

An Illinois
Species Status Assessment
for
Northern Riffleshell and Clubshell

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Northern Riffleshell (top) and Clubshell (bottom). Photos from Tiemann (2014).

NOTE

Both Northern Riffleshell and Clubshell are included in this Illinois Species Status Assessment as they have similar status in Illinois and are studied and surveyed simultaneously; however, abundance and distribution information are summarized separately. The United States Fish and Wildlife Service also selected to complete one combined federal species status assessment addressing both species.

SECTION 1. SPECIES DESCRIPTION

Physical Characteristics and Ecology

The Northern Riffleshell (*Epioblasma rangiana*) is up to 6 cm (2.5 inches) in length with an elongate and laterally compressed shell. Live coloration of periostracum is yellowish brown with numerous fine green rays. It has medium-sized, well developed hinge teeth and nacre is white. The species exhibits sexual dimorphism; females have a broadly rounded posterior margin that males lack. Males have a wide, shallow sulcus. The Northern Riffleshell is a long-term brooder, meaning spawning occurs in summer and glochidia are held by the female until the next spring. It most often can be found in firm sand or gravel of riffles or runs in medium to large rivers.

The Clubshell (*Pleurobema calva*) is up to 80 cm (3 inches) in length with a triangular and slightly compressed shell. Live coloration of periostracum is yellowish brown with green rays near the umbo. It has well-developed teeth and pearly white nacre. The Clubshell is a short-term brooder, meaning spawning and release of glochidia occur in the same year, during late spring to early summer. It is mostly found in small to medium rivers in areas of firm sand and gravel, often in runs at the downstream end of riffles.

SECTION 2. QUALITATIVE CONSERVATION STATUS ASSESSMENTS

Northern Riffleshell and Clubshell conservation status has been synthesized at multiple spatial scales using qualitative assessment frameworks (Table 1).

Table 1. Global, regional, subregional, and state conservation status of Northern Riffleshell and Clubshell.

Assessment	Northern Riffleshell	Clubshell
Global Rank (G-rank) ¹	G1 (critically imperiled)	G1 (critically imperiled)
Midwest Species of Greatest Conservation Need ²	SGCN	SGCN
Subregional Rank (S-rank) ³	S1? (critically imperiled)	S1S2 (critically imperiled/imperiled)
Federal Conservation Status	Endangered	Endangered
Illinois Conservation Status ⁴	Endangered	Endangered

1. NatureServe (2022)

2. Terwillger Consulting (2021)

3. Feng et al. (2021). Assessment conducted using data through 2018.

4. Illinois Endangered Species Protection Board 2020

The global conservation rank for both Northern Riffleshell and Clubshell is G1, critically imperiled (NatureServe 2022), and both species are included as Midwestern United States Species in Greatest Conservation Need (Terwillger Consulting 2021). The subregional

conservation rank for Northern Riffleshell is S1? (critically imperiled) and for Clubshell is S1S2 (critically imperiled/imperiled; Feng et al. 2021). Northern Riffleshell is ranked S1 in eight states and provinces and S2 in one state (Figure 1). Clubshell is ranked S1 in six states, S2 in one state, and presumed or confirmed extirpated in three states (Figure 2). Both species were listed as federally endangered in 1993 (US Fish and Wildlife Service 1993). Clubshell was listed as endangered in Illinois in 1989 while Northern Riffleshell was listed as endangered in 2010 following its reintroduction to Illinois.

