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THE FISHES OF ILLINOIS

BY

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Order **EVENTOGNATHI**

(THE CARP-LIKE FISHES)

Skeleton osseous; anterior vertebræ modified, with Weberian apparatus; fins without spines in typical forms; ventral fins abdominal; pectoral arch suspended from the skull; a mesocoracoid present; opercular bones all present; branchiostegals few, usually 3 or 4; air-bladder with open duct; jaws without teeth. Species exceedingly numerous, in all of the streams and lakes of the northern hemisphere.

Key to Families of **EVENTOGNATHI** found in Illinois

a. Dorsal fins of more than 25 rays, or shorter and the lips thickened and covered with plicate or papillose skin; pharyngeal teeth numerous and comb-like.....**Catostomidæ.**

aa. Dorsal fin of not more than 10 rays; lips usually thin, never plicate or papillose; pharyngeal teeth fewer than 8 on a side, in 1 to 3 rows...**Cyprinidæ.**

Family **CATOSTOMIDÆ**

(THE SUCKERS)

Body oblong or elongate, usually more or less compressed, covered with large or small cycloid scales; head naked; lateral line usually present; belly not serrated; skeleton osseous; anterior 4 vertebræ modified and provided with Weberian apparatus or *ossicula auditus*; fins without spines; ventrals abdominal; no adipose fin; tail more or less forked; a mesocoracoid arch present; gill-membranes more or less united to the isthmus, restricting the gill-openings to the sides; pseudobranchiæ present; branchiostegals 3; margin of upper jaw formed in the middle by the small premaxillaries, and on the sides by the maxillaries; jaws toothless; lower pharyngeal bones falciform, armed with a single row of numerous comb-like teeth; mouth usually protractile and with fleshy lips (sucker-like); alimentary canal long; stomach simple; no pyloric cæca; air-bladder large, divided into 2 or 3 parts by transverse constrictions, not surrounded by a bony capsule, communicating with the œsophagus by a slender open duct.

One of the most striking characteristics of the fish fauna of Illinois, and indeed of the whole Mississippi Valley, is the prominence of the sucker family, which includes, within the limits of this state, eight genera and fifteen recognized species, several of them among the most abundant and most generally distributed of our larger fishes.

The family is found in the fresh waters of North America at large, in which about 15 genera and 60 species occur; and there are 2 species also in eastern Asia. They range in length from 6 inches to 3 feet. The suckers have usually been regarded by European writers as a subfamily of *Cyprinidæ*, from which they differ chiefly in the structure of the mouth and the lower pharyngeal bones. They are generally of sluggish habit and, as a rule, prefer water of good depth and little current, but some of them may be found in almost every stream and pond within their range. Their spring migration is familiar to all fishermen, and to many who do not fish, all of our species running up the smaller streams in May or June to deposit their eggs. The males of most species develop black or red pigment on the body and fins in spring, and in many kinds peculiar wart-like tubercles, called pearl organs, appear at this season on the head, fins, and caudal peduncle.

The suckers are, on the whole, an unusually homogeneous group as represented in Illinois, not only agreeing in the character of their feeding structures which gives them their common name, but unusually similar also in their movements, habits, modes of life, and places of most frequent resort. They feed, without exception, on the bottom of the waters they inhabit, and commonly on substantially the same kinds of food, differing somewhat in respect to the places in which they seek it. The buffalo-fishes, for example, are from $2\frac{1}{4}$ to 3 times as abundant in our collections from the bottom-land lakes as they would be if they had been equally distributed throughout all waters. In other words, the frequency coefficient of one of the two buffaloes is 2.26 for lowland lakes and that of the other is 2.93. On the other hand, the common sucker, the chub-sucker, and the striped sucker show a decided preference for the smaller streams, their coefficients of frequency in creeks being 4.27, 3.41, and 3.17 for the three species respectively. The most marked departure from the average habit of the family is made by the hogsucker, or stone-roller (*Catostomus nigricans*), which especially frequents swift water on rocky stretches of the larger streams, filling there the place which the darters occupy in creeks and brooks.

Notwithstanding these divergencies in local distribution, the family as a whole forms a rather definite ecological group, as is shown especially by the frequency with which representatives of the several species are found in company in the same situations and appear together, consequently, in our collections. The average frequency of this joint occurrence of the species of suckers and

buffaloes in collections is decidedly greater, according to our experience, than the corresponding average for the darters or the sunfish, being represented, for suckers, by the general coefficient of 2.45, for darters by 2.02, and for sunfish—that is, the *Centrarchidæ* exclusive of the black bass—by 1.87.

When full grown, the majority of the species are safe from any enemies of their kind which the water contains, but their survival to adult age is dependent on their fortune in escaping from a host of predaceous and voracious fishes against which they have no defense, and to whose depredations their haunts and habits freely expose them. In the food of 1,221 Illinois fishes, representing 87 species, studied by the senior author during the dozen years preceding 1888, suckers and buffalo-fish were found most frequently in the food of the pike, but occurred also in that of dogfish, bullheads, sheepsheads, and sunfish. The sucker family would evidently suffer much more severely, however, if it were not for the presence in the waters they inhabit of the gizzard-shad, more abundant, and probably more accessible to pike and other predaceous fishes, than are either suckers or young buffaloes. It is an interesting illustration of the way in which companion species having little or nothing to do with each other directly may nevertheless greatly influence each others' welfare, that while 20 pike out of 37 had eaten gizzard-shad, which made, in fact, nearly half the food of the entire number, only 3 per cent. of their food came from the sucker family, and this had been eaten only by three of the pike.

Examining the other side of the food relation, we find that the food of this family itself, as illustrated by a careful study of the stomach contents of 109 specimens, belonging to five genera and eleven species, consisted mainly of the smaller mollusks living in the mud and larvæ of aquatic insects, the two being about equal in ratio and together making more than three fourths of the entire food. Vegetation contributed less than 10 per cent. to the mass examined, and no element of this class was especially prominent.

The structures of alimentation vary noticeably in definite directions as one passes along the series from the most cylindrical suckers to the thin and deep-bodied buffalo and carp. In the former the pharyngeal bones are heavy, and the lower teeth are thick and strong, usually with a well-developed grinding surface, while the gill-rakers are short, thick, and few, and the intestine is comparatively short and large. As the body deepens, the pharyngeal bones become longer, the pharyngeal teeth smaller and more numerous, with diminished grinding surface; the gill-rakers are

longer and more numerous, making a more effective straining apparatus, and the intestines become longer and smaller. Corresponding to these differences of structure, mollusks form a larger percentage of the food of the cylindrical suckers, and *Entomostraca* and vegetable food a very much greater part of that of the deep-bodied species. All the species commonly swallow much mud, since they collect most of their food from the bottom by suction, to which their protractile mouths and fleshy lips are peculiarly adapted.

As food fishes they do not hold a high place, the flesh being rather coarse, dry, and either flavorless or strong, and always provokingly full of small bones. The buffalo and sucker fishery is nevertheless an important one in the Mississippi Valley and the Great Lake region. (See under *Ictiobus*.) Of the 15 species found in the waters of the Illinois alone, about one third have a greater or less commercial value.

Key to the Genera of **CATOSTOMIDÆ** found in Illinois

a. Dorsal fin elongate, with 25 to 40 developed rays.

b. Posterior fontanelle almost obliterated by the union of the parietals; head small and slender, its length 6 to 7 times in body; lips with several series of tubercle-like papillæ..... **Cycleptus.**

bb. Posterior fontanelle well developed, extending forward between frontals a distance equal to more than ⅓ of their length; head 3½ to 5 times in body; lips plicate, striate, or smooth.....

c. No anterior fontanelle, the frontals being closely joined with the ethmoid; cheek somewhat shallow and foreshortened, distance from eye to lower posterior angle of preopercle about ¾ of that to upper corner of gill-cleft; subopercle broadest at its middle, subsemicircular..... **Ictiobus.**

cc. Anterior fontanelle well developed, separating anterior edges of frontals and notching ethmoid; cheek relatively deep and long, eye about equidistant between upper corner of gill-cleft and infra-posterior angle of preopercle; subopercle broadest below its middle, subtriangular..... **Carpiodes.**

aa. Dorsal fin short, with 10 to 18 developed rays.

d. Lateral line more or less incomplete or wholly wanting; scales large and uniformly distributed, 30 to 50 in lateral line

e. Lateral line entirely wanting at all ages..... **Erimyzon.**

ee. Lateral line more or less developed in adults..... **Minytrema.**

dd. Lateral line complete and continuous.

f. Scales small and crowded anteriorly, the number in the lateral line 55 to 110 (except in *C. nigricanus*, for which see below **ff**)..... **Catostomus.**

ff. Scales large and nearly equal all over the body, 40 to 55 in the lateral line.

g. Air-bladder in two parts; scales 48 to 55 in lateral line..... **Catostomus (Hypentelium) nigricans.**

gg. Air-bladder in three parts; scales larger, 40 to 50 in lateral line.

h. Upper lip protractile, lower entire or incised only part way to anterior margin.

i. Pharyngeal teeth compressed; mouth wholly inferior..... **Moxostoma.**

ii. Lower pharyngeal teeth much enlarged, subcylindrical and truncate; mouth somewhat oblique, lips very thick..... **Placopharynx.**

hh Upper lip not protractile; lower lip in two separate lobes..... **Lagochila.**

Genus **CYCLEPTUS** Rafinesque

Body elongate, little compressed, caudal peduncle very long; head very small, short and slender; mouth small, inferior; lips tuberculate. The skeleton is remarkable for deficiencies of ossification and other features which may indicate affinity with a primitive catostomoid stock. Forward portion of chondrocranium strongly developed, the trabeculæ fusing anteriorly into a broad and thick ethmoid plate, which is continuous in front with the bulbular cartilages of the end of the vomer, and above with the broad girdle-like *tegmen cranii*; bones of skull somewhat heavy, their exposed surfaces more or less rough; prefrontals, meso- and ento-pterygoids very spongy, and other bones subject in varying degress to incompleteness of ossification; sutures very distinct, never close and strongly joined, with cartilage between the edges of the articulating elements in many instances; configuration of roofing bones of brain case and orbits much as in *Ictiobus*; nasal foramen closed externally by a sieve-like plate; a small supraorbital bone intervening between lateral wings of prefrontal and frontal; posterior fontanelle represented by a small opening at intercalation of supraoccipital and frontals; anterior fontanelle present, notching ethmoid and extending a short distance backward between frontals; sub- and inter-operculum and branchiostegals rather small; pharyngeal bones narrow and spongy, the teeth from 25 to 35 in number, the lower ones somewhat compressed but strong, the remaining teeth weak, diminishing rapidly in size upward; vertebræ 49 in number, rather heavy and poorly sculptured; ribs 13, short and weak; floating pairs 14, very slender and thread-like, their parapophyses (vertebræ 17 to 30) short and stout and similar in form and size, with distal extremities expanded and their free margins crenate; air-bladder in two parts, the posterior very long and slender and much tapered behind, furnished interiorly with a spiral band of supporting cartilage; dorsal rays about 30, the first rays elongated, about half the length of the fin; scales elongate, with a broad membranous posterior border; lateral line complete, a peculiar and conspicuous membranous area about the posterior terminus of each tube. Mississippi Valley; one species known.

CYCLEPTUS ELONGATUS (Le Sueur)

(MISSOURI SUCKER; BLACK-HORSE)

Le Sueur, 1817, J. Ac. Nat. Sci. Phila., I, 103 (**Catostomus**).
G., VII, 23 (**Sclerognathus**); J. & G., 121; M. V., 46; J. & E., I, 168; N., 50; J., 64; F., 81; L., 12.

