

DESCRIPTION OF THE HABITAT OF THE ENDANGERED MUSSEL  
*PLETHOBASUS COOPERIANUS*

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ABSTRACT

A total of 26 species of unionids, in addition to the Asian Clam, *Corbicula*, were collected at a mussel bed on the Ohio River near Olmsted, Illinois. The bed was dominated by *Corbicula* (1475/m<sup>2</sup>, 128.2 g/m<sup>2</sup> of Tissue Dry Mass, TDM) and *Fusconaia ebena* (66.0/m<sup>2</sup> and 39.7/m<sup>2</sup> of TDM) although eight other unionids, *Amblema plicata*, *Elliptio dilatatus*, *Leptodea fragilis*, *Ligumia recta*, *Megaloniaias gigantea*, *Pleurobema cordatum*, *Potamilus alatus*, and *Truncilla donaciformis* were also judged common. In addition, three live specimens of the Federally endangered Orange-footed Pimpleback Mussel, *Plethobasus cooperianus*, were identified. All appeared healthy and were adult-sized, ranging in total shell length from 68 to 74 mm. While there are no records of recent recruitment for *P. cooperianus*, it appears that this mussel bed, which contains a diverse community of bivalves in addition to a dense population of *Corbicula*, provides good habitat for this particular species.

Three live specimens of the Endangered *Plethobasus cooperianus* (Lea 1834), the Orange-footed Pimpleback Mussel, were found in September 1983 during a survey of a gravel bar in the Ohio River near Olmsted, Illinois. In the summer of 1982, Williams and Schuster (1982) collected mussels at this site and found a single live *P. cooperianus*. However, other workers brailed this gravel bar and found no live endangered species (Neff & Pearson 1980, Williams 1969). The purpose of this paper is to document the existence of this species, and to provide information on habitat characteristics and community structure where it was collected.

The historical range of *P. cooperianus* included the Ohio River from western Pennsylvania to southern Indiana; the Wabash River below Mt. Carmel, Illinois; the Cumberland River from Cumberland County, Kentucky, to the vicinity of Nashville, Tennessee; the lower Clinch River in Anderson County, Tennessee; and the Tennessee River from near Knoxville, Tennessee, to Kentucky Lake, Benton County, Tennessee. It has also been recorded from the Caney Fork, Holston, and French Rivers in

Tennessee and from the Green and Rough Rivers in Kentucky. At present, *P. cooperianus* is restricted to the Ohio and lower Wabash Rivers where it is uncommon and to the lower Tennessee River in Alabama and western Tennessee where it is also uncommon.

The shell of *P. cooperianus* is up to 87 mm long, 75 mm high, and 45 mm wide; it is heavy, subcircular, and tuberculate. The periostracum is chestnut colored and the nacre is either white or faintly pink and iridescent posteriorly.

Superficially this species resembles *Q. pustulosa*, but the latter species is usually smaller and has fewer and relatively larger tubercles which tend to be laterally rather than radially extended. In addition, *Q. pustulosa* exhibits white nacre and young specimens have prominent green rays, whereas in *P. cooperianus* the rays are obscure and narrow. The most definitive characteristic in *P. cooperianus* is the bright orange viscera, which can be seen in live specimens by gently prying the valves apart (Clarke and Fuller 1983).

Wilson and Clark (1914) reported collecting two gravid females in June from the Cumber-

land River; evidently it is a summer breeder although the host fish is unknown. Although ecological data are virtually non-existent, this is a large river species which has been collected from sand and gravel substrate in shoals and riffles.

### Methods and Study Area

On 26-29 September 1983 molluscs were collected from a reach of the Ohio River below Lock and Dam 53 near Olmsted, Illinois. The study area included the upper portion of a mussel bed delimited by Williams (1969) and Williams and Schuster (1982). During the four-day study bivalves were collected by hand along the shore, with the use of a 5-ft brail bar, and by an experienced shell diver using underwater breathing apparatus. As part of this work the diver completed three 30-min qualitative searches, and collected six 0.25- m<sup>2</sup> quadrat samples from each of four sites on the mussel bed. This project was undertaken for the U. S. Army Engineer District, Louisville, to provide information for a Feasibility Report and Environmental Impact Statement for the Lower Ohio River Navigation Project.

The gravel bar where mussels were collected was about 3 miles long and followed the Illinois shoreline. Substrate consisted of densely packed coarse sand and gravel. Particle sizes varied from less than 1.0 cm to more than 10.0 cm with the greatest fraction of total weight in the 1- to 3- cm range. Water depths where *P. cooperianus* were taken ranged from approximately 3 to 6 m deep. The study site was Ohio River Mile 966.6 to 967.2, approximately 4 miles downriver of Lock and Dam 53; navigation and barge fleet-ing were taking place in the immediate area. No recent evidence of sedimentation, physical abrasion, or propeller wash from navigation activities, were noted at this portion of the gravel bar.

### Results

Using qualitative and quantitative techniques, 26 species of unionids, in addition to the Asian Clam, *Corbicula*, were collected at or adjacent to the gravel bar (Table 1). Although nine species were judged common, the most abundant bivalves were *Corbicula*, *Amblema plicata*, *Fusconaia ebena*, *Lampsilis teres*, *Megaloniaias gigantea*, and *Potomilus alatus*.

