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The Fishes of the Des Moines Basin

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specimen taken in Emmet county. He found the material to represent a species new to science and gave it the name of *Cupressinoxylon glasgovi*, after its discoverer. He concludes that it represents a horizon which is Cretaceous in age. In the absence of any information to the contrary it is fair to assume that the specimen came from the rocks *in situ* but, if so, it is the only case on record of the occurrence of silicified wood so situated in the limits of the State. It would be interesting to institute studies of these woods in connection with the great masses of silicified woods found so abundantly along the upper Missouri; such study might serve to indicate the real origin of these straggled specimens.

In the Pleistocene of this State occasional large examples of silicified wood have been found; the ones examined by Professor Knowlton were small. The writer has noted two or three, in and about the city of Des Moines, that would weigh an hundred pounds or more; the largest of these was little water-worn.

Throughout the central and east-central portions of the State, and occasionally, in other parts of the commonwealth, large trunks of coniferous trees are reached in well and coal borings. These belong, without question, to that earlier, Pleistocene stratum which many geologists denominate "the forest bed." In the debris which was thrown out of the famous Belle Plaine artesian well, when water was found, there came from this stratum large masses of coniferous woods, sometimes quite large logs, mingled with sands and gravel. They constituted one of the features which made the well famous.

Similar woods have occurred in deep wells within the city of Des Moines, even when the highest lands within the city were penetrated. The writer has now in his possession fine examples of such wood taken from a well thirty-six feet in depth in the heart of the city. They are much crushed and twisted, one end of one piece being broken or crushed into fibers by some heavy grinding weight, and give clear evidence of the harsh treatment which they have received. In no case have these fossil woods been compared with those which are silicified; so that identity in generic relation cannot be postulated. It is fair to remark, however, that no member of the forest bed proper has yet furnished a single example of silicified wood; that is no specimen of wood which became silicified since burial in that particular stratum. It would appear, therefore, that the real origin of the silicified woods found in the Pleistocene of this state must be sought outside of its limits.

THE FISHES OF THE DES MOINES BASIN.

BY R. ELLSWORTH CALL.

To one familiar with so much of the literature of science as pertains to the natural history of the State of Iowa it is surprising that so little has been done in relation to its fishes. A list designed to stand for the ichthyic fauna of the State has yet to be compiled. There have appeared but three papers devoted to Iowa fishes. Of these three one was published under the auspices of the United States

National Museum,* the others were both published in Iowa[§], under Iowa auspices and by an Iowa man. The first of these papers lists thirty species from the Des Moines river, at Ottumwa, of which list two were new to science. The two forms were *Notropis gilberti* and *Ammocrypta clara*. From the Chariton river, at Chariton, there were listed in the same paper thirteen species. From the Hundred and Two river, near Bedford, there were taken nineteen forms. The latter stream furnished no new species while one, *Etheostoma iowae*, was found in the Chariton.

The second of these papers was preliminary to a complete account of Iowa fishes and is not yet finished. It aims to present the main facts, regarding species and their identification, thus far gathered through personal observation and collated from other sources. In it may be found certain notes on the geographic distribution of the more common forms, but recent investigations have already rendered this feature of little value. But little may be found in it concerning the forms that occur within our limit.

The third paper deals only with the larger forms of Iowa fishes and mainly with those that have food value. It also contains notes on geographical distribution, but this feature here likewise does not represent the facts as now understood.

With this brief list the bibliography of Iowa fishes practically ends. Such work as has been done and as has been published indicates that very much yet remains to be accomplished before the list of Iowa fishes can be completed. To facilitate this work and to secure as a basis for comparison in respect to richness in species, abundance, and geographical distribution a list that would be fairly representative of the strictly defined Iowa fish fauna the writer has collected and studied a great many fishes from the basin of the Des Moines. The main facts which this study has made known are made the basis of this preliminary paper.

As yet the investigations of the area limited by the hydrographic basin of the Des Moines are unfinished. Practically only the streams of the central portion of the area have been studied. These streams all present, as would be expected, a great sameness of fauna, but at the same time they present a characteristic one. Without exception they are all typical prairie streams with physical features common to all alike. Minor differences, such as greater clearness, less depth, more rapid current, rockier bottoms and a greater number of cold springs characterize all as their source is neared. Correlated with this are certain forms found only at or near the rivers' sources that have, therefore, a somewhat limited distribution.

Several small streams, chiefly located within a few miles of the city of Des Moines, have been examined with the greatest thoroughness and they have little or nothing more to yield to continued exploration. These streams may therefore stand as typical for all similar streams in Central Iowa. One of these, Beaver Creek, will be further described in connection with the list collected therein and this list, it is believed, will stand as a type of all similar ones based on so small an area as a single creek.

The physical features of the Des Moines river demand but a passing mention. Its bed is ever varying from soft ooze to hard rock, grading in all ways from mud through sand and gravel to coarse boulders. With these varying conditions there is also a various fauna. Certain forms as the *Siluridae*, the *Acipenseridae* and

* Proceedings of the United States National Museum, 1885, Vol. VIII.

