Conservation Assessment
for
The Salamander Mussel (Simpsonaias ambigua) Say, 1825

USDA Forest Service, Eastern Region
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EXECUTIVE SUMMARY

The Salamander Mussel, *Simpsonaias ambigua* (Say, 1825) is a small, elliptical, thin-shelled mussel that is found in medium to large sized rivers often under large flat stones. It should be easily distinguishable from other mussels by the above characters and its poorly developed hinge teeth. The historical range of *S. ambigua* includes the Ohio River Basin and the Mississippi River Basin from Arkansas north to Michigan. In Canada, specimens are reported from the Sydenham River (Lake St. Clair Dr.) in Ontario.

Simpsonaias ambigua is not listed by the U. S. Fish and Wildlife Service as threatened or endangered, whereas several states list this species as endangered, threatened, or of special concern. *Simpsonaias ambigua* is thought to be bradytictic: spawning occurs in the summer, and the larvae are released the following spring. There appears to be a single host for this species, the mudpuppy (*Necturus maculosus*). Factors considered detrimental to the persistence of this species are pollution and siltation, although specific information on the effects of anthropogenic insults on *S. ambigua* is lacking. Additional information regarding the distribution, life history and genetic variation in *S. ambigua* should be obtained prior to initiation of any captive breeding and re-introduction or translocation projects.

Simpsonaias ambigua (Say, 1825) Salamander Mussel

SYNONOMY

Alasmodonta ambigua Say, 1825; Say, 1825:131
Unio hildrethianus Lea, 1834; Lea 1834:36, pl. 3, fig. 8
Alasmodonta dubia Ferussac, 1835, Fersussac, 1835:26
Margarita (*Unio*) *hildrethianus* (Lea, 1834); Lea, 1836:28
Margaron (*Margaritana*) *hildrethianus* (Lea, 1834); Lea, 1852c:43
Baphia hildrethiana (Lea, 1834); H. and A. Adams, 1857:499
Margaritana ambigua (Say, 1825); Küster, 1862:300, pl. 99, fig. 7
Margaritana hildrethiana (Lea, 1834); B. H. Wright, 1888: no pagination
Hemilastena ambigua (Say, 1825); Simpson, 1914:325
Simpsonaias ambigua (Say, 1825); Frierson, 1914:7
Simpsoniconcha ambigua (Say, 1825); 1914:40
Simpsoniconcha ambigua (Say, 1825); Ortmann and Walker, 1922:38

