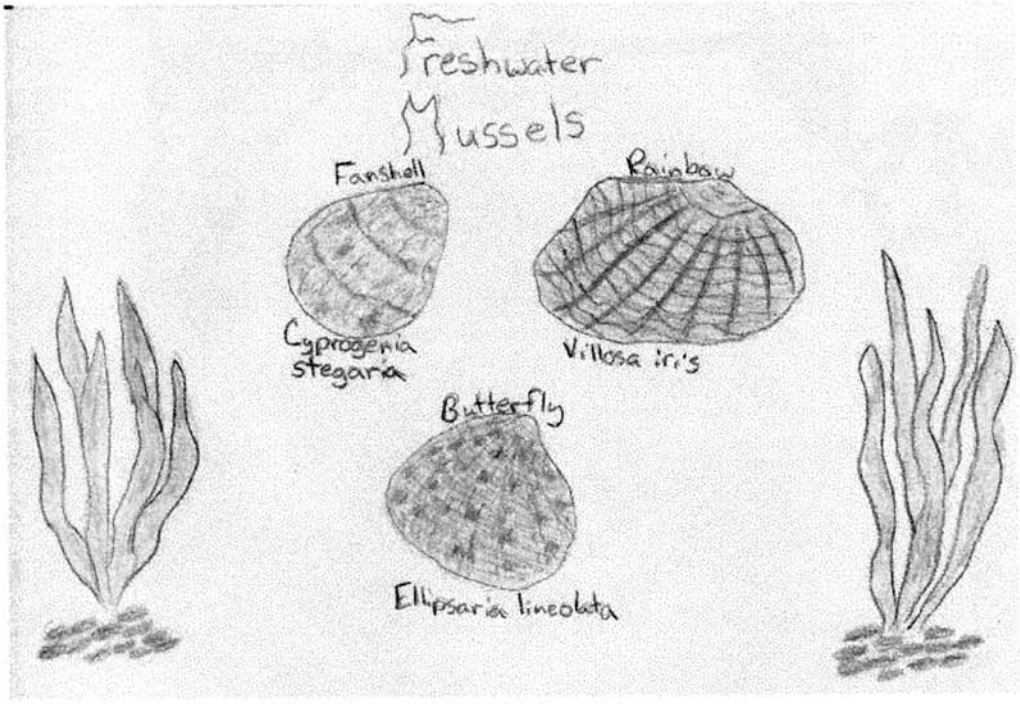
TRIANNUAL UNIONID REPORT

Report No. 19

March 2000

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 CHELSEA RATZLAFF, FAIRVIEW, NORTH CAROLINA

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MARCH 2000

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Freshwater Mollusk Conservation Society

An open letter to the subscribers of the
Tri-Annual Unionid Report

February 25, 2000

Dear Mollusk Enthusiasts,

You hold in your hands the final issue of the Tri-Annual Unionid Report (TUR) published by the Asheville Field Office of the USFWS. This report will shortly change form and venues, and will become integrated into *Ellipsaria*, the newsletter of the Freshwater Mollusk Conservation Society (FMCS).

This venue change is being made for several reasons. Foremost, Dick Biggins, who created and has edited this report for the last 7 years, is making preparations to retire in a few years. However, before Dick retires, he wants to establish a similar report for imperiled southeastern freshwater fishes. Since its inception, the TUR report has become a valuable tool to many investigators working in the field of freshwater mussel conservation. Many have come to rely on the report as a vehicle for the dissemination of general news and announcing important preliminary research results or newly published scientific literature. By becoming part of *Ellipsaria*, this insures the continuation of the TUR, and the newsletter format of *Ellipsaria* will allow for the inclusion of other important information related to freshwater mollusk conservation.

As a result of this change in venues, only members of the FMCS will receive future issues of the newsletter. In the past, Dick has been able to allocate USFWS monies used specifically for outreach projects to cover the costs of producing the TUR. Because these monies will not be available to the FMCS, the society must recover their expenses for publishing and mailing the newsletter. If you wish to become a member of the FMCS and receive future copies of the newsletter, a membership form is attached. As an FMCS member you will also receive a discount in the registration fees for society symposia and workshops, and publications in addition to the newsletter.

On behalf of the FMCS, I would like to express our sincere thanks to Dick for his many tireless efforts to promote and support freshwater mussel conservation. The shaping of the plight of freshwater mussels into an important conservation issue, is in no small part due to his many efforts. All of us in this field owe him many thanks.

Happy Fishing Dick,

Paul Johnson

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President-elect
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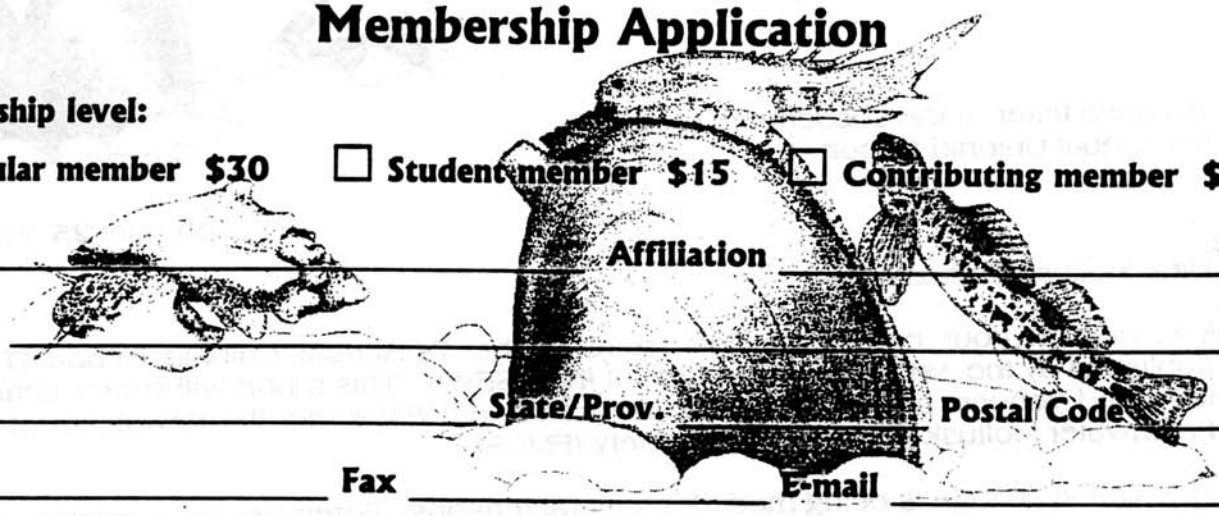
Freshwater Mollusk Conservation Society

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

Membership Application



Membership level:

☐ **Regular member $30** ☐ **Student member $15** ☐ **Contributing member $125**

Name _____ **Affiliation** _____

Address _____

City _____ **State/Prov.** _____ **Postal Code** _____

Phone _____ **Fax** _____ **E-mail** _____

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Information for FMCS Membership Directory

Education:

Bachelor's ☐, **Master's** ☐, **Doctorate** ☐, **Other** ☐

Taxa Group:

Unionids ☐, **Gastropods** ☐, **Sphaeriids** ☐

Primary area(s) of interest (please check all that apply):

Environmental impact/ assessment	____	Toxicology / bioassay	____	Commercial	____
Power plant / industrial impact	____	Taxonomy / systematics	____	Zoogeography	____
Statistics / computer science	____	Education / Outreach	____	Regulation	____
Propagation / translocation	____	Endangered species	____	Ecology/life history	____

Our standing committees need your help! If you would be willing to assist with one or more of the following committees, we would like to hear from you! (please check all that apply):

____ Guidelines & Techniques	____ Outreach / Education	____ Water quality / Habitat / Zebra
____ Status / Distribution of Unionids	____ Information exchange	____ Commercial
____ Status / Distribution of Gastropods	____ Restoration / Propagation	____ Symposium

Additional copies of this form are available online at http://www.sari.org/FMCS_Membership_Form.htm

FRESHWATER MUSSELS IN THE NATIONAL MOLLUSC COLLECTION OF THE HEBREW UNIVERSITY IN JERUSALEM
1. THE GENUS *MICROCONDYLAEA*

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The genus *Microcondylaea* von Vest, 1866 contains only a single living species: *Microcondylaea compressa* (Menke, 1828) (Haas, 1969). Due to its variability this rare mussel species has received a number of different names, which have been enumerated by Haas (1940 and Alzona, 1971).