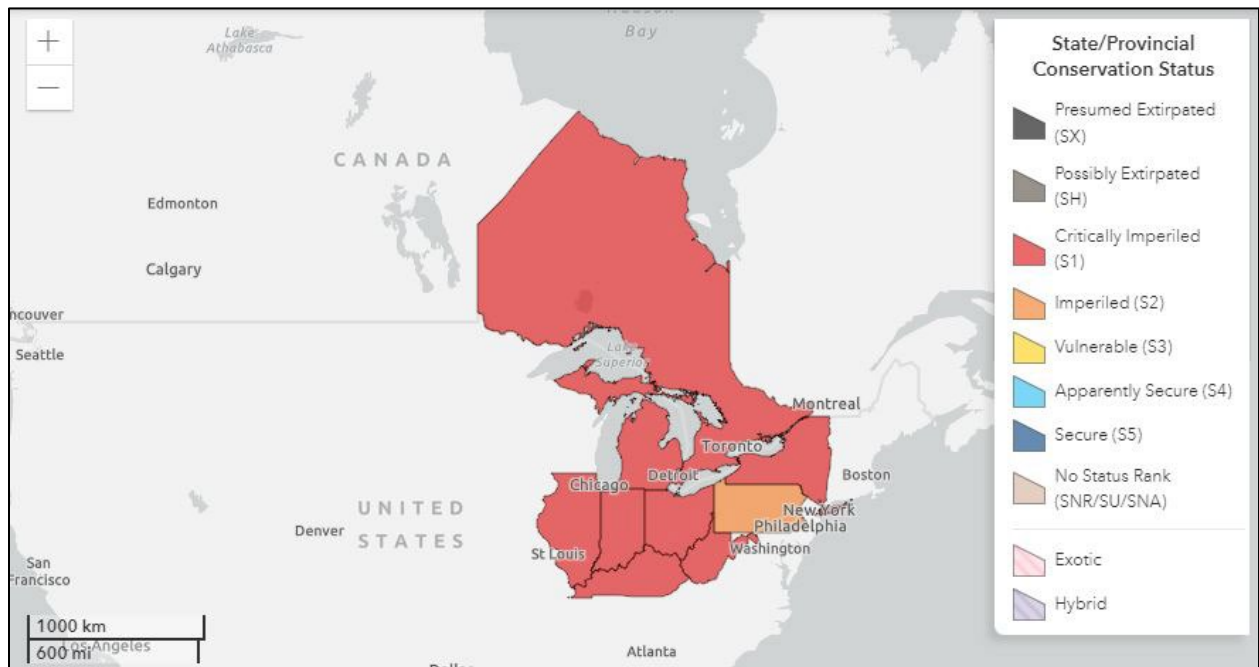


Figure 1. Subnational ranks (i.e., S-ranks) for Northern Riffleshell (NatureServe 2022).