Type Locality: Northwestern Territory

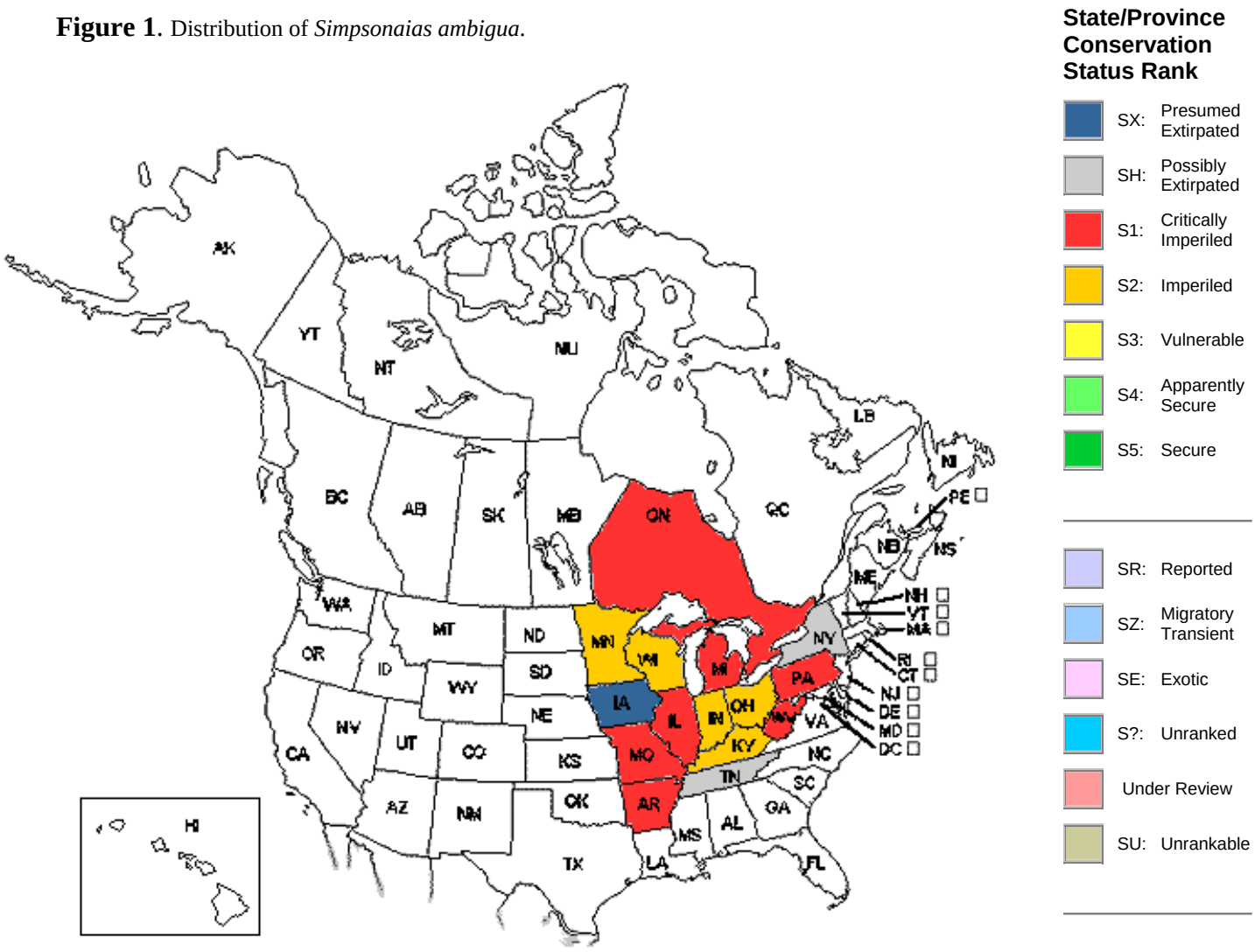
DISTRIBUTION

The Ohio River Basin and the Mississippi River Basin from Arkansas north to Michigan. Arkansas (S1?), Illinois (S1), Indiana (S2), Iowa (SX), Kentucky (S2S3), Michigan (S1), Minnesota (S2), Missouri (S1?), New York (SH), Ohio (S2), Pennsylvania (S1?), Tennessee (SH), West Virginia (S1), Wisconsin (S2S3). In Canada, Clarke (1981) reported specimens from the Sydenham River (Lake St. Clair Dr.) in Ontario.

Global Range Comments:

Clarke (1985) gave the geographical records for this species. It is known from the Lake St. Clair, Lake Huron, and Lake Erie drainages; and from the Ohio River System, the Cumberland River System (Red River, Kentucky), and the upper Mississippi River System (Illinois, Iowa, Wisconsin, Missouri and Arkansas). Its distribution in part is apparently related to the distribution of its glochidial host, the mudpuppy.

Figure 1. Distribution of *Simpsonaias ambigua*.



DESCRIPTION

A generally small species, the shell is elongate and inflated. The beak is anterior to the middle of the shell and is barely raised above the hinge line. The posterior ridge is broadly rounded as is the posterior margin of the shell. Both dorsal and ventral margins are nearly straight, the ventral margin is often slightly curved. The periostracum ranges from yellowish brown to brown and growth lines are apparent. The nacre is bluish white. The glochidia are described as ovate subtriangular, and slightly asymmetric (Hoggarth, 1999). The average length and height are 255 and 261µm respectively. The ventral edge of each valve is covered by micropoints and is broken by a single large median styliform hook. The hook is triangular and covered centrally by micropoints. The exterior surfaces of the valves are uniformly pitted.

LIFE HISTORY AND ECOLOGY

The salamander mussel is the only North American known to parasitize a non-fish host. Glochidia of this species are only known to utilize *Necturus maculosus* as a host (Howard, 1951). In a laboratory infection study Barnhart et al. (1998) found that glochidia transformed on *N. maculosus* but not on any of the 12 fish species tested. *Simpsonaias ambigua* is typically found under flat rocks, a common habitat for *N. maculosus*. Call (1900) also reported this species from mud and gravel bars. This species is rarely encountered, but when found is often quite numerous. The breeding season appears to be consistent with the bradytictic (long-term) habit (Baker, 1928). Howard (1915) reported finding infested salamanders in mid October, and Barnhart et al. (1998) recovered a gravid female salamander mussel in early April.

STATUS

Williams et al. (1993) list *S. ambigua* as a species of special concern. Illinois and Michigan list this species as endangered. Kentucky, Minnesota, and Wisconsin consider *S. ambigua* a threatened species. Indiana considers *S. ambigua* to be a species of special concern, and is imperiled within the state. West Virginia give this species a rank of S1 (critically imperiled) and G5 (widespread), whereas Missouri and Pennsylvania assigned it a rank of S1? (Inexact rank) and G3 (either very rare and local throughout its range or locally abundant). Because of the extreme host specificity exhibited by *S. ambigua*, its survival is closely tied to the persistence of *Necturus maculosus* which appears to be widespread and relatively common at present. *Simpsonaias ambigua* is not a commercially valuable species and so is not threatened by the shell industry. It appears that its close association with *N. maculosus* and its concentration under large flat rocks may have influenced the perception of the abundance of this species. A coordinated survey targeting this species would provide a better estimate of its true status. This species is not well represented in museum collections.

LIMITING FACTORS

Approximately 67% of freshwater mussel species are vulnerable to extinction or are already extinct (National Native Mussel Conservation Committee, 1998). Factors implicated in the decline of freshwater bivalves include the destruction of habitat by the creation of impoundments,

siltation, gravel mining, and channel modification; pollution and the introduction of non-native species such as the Asiatic clam and the Zebra Mussel.