Microcondylaea compressa was known only from watersystems flowing into the northern and eastern Adriatic Sea i.e. northern Italy, former Yugoslavia and Albania (Alzona, 1971; Bole, 1992; Dhora & Welter-Schultes, 1996; Falkner, 1990; von Gallenstein, 1894; Haas, 1940; Jaeckel et al., 1957 and Modell, 1951 & 1964). Due to changes in the natural habitats and ever increasing pressure caused by pollution, it has disappeared over much of that range.

It is now considered an endangered species in Europe and features as such on the list approved by the Convention of Bern.

Recently some viable populations within its former range of distribution have been rediscovered in northern Italy (Nagel & Hoffmeister, 1986) and Croatia (Fischer, 1999). Has this to be considered an indication that there is still some hope for its survival?

The National Mollusc Collection at the Hebrew University of Jerusalem contains seven samples of *Microcondylaea compressa.* They are enumerated here in the hope that the locality data may throw some light on the past and present distribution of this interesting species.

Microcondylaea compressa (Menke, 1828)

ITALY: Veneto, ex Coen-5090 (HUJ 7942/2); Tricerro, Vercellese, leg. A. Viglino, ex Coen-10717 (HUJ 7943/2); mouth of a stream near Feriolo, Lago Maggiore, leg. G.S. Coen, ex Coen 5092 (HUJ 7945/1); Fontanellaso, Parma, ex Coen 5091 (HUJ 7946/1); Lago di Garda, leg. G.S. Coen, ex Coen 9019 (HUJ 7947/2); Fonte, ex Coen 5093 (HUJ 7948/2); Piemote, rice fields near Vercelli, leg. L.A.W.C. Venmans (HUJ 7944/1 + loose valve).

All localities are situated within the known range of distribution of this mussel, except for Feriolo on the western shore of the Lago Maggiore. This seems to be an unrecorded locality and extend its Italian range in a more western direction.

Both valves of the specimen from Feriolo show two medium sized blisterpearls and several smaller ones.

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FRESHWATER MUSSELS IN THE NATIONAL MOLLUSC COLLECTION OF THE HEBREW UNIVERSITY IN JERUSALEM
2. THE GENUS *MARGARITIFERA*

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The genus *Margaritifera* Schumacher, 1816 is confined in its distribution to boreal and temperate areas of the northern hemisphere. Representatives are found in both the Old and New World. An excellent example for this distribution pattern is formed by *Margaritifera margaritifera* s.l., which ranges from the eastcoast of North America, throughout Eurasia to as far as northern Japan. Only a handful of recent species are known of which four are living in North America.

In Europe only one species occurs: *Margaritifera margaritifera* (Linnaeus, 1758), the type of the genus. Once it occurred over fast areas in North and Central Europe, but in the second half of the 20th Century its range has declined rapidly due to increasing pollution and changes in the habitat: drainage of wetlands, building of dams, canalization of brooks and rivers (Bauer, 1979, Killeen et al., 1998 and Valovirta, 1998). It is not clear whether over collecting by pearlfishers has also played a role in the local disappearance of the freshwater pearlshell in Europe. In each case the situation in Europe seems to detoriate rapidly and many of the existing populations consist of non-reproducing gerontic specimens only.

Margaritifera margaritifera has been declared a protected species in Europe by the Convention of Bern. Hopefully national and international campaigns to protect and extend living European populations of *Maragaritifera margaritifera* like the one going on in the triangle: Bohemia-Bavaria-Saxony and described in a beautifully executed booklet (Anonymous, 1996), and elsewhere (Chesney & Oliver, 1998 and Costello et al., 1998) will show some results in the near future.

The situation in North America seems somewhat better, however, at least one of the endemic species: the Louisiana Pearlshell - *Margaritifera hembeli* (Conrad, 1838) is declared a threatened species by the U.S. Fish and Wildlife Service.

The National Mollusc Collection of the Hebrew University in Jerusalem contains 21 samples of *Margaritifera* belonging to two species. All the sample are enumerated here.

Margaritifera falcata (Gould, 1850)
CANADA: British Columbia, ex-Coen 10718 (HUJ 8016/1).

NORTH AMERICA: ex J.E. Cooper/Blok 927A (HUJ 8032/1).
U.S.A.: Connecticut, Trading Cove Brook, Montville (HUJ 8029/3).
IRELAND: Co. Wicklow, Portland, ex-Wintle/Blok (HUJ 8021/1); Co. Cork, near Glengarriff, ex-Wintle/Blok (HUJ 8026/2); Co. Cork, River Clodagh, ex-Wintle/Blok (HUJ 8028/1); Co. Laoighis (formerly Queen's) River Nore near Durrow, leg. R.A. Phillips, 8 October 1926, ex-Wintle/Blok (HUJ 40660/1 - syntype of *Margaritifera durrovensis* Phillips, 1928); idem, leg. T. Pain, ex-Blok 11413 (HUJ 8027/2).
SCOTLAND: Co. Perth, River Tay, ex-Wintle & Dalgleish/Blok (HUJ 8020/1 and 17 loose pearls).
ENGLAND: ex-Coen 9741 (HUJ 8011/1); ex-Wintle/Blok (HUJ 8017/1 - one valve figured in Phillips, 1928: plt. 4, fig. 2); ex-Wintle/Blok (HUJ 8018/1 + 2 loose valves); Herefordshire, Hereford, River Wye, ex-Coen 9739A (HUJ 8012/1); idem, ex-Coen 9740 (HUJ 8013/1); idem, leg. A.E. Boycott, ex-Blok (HUJ 8024/1); Yorkshire, River Calder, ex-Wintle/Blok (HUJ 8019/1); Lancashire, River Lune near the railway bridge, Caton, leg. F. Taylor, 12 July 1913, ex-Blok 9727 (HUJ 8025/2); Conan, leg. J.G. Dalgleish, ex-Blok (HUJ 8023/2).
SWEDEN: Norrbotten, Pärlälven, Jokkmokk, leg. N.H. Odhner, ex-Coen 9739B (HUJ 8014/loosevalve); Öster Götland, Bulsjö-å, Silversvärd, ex-Museum Stockholm/Coen 9739C (HUJ 8015/2).
AUSTRIA: Upper Austria, Grosse Mühl, leg. Kaüfel (HUJ 8022/1).

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MORE TYPE MATERIAL OF FRESHWATER MUSSELS IN THE COLLECTION OF THE HEBREW UNIVERSITY OF JERUSALEM

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A check of freshwater mussels from Italian localities and preserved in the National Mollusc Collection of the Hebrew University of Jerusalem revealed the presence of yet an other type sample of an Unionid species in the former Arthur Blok-collection. Although the sample is mentioned in his catalogue, it appears without an indication that we are dealing with type material.

The following entry may be added to those already listed by Mienis (1999 & 2000).

Family Unionidae

11. *Unio lawleyianus* Gentiluomo, 1868: 54, plt. 4, figs. 1-3.
Type locality: Italy, Lucca, San Quirico.
Type category: Syntype - HUJ 7989 (= Blok 3765 ex coll. R. Lawley).

Acknowledgement

I like to thank my colleague Robert G. Moolenbeek (Zoological Museum Amsterdam, the Netherlands) for sending me a copy of Gentiluomo's paper.

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Gentiluomo, C., 1868. Specie nuove 1. *Unio lavvleyianus* [sic!]. - Mihi. Bulletino Malacologico Italiano, 1: 54-58, plt. 4, figs. 1-3. (the specific name is spelled correctly as *lawleyianus* in the text)

Mienis, H.K., 1999. Type specimens of freshwater mussels in the collection of the Hebrew University of Jerusalem. Triannual Unionid Report, 17: 3-4.

