A SURVEY OF THE MUSSELS (UNIONIDAE) of the UPPER TENNESSEE RIVER - 1978

W. Jeffrey Pardue
Tennessee Valley Authority

This account of the mussels of the upper Tennessee River includes portions of the mainstream Tennessee River from Walden Gorge, west of Chattanooga, Tennessee, to Fort Loudoun Dam, south of Knoxville, Tennessee. Collections were made downstream from each of the three mainstream dams (Fort Loudoun, Watts Bar, Chickamauga) for varying distances depending on the quality of the substrate. Eighty-six stations were sampled which yielded a total of only 21 extant species as compared to 57 species reported by Ortmann (1918). Slight changes in faunal composition have occurred since Scruggs' survey (1960). Most notable of the changes are (1) invasion of typical post-impoundment species (6 of the 21 extant species) and (2) the occurrence of *Dromus dromas* (lea, 1834), a Cumberlandain species not reported from the Tennessee River since Ortmann (1918).

Introduction

The Tennessee River has long been noted for its indigenous mussel fauna. Within the Tennessee River, species originating in the upper Tennessee or Cumberland River basins (Cumberlandian) are merged with species originating in the lower Ohio River basin (Ohioan) together with species of undetermined origin.

This account of the mussels of the upper Tennessee River includes portions of the mainstream Tennessee River from Walden Gorge, west of Chattangooa, Tennessee, to Fort Loudon Dam, south of Knoxville, Tennessee (Figure I). Collections were made downstream from each of the three mainstream dams (Fort Loudon, Watts Bar, Chickamauga) for varying distances depending on the quality of the substrate. Eighty-six stations were sampled which yielded a total of 21 extant species as compared to 57 species by Ortmann (1918).

The classical work by Ortmann and Walker (1922) has formed the basis for nomenclatural decisions in this paper. Historical records have been synonymized following the recent publication by Bates and Dennis (1978). The "50 year rule" of zoological nomenclature has been adhered to in this publication. Voucher specimens for most species are deposited with the Museum of Zoology, Mollusk Division, University of Michigan, Ann Arbor, Michigan, 48104. Vouchers are not available for those species which are protected as endangered species or those species which the author deems "rare" in the upper Tennessee River.

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Historic Background

The Tennessee River proper is formed east of Knoxville, Tennessee, at the confluence of the Holston and French Broad Rivers (Figure 1). It flows generally southwesterly to Guntersville, Alabama, westward through Muscle Shoals, Alabama, to the Alabama-Mississippi state line, then northward through Tennessee to Paducah, Kentucky, where it joins the Ohio River.

Ortmann (1918) provides the basic reference to the mussel fauna of the upper Tennessee River prior to the major impoundment projects on the Tennessee River which began in 1936. In his account, he provides baseline for all of the upper Tennessee River drainage, including the Clinch, Powell, Holston, and French Broad rivers. In reports his collections along with the records of Lewis (1872), Pilsbry and Rhoads (1896), the Bryant Walker collection (Adams, 1901), the Carnegie Museum (Hartman collection (H.), Smith collection (S.), and Juny collection, Ortmann lists 66 species (57 in synonymy from the Tennessee River between Chattanooga and Knoxville, Tennessee (Table I).

Cahn (1936) collected mussels from the Clinch River downstream from Norris Dam upon the closure of that structure. His collections (34 species in synonomy) are one of the last records of the mussel fauna prior to the major impoundment projects on the Tennessee River. Three species, *Quadrula metanevra, Alasmidonta holstonia (Lea)* and *Dysnomia florentina* (Lea, 1857) were not reported by Ortmann (1918).

Scruggs (1960) provides post impoundment data on the fauna of Tennessee River. He collected in Chickamauga Reservoir between Tennessee River Mile (TRM) 498.0-519.0 and recorded 17 species (Table 1). In evaluating the status of the mussel stocks, Scruggs suggested that overharvesting (by commercial fishermen), rapid deterioration of suitable habitat, and water quality were responsible for the declining mussel fauna. Isom (1969) concurred with Scruggs' assessment regarding overharvesting and reduction in suitable habitat; however, water quality was considered generally good, with prospects for continued improvement. In conducting post impoundment mussel surveys in the upper Tennessee River, Isom (1969) recorded 15 species, five of which constituted new records for the upper Tennessee River. These species are widely distributed on overbanks throughout the mainstream reservoir.

Bates (1975) conducted tailwater and overbank mussel surveys in the Tennessee River. He collected a total of eight species. Three of these, *Anodonta grandis, A. corpulenta,* and *Proptera laevissima* are definitely post impoundment species.

