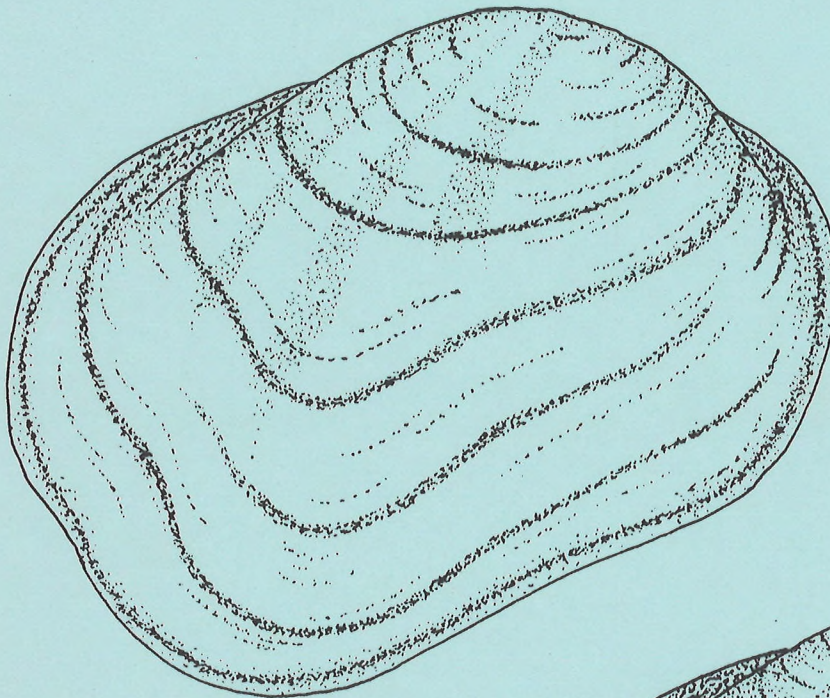


# A Survey of the Freshwater Mussels of the Kanawha River

from Riverhead  
(Gauley Bridge, WV)

to River Mouth  
(Point Pleasant, WV)



**US Army Corps  
of Engineers**  
Huntington District

by **Ralph W. Taylor, Ph.D.**



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from River Head (Gauley Bridge, WV)  
to River Mouth (Point Pleasant, WV)

A Report Submitted To  
The U. S. Army Corps of Engineers  
Huntington District

February 15, 1983

By  
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## PREFACE

The present report was prepared at the request of the U.S. Army Engineer District, Huntington. It is one part of a series of studies intended to provide the Corps baseline information for the preparation of documents pertaining to the environmental impacts of improved navigation on the Kanawha River, West Virginia.

This report is a primary research effort with a secondary review of the current scientific literature. To date this is the only document in print covering the mussel fauna of the entire Kanawha River from mouth to head. Because of the report's potential general applicability to public and private river projects, as well as future academic endeavors, it is being disseminated by the Huntington District, U.S. Army Corps of Engineers.

The report was prepared by Dr. Ralph W. Taylor, Associate Professor of Biological Sciences, Marshall University, under contract number DACW69-82-C-0081. Technical and editorial review was provided by Huntington District personnel.

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TABLE OF CONTENTS

|   | Page |
|---|------|
| Project Personnel . . . . .                           | i    |
| List of Tables . . . . .                              | iii  |
| Abstract . . . . .                                    | 1    |
| Introduction . . . . .                                | 2    |
| The Kanawha River: A Historical Perspective . . . . . | 6    |
| Kanawha River Map . . . . .                           | 7    |
| Materials and Methods . . . . .                       | 8    |
| Species Account . . . . .                             | 19   |
| Results . . . . .                                     | 47   |
| Relative Abundance By Sampling Site . . . . .         | 55   |
| Age Class Distributions . . . . .                     | 58   |
| Literature Cited . . . . .                            | 60   |
| Recommendations For Future Studies . . . . .          | 62   |

## List of Tables

| Table  | Page |
|--|------|
| 1. A comparison of the findings of Taylor (1982), Clarke (1982) and Stansbery (1980) . . . . .   | 4    |
| 2. A preliminary list of the Naiad shells recovered from the Buffalo Site: An archeological deposit, Putnam County, WV (46 Pu 31) . . . . .          | 9    |
| 3. Shells recovered from an archeological site designated as 46 Ms 41, Mason County, West Virginia. Location: Kanawha River mile 8.7, L.D.B. . . . . | 10   |
| 4. Mussels reported from the Elk River, Taylor and Hughart (1981) . . . . .  | 12   |
| 5. Additional Elk River species from old museum records (O.S.U.) . . . . .   | 13   |
| 6. Mussel species collected from the Pocatalico River . . . . .  | 14   |
| 7. Mussel species collected from the Coal River . . . . .  | 15   |
| 8. Mussel species collected from the New River . . . . .   | 16   |
| 9. Mussel species collected from Little Hurricane Creek . . . . .  | 17   |
| 10. Mussel species collected from Hurricane Creek . . . . .  | 18   |
| 11. Mussels found in the Kanawha River during 1982 study . . . . .   | 48   |
| 12. Freshwater mussels collected by earlier investigators but not found during this study . . . . .  | 49   |
| 13. Mussels collected in the Elk River at first shoals ERm 4.0 during this study . . . . .   | 51   |
| 14. Localities where <u>Corbicula fluminea</u> was found in large numbers . . . . .  | 53   |
| 15. Mussel species occurring above Kanawha Falls . . . . .   | 54   |
| 16. Mussel Bed Localities and Resident Species . . . . .   | 59   |

## Abstract

A reconnaissance of the Kanawha River from head to mouth produced data on 27 species of freshwater mussels plus the Asian clam. The majority of specimens was found in a stretch of river, approximately five miles long, immediately below Kanawha Falls. Only six species of mussels were found above the falls.

The large population below Kanawha Falls is healthy and in no apparent danger at this time. It is located above slackwater and well above the navigation pool. Increased use of the Kanawha by barge traffic should have no effect on this population.

The lower 75 miles are presumed to be devoid of mussel life with the exception of the Asian clam. Good populations of this clam were found sporadically along the reach of the river.

Two species of freshwater mussels, which are currently listed by the U.S.F.W.S. as endangered or threatened, have been reported in recent times as occurring in the Kanawha River headwaters. Only one of the two species, Lampsilis orbiculata, was found during this study. Epioblasma t. torulosa was not found and can be presumed to no longer survive in this drainage. Lampsilis orbiculata was found only in the stretch between Kanawha Falls and the head of slackwater. A fairly good-sized healthy population exists at this locality.



## Introduction

The naiad population of the Kanawha River main stem has been for some time, and still remains, somewhat of a mystery. For some unknown reason the early "greats" in the field of malacology did not choose to venture into the Kanawha valley, or if collections were made they have gone unreported in the scientific literature.

Dr. David H. Stansbery and his colleagues from the Ohio State University Museum of Zoology have made occasional collections in the Kanawha River near Kanawha Falls for over a decade. This material is deposited with the O.S.U. Museum, but the work remains unpublished. Morris and Taylor (1978) published the only work to this date dealing with the Kanawha River naiad fauna.

The discovery, many years ago, that there might persist, in the Kanawha River, relict populations of two mussel species currently listed on the U. S. Fish and Wildlife Service Rare and Endangered Species list has generated a new interest in the Kanawha. Federal and state regulatory agencies are now acutely aware and sensitive to changes resulting in environmental degradation.

In 1980, Stansbery searched approximately five miles of the Kanawha River below Kanawha Falls. This project was conducted to study possible deleterious effects that construction of some proposed sewer lines across the river would/could have on the populations of the two previously mentioned rare species. Stansbery found only one of the endangered species Lampsilis orbiculata (= abrupta) still surviving in small numbers in the pool below Kanawha Falls. He also reported an additional 27 species of naiads inhabiting the stream just below the falls.

Clarke (1982), under contract to the U. S. Fish and Wildlife Service, returned to the scene with essentially the same mandate: to ferret out these two illusive species and make a statement on presence or absence, population numbers, microhabitat requirements and potential danger of extirpation if any. Clarke's findings were comparable to Stansbery's as they worked the same Ca. five-mile stretch of river. He also failed to find Epioblasma t. torulosa, but did find a rather sizeable population of L. orbiculata in addition to 23 other resident naiad species. The findings of Clarke, Stansbery and this team are compared in Table 1.

The charge of this project was to survey the reach of the river from its origin as the Gauley and New Rivers join at Gauley Bridge, West Virginia to the confluence of the Kanawha and Ohio Rivers near Point Pleasant, West Virginia. Our search began at Point Pleasant and continued for approximately two miles upstream of Kanawha Falls. This project also includes some work on the major tributaries of the main stem (Elk, Pocatalico and Coal) and some smaller streams.

This paper corroborates some earlier findings and adds a few additional species, thus bringing the probable number of naiad species living in the Kanawha River below Kanawha Falls to 34 (Table 1). We have extended the known mussel population down a few more miles of river. We have not, however, solved the original mystery of the Kanawha: what happened to the apparently quite large naiad population that existed throughout the river prior to the turn of the twentieth century (Stansbery, 1964). The fact remains that below Kanawha River Mile 79 the river, with reference to Unionid bivalves, is apparently DEAD. Many scientists believe a combination of factors leads to the eradication of mussels from streams of this type. These factors include

Table 1. A comparison of the findings of Taylor (1982), Clarke (1982) and Stansbery (1980).

| Scientific Name                                       | Taylor | Clarke | Stansbery |
|---|--------|--------|-----------|
| <u>Anodonta imbecillis</u> Say, 1829                  | X      |        | X         |
| <u>Anodonta g. grandis</u> Say, 1829                  | X      |        | X         |
| <u>Strophitus u. undulatus</u> (Say, 1817)            | X      | X      | X         |
| <u>Simpsonaias ambigua</u> (Say, 1825)                |        |        | X         |
| <u>Lasmigona costata</u> (Rafinesque, 1820)           | X      | X      | X         |
| <u>Lasmigona subviridis</u> (Conrad, 1835)            |        |        | X         |
| <u>Megalonaias nervosa</u> (Rafinesque, 1820)         |        | X      |           |
| <u>Tritogonia verrucosa</u> (Rafinesque, 1820)        | X      | X      | X         |
| <u>Quadrula pustulosa pustulosa</u> (Lea, 1831)       | X      | X      | X         |
| <u>Amblema p. plicata</u> (Say, 1817)                 | X      | X      | X         |
| <u>Fusconaia m. maculata</u> (Rafinesque, 1820)       | X      | X      | X         |
| <u>Cyclonaias tuberculata</u> (Rafinesque, 1820)      | X      | X      | X         |
| <u>Pleurobema sintoxia</u> (Rafinesque, 1820)         | X      | X      | X         |
| <u>Pleurobema cordatum</u> (Rafinesque, 1820)         | X      | X      |           |
| <u>Pleurobema rubrum</u> (Rafinesque, 1820)           | X      |        |           |
| <u>Elliptio c. crassidens</u> (Lamarck, 1819)         | X      | X      | X         |
| <u>Elliptio dilatata</u> (Rafinesque, 1820)           | X      | X      | X         |
| <u>Ptychobranchnus fasciolaris</u> (Rafinesque, 1820) | X      | X      | X         |
| <u>Plethobasus cyphus</u> (Rafinesque, 1820)          |        | X      |           |
| <u>Obliquaria reflexa</u> Rafinesque, 1820            |        | X      |           |
| <u>Cyprogenia stegaria</u> (Rafinesque, 1820)         |        | X      | X         |
| <u>Actinonaias l. carinata</u> (Barnes, 1823)         | X      | X      | X         |
| <u>Ellipsaria lineolata</u> (Rafinesque, 1820)        | X      |        |           |
| <u>Obovaria subrotunda</u> (Rafinesque, 1820)         | X      | X      | X         |
| <u>Truncilla truncata</u> Rafinesque, 1820            |        |        | X         |
| <u>Leptodea fragilis</u> (Rafinesque, 1820)           | X      | X      | X         |
| <u>Potamilus alatus</u> (Say, 1817)                   | X      | X      | X         |
| <u>Ligumia recta</u> (Lamarck, 1819)                  | X      | X      | X         |
| <u>Villosa i. iris</u> (Lea, 1829)                    | X      |        | X         |
| <u>Lampsilis r. luteola</u> (Lamarck, 1819)           | X      |        |           |
| <u>Lampsilis orbiculata</u> (Hildreth, 1823)          | X      | X      | X         |
| <u>Lampsilis ventricosa</u> (Barnes, 1823)            | X      |        | X         |
| <u>Lampsilis ovata</u> (Say, 1817)                    | X      | X      | X         |
| <u>Lampsilis fasciola</u> Rafinesque, 1820            | X      | X      | X         |
| Total Number of Species                               | 27     | 24     | 27        |
| Combined Total of Species = 34                        |        |        |           |

damming, dredging, siltation, industrial and human pollution, acid mine-runoff and probably many others. Several other large river systems have suffered similar tragedies within this century (Starrett, 1971).

It is the hope of this team that all concerned will have a heightened awareness concerning the plight of the very rich population that exists below Kanawha Falls. These 34 species constitute by far the richest naiad faunal assemblage in the State of West Virginia and should be preserved at all costs.

