THE

AMERICAN JOURNAL

OF

SCIENCE AND ARTS.

CONDUCTED BY

PROFESSORS B. SILLIMAN, B. SILLIMAN, JR.,

AND

JAMES D. DANA,

IN CONNECTION WITH

PROF. ASA GRAY, OF CAMBRIDGE,
PROF. LOUIS AGASSIZ, OF CAMBRIDGE,
DR. WOLCOTT GIBBS, OF NEW YORK.

SECOND SERIES.

VOL. XIX.—MAY, 1855.

NEW HAVEN: EDITORS.
NEW YORK: G. P. PUTNAM & CO.

Printed by B. L. HAMLEN—Printer to Yale College.

CONTENTS OF VOLUME XIX.

NUMBER LV.

SCIENTIFIC INTELLIGENCE.

Vol. XIX. JANUARY, 1855. No. 55.

Published the first day of every second month, price $5 per year.

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1st Ser., 1818–1845, 50 vols., including a General Index. Edited to 1833 by Prof. B. SILLIMAN; after July, 1833, by Prof. B. SILLIMAN and B. SILLIMAN, Jr. Price for complete set, unbound, - - - - - - - - - $100 00

2nd Ser., commenced January, 1846, by Prof. B. SILLIMAN, B. SILLIMAN, Jr., and J. D. DANA. Price for the 18 vols. published, unbound, - - - $36 00

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posed that the rise and fall which takes place during periods of from three to seven years, to be possibly the effect of increased depth of water in the Lake, caused by an unusual amount of snow on its borders and tributary streams, or an uncommon rainy season; and that it even appeared from an extract from the *New York Advertiser*, that a gentleman just then (1828) returned from a tour to the West, had informed the editor that the waters of Lakes Ontario and Erie were then nearly a foot higher, while those of Lake Superior were considerably lower than ever known. The General was therefore led to suggest that, to obtain full, and exact data as to the rise and fall of the different Lakes tide-guages should be placed at a number of points on the shore of each, both in their narrowest and broadest dimensions, and the changes carefully observed for a whole year, or at least for several months, and accurate tables kept of the times and extent of each flux and reflux, in which the position, as respects the meridian and the phases of the moon, and also the course of the winds should be noted;—a plan which, it will be perceived, is very similar to that proposed by myself in my late paper on the establishment of simultaneous meteorological observations.

(*To be continued.*)

ART. XII.—*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.

CYPRINOIDS.

IN order rightly to appreciate the natural relations of the representatives of this family living in the fresh waters of the western slope of this continent, to those found in the waters of its eastern slope and elsewhere, it is important first to reconsider the many genera established by Rafinesque in his "Ichthyologia Ohiensis," as well as those recently added by Messrs. Baird and Girard, and to institute a careful comparison between them and those founded by European ichthyologists; for though it is gratifying to behold the zeal with which important additions are daily making to our fauna by the activity of the scientific members of the various expeditions which have lately explored the western parts of the United States by order of the Central Government, it is deeply to be regretted that no more criticism is displayed in the notices which have been published descriptive of these animals. Instead of careful comparisons with more or less allied foreign forms, we are presented with such descriptions of our fishes and reptiles, as would leave the impression that nothing like them is to be found in any other part of the world.

The family of Cyprinoids presents peculiar difficulties whenever we attempt to characterise its genera, as is too well shown by the conflicting views of those who have written upon this subject.

This difficulty arises chiefly from the uniformity of its representatives, greater than is observed, in most other families, and also from the necessity of resorting to dissections to trace their most important characteristics.

In a paper published in 1834 in the Mémoires de la Société des Sciences Naturelles de Neuchâtel, I have however shown that reliable characters may be obtained from the pharyngeal teeth, and the more recent investigations of Heckel upon this subject have confirmed my statements and extended them over a large number of genera and species unknown to science at the time I published the results of my first investigations. At the time Heckel published his valuable remarks upon Cyprinoids, he seems to have been but scantily provided with American representatives of this family.

It is this gap in our knowledge I intend to fill here in connection with a more full description of the species collected in Oregon and California by the naturalists of the expedition of Capt. Wilkes.

The propriety of establishing new genera among Cyprinidæ will appear very questionable to the ichthyologists who have traced the almost endless divisions to which this family has of late been submitted. Nevertheless I feel compelled to introduce some new divisions among them, to classify several fishes which have been collected by the United States Exploring Expedition, and some others long known from the eastern parts of this continent.

Few Cyprinidæ have as yet been described from the fresh waters of the northwest coast of America, and the species brought home by the Exploring Expedition form an interesting addition to our knowledge.

The first question which arises upon examining these fishes is naturally,—to what genus do they belong? Are they in any way analogous to the Cyprinidæ of the eastern or Atlantic side of North America, or do they resemble those of western Europe, or are they in any way related to the Asiatic types? As soon as I knew that species of that family had been preserved among the collections of the Exploring Expedition, my first care was to examine their generic relations, and, to my utter astonishment I found that they do not belong to any of the numerous genera established by myself, Heckel, Prince Canino, or McLelland for the species of the old world, and that, with one exception, they correspond as little to any of the types which occur in the eastern parts of the North American continent. They constitute in fact by themselves a natural group of species, remarkable for the development of their lips, and the horny covering which protects

the outline of the mouth. Their pharyngeal teeth also, as far as I have been able to ascertain, have a peculiar structure. Even if the subdivision of the Cyprinidæ into genera had never been extended beyond the limits marked out by Cuvier, three, at least of the species from Oregon should be admitted as new types of this family, for which genera I shall propose the names of Mylocheilus, Ptychocheilus and Acrocheilus.

TRIBE OF CATOSTOMI.

Heckel subdivides the family of Cyprinoids into ten tribes, the fourth of which embraces our Catostomi. This tribe is very natural, if we exclude from it the genus Exoglossum, the true affinities of which are with Chondrostoma and not with Catostomi as Heckel admits. The true Catostomi have very remarkable pharyngeal bones, with a large number of compressed teeth, arranged like the teeth of a comb, upon the inner prominent edge of these bones, and gradually increasing in size from above downwards, whilst in Exoglossum the teeth are few in number, obliquely truncate and occupying only the middle of the curve of the pharyngeals as in Chondrostoma.

For a long time past I have sought in vain to find out the homology of these curious pharyngeal teeth, so peculiar, and so characteristic in the family of the Cyprinoids. It was not until I began to investigate the various types of the old genus Catostomus, that I found a clue to their true significance. The armature upon the inner curve of the branchial arches of Cyprinoids differs so completely from the common type of their pharyngeal teeth, in the genera of the old world, that even a comparison between them is hardly suggested; but in Catostomus the extensive row of comb-like teeth, upon the posterior edge of the inner margin of the pharyngeal arches is so combined with a row of horny serratures upon the anterior edge of the same margin, that the homology of the two becomes at once obvious. See fig. 2, a' and a''. The pharyngeal teeth correspond to the armature upon the inner curve of the branchial arches; they may, however, be either simple epidermic serratures or papillæ, or assume the structure of genuine teeth and become soldered to the bone upon which they are formed, as is the case also with the maxillary teeth of so many fishes.