Methods and Materials

Sampling was conducted during 1978. Eighty-six stations were sampled, 21 downstream from Fort Loudon Dam (Watts Bar Reservoir), 55 downstream from Watts Bar Dam

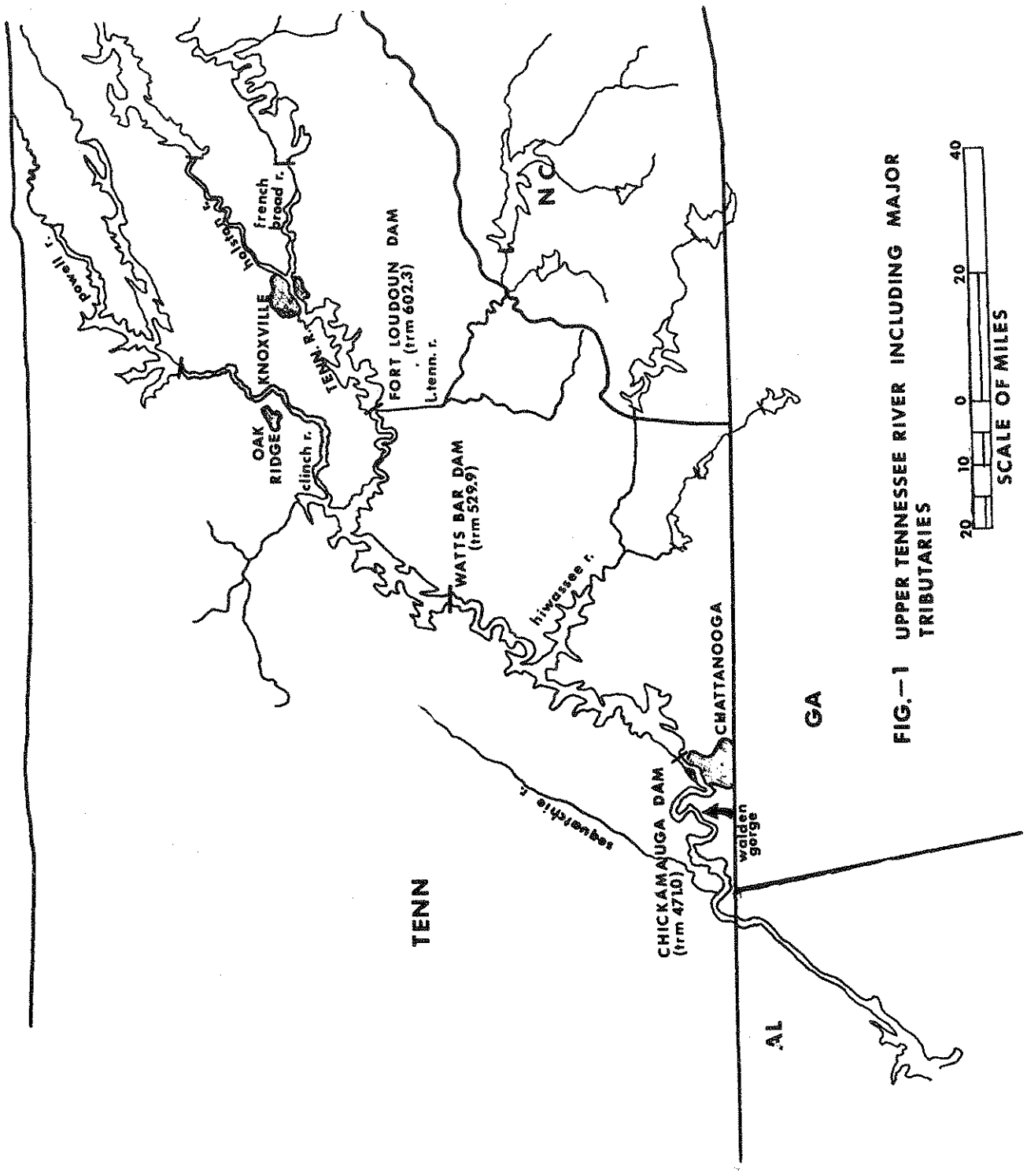

FIG.—1 UPPER TENNESSEE RIVER INCLUDING MAJOR TRIBUTARIES

(Chickamauga Reservoir), and 10 downstream from Chickamauga Dam (Nickajack Reservoir).

All samples were collected by biologists who are also certified scuba divers. At each station visited, divers collected every mussel encountered during timed random searches. Mussels were placed in nylon mesh bags and brought to the surface for identification and enumeration. Each specimen was identified, using voucher specimens as necessary, and returned to the river. Only the number of each species was recorded, i.e., no determinations of age, class, or size were made. Type of substrate, water depth, and any unusual conditions were recorded at each station.

Results

Overall Chickamauga Reservoir provides the most productive mussel habitat. Species composition estimates (Table 2) indicate that *Elliptio crassidens* and *Pleurobema cordatum* are the most common species collected.

Watts Bar Reservoir

The range of sampling stations covered 24.4 river miles from TRM 576.4-600.8. The most upstream stations (TRM 597.4-600.8) were relatively unproductive in terms of the mussel fauna. Only two species, *Proptera alata* and *Elliptio crassidens*, are represented in this reach. The substrate is characterized by large rocks with scattered pockets of cobble and sand, thus suitable habitat is minimal.

From TRM 597.3 downstream to TRM 588.4, two areas were located which supported 11 species. Mussels were found primarily in areas characterized by a cobble, gravel, sand mixture with only moderate siltation. Downstream from TRM 588.0 the substrate becomes decreasingly suitable for most riverine species of mussels with areas of heavy siltation evident and large areas of shifting sand. The distribution of mussel species found in upper Watts Bar Reservoir is provided in Table 3.