## The Kanawha River: A Historical Perspective

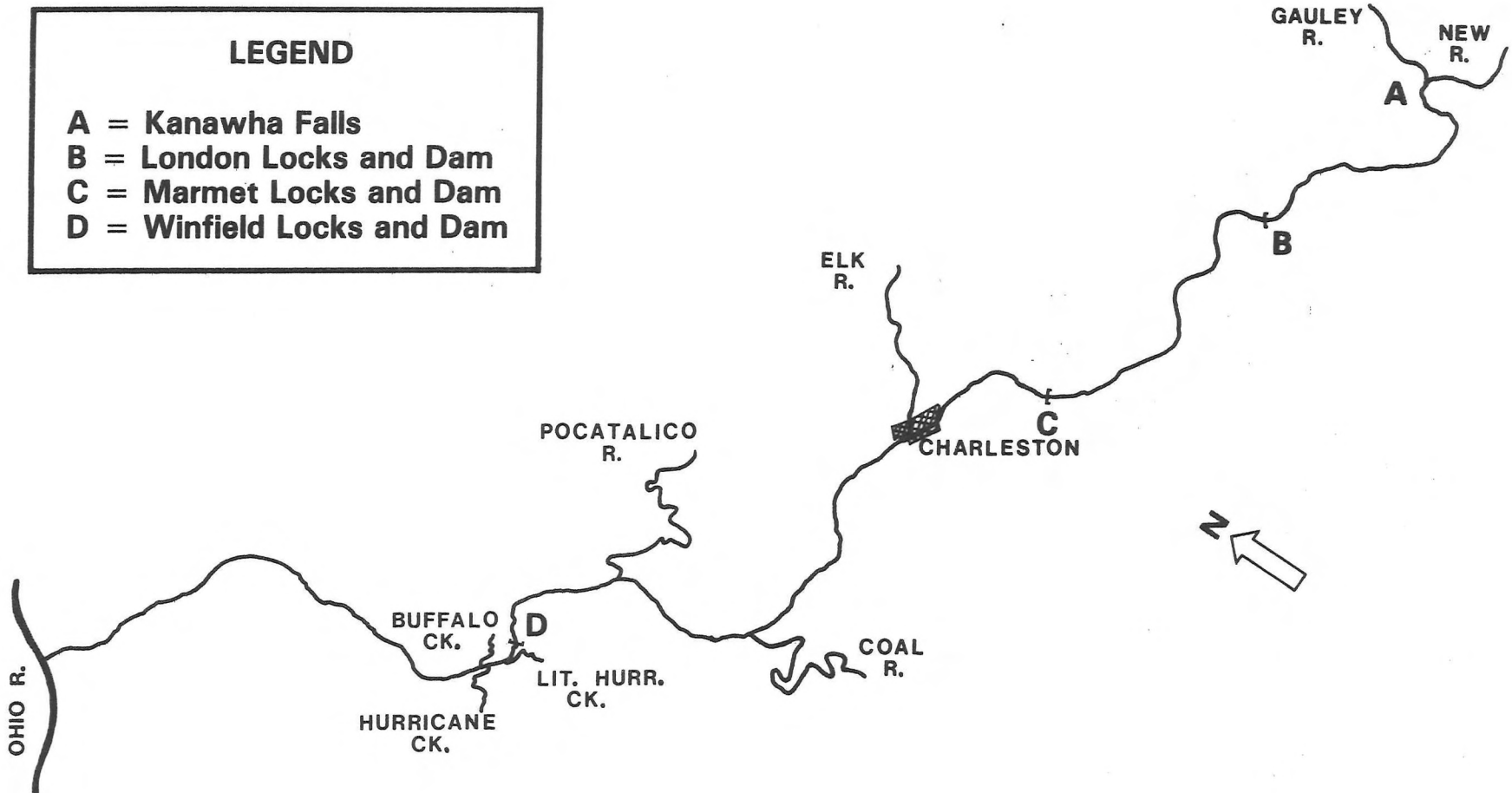
The Kanawha River ran free and unmodified well into historical times. As early settlements sprang up along the river's edge, there developed a need for improved navigational capabilities. The first extensive modification of the Kanawha mainstem was completed in 1823 as a series of wing dams and chutes were constructed to guarantee a three-foot navigable channel. Along with an increased urbanization of the Kanawha Valley during the 1880's came a need for further development of the river's potential as a major artery for transporting produce, raw materials and manufactured products. Bigger barges required deeper water, so a series of locks and dams were completed in 1889, thus guaranteeing a navigable pool of six feet. This still was not adequate for the transportation needs of the region, so in 1934 Marmet Locks and Dam and London Locks and Dam were completed, and in 1937 Winfield Locks and Dam became functional thus guaranteeing a nine-foot channel throughout 90 miles of the Kanawha. The lower Kanawha from Winfield Locks and Dam to the Ohio River also maintains a nine-foot channel as a result of the backwaters of Gallipolis Locks and Dam (completed in 1937) on the Ohio River. It is assumed that this channel depth will meet shipping needs well into the twenty-first century (U.S.A.C.E., 1975).

As navigation capabilities grew so did cities, towns and their related industries. Growth was good for the region, good for the people and good for industry. It was not in many ways, however, good for the environment.

The impacts upon the aquatic inhabitants of the Kanawha River have been great. Habitat degradation has been severe. When a stream is modified to encourage navigation, it becomes a totally different habitat type. What was once a stream consisting of a series of shallow pools interrupted intermittently by shoals has now become a series of rather deep lake-like impoundments. The shoal habitat is gone, water flow rate decreases and silt and sediment load increases. Water temperatures near the substrate, where benthic forms live, tend to be cooler and dissolved oxygen levels fall. Add to these already serious modifications the heavy pollution load originating in industrial and city sewage-system effluents and the possibility of much of anything, in the form of plant or animal life, surviving seems miraculous. One could also mention acid mine drainage, enrichment resulting from agricultural practices and increased erosion, and thus siltation resulting from deforestation. A combination of these factors led to the inevitable fact that for many years the Kanawha River had been a biological desert. Much evidence exists today which indicates that the Kanawha is currently in better shape than it has been for many years. Through the activities of local, state and national agencies, the river is again becoming suitable habitat for some kinds of aquatic life.

**LEGEND**

- A = Kanawha Falls**
- B = London Locks and Dam**
- C = Marmet Locks and Dam**
- D = Winfield Locks and Dam**



Very little is known about the plants and animals that inhabited the Kanawha River prior to the above-mentioned modifications. None of the great naturalists who roamed much of the backwoods of North America during the late nineteenth and early twentieth centuries visited the river, so no historical record is available. Without baseline data on pristine conditions, any attempt to document changes in the river's resident flora or fauna, occurring as a result of man's activities, would at best be subjective, hardly scientific and highly suspect.

Through the use of archeological evidence a great deal can be learned about life forms that existed during an earlier time. The American Indian of this area derived from the river much of his food resources for at least some portion of the year. Fortunately, at least from the standpoint of this paper, freshwater mussels played an important role in the daily lives of these people. Shells were gathered as a source of food and as a source of raw material useful in the manufacturing of pottery. Shells were also used as scrapers, digging implements and ornaments. When a shell was no longer needed it was discarded in middens (garbage piles) and many have remained there, little changed by time, until the present. By sifting through the middens along the banks of the Kanawha River one can piece together the mussel fauna that existed in the river prior to its modification by man. This team collected many shells from the site designated as 46 Ms 41, and Stansbery (1975) reported on work at 46 Pu 31. Evidence from these two sites indicates an extensive freshwater mussel fauna inhabiting much of the Kanawha River where, as was mentioned earlier, nothing lives today. These data are presented in Tables 2 and 3. At least 28 species of mussels were inhabitants of the lower Kanawha until fairly recent times.

#### Materials and Methods

A reconnaissance survey of the freshwater mussel fauna of the Kanawha River was conducted during the months of September, October and November of 1982. Most of the search was carried out using a 16 foot bass boat outfitted with a 50 horsepower engine. In areas where there were no launching facilities available a 12 foot aluminum fishing boat, equipped with a 10 horsepower motor, was utilized.

Both banks were scanned with the hopes of finding some evidence of the presence of mussels. The most successful technique involved finding muskrat middens (shells left behind after a muskrat had eaten the flesh). All areas of likely-looking habitat were also checked, even though no shell remains were immediately obvious. When shells were found the area was thoroughly checked through a combination of activities. Shallow waters were waded and specimens collected by hand. In order to check deeper waters a ten-foot long crow-foot brail was utilized. Local fishermen were quizzed concerning their knowledge of mussels being present in the Kanawha years ago, but none could document current populations of anything except the ubiquitous Asian Clam (Corbicula fluminea).

Table 2. A preliminary list of the Naiad shells recovered from the Buffalo Site: An archeological deposit, Putnam County, WV (46 Pu 31).

| Species  | Percent of<br>Total Population |
|--|--------------------------------|
| <u>Quadrula c. cylindrica</u> (Say, 1817)            | .2                             |
| <u>Quadrula metanevra</u> (Rafinesque, 1820)         | .9                             |
| <u>Quadrula p. pustulosa</u> (Lea, 1831)             | 2.7                            |
| <u>Amblema p. plicata</u> (Say, 1817)                | 2.1                            |
| <u>Fusconaia maculata</u> (Lea, 1831)                | 26.0                           |
| <u>Cyclonaias tuberculata</u> (Rafinesque, 1820)     | 4.7                            |
| <u>Plethobasus cyphyus</u> (Rafinesque, 1820)        | 1.4                            |
| <u>Plethobasus cicatricosus</u> (Say, 1829)          | .5                             |
| <u>Plethobasus striatus</u> (Rafinesque, 1820)       | .3                             |
| <u>Pleurobema clava</u> (Lamarck, 1819)              | 12.2                           |
| <u>Pleurobema plenum</u> (Lea, 1840)                 | 1.9                            |
| <u>Pleurobema sintoxia</u> (Rafinesque, 1820)        | 1.7                            |
| <u>Pleurobema cordatum</u> (Rafinesque, 1820)        | 4.0                            |
| <u>Pleurobema rubrum</u> (Rafinesque, 1820)          | 4.7                            |
| <u>Elliptio c. crassidens</u> (Lamarck, 1819)        | 15.0                           |
| <u>Elliptio dilatata</u> (Rafinesque, 1820)          | 2.4                            |
| <u>Ptychobranthus fasciolaris</u> (Rafinesque, 1820) | 5.7                            |
| <u>Cyprogenia stegaria</u> (Rafinesque, 1820)        | .7                             |
| <u>Plagiola lineolata</u> (Rafinesque, 1820)         | .2                             |
| <u>Obovaria subrotunda</u> (Rafinesque, 1820)        | .2                             |
| <u>Obovaria retusa</u> (Lamarck, 1819)               | .3                             |
| <u>Ligumia recta</u> (Lamarck, 1819)                 | 4.5                            |
| <u>Lampsilis r. luteola</u> (Lamarck, 1819)          | .5                             |
| <u>Lampsilis orbiculata</u> (Hildreth, 1828)         | 1.0                            |
| <u>Lampsilis ventricosa</u> (Barnes, 1823)           | .2                             |
| <u>Lampsilis ovata</u> (Say, 1817)                   | 2.6                            |
| <u>Epioblasma personata</u> (Say, 1829)              | .2                             |
| <u>Epioblasma t. torulosa</u> (Rafinesque, 1820)     | 3.3                            |



Table 3. Shells recovered from an archeological site designated as 46 Ms 41, Mason County, West Virginia. Location: Kanawha River mile 8.7, L.D.B.

---

Amblema p. plicata

Pleurobema cordatum

Pleurobema rubrum

Quadrula p. pustulosa

Fusconaia maculata

---

In addition to the reconnaissance of the reach of the river, five stations were designated for intensive study. Although no evidence of mussels was available at these sites, the areas were brailed extensively. These areas are currently being monitored through the Kanawha River Navigation System Environmental Studies. Any evidence concerning mussels would serve as an adjunct component to these studies. The five sites were located as follows.

- a. Rivermile 30.6      Winfield Dam light and day mark
- b. Rivermile 32.0      Downstream of Winfield bridge
- c. Rivermile 67.3      Near mouth of Burning Springs Branch
- d. Rivermile 70.6      Downstream end of Witcher's Island
- e. Rivermile 82.2      Near London light and day mark

No living mussels were killed as a result of this study. When a live specimen was collected it was identified, its location was noted and it was returned to the water. A sufficient sample of fresh dead shells was collected to negate the value of taking live material. Shells collected were returned to the laboratory where they were cleaned, identified, aged and measured. Data gleaned from this activity are included in the Results section of this report.

A sizable collection of specimens was cataloged and retained as a permanent record in the Marshall University Malacological Collections. Voucher specimens have also been placed in The Ohio State University Museum of Zoology. Dr. David H. Stansbery of that institution confirmed the identification of some questionable specimens and positively confirmed the identity of several specimens of the Pink Mucket Pearly Mussel (Lampsilis orbiculata). This species is currently on the Federal Endangered and Threatened list.

Information on the mussel faunas of the stream's tributary to the Kanawha was gleaned from a variety of sources. This author has collected fairly extensively in all the major tributaries and these collections are housed at Marshall University. Additional records were found in the collections at The Ohio State University Museum of Zoology, Columbus, Ohio and the Carnegie Museum, Pittsburgh, Pennsylvania. Some literature records were also included. These data are presented in Tables 4-10.

Table 4. Mussels reported from the Elk River, Taylor and Hughart (1981).

---

Strophitus u. undulatus

Lasmigona costata

Quadrula pustulosa

Amblema plicata

Fusconaia maculata

Fusconaia flava

Pleurobema clava

Pleurobema sintoxia

Elliptio crassidens

Ptychobranhus fasciolaris

Actinonaias ligamentina carinata

Obovaria subrotunda

Ligumia recta

Villosa i. iris

Lampsilis radiata luteola

Lampsilis ventricosa

Lampsilis fasciola

---

Table 5. Additional Elk River species from old museum records (O.S.U.).  
(All specimens were taken at Kanawha Falls.)

---

Alasmidonta marginata

Cyclonaias tuberculata

Truncilla truncata

Lampsilis orbiculata

Lampsilis ovata

Epioblasma torulosa rangiana

---

Table 6. Mussel species collected from the Pocatalico River. These specimens are currently housed at Marshall University.

---

Lampsilis radiata luteola

Lampsilis ventricosa

Amblema plicata

Tritogonia verrucosa

Villosa lienosa

Strophitus u. undulatus

Anodonta g. grandis

Obovaria subrotunda

Fusconaia flava

Quadrula quadrula

Anodontoides ferussacianus

Anodonta imbecillis

Quadrula pustulosa

Lasmigona complanata

Toxolasma parvus

---

Table 7. Mussel species collected from the Coal River. These specimens are housed at the Marshall University Malacological Collections.

---

Quadrula p. pustulosa

Ptychobranthus fasciolaris

Fusconaia flava

Lampsilis r. luteola

Obovaria subrotunda

Amblyma p. plicata

---

Table 8. Mussel species collected from the New River. Specimens are housed at the Marshall University Malacological Collections.

---

Lampsilis ventricosa

Actinonaias l. carinata

---

Table 9. Mussel species collected from Little Hurricane Creek.  
Specimens are housed at the Marshall University Malacological  
Collections.

---

Strophitus u. undulatus

Lampsilis r. luteola

Anodonta g. grandis

---



Table 10. Mussel species collected from Hurricane Creek. Specimens are housed at the Marshall University Malacological Collections.

---

Fusconaia flava

Lasmigona complanata

Anodonta g. grandis

Anodontoides ferussacianus

Quadrula quadrula

Simpsonaias ambigua

Lampsilis ventricosa

---

## Species Account

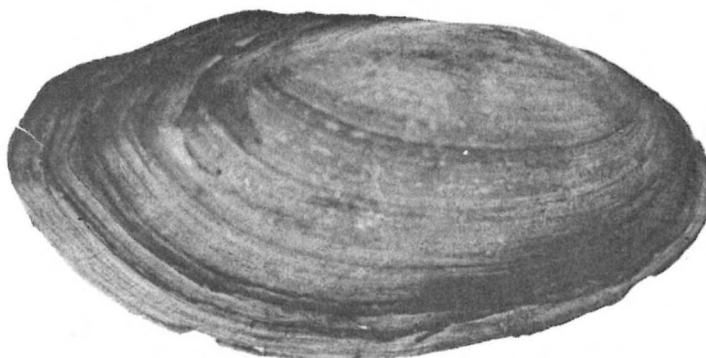
This section provides information on each species collected during this study. Host fish species are given when known. Only fish known to be currently found in the Kanawha River are listed even though other host species may have been identified. This information was principally derived from the work of Fuller (1974).

The current distribution is based upon museum records, published records and the records accumulated by this team at Marshall University over the last decade. These records are recent and extend back no further than 25 years. The additional museum records may go back to the early part of this century.

Little is known about specific micro-habitat requirements for most of the mussel species. The data presented in this section are necessarily very generalized. They are taken from the works of Ortmann (1919) and Starrett (1971) and include this author's personal observations.

Under the current status section the terms RARE, MODERATELY RARE and COMMON are used. These words are defined and used in this text with the following meaning:

- RARE: Current existence limited to small populations in one or two streams within West Virginia; may be quite common elsewhere.
- MODERATELY RARE: May be occasionally found in several streams statewide but never in significant numbers; may also be quite common elsewhere.
- COMMON: Found in large numbers in practically every stream in the state.



