

The Final Report on a Status Survey of the
Carolina Heelsplitter, Lasmigona decorata
and the Carolina Elktoe, Alasmidonta robusta

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There are approximately 300 recognized species of freshwater naiades in the United States. At least one-fifth or 60 species are found in the rivers draining into the Atlantic coast of the United States. There are anywhere from eighteen to over twenty of these Atlantic species which are currently recorded from a single river or river system; approximately eight species are endemic to rivers in North Carolina and South Carolina. Two of the least known are Lasmigona decorata (Lea, 1852), the Carolina heelsplitter, and Alasmidonta robusta Clarke, 1981, the Carolina elktoe. To the best of our knowledge neither species has been collected this century. However, none of the collections examined in the museums contained any collections with dates.

In an effort to determine whether either species still survives, the North Carolina State Museum of Natural Science was contracted in 1986 by the Office of Endangered Species, U. S. Fish and Wildlife Service, to make status surveys of Lasmigona decorata and Alasmidonta robusta. These surveys included the upper part of the Saluda River system, the upper and middle parts of the Catawba River system, the middle section of the Pee Dee River system and the upper part of Lynches River system. Field work was subcontracted to Eugene P. Keferl and conducted from the Fall of 1986 to the Fall of 1987. A few collections were added by Dick Biggins of the USFWS, Asheville, North Carolina, and preliminary sampling was done by Andrew G. Gerberich, J. B. Alexander and Dick Biggins, May and July 1986.

PROCEDURES

In order to learn the identity of Lasmigona decorata and Alasmidonta robusta it was necessary to examine as many of the type specimens as possible. According to Clarke (1981, 1985) they are located in the National Museum of Natural History, Smithsonian Institution, in Washington, D. C. and the Academy of Natural Sciences in Philadelphia. These institutions were visited from March 21 - 26, 1986, to examine the types, and compare them with related species.

Historically, Alasmidonta robusta and Lasmigona decorata were found most often in small bodies of water. Therefore, most of the sites visited were in tributaries of the Saluda, Catawba, and Pee Dee Rivers. Several small lakes and reservoirs were also visited, but most large impoundments were avoided. It is doubtful that either species inhabits these relatively recent impoundments, and if so, they would not be located without SCUBA equipment and a boat.

Whenever possible the streams or rivers were first examined visually for signs of mollusks, and naiades were located by raking, handpicking and direct observation while wading. Waters up to 4 feet were examined fairly thoroughly for naiades. The distance covered at each site varied considerably. The time spent and the distance covered at each site depended on the size of the stream or river, the average depth, access, the diversity of habitat, the types of substrate and the number and diversity

of Mollusca being encountered. The time and distance covered at each site was directly related to the prospect of finding the target species.

Examples of all species of Mollusca encountered were collected. All unoccupied molluscan shells were also collected. In addition, any specimen which could not be identified in the field was collected. The specimens collected have been deposited in the North Carolina State Museum of Natural Science at Raleigh, North Carolina.

Observational data concerning each site was recorded on a "Field Data Record" (See Figure 1). These data records included information about the substrates, type of shore, turbidity, current, depth and relative water temperature. When the target species was located a more detailed record of its habitat was made.

RESULTS AND DISCUSSION

A detailed account of all the species collected at all the sites visited will not be presented in this report. The sites are listed Appendix I, and Table 1 summarizes some of the results. There were 460 visits to 452 different sites on 237 different rivers, streams and impoundments in the Saluda, Catawba, Pee Dee and Lynches River systems (See Figures 2, 3, 4, 5 and 6).

Two-thirds of the rivers and streams visited in both the Catawba River and Pee Dee River Systems contained mollusks, but

only 20% of the Catawba and 36% of those in the Pee Dee had naiades. The percentage of streams and rivers with Corbicula was not significantly different in the Saluda River (50%), Catawba River (49%) and the Pee Dee River (46%) system, but the diversity of the molluscan fauna varied significantly. The Pee Dee River system had 29 species while the Saluda drainage had only 10 species. These results should be considered significant only in the context of this survey. The objective of this survey was to locate two specific species of naiades. None of the sites were thoroughly examined over several seasons in order to locate the more seasonal species of gastropods. Also, no great effort was made to locate small gastropods or sphaeriids.

Lasmigona decorata (Lea, 1852), The Carolina Heelsplitter

The Carolina heelsplitter was originally described as Unio decoratus by Lea in 1852 from the "Abbeville District, South Carolina," (See Figure 9). This species was synonymized with Lasmigona subviridis (Conrad, 1835) by Johnson (1970:343-345). Clarke (1985:57-60) recognized Lasmigona decorata as a distinct species on the basis of its much larger size, its diversity of habitats, and its geographical location. Clarke (1985:57) synonymized Unio charlottensis Lea, 1863 from "Near Charlotte, Mecklenberg [sic] County, N. Carolina" (See Figure 12) and Unio insolidus Lea, 1872 from "Abbeville Dist., S.C. and Irwin's

Creek, N.C." (See Figure 11) with Lasmigona decorata (Lea, 1852). A taxonomic history, with a more detailed discussion of why it was separated from L. subviridis, is provided in Clark (1985:57-60).

Description

Lasmigona decorata is known only from shell characteristics. No soft anatomy or glochidia are known for the species. The shell of the largest known L. decorata attains a length of 114.8 mm, a height of 68.0 mm, and a width of about 39 mm (Clarke, 1985:58). This is nearly twice the size of a large L. subviridis. The thickness of the shell is also greater in L. decorata. The shell is an ovate trapezoid and unsculptured. The anterior margin is rounded, the ventral margin is straight to slightly convex; the posterior margin slightly biangulate below, exhibiting a rounded blunt end; then an oblique straight slope to the dorsal margin; the dorsal margin is straight or sinuate and slopes down toward the beaks and anterior end. The beaks are depressed and project a little above the hinge line. The posterior slope is rounded to subangulate. The yellowish, greenish, brownish periostracum is darker and thicker than pale yellowish or brownish color of L. subviridis. Lasmigona decorata also has greenish or blackish rays. The hinge teeth are well developed and heavy. The beak sculpture is double looped. According to Clarke (1985:58) L. decorata does not differ

significantly from L. subviridis in shell morphology except for its size.

Distribution

Lasmigona decorata has been known only from the Abbeville District in South Carolina (See Figure 7) and the area around Mecklenburg County in North Carolina. One specimen of L. decorata is recorded from Corsier's Branch, supposedly a tributary of the Pee Dee River. The Abbeville District, a terminology no longer employed, may be generally considered as being bordered on the south by the Savannah River and on the north by the Saluda River (see Figure 7). The Saluda River drains into the Congaree-Wateree-Santee River system. Mecklenburg County (Charlotte Area) is drained by the Catawba and Pee Dee Rivers which is also part of the Wateree-Santee River system. The Catawba River (Irwin Creek drainage) in Mecklenburg County, North Carolina, and the Saluda River in the Abbeville District of South Carolina are on opposite sides of the large Congaree-Wateree-Santee River System. It is therefore more likely that the type locality of L. decorata is in the Saluda River drainage of the "Abbeville District" than in the Savannah River drainage. Johnson (1970:344) refers to the type locality as being in the latter. Nothing resembling L. decorata has been recorded from the Savannah River system, and consequently the search for Lasmigona decorata was concentrated in the Saluda

River drainage near the old Abbeville District South Carolina (see Figure 7), and the Catawba and Pee Dee River drainages in and around Mecklenburg County, North Carolina.

According to Clarke (1985:59-60) the distribution of this species is confined to the upper drainages of the Wateree-Santee River system. Since no living populations were known, one of the principle objectives of this study was to determine if any existed, and whether L. decorata is currently threatened or endangered.

Life History and Habitat

Nothing is known about the life history of L. decorata. Very little is known about its habitat except that specimens were collected from creeks, streams, a river and ponds. According to Clarke (1985:60) a pond would be an unusual habitat for L. subviridis.

Geographical Records

The following list of localities was obtained from the unionid collections at the Academy of Natural Sciences at Philadelphia (ANSP) and the United States National Museum (USNM).

Pee Dee River Drainage

1. Crosier's Branch, Cabarrus County, North Carolina, Wheatley Collection (This is a part of the Pee Dee River system)
 - a) ANSP 127186 - 1 specimen

Catawba River Drainage

1. Irwins Creek, Mecklenburg County, North Carolina, Wheatley Collection (This creek flows through Charlotte and empties into Sugar Creek)
 - a) USNM 83974 - Holotype of Unio insolidus Lea, 1872 - 1 specimen
 - b) ANSP 126703 (This lot was mislabeled. It is actually catalogued as ANSP 126704.) - Paratypes of Unio insolidus Lea, 1872 - 7 specimens
 - c) ANSP 126702 (This lot was mislabeled. It is actually catalogued as ANSP 126703) - 2 specimens
2. Paw Creek, Mecklenburg County North Carolina, Wheatley collection
 - a) ANSP 126703 (This lot was mislabeled. It is actually catalogued as ANSP 126702) - 1 specimen
3. Sugar Creek, Mecklenburg County, North Carolina, Wheatley Collection (Sugar Creek flows through York County, South Carolina before joining the Catawba River. The shell is specifically labeled "Sugar Creek, N. Car.") - 1 specimen
4. Catawba River, North Carolina, Wheatley Collection (county not known).
 - a) ANSP 126711 - 3 specimens
5. Mecklenburg County, North Carolina, Wheatley Collection (Body of water unknown).
 - a) USNM 85402 - 2 specimens
6. Near Charlotte, Mecklenburg County, North Carolina, Wheatley Collection (Body of water unknown).
 - a) USNM 85402 - Holotype of Unio charlottensis Lea, 1863 - 1 specimen, figured by Clarke (1985: 58) from Emmons (See Figure 12).
 - b) USNM 85402 - 1 specimen (probably not a paratype since Lea Obs. XI, 13 specifically states that one specimen was sent by Dr. Emmons)
 - c) ANSP 126714 - 6 specimens
7. Bissels Pond, Mecklenburg County, near Charlotte, North Carolina, Wheatley Collection (Pond not located yet)
 - a) USNM 85402 - 1 specimen (See Figure 10)
 - b) ANSP 126713 - 12 specimens

8. Elias Pond, Mecklenburg County, Charlotte, North Carolina, Wheatley Collection (Pond not located yet).
 - a) ANSP 126709 - 1 specimen
9. Flanigan's Pond, Mecklenburg County, Charlotte, North Carolina, Wheatley Collection (Pond not located yet)
 - a) ANSP 126712 - 3 specimens
 - b) ANSP 126784 - 2 specimens
10. Pfeiffer's Pond, Mecklenburg County, Charlotte, North Carolina, Wheatley Collection (Pond not located yet).
 - a) ANSP 126707 - 9 paired specimens and 9 single valves
One specimen is figured by Clarke (1985: 58).

