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The Darters (Etheostominae) Of Minnesota

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The Hairless gene might then be thought of as acting through a disturbance of the reactions involved in the reduction of cell isopotency during late larval life. The Minutes could then produce their effect by interfering with the time relationships of these reactions.

1 1 1

NOTES ON MALARIA-CARRYING MOSQUITOES OF NORTH-CENTRAL MINNESOTA

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ABSTRACT

The influx of 40,000 soldiers, many of them from the South, to Camp Ripley and the surrounding area during the summer maneuvers of 1940 raised the question of the possibility of malaria transmission by local species of mosquitoes and with this in mind a survey was undertaken by the State Department of Health.

The area surveyed extended from St. Cloud to Brainerd and from Lake Mille Lacs to Sauk Centre, and stations were set up at various places during successive weeks from June fifteenth to September fifteenth.

Three species of Anophelines, *maculipennis*, *punctipennis* and *walkeri* were found, in numbers far exceeding expectations. Two-thirds of possible adult resting places such as stables, privies, hog houses, etc. examined contained Anophelines, 95 percent of them being *maculipennis*.

Breeding areas were mapped and species preferences to certain habitats were noted. *Maculipennis* was again dominant as it was present in three-fourths of larval collections.

The significance of the races of *maculipennis* is briefly discussed.

1 1 1

THE DARTERS (ETHEOSTOMINAE) OF MINNESOTA

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It is surprising that the distribution of a group of fishes as interesting and common as the darters should be so little known. They are the most brightly-colored fishes found in Minnesota. Forbes and Richardson¹ say that the darters "are to the fishes of

¹ Forbes, S. A. and R. E. Richardson, 1920. The Fishes of Illinois State Natural History Laboratory.

North America what the hummingbirds are to the South American birds. They seem not so much dwarfed as concentrated fishes, each embodying in small space all the complexity, spirit, and activity of a perch or a wall-eyed pike."

The distribution of the darters is little known for two reasons. First, because of their small size, they are often overlooked. Even the largest darters seldom reach a length of six inches. Second, the identification of the various species of darters is quite difficult. The characters used in their identification are variable and the synonymy of some species is extremely complicated. In recent years, however, C. L. Hubbs and a few other investigators have cleared up many of these taxonomic tangles.

In the present study, all the specimens of darters in the fish collections at the University of Minnesota have been examined. Most of these records had not been previously reported. In the remainder of this paper, all the available data on the distribution of the darters in Minnesota have been summarized. The references to literature are cited only once and the footnotes are numbered consecutively.

The lists of synonyms given under each species are in no way complete. An attempt has been made to include only those names which have been used in Minnesota records. More complete lists of synonyms are given in papers by Hubbs. The following key is modified from Hubbs and Lagler.²

- | | | |
|----|--|---|
| 1 | Body very elongate (pencil-shaped; depth 7.8 to 9.0 in length); flesh pellucid in life; single anal spine; scales of trunk confined to median sides | |
| | | <i>Ammocrypta pellucida</i> |
| 1' | Body less extremely elongate (depth 5.0 to 7.0); flesh opaque; two anal spines; squamation of body almost complete | 2 |
| 2 | Premaxillaries fused to preorbitals at the sides and overhung slightly by a very gibbous snout; color largely green in life | <i>Etheostoma blennoides blennoides</i> |
| 2' | Premaxillaries free from the preorbitals at the sides | 3 |
| 3 | Premaxillaries distinctly protractile, even the midline separated by a deep groove from the snout | <i>Boleosoma nigrum</i> , two intergrading subspecies |
| 3' | Premaxillaries scarcely protractile, bound to the snout by a fleshy frenum (which, however, may be crossed by a shallow groove, especially in <i>Imostoma</i> , when mouth is tightly closed) | 5 |
| 4 | Nape, cheeks and breast well-scaled | <i>Boleosoma nigrum eulepis</i> |
| 4' | Nape, cheeks, and breast scaleless | <i>Boleosoma nigrum nigrum</i> |
| 5 | Midline of belly with a definite single file of scales which are more or less enlarged, thickened, caducous, and separated by a slight groove from the scales on either side (these scales may be only weakly specialized in <i>Imostoma</i> and in females of other genera.); one such scale between pelvic fins. Pelvics separated by a space at least three-fourths as wide as base of either fin; anal fin usually almost as large as the second dorsal or larger; body typically elongate and little compressed | 6 |
| 5' | Midline of belly without median file of specialized scales; no specialized spiny scale between pelvics; pelvics separated by a space less than three-fourths as wide as base of either fin; anal fin smaller in area than second dorsal; body deeper and more compressed | 10 |

² Hubbs, C. L. and K. F. Lagler, 1939. "Keys for the identification of the fishes of the Great Lakes and tributary waters". Ann Arbor.