Chickamauga Reservoir

Sampling stations were located within a 15 mile reach of river downstream from Watts Bar Dam (TRM 528.9-514.2). The most productive areas (no. species 10) were TRM 528.1-527.4, TRM 525.0, and TRM 521.3-520.3. Downstream from TRM 520.3 to TRM 514.2 the faunal assemblage is substantially reduced, and the species found are those typically (within the Tennessee River) found in area of moderate sediment deposition. General substrate characteristics are indicated in. The most productive area, as indicated by the number of species, occurs on the east side of the river between TRM 521.3 and TRM 520.3. Twenty of the twenty-one species recorded from this reservoir are reported from this area. Most notable among these species is the presence of *Dromus dromas*. This record is the first reported occurrence for this species in the mainstream upper Tennessee River since Ortmann (1918). The distribution of all species found in upper Chickamauga is provided in Table 4.

Nickajack Reservoir

The reach of the river between Chickamauga Dam and Walden Gorge is influenced considerably by urban runoff and industrial discharges from the Chattanooga, Tennessee, area. Ten sampling stations from TRM 468.3-454.0 were surveyed. The mussel fauna is generally depauperate with the exception of one station (TRM 468.0) where 11 species were found. Substrate does not seem to be an obvious limiting factor since extensive areas of silt free cobble and gavel were observed. The distribution of all species found in this reach is provided in Table 5.

FAMILY UNIONIDAE, Ortmann, 1911
SUBFAMILY UNIONINAE, Ortmann, 1919

Fusconaia (Simpson, 1900)

The *Fusconaia subrotunda* (Lea, 1831) complex presents some taxonomic difficulties in the headwater forms (see Bates and Dennis, 1978). However, the *F. subrotunda* specimens collected from the upper Tennessee River do not appear similar to headwater forms but rather to the lower Tennessee River *F. subrotunda*. Very few specimens of this taxa were collected and its continued existence in the upper Tennessee is questionable.

Megalonaias Utterback, 1915

Megalonaias gigantea (Barnes, 1823) belongs to the Ohioan faunal (Interior Basin) group. *Megalonaias gigantea* was not reported from the upper Tennessee by Ortmann (1918) nor by more recent workers. It has now been collected from one station in Nickajack Reservoir (at Chattanooga, Tennessee) and from three stations in chickamauga Reservoir. Impoundment has apparently facilitated the expansion of the range of *M. gigantea*. If it has not already done so, it will certainly expand its range into Watts Bar Reservoir and Fort Loudoun Reservoir.

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Amblema Raf., 1819

Amblema costata Raf., 1820, belongs to the Ohioan faunal group. It has been reported from the upper Tennessee River by Ortmann (1918) and by Scruggs (1960). Presently, it is a relatively common species in each of the reservoirs surveyed.

Quadrula Raf., 1820

Of the four species of this genus reported by Ortmann (1918), only two species were found, *Q. pustulosa* (Lea, 1831) and *Q. metanevra* (Raf., 1820). *Quadrula cylindrica* (Say, 1817) and *Q. intermedia* (Conrad, 1836) still occur in the Powell and Duck Rivers but have apparently been extirpated from the upper Tennessee. *Quadrula cylindrica* has been recently collected (Neill and Pardue, 1978, unpublished) from the tailwater area of the Tennessee River downstream from Kentucky Dam and from the Clinch River (Bates and Dennis, 1978).

Quadrula pustulosa is one of the frequently collected species in the upper Tennessee River with estimates of abundance ranging from 4.0 to 11.1 percent of the fauna. It occurs in each of the three reservoirs surveyed. *Quadrula metanevra* is somewhat less common than *Q. pustulosa* but is not considered rare in the upper Tennessee River.

Tritogonia **Agassiz, 1852**

This monotypic genus of uncertain faunal origin was reported by Scruggs (1960). It has been collected from the same general area as that visited by Scruggs and within 2-4 miles downstream from Watts Bar Dam. It is frequently collected from the lower Tennessee River but is presently know only from Chickamauga Reservoir in the upper Tennessee River.

Cyclonaias **Pilsbry, 1922**

Cyclonaias tuberculata has been reported from the upper Tennessee by Ortmann (1918), Scruggs (1960), and Isom (1969). It remains a very common component of the upper Tennessee River fauna and is reported from each of the three reservoirs surveyed.

Plethobasus **Simpson, 1900**

Plethobasus cooperianus (Lea, 1934) has been reported from the upper Tennessee River by Ortmann (1918) and Scruggs (1960). Ortmann, reporting the work of Pilsbry and Rhoads, records *P. cooperianus* from the Tennessee River at and below Knoxville, Tennessee, to Chattanooga, Tennessee. Scruggs records it from the Washington Ferry area of the Tennessee River (Chickamauga Reservoir). The author failed to collect any specimens of *P. cooperianus* from either Chickamauga or Nickajack Reservoirs; however, a single specimen was collected from Watts Bar Reservoir (TRM 595.0). Recent studies (Bates and Dennis, 1978, Tennessee Valley Authority, 1979, unpublished) have failed to document this species from either the Clinch or Powell Rivers. This member of the Ohioan faunal group is certainly very rare in the upper Tennessee River.

