

Neves

RICHARD J. NEVES

TVA
1979

AN EVALUATION OF MUSSEL POPULATIONS IN
THE CLINCH RIVER, TENNESSEE AND VIRGINIA

August 1979

Pseudis IS RM 226.3
OR SPA *subvarium*
umbos
edgaria

Lower Clinch
Survey

P. pleurum
L. subulatus
C. caudata
B. depressa
P. umbos
P. edgaria

Division of Water Resources
Fisheries and Aquatic Ecology Branch
Tennessee Valley Authority

This report summarizes the results of TVA's recent evaluation of mussels in the Clinch River. The investigation was conducted to provide comprehensive, up-to-date information on the distribution and density of endangered species in the reach of the river from downstream from the U.S. Route 25E bridge (CRM 151.0) to Craft Mill (CRM 219.4). In addition, the results establish, in part, baseline information from which the direction and effectiveness of a TVA program to conserve and enhance Cumberlandian mussels in the Tennessee Valley will be determined.

Methods

Three field crews, each led by a biologist competent in malacology, were assigned approximately 23-mile reaches of river to investigate. Each crew, including two certified scuba divers, floated the entire length of their reach in a small boat. As a crew encountered habitat which, in the opinion of the biologist, had the potential to contain mussel populations, the area was searched by diving, snorkeling, and wading. When mussels were observed, a thorough qualitative evaluation was conducted noting each species present. Sites which proved to have a dense, diverse mussel population were surveyed quantitatively. Presence of endangered species in unusual numbers also led to quantitative evaluation. In both cases, the decision was based on the judgment of the biologist.

Quantitative estimates of abundance were made by randomly sampling each site using a square metal frame, which when placed in the substrate, enclosed an area of 0.25 square meter. All mussels

within the quadrat were counted by species and returned to the river in approximately the same place from which they were removed. The number of quadrat samples to be taken at each site varied from 12 to 40 depending on the area covered by the mussel bed.

Results

A total of 47 sites were investigated over the 68-mile reach of the Clinch River (Table 1). Of these, 8 were evaluated quantitatively with a total of 248 quadrat samples taken. Every site yielded two or more species and a maximum of 32 species were found at CRM 184.7. In all, 40 species were collected of which 14 were Cumberlandian forms (Table 2). Six of the species encountered (Conradilla caelata, Dromus dromas, Fusconaia cuneolus, Fusconania edgariana, Lampsilis orbiculata, and Pleurobema plenum) are listed as endangered by the U.S. Fish and Wildlife Service.

Mussels were both diverse and abundant throughout this 68-mile reach of the river. Every site visited was found to contain live mussels and eight sites (between CRM 184.7 and CRM 219.2) yielded more than 20 species each. Twelve or fewer species were found at each site between CRM 151.0 and 172.2, however, the total from these sites was 24 species. Abundance estimates, based on the eight quantified sites (Table 3), indicated a range of 3.7 to 31.5 specimens per square meter of mussel habitat. The three sites sampled quantitatively between CRM 184.7 and CRM 206.9 each were found to have over 10 animals per square meter and the overall average at all quantitative sites was 12.22 specimens per square meter. The highest average abundance (31.51 animals per square meter) was based on a relatively large sample (41 quadrats) taken in the Kyles Ford area (CRM 189.6).

Specimens of Conradilla caelata were found at five sites between CRM 184.7 and CRM 219.1 (Table 4). At one of these sites (CRM 189.6), an estimate of 0.10 specimens per square meter of mussel habitat was derived from one specimen taken in a quantitative sample. The ages of some specimens (Table 5) indicated that age variation is present in the river.

Dromus dromas specimens were collected at seven sites between CRM 169.8 and CRM 189.3. At CRM 172.2 an abundance estimate of 0.10 specimens per square meter was derived from one individual taken in a quantitative sample. Eight animals that were aged indicated a relatively broad range but do not form any apparent pattern as to the age structure of the population.

Fusconaia cuneolus was reported from sixteen sites throughout this river reach (CRM 155.7 to CRM 219.2).^{*} Three specimens of this species found in quadrat samples at CRM 189.6 resulted in an estimate of 0.29 animals per square meter of mussel habitat at that site while single specimens in quadrat samples at CRM 219.1 and CRM 219.2 led to estimates of 0.10 and 0.16 animals per square meter for those sites, respectively.

Fusconaia edgariana was found to be present at thirteen sites between CRM 184.7 and CRM 219.2. This species was represented in quantitative samples only at CRM 189.6 where two animals resulted in an abundance estimate of 0.20 specimens per square meter.

Lampsilis orbiculata, one of two non-Cumberlandian endangered species found during this survey, was represented by a single fresh

*It may be relevant to note that Bates and Dennis (Sterkiana 69-70:3-23, 1978) have not recognized Fusconaia cuneolus from the Clinch River. We are continuing to examine the identification of this taxon.

dead specimen taken at CRM 184.7. This animal was estimated to be nine years old.