Pond paper shell

Anodonta imbecillus

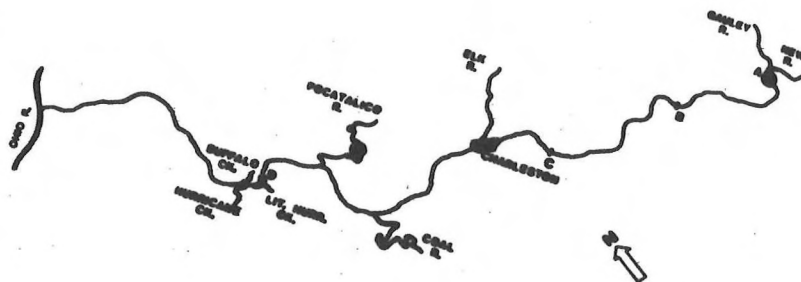
Host fish: Semotilus atromaculatus (Creek chub)  
Lepomis cyanellus (Green sunfish)

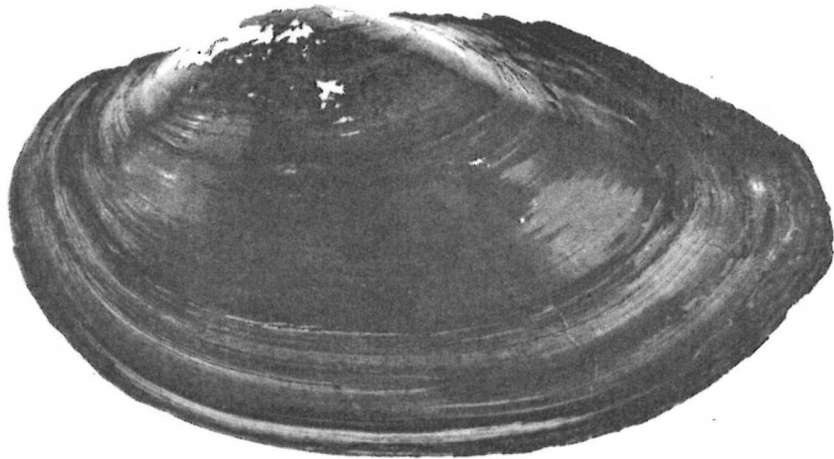
Current distribution in West Virginia: Beech Fork Creek, Twelvepole Creek, Pocatalico River, Kanawha River.

Additional museum records: None.

Preferred habitat: Ponds and quiet waters of small streams.

Current status in West Virginia: Its status is not known at this time but must be considered as moderately rare.





Giant floater

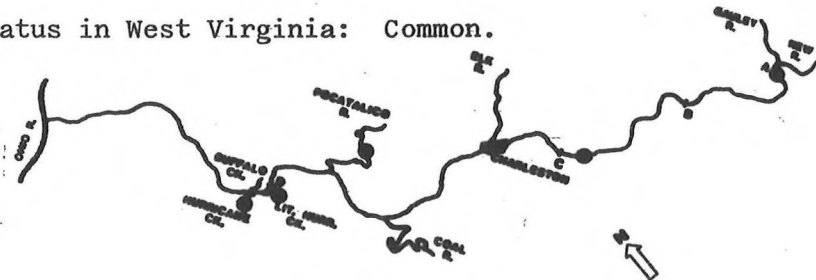
Anodonta grandis grandis

Host fish: Lepisosteus spatula (Alligator gar)  
Alosa chrysochloris (Skipjack herring)  
Dorsoma cepedianum (Gizzard shad)  
Cyprinus carpio (Carp)  
Notemigonus chrysoleucas (Golden shiner)  
Ictalurus natalis (Yellow bullhead)  
Morone chrysops (White bass)  
Ambloplites rupestris (Rock bass)  
Lepomis cyanellus (Green sunfish)  
Lepomis macrochirus (Bluegill)  
Lepomis megalotis (Longear sunfish)  
Micropterus salmoides (Largemouth bass)  
Pomoxis annularis (White crappie)  
Pomoxis nigromaculatus (Black crappie)  
Ethiostoma nigrum (Johnny darter)  
Perca flavescens (Yellow perch)  
Aplodinotus grunniens (Freshwater drum)

Current distribution in West Virginia: Middle Island Creek,  
 Monongahela, Little Kanawha, Pocatalico, Kanawha, Twelvepole  
 Creek.

Preferred habitat: Quiet water in slowly moving streams and lakes;  
 fairly shallow water over mud and sand substrate.

Current status in West Virginia: Common.





Squaw foot

Strophitus u. undulatus

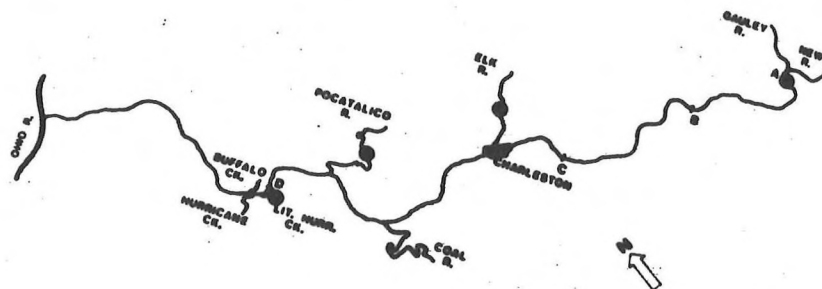
Host fish: Semotilus atromaculatus (Creek chub)  
Lepomis cyanellus (Green sunfish)  
Micropterus salmoides (Largemouth bass)

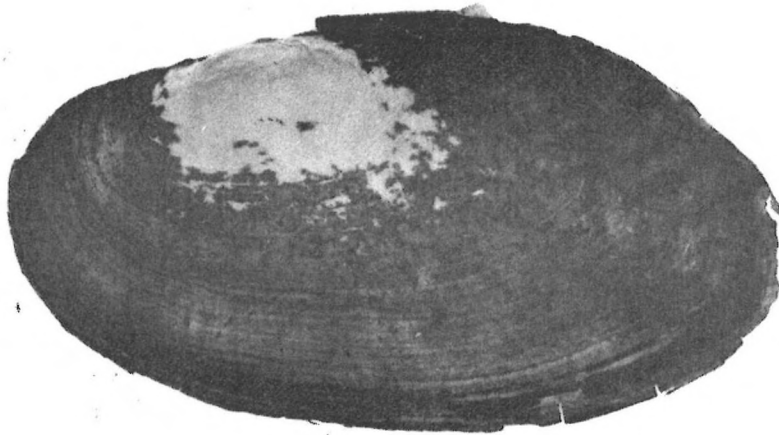
Current distribution in West Virginia: Elk, Monongahela, Middle Island Creek, Little Kanawha, Kanawha, Mud, Twelvepole Creek, Pocatalico River, Little Hurricane Creek.

Additional museum records: West Fork River, Hughes, Sand Fork, Wheeling Creek, Shanandoah River, Coal, Cheat, Reedy Creek, Tygart River.

Preferred habitat: Most commonly found in creeks and small rivers on sand and gravel substrate.

Current status in West Virginia: Common.





Fluted mussel  
Lasmigona costata

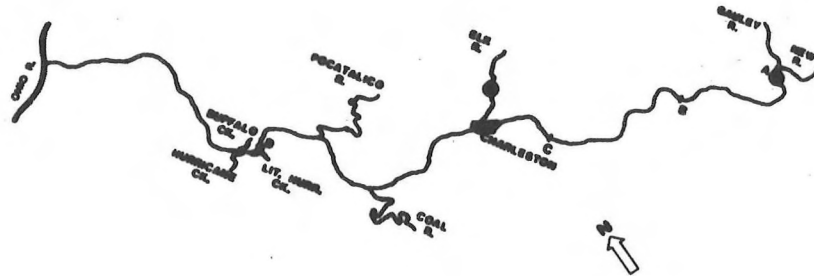
Host fish: Cyprinus carpio (Carp).

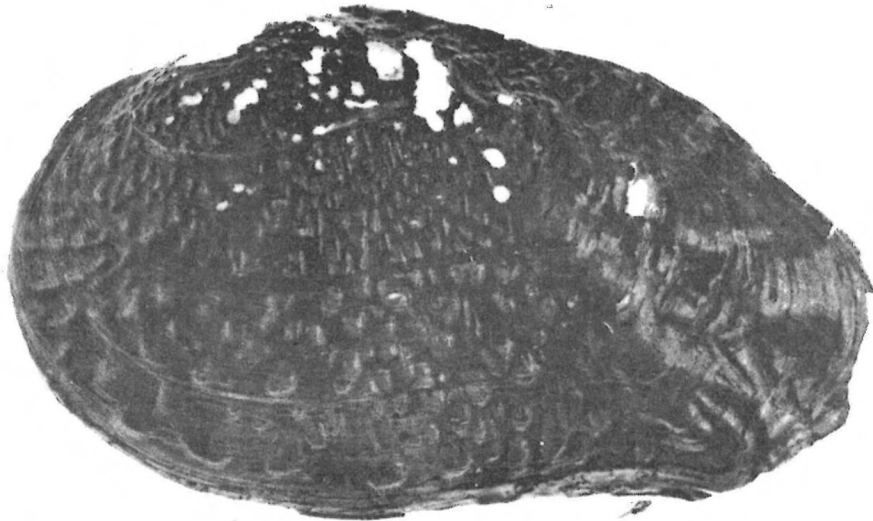
Current distribution in West Virginia: Monongahela, Little Kanawha, Mud, Middle Island Creek, Elk, Kanawha, Twelvepole Creek.

Additional museum records: West Fork River, Hughes, Fish Creek, Coal River, Cheat, Tygart.

Preferred habitat: Small to large rivers over sand and gravel riffles; occasionally over sand in quiet waters.

Current status in West Virginia: Common.





Pistol grip

Tritogonia verrucosa

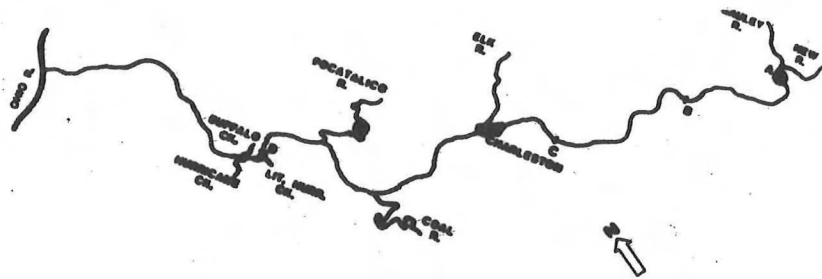
Host fish: Not known.

Current distribution in West Virginia: Little Kanawha, Monongahela, Twelvepole Creek, Middle Island Creek, Pocatalico, Greenbrier, Kanawha.

Additional museum records: Hughes, New, Reedy Creek.

Preferred habitat: Mostly a small stream species, commonly found on riffles in shallow water, with mud and sand bottoms.

Current status in West Virginia: Common.





White wartyback

Quadrula pustulosa

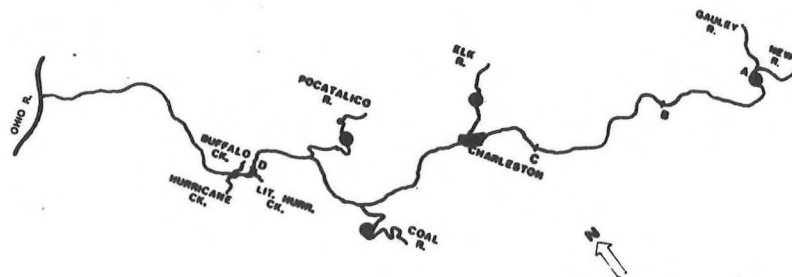
Host fish: Ictalurus melas (Black bullhead)  
Ictalurus nebulosus (Brown bullhead)  
Ictalurus punctatus (Channel catfish)  
Pylodictis olivaris (Flathead catfish)  
Pomoxis annularis (White crappie)

Current distribution in West Virginia: Coal, Pocatalico, Little Kanawha, Twelvepole Creek, Elk, Middle Island Creek, Kanawha.

Additional museum records: Monongahela.

Preferred habitat: Found in rivers and large creeks; prefers relatively shallow waters over sand, gravel and mud substrates.

Current status in West Virginia: Common.







Three ridge

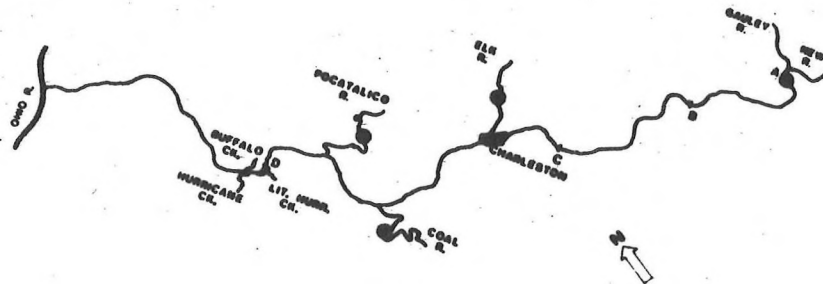
Amblema plicata plicata

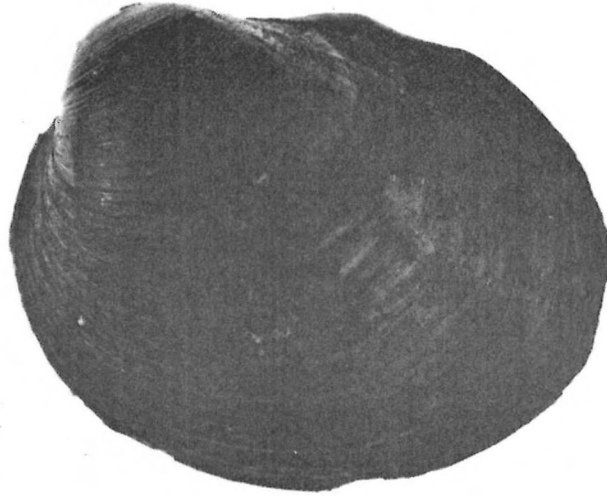
Host fish: Lepisosteus platostomus (Shortnose gar)  
Esox lucius (Northern pike)  
Carpoides velifer (Highfin carpsucker)  
Ictalurus punctatus (Channel catfish)  
Pylodictis olivaris (Flathead catfish)  
Morone chrysops (White bass)  
Ambloplites rupestris (Rock bass)  
Lepomis cyanellus (Green sunfish)  
Lepomis gibbosus (Pumpkinseed)

Current distribution in West Virginia: Coal, Mud, Elk, Twelvepole Creek, Pocatalico, Monongahela, Middle Island Creek, Little Kanawha, Kanawha.

Preferred habitat: Prefers small to medium sized streams with sand and gravel substrates in relatively shallow waters.

Current status in West Virginia: Common.





Long solid mussel  
Fusconaia maculata

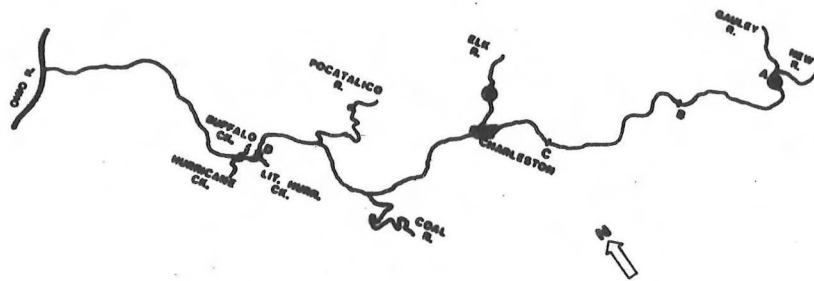
Host fish: Not known.

