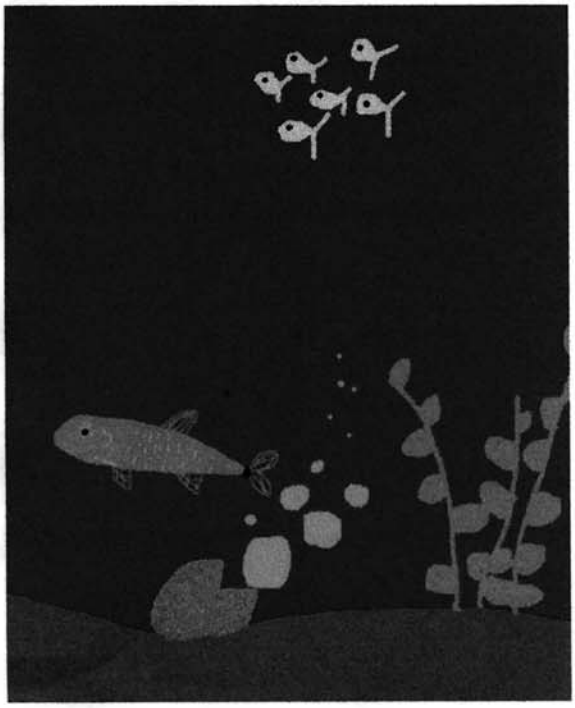
# TRIANNUAL UNIONID REPORT

## Report No. 18

## October 1999

A forum for the informal exchange of information on the status of North American unionid research, management, and conservation



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**NOTE:** The intent of this report is to expedite the exchange of information in an informal format. Report submissions were solicited from individuals and agencies involved in unionid conservation, copied as received, and assembled into this report. The submissions were **not** edited and were **not** peer-reviewed.

FRONT COVER ART: THANKS TO EMILY LYDEARD, TUSCALOOSA, ALABAMA.

**OCTOBER 1999**

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**The following are selected abstracts of presentations given at the 31st annual meeting of the Mississippi River Research Consortium, April 22-23, 1999**

# Freshwater Mollusk Conservation Society



*...dedicated to the advocacy and conservation science of freshwater molluscan resources.*

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| ____ Status / Distribution of Unionids | ____ Information exchange | ____ Commercial |
| ____ Status / Distribution of Gastropods | ____ Restoration / Propagation | ____ Symposium |

# ONCE MORE *ANODONTA (SINANODONTA) WOODIANA*

by

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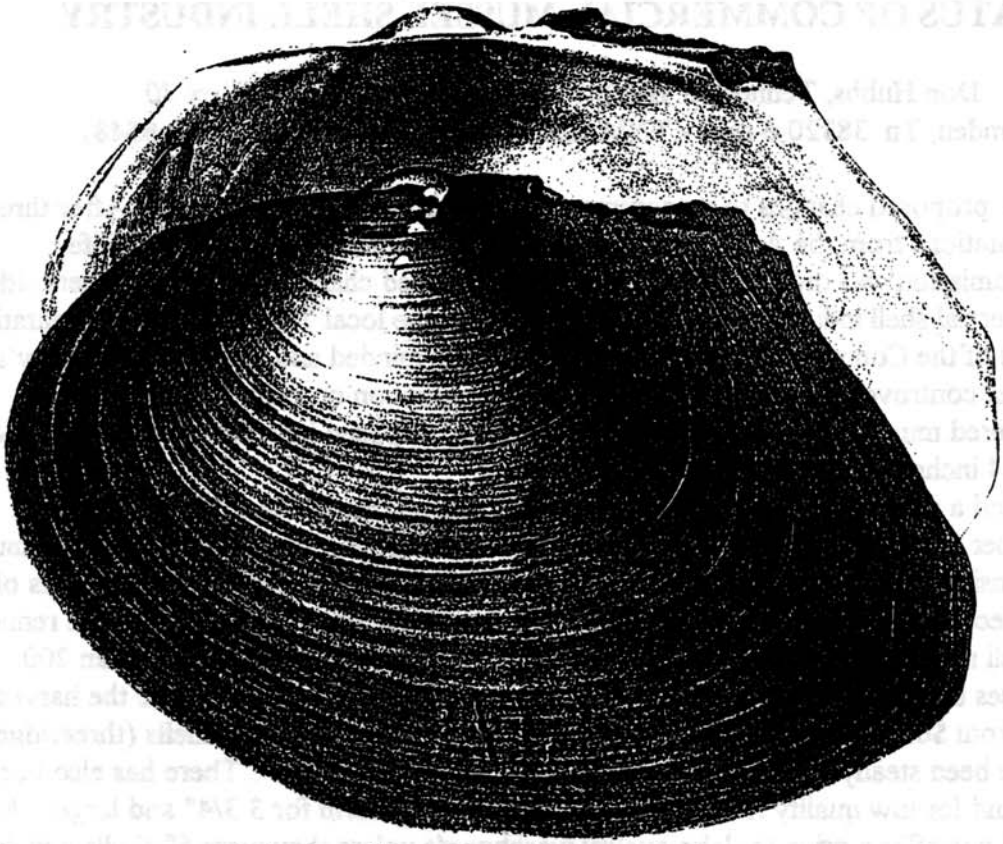
In a previous issue of the "Triannual Unionid Report" G. Thomas Watters (1999) reported a recent find of *Anodonta (Sinanodonta) woodiana* (Lea, 1834) from Italy. Manganelli et al. (1998) had mentioned it already from two areas in Italy, while more detailed reports concerning the presence of the mussel in that country seem to be in preparation.

Less known are several brief reports of the expansion of the Chinese Pond mussel to some additional European countries.

SLOVAKIA: Košel (1995) reported the find of a single specimen in the inundation area of the Danube river near the village of Cicov in 1994.
CZECHIA: Beran (1997) collected one living specimen and two empty shells in a meander of the Dyje River near Breclav, South Moravia (Danube River Basin) in 1996.
AUSTRIA: Reischütz (1998) listed it as an introduced species now occurring in Austria, but so far I failed to trace the original record containing some more details.
POLAND: Böhme (1998) reported on the find of the Chinese pond mussel in the river Narew (Narew Landscape Parc) near the village of Topilec, not far from Bialystok, East Poland, while Soroka (1998) is currently working on the conchological and genetic variation of specimens living in the Konin lakes, Central Poland.

