Conservation Assessment

For

Ellipse (Venustaconcha ellipsiformis)

USDA Forest Service, Eastern Region
2003

Prepared by:

This Conservation Assessment was prepared to compile the published and unpublished information and serves as a Conservation Assessment for the Eastern Region of the Forest Service. It does not represent a management decision by the U.S. Forest Service. Though the best scientific information available was used and subject experts were consulted in preparation of this document, it is expected that new information will arise. In the spirit of continuous learning and adaptive management, if you have information that will assist in conserving the subject community, please contact the Eastern Region of the Forest Service - Threatened and Endangered Species Program at 310 Wisconsin Avenue, Suite 580 Milwaukee, Wisconsin 53203.

Table of Contents

NOMENCLATURE AND TAXONOMY **4**
RANGE: **4**
PHYSIOGRAPHICAL DISTRIBUTION: **5**
HABITAT: **6**
SPECIES DESCRIPTION: **6**
LIFE HISTORY: **7**
NATURAL AND HUMAN LAND USE THREATS: **7**
VIABILITY: **8**
MANAGEMENT: **8**
MONITORING **9**
RESEARCH NEEDS: **9**
REFERENCE LIST: **10**

NOMENCLATURE AND TAXONOMY

Scientific Name: *Venustaconcha ellipsiformis* (Conrad, 1836)

Common Name: Ellipse

Family: Unionidae

Synonyms: *Unio spatulatus* Lea, *Lampsilis spatulatus* (Lea), *Lampsilis ellipsiformis* (Conrad), *Eurynia ellipsiformis* (Conrad), *Ligumia ellipsiformis* (Conrad), and *Actinonaias ellipsiformis* (Conrad)

The ellipse has been treated as three separate species (Ortmann 1918) or as one species with two subspecies (Oesch 1984). Today, two species are recognized, the ellipse, *Venustaconcha ellipsiformis* (Conrad, 1836) in the upper Midwest and the bleadingtooth mussel, *Venustaconcha pleasii* (Marsh, 1891) of the Ozarks (Turgeon et. al. 1988). No allozymic or other genetic data are available and the phylogenetic relationships of this species or genus to other lampsilines have not been investigated.

USFS Region 9 Status: Sensitive

USFWS Status: None. The ellipse has no federal protection as a threatened or endangered species. However, it was listed as a species of special concern by the freshwater mussel subcommittee of the endangered species committee of the American Fisheries Society (Williams, et. al. 1993). In the Midwest, the ellipse has been extirpated from Ohio, is threatened in Iowa and Wisconsin, is a species of special concern in Indiana, and is on the watch list in Illinois (Cummings & Mayer 1992).

Illinois Status: Watch list

Global And State Rank: The Nature Conservancy's Heritage Program ranks this species as G3/G4. The ranking means that the ellipse is probably rare and uncommon globally, but information is lacking hence its given two ranks.

RANGE:

This northern species of freshwater mussel has a range extending from Indiana and Michigan to southeastern Minnesota, Iowa, southeastern Kansas, Missouri, Oklahoma, Arkansas and Kentucky, and has apparently been extirpated from Ohio. van der Schalie and van der Schalie (1963) had expressed concern that it might be endangered in Michigan, but Hoeh (pers. com.) stated that his field experience suggested that it may be faring well. Out of 28 stations recently surveyed along the Tittabawassee River of Michigan, a tributary to the Saginaw, the species was present at 16 and abundant at eight stations (Hoeh, pers. com.). Currently, the species is found at 11 sites in five southeastern Wisconsin river systems. It also occurs in the Fox River drainage in the southwestern part of the state. (K.S. Cummings pers. obs., Mathiak 1979). In Kansas, range is restricted to the Spring River in the