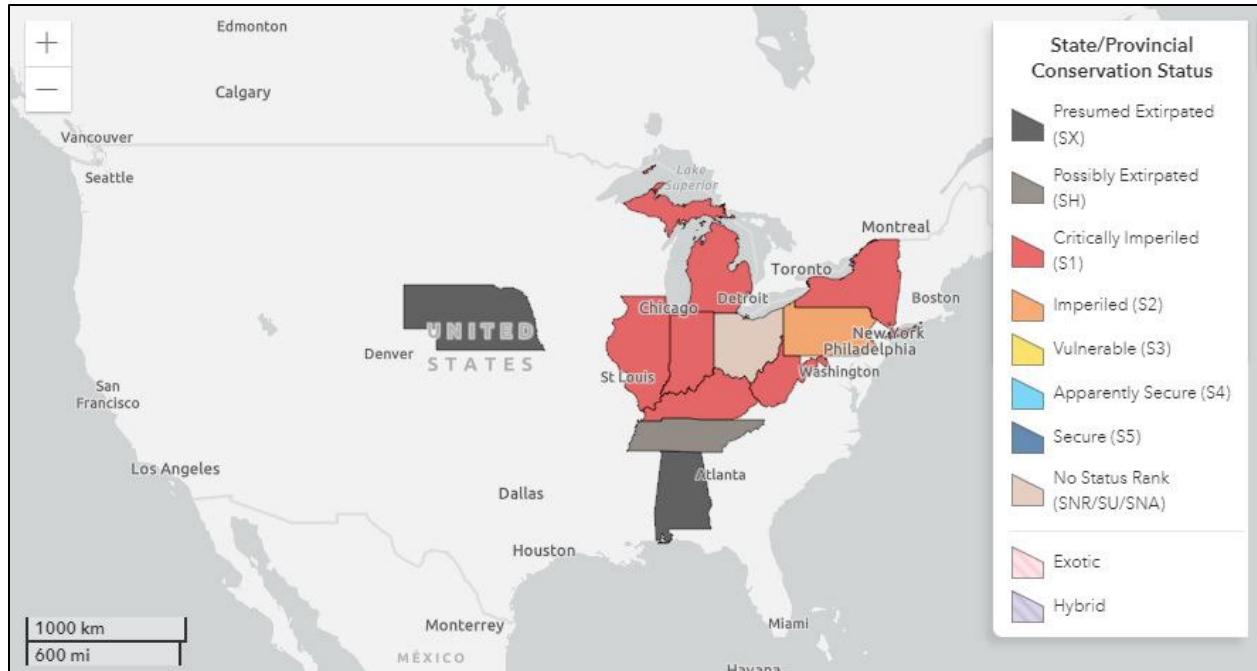


Figure 2. Subnational ranks (i.e., S-ranks) for Clubshell (NatureServe 2022).

SECTION 3. DISTRIBUTION

North American Range

Northern Riffleshell’s historic range included much of the Ohio River basin and tributaries of Lake Erie and Huron (Figure 3). Northern Riffleshell now occurs in the Great Lakes and Ohio River basins of Ontario, New York, Pennsylvania, West Virginia, Kentucky, Michigan, Ohio, Indiana, and Illinois (Figure 1, Figure 4). The US Fish and Wildlife Service (2019b) recognizes eight extant populations, five of which are a result of stocking or reintroduction efforts. One additional extant population occurs in the Lake Erie basin of Ontario.



Figure 3. Historic range of Northern Riffleshell (Tiemann 2014).

Clubshell's historic range includes much of the Ohio River basin and the northern Tennessee River basin (Figure 5). Clubshell now occurs in the Great Lakes and Ohio River basins of New York, Pennsylvania, West Virginia, Michigan, Indiana, and Illinois (Figure 2, Figure 6). The US Fish and Wildlife Service (2022a) also indicates populations are present in Tennessee and Alabama (Figure 5), but NatureServe (2022) considers those populations extirpated (Figure 2). There are eleven extant populations of Clubshell in North America, three of which are the result of reintroductions (US Fish and Wildlife Service 2019a).



Figure 4. County or basin records for Northern Riffleshell (US Fish and Wildlife Service 2022b; data updated 2020).



Figure 5. Historic range of Clubshell (Tiemann 2014).



Figure 6. County or basin records for Clubshell (US Fish and Wildlife Service 2022a; data updated 2021).

Illinois Distribution

Northern Riffleshell were present in the Wabash River and the Vermilion River (of the Wabash) basin (Douglass and Stodola 2014; Figure 7), but prior to reintroduction efforts the species had not been recorded for more than 70 years in Illinois. Between 2010 and 2014 Northern Riffleshell were translocated from the Allegheny River in Pennsylvania to eight locales in the Salt Fork and Middle Fork of the Vermilion River (of the Wabash River) basins (Stodola et al. 2017; Figure 7). Individuals have been recorded at eight locales in the Vermilion River basin between 2010 and 2019. All eight locales are those that received translocated individuals. Twenty locales, which did not include the eight translocation locales, in both the Salt Fork and Middle Fork of the Vermilion River basin were surveyed in 2020 and no Northern Riffleshell were recorded (Ruellan 2022).