- 6 Snout extended forward as a small conical protuberance beyond the upper lip; mouth horizontal; anal spines, flexible; scales 78 to 103 in lateral line; cross-bars numerous and narrow. *Percina caprodes semifasciata*
- 6' Snout not extended beyond upper lip; mouth more or less oblique; anal spines stiff; scales fewer than 80; cross bars either broad or obsolete. 7
- 7 Belly largely scaleless medially, but crossed before anus by a bridge of scales; scales of midline only incipiently modified; premaxillary frenum usually hidden by a shallow furrow. *Imostoma shumardi*
- 7' Belly mostly scaled and with the scales of the midline strongly modified (at least in males); premaxillary frenum usually not hidden by a cross furrow. 8
- 8 Gill membranes united into a broad curve, distinctly more distant from tip of snout than is the back of the eye; lateral blotches small; spinous dorsal with a submarginal orange band in life. *Hadropterus phoxocephalus*
- 8' Gill membranes not united, but meeting at a sharp angle and on the midline scarcely farther from tip of snout than is back of eye; lateral blotches large; spinous dorsal without orange. 9
- 9 Scales in lateral line 52 to 67; cheeks naked; bands broad, large, and squarish; color gilt in life. *Hadropterus eviles*
- 9' Scales in lateral line 65 to 85; cheeks at least partly scaled; bands narrower; not gilt in life. *Hadropterus maculatus*
- 10 Lateral line obsolete; dorsal spines usually 6; lower fins much produced and pointed in breeding males; adults seldom as long as 1½ inches
 *Microperca microperca microperca*
- 10' Lateral line at least partly developed; dorsal spines 8 or more; lower fins not greatly developed; adults usually over 1½ inches. 11
- 11 Conspicuously marked with longitudinal rows of spots or dashes; head scaleless; males not brightly colored; dorsal spines of breeding males ending with fleshy knobs *Catonotus flabellaris lineolatus*
- 11' Not conspicuously marked with longitudinal rows; head partly scaled; males brightly colored; dorsal spines without knobs. 12
- 12 Gill membranes very broadly connected; green color in life
 *Poecilichthys zonalis zonalis*
- 12' Gill membranes not broadly connected; not green. 13
- 13 Body rather slender (depth 5.4 to 6.2 in length); soft dorsal rays 9 to 11 (occasionally 12). *Poecilichthys exilis*
- 13' Body rather deep (depth 4.5 to 5.4); soft dorsal rays 12 to 14. 14
- 14 Cheeks covered with ctenoid scales; 49 to 57 scales in lateral line
 *Poecilichthys jessiae*
- 14' Cheeks scaleless or with a few embedded scales around eye; scales 43 to 53 in lateral line. *Poecilichthys coeruleus*

NORTHERN LOG PERCH, *Percina caprodes semifasciata* (De Kay)

Pileoma zebra Agassiz, *Percina caprodes zebra* (Agassiz)

Published records: Lake Superior.³ Upper Mississippi River system.^{4 5 6} Lower Mississippi.⁷ St. Louis River system.⁴ Kettle River.⁵ Platte River.⁶ St. Croix River.⁷ Lake of the Woods.⁸ Cass Lake.⁹ Kandiyohi County.⁵ Pine County.⁵

University collections: 36 collections from the following counties: St. Louis, Koochiching, Lake of the Woods, Itasca, Cass, Hubbard, Wadena, Crow Wing, Aitkin, Carlton, Mille Lacs, Morrison, Anoka, Ramsey, LeSueur, Goodhue, Wabasha, Winona and Fillmore.

The log perch is one of the commonest darters in Minnesota and is found in all parts of the state except the southwest. Further collecting would probably reveal it there also.

³ Agassiz, Louis, 1850. "Lake Superior." Boston. Gould, Kendall and Lincoln.

⁴ Cox, Ulysses O., 1897. "A preliminary report on the fishes of Minnesota." Geol. and Nat. Hist. Surv. of Minn.

⁵ Surber, T., 1920. "A preliminary catalogue of the fishes and fish like vertebrates of Minnesota." Append. Bienn. Rept. State Game and Fish.