southeastern corner of the state and the mussel is considered a peripheral species (Busby, pers. com.). In Missouri, range formerly covered areas north of the Missouri River. Current range is the streams that flow north off the Salem and Springfield Plateaus (Oesch, 1984). The first record from Minnesota was from the Cannon River in 1987 (Davis, 1987). Within the Cannon River watershed, extant populations were discovered in the Straight River, Wolf Creek and the Cannon River proper. The largest population was found within the tailwaters of an old mill dam on the Straight River (Davis, 1987). Although presently limited in distribution within the drainage, past distribution appears to have been much wider. Subsequent to the Cannon River survey, sites have been found in other river systems within the southeastern corner of the state, the Zumbro (Bright, pers. com.) and tributaries to the Root (Ostlie, pers. obs.). In Iowa, range is the upper reaches of rivers in the northeastern third of Iowa (Frest, pers. com.; Howell, pers. com.). Although some records are available from large rivers (judging from recent records of this species from the Mississippi River at Davenport, Muscatine, Prairie du Chien and Keokuk, Frest, pers. com.) it is rarely found in large river habitats. There have been no records in the state of Ohio (Hoggarth, pers. com.). Sterki (1907) recorded *V. ellipsiformis* from the Ohio River, but that record did not come from the Ohio portion of the river (Hoggarth, pers. com.). Although some records also exist in Lake Erie tributaries, none of these are from Ohio. The ellipse was historically found in the northern half of Illinois, particularly in the northeast. However, many streams in that part of Illinois have been negatively effected by urban development and agricultural impacts and many populations have been extirpated. The ellipse is now relatively uncommon in Illinois. A few apparently healthy populations can still be found in tributaries to the Kankakee, Fox, Mackinaw, and Vermilion (Illinois River drainage) rivers. This mussel is rare in Indiana occurring only at a few sites primarily in streams draining into Lake Michigan. A few historical records exist for glacial lakes in the headwaters of the Tippecanoe River (K.S. Cummings pers. obs.). Figure 1 shows the current known range of the *Venustaconcha ellipsiformis* in the upper Midwest.

In Illinois, *Venustaconcha ellipsiformis* was historically found in the following counties: Boone, Bureau, Champaign, Cook, DeKalb, DeWitt, DuPage, Grundy, Iroquois, Kane, Kankakee, Kendall, Knox, Lake, LaSalle, Lee, Livingston, Logan, McHenry, McLean, Mercer, Ogle, Piatt, Rock Island, Stark, Stephenson, Tazewell, Vermilion, Whiteside, Will, Winnebago, and Woodford. Since 1980 is has been found in: Boone, Cook, DeKalb, DeWitt, Grundy, Iroquois, Kane, Kankakee, Kendall, LaSalle, Livingston, McHenry, McLean, Will, Winnebago, and Woodford. Figure 2 shows the known distribution since 1980 in Illinois.

PHYSIOGRAPHICAL DISTRIBUTION:

The Ellipse in Illinois is found in the Central Till Plains Section and the Central Dissected Till Plains Section of the Prairie Parkland Province and the Central Till Plains, Oak-Hickory Section and the Southwestern Great Lakes Morainal Section of the Eastern Broadleaf Forest Province (Keys et. al. 1995). Illinois has been divided up into Natural Divisions based on physiography, flora and fauna (Schwegman et. al. 1973). The Ellipse is found within the Grand Prairie Division, the Northeastern Morainal Division, the Rock River Hill Country Division, the Western Forest-Prairie Division, the Middle Mississippi Border Division, the

Upper Mississippi River and Illinois River Bottomlands Division, and the Illinois River and Mississippi River Sand Areas Division.

HABITAT:

In Illinois this species is found in clear, small to medium-sized streams in gravel or mixed sand and gravel, in riffles or runs with a swift to moderate current. Rarely found in mud. Very rare in large rivers (Cummings & Mayer, 1992). In Michigan, preferred habitat is small, clear streams that possess a gravel, rocky substrate (Hoeh, pers. com.; Hoggarth, pers. comm; van der Schalie and van der Schalie, 1963). In these small streams the mussel appears to be restricted to areas with moderate or strong currents (van der Schalie and van der Schalie, 1963). Kansas habitat is one Ozark stream that flows through agricultural land and forests. The mussel occupies diverse aquatic habitats, including pools, riffles, runs and backwaters. The substrate is variable, ranging from bedrock to rubble, gravel and silt (Busby, pers. com.). In Missouri, habitat is small to medium-sized streams that have a gravel substrate (Oesch, 1984). All specimens located during the Cannon River, Minnesota survey were found in pool habitats, either due to preference toward this habitat or displacement by floodwaters into it (Davis, 1987). In other southern Minnesota rivers habitat is clear headwater areas with substrates of gravel, cobbles and boulders (Bright, pers. com.). Preferred habitat in Iowa is substrates that are typically composed of mixed sand and gravel (Frest, pers. com.; Howell, pers. com.). The mussel is able to live in river lakes, but is generally absent from kettle lakes. It can be found occasionally in kettle lakes that are large and possess sand bottoms, however (Frest, pers. com.).