Body elongate, little compressed and the back little elevated, depth 4 to 5 in length. Size large; length 2½ feet. Color dark, bluish black about head; fins dusky to black; spring males almost black, the head covered with small tubercles. Head very small and slender, conic, its length 5.8 to 6.4, width 8.2 to 8.8, depth 8.1 to 8.5 in length of body; snout fleshy, tapering to the bluntly pointed muzzle, which extends

considerably beyond the decidedly inferior mouth; distance from eye to muzzle 2 to 2.2 in head; mouth small, its width from 5.8 to 6 in head; lips rather thick, protractile almost directly downward, each furnished with 5 or 6 rows of strongly developed tubercle-like papillæ; lower lip incised behind; eye very small, located a little back of center of head, 6 to 8.3 in its length; interorbital space convex, about 2 in head. Dorsal rays 31 to 32, the first two developed rays elevated to about ½ the length of base of fin, the succeeding rays rapidly shortened to about the eighth, the remaining rays all low and of about equal height; position of dorsal well forward, the distance from insertion of fin to muzzle 2.2 to 2.4 in length of body; caudal deeply forked, the lobes about equal. Scales 9 or 10, 55–58, 8–10, much longer than broad, much crowded on nape, breast, and belly, and at base of dorsal fin; lateral line complete.

This peculiar species, the only one of its genus, is confined to the Ohio and the Mississippi rivers. It is reported abundant at Pittsburg, but is not common in the Mississippi above the latitude of Quincy. It is frequently taken in spring at Cairo and at Grafton, on the Mississippi, and in the lower part of Rock River, but it disappears from the product of the fisheries, except for an occasional specimen, about the last of June, as soon as the spring run is over. It is also caught in spring in considerable quantities in the Illinois River, but much less abundantly now than in former years. To Illinois and Mississippi River fishermen in this state it is commonly known as the Missouri sucker, or occasionally as the black sucker. The name "black-horse" we have not found in current use.

It reaches a length of 2 or 2½ feet, and Ashlock reports specimens taken at Alton of a weight of 16 pounds. As a food fish it is the best of the suckers. It is caught on set-lines as well as in fyke-nets and with seines. Its habits are but little known, but it apparently lives in the deeper water of the river channels, except during the spawning migration. Eggs are deposited in May and June.

Genus **ICTIOBUS** Rafinesque

Body robust, compressed, both dorsal and ventral outlines curved; head rather large; mouth terminal or slightly inferior; lips thin, plain or more or less strongly plicate, the upper protractile, the lower lobed at corners of mouth, plicate. The generally heavier bones, with more or less roughened surfaces, and the different configuration of certain cranial elements (see key to genera of *Catostomidæ*) in *Ictiobus* furnish the most reliable means of distinction between this genus and *Carpiodes*. Frontals joined closely with ethmoid, obliterating anterior fontanelle, posterior fontanelle large, somewhat narrowed forward, its posterior margin formed by the supraoccipital; a supraorbital bone present; suboperculum symmetrically rounded, subsemicircular,

broadest at its middle; cheek shorter and not so deep as in *Carpiodes*, the lower posterior border of the preopercle a gentle curve, the eye evidently closer to the angle of the preopercle than to the upper corner of the gill-cleft; pharyngeal bones broad, but thin and weak, the teeth short and compressed; vertebræ 36; air-bladder in two parts; dorsal fin long, with from 25 to 30 rays, the anterior rays produced, about ½ the length of base of fin; scales roundish; lateral line complete; color rather dark, never silvery; sexual differences slight.

Mississippi and Ohio rivers and their larger tributaries; three species known, all of them common to our larger streams. These fishes are the largest in size of the *Catostomidæ*, not infrequently reaching a length of 3 feet and a weight of 50 pounds. The name "buffalo-fish" refers to the bull-like hump at the nape in old individuals. The relationships of these fishes with the carp are remote. The view, not uncommon among fishermen, that carp and buffalo interbreed is not supported by any facts in our knowledge, and is probably based solely on the superficial* resemblance of the buffalo and the carp in the form of the body and of the dorsal fin.

The species are gregarious and nocturnal, coming out at night on bars not frequented by them by day, and where they may be readily reached by the seine. Fishermen report that they move into lakes in cold weather, spending the winter as much as possible in weedy water. They are said to dig holes in the bottom, like the German carp. This genus includes closely related species of identical general distribution in Illinois, but differing noticeably in respect to the structures of food selection, and likewise to some extent in situations preferred, one of the more abundant species especially (*bubalus*) habitually occurring in deeper water than the other. In the red-mouth buffalo (*cyprinella*) the pharyngeal jaws are lighter than in *bubalus*, their teeth have a smaller grinding surface, and the gill-rakers are longer and more numerous.

The feeding habits of the buffaloes, like those of all the fishes inhabiting the muddy waters of central Illinois, are difficult of observation, but several fishermen and other river men have reported to us that these fishes have the habit of whirling around in shallow water, or plowing steadily along with their heads buried in the mud, their bodies in an oblique position, and their tails occasionally showing above the surface. These operations have nothing to do with the act of spawning, and probably indicate a search for small mollusks and insect larvæ living in the mud. Buffaloes

*The presence of the conspicuous maxillary barbels in the carp, entirely wanting in the buffalo, and the heavy serrated dorsal spine of the carp—all fins of the buffalo being spineless—are sufficient marks of distinction.

breed in the spring, depositing their eggs in great numbers near the edges of sloughs. Fishermen on the Illinois say that their set-nets become coated with eggs when spawning is in progress. All species spawn early, ordinarily in April. Mosher (Bull. U. S. Fish Comm., 1885, p. 190) has described their spawning behavior. They proceed shoreward in shallow water to deposit their eggs, each female forming the center of a bunch of 3 to 8 males. The oviposition is attended with a tremendous splashing, which on a still evening may be heard a mile. The people call it tumbling; in fact it is a sight which once seen will never be forgotten.

Buffaloes form a large part of the fish catch in the Mississippi Valley, 11,491,000 lb having been taken from the Mississippi and its tributaries in 1903. The annual product of the Illinois River and its tributary streams, although decreasing considerably during the past twenty years, is now about 3,000,000 lb. The flesh of the buffalo, while perhaps superior to that of the carp, is not much more esteemed, and brings a low price.

Key to the Species of **ICTIOBUS** found in Illinois

a. Mouth large, oblique, upper lip about on level with lower margin of orbit, angle of mandible with horizontal more than 40°; maxillary as long as snout; lips thin and nearly smooth ..... **cyprinella.**

aa. Mouth smaller, little oblique, level of upper lip about midway between chin and lower margin of orbit, angle of mandible with horizontal slight, less than 20°; maxillary not more than ¾ length of snout; lips more or less coarsely striate.

b. Back scarcely elevated, depth 3 to 3¼ in length ..... **urus.**

bb. Back elevated and compressed, depth 2½ to 2¾ in length ..... **bubalus.**

ICTIOBUS CYPRINELLA (Cuvier & Valenciennes)

(red-mouth buffalo; big-mouth buffalo)

Cuvier & Valenciennes, 1844, XVII, 477 (**Sclerognathus**).

G., VII, 24 (**Sclerognathus**); J. & G., 114 (**bubalus**); M. V., 44; J. & E., I. 163; N., 49 (**bubalus**); J., 65 (**bubalus**); F., 82; F. F., I. 2, 81 (**bubalus**), II. 7, 451 (**cyprinellus**); L., 11.

Body elliptical, robust, dorsal outline but little more curved than ventral; body compressed somewhat more above than below median axis, but nowhere keeled, being rather broadly rounded at belly and nape; greatest depth from 2.8 to 3.3 in length, usually 3. Size large, reaching a length of 2½ feet and a weight of 40 lb. General coloration a dull brownish olive, never silvery, fins dusky. In breeding dress top of head slate with a tinge of greenish, cheeks and opercles olive-green; upper part of body, except in front of dorsal, of a coppery tint; region of

median axis a pale green; ventral region white dulled with bluish; predorsal region and upper part of caudal peduncle slate; dorsal and caudal fins drab-gray; anal dusky olive; ventrals lighter; pectorals dull white under olive. Head large and heavy, its length from 3.3 to 3.7, depth 3.9 to 4.2, width 4.8 to 5.2 in length of body; snout blunt and broadly rounded; interorbital space convex, 2 to 2.4 in head; snout separated from frontal region of head by a slight transverse depression in front of orbits, giving it a turned-up appearance; mouth large and wide, terminal, protractile forward, very oblique, upper edge of mandible about reaching level of median axis, upper lip almost on a level with lower margin of orbit; mandibles strong and broad, forming a wide protruding angle at their union with the quadrate; lips thinner and smoother than in other species of *Ictiobus*, upper very thin and nearly smooth, lower thicker and somewhat lobed at corners, rather faintly and finely striate; eye 5.6 to 7 in head, situated well forward; opercle strongly striated and very broad. Dorsal rays 24 to 28, longest ray a little more than half the base of fin; caudal not deeply forked; anal short, inserted under last rays of dorsal; ventrals falling about as short of vent as pectorals do of ventrals. Scales large, uniform in size and evenly distributed, rather loosely imbricated, their number 7 or 8, 37 to 40, 6 or 7; lateral line complete, rather flexuose posteriorly and somewhat abruptly elevated in front of dorsal fin.

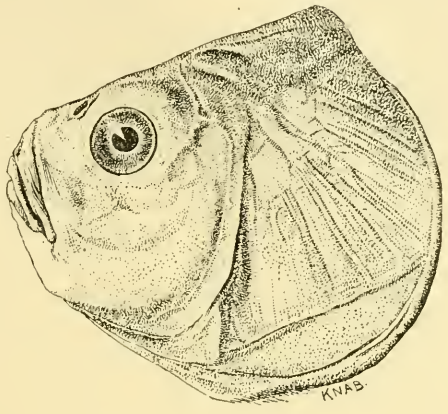


FIG. 14

Sexual differences slight, the males averaging a little smaller in size and darker in color than the females; spring males without tubercles.

Distributed throughout the Mississippi Valley, in rivers, lakes, ponds, and larger creeks; also in the Red River of the North to Winnipeg. It does not occur east of the Alleghanies, nor in the Great Lakes.

This is a very abundant fish in our larger streams and in the lakes of the river bottoms, being one of the three species most commonly shipped from the Illinois and the Mississippi under the name of "buffalo-fish." It is taken abundantly in the latter river at Cairo, Grafton, and Quincy, and is one of the important commercial species of the Illinois, from which it is caught in large numbers as far north as Henry. It is much less abundant now, however, than some years ago. It is the common "buffalo-fish" of the fishermen, and generally receives no more distinctive name.

It grows to a large size, sometimes reaching a weight of 50 pounds. Although its flesh is of poor quality, it is used everywhere as food.

Its structures of food prehension and appropriation—the mouth, the gill-rakers, and the pharyngeal jaws and teeth—are so constructed as to enable it to collect its food readily from a muddy bottom, to strain away the greater part of the mud, retaining objects large enough to serve as food, and to crush and masticate hard or shell-covered objects, unfit for digestion entire. Its pharyngeal jaws are not so strong as those of *bubalus*, the thickness being about a fourth the depth. The teeth are some seventy-five in number on each jaw, minute above, gradually but not greatly thickened below, the ten lowest occupying nearly a fifth of the length of the arch. The gills are compactly disposed in a rather small branchial chamber, the upper ends of the arches being decurved and the lower elevated so that each gill forms about three fourths of a circle. There are seventy-five gill-rakers in the anterior row, the longer of which are fully equal in length to the corresponding gill-filaments, and eight or ten of the lower rakers are fused in the form of thick oblique ridges.

About a third of the food of seventeen specimens examined, consisted of algæ, seeds of aquatic plants, and distillery slops, the last obtained off the Peoria city front where the wastes from distilleries were emptied into the stream. Of the remaining two thirds, nearly half consisted of *Entomostraca*, and more than half of aquatic insects, very largely *Chironomus* larvæ and larvæ of day-flies.

The species breeds in early spring, ordinarily between the 10th and 20th of April (Capt. Schulte). In 1898 the red-mouth spawned between the 15th and the 30th of that month.

