specimens, with Annotations. By F. W. Putnam. =Bulletin of the Museum of Comparative Zoology, Cambridge, Massachusetts, U. S. A., 1863, (No. 1).

[Contains names of 10 species, with references to descriptions by Professor Agassiz.]

COPE (Edward Drinker). Partial Catalogue of the Cold-blooded Vertebrata of Michigan. Part 1. By Prof. E. D. Cope.

[Notes on several species.]

GILL (Theodore Nicholas). Synopsis of the Fishes of the Gulf of St. Lawrence and the Bay of Fundy. By Prof. Theodore Gill, M. A. <Canadian Naturalist, August, 1865, (pp. 1–24 in reprint).

[Records *Catastomus bostoniensis* and *Moxostoma oblongum.*]

BLEEKER (Pieter van). Notices sur Quelques Genres et Espèces des Cyprinoïdes de Chine par P. Bleeker. <Nederlandsch Tijdschrift voor de Dierkunde, uitgegeven door het Koninklijk Zoologisch Genootschap, Natura Artis Magistra, te Amsterdam, onder Redaktie van P. Bleeker, H. Schlegel en G. F. Westerman, tweede jaargang, 1865.

[Description of *Carpiodes asiaticus,* sp. nov.]

THOREAU (Henry David). A Week on the Concord and Merrimack Rivers, by Henry D. Thoreau, author of "Walden," etc. New and revised edition. Boston: Ticknor and Fields. 1868.

[Contains an account of the habits of *Catostomus bostoniensis* and *C. tuberculatus.*]

GÜNTHER (Albert). Catalogue of the Physostomi, containing the families Heteropygii, Cyprinidæ, Gonorhynchidæ, Hyodontidæ, Osteoglossidæ, Clupeidæ, Chirocentridæ, Alepocephalidæ, Notopteridæ, Halosauridæ, in the collection of the British Museum, by Dr. Albert Günther. London: Printed by order of the trustees. 1868. =Catalogue of the Fishes of the British Museum by Albert Günther, M. A., M. D., Ph. D., F. R. S., F. Z. S., etc., etc. Volume seventh.

[Contains descriptions of twenty-four species, besides twenty-one doubtful species merely enumerated, arranged in four genera, *Catostomus*, *Moxostoma*, *Sclerognathus*, and *Carpiodes*.]

COPE (Edward Drinker). On the Distribution of Fresh Water Fishes in the Alleghany Region of South-Western Virginia. By E. D. Cope, A. M. < Journal of the Academy of Natural Sciences of Philadelphia, new series, vol. vi, part iii, January, 1869, pp. 207–247.

[Description and figure of *Teretulus cervinus*, sp. nov., with notes on *T. duquesnei*, *Catostomus nigricans*, and *C. communis*.

GÜNTHER (Albert). An Account of the Fishes of the States of Central America based on Collections made by Capt. J. M. Dow, F. Godman, Esq., and O. Salvin, Esq. By Albert Günther, M. A., M. D., Ph. D., F. R. S., F. Z. S. < Transactions of the Zoological Society of London, vol. vi, 1869, pp. 377–494.

[Description of *Bubalichthys meridionalis*, sp. nov.]

COPE (Edward Drinker). Partial Synopsis of the Fishes of the Fresh Waters of North Carolina, by Edw. D. Cope, A. M. < Proceedings of the American Philosophical Society of Philadelphia, 1870, pp. 448–495.

[Descriptions of *Placopharynx carinatus* (gen. et sp. nov.), *Ptychostomus papillosus* (sp. nov.), *P. velatus* (sp. nov.), *P. collapsus* (sp. nov.), *P. pidiensis* (sp. nov.), *P. coregonus* (sp. nov.), *P. albus* (sp. nov.), *P. thalassinus* (sp. nov.), *P. robustus* (sp. nov.), *P. erythrurus*, *P. lachrymalis* (sp. nov.), *P. macrolepidotus*, *P. duquesnei*, *P. carpio*, *P. oneida*, *P. aureolus*, *P. sueurii*, *P. crassilabris* (sp. nov.), *P. breviceps* (sp. nov.), *P. conus* (sp. nov.), *P. cervinus*, *Carpiodes difformis* (sp. nov.), *C. cutisanserinus* (sp. nov.), *C. selene* (sp. nov.), *C. velifer*, *C. grayi* (sp. nov.), *C. thompsoni*, *C. bison*, *C. cyprinus*, and *C. nummifer* (sp. nov.), with notes on other species, and a very useful analysis of the species of *Ptychostomus* and *Carpiodes*.]

