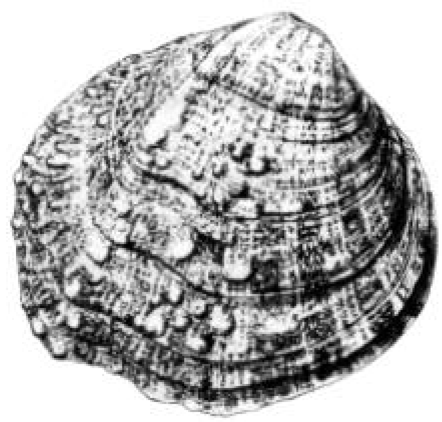
# *Conservation Assessment*
# *for*
# Western Fanshell (Cyprogenia aberti)

*Conrad, 1850*



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## Table of Contents

## EXECUTIVE SUMMARY

The western fanshell, *Cyprogenia aberti* (Conrad, 1850) is a small to medium sized mussel that is found in medium to large sized rivers in a variety of substrates. It should be easily distinguishable from other mussels by its rhomboid shape and distinctive coloration and shell sculpture. The historical range of *C. aberti* includes the Arkansas, White, Black, and St. Francis river basins in Arkansas, Missouri, Kansas and Oklahoma. *Cyprogenia aberti* is not listed by the U.S. Fish and Wildlife Service as threatened or endangered, although it is State listed in Kansas, and Missouri. *Cyprogenia aberti* is considered to be bradytictic: spawning occurs in the summer, and the larvae are released the following winter/spring. Several potential host fishes have been found for this species through laboratory studies. Potential host species identified to date are *Cottus carolinae*, *Etheostoma flabellare*, and *Percina caprodes.* Significant genetic differences have been detected between and within populations of *C. aberti.* Factors considered detrimental to the persistence of this species are pollution and siltation, impoundments and invasive species. Additional information regarding the life history and genetic variation in *C. aberti* should be obtained prior to initiation of any captive breeding and re-introduction or translocation projects.

## NOMENCLATURE AND TAXONOMY

*Cyprogenia aberti* (Conrad, 1850) Western fanshell

<u>Synonomy</u>:

*Unio aberti* Conrad, 1850; Conrad, 1850:10

*Unio lamarckianus* Lea, 1852; Lea, 1852:266

*Margaron* (*Unio*) *lamarckianus* Lea, 1852; Lea 1852: 23

*Margaron* (*Unio*) *aberti* (Conrad, 1850); Lea, 1870: 34

*Cyprogenia aberti* (Conrad, 1850); Simpson, 1900:610

*Unio popenoi* Call, 1885; Call, 1885:48

<u>Type Locality</u>: The type locality is listed by Conrad as "Chambers' Ford rapids of Verdigris River, Arkansas" which is incorrect, as the Verdigris River does not occur within the borders of Arkansas. Chambers' Ford is within the borders of present day Kansas.

## DESCRIPTION OF SPECIES

The shell of *C. aberti* is rhomboid in outline with a broadly rounded anterior margin. The ventral margin is rounded anteriorly, but tapers towards the posterior end. In some populations the ventral margin can be convex anteriorly and concave posteriorly. The shell ranges from slightly inflated to compressed. The shells are quite solid, and are thicker anteriorly. The beaks are somewhat pointed and extend only slightly above the hinge line. In some populations the posterior ridge sharply demarcates the posterior slope from the rest of the disk whereas in others the posterior ridge is more rounded and almost not visible. The surface of the shell is covered with concentric, faint ridges as well as numerous pustules or wrinkles that are oriented along the dorsal/ventral axis. The periostracum typically consists of a tan or straw yellow background with numerous broad green rays radiating from the umbo. In addition, the disk is covered with numerous green vermiculate lines or specks. The pseudocardinal teeth are heavy and pyramidal and are separated from the short, heavy lateral teeth by a large interdentum. The nacre is white. The glochidia of the western fanshell were described by Hoggarth (1999) as elongate oval. The average length and height are 208 and 154 µm respectively. Micropoints were poorly organized along the ventral margin, lanceolate and bluntly pointed.

## LIFE HISTORY

*Cyprogenia aberti* is generally found in upland streams in mud, sand, gravel or rocky substrates in slow to fast flowing currents (Buchanan, 1980, Obermeyer, 1999, Roe, pers. obs.). It occurs in depths of water from 7.5 cm to 1 meter. Obermeyer et al (1997) found *C. aberti* more frequently among cobble than other species. The marsupium of *C. aberti* is restricted to the outer demibranchs. When gravid, the marsupia of female *C. aberti* like *C. stegaria* are coiled (Ortmann, 1912; Chamberlain, 1934). The Western Fanshell produces long, worm-like conglutinates, that are released in late winter through early spring (Obermeyer, 1999). The morphology and color of these conglutinates varies within and across populations and appear to be correlated with genetic variation (J. Serb, pers. comm.). Host fishes identified to date include three native fishes that were identified by laboratory infestation. These species produce transformed juvenile mussels: *Cottus carolinae, Etheostoma flabellare,* and *Percina caprodes* (Barnhart, 1997).

## DISTRIBUTION AND ABUNDANCE .

*Cyprogenia aberti* is found in portions of the Arkansas, White, Black and St. Francis rivers in Kansas, Missouri, Arkansas.