Notwithstanding the similarity of the general arrangement of the pharyngeal teeth in all Catostomi, there are still such differences in their form and number, and especially in the shape of their inner edge, that these peculiarities afford additional evidence of the propriety of acknowledging several genera among them, most of which have already been indicated, though very indiffer-

ently characterised by Rafinesque. In order to ascertain beyond a question the generic value of these characters I have examined the pharyngeals of every one of the species described in this paper, and of several of them compared a number of specimens of different ages and sexes with one another, and I have invariably found that within the limits within which the genera are circumscribed here, they present a peculiar type for each genus, reproduced in the different species with slight variations in the size and proportions of the teeth, the strength of the arch and the length of its symphysis.

Thus far the whole tribe of Catostomi must be considered as belonging exclusively to North America, the true relations of the Catostomus Tilesii, founded by Valenciennes, upon the description of the Cyprinus rostratus, from Northern Asia, by Tilesius being still doubtful, or wanting at least the only confirmation acceptable in our days, that is based upon a direct comparison of original specimens. Catostomi are found as far south as Texas and along the northern boundaries of Mexico, as is shown by the descriptions of several species published by Messrs. Baird and Girard in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1854, but I have been unable to ascertain whether they inhabit the waters of Cuba.

It is a very interesting fact that while America has no native representation of the tribe of Carps, some of its Catostomi, the Carpiodes, Ichthyobus and Bubalichthys, remind us strongly by their external appearance of the true Cyprini of the old world, whilst others, the Cycleptus and Moxostoma resemble more the Barbus of Europe, Asia and Africa and the Tinca of Europe, which are also entirely wanting in America, and still others, the Catostomi proper have not even analogous representatives in the eastern continents.

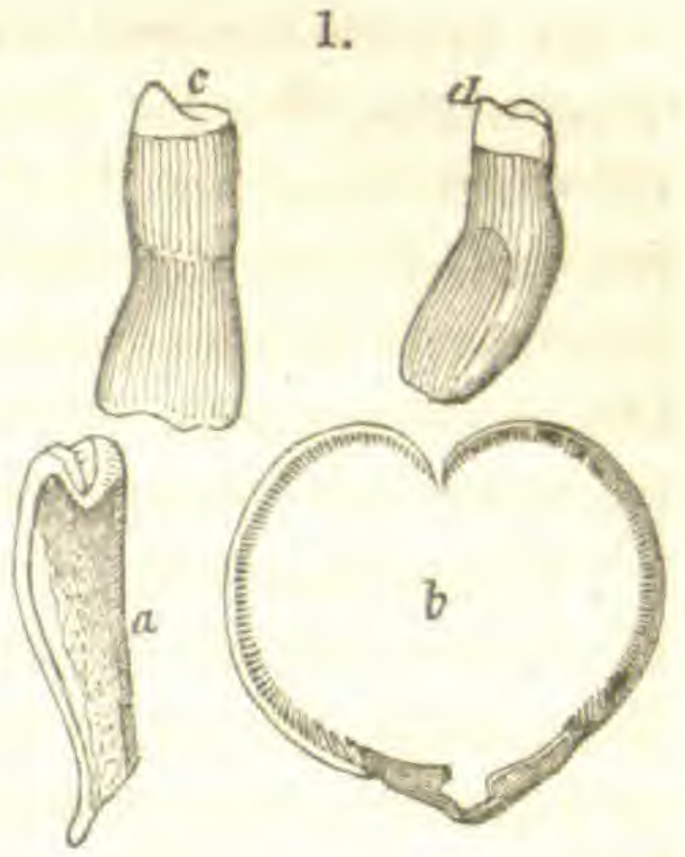
Carpiodes, Raf.

1. The body is very high and strongly compressed, the narrow ridge of 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 inside, 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. Fig. 1, *a*, represents the inner surface of the right pharyngeal, *b*, the dental edge of the two pharyngeals in their natural position, *c* and *d*, magnified teeth in profile.



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 distant from one another. The ventral ridge of the body is flat. The scales have many narrow, radiating furrows upon the anterior field, and one, 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.

Cuvier referred erroneously the type of this genus to his genus Labeo, in which he has been followed by DeKay, whilst Valenciennes founded upon it his genus Sclerognathus. Rafinesque however, had already called it Carpiodes; this latter name having the priority, must therefore be retained. Moreover Valenciennes describes as a second species of that genus under the name of Sclerognathus Cyprinella, a fish from Lake Pontchartrain, which belongs to Rafinesque's genus *Ichthyobus*, as I shall show below. In recognising the generic differences which distinguish these two fishes, Rafinesque has really been much in advance of more recent observers, though the characteristics he ascribes to them are very loosely and imperfectly drawn.

I know now four species, of this curious genus, one of which inhabits the fresh waters of our middle States, emptying into the Atlantic, the Catostomus Cyprinus of Lesueur; another occurs in Lake Champlain and the waters of our Northern States, emptying into the St. Lawrence, the Catostomus Cyprinus of the Rev. Zad. Thompson; a third is found in the Ohio, and its tributaries, and has been described under the same name as the preceding ones, by Dr. Kirtland in his "Fishes of the Ohio." I have lately obtained a fourth from the Osage River, through the kindness of Mr. George Stolley, which I have inscribed as *Carpiodes Bison* in my notice of the Fishes of the Tennessee River.* It occurs also in the Mississippi, above its junction with the Missouri, as I have ascertained recently from specimens forwarded to me by Dr. Rauch of Burlington, Iowa; whether it is found farther south, I do not know.

* See this Journal, 2nd Ser., vol. xvii, p. 356.

In my enumeration of the fishes of the southern bend of the Tennessee River, I made a mistake in preserving the name of *C. Cyprinus* for the Ohio species; but having known that species for many years, I took it as the type of the genus the more readily, since Rafinesque has established the genus Carpiodes from Ohio specimens. Yet this species, *C. Cyprinus*, was described by Lesueur from Pennsylvania specimens, so that the name of *C. Cyprinus* belongs to it by right of priority, and the name of *C. Vacca* which I have applied in my notice of the fishes of the Tennessee River to the Pennsylvania species, must be considered as a mere synonym of *Catostomus Cyprinus* of Lesueur, and the Ohio species must retain Rafinesque's name of *Carpiodes velifer*. Lesueur himself had already pointed out in the Journal of the Academy of Natural Sciences, vol. i, p. 110, the differences he noticed between some specimens obtained in the Ohio River, by Mr. Thomas Say, and preserved in the Museum of the Academy of Nat. Sci. in Philadelphia, and those from the Chesapeake Bay he described under the name of *C. Cyprinus*. Upon these indications, Rafinesque founded his *Carpiodes velifer*, Ich. Oh., p. 56, without perceiving that it is identical with his own *Carp. Carpio;* though he had already a few lines higher in the page called it *C. setosus*, referring that name erroneously to Lesueur. Again page 51, Rafinesque describes the same species once more, from a drawing of Mr. Aububon, under the name of *Catostomus anisopterus*, referring it to his subgenus Moxostoma, though he points out himself its true affinity to *C. velifer*. With these materials before me, I was very anxious to obtain also original specimens of the fish described by Rev. Z. Thompson, under the name of C. cyprinus, from Lake Champlain. To that gentleman himself, I am now indebted for the means of comparing it with the species described by Lesueur and Rafinesque, and I find that it is still another species for which I propose the name of *C. Thompsoni*.