Unknown Drainage

1. Beaver Creek, North Carolina, Wheatley Collection (This site has not been located. There are two Beaverdam Creeks draining into the Catawba River, one in Gaston County, North Carolina and York County, South Carolina, and the other one is in Chester County, South Carolina. There is a Beaver Creek draining into the Catawba River in Kershaw County, South Carolina.)
 - a) ANSP 126710 - 7 specimens
2. Locality Unknown
 - a) ANSP 126791 - 3 specimens

Saluda River Drainage

1. Abbeville District, South Carolina, Barratt collection
 - a) USNM 83972 - Holotype of Unio decoratus Lea, 1852 - 1 specimen
 - b) USNM 83972 - Paratype of Unio decoratus Lea, 1852 - 1 specimen
 - c) USNM 83973 - 3 specimens
 - d) USNM 122339 - 1 specimen

Recent Collections

Lasmigona decorata was not located in the Saluda River system and probably no longer exists there since the main river has many dams and the most of the larger tributaries have been greatly

altered by some form of urbanization. Seven species of naiades were collected in the Saluda River system, most from areas just below impoundments on the Saluda River and in the Ninety Six Creek drainage. See Tables 1 and 4 for a summary of the Mollusca collected in the Saluda River System.

Lasmigona decorata was found in three separate drainages; Waxhaw creek, a small tributary of the Catawba River; Goose Creek, a small tributary Rocky River of the Pee Dee River system; and the Lynches River, a larger tributary of the Pee Dee River system. All three streams have their headwaters in Union County, North Carolina, which is adjacent to and southeast of Mecklenburg County. Mecklenburg County is the source of most of the historical records.

Of the 196 different sites on 92 streams and rivers in the Catawba River system examined (see Figures 3 and 4), only Waxhaw Creek has a population of L. decorata (See Figure 8). See Table 1 and Appendix I for a summary of the collections from the Catawba River system. Naiades were found in only eighteen (20%) of the 92 streams and rivers, and in just three above Charlotte, Mecklenburg County. With the exception of a few populations in lower Mecklenburg and those in Union Counties, most of the naiades in the Catawba River system occur in South Carolina. The chances of finding populations of L. decorata in the Catawba River system above Charlotte are remote, since the entire basin

has been greatly altered by man. Channelization, dredging, damming, agricultural run off, siltation, sand mining, and increased runoff due to urbanization are very evident throughout the system. We doubt that the Corbicula invasion has been a factor in the decline of the naiades in this river system. Considering that there were no traces of old shells, these streams probably have not had naiades in them for a long time. Besides, just 49% of the streams examined had Corbicula. Most streams with good naiad populations also had Corbicula.

Waxhaw Creek

Waxhaw Creek is a small narrow, meandering tributary of the Catawba River draining Union County, North Carolina and a small part of Lancaster County, South Carolina. It originates in southwestern of Union County (See Figure 8), approximately 13 kms southwest of Monroe and it flows southwestward to the Catawba River about 13 kms northwest of Lancaster. It is about 36 kms long. Most of Waxhaw Creek flows through an agricultural area, and at the present time, it appears relatively undisturbed. The stream is bordered by wooded vegetation on seventy-five percent of its length. It is characterized by numerous fallen trees and sunken logs, and consequently has many long pooled areas.

The waters remained cool most of the summer. The turbidity was usually moderate to high, clearing only in late summer. Most of the banks are moderately steep with exposed clay, so a little

rain quickly clouds the water. During low waters the current was moderate only in the lower reaches of the stream and slow in most other areas. However, in late summer there was no discernible flow.

The substrate of Waxhaw Creek varied from bedrock, gravel and sand to mud and organic matter. The sites where naiades were most common contained a mixture of substrates including bedrock, boulders, sandy-gravel or muddy-gravel, sand, and soft mud.

Lasmigona decorata was found at two sites in Waxhaw Creek (See Figure 8); a living specimen and 1/2 valve at county road 1117 bridge, 6.0 kms SE of Waxhaw and 18.7 kms SW of Monroe; and two valves at county road 1137 bridge, 5.6 kms SE of Waxhaw, both Union County, North Carolina. The living specimen was taken from a muddy-sand or a sandy-gravel substrate in a pool that was up to three feet deep (See Figure 13). The water was cool, moderately turbid, and the current was slow. The exact substrate and location in the stream cannot be given because the specimen was not identified as L. decorata until it was examined in the laboratory weeks later. This site was visited two other times, and only 1/2 valve was located farther upstream. Other mollusks in this pool were Elliptio complanata (Lightfoot, 1786), E. icterina (Conrad, 1834), Anodonta cataracta (Say, 1817), Villosa delumbis (Conrad, 1834), Sphaerium striatinum (Lamarck, 1818) (see Table 7).

A complete set of L. decorata valves was found above county

road 1137 bridge approximately 4 kms upstream from the previous site. This part of Waxhaw Creek contains a wide variety of substrates and meanders through either treelined or wooded banks. The stream is narrow with moderately high steep banks, and there are numerous small pools, three feet or less deep.

Lasmigona decorata is rare in Waxhaw Creek. Of the 198 specimens collected in the creek only 2 1/2 were L. decorata.

Goose Creek

Goose Creek is a small tributary of the Rocky River in the Pee Dee River System (See Figure 8), originating approximately 7.5 kms east of Matthews along the Mecklenburg/Union County line. It drains the southwest corner of Union County and flows into the Rocky River 5.2 kms south of Midland, North Carolina. The entire stream is approximately 25 kms long.

Goose Creek was examined at two sites and its tributary, Duck Creek, at one site. All sites were bordered by woods, or shrubs and small trees, and Goose Creek is bordered by woods on seventy-five percent of its length. The banks of both Goose Creek sites were low to medium (6') high and gradually sloping to steep sided. The waters were shaded and cool, the turbidity varied from slight to high. The water was also tea colored. The current was non-existent to slow. The deepest pools examined were about 4 feet. The substrates included mud, muddy-sand, sandy-gravel, muddy-gravel, rocks and bedrock.

Lasmigona decorata was found living at one site in Goose Creek (county road 1547 bridge) in either mud, a muddy-gravel or a sandy-gravel substrate along the banks. At this site most substrates had some mud in or on them. Lasmigona decorata was found in less than two feet of water along with several other species of naiades: Elliptio complanata, Strophitus undulatus, Villosa constricta, Villosa delumbis, an unknown species of Villosa, and Corbicula fluminea (See Table 7). Most naiades were found in the soft mud, sandy-gravel and muddy-gravel along the banks and backwaters. Of the 24 naiades collected at this site, three were Lasmigona decorata.

Neither of the other two sites in the Goose Creek basin contained Lasmigona decorata. The Goose Creek site farther up stream (NC 218 bridge) did contain Elliptio sp., Villosa constricta and Villosa delumbis. The Duck Creek site (County Road 1600 bridge) contained a living E. complanata and a living Strophitus undulatus along with some gastropods and Corbicula fluminea.

Lynches River

Lynches River is a medium sized river (over 200 kms long) that originates about 11 kms south of Monroe, Union County, North Carolina, and flows southeastward into South Carolina, joining with the Great Pee Dee River on the Coastal Plain about 8 kms east of Johnsonville, Florence County. For the most part, the

Lynches River is a coastal plain river unlike the small Piedmont streams where L. decorata was first recorded. Only three headwater sites were examined. The Lynches River drainage was not considered a likely location for L. decorata and was not given a high priority.

Lasmigona decorata was found at two of three Lynches River sites examined as a part of this survey. In this study, a total of four specimens were recovered; 1 living and 3 pairs of valves (See Figures 14, 15, and 16). It has been subsequently collected alive at two other headwater sites. It was not found in any of the four tributaries examined. The river has a variable substrate, bank height, and bank slopes, and flows through different plant communities. We describe in general terms the two sites where L. decorata was located and the specific habitat of the one living specimen.

The Lynches River at the SC Route 265 bridge was sampled on two occasions. The river was very low, and the waters were clear and cool with a moderate current. The substrate was predominantly sand with some gravel. In some areas bedrock, rock and mud was also evident. Most of the naiades were found buried in the mud or muddy-sand at the base of the steep stable banks. The naiades in the sand were widely scattered and were usually located by following trails. A few were buried 6" to 1' in the sand banks. The banks bordering this part of the river were very low to high with variable slopes, however, during higher waters

the entire area would be bordered by steep banks.

Three sets of fresh valves of L. decorata were found at the SC Route 265 site on the Lynches River; no living specimens were located (one living specimen has been subsequently found). All the valves were on low, flat sand bars. Nothing can be said concerning the specific habitat of L. decorata at this site.

There are at least seven species of naiades in the Lynches River at the SC Route 265 bridge site (See Table 7). The predominant species complex is in the genus Elliptio. Elliptio complanata is the most common species in the area and it has at least two forms which overlap morphologically with a "lanceolate" species of Elliptio and also with what appears to be E. congaraea. We cannot currently determine the limits of one species by examining shell characters and papillae. In addition to the Elliptio species, Strophitus undulatus, Alasmidonta varicosa, and Villosa constricta were also found in low numbers. Corbicula fluminea and Elimia caternaria dislocata were common throughout. The second site where L. decorata was located on the Lynches River was at the SC Route 903 bridge. The river was low, the waters were clear, cool with a slow to moderate current. There were some pools that were up to five feet deep. The predominate substrate was sand. There were some clays along the banks along with a few rocks. Lasmigona decorata, the only living naiad found was, in the sand at the base of a steep bank in about two feet of water with a moderate current. The entire

site was wooded and the banks were shaded by trees. Most of the banks in this area were high and steep.