Pleurobema **Raf., 1818**

Pleurobema cordatum, which was collected from each of the reservoirs surveyed, was the only species of this genus represented in the upper Tennessee River fauna. However, it was the second most abundant species present in the collections. Once very abundant in Chickamauga Reservoir, this species has declined progressively since Scruggs' (1960) survey. Improving water quality and the establishment of a mussel sanctuary in upper Chickamauga Reservoir should aid in the recovery of this species to near its former abundance.

Elliptio **Raf., 1820**

Elliptio crassidens (Lamarck, 1819) is by far the most abundant species in the upper Tennessee River. Estimates of abundance indicate that it comprises from 53 to 85 percent of the fauna. Ortmann (1918) reported it extremely abundant in the Tennessee River between Knoxville and Chattanooga, Tennessee.

Elliptio dilatatus (Raf. 1820) is considerably less abundant than *E. crassidens* and was collected only from Chickamauga and Watts Bar Reservoirs. No specimens were collected from Nickajack Reservoir. Similarly, Isom (1969) did not report *E. dilatatus* from Nickajack Reservoir. Based on Ortmann's (1918) discussion, *E. dilatatus* is apparently less abundant than it was prior to impoundment. Isom (1969) reported a density of 0.011 per square yard which is probably not substantially different than that today.

SUBFAMILY ANODONTINAE

Anodonta **Lamarck, 1799**

Three species of this genus were collected from the upper **Tennessee River.** *Anodonta imbecillis* Say, 1829; *A. corpulenta* Cooper, 1834; and *A. grandis* Say, 1829. Members of this genus were first reported from the upper Tennessee River by Isom (1969). These typical impoundment species occur throughout the mainstream of the Tennessee River, being most abundant on the overbank areas.

SUBFAMILY LAMPSILINAE

Obliquaria **Raf., 1820**

Obliquaria reflexa Raf., 1820, has been reported from the upper Tennessee River since Ortmann (1918). It occurs in each of the three reservoirs surveyed, and has adapted reasonably well to impoundment since it is frequently collected from overbank areas. It also occurs throughout the mainstream of the lower Tennessee River.

Cyprogenia **Agassiz, 1852**

Cyprogenia irrorata (Lea, 1828) was collected from four stations in upper Chickamauga Reservoir. These collections are the first reported from the upper Tennessee since Ortmann (1918) recorded *C. stegaria* (Raf., 1820). Ortmann indicated that it was quite abundant in the lower Clinch. Recently the author has collected *C. irrorata* also from Guntersville Dam tailwater and Kentucky Dam tailwater while Gooch and Wade (1978, unpublished) record it from Kentucky Reservoir. In each of these localities it must be considered among the rare shells collected.

Dromus **(Simpson, 1900)**

Dromus dromas (Lea, 1834) was collected from three stations in Chickamauga Reservoir, all within one mile of each other. This Cumberlandian species has not been reported from the Tennessee River since Ortmann (1918) reported it, three miles below Knoxville, Tennessee. Based on the number of shells in the Indian middens, this species was once very common in the upper Tennessee River. However, despite extensive surveys throughout the mainstream Tennessee River, these most recent collections are the only known localities for this species in the Tennessee River proper. It has been collected from the Cumberland River (TVA, unpublished, 1976) and the Clinch River (Bates and Dennis, 1978). Bates and Dennis (1978) also report it from the Powell River; however, recent surveys (TVA, unpublished, 1979) recorded only the headwater subspecies *Dromus dromas caperatus* (Lea, 1845). In any instance it must be considered very rare.

Plagiola **Lea., 1829**

This monotypic genus is represented by *P. lineolata* (Lea. 1829) and occurs in each of the three reservoirs surveyed. It is a large river species historically occurring in the upper Tennessee River. It is relatively common in Nickajack and Chickamauga Reservoirs but somewhat more rare in Watts Bar Reservoir.

Leptodea **Raf., 1820**

Leptodea fragilis (Raf., 1820) was collected from only one

station in Chickamauga Reservoir. It was reported by Ortmann (1918) from a pond in the area but not from the river. Although not generally considered rare, recent surveys in the lower Tennessee River have yielded only a few specimens.

***Proptera* Raf., 1819**

Proptera alata (Say, 1817) was frequently collected from each of the reservoirs surveyed and especially abundant in Nickajack Reservoir (13.7 percent of the total collected). This species is historically a member of the upper Tennessee River fauna. *Proptera alata* seems to be well adapted to survival in the impoundments as evidenced by the number of specimens which the author and others have collected from overbanks and other areas with significant silt deposition.

***Ligumia* Swainson, 1840**

Ligumia recta latissima (Raf., 1820) was collected in each of the reservoir survyed. It has historically been recorded from the upper Tennessee by Ortmann (1918) and Scruggs (1960). *L. recta lattissima* occurs throughout the mainstream of the Tennessee River but never in large numbers.