These data show that *Anodonta (Sinanodonta) woodiana* occurs now at least in four additional Central European countries. As it seems to have penetrated the Danube river (Frank et al., 1990; Nesemann, 1993; Košel, 1995) records may be expected in future also from Germany, Serbia and Bulgaria.

The spread of the Chinese Pond mussel seems to be closely correleted to the introduction of the Grass Carp: *Ctenopharyngodon idella* (Valenciennes, 1844) and the Silver Carp: *Hypophthalmichthys molitrix* (Valenciennes, 1844) to many European countries. These species of Carp have also been introduced to several Middle Eastern countries. Therefore records of this highly successful, invasive mussel species may be expected in the near future from elsewhere in Europe and maybe even from the Middle East.



*Anodonta (Sinanodonta woodiana* (Lea, 1834)

## References


Beran, L., 1997. First record of *Sinanodonta woodiana* (Mollusca: Bivalvia) in the Czech Republic. Acta Soc. Zool. Bohem., 61: 1-2.

Böhme, M., 1998. Ein neuer Fundort der Chinesischen Teichmuschel (*Sinanodonta woodiana*) in Mitteleuropa. Heldia, 2 (5-6): 166, plt. 19.

Frank, C., Jungbluth, J. & Richnovszky, A., 1990. Die Mollusken der Donau vom Schwarzwald bis zum Schwarzen Meer (Eine monographische Darstellung). 142 p. Budapest.

Košel, V., 1995. The first record of *Anodonta woodiana* (Mollusca, Bivalvia) in Slovakia. Acta Zool. Univ. Comen. (Bratislava), 39: 3-7.

Manganelli, G., Bodon, M., Favilli, L., Castagnolo, L. & Giusti, F., 1998. Checklist delle specie della fauna d'Italia, molluschi terrestri e d'acqua dolce. Errata ed addenda, 1. Bollettino Malacologico, 33 (9-12): 151-156.

Nesemann, H., 1993. Zoogeographie und Taxonomie der Muschel-Gattungen *Unio* Philipsson 1788, *Pseudanodonta* Bourguignat 1877 und *Pseudunio* Haas 1910 im oberen und mittleren Donausystem (Bivalvia: Unionidae, Margaritiferidae). Nachrichtenblatt der Ersten Vorarlberger Malakologischen Gesellschaft, 1: 20-40.

Reischütz, P.L., 1998. Vorschlag für deutsche Namen der in Österreich nachgewiesenen Schnecken- und Muschelarten. Nachrichtenblattt der Ersten Vorarlberger Malakologischen Gesellschaft, 6: 31-44.

Soroka, M., 1998. Conchological and genetic variation of *Anodonta* (Bivalvia: Unionidae) in the Konin lakes. (Abstract). Folia Malacologica, 6 (1-4): 81.

Watters, G.T., 1999. More *Anodonta woodiana.* Triannual Unionid Report, 17: 18.

# STATUS OF COMMERCIAL MUSSEL SHELL INDUSTRY

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TWRA proposed changes to its commercial mussel regulations this April. After three hours of presentations from the Agency staff and comment from the public, the Wildlife Resources Commission was divided in supporting the proposed changes. Some members sided with the commercial shell industry which had support from the local Tenn. State Representative. Other members of the Commission were more conservation minded and backed the Agency's proposal. Most controversy centered on the proposed expansion on mussel sanctuaries to protect endangered mussel species. The shell industry also opposed increasing the size limit on washboards to 4 inches.

In the end a compromised proposal was passed that increased the size on washboard mussels 1/16" per year for four years to reach a 4-inch size limit in March 2003. The only mussel sanctuary expansion approved by the Commission was the inclusion of the lower 100 miles of the Duck River. Recent surveys on the Duck River have revealed approximately 45 species remain.

The shell market has remained weak this summer. Tennessee has sold less than 200 harvester licenses this year. Ebony shells *(Fusconaia ebena)* continue to dominate the harvest. Prices ranged from $0.20/lb for 2 3/8" to $0.85/lb for 2 3/4". The lake mix shells (threeridge, mapleleaf) have been steady at $0.50/lb for 2 5/8" and $1.40/lb for 2 3/4". There has also been an increased demand for low quality river grade washboards at $1.25/lb for 3 3/4" and larger. Most shell buyers did not offer a price for lake quality washboards unless they were 5" shells which brought $5.50/lb live, $8.50/lb open.

Given the low number of harvesters and shell prices, the annual harvest tonnage should be around 600 tons again this year. Shell industry sources do not expect the market to significantly improve in the fore seeable future. There is some increased interest from shell buyers from China, but it is for the low-priced ebony shells. All of this decreased harvest pressure is paying off for the beleaguered mussel populations. Our survey data has documented increases in the percentage of legal sized mussels, which now range from 15% to 40%. In the past (1992-96), the percentage of legal sized mussels ranged from 2% to 15%. Diehard shell harvesters have also noticed this increase and are requesting TWRA implement a quota system to regulate the number of shellers. This would be beneficial to both the long term survival of the resource and the fishermen. This system is opposed by the industry because "it would limit their ability to produce containers of shell in a timely manner."

# Seven potential hosts for *Ligumia recta* (Lamarck, 1819)

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*Ligumia recta* is a threatened species in Ohio. A host suitability experiment was conducted to better understand the life history requirements of this unionid. *L. recta* was collected from the Ohio River in early July by U.S. Fish and Wildlife Service divers and transported to the Aquatic Ecology Laboratory. All fishes, except musky, white sucker, and gourami, were infested in a glochidia soup on 6 July 1999 and maintained at 70-75°F. Muskellunge, white sucker and gourami were infested by the same technique and maintained from 20 July 1999 until the conclusion of the test.