——— Report on the Reptiles and Fishes obtained by the Naturalists of the Expedition, by E. D. Cope, A. M. < Preliminary Report of the United States Geological Survey of Wyoming, and contiguous territories, (being a second annual report of progress,) conducted under the authority of the Secretary of the Interior by F. V. Hayden, United States Geologist. Washington: Government Printing Office. 1872.

[*Catostomus discobolus*, *Minomus delphinus*, *Minomus bardus*, and *Ptychostomus bucco*, sp. nov.]

——— On the Plagopterinæ and the Ichthyology of Utah. By Edward D. Cope, A. M. Read before the American Philosophical Society, March 20th, 1874. < Proceedings of the American Philosophical Society of Philadelphia, vol. 14, pp. 129–139, 1874.

[*Minomus platyrhynchus* and *Minomus jarrovii* described as new species.]

JORDAN (David Starr). Synopsis of the Genera of Fishes to be looked for in Indiana, by Prof. David S. Jordan, M. D. < Sixth Annual Report of the Geological Survey of Indiana, made during the year 1874, by E. T. Cox, State Geologist; assisted by Prof. John Collett, Prof. W. W. Borden, and Dr. G. M. Levette. Indianapolis. Sentinel Company, Printers. 1875. pp. 197–228.

[Nine genera characterized and one or two species mentioned under each.]

——— Concerning the Fishes of the Ichthyologia Ohiensis, by David S. Jordan, M. S., M. D. < Proceedings of the Buffalo Society of Natural History, 1876, pp. 91–97.

[Contains identifications of the species described by Rafinesque; a new genus, *Erimyzon*, being proposed for *Cyprinus oblongus* Mitchill.]

JORDAN (**David Starr**). Manual of the Vertebrates of the Northern United States, including the district east of the Mississippi River, and north of North Carolina and Tennessee, exclusive of marine species. By David Starr Jordan, M. S., M. D., Professor of Natural History in N. W. C. University and in Indiana State Medical College. Chicago: Jansen, McClurg & Company. 1876.

[Twenty-three species briefly described, and referred to nine genera.]

NELSON (**Edward W.**) A Partial Catalogue of the Fishes of Illinois, by E. W. Nelson. < Bulletin of the Illinois Museum of Natural History, i, 1876.

[Notes on 21 species; *Ichthyobus cyanellus* described as a new species, and the genus *Carpiodes* united to *Ichthyobus*.]

UHLER (**P. R.**) *and* **LUGGER** (**Otto**). List of Fishes of Maryland, by P. R. Uhler and Otto Lugger. < Report of the Commissioners of Fisheries of Maryland, pp. 67–176, (1876).

[Seven species described.]

COPE (**Edward Drinker**) *and* **YARROW** (**Henry C.**) Report upon the collections of Fishes made in portions of Nevada, Utah, California, Colorado, New Mexico and Arizona during the years 1871, 1872, 1873 and 1874, by Prof. E. D. Cope and Dr. H. C. Yarrow. = Chapter VI. < Report upon Geographical and Geological Explorations and Surveys West of the One Hundredth Meridian, in charge of First Lieut. Geo. M. Wheeler, Corps of Engineers, U. S. Army, under the direction of Brig. Gen. A. A. Humphreys, Chief of Engineers, U. S. Army, published by authority of Hon. Wm. W. Belknap, Secretary of War, in accordance with acts of Congress of June 23, 1874, and February 15, 1875. In six volumes. Accompanied by one topographical and one geological atlas. Vol. V.—Zoology. Washington: Government Printing Office. 1875. (Issued in 1876.)

[Contains descriptions of *Pantosteus* (gen. nov.), *Pantosteus platyrhynchus*, *Pantosteus jarrovii*, *Pantosteus virescens* (sp. nov.), *Catostomus insigne*, *Catostomus alticolum*, *Catostomus discobolum*, *Catostomus fecundum* (sp. nov.), *Catostomus guzmanicnse*, *Moxostoma trisignatum* (sp. nov.), *Ptychostomus congestus*, and *Carpiodes grayi*, with figures of most of the species.]

