

Conservation Review of the Longnose Dace *Rhinichthys cataractae* (Valenciennes) in Northwestern Illinois

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ABSTRACT

The longnose dace *Rhinichthys cataractae* (Valenciennes) is a small, elongated, slightly dorsoventrally compressed minnow that possesses the widest distribution of any North American cyprinid. In Illinois, it is considered rare and currently is known from streams in the Wisconsin Driftless Area and the shoreline of Lake Michigan and some of its tributaries. We examined the distribution, population status, and habitat requirements of *R. cataractae* in the Wisconsin Driftless Area in Illinois. The dace was collected at 12 of 33 sites sampled, and catch-per-unit-effort (number of individuals per hour collecting) varied from 0.8-52 per site. It was found most often in gravel/cobble riffles in small- to medium-sized streams. Although its range is limited in Illinois, the dace is locally abundant in several basins and we feel it does not warrant listing at this time.

Key Words:

Longnose dace, *Rhinichthys cataractae*, Wisconsin Driftless area, endangered species

INTRODUCTION

The longnose dace *Rhinichthys cataractae* (Valenciennes) is a slightly dorsoventrally compressed minnow (Cyprinidae) with a long fleshy snout. The species can reach 15 cm in length (Smith, 1979; Becker, 1983) and possesses the widest distribution of any North American minnow, generally occurring in areas above 40°N (Page and Burr, 1991). *Rhinichthys cataractae* is distributed from north of the Arctic Circle south to the Appalachian Mountains and west to the Rocky Mountains. Individuals occupy gravel/cobble riffles in small- to medium-sized cool-water streams and in wave swept shallows of the Great Lakes. In Illinois, the species is considered rare (Smith, 1979) and has been found only in a few of the streams of the Wisconsin Driftless Area (e.g., Menominee, Little Menominee, Sinsinawa, and Plum river basins) in Jo Daviess and Carroll counties, along the shores of Lake Michigan and in a few streams that feed into the Lake in Cook and Lake counties. Records also exist from Union County but the dace is considered extirpated from southern Illinois (Smith, 1979).

While *R. cataractae* has been a known component of the Illinois fish fauna since 1884 (Forbes, 1884), little is known about its range and habitat preferences in the Wisconsin Driftless Area of the state. The species was reported to be “very rare” in inland waters by both Forbes and Richardson (1920) and Smith (1979). To address these uncertainties, we conducted the first targeted status survey of *R. cataractae* in northwestern Illinois. The objectives of our study were to 1) gather distribution and abundance data for the Illinois Endangered Species Protection Board to assist in listing decisions under the Illinois Endangered Species Act; 2) provide valuable natural history data (e.g., habitat requirements) on one of Illinois’ rarest fishes; and 3) use geographic information systems to determine if geologic, hydrologic, or landscape variables can predict the distribution of *R. cataractae*. Such data can assist natural resource agencies in determining geographic regions that may hold the highest potential for long-term protection of the longnose dace.

METHODOLOGY

Fish sampling – Thirty-three sites were sampled in streams within the Wisconsin Driftless Area (Table 1; Fig. 1) from 18 June 2008 – 18 June 2009. Sites were selected based on either historical records for *R. cataractae* or habitat characteristics (e.g., gravel/cobble riffles in small- to medium-sized cool-water streams) that looked suitable for the dace. Historical records were defined as collection locations from unpublished literature (e.g., internal reports from Illinois Department of Natural Resources, Western Illinois University, or U.S. Fish and Wildlife Service) or locations for which vouchered specimens exist at a museum. Of the 12 fish collections contacted, only three (Field Museum of Natural History [FMNH], Chicago; Illinois Natural History Survey [INHS] Fish Collection, Champaign; Milwaukee Public Museum [MPM], Milwaukee) had records from our study area. At most sites, fishes were collected for 45 minutes using a barge electro-shocker set at 200 volts; however, a few sites were too small to accommodate the barge and therefore were sampled using a 3.05 m minnow seine for 45 minutes. Fishes were identified, counted, and released upon completion of sampling at a site, and at least one dace was vouchered from each site and deposited in the INHS Fish Collection. Four historical sites (Table 2) were not visited because access could not be gained or *R. cataractae* had been collected at the site within the past five years.