§ Bulletin from the Laboratories of Natural History of the State University of Iowa Vol. I, No. 2, 1889.

° Proceedings of the Iowa Academy of Sciences, for 1889-90.

the *Catostomidae* delight in muddy waters and muddy bottom. The *Centrarchidae*, the *Percidae* and the *Cyprinodontidae* delight most in clear cold streams. Especially abundant are they if to clearness and coldness be added a bottom studded with boulders and smaller rocks affording thus means for hiding. In such situations especially may the beautiful genus *Etheostoma* be found, both in great numbers and variety.

The subjoined list of species collected and studied by the writer in this area is made after the system adopted by Doctors Jordan and Gilbert, in their masterly "Synopsis of the Fishes of North America"*.

PETROMYZONTIDÆ.

(The Lampreys.)

Petromyzon concolor Kirtland.—This form has occurred only in the Des Moines river, at Des Moines. Two specimens have been secured, and both of these were taken from large catfish caught in the river within the city limits. Both were captured in March, one in 1887, the other in 1889. It is the habit of this species to ascend the river to spawn but it does so with the aid of other and larger fish. It is fairly common, according to report of fishermen, on large catfish in early spring, though but these two have been secured by us.

LEPIDOSTEIDÆ.

(The Gars.)

Lepidosteus osseus Linnaeus.—Des Moines river; Raccoon river, Des Moines and Adel.

The common or long-nosed gar is not taken except by fishermen and they obtain it rarely. Two forms of this genus are commonly recognized but only one of these has been seen by us within our limits.

SILURIDÆ.

(The Catfishes.)

Ictalurus punctatus Rafinesque.—Raccoon river at Adel, Perry and Des Moines; Middle river; North river, Walnut creek; Beaver creek; Des Moines river at Des Moines and Ft. Dodge.

This is a very abundant fish throughout the area studied. A peculiar feature in relation to its habitat consists in the fact that it commonly is confined to the more rapid portions of the streams and is not often taken in still waters. Its use for food commends it to popular attention.

Ameiurus melas Rafinesque.—North River; Raccoon river at Des Moines, Perry and Adel; Walnut creek, Beaver creek.

The chief characters of this fish are sufficiently well indicated by its generic and specific names. The very short and broad, or curtailed, caudal fin and its deep blue-black color serves to readily distinguish it from its congeners. Its habits are peculiar in that it is rarely taken in swiftly flowing or clear water but appears to thrive best in deep and muddy streams, with slowly moving current, or in the bayous formed by the abandonment of former river channels. In such situations it is both abundant and large. Near the city of Des Moines is an old river channel in which this form is so abundant that a single haul of the seine brought to land several thousands of them. Among the lot thus obtained many were the maximum length for this species, or about twelve inches. The larger specimens

* Bulletin United States National Museum, No. XVI, 1883.

are common in the city markets in the winter, being seined by fishermen through holes cut in the ice. At their best they are fish of slow movement and are easily captured.

Noturus exilis Nelson.—Raccoon river, Perry.

This form has occurred but once and is represented by but a single specimen. It presents no facts worthy of especial mention.

Noturus gyrinus Mitchell.—Raccoon river, Des Moines; Des Moines river at Des Moines. Rare.

The stone cats delight in muddy bottoms, are fish of slow movement, easily captured and of little or no use for food purposes. Neither of the species of *Noturus* has been taken save rarely, but of the two forms found the last named is by far the most abundant. There are several other well defined members of the genus which should be found within our area and may yet be discovered on more complete investigation.

CATOSTOMIDÆ.

(The Suckers.)

Ictiobus velifer Rafinesque.—Walnut creek; Beaver creek; Raccoon river at Perry, Adel, and Des Moines; Des Moines river at Des Moines and Ft. Dodge; Lizard creek; Middle river; North river.

This is beyond doubt the most abundant of the Buffalo fishes in Iowa. Throughout our area it is most common, the seine often landing several hundred pounds of this fish. Like most of the suckers it is to be found abundantly in rather deep but muddy water. It often attains a considerable size but does not grow to so great a size as the common Buffalo of commerce, the *Ictiobus cyprinella*. The form presents variations of note in the matter of scale formulæ, length of spine on back, depth, number of rays to the fins, and other features that would seem to render very promising the careful study of a large number. There is no other Iowa fish presenting so great variation.

Ictiobus difformis (?) Cope.—Middle river, Warren county.

This identification is somewhat doubtful but the specimens, four in all, seem to belong under this form. The species has not before been recorded from Iowa outside of the Missouri drainage. The determination is based upon comparison of specimens received from Dr. Chas. H. Gilbert, taken at New Harmony, Indiana.

Catostomus teres Mitchell.—Raccoon river at Des Moines, Adel and Perry; Middle river; North river; Des Moines river at Des Moines and Ft. Dodge; Beaver creek; Walnut creek.