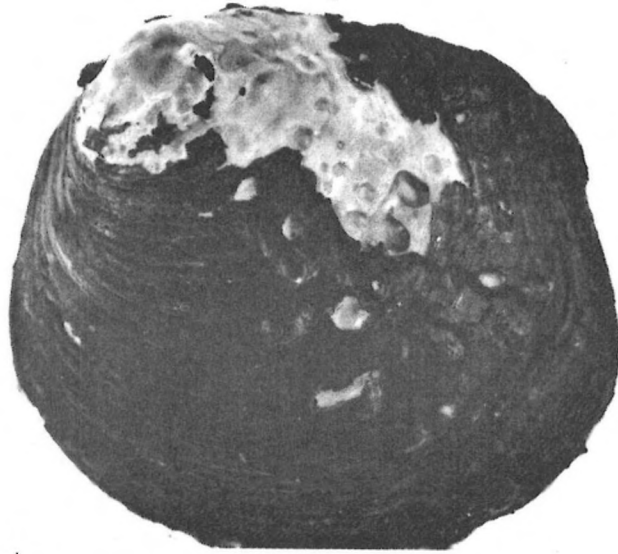
Current distribution in West Virginia: Elk, Kanawha.

Additional museum records: West Fork River, Little Kanawha.

Preferred habitat: No precise data available; seems to prefer shallow larger rivers with gravel substrates.

Current status in West Virginia: RARE; probably restricted to the Kanawha River system at the present time.





Pink pimpleback

Cyclonaias tuberculata

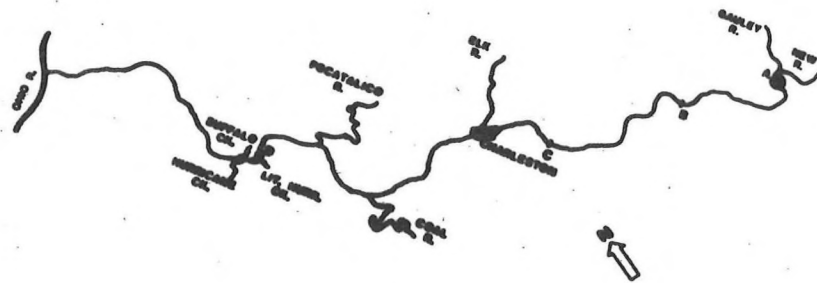
Host fish: Not known.

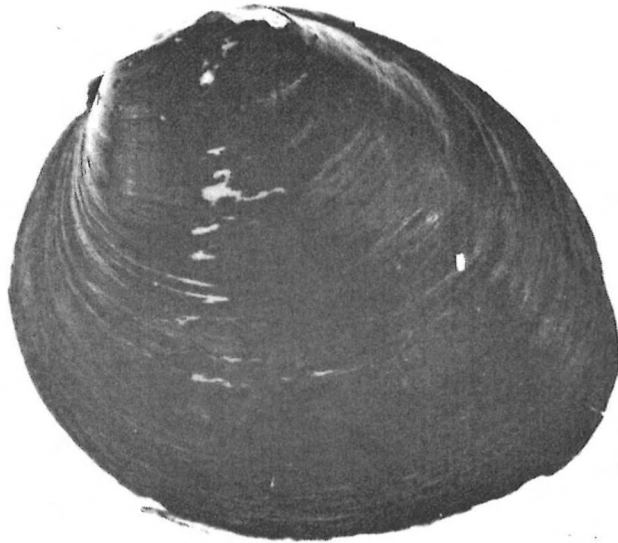
Current distribution in West Virginia: Kanawha, Little Kanawha, Greenbrier.

Additional museum records: West Fork River, Elk, New.

Preferred habitat: Small to large rivers over substrate ranging from mud to gravel in water one to two meters in depth.

Current status in West Virginia: RARE.





Pink pigtoe

Pleurobema sintoxia

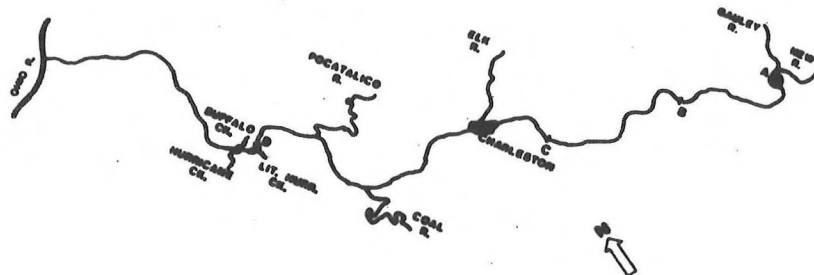
Host fish: Not known.

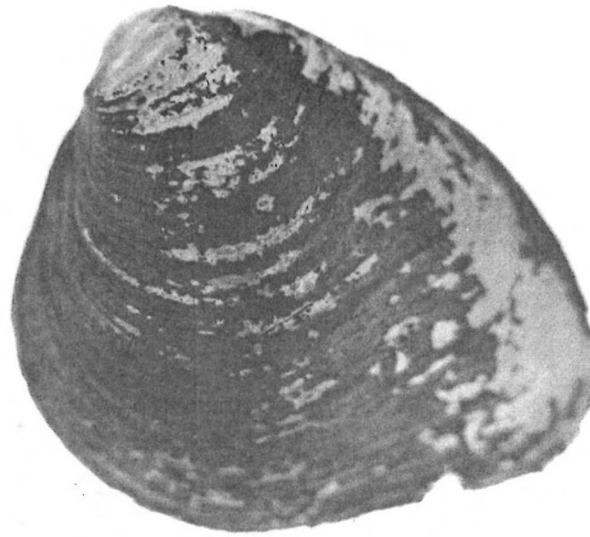
Current distribution in West Virginia: Little Kanawha, Kanawha, Monongahela.

Additional museum records: Elk River.

Preferred habitat: A species of smaller rivers and creeks; shallow water over riffles and sand and gravel bars.

Current status in West Virginia: RARE.





Pigtoe

Pleurobema cordatum

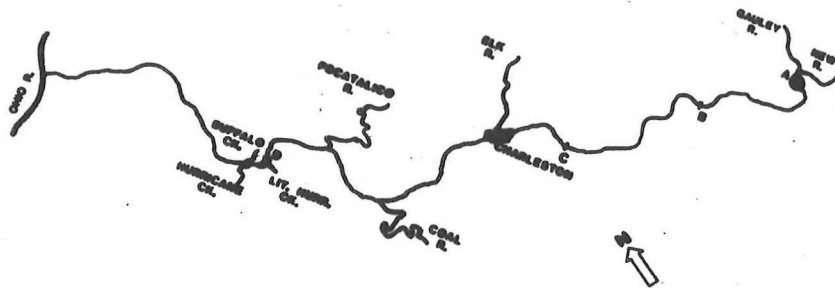
Host fish: Notropis ardens (Rosefin shiner).

Current known distribution in West Virginia: Kanawha River.

Additional museum records: Little Kanawha River.

Preferred habitat: Largely restricted to large rivers; little is known about specific habitat requirements.

Current status in West Virginia: RARE.





Pigtoe

Pleurobema rubrum

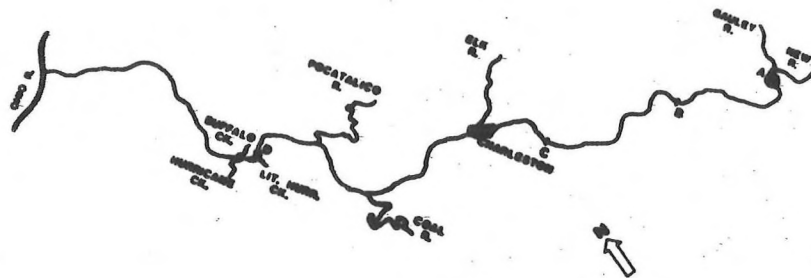
Host fish: Not known.

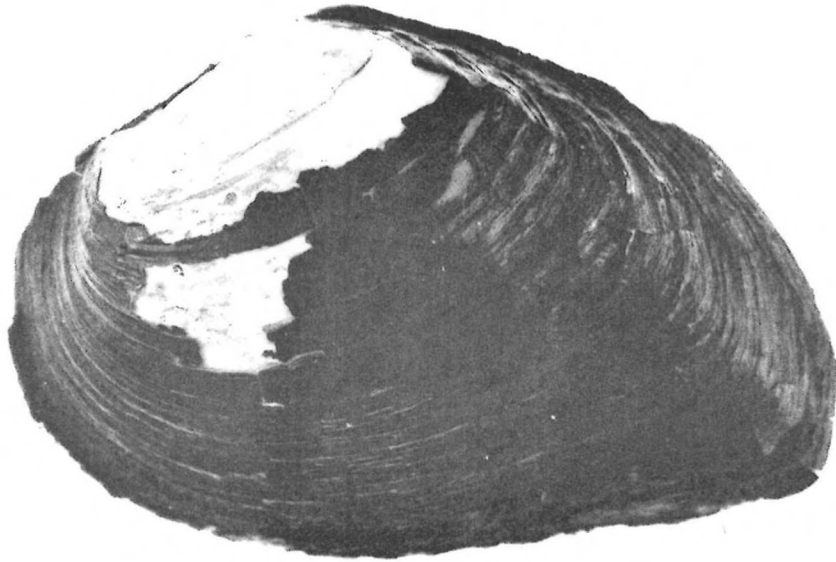
Current distribution in West Virginia: Kanawha River.

Additional museum records: West Fork River, Little Kanawha, Little Coal River.

Preferred habitat: Found usually in large streams; little evidence available on specific habitat requirements.

Current status in West Virginia: RARE.





Elephant ear or mule's ear

Elliptio crassidens

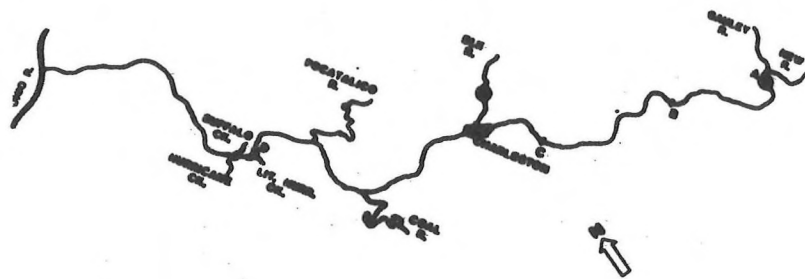
Host fish: Allosa chrysochloris (Skipjack herring).

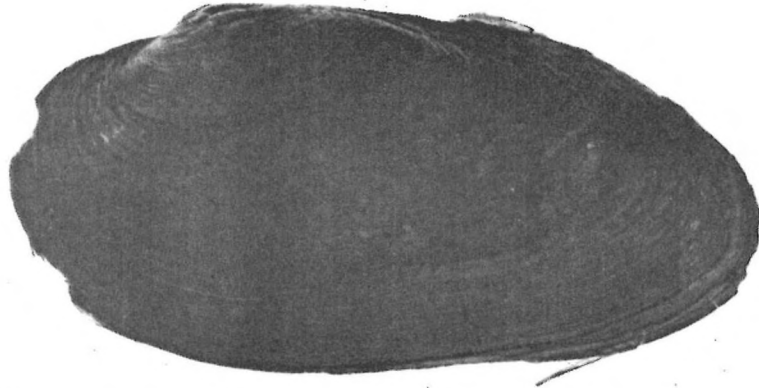
Current distribution in West Virginia: Elk, Kanawha, Twelvepole Creek.

Additional museum records: Monongahela, Ohio Rivers.

Preferred habitat: A species of large rivers over gravel and stone substrate with rapid current in deep water.

Current status in West Virginia: RARE.





Lady finger

Elliptio dilatata

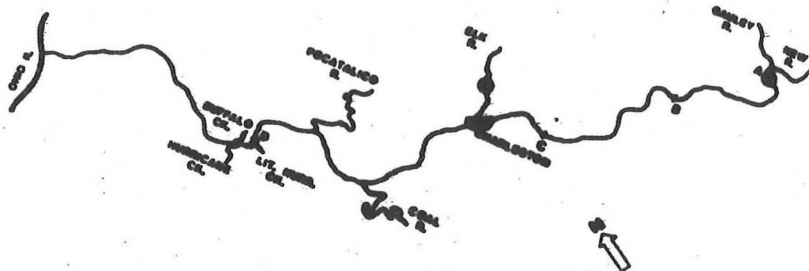
Host fish: Dorosoma cepedianum (Gizzard shad)  
Pomoxis annularis (White crappie)  
Pomoxis nigromaculatus (Black crappie)  
Perca flavescens (Yellow perch)

Current distribution in West Virginia: Elk, Little Kanawha, Middle Island Creek, Greenbrier, Kanawha, Monongahela, Bluestone.

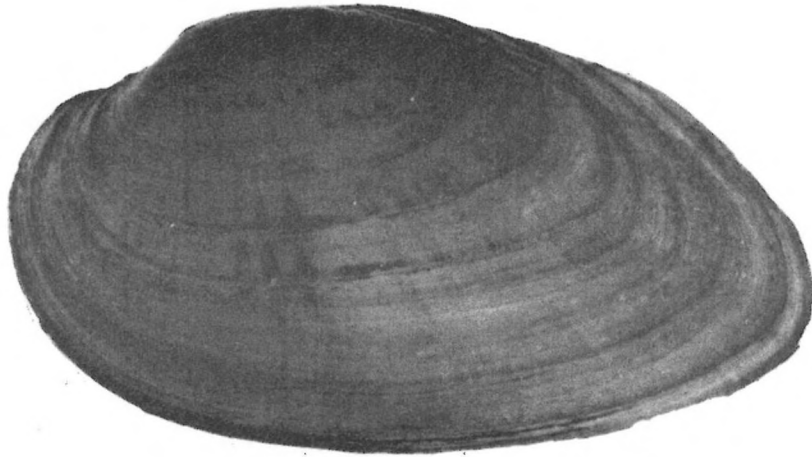
Additional museum records: West Fork River, Hughes, Cheat, New.

Preferred habitat: Small to medium size streams with mud, sand and/or gravel substrate, shallow water and moderate to good current.

Current status in West Virginia: Common.







Kidney shell

Ptychobranchus fasciolaris

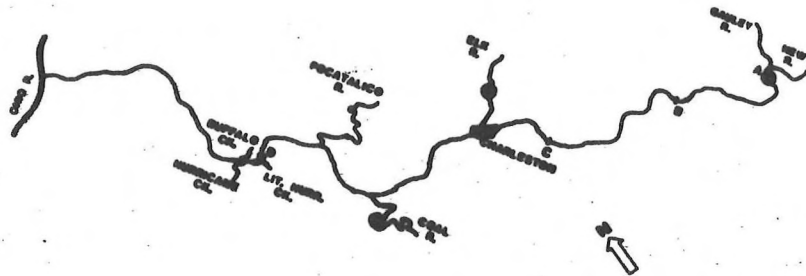
Host fish: Not known.