Clubshell have been recorded in the Ohio River, Wabash River, Embarrass River, and Vermilion River (of the Wabash) basins (Douglass and Stodola 2014; Figure 8). By 1950 Clubshell could only be found in the North Fork Vermilion River. No live Clubshell have been observed in the North Fork Vermilion River since 1998. Between 2010 and 2014 Clubshell were translocated from the Allegheny River in Pennsylvania to eight locales in the Salt Fork and Middle Fork of the Vermilion River (of the Wabash River) basin (Stodola et al. 2017; Figure 8). Individuals have been recorded at five locales in the Vermilion River basin between 2012 and 2019. Twenty

locales in both the Salt Fork and Middle Fork of the Vermilion River basin were surveyed in 2020 and no Clubshell were recorded (Ruellan 2022).

SECTION 4. ABUNDANCE

It is unlikely any Northern Riffleshell were present in Illinois between approximately 1950 and 2010 and few, if any, Clubshell were present by the early 2000s. Then, beginning in 2010, 3699 Northern Riffleshell and 4166 Clubshell were translocated to eight locales in the Salt Fork and Middle Fork Vermilion River. Monitoring at translocation locales indicates a large decline in abundance at those locales (Figure 9; see also Stodola, et al. 2017). Estimated annual survival for Clubshell is 0.79 and for Northern Riffleshell is 0.30. Northern Riffleshell and Clubshell monitoring detections after approximately six years are less than 5% of abundance at the time of translocations (Figure 9). Although the trend of decreasing abundance is likely accurate, it is unclear if sampling effort has remained constant between monitoring events and therefore abundance at these locales is difficult to estimate. Limited sampling has occurred outside of translocation locales, so it also is difficult to estimate statewide total abundance for both species.

SECTION 5. POPULATION VIABILITY

Population Delineation

No estimates of dispersal are available for Northern Riffleshell and Clubshell. No transplanted individuals have been collected more than 0.5 km downstream from their transplant locales. Translocation locales are spread over approximately 41km in the Middle Fork Vermilion River (minimum 9km between locales) and 30km in the Salt Fork (minimum 12km between locales). Douglass et al. (2019) observed passive dispersal of mussels of only hundreds of meters annually; therefore, it seems unlikely Northern Riffleshell or Clubshell could disperse between translocation locales, suggesting each occurrence locale may represent an individual population.

Northern riffleshell (*Epioblasma rangiana*)