This is one of the most common suckers in the smaller streams. The young are much spotted with blackish or brownish spots which almost or entirely disappear in the aged specimens. It is almost useless for food because of the great number of small bones, scattered apparently without order throughout the myocommas.

Catostomus nigricans La Sueur.—Beaver creek; Raccoon river at Des Moines, Adel and Perry; Des Moines river at Ft. Dodge and Des Moines; Middle river.

This is an abundant form occurring all over Iowa. It has a peculiarly long snout, hog-like and distensible, and is much blotched with blackish or brown pigment. It is often found in the swiftest streams, lying usually on the bottom and loves best clear water. Its value as a food fish is small indeed.

Moxostoma duquesnei Le Sueur.—Beaver creek; Des Moines river at Ft. Dodge and Des Moines; Raccoon river at Des Moines, Perry and Adel; Middle river.

This is a well marked variety of *Moxostoma macrolepidotum* and is quite common in our area. The large sized, red fins, coarse scales, and peculiarly compressed pharyngeal teeth render it very easy of distinction. It is found in streams of either rapid or slow current, appearing indifferent to either condition. In the deeper holes in the larger streams it may always be found.

Moxostoma aureolum Le Sueur.—Lizard creek, Ft. Dodge.

This species occurred to us but once within the limit assigned to this paper. The locality abounds with the common *Moxostoma duquesnei* and among them were found a dozen or more of this species. It is common in the great lakes of the north and may not stand as a good species on further study.

Placopharynx carinatus Cope.—Raccoon river, Adel and Perry.

This form will yet, no doubt, be found throughout our area. It is essentially western, having been described from the upper Missouri. It is difficult of separation from the common red-horse which it greatly resembles superficially except on careful examination of the pharyngeal teeth. It is "a large coarse sucker, externally similar to the species of *Moxostoma*, from which genus it differs only in the remarkable development of the lower pharyngeals and their teeth; the bones are very strong, and six to ten of the lower teeth are enlarged, little compressed, with a broad rounded or flattened grinding surface; the mouth is larger and more oblique than in *Moxostoma macrolepidotum* and the lips are thicker."—Jordan. Large numbers of this form were taken the present year in Northwestern Iowa, but the localities are all outside the limits imposed by this paper.

CYPRINIDÆ.
(The Minnows.)

Campostoma anomalum Rafinesque.—Beaver creek; Four Mile creek; Raccoon river at Adel, Des Moines; North river; Middle river; Walnut creek; Beaver creek, and Four Mile creek, Polk county.

This usually abundant form has not occurred to us in the great numbers which characterize its presence generally. It is one of the most easily recognized of the *Cyprinidae* because of the great peculiarity of certain anatomical features, the intestines alone being several times the length of the body. Moreover this organ is coiled in a characteristic manner about the air-bladder, a fact which no other minnow, the world over, presents. A vegetarian in food habit, the great length of the intestines is readily understood. When taken the abdomen, or ventral region, is usually distended and greenish in color, due to the nature of the contained food. The scales are irregularly mottled, giving to the fish a peculiarly dirty appearance. In common with the other *Cyprinidae* it never attains but small size.

Chrosomus erythrogaster Rafinesque.—Walnut creek.

This most beautiful minnow has occurred but once in our area. Three specimens represent the results of most assiduous collecting. The small but clearly defined scales, closely crowded, the graceful outline, the brilliant spring colors of males and females all conspire to render this form of easy determination; the infrequency of its occurrence in aquaria, therefore, seems to point to its rarity in this section of Iowa, though it is reported abundant in other localities. While widely distributed throughout the great Mississippi Valley, it attains its maximum abundance and beauty in the Ozark region of Missouri and Arkansas. It is, in nuptial coloration, probably the most gaudy fish in our waters.

Hybognathus nuchalis Agassiz.—Walnut creek; Raccoon river at Adel, Perry and Des Moines; Beaver creek; Squaw creek, Ames.

A minnow not easy, always, of separation because of great variability. Rather common in our collections, that is, occurs in nearly all our streams, but not in great abundance.

Pimephales notatus Rafinesque.—Middle river; North river; Raccoon river at Adel, Des Moines and Perry; Des Moines river at Des Moines and Ft. Dodge; Beaver creek; Walnut creek; and in a small stream without name in the city of Des Moines, but connected with no other stream.

Without exception this form is the most common and most abundant Cyprinoid in Iowa. Throughout our area it occurs in nearly every collection made and in the greatest abundance. All collections made in the spring presented males with a black head, much enlarged, apparently, due to the great number of large epidermal tubercles. These number, usually, fourteen and are generally arranged in constant order. The somewhat large light, colored scales render it of easy separation from its only congener, the following species. It is the one fish to be always found in the bait-pail of the sportsman.

Pimephales promelas Rafinesque—Four Mile creek; North river; Raccoon river at Perry, Adel and Des Moines; Walnut creek, Beaver creek.