Geographic Information Systems – The potential distribution of *R. cataractae* was predicted using georeferenced locality data, GIS environmental layers, and the Maxent species distribution algorithm (Phillips et al., 2006). Maxent is a general-purpose machine learning approach to modeling of species distributions using presence-only data (Phillips et al., 2006). Maxent predicts potential distribution of a species by estimating probability distribution of maximum entropy across a specified region, subject to a set of constraints that represent incomplete information about the target distribution (Phillips et al., 2006). Locality data across the range of *R. cataractae* in Illinois was integrated with landcover and physical GIS data to predict potential areas of occurrence in the state. GIS data included measures of elevation, slope, flow accumulation, drift thickness, and landcover characteristics (e.g., riparian forest density). The predicted distribution of *R. cataractae* was then compared to sites not containing the species to further explore the importance of abiotic and biotic factors regulating the distribution and presence of *R. cataractae*.

RESULTS

Distribution and population status – *Rhinichthys cataractae* was collected at 12 of the 33 sites sampled, and catch-per-unit-effort (standardized by number of individuals collected per hour of collecting effort) varied from 0.8-52 per site (Table 1). The species was collected throughout the Menominee, Little Menominee, Sinsinawa, and Plum river basins and in two sites in the Galena River basin (Fig. 1). The species was most often collected in areas with swift flows over gravel/cobble riffles with depths ranging from 0.1-0.5 m. Even though there are unconfirmed records available (e.g., internal reports from Illinois Department of Natural Resources, Western Illinois University, or U.S. Fish and Wildlife Service), we failed to collect *R. cataractae* in the Apple or Rock river basins and voucher specimens do not exist for this species in these basins. We believe the dace does not occur in the Apple or Rock river basins and all records have been based on misidentified blacknose dace *Rhinichthys atratulus*. However, we cannot rule out that *R. cataractae* might have possibly become extirpated in these basins.

Geographic Information Systems – Fish localities were evenly divided for development and testing during Maxent species distribution model generation. The Maxent model produced a significant prediction of the distribution of *R. cataractae* across the study area ($AUC = 0.742$, $P = 0.041$). Landcover classification (66.3%) and flow accumulation (33.6%) contributed 99.9% of the explanatory power of the model prediction, suggesting these two variables are of primary importance in predicting presence of the species. Finally, the distribution model generated for *R. cataractae* was tested using sites where no dace were collected. In this case, the Maxent model was not able to predict areas without *R. cataractae* ($AUC = 0.635$, $P = 0.092$). This result suggests sites where the fish was absent in our collections do not contain suitable habitat for *R. cataractae* based on the GIS data sets used to generate the models.

DISCUSSION

Rhinichthys cataractae appears stable in Illinois. Our field survey found the species at a total of 12 sites (Table 1). Of those sites, four were ones at which the species had been previously collected and eight were new. Of the eight new sites, two were in the Galena River drainage. These two records represent the first vouchered records for the species in this drainage in Illinois. While population sizes in the Galena River drainage sites were small (<1.5 individuals per hour), habitat at those sites was identical to that found at other locations with larger populations. Further work will be needed in the Galena River drainage to determine if significant population changes are occurring.

Habitat at sites containing *R. cataractae* was relatively uniform. The species was always found in areas with moderate to strong flow and substrates of clean, cobble sized (0.1-0.3 m diameter) rocks. There was variation in stream width (8-20 m) and water depth (0.1-0.5 m) among sites.

The results of the Maxent species distribution models suggest presence of *R. cataractae* can be predicted by landscape-level variables, particularly flow accumulation (essentially a measure of how far downstream the species occurs) and riparian landcover type. The dace primarily was found at sites with upland forest (41.7% of sites) and rural grassland

(25.0% of sites) riparian landcover classifications and in more upstream locations within drainage basins. These habitat characteristics are consistent with those reported for the species from across its range (Smith, 1979; Becker, 1983; Aadland, 1993; Goldstein, 2009).

With the exception of the two Galena River drainage populations discussed above and one Carroll Creek site located in Mt. Carroll, longnose dace were relatively common in suitable habitat at most sampling sites (Table 1). Number of individuals collected per hour of sampling effort ranged from 0.8-52.0. During our survey, we not only documented the species in a new basin, but also showed the dace continues to occur at multiple sites in the Menominee, Little Menominee, Sinsinawa, and Plum river drainages. Also, *R. cataractae* occurs at several sites in the Wisconsin side of these basins (data from MPM). When combining these factors, we feel the longnose dace does not warrant listing at the state level as threatened or endangered at this time. We did not assess the status of Lake Michigan populations in Illinois. However, the fish has been recently (post-1980) collected throughout the area including the Lake and some of its tributaries in Cook and Lake counties, Illinois, Lake County, Indiana, and Kenosha County, Wisconsin (Retzer and Batten, 2005; data from FMNH, INHS, and MPM).