Table 1. Results of *L. recta* host suitability experiment.

| Species (n)= # fish infested | Parasitic Duration (days) | # Glochidia Attached Total | # Juveniles Recovered | % Transformation Success |
|---|---|---|---|---|
| **Centrarchidae** | | | | |
| Bluegill (2) | 29 | 17 | 5 | 29.4 |
| Largemouth Bass (1) | 31 | 502 | 194 | 38.6 |
| Longear (1) | 17 | 18 | 17 | 94.4 |
| Pumpkinseed (3) | 22 | 50 | 45 | 90.0 |
| Rockbass (1) | 17 | 6 | 0 | 0.0 |
| Smallmouth Bass (1) | 31 | 19 | 0 | 0.0 |
| Warmouth (1) | 17 | 11 | 0 | 0.0 |
| **Cyprinidae** | | | | |
| Bluntnose Minnow (5) | <15 | 0 | 0 | 0.0 |
| Hornyhead Chub (2) | 27 | 40 | 0 | 0.0 |
| Redfin Shiner (3) | 20 | 34 | 1 | 3.0 |
| Rosyface Shiner (1) | 24 | 20 | 4 | 20.0 |
| Sand Shiner (3) | 15 | 2 | 0 | 0.0 |
| Spotfin Shiner (4) | 20 | 32 | 0 | 0.0 |
| Stoneroller (1) | 31 | 39 | 8 | 20.5 |
| **Esocidae** | | | | |
| Muskellunge (1) | 14 | 131 | 0 | 0.0 |
| **Ictaluridae** | | | | |
| Black Bullhead (1) | 17 | 29 | 0 | 0.0 |
| Channel Catfish (2) | 22 | 7 | 0 | 0.0 |
| **Lepisosteidae** | | | | |
| Longnose Gar (1) | 15 | 1 | 0 | 0.0 |
| **Percidae** | | | | |
| Logperch (1) | 24 | 2 | 0 | 0.0 |
| Rainbow Darter (2) | 29 | 50 | 0 | 0.0 |
| Variegate Darter (2) | 17 | 2 | 0 | 0.0 |
| **Exotic *spp.*** | | | | |
| Lavender Gourami (1) | 14 | 24 | 0 | 0.0 |
| Goldfish (3) | 17 | 5 | 0 | 0.0 |

Previously suggested hosts include black and largemouth bass, bluegill, sauger, walleye and white crappie. Bluegill and largemouth bass were also identified as potential hosts in this experiment. Centrarchids and cyprinids appear as the most suitable hosts. However, additional studies should be conducted to identify other potential hosts for *L. recta.*

**Hosts of *Pyganodon cataracta* (eastern floater) and *Strophitus undulatus* (squawfoot) from the Upper Susquehanna River basin, Pennsylvania**

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Hosts for *Pyganodon cataracta* (eastern floater) and *Strophitus undulatus* (squawfoot) were identified in the laboratory. *Pyganodon cataracta* was collected from a pond in Little Marsh, Tioga County, Pennsylvania. *Pyganodon cataracta* glochidia transformed on *Catostomus commersoni* (white sucker), *Ambloplites rupestris* (rock bass), and *Lepomis gibbosus* (pumpkinseed). *Perca flavescens* (yellow perch) died by 14 days post-infection but glochidia remained attached at time of death. Number of juveniles recovered per host varied from 2-35, with recovery occurring 16-30 days post-infestation at 15°C. Hosts of *P. cataracta* were previously unknown, although attachment of *P. cataracta* glochidia has been observed to *Cyprinus carpio* (common carp), *C. commersoni*, and *L. gibbosus* in the field or laboratory (Conner 1905, Lefevre and Curtis 1910, Wiles 1975).

*Strophitus undulatus* was collected from and later returned to Pine Creek, Tioga County, Pennsylvania. Transformation of *S. undulatus* glochidia occurred on *Luxilus cornutus* (common shiner), *Nocomis micropogon* (river chub), *Rhinichthys cataractae* (longnose dace), *A. rupestris*, *Micropterus salmoides* (largemouth bass), and *P. flavescens*. Recovery of juveniles occurred 15-41 days post-infestation at 14-17°C. Number of juveniles recovered per host varied from 5-36. Transformation did not occur on *C. commersoni*, *Exoglossum maxillingua* (cutlips minnow), and *Pimephales notatus* (bluntnose minnow). Hosts of *S. undulatus* have been reported by other investigators (Howard in Baker 1928, Hove et al. 1997, Watters et al. 1998, Wicklow and Beisheim 1998).

**Literature Cited**

Baker, F.C. 1928. The fresh water Mollusca of Wisconsin. Part II. Pelecypoda. Bulletin of the Wisconsin Geologic and Natural History Survey. 70:1-495.

Conner, C.H. 1905. Glochidia of *Unio* on fishes. Nautilus 1905:142-143.

Hove, M.C., R.A. Engelking, M.E. Peteler, E.M. Peterson, A.R. Kapuscinski, L.A. Sovell, and E.R. Evers. 1997. Suitable fish hosts for glochidia of four freshwater mussels. Pp. 21-25 in K.S. Cummings, A.C. Buchanan, C.A. Mayer, and T.J. Naimo, eds. Conservation and management of freshwater mussels II: initiatives for the future. Proceedings of a UMRCC symposium, 16-18 October 1995, St. Louis, Missouri.

Lefevre, G. and W.C. Curtis. 1910. Experiments in the artificial propagation of fresh-water mussels. Journal of Experimental Zoology. 1910:79-116.

Watters, G.T., S.H. O'Dee, and S. Chordas. 1998. New potential hosts for *Strophitus undulatus* - Ohio River drainage; *S. undulatus* – Susquehanna River drainage; *Alasmidonta undulata* - Susquehanna River drainage; *Actinonaias ligamentina* – Ohio River drainage; and *Lasmigona costata* – Ohio River drainage. Triannual Unionid Report. 15: 27-29.

Wicklow, B.J. and P.M. Beisheim. 1998. Life history studies of the squawfoot mussel *Strophitus undulatus* in the Piscataquog River watershed, New Hampshire. P. 41 in Conservation, Captive Care, and Propagation Freshwater Mussel Symposium Program and Abstracts, 6-8 March 1998, Columbus, Ohio.