P. promelas is easily distinguished from its congener by the dark coloration of the anterior portion of the body, the smaller scales crowded before, the dusky color line along the side of the body, the short blunt head, and the incomplete lateral line. It does not attain the size of *P. notatus*, specimens rarely or never exceeding three inches in length. It is commonly abundant in all our collections.

Cliola vigilax Baird and Girard.—Middle river; Raccoon river at Des Moines Perry and Adel; Des Moines river at Des Moines.

This species is readily known by the black spot at the end of the lateral line at the base of the caudal, its light coloration and the short, blunt, decurved snout. From *Phenacobius mirabilis*, which it superficially resembles, it is readily distinguished by the peculiar mouth of the latter. This form occurred in our collections in warm waters, with muddy bottoms, being rarely taken in streams with rapid currents. It occurred to us in great abundance at Adel in a shallow bayou representing a former river channel.

Notropis ardens Cope.—Des Moines river, Des Moines; Beaver creek.

This form is rare in our collections, one locality, the first, presenting but a single specimen. Among the difficult forms belonging to this genus this takes rank among the most difficult, has a synonymy which is increasing as more is known of the genus, and is the smallest species of *Notropis* in Iowa. Doctor Jordan justly remarks of the genus that it presents the most puzzling fishes in the world. Its Iowa representatives are especially difficult owing to the great similarity of habitat and the absence of those marked station peculiarities which may be assumed justly as a cause of the more marked differences in the *Notropides* of other States. Only the closest scrutiny succeeds in establishing specific characters and then the result is often not satisfactory. That this form is more widely distributed than our personal collections indicate is probable.

Notropis cayuga Meek.—Squaw creek; Beaver creek; Raccoon river, Adel.

This is a rare form in Iowa. Occasionally occurring in fair numbers it is yet true that a day's collecting in a most favorable locality will discover but a half dozen in number. The chief characters presented are the very close or large scales, few in number before the dorsal fin and the well defined black line passing from the tip of the snout to the base of the caudal fin. This line, moreover, is continuous to and around the front of the face, on the upper lip only, which fact serves as a clear diagnostic character. In forms looking much like it the color

band descends to and includes the upper portion of the lower lip; this form constantly never has the line on the lower lip. In habit *Notropis cayuga* is somewhat peculiar. It has never occurred to us except in water that was warm, with muddy bottom, and never yet in water flowing swiftly or cold water. It would seem, therefore, that it may be sought for in bayous and similar situations with hopes of success. It is one of the most beautiful fishes in the genus.

Notropis deliciosus Girard.—Des Moines river, Des Moines and Ft. Dodge; Raccoon river at Des Moines, Adel and Perry; Beaver creek; Walnut creek; Squaw creek; Middle river.

It will be noted that this species is of wide distribution in our area and it is likewise abundant, being exceeded in point of numbers only by *Pimephales notatus*. It is difficult of distinction from certain of its congeners, notably *Notropis gilberti*, the last named, however, having a much larger eye and larger mouth, with a greater number of scales before the dorsal, the scales being, also, somewhat larger. In *deliciosus* the mouth is very small, on which character the specific name is based.

Notropis dilectus Girard.—Beaver creek; Walnut creek; North river; Raccoon river at Des Moines, Adel and Perry; Des Moines river at Des Moines.

A form of common occurrence, but few in numbers. It is believed that the form called *rubrifrons*, listed below, is to be properly considered a synonym of this species.

Notropis gilberti Jordan and Meek.—Raccoon river at Des Moines, Adel and Perry; Four Mile creek; Walnut creek; Beaver creek; North river; Middle river.

This species' name is based upon certain forms discovered by Messrs. Jordan and Meek in the Des Moines river, at Ottumwa. Allied to *Notropis boops* Gilbert, it is readily distinguished from that form by the smaller eye. It is very abundant in all of our collections, hardly less so than is *Notropis deliciosus* with which it presents some features in common.

Notropis megalops Rafinesque.—Beaver creek; Four Mile creek; Raccoon river at Des Moines, Adel and Perry; Des Moines river at Des Moines and Ft. Dodge; Walnut creek; North river; Middle river.

This species is the largest and most variable *Notropis* in Iowa if not in North America. The old forms, especially the males, present features so entirely different from those of the young that the wonder is not that so great a synonymy is found under this species but that the list of names is not greater. The old males are very deep, the lateral line much decurved, the scales larger and proportionately broader, the eye smaller and the whole facies of the fish, as seen in the smaller forms, entirely different. Its synonymy will embrace more names than any other species in the genus. Throughout our limit it is a very abundant and ever present form in the small and large streams alike. Like *Pimephales notatus* it is rarely absent from the fisherman's bait-pail. It is a common form in the aquaria in Des Moines.

Notropis rubrifrons Cope.—Squaw creek.

A form which is properly to be placed in the synonymy of *Notropis ardens* Cope.

Notropis umbratilis Girard.—North river; Raccoon river at Adel, Des Moines and Perry; Des Moines river at Des Moines; Middle river; Walnut creek; Beaver creek.