These species, though very similar in general outline and compression of body, instantly strike one on comparing them as distinct; the different form and size of scales give to each a very peculiar appearance. In *Carpiodes velifer*, which has the largest scales, their hind border is very broadly arched or rounded, whilst in *Carpiodes Thompsoni*, it forms a very blunt or open angle. Hence in the former species, the posterior margin of a row of scales extending obliquely from the dorsal to the ventral region is strongly waved, but in the latter species it is straight. In Carpiodes velifer the radiating lines on the opercle are more prominent, and the subopercle is longer and not so broadly rounded at its lower angle, and the anterior lobe of the dorsal is higher and much more slender than in Carpiodes Thompsoni. *C. Cyprinus* is more elongated than either, and *C. Bison*, from Osage River, is

the most elongated of the four species, and its snout is most prominent. Valenciennes states that *C. Cyprinus* occurs also in Lake Pontchartrain, Louisiana; but this is incorrect. He has mistaken my *C. Taurus*, which belongs to the genus Bubalichthys, for the true Cyprinus of Lesueur. This result shows how important it is in identifying fishes from distinct water basins, not to trust implicitly to descriptions for comparison, but to resort as far as possible to original specimens. I shall have full opportunity below to show also how dangerous it may be to take for granted that because fishes occur in distant regions, they must differ specifically, and to describe them as such.

Whether *Carpiodes tumidus*, B. and G., from Texas, belongs to this or the following genus, or to Ichthyobus, I am unable to ascertain from the description published by Messrs. Baird and Girard in the Proceedings of the Academy of Natural Sciences in Philadelphia, 1854, p. 28.

I am entirely at a loss to understand why Rafinesque should have referred his *Catostomus xanthopus* with C. Cyprinus and Velifer to his subgenus Carpiodes. It certainly does not belong to the same genus as the description shows, in which the dorsal is said to be "hardly falcate with 14 rays," I have scarcely any doubt that Rafinesque had an old specimen of Lesueur's *Catostomus nigricans* before him when he described his *Cat. xanthopus*. Not supposing that species to occur in the Ohio, he did not even compare it with the description of Lesueur; but the name "mud sucker," the specific name xanthopus and the statement that the "head is larger, flattened above," &c., apply together only to Cat. nigricans, which, as Dr. Kirtland has already shown, and as I also know from direct observation, is not only found in the Ohio, but occurs very extensively in our western waters, even as far as Osage River, whence I have obtained specimens through Mr. George Stolley, and also in the middle Atlantic States.

Bubalichthys, Agass.

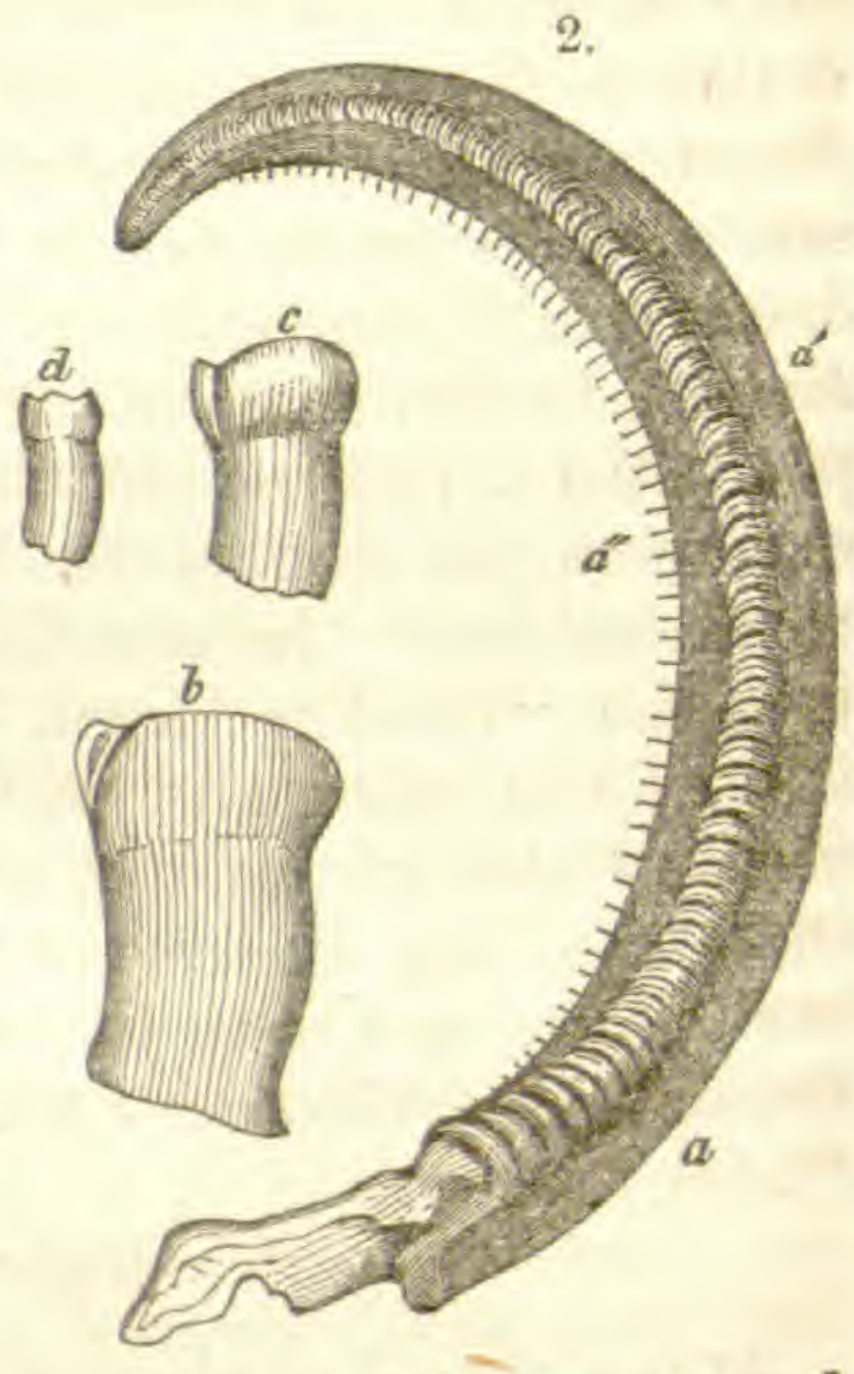
At the time I vindicated the propriety of restoring some of the genera established by Rafinesque among Cyprinoids.* I did not suspect that the genus Carpiodes as I then represented it, still contained two distinct types, though I had noticed that some of the species had the anterior margin of their dorsal greatly prolonged, whilst in others it hardly rises above the middle and posterior portion 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 proper, have in addition very thin flat pharyngeals with extremely minute teeth, whilst those with a low dorsal have triangular pharyngeals with

* See this Journal 2nd Ser., vol. xvii, page 353.

larger teeth, increasing gradually in size and thickness from the upper margin of these bones towards their 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 an anterior plane, meeting under an acute angle. This structural homology is satisfactorily traced by the difference in 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 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 its surface, as in Carpiodes, Ichthyobus and Cycleptus.