The other non-Cumberlandian endangered species, Pleurobema plenum, was represented by sixteen specimens collected at CRM 179.4 and CRM 184.7. None of these specimens were found in quantitative samples.

The proposed endangered river snail Io fluviialis (Say 1825) was found at many locations throughout this study area but was not one of its formal interests. Between CRM 152 and CRM 175, Io fluviialis was relatively uncommon and not present in any of the quadrat samples. Between CRM 175 and CRM 195, this species was found at 12 of the twenty-two sites and six specimens that occurred in quadrat samples at CRM 189.6 led to an abundance estimate of 0.58 animals per square meter. Between CRM 195 and CRM 219, Io fluviialis was considered to be abundant and was not mentioned in either the qualitative or quantitative sampling.

To summarize, mussels were found throughout the 68-mile reach of the Clinch River (CRM 151.0-CRM 219.4) surveyed in August 1979. Two or more species were found at all 47 sampling sites and 20 or more species were found at eight sites located between CRM 184.7 and CRM 219.2. Mussel abundance estimates derived from quantitative sampling at eight sites averaged 12.22 specimens per square meter of suitable mussel habitat and the Kyles Ford area (CRM 189.6) produced the highest estimate of 31.51 animals per square meter. Representatives of six endangered species (Conradilla caelata, Dromus dromas, Fusconaia cuneolus, Fusconaia edgariana, Lampsilis orbiculata, and Pleurobema plenum) were found at various numbers of sites throughout this river reach. Four of these species were found in quantitative samples. Lampsilis orbiculata

and Pleurobema plenum were not present in the quantitative survey. The proposed endangered river snail Io fluvialis occurred throughout the study area with greatest abundance toward the upper end of the river reach.

A comparison of the recently surveyed reaches of the Duck, Powell, and Clinch Rivers is presented in Table 6. With regard to endangered species, only Conradilla caelata was found in all three river reaches. This species was found at 24 sites on the Duck River, 5 sites on the Powell River, and 5 sites on the Clinch River. Abundance estimates for C. caelata ranged up to 1.38 specimens per square meter on the Duck River. The only estimate on the Clinch River was 0.10 per square meter and no specimens were found in quantitative samples on the Powell River.

Table 1. Location of all Clinch River sample sites in river miles (CRM) and number of species at each site, August 1979.

Clinch River Mile	Number of Species
153.8 (above U.S. Rt. 25E bridge)	9
155.7	9
158.1	10
159.2	12
160.0	7
164.8	8
166.4	6
168.0	7
169.8	11
172.2 (just below Swan Island)	11
174.8	17
177.3 (Sneedville bridge)	7
179.4	14
179.8	10
181.2	11
181.8	14
182.2	19
182.6	15
182.9 (Brooks Island)	12
183.3	11
183.7	8
184.7	32
186.0	9
187.0	19
187.5	16
189.3 (Kyles Ford area)	28
189.6	28
192.0	13
192.4	19
192.7	11
193.0	2
193.3	14
194.0	13
198.0	21
201.2	16
202.0 (VA-TN line)	30
203.4	14
206.9	27
208.4	15
209.5	19
210.0	14
210.9	25
211.2 (Speers Ferry)	14
213.4 (Clinchport)	14
217.0	9
219.1	27
219.2 (Craft Mill)	21

Pendleton IS

Purple Pass

Table 2. Mussel species occurring in the Clinch River (CRM 151.0-CRM 219.4), August 1979.