Elliptio complanata, Elliptio "lanceolate" species, and Villosa delumbis probably exist in the area. However, only shells of these species were located. The waters were rather cold, and fallen leaves interfered with viewing the bottom. The area was not thoroughly searched for living naiades. Corbicula fluminea was common and E. catenaria dislocata was occasional.

Description of Some Collected Specimens

Clarke (1985: 57-60) did not describe L. decorata, but did compare its size and thickness to L. subviridis. Clarke (1985: 59) also gave shell measurements for several lots of museum specimens. Shell measurements for the specimens collected in this survey are given in Table 2 and summarized in Table 3.

In an effort to add to the composite description of the species made earlier in this report from museum collections, a specimen from Waxhaw Creek and a specimen from the Lynches River will be described separately.

The shell of a living specimen collected in Waxhaw Creek, county road 1117 bridge, Union County, North Carolina, is described as follows. The shell is 100 mm in length (L), 55 mm in height (H), and 36 mm in width (W); the beak to anterior end (B-A) is 27.5 mm; the W/L is .36, the H/L is .55 and the B-A/L is .275; the shell is an elliptical trapezoid; the dorsal margin is

straight and then slopes from the posterior end of the hinge to a mid-point at the posterior end; the posterior dorsal wing is reduced; there is a bluntly rounded posterior margin; the rounded convex posterior slope ends at the posterior-ventral margin; the posterior end appears to be slightly biangulate; the ventral margin is slightly arcuate; the anterior end is rounded; the beaks are slightly elevated above the dorsal margin; the umbo is somewhat flattened; the periostracum is dark brown; on the inside of the shell the nacre is pearly white posteriorly and grades to a stained orange in the umbo region; the pseudo-cardinal teeth are lamellar and parallel to the dorsal margin, there is a slight interdentum; the two lateral teeth in the left valve are thin and irregular with a narrow space between them.

The shell of a dead specimen collected in the Lynches River, S. C. Route 265 bridge, Chesterfield/Lancaster Cos., South Carolina, is described as follows. The shell is 49.5 mm in length (L), 27.5 mm in height (H), and 15.5 mm in width (W); the beak to anterior end (B-A) is 14.0 mm; the W/L is .313, the H/L is .556 and the B-AL is .283; the shell is an elliptical trapezoid; the dorsal margin is straight with a slight wing; the dorsal margin, then slopes from the posterior end of the hinge with a gently curve down to the mid-point of the posterior end; the posterior end is rounded and slightly biangulate; the ventral margin is straight; the anterior end is rounded; the beaks are slightly elevated above the dorsal margin; the umbo is flattened;

the periostracum is brown with very wide, faint, greenish brown rays; on the inside of the shell the nacre is an irridescent bluish-white and a pale orange in the umbo region; the shell is thin, but stout and it is thicker at the anterior end.

In the left valve, the anterior pseudocardinal tooth is faintly serrated, thin, triangular and parallel to the curved dorsal line. The posterior pseudocardinal tooth is smaller, more serrated and deflects ventrally away from the dorsal margin. The posterior pseudocardinal tooth is just anterior to the beak. The interdentum is slightly raised. The lateral teeth in the left valve are not well developed. The ventrolateral tooth is long, thin and blade like, but the dorsolateral tooth is short, thin and poorly developed. The pseudocardinal tooth in the right valve is heavier than either one in the left valve. It is also an elongated triangle with an irregular surface. This tooth is parallel to the sloping dorsal margin. The lateral tooth in the right valve is thin, but well formed.

The following shell characters are somewhat variable when considering all the specimens collected. The periostracum varies from greenish-brown to a dark brown. The younger specimens show very faint greenish-brown rays over the posterior two-thirds of the shell. The older specimens are usually eroded, but they have a dark brown periostracum with no rays. The posterior end of the dorsal margin is sometimes slightly winged. The interdental tooth may be absent in some specimens. In the left valve, the

lateral tooth may be single or double. The nacre varies from irradescant white to mottled pale orange.

Comparison With Lasmigona subviridis

Lasmigona decorata differs significantly from L. subviridis in several ways. Lasmigona decorata definitely has a larger and heavier shell; L. subviridis does not approach the size of L. decorata at the same age. The periostracum in L. decorata rarely shows distinct rays and is rarely yellow as is that of L. subviridis. The mean height/length ratio is lower in L. decorata. The beaks are closer to the anterior end in L. decorata than in typical L. subviridis. The ventral margin is usually straighter in L. decorata than in L. subviridis.

The large size of L. decorata is striking, especially since it was once synonymized (Johnson, 1970) with L. subviridis is a fairly small species. The largest specimens collected were from Waxhaw Creek, a small creek which was well shaded and the waters remained cool all summer. The naiades in this creek probably do not have more food or a substantially longer growing season than a population of L. subviridis less than one hundred miles north in the Neuse River System. The large size of L. decorata is best explained by genetics, not environment.

Life History and Habitat

Almost nothing is known about the life history of L. decorata. A few living specimens have been obtained. At least one living specimen has been obtained for each of the following dates; 29 June 1987, 26 August 1987 and 24 October 1987.

Lasmigona decorata was found in two small streams and a small river. It was found along a bank in a ponded portion of a small stream with a slow current and in a run along a steep bank with a moderate current. All specimens were found in less than three feet of water during summer and during low waters in the fall. All habitats were near banks shaded by overhanging trees. The substrates included soft mud, sand, muddy-sand, or sandy-gravel.

In the past, the locations for Lasmigona decorata were small streams (Irwins Creek, Paw Creek, Beaver Creek), a large stream (Sugar Creek), a large river (Catawba River) and "ponds" (Bissels Pond, Elias Pond, Flanigans Pond and Pfeiffers Pond). The habitat which really does not fit well are the "ponds". After having systematically examined the Catawba River system it is believed that the "ponds" were mill ponds. Many remnants of small dams and walls made of native rock were discovered. There were many mills in the river system, especially on the small streams. Each mill pond was probably named after the mill or family running the mill. These were also places where collectors could have easy access to the waters.

Alasmidonta robusta Clarke, 1981, The Carolina Elktoe

Until Arthur H. Clarke monographed the Genus Alasmidonta in 1981 the Carolina elktoe was not recognized as a distinct species. According to Clarke (1981: 83) this species is known only from the type lot. The type was collected from Long Creek (near Charlotte), Mecklenburg County, North Carolina. There are five specimens in the type lot, four are in the Academy of Natural Sciences in Philadelphia and one is now in the Museum of Comparative Zoology at Harvard.

Clarke (1981: 83) believes that this species is either very rare or extinct. He examined the type locality (Long Creek) and found most of its tributaries impounded by dams. Long Creek is a tributary of the Catawba River, which is part of the Wateree-Santee River System of North Carolina and South Carolina. When Clarke examined Long Creek on 29 May 1979 he found that it carried very little water.

Description

Alasmidonta robusta Clarke, 1981 is known only by its shell characteristics (See Figure 17). No soft anatomy or glochidia are known for the species. The type of the species is 66 mm long, 43 mm high and 33 mm wide, the umbos are about 26 mm from the anterior end of the shell. Clarke (1981: 83) includes all

the measurements for the type lot. The shell is thin, but not fragile. The anterior margin is well rounded; ventral margin broadly curved; posterior margin terminating in a round point below the center and flatly convex above; the dorsal margin is slightly curved. The periostracum is glossy, pale greenish yellow with mostly broad greenish rays which diminish at the posterior ridge. The posterior slope is not rayed. The rays of the left and right valve do not match. The posterior slope is covered with corrugations which are perpendicular to the posterior margin of the posterior slope. Alasmidonta robusta has a large interdental projection in the left valve (See Figure 19).

Alasmidonta robusta differs markedly from most of the Alasmidonta varicosa (Lamarck, 1819) examined (See Figure 18). Alasmidonta robusta does not have any dark green checks, marks or flecks superimposed on the rays as is common on the periostracum of A. varicosa. The umbo in A. robusta is broader and the dorsal margin posterior to the umbo is shorter than the corresponding features of A. varicosa. The posterior end of A. robusta is narrower than in A. varicosa. The widest portion of the valves of A. varicosa is more on the posterior side of center and farther from the umbo. The two species appear to be quite distinct based upon material examined at the Academy of Natural Sciences in Philadelphia.

Recent Investigations

The only known location for A. robusta was Long Creek, Mecklenburg County, North Carolina. Eight sites on Long Creek and its tributaries were examined on nine visits. Even during mid-summer when the water was very low there were many pools that could support naiades, but only a small piece of one valve was found. Corbicula fluminea and Elimia were common at several locations.

We do not think Alasmidonta robusta still lives in Long Creek. After having examined most of the tributaries of the Catawba and Pee Dee Rivers in the area surrounding the type locality, we believe Alasmidonta robusta to be extinct. Naiades are uncommon in the Catawba River System in North Carolina above Union County. With the exception of one site on the Linville River, A. varicosa is rare throughout the Catawba and Pee Dee River systems. It is very unlikely that A. robusta an even rarer species, would turn up anywhere in these river systems.

CONCLUSIONS

1. Status of Lasmigona decorata, The Carolina Heelsplitter

Lasmigona decorata was collected at five sites in three streams in two river systems. Living specimens were taken at four of these five sites. Lasmigona decorata was found living in Waxhaw Creek of the Catawba River system, Goose Creek and Lynches River of the Pee Dee River system.

Lasmigona decorata is uncommon or rare at all sites examined.

In Waxhaw Creek L. decorata is known from one living specimen and one and one half shells. Considering that naiades are common in Waxhaw Creek and many specimens have been examined, this species should be considered rare in this stream. Lasmigona decorata is uncommon at Goose Creek and Lynches River. In Goose Creek L. decorata comprised 3 of the 24 naiades collected. In the Lynches river it is known from four specimens.

The Department of Transportation in North Carolina, the Departments of Highways and Public Transportation in South Carolina, the Department of Natural Resources and Community Development in North Carolina, and the Army Corps of Engineers in the Wilmington District were contacted about possible projects on Waxhaw Creek and Lynches River (see Appendix B). All agencies are unaware of any projects that would have negative impact on the habitat of either of these two streams.