Fig. 2, *a*, represents the right pharyngeal seen from behind, *a'* being the crest of teeth, *a''* the armature of the anterior edge of the inner curve, *b* one of the lower, *c* one of the middle, and *d* one of the upper teeth.

2.



In this genus the bulk of the body is not placed so far forwards as in Carpiodes, the greatest height being midway between the 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 field, converging to the centre of radiation to which the tubes of the lateral line extends also. For this new genus I propose the name of Bubalichthys, intending to recall the name of Buffalo fish, commonly applied to its species. To this genus belong the species I have described as *Carpiodus Urus* from the Tennessee River,* *C. Taurus* from Mobile River, and *C. Vitulus*

* See this Journal, 2nd Ser., vol. xvii, p. 355 and 356.

from the Wabash, and also the *Catostomus niger* of Rafinesque and *Catostomus Bubalus* of Dr. Kirtland from the Ohio, but not *Cat. 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 sometimes 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 that 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 have 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

* Dr. Kirtland and Dr. Storer, who follows him, are certainly mistaken in referring C. niger of Raf., to Cat. elongatus of Lesueur, as the description in the Ichthyologia Ohiensis clearly shows.

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. 19, fig. 2, I believe his C. Bubalus to be the small-mouthed species. I myself have however only seen one specimen of the big-mouthed species from the Ohio, and that in a rather 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 as well in the Ohio, as in the Mississippi, to avoid introducing new names, I would 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 to it 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 his species, this point must remain undecided, as it is impossible from mere descriptions to institute a sufficiently minute comparison. The specimen 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.

I therefore turn now to the genus—

Ichthyobus, Rafin.*

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.

* Rafinesque spells the name incorrectly Ictiobus; as its name means Bull or Buffalo fish, from ἰχθὺς and βοῦς it ought to be spelled Ichthyobus, as I have already stated it in my Nomenclature Zoologicus: Index universalis, p. 194.

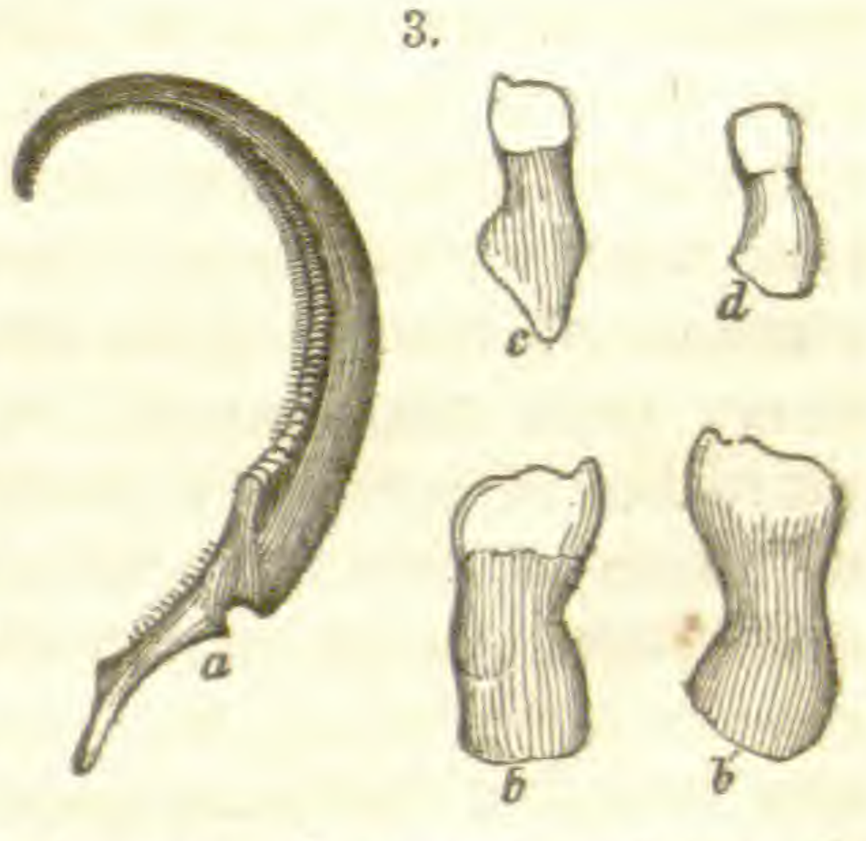
The eye is small, and the opercular pieces very large.

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.

The pharyngeal bones are neither flat, as in the 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.

Fig. 3, *a*, represents the right pharyngeal of *Ichthyobus Rauchii*, from the inner side, *b* and *b'* lower teeth from both sides, *c* a tooth from the middle of the comb, and *d*, one from its upper end.

3.



Thus far a single species of this genus has been accurately described by Valenciennes, under the name of *Sclerognathus Cyprinella*, from lake Pontchartrain, near New Orleans; but as I have remarked above, the genus Sclerognathus can not stand, since it includes two distinct types, for both of which Rafinesque has already introduced unobjectionable names. One of these genera is founded upon the Catostomus Cyprinus of Lesueur, and will retain the name of *Carpiodes*, as characterised above, the other is the subject of this paragraph, for which the name of *Ichthyobus* must be preserved, even though its typical species C. Bubalus was so imperfectly described by Rafinesque as to be mistaken by Dr. Kirtland for the common Buffalo of the Ohio, as I have shown above. *Ichthyobus Bubalus*, Raf., is easily distinguished from the two following new species by its low dorsal, its small fins, and high scales.

Ichthyobus Rauchii.—Dorsal much higher than in I. Bubalus, all other fins much larger, and the scales not higher than long; from Burlington, Iowa. Received from Dr. Rauch, to whom I am indebted for a very large collection of fishes from the Mississippi, and its tributaries in the State of Iowa.

Ichthyobus Stolleyi.—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.

I have obtained this species from Mr. George Stolley, who has made extensive zoological collections for me in the western and southern parts of the State of Missouri especially along the Osage River and its tributaries.