***Lampsilis* Raf., 1820**

This genus is represented by two species in these most recent collections, *L. ovata* (Say, 1817) and *L. orbiculata* (Hildreth, 1828). Both species occur in Chickamauga and Watts Bar Reservoirs. *Lampsilis orbiculata* was collected from 13 stations in chickamauga Reservoir and 2 stations in Watts Bar Reservoir. *Lampsilis ovata* has been reported by Ortmann (1918) and Scruggs (1960) while *L. orbiculata* was reported only by Ortmann (1918). *Lampsilis orbiculata,* though generally not occurring in large numbers, is widely distributed throughout the mainstream Tennessee River.

SUMMARY AND CONCLUSIONS

The fauna of the upper Tennessee River is obviously quite reduced from Ortmann's list of 57 species (synonymized names). Chickamauga Reservoir apparently provides the best environmental conditions for the survival of the mussel fauna. Part of this area is protected from commercial musseling by the State of Tennessee. This fact in conjuntion with improving water quality should result in enhancement of the diversity and abundance of the mussel fauna in this reach of the river.

Pollution and a lack of sources for recolonization apparently continue to be a limiting factor restricting the diversity and abundance of mussels in Nickajack Reservoir. The extent and potential sources of pollution in this reach of river will probably preclude the development of increased mussel diversity for years to come.

Isolated areas exist in Watts Bar Reservoir where mussels continue to survive. Low dissolved oxygen releases from Fort Loudoun Dam may partially account for the lack of any significant fauna in the immediate tailwater area. However, even in downstream areas, assuming dissolved oxygen has been replenished, the substrate rapidly becomes comprised of increasing percentages of silt.

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Table 1

MUSSEL RECORDS: UPPER TENNESSEE RIVER; ORTMANN (1918), SCRUGGS (1960), ISOM (1969), BATES (1975), PARDUE (1980)

	Ortmann (1918)	Scruggs (1960)	Isom (1969)	Bates (1975)	Pardue (1980)
Unioninae					
Cumberlandia monodonta (Say, 1829)	x	-	-	-	-
Fusconaia subrotunda (Lea, 1831)	-	-	-	-	x
Fusconaia barnesiana (lea, 1838)	x	-	-	-	-
Fusconaia pilaris (Lea, 1840)	x	-	-	-	-
Fusconaia cuneolus (Lea, 1840)	x	-	-	-	-
Fusconaia edgariana (Lea, 1840)	x	-	-	-	-
Megalonaias gigantea (Barnes, 1823)	-	-	-	-	x
Amblema costata (Raf., 1820)	x	x	-	-	x
Quadrula pustulosa (Lea, 1831)	x	x	x	x	x
Quadrula metanevra (Raf., 1820)	x	x	x	-	x
Quadrula intermedia (Conrad, 1836)	x	-	-	-	-
Quadrula cylindrica (Say, 1817)	x	-	-	-	-
Tritigonia verrucosa (Raf., 1820)	-	x	-	-	x
Cyclonaias tuberculata (Raf., 1820)	x	x	-	-	x
Plethobasus cyphyus (Raf., 1820)	x	x	-	x	-
Plethobasus cooperianus (Lea, 1834)	x	x	-	-	x
Lexingtonia dolabelloides (Lea, 1840)	x	-	-	-	-
Pleurobema oviforme (Conrad, 1834)	x	-	-	-	-
Pleurobema cordatum (Raf., 1820)	x	x	x	x	-
Elliptio crassidens (Lamarck, 1819)	x	x	x	x	x
Elliptio dilatatus (Raf., 1820)	x	x	x	-	x
Lastena lata (Raf., 1820)	x	-	-	-	-
Anodontinae					
Lasmigona costata (Raf., 1820)	x	-	-	-	-
Lasmigona complanata (Barnes, 1823)	-	-	-	-	x
Anodonta grandis (Say, 1829)	-	-	x	-	x
Anodonta corpulenta (Cooper, 1834)	-	-	x	x	x
Anodonta imbecillis (Say, 1829)	-	-	x	-	x
Anodonta suborbiculata (Say, 1831)	-	-	x	x	-
Alasmidonta marginata (Say, 1819)	x	-	-	-	-
Strophitus rugosus (Swainson, 1822)	x	-	-	-	-
Lampsilinae					
Ptychobranchus fasciolaris (Raf., 1820)	x	-	-	-	-
Ptychobranchus subtentum (Say, 1825)	x	-	-	-	-
Obliquaria reflexa (Raf., 1820)	x	x	x	x	x
Cyprogenia irrorata (Lea, 1828)	x	-	-	-	x
Dromus dromas (Lea, 1834)	x	-	-	-	x
Dromus dromas caperatus (Lea, 1845)	x	-	-	-	-
Obovaria subrotunda (Raf., 1820)	x	-	-	-	-
Obovaria retusa (Lamarck, 1819)	x	-	-	-	-
Obovaria olivaria (Raf., 1820)	-	x	-	-	-

Table 1 (continued)