More work on the status of L. decorata needs to be done. Since the species is sometimes difficult to identify in the field and it was not discovered in the Goose Creek and Lynches River until late in the survey, the exact status of this species is difficult to ascertain. Based upon present data, L. decorata is at the very least, threatened. It survives in very few streams, far fewer than its historical distribution, and is uncommon or rare.

2. Status of Alasmidonta robusta, the Carolina Elktoe

Alasmidonta robusta was not found at any of the 452 different sites examined in the Saluda, Catawba or Pee Dee River systems. A thorough search of its only known locality in Long Creek, Mecklenburg County, North Carolina, yield no specimens. Based upon current data this species is probably extinct.

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Lea, Isaac

1872. Description of Twenty-nine New Species of Unionidae from the United States, Proceedings of the Academy of Natural Sciences of Philadelphia, 24:155-161.

Mills, Robert

1826. Statistics of South Carolina Including a View of its Natural, Civil, and Military History, General and Particular. Hurlbut and Lloyd, Charleston, S. C.

Figure 1. Field data collection record.

Field Data Record

Date _____ Field No. _____

Time _____ Sta. No. _____

Coll. By _____

Lat _____ Long _____ Chart _____

Locality _____

Area of Locality Sampled _____

Vegetation on the banks _____

Vegetation in the water _____

Substrate _____

Type Shore _____

Turbidity _____ Current _____ Water Temp _____

Depth Water _____ Depth Investigated _____ Method Capture _____

Preservative _____ Photographs _____

General Notes _____

Species Collected	Depth	Substrate	Current
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
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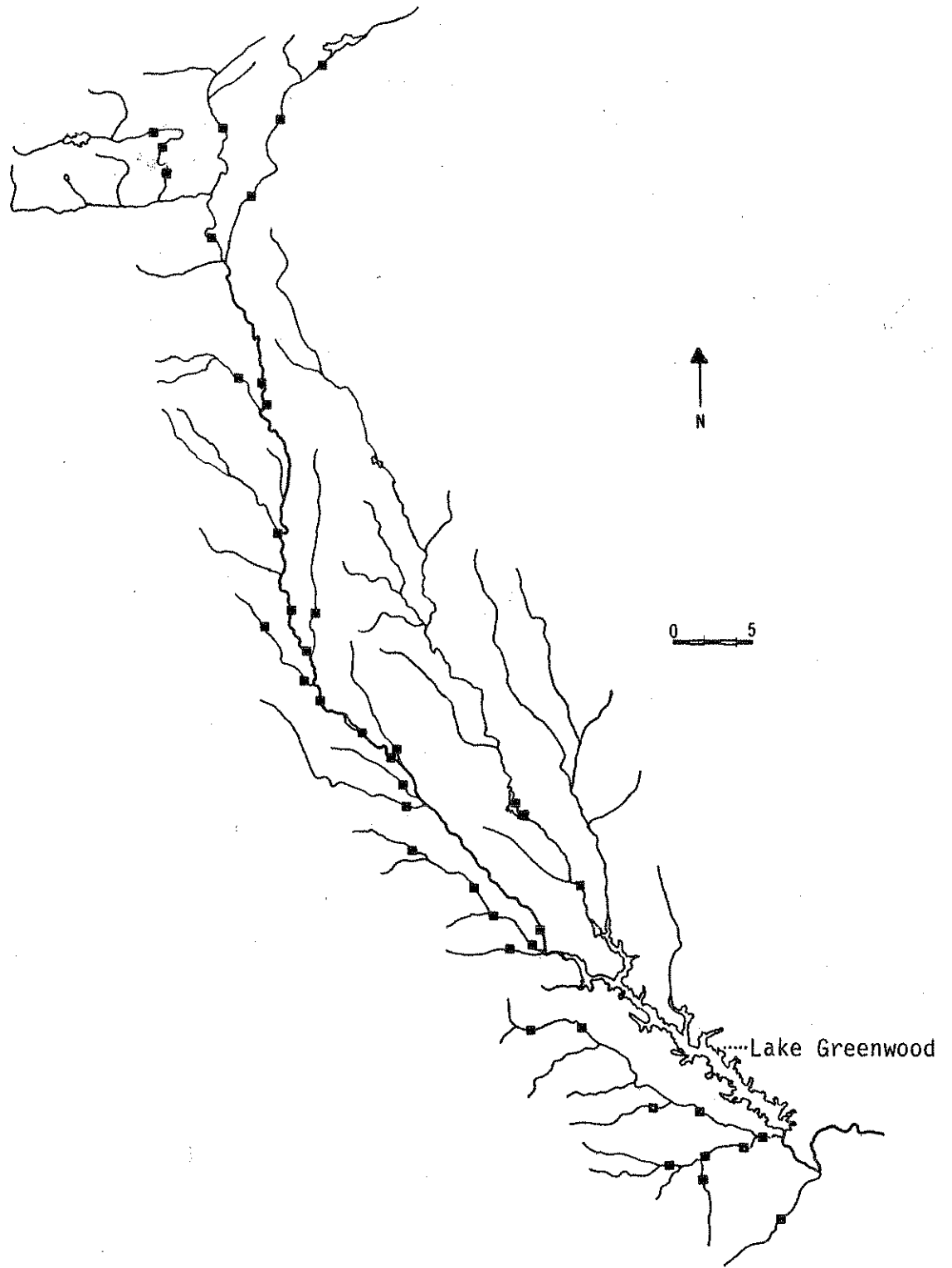


Figure 2. Collection Areas in the Upper Saluda River Basin

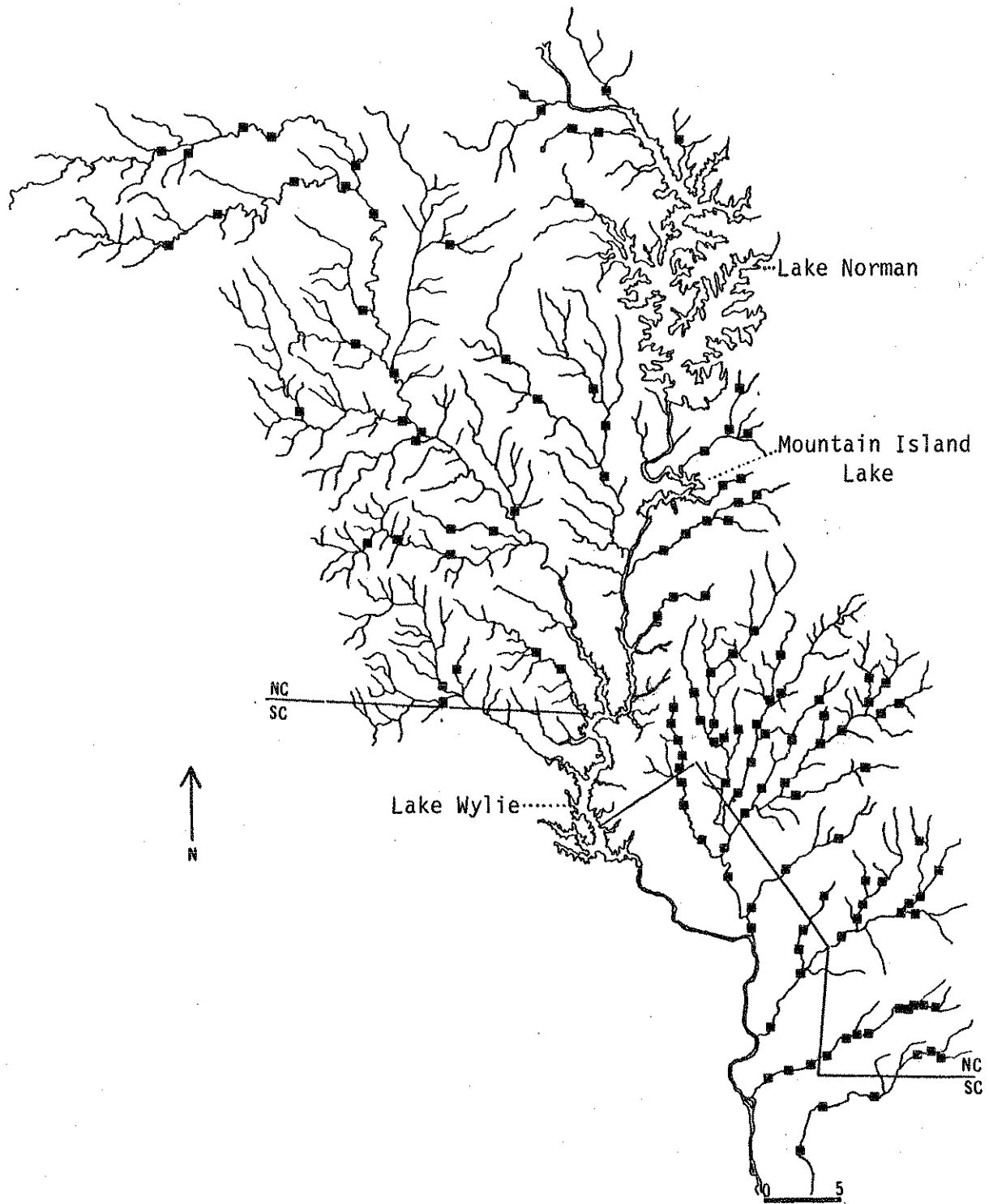


Figure 3. Collection Areas in the Lower Basin of the Catawba River.