SPECIES DESCRIPTION:

A freshwater mussel, small, relatively think shell, elliptical in shape, greenish-brown in color with wavy green rays on the posterior end.

Shell: Shell small, solid, elliptical, and compressed. Anterior end rounded, posterior end bluntly pointed. Ventral margin straight to slightly curved. Umbos only slightly elevated above the hinge line. Beak sculpture of 3-4 very fine double-looped ridges. Shell usually smooth with a few wrinkles or folds on the posterior half in older shells. Periostracum green or greenish yellow with numerous dark green rays, becoming wavy on the posterior half of the shell. Length to 3 inches. Pseudocardinal teeth triangular, heavy, roughened, and divergent; two in the left valve, one in the right (occasionally with a thin ridge-like tooth in front). Lateral teeth, relatively short, thick, and straight to slightly curved. Beak cavity shallow. Nacre white, iridescent posteriorly (Cummings & Mayer 1992).

Animal: "Anal and supra-anal openings separated by small mantle connection; branchial opening with many yellowish papillae; anal opening with fine crenulations; supra-anal opening small; inner lamellae of inner gills entirely connected with visceral sac. Marsupium occupying posterior half of outer gills, consisting of about 20 ovisacs; when gravid extending to below edge of sterile gill; mantle edge anterior to branchial opening with papillae which extend to about the center of the mantle margin, terminating in fine crenulations; conglutinates not described." (Baker 1928:264).

LIFE HISTORY:

The ellipse is a long-term (bradytictic) brooder. Eggs are fertilized in the late summer or early fall and glochidia are released in the late spring or early summer the following year. The ellipse was reported gravid on August 27th at Forked Creek (Kankakee River Drainage) near Wilmington, Illinois (Wilson & Clark, 1912). As part of their life history study on the ellipse in Michigan, van der Schalie and van der Schalie (1963) seined 16 species of fish and examined them for glochidia. None were found infected with glochidia, and the natural host(s) for the ellipse remains unknown (Watters 1994).

In the Michigan study sexual maturity was usually not attained until the third year. The size at sexual maturity was not reported. The sex ratio of 238 individuals examined was 130 males to 108 females. Of all specimens examined only one hermaphrodite was found (van der Schalie & van der Schalie 1963).

The number of eggs and ovisacs appears to be a function of the age and size of the female. In the Michigan study, the number of ovisacs in one gill ranged from an average of nine in an individual 32 mm in length to 25 in a 55 mm female. The gonads of females examined in April were found to contain many eggs in the early stage of development. In June eggs began to show an encasing vitelline membrane and by July most of the eggs (still unfertilized) moved to the gills where they were fertilized and carried until the following spring or early summer. The average dimensions of seven glochidia measured with an occular micrometer was 0.237 x 0.285 mm (van der Schalie & van der Schalie 1963).

In the Michigan life-history study, specimens were aged using visual inspection of annuli and reported to live to a maximum age of 12 years (van der Schalie & van der Schalie 1963).

NATURAL AND HUMAN LAND USE THREATS:

Smith (1971) ranked the causes of extirpation or declines in fish species as follows: siltation, drainage of bottomland lakes, swamps, and prairie marshes, desiccation during drought, species introductions, pollution, impoundments, and increased water temperatures. All of these factors render habitats unsuitable, cause extirpations, and lead to the isolation of populations thereby increasing their vulnerability to extirpation for many aquatic species (including mussels) throughout North America. Zebra mussels *Dreissena polymorpha* have destroyed mussel populations in the Great Lakes and significantly reduced mussels in many of the large rivers of the eastern North America and has the potential to severely threaten and other populations especially if it makes its way into smaller streams.

