DESCRIPTIONS OF TWO NEW SPECIES OF DARTERS FROM LAKE MAXINKUCKEE, INDIANA.

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During the summer and fall of 1899 the writer was engaged, under the direction of the Commissioner of Fish and Fisheries, in making a physical and biological survey of Lake Maxinkuckee, Indiana. While carrying on these investigations particular attention was, of course, paid to the fishes found in the lake. Careful studies were made of the abundance, distribution, feeding habits, and rate of growth of the more important species, and sufficient collections were made to supply data for cataloguing the species of fishes, mollusks, and crustaceans inhabiting the lake. Among the fishes obtained are two species of darters which appear to be new. As it is the intention to continue the study of this lake during another season, and as the detailed report upon the investigations will not be published until next year, it has been thought advisable to publish the descriptions of these new species in advance of the general report.

Lake Maxinkuckee is in the southwest corner of Marshall County, Ind., on the Logansport and Terre Haute railroad, 32 miles north of Logansport. It is about 2.75 miles long, from north to south, 1.75 miles wide, and is quite regular in outline. Like all the lakes of northern Indiana, it is of glacial origin. Its greatest depth, so far as known, is 86 feet. The bottom is of compact sand and gravel near the shore, then a wide bed of marl, and soft mud in the deeper parts. There are only one or two short reaches near the shore where the bottom is soft. The water is relatively pure and clear. The bottom temperature in summer is 47° to 50° F., while the surface gets as warm as 77° to 80°.

The lake is well supplied with aquatic vegetation, *Chara*, *Potamogeton*, *Myriophyllum*, *Ceratophyllum*, *Nitella*, *Vallisneria*, and *Scirpus* being abundant. At least 10 species of *Potamogeton* and 2 species of *Scirpus* are found. *Chara* is abundant, great beds of it covering the bottom in many places from near shore out to a depth of 12 or 15 feet.

The catchment basin of the lake is small. The tributary streams comprise one very small brook at the south end, a somewhat larger one at the southeast corner, and three small ones upon the east and northeast sides. They are short and sluggish and vary but little in size at any time. The total inflow from them is but a few gallons per minute.

The more important of these streams are the one at the southeast corner, popularly known as "the inlet," one near the middle of the east side, and one at the northeast corner, known as "Culver Inlet."

The stream on the east has been called Aubeenaubee Creek, from the Pottawattomie chief of that name who once owned the land on the east side of the lake. From this small creek the specimens of the new species were obtained. Aubeenaubee Creek rises in a small marsh and flows through a low, level meadow or prairie region. It is about 2 miles long, 4 feet wide, and averages only 3 to 6 inches deep, with deeper holes at intervals. Throughout most of its length the stream is overhung by bushes and briars and is full of sticks and brush. The bed and banks are of black mud with a mixture of sand. In some places the ground is quite boggy. The mid-day temperature of the water in this stream in summer is about 72°.

The fishes in Aubeenaubee Creek differ almost wholly from those in the lake proper, a fact illustrating clearly the importance of even slight differences in geographic location if accompanied by stable environmental differences. The principal fishes in this creek are *Semotilus atromaculatus*, *Campostoma anomalum*, *Umbra limi*, *Lucius vermiculatus*, *Notropis cornutus*, and young *Micropterus salmoides*. Craw-fishes were abundant.

The two darters described as new both occur in Aubeenaubee Creek, and nowhere else, so far as known. The nearest relative of the first of these species (*Hadropterus maxinkuckiensis*) is *H. scierus* which, though not occurring in Lake Maxinkuckee, is found in Yellow River, of the Kankakee drainage, only a few miles north, and also in the Tippecanoe River at Delong, some 5 miles south of the lake, and into which the outlet of Lake Maxinkuckee flows.

The other darter (*Etheostoma aubeenaubei*) here described is given full specific rank, though further investigation may show that its characters possess only subspecific value. It is evidently derived from *E. iowæ*, which is found in many of the streams of western Indiana and is somewhat abundant in Lake Maxinkuckee, but is not known to occur in Aubeenaubee Creek.