The longnose dace is considered a cool-water, sensitive species (Lyons et al., 2010). The fish's preference for clean cobble substrates in northwestern Illinois streams highlights one potential threat for the species. Lyons et al. (2010) predicted climate warming could affect the distribution of *R. cataractae*. Also, non-point source pollution by siltation can overlay cobble and prevent fish from taking shelter and/or feeding in interstitial spaces. While agricultural and livestock activities have been prevalent in northwestern Illinois for 100-150 years and some degradation of streams in that region has occurred, continued efforts must be made to limit suspended solid input into streams to protect populations of longnose dace and other aquatic taxa.

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LITERATURE CITED

- Aadland, L.P. 1993. Stream habitat types: their fish assemblages and relationship to flow. *North American Journal of Fisheries Management* 13:790-806.
- Becker, G.C. 1983. *Fishes of Wisconsin*. University of Wisconsin Press, Madison. 1052 p.
- Forbes, S. A. 1884. A catalogue of the native fishes of Illinois. Report of the Illinois State Fish Commissioner for 1884:60-89.
- Forbes, S. A. and R. E. Richardson. 1920. *The fishes of Illinois*. 2nd Edition. Illinois Natural History Survey. 357 p.

- Goldstein, R.M. 2009. Interpreting stream physical characteristics Index of Biotic Integrity classifications: general similarities and specific differences. *North American Journal of Fisheries Management* 29:151-162.
- Lyons, J., J.S. Stewart, and M. Mitro. 2010. Predicted effects of climate warming on the distribution of 50 stream fishes in Wisconsin, U.S.A., *Journal of Fish Biology* 77: 1867-1898.
- Phillips, S.J., R.P. Anderson, and R.E. Schapire. 2006. Maximum entropy modeling of species geographic distributions. *Ecological Modelling* 190:231-259.
- Retzer, M.E. and B. Batten. 2005. Fishes of the Chicago region: A review of the Dennison and Illinois Natural History Survey Collections. *Transactions of the Illinois State Academy of Science* 98:63-73.
- Smith, P.W. 1979. *The Fishes of Illinois*. University of Illinois Press, Urbana. 314 p.

Table 1. Sites sampled during the 2008-2009 *Rhinichthys* survey. Dace column indicates which *Rhinichthys* species were present at a given location and catch-per-unit-effort is standardized by number of *R. cataractae* per hour collecting. Asterisk (*) indicates that two individuals were vouchered but CPUE was not determined.