JORDAN (**David Starr**) *and* **COPELAND** (**Herbert Edson**). Check List of the Fishes of the Fresh Waters of North America, by David S. Jordan, M. S., M. D., and Herbert E. Copeland, M. S. < Bulletin of the Buffalo Society of Natural History, ii, 1876, pp. 133–164.

[Eighty-three nominal species enumerated, referred to ten genera, viz:— *Catostomus*, *Pantosteus*, *Hypentelium*, *Erimyzon*, *Teretulus*, *Placopharynx*, *Carpiodes*, *Ichthyobus*, *Bubalichthys*, and *Cycleptus*.]

JORDAN (**David Starr**). On the Fishes of Northern Indiana. < Proceedings of the Academy of Natural Sciences of Philadelphia, 1877.

[Notes on several species; *Ichthyobus ischyrus* and *Bubalichthys altus* described as new species, from MSS. left with the author by Mr. Nelson; an analysis of the genera of *Catostomidæ* is given, nine of them being "accepted by Prof. Cope and the writer".]

——— A Partial Synopsis of the Fishes of Upper Georgia, by David S. Jordan, M. D. < Annals of the New York Lyceum of Natural History, 1876. (Published in 1877.)

[Notes on numerous species, *Myxostoma curyops* being described as new.]

KLIPPART (**John H.**) First Annual Report of the Ohio State Fish Commission to the Governor of the State of Ohio, for the years 1875 and 1876. Columbus: Nevins & Myers, State Printers. 1877.

[Descriptions of *Catostomus teres*, *Teretulus oblongus*, *Placopharynx carinatus*, *Carpiodes difformis*, and *Carpiodes velifer*, with woodcuts of all but *P. carinatus* and *C. velifer*. The descriptions are by Charles H. Gilbert, mostly arranged from MSS. notes of D. S. Jordan; the notes on habits, etc., by Mr. J. H. Klippart.]

JORDAN (David Starr) *and* **BRAYTON** (Alembert Winthrop). On Lagochila, a new genus of Catostomoid fishes. <Proceedings of the Academy of Natural Sciences of Philadelphia, 1877, pp. 280–283.

[Description and figure of *Lagochila lacera* (gen. et sp. nov.), with an analysis of the genera of *Catostomidæ* admitted, viz:—*Lagochila*, *Placopharynx*, *Myxostoma* *Erimyzon*, *Hypentelium*, *Catostomus*, *Pantosteus*, *Cycleptus*, *Carpiodes*, *Ichthyobus*, *Bubalichthys*, and *Myxocyprinus*.]

HALLOCK (Charles). The Sportsman's Gazetteer and General Guide. The Game Animals, Birds and Fishes of North America: their Habits and Various Methods of Capture. Copious Instructions in Shooting, Fishing, Taxidermy, Woodcraft, etc. Together with a Directory to the Principal Game Resorts of the Country: illustrated with maps. By Charles Hallock, Editor of "Forest and Stream", Author of the "Fishing Tourist", "Camp Life in Florida", etc. New York: Forest and Stream Publishing Company. 1877.

[Contains descriptions and notices of numerous species; the Red Horse, *M. macrolepidotum*, being on p. 338 inadvertently called "*Catostomus cepedianum*".]

JORDAN (David Starr). Contributions to North American Ichthyology, based primarily on the Collections of the United States National Museum. I. Review of Rafinesque's Memoirs on North American Fishes, by David S. Jordan. Washington: Government Printing Office. 1877. =Bulletin of the United States National Museum, No. 9. pp. 53.

[Contains identifications of the various nominal species described by Rafinesque.]

——— Contributions to North American Ichthyology, based primarily on the Collections of the United States National Museum. II. A.—Notes on *Cottidæ*, *Etheostomatidæ*, *Percidæ*, *Centrarchidæ*, *Aphododeridæ*, *Dorysomatidæ*, and *Cyprinidæ*, with revisions of the genera and descriptions of new or little known species. B.—Synopsis of the *Siluridæ* of the fresh waters of North America. By David S. Jordan. Washington: Government Printing Office. 1877. =Bulletin of the United States National Museum, No. 10. pp. 116.

[Description of *Myxostoma pœcilura*, sp. nov.]