Cycleptus, Raf.

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 descriptions of our western fishes ought to be most 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 to his genera any characters by which they may be recognized, yet, when the species upon which they are 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 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. This 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 characteristic 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 that fin; occasionally these long rays split, and accidentally separate from the following ones, when they seem to form two dorsals.

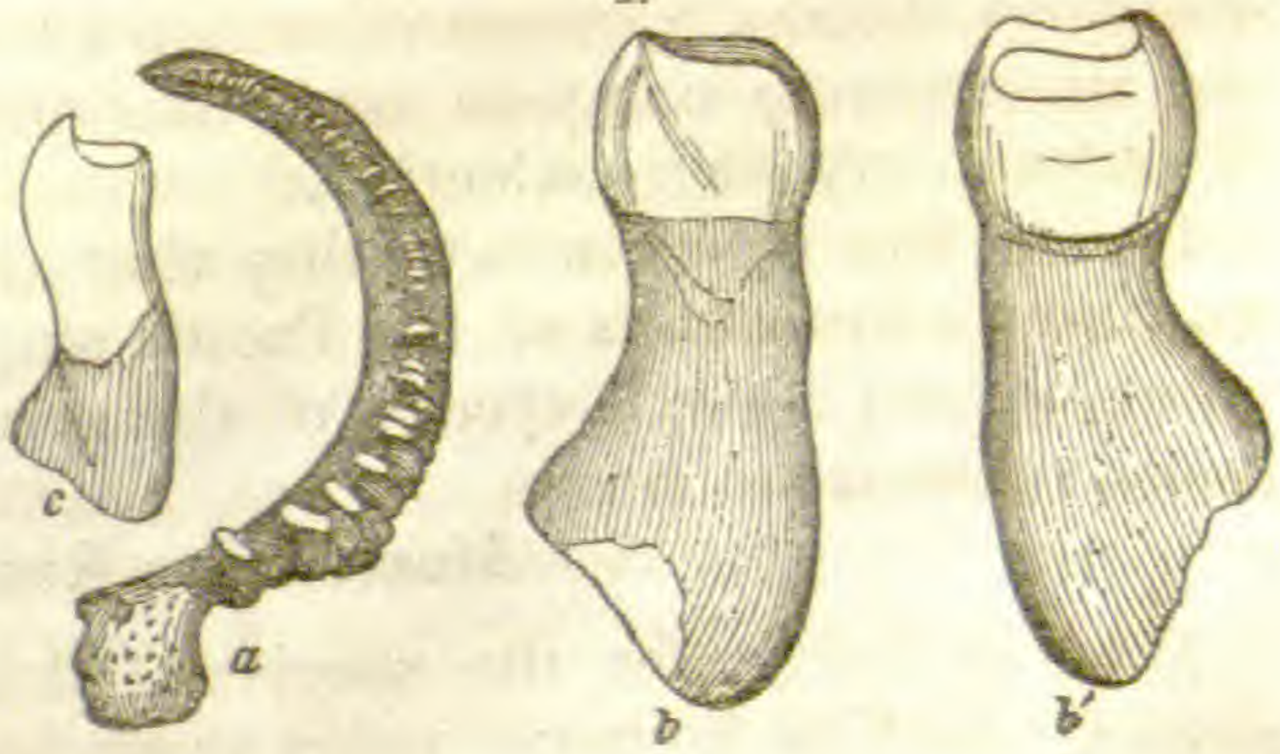
The character of this genus, as far as the dorsal fin is concerned, consists in reality not in its division, but in its great extension along the back, and the elongation of its anterior rays. The anal is very small in proportion to the size of the fish, and inserted far back, so that the length of the abdominal cavity is greater than in the genera Carpiodes, Ichthyobus and Bubalichthys, with which Cycleptus is closely allied by the peculiar form of its dorsals. 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 their 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 penduncle 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 its 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.

Fig. 4, *a*, represents the right pharyngeal of *Cycleptus nigrescens*

4.



from the posterior side, *b* and *b'* being two lateral views of the lower teeth, and *c* a view of an upper tooth.

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 that 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 recognize it as Rafinesque's name, I shall therefore not urge the change. I must leave it doubtful whether we have more than one species of this interesting genus. I have before me specimens from Cincinnati, kindly forwarded to me by Prof. Baird, and others from St. Louis, Missouri, for which I am indebted to Dr. George Engelmann, but they differ so much in size, those from Ohio being young and those from Mississippi rather large, that I am unable to decide whether the differences they exhibit are specific or merely characteristic of their age. In the St. Louis specimens the peduncle of the tail is shorter, the lobes of the caudal fin broader, the scales of the sides of the body less pointed behind and the caudal fin not so deeply forked. Should these differences prove specific, the name of *Cycl. nigrescens* proposed by Rafinesque may be retained for the St. Louis type, and that of *C. elongatus* for that of Cincinnati; should they be the same, the name *elongatus*, applied by Lesueur for his Catostomus elongatus, having the priority over that of Rafinesque, must be preserved for both.

The preceding descriptions show that instead of four species of *Catostomi with a long dorsal*, mentioned in Dr. Storer's Synopsis of the fishes of North America, as Catostomus elongatus and Bubalus and Sclerognathus Cyprinus and Cyprinella, we have not less than four distinct genera of this type: Carpiodes, Bubalichthys, Ichthyobus and Cycleptus, numbering together sixteen or seventeen species, fourteen of which I have been able to describe and minutely to compare with one another, having specimens of them in my own collection.

It is a fact worth mentioning that the whole of this type is wanting in the waters of the Pacific slope of our continent, from which indeed a single species of the genus Catostomus proper is known thus far.

Moxostoma, Raf.

Most authors refer the species of this genus to Catostomus proper. DeKay however refers them to Cuvier's genus Labeo,

though they bear only a remote resemblance to it. I have been unable to trace the etymology of the name Moxostoma. It may be a misspelling for Myzostoma, but in that form the name is already applied to a genus of worms.

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 an externally visible 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 exceed 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 different sexes. The young also differ strikingly from the adults both in form and coloration: the mouth is not surrounded by such thick lips, nor turned so far downwards, so that they may easily be mistaken for young Leucisci, and as they are marked with a broad, longitudinal black band extending from the snout through the eye to the end of the tail, they bear the closest resemblance to the Cyprinus atronasus of Mitchill, (my Rhinichthys atronasus) and have more than once been mistaken for that species. This lateral band which I have observed in the young of all the four species of this genus, which I have had an opportunity of examining, gradually fades

* In the genus Mugil we observe another extreme in this system of tubes, every scale from back to belly, being perforated by a tube, as the lateral line alone shows them in most fishes; in other fishes, such as our *Rhombus cryptosus*, we have still another arrangement; for besides the perforations of the scales of the lateral line, there are in this fish, several rows of similar holes above and below the lateral line, and along the base of the dorsal, and below the insertion of the pectoral, all of which converge towards the upper angle of the thoracic arch and open into the sinus of Cuvier.

and finally vanishes entirely in specimens of about three inches in length. Such a young specimen of our eastern species has been described by Lesueur as Catostomus vittatus. The body of Moxostoma is elongated and somewhat compressed; though stouter than that of the Ptychostomus and Catostomus proper; its greatest depth is above 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 these dimensions are more nearly equal. The pectoral 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; their cutting edge is slanting outwards, the innermost edge rising into an acute point, which is more prominent in the middle and upper teeth, than in the lower ones. Fig. 5, *a*, repre-

5.

sents the right pharyngeal of Moxostoma oblongum, *b* one of the lower teeth in profile; *c* another in the same position; *d* the same, from the sharp side.