Mienis, H.K., 2000. Additional type material of freshwater mussels in the collection of the Hebrew University of Jerusalem. Triannual Unionid Report, 19:

ADDITIONAL TYPE MATERIAL OF FRESHWATER MUSSELS IN THE COLLECTION OF THE HEBREW UNIVERSITY OF JERUSALEM

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A study of the freshwater Pearl mussels belonging to the genus *Margaritifera* Schumacher, 1816, present in the National Mollusc Collection of the Hebrew University of Jerusalem (Mienis, in prep.) revealed the presence of an additional type sample in the collection of W.J. Wintle now in the former Arthur Blok-collection. Although Blok's own collection had been fully catalogued by its former owner, some sub-units, like the private collections of J.G. Dalgleish, A.J. Peile (part), and W.J. Wintle or donations by L.Soós (part), have remained unregistered so far. Especially those of Peile and Wintle may contain some type material.

The following entry may be added to the type specimens already listed by Mienis (1999).

Family Margaritiferidae

10. *Margaritifera durrovensis* Phillips, 1928: 71, plt. 3, figs. 1 & 3, plt. 4, figs. 1 & 3.

Type locality: Ireland, Queen's County, River Nore near Durrow, leg. R.A. Phillips, 8 October 1926.

Type category: Syntype - HUJ 40660 (ex Wintle in Blok).

Additional Remark

Margaritifera durrovensis is considered by Chesney, Oliver & Davis (1993) an ecophenotype of *Margaritifera margaritifera* (Linnaeus, 1758) living in hard waters in Ireland.

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The Scaleshell *Leptodea leptodon* (Rafinesque, 1820) in the Missouri River

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The current range of the scaleshell mussel, *Leptodea leptodon* (Rafinesque, 1820), is much reduced from its historic extent. Of the 53 locales in which the scaleshell has been collected historically, the U.S. Fish and Wildlife Service (1999) reports that only 13 are believed to contain extant populations. The western-most population, located in the Missouri River on the Nebraska-South Dakota border (Hoke, 1983), was excluded from those populations considered extant, apparently based upon the later unsuccessful collection effort by Clarke (1996) at that site under high water conditions. Since the scaleshell has been reported only from one site in the Missouri River, that stream was excluded from the current range of the mussel.

In a currently unpublished survey of the mussels of the lower Missouri River between the Gavin's Point Dam and the mouth near St. Louis Missouri conducted by the writer between 1988 and 1990, a second scaleshell was recovered. The specimen, a fresh, articulated, adult male was collected from the Missouri River in Gasconaide County, Missouri in January of 1990. The identification of this specimen was confirmed by Dr. David H. Stansbery, Museum of Biological Diversity, Ohio State University, and this as well as the earlier specimen are deposited at the Museum of Biological Diversity.

Since no live specimens were collected at either site, the habitat of the scaleshell in the Missouri River can not be directly determined, however, the habitats at the points of collection have some similarities. Both collection sites were shielded from the main current of the Missouri River, both were found along reaches with stable sand bottoms, in moderate current. This type of habitat, though uncommon in the Missouri River since its channelization, is still present in widely separated locales throughout the length of the stream. The recovery of specimens of the scaleshell at two of these locales suggests the probability that additional, though widely spaced populations, exist in the stream in similar habitats between its mouth north of St. Louis and the Gavin's Point Dam.

Though this report does extend the current range beyond that assumed in the U.S. Fish and Wildlife Service proposal, it should be emphasized that the scaleshell is extremely rare in the Missouri River, and constitutes less and perhaps much less than 0.1% of the unionids present in the stream. Further, its habitat in the river is very uncommon, and subject to development. A return to the Gasconaide County site in January, 2000 revealed that the collection site had been destroyed to create a riverfront park. In this writer's opinion, the scaleshell is an extant but very endangered component of the unionid fauna of the Missouri River.

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Recent Freshwater-mussel Surveys of the Rio Grande, Texas and Mexico

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Historically, surveys of freshwater mussels within the Rio Grande drainage have been limited. In addition to some historical collections, Neck and Metcalf (1988) discussed work in the Lower Rio Grande Valley downstream of Falcon Reservoir and Metcalf (1982) reported on both fossil and recent specimens in three tributaries. In 1992, Texas Parks and Wildlife (TPW) initiated statewide surveys for freshwater mussel status and abundance that included the Rio Grande. Additionally, Texas joined with New Mexico Department of Game and Fish specifically to survey freshwater mussel fauna of the Rio Grande (1997-2000). From these studies, Howells and Garrett (1995) reported on collections in some Mexican tributaries of the Rio Grande and Howells and Ansley (1999) discussed collections in the Big Bend area. Additional collections in 1998 and 1999 by TPW have increased the number of sample sites to over 140 in the Rio Grande and minor U.S. tributaries, 12 in the Pecos River, 9 in the Devils River, and 19 in Mexican tributaries.

Sadly, the unionid fauna of Rio Grande drainage basin appears to have declined dramatically. Among over 180 locations examined, only 15 sites (8%) contained living mussels and 23 (13%) had recently-dead or relatively-recently dead shells suggesting possible surviving populations in the area. However, 79% of the locations examined produced either long-dead or subfossil shells or fragments, or no trace of unionids at all. In addition, species diversity also appears to have been reduced.

Cyrtonaias tampicoensis maintained populations in Amistad, Falcon, and Casa Blanca reservoirs and at a number of sites in smaller reservoirs, canals, and resacas in the lower Rio Grande Valley of Texas. *Quadrula apiculata* was absent from Amistad Reservoir, but otherwise had a similar distribution. *Utterbackia imbecillis* was found alive in Lake Balmorhea in Reeves County and as recent shells from Amistad Reservoir and at sites downstream in the lower valley. *Toxolasma parvus* was taken alive on one occasion in Falcon Reservoir. Endemic *Popenaias popei* and *Potamilus salinasensis* were represented by several recently-dead shells each in the Rio Grande between Big Bend and the Pecos River, but no living specimens have been located in Texas or Mexico. Additionally, living *Potamilus purpuratus* were found in Amistad Reservoir, apparently as an introduction (Howells 1997).

No specimens of endemic *Quadrula couchiana* or *Truncilla cognata* have been found in TPW surveys and *Quincuncina mitchelli*, that occurred in the Rio Grande and in Central Texas, has also been absent. Other species reported from the Rio Grande including *Lampsilis teres, Megalonaias nervosa, Pyganodon grandis, T. texasiensis,* and *Uniomerus* spp. (Howells *et al.* 1996) have either not been found or have been represented by long-dead or subfossil shells. The absence of species like *L. teres* and *P. grandis* is particularly interesting in view of how abundant both frequently are elsewhere in Texas and the U.S.

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STATUS OF COMMERCIAL MUSSEL SHELL INDUSTRY

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In 1999, the shell market rebounded slightly from decreased harvests experienced during 1997-98. Although, Tennessee sold only 200 mussel harvester licenses, the shell harvest is expected to be around 1,300 tons with a wholesale value of approximately $1.7 million. This figure doubles the 1998 harvest of 601 tons valued at $709,000. Ebony shells *(Fusconaia ebena)* continue to dominate the harvest, due largely to their abundance and demand for small to medium sized bead producing shells. Prices averaged $0.28/lb. for 2 3/8" to $0.95/lb. for 2 3/4". The price on lake mix shells (threeridge, mapleleaf) averaged $0.58/lb. for 2 5/8" and $1.43/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. Lake quality washboards were severely under their historic value at $1.48/lb. for 3 3/4" and $1.85/lb. for 4". The large washboards (5" and up) shells brought $5.50/lb. live, $8.50/lb. open.

Given the low number of harvesters and shell prices, the 2000 shell harvest is expected to be similar to 1999. The continued 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 start a quota system to regulate the number of shellers. This would be beneficial to both the long term survival of the resource and the shell harvesters. This system was opposed by the industry because "it would limit their ability to produce containers of shell in a timely manner." Based on the opposition from the industry, and the citing a desire not to interfear with "business practices", the Tennessee Wildlife Resources Commission decided not to pursue this option.

New Publications

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Watters, G.T. & S.H. O'Dee. 1999. Glochidia of the freshwater mussel *Lampsilis* overwintering on fish hosts. *Journal of Molluscan Studies, London* 65: 453-459.

