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honor to reproduce these drawings in the Quarterly Journal of the Geological Society for May, 1889, p. 183, in an article: "On the Growth of Crystals in Igneous Rocks after Consolidation." In this interesting paper Prof. Judd concludes that the crystal enlargements from Missouri belong to the same general class observed in fragmental rocks by different workers, especially by Irving and Van Hise.³

It seems to the writer that the examples produced by Prof. Judd from Mull, in the Western Isles of Scotland, are so dissimilar to the Missouri specimens that it is unsafe to class them together. His is a *Labradorite-andesite* with large porphyritic crystals of labradorite, and a glassy base. The Missouri specimens are from a fairly well crystallized granite; one having idiomorphic crystals, it is true, but which is very far removed from a rock with a glassy base. Judd's idea is that "the growth of crystals of felspar and quartz goes on, at the expense of a more or less vitreous matrix, long after the solidification of the rock," etc.

Neither the field work nor the laboratory work on the Missouri crystalline rocks is completed. The writer will hold himself ready to alter his views on any of the subjects, or to entirely abandon them, should subsequent evidence demand it.

THE NATIVE FOOD FISHES OF IOWA.

BY PROF. SETH E. MEEK, M. S.

(Abstract.)

In the waters of Iowa, including the Mississippi River along her eastern border, are found about one hundred species of fishes, of these about thirty-six are usually found in our markets, and are regarded as food fishes of more or less value. About eight of the remaining species are large enough for food, but for various and just reasons, have no market

3. See Bull. 8, U. S. G. S. and Am. J. Science, (3), 30. 233, 35.

value. In some the flesh is poor, tough and rank flavored, while in others it is dry, tasteless and full of very small bones. Among such are the shovel-nosed sturgeon, the dog fish, the garpikes, the hickory shad, the skip jack and others never used more than once for food by the same person.

The remaining species are all small, and while directly are of no value, yet indirectly are of much importance. These small fishes, together with the young of all species, furnish much of the food for the large predatory fishes.

In the present paper is given a systematic list of our native food fishes together with a few notes as to their distribution in our waters, their habits and their value as good fishes.

Detailed descriptions of all the fishes enumerated in this paper can be found (1) in Jordan and Gilbert's "Synopsis of the Fishes of North America," published by the Department of the Interior. (2) "Jordan's Manual of Vertebrates of Eastern United States," published by A. C. McClurg & Co. Descriptions and figures of most of them are found in "History of Aquatic Animals," published by the Census Bureau.

Family 1--POLYODONTIDÆ.

2. *Polyodon spathula* Walbaum. Paddle Fish.

This species is known by the prolongation of the long, flat blade which overhangs the broad terminal snout; it inhabits only the larger streams of the Mississippi basin. In this State specimens are occasionally taken from the Cedar River, the Iowa River, the Missouri River and from the Mississippi River. It no doubt inhabits all of the larger streams of the State. Fishermen on the Mississippi River find it more common in the fall and then in bayous. It lives chiefly on small forms of animal life which it stirs up from the mud with its long snout. This remarkable fish attains a length of six feet and is but little esteemed for food.

Family 2—ACIPENSERIDÆ.

2. *Acipenser rubicundus* Le Sueur. Lake Sturgeon, Rock Sturgeon.

This species may be known from the shovel-nosed sturgeon by the presence of spiracles, the sub-conic snout and by the tail which is not depressed nor completely mailed. This species is common in the Mississippi River in the spring, rather scarce at other times of the year. I have no positive record of its being taken in streams within the state, yet it no doubt inhabits them. It reaches a length of six feet and is a fairly good food fish.

Family 3—SILURIDÆ.

3. *Ictalurus furcatus*, Cuv. and Val. Chuckle Headed Cat.

This species may be known by its deeply forked tail, and long anal fin, the latter with thirty-two to thirty-five rays. This species is not common in the state, and is found only in the larger rivers. It reaches a length of two and one-half feet and is the best food fish in the family.

- Ictalurus punctatus*, Rafinesque. Channel Cat, Silver Cat.

This species differs from the above in having twenty-four to thirty rays in the anal fin. It is common in all the streams and the larger bodies of water in the state. It is larger than the preceding, and as a food fish is not distinguished from it.

4. *Ameiurus nigricans*, Le Sueur.

This species is distinguished from the other *Ameiuri* by having a forked tail, and from the two preceding it can be recognized by its more robust form and darker color. I know of no specimens of this species being taken in this state except from the Mississippi River. It no doubt inhabits the larger streams. This is the largest cat-fish found in the state. Specimens of immense size used to be taken from the Mississippi River, some said to weigh two hundred pounds. At pres-

ent one is seldom taken reaching a weight of sixty pounds. It is a good food fish though its flesh is rather tough.

5. *Ameiurus natalis*, Le Sueur. Yellow Cat.