	Ortmann (1918)	Scruggs (1960)	Isom (1969)	Bates (1975)	Pardue (1980)
Actinonaias carinata (Barnes, 1823)	x	x	-	-	-
Actinonaias pectorosa (Conrad, 1834)	x	-	-	-	-
Plagiola lineolata (Raf., 1820)	x	x	x	-	x
Truncilla truncata (Raf., 1820)	x	-	x	-	-
Leptodea fragilis (Raf., 1820)	x	-	-	-	x
Leptodea leptodon (Raf., 1820)	x	-	-	-	-
Proptera alata (Say, 1817)	x	x	x	-	x
Proptera laevissima (Lea, 1829)	-	-	-	x	-
Carunculina moesta (Lea, 1841)	x	-	-	-	-
Conradilla caelata (Conrad, 1834)	x	-	-	-	-
Medionidus conradicus (Lea, 1834)	x	-	-	-	-
Ligumia recta latissima (Raf., 1820)	x	x	-	-	x
Micromya fabalis (Lea, 1831)	x	-	-	-	-
Micromya nebulosa (Conrad, 1834)	x	-	-	-	-
Micromya vanuxemensis (Say, 1838)	x	-	-	-	-
Lampsilis ovata (Say, 1817)	x	x	-	-	x
Lampsilis fasciola (Raf., 1820)	x	-	-	-	-
Lampsilis orbiculata (Hildreth, 1828)	x	-	-	-	x
Dysnomia triquetra (Raf., 1820)	x	-	-	-	-
Dysnomia arcaeformis (Lea, 1831)	x	-	-	-	-
Dysnomia lenoir (Lea, 1843)	x	-	-	-	-
Dysnomia haysiana (Lea, 1834)	x	-	-	-	-
Dysnomia brevidens (Lea, 1831)	x	-	-	-	-
Dysnomia stewardsoni (Lea, 1852)	x	-	-	-	-
Dysnomia lewisi (Walker, 1910)	x	-	-	-	-
Dysnomia capsaeformis (Lea, 1834)	x	-	-	-	-
Dysnomia torulosa gubernaculum (Reeves, 1865)	x	-	-	-	-
Dysnomia propinqua (Lea, 1857)	x	-	-	-	-

x Denotes presence of taxa
- Denotes absence of taxa

Table 2

SPECIES COMPOSITION OF SAMPLES TAKEN FROM SELECTED AREAS WITHIN EACH OF THE UPPER TENNESSEE RESERVOIRS

	WATTS BAR TRM 576.4 - 600.8 Percent of Total	CHICKAMAUGA TRM 526.4 - 528.1 Percent of Total	CHICKAMAUGA TRM 520.0 - 521.0 Percent of Total	NICKAJACK TRM 454.0 - 468.3 Percent of Total
Fusconaia subrotunda	0.1	-	0.2	-
Megalonais gigantea	-	1.3	0.1	1.0
Amblema costata	0.6	6.2	0.1	1.0
Quadrula pustulosa	4.0	11.1	6.9	4.2
Quadrula metanevra	0.7	0.3	2.6	4.2
Tritigonia verrucosa	-	0.5	0.2	-
Cyclonaias tuberculata	1.1	4.9	8.0	1.0
Plethobasus cooperianus	0.1	-	-	-
Pleurobema cordatum	3.1	21.4	10.2	12.6
Elliptio crassidens	85.2	-	66.9	52.6
Elliptio dilatatus	0.2	-	0.2	-
Anodonta grandis	-	0.5	-	-
Anodonta corpulenta	-	-	<0.01	1.0
Anodonta imbecillis	-	-	-	1.0
Obliquaria reflexa	0.5	3.4	0.2	3.1
Cyprogenia irrorata	-	-	0.1	-
Dromus dromas	-	-	0.2	-
Plagiola lineolata	0.2	2.3	2.3	1.0
Leptodea fragilis	-	0.3	-	-
Proptera alata	3.0	1.8	1.1	13.7
Ligumia recta lattisima	0.8	0.8	0.3	3.1
Lampsilis ovata	0.1	0.3	<0.1	-
Lampsilis orbiculata	0.2	1.5	0.4	-

Table 3

DISTRIBUTION OF MUSSELS IN UPPER WATTS BAR RESERVOIR
TRM 600.8-576.4

	TRM	600.8	598.8	597.4	597.3	597.3	597.2	596.2	595.1	595.0	595.0	594.3	594.1	592.2	592.3	591.5	591.0	598.7	588.4	588.0	584.4	576.4
	*	(50%)	(50%)	(50%)	(75%)	(25%)	(50%)	(25%)	(25%)	(75%)	(25%)	(75%)	(25%)	(25%)	(25%)	(75%)	(75%)	(50%)	(75%)	(75%)	(25%)	(75%)
Unioninae																						
Fusconaia subrotunda		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-
Amblema costata		-	-	-	-	-	-	-	-	-	-	x	-	x	x	-	-	-	-	-	-	-
Quadrula pustulosa		-	-	-	x	-	x	-	-	-	x	-	x	x	-	-	-	-	x	-	-	-
Quadrula metanevra		-	-	-	-	-	-	-	-	-	x	-	-	x	-	x	-	-	x	-	-	-
Cyclonaias tuberculata		-	-	-	-	-	-	-	-	-	x	-	-	x	-	-	-	-	x	-	-	-
Plethobasus cooperianus		-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-
Pleurobema cordatum		-	-	-	x	-	x	-	-	-	x	-	x	x	-	-	-	-	x	-	-	-
Elliptio crassidens		-	-	x	x	x	x	-	-	-	x	x	x	x	x	x	-	-	x	x	-	-
Elliptio dilatatus		-	-	-	-	-	-	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-
Lampsilinae																						
Obliquaria reflexa		-	-	-	-	-	-	-	-	-	-	x	-	x	-	-	-	-	x	-	-	-
Plagiola lineolata		-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-
Proptera alata		x	-	-	x	x	x	-	-	-	x	-	x	x	-	-	-	-	x	-	-	-
Ligumia recta latissima		-	-	-	-	-	x	-	-	-	x	-	x	x	-	-	-	-	x	-	-	-
Lampsilis ovata		-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lampsilis orbiculata		-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	x	-	-	-
No. Species		1	0	1	5	2	6	0	0	0	8	3	6	11	2	2	0	0	11	1	0	0
Total Collection Time (Min)		24	10	6	32	28	30	6	2	10	56	26	28	30	8	14	4	2	42	10	8	6