Abstract. Largemouth bass were infected with glochidia of the freshwater mussel *Lampsilis cardium*. Three fishes each were held at 4.5, 10, and 15.5 °C; five fish were held at 21 °C. By 64 days, metamorphosed juveniles were found in the 15.5 and 21 °C trials but not in the 5.5 and 10 °C trials, indicating that the lower threshold temperature for metamorphosis was between 10 and 15.5 °C for this duration. In a second experiment, largemouth bass were infected with glochidia of *L. cardium* and held at 10 °C. A sample of fishes was removed monthly and brought to 21 °C. Numbers of glochidia that metamorphosed after being warmed were compared to the number that metamorphosed without warming. The percentage that metamorphosed after warming decreased linearly with time. At one month, 100% of the glochidia metamorphosed after warming. This decreased to 80% by two months, to 30% by four months and 3% by six months. Although this post-warming percentage decreased with time, the total percentage of metamorphosed juveniles (at all temperatures) was not correlated with time. Controls kept at 21 °C required three weeks to reach peak metamorphosis, but test subjects subjected to 10 °C required less than nine days to metamorphose once warmed. Many overwintering glochidia therefore complete a portion of their development on the host at winter temperatures, but stop short of excystment. Some glochidia metamorphosed without being warmed, but this phenomenon is not understood. This study confirms that glochidia may overwinter on hosts, with some glochidia persisting for more than six months before metamorphosing when warmer conditions return.

Watters, G.T. 1999. Morphology of the conglutinate of the kidneyshell freshwater mussel, *Ptychobranchus fasciolaris. Invertebrate Biology* 118: 289-295.

Abstract. Many freshwater mussels of the family Unionidae form conglutinates, specialized packets of parasitic glochidia that often mimic host prey items. Conglutinates of the Kidneyshell, *Ptychobranchus fasciolaris*, resemble either insect larvae or fish fry. These structures, examined with light and scanning electron microscopy, are composed of three acellular layers separated by fluid or mucoidal layers. Regions of the conglutinate that appear to mimic "eyes" are shown to be particularly thin areas that readily rupture and liberate glochidia. Thus, elaboration of mimicry characteristics, such as "eyes," is accompanied by functional differentiation of regions of the conglutinate.

Recent and Forthcoming Papers on Freshwater Mussels and Other Mollusks

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

Graf, D.L. 1997. Northern redistribution of freshwater pearly mussels (Bivalvia: Unionoidea) during Wisconsin deglaciation in the southern Glacial Lake Agassiz region: a review. *American Midland Naturalist* **138**: 37-47.

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Graf, D.L. & J.C. Underhill. 1997. The western Lake Superior freshwater mussel (Bivalvia: Unionidae) community and its origin. *Occasional Papers on Mollusks* **5**(74): 409-417.

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Graf, D.L. 1998. Freshwater Pearly Mussels: Pigtoes and Ortmann's Law. *American Conchologist* **26**(2): 20-21.

Graf, D.L. 2000. The Etherioidea revisited: a phylogenetic analysis of hyriid relationships (Mollusca: Bivalvia: Paleoheterodonta: Unionoida). *Occasional Papers of the University of Michigan Museum of Zoology*, in press.

Graf, D.L. & D. Ó Foighil. 2000. The evolution of brooding characters among the freshwater pearly mussels (Mollusca: Bivalvia: Unionoidea) of North America. *Journal of Molluscan Studies*, in press.

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Graf, D.L. 2000. The Cleansing of the Augean Stables, or a Lexicon of the Nominal Species of the Pleuroceridae (Gastropoda: Prosobranchia) of Recent North America, North of Mexico. *Walkerana*, in press.

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Summary - Life History of *Lampsilis australis*

A *Lampsilis australis* specimen (61.7 mm in length) collected in July of 1998 released a superconglutinate in the FCSC laboratory between 6:30 p.m. 13 April 1999 and 1:30 p.m. 14 April 1999 (water temperature was between 20° C and 24° C). The superconglutinate was rust colored on the dorsal side, black on the ventral side and was cream colored through the center. Fecundity was volumetrically estimated between 59,760 and 122,400 glochidia for the specimen examined. SEM photographs of *Lampsilis australis* glochidia show a sub-spatulate shape with sculpturing near the hinge with fine concentric ridges. Micropoints on the flange region are arranged in incomplete vertical rows. Glochidia were reactive to NaCl and were considered viable for host fish experiments. Preliminary results indicate that largemouth bass, *Micropterus salmoides*, may serve as the host fish. After 26 days of infection, juveniles were collected on 10 May 1999. Additional host fish experiments will be conducted during spring 2001. Recent surveys conducted at approximately 320 sites between 1995 and 1999, in the Escambia, Yellow, and Choctawhatchee River drainages (Blalock et al., 1998; Blalock-Herod et al., unpublished data, Williams et al., unpublished data) limited the current distribution of *L. australis* to 28 locations (9%) within these basins.

Summary - Population Biology of *Elliptio mcmichaeli*

Shell morphology data was collected from two populations of *Elliptio mcmichaeli* within the Choctawhatchee River Drainage of Alabama and Florida. The population from the main channel of the Choctawhatchee River was significantly larger than the population collected from the Pea River (the largest tributary of the Choctawhatchee). These are baseline data collected for an endemic species. A comparison of spring and fall glycogen levels within and between *E. mcmichaeli* populations will be completed spring 2000.

New Publications

Blalock, H.N. and J.J. Herod. 1999. A comparative study of stream habitat and substrate utilized by *Corbicula fluminea* in the New River, Florida. *Florida Scientist* 62 (2):145-151.

Brim Box, J. and J. Mossa. 1999. Sediment, land use, and freshwater mussels: prospects and problems. *Journal of the North American benthological Society*. 18(1):99-117.

Lydeard, C., J.T. Garner, P.Hartfield, and J.D.Williams. 1999. Freshwater mussels in the Gulf region: Alabama. *Gulf of Mexico Science* 1999 (2):125-134.

O'Brien, C.A. and J. Brim Box. 1999. Reproductive biology and juvenile recruitment of the shinyrayed pocketbook, *Lampsilis subangulata* (Bivalvia: Unionidae) in the Gulf coastal plain. *American Midland Naturalist* 142(1) 129-140.

Williams, J.D. and A. Fradkin. 1999. *Fusconaia apalachicola*, a new species of freshwater mussel (Bivalvia: Unionidae) from pre-Columbian archaeological sites in the Apalachicola basin of Alabama, Florida, and Georgia. *Tulane Studies in Zoology and Botany* 31(1):51-62.

Lydeard, Garner, Hartfield, and Williams published a checklist of Alabama's unionids including national and state-level conservation status. The format follows Williams et al. (1992) and Turgeon et al. (1998).

Freshwater mussels in the Gulf region: Alabama. Gulf of Mexico Science 1999(2): 125-134.

Reprints can be obtained from any of the co-authors.

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A request for assistance in obtaining mussel parasites

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I am interested in hooking up with a team doing mussel survey work this summer in the east, southeast, or mid-west who would allow me to work up a few common mussel specimens for their parasites. Specifically, I would like to collect aspidogastrid trematodes, such as *Cotylaspis insignis* and *Aspidogaster conchicola*, not only for new locality data (Hendrix *et al.* 1985) but also for worm egg-laying for larvae and for DNA analysis. If you are willing to let me help collect mussels and necropsy fresh unionids for this purpose, please contact me at the address above.

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Hendrix, S. S., M. L. Vidrine, and R. H. Hartenstine. 1985. A list of records of freshwater aspidogastrids (Trematoda) and their hosts in North America. Proceedings of the Helminthological Society of Washington 52:289-296.

New Publications on Freshwater Mussels

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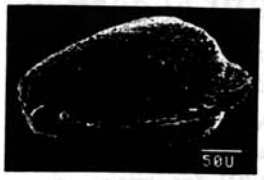
McMurray, S.E., G.A. Schuster, and B.A. Ramey. 1999. Possible decline in reproduction in a freshwater unionid (Mollusca: Bivalvia) community in the Licking River at Butler, Kentucky. *Journal of the Kentucky Academy of Science* 60(2):67-72.