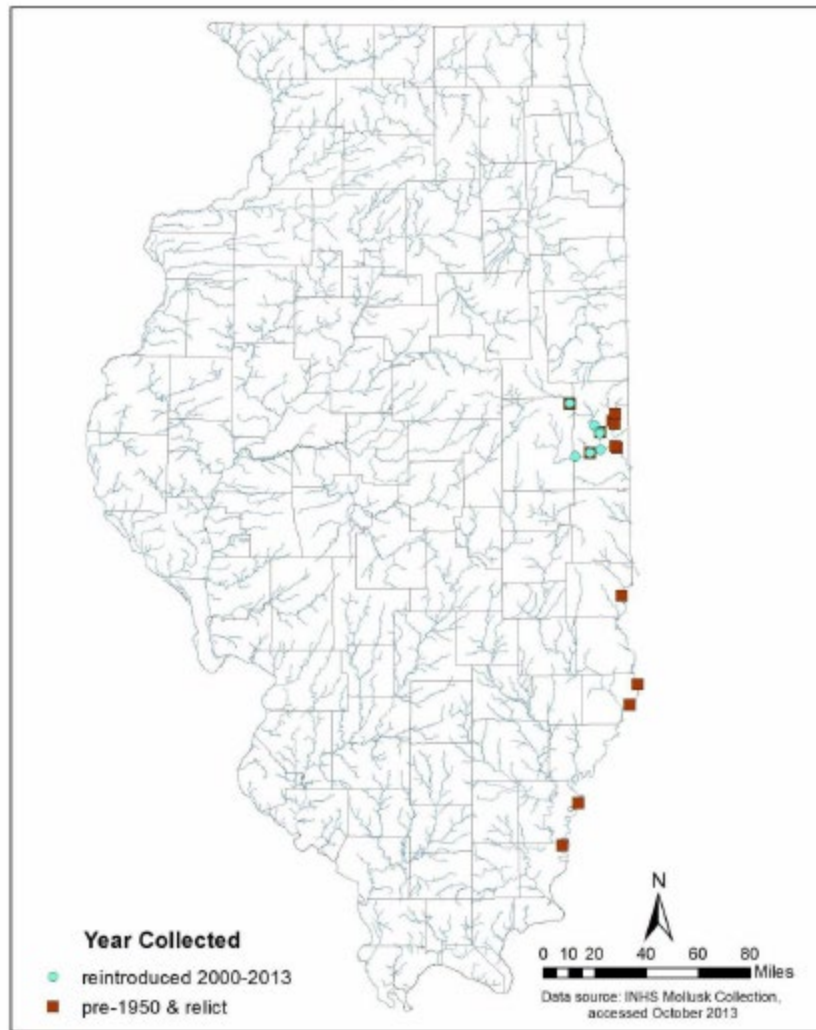


Figure 7. Illinois Northern Riffleshell occurrence records (Douglass and Stodola 2014).

Clubshell (*Pleurobema clava*)

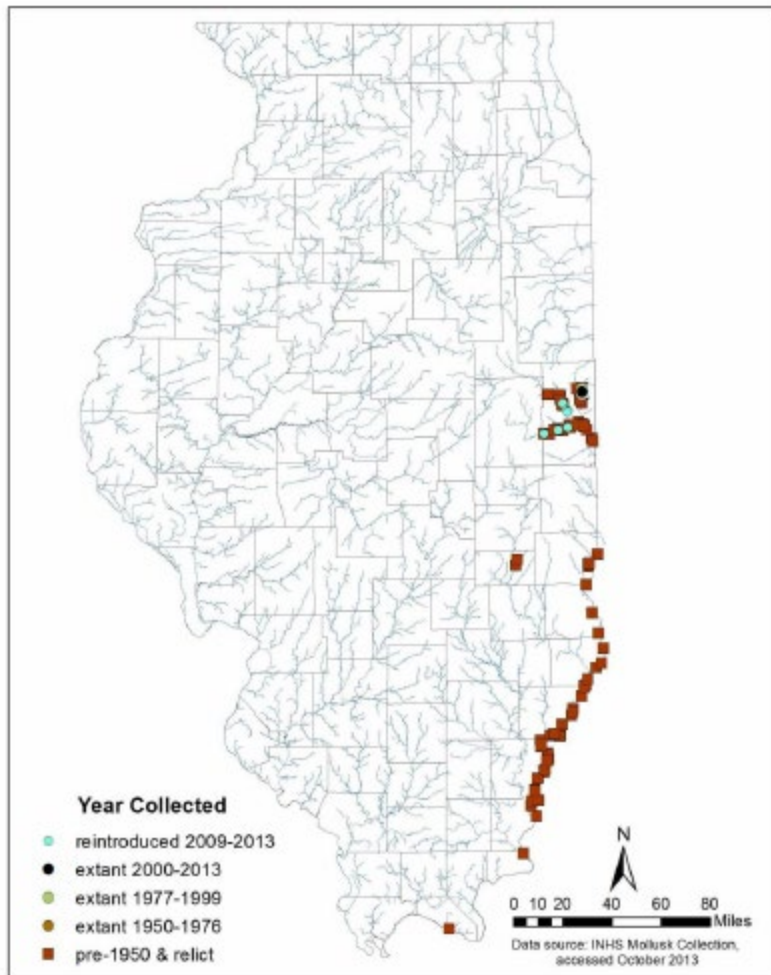


Figure 8. Illinois Clubshell occurrence records (Douglass and Stodola 2014).