Pollution through point (industrial and residential discharge) and non-point (siltation, herbicide and fertilizer run-off) sources is perhaps the greatest on-going threat to this species and most freshwater mussels. The ellipse may be especially hard hit by siltation since it frequents small stream and headwaters (Hoeh, pers. com.). Lowered dissolved oxygen

content and elevated ammonia levels (frequently associated with agricultural runoff and sewage discharge) have been shown to be lethal to some species of freshwater naiads (Horne and McIntosh, 1979). Residential, mineral and industrial development, particularly along the Spring River in Missouri pose a significant threat to this species in Kansas (Busby, pers. com.). Destruction of habitat through stream channelization and maintenance and the construction of dams although slowed in recent years is still a threat in some areas. Impoundments reduce currents that are necessary for the most basic physiological activities such as feeding, waste removal and reproduction. In addition, reduced water flow typically results in a reduction in water oxygen levels and a settling out of suspended solids (silt, etc.), both of which are detrimental. Dredging of streams has an immediate effect on existing populations by physically removing and destroying individuals. Dredging also affects the long-term recolonization abilities by destroying much of the potential habitat, making the substrates and flow rates uniform throughout the system. Van der Schalie and van der Schalie (1963) expressed concern over the small number of juvenile individuals with respect to other age classes at a particular site. They attributed this situation to destruction of preferential habitat caused by power dam construction, pollution and siltation. Rotenone, a toxin used to kill fish in bodies of water for increased sport fishery quality, has been shown to be lethal to mussels as well (Heard, 1970). Natural predators include raccoons, otter, mink, muskrats, turtles and some birds, which feed heavily upon freshwater mussels (Simpson 1899; Boepple and Coker 1912; Evermann and Clark 1918; Coker, et. al. 1921; Parmalee 1967; Snyder & Snyder 1969). Domestic animals such as hogs can root mussel beds to pieces (Meek & Clark 1912). Fishes, particularly catfish, *Ictalurus spp*. and *Amieurus spp*. and freshwater drum, *Aplodinotus grunniens* also consume large numbers of unionids. Intensive agriculture practices are thought to have caused demise of the ellipse throughout its historic range in the southern half of Wisconsin. In Iowa, historical records show that the species may have inhabited much of the state in presettlement times, but siltation and pollution have eliminated the species from much of its former range.

VIABILITY:

The overall goal is to maintain a viable population of *Venustaconcha ellipsiformis* in appropriate streams. Soule (1980) suggested that minimum viable populations are the smallest size that can persist over a period of years (usually 100 is used) with a low extinction probability (less than 5%) and with enough genetic diversity to adapt to changing conditions in the environment. Where there is little information regarding the current population size, so it's impossible to come up with a population size that should be maintained. In the short term, until more information is available on the status of *Venustaconcha ellipsiformis*, the goal should be to protect and improve the water quality of suitable streams. Improving the water quality should improve the habitat for *Venustaconcha ellipsiformis*.

MANAGEMENT:

The following management practices will help ensure a viable population of *Venustaconcha ellipsiformis*:

1) Cattle, hogs, horses, or other domesticated animals should not have unlimited access to

streams likely to have mussels. If livestock watering is necessary, limit it to a small area to protect the mussels from trampling.

2) Establish a buffer between the livestock grazing areas and the streams to keep livestock from disturbing the banks adding to siltation. A buffer would also help cut down on nitrogen runoff from livestock manure.

3) Constructed dams and debris dams can limit fish movement, thus limiting mussel colonization. Constructed dams should be removed or not installed. Debris dams at fences, culverts, railroad tressels, and bridges can limit fish movement, thus limiting mussel colonization. Debris dams can also modify the flow causing bank erosion and siltation of the streams.