## RANGE WIDE STATUS

Williams et al. (1993) list *C. aberti* as a threatened species. This species has always had a restricted distribution. It is considered to have occurred in Arkansas, Kansas, Oklahoma, and Missouri. Museum records for Arkansas date from the early 20th century through the 1990's. Museum records for Missouri date from the early 20th century through the 1970's. No museum records were found for Oklahoma and the specimens from Kansas were probably collected during the earlier part of the 20th century, although no collection dates were recorded. Sizable populations are known to still be present in Arkansas and Missouri and *C. aberti* can still be found in southeastern Kansas. The western fanshell is endangered in Kansas. In Missouri it is given the rank of S1/S2 indicating that it is considered very vulnerable to extinction. It is considered to be extirpated from Oklahoma (Mather, 1990).

## POPULATION BIOLOGY AND VIABILITY

The habitat preferences of the western fanshell and the availability of that habitat have produced a series of isolated populations across the species range. Genetic surveys of *C. aberti* indicate the presence of several genetically distinct populations and imply the possible existence of cryptic species (J. Serb, pers. com). If the trend of habitat reduction and fragmentation continues the continued loss of genetic variation through genetic drift has the potential to reduce the genetic variation within populations to the point where they may no longer be able to adapt to changing environmental conditions. Propagation and reintroduction plans for the western fanshell should take into account existing genetic variation and develop management plans that will maximize genetic variation.

*Cyprogenia aberti* is one of two recognized species in the genus *Cyprogenia* although as stated earlier several cryptic species may be present (see Population Biology and Viability). Members of *Cyprogenia* produce unique conglutinates and have a distinct marsupium morphology.

## POTENTIAL THREATS

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.

<u>Zebra Mussels/*Corbicula*</u>: The introduction of and 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* to the valves of native mussels. In sufficient numbers, *D. polymorpha* can interfere with feeding, respiration, excretion, and locomotion (Haag et al. 1993, Baker and Hornbach 1997) and possibly reproduction. 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. Berg et al. (1993) reported differences in mortality of encrusted mussels between species and between sexes, with females exhibiting higher mortality than male mussels. Zebra mussels do occur in the mainstem of the Arkansas River as far upstream as eastern Oklahoma, and so have the potential to threaten extant populations of *C. aberti* in that drainage. Asian clams (*Corbicula fluminea*) have been implicated as a competitor with native mussels (Neves and Widlak, 1987). Yeager et al. (2001) found that in high densities *C. fluminea* had a negative impact on the survival and growth of juvenile native mussels. Laboratory experiments found that *C. fluminea* will readily ingest glochidia, and that *C. fluminea* density and juvenile mussel mortality is positively correlated.

Gravel Mining: Removal of gravel from a stream has a dramatic impact on stream channel stability as well as water quality (Brown and Curole, 1997). In Arkansas, research has found that in-stream gravel mining in the Ozark region has altered channels including a decrease in the occurrence of riffle habitats and the abundance of silt sensitive species (Brown and Lyttle, 1992). Infaunal invertebrates are severely affected by removal of substrate and the associated settling of fine sediments disturbed by the mining process (Femmer, 2002). Gravel mining can also result in the creation of unstable stream margins that slough into the stream and create channel instability further upstream. This phenomena is referred to as headcutting (Hartfield, 1993). Because of its dramatic effects on the substrate composition, water quality, and channel stability any gravel mining and related activities that affect the in-stream environment should be avoided in areas where *C. aberti* occurs.

Siltation: Accumulation of sediments has long been implicated in the decline of native mussels. Fine sediments can adversely affect mussels in several ways. Fine sediments can interfere with respiration, feeding efficiency by clogging gills and overloading cilia that sort food. Excessive sedimentation 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. *Cyprogenia aberti* appear to prefer clear, fairly high-gradient streams that normally are low in suspended silt. In situations where lack of current or seasonal flooding cannot clear away accumulated silt, it is conceivable that interstitial spaces could become clogged with sediment that could potentially suffocate mussels and preclude settlement of juvenile *C. aberti* thereby limiting recruitment. Siltation can also have adverse affects on host fishes. Potential host fishes identified to date prefer silt free streams and flowing water.

Pollution: Chemical pollution from domestic, agricultural, and domestic sources were responsible for the localized extinctions of native mussels in North America throughout the 20$^{th}$ 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. Glochidia and juvenile mussels appear to be particularly susceptible to contaminants (Robinson et al. 1996, Jacobson et al., 1997). Although continued chronic exposure to pesticides and other toxicants can have a negative impact on freshwater mussels (Naimo, 1995), acute exposure from chemical spills can have disastrous effects. In a recent spill on the Clinch River over 7,000 individual mussels were killed including three federally listed species (Jones et al. 2001). In 1999 a spill on the Ohio River resulted in the mortality of all mussels (~1 million individuals) along a 10-mile stretch of river (Butler, 2002). Because many populations of *C. aberti* are small and somewhat isolated, a catastrophic accident such as those that occurred in the Clinch and Ohio rivers has the potential to result in the extirpation of large percentage of extant *C. aberti.*

Dams/Impoundments: Impoundments whether for navigational purposes or for the generation of power can dramatically affect the habitat of freshwater mussels, particularly those species that inhabit riffles and shoals. 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). In addition to habitat fragmentation and temperature alteration, the increase in siltation above impoundments alters the substrate making it unsuitable for many species such as *C. aberti* that prefer gravel/cobble substrates.

## SUMMARY OF EXISTING MANAGEMENT ACTIVITIES

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). Genetic data collected to date has revealed some surprising results and indicates that substantial genetic variation occurs within and between populations of *C. aberti* (J. Serb, pers. com).

Current information about the life history of *C. aberti* indicates that further study is required to form a complete understanding of this species. Although research to date has identified some potential hosts fishes for the western fanshell, additional research is required to determine if there is variation in host preferences across the range of what appears to be a species complex.

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Figure 1. Distribution of *Cyprogenia aberti* by county, based on a survey of museum records.