Wiles, M. 1975. The glochidia of certain Unionidae (Mollusca) in Nova Scotia and their fish hosts. Canadian Journal of Zoology. 53:33-41.

# A 1998 UNIONID MOLLUSK TRANSLOCATION, LAKE MALLALIEU/WILLOW RIVER DAM, ST. CROIX RIVER MILE 17.9, HUDSON/NORTH HUDSON, WISCONSIN.

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The Lake Mallalieu dam, at the mouth of the Willow River, St. Croix River Mile 17.9, between Hudson/North Hudson, WI, is being rehabilitated. A scour hole below the dam, 30.5 m X 30.5 m, was to be filled with rock. This site, including a 6 m buffer zone on three sides, was 36.58 m out into the channel and 42.67 m long (1561 m2). A mussel survey was done 22 September 1998. Five-0.25 m2 quadrats were sampled on each of six transects below the dam, perpendicular to the St. Croix flow. Thirty samples yielded a low mean density of 0.53 mussels/m2. One *Dreissena polymorpha* (Pallas 1771), 25 mm long, 3-4 yrs of age, was attached to an anchor-line caught on a submerged tree. This *D. polymorpha* was probably brought into the area in 1998, attached to the anchor line, judging by the condition of the anchor and rope. Since the early 1990's various state and federal agencies have made serious efforts to keep recreational boats contaminated with *D. polymorpha* out of St. Croix River. There are significant mussel populations in this river.

Although there were very low densities, one living federally endangered *Lampsilis higginsi* (Lea 1857) was found on the first random dive, within 6 m of the shoreline, near the southern limits of the project site. This male, 93 mm L, 63 mm H, and 9-10 yrs of age, was marked 550 on the lower anterior edge of both valves. All living unionids were returned to the St. Croix, 65 m upstream from the dam. Divers reported more mussels at Translocation Site 1, than at the dam, apparently because of more suitable substrata.

After federal consultation, the remaining mussels were moved to Translocation Site 2, a gravel bar 25-30 m offshore, 2-3 m deep, St. Croix River Mile 18.0, 22-25 October 1998 (15 species including another *Lampsilis higginsi*, #650, 105 mm L, 70 mm H, 20 yrs old, probably a sterile female). *Amblema p. plicata* (Say 1817) was 36.6%, Potamilus alatus (Say 1817) 23.3%, and Pyganodon grandis corpulenta (Cooper 1834) was 17.1% of the fauna, an unusual species distribution. One WI special status mussel was found at Translocation Site 2, *Pleurobema sintoxia* (Raf.1820) (34 mm long, 30 mm high, 10 yrs old). Two species were represented by empty shells. A *Necturus m. maculosus* (Rafinesque 1818) from the dam-face substrata was photographed. After discussion regarding construction techniques, we also moved mussels from Translocation Site 1 because the site was too close to the project area. Water temperatures were 53-56o F.

One-year follow-up was done 11 August 1999. WI DNR divers recovered *Lampsilis higginsi* #550, and about 10% of the hash-marked unionids (100% survival of 10% of the translocated mussels after one year). In 1999 two unmarked *L. higginsi* were also found, within 3 m of Translocation Site 2 confirming a very suitable substrata of sand and gravel.

Fuller, S. L. H. 1978. Fresh-water mussels (Mollusca: Bivalvia: Unionidae) of the Upper Mississippi River: Observations at selected sites within the 9-foot channel navigation project on behalf of the United States Army Corps of Engineers. Academy of Natural Sciences, Philadelphia, PA. 401 pp.

Dawley, C. 1947. Distribution of aquatic mollusks in Minnesota. American Midland Naturalist 38:671-697.


# MUSSEL SURVEY OF CHIPPEWA NATIONAL FOREST REVEALS SECOND RECORD OF FLUTED SHELL IN RAINY RIVER BASIN

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The Forest Service is a land management organization dedicated to wise management of the Nation's natural resources. It is interested in providing to the public a variety of goods and services, and it is in the interest of the Forest to convey to the public that these goods and services can be obtained on a sustainable basis, while improving the land and maintaining its biological diversity.

Relatively little mussel survey work has been conducted in north central Minnesota (Graf 1997). The Continental Divide bisects the Chippewa National Forest. Two-thirds of the Forest drains to the Mississippi River basin, while one-third drains to Hudson Bay via the Big Fork River and Red River of the North.

Nineteen sites among sixteen streams in the Chippewa National Forest were surveyed for mussels. We used snorkeling equipment and water scopes to find mussels at each site. All mussels were identified and tallied at each site. Live mussels were returned to the collection site and dead shells were deposited at the Bell Museum of Natural History.

Seven species of live mussels were collected during the survey. The three most commonly observed species (in order of abundance) were fatmucket (*Lampsilis siliquoidea*), cylindrical papershell (*Anodontoides ferussacianus*), and giant floater (*Pyganodon grandis*). A few creek heelsplitter (*Lasmigona compressa*), pocketbook (*Lampsilis cardium*), white heelsplitter (*Lasmigona complanata complanata*), and paper pondshell (*Utterbackia imbecillis*) were also observed. Black sandshell (*Ligumia recta*) and flutedshell (*Lasmigona costata*) were collected as empty valves. Black sandshell, creek heelsplitter, and flutedshell are special concern species in Minnesota.

Of particular interest was the observation of two little known species from the Rainy River basin. A pair of flutedshell valves were collected at Rice River. This is only the second time flutedshell has been collected from the Rainy River basin. The other specimen was collected in 1997 from South Fork Coon Creek (Hove *et al.* 1997). We also collected paper pondshell in a tributary to Jessie Lake. Prior to this survey the paper pondshell was only known from literature records and Bell Museum vouchers collected from two locations on the Bowstring River (Graf 1997, Hove *et al.* 1997).

Literature Cited

Graf, D. L. 1997. Distribution of unionoid (Bivalvia) faunas in Minnesota, USA. The Nautilus 110(2): 45-54.

Hove, M., S. Strong, A. Jacobson, J. Schussler, and V. Kurth. 1997. Northern Minnesota river holds three state-listed mussels. Triannual Unionid Report. Report No. 13, p. 22.