Etheostoma iowæ, in extending its range from its original center of distribution, in all probability found its way into Lake Maxinkuckee from the Tippecanoe River. Having once become established in the lake, individuals sooner or later began entering its tributary streams. Some of the individuals entering Aubeenaubee Creek, finding the conditions easy, remained and bred there, and thus a creek colony was established. It is altogether probable that for some years, possibly many, individuals from the colony would occasionally return to the lake and interbreed with individuals that had never left the lake. And the reverse would also take place—individuals from the lake would probably continue for many years to invade the domain of the creek colony and interbreed with its members. Under such conditions those of the colony going farthest toward the head of the creek were probably

sooner freed from the influence of the lake and, breeding only among themselves, were modified most rapidly by the new environment. In time they became so well differentiated as to be readily distinguishable from the parent form in the lake.

But during the continuance of the migrations and countermigrations between the lake and the stream, there would be found in the lower part of the stream and in the lake about its mouth the progeny of the individuals from the lake and creek which had interbred. These would possess characters more or less intermediate between the parent species (*Etheostoma iowæ*) and the derived form inhabiting the creek. So long as these intermediate forms continued to exist the form found in the creek would be only an incipient species, and as such it would be a subspecies of *E. iowæ*, and would receive a trinomial name. But if, in course of time, invasions of one habitat by individuals from the other should cease, then the intergrading forms would, through interbreeding with the extreme forms, be gradually absorbed by them and finally disappear altogether. In the creek would then be found a form differing clearly and constantly from the lake form and without any connecting forms. Under these circumstances the form in the creek, as well as that in the lake, must rank as a distinct species.

This is the present condition, so far as our investigations have enabled us to determine. There is no difficulty in distinguishing individuals taken in the lake from those found in the creek, and neither form seems to invade the habitat of the other. Large collections were made, not only of the fishes inhabiting the lake, but also of those in the creek. The latter was carefully seined twice from its source to its mouth, and not a single example of *E. iowæ* or any form showing intergradation was seen. Similarly careful investigations were made in the lake without discovering any individuals of the creek form or any showing intergradation. Whether further collecting will discover connecting forms can not, of course, be stated. The small size of the creek and of the lake, and their close geographic relation, render it almost certain that individuals of the one form would occasionally invade the habitat of the other, and vice versa. While the environment of the creek is markedly different from that of the lake, it is improbable that a change from one to the other would prove disastrous to the individuals concerned. Some of such individuals would, it seems, be able to survive, and some would probably interbreed with individuals of the other form whose habitat they had invaded. This was quite likely the condition in the beginning, and the creek form, so long as it remained connected with the parent species by the intergrading forms resulting from such interbreedings, would be a subspecies of the parent species. But, as already stated, no such connecting forms have yet been found, and the form inhabiting the creek is a distinct species.

There is one other condition worth considering. Let us suppose, after the creek colony had become well established, and for many generations had not intermingled in any way with the parent species in

the lake, that the habits of one or the other, or both, should change somewhat and that they should again begin to invade each other's habitat, and to interbreed. However rarely this might occur, no one will deny its possibility. The result of this interbreeding would be the appearance of individuals possessing morphological characters more or less intermediate between the lake and the creek forms. In other words, individuals would be found showing that the two forms intergrade and placing them again in the relation of species and subspecies. If we could *know* this to have been their history, however, we would certainly not place them in the relation of species and subspecies. We would regard them as two distinct species, and the individuals which seem to show intergradation we would call hybrids, which they really are. But we can rarely, if ever, *know* that such has been the history. So long as intergradations are found connecting the two forms, the one last discovered must be regarded as a subspecies of the other, but in the present case no intergradations seem to exist, and the relation is that of two distinct species.

Hadropterus maxinkuckiensis Evermann, new species.

Head 3.75; depth 6; eye 4.5; snout 4.2; maxillary 3.25; mandible 2.75; interorbital 6; pectoral 1.3; ventral 1.4; D. XIV, 13; A. II, 9; scales 7-62-10.

Body rather long, slender, and subterete; caudal peduncle somewhat compressed, its least width one-half its least depth; head rather long, snout pointed; mouth rather large, somewhat oblique, maxillary reaching anterior edge of pupil; lower jaw included; eye rather large, slightly above axis of body; interorbital moderately wide, nearly flat; gill-membranes free from each other and from the isthmus; opercle with a rather long flap and stout spine; premaxillaries not protractile; fins rather large; distance from origin of spinous dorsal to tip of snout slightly greater than base of spinous dorsal, or nearly twice base of soft dorsal; longest dorsal spine 2.75 in head; soft dorsal higher than spinous portion, 2.25 in head, the free edge gently curved; origin of anal under that of soft dorsal, its base 1.9 in head; caudal slightly emarginate.