Former investigators, unconscious of the marked differences which exist in this genus between individuals of different sexes and ages, in different seasons of the year, have described a number of nominal species, which may now safely be reduced to their true relations. DeKay, in his Natural History of the State of New York, describes the species so common in the Eastern States, under no fewer than five different names, as Labeo gibbosus, Labeo elegans, Labeo esopus, Labeo oblongus, and Catostomus tuberculatus, and mentions it a sixth time under the name of Catostomus vittatus, given to the young by Lesueur. Dr. Storer in his synopsis of the fishes of North America, has it under five different names, as Catostomus gibbosus, oblongus, elegans, esopus, and vittatus. The oldest name applied to this fish being that of Cyp-

rinus oblongus, introduced by Dr. Mitchell in his Report of the fishes of New York, the specific appellation of *oblongus* must of course be preserved for it. Since DeKay has represented four forms of this species, I may avail myself of his figures to give an idea of its variations: *Catostomus tuberculatus*, Pl. 31, fig. 97 represents the male in the spawning season, with tubercles upon the snout, a long dorsal and a lobed anal. DeKay mentions its appearance in April. *Labeo oblongus*, Pl. 42, fig. 136, is an adult male in winter, with a long dorsal and a lobed anal, but without tubercles. DeKay observed its appearance in December. *Labeo gibbosus*, Pl. 32, fig. 101, is a younger male, with less deeply lobed anal; *Labeo elegans*, Pl. 31, fig. 100, is a young female in winter dress, with a shorter dorsal, trapezoidal anal and a more slender form. Dekay observed his specimens in October and November; *Labeo Esopus* is an adult female with a somewhat emarginate anal, broader than the preceding; *Catostomus vittatus*, Lesueur, with "a black stripe passing from the snout through the eye to the caudal fin, dividing the body equally" in the young. I have traced all these differences in specimens taken from the same pond in different seasons of the year. Lesueur, who first described Catostomus gibbosus and tuberculatus, already remarked that these species may be founded upon the two sexes of one and the same species. Instead of availing himself of this hint and ascertaining its correctness, DeKay has only increased the confusion by describing three other forms as so many additional species, and he has unfortunately been followed by later compilers. This species ranges through the States of Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, and Maryland. I have obtained specimens from the Susquehannah through the kindness of Prof. S. S. Haldeman, from Carlisle, Pa., through Prof. Baird, from Chestertown and Havre de Grace, Maryland, through F. R. Williams, Esq. and Dr. Wroth. I entertain serious doubts as to the identity of the form found in Lake Champlain. The other species of the genus are Catostomus Sucetta, *Les.* (Cyprinus Sucetta, *Lacep.*), from Charleston, and other localities in South Carolina. This species occurs also in Georgia. I have received specimens from that State from Athens, through the kindness of Prof. J. Le Conte, and from the Altamaha, through G. Belknap, Esq.

The third species is the Catostomus (Moxostoma) anisurus, *Raf.*, from the Ohio, which I have found as far west as the vicinity of St. Louis (Missouri), and of which specimens have been kindly forwarded to me from the Scioto River, by J. Sullivant, Esq., from Lake Erie, by Dr. Kirtland, from Lebanon, Tennessee, by Prof. J. M. Safford, from Quincy, Illinois, by Dr. Watson, and from Milwaukie, Wisconsin, by Prof. Lapham. I have obtained a new species from the neighborhood of Mobile, Alabama, through the kindness of Albert Stein, Esq. of Springhill,

which I shall call *Moxostoma tenue*, as it differs from the others, by its more elongated form, and less prominent differences between males and females. I would unhesitatingly refer also *Catostomus congestus*, B. and G., to this genus, from the characters assigned to this species, were the lateral line not described as running straight along the middle of the side, when the absence of a lateral line is the most prominent character of the genus Moxostoma. Not having however seen a specimen, I must leave it for Messrs. Baird and Girard to determine whether it is a genuine Catostomus, as the genus is now circumscribed.

Ptychostomus, Agass.

In respect to form of body and the structure and position of 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. Such differences between the sexes do not exist in the species of Catostomus proper.

The scales are as large on the anterior as on the posterior parts 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 inwards 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. Fig. 6, *a*, represents the right pharyngeal of Ptychostomus macrolepidotus from its inner surface, *b* one of the lower teeth, *c* and *d*, teeth from the middle and upper part of the arch.

6.

I know four distinct species of this genus from personal examination, all well described and figured by Lesueur and Dr. Kirtland, viz: Catostomus Aureolus, *Les.*, Catost. Duquesnii, *Les.*, Catost. macrolepidotus, *Les.*, and Catost. melanops, *Rafin.* The Catost. Sueurii, *Rich.*, Fauna Boreali-Americani, I have not seen myself, nor the Catost. Carpio, *Val.*, but from their description, and from the figure given of the latter by Valenciennes, I am inclined to believe that Cat. Sueurii is founded upon the male of Catost. aureolus, *Les.*, and that C. Carpio is the male of C. macrolepidotus. The circumstance that I have found C. aureolus in the Lake Superior in lat. 47° would connect the range of this species from the middle western States through the great Canadian Lakes to the locality from which Dr. Richardson (now Sir John), obtained his C. Sueurii in lat. 54. DeKay's Cat. Oneida is probably also C. macrolepidotus. That it belongs to the genus Ptychostomus, the description of DeKay leaves no doubt, and his remark that the scales are *very large*, points rather to C. macrolepidotus than to Duquesnii. It cannot be a distinct species, since three species only of this genus are found within the natural boundaries of the fresh-water fauna of New York:—Catost. aureolus, Catost. Duquesnii, and Catost. macrolepidotus, one of which, C. aureolus, DeKay has himself accurately described. Rafinesque's Catostomus erythrurus is identical with Lesueur's Cat. Duquesnii. As to Catostomus melanops, *Raf.*, it is a well characterised species, which Dr. Kirtland has for the first time satisfactorily described; but the species Valenciennes described afterwards under the name of C. fasciatus from specimens sent him by Lesueur under that name, is synonymous with it, as is also his own Cat. melanotus. Judging from the form of the anal, and the position of the dorsal, I believe that Catostomus insignis, *B. & G.*, which I have not seen, also belongs to this genus, though no mention is made in their description of the character of the lips, so important in this tribe, as Lesueur has already shown. The black dot at the base of each scale, brings it near Ptychostomus melanops.