GILL (Theodore Nicholas). Johnson's New Universal Cyclopædia; a scientific and popular treasury of useful knowledge. Illustrated with maps, plans and engravings. Editors in chief, Frederick A. P. Barnard, S. T. D., LL. D., L. H. D., M. N. A. S., President of Columbia College, New York; Arnold Guyot, Ph. D., LL. D., M. N. A. S., Professor of Geology and Physical Geography, College of New Jersey. Associate Editors—[29 persons, among them Theodore Gill, A. M., M. D., Ph. D., M. N. A. S., Late Senior Assistant Librarian of the Library of Congress]. With numerous contributions from writers of distinguished eminence in every department of letters and science in the United States and in Europe. Complete in four volumes, including appendix. Volume IV, S—Appendix. (Testimonials at the end of the volume.) Alvin J. Johnson & Son, 11 Great Jones Street, New York. MDCCCLXXVIII.

[Contains a description of the family *Catastomidæ*, a list of the genera, and a diagnosis of *Myxocyprinus*, gen. nov.]

JORDAN (David Starr). Manual of the Vertebrates of the Northern United States, including the district East of the Mississippi River, and North of North Carolina and Tennessee, exclusive of Marine Species, by David Starr Jordan, Ph. D., M. D., Professor of Natural History in Butler University. Second Edition Revised and Enlarged. Chicago: Jansen, McClurg & Company. 1878.

[Descriptions of forty species, referred to eleven genera:—*Lagochila*, *Placopharynx*, *Myxostoma*, *Minytrema* (gen. nov.), *Erimyzon*, *Hypentelium*, *Catostomus*, *Cycleptus*, *Carpiodes*, *Ichthyobus*, and *Bubalichthys*. In the Addenda, the name *Quassilabia* is suggested as a substitute for *Lagochila*.]

JORDAN (**David Starr**). A Catalogue of the Fishes of the Fresh Waters of North America. By David S. Jordan, M. D. <Bulletin IV, Hayden's Geological Survey of the Territories, No. 2, pp. 407–442. Washington, May 3, 1878.

[Fifty-one species enumerated; arranged in thirteen genera, viz:—*Bubalichthys*, *Ichthyobus*, *Carpiodes*, *Cycleptus*, *Pantosteus*, *Catostomus*, *Chasmistes* (gen. nov.), *Erimyzon*, *Minytrema*, *Myxostoma*, *Placopharynx*, and *Quassilabia*.]

——— Notes on a Collection of Fishes from the Rio Grande, at Brownsville, Texas. By David S. Jordan, M. D. <Bulletin Hayden's United States Geological and Geographical Survey, vol. iv, No. 2. Washington, May 3, 1878.

[Synonymy and note on *Carpiodes tumidus*.]

——— A Catalogue of the Fishes of Illinois, by Prof. David S. Jordan. <Illinois State Laboratory of Natural History. The Natural History of Illinois. Bulletin No. 2. Bloomington, Ill., June, 1878.

[Twenty-three species enumerated, with notes; these are arranged in nine genera.]

FORBES (**S. A.**) The Food of Illinois Fishes by S. A. Forbes. <Bulletin of the Illinois State Laboratory of Natural History, No. 2, 1878.

[Valuable notes on the food of *Catostomidæ*.]

JORDAN (**David Starr**). Notes on a Collection of Fishes from the Rio Grande, at Brownsville, Texas, continued. By D. S. Jordan M. D. <Hayden's Bulletin of the Geological and Geographical Survey of the Territories, vol. iv, No. 3. Washington, July 23, 1878.

[Remarks on the probable identity of *Carpiodes grayi* and *Ictiobus tumidus* with *Carpiodes cyprinus*.]

——— Catalogue of the Fishes of Indiana, in Article Pisciculture (by Alexander Heron). <Twenty-seventh Annual Report of the Indiana State Board of Agriculture, 1877. Volume XIX. Indianapolis. 1878.

[Twenty-two species enumerated, referred to ten genera.]

JORDAN (**David Starr**) *and* **BRAYTON** (**Alembert Winthrop**). On the Distribution of the Fishes in the Alleghany Region of South Carolina, Georgia and Tennessee, with Descriptions of New or Little Known Species. By David S. Jordan and Alembert W. Brayton. <Bulletin of the United States National Museum, No. 12. Washington, Government Printing Office, 1878.

[Notes on numerous species.]

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