Scales firm and strongly ctenoid; lateral line complete and straight, beginning over opercular spine; top of head and an oblong area on nape naked; space in front of spinous dorsal with small embedded scales; opercle with about seven rows of scales; cheek with a few small embedded scales; breast naked, except two or three partially embedded scales on median line; one large scale between ventrals; belly naked anteriorly, but with about 10 enlarged, stellate scales posteriorly; space between ventrals broad, equal to width of base of ventral; preopercle smooth.

Color in life essentially as in *H. scierus;* mottled and vermiculated with light and dark brown, or blackish, the middle line of back with about 9 large, roundish, dark, confluent areas, each surrounded by a wavy, whitish line; middle of side with about 7 large confluent dark spots, the anterior two largest and longest, the third small, the fourth large, and the remaining three progressively smaller; under parts yellowish white; top of head dark; a narrow whitish line around upper posterior part of orbit; a broad black line downward from eye; upper part of preopercle and nearly whole opercle dark, each dusted on lower part; cheek dusted with fine dark specks; an irregular pale area at anterior end of lateral line; spinous dorsal ashy, membrane of the first three spines black on middle portion, the other membranes dark, but less distinctly so; tips of last few spines dark; soft dorsal light brownish or grayish, crossed near the base by a series of dark spots and above by two series of whitish spots; caudal spotted with white and brown; anal white, dusted with brownish; ventrals whitish, with fine dark dustings; pectoral whitish, yellowish at base, followed by alternating series of dusky and whitish spots.

This species differs from *H. scierus* chiefly in the much larger mouth, the longer maxillary, the larger scales, the fewer scales on the opercle and cheek, the free gill-membranes, the smooth preopercle, and closer approximation of the dorsal fins.

One example, 3.5 inches long, taken in Aubeenaubee Creek, the eastern inlet of Lake Maxinkuckee, about half a mile from the lake, August 4, 1899.

Type No. 49378, U. S. N. M. Evermann & Scovell, collectors.

Etheostoma aubeenaubei Evermann, new species.

Head 3.6; depth 5; eye 4; snout 5; maxillary 3; interorbital 5; D. x-11; A. II, 8; scales 4-58 to 63-9, 8 to 24 pores.

Body rather elongate, not much compressed except posteriorly; head rather short; snout short, somewhat decurved; mouth moderate, slightly oblique, lower jaw included, maxillary reaching past front of orbit; eye rather small, above axis of body; premaxillaries not protractile; gill-membranes free from the isthmus and each other. Fins not large, the dorsals usually distinctly but narrowly separated, sometimes scarcely separate; origin of spinous dorsal one-third distance from tip of snout to base of caudal; outline of spinous dorsal gently rounded, the longest spine about 3 in head; longest dorsal ray about 2; first anal spine longer, and slightly stronger than second, 3 to 3.5 in head; longest anal ray about 2; pectoral short, about 1.3 in head; ventrals close together, about 2 in head; caudal rounded, 1.5 in head. Scales rather small, rough-ctenoid; lateral line incomplete, usually developed on only 8 to 24 scales at anterior end; cheek usually naked, or with a few small, more or less embedded scales; opercle usually about half-scaled, sometimes with but few scales; breast always naked; belly with ordinary scales; nape usually densely and regularly scaled, occasionally some scales embedded; preopercle entire; opercular flap moderate, broad; opercular spine rather small; no humeral spot or process.

Color in life, greenish brown above, side with about 12 or 13 vertical, dark blotches, separated by pale orange-red areas of similar size; another series of similar but smaller orange blotches along lower part of side anterior to anal fin; under parts whitish; caudal peduncle grayish; head dark above; opercle and cheek dark, with greenish shade; a dark line downward from eye; snout grayish; spinous dorsal with a narrow dark border, below which is a broad orange band, then a broad but irregular dark band near base of fin; soft dorsal and caudal barred with white and grayish, the latter in spots on the rays; anal and ventrals without markings; pectoral somewhat dusky.

This species is close to *E. iowæ*, from which it is evidently descended, and from which it differs in the almost naked cheek, the less complete scaling of the opercle, the somewhat longer maxillary, more oblique mouth, much closer approximation of the dorsal fins, and the coloration.

Many examples, each about 2 inches long, taken in Aubeenaubee Creek, the east inlet of Lake Maxinkuckee, August 4 and 23, and on other days in August and September, 1899.

Type No. 49379, U. S. N. M. Evermann & Scovell, collectors.