This small but well defined form is common in occurrence but somewhat rare in point of numbers, three or four specimens alone rewarding patient and continued search in each of the above localities.

Notropis whipplei Girard.—Raccoon at Des Moines, Adel and Perry; Walnut creek; Middle river; North river; Des Moines river at Des Moines and Ft Dodge; Squaw creek; Yader creek.

This specimen is one of the prettiest of the genus. The closely set scales, bluish or steel blue in color, the graceful outline, the brilliant yellow or red fins of the nuptial dress in spring all make this species as conspicuous in the seine as the beautiful *Chrosomus erythrogaster*. It is very abundant in all parts of our area. The males are armed in spring with a great number of small tubercles which extend backwards over the head and nape even to the dorsal fin. Compared to its length its depth exceeds that of any other *Notropis* except *Notropis lutrensis*, a species not found in our limit but abundant in Northwestern Iowa. The form was originally described from Arkansas, thus showing the wide geographical distribution of this species. As a usual thing great range of distribution is correlated with great variation in certain characters, but in this case there is a marked departure from the law, the variations being slight. Little or no differences are noticeable on careful comparison.

Phenacobius mirabilis Girard.—Middle river; North river; Beaver creek; Raccoon river; Des Moines; Squaw creek; Four Mile creek.

Large, fine examples of this species are found in the smaller streams and in the bayous along the larger ones all over our area. The marked black spots at the base of the caudal is a conspicuous character which, joined to the peculiar mouth, renders the form of easy identification. The only fish with which it is likely to be confused is *Notropis cayuga* but from this it is readily distinguished by color and size and by the mouth. The species is fairly common.

Rhynchthys atronasmus Mitchell.—Walnut creek; Beaver creek.

A single example of this form occurred in each of these streams, indicating its rarity in our area. The genus, which comprises two species only in the United States, is one confined mainly to clear mountain streams and the State of Iowa does not offer suitable habitats for the forms. It is to be classed among the rarest of our Cyprinoids.

Hybopsis kentuckiensis Rafinesque.—Raccoon river at Des Moines, Adel and Perry; North river; Beaver creek; Des Moines river at Des Moines and at Ft. Dodge; Walnut creek.

This chub is one of the most abundant of the larger Cyprinoids and is rather constant in its characters. In some localities, especially in the smaller streams named above, it is very abundant and large. Those streams which are clear the major part of the summer or which are fed by cold and perennial springs are most favorable to its development. In Walnut creek occurred many specimens which were affected with a crustacean parasite fastened to the soft flesh at the angle formed by the junction of the pectoral fins with the body. While many of these fishes were so affected it was noticeable chiefly on those fishes which were taken in muddy water or in water with deep muddy bottom. The parasite is as yet unstudied.

Hybopsis storerianus Kirtland.—Raccoon river, Perry, Des Moines and Adel; Walnut creek; Middle river.

This easily recognized and highly characteristic species is very abundant in the larger of the streams named. The largest and finest specimens came from the Raccoon river at Adel and from the Middle river, the form being especially abundant in the last named stream. The decurved mouth, giving it a sucker-like appearance at first view is characteristic and is a feature presented by no other

form in our area. Specimens nearly eight inches in length were collected in the Middle river.

Semotilus atromaculatus Mitchell.—Walnut creek; Beaver creek; Raccoon and Des Moines rivers, Des Moines; North river.

A species of very wide distribution in all streams, both large and small, but preferring clear creeks or brooks. This dace often attains a length of quite one foot, though none that would exceed seven inches have been taken by us. The locality producing this form in greatest numbers is Walnut creek, in which many and large examples were taken.

Notemigonus chrysoleucus Mitchell.—Raccoon river, Des Moines; Beaver creek.

This beautiful fish has occurred in only the two localities named though it is said to be common in sluggish or weedy waters. The form is rare with us, only six or seven specimens having been taken. Its bright golden hue, great depth of body, characters of the opercular covering, and the sharp ridged dorsum will enable it to be readily distinguished. It occurred in our collections in a deep hole, removed from the Raccoon river, and seems to do best in streams of muddy bottom. It possibly occurs in plenty in favorable localities.

CYPRINODONTIDÆ.

(The Top-Minnows.)

Zygonectes notatus Rafinesque.—Squaw creek; Raccoon river, Des Moines.

This form is rare at Des Moines, only one specimen having been taken, but it is abundant in Squaw creek at Ames. None of the specimens seen attained the maximum size which is stated to be three inches. It thrives best in still waters.

ESOCIDÆ.

(The Pikes.)

Esox vermiculatus Le Sueur.—Beaver creek; Yader creek.

Three examples were taken in Beaver creek and one seen in an aquarium, said to have been seined in Yader creek, a small stream in South Des Moines, tributary to the Des Moines river but dry the most of the year. The peculiar character of the markings on the side of the body distinguish the least pickerel from its remaining congeners. In the following species, the pike—*Esox lucius*—these markings are a deeper yellow, are disconnected commonly, and are oval in shape. The general yellow cast of the pike enables ready distinction, though by fishermen the species are not separated. The least pickerel rarely ever exceeds twelve inches in length though specimens have been seen from the northern portion of the State fully fifteen inches in length.