The tail is not forked in this species and the following species of the genus. Anal rays twenty-four to twenty-six rays. I have collected but one specimen of this species in the State; it was taken from Indian Creek near Marion. This species attains a length of twelve to fifteen inches. It frequents sluggish streams and still bodies of water. The large head and small body prevents this species as well as the two following from ever being used extensively as a food fish, all rank fairly well as food fishes, especially when not taken from warm stagnant pools.

6. *Ameiurus nebulosus*, Le Sueur. Bull Head, Horn Pout.

Anal rays twenty-two, similar to the preceding. This fish is very tenacious of life. It is common everywhere in the State yet less so than the following. Length twelve inches.

7. *Ameiurus melas*, Rafinesque. Small Black Cat.

Anal rays eighteen to twenty. Found with the preceding from which it not distinguished by fishermen.

8. *Leptops olivaris*, Rafinesque. Mud Cat, Flat Head Cat.

This is the largest of the cat fishes except *A. nigricans* from which it may be distinguished by its flat head and shorter anal fin. Anal rays twelve to fifteen. It inhabits the larger streams of the State and is less common in the Mississippi River than in former years. It reaches a weight of seventy-five pounds, but seldom one is found at present which reaches half this weight. A very good food fish.

Family 4—CATOSTOMIDÆ. The Suckers.

9. *Ictiobus cyprinella*, Cuv. and Val. Common Buffalo Fish.

This species may be distinguished from the other buffalo fishes by its thin lips, large terminal mouth, which is pro-

tractible forward. It inhabits still water and is seldom found in the river currents. Very common in bayous. It is extensively used as a food fish, though its flesh is rather coarse and full of small bones. It frequently reaches a weight of thirty pounds.

10. *Ictiobus urrus*, Agassiz. Razor Backed Buffalo.

Known by the thin lips and the sub-inferior mouth which is protractible downwards. It is very similar to the preceding, and more frequently found in the river current. Length about two and one-half feet.

11. *Ictiobus bubalus*, Rafinesque. Small Mouthed Buffalo.

Lips thick and sucker-like, mouth sub-inferior. Common in Mississippi River, less frequently taken in bayous. It reaches a length of two and one-half feet and is usually more abundant in the market than any of the buffalo fishes.

12. *Cycleptus elongatus*, Le Sueur. Black Horse, Missouri Sucker.

This species is known by the very long head, pointed snout and small eye. Not common, and found only in the larger streams. It reaches a length of two and one-half feet, and is more highly esteemed for food than any other of the suckers.

13. *Catostomus teres*, Mitchell. Common Sucker, White Sucker, Fine Scaled Sucker.

Known from the other suckers by the smaller size of the scales on anterior part of body, sixty-five to seventy scales in lateral line. This is one of the most abundant fishes in Iowa. It reaches a length of one and one-half feet. As a food fish it is of little value.

14. *Erinnyzon sticetta*, Lacepede. Chub Sucker.

This is the only sucker found in the State without a lateral line. It is not common in the streams of Iowa. It seldom exceeds a foot in length and is little valued as a food fish.

15. *Minytrema melanops*, Jordan. Striped Sucker.

On each scale is a black spot, these spots forming dark longitudinal stripes. I have found this fish only in Squaw Creek, near Ames, Iowa, and in the bayous near Muscatine. It is not very common and is usually taken in the spring. Too small to be regarded as a good food fish.

16. *Moxostoma duquesnei*, Le Sueur. Common Red Horse, Mullet.

This species may be known by its slender form and the larger scales on the body, about forty-five in the lateral line, pale and silvery. The species is very abundant in the State. It reaches a length of two feet and is not regarded as a valuable food fish. It is found usually in clear water.

Family 5—**SALMONIDÆ**. The Salmon.17. *Salvelinus fontinalis*, Mitchill. Brook Trout, Speckled Trout.

On May, 14, 1889, a specimen of this species was taken from Mad Creek, Muscatine, Iowa. I am also informed by Mr. Minott, a well known hunter and fisherman on the Cedar River, that they used to be found frequently in a small tributary of the Cedar River, near Mt. Vernon. At present but few are taken in Iowa and these are stragglers from farther north. I do not know of other salmon being taken in Iowa. As a food fish the brook trout ranks among the very best.

Family 6—**ESOCIDÆ**. The Pikes.18. *Esox vermiculatus*, Le Sueur. Little Pickerel.

This species is known from the other pikes of this region by its entirely scaled cheeks and opercles. It is quite common in this State. It attains a length of twelve to fifteen inches. Its flesh is excellent, but its small size makes it a food fish of little importance. "It delights to quietly loiter in the shelter of the pads of the pond-lily and in the shadows of the dense masses of *Potamogeton*, a few inches below the surface of the water. Motionless, in such situations, it awaits the

coming of the unwary minnow, when, quicker than thought, it darts upon its prey, and while you look sinks slowly from sight. There is no apparent motion of fin or tail, but ere you realize it, the ravenous beauty is gone. Its coming to the surface is as motionless and unexpected."—*Call.*

19. *Esox lucius*, Linnæus. Pike, Northern Pickerel.