Abstract: In the Licking River at Butler, Pendleton County, Kentucky, glochidia, fishes, and unionids were collected to analyze recruitment in an historically diverse unionid community. Only 14 unionid glochidia and 50 juvenile *Corbicula fluminea*, were collected with drift nets. No fishes collected had any evidence of glochidial infestation. A small percentage of the unionids collected (13.5%) had gills modified as marsupia. Sex ratios, stage of gametogenesis, and marsupial contents of two target species (*Actinonaias ligamentina* and *Elliptio dilatata*) were determined in the laboratory. *Actinonaias ligamentina* was found to exhibit a 1:1 male-to-female ratio; *E. dilatata* had a ratio statistically different from 1:1. Causal factors for this possible decline in reproduction were unclear.

McMurray, S.E., G.A. Schuster, and B.A. Ramey. 1999. Recruitment in a freshwater unionid (Mollusca: Bivalvia) community downstream of Cave Run Lake in the Licking River, Kentucky. *American Malacological Bulletin* 15(1):57-63.

Abstract: Unionids, fish, and glochidia were collected to determine why recruitment had ceased or had been dramatically decreased in a speciose unionid community in the Licking River at Moores Ferry, Kentucky, 35.4 km downstream of Cave Run Lake. Only six unionid glochidia were collected with drift nets, and only six fish collected had infestations of glochidia. A small percentage (10.1%) of the unionids observed had their gills modified as marsupia. An analysis of water temperature and discharge indicated no significant difference in average monthly discharge ($p > 0.05$) and a significant decrease in temperature ($p < 0.05$) between pre- and post-impoundment periods. Average monthly discharge and temperature may not be as biologically important as the spikes of discharge and corresponding sudden decreases in temperature that are caused by releases of hypolimnionic water from the reservoir.



Juvenile mussels collected from naturally infested darters may be ellipse

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We are trying to determine if ellipse (*Venustaconcha ellipsiformis* (Conrad, 1836)) hosts identified in the laboratory serve as hosts under natural conditions. Darters facilitate ellipse glochidia metamorphosis in the laboratory[1,2,3]. We collected blackside and fantail darters living among ellipse and other mussels from the Zumbro River, Minnesota. Juvenile Lampsilines were collected from these fishes[4]. Zumbro River Lampsilines include: black sandshell (*Ligumia recta*), ellipse, fatmucket (*Lampsilis siliquoidea*), lilliput (*Toxolasma parvus*), mucket (*Actinonaias ligamentina*), and pocketbook (*Lampsilis cardium*)[5].

We used a scanning electron microscope and Hoggarth[6] to try and identify juvenile mussels recovered from the darters. We determined that the unknown juveniles are not lilliput or mucket due to the smaller size and circular outline of these species' glochidia (Figures 1 and 2). The outlines of pocketbook and fatmucket glochidia are subspatulate and differ from the subelliptical outline of the unknown juveniles (Figures 3 and 4). Ellipse and black sandshell glochidia are very similar to each other and the unknown juveniles. Although Hoggarth[6] found ellipse may be larger than black sandshell we found the range of glochidial heights and lengths of twelve ellipse [238-288μ (266±14μ (1 s.d.)), and 193-231μ (210±11μ) respectively] overlapped with those of three black sandshell [260-277μ (269±8μ), and 210-217μ (213±3μ] respectively). Subsequently, we could not confidently identify the unknown juveniles (Figures 5-8).

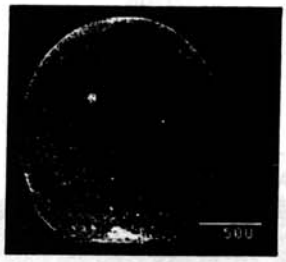

Fig. 1. Lilliput glochidium.

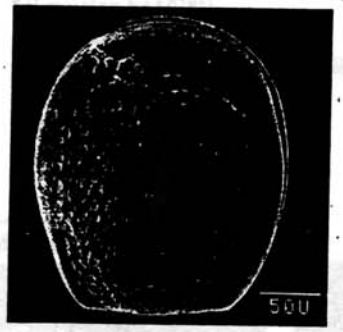

Fig. 2. Mucket glochidium.

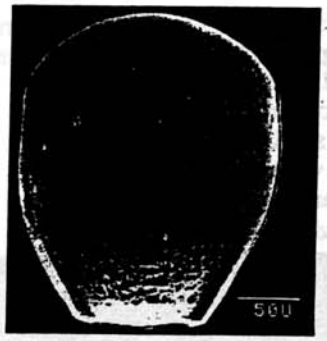

Fig. 3. Pocketbook glochidium.

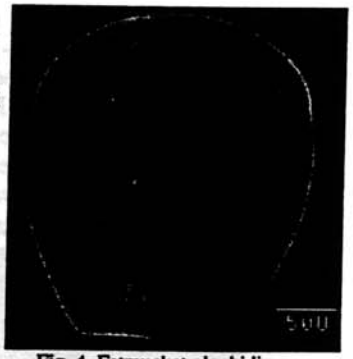

Fig. 4. Fatmucket glochidium.

Fig. 5. Ellipse glochidium.

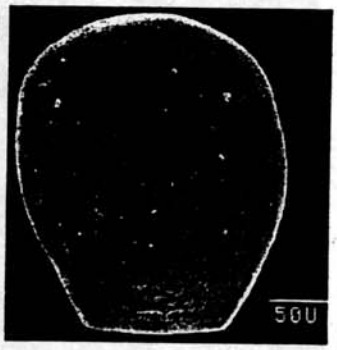

Fig. 5. Black sandshell glochidium.

Fig.6. Unknown juvenile number 1.

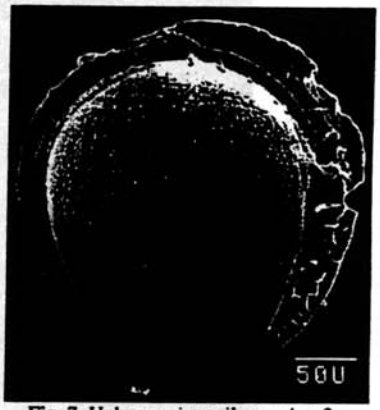

Fig. 7. Unknown juvenile number 2.

Although we could not determine if the recovered juveniles were ellipse or black sandshell there is some evidence that they are ellipse. Laboratory studies suggest darters may not facilitate metamorphosis of black sandshell glochidia[7,8]. These observations hint that the juvenile mussels are ellipse.

Support for this study was provided by the Minnesota Legislature, as recommended by the Legislative Commission on Minnesota Resources from the Minnesota Environmental and Natural Resources Trust Fund, University of Minnesota Undergraduate Research Opportunities Program, and Bell Museum of Natural History.

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[3]Hove, M. & J. Kurth. 1998. Darters, sculpins, & sticklebacks serve as suitable hosts for *V. ellipsiformis* glochidia. TUR 14: 8.
[4]Hove, M., J. Weiss, J. Berkner, & A. Kapuscinski. 1999. Juvenile Amblemines appear to excyst more rapidly in warm water. TUR 17: 9.
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[6]Hoggarth, M. A. 1999. Descriptions of some of the glochidia of the Unionidae (Mollusca: Bivalvia). Malacologia 41(1): 1-118.
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[8]Watters, G. T., S. H. O'Dee, S. Chordas, and D. Glover. 1999. Seven potential hosts for *Ligumia recta* (Lamarck, 1819). TUR 18: 5.

Winged mapleleaf glochidia metamorphose on channel catfish

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During fall and winter 1999 we attempted to identify host(s) for the federally endangered winged mapleleaf (*Quadrula fragosa* (Conrad, 1835)). Unlike most Amblemines, which brood glochidia during spring and summer, winged mapleleaf brood glochidia during a relatively short period in September and October (Heath *et al.* 1999). A brooding winged mapleleaf collected in October 1999 released glochidia that were used in host suitability tests. Trials were conducted using standard protocol (Neves *et al.* 1985) at water temperature 11±1 °C.

Eleven fish species (three families) were tested. Glochidia grew while attached to Ictalurids. Two juveniles excysted from a channel catfish (Tables 1 and 2).

Table 1. Glochidial transformation observed.

Species	Number tested	Juvenile collection period (d)
channel catfish*	1	117-123

* Test subject died before end of study.

Additional juveniles might have been collected from the catfish but a low-grade Ich infection flared during the excystment period killing the fish. Glochidia collected from most Ictalurids exhibited growth after four weeks. The shell diameter doubled by six weeks, and by twelve weeks the shell diameter of several individuals was triple the glochidial shell diameter (figures 1 and 2).