Waters, T. F. 1977. The streams and rivers of Minnesota. University of Minnesota Press, Minneapolis, MN. 373 pp.

Figure 1. Specimen from upper Saint Croix River.

# Range extension of the federally endangered winged mapleleaf: valves collected from upper Saint Croix River, Minnesota

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Work conducted this summer extends the range of the winged mapleleaf, *Quadrula fragosa* (Conrad, 1835), to the upper St. Croix River. The historic distribution of the species included much of the upper Mississippi River basin including 34 rivers across 12 states (U.S. Fish and Wildlife Service 1997). Since the 1920's the community has declined drastically to where only two small populations of winged mapleleaf are now known, one in the Ouachita River, Arkansas (Posey *et al.* 1996), and the last known reproducing population in the St. Croix River, Wisconsin (Hornbach *et al.* 1996). Recent surveys reported the presence of the species only in the lower St. Croix River.

This summer three winged mapleleaf valves were collected at Wild River State Park, Minnesota. Two pairs of valves were collected during a mussel relocation study. One pair is worn and old, the other is less eroded and may have been deposited more recently. To determine if live winged mapleleaf occurred nearby the U. S. Fish and Wildlife Service funded a small survey of the area. We surveyed ten sites within one mile of Wild River State Park with SCUBA. At each site a 15 minute timed search for all live mussels was conducted followed by a 90 minute search for live or dead winged mapleleaf. During the survey an additional subfossil winged mapleleaf valve was collected at the location where the first two valves were found. Unfortunately no live winged mapleleaf were observed. We are seeking additional species identification confirmation for the three valves.

During the survey we also collected an unusual purple wartyback (*Cyclonaias tuberculata*) with flutings along its dorsal and much of its posterior margin. Images of the animal are available on a link to our web page (http://www.macalstr.edu/~hornbach/). We are interested in learning if this phenotype is common or not. Please visit the web sight and share your experience.

It is difficult to ascertain the cause(s) for the status of winged mapleleaf in this portion of the river. The mussel community at Wild River State Park is diverse and robust. Some thought should be given to the suitability of this habitat if it is to be considered as a relocation site for winged mapleleaf.

Funding for the project came from the U.S. Fish & Wildlife Service, and Minnesota Legislature,1999 Minnesota Laws, Ch. 231, Sec. 16, Subd. 15b as recommended by the Legislative Commission on Minnesota Resources from the Minnesota Environmental Trust Fund. We thank Lisie Kitchell for assistance in the field.

Literature Cited

Hornbach, D. J., J. G. March, T. Deneka, N. H. Troelstrup, and J. A. Perry. 1996. Factors influencing the distribution and abundance of the endangered winged mapleleaf *Quadrula fragosa* in the St. Croix River, Minnesota and Wisconsin. American Midland Naturalist 136(2): 278-286.

Posey, W. R., J. L. Harris, and G. L. Harp. 1996. New distribution records for freshwater mussels in the Ouachita River, Arkansas. Proceedings Arkansas Academy of Science 50: 96-98.

U.S. Fish and Wildlife Service. 1997. Winged Mapleleaf Mussel (*Quadrula fragosa*) Recovery Plan. Ft. Snelling, Minnesota.

## Quantitative long-term monitoring of freshwater mussel species in the Clinch and Powell rivers of eastern Tennessee and southwestern Virginia

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The Clinch and Powell rivers have been sampled for mussels quantitatively ($0.25m^2$ quadrats) every five years at fixed sites established in 1979. Sites chosen as fixed sites were based on the presence of federally listed endangered species and Cumberlandian endemics. Both rivers were re-sampled in July and August, 1999. Fourteen sites were sampled in the Clinch and 18 sites were sampled in the Powell. In addition, timed qualitative searches were conducted to document mussel species not collected quantitatively. The last qualitative sample was done in 1979 in conjuction with quantitative sampling. This study is providing much needed long-term information for respective state agencies on mussel distributions, recruitment, and/or declines in the fauna over time. The present documentation of federally listed species is important for obtaining gravid specimens for mussel restoration efforts. Live federally listed species were reported as follows: *Cyprogenia stegaria, Dromus dromas, Epioblasma capsaeformis, E. brevidens, Fusconaia cor, F. cuneolus, Hemistena lata, Lemiox rimosus, Pleurobema plenum, Quadrula intermedia, and Q. sparsa*. Mussel reproduction on the Tennessee side of the Clinch River is subtantial for both common and some federally listed species. Of concern is the decline of *F. cuneolus* which was relatively abundant in the Clinch (1980s) in both Tennessee and Virginia. In general, mussel recruitment on the Virginia side of the Clinch was noted at a few sites and mussels were totally eliminated from the river at Cedar Bluff, Virginia, following a tanker spill in September 1998. Cedar Bluff was the only location in the mainstem Clinch that had populations of *Epioblasma walkeri* and *Villosa perpurpurea* (1994 survey). At least 6-miles of the river were killed downstream from Cedar Bluff. The mussel fauna in the Powell River continues to decline with recruitment being limited to three of the most common species *Actinonaias ligamentina, A. pectorosa*, and *Medionidus conradicus*. Recent dead specimens of *Fusconaia subrotunda* were found in the river and large deposits of coal fines, sand, and silt were observed everywhere.

Another project connected to the Clinch and Powell mussel study was the collection of mussel mantel tissue. To date, mantle clips were obtained from 31 species from the Clinch and Powell rivers. Mantle tissue from an additional 21 species have also been obtained from mussels in the Big South Fork Cumberland and Duck rivers. The purpose for obtaining mantle tissue is to get a genetic DNA print for each species. This will help to resolve taxonomic confusion between species. Some examples of this are: *Epioblasma capsaeformis* (Clinch)/ *E. walkeri* (Indian Creek), *E. capsaeformis/E. walkeri* (Big South Fork Cumberland?), *E. capsaeformis* (Clinch)/*E. capsaeformis* (Duck); *Quadrula sparsa* (Powell)/*Q. metanevra* (Tennessee River); *Villosa perpurpurea* (Indian Creek)/*V. trabalis* (Big South Fork Cumberland). All mantle tissue clips have been sent to Dr. Charles Lydeard at the University of Alabama for DNA sequencing.