ICTIOBUS URUS (Agassiz)

(MONGREL BUFFALO; ROUND BUFFALO)

Agassiz, 1854, Amer. J. Sci. Arts (Silliman's Journal), XVII, 355 (**Carpiodes**).

J. & G. (**Bubalichthys**), 116; M. V., 44; J. & E., I, 164; N., 50 (**Bubalichthys niger**); J., 65 (**Bubalichthys**); F., 82; F. F., I. 2, 81 (**Bubalichthys niger**), II. 7, 452; L., 11.

Body robust, elliptical, the dorsal and ventral outlines nearly equally curved, the general form being much as in *cyprinella* except that the body is somewhat more elongate and the back more broadly rounded in front of dorsal; depth 3 to 3.4 in length. Size large, about as in last species. Color usually darker than in *cyprinella*, a dark slaty gray, shading to almost black when taken from clear water; all fins dark. Head thick

and heavy, its length 3.7 to 4, depth 4 to 4.8, width 4.9 to 5.6 in length of body; snout very blunt and broadly rounded, its profile continuous with that of frontal region; interorbital space 2 to 2.3 in head; mouth moderate, considerably smaller than in last species, and but slightly larger than in next species, subterminal, protractile forward and downward, as a rule but little oblique, the edge of the mandible falling considerably below median axis, level of upper lip about midway between chin and lower margin of orbit; angle formed by articulation of mandible with quadrate evident, but less prominent than in *cyprinella*; lips rather thin, but less so than in last species, the upper faintly, the lower rather coarsely, striated; eye 5.1 to 6.6 in head, situated well upward and forward; opercles not so broad as in the last.

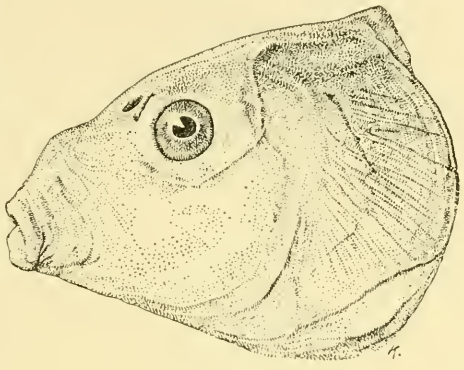


FIG. 15

Dorsal rays 29 or 30, the longest considerably less than ½ base of fin; other fins about as in the preceding species, the caudal not quite so deeply forked. Scales 7 or 8, 36–40, 6 to 8; lateral line complete, less flexuose posteriorly and not so abruptly elevated in front of dorsal as in *cyprinella*.

Spring males without tubercles.

The mongrel buffalo appears to vary somewhat more than either *I. cyprinella* or *bubalus*, but we have met with no cases which appear to show intergradation with either. This species seems to be always distinguishable from the former by its much smaller and less oblique mouth, the upper lip falling far below the level of the lower margin of the orbit, and by the coarsely striate lower lips; from the latter by the more elongate and less compressed body, and by the broad rounding of the frontal region and of the back in front of the dorsal fin.

Distributed throughout the Mississippi Valley practically as the red-mouth is, but less abundantly.

This is a large species, sometimes exceeding 50 pounds in weight, though commonly less than 20. It resembles the red-mouth in habits and value.

The same may be said with respect to its food, our 17 specimens, well distributed as to time and place of capture, having taken ratios of animal and vegetable food almost identical with those of *cyprinella*—67 per cent. and 33 per cent. respectively. There was a larger ratio of mollusks and of insects—the latter 42 per cent.—but

the principal species of each were the same as in *cyprinella*. The *Crustacea* (13 per cent.) were almost all *Entomostraca*, a young crawfish taken by one of the buffaloes being the only exception. This species had likewise eaten distillery slops and various forms of aquatic plants, including duckweeds and unicellular algæ.

This buffalo spawned at Havana in 1898 between the 15th and the 30th of April, but ripe females were caught the following year as late as May 29.

ICTIOBUS BUBALUS (Rafinesque)

(SMALL-MOUTH BUFFALO; RAZOR-BACKED BUFFALO; QUILLBACK BUFFALO)

Rafinesque, 1818, J. Phys., 421 (**Amblodon**).

G., VII, 22 (**Sclerognathus urus**); J. & G., 116 (**Bubalichthys altus**); M. V., 44; J. & E., I, 164; N., 49, (**cyanellus**); J., 66 (**Bubalichthys cyanellus**); F., 82; F. F., II, 7, 448; L., 11.

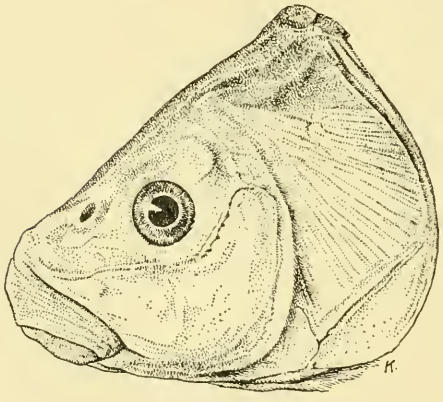


Fig 16.

Body compressed, back much elevated; ventral line not much decurved; back in front of dorsal fin compressed into a keel; depth from 2.5 to 2.9 in length of body. Size somewhat smaller than in the two preceding species. General coloration much as in *cyprinella*, but becoming paler in adults, sometimes exceedingly so, old specimens usually a muddy whitish, with but faint traces of blue and coppery about head and anterior half of body; young specimens usually quite dark, the head dark bluish gray below; all fins more or less dusky. Head smaller, more compressed, and more pointed than in the foregoing species, the occipital region high and sharply arched transversely, length of head 3.6 to 4.1, depth 4.4 to 5, width 5.1 to 5.8 in body; interorbital space 2.1 to 2.6 in head; snout pointed; mouth small, inferior, protractile downward and forward, in size and form sometimes scarcely distinguishable from that of the last species; lips rather coarsely and brokenly plicate; mandibles nearly horizontal, scarcely forming an evident angle at the articulation with the quadrate; eye 4.4 to 6.2 in head, rather larger than in either of the preceding species; opercle about as in last. Dorsal rays 27 to 30, the longest a little less than half base of fin; caudal somewhat more deeply forked than in *cyprinella* or *urus*. Scales 7 or 8, 37–39, 5 to 7; lateral line complete, gently flexuose.

♂ Head and snout of males finely tuberculate in spring.

Distributed throughout the Mississippi Valley much as the other buffalo are, but tending more generally to deep water, according to the reports of fishermen.

It is common in the Mississippi and the Illinois rivers, and in the principal streams of the state at large. It is not so frequently taken in shallow water as the other species, and it is said to have a stronger preference for flowing streams. Nevertheless, it must be said that more than two thirds of the specimens in our collections came from lakes and sloughs, the greater part of the remainder being from rivers of the larger size.

This buffalo does not average as large as the preceding species, its maximum weight in the Mississippi being, according to Mr. Ashlock, of Alton, less than 40 lb.

About a fifth of the food of the specimens examined, consisted of vegetation, mainly duckweed, but with an occasional admixture of terrestrial rubbish. The animal food was divided, with approximate equality, between mollusks, insects, and *Entomostraca*, the latter taken chiefly in spring when they are present in the greatest abundance. The food of the young of this buffalo consists largely of the minuter forms of the plankton, including especially *Protozoa*, rotifers, and unicellular algæ.

The gill-rakers of this species are less numerous than those of *cyprinella* and scarcely so long, and seem to form a less efficient straining apparatus. The pharyngeal jaws are heavier, triangular in section, and about as thick as high. Seventeen specimens of this species, collected from the Illinois and the Mississippi in various months from April to October, contained aquatic vegetation amounting to about a third of the total food, the principal element being a small duckweed (*Wolffia*) especially abundant where a part of the fishes were taken, and amounting in some cases to 95 per cent. of the contents of the stomach. A larger duckweed, fragments of hornwort (*Ceratophyllum*), diatoms, and other unicellular algæ had also been eaten. Animal food (80 per cent.) was fairly equally divided between mollusks, insects, and *Crustacea*, the first (30 per cent.) being mainly a thin-shelled bivalve (*Sphærium*) common in the mud. Several specimens had eaten nothing but this mollusk. *Chironomus* larvæ and *Entomostraca* were the principal other elements, each making practically a fifth of the entire food.

Genus **CARPIODES** Rafinesque

(CARP-SUCKERS)

Body more or less thin and compressed, becoming deeper and more arched above with age; ventral line almost straight or but slightly curved downward; head small, short, somewhat compressed; lips thin and slightly striate; bones of skull with generally smoother surfaces and not so heavy as in *Ictiobus*; a well-developed anterior fontanelle at intercalation of frontals and ethmoid; a supraorbital bone present; posterior fontanelle narrowest behind, its posterior margin formed by the converging parietals; suboperculum very broad, subtriangular, its greatest breadth below middle; cheek deep and long, the lower posterior border of the preopercle somewhat angled, the center of orbit equidistant between its infraposterior angle and the upper corner of the gill-cleft; pharyngeal bones broad but very thin, the teeth very much compressed, weaker than in *Ictiobus*; vertebræ 35 or 36; air-bladder in two parts; dorsal fin long, rays 23 to 30, the anterior rays sometimes produced into a long filament that may reach almost to the caudal; scales large; lateral line complete; color light, usually more or less silvery; snout tuberculate in spring males of some species (*difformis* and *velifer*).

Four species of these fishes are known in Illinois, mostly of small size, seldom over 12 inches long, and of little or no commercial value. The name of carp was applied to them by the early settlers of Virginia, although they bear only a general resemblance to the European species of that name. Since the latter was introduced into our waters the native species have been called "American carp." Since they belong to a different family from the foreign species, to which the name was originally given, the common name of carp-sucker, already considerably used, is much to be preferred.

In Illinois they are distributed throughout the greater rivers of the state and their larger tributaries, and occur also in Lake Michigan and the smaller lakes of northern Illinois. They are extremely common in the lakes and ponds of the river bottoms.

The carp-suckers are rather filthy feeders, swallowing a greater quantity of mud than the nearly related buffalo-fish. The structures of food prehension carry to its extreme a development of the gill-rakers and a correlative degradation of the pharyngeal jaws and teeth. The pharyngeal bones are very thin and brittle, each with about 200 teeth, minute above and gradually enlarging downwards, but not thickening or lengthening greatly on the lower part of the arch. The intestine is very slender, and about four times as long as the head and body taken together. The gills are remarkably compacted, the upper and lower ends nearly meeting when the mouth

is closed, and the longest of the anterior series are a little longer than the corresponding filaments.

Nineteen specimens, representing 13 localities from extreme northern to extreme southern Illinois, and various dates from April to October, indicate that our native carp differ from their near allies, the buffalo-fishes, in the smaller amount of vegetation eaten, in the greater quantity of mud mingled with the food, and in a deficiency of the larger insect larvæ. The vegetable food of these specimens was only 8 per cent., mostly the small duckweed, *Wolffia*. Mollusks made about a fourth of the food, all the thin-shelled bivalve *Sphærium*. Insects averaged about a third, the greater part larvæ of *Chironomus*. *Entomostraca* made nearly a fourth, and included a considerable list and variety of our more abundant species.