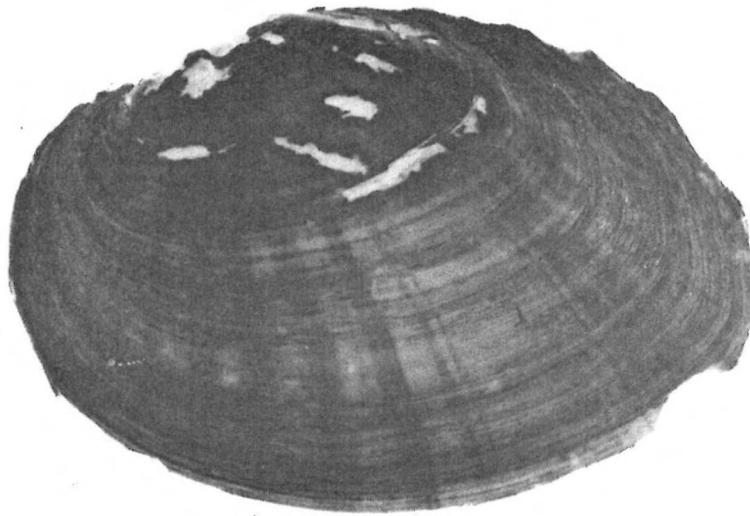
Current distribution in West Virginia: Coal, Kanawha, Elk, Monongahela, Little Kanawha, Middle Island Creek.

Additional museum records: West Fork River, Hughes, Cheat.

Preferred habitat: Streams of all sizes in rapids in solidly packed sand and gravel.

Current status in West Virginia: Common.





Actinonaias ligamentina carinata

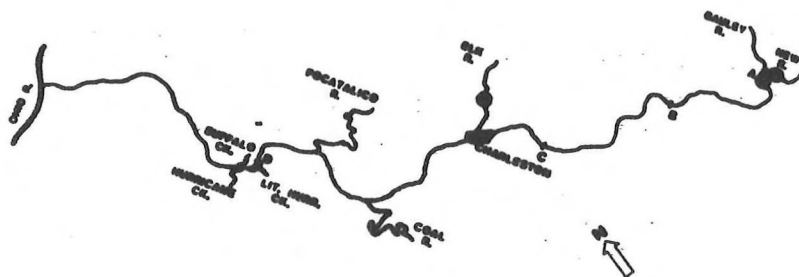
Host fish: Anguilla rostrata (American eel)  
Noturus gyrinus (Tadpole madtom)  
Morone chrysops (White bass)  
Ambloplites rupestris (Rock bass)  
Lepomis cyanellus (Green sunfish)  
Lepomis macrochirus (Bluegill)  
Micropterus dolomieu (Smallmouth bass)  
Micropterus salmoides (Largemouth bass)  
Pomoxis annularis (White crappie)  
Pomoxis nigromaculatus (Black crappie)  
Perca flavescens (Yellow perch)  
Stizostedion canadense (Sauger)

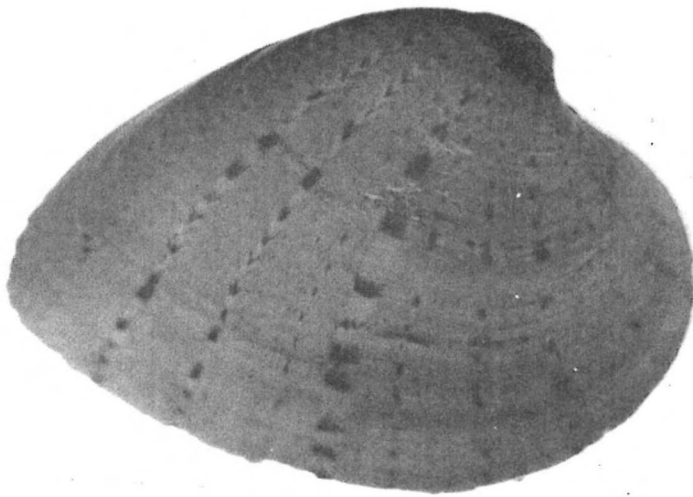
Current distribution in West Virginia: Greenbrier, Mud, Elk, Middle Island Creek, Little Kanawha, Kanawha.

Additional museum records: New.

Preferred habitat: Typically found in large streams and rivers; sand and gravel bars preferred; rarely in mud with rather swift current.

Current status in West Virginia: Common.





Butterfly

Ellipsaria lineolata

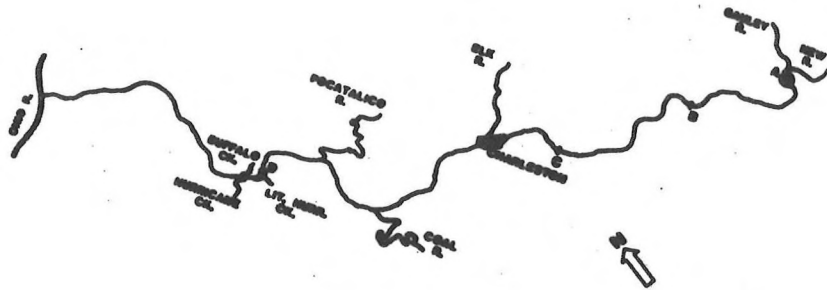
Host fish: Aplodinotus grunniens (Freshwater drum).

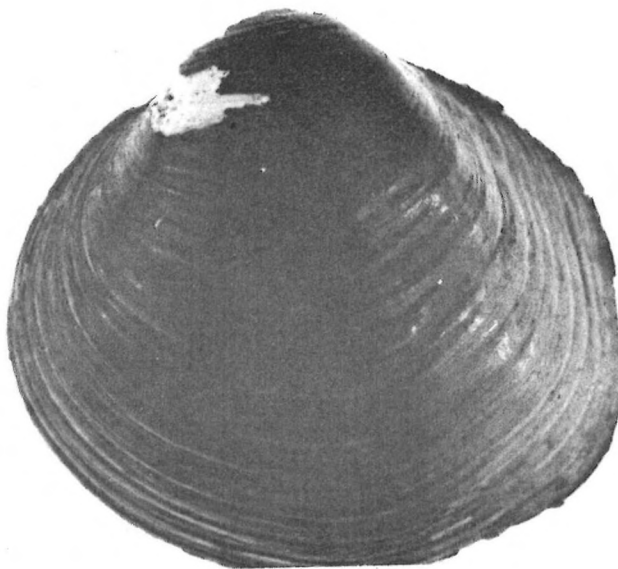
Current distribution in West Virginia: Kanawha River.

Additional museum records: None.

Preferred habitat: Distinctly prefers big rivers; specific habitat requirements not known.

Current status in West Virginia: Previously thought to be extinct in the state.





Round shell

Obovaria subrotunda

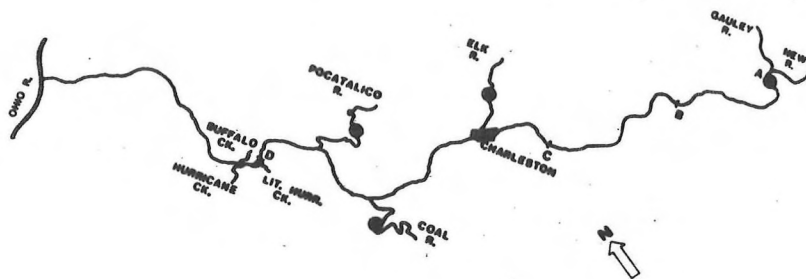
Host fish: Not known.

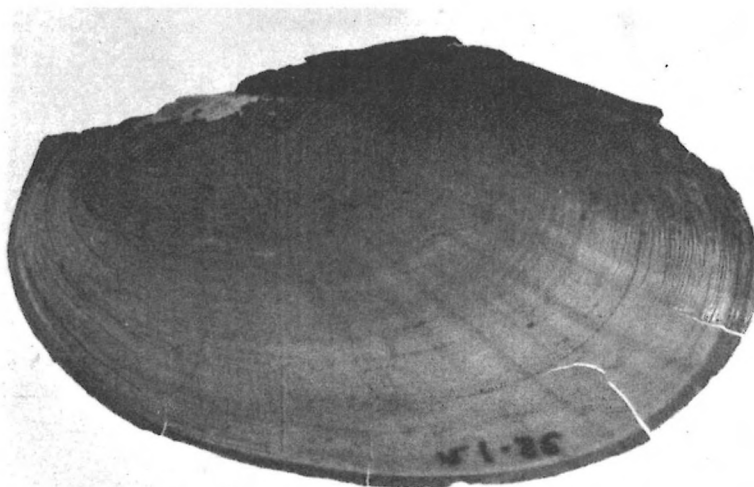
Current distribution in West Virginia: Coal, Mud, Twelvepole Creek, Pocatalico, Elk, Kanawha, Monongahela, Middle Island Creek, Kanawha River, Hughes.

Additional museum records: Meeting Home Fork, Reedy Creek.

Preferred habitat: Small rivers on sand and gravel bars.

Current status in West Virginia: Common.





Fragile paper shell

Leptodea fragilis

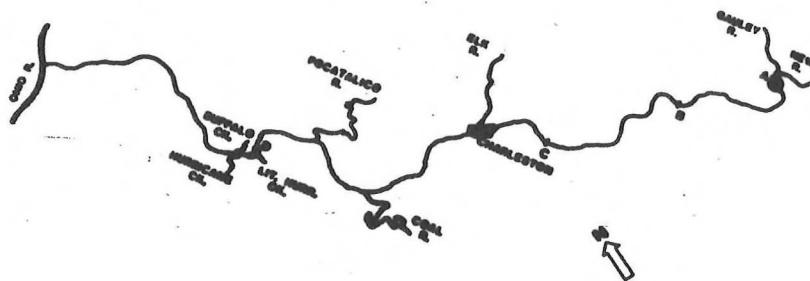
Host fish: Aplodinotus grunniens (Freshwater drum).

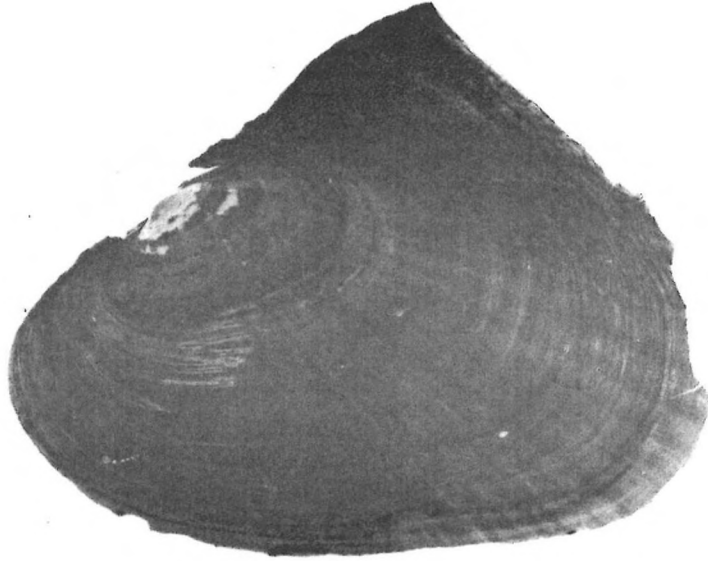
Current distribution in West Virginia: Little Kanawha, Twelvepole Creek, Kanawha, Mud.

Additional museum records: None.

Preferred habitat: In shallow rivers and streams primarily in riffles over sandy mud.

Current status in West Virginia: Common.





Pink heel splitter

Potamilus alatus

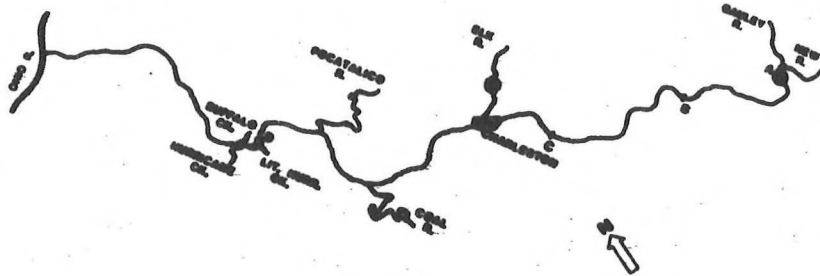
Host fish: Aplodinotus grunniens (Freshwater drum).

Current distribution in West Virginia: Little Kanawha, Twelvepole Creek, Kanawha.

Additional museum records: Hughes, Pocatalico.

Preferred habitat: Streams and lakes in shallow water on gravel and rocky substrates.

Current status in West Virginia: Common.





Black sand shell

Ligumia recta

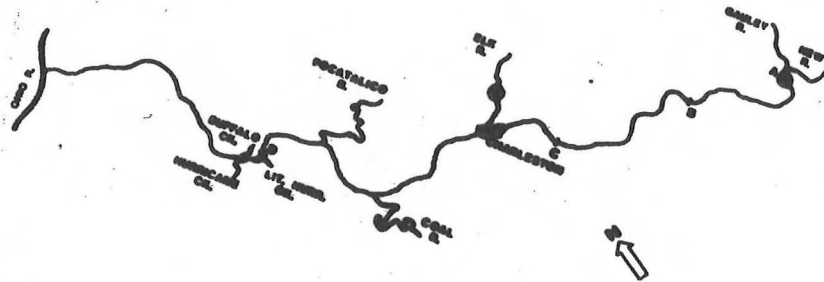
Host fish: Anguilla rostrata (American eel)  
Lepomis macrochirus (Bluegill)

Current distribution in West Virginia: Elk, Kanawha.

Additional museum records: Little Kanawha, Cheat.

Preferred habitat: Still lakes to swiftly flowing streams and riffles;  
 also shallow waters on sand and gravel substrates.

Current status in West Virginia: RARE; apparently limited to the  
 Kanawha River system.





Rainbow shell

Villosa iris iris

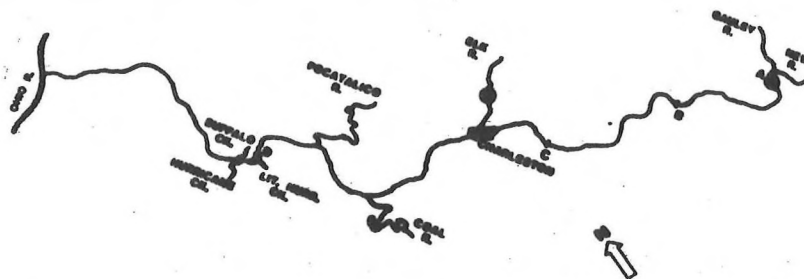
Host fish: Not known.

Current distribution in West Virginia: Little Kanawha, Middle Island Creek, Kanawha.