Esox lucius Linnaeus.—Raccoon river, Des Moines and Adel; Des Moines river, Des Moines and Ft. Dodge.

This is the common pike and is now commonly taken by sportsmen in our region. It takes the hook far more freely than the preceding form. It is common or even abundant in the lakes and streams of the northern and northwestern portions of the State. Prof. S. E. Meek and the writer have taken or seen specimens of eight and ten pounds weight in number in Storm Lake and in the Cherokee river. It is found in deep and still water and most abundantly in deep streams that have many weedy patches. A seine pulled over or through such a locality is certain to capture a specimen, the fish lurking in the shadow of the weeds escaping thus the observation of the unsuspecting minnow. They are very ravenous and are

exceeded in this particular by no fish in our waters. The writer has frequently placed a minnow in the mouth of a pike just or recently landed and watched "the thing swallow", which is done in great haste. Even on land, thus, is shown the inordinate appetite of this veritable shark of the fresh water streams.

Esox masquinogy Mitchell.—Skunk river, near Ames.

While not found within our area so far as known this species is likely to be found though not commonly. It is known from the Mississippi river but from the locality mentioned above this is the only representative. The head of this magnificent specimen is now preserved in the Iowa Agricultural College museum. It is reported from the Squaw creek but no authentic specimen is known therefrom. This form is the *Esox nobilior* or "Muskalunge" of the northern waters.

ANGUILLIDÆ.

(The Eels.)

Anguilla anguilla var. ***rostrata*** Le Sueur.—Raccoon river, Adel; Des Moines river, Des Moines.

This species is common in the larger streams throughout our limit though most common in the Des Moines. The form is anadromous, that is, it is a marine fish which ascends the fresh-water streams to spawn. Very little is known of its life history though its food habits have been well made out. It is extremely voracious foraging most freely at night; it is commonly taken on trot lines set at night in this region though the writer has several very fine specimens, including one very large one, taken in the Des Moines with hook and line in the day time.

ATHERINIDÆ.

(The Silversides.)

Labidesthes sicculus Cope.—Raccoon river, Des Moines and Adel; Des Moines river, at Ft. Dodge.

The specific name of this little fish is by no means always indicative of its habitat. Though common in "half dry pools," in allusion to which the name is bestowed, it is very common in the Raccoon at Adel in the rapidly flowing stream where the bottom is sandy. A number of specimens were there captured and had their presence been suspected many more might have been taken. The snout reminds one of the "pipe-fishes" of the Atlantic coast but is far less produced; of course the resemblance is superficial. The fish is quite transparent, so much so that the gross anatomy may be fairly made out without dissection—a feature presented by at least one other fresh-water fish in our area. It is in many respects our most interesting fish.

CENTRARCHIDÆ.

(The Basses.)

Pomoxys annularis Rafinesque.—Raccoon river, Des Moines; Middle river.

These two localities have together furnished but four or five specimens. Very valuable as a food fish, its flesh being both white and sweet, it is the delight of the youthful angler. It has occurred to us only in an abandoned channel of the Raccoon, in deep water, and in a deep hole in Middle river; from the circumstances of its habitat, in these localities, it would seem to prefer quiet and deep muddy waters. It is a powerful swimmer, takes the hook with great eagerness and is quite gamey making it a good fish for sport. The localities named are among the most northern known, the fish being a southern form. The related "crappie", *Pomoxys sparoides*, has not yet been found in our limit though an abundant form in the Mississippi on the eastern border of the State.

Ambloplites rupestris Rafinesque.—Raccoon river at Adel, Des Moines and Perry; Des Moines river, at Des Moines, Ft. Dodge and Estherville.

This abundant fish is to be found wherever there is a clear rocky bottom affording means of concealment. In clear streams with bottoms thus characterized, and affording abundant weeds, grass or river-moss it is always to be found loitering in the shadow of the rocks alike alert for food or enemies. It does not take the hook readily and is very suspicious of danger when one is temptingly dangled in its very face. The numerous black blotches on the side, extending from the dorsum to nearly the base of the anal and pectoral fins sufficiently well indicate the color markings by which it may be distinguished from related forms.

Lepomis humilis Girard.—Beaver creek; Walnut creek; Middle river; North river; Raccoon river at Des Moines, Adel and Perry; Des Moines river at Des Moines and Ft. Dodge; Squaw creek.

Always abundant this species is nevertheless to be found in excessive numbers in nearly all streams in which it occurs in the State of Iowa. There is a well marked difference between the females and the males in respect to color markings. The females have little of the deep yellow or red color on the belly while they have a number of the coppery colored markings on the sides scattered without order or apparent arrangement. The males are characterized by the presence of a great many orange colored spots, also without definite order, on the sides, while the lower fins are deep red or bright yellow. The more somber hues assumed by the females render it sometimes a matter of question as to specific identity. The organs of reproduction are then the last resort. The species is very abundant throughout the entire northwestern portion of the State occurring in every stream; in some of the smaller muddy creeks which empty into the Missouri it is almost the only fish we found. This and the next form are the most common ones of the genus in our area.