Zebra Mussels:

The introduction of consequent spread of *Dreissena polymorpha* in the mid to late 1980's has severely impacted native mussel populations in the Lower Great Lakes region (Schlosser et al. 1996). Adverse effects on unionid mussels stem primarily from the attachment of *D. polymorpha* the valves native mussels. In sufficient numbers, *D. polymorpha* can interfere with feeding, respiration, excretion, and locomotion (Haag et al. 1993, Baker and Hornbach 1997). It has been estimated that the introduction of *D. polymorpha* into the Mississippi River basin has increased the extinction rates of native freshwater mussels from 1.2% of species per decade to 12% per decade.

Native mussels have shown differential sensitivity to *D. polymorpha* infestations. Mackie et al. (2000) stated that smaller species with specific substrate requirements and few hosts and were long-term brooders were more susceptible than larger species with many hosts, that were short-term brooders. It is unclear how susceptible *S. ambigua* is to zebra mussel colonization; its habit of remaining under large flat rocks might reduce its exposure to and hence colonization by *D. polymorpha*.

Siltation:

Accumulation of sediments has long been implicated in the decline of native mussels. Fine sediments can adversely affect mussels in several ways they can interfere with respiration, feeding efficiency by clogging gills and overloading cilia that sort food. It can reduce the supply of food by interfering with photosynthesis. Heavy sediment loads can also smother juvenile mussels. In addition, sedimentation can indirectly affect mussels by affecting their host fishes (Brim-Box and Mossa, 1999). Strayer and Fetterman (1999) have suggested that fine sediments may be more harmful to mussels in lower gradient streams where sediments can accumulate. It is unclear what the effects of sedimentation are on *S. ambigua*. In situations where lack of current or seasonal flooding cannot clear away accumulated silt, it is conceivable that the undersides of flat rocks could become clogged with sediment that could potentially suffocate the mussels under it.

Pollution:

Chemical pollution from domestic, agricultural, and domestic sources were responsible for the localized extinctions of native mussels in North America throughout the 20th century (Baker, 1928, Bogan, 1993). According to Neves et al. (1997) the eutrophication of rivers was a major source of unionid decline in the 1980's, while Havlik and Marking (1987) showed that many types of industrial and domestic substances: heavy metals, pesticides, ammonia, and crude oil were toxic to mussels. It is not known what the effects of these pollutants are on *S. ambigua* specifically.

Dams/Impoundments:

Impoundments whether for navigational purposes or for the generation of power can dramatically affect the habitat of freshwater mussels. Impoundments alter flow, temperature, dissolved oxygen, substrate composition (Bogan, 1993). In addition, they can isolate freshwater mussels from their host fishes thereby disrupting the reproductive cycle. Changes in water temperature can suppress or alter the reproductive cycle and delay maturation of glochidia and juvenile mussels (Fuller, 1974, Layzer et al. 1993). Other than the indirect effects of siltation caused by impoundments it is unclear what their effect is on *S. ambigua*.

POPULATION BIOLOGY AND VIABILITY

The observation of *S. ambigua* clustered under rocks might predict a series of isolated populations throughout the species range. To date no genetic survey has been conducted on this species, such information would be a valuable resource for constructing a species wide management plan that would preserve existing genetic variability of existing populations of *S. ambigua*. This species appears to in habit a subset of its hosts range (Connant, 1986). Although two subspecies of *N. maculosus* are recognized within the range of *S. ambigua*, it is not known if any host specificity is exhibited by population of *S. ambigua*.

SPECIAL SIGNIFICANCE OF THE SPECIES:

The fact that *S. ambigua* utilizes a non-fish host makes this species unique among North American unionoids. This species is also the sole member of the genus *Simpsonaias*.

MANAGEMENT RECOMMENDATIONS

Plans for the conservation of North American freshwater mussels have generally taken one of two approaches:

1.) the preservation of existing populations and allow the mussels to re-invade historical ranges naturally, and,

2.) to actively expand the existing ranges by re-introducing mussels through translocation from "healthy" populations or from captive rearing programs (NNMCC, 1998). The second strategy is the more pro-active, and may ultimately prove to be effective, however several important factors should not be over-looked. Before translocations or re-introductions occur it should be established that conditions at the re-introduction site are suitable for the survival of mussels. Mussel translocation projects have had mixed success (Sheehan et al. 1989, Cope and Waller, 1995). Re-introducing mussels into still contaminated or otherwise un-inhabitable habitat is a waste of resources and can confound attempts to obtain unbiased estimates of the survival of species after re-introduction. Additionally, the genetic variation across and within populations should be assessed prior to the initiation of a reintroduction/translocation scheme (Lydeard and Roe, 1998). Evaluation of the genetic variation is crucial to establishing a captive breeding program

that maintains the maximal amount of variation possible and avoid excessive inbreeding (Templeton and Read, 1984) or outbreeding depression (Avise and Hamrick, 1996).

Additional information about the life-history of *S.ambigua* is severely lacking. Simple information on distribution and abundance of this species and its host is also required to form a complete understanding of this species status through its range.

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