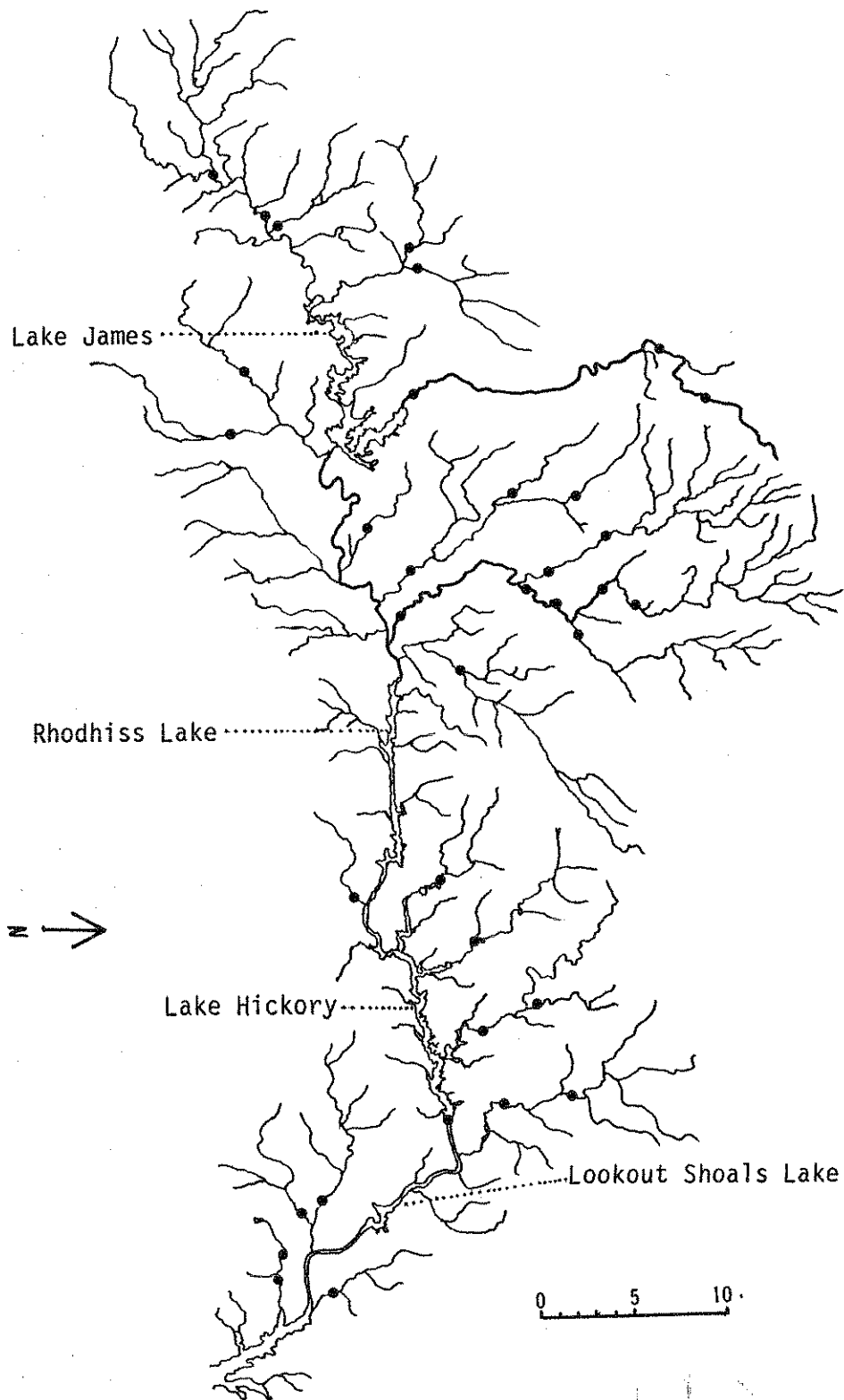


Figure 4. Collection Areas in the Upper Basin of the Catawba River

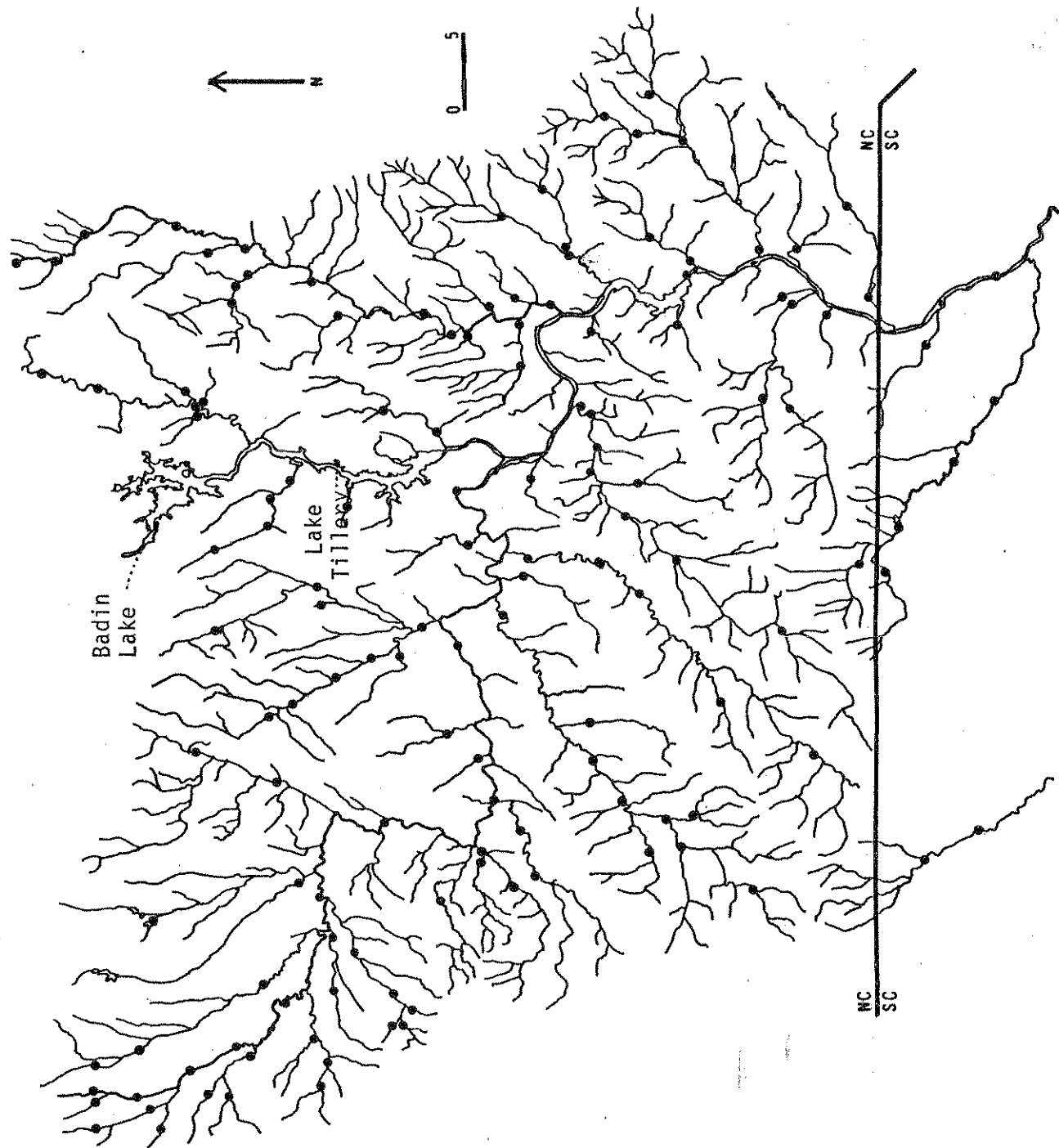


Figure 5. Collection Areas for the Lower Section of the Yadkin-Pee Dee River Basin.

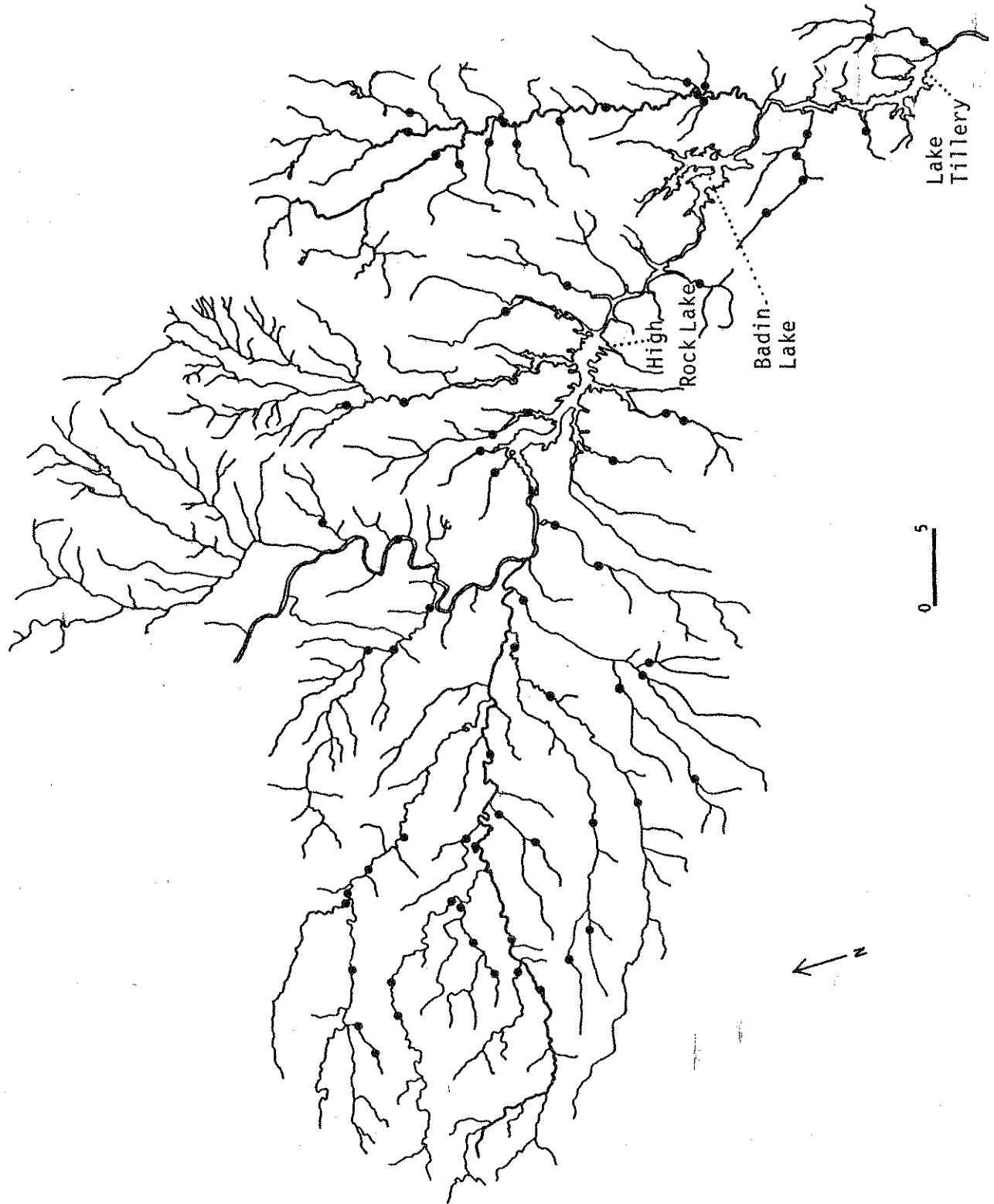


Figure 6. Collection Areas for the Middle Section of the Yadkin-Pee Dee River Basin.