* Percent from left bank looking downstream
- Denotes absence of species
x Denotes presence of species

Table 4

DISTRIBUTION OF MUSSELS IN UPPER CHICKAMAUGA RESERVOIR
(TRM 528.9-514.2)

TRM	528.9	528.9	528.4	528.2	528.1	528.0	527.4	527.2	526.5	526.4	526.1	526.0	525.8	525.0	524.9	524.0	552.8	522.1
% *	(25%)	(75%)	(75%)	(25%)	(25%)	(25%)	(25%)	(75%)	(75%)	(75%)	(75%)	(75%)	(75%)	(75%)	(75%)	(25%)	(75%)	(25%)
Unioninae																		
Fusconaia subrotunda	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-
Megalonaias gigantea	-	-	-	-	-	x	x	-	-	-	-	-	-	-	-	-	-	-
Amblema costata	-	x	-	x	x	-	x	x	x	x	-	-	-	x	x	-	-	-
Quadrula pustulosa	-	x	-	x	x	x	x	-	x	x	x	-	-	x	x	x	-	-
Quadrula metanevra	-	x	-	-	-	-	x	-	-	-	-	-	-	x	-	x	-	-
Tritigonia verrucosa	-	-	-	-	x	-	-	-	-	x	-	-	-	x	-	-	-	-
Cyclonaias tuberculata	-	x	-	-	x	x	x	-	x	x	x	-	-	x	x	-	-	-
Pleurobema cordatum	x	x	-	-	x	x	x	-	x	x	x	-	-	x	x	x	-	-
Elliptio crasidens	x	x	-	x	x	x	x	-	x	x	x	x	-	x	x	x	-	x
Elliptio dilatatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anodontinae																		
Anodonta grandis	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-
Anodonta corpulenta	-	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lampsilinae																		
Obliquaria reflexa	-	-	-	-	x	-	x	x	-	x	x	-	-	x	-	-	-	-
Cyprogenia irrorata	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-
Dromus dromas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plagiola lineolata	-	-	-	-	x	x	x	-	-	x	x	-	-	-	-	x	-	-
Leptodea fragilia	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-
Proptera alata	-	x	-	x	x	x	x	-	x	-	x	x	-	x	-	x	-	-
Ligumia recta	-	-	-	-	x	x	x	-	-	-	-	-	-	x	-	x	-	-
Lampsilis ovata	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-
Lampsilis orbiculata	-	-	-	-	x	x	x	-	-	-	-	-	-	x	-	-	-	-
No. Species	2	7	1	4	11	9	13	2	7	9	7	7	0	13	5	7	0	1
Total Collection Time (Min.)	10	36	14	18	58	42	42	18	24	50	30	8	3	76	24	40	10	10

TRM	521.6	521.4	521.3	521.2	521.0	521.0	521.0	520.8	520.7	520.7	520.5	520.5	520.4	520.4	520.3	520.2	520.2	520.0	519.8
% *	(25%)	(75%)	(50%)	(25%)	(75%)	(50%)	(25%)	(25%)	(25%)	(50%)	(25%)	(50%)	(25%)	(50%)	(25%)	(25%)	(50%)	(25%)	(25%)
Unioninae																			
Fusconaia subrotunda	-	-	-	-	-	-	-	-	-	-	-	-	x	-	x	-	-	-	-
Megalonaias gigantea	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-
Amblema costata	-	-	-	-	-	-	x	-	-	-	-	-	x	-	x	-	-	-	-
Quadrula pustulosa	-	-	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	-	x
Quadrula metanevra	-	-	x	x	-	x	-	x	-	x	x	x	x	x	x	-	-	x	-
Tritigonia verrucosa	-	-	x	-	-	-	-	-	-	x	-	-	x	x	-	x	x	-	-
Cyclonaias tuberculata	-	-	x	x	-	x	x	x	x	x	-	x	x	x	x	x	x	-	x
Pleurobema cordatum	-	-	x	x	-	x	x	x	x	x	x	x	x	x	x	x	-	-	x
Elliptio crasidens	-	-	x	x	-	x	x	x	x	x	x	x	x	x	x	x	x	x	-
Elliptio dilatatus	-	-	-	-	-	-	-	-	-	-	-	x	x	-	x	-	-	-	-
Anodontinae																			
Anodonta grandis	-	-	-	-	-	-	-	x	-	-	-	-	-	-	-	-	-	-	-
Anodonta corpulenta	-	-	-	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-
Lampsilinae																			
Obliquaria reflexa	-	-	-	-	-	-	-	-	-	-	x	-	-	-	x	-	-	-	-
Cyprogenia irrorata	-	-	x	-	-	-	x	-	-	-	-	-	-	-	-	x	-	-	-
Dromus dromas	-	-	-	-	-	-	-	x	-	-	-	x	-	-	-	x	-	-	-
Plagiola lineolata	-	-	x	x	-	x	x	x	x	x	x	x	-	x	x	-	-	-	x
Leptodea fragilia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proptera alata	-	-	-	x	-	-	-	x	x	-	x	x	x	x	x	-	-	-	-
Ligumia recta	-	-	-	x	-	x	x	-	-	-	x	-	-	-	x	x	-	-	-
Lampsilis ovata	-	-	x	-	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-
Lampsilis orbiculata	-	-	x	-	-	x	x	-	-	x	-	-	x	-	x	x	-	-	-
No. Species	0	0	10	8	0	8	9	9	7	8	8	9	13	8	13	9	3	7	4
Total Collection Time (Min.)	4	8	40	36	5	52	30	40	46	32	58	76	40	94	114	60	10	30	9