Stream	State: County	Common location	Lat/Long	Dace	CPUE
Menominee River	IL: Jo Daviess	3.7 mi E of Dubuque, IA	N42.50456, W90.59150	<i>R. cataractae</i>	4.0
Little Menominee River	IL: Jo Daviess	6.8 mi E of Dubuque, IA	N42.48716, W90.53232	<i>R. cataractae</i>	8.0
Little Menominee River	IL: Jo Daviess	6.8 mi WNW of Galena, IL	N42.46167, W90.54689	<i>R. cataractae</i>	14.7
Sinsinawa River	IL: Jo Daviess	5.2 mi NNW of Galena, IL	N42.47952, W90.48580	<i>R. cataractae</i>	*
Sinsinawa River	IL: Jo Daviess	4.3 mi NW of Galena, IL	N42.45670, W90.49397	<i>R. cataractae</i>	4.0
Sinsinawa River	IL: Jo Daviess	3.2 mi NNW of Galena, IL	N42.43277, W90.48820		
Galena River	IL: Jo Daviess	4.3 mi NNE of Galena, IL	N42.47666, W90.40684	<i>R. cataractae</i>	0.8
East Fork Galena River	IL: Jo Daviess	3.6 mi NE of Galena, IL	N42.45323, W90.37774	<i>R. cataractae</i>	1.3
Smallpox Creek	IL: Jo Daviess	3.8 mi SE of Galena, IL	N42.37408, W90.38259	<i>R. atratulus</i>	
Trib Smallpox Creek	IL: Jo Daviess	4.7 mi SSE of Galena, IL	N42.35261, W90.39854		
Trib Mississippi River	IL: Jo Daviess	7.7 mi S of Galena, IL	N42.30674, W90.40259		
Trib Mississippi River	IL: Jo Daviess	6.1 mi SSE of Galena, IL	N42.33134, W90.39968	<i>R. atratulus</i>	
Beaty Hollow Creek	IL: Jo Daviess	5.1 mi NW of Hanover, IL	N42.29883, W90.36081	<i>R. atratulus</i>	
Beaty Hollow Creek	IL: Jo Daviess	5.4 mi WNW of Hanover, IL	N42.27174, W90.38270		
Trib Mississippi River	IL: Jo Daviess	2.1 mi SW of Hanover, IL	N42.23384, W90.30610		
Apple River	IL: Jo Daviess	7.3 mi NNW of Stockton, IL	N42.44879, W90.05540		
Apple River	IL: Jo Daviess	8.1 mi NE of Elizabeth, IL	N42.40484, W90.11684		
Apple River	IL: Jo Daviess	3.0 mi NNE of Elizabeth, IL	N42.35366, W90.18855		
Irish Hollow Creek	IL: Jo Daviess	4.2 mi NNW of Hanover, IL	N42.31338, W90.30627	<i>R. atratulus</i>	
Welsh Hollow	IL: Jo Daviess	4.9 mi NE of Elizabeth, IL	N42.36036, W90.14499	<i>R. atratulus</i>	
Furnace Creek	IL: Jo Daviess	2.3 mi NW of Elizabeth, IL	N42.33646, W90.25866	<i>R. atratulus</i>	
Furnace Creek	IL: Jo Daviess	2.0 mi WNW of Elizabeth, IL	N42.32993, W90.25776		
Rush Creek	IL: Jo Daviess	6.3 mi SE of Elizabeth, IL	N42.31229, W90.09727		
Little Rush Creek	IL: Jo Daviess	3.5 mi SE of Elizabeth, IL	N42.28083, W90.17325		
Plum River	IL: Jo Daviess	7.0 mi SSW of Stockton, IL	N42.25284, W90.03830		
Plum River	IL: Carroll	5.3 mi N of Mount Carroll, IL	N42.17094, W89.97069	<i>R. cataractae</i>	6.6
Crane Grove Creek	IL: Stephenson	3.75 mi SSE Freeport	N42.23691, W89.60449	<i>R. atratulus</i>	
Carroll Creek	IL: Carroll	1.6 mi E of Mount Carroll, IL	N42.09490, W89.94827	<i>R. atratulus</i> <i>R. cataractae</i>	40.0
Carroll Creek	IL: Carroll	Mt. Carroll, IL city park	N42.10077, W89.97618	<i>R. cataractae</i>	2.0
Carroll Creek	IL: Carroll	4.1 mi WNW Mount Carroll, IL	N42.10870, W90.05673	<i>R. cataractae</i>	52.0
Camp Creek	IL: Carroll	3.9 mi NNE of Savanna, IL	N42.14525, W90.12274	<i>R. cataractae</i>	20.3
Deer Creek	IL: Carroll	5.3 mi WSW of Mount Carroll, IL	N42.05363, W90.06570	<i>R. atratulus</i>	
Johnson Creek	IL: Carroll	5.2 mi SSW of Mount Carroll, IL	N42.02494, W90.01644	<i>R. atratulus</i>	

Table 2. Historical sites where *Rhinichthys cataractae* has been collected but were not sampled because sites were either inaccessible (I) or a recent (R) record exists for the fish since 2005. Specimens housed at the Illinois Natural History Survey Fish Collection, Champaign.

Stream	State: County	Common location	Lat/Long	Last observed	Reason
Little Menominee River	IL: Jo Daviess	6.1 mi E of Dubuque, IA	N42.48306, W90.54625	22 June 2005	R
Little Menominee River	IL: Jo Daviess	6.3 mi WNW of Galena, IL	N42.45096, W90.54439	28 April 1992	I
Plum River	IL: Carroll	6.0 mi NW of Mount Carroll, IL	N42.14581, W90.07369	17 July 1963	I
Carroll Creek	IL: Carroll	2.7 mi WNW of Mount Carroll, IL	N42.10474, W90.02817	23 June 1995	I

Figure 1. Map of the study area. Stars indicate sites where *R. cataractae* has been vouchered (data taken from the Illinois Natural History Survey Fish Collection, Champaign) and circles designate those sites where we failed to collect the dace during our survey.