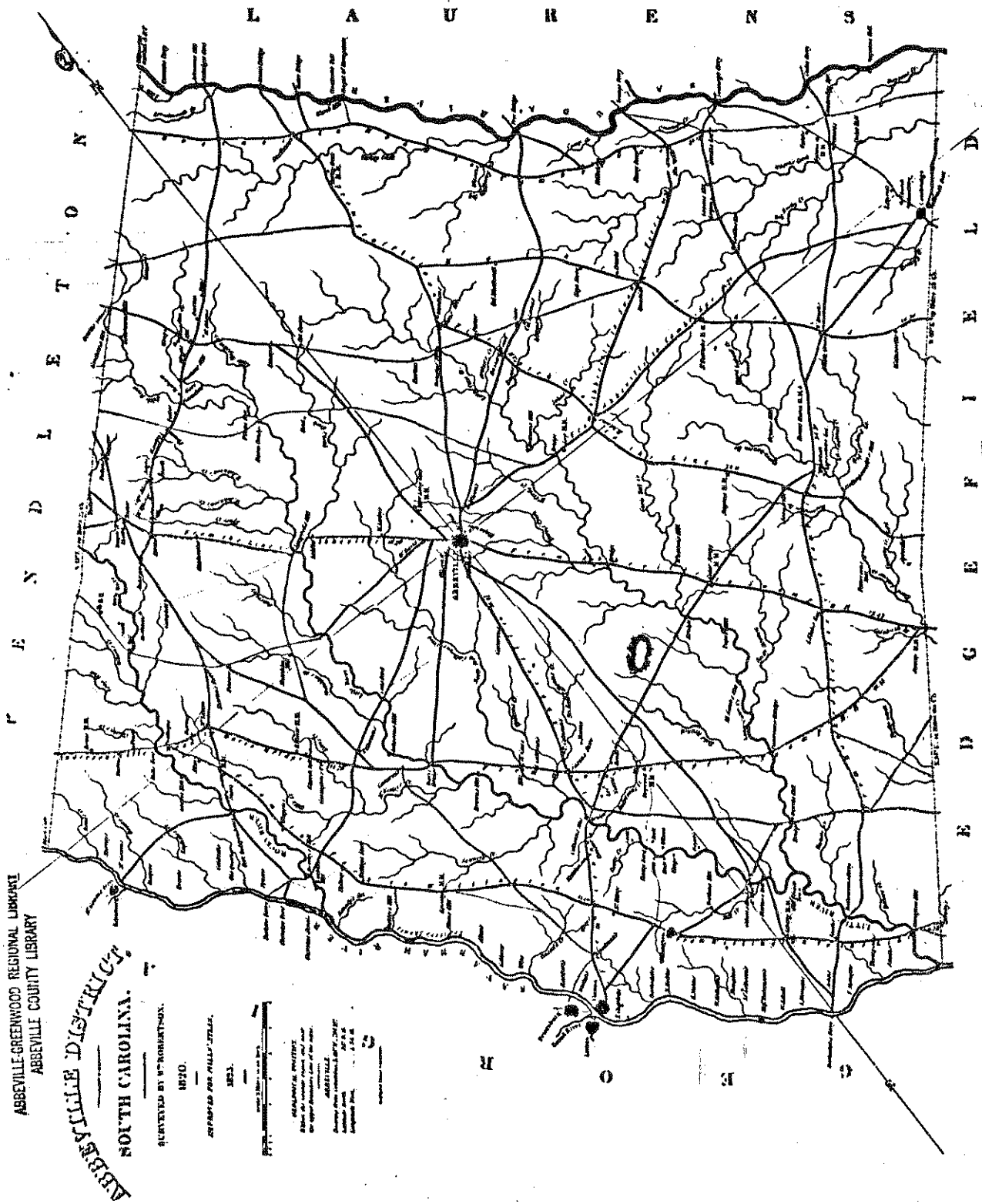


Figure 7. Map of the Abbeville District, South Carolina. Surveyed by William Robertson in 1820 and improved for Robert Mills in 1823 (Mills, 1826).

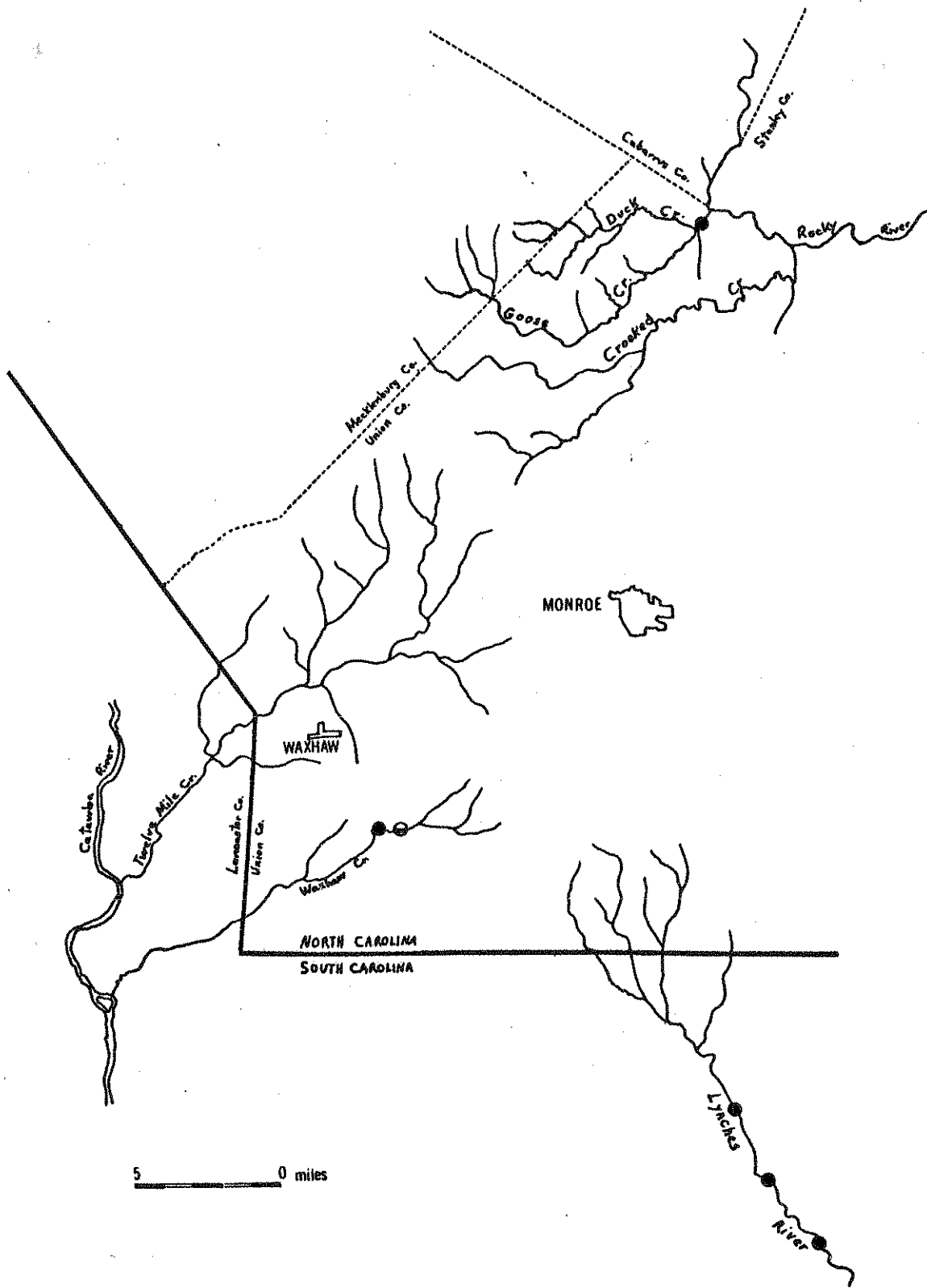


Figure 8. Distribution of *Lasmigona decorata* based upon this study.

- Shells Only
- Living Specimens

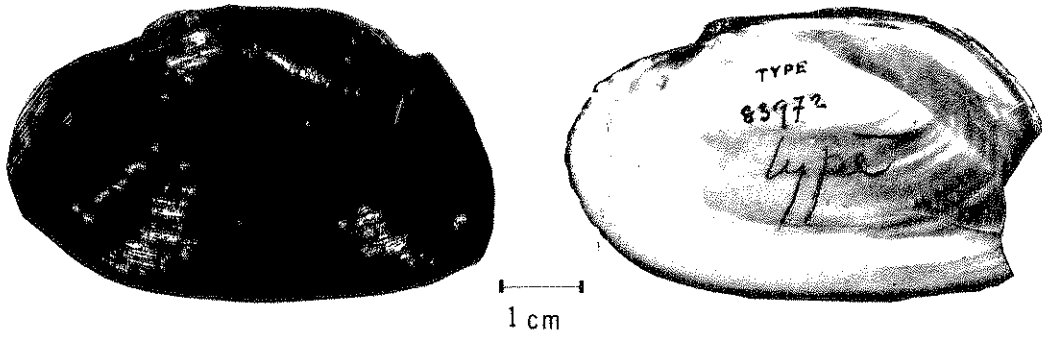


Figure 9. Unio decoratus Lea, 1852, holotype from Abbeville District South Carolina (USNM 83972).