Table 2. Glochidial transformation not observed.

Species	Number tested	Encystment period (d)
slender madtom	1	94-95
flathead catfish I	3	74-82
blue catfish*	29	46-48
flathead catfish II*	43	39-43
yellow bullhead	9	108-118
black bullhead	20	61-68
stonecat	2	1-4
tadpole madtom	4	1-4
freshwater drum	4	4-9
orange spotted sunfish	2	1-4

* Test subjects died before end of study.

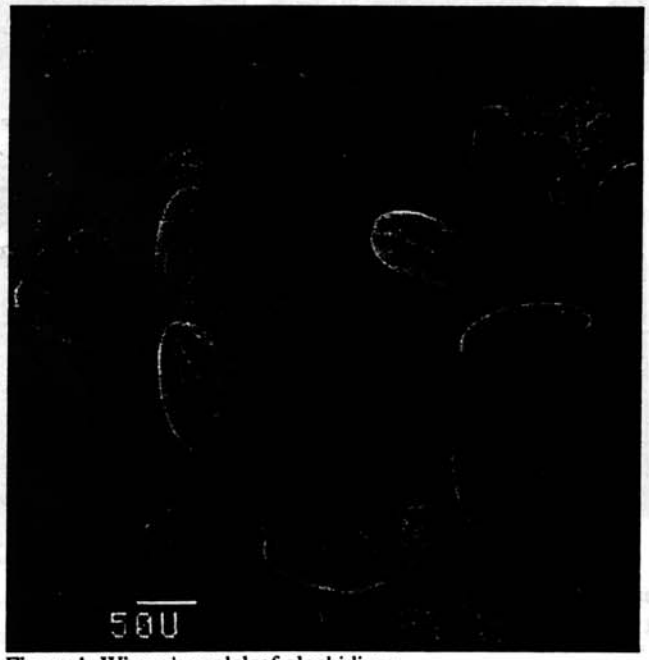

Figure 1. Winged mapleleaf glochidium.

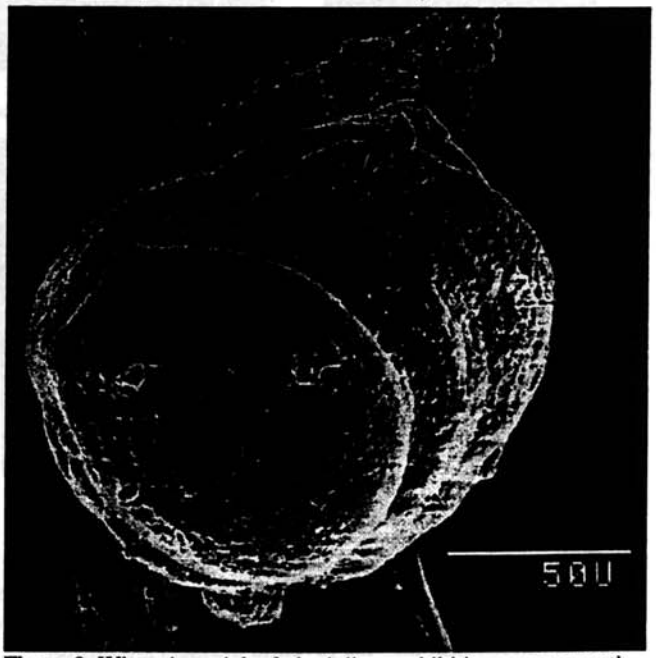

Figure 2. Winged mapleleaf glochdium exhibiting some growth.

During fall 1999 we tried to collect Ictalurids naturally infested with winged mapleleaf glochidia from the St. Croix River. Using SCUBA we searched a 60 ft deep pool and found several young and one older channel catfish. One small catfish was brought to the laboratory and two non-winged mapleleaf juvenile mussels excysted. We will attempt to collect catfishes again this year in hopes of obtaining juvenile winged mapleleaf from naturally infested fishes.

We thank Robert Hay of the WI DNR. Funding was provided through federal aid under Section 6 of the Endangered Species Act with matching funds from the WI DNR, MN DNR, and MN Environment & Natural Resources Trust Fund.

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***Ligumia recta, Leptodea fragilis,* and *Anodontoides ferussacianus*, new to the Lake Nipissing Drainage, Ontario.** *Frederick W. Schueler,* Eastern Ontario Biodiversity Museum, Box 1860 Kemptville, Ontario, CANADA K0G 1J0 **bckcdb@istar.ca** (613)258-3107

Until about 3900 yrs ago the Upper Great Lakes drained through what is now Lake Nipissing, to the Mattawa and Ottawa rivers, into the St Lawrence. While the east-draining Mattawa and west-draining Lake Nipissing and French River were the pre-railway route of transcontinental travel along the southern Canadian Shield, they are relatively inaccessible from highways. Perhaps as a consequence, their Unionid fauna is unstudied, despite its critical position in the post-glacial enfaunation of much of eastern Canada, and in contrast to the attention paid, for this reason, to its piscine hosts (Mandrak, N.E. & E.J. Crossman. 1992. *Postglacial dispersal of freshwater fishes into Ontario.* **Canadian Journal of Zoology** 70(11): 2247-2259).

Recently, I have briefly visited about a dozen places where Lake Nipissing and some tributaries are road-accessible, and found three Unionids far beyond their known ranges. I thank Alex Mathias & family, and Aleta Karstad & Jennifer H. Schueler for help in the field, Sturgeon River House & the Monitoring Salamanders Conference for subsidizing transportation, Wayne Grimm for picking the first *Leptodea* out of a box of *Lampsilis*, Janice Metcalfe-Smith, Claude Renaud, & Noel Alfonso for help with literature, and the Carleton University Map Library for impeccable coverage of any place one might wish to go. Co-ordinates are from Garmin 45 GPS, reported in WGS 1984 map datum; specimens are in the collection of the EOBM; authorities for known ranges are A. H. Clarke (1981.***The Freshwater Molluscs of Canada.*** NMNS, National Museums of Canada, Ottawa. 446 pp.) and the Canadian Museum of Nature (CMN) collection.

Leptodea fragilis: Two collections from sandy habitats in Lake Nipissing extend the range more than 350 km WNW from the lower Ottawa River, or 270 km NNE of southern Bruce County. On 27 May 1999 we found a 67 mm fresh pair on fine-sand flats exposed by low water at **Dutrisacs Bay**, S of **Sturgeon Falls** (46.3367°N 79.9252°W), and on 29 Oct 1999, 7 shells, the largest 85 mm, on the sandy beach of the **North Bay** municipal waterfront park (46.3146°N 79.4721°W).

Ligumia recta: Small numbers of heavy-shelled, white-nacred *L. recta* occur in the Ottawa River and its tributaries, the Mississippi and Rideau rivers. In the gravelly-cobbly **Temagami River,** 1.4 km NW & 2.5 km NE of the village of **River Valley** (Nipissing Dist, 46.5975°N 80.1933°W & 46.6059°N 80.1642°W, 10-11 Sept 1998) we found shells (large & relatively thin, the nacre purplish pink) of *L. recta* in Muskrats' shell piles along the banks and on the bottom. This is 320 km WNW of the Ottawa records, and 270 km N of collections from southern Bruce County. Shell fragments in the Petawawa River (**Petawawa**, 45.903°N 77.285°W) suggest this species also occurs in the upper Ottawa drainage.

Anodontoides ferussacianus: One 56 mm individual from the eroding fine-sand bank of the meandering **Obabika River,** 0.4 km below **Obabika Lake** (Sudbury Dist: Delhi Twp., 47.1086°N 80.3077°W, 9 Sept. 1998), is 270 km NNE of a CMN specimen from the North Channel of Georgian Bay, and 600 km ESE of Albany drainage records reported by Clarke (1973. *The Freshwater Molluscs of the Canadian Interior Basin.* **Malacologica** 13(1-2):93). In the nearby Ottawa River drainage we had found a 60 mm shell in a boat-mooring basin (**Lake Temagami**, Finlayson Point Park, Nipissing Dist: Temagami Twp., 47.0555°N 79.8092°W, 9 Sept. 1997), and since this species is characteristically found in small streams, and at low densities, it will likely turn out to be widely distributed in NE Ontario.