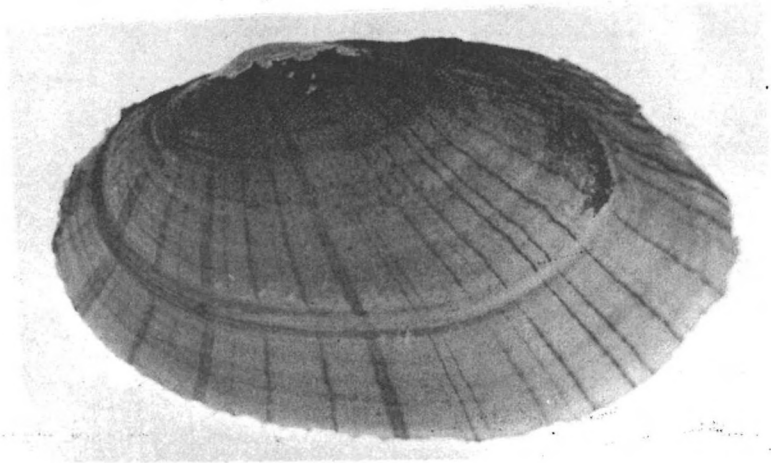
Additional museum records: West Fork River, Hughes, Little Coal, Elk.

Preferred habitat: Shoals of small rivers over sand and gravel substrate.

Current status in West Virginia: Common.







Fat mucket

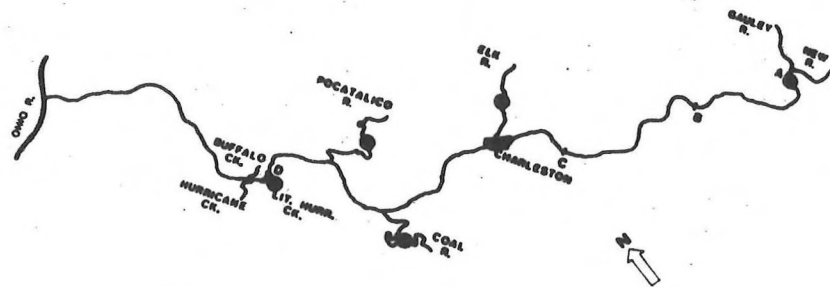
Lampsilis radiata luteola

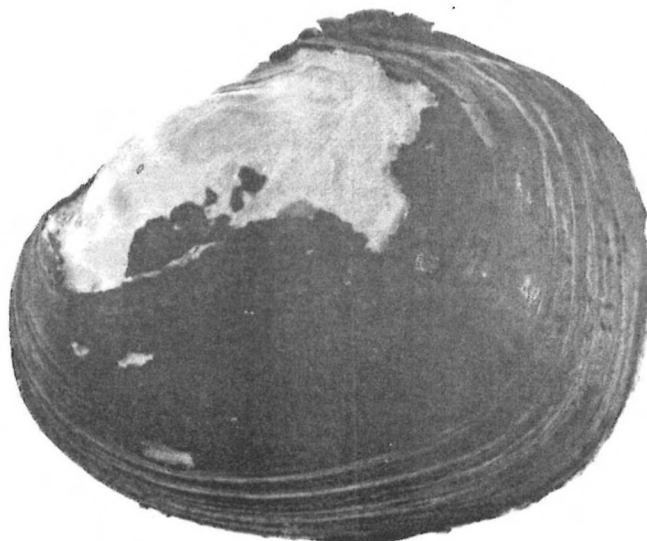
Host fish: Noturus gyrinus (Tadpole madtom)  
Morone chrysops (White bass)  
Ambloplites rupestris (Rock bass)  
Lepomis macrochirus (Bluegill)  
Micropterus dolomieu (Smallmouth bass)  
Micropterus salmoides (Largemouth bass)  
Pomoxis annularis (White crappie)  
Pomoxis nigromaculatus (Black crappie)  
Perca flavescens (Yellow perch)  
Stizostedion canadense (Sauger)  
Stizostedion vitreum (Walleye)

Current distribution in West Virginia: Probably in every small stream in the state.

Preferred habitat: Limited to small to medium sized streams over sand, gravel or mud substrates.

Current status in West Virginia: Most common mussel in West Virginia.





Pink mucket pearly mussel

Lampsilis orbiculata

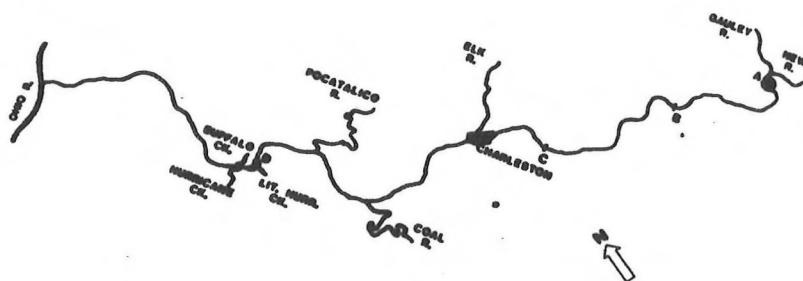
Host fish: Not known.

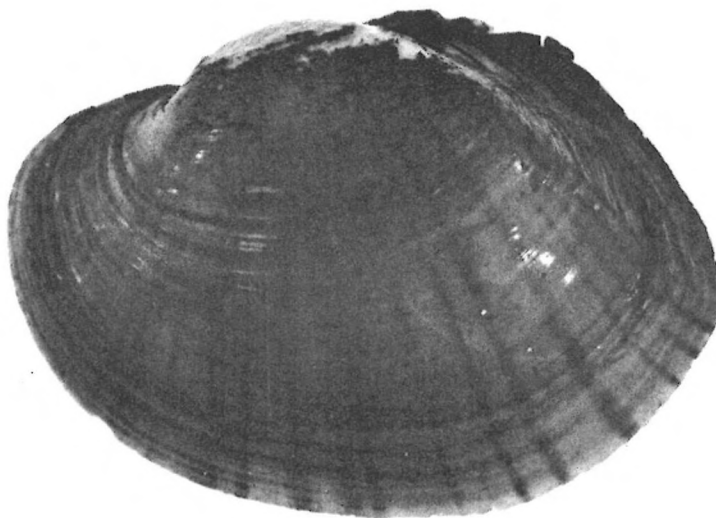
Distribution in West Virginia: Kanawha River.

Additional museum records: Elk, Ohio.

Preferred habitat: Usually found only in large rivers; no exact data available on microhabitat requirements.

Current status in West Virginia: RARE; this is probably the only remaining population in the state.





Fat pocketbook

Lampsilis ventricosa

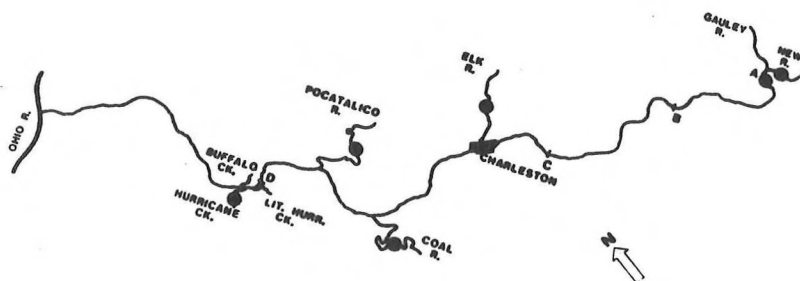
Host fish: Lepomis macrochirus (Bluegill)  
Micropterus dolomieu (Smallmouth bass)  
Micropterus salmoides (Largemouth bass)  
Pomoxis annularis (White crappie)  
Perca flavescens (Yellow perch)  
Stizostedion canadense (Sauger)

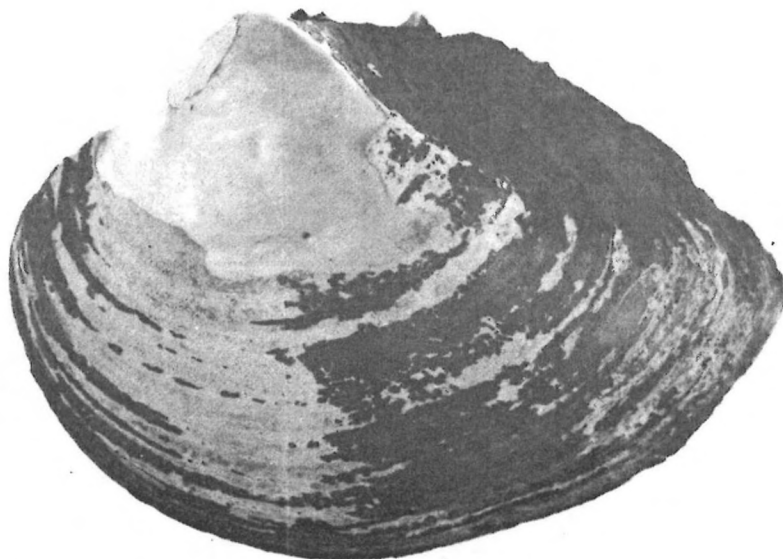
Current distribution in West Virginia: Middle Island Creek, Twelvepole Creek, Greenbrier, Elk, Pocatalico, Mud, Bluestone.

Additional museum records: West Fork River, Little Kanawha, Back Creek, Little Coal River, Cheat, New.

Preferred habitat: All size rivers and creeks; usually found over sand and gravel substrate in shallow to moderately deep running waters.

Current status in West Virginia: Common.





Pocketbook

Lampsilis ovata

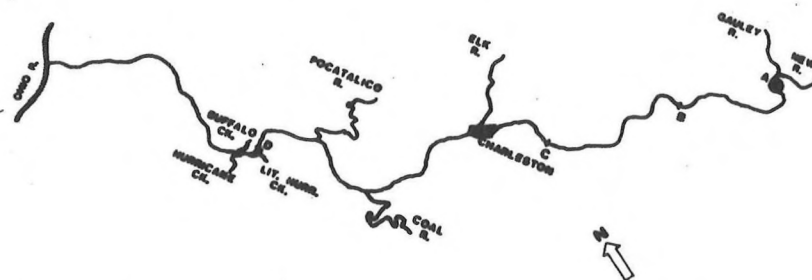
Host fish: Assumed to be the same as L. ventricosa.

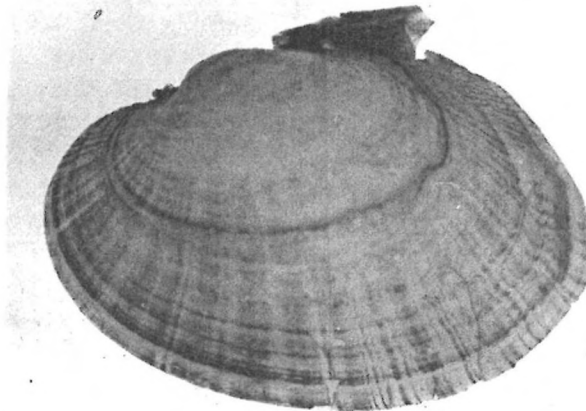
Current distribution in West Virginia: Kanawha River.

Additional museum records: Elk, Ohio Rivers.

Preferred habitat: Generally found in large rivers; no specific microhabitat requirement data available.

Current status in West Virginia: RARE; this is probably the only remaining population of this species in the state.





Small mucket

Lampsilis fasciola

Host fish: Not known.

Current distribution in West Virginia: Little Kanawha, Middle Island Creek, Elk, Greenbrier, Kanawha.

Additional museum records: Mud, Back Creek, Little Coal River, Cheat, New, Pocatalico.

Preferred habitat: Large creeks and small rivers over sand and gravel substrate with rapidly flowing waters.

Current status in West Virginia: Common.



## Results

Data included in this report were derived from field collecting during the months of September–November 1982. Field data were supplemented with museum records from the Marshall University Malacological Collections, The Ohio State University Museum of Zoology and The Carnegie Museum. As a result of the field work 2,991 specimens representing 27 species of freshwater (Naiads) mussels were collected (Table 11). Museum records indicate the presence of an additional six species within the twentieth century bringing the total number of mussel species occurring in the Kanawha River during recent times to 33. Stansbery's archeological work (1975) (Table 2) and work also carried out at an archeological site collected during this study (Table 3) present a picture of the status of freshwater mussels in the Kanawha River before the arrival of early settlers. The archeological deposits indicate a thriving population of mussels, throughout the Kanawha River, consisting of at least 26 species in prehistoric times. Seventeen of the originally occurring species still persist in the Kanawha. Nine of these original species were not found during this study and can be presumed to be currently extinct in the stream or very rare. Most of the species that have recently taken up residence in the Kanawha River have done so as a result of stream modification through damming. As the habitat became more lake-like, those species which prefer a lake-like environment moved in. The modified environment was not suitable for all the mussels and some, being unable to make the transition, no longer survive in the river.

As a result of a combination of environmental factors (i.e. damming, pollution, increased siltation, etc.) the lower 81 miles of the Kanawha River must be considered as being devoid of native mussel life. A single live specimen of the Giant floater collected at KRm 33 rdb was the only Unionid mussel found in this reach of the river. Throughout this stretch, however, the Asian clam (*Corbicula fluminea*) was fairly common. Table 12 lists several sites where this tiny pest species was found in considerable numbers.

All tributaries large enough to enter by boat were checked for the presence of mussels. The streams checked are as follows:

|                        |                  |
|------------------------|------------------|
| Ninemile Creek         | Pocatalico River |
| Eighteenmile Creek     | Manila Creek     |
| Hurricane Creek        | Heiser Creek     |
| Little Hurricane Creek | Coal River       |
| Little Guano Creek     | Elk River        |
| Guano Creek            | Cabin Creek      |
|                        | Loup Creek       |

All the mouths of the named streams are slackwater areas and thus heavily silted. Only in Little Guano Creek were any mussels found. Several live specimens of the Giant floater (*Anodonta g. grandis*) were found in a shallow embayment in two feet of water over 8–10 inches of muck.

Table 11. Mussels found in the Kanawha River during 1982 study.

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|  |
|--|
| <u>Anodonta imbecillis</u> Say, 1829                   |
| <u>Anodonta grandis grandis</u> Say, 1829              |
| <u>Strophitus undulatus undulatus</u> (Say, 1817)      |
| <u>Lasmigona costata</u> (Rafinesque, 1820)            |
| <u>Tritogonia verrucosa</u> (Rafinesque, 1820)         |
| <u>Quadrula pustulosa pustulosa</u> (Lea, 1831)        |
| <u>Amblema plicata plicata</u> (Say, 1817)             |
| <u>Fusconaia maculata maculata</u> (Rafinesque, 1820)  |
| <u>Cyclonaias tuberculata</u> (Rafinesque, 1820)       |
| <u>Pleurobema sintoxia</u> (Rafinesque, 1820)          |
| <u>Pleurobema cordatum</u> (Rafinesque, 1820)          |
| <u>Pleurobema rubrum</u> (Rafinesque, 1820)            |
| <u>Elliptio crassidens crassidens</u> (Lamarck, 1819)  |
| <u>Elliptio dilatata</u> (Rafinesque, 1820)            |
| <u>Ptychobranthus fasciolaris</u> (Rafinesque, 1820)   |
| <u>Actinonaias ligamentina carinata</u> (Barnes, 1823) |
| <u>Plagiola lineolata</u> (Rafinesque, 1820)           |
| <u>Obovaria subrotunda</u> (Rafinesque, 1820)          |
| <u>Leptodea fragilis</u> (Rafinesque, 1820)            |
| <u>Potamilus alatus</u> (Say, 1817)                    |
| <u>Ligumia recta</u> (Lamarck, 1819)                   |
| <u>Villosa iris iris</u> (Lea, 1829)                   |
| <u>Lampsilis radiata luteola</u> (Lamarck, 1819)       |
| <u>Lampsilis orbiculata</u> (Hildreth, 1828)           |
| <u>Lampsilis ventricosa</u> (Barnes, 1823)             |
| <u>Lampsilis ovata</u> (Say, 1817)                     |
| <u>Lampsilis fasciola</u> Rafinesque, 1820             |

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Table 12. Freshwater mussels collected by earlier investigators but not found during this study.

| <u>Scientific Name</u>      | <u>Common Name</u>               |
|-----------------------------|----------------------------------|
| <u>Lasmigona subviridis</u> | None                             |
| <u>Plethobasus cyphus</u>   | Bullhead                         |
| <u>Cyprogenia stegaria</u>  | Fan shell                        |
| <u>Truncilla truncata</u>   | Deer-toe                         |
| <u>Epioblasma torulosa</u>  | Tuberculed blossom pearly mussel |
| <u>Simpsonaias ambigua</u>  | Salamander mussel                |



Seven species of mussels were found in the lower Elk at the first shoals (Table 13). Even in this stream, which has a very rich mussel fauna farther upstream, none could be found in the slackwater area.