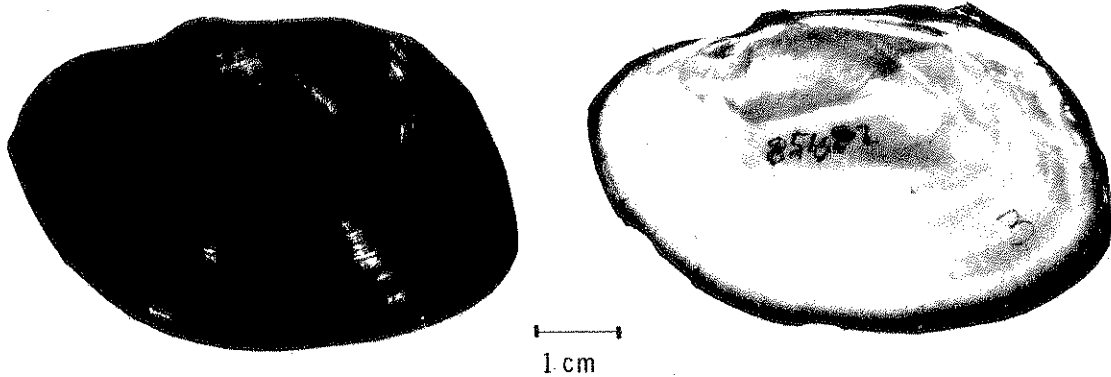


Figure 10. Lasmigona decorata (Lea, 1852) from Bissels Pond, Mecklenburg County, near Charlotte, North Carolina (USNM 85402).

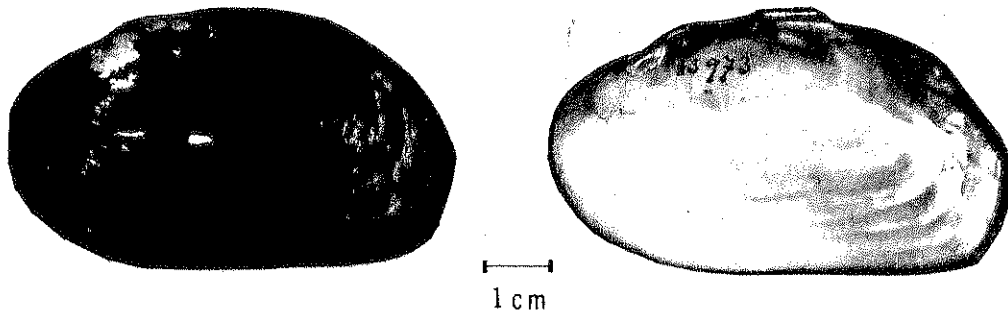


Figure 11. Lasmigona decorata (Lea, 1852) from Abbeville District, South Carolina (USNM 83973). Specimen was labeled Unio insolidus Lea, 1872.

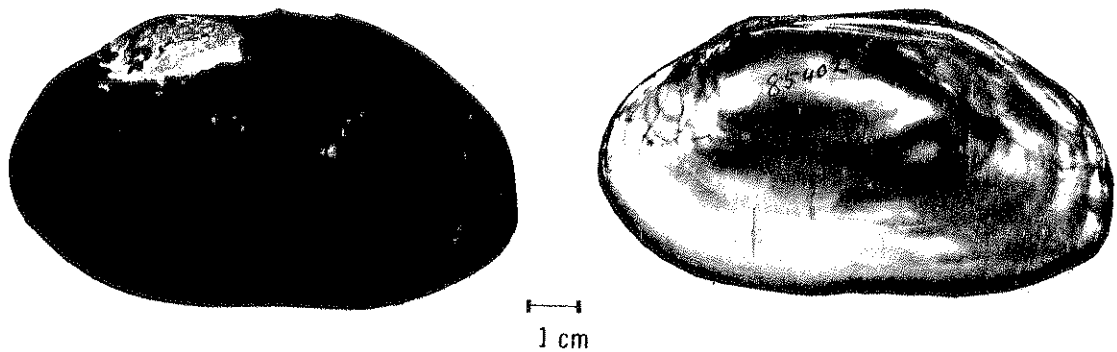


Figure 12. Unio charlottensis Lea, 1863, holotype from Mecklenburg County, near Charlotte, North Carolina (USNM 85402).



Figure 13. Lasmigona decorata from Waxhaw Creek, Union County, North Carolina; inside of left valve and soft anatomy in right valve.

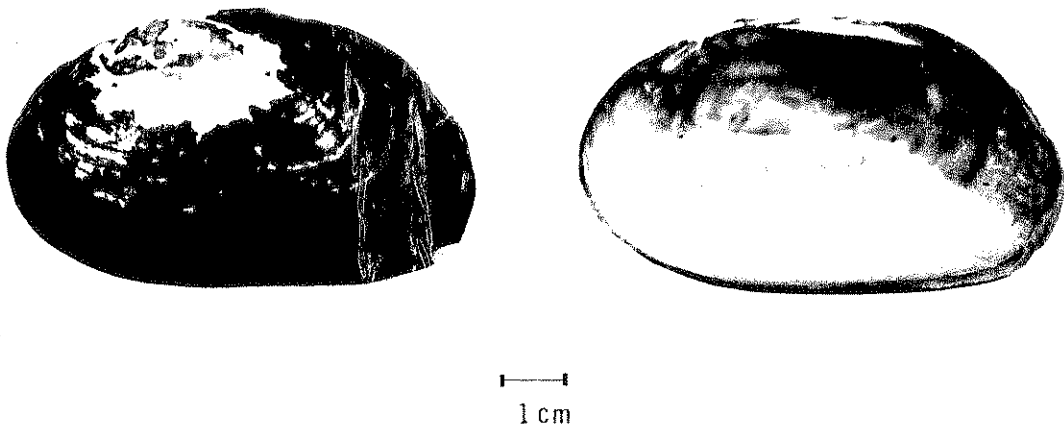


Figure 14. Lasmigona decorata from Lynches River Chesterfield/Lancaster Counties, South Carolina; outside of left valve and inside of right valve.

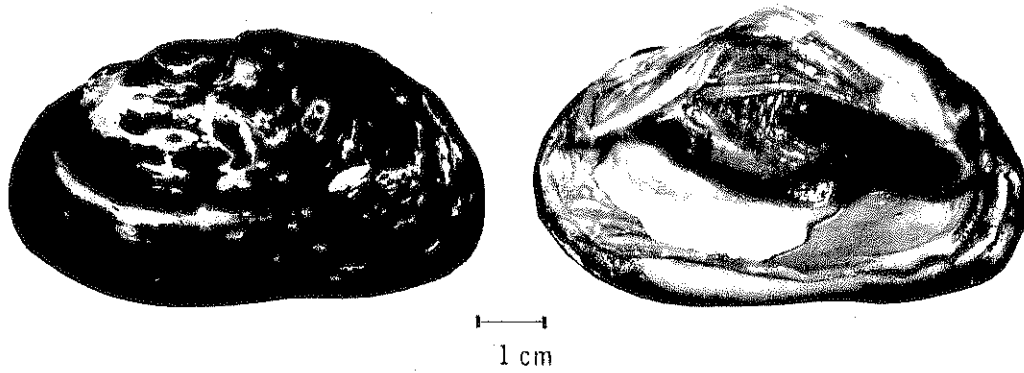


Figure 15. Lasmigona decorata from Lynches River, Chesterfield/Kershaw Counties, South Carolina; outside of left valve and soft anatomy in the right valve.

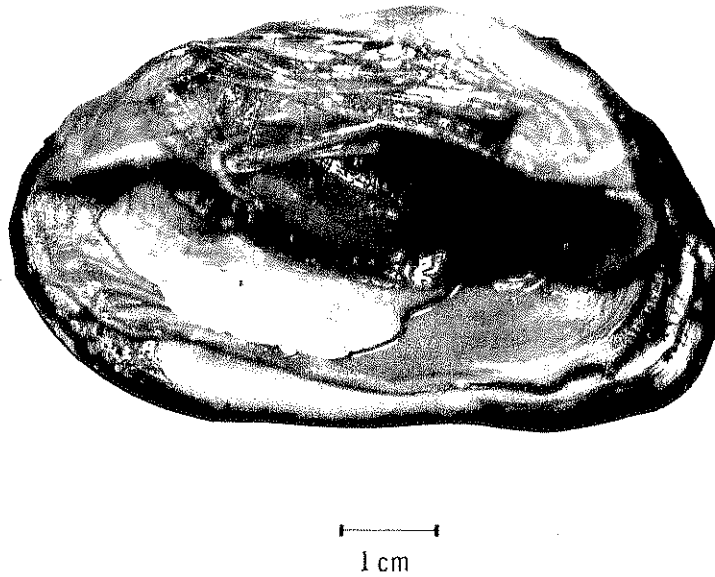


Figure 16. Enlarged view of the soft anatomy of Lasmigona decorata from the Lynches River.

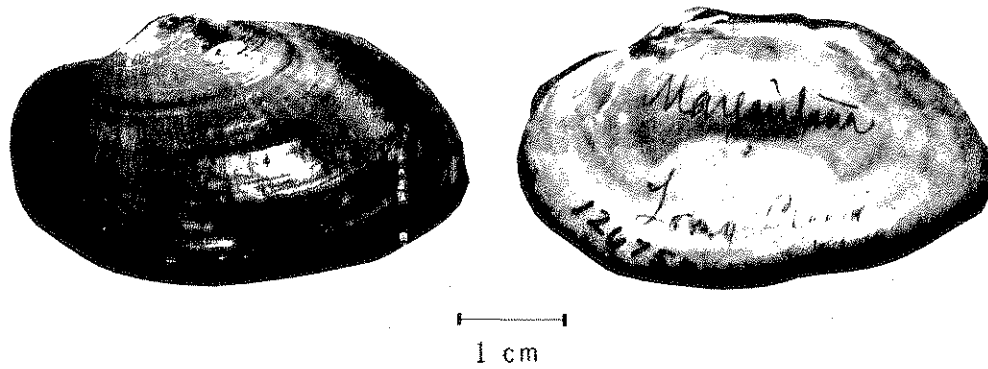


Figure 17. Alasmidonta robusta Clarke, 1981 a paratype from Long Creek, North Carolina (ANSP 126755).