- Actinonaias carinata (Barnes 1823)
 *Actinonaias pectorosa (Conrad 1834)
Alasmodonta marginata Say 1818
Amblema costata (Barnes 1823) = A. plicata (Say 1817)
 +*Conradilla caelata (Conrad 1834) = Lemiox rimosus (Rafinesque 1831)
Cumberlandia monodonta (Say 1829)
Cyclonaias tuberculata (Rafinesque 1820)
Cyprogenia irrorata (Lea 1830) = C. stegaria (Rafinesque 1820)
 +*Dromus dromas (Lea 1834)
 *Dysnomia brevidens (Lea 1831)
 *Dyanomia capsaeformis (Lea 1834)
Dynsomia triquetra (Rafinesque 1820)
Elliptio dilatatus (Rafinesque 1820)
 *Fusconaia barnesiana (Lea 1838)
 +*Fusconaia cuneolus (Lea 1840)
 +*Fusconaia edgariana (Lea 1840) = F. cor (Conrad 1834)
Fusconaia subrotunda (Lea 1831)
Lampsilis fasciola (Rafinesque 1820)
 +Lampsilis orbiculata (Hildreth 1828)
Lampsilis ovata (Say, 1817)
Lasmigona costata (Rafinesque 1820)
Lastena lata (Rafinesque 1820) = Hemistena lata (Rafinesque 1820)
Leptodea fragilis (Rafinesque 1820)
Ligumia recta (Lamarck 1819)
 *Medionidus conradicus (Lea 1834)
Plethobasus cyphus (Rafinesque 1820)
Pleurobema cordatum (Rafinesque 1820)
 *Pleurobema oviforme (Conrad 1834)
 +Pleurobema plenum (Lea 1840)
Pleurobema pyramidatum (Lea 1831) = P. rubrum (Rafinesque 1820)
Proptera alata (Say 1817) = Potamilus alatus (Say 1817)
Ptychobranthus fasciolaris (Rafinesque 1820)
 *Ptychobranthus subtentum (Say 1825)
Quadrula cylindrica (Say 1817)
Quadrula pustulosa (Lea 1831)
Strophitus rugosus (Swainson 1822) = S. undulatus (Say 1817)
Truncilla truncata (Rafinesque 1820)
 *Villosa nebulosa (Conrad 1834)
 *Villosa perpurpurea (Lea 1861)
 *Villosa vanuxemensis (Lea 1838)

*Cumberlandian Form (14)

+Endangered Species (6)

Table 3. Mean number of mussels per square meter in the Clinch River, August 1979.

Clinch River Mile	Number of Samples ($\frac{1}{4}$ m ²)	\bar{x}
159.2	20	8.20
172.2	40	7.00
184.7	26	11.38
189.6	41	31.51
206.9	16	18.75
211.1	40	3.70
219.1	40	8.10
219.2	25	9.12

Table 4. Locations where Cumberlandian and endangered species were collected in the Clinch River (CRM 151.0-CRM 219.4), August 1979.

<u>Actinonaias pectorosa</u>							
Occurrence Location (CRM)	158.1	159.2	172.2	174.8	177.3	181.8	182.2
Number/m ²	NE*	0.20	0.60	NE	NE	NE	NE
	182.9	183.3	184.7	187.0	187.5	189.3	189.6
	NE	NE	0.31	NE	NE	6.24	6.24
	192.0	192.4	192.7	193.3	194.0	201.2	202.0
	NE	NE	NE	NE	NE	NE	NE
	203.4	206.9	209.5	210.0	210.9	211.2	213.4
	NE	2.75	NE	NE	NE	1.10	NE
	219.1	219.2					
	0.30	0.48					
<u>Conradilla caelata</u>							
Occurrence Location (CRM)	184.7	189.3	189.6	206.9	219.1		
Number/m ²	NS**	NE	0.10	NS	NS		
<u>Dromus dromas</u>							
Occurrence Location (CRM)	169.8	172.2	174.8	179.4	181.8	187.0	189.4
Number/m ²	NE	0.10	NE	NE	NE	NE	NE
<u>Dysnomia brevidens</u>							
Occurrence Location (CRM)	174.8	182.2	184.7	187.0	189.6	192.4	198.4
Number/m ²	NE	NE	NS	NE	0.10	NE	NE
	202.0	206.9	208.4	209.5	210.0	210.9	213.4
	NE	0.25	NE	NE	NE	NE	NE
	217.0	219.1	219.2				
	NE	NS	0.16				

Va

206.9 219.1
NS NS

Table 4. (Continued)

Dysnomia capsaeformis

Occurrence Location (CRM) Number/m ²	174.8 NE	179.8 NE	181.2 NE	181.8 NE	182.6 NE	183.3 NE	184.7 NS
	187.0 NE	187.5 NE	189.3 NE	189.6 0.39	192.0 NE	192.4 NE	192.7 NE
	193.3 NE	202.0 NE	206.9 2.00	208.4 NE	209.5 NE	210.0 NE	210.9 NE
	211.2 0.20	219.1 NS	219.2 0.64				

Fusconaia barnesiana

Occurrence Location (CRM) Number/m ²	153.8 NE	155.7 NE	158.1 NE	159.2 0.20	169.8 NE	172.2 0.10	174.8 NE
	179.4 NE	182.2 NE	182.6 NE	182.9 NE	183.7 NE	184.7 NS	187.0 NE
	187.5 NE	189.3 NE	189.6 2.15	192.4 NE	192.7 NE	193.3 NE	198.0 NE
	202.2 NE	206.9 NS	209.5 NE	210.0 NE	213.4 NE	217.0 NE	219.1 0.40
	219.2 0.48						

Fusconaia cuneolus

Occurrence Location (CRM) Number/m ²	155.7 NE	159.2 NS	179.4 NE	184.7 NS	189.6 0.29	198.0 NE	201.2 NE
	VA 202.0 NE	203.4 NE	206.9 NS	209.5 NE	210.0 NE	210.9 NE	211.2 NS
	219.1 0.10	219.2 0.16					