The geographical distribution of these species presents some interesting peculiarities; for three of them, C. aureolus, Duquesnii and macrolepidotus are found in the Canadian Lakes, and yet they do not cover the same areas, C. aureolus, extending chiefly northwards, Catostomus Duquesnii westwards, and C. macrolepidotus eastwards; C. melanops on the contrary, is only found in the West and Southwest, and not in the great Lakes. If, upon close examination, Catostomus insignis should prove to belong to this genus, it would furnish additional evidence that the Ptychostomi with dotted scales are the southwestern type of the genus.

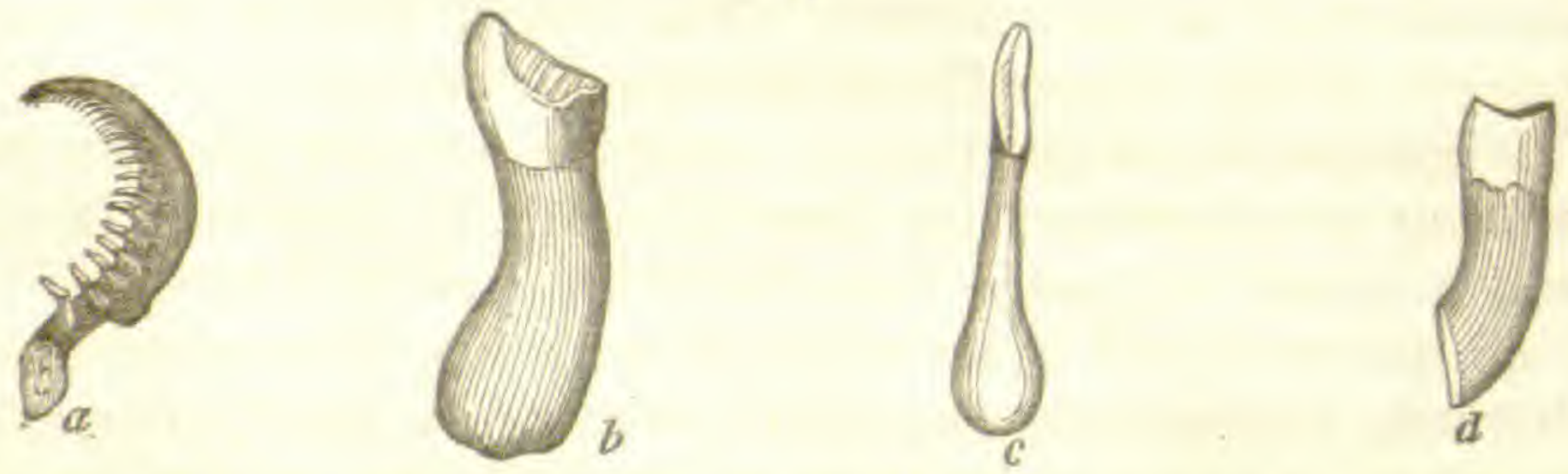
Hylomyzon, Agass.

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 by small granules 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 caudals. 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; no radiating furrows upon the lateral 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 projecting more than the outer one. Fig. 7, *a*, represents the right pharyngeal of Hylomyzon nigricans, *b* and *c*, one of the lower teeth from two sides, and *d* one of the middle teeth in profile.

7.



There is no species in the whole tribe of Catostomi which has been described under so many names as the type of this genus. It was first described by Lesueur under the name of Cat. nigricans, from specimens obtained in Lake Erie. At the same time he described specimens from Pipe Creek, Maryland, under the

name of Catostomus maculosus, suspecting however, what is true, that this may be only a variety of the former. Soon afterwards Rafinesque described the same species from the Ohio and its tributaries, under four different names, as Catostomus fasciolaris, C. flexuosus, C. megastomus, and C. xanthopus. Again, his Exoglossum macropterum, for which he afterwards proposed the generic name *Hypentelium* is only the young of the same species; finally Valenciennes, though copying the description of Cat. nigricans and C. maculosus from Lesueur's paper, describes anew original specimens of the former species, which Lesueur had sent to the Jardin des Plantes under a new name, as Cat. planiceps. We have thus eight specific names for a single species, the only one thus far known of this genus. In order to substantiate this assertion. I ought to state that though there are no marked differences between males and females in this genus, which may lead to the establishment of nominal species, as in the genus Moxostoma, the young and adult differ greatly in their coloration, being first strongly banded transversely, then more mottled, and afterwards the bands and blotches of dark color fading into isolated specks and finally disappearing entirely, the lower fins, and the abdomen becoming in the same proportion more brightly tinged, especially in the spawning season, as the upper parts of the body grow lighter. These four stages have misled Rafinesque to distinguish four species; his C. fasciolaris, about eight inches long, with *small transversal black lines*, is described from a juvenile specimen, his C. flexuosus *from ten to twelve inches long, more plain*, is described from nearly full grown specimens; his C. megastomus, *yellowish beneath*, appearing in shoals in March. is drawn from a male in the spawning season; his C. xanthopus, *with lower fins yellowish* is a younger male; his Exoglossum macropterum is drawn from a *very young* specimen with fully protruded mouth. Thus we account for all the nominal species of Rafinesque. That he should have taken no notice of Lesueur's descriptions, is the natural consequence of the assumption upon which Rafinesque works throughout, that the fishes of our western waters differ uniformly as species from those of the Atlantic streams. The mistake of Valenciennes arose from another source. It was the habit of Lesueur to send to the Jardin des Plantes, original specimens of all his species, carefully labelled, whether he had published descriptions of them or not, and we find in the great Histoire Naturelle des Poissons, many species described by Cuvier and Valenciennes, under Lesueur's name, even though the latter had never himself published any notice of them.* Of Catostomus nigricans, Lesueur sent two dried speci-

* How honorably this course contrasts, with the race some Naturalists are running, for the questionable distinction of being the first to name species, using even all sorts of unworthy tricks to secure them.

mens to Paris from the Wabash, the labels of which seem to have been lost; at least Valenciennes, who describes them as Cat. planiceps, says he received them from Lesueur without a name, not recognising that they were original specimens of the *Catost. nigricans* of Lesueur, as the description of Valenciennes clearly shows them to be. Hylomyzon nigricans has the widest geographical distribution of all our Catostomi. It occurs in the northern and middle Atlantic States, in all the great Canadian Lakes, with the exception of Lake Superior, through all the middle western States as far as Missouri. Its southernmost localities are Lebanon, Tennessee, from which place I have received specimens through Prof. J. M. Safford, and Huntsville, Alabama, whence J. H. Newman, Esq., sent me also several specimens. Its westernmost range is in the Osage River, Missouri, from which Mr. G. Stolley has sent me quite a number. I have repeatedly and most carefully compared with one another the specimens from the remotest localities, without finding the least specific difference between them.