Spiny riversnails (*Io fluvialis*) reintroduced into the Holston and French Broad rivers over the last four years are surviving and dispersing in both rivers. It is becomming increasingly harder to

locate them because of flows and vegetation. However, the snails in the Holston appear in great condition and are adding shell growth. Spiny riversnails in the French Broad are becomming more eroded on some specimens while others show no effects of erosion. In September, 1999, an additional 400 specimens were translocated from the Clinch to both rivers. Snail reintroductions will continue for at least an additional two years.

Pleurocerid riversnails of four common species were translocated from the Nolichucky River the last four years into the Pigeon River. No live pleurocerid snails remain on the Tennessee side of the Pigeon River because of past pollution problems associated with the Champion International paper plant located in North Carolina. Because of pollution abatement, fish and aquatic insects are beginning to recolonize the river. Snails that have been translocated into the Pigeon River are surviving but no reproduction has been noted thus far. If snails successfully reproduce, native mussels will be reintroduced into the river.

Funding for all these projects is being provided by Dick Biggins, USFWS; Michael Turner, Corp of Engineers; and David McKinney, Tennessee Wildlife Resources Agency.

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New Publication

Johnson, R. I. 1999. Unionidae of the Rio Grande (Rio Bravo del Norte) System of Texas and Mexico. Occasional Papers on Mollusks 6 (77): 1-65, pls. 1-7, map (August)

also:

Taxa omitted from "Unionacea" by Fritz Haas, 1969. p. 66

ABSTRACT. The Rio Grande Subprovince is redefined as being limited to the Rio Grande System of Texas and Mexico. Fifteen species of Unionidae occur there. *Quadrula couchiana* (Lea), the recently described *Disconaias conchos* Taylor, and *Potamilis metnecktayi* Johnson, bring the total number of endemic Unionidae to three. *Truncilla macrodon* (Lea), formerly regarded as endemic, is placed in the synonymy of *T. donaciformis* (Lea). Of the twelve species that occur north of the Rio Grande, only two, *Popenaias popei* (Lea) and *Cyrtonaias tampicoensis* (Lea), also occur in the Mexican Gulf Coastal Region.

# Lake Champlain native mussels listed in Vermont

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The infestation of zebra mussels (*Dreissena polymorpha*) in Lake Champlain has severely impacted the native unionids associated with the lake. Of the fourteen species of native mussels found in the Lake Champlain drainage, seven are particularly vulnerable to the invasive zebra mussels. To promote and protect these imperiled native mussels the Vermont Agency of Natural Resources has successfully listed seven of the native unionids as Endangered or Threatened. The listings are as follows:

| SCIENTIFIC NAME | COMMON NAME | STATUS |
|---|---|---|
| *Pyganodon grandis* | giant floater | Threatened |
| *Lampsilis ovata* | pocketbook | Endangered |
| *Ligumia recta* | black sandshell | Endangered |
| *Leptodea fragilis* | fragile papershell | Endangered |
| *Potamilus alatus* | pink heelspliter | Endangered |
| *Lasmigona costata* | fluted shell | Endangered |
| *Anodontoides ferussacianus* | cylindrical papershell | Endangered |

# 1999 Mississippi River Research Consortium abstracts

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The following abstracts were selected from presentations made at the 31st annual meeting of the Mississippi River Research Consortium (22-23 April 1999). The next meeting will take place on April 13 and 14, 2000 at the Radisson Hotel in La Crosse, Wisconsin. Additional information is available on the consortium's web site (http://www.emtc.usgs.gov/mrrc.html).

## FISH PREDATION EFFECTS ON ZEBRA MUSSEL (*DREISSENA POLYMORPHA*) COLONIZATION IN POOL 8 OF THE UPPER MISSISSIPPI RIVER.

**Michelle R. Bartsch**, Lynn A. Bartsch, and Steve Gutreuter.
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We assessed the effects of fish predation on zebra mussel colonization in Navigation Pool 8 of the Upper Mississippi River (UMR), from May 13 to October 5, 1998. Concrete block samplers were deployed at 18 randomly chosen sites in the main channel border, with six sites in the upper, middle, and lower reaches of the pool. Two blocks were deployed at each site, one of which was enclosed in a cage; the other block was uncaged. At the end of the 145-d colonization period, zebra mussels were found at all sites. Densities (number/$m^2$) of zebra mussels were higher on caged blocks than uncaged blocks ($P < 0.01$). However, the magnitude of these differences was affected by pool reach ($P < 0.01$). Mean mussel density was reduced by 76, 98, and 38% in the upper, middle, and lower pool reaches, respectively. Similarly, biomass (g dry wt/$m^2$) of zebra mussels was higher on caged blocks than uncaged blocks ($P = 0.04$), but no reach effect was detected ($P = 0.48$). Mean mussel biomass on uncaged blocks, relative to caged blocks, was reduced by 66% pool-wide. Zebra mussels were consumed by at least five fish species (redhorse suckers, *Moxostoma* spp.; common carp, *Cyprinus carpio*; bluegill, *Lepomis macrochirus*; quillback carpsucker, *Carpiodes cyprinus*; flathead catfish, *Pylodictis olivaris*) in Pool 8 of the UMR. Fish were electroshocked at or near the sites where blocks were located, during three sampling periods (June 15-July 31, August 1-September 14, September 15-October 31), and their gut contents were qualitatively examined for the presence of zebra mussel shell fragments. Gut analysis was performed on a total of 154 fish, 91 of which contained shell fragments. Of the fish species with zebra mussels in their gut, the highest frequencies of predation were from redhorse suckers (59%) and common carp (35%). Our preliminary results suggest that fish predation may already be having an effect on zebra mussel demographics in Pool 8 of the UMR.