The other species found at each of these sites were *Elliptio complanata, Lampsilis radiata siliquoidea,* and *Pyganodon cf grandis* (though in the Temagami River the majority of the *Lampsilis* were not similar to *L. r. siliquoidea,* and in Lake Nipissing the *Pyganodon* are distinctively small and inflated). The discovery of such significant range extensions, in visits to so few sites, strongly suggests that there is much more to learn about the Unionids of the Nipissing drainage and the rest of northeastern Ontario.

A UNIONID SURVEY AT THE ALLIANT GENERATING PLANT, MISSISSIPPI RIVER MILE 659.4-660.4, LANSING, ALLAMAKEE COUNTY, IOWA, JULY-AUGUST 1999

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We conducted a mussel survey at three potential dredge sites at the Alliant Generating Plant, Mississippi River Mile 660.4-659.4. A total of 18 live species were found; an additional five species were represented by empty shells only. In the fleeting area (Site 3), downstream of the power plant, we found 15 living (plus six dead) species, including five federally and state endangered Lampsilis higginsi (Lea 1857). Fifty-one 0.25 m2 quadrats yielded a mean density of 4.71 mussels/m^2. Three L. higginsi (4.9%; 0.24/m^2) were 12, 15, and 18 m offshore respectively, at 3-4 m deep. The remaining L. higginsi were found in the same area, but closer to the shore in water 1 m deep (river stage 0.8 m above Low Control Pool). A dead Iowa listed mussel (tissue attached), Strophitus u. undulatus (Say 1817), was also found. Mussel concentrations were in the downstream half of Site 3, up to 50 m lateral to mooring cells and the shoreline. Mississippi River levels were up, the current strong, and divers reported almost no visibility. Dreissena polymorpha (Pallas 1771), was present in moderate to large numbers. Qualitative sampling was also done, mostly in shallow water near the Iowa shoreline. Numbered, rare mussels were hand planted at the downstream end of the fleeting area, 20 m offshore, in 3 m of water, along with a very rare, living Fusconaia ebena (Lea 1831). Visible Dreissena were removed from all unionids before they were returned to the river. A dead L. higginsi was found with a broken posterior tip, but it is not known when or how this damage occurred.

#	FEDERAL ENDNDANGERED SP.	LENGTH	HEIGHT	AGE	SEX
100	L. higginsi	80	60	9	M
101	L. higginsi	80	65	10	M
102	L. higginsi	59	42	4	J/F
103	L. higginsi	104		12	M
104	L. higginsi	94	56	7	M

Fourteen 0.25 m2 quadrats were sampled near the water intake pipes (Site 2). Five mussel species found were within 40-75 m of the intake pipes. This area had mostly silty substrata (mean density 2.57/m2). At the coal unloading/cleanout docks (Site 1), upstream of the Generating Plant, 112-0.25m^2 quads were done. Only seven mussels (five species) were found for a very low density of 0.25/m2 in a coal-rubble-silt substrata. The exotic Corbicula fluminea (Muller 1774) was common in nearly every Site 1 quadrat. Only two live mussels were found during random collections by divers. Random samples were also done by wading in shallow water between the mooring cells and the shoreline, yielding 59 mussels (five species) upstream of the coal unloading dock, and 21 mussels (four species) downstream of the coal dock for a total of seven common living species. No special status unionids were found at either Sites 1 or 2.

1999 St. Croix River Research Rendezvous abstracts

The following abstracts were selected from presentations made at the 11th annual meeting of the St. Croix River Research Rendezvous. The meeting was held on October 19, 1999 at Marine on the St. Croix, Minnesota and sponsored by the Science Museum of Minnesota. All abstracts presented at the meeting may be viewed on the Web at http://www.smm.org/information_zone/research/SCWRS/Rendezvous.html.

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TAXONOMIC IDENTIFICATION OF FRESHWATER MUSSELS OF THE ST. CROIX RIVER THROUGH DNA ANALYSIS

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Freshwater mussels are an important component of freshwater ecosystems, storing energy that otherwise would be lost downstream, while serving as good ecological indicators and food sources for other organisms. They are a highly diverse family of organisms that are rapidly declining in species richness and abundance. Mussels undergo a period of parasitic encystment on fish hosts during the larval (glochidial) stage of their life cycle. A better understanding of host- parasite relationships would be highly beneficial to mussel conservation; however, mussels in the glochidial stage are very small and therefore extremely difficult to identify. In this project, we use the polymerase chain reaction (PCR) and restriction fragment length polymorphism (RFLP) techniques on the ITS-1 region of the mussel genome in an attempt to identify genetic markers for each species. To do this, genomic DNA is extracted from adult mussel specimens, the ITS-1 region is amplified using PCR and the amplified DNA digested with a selected array of restriction enzymes. Our goal is to create an identification key based on these genetic markers for all the mussel species of the St. Croix River. The resulting taxonomic key may be used to unambiguously identify mussels while in their glochidial forms. To date, DNA patterns have been recorded for 22 mussel species. Currently, we are working on expanding this database, and refining our protocols to make identification more accurate and efficient. Our data thus far suggests that the mussel species of the St. Croix River can indeed be distinguished using this technique, and that these methods may serve as a valuable tool for mussel conservationists.

PRESERVING THE BIODIVERSITY OF UNIONID MUSSELS IN THE ST. CROIX RIVER BY DEVELOPMENT OF IN SITU REFUGIA

Michelle R. Bartsch[1], Diane L. Waller[1], Gregory Cope[2], Heidi L. Dunn[3], Sue Jennings[4], and Ronald G. Rada[5]. [1]U.S. Geological Survey, Upper Midwest Environmental Sciences Center; [2]Department of Toxicology, North Carolina State University; [3]Ecological Specialists, Inc. St. Peters, Missouri; [4]National Park Service, Big South Fork NRRA; [5]River Studies Center, University of Wisconsin-La Crosse.

Relocation of native mussels to refugia has been considered as a potential mechanism for protecting unionid populations at risk from colonization by the zebra mussel *Dreissena polymorpha*. Types of refugia that have been proposed include relocating mussels to man-made ponds or to fish hatcheries. The use of system-specific, *in situ* refugia, offers several advantages over other types of refugia because of the similarity of water quality, substrate characteristics, and the availability of necessary fish hosts. Moreover, in situ refugia allow the retention of genetic diversity of the mussel and host fish populations in the system. In 1996, we relocated 450 unionid mussels into system-specific, *in situ* refugia in the National Park Service managed zone of the St. Croix River, in Minnesota and Wisconsin. The purpose of our project was to refine protocols for relocating mussels and to serve as a conservation measure for protecting the mussel fauna of the St. Croix from zebra mussel infestation. Two species of unionids representing the subfamily Ambleminae (Pimpleback, *Quadrula pustulosa* and Spike, (*Elliptio dilatata*) and one representing the subfamily Lampsilinae (Higgins' Eye Pearly mussel, *Lampsilis higginsi*) were collected from the lower St. Croix River near Lakeland, Minnesota, and relocated to three 5 x 5 m study grids, two in the experimental

refuge 40 miles upstream, near Franconia, Minnesota, and one at Lakeland, Minnesota, which served as a source-site control. Mussel survival, recovery, and substrate characteristics were evaluated annually at each of the sites for two years. Recovery of all three species at the sites ranged from 90 to 98% in 1997 and from 81 to 100% in 1998. The survival of recaptured mussels ranged from 85 to 100% in 1997 and from 93 to 100% in 1998. Among the three species, the lowest recovery (81%) and survival (93%) occurred with *E. dilatata* at the reference site in 1998 and was due to sedimentation of sand that had deposited over several of the randomly selected placement cells in the grid where *E. dilatata* was placed. The textural characteristics (cobble-gravel and sand fractions) of the substrate differed significantly (ANOVA, $p < 0.01$) between the reference site and the two refuge sites at the beginning of the study, and did not differ from this initial status among subsequent years. The relatively high survival and recovery of mussels during this study demonstrates the importance of proper handling and transport protocols when relocating mussels and the selection of suitable relocation habitat with stable substrate. If established correctly, the use of system-specific, *in situ* refugia is a viable tool for preserving the biodiversity of unionid mussels.