Key to the Species of **CARPIODES** found in Illinois

a. Snout short, 3½ to 4½ in head; nostrils well forward, the distance from anterior nostril to end of snout considerably less than diameter of eye; tip of lower jaw little in advance of nostrils.

b. Body robust, subfusiform, depth 2⅔ to 3 in length; snout obtusely pointed; eye moderate, 4½ to 5 in head; anterior rays of dorsal scarcely elevated, osseous at base; large species, reaching over 5 lb in weight..... **carpio.**

bb. Body thin and compressed, the back much elevated in adults, depth 2¼ to 2¾ in length; snout very blunt, squarish at tip; eye large, 3¾ to 4½ in head; anterior rays of dorsal much lengthened, sometimes equaling length of base of fin; small species, not over 12 inches in length ..... **difformis.**

aa. Snout longer, 3 to 3½ in head; nostrils situated well back, the distance from anterior nostril to end of snout usually greater than diameter of eye; tip of lower jaw far in advance of nostrils.

c. Body robust, subfusiform, depth 2⅔ to 3½ in length; anterior rays of dorsal scarcely elevated, about ½ length of base of fin; halves of lower tip meeting at a wide angle; large species, reaching a weight of 5 lb..... **thompsoni.**

cc. Body compressed, the back more or less arched, depth 2½ to 3 in length; anterior rays of dorsal much elevated, nearly or more than equaling length of base of fin; halves of lower lip meeting at a sharp angle; species of small size, not exceeding 12 inches..... **velifer.**

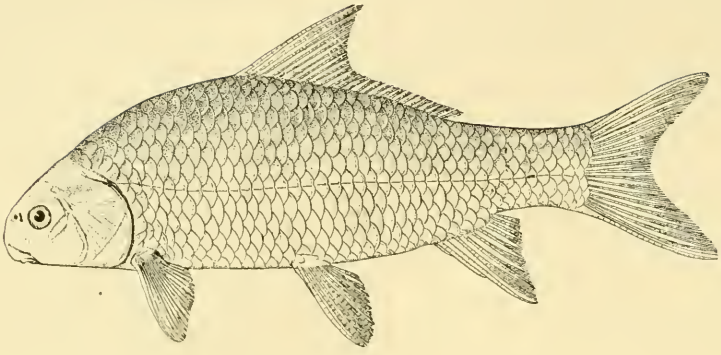


Fig. 17

CARPIODES CARPIO (Rafinesque)

(COMMON RIVER CARP)

Rafinesque, 1820, Ichth. Oh., 56 (**Catostomus**).

J. & G., 118; M. V., 45 (**Ictiobus**); J. & E., I, 166; N., 49 (**Ichthyobus carpio** and (?) **bison**); J., 65 (**carpio** and (?) **bison**); F., 81 (**Ictiobus cyprinus**, part); L., 11.

Body elongate, subelliptical, somewhat compressed, but more fusiform than in the next species, the back not greatly arched and the ventral line nearly straight; depth 2.9 to 3.3 in length. Size large, frequently taken weighing 3 or 4 lb and said sometimes to reach a weight of 7 or 8 lb. Color smoky to olivaceous over silvery, lighter below. Head short, deep and heavy, its length 4 to 4.4, depth 4.9 to 5.4, width 6 to 6.8 in length of body; snout short, somewhat pointed, 3.3 to 4.1 in head; the nostrils well forward, but not quite so much so as in the next species, the distance from the anterior nostril to end of snout $\frac{3}{5}$ to $\frac{4}{5}$ of diameter of eye; mouth wide and short, wholly inferior, the tip of lower lip very slightly in advance of nostrils; lips thin, the halves of lower meeting at a very wide angle or open curve; interorbital space 2.2 to 2.6 in head; eye moderate, 4.4 to 5.1 in head. Dorsal rays 23 to 27, the first rays notably osseous at base, little elongated, about $\frac{1}{2}$ length of base of fin. Scales large, 6, 35–37, 6, usually 35 or 36 in longitudinal series; lateral line complete, almost straight; scales (as in *difformis*) somewhat thinner and less closely imbricated than in *thompsoni* and *velifer*.

Occurs throughout the Ohio and Mississippi valleys, ranging southwest to central Texas. It seldom ascends the smaller streams, and our collections have come mainly from the Illinois at Meredosia and Havana, and from the Mississippi at Grafton. We have not found it anywhere abundant. It is said by Mississippi River fishermen sometimes to reach a weight of 10 lb. It is sold for food, but

is flavorless and soft. It breeds in spring, but the time of spawning is not indicated by our notes.

This fish is closely related to *C. difformis*, from which it may be distinguished by the more pointed snout, smaller eye, and more robust, subfusiform body. It and the next species agree in the shortness of the snout, $3\frac{1}{3}$ to $4\frac{1}{2}$ in head, and in the anterior position of the nostrils, and both are by these marks readily distinguishable, except in the case of very young specimens, from *thompsoni* and *velifer*, in which species the snout is notably longer, 3 to $3\frac{1}{2}$ in head, and the nostrils are situated far back from the end of the snout, the distance from the anterior nostril to the end of the muzzle being greater than the diameter of the eye.

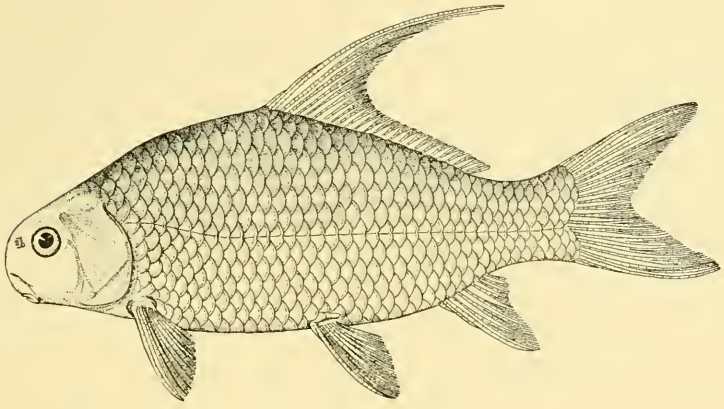


Fig. 18

CARPIODES DIFFORMIS Cope

(BLUNT-NOSED RIVER CARP)

Cope, 1870, P. Amer. Phil. Soc., 480.

J. & G., 120; M. V., 45 (**Ictiobus**); J. & E., I, 166; N., 49 (**Ichthyobus**); J., 65 (**difformis** and (?) **cutisanserinus**); F., 81 (**Ictiobus cyprinus,** part); L., 12.

Body short, compressed, the back much arched, ventral surface broad and nearly straight; depth 2.4 to 2.7 in length. Size small, seldom over 12 inches in length. Color silvery, obscured above by smoky olive, much as in the preceding species. Head small, short and deep, its length 3.9 to 4.3, depth 4.5 to 4.9, width 5.7 to 6.4 in length of body, snout short, very blunt, the muzzle squarish, distance from eye to tip 3.9 to 4.5 in head, usually greater than 4; nostrils near tip of snout, distance from anterior nostril to end of snout being $\frac{1}{3}$ to $\frac{3}{5}$ diameter of

orbit; mouth wholly inferior, not quite so wide as in the last species, the lips somewhat thicker, weakly plicate, the halves of lower meeting at a rather sharp angle; tip of lower lip scarcely in advance of nostrils; interorbital space 2.2 to 2.5 in head; eye larger than in other species of *Carpiodes*, 3.9 to 4.6 in head, usually but little more than 4. Dorsal rays 24 to 25, the first rays rather osseous at base, but not so robust as in *carpio*, and as a rule much elongated, sometimes exceeding in length the base of the fin. Scales large, 6–7, 35–37, 6, usually 35 or 36, rather loosely imbricated; lateral line complete, nearly straight.

Males with snout tuberculate in spring.

Ohio Valley and westward; generally common. Common in our collections, seeming to prefer the shallow waters of the smaller streams, where the young are often found in large numbers; adults taken sparingly in the Illinois and Rock rivers.

Represented in 102 of our collections, more than half of which are from creeks. We have found it less frequent in the larger than in the smaller rivers, and still less so in lakes and ponds. The size is small and the species is of little value as food. It is abundantly distributed throughout central Illinois, but has occurred less commonly in our southern Illinois collections, and is absent from the most of those made in the extreme northern part of the state. It apparently avoids in great measure the lower Illinoisan glaciation, having been taken but five times by us within that area.

CARPIODES VELIFER (Rafinesque)

(QUILLBACK; SILVER CARP)

Rafinesque, 1820, Ichth. Oh., 56 (**Catostomus**).

J. & G., 118 (**tumidus**), 119 (**cyprinus**); M. V., 45 (**Ictiobus**); J. & E., I, 167; N., 49 (**Ichthyobus**); J., 65; F., 81 (**Ictiobus cyprinus,** part); L., 12.

Body ovate, compressed, back much arched in adults; ventral line almost straight; depth 2.7 to 3 in length. Size small, seldom exceeding 12 inches. Color light olive above, sides silvery, fins pale. Head moderate, its length 3.6 to 4, depth 4.3 to 5.2, width 6 to 6.7 in length of body; snout long, bluntly pointed, as in last species, 2.9 to 3.5 in head, usually less than 3.2; nostrils well back, distance from anterior opening to end of snout greater than diameter of eye; mouth rather narrow, slightly oblique, tip of lower lip far in advance of nostrils; lips weakly plicate, rather thick, the lower halves meeting in a sharp angle; interorbital space 2.3 to 2.5 in head; eye small, 4.8 to 5.5 in head. Dorsal rays 27 to 30, usually 27, the anterior rays slender and elongate, sometimes longer than base of fin. Scales 7, 39–40, 6; lateral line complete, usually somewhat flexuose.

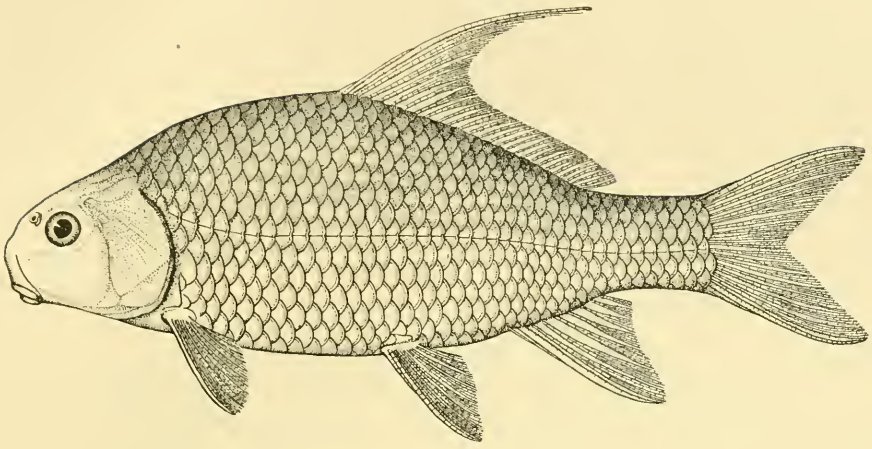


FIG. 19

This species, unlike the others of its genus, is most abundant in northern Illinois and least so in the southern part of the state. It is almost wholly wanting from our southern Illinois collections made within the area of the lower Illinoisan glaciation. Like the preceding species, however, it is found chiefly in the smaller rivers and creeks, nearly twice as frequently in the latter as in the rivers of larger size. It ascends small streams freely at the time of the spring floods. In 1898 it spawned at Havana about April 15. The snout of the male is tuberculate in the spawning season.

CARPIODES THOMPSONI AGASSIZ

(LAKE CARP)

Agassiz, 1855, Amer. J. Sci. Arts, XIX, 76.

J. & G., 119; M. V., 45 (**Ictiobus**); J. & E., I, 167; N., 49 (**Ichthyobus**); J., 65 (**thompsoni** and (?) **selene**); F., 81 (**Ictiobus cyprinus,** part).

Body elongate, subfusiform, the back little arched and the ventral line nearly straight, in general form and proportions very close to *C. carpio*, depth 2.8 to 3.2 in length. Larger than *difformis* and *velifer*, known to reach a weight of 3 to 5 lb, and said by lake fishermen to grow much larger. Color not different from that of *carpio*. Head moderate, its length 3.7 to 4, depth 4.5 to 5.1, width 5.7 to 6.4 in length of body; snout long, bluntly pointed, 3 to 3.4 in head; nostrils situated well back from end of snout, distance from anterior opening to tip of muzzle greater than diameter of eye; mouth narrower and longer than in the two preceding species, subterminal and somewhat oblique, the tip

of the lower lip far in advance of the nostrils; lips evidently plicate, not very thin, the halves of the lower one meeting at a rather wide angle; interorbital space 2.4 to 2.7 in head; eye small, 5 to 6.4, usually more than 5.5. Dorsal rays 25 to 30, usually nearer 30, anterior rays slender, little elevated, scarcely more than half the length of base of fin. Scales somewhat smaller and more closely imbricated than in the two preceding species, 7, 38 to 40, 6, usually 39 in longitudinal series; lateral line complete, nearly straight.