In stark contrast to the lower Kanawha River, the headwaters (river mile 91-95) support a phenomenally rich freshwater mussel fauna. This study produced large numbers of specimens representing 27 species. Single specimens of two additional species (Cyprogenia stegaria and Megalonaias nervosa) were recently collected by John Schmidt of the West Virginia Department of Natural Resources and Dr. Arthur Clarke (Schmidt 1982, personal communication). This population compressed into the upper approximately five miles of headwaters, consisting of at least 34 species (Table 1), is undoubtedly the richest single stream site in the State of West Virginia.

As one looks at this rather strange distribution pattern one single environmental parameter seems to be the causative agent. With the exception of a small population at Pratt, West Virginia (KRM 81.5 rdb) all other mussel beds are above slackwater. It may be that impoundment, in conjunction with other environmentally degrading phenomena, in this particular river creates a habitat totally unsuitable for freshwater mussel life.

The occurrence of the federally listed rare species Lampsilis orbiculata in fairly good numbers in the headwaters of the Kanawha River must be considered as a rather significant find. This population represents the only known one still extant in West Virginia. It appears to be holding its own and, barring further habitat degradation, does not seem to be in any great danger at this time. The other federally listed species Epioblasma torulosa torulosa, known to have occurred at this locality in recent times, was not found during this study and could be presumed to be no longer present.

Several other species which occur at this site have been recommended by Taylor (1982) for inclusion on the West Virginia Rare and Endangered list. This paper has yet to be published, so no official action has been taken. The six species recommended for listing are: Lampsilis ovata, Pleurobema rubrum, P. cordatum, P. sintoxia, Ligumia recta and Elliptio crassidens. They are with few exceptions restricted in distribution, in West Virginia, to the Kanawha River basin.

A single fresh valve of the Butterfly shell Plagiola lineolata was found at the Pratt site (KRM 81.5 rdb). This may constitute the most significant find of the entire study. This species has not previously been reported from the state. Stansbery (1975) reported it as occurring in the Kanawha River and Taylor (1980) in the Ohio River in prehistoric times. Few records are available for this species east of the Mississippi River. Williams (1969) reported less than a dozen specimens for the entire lower Ohio River. This species is in an apparent decline as the large rivers, which are its preferred habitat, are modified through impoundment. If in fact a population does still exist in the Kanawha, it must be studied further and extraordinary efforts extended to assure its continued existence.

Table 13. Mussels collected in the Elk River at first shoals ERM 4.0 during this study.

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Potamilus alatus\*

Lampsilis r. luteola

Ligumia recta

Actinonaias l. carinata

Lampsilis fasciola

Lampsilis ventricosa

Elliptio dilata

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\*This report represents the first record for this species in the Elk River.

The five sites, designated for intensive study, were in fact intensively studied. The river was brailed from shore to shore for approximately one-half mile above and below the designated site. The results at all five sites were negative. The Asian clam was found in close proximity to some of the designated sites as can be seen in Table 14. There were, however, no large accumulations at any of these specific sites.

The naturally occurring 30 foot falls at Glen Ferris is apparently an effective barrier to the movement of mussels. This more than likely results from the inability of host species to navigate the falls. Twenty-one species live in the pool immediately below the falls, and only a few specimens, representing six species, could be found above the falls. These are listed in Table 15. Wilson and Clark (1914) reported similar results in their study of the Cumberland Falls area of the Cumberland River.

Table 14. Localities where Corbicula fluminea was found in large numbers. (rdb = right descending bank; ldb = left descending bank.)

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|          |     |
|----------|-----|
| KRm 4.0  | rdb |
| KRm 6.5  | rdb |
| KRm 9.7  | rdb |
| KRm 17.8 | rdb |
| KRm 26.3 | ldb |
| KRm 33.8 | rdb |
| KRm 34.4 | ldb |
| KRm 39.7 | rdb |
| KRm 42.0 | rdb |
| KRm 57.2 | rdb |
| KRm 76.0 | ldb |
| KRm 77.8 | rdb |
| KRm 79.6 | rdb |
| KRm 86.0 | ldb |
| KRm 89.8 | ldb |
| KRm 90.1 | ldb |
| KRm 92.0 | rdb |

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Table 15. Mussel species occurring above Kanawha Falls. The number of specimens is included in parenthesis.

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Lampsilis orbiculata (1)

Lampsilis ventricosa (2)

Obovaria subrotunda (2)

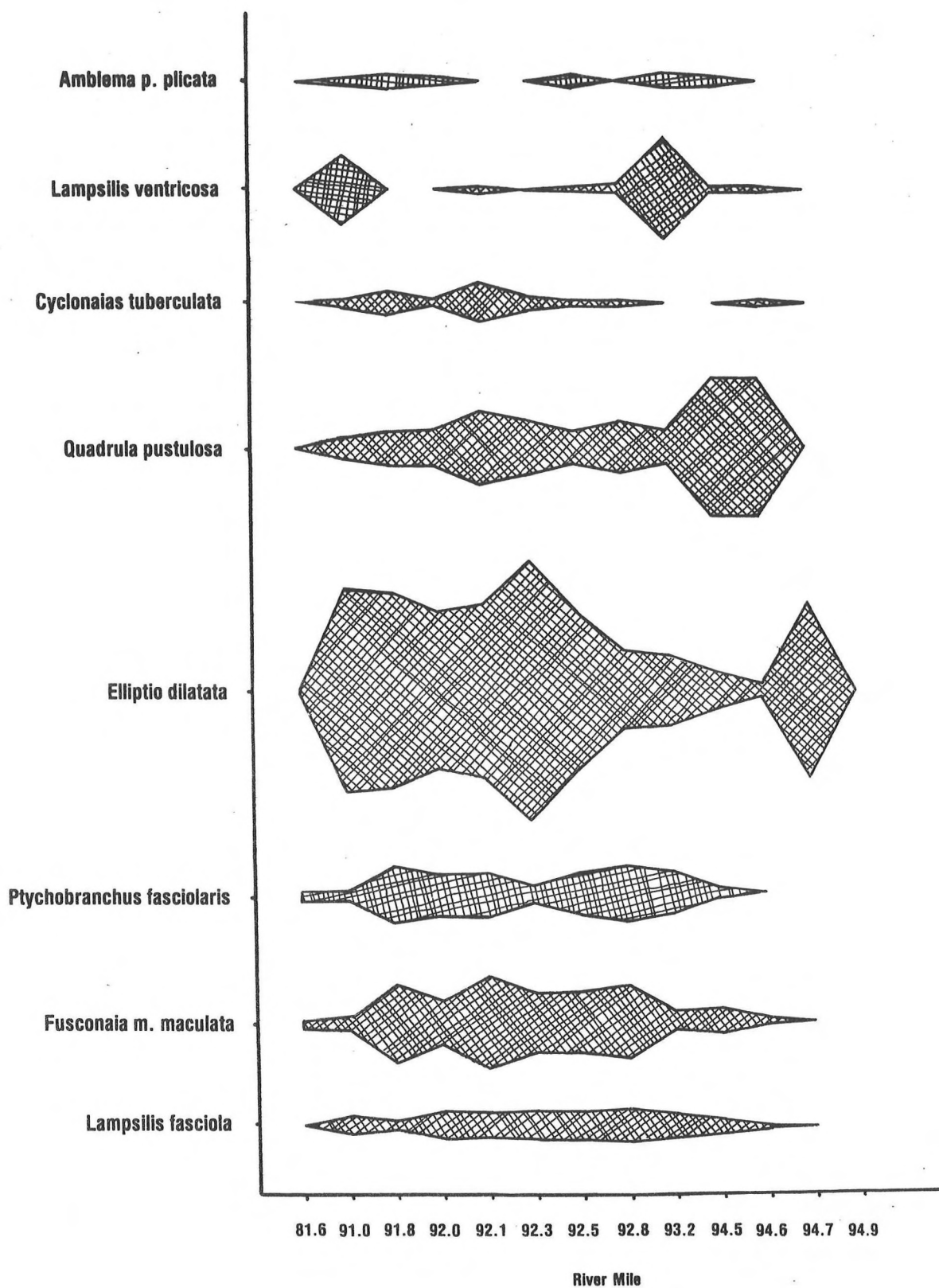
Elliptio dilatata (7)

Actinonaias l. carinata (20)

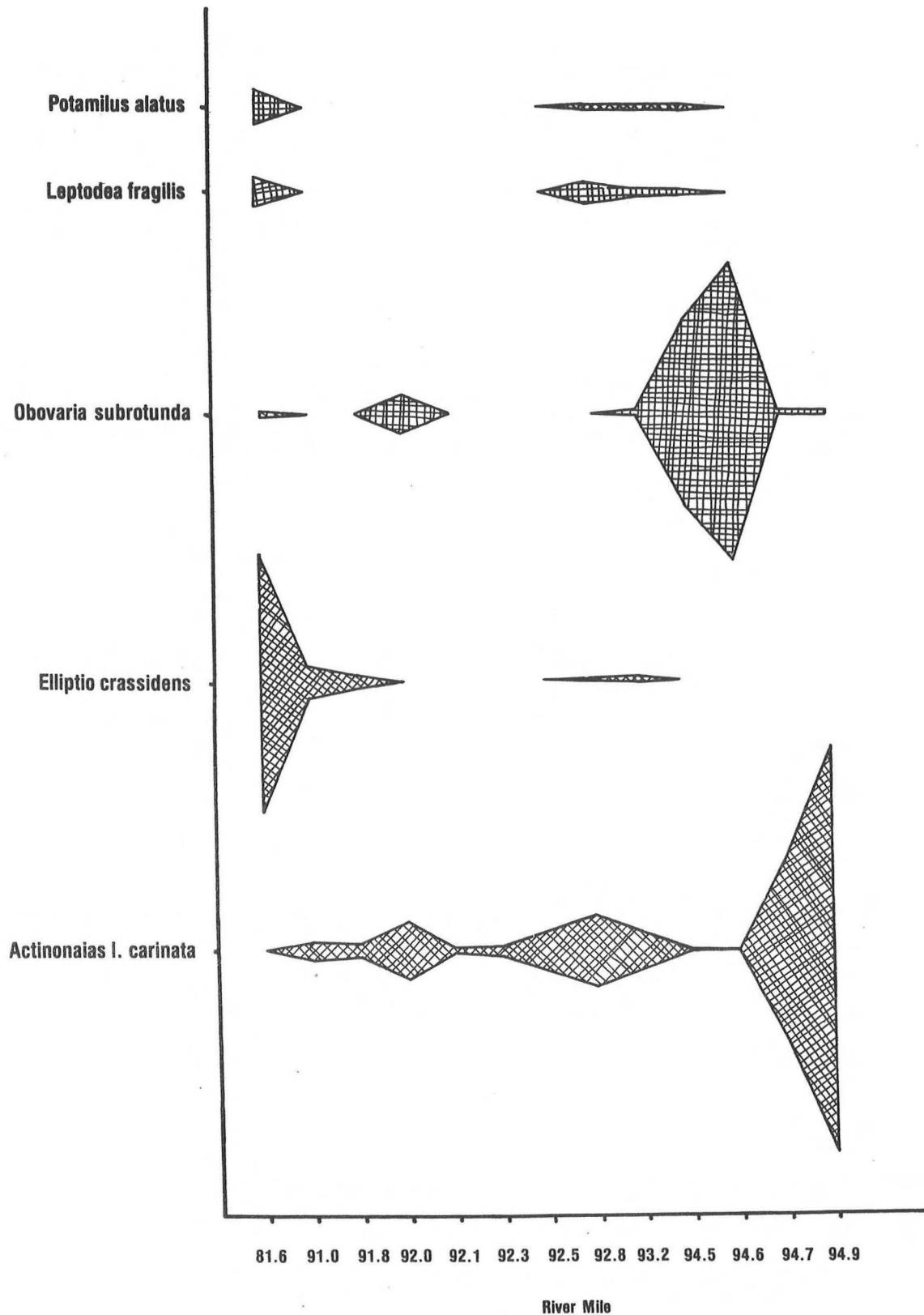
Lasmigona costata (1)

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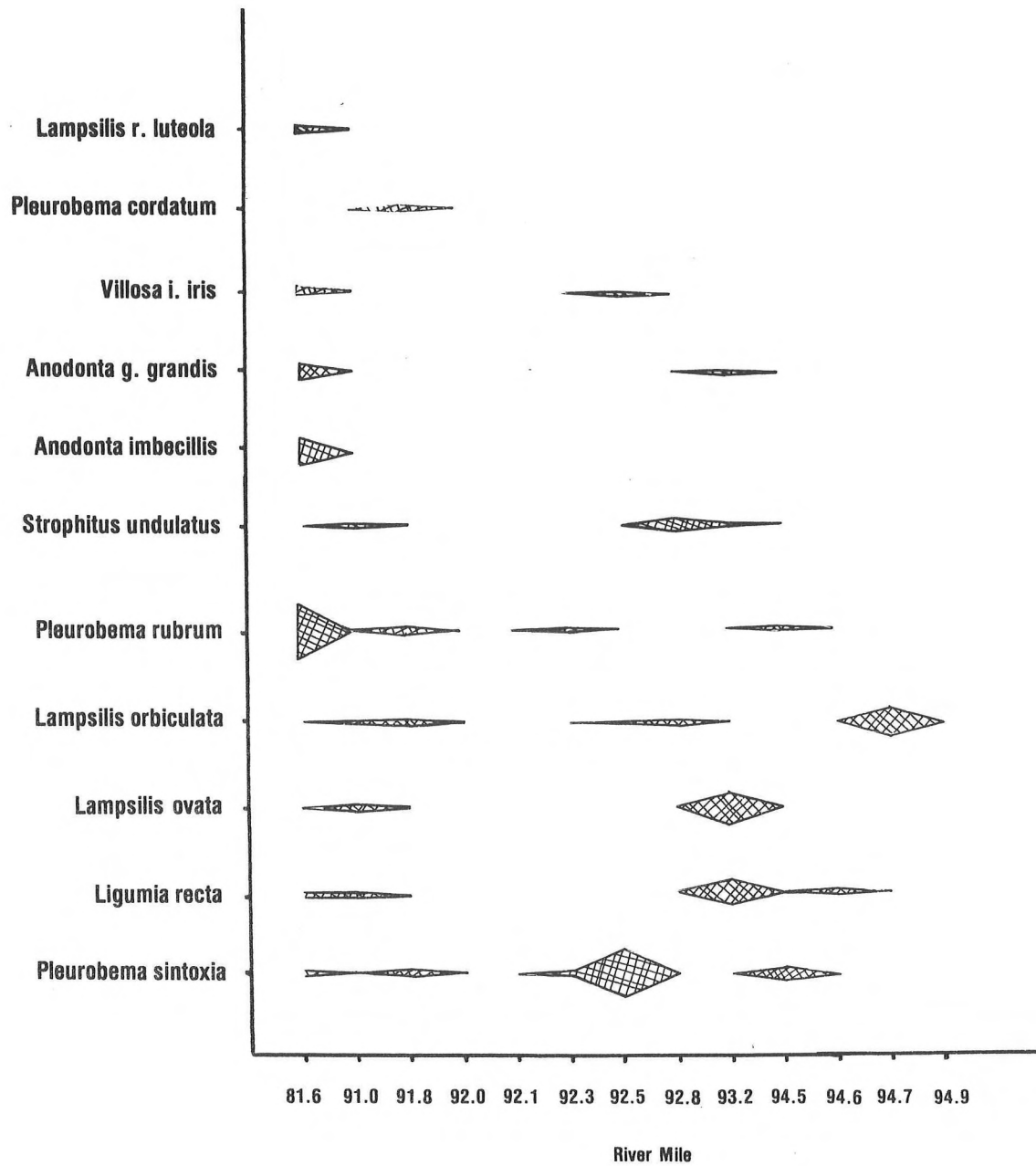
**Relative abundance by sampling site  
(Percent frequency of occurrence)**