SUGGESTED READING:

Cope, W. G. and D. L. Waller. 1995. Evaluation of freshwater mussel relocation as a conservation and management strategy. Regulated Rivers: Research & Management. 11:147-155.

THE EFFICACY OF MUSSEL RELOCATION AS A RESOURCE MANAGEMENT TOOL: AN EXPERIMENT IN THE ST. CROIX RIVER

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Increasing threats to the native mussel community in the St. Croix River (*e.g.* bridge construction, zebra mussel outbreaks) make it necessary to study the efficacy of relocating mussels to less-threatened parts of the river. To determine the effects of relocation on mussel growth and survival a three-year *in situ* experiment was conducted at Wild River State Park, Minnesota. In 1997 a 25 m^2 study grid containing 25 cells was placed near the confluence of the St. Croix and Sunrise rivers (reference site), and another was placed at the eastern boat launch at Wild River State Park (relocation site). Each cell was randomly assigned one of the following treatments: (1) double resident mussel density, (2) addition of 10 pimplebacks, (3) addition of 10 spikes, (4) addition of 10 pocketbooks, and (5) control (no manipulation occurred during the first year). In 1997 mussels were collected from the reference site, placed into study grids, and individuals from the first four treatments were measured, weighed, and marked. In 1998 and 1999 mussels were measured and weighed. Those found without a number were recorded as "new" and marked, those missing from the 1998 census were logged as "missing", and the rest were logged as "recovered", "control", or "dead" as applicable to their status. Preliminary examination of data indicates no difference in growth or mortality between treatments. Mortality was low (5 %) compared to similar studies (Cope and Waller 1995). Results suggest that relocating mussels to similar habitats may be an effective strategy for conserving mussel populations living in potentially harmful parts of the St. Croix River.

Funding provided by the Minnesota Legislative Commission on Minnesota Resources.

Suggested Reading:

Cope, W.G. and D.L. Waller. 1995. An evaluation of freshwater mussel relocation as a conservation and management strategy. Regulated Rivers: Research and Management 11: 147-155.

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

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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, 30.5m X 30.5m, was to be filled. This site, including a 6 m buffer zone on 3 sides, was 36.58 m out into the channel and 42.67 m long (1561 m2). A

mussel survey was done 22 September 1998. 5-0.25 m^2 quadrats were sampled on each of 6 transects below the dam, perpendicular to the St. Croix flow. 30 samples yielded a live mean mussel density of 0.53 mussels/m^2. 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. Although there were very low densities, one living federally endangered *Lampsilis higginsi* (Lea 1857) was found on the first random survey 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, translocation, all mussels (15 species including another *L. higginsi*, #650, 105 mm L, 70 mm H, 20 yrs old, probably a sterile female), 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. *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 53-56 °F. One year follow-up was done August 1999. WI DNR divers recovered *L. higginsi* #650, and about 20 hash-marked unionids (100% survival). In 1999 2 unmarked *L. higginsi* were found within 3 m of Translocation Site 2 confirming a very suitable substrata of sand and gravel.

SUGGESTED READING:

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.

LONG TERM CHANGES IN MUSSEL POPULATIONS OF THE ST. CROIX RIVER

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Population dynamics of freshwater mussels (Unionidae) were observed since 1991 at three locations in the St. Croix River. Mussel communities were assessed quantitatively and qualitatively to calculate density, species richness, and age structure to identify long-term trends. Mussels and substrate were collected from at least 100 0.25 m^2 quadrats at each location. Substrate was separated into 5 size classes and all mussels were identified and measured. From these measurements, population density and community diversity were calculated at each location and compared to past sampling years. At Franconia mussel density decreased from 10.44 mussels/m^2 in 1991 to 9.76 mussels/m^2 in 1995, and 4.52 mussels/m^2 in 1999. Species richness decreased from 26 species in 1991 to 19 species in 1995, and 15 species in 1999. One endangered winged mapleleaf mussel was found in quantitative samples in 1995. At Wild River State Park, mussel density decreased from 37.36 mussels/m^2 in 1993 to 29.56 mussels/m^2 in 1996 continuing to decline to 21.08 mussels/m^2 in 1999. Species richness decreased from 21 species in 1993 to 18 species in 1996, and remained the same in 1999. At Prescott, Wisconsin mussel density decreased from 7.8 mussels/m^2 in 1994 to 5.64 mussels/m^2 in 1999, while species richness declined from 21 to 18 species. One Higgins' Eye (*Lampsilis higginsi*) was found in both 1994 and 1999. In addition we found two invasive bivalve species at Prescott: one live zebra mussel attached to an threeridge (*Amblema plicata*) as well as one Asian clam (*Corbicula fluminea.*). We will statistically analyze these data to determine if these trends are significant and warrant management action.

RANGE EXTENSION OF THE FEDERALLY ENDANGERED WINGED MAPLELEAF MUSSEL: SHELLS COLLECTED FROM THE UPPER ST. CROIX RIVER

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Work conducted this summer extends the range of the winged mapleleaf to the upper St. Croix River. The historic distribution of the species ranged throughout the upper Mississippi River basin including 34 rivers across 12 states. Since the 1920's the community has declined drastically to where now only two small populations are known, one in the Ouachita River, Arkansas, and the last known reproducing population in the lower St. Croix River. Prior to this summer the winged mapleleaf had only been observed in the lower St. Croix River (the reach downstream of the falls). This summer three winged mapleleaf shells were collected at Wild River State Park, Minnesota. Two of the valves are worn and old, the other valve is less eroded and may have been deposited more recently. Ten sites were surveyed for live winged mapleleaf 1 mile upstream and downstream of the western Wild River State Park boat launch but none were observed. The mussel community at Wild River State Park is diverse and robust. It is difficult to ascertain the cause(s) for the status of winged mapleleaf in this portion of the river. Some thought should be given to the suitability of this habitat if it is to be considered as a relocation site for winged mapleleaf should zebra mussels threaten the population in lower reach of the river.

Suggested reading:

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

EFFECTS OF AMMONIA ON UNIONID MUSSELS: A THREAT TO THEIR BIODIVERSITY IN THE ST. CROIX NATIONAL SCENINC RIVERWAY

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The St. Croix River basin (SACN) is experiencing rapid land-use changes--from forest and agriculture to suburbanization--as the metropolitan area of Minneapolis-St. Paul expands. Although the upper reaches of the St. Croix and the Namekagon rivers contain surface waters of high quality, threats to water and sediment quality have accelerated in recent years. These threats include agricultural runoff, urban development, and toxic contaminants from one of the 15 point-source discharges in the SACN. The National Park Service is concerned that increased urbanization will also increase the output of nutrient-laden effluent from wastewater treatment plants, as well as other point and non-point source discharges, into the St. Croix River. One potential result of this urbanization may be an elevation of ammonia in sediment porewater. At alkaline pH, ammonia dissociates from organic molecules into un-ionized ammonia which is quite toxic to benthic organisms. The SACN contains an extremely rich fauna of unionid mussels—animals sensitive to changes in habitat quality--and increased sedimentary ammonia may pose a significant threat to this fauna. Our objectives are: (1) to describe the density and species richness of the molluscan community at selected sites along a eutrophication gradient in the SACN; (2) to examine the in situ effects of ammonia enrichment on the survival and growth of juvenile unionids in the SACN; and (3) to determine the tolerance thresholds for total ammonia nitrogen in juvenile unionids in laboratory sediment toxicity tests. In August 1999, we conducted preliminary sampling for sedimentary ammonia at 28 sites in the basin (River Miles 0 to 94), including sites on three tributaries (Snake, Sunrise, and Apple rivers) to define the range of ammonia concentrations in the basin and to assist with selection of study sites. Total ammonia nitrogen (TAN) ranged from 0.3 to 19.0 mg/L and un-ionized ammonia (NH^3) ranged from 2.5 to 141.5 ug/L. Highest concentrations were observed in the South Branch of the Sunrise River, with a mean of 12.3 mg TAN/L and 84.7 ug NH^3/L‹levels approaching those shown to be toxic to molluscs in laboratory tests. Furthermore, concentrations of sedimentary ammonia generally increased as river miles decreased‹paralleling spatial patterns in nutrients in the water column. We intend to use this presentation to solicit input from our colleagues on potential study sites and experimental design options.