BLACK-SIDED DARTER, *Hadropterus maculatus* (Girard)*Atvordus maculatus* Girard, *Hadropterus aspro* (Cope and Jordan)*Published records:* Minnesota River system^{4,5}; Red River system^{4,10}; Otter Tail River³; St. Croix River⁷;*University collections:* 6 collections from: the Mississippi River at the mouth of the Zumbro; a creek in Fillmore County; Red Lake River; Rock River near Luverne; and Sturgeon River.

This species is primarily a river and stream fish. It is interesting that it has not been found in the Mississippi River north of the St. Anthony Falls although numerous fish collections have been made.

SLENDER-HEADED DARTER, *Hadropterus phoxocephalus* (Nelson)*Published records:* St. Croix River on Wisconsin side.⁷

Further collections would probably reveal this species in Minnesota.

GILT DARTER, *Hadropterus evides* (Jordan and Copeland)*Published records:* St. Croix River on Wisconsin side.⁷*University collections:* Mississippi River at mouth of the Cannon River.

Greene⁷ and Forbes and Richardson¹ report that this species is found only in the larger clear streams.

EVERMANN'S DARTER, *Hadropterus evermanni* Moenkhaus

This darter is probably just a hybrid and therefore not a valid species. Moenkhaus, who first discovered the species in Indiana, thought that his specimen might be a hybrid individual. However, he described it as a new species when he found five additional specimens. Since his description, specimens have been reported from Illinois, Michigan, and Ontario. Hubbs¹¹, however, believes that the species is really a hybrid between *Percina caprodes semifasciata* and *Hadropterus maculatus*.

In 1940, one specimen of Evermann's darter was collected in Lake of the Woods. *Hadropterus maculatus*, one of its supposed parents, has never been found in this lake. A somewhat similar species, *Imostoma shumardi*, may be the parent in this case, however, for a large number of this species and the log perch were taken with the specimen.

The specimen resembled both of the supposed parents and yet was distinctly different from either. It had ten dark blotches on the side. There was a dark spot at the base of the caudal similar to that

⁴ Friedrich, G. W., 1933. "A catalogue of fishes of Central Minnesota." *Copeia*. 1933(1).

⁷ Greene, C. W., 1935. "The Distribution of Wisconsin Fishes." Wisc. Cons. Dept.

⁸ Evermann, B. W., and Latimer, 1910. "Fishes of Lake of the Woods and connecting waters." Rept. U. S. Comm. Fish.

⁹ Hubbs, C. L. and A. M. White, 1923. "A list of fishes from Cass Lake, northern Minnesota." *Copeia*. 123: 103-104.

¹⁰ Hankinson, T. L., 1929. "Fishes of North Dakota." Pap. Mich. Acad. of S. A. & L. 10: 439-460.

¹¹ Hubbs, C. L., 1926. "A check-list of the fishes of the Great Lakes and tributary waters." Misc. Publ. Mus. Zool. U. Mich. 15: 1-77.

of the log perch. It was 43.9 mm. long; body stoutish, only moderately elongate and very little compressed. Depth, 4.82 in length. Head 3.90 in length. Eye, 3.77 in head. Snout, 6.58 in head. Pre-maxillaries not protractile. Cheeks and opercles, partially scaled. Nape and breast naked. The belly with a row of specialized scales separated by grooves on both sides. Rest of belly naked. 59 scales in lateral line. Dorsal fins XII-13, scarcely separated.

RIVER DARTER, *Imostoma shumardi* (Girard)

Hadropterus guntheri (Eigenmann and Eigenmann)

Published records: Red River.⁴ Red Lake River.⁴ Rapid River.⁸ Rainy River.⁸ Lake Pepin.¹² Mississippi River.⁷ St. Croix.⁷

University collections: Lake of the Woods and Rainy River.

This species may be quickly recognized in fresh specimens by the black blotches between the first and second spines and between the last three spines on the spiny dorsal fin.

GREEN-SIDED DARTER, *Etheostoma blennoides* (Rafinesque)

Diplesion blennoides (Rafinesque)

Published record: A questioned field record, White Water River, Olmsted and Winona Counties.⁹

Dr. Surber, at the time he made his observations, questioned his determination. He was unable to secure specimens. The nearest approach of the normal range of this species to Minnesota is in southeastern Wisconsin where one collection was made.⁷

JOHNNY DARTER, *Boleosoma nigrum* (Rafinesque)

Published records: Lake Superior.⁴ Lake of the Woods.⁴ Upper Mississippi.⁴ Sauk River.⁶ Minnesota River.⁴ Blue Earth River.⁴ Des Moines River.⁴ Red River.⁴ Cass Lake.⁹ St. Croix River.⁵ Lower Mississippi.⁷