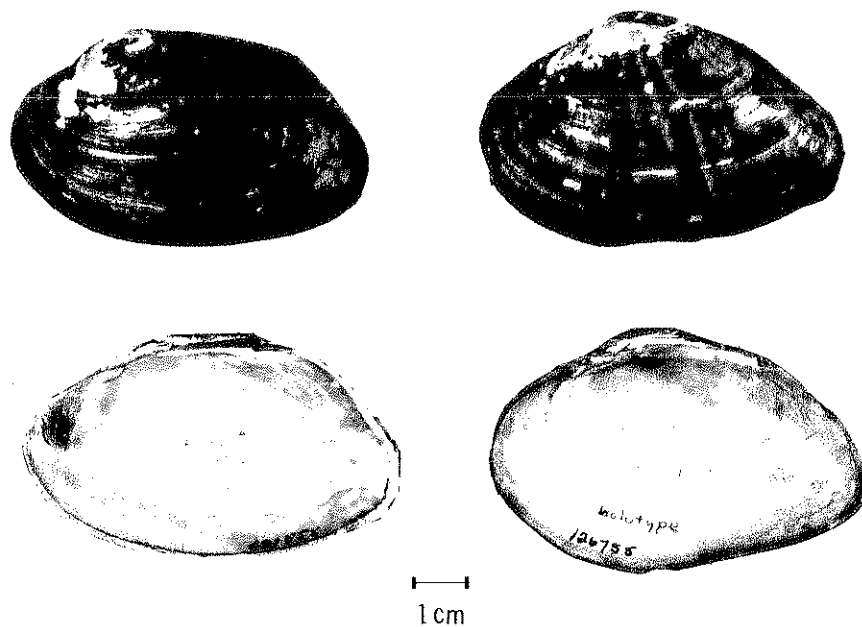
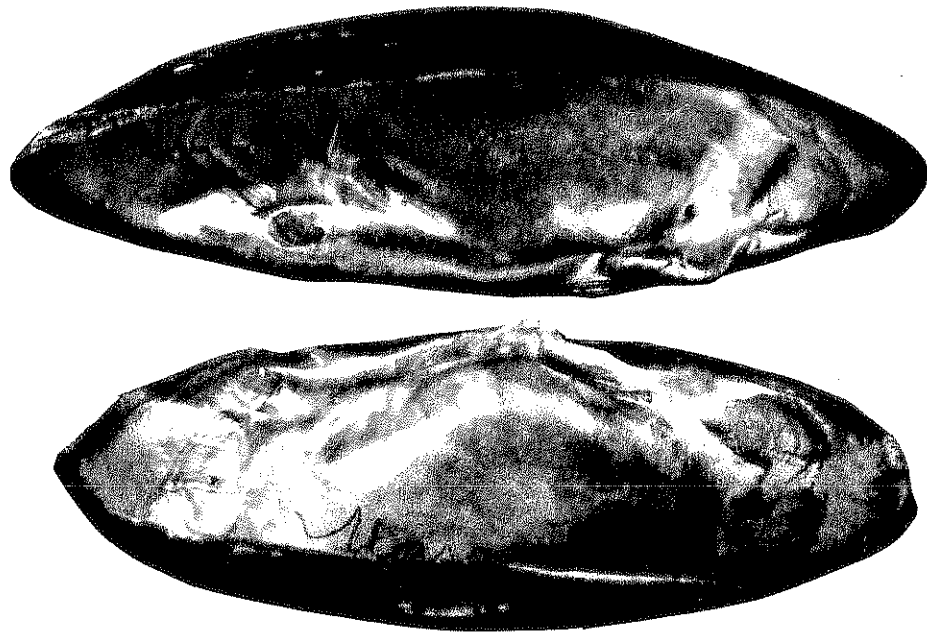


Figure 18. Comparison of Alasmidonta varicosa (Lamarck, 1819) (ANSP 101555) from Sancony Creek, near Coatstown, Pennsylvania, on the left with Alasmidonta robusta Clarke, 1981, on the right.



1 cm

Figure 19. Internal tooth structure of Alasmidonta robusta holotype (ANSP 126755).

Table 1. Summary of Survey Collections

	Saluda River System	Catawba River System	Pee Dee River System	Lynches River	Total
Total Number of Visits Made	44	201	207	8	460
Total Number of Different Sites	44	196	205	7	452
Total Number of Different Rivers and Streams Examined	24	92	116	5	237
The Number of Different Rivers & Streams Which Had Mollusca	14 (58%)	62 (67%)	77 (66%)	2 (40%)	155 (65%)
Rivers & Streams Which Had No Mollusca	10 (42%)	30 (33%)	39 (34%)	3 (60%)	82 (35%)
Rivers & Streams With Naiades	6 (25%)	18 (20%)	42 (36%)	2 (40%)	68 (29%)
Rivers & Streams With Corbicula	12 (50%)	45 (49%)	54 (46%)	2 (40%)	113 (48%)
Number of Molluscan Species Found	10	20	29	14	29
Number of Naiad Species Found	7	11	18	9	18

Table 2. Some Morphometric Measurements of the *Lasmigona decorata* collected.

Collection Number	Bridge	Stream	L (mm)	H (mm)	W (mm)	B-A (mm)	H/L	W/L	B-A/L
EPK:1987:32	Co.Rd 1117	Waxhaw Ck	100.0	55.0	36.0	27.5	.55	.36	.28
EPK:1987:33	Co.Rd 1137	Waxhaw Ck	101.5	35.0	35.0	31.0	.53	.35	.31
EPK:1987:367	Co.Rd 1117	Waxhaw Ck	118.0	63.5	ca40.0	31.0	.54	.34	.26
EPK:1987:345	Co.Rd 1547	Goose Ck	60.0	35.0	19.5	18.0	.58	.33	.30
EPK:1987:345	Co.Rd 1547	Goose Ck	70.0	39.5	23.0	20.0	.56	.33	.29
EPK:1987:429	SC.Rt 265	Lynches River	68.5	39.0	22.3	20.0	.57	.33	.29
EPK:1987:447	SC.Rt 903	Lynches River	77.0	42.5	29.0	23.0	.55	.38	.30
EPK:1987:448	SC.Rt 265	Lynches River	49.5	27.5	15.5	14.0	.56	.31	.28
EPK:1987:448	SC.Rt 265	Lynches River	55.3	31.1	19.0	15.0	.56	.34	.27

Table 3. Range and Means of Shell Morphometric Measurements for the Lasmigona decorata collected.

	Range	Mean
Length (L)	49.5 - 118mm	77.8mm
Height (H)	27.5 - 63.5mm	43.0mm
Width (W)	19.0 - 40.0mm	26.6mm
Beak-Anterior End (B-A)	14.0 - 31.0mm	22.2mm
H/L	.53 - .58	.556
W/L	.31 - .38	.34
B-A/L	.26 - .31	.286

Table 4. Mollusca Collected From The Saluda River System.

Unionidae

Elliptio complanata (Lightfoot, 1786)

Elliptio sp. icterina complex

Elliptio sp. (a lanceolate species)

Uniomerus sp.

Anodonta cataracta Say, 1817

Anodonta imbecillis Say, 1829

Villosa delumbis (Conrad, 1834)

Corbiculida

Corbicula fluminea (Muller, 1774)

Viviparidae

Campeloma limum (Anthony, 1860)

Planorbidae

Helisoma anceps (Menke, 1830)

Table 5. Mollusca Collected in The Catawba River System

Unionidae

Elliptio complanta (Lightfoot, 1786)
Elliptio icterina (Conrad, 1834)
Elliptio sp. (a lanceolate species)
Uniomerus sp.
Anodonta cataracta Say, 1817
Anodonta imbecillis Say, 1829
Alasmidonta varicosa (Lamarck, 1819)
Lasmigona decorata (Lea, 1852)
Strophitus undulatus (Say, 1817)
Villosa delumbis (Conrad, 1834)
Villosa constricta (Conrad, 1838)

Corbiculidae

Corbicula fluminea (Muller, 1774)

Sphaeriidae

Sphaerium striatinum (Lamarck, 1818)

Pleuroceridae

Elimia proxima (Say, 1825)
Elimia catenaria (Say, 1822)
Elimia symmetrica (Haldeman, 1841)

Viviparidae

Campeloma limum (Anthony, 1860)

Planorbidae

Helisoma anceps (Menke, 1830)

Lymnaeidae

Pseudosuccinea columella (Say, 1817)

Physidae

Physella sp.

Table 6. Mollusca Collected in The Pee Dee River System

Unionidae

Elliptio complanta (Lightfoot, 1786)
Elliptio icterina (Conrad, 1834)
Elliptio congaraea (Lea, 1831)
Elliptio sp. (a lanceolate species)
Elliptio folliculata (Lea, 1838)
Elliptio sps.
Unio sp.
Fusconaia masoni (Conrad, 1834)
Anodonta cataracta Say, 1817
Anodonta imbecillis Say, 1829
Alasmidonta varicosa (Lamarck, 1819)
Lasmigona decorata (Lea, 1852)
Strophitus undulatus (Say, 1817)
Lampsilis radiata conspicua (Lea, 1872)
Villosa delumbis (Conrad, 1834)
Villosa constricta (Conrad, 1838)
Villosa vibex (Conrad, 1834)
Villosa sp.
Ligumia nasuta (Say, 1817)
Toxolasma pullus (Conrad, 1838)

Corbiculidae

Corbicula fluminea (Muller, 1774)

Sphaeriidae

Sphaerium striatinum (Lamarck, 1818)

Hydrobiidae

Unidentified species

Pleuroceridae

Elimia proxima (Say, 1825)
Elimia catenaria (Say, 1822)
Elimia symmetrica (Haldeman, 1841)

Viviparidae

Campeloma limum (Anthony, 1860)

Planorbidae

Helisoma anceps (Menke, 1830)
Planorbella trivolvis (Say, 1817)

Lymnaeidae

Pseudosuccinea columella (Say, 1817)

Physidae

Physella sp.

Appendix A.

Localities examined in the Saluda, Catawba and
Pee Dee River Systems in North Carolina and South Carolina

9/8/88

I have now made extra
copies of Appendix A. If you
have a real need for this data
I will try to provide it later

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