4) Where practical channelized portions of streams should be restored. Channelized streams should be put back into their original channels. This should help control the down cutting of the channel and shoreline with resulting added siltation. Care needs to be taken to not destroy mussel beds in the process of re-channelization.

5) Runoff from trails, roads, parking lots and other development should be controlled. Runoff should be directed away from the streams to control siltation and chemicals from getting into the streams.

6) Agricultural runoff needs to be controlled. Agricultural runoff should be directed away from the streams. Field tiles that drain directly or indirectly into the streams could be a problem. These tiles should be removed to prevent agricultural chemicals and fertilizers from getting into the streams.

7) The banks of the streams should be re-vegetated where erosion has occurred to help control further erosion and siltation. Native vegetation should be utilized to control erosion.

MONITORING

The mussel populations of streams need to be determined and monitored on a yearly basis to aid in developing a viable population goal.

RESEARCH NEEDS:

In order to effectively manage mussel species it is necessary to work out certain life history characteristics first. Because of their unusual life-cycle and dependence on fish for completion of that cycle, it is imperative that the host species for the ellipse be ascertained. Although some life history information has been published for the ellipse in Michigan (van der Schalie & van der Schalie 1963), additional work needs to be done to identify age and size at sexual maturity, recruitment success, age class structure, and other important life history parameters.

Research is needed to assess the success of watershed protection on mussel populations. Abundance and distribution of selected species needs to be monitored in order to ascertain how species abundance's change over time. From that we can assess what land-use changes, conservation practices, and physical/chemical parameters are correlated with, and possibly responsible for, the biological changes.

REFERENCE LIST:

Baker, F.C. 1928. The fresh water Mollusca of Wisconsin. Part II. Pelecypoda. Bulletin of the Wisconsin Geological and Natural History Survey. University of Wisconsin. 70(2):vi-495 + 76 plates.

Boepple, J.F., and R.E. Coker. 1912. Mussel resources of the Holston and Clinch rivers of eastern Tennessee. Reports and Special Papers of the U.S. Bureau of Fisheries. [Issued separately as U.S. Bureau of Fisheries Document 765]. 1911:1-13.

Bright, R. Professor [deceased]. University of Minnesota.

Busby, W. Zoologist/Data Mgr. Kansas Natural History Inventory. Kansas Biological Survey. 2041 Constant Avenue. Lawrence, KS 66047-2906.

Coker, R.E., A.F. Shira, H.W. Clark, and A.D. Howard. 1921. Natural history and propagation of fresh-water mussels. Bulletin of the Bureau of Fisheries. [Issued separately as U.S. Bureau of Fisheries Document 893]. 37(1919-20):77-181 + 17 plates.

Conrad, T.A. 1836. Monography of the Family Unionidae, or naiades of Lamarck, (fresh water bivalve shells) of North America, illustrated by figures drawn on stone from nature. J. Dobson, 108 Chestnut Street, Philadelphia, Pennsylvania. 7:57-64, plates 32-36.

Cummings, K.S., and C.A. Mayer. 1992. Field guide to freshwater mussels of the Midwest. Illinois Natural History Survey, Manual 5. 194 pp.

Davis, M. 1987. Freshwater mussels (Mollusca: Bivalvia: Unionidae) of the Cannon River Drainage in southeastern Minnesota. Report submitted to the Non-Game Wildlife Program. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Evermann, B.W., and H.W. Clark. 1918. The Unionidae of Lake Maxinkukee. Proceedings of the Indiana Academy of Science 1917:251-285.

Frest, Terry. Deixis Consultants. 2517 NE 65th St. Seattle, WA. 98115-7125. (206) 527-6764.

Heard, W.H. 1970. 3. Eastern freshwater mollusks. (II). The south Atlantic and Gulf drainages. pp. 23-27 in A.H. Clarke, (ed.) Papers on the Rare and Endangered Mollusks of North America. Malacologia 10(1).

Hoeh, Walter R. Malacologist, Museum of Soology, Mollusk Division, University of Michigan, Ann Arbor, Michigan.

Hoggarth, M. A. 1985. Museum of Zoology, Ohio State University. Personal communication.