Two subspecies are found in the state: *Boleosoma nigrum nigrum* (Rafinesque), the western Johnny darter, and *Boleosoma nigrum eulepis* Hubbs and Greene, the scaly Johnny darter. The subspecies of all the specimens in the University collections were determined. The distribution and relationships of these two subspecies were first worked out in Wisconsin.⁷ Greene found that *B. n. nigrum* was found in all the watersheds. *B. n. eulepis* was found in only three rather limited areas. In competition, *B. n. nigrum* appeared to be dominant. During the glaciation, *B. n. eulepis* had the more northern distribution. When the glaciers receded, however, *B. n. nigrum* extended its range northward, engulfing the range of *B. n. eulepis*. Now *B. n. nigrum* has the more northern range and is the only subspecies found in the Lake Superior drainage. *B. n. eulepis* is found only in glacial lakes where it seems to have found its optimum habitat. Around the present range of *B. n. eulepis* and in the areas that were formerly occupied by this subspecies, many of the Johnny darters show intermediate characters.

In Minnesota, the distribution is quite similar. *B. n. nigrum* has statewide distribution while *B. n. eulepis* is found only in one

¹² Wagner, G., 1908. "Notes on the fish fauna of Lake Pepin." Trans. Wisc. Acad. S. A. & L. 16(1).

limited region. Intermediate forms were quite widely distributed. For the purpose of the present study, unless the specimens were clearly one or the other subspecies, they were designated as intergrades. If some specimens in a collection were intergrades, all specimens were designated as intergrades.

Boleosoma nigrum nigrum (Rafinesque). The Western Johnny Darter.

University collections: Specimens from the following counties: Cook, Lake, St. Louis, Lake of the Woods, Itasca, Cass, Wadena, Crow Wing, Aitkin, Morrison, Mille Lacs, Benton, Isanti, Chisago, Wright, Hennepin, Carver, Scott, LeSueur, Goodhue, Fillmore, Mower, Freeborn, Cottonwood, Pipestone, Rock, and Nobles.

This subspecies is distributed throughout the state and over half of the collections were of this subspecies. All of the Johnny darters in the northeastern part of the state, the Lake Superior drainage, were of this subspecies.

Boleosoma nigrum eulepis Hubbs and Greene. Scaly Johnny darter

University collections: Bowstring Lake and Moose Lake in Itasca County and Big Lake, Beltrami County.

Dr. Hubbs in a letter to the author (Oct. 24, 1940) reported specimens of this subspecies from Lake LaSalle, Hubbard County; Mississippi River between Cass Lake and Bemidji; Upper Red Lake; and Lower Red Lake. These records are all in the same portion of the state as the University specimens.

In addition to these collections, there are numerous collections that include typical *eulepis* specimens, but are included as intergrades because some intergrade individuals were in the same collection.

Boleosoma nigrum nigrum x eulepis intergrades

University collections: From the following counties: Itasca, Beltrami, Clearwater, Cass, Wadena, Crow Wing, Aitkin, Morrison, Mille Lacs, Benton, Sherburne, Anoka, Washington, Ramsey, Dakota, Goodhue, Wabasha, Winona, Fillmore, Nobles, and Rock.

Intergrades were found in all except the northeastern part of the state. Most of the Johnny darters collected in the Mississippi River were intergrades. In the region around the range of the typical *eulepis*, intergrades were common. Some of the collections in the southwestern part of the state were intergrades although no *eulepis* specimens have been reported for this drainage.

Many of the collections closely resembled *B. n. eulepis*: viz. Cass Lake, Leech Lake, Cut Foot Sioux Lake, Mississippi River near Itasca, Pug Hole Creek (Crow Wing Co.), Platt River, and Lake Johanna (Ramsey Co.) Except for the last two these are all in the area where *eulepis* is found.

THE SAND DARTER, *Ammocrypta pellucida* (Baird)

Ammocrypta pellucida clara (Jordan and Meek)

Published records: Minnesota and Blue Earth Rivers at Mankato.⁴ Mississippi River at mouth of Zumbro.⁷

University collections: Four localities in the Mississippi between the mouth of the Zumbro and Winona.

No specimens have been reported from Minnesota since 1900. Collections should be made on the sand bars of the Mississippi to determine its present status.