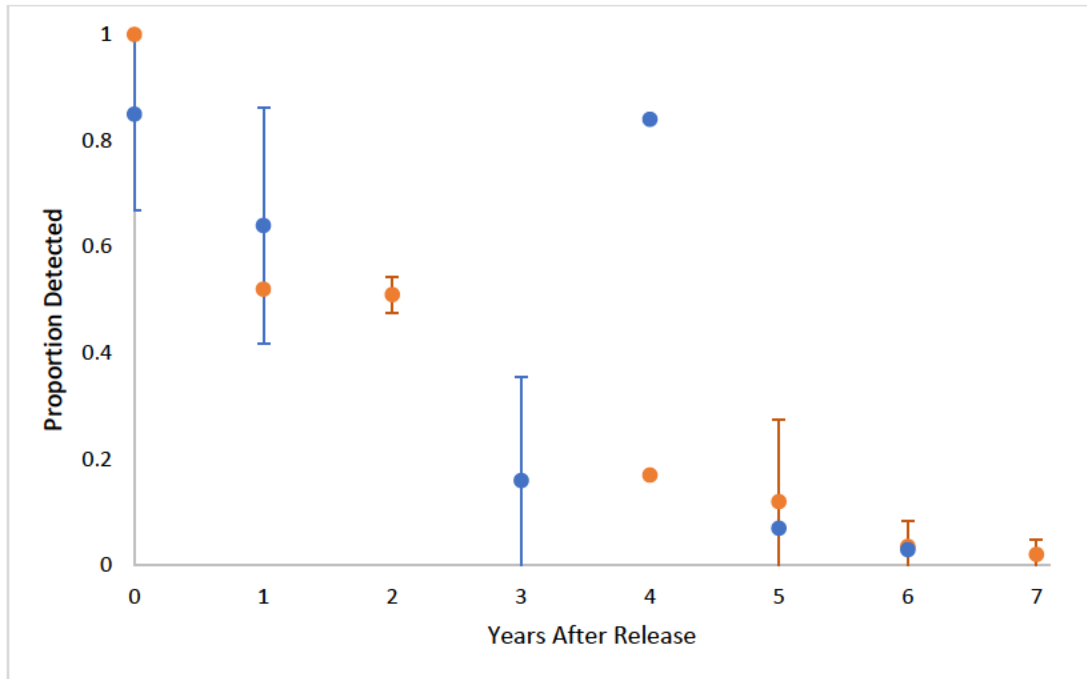


Figure 9. Mean (and standard deviation) proportion of translocated individuals detected in subsequent monitoring surveys at translocation locales. Orange symbols are values for Northern Riffleshell and blue symbols are values for Clubshell.

Element Occurrence Ranks

Element Occurrences (EOs), or occurrence records grouped by proximity, can be used as surrogates for populations. NatureServe provides guidance for ranking the viability, or likelihood of continued persistence over the next 20-30 years, of EOs (Hammerson et al. 2020). The Natural Heritage database identifies six EOs for Northern Riffleshell (Table 2, Figure 10). Abundance at each Northern Riffleshell EO is declining and the species' annual survival rate is estimated at 0.30 (Stodola et al. 2017). All EOs for the species are ranked D (poor viability) due to decreasing abundance, low survival rates, and lack of documented reproduction. The Natural Heritage Database identified seven EOs for Clubshell (Table 2, Figure 11). Abundance at each Clubshell EO is declining and the species' estimated annual survival rate is 0.79 (Stodola et al. 2017). There is one EO ranked H (historic) and one ranked X (extirpated), both in the North Fork Vermilion River, and five EOs ranked D due to decreasing abundance, low survival rates, and lack of documented reproduction.

Table 2. Element occurrence (EO) ranks for Northern Riffleshell and Clubshell.