Lepomis cyanellus Rafinesque.—North river; Walnut creek; Beaver creek; Raccoon river, at Adel, Des Moines and Perry; Squaw creek; Des Moines river, at Des Moines, Ft. Dodge and Estherville.

The "green sun-fish" is nearly or quite as common as the preceding form. Its deeper coloration, inclining more to blue than to green enables ready separation. Then, too, it is a deeper and thicker fish, attains a greater size, and the sexes are not so easily discerned. Indeed, so far as our observations have extended the sexes cannot be readily separated. The habitat is the same as that of *Lepomis humilis* and where one is found the other usually comes to light also.

Lepomis pallidus Mitchell.—Raccoon river, Adel and Des Moines.

This form is rare in our area, but three specimens having been discovered.

Lepomis megalotis Rafinesque.—Beaver creek.

A single specimen of this species has thus far alone rewarded our search. In common with all the members of the genus little is known of its breeding habits though all have a similar habitat. All are used more or less for food but their small size renders them of little value for that purpose. They are tenacious of life and make acceptable aquaria stock. As justly remarked by Doctor Jordan the genus is among the most difficult of our fish fauna.

Micropterus dolomieu Lacepede.—Raccoon river, at Adel and Des Moines; Middle-river; Beaver creek; Des Moines river at Des Moines and Ft. Dodge.

The small mouthed black bass is very common in the larger streams in our limit. In the deeper portions of the clear rivers it best thrives though it is not uncommon in the muddy streams like the Raccoon. It is a darker fish than its congener and far more abundant but less commonly taken by the hook. It is the stream bass

while the following is found in still waters like bayous and lakes. It is considered a very good game fish ranking all others for sport. Its habits, food, chief characters, distribution, relationships, all are quite well understood and form the subject of numerous memoirs both scientific and popular. It is, probably, the most widely known fresh-water fish.

Micropterus salmoides Lacepede.—Beaver creek; Raccoon river at Adel and Des Moines; Des Moines river at Des Moines.

This form is far less common than the preceding but is often taken on the hook. It is a lighter colored fish, much larger, and esteemed more highly than any other of our native game fishes. The largest specimens seen came from the Des Moines. It is rather more slender than *Micropterus dolomieu* and is readily distinguished by the less number of rows of scales on the cheeks, this form having but ten, the preceding possessing seventeen rows.

PERCIDÆ.
(The Perches.)

Of this family only the genus *Etheostoma* is represented in our area so far as specimens establish the fact. Known commonly to the professional naturalist and rarely seen by the sportsman or amateur, this interesting group has lately been carefully studied with the result that rich avenues for investigation have been opened. The forms are among the smallest that are known to us and at the same time comprise many that are of surpassing beauty and grace. Among them are to be found the gaudiest of our fishes. Common alike in large and small streams they escape observation because they do not take the hook, being too small, and their habits also render them less liable to be noticed. In muddy streams certain protectively colored forms live in great numbers, while, again, in streams with grassy or weedy bottoms other forms abound. Among rocks or weeds, on gravel and shallow sand bars, in pond, lake, creek, river, even rill, the "johnnies" are to be found, and always found in situations seemingly conducive to personal safety. About fifty species are recognized with the probability that the field is not yet exhausted. Of these seven have thus far been found in our area.

Etheostoma aspro Cope and Jordan.—Beaver creek; North river; Raccoon river, at Adel; Des Moines river, at Des Moines and Ft. Dodge.

This is one of the largest species of the genus and is found in considerable abundance, locally, throughout our limit. The large black blotches on the sides distinguish it from associated forms. It loves streams the bottoms of which are paved with rocks.

Etheostoma caprodes Rafinesque.—Des Moines river, at Des Moines and Estherville.

A single specimen only has come to light in the collections we have made at Des Moines. It is the largest darter known. Our specimens are not of the maximum size.

Etheostoma flabellare Rafinesque.—Beaver creek; Raccoon river, Des Moines.

But few specimens have been found by us. It is said to be abundant in clear streams. Among other peculiarities this form has the lateral line developed about half way.

Etheostoma jessie Jordan and Brayton.—Beaver creek; Squaw creek.

This form, a southern one, is very rare in our collections, but a single specimen having been found in Polk county. It is among the smaller of the darters.

Etheostoma nigrum Rafinesque.--Beaver creek; Squaw creek; Raccoon river, at Des Moines, Perry and Adel; Walnut creek; North river; Des Moines river, at Ft. Dodge.