Catostomus.

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.

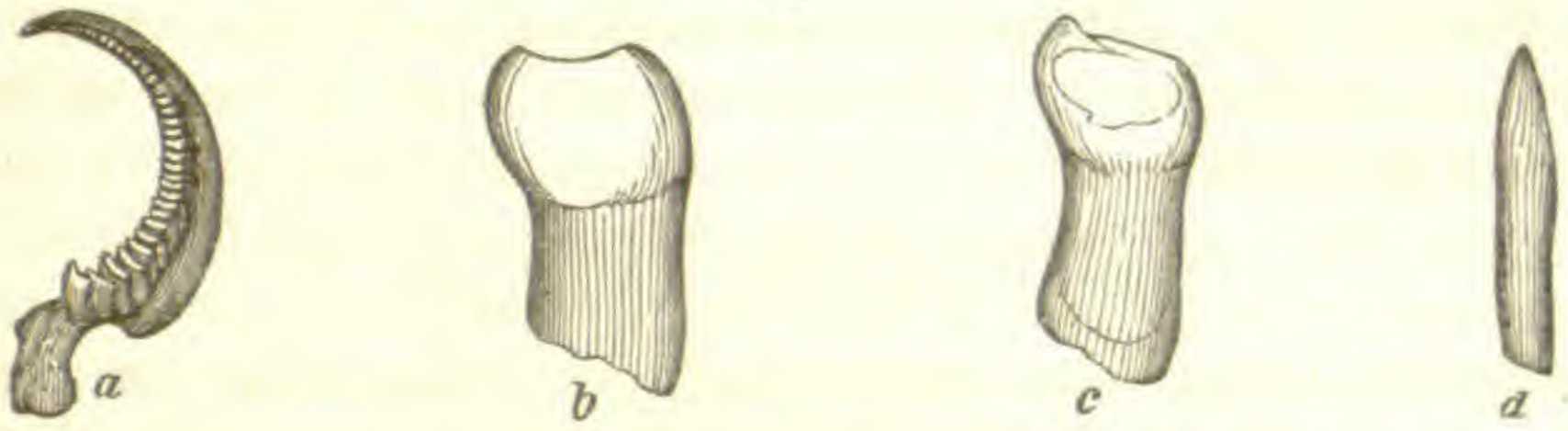
The sexual differences so conspicuous in the genus Moxostoma and Ptychostomus, are hardly to be noticed in this genus. The other fins are of moderate size, and more or less pointed.

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 encroaching 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. Fig. 8, *a*, represents the right pharyngeal

8.



of Catostomus communis, *b* being one of the lower teeth, *c* one from the middle of the arch and *d* a side view of the same.

This genus has representatives over a much greater geographical area than any other of the tribe, some are found even as far north as the fur countries of North America, others in Lake Superior; farther south they occur in all the fresh waters of the United States as far as Texas and the northern boundaries of Mexico, whence Mr. John H. Clark has obtained several new species described by Messrs. Baird and Girard in the Proceedings of the American Academy of Natural Sciences of Philadelphia, for 1854, page 27. I have myself received a new species from N. Mexico, through the kindness of Dr. Henry of the U. S. Army and another from Georgia through Prof. J. LeConte. Sir John Richardson mentions their occurrence in the Columbia River. I have myself received a new species from San Francisco, California, from my friend T. G. Carey, Jun., Esq. Valenciennes refers to this genus, a species described by Tilesius under the name of Cyprinus rostratus, from Siberia. This would be the only Catostomus from the old world. As the species of this genus are closely allied to one another and their distinguishing characters could not be plainly illustrated without figures, I will not enter into more details about them for the present and limit myself to enumerating them and describing the species from San Francisco.

The first species known is that which Lesueur has called *Catostomus Hudsonius*, the Cyprinus Catostomus of Forster. Next to it comes my *C. Forsterianus*, for which I regret having adopted that name, as it conflicts with the *Catostomus Forsterianus* of Richardson (my Cat. Aurora), an entirely different species. There are however still some difficulties about these northern species to be solved, as it remains doubtful whether there are three or four or only two species ranging from the great Canadian Lakes northward. I am unable to find any difference between Catostomus teres, *Les.* (Cyprinus teres, *Mitchill*) and his own Cat. communis, to which Cat. gracilis, Kirtland, seems also to belong, as he himself has more recently admitted. Catostomus Clarkii and Catostomus plebeius, *B. & G.*, are distinct species.

For their Catostomus congestus and insignis I must refer to my remarks under the head of Moxostoma and Ptychostomus.

Catostomus Bostonensis, *Les.*, Cat. pallidus, *DeKay*, and florealis, *Baird*, are so closely allied that I am unable to distinguish them; I have however seen only one specimen of the latter. As to Cat. Tilesii, *Val.*, it has not been seen since Tilesius described it under the name of Cyprinus rostratus, and its true affinities remain still doubtful.

Catostomus occidentalis, Agass.

This species resembles very closely C. communis, in general outline and appearance, but differs from it in the following respects. The head is less square; the profile steeper, but the snout is more pointed. The sides of the head are nearly triangular instead of trapezoidal and converge more rapidly forwards. The longitudinal rows of tubes upon the top of the head are more waved. The mouth is smaller; the hind margin of the lower lip is perpendicularly under the anterior nasal opening. The lower border of the eye and the posterior angle of the opercle are on the same horizontal line. The centre of the eye is nearer the anterior edge of the upper lip than the hind or lower angle of the subopercle. The opercle and subopercle are larger and longer and together form one-half of the side of the head. The lowest angle of the opercle is less acute, and its hind angle smaller; its waving border is directed more forwards and backwards.

The pectorals are broader; the dorsal is longer, considerably emarginated above, its last rays shorter and its upper angle more acute. The ventrals are more pointed.

The scales on the anterior part of the body are smaller.

TRIBE OF CHONDROSTOMI.

There lives in Europe a remarkable fish of the family of Cyprinoids which was first described by Linnæus as Cyprinus Nasus, and in which I recognised about twenty years ago the type of a distinct genus, *Chondrostoma*. This fish differs so strikingly from the other Cyprinoids that Heckel in his synopsis, considers it as the type of a distinct tribe, to which he ascribes the following characters:

Os inferum in aciem cartilagineam attenuatum, labiis et plica menti deficientibus; rostrum incrassatum; preoperculum ante occiput. Pinna dorsalis subelongata, analis brevis, utraque radio osseo nullo. Tractus intestinalis longissimus tenuissimus.

The cartilaginous lips, with a sharp edge of the lower lip at least and the chisel-like teeth, with a narrow flat grinding surface, supported upon pharyngeals the outer margin of which has a spoon-shaped lateral expansion, truly characterise this tribe as a natural group in the family of Cyprinoids.