Keywords: zebra mussel, Upper Mississippi River, predator exclusion cage, density

## LONGITUDINAL PATTERNS ON INVERTEBRATE PRODUCTION (*DREISSENA POLYMORPHA*) IN THE UPPER MISSISSIPPI RIVER.

**Sarah E. Curl, Myra L. Kunas**, and Michael D. Delong.
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Navigational dams have created dramatic changes in the flow patterns of the upper Mississippi River. Within each reach of the river, there are now three separate hydrological patterns: high

velocity (just below a dam), normal velocity (middle of reach), and low velocity (just before dam). The purpose of this study was to assess the effect of location in a navigation reach on secondary production of a benthic invertebrate. Four rock samples were hand-collected from below dam, middle reach, and above dam locations in reaches 5 and 6. Samples were bagged and preserved in 70% ethanol for later processing. Zebra mussels were removed from rocks and separated into 2-mm size classes. Rocks were measured for determination of surface area. Secondary production was estimated using the instantaneous growth method. Size-class specific growth rates were determined using growth rates of mussels attached to clay tiles (refer to poster by Doyle *et al.*). New cohorts began to appear in late July and continued to be evident through the completion of the study in late October. Differences were evident in secondary production, with production highest in the middle areas of the reaches.

Keywords: navigation, secondary production, Mississippi River, zebra mussel, *Dreissena polymorpha*

## FRESHWATER MUSSEL - FISH INTERACTIONS IN THE SUPERIOR NATIONAL FOREST AND CANNON RIVER WATERSHED, MINNESOTA.

**Stacy DeRuiter.**
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Freshwater mussels (Unionoidea) are an important group of aquatic environmental indicator species. Their value as indicators has generated significant interest in the factors affecting mussel distribution and abundance. I investigated the effect of one such factor, fish distribution, on the mussel faunas of ten lakes in the Superior National Forest (SNF) (near Ely, MN) and the Cannon River watershed (south-central MN). Mussel larvae, or glochidia, are obligate parasites on specific host fishes, and mussels cannot reproduce unless their fish hosts are present. I compared mussel distribution data from summer 1998 and summer 1987 with DNR records of fish distributions for the same sites. My analysis showed that host fish distributions did not influence mussel distributions in the SNF lakes. In the Cannon River watershed, however, my results suggest that distribution of the pink heelsplitter (*Potamilus alatus*) was limited by distribution of its host fish, the freshwater drum (*Aplodinotus grunniens*).

Keywords: Unionids, mussel distribution, fish distribution, *Potamilus alatus*, *Aplodinotus grunniens*

## A COMPARISON OF STREAM SEGMENT AND QUADRAT MUSSEL SAMPLING TECHNIQUES.

**Timothy L. Dickson.**
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The importance of freshwater mussels in river ecosystem dynamics and as environmental indicators and endangered species is well recognized. Well designed, rapid methods of sampling mussels are needed. We tested the more traditional method of 1 $m^2$ quadrat searches against 10 m long bank-to-bank searches. Using data collected during the summer from local streams we calculated how well the two sampling techniques measured mussel density, mussel richness (total number of species present), and mussel aggregation. We found that quadrats required more samples for a particular

level of precision in density estimates than did 10m searches, however 10m searches may still be more time-consuming. A better estimate of species richness is provided by 10m searches, and 10m searches also tended to detect uniform distributions, while quadrats tended to detect clumped distributions within the same population. Ten meter long bank-to-bank searches appear to be a viable alternative to quadrat sampling.

Keywords: Unionids, sampling, quadrat, stream-segment, richness

## LOCATION-SPECIFIC EFFECTS ON GROWTH OF ZEBRA MUSSELS IN THE UPPER MISSISSIPPI RIVER.

**Timothy B. Doyle, Kristen M. Mack**, and Michael D. Delong.
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Navigational dams have created dramatic changes in the flow patterns of the upper Mississippi River. Within each reach of the river, there are now three separate hydrological patterns: high velocity (just below a dam), normal velocity (middle of reach), and low velocity (just before dam). Since zebra mussels rely, to a degree, on food that passes by them, water velocity may play an important role in the growth of zebra mussels. The purpose of this study was to assess the effect of location in navigational reaches on the growth rate of zebra mussels in the upper Mississippi River. A total of 36 tiles were deployed into Reaches 5 and 6 of the upper Mississippi River, with 6 tiles being placed in each section (top, middle, bottom) of a reach. The tiles were set at a depth of 2-m, with a weight holding them down while a float showed their position. A total of 16 zebra mussels from 4 different size classes (covering a range of 4-30 mm total length) were initially glued to specific sites on the tiles. The length and location of these mussels were recorded monthly. Location on a tile and total length were also recorded for any zebra mussels that colonized tiles during the 6 months of sampling. Preliminary results indicate that growth rates were highest for zebra mussels less than 10 mm. As the size classes got larger, the growth rates of zebra mussels declined, with increasing size producing an inverse relationship between size class and growth rate. Preliminary results also indicate that the overall growth rates of the zebra mussel were the highest in the bottom of the reaches, followed by middle and then top. Conclusions from this study demonstrate that there is evidence of a location effect on the primary growth rates of zebra mussels in reaches 5 and 6 of the upper Mississippi River.

Keywords: navigation, growth, Mississippi River, zebra mussel, *Dreissena polymorpha*

## TEMPORAL VARIATION OF GLYCOGEN IN TWO POPULATIONS OF *AMBLEMA PLICATA PLICATA*: RIVERINE AND RELOCATED.

**Emy M. Monroe** and Teresa J. Naimo.
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Glycogen has been shown to be an indicator of stress in unionids, yet little is known about temporal variation of glycogen in mussels. We measured glycogen in foot and mantle tissue of *Amblema plicata plicata* (Say, 1817) about monthly for 2 years in two groups of mussels. The first group was sampled directly for the Upper Mississippi River (riverine) and the second group was removed from

the River and placed into an artificial pond for 20 months (relocated) before analysis. In both groups, glycogen concentrations in foot and mantle tissue (mg/g dry weight) varied substantially over time. However, fluctuation in glycogen was greatest in the riverine mussels, where glycogen varied 72% in mantle (182 to 660 mg/g) and 52% in foot (87 to 181 mg/g) tissue within a given year. Conversely, in the relocated group, glycogen concentrations in both tissues declined by about 50% in the first two months after relocation but varied little thereafter. In addition, we observed tissue-specific differences in glycogen in the riverine group, but not in the relocated group. Peak concentrations of glycogen in mantle tissue from the riverine group differed considerably between years. The substantial temporal variation in glycogen in the riverine mussels probably paralleled periods of reproductive activity in this short-term brooder, whereas the variation in the relocated mussels likely resulted from the initial stress associated with relocation. These data suggest that the energetic status of relocated unionids is substantially altered and does not appear to recover for up to 20 months after relocation.