Fusconaia edgariana

Occurrence Location (CRM) Number/m ²	184.7 NS	189.3 NE	189.6 0.20	198.0 NE	201.2 NE	VA 202.0 NE	203.4 NE
	206.9 NS	209.5 NE	210.9 NE	213.4 NE	219.1 NS	219.2 NS	

Table 4. (Continued)

+Lampsilis orbiculata

Occurrence Location 184.7
Number/m² NS

Medionidus conradicus

Occurrence Location (CRM)	158.1	160.0	172.2	177.3	181.8	183.3	187.5
Number/m ²	NE	NE	0.10	NE	NE	NE	NE
	189.3	189.6	192.4	192.7	193.3	194.0	198.0
	NE	2.44	NE	NE	NE	NE	NE
	202.0	203.4	206.9	209.5	210.0	210.9	217.0
	NE	NE	2.50	NE	NE	NE	NE
	219.2						
	0.16						

Pleurobema oviforme

Occurrence Location (CRM)	181.8	184.7	187.0	189.3	189.6	219.1
Number/m ²	NE	NS	NE	NE	0.29	NS

+Pleurobema plenum

Occurrence Location (CRM)	179.4	184.7
Number/m ²	NE	NS

Ptychobranthus subtentum

Occurrence Location (CRM)	153.8	158.1	159.2	172.2	174.8	177.3	181.2
Number/m ²	NE	NE	0.80	0.10	NE	NE	NE
	182.2	182.6	182.9	183.3	183.7	184.7	187.0
	NE	NE	NE	NE	NE	0.15	NE
	189.3	189.6	192.0	192.4	192.7	193.3	194.0
	NE	4.20	NE	NE	NE	NE	NE
	198.0	201.2	202.0	203.4	206.9	208.4	209.5
	NE	NE	NE	NE	2.00	NE	NE
	210.0	210.9	211.2	213.4	217.0	219.1	219.2
	NE	NE	0.50	NE	NE	0.10	NS

Table 4. (Continued)

Villosa nebulosa

Occurrence Location (CRM)	164.8	169.8	189.6	192.7	198.0	201.2	202.0
Number/m ²	NE	NE	0.39	NE	NE	NE	NE
	209.5	210.0	210.9	213.4	217.0	219.1	
	NE	NE	NE	NE	NE	NS	

Villosa perpurpurea



Occurrence Location (CRM)	206.9
Number/m ²	NS

Villosa vanuxemensis

Occurrence Location (CRM)	182.6	189.3	192.4	194.0	198.0	202.0	210.0
Number/m ²	NE	NE	NE	NE	NE	NE	NE
	210.9	219.1					
	NE	NS					

*No quantitative evaluation. *NE*
 **Not in quantitative sample. *NS*
 †Not a Cumberlandian species.

Table 5. Number of specimens per age class for some endangered species in the Clinch River, August 1979.

Age Class	<u>Conradilla caelata</u>	<u>Dromus dromas</u>	<u>Lampsilis orbiculata</u>
1			
2			
3			
4			
5	1		
6	1		
7	1		
8			
9	1	1	
10	1		1
11	1	4	
12			
13	1		
14		1	
15			
16			
17			
18			
19			
20			
21		1	
22		1	

Table 6. Comparison of the mussel faunas in the reaches of the Duck, Powell, and Clinch Rivers surveyed in 1979.

River, Reach and Length	Total Number of Species**	Number of Cumberlandian species**	Endangered Species and Number of Sites for each	General Area with 5 or more species	Mussel Densities (averages and extremes)
Duck River DRM 132.0- DRM 248.6 116.6 Miles	32	12	<u>Conradilla caelata</u> - 24 <u>Quadrula intermedia</u> - 3	35 Miles (30%)	2.58 0-10.50
Powell River PRM 65.1- PRM 177.2 111.1 Miles	38	16	<u>Conradilla caelata</u> - 5 <u>Dromus dromas</u> - 17 <u>Fusconaia edgariana</u> - 14 <u>Quadrula intermedia</u> - 11 <u>Quadrula sparsa</u> - 8	70 Miles (63%)	7.38 2.12-21.00
Clinch River CRM 151.0- CRM 219.4 68.4 Miles	40	14	<u>Conradilla caelata</u> - 5 <u>Dromus dromas</u> - 7 <u>Fusconaia cuneolus</u> - 16 <u>Fusconaia edgariana</u> - 13 <u>Lampsilis orbiculata</u> - 1 <u>Pleurobema plenum</u> - 2	68 Miles (100%)	12.22 3.70-31.51

*Species common to three reaches - 22

**Cumberlandian species common to all three reaches - 8