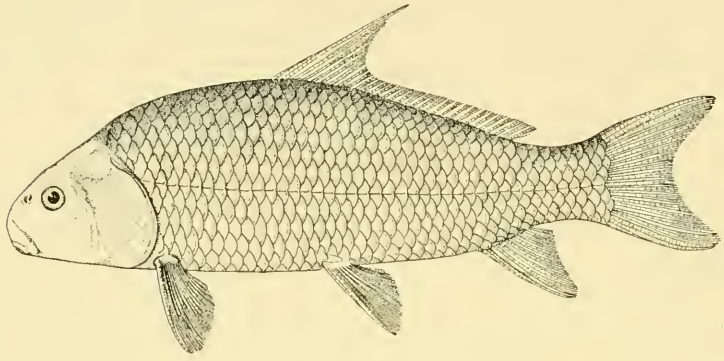


FIG. 20

This species can be separated with readiness from both the preceding by its longer nose, more oblique mouth, and more posterior nostrils; it is easily distinguished from the next when adult by its larger size and by the differences in general proportions, and by the shortness of the first dorsal rays. The young of these two species can not be separated with any certainty.

This carp-sucker belongs to the fauna of the Great Lake region and is but rarely taken in the inland waters of Illinois, our adult specimens numbering a very few from the Illinois river at Ottawa, Henry, Havana, and Meredosia. It is too rare in our waters to be commercially important. Its special habits are unknown.

GENUS **ERIMYZON** JORDAN

(CHUB-SUCKERS)

Body oblong, more or less compressed; mouth subinferior; upper lip protractile; lower lip plicate, infolded, forming an acute angle in front; no anterior fontanelle; posterior fontanelle well developed; no supraorbital bone; suborbital bones well developed, not much narrower than the fleshy portion of the cheeks below; pharyngeal bones weak,

the teeth small and slender, rapidly diminishing in length upward; vertebræ 34; ribs 13; dorsal rays 11 or 12; scales large; lateral line wanting at all ages; air-bladder with two chambers. Fresh waters of the United States; one species, widely distributed.

ERIMYZON SUCETTA OBLONGUS (Mitchill)

(CHUB-SUCKER; SWEET SUCKER)

Mitchill, 1815, T. Lit. & Phil. Soc. N. Y., 1 (**Cyprinus oblongus**).
G., VII, 21 (**Moxostoma oblongum**); J. & G., 133; M. V., 46; J. & E., I, 186; N., 48 (**Erimyzon oblongus**); J., 64; F., 80; F. F., II. 7, 447; L., 12.

Body oblong, compressed, the depth increasing with age; predorsal region often more or less elevated and profile angled at nape in old specimens; depth 3.1 to 3.9 in length. Size small, length about 10 inches. Coloration varying considerably with age; in adults a nearly uniform brownish olive, intermixed with pinkish anteriorly, and everywhere with more or less of a coppery luster; paler below; fins dusky, ventrals and anal most so. In young specimens the sides are marked by four distinct bands of color: a dark band extending from occiput backward on each side of dorsal fin to middle of caudal peduncle, covering 4 upper rows of scales; below this a band of light color, extending from just above upper corner of gill-cleft to upper part of base of caudal; next, and most prominent, a narrow band of purplish black, extending from center of base of caudal forward along sides and through eye to end of snout; and beneath this dark lateral band the sides pale to the whitish or silvery belly. Adults are found which retain to a greater or less extent the markings of the young, specimens from 6 to 8 inches in length sometimes showing more or less plainly the dark lateral stripe, as well as the apportionment of color in bands above and below; the black lateral band may break up into indistinct bars with age, various stages between the barred condition and a uniform dusky coloration being found. Head short, compressed, considerably tapered, its length 3.5 to 4.1, width 5.1 to 6.5, depth 4.6 to 5.6 in length of body; interorbital space weakly convex, 2.2 to 2.6 in head; snout (usually) 2.5 to 3.2 in head; mouth subterminal, rather small, mandibles more or less obliquely set, tip of upper lip in old specimens sometimes not far below level of lower rim of orbit; lower lip strongly plicate, its halves meeting in a rather acute angle; eye large, 3.8 to 5.8 in head. Dorsal fin a little higher than long, its developed rays 9 to 12. Scales large, 36 to 45 in longitudinal series, transverse rows 13 to 15; scales more or less crowded anteriorly and somewhat irregularly arranged on posterior half of body; lateral line as a rule entirely wanting at all ages; specimens occasionally found with one or two imperfectly developed pores.

Head of spring males with three large tubercles on each side of snout, two in longitudinal series in front of eye, one lower down, near corner of mouth.

This species, with its two varieties, extends throughout the Great Lake region; northeast to the St. Lawrence and the Connecticut rivers, and to the St. Johns River, in New Brunswick; southeast to Georgia, South Carolina, and Florida; southward to the Gulf, southwest to the Rio Grande, and northward to the Dakotas. The northern representatives of the species belong to the variety *oblongus* and the southern to *sucetta*.

In this state it is widely distributed in large and small streams, and in the small lakes of McHenry county, in northeastern Illinois; but it is much the most abundant in the eastern part of the state in the drainage of the Wabash and the Ohio rivers, and in the headwaters of the Sangamon and of the Kaskaskia adjacent to these. A line drawn through the middle of the state from north to south but swerving slightly to the west below central Illinois, has 101 of our localities for this species to the east of it and but 8 to the west. It is essentially a creek species, occurring proportionally five times as frequently in our collections from creeks as from rivers, large or small, and eight times as frequently as from lakes and ponds.

The chub-sucker is a bottom feeder, and has the habit of supporting itself on the bottom, like the darter, by means of its paired fins. In ordinary seasons it spawns in central Illinois in April and May. Ripe males were taken at Havana April 10, 1899, and females with ripe ovaries from March 20 to April 15. This fish bites readily at a small hook, but its flesh is bony and without flavor, and owing to its small size the species has no commercial value.

Genus **MINYTREMA** Jordan

(spotted suckers)

Body elongate, compressed; mouth inferior; upper lip freely protractile; lower lip plicate, forming an angle posteriorly; posterior fontanelle large; supraorbital bone present; suborbital bones well developed; pharyngeal bones as in *Erimyzon*, but the teeth somewhat coarser; vertebræ 39; thoracic ribs 17; dorsal rays about 12; scales rather large, nearly equal all over the body; lateral line interrupted in adults, more or less imperfect in half-grown specimens and entirely obsolete in the young; air-bladder with two chambers. Fresh waters of the United States; one species known.

MINYTREMA MELANOPS (RAFINESQUE)

(SPOTTED SUCKER; STRIPED SUCKER)

Rafinesque, 1820, Ichth. Oh., 57 (**Catostomus**).
G., VII, 19 (**Catostomus fasciatus**); J. & G., 136; M. V., 47; J. & E., I, 187; N., 48 (**Erimyzon**); J., 64; F., 80; F. F., II. 7, 444; L., 12.

Body oblong, little compressed, adults becoming deeper, depth 3.9 to 4.5 in length. Size rather large, reaching a length of 18 inches. Head olivaceous above, lighter olive to silvery on cheeks and opercles, with some coppery; sides coppery above, greenish gray to silvery below; each scale along sides with a quadrate spot of very dark greenish at base, the spots forming rows lengthwise of body; belly greenish to silvery, with suggestions of coppery luster; fins scarcely dusky, the membranes light greenish. Head 3.9 to 4.6 in length of body, its width 5.9 to 6.8, depth 5.3 to 6, rather flattened above but not depressed; snout 2.3 to 2.7 in head, bluntly pointed; upper lip with faint plicæ, lower evidently plicate, its halves meeting at a rather sharp angle; interorbital space 2.2 to 2.5 in head; eye small, 4.4 to 6.9 in head, placed high, about midway of length of head. Dorsal rays 11 to 12, not including rudiments, the fin higher than long, its position about midway, usually a very little forward. Scales large, 6 or 7, 42–46, 5 to 7, regularly imbricated, not crowded forward; lateral line incomplete in adults, in young specimens imperfect or wanting.

Head of old males covered with small tubercles in spring.

This species is found in the Great Lake region, the upper Mississippi Valley as far north as the Yellowstone, southward and southwestward to the Gulf and to Texas, and on the Atlantic slope from New Jersey to North Carolina. In Illinois it has been taken in all our stream systems, including the Lake Michigan drainage, but most abundantly in the Wabash and the Kaskaskia basins. In proportion to the number of collections made, it has been found in central Illinois twice as frequently as in northern, and in southern Illinois twice as frequently as in central. It is mainly a species of creeks and the smaller rivers—twice as abundant in the former as in the latter—and is comparatively rare in lakes and ponds. It grows to a length of 18 inches, but is not abundant enough in Illinois to have any noticeable value. From the little that is known of its food we may surmise that it lives largely on mollusks and insect larvæ.

GENUS CATOSTOMUS LE SUEUR

(FINE-SCALED SUCKERS)

Head more or less elongate; mouth inferior, the upper lip thick, protractile, papillose; lower lip greatly developed, incised behind so as

to form two lobes; posterior fontanelle large; supraorbital bone wanting, as in *Erimyzon* and *Moxostoma*; suborbital bones narrow; pharyngeal teeth shortish; vertebræ (*commersonii*) 44; ribs 17; dorsal rays 9 to 14; scales usually small, 50 to 115 in the lateral series; lateral line well developed; air-bladder with two chambers. Species numerous; fresh waters of the United States and Canada, east and west of the Rockies; one species (*C. rostratus tilesius*) found in Siberia; two species found in Illinois. Breeding males of most species with a rosy lateral band, with median fins higher than in female, and with anal swollen and tuberculate.

Key to the Species of **CATOSTOMUS** found in Illinois

a. Head transversely convex above, the orbital rim not elevated; scales in lateral line 60 or more, crowded and smaller anteriorly.
b. Scales in lateral line 95–115 ..... **catostomus.**
bb. Scales in lateral line 68–80 ..... **commersonii.**
aa. Head broad, depressed, transversely concave between the orbits; scales nearly equal all over the body, not crowded anteriorly, 48 to 55 in the lateral line ..... **nigricans.**

CATOSTOMUS CATOSTOMUS (Forster)

(LONG-NOSED SUCKER; NORTHERN SUCKER; RED SUCKER)

Forster, 1773, Phil. Trans., 155 (**Cyprinus**).

Body elongate, subterete, the depth $4\frac{1}{4}$ to $4\frac{3}{4}$ in length. Head quite long and slender, $4\frac{1}{4}$ to $4\frac{2}{3}$ 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, rarely 4, rows of tubercles; lower lip deeply incised, the lobes shorter than in *C. griseus*, and the mouth narrower. Lower jaw with a short cartilaginous sheath. Eye rather small, behind the middle of the head. Scales very small, much crowded forward, 95 to 114 in the lateral line, and about 29 (26 to 31) in a cross-row from dorsal to ventrals. Dorsal rays 10 to 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. Length $2\frac{1}{2}$ feet. Great Lakes, upper Missouri river, upper Columbia, and northwestward to Alaska; very abundant northward, but not coming south of lat. 40°.—Jordan and Evermann (Bull. U. S. Nat. Mus., No. 47, I., p. 176).

Found in lower Lake Michigan at Miller, Indiana, and doubtless occurring in the lake within the limits of Illinois.