Keywords: Unionids, glycogen, Mississippi River, *Amblema plicata plicata*, relocation

## FINGERNAIL CLAM (SPHAERIIDAE) DENSITIES AND DIVING DUCK USE IN THE UPPER MISSISSIPPI RIVER LOWER POOL 8.

Randy Burkhardt[1], **Jennifer S. Sauer**[1], Lara Hill[2], and Shawn Weick[1].
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Fingernail clam densities in Mississippi River Lower Pool 8 have been relatively low from 1992-1997 (0-211.5 $m^{-2}$; data collected by the Long Term Resource Monitoring Program). However, data collected from fall/winter sampling in lower Pool 8 indicated that fingernail clam densities significantly ($P<0.05$) increased during 1998, reaching densities as high as 8,519 $m^{-2}$. More importantly for diving ducks, these clams were available as a food source during the 1998 fall migration. In mid-November of 1997, diving duck counts on Pool 8 were low (total=710; data collected by the U.S. Fish and Wildlife Service). With the increase of fingernail clams, diving duck total counts increased to 45,420 in Pool 8 during mid-November of 1998. The direct cause of the increase in fingernail clam densities is not completely understood. Recent findings however, suggest that flow and water depth may play an important role in determining fingernail clam location and densities, but we need to further verify the causal relationships.

Keywords: fingernail clam, diving duck, Mississippi River, macroinvertebrate, *Musculium transversum*

## EFFECTS OF DREDGE MATERIAL PLACEMENT ON MACROINVERTEBRATE COMMUNITIES.

**Kip E. Stevenson**, Todd M. Koel, and K. Douglas Blodgett.
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The U.S. Army Corps of Engineers Rock Island District is responsible for the operation and maintenance of a 9-foot-deep navigation channel on the Illinois River (RM 80.0-327.0). Maintenance often requires removal of accumulated sediments; hydraulic dredging is often used with bankline placement of dredged material. Impacts of this dredged material on benthic

macroinvertebrate communities is not well documented or understood. The major purpose of this study was to determine if there were differences in benthic macroinvertebrate abundances between sites which had received dredged material placement and those which had not. We sampled benthic macroinvertebrate communities in main channel borders of La Grange Reach of the Illinois River to compare densities (organisms/$m^2$) between (1) sites that had received dredged material placement and those that had not, and (2) among sites that had received dredged material placement in different years. We also compared macroinvertebrate densities on different substrates. During May/June 1997 we used a stratified random design to sample 161 sites, collecting three ponar grabs at each site. Sites were stratified by the year they had last received dredged material placement (i.e., 1996, 1995, 1994, 1984-1992, 1941-1969, or never). Overall densities of target macroinvertebrates (mayflies, midges, fingernail clams, Asiatic clams, zebra mussels, and other) were low (1.97/$m^2$), probably because many insect larvae had already emerged and recruitment had not yet taken place. During November 1997 we used a similar stratified random design to collect 15 ponar grabs at each of 35 sites, and we identified and enumerated target macroinvertebrates (mayflies, midges, fingernail clams, Asiatic clams, zebra mussels, dragonflies, unionid mussels, snails, and other). These sites had received dredged material placement in 1997 (P97 sites), 1996 (P96 sites), or never (NP sites). Mean densities of all target organisms combined were higher in November samples than they were in the May/June samples (5.21/$m^2$ versus 1.07/$m^2$). During our field collections we classified sampled substrates into one of four substrate classes (silt/clay, silt/clay with sand, sand with silt/clay, and sand) by visual inspection and touch, and we compared densities of target macroinvertebrates among the four classes. Overall, densities of most target organisms were higher in silt/clay substrates than they were in those identified as containing significant proportions of sand (silt/clay with sand, sand with silt/clay, and sand).

Keywords: Illinois River, macroinvertebrate, dredged material, substrate, ponar grab

## MUSSEL DISTRIBUTION AND ABUNDANCE IN THE CANNON RIVER WATERSHED AND SUPERIOR NATIONAL FOREST, MINNESOTA.

**Gary E. Wagenbach** [1], M.C. Swift [2], Stacy DeRuiter [2], Timothy L. Dickson [2], C. Harbison [1], and G. Jesperson [1]. [1] Biology Department, Carleton College, Northfield, MN 55057; [2] Biology Department, St. Olaf College, Northfield, MN 55057.

We studied the distribution and abundance of mussels in the Cannon River (4 sites) and its tributaries (5 sites) and in 10 lakes in the Range River watershed in Superior National Forest. In the Cannon River we found 12 species (12 and 8 at trunk and tributary stations, respectively). The most commonly encountered species was *Lasmigona complanata* (11 stations) followed by *Pyganodon grandis* (8), *Lampsilis siliquoidea* (7), and *Potamilus alatus* (6). We also collected *Anodontoides ferussacianus* (6), *Lasmigona compressa* (5), *Elliptio dilatata* (4), *Liqumia recta* (3), *Actinonaias carinata* (2), *Pleurobema sintoxia* (2), *Lampsilis cardium* (1), and *Strophitus undulatus* (1). Individual trunk stations had higher species richness (9, 7, and 6 species) than tributary stations (6 or fewer species). Distribution and abundance were not clearly related to physical or chemical parameters in the Cannon River watershed. In lakes in the Range River watershed we found two species (*P. grandis*, 8 lakes; *Utterbackia imbecilis*, 2 lakes). Both species were found in two lakes. Abundance varied tremendously among lakes and appeared to be related to the availability of appropriate habitat and the effects of poisoning prior to trout stocking. The distribution of *Utterbackia* may be related to historical fish stocking.

Keywords: Unionid, Cannon River, Superior National Forest, lakes, abundance