TRM	519.5	519.5	519.2	519.2	518.5	518.4	518.2	518.2	518.0	518.0	517.6	517.2	517.0	516.4	516.4	516.0	514.4	514.2
% *	(50%)	(75%)	(25%)	(75%)	(25%)	(75%)	(50%)	(75%)	(50%)	(75%)	(25%)	(75%)	(75%)	(25%)	(50%)	(75%)	(25%)	(50%)
Unioninae																		
Fusconaia subrotunda	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Megalonaias gigantea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Amblema costata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Quadrula pustulosa	x	-	-	-	x	x	x	-	x	x	-	-	x	-	-	x	x	x
Quadrula metanevra	-	-	-	-	x	-	-	-	-	x	-	-	-	-	-	-	-	-
Tritigonia verrucosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	x	-
Cyclonaias tuberculata	-	-	x	-	-	x	x	-	x	x	-	x	x	-	-	x	x	x
Pleurobema cordatum	x	-	x	-	x	x	x	-	x	x	-	-	x	-	x	x	x	x
Elliptio crasidens	x	-	x	-	x	x	x	-	x	x	-	x	x	-	x	x	x	x
Elliptio dilatatus	-	-	x	-	-	-	-	-	x	-	-	-	-	-	x	-	-	-
Anodontinae																		
Anodonta grandis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anodonta corpulenta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lampsilinae																		
Obliquaria reflexa	-	-	-	-	-	-	-	-	x	-	-	-	-	-	-	x	-	x
Cyprogenia irrorata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dromus dromas	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plagiola lineolata	-	-	-	-	x	x	-	-	-	x	-	x	-	-	-	x	x	-
Leptodea fragilia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Proptera alata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ligumia recta	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lampsilis ovata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lampsilis orbiculata	-	-	-	-	x	-	-	-	x	-	-	-	-	-	-	-	-	-
No. Species	3	0	3	0	6	5	4	0	7	6	0	3	4	0	2	8	6	5
Total Collection Time (Min.)	6	2	24	2	48	34	30	3	18	51	10	13	14	5	4	45	19	17

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* Percent from left bank looking downstream
\- Denotes absence of species
x Denotes presence of species

Table 5

DISTRIBUTION OF MUSSELS IN UPPER NICKAJACK RESERVOIR
TRM 468.3-454.0

	*	(25%)	(75%)	(50%)	(50%)	(50%)	(25%)	(25%)	(25%)	(75%)	(25%)
	TRM	468.3	468.0	465.5	465.2	465.0	461.3	459.5	455.4	455.2	454.0
Unioninae											
Megalonaias gigantea		-	x	-	-	-	-	-	-	-	-
Amblema costata		x	-	-	-	-	-	-	-	-	-
Quadrula pustulosa		-	x	-	x	-	-	-	-	-	-
Quadrula metanevra		-	x	-	x	x	-	-	-	-	-
Cyclonaias tuberculata		-	x	-	-	-	-	-	-	-	-
Pleurobema cordatum		-	x	x	x	x	-	-	-	-	-
Elliptio crassidens		x	x	-	x	-	-	-	-	-	-
Anodontinae											
Anodonta imbecillis		-	-	x	-	-	-	-	-	-	-
Anodonta corpulenta		-	x	-	-	-	-	-	-	-	-
Lampsilinae											
Obliquaria reflexa		-	x	-	-	-	-	-	-	-	-
Plagiola lineolata		-	x	-	-	-	-	-	-	-	-
Proptera alata		-	x	x	x	x	x	-	-	x	x
Ligumia recta latissima		-	x	-	-	-	-	-	-	-	-
No. Species		2	11	3	5	4	1	0	0	1	1
Time of Search (Min.)		10	30	22	20	18	10	12	6	12	10

* Percent from left bank looking downstream
- Denotes absence of species
x Denotes presence of species