CATOSTOMUS COMMERSONII (LACÉPÈDE)

(COMMON SUCKER; FINE-SCALED SUCKER)

Lacépède, 1803, Hist. Nat. Poiss., V, 502 (**Cyprinus**).
G., VII, 15 (**teres**); J. & G., 129; M. V., 46 (**teres**); J. & E., I, 178; N., 48 (**teres**); J., 64; F., 81 (**teres**); F. F., II. 7, 444 (**teres**); L., 12.

Body elongate, subterete, rather heavy forward, depth 4.3 to 5.3 in length, usually 4.5 to 5. Length 18 inches. Color olivaceous on back and sides, with more or less golden luster; belly whitish; vertical fins with some dusky on rays, membranes paler, those of ventrals and pectorals orange, becoming deeper in spring males, which also have a faint rosy lateral band. Young brownish with blackish blotches and mottlings which are more or less confluent, sometimes forming an indistinct lateral band. Head rather stout, subconical, flattish above, its length 4 to 4.8, width 5.5 to 7, depth 5.5 to 6.6 in body; interorbital space nearly flat, 2.1 to 2.6 in head, snout blunt, decurved, squarish at tip; mouth inferior, rather large, the lips strongly papillose, the upper rather thick, with 3 or 4 rows of papillæ; eye moderate, 4.5 to 6.2 in head, more than 5 in adults. Dorsal fin with 11 to 13, usually 12, rays, its height scarcely, if at all, exceeding the length of the fin's base. Scales 10–11, 63–80, 9–11, crowded anteriorly and below; lateral line complete in adults, pores wanting on some scales in young.

The fine-scaled sucker occurs in streams and ponds from the Great Lakes to New Brunswick and Laborador, in the Hudson River, on the Atlantic slope from New Jersey to South Carolina, and northward to Great Bear Lake and Hudson's Bay. It is abundant throughout the central part of the eastern United States from Massachusetts to Kansas, and is common in the northern third of Illinois, especially in the smaller rivers and larger creeks. It occurs but rarely in the Illinois River as far south as Peoria, and has not been taken by us south of Alton except in the streams of extreme southern Illinois below the Illinoisan glaciation. It is with us essentially a species of creeks and small rivers, nearly four times as common, according to our data, in the former as in the latter. It has been taken but four times in our 293 collections from rivers of the larger size, and but twice from 591 collections made from lakes, ponds, and sloughs. It is common, however, in Lake Michigan. Our collection data show that it is much more likely to be abundant on bottoms with more or less rock and sand than on a completely muddy bottom, and that it has also a decided preference for clear, swift waters. The species reaches a length of 22 inches and a weight of 5 lb.

The food of this sucker has not been carefully studied, but the strong, thick pharyngeal jaws, nearly twice as wide as high, and the

relatively small number of pharyngeal teeth, the lower of which are very much thickened, with expanded crowns, constitute a crushing and grinding apparatus which strongly suggests a prevailing molluscan diet. The gill-rakers are less effective than those of the red-horse, indicating a smaller ratio of crustacean food.

The species spawns in April or May, preferring for the purpose riffles or swift-flowing water to quiet pools.

Though bony, these fishes have a sweet, firm, and flaky flesh, and furnish a food of considerable importance in many parts of the country. They are frequently salted for winter use, and are sometimes sold in our local markets under the name of "family whitefish." They are taken with seines, traps, and gill-nets, bite readily at the hook baited with worms or bits of crawfish, and are sometimes caught by boys in spring with snares fastened to poles.

CATOSTOMUS NIGRICANS Le Sueur

(HOGSUCKER; HOGMOLLY; STONE-ROLLER)

Le Sueur, 1817, J. Ac. Nat. Sci. Phila., 102.
G., VII, 17; J. & G., 130; M. V., 46; J. & E., I, 181; N., 48 (**Hypentelium**); J., 64; F., 81; F. F., II. 7, 445 (**Hypentelium**); L., 12.

Body moderately elongate, subcylindrical, heavy forward, much tapered posteriorly, depth 4.6 to 5.1 in length. Size rather large, reaching a length of 2 feet. Color olivaceous, with brassy luster on sides; belly satiny white; back and sides in younger specimens with 4 rather broad and distinct oblique bars of dark color, one half way between occiput and dorsal, one just behind fin, and one half way between back of dorsal and base of caudal, these bars becoming faint or obsolete in adults; lower fins reddish, with some dusky shading, appearing as faint mottlings on pectorals and ventrals. Head very large, the frontal region broad and foreshortened, length of head 3.6 to 4.5, width 4.7 to 5.8, depth 5.9 to 6.6 in body; interorbital space transversely concave, 1.9 to 2.5 in head; snout long and strongly decurved, 1.8 to 2.2 in head; mouth wholly inferior, the lips very thick and strongly papillose, the upper almost as thick as the lower, with 8 to 10 series of papillæ; lower lip less incised behind than in *Catostomus* proper; eye moderate, 4.8 to 6 in head, over 5 in adults. Dorsal fin with 10 or 11 rays, rather low, the longest ray scarcely equaling the length of the base of the fin; pectorals very long, reaching $\frac{2}{3}$ to $\frac{3}{4}$ of distance to ventrals. Scales rather large, 7, 46–51, 6, somewhat smaller on breast and belly, but not crowded forward on sides or in predorsal region; lateral line complete, almost straight.

This peculiar sucker is distributed throughout the Great Lake region and along the Atlantic slope as far as the Carolinas, westward to Minnesota and Kansas, north to the Lake of the Woods, and

south to Arkansas. It is especially abundant in swift and rapid streams, and is rarely found in muddy water. Its avoidance of muddy situations is illustrated especially by its distribution in Illinois, not a single collection of this species having been made by us from the persistently turbid waters of the lower Illinoisan glaciation. It is rare in the southern third of the state, and was taken by us but once from any locality of extreme southern Illinois. It has occurred in our collections most abundantly in the headwaters and smaller tributaries of the Illinois, the Kaskaskia, the Embarras, and the Big Vermilion, in the northern and eastern parts of the state.

The most striking peculiarities of this fish are related to its haunts and feeding habits. The large bony head and the unusually developed pectoral fins, together with the full lips and the papillose mouth, are all related to the fact that it seeks its food in the more rapid parts of streams, pushing about the stones upon the bottom and sucking up the ooze and slime thus exposed, together with the insect larvæ upon which it mainly depends for food. The slender body, the large pectoral fins, and the comparatively high coloration of this species give it the aspect of a darter among the suckers, and its active habit and the peculiar character of its food resources is another point of affinity with that interesting group. It has also, like the darters, the habit of resting quietly on the bottom, supported by its paired fins, where its coarsely mottled colors serve well to conceal it among the surrounding stones.

Proportionately to the number of collections made by us, this species was about three times as abundant in central Illinois as in southern, and three and a half times so in northern Illinois as in central. It was much commonest in the smaller rivers and about half as abundant in creeks, although not wholly wanting in either the larger rivers or in the glaciated lakes of northeastern Illinois. It was not taken by us at all off really muddy bottoms.

Widely different as are the food and feeding habits of this species and those of the common sucker, its nearest ally in our waters, their alimentary structures are not remarkably unlike. The pharyngeals of the present species are somewhat lighter, the pharyngeal teeth more slender and more prominently hooked, and the gill-rakers somewhat stouter, thus affording a better apparatus for the retention of the relatively large insect larvæ upon which this species chiefly feeds. It is, in short, a molluscan feeder which has become especially adapted to the search for insect larvæ occurring

in rapid water under stones. It feeds, so far as our observations go, almost wholly upon aquatic larvæ, mainly those of day-flies, more than half of the food of the specimens examined consisting of a single form (*Cænis*) abundant under stones.

A few aquatic larvæ of a gnat (*Chironomus*), and some other insect remains, with an insignificant ratio of small bivalve mollusks, were the other elements of its food.

It ascends the swifter brooks in spring, no doubt for spawning, although its habits of reproduction are not known. It is sometimes used for food, but has virtually no economic value.

Genus **MOXOSTOMA** Rafinesque

(RED-HORSE)

Body more or less elongate, usually more or less compressed; mouth inferior; lips with transverse plicæ, the folds rarely so broken up as to form papillæ; posterior fontanelle always well open; supraorbital bone wanting; suborbitals very narrow; pharyngeal bones weak, the teeth rather coarser than in *Erimyzon* and *Catostomus*; vertebræ (*aureolum*, *breviceps*) 39 to 41; ribs 15 to 17; dorsal rays 11 to 17, usually about 13; scales large, usually about 44 in the median lateral series; lateral line well developed; air-bladder with 3 chambers. Males in spring with lower fins reddened (whence the common name), and with anal rays swollen and tuberculate.

United States, east of the Rocky Mountains; species numerous; 3 species found in Illinois.

The gill-rakers of the red-horse are largely modified into transverse leaf-like plates with notched edges projecting in triangular outline only a little beyond the margin of the thick, strong arch. Those of the anterior gill are more elongate, but stout and triangular, and about three fourths as long as the gill-filaments, the whole branchial apparatus being thus coarse and strong, better adapted to hold hard and somewhat bulky objects than to strain from the water small and delicate ones. The pharyngeal jaws are moderately heavy, with strong teeth, and the intestine is small and about one and a fourth times the length of the head and body. Quite in correspondence with these features of the feeding apparatus, the main food of the red-horse consists of water-snails of various species, and small bivalve mollusks belonging to the genus *Sphærium*. About a third of the food of specimens examined by us consisted of insects, practically all aquatic larvæ. The vegetable matter present in the food of specimens taken from the Illinois River at Peoria was mainly

distillery slops entering the streams from the adjacent distilleries. The latter element was insignificant, however, in total amount, insects and mollusks making fully 95 per cent. of the stomach contents studied, mollusks being nearly twice as abundant as insects. In consequence of the manner in which the food is collected from the bottom, considerable quantities of mud are, of course, swallowed with it.

These fishes are caught mainly with seines and pound-nets, but they also bite readily at the hook.

Key to Species of **MOXOSTOMA** found in Illinois

a. Folds of lower lip more or less broken up into papillæ.
b. Head short, $4\frac{1}{2}$ to $5\frac{1}{2}$ in body; lower lip truncate behind, mouth small; developed dorsal rays 12 or 13 ..... **breviceps.**
bb. Head longer, $3\frac{1}{2}$ to $4\frac{1}{3}$ in body; halves of lower lip meeting in a sharp angle, mouth large; developed dorsal rays 14 to 16 ..... **anisurum.**
aa. Lips strongly plicate.
c. Head 4 to $4\frac{1}{2}$ in body; halves of lower lip meeting in a rather wide angle, mouth large; developed dorsal rays 12 to 14 ..... **aureolum.**

MOXOSTOMA ANISURUM (Rafinesque)

(WHITE-NOSED SUCKER)

Rafinesque, 1820, Ichth. Oh., 54 (**Catostomus**).
G., VII, 20 (**Catostomus carpio**); J. & G., 139 (**carpio**); M. V., 47; J. & E., I, 190; N., 49 (**Teretulus carpio**); J., 63 (**Myxostoma carpio**); F., 80 (**carpio**).

Body stout, heavy forward, deep and compressed, the back elevated, rather humped in front of dorsal in old specimens; depth 3.3 to 4.1 in length. Size large, reaching a weight of 5 to 10 lb. Color pale, silvery, darker above, nose and chin whitish; dorsal and caudal with some dusky, lower fins white or light reddish. Head broad and short, squarish in cross-section in region of orbit, its length 3.5 to 4.3, width 5.2 to 6.5, depth 4.6 to 5.5 in head; interorbital space flat, 2.2 to 2.6 in head; snout rather long, 2.1 to 2.6 in head; its tip squarish, little decurved, the profile nearly straight to its tip when the mouth is closed; mouth rather large, the upper lip thin, plicate-papillose, the lower thicker, its folds broken into evident papillæ, the halves meeting at a sharp angle; eye rather large, slightly back of middle of head, 4 to 6.4 in its length. Dorsal fin long, its rays about 15 (14 to 17), the longest about $\frac{5}{8}$ length of base of fin, the free margin straight; lower fins long, pectorals reaching $\frac{3}{4}$ of distance from pectoral to ventral basis; upper lobe of caudal a little longer than lower. Scales 6, 42–45, 6; lateral line complete, somewhat flexuose, but nearly straight.