<u>Species</u>	<u>EO Name</u>	<u>EO ID</u>	<u>EO Rank</u>	<u>Most Recent</u>	
				<u>Record</u>	<u>Rank Justification</u>
Northern Riffleshell	[REDACTED]	8570	D	2012	Abundance decreasing, low annual survival rate, no documented reproduction
Northern Riffleshell	[REDACTED]	9436	D	2017	Abundance decreasing, low annual survival rate, no documented reproduction
Northern Riffleshell	[REDACTED]	9440	D	2017	Abundance decreasing, low annual survival rate, no documented reproduction
Northern Riffleshell	S [REDACTED]	9433	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Northern Riffleshell	[REDACTED]	8569	D	2017	Abundance decreasing, low annual survival rate, no documented reproduction
Northern Riffleshell	S [REDACTED]	9437	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	[REDACTED]	9434	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	S [REDACTED]	9432	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	[REDACTED]	9438	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	[REDACTED]	9435	D	2017	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	[REDACTED]	9441	D	2019	Abundance decreasing, low annual survival rate, no documented reproduction
Clubshell	[REDACTED]	5188	X	1998	Two searches since 1998 have not recorded the species.
Clubshell	[REDACTED]	11488	H	1958	Unknown if any searches since 1958 have occurred.

Demographic Evaluation

All Northern Riffleshell and Clubshell translocated to Illinois had external growth ring counts greater than three. Multiple year classes were present in translocated individuals but the demographic composition at each locale was not recorded. There are no records of juveniles in the Natural Heritage database for either species.

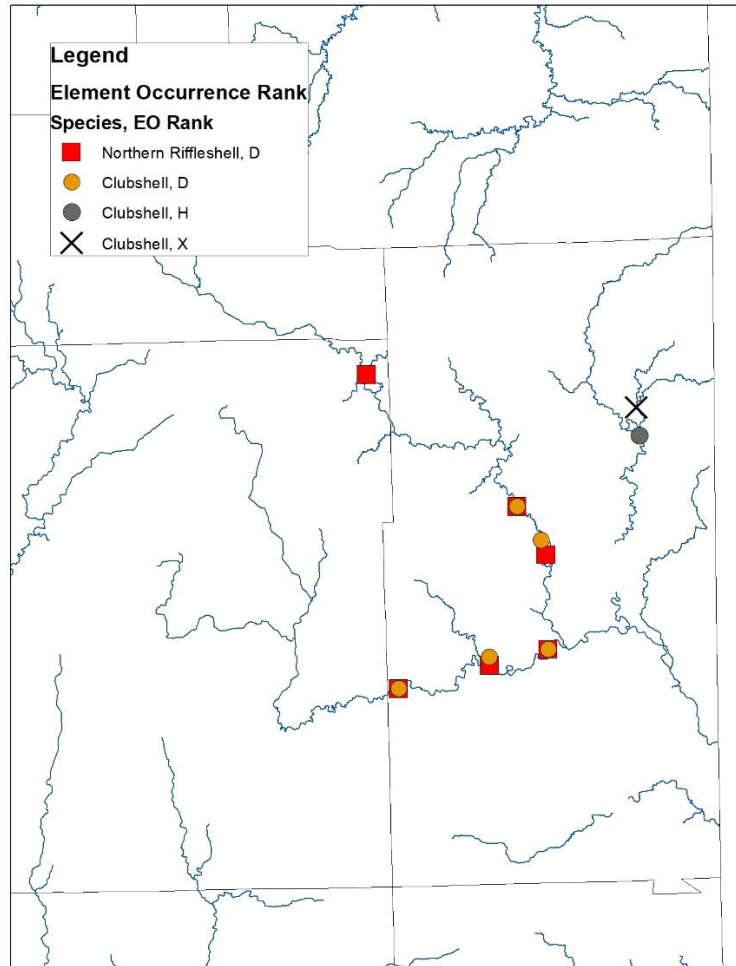


Figure 10. Northern Riffleshell and Clubshell Element Occurrence (EO) ranks.

SECTION 6. LITERATURE CITED

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