This is the most abundant etheostomoid fish in Iowa. In nearly every stream it is abundant, often, in favored localities exceeding in numbers all other members of the genus together. The general light straw colored back ground, on which are arranged the characteristic "W" markings will enable its ready separation. In all streams examined by us from Ft. Dodge to the Missouri it is a most constant member of their fauna. It appears to delight equally in muddy and clear waters, with bottoms of all natures. It loves to lie in concealment under leaves, stones, twigs, or even lies half buried in the sand.

Etheostoma pellucidum Baird.--Raccoon river, at Des Moines and Adel; Des Moines river, at Ft. Dodge.

The pellucid darter is well named. Like *Labidesthes sicculus* it is quite transparent and the gross anatomy may be made out, measurably well, without dissection. It is nearly white in color, with a few double but small dark spots along the dorsum from the nape to the base of the caudal. A similar row is to be seen, often but faintly, on the sides just above the lateral line. The lateral line itself is in the midst of a series of from five to six rows of scales which widen out to a fan-like shape at the base of the caudal fin. Otherwise the fish is without color. Its choice habitat is in shallow water, on sandbars, its coloration being admirably adapted to protection. It is possibly the best illustration of protective coloration that the genus affords. It is very abundant at all the localities named on sandbars in swiftly flowing water. From its habit of concealment by plunging beneath the sand with only the eyes out of "sand" it has been made the type of the subgenus *Ammocrypta*. A related species, possibly but a synonym, has been described from the Des Moines under the name of *Ammocrypta clara*. The locality for the new species is Ottumwa.

Etheostoma phoxocephalum Nelson.--Raccoon river, at Adel.

But two specimens have been found by us at this locality. They were taken in rather rapidly flowing water and in a portion of the stream abounding in large drift boulders. The species is easily recognized by the color markings and peculiar tapering head, which latter character it shares in common with no other etheostomoid fish.

While the present paper is designed only to record the results of personal collection and the study of the fishes of Central Iowa it will be helpful, perhaps, to list in addition all forms recorded by others from our area. The first bibliographic reference given above lists from the Des Moines, at Ottumwa, the following:

- Noturus flavus** Rafinesque.
- Notropis boops** Gilbert.
- Hybopsis dissimilis** Kirtland.
- Ameiurus nebulosus** Le Sueur.
- Hybopsis hyostomus** Gilbert.
- Hybopsis biguttatus** Kirt.
- Hadropterus evides** Jordan and Copeland.
- Boleosoma olmstedii maculatum** Agassiz.
- Ammocrypta clara** Jordan and Meek.

The total number of species now known from this limited area is, therefore, sixty-three. A few more than one hundred species are known in the State. Our

area then shows, thus far, a fauna numbering over 60 per cent of the species known to Iowa. That this list will be largely increased is most probable.

The nature of the fish fauna of Central Iowa, so far as known, may be best exhibited in the following tabular view:

FAMILY.	GENERA.	SPECIES.
<i>Petromyzontidae</i>	One	One
<i>Lepidosteidae</i>	One	One
<i>Siluridae</i>	Three	Six
<i>Catostomidae</i>	Four	Six
<i>Cyprinidae</i>	Twelve	Twenty-five
<i>Cyprinodontidae</i>	One	One
<i>Esocidae</i>	One	Three
<i>Anguillidae</i>	One	One
<i>Atherinidae</i>	One	One
<i>Centrarchidae</i>	Four	Eight
<i>Percidae</i>	Six	Ten
Eleven.	Thirty-five.	Sixty-three.

ON AN ABNORMAL HYOID BONE IN THE HUMAN SUBJECT.

BY R. ELLSWORTH CALL.

(ABSTRACT.)

The hyoid bone lies at the base of the tongue just above the upper border of the thyroid cartilage. It is not articulated with any other bone in the body.

It is usually studied as consisting of five parts, all of which may readily be distinguished in the normal specimen, especially in the young subject. There is the body of the bone, or the basi-hyal; there are also two cerato-hyals, or lesser cornua, and two thyro-hyals, or greater cornua. The whole forms a horse-shoe shaped bone to which the name hyoid has been given in allusion to the shape of the Greek letter *upsilon*, which the bone greatly resembles.

In the normal bone the body is commonly compressed antero-posteriorly, curved and extended transversely. On the anterior lower border is a rather prominent but blunt tubercle. Owen describes the cerato-hyals as "mere pisiform nodules of bone projecting from the line of union of the basi-hyal and thyro-hyal portions," that is to say, they arise from the area of junction. Strong, somewhat rounded ligaments extend from the cerato-hyals, or lesser cornua, to the styloid processes of the temporal bones, or rather to their petrosal portions.

Also, normally, both the thyro-hyals and the cerato-hyals are separated from the basi-hyal or body to a late period in life. A slight expansion of the posterior end of the thyro-hyals is usually seen and these often bear—indeed I have never seen any other condition—epiphyses. From these processes extend ligaments which reach to the thyroid cartilage and this occasions the name bestowed upon them. All these five bones become completely ossified and ankylosed at from thirty-five to forty years of age.

It may be further remarked that the cerato-hyals are described by Holden as being "of the size of barley-corns."