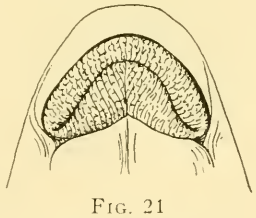


Fig. 21
Lips of *Moxostoma anisurum*

Found in the Great Lake region and the Ohio Valley, including Pennsylvania and New York; also ranging down the St. Lawrence and into the streams of the Atlantic coast as far south as North Carolina. Northward its range extends to Lake Winnipeg and the Assiniboin River.

This is the so-called white-nosed sucker of the Great Lakes. It is distributed throughout Illinois, but in rather moderate numbers, and mainly in the larger streams—the Illinois, the Rock, the Mississippi, the Ohio, and the Wabash. The species reaches a large size, varying in length from one to two feet, and it is a somewhat acceptable, though not abundant, food fish. At some points on Lake Michigan it contributes a considerable percentage to the catch of suckers, although the fine-scaled sucker and the short-nosed redhorse commonly outnumber it.

MOXOSTOMA AUREOLUM (Le Sueur)

(COMMON RED-HORSE)

Le Sueur, 1817, J. Ac. Nat. Sci. Phila., I, 95 (**Catostomus**).

G., VII, 18 (**Catostomus duquesni**); J. & G., 140 (**macrolepidotum,** part); M. V., 47 (**macrolepidotum duquesnei** and (?) **aureolum**); J. & E., I, 192; N., 49 (**Teretulus duquesnii** and **macrolepidotum**); J., 63 (**Myxostoma macrolepidotum** var. **duquesnii**); F., 80 (**macrolepidotum**); F. F., II. 7, 442 (**macrolepidotum**).

Body elongate, heavier forward, considerably compressed, the back little elevated; depth 4 to 4.4 in length. Size rather large, attaining a weight of 5 or 6 lb. Color of back and sides an almost uniform olivaceous, very litttle darker above, taking on a faint silvery tinge lower down; faint tints of salmon or yellowish along sides in front of dorsal; belly smoky white; dorsal quite dusky, without pale edge; caudal grayish olive; lower fins with some orange near base, the broad outer margins faintly dusky. Head moderate, 3.9 to 4.5 in length, its width 5.7 to 6.8, depth 5.2 to 5.9, not strongly tapered, rather flattened above, the cheeks nearly vertical; interorbital space nearly flat, 2.2 to 2.6 in head; snout 2.3 to 2.8 in head, its tip squarish, little decurved; mouth large, both upper and lower lips thick, strongly and coarsely plicate, halves of lower lip meeting at a rather wide angle; eye large, 4 to 5 in head. Dorsal rays 12–14, the fin a little higher than long, last ray more than half the length of longest anterior ray; free margin of dorsal straight; lower fins rather longer than in the next species, longest in the males, pectorals reaching $\frac{2}{3}$ to $\frac{3}{4}$ of distance from pectoral to ventral basis; upper lobe of caudal a little longer than lower. Scales 6, 41–48, 5–7; lateral line complete, faintly flexuose.

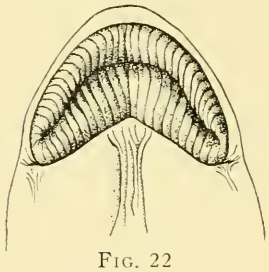


FIG. 22
Lips of *Moxostoma aureolum*

This species, much the most abundant of the Illinois red-horse, occurs outside our limits from the St. Lawrence and the Hudson rivers through the Great Lakes to the Missouri River, north to Winnipeg and the Assiniboin, and southward to Arkansas and Georgia. In this state it is much the commonest in the northern and eastern two thirds of our area, showing a tendency, like the preceding species, to avoid the turbid waters of southern Illinois, although present in the clearer waters south of the lower Illinoisan glaciation. It occurs in 148 of our collections, most abundantly, in proportion to the number made, in the Rock River and the northwest basins, and in the Kaskaskia and Wabash systems. It has been taken by us, however, in all the other stream systems except that of the Big Muddy. It is much the commonest in creeks and the smaller rivers, the numbers found in the larger rivers being only half the normal ratio for the species, and those in lakes and sloughs a fourth that ratio. Its preference for swiftly flowing streams and its avoidance of a mud bottom are also conspicuously shown by our data of ecological distribution.

This red-horse is not tenacious of life, but dies quickly in the aquarium if the water is in the least impure. It also readily succumbs to impure conditions of its native waters such as are likely to occur in midsummer, sometimes perishing in vast numbers and stranding along the banks when violent summer rains, following long periods of drought, overload the streams with mud and decomposing vegetation.

It spawns in April and May, ascending the smaller streams for the purpose. Females taken from the Illinois River at Meredosia May 5, 1899, were already spent.

MOXOSTOMA BREVICEPS (Cope)

(SHORT-HEADED RED-HORSE)

Cope 1870, P. Am. Phil. Soc., 478 (**Ptychostomus**).

J. & G., 141 (**anisurum** and (?) **aureolum**); M. V., 48 (**crassilabre**); J. & E., I, 196; N., 49 (**Teretulus aureolum**); J., 63 (**Myxostoma aureolum**); F., 80 (**aureolum**); F. F., II. 7, 444 (**aureolum**); L., 12 (**macrolepidotum**).

Body subfusiform, moderately compressed, rather deep under front of dorsal, in form much like a *Coregonus*; depth 3.8 to 4.4 in length. Size moderate, our largest specimens about 15 inches in length. Color pale yellowish olive, with a faint coppery tint on sides in predorsal region; rest of sides and caudal peduncle very light pea-green, grading to whitish or dull silvery lower down and on belly; dorsal very pale olive, scarcely dusky; caudal light reddish outward, olive near base; lower fins salmon

with paler, greenish margins. Head extremely short, subconical, tapering both above and below to the tip of the pointed snout; length of head 4.6 to 5.4 in body, usually more than 5 in adults, width 6.6 to 7.6, depth 5.7 to 6.7; interorbital space 1.9 to 2.4 in head, noticeably convex; chin convex; cheeks shallow, not vertically continuous to a flat chin as in *aureolum* and *anisurum*, a cross-section of the head in the orbital region not being squarish as in those species; snout 2.3 to 2.9 in head, not at all decurved; mouth small, upper lip rather coarsely plicate, the folds shallow and not continued back to the inside of the lip; lower lip truncate behind, the two halves scarcely separated at the shallow incision, the coarse but shallow plicæ evident in front, but breaking up into irregular papillæ posteriorly; eye small in comparison with length of body, but contained 4 to 5 times in the very short head. Dorsal rays 12 or 13, the fin notably higher in front than behind, the last ray being less than half the length of the longest anterior ray, which is usually considerably longer than the base of the fin; free margin of dorsal concave; pectorals longer than the short head, but relatively shorter than in the two preceding species, scarcely reaching $\frac{2}{3}$ of the distance from pectoral to ventral basis; upper lobe of caudal falcate, usually, though not always, longer than lower. Scales 6, 43–45, 5 or 6; lateral line complete, nearly straight.

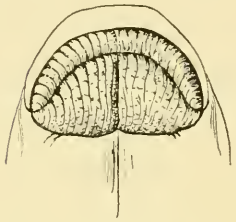


FIG. 23
Lips of *Moxostoma breviceps*

This species occurs in the Ohio Valley and the Great Lake region, being especially abundant in Lake Erie. In the Mississippi Valley it ranges up the Missouri to Cheyenne Falls. It is especially a northern Illinois fish, only one of our collections made in the southern part of the state containing it, and this falling outside the area of the lower Illinoisan glaciation. It is about equally common in central and northern Illinois, and has been more uniformly distributed, according to our observations, than the other species of its genus, occurring in about equal frequency, relatively to the number of collections made, in the larger rivers and in creeks and lakes, but about twice as abundantly in the smaller rivers. It shows also considerably less marked preference than the preceding species for clear and swiftly flowing waters.

GENUS **PLACOPHARYNX** COPE

(PAVEMENT-TOOTHED RED-HORSE)

Suckers like *Moxostoma* 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 cylindrical in form, but little compressed and with a broad and more or less

flattened grinding surface; mouth larger and more oblique, and lips thicker than in most species of *Moxostoma*. Fresh waters of southeastern United States; one species known.

PLACOPHARYNX DUQUESNEI (Le Sueur)

Le Sueur, 1817, J. Ac. Nat. Sci. Phila., I, 105 (**Catostomus**).
J. & G., 143 (**carinatus**); M. V., 48 (**carinatus**); J. & E., I, 198; N., 49 (**carinatus**); J., 63 (**carinatus**); F., 80 (**carinatus**); F. F., II. 7, 441 (**carinatus**); L., 13.

Body elongate, heavier forward, the form much as in *Moxostoma aureolum*, but the back less elevated and the body somewhat less compressed; depth 3.8 to 4.5 in length. Length 15 to 30 inches. "Color dark olive-green, the sides brassy, not silvery; lower fins and caudal orange-red" (Jordan & Evermann). Head broad, flattish above, but less so than in *M. aureolum*, cheeks vertical, chin flat; length of head 4.2 to 4.5, width 6.2 to 6.7, depth 5.3 to 6 in body; interorbital space slightly convex, 2.1 to 2.3 in head; snout blunt, squarish at tip, scarcely decurved, 2.3 to 2.4 in head; mouth very large, the lower jaw oblique when the mouth is closed; lips very thick and coarsely plicate, the folds broken in places into very fine papillæ in old specimens; lower lip very large, protruding when mouth is closed, its halves meeting behind in an almost straight line; eye large, 4.3 to 5 in head. Dorsal fin with 12 or 13 rays, higher than long, its free margin weakly concave, last ray half length of longest anterior ray; pectorals short, reaching but about $\frac{2}{3}$ of distance from pectoral to ventral basis; ventrals short, their tips 5 or 6 scales from vent. Scales 6, 43–47, 6 or 7; lateral line complete, almost straight.

This fish has not ordinarily been separated readily from specimens of *Moxostoma* without removal and examination of the characteristic pharyngeal bones, but, as it seems to us, its very large mouth and subtruncate lower lip, and its shorter lower fins should enable one to distinguish it with ease from both *Moxostoma anisurum* and *M. aureolum*—the only species found in its range, so far as is known, that resemble it at all closely.

Its branchial apparatus is not notably different from that of *Moxostoma*, the gill-rakers being short and few, and effective only on the upper part of the arch, the lower arm being, like that of *Moxostoma*, covered by a rigid pad. The species is very remarkably distinguished, however, by its heavy pharyngeal jaws and its thick and strong pharyngeal teeth with conspicuous grinding surface. These number about 30 on each pharyngeal, the upper ones minute and useless rudiments, and the lower 10 very large, occupying about two thirds the length of the arch—the lower 6, in fact, about half of it. It is probable that this apparatus is related to a preference for mollusks as food, but the number of specimens available for our examination has been too small to test this supposition.

In two examples taken from the Illinois River at Havana in October, the food was about a third mollusks and two thirds insects, the latter largely larvæ of May-flies and of large water-beetles (*Hydrophillidæ*).

Michigan to Tennessee, Georgia, and Arkansas; especially abundant in the Ozark region and in the French Broad River basin. Rare in Illinois: one specimen from the Wabash; two specimens from the Illinois; and two or three others from localities unknown.