This species is known by the half bare opercles and by being light spotted on a darker back ground. The habits of this species are similar to the preceding. It attains a length of four feet and is one of our very best food fishes. It is a favorite game fish and many are caught each year by anglers in the lakes in this state.

20. *Esox nobilior*, Thompson. Muskallunge.

This species is known by the absence of scales on the lower half of the cheeks and opercles and by being dark spotted on a lighter back ground. The muskallunge reaches a length of six feet and attains a weight of over eighty pounds. It is one of the most voracious of fishes and decidedly gamey. They are found only in small numbers. Specimens are occasionally taken in the Mississippi River. The head of a large specimen taken from the Skunk River, near Ames, is in the Iowa Agricultural College Museum, others are said to have been taken from the same place. This species is not always distinguished from the preceding. It is an excellent food fish.

Family 7—**ANGUILLIDÆ.** The Eels.

21. *Anguilla rostrata*, Le Sueur. Common American Eel.

The common eel is found in all the larger streams of the State, though it is not abundant anywhere. As a food fish it ranks well.

Family 8—**CENTRARCHIDÆ.** The Sun Fishes.

22. *Pomoxis sparoides*, Lacepede. Calico Bass, Grass Bass, Crappie.

This species is very abundant near Muscatine. It is usually called crappie and usually not distinguished from the latter

by the fishermen. It can be told from other sun-fishes in this State by the presence of seven or eight dorsal spines and seven anal spines. It reaches a length of twelve inches and is a fairly good food fish.

23. *Pomoxis annularis*, Rafinesque. Crappie, Batchelor, New Light.

Apparently much less abundant than the former, from which it differs chiefly in color and one less dorsal spine.

24. *Ambloplites rupestris*, Rafinesque. Rock Bass, Red Eye, Goggle Eye.

The only sun-fish found in this State with nine dorsal and six anal spines. It is quite common in this State. It attains a length of about twelve inches and is a good food fish.

25. *Chaenobryttus gulosus*, Cuv. and Val. War-Mouth, Red Eyed Bream.

Similar to the preceding but with three anal spines. It is a very voracious fish, living in sluggish and grassy waters, quite common in bayous along the Mississippi River. I have not seen it elsewhere in the State. Length twelve inches; a good food fish.

26. *Lepomis cyanellus*, Rafinesque. Green Sun Fish.

27. *Lepomis megalotis*, Rafinesque. Long Eared Sun Fish.

28. *Lepomis pallidus*, Mitchill. Blue Sun Fish.

29. *Lepomis gibbosus*, Linnaeus. Common Sun Fish, Pumpkinseed.

These four species are found throughout the State, the last being the more abundant. Their flesh is fine but their small size prevents them from being important food fishes.

30. *Micropterus dolomieu*, Lacepede. Small Mouthed Black Bass.

31. *Micropterus salmoides*, Lacepede. Large Mouthed Black Bass, Oswego Bass.

These two species are perhaps our best game fishes. They are found in considerable numbers in the rivers and lakes of the State, one seems about as abundant as the other. They grow about the same size, seldom exceeding a weight of eight pounds. The small mouthed bass is a dull olive green, the young with cross bars. The large mouthed is lighter with

usually a broad dark lateral band. As food fishes both are among our best.

Family 9—**PERCIDÆ**. The Percies.

32. *Perca flavescens*, Mitchill. Yellow Perch, Ringed Perch.

This species is quite common in this State especially in some of our northern lakes. It seldom reaches a length of fifteen inches. It is a good game fish. Its small size prevents its being an important food fish.

33. *Stizostedion vitreum*. Wall Eyed Pike, Jack Salmon.

This species is one of our most important food fishes. It is taken in large numbers every year in Spirit Lake and in our larger streams. It is an excellent game fish, reaching a weight of twenty to forty pounds.

34. *Stizostedion canadense*, Smith. Sanger, Sand Pike, Gray Pike.

Similar to the above but smaller, and perhaps less abundant.

Family 10—**SERANIDÆ**. The Sea Basses.

35. *Roccus chrysops*, Rafinesque. White Bass. Striped Bass.

This species is not very abundant in the State. It seldom reaches a length of fifteen inches. It possesses some of the qualities of a game fish and as a food fish is not very inferior to the black bass.

Family 11—**SCIENIDÆ**. The Drums.

36. *Aplodionotus grunnius*, Rafinesque. Fresh Water Drum, Croaker.

This species attains a length of two feet or more but is a food fish of inferior quality.

NOTES ON THE NATIVE FOREST TREES OF EASTERN ARKANSAS.

BY PROF. R. ELLSWORTH CALL.

(Abstract.)

During the summers of 1888 and 1889 opportunity was presented the writer, in connection with geologic work on