IOWA DARTER, *Poecilichthys exilis* (Girard)

Etheostoma iowae Jordan and Meek; *Boleichthys exilis* Girard; *Boleichthys fusiformis* (Girard)

Published records: Blue Earth River.¹ Upper Mississippi River.^{4, 6} Minnesota River.⁴ Red Lake River.⁴ West Okabena Lake.⁴ Des Moines River.⁴ Red River.¹⁰ Mille Lacs Lake.³ Pleasant Lake.⁶ St. Croix.⁷

University collections: 48 collections from the following counties: Cook, Lake, St. Louis, Lake of the Woods, Itasca, Cass, Clearwater, Crow Wing, Pope, Anoka, Hennepin, Ramsey, Washington, Dakota, Goodhue, and Cottonwood.

This species has been a difficult one for taxonomists. Most of the characters are quite variable. Cox⁴ included records of *Etheostoma iowae*, *Boleichthys exilis*, and *B. fusiformis*, all of which are now believed synonyms.

Because of these taxonomic difficulties, it was felt desirable to determine the amount of variation in certain characters, as shown by the Minnesota specimens. The cheek, opercles, and nape were completely scaled in all specimens. The breast was naked. The gill-membranes were slightly or not at all connected. The lateral line in about half the specimens was almost straight. In other specimens considerable arching anteriorly was apparent. This did not seem a valid character for separation into species. The number of scales in the lateral line varied from 49 to 69, but usually was 55 to 66. In no case was the lateral line complete. From 16 to 61% of the scales in the lateral line were pored, usually 29 to 47%. The dorsal fin had 7 to 10 spines, mostly 9. One of the characters often used in separating this species from others in the genus is that this species has 9 to 11 soft rays in the dorsal fin, while others have 12 to 15. Some Minnesota specimens were found to have 12 rays, however. In counting these rays, the last (a forked) ray was counted as one, although at times it was difficult to determine whether it was forked or composed of two rays. The Minnesota specimens with 12 rays were all collected with specimens with fewer rays and except for this character were indistinguishable. This species may be readily distinguished from other members of the genus in Minnesota by its more slender form.

MUD DARTER, *Poecilichthys jessiae* Jordan and Brayton

Etheostoma jessiae (Jordan and Brayton)

Published records: Lake St. Croix and Mississippi River below Lake Pepin on Wisconsin side.⁷

University collections: Hay Creek, Red Wing.

RAINBOW DARTER *Poecilichthys caeruleus* (Storer)

Etheostoma caeruleum Storer

Published records: Blue Earth River.⁴ Root River, Fillmore Co.⁵ Mississippi River near Winona.⁷

University collections: Red Wing.

EASTERN BANDED DARTER, *Poeciliothys zonalis zonalis* Cope
Etheostoma zonale (Cope)
 Published records: Blue Earth River.⁴
 University collections: Hay Creek, Red Wing.

NORTHERN LEAST DARTER, *Microperca microperca microperca* (Jordan
 and Gilbert)
Microperca punctulata Putnam
 Published records: Pine Creek, Crow Wing Co.⁴ Grand Rapids.⁴
 University collections: Crystal Lake, Minneapolis; Pug Hole Creek, Crow Wing
 County; Rum River near Anoka.

Specimens collected in Pug Hole Creek in October, 1940 by
 Jesse Douglass had bright dorsal fins similar to those of breeding
 Iowa darters collected at the same time.

STRIPED FANTAIL DARTER, *Catnotus flabellaris lineolatus* Agassiz
Etheostoma flabellare lineolatum (Agassiz)
 Published records: Des Moines River.⁴ Mississippi River at mouth of St. Croix.⁵
 University collections: Purgatory Creek, Hennepin Co.; Credit River, Savage, and
 Orchard Creek, Austin.

Summary

There are well-substantiated records of thirteen species of darters in Minnesota. In addition one species, *Hadropterus phoxocephalus*, has been collected from the St. Croix River on the Wisconsin side but never in Minnesota. Another species *Etheostoma blennioides* has been tentatively identified in the field but never collected. A third species, *Hadropterus evermanni* is believed to be a hybrid rather than a true species. Two other species have been reported for Minnesota but these are now considered synonyms of *Poeciliothys exilis*.

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THE EFFECT OF ADRENALECTOMY UPON THE CYTOLOGY OF THE ANTERIOR LOBE OF THE ALBINO RAT HYPOPHYSIS

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ABSTRACT

Preliminary histological and cytological studies have been made on the testes and the hypophyses of three groups of albino rats, which were bilaterally adrenalectomized. They were sacrificed one month after their maintenance on sodium salts (0.5% NaCl and 0.5% Na citrate) in the drinking water.

The growth rate of the salt-treated adrenalectomized animals is increased over that of the control groups. The thymus and the spleen have increased considerably in weight, the former as much as 100% in some instances. The testes did not show any histological