Relative abundance by sampling site  
(Percent frequency of occurrence)

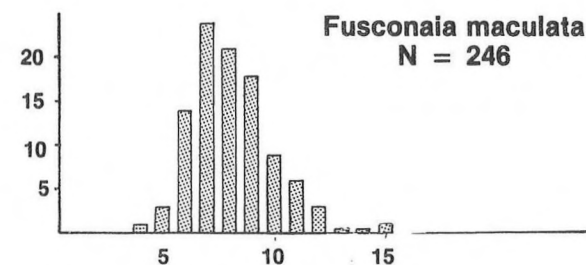
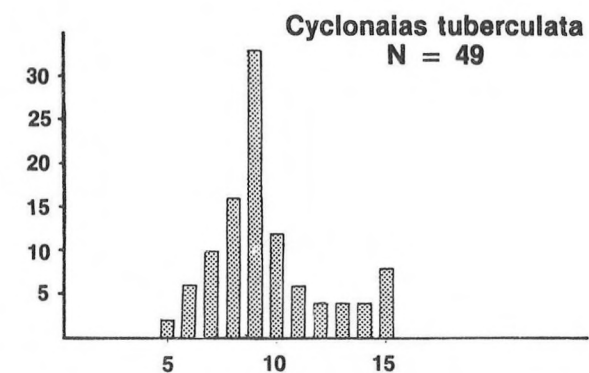
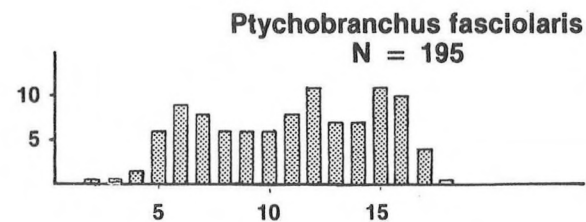
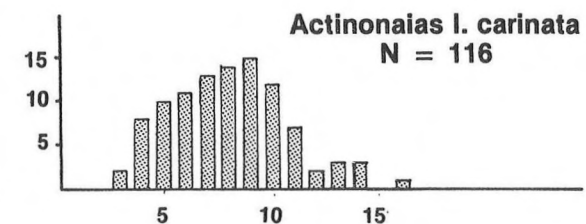
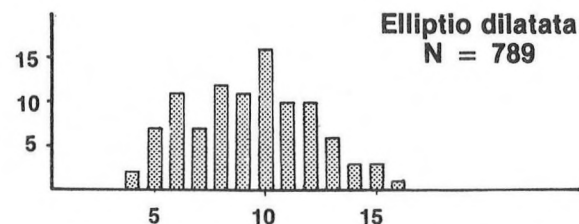
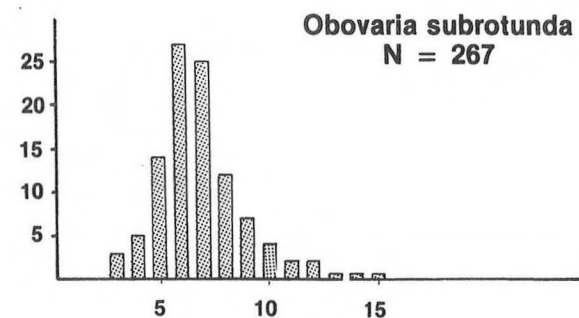
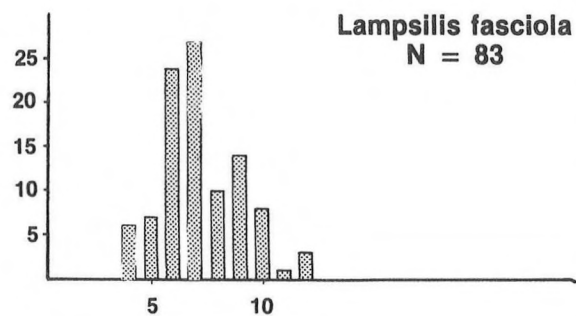
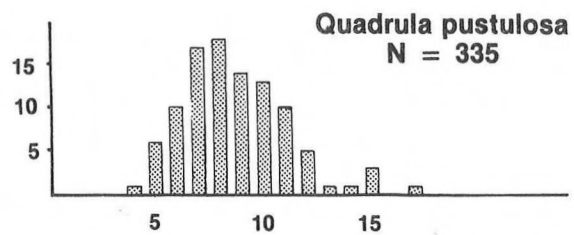
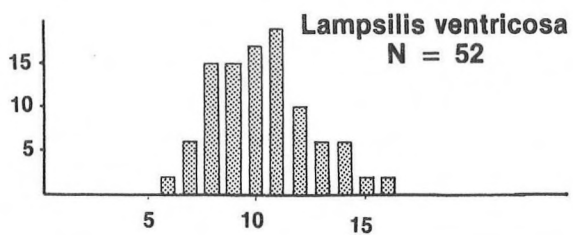


**Relative abundance by sampling site  
(Percent frequency of occurrence)**





## Age Class Distributions



Vertical axis = percent of population

Horizontal axis = age classes

## MUSSEL BED LOCALITIES AND RESIDENT SPECIES

| Site by rivermile                  | RDB<br>LDB | 81.6 |      |      | 92  |     |      | 92.5 |     | 93.2 |     | 94.6 |     |      | No.  | % occurrence<br>in population |      |
|------------------------------------|------------|------|------|------|-----|-----|------|------|-----|------|-----|------|-----|------|------|-------------------------------|------|
|                                    |            |      | 91.0 | 91.8 |     | 92  | 92.1 | 92.3 |     | 92.8 |     | 94.5 |     | 94.7 |      |                               | 94.9 |
| <i>Lampsilis orbiculata</i>        |            |      | 4    | 2    |     |     |      | 2    | 1   |      |     |      | 1   |      | 10   | .33                           |      |
| <i>L. fasciola</i>                 |            |      | 19   | 5    | 13  | 4   | 6    | 38   | 23  | 9    | 12  | 9    | 1   |      | 139  | 4.64                          |      |
| <i>L. ventricosa</i>               |            |      | 75   | 1    | 1   |     | 1    | 1    | 3   | 3    | 50  | 2    | 1   | 1    | 140  | 4.78                          |      |
| <i>L. ovata</i>                    |            |      | 7    |      |     |     |      |      |     |      | 14  |      |     |      | 21   | .70                           |      |
| <i>L. r. luteola</i>               | 1          |      |      |      |     |     |      |      |     |      |     |      |     |      | 1    | .03                           |      |
| <i>Pleurobema rubrum</i>           | 9          |      |      | 3    |     |     |      | 1    | 1   |      |     | 1    |     |      | 15   | .50                           |      |
| <i>P. cordatum</i>                 |            |      |      | 1    |     | 1   |      |      |     |      |     |      |     |      | 2    | .03                           |      |
| <i>P. sintoxia</i>                 | 1          |      |      | 3    |     |     |      | 5    | 33  |      |     | 6    |     |      | 48   | 1.60                          |      |
| <i>Fusconia maculata</i>           | 2          | 16   | 34   | 10   | 16  | 21  | 76   | 47   | 19  | 10   | 11  | 2    |     |      | 264  | 8.83                          |      |
| <i>Ligumia recta</i>               | 1          | 6    |      |      |     |     |      |      |     | 11   |     | 1    |     |      | 19   | .65                           |      |
| <i>Villosa i. iris</i>             | 1          | 1    |      |      |     |     |      | 2    |     |      |     |      |     |      | 4    | .13                           |      |
| <i>Cyclonaias tuberculata</i>      |            | 5    | 8    |      | 4   | 8   | 18   | 4    | 1   | 1    |     | 1    |     |      | 50   | 1.67                          |      |
| <i>Quadrula pustulosa</i>          |            | 27   | 14   | 12   | 20  | 17  | 73   | 25   | 15  | 16   | 72  | 69   |     |      | 360  | 1.20                          |      |
| <i>Obovaria subrotunda</i>         | 1          | 1    |      | 24   |     |     |      | 2    |     | 3    | 92  | 149  | 1   | 1    | 274  | 9.16                          |      |
| <i>Elliptio dilatata</i>           | 1          | 224  | 84   | 18   | 83  | 40  | 337  | 127  | 24  | 34   | 20  | 8    | 7   |      | 1007 | 33.67                         |      |
| <i>E. crassidens</i>               | 47         | 36   | 6    |      | 1   |     | 1    |      | 1   | 3    |     |      |     |      | 95   | 3.18                          |      |
| <i>Ptychobranchnus fasciolaris</i> | 2          | 10   | 23   | 13   | 13  | 10  | 25   | 35   | 15  | 21   | 6   |      |     |      | 172  | 5.78                          |      |
| <i>Amblema p. plicata</i>          |            | 6    | 6    | 4    | 1   |     | 1    | 11   |     | 7    | 6   | 2    |     |      | 44   | 1.47                          |      |
| <i>Potamilus alatus</i>            | 6          | 1    |      |      |     |     |      | 1    | 1   | 4    | 3   |      |     |      | 16   | .53                           |      |
| <i>Leptodea fragilis</i>           | 5          |      |      |      |     |     |      |      | 6   | 4    | 3   | 2    |     |      | 20   | .67                           |      |
| <i>Actinonaias l. carinata</i>     |            | 22   | 6    | 26   | 7   | 1   | 11   | 33   | 19  | 16   | 2   |      | 7   | 13   | 163  | 5.45                          |      |
| <i>Strophitus undulatus</i>        |            | 3    |      |      |     |     |      |      |     | 3    | 2   | 1    | 1   |      | 10   | .33                           |      |
| <i>Anodonta grandis</i>            | 3          |      |      |      |     |     |      |      |     |      | 1   |      |     |      | 4    | .13                           |      |
| <i>Anodonta imbecillis</i>         | 5          |      |      |      |     |     |      |      |     |      |     |      |     |      | 5    | .17                           |      |
| <i>Tritogonia verrucosa</i>        | 1          | 7    |      |      | 1   |     | 1    | 2    | 1   | 5    |     |      |     |      | 18   | .60                           |      |
| <i>Lasmigona costata</i>           |            | 33   |      | 13   |     | 1   | 3    | 8    | 11  | 16   | 2   |      | 1   |      | 88   | 2.94                          |      |
| <i>Ellipsaria lineolata</i>        | 1          |      |      |      |     |     |      |      |     |      |     |      |     |      | 1    | .03                           |      |
| Total numbers                      |            | 87   | 503  | 196  | 134 | 151 | 105  | 591  | 359 | 129  | 230 | 236  | 237 | 18   | 15   | 2991                          |      |

## Literature Cited

- Clarke, A. H. 1982. Survey of the freshwater mussels of the upper Kanawha River (RM 91-95), Fayette County, West Virginia, with special reference to Epioblasma t. torulosa (Raf.) and Lampsilis abrupta (Say) (= L. orbiculata (Hildreth)).
- Fuller, S. L. H. 1974. Clams and mussels (Mollusca: Bivalvia) in C. Hart and S. Fuller (eds.). Pollution ecology of freshwater invertebrates. Acad. Press, New York.
- Morris, J. S. and R. W. Taylor. 1978. A survey of the freshwater mussels (Bivalvia: Unionidae) of the Kanawha River of West Virginia. The Nautilus 92(4):153-155.
- Ortmann, A. E. 1921. A monograph of the naiads of Pennsylvania. Annals of the Carnegie Museum. Vol. VIII:1-384.
- Smith, K. J. 1981. A survey of the mussels of Twelvepole Creek, West Virginia with a study of commensal algae found on selected mussels. Unpublished Master's Thesis, Marshall University, Huntington, WV. 48 pp.
- Stansbery, D. H. 1972. A preliminary list of the naiad shells recovered from the Buffalo Site. Appendix A (105-106) In Broyles, Betty J., A late 17th century Indian village site (46 Pu 31) in Putnam County, WV. Report of Archeological Investigations Number 5, West Virginia Geol. and Econ. Survey, Morgantown, WV.
- Stansbery, D. H. 1980. The naiad mollusks of the Kanawha River below Kanawha Falls with special attention to endangered species (BIVALVIA:UNIONIDA:UNIONIDAE). Unpublished technical report. The Ohio State University Museum of Zoology, Columbus. 16 pp.
- Starrett, W. C. 1971. A survey of the mussels of the Illinois River: A polluted stream. Bull. Ill. Nat. Hist. Survey. Vol. 30 Art. 5:267-403.
- Taylor, R. W. and R. Hughart. 1981. The freshwater naiads of Elk River, West Virginia with a comparison of earlier collections. The Nautilus 95(1):21-25.
- Thomas, N. A. and K. M. Mackenthun. 1964. Asiatic clam infestation at Charleston, West Virginia. The Nautilus 78(1):28.
- U. S. Army Corps of Engineers. 1975. Kanawha River Navigation System, Fayette, Kanawha, Putnam and Mason Counties, West Virginia. Huntington District. 186 pp.
- West Virginia Geological Survey. 1973. A report on water pollution in the Elk River and its tributaries. West Virginia Geol. and Econ. Survey, Charleston, WV. 39 pp.

Wilson, C. B. and H. W. Clark. 1914. The mussels of the Cumberland River and its tributaries. U. S. Bureau Fish. Doc. No. 781. 63 pp.

Zeto, M. 1982. Notes on the freshwater mussels (Unionidae) of the upper Monongahela River Basin, West Virginia. The Nautilus 96(4):127-129.

#### Recommendations For Future Studies

1. The status of the Butterfly Mussel Ellipsaria lineolata must be determined. Once that determination is made, and critical habitat defined, recommendations could be made to the proper authorities and necessary actions could be taken to assure its continued existence.
2. The status of Lampsilis orbiculata should be monitored on a continuing basis (perhaps every five years or so). We simply need to know more about critical habitat requirements. Until we better understand the ecology of these animals, efforts directed towards recolonization or recovery of existing populations will be futile.