Horne, F.R., and S. McIntosh. 1979. Factors influencing distribution of mussels in the Blanco River of Central Texas. Nautilus 94(4):119-133.Horne, F.R., and S. McIntosh. 1979. Factors influencing distribution of mussels in the Blanco River of Central Texas. Nautilus 94(4):119-133.

Howell, D. 1990. Coordinator/Zoologist. Iowa Natural Areas Inventory. Bureau of Preserves and Ecological Services. Department of Natural Resources. Wallace State Office

Building. Des Moines, IA 50319. (515) 281-8524.
Marsh, W.A. 1891. Description of two new species of Unio, from Arkansas. Nautilus 5(1):1-2.
Mathiak, H.A. 1979. A river survey of the unionid mussels of Wisconsin 1973-1977. Sand Shell Press. Horicon, Wisconsin. 75 pp.
Meek, S.E., and H.W. Clark. 1912. The mussels of the Big Buffalo Fork of White River, Arkansas. Report and Special Papers of the U.S. Fish Commission. [Issued separately as U.S. Bureau of Fisheries Document 759]. 1911:1-20.
Oesch, R.D. 1984. Missouri naiades: a guide to the mussels of Missouri. Jefferson City: Conservation Commission of the State of Missouri. 270pp.
Ortmann, A.E. 1918. The systematic position of two species of mussels from the Ozarks. Nautilus 32(1):13-15.
Parmalee, P.W. 1967. The fresh-water mussels of Illinois. Illinois State Museum Popular Science Series 8:1-108.
Simpson, C.T. 1899. The pearly fresh-water mussels of the United States; their habits, enemies, and diseases, with suggestions for their protection. Bulletin of the U.S. Fish Commission. [Issued separately as U.S. Bureau of Fisheries Document 413]. 18(1898):279-288.
Smith, P. W. 1971. Illinois streams: A classification based on their fishes and an analysis of factors responsible for disappearance of native species. Illinois Natural History Survey Biological Notes (76):1-14.
Snyder, N., and H. Snyder. 1969. A comparative study of mollusk predation by limkins, everglade kites, and boat-tailed grackles. Eighth Annual Report of the Cornell Laboratory of Ornithology 8:177-223.
Soule, M.E. 1980 Thresholds for survival: maintaining fitness and evolutionary potential. Pages 111-124 *in* Conservation Biology: an Evolutionary Perspective (M.E. Soule & B.A. Wilcox, eds) Sinauer, Sunderland, MA.
Sterki, V. 1907. A preliminary catalogue of the land and fresh-water Mollusca of Ohio. Proceedings of the Ohio State Academy of Science 4(8):367-402.
Surber, T. 1912. Identification of the glochidia of freshwater mussels. Report submitted to U.S. Com. Fish. for 1912 and Sp. paper. pp. 1-10.
Turgeon, D.D., A.E. Bogan, E.V. Coan, W.K. Emerson, W.G. Lyons, W.L. Pratt, C.F.E. Roper, A. Scheltema, F.G. Thompson, and J.D. Williams. 1988. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. American Fisheries Society, Special Publication 16:viii + 277 p. + 12 pls.
van der Schalie, H., and A. van der Schalie. 1963. The distribution, ecology, and life history of the mussel, *Actinonaias ellipsiformis* (Conrad), in Michigan. Occasional Papers of the Museum of Zoology, University of Michigan No. 633. 17 pp.
Watters, G.T. 1994. An annotated bibliography of the reproduction and propagation of the Unionoidea (Primarily of North America). Ohio Biological Survey Miscellaneous Contributions No. 1 158 pp.
Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18(9):6-22.
Wilson, C.B., and H.W. Clark. 1912. The mussel fauna of the Kankakee basin. Report and Special Papers of the U.S. Fish Commission. [Issued separately as U.S. Bureau of

Fisheries Document 758]. 1911:1-52 + 1 map.

FIGURES

Figure 1. North American Distribution of *Venustaconcha ellipsiformis*
Figure 2. Illinois Distribution of *Venustaconcha ellipsiformis* By County