TABLE 1. Bivalves collected at a gravel bar near Olmsted, Illinois, 26-29 September 1983. All taxa were collected alive.

Scientific Name	Presence*
Family Unionidae	
<i>Actinonaias carinata</i>	UC
<i>Amblema plicata</i>	C
<i>Cyclonaias tuberculata</i>	UC
<i>Ellipsaria lineolata</i>	FC
<i>Elliptio crassidens</i>	FC
<i>Elliptio dilatatus</i>	UC
<i>Fusconaia ebena</i>	C
<i>Lampsilis ovata</i>	UC
<i>Lampsilis teres</i>	C
<i>Lasmigona complanata</i>	UC
<i>Leptodea fragilis</i>	C
<i>Ligumia recta</i>	C
<i>Megaloniaias gigantea</i>	C
<i>Obliquaria reflexa</i>	FC
<i>Obovaria olivaria</i>	UC
<i>Plethobasus cooperianus</i>	UC
<i>Plethobasus cyphus</i>	UC
<i>Pleurobema cordatum</i>	C
<i>Potamilus alatus</i>	C
<i>Quadrula metanevra</i>	FC
<i>Quadrula nodulata</i>	FC
<i>Quadrula pustulosa</i>	FC
<i>Quadrula quadrula</i>	FC
<i>Tritogonia verrucosa</i>	UC
<i>Truncilla donaciformis</i>	C
<i>Truncilla truncata</i>	UC
Family Corbiculidae	
<i>Corbicula manilensis</i>	C

\* Presence, for this study:  
 UC = Uncommon, < 6 collected  
 FC = Fairly common, 6-20 collected  
 C = Common, > 20 collected

A total of 14 species of unionids were collected in 24 0.25-m<sup>2</sup> quadrat samples (Table 2). Total unionid density ranged from 28 to 124/m<sup>2</sup> ( $\bar{X}$  = 60). Numerically, *F. ebena* ( $\bar{X}$  = 46/m<sup>2</sup>) and *Truncilla donaciformis* ( $\bar{X}$  = 12/m<sup>2</sup>) dominated the unionids. Two species, *Q. metanevra* and *Q. nodulata*, judged fairly common in the study area, were found in only 1 of the 24 quantitative samples. The gravel bar was numerically dominated by *Corbicula*, with numbers ranging from 556 to 2628/m<sup>2</sup> ( $\bar{X}$  = 1475). Average tissue dry mass (TDM) for *Corbicula* (128.2 g/m<sup>2</sup>) was approximately three times that for total unionids ( $\bar{X}$  = 39.7). Because of their large size and high

TABLE 2. Bivalves collected in 24 0.25-m<sup>2</sup> quadrat samples at a gravel bar near Olmsted, Illinois, 28-29 September 1983.

Species	Occurrence*	No./m <sup>2</sup>	TDM/m <sup>2</sup>
<i>Corbicula manilensis</i>	24	1475	128.2
Total unionids	24	66.0	39.7
<i>Fusconaia ebena</i>	24	45.5	27.4
<i>Truncilla donaciformis</i>	24	11.5	0.4
<i>Leptodea fragilis</i>	11	2.5	1.3
<i>Obliquaria reflexa</i>	9	1.8	0.8
<i>Quadrula pustulosa</i>	8	1.5	1.4
<i>Amblyma plicata</i>	6	1.0	3.1
<i>Ellipsaria lineolata</i>	7	1.3	1.5
<i>Tritogonia verrucosa</i>	3	0.5	0.4
<i>Lampsilis ventricosa</i>	6	1.2	0.03
<i>Quadrula quadrula</i>	5	0.8	1.3
<i>Quadrula metanevra</i>	1	0.2	0.1
<i>Quadrula nodulata</i>	1	0.2	0.1
<i>Megalonaias gigantea</i>	2	0.3	1.3
<i>Actinonais carinata</i>	1	0.2	0.3

\* Occurrence - Number of quadrats with live organisms (total quadrats collected = 24).

numbers, *F. ebena* represented the majority, about 70% (27.4 g/m<sup>2</sup>) of the total unionid biomass. Although numerically dominant, *T. donaciformis*, because of its small size, represented only about 1% ( $\bar{X}$  = 0.4 g/m<sup>2</sup>) of the unionid biomass. Based upon these quantitative collections, evidence of recent recruitment (presence of clams less than 12 months old judging from their small size and unweathered appearance) was observed for 12 of the 14 unionids collected in the quadrats.

The three specimens of *P. cooperianus* were obtained near Ohio River Mile 967.2 by the diver during two of the three 30-min qualitative searches of the bar. The diver had been instructed to concentrate on pustulate organisms or species judged uncommon by our earlier work. On the second search, he obtained eight species, including one *P. cooperianus* and two *Q. pustulosa*. During the final search he retrieved eleven species, including two *P. cooperianus* and two *Q. pustulosa*. The Orange-footed Pimpleback was not found with the brail, on any of the

shoreline searches, or in the quadrat samples.

Conchological data on the three live *P. cooperianus* are as follows:

Length (mm)	Height (mm)	Width (mm)
74	63	37
68