

THE STATUS OF FRESHWATER MUSSELS IN SOME GEORGIA, SOUTH CAROLINA AND NORTH CAROLINA WATERS

Eugene P. Keferl

AUTHOR: Professor of Biology, Department of Natural Sciences and Mathematics, Brunswick College, Altama at Fourth, Brunswick, Georgia 31523.

REFERENCE: *Proceedings of the 1993 Georgia Water Resources Conference*, held April 20 and 21, 1993, at The University of Georgia, Kathryn J. Hatcher, Editor, Institute of Natural Resources, The University of Georgia, Athens, Georgia.

Abstract. Freshwater mussel populations in eastern United States are in trouble. Survey data indicates a significant decline in mussel populations in North Carolina, South Carolina, and Georgia. Additional work needs to be done to assess the status of mussels in all major drainages. All freshwaters need to be managed to prevent further loss.

A THREATENED FAUNA

The management of our freshwater resources is a very important issue in the United States. This vital resource is currently managed for drinking water, waste disposal, industry, agriculture and recreation. It is not being managed very well to preserve our biodiversity. Mussels were once a major part of our freshwater fauna. This important part of our biodiversity is fast disappearing.

The most threatened freshwater organism in eastern United States belongs to the family Unionidae, the freshwater mussels Neves (1992). Of approximately 300 species in the United States, 42 mussel species are now on the federal list of threatened and endangered species. According to Neves (1992), 20 species are presumed extinct, 42 species are nearly extinct with no viable populations, and another 75 species are rare. That represents over 45% of the species lost or in trouble in the United States. These numbers will only increase if conditions do not change.

The life cycle and ecology of the Unionidae predispose them to many problems when their environment is altered. Freshwater mussels have a larval stage which is parasitic on some restricted group of fish. The survival of freshwater mussels is intimately tied to the continued existence of the native fish species. Freshwater mussels are slow growing, sedentary, filter feeders. They are unusually sensitive to contaminants in the water and thus require high water quality (Fuller, 1977). Most species require a stable substrate and disappear when the substrate is altered or moved around. Consequently, dams, sand and gravel mining, channelization, poor agricultural practices, poor timbering practices, siltation, increased run-off volume, municipal sewage, industrial wastes and pesticides have

had a devastating effect on these organisms (Fuller 1974 and 1977, Ahlstedt 1984, Neves 1984, Oesch 1984, and Moser 1991).

CAROLINA SURVEYS

Since 1986 I have examined 896 sites on some 421 different streams and rivers in North Carolina and South Carolina. My sampling efforts have focused on the Edisto River system in South Carolina, the Cooper-Santee River system and the Pee Dee River system in North and South Carolina, and the Neuse River system of North Carolina. Most of this survey work was done as a part of work sponsored by the U.S. Fish and Wildlife Service to conduct status surveys for candidate species for listing under the Endangered Species Act of 1973. Two surveys involving the Carolina heelsplitter, *Lasmigona decorata* (Lea, 1852) and the Carolina elktoe, *Alasmidonta robusta* Clarke, 1981 (Keferl and Shelley, 1988 and Keferl, 1991) have been completed, and two other status surveys are in process.

Mollusks are present in most natural freshwaters. One should expect to find some species of mollusk in most freshwaters. Mollusks were found in 269 (64%) of the 421 different streams and rivers sampled. Mussels were found in only 113 (27%). This is frightfully low. I found ten rivers with almost no mussels at all, including:

- (1) Pee Dee River system: Rocky River (North Carolina);
- (2) Broad River system: First Broad River (North Carolina), Second Broad River (North Carolina), Pacolet River (South Carolina), Tyger River (South Carolina), Enoree River (South Carolina), Sandy River (South Carolina), Little River (South Carolina); and
- (3) Saluda River system; Saluda River (South Carolina), Reedy River (South Carolina).

The largest area with almost no mussel fauna was in the Broad River system where only 10% of the streams and rivers sampled had any mussels at all. Only eight species were found in the Broad River system. The Saluda River system appears to be much better than the Broad River system, but most of the area has few species of mussels left. Most of the mussel species are confined

to a few streams. The mussel fauna of the South Carolina piedmont is at best, depauperate and fragmentary.