Genus **LAGOCHILA** Jordan & Brayton

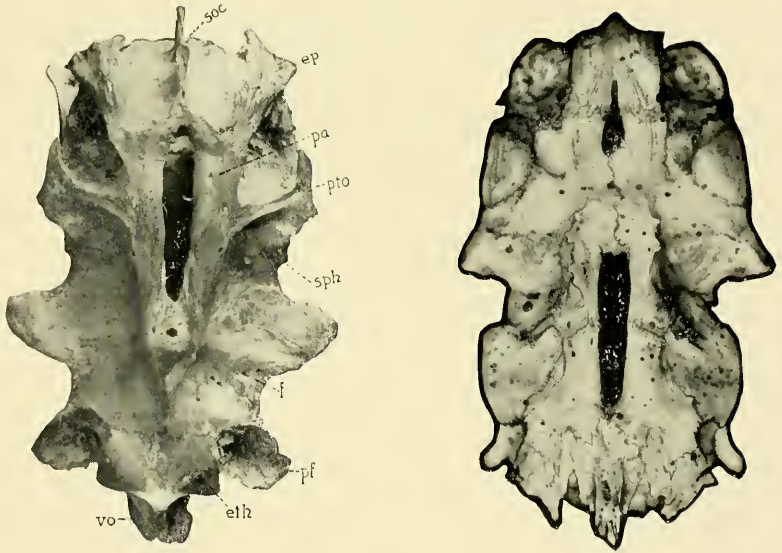
(RABBIT-MOUTH SUCKER)

Suckers in all respects like *Moxostoma* except for the singular structure of the mouth; upper lip not protractile, greatly prolonged and closely plicate; lower lip much reduced, divided into two distinct lobes, which are weakly papillose, the split between the lobes extending backward to the edge of the dentary bones; lower lip entirely separated from upper at angles by a deep fissure, which is mostly covered by the skin of the cheeks. Ozark region, Wabash, Clinch, Scioto, Cumberland, Chickamauga, and White (Arkansas) rivers. One species known, *L. lacera* Jordan & Brayton, not at present known from Illinois, although not unlooked for in collections from the Wabash basin. (For description see Jordan & Evermann, Bull. U. S. Nat. Mus., No. 47, I., p. 199.)

Family **CYPRINIDÆ**

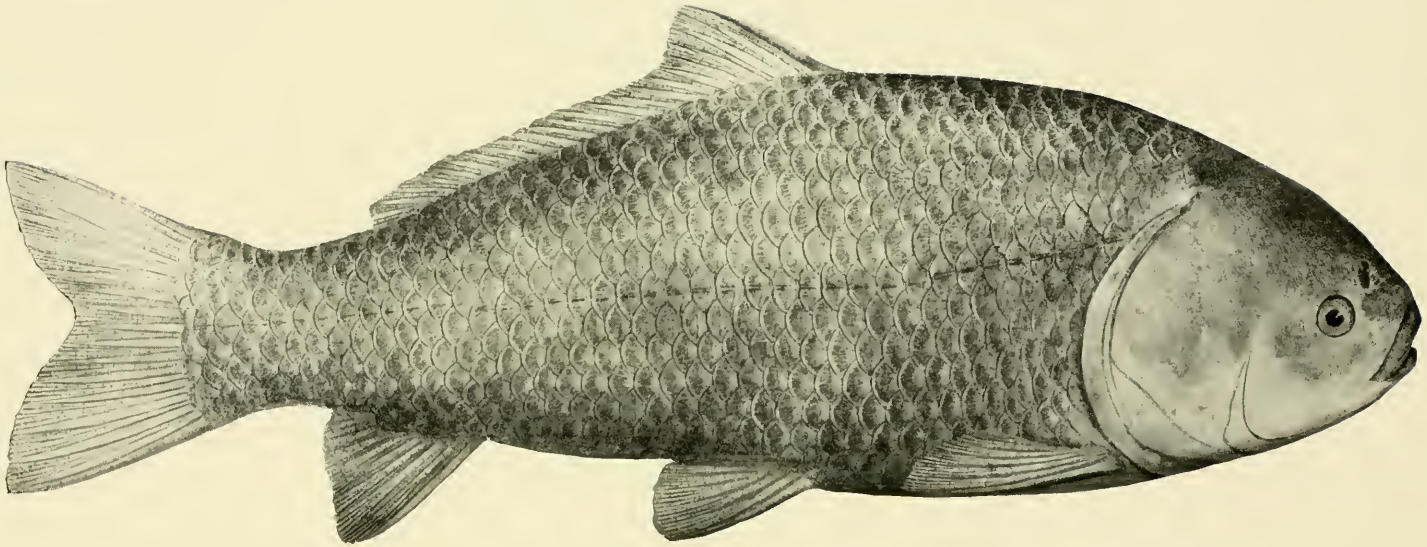
(THE MINNOWS AND THE CARP)

Form varied, elongate and subfusiform, more or less compressed, or sometimes thin and deep; head naked; body scaly, except in a few forms not occurring in the United States; scales cycloid; skeleton osseous; anterior vertebræ modified and provided with Weberian apparatus; fins typically without spines; ventrals abdominal; no adipose fin; a mesocoracoid arch present; gill-membranes broadly joined to isthmus; pseudobranchiæ usually present; branchiostegals 3; margin of upper jaw formed by premaxillaries alone; jaws toothless; lower pharyngeal bones well developed, falciform, and nearly parallel with the gill-arches, each armed with 1 to 3 series of teeth, 4 to 7 in the main row, and a less number in the others, if more rows are present; stomach without appendages, being a simple enlargement of the intestine; intestinal canal short or long, usually less than twice length of body in species partly or wholly carnivorous (see key), but often very much longer in herbivorous and limophagous forms; air-bladder typically present and with open duct, commonly divided into 2 more or less distinct chambers.



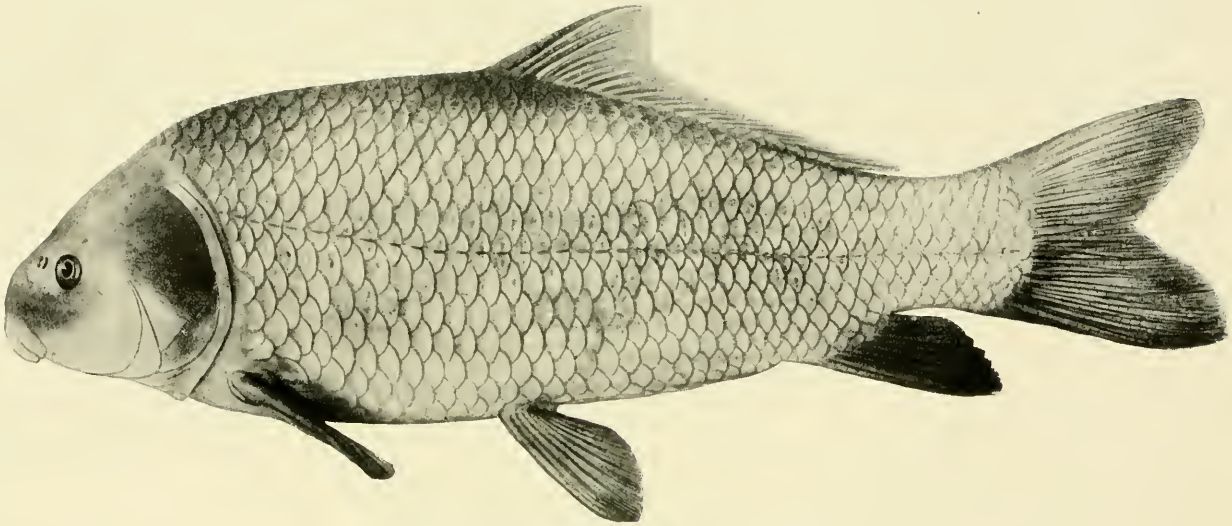
A. B.

Dorsal view of skull of (A) *Ictiobus bubalus* (Rafinesque) and of (B) *Carpiodes carpio* (Rafinesque): *ep*, epiotic; *eth*, ethmoid; *f*, frontal; *pa*, parietal; *pf*, prefrontal; *pto*, pterotic; *sph*, sphenotic; *soc*, supraoccipital; *vo* vomer.

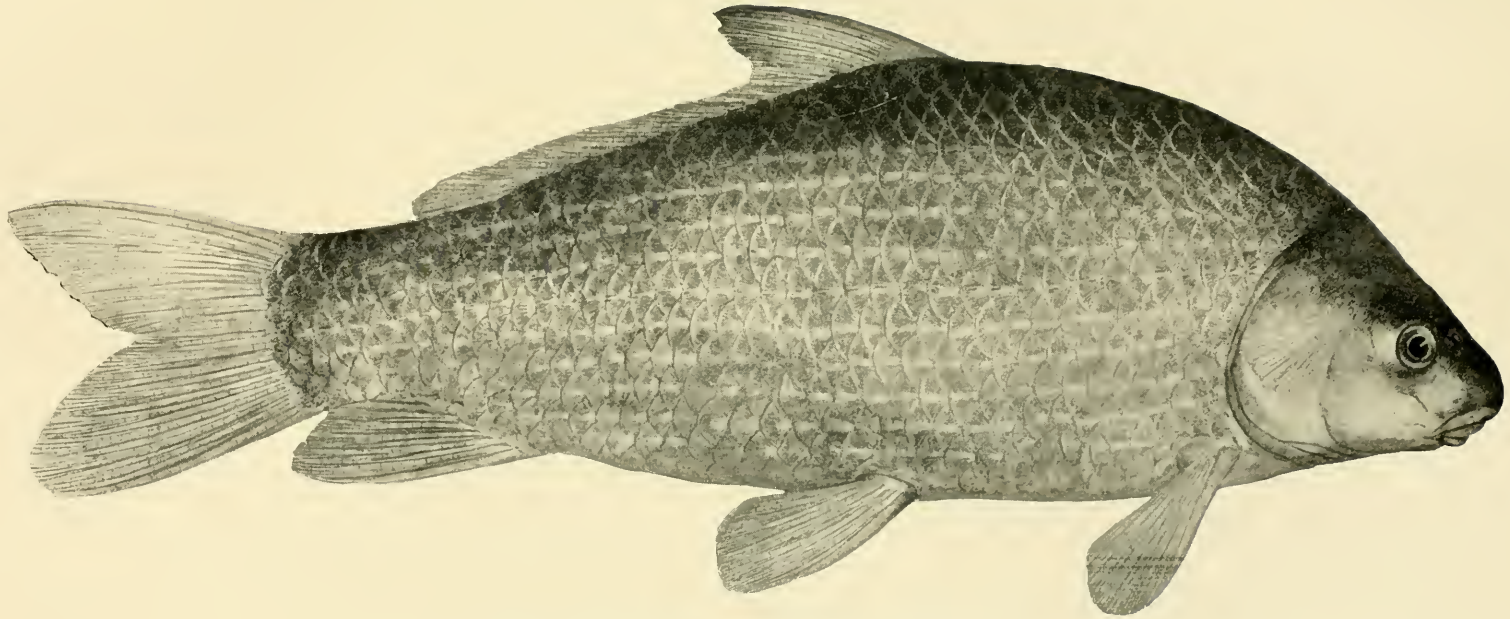


Red-mouth Buffalo, *Ictiobus cyprinella* (Cuvier & Valenciennes)

SMALL-MOUTH BUFFALO, *Ictiobus bubalus* (Rafinesque)



Mongrel Buffalo, *Ictiobus urus* (Agassiz)



Small-mouth Buffalo, *Ictiobus bubalus* (Rafinesque)

QUILLBACK, *Carpiodes velifer* (Rafinesque)

CHUB-SUCKER, *Erimyzon sucetta oblongus* (Mitchill)

SPOTTED SUCKER, *Minytrema melanops* (Rafinesque)

COMMON SUCKER, *Catostomus commersonii* (Lacépède)

HOGSUCKER, *Catostomus nigricans* Le Sueur

SHORT-HEADED RED-HORSE, *Moxostoma breviceps* (Cope)

Placopharynx duquesnei (Le Sueur)