Some Historic Comparisons. To further illustrate the decrease in the mussel fauna, consider Mecklenburg County, North Carolina, which has drainage into the Catawba River of the Cooper-Santee River system and the Rocky River of the Pee Dee River system. Between 1863 and 1872 Isaac Lea (1829-1874) described 18 species of freshwater mussels from Mecklenburg County, North Carolina. Based on those descriptions and some other collection data, it can be documented that there were at least 13 species of mussels in Mecklenburg County and at least 18 species in the entire Catawba River drainage during the middle 1800's. The mussel fauna from Rocky River drainage was never documented.

In a 1987 mussel survey in Mecklenburg County, 70 sites in the Catawba River drainage and 33 sites in the Rocky River drainage were examined (Keferl and Shelley, 1988). Just eight sites (8%) had any evidence of mussels. Only three species were found. Historically mussels can be documented from mill ponds and streams throughout the county. Mecklenburg County is where Charlotte, North Carolina is located and this area has been growing rapidly in the last couple of decades.

A similar story is emerging from a rural area in South Carolina. This is the old Abbeville District, which included present day Abbeville County and parts of McCormick and Greenwood counties. From 1857 to 1874, Isaac Lea described 21 species of mussels from the Abbeville District, South Carolina. All the survey work in this area is not completed yet, but it looks as if very few of these species still exist in the "Abbeville District".

Unfortunately there are few areas in Georgia, North Carolina and South Carolina where it is possible to compare historic records with what exists in that same place today. Some of the only evidence concerning what existed in some areas comes from the original species descriptions. Isaac Lea described 158 species from Georgia, 66 species from North Carolina and 32 species from South Carolina. The number of mussel species originally described by Isaac Lea has been reduced. Johnson (1970) synonymized many of Lea's species. However, it does give some idea of the mussel fauna in these three states in the middle 1800's.

Other Recent Surveys. Few surveys for mollusks have been conducted since the time of Isaac Lea in the 1800's. Today in Georgia and South Carolina, we are faced with a lack of good data concerning the distribution of many species, and we have even less information about their ecology and life history. The situation is a little better in North Carolina. With the help of several biologists interested in mussels and the North Carolina Nongame and Endangered Wildlife Program, the North Carolina mussel fauna is being surveyed. In the last forty years only

30 studies show a significant amount of survey work for mussels in the waters of North Carolina, South Carolina and Georgia (See Table 1). Many streams have never been surveyed.

Table 1. Surveys Freshwater Mussels in North Carolina, South Carolina, and Georgia since 1950.

| | |
|-------------------------------------|---|
| 1. Adams (1990) | Greenfield Lake Basin, NC. |
| 2. Alderman (1988) | Tar River, NC. |
| 3. Alderman (1991) | Contentnea Creek drainage, Neuse River Basin, NC. |
| 4. Britton & Fuller (1979) | Savannah River Plant, Savannah River Basin, SC. |
| 5. Coney, DeCamp & Harrelson (1983) | Great Pee Dee River, SC |
| 6. Clarke (1983) | Tar River Basin, NC. |
| 7. Clench & Turner (1956) | Gulf drainage of Alabama, Georgia and Florida. |
| 8. Fuller (1973) | Fusconaia masoni in NC, SC, GA |
| 9. Fuller, Imlay & Williams (1976) | Waccamaw River Basin, NC & SC. |
| 10. Fuller (1977) | Endangered mussels in NC. |
| 11. Fuller (1978) | Mussels in coastal SC. |
| 12. Heard (1970) | Endangered mussels of South-eastern U.S. |
| 13. Heard (1975) | Endangered mussels of South-eastern U.S. |
| 14. Horn & Porter (1981) | Lake Waccamaw mussels, NC |
| 15. Hurd (1974) | Coosa River Basin, AL and GA. |
| 16. Keferl (1971) | Ohoopsee River drainage, Altamaha River Basin, GA. |
| 17. Keferl & Shelley (1988) | Status survey of Lasmigonadec orata and Alasmidonta robusta in NC and SC. |
| 18. Keferl (1991) | Further status work on Lasmigona decorata in NC, SC. |
| 19. Keferl (1993) | Contentnea Creek drainage, Neuse River Basin, NC. |
| 20. McGrath (1991) | Upper Neuse River Basin, NC. |
| 21. Moore & Coney (1983) | Congaree Swamp National Monument, Santee-Wateree River, SC |
| 22. Patrick, Cairns & Roback (1967) | Savannah River Basin, SC and GA. |
| 23. Porter (1985) | Lake Waccamaw, NC. |
| 24. Porter & Horn (1984) | Waccamaw River Basin, N.C., S.C. |
| 25. Raulerson & Burbanck (1962) | Elliptio hopetonensis, Altamaha River Basin, GA. |
| 26. Shelley (1987) | Cape Fear River Basin, NC. |
| 27. Sickel (1969) | Altamaha River Basin, GA. |
| 28. Sickel (1980) | Altamaha River Basin, GA |
| 29. Stansbery (1978) | Lake Waccamaw, NC |
| 30. Walter (1956) | Neuse River Basin, NC |

GEORGIA MUSSELS

Georgia has a much more diverse mussel fauna than either North or South Carolina. Over 300 names of mussels having been recorded from Georgia, with about 100 species documented from Georgia waters. One reason for this diversity is that Georgia has streams that drain into four different areas: (1) a small drainage basin which is a part of the Tennessee River system, (2) a part of Mobile-Alabama-Coosa River system, (3) drainage into the Apalachicola River, and (4) all the Atlantic coast river systems. Each drainage area as its own distinctive freshwater fauna.

Twelve mussel species are endemic to Georgia or waters bordering Georgia. At least three species are extinct and another 35 species are endangered in Georgia now. Much field work needs to be done to gather supporting data on each species in Georgia. Since 1975, I have examined some 220 sites in all major river systems in Georgia. About half of these sites were part of specific studies (Keferl, 1981), while the rest were scattered all over the state.

Two major surveys are presently being conducted, one in the Apalachicola River system and the other in the Altamaha River system. Both studies are focusing on some federal candidate species, but each survey will contribute greatly to the overall knowledge of the mussels in Georgia.

Of the four major mussel faunas in Georgia, the Atlantic coast fauna is in the best condition. The Tennessee River, Coosa River and Apalachicola River systems in Georgia have lost a substantial part of their fauna. Some rivers and streams in Georgia look good and probably have good water quality now, but there are virtually no mussels left in them. Good mussel populations have been found in the Ogeechee, Satilla and St Marys rivers.

Savannah River. The Savannah River system has never been well surveyed. The Savannah River has several large impoundments on it, and no one has documented the effects of these impoundments on the mussel fauna. The status of several species from the Savannah River needs to be investigated. Some random sampling indicates that several of its tributaries have reduced mussel faunas.

Altamaha River. The Altamaha River is the biggest question. This river has seven endemic species. It is possible that at least four of the seven endemics in the Altamaha River may be in trouble. One of the endemics in trouble is *Elliptiospinosa* (Lea, 1836), the Altamaha spiny-mussel. This is the largest and most spectacular of three known spiny mussels in the world. *Alasmidonta arcula* (Lea, 1838), *Elliptio shepardiana* (Lea, 1834), *Lampsilis dolabraeformis* (Lea, 1838) and *Toxolasma pullus* (Conrad, 1838) may also be declining in the Altamaha River.

RECOMMENDATIONS

Georgia needs to do more to assess its entire freshwater fauna, not just mussels. A freshwater biodiversity data base needs to be established as a basis for future decisions about the management of freshwater. Georgia does have several endangered freshwater mussels and, more than likely, they will be put on the federal list of threatened and endangered species. Total protection for all species in all waters is unrealistic, but much more must be done to preserve the freshwater biodiversity of Georgia. At the present time the largest part of freshwater biodiversity is being ignored, the invertebrates. I am convinced that if we can preserve the mussel fauna most of the rest of the fauna will be preserved as well.

SUMMARY

Freshwater mussels in Georgia, South Carolina and North Carolina are in trouble. Many species are fast disappearing. Surveys over the last several years indicate the freshwater mussels diversity is greatly reduced in many streams and rivers. More effort needs to be made to survey our mussel fauna before we lose any more species. We need to preserve our freshwater biodiversity, including the invertebrates. Mussels are good indicators which should be monitored to give us more information about the health of our waters.

LITERATURE CITED

- Adams, William F., 1990. Recent changes in the freshwater molluscan fauna of the Greenfield Lake Basin, North Carolina. *Brimleyana* No. 16, 103-117.
- Ahlstedt, Steven, 1984. Recovery plan for the rough pigtoe pearly mussel (*Pleurobema plenum*). U.S. Fish and Wildlife Service, USFWS Region 4, Atlanta, Georgia.
- Alderman, John M., 1988. Tar River spiny mussel survey. pp. 192-218, In: Annual Performance Report. North Carolina Wildlife Resources Commission, Division of Wildlife Management, Raleigh.
- Alderman, John M., 1991. Survey for the dwarf wedge mussel (*Alasmidonta heterodon*) in Contentnea Creek. Non-game Project Report. Nongame and Endangered Wildlife Program. Division of Wildlife Management. North Carolina Wildlife Resources Commission.
- Britton, Joseph C. and Samuel L. H. Fuller, 1979. The freshwater bivalve Mollusca (Unionidae, Sphaeriidae, Corbiculidae) of the Savannah River Plant, South Carolina Savannah River Plant National Environmental Research Park Program, U.S. Dept. of Energy SNO-N-ERP-3.

- Clarke, Arthur H., 1983. Status survey of the Tar River spiny mussel. Final Project Report for the U.S. Fish and Wildlife Service, Asheville, NC.
- Clench, William J. and Ruth D. Turner, 1956. Freshwater mollusks of Alabama, Georgia and Florida from the Escambia to the Suwannee River. *Bulletin of the Florida State Museum*, 1 (3): 96-239.
- Coney, C. Clifton, Gregory C. DeCamp and Michael E. Harrelson, 1983. The Bivalvia of the Great Pee Dee River in Florence County, South Carolina. *Bulletin of the South Carolina Academy of Science* 45: 87.
- Fuller, Samuel L. H., 1973. *Fusconaia masoni* (Conrad, 1834) (Bivalvia: Unionacea) in the Atlantic Drainage of the southeastern United States. *Malacological Review*, No. 6: 105-117.
- Fuller, Samuel L. H., 1974. Clams and mussels (Mollusca: Bivalvia). In Hart, C. W. and S. L. H. Fuller (eds). *Pollution Ecology of Freshwater Invertebrates*. Academic Press, New York, N.Y. pp. 215-273.
- Fuller, Samuel L. H., 1977. Freshwater and terrestrial mollusks. In J. E. Cooper, S. S. Robinson, and J. B. Funderburg (eds). *Endangered and threatened plants and animals of North Carolina*. N. C. State Museum of Natural History, Raleigh, NC. pp. 143-194.
- Fuller, Samuel L. H., 1978. Freshwater mollusks. pp. 136-152, In: Richard G. Zingmark (ed.), *An annotated checklist of the biota of the coastal zone of South Carolina*. University of South Carolina Press, Columbia, South Carolina.
- Fuller, Samuel L. H., Marc J. Imlay and James D. Williams, 1976. Endangered or threatened freshwater mussels (Mollusca: Bivalvia: Unionidae) of the Waccamaw River basin of the Carolinas. *Assoc. SE Bio. Bull.* 23(2): 60.
- Heard, William H. 1970. Eastern freshwater mollusks (II), The South Atlantic and Gulf Drainage. pages 23-37, In A. H. Clarke (ed). *Papers on the Rare and Endangered Mollusks of North America*. *Malacologia*, 10: 1-56.
- Heard, William H., 1975. Determination of the endangered status of freshwater clams of the Gulf and southeastern States. Final Report, Office of Endangered Species, U. S. Fish and Wildlife Service.
- Horn, Karen J. and Hugh J. Porter, 1981. Correlations of shell shape of *Elliptio waccamawensis*, *Leptodea ocharacea* and *Lampsilis* sp. (Bivalvia: Unionidae) with environmental factors in Lake Waccamaw, Columbus County, North Carolina.
- Hurd, John Carleton, 1974. Systematics and zoogeography of the Unionacean mollusks of the Coosa River drainage of Alabama, Georgia and Tennessee. Ph.D. Dissertation, Auburn University
- Johnson, Richard I., 1970. The Systematics and zoogeography of the Unionidae (Mollusca: Bivalvia) of the southern Atlantic slope region. *Bulletin of the Museum of Comparative Zoology*, 140 (6): 263-449.
- Johnson, Richard I., 1972. The Unionidae (Mollusca: Bivalvia) of peninsular Florida. *Bulletin of the Florida State Museum Biological Sciences*, 16 (4):181-249.
- Keferl, Eugene P., 1981. A survey of the naiades of the Ohoopsee River, Georgia. *The Bulletin of the American Malacological Union, Inc.* pgs. 11-15.
- Keferl, Eugene P., 1991. A status survey for the Carolina heelsplitter (*Lasmigona decorata*), a freshwater mussel endemic to the Carolinas. U.S. Department of the Interior, Fish and Wildlife Service.
- Keferl, Eugene P., 1993. Mussel survey of the upper Contentnea Creek drainage basin in Wilson, Johnston, and Nash Counties, North Carolina. A Technical Report to CZR Incorporated, Wilmington, North Carolina.
- Keferl, Eugene P. and Rowland M. Shelley, 1988. The final report on a status survey of the Carolina heelsplitter, *Lasmigona decorata* and the Carolina elktoe, *Alasmidonta robusta*. U.S. Department of the Interior, Fish and Wildlife Service.
- Lea, Isaac, 1829-1874. *Observations on the genus Unio*. Vols. 1-13. Isaac Lea, Philadelphia, Pennsylvania.
- McGrath, C., 1991. Freshwater mussel distribution and the threat analysis in the Upper Neuse River Basin in Durham County. Masters Thesis, Duke University.
- Moore, Richard H. and C. Cliff Coney 1983. Aquatic fauna of the Congaree Swamp National Monument. *Bulletin of the South Carolina Academy of Science* 45: 103.
- Moser, G. Andrew 1991. Dwarf wedge mussel (*Alasmidonta heterodon*) Recovery Plan. Technical/Agency Draft. U.S. Fish and Wildlife Service. Region 5, Newton Corner, MA.
- Neves, Richard J., 1984. Recovery Plan for the fine-rayed pigtoe pearly mussel (*Fusconaia cuneolus*). U.S. Fish and Wildlife Service, USFWS Region 4, Atlanta, Georgia.
- Neves, Richard J., 1992. A state-of-the-unionids address. Keynote address at the Conservation and Management of Freshwater Mussels meetings, October 12, St. Louis, Missouri, Upper Mississippi River Conservation Committee, U.S. Fish and Wildlife Service, and Mussel Mitigation Trust. North Carolina Wildlife Resources Commission. 1989. Population status, distribution, biology of the Tar River spiny mussel, *Elliptio* (*Cantabria*) *steinmansana* (Johnson and Clarke), in North Carolina. Final Report to the U.S. Fish and Wildlife Service.
- Oesch, Ronald C., 1984. Missouri naiades, A guide to the mussels of Missouri. Missouri Department of Conservation, Jefferson City, Missouri.
- Patrick, R., J. Cairns, Jr., and S. Roback, 1967. An ecosystematic study of the fauna and flora of the Savannah River. *Proc. Acad. Nat. Sci. Phila.*, 118: 109-407.

- Porter, Hugh J., 1985. A molluscan census and ecological interrelationships. Rare and Endangered Fauna of Lake Waccamaw, North Carolina Watershed System, Vol. 1 and 2, North Carolina Endangered Species Restoration, Final Report, NC Wildlife Resources Commission, Raleigh.
- Porter, Hugh J. and Karen J. Horn, 1984. Freshwater Mollusca of upper Waccamaw River, North and South Carolina. J. Elisha Mitchell Scientific Society, 97:270.
- Raulerson, L. and W. D. Burbanck. 1962. The life cycle and ecology of *Elliptio hopetonensis* Lea. Assoc. Southeast. Biol., 9: 39, Abstract.
- Shelley, Rowland M. 1987. Unionid mollusks from the upper Cape Fear River basin, North Carolina, with a comparison of the faunas of the Neuse, Tar and Cape Fear drainages (Bivalvia: Unionacea). *Brimleyana* No. 13, 67-89.
- Sickel, James B., 1969. A survey of the mussel populations (Unionidae) and Protozoa of the Altamaha River with references to their use in monitoring environmental changes. Master's Thesis, Emory University, Atlanta, Georgia.
- Sickel, James B., 1980. Correlation of unionid mussels with bottom sediment composition in the Altamaha River, Georgia. The Bulletin of the American Malacological Union, Inc. 1980 pages 10-13.
- Stansbery, David H. and William J. Clench 1978. The Mollusca of Lake Waccamaw in North Carolina. Bulletin of American Malacological Union. p. 63.
- Walter, Waldemar M., 1956. Mollusks of the Upper Neuse River basin, North Carolina. Journal of Elisha Mitchell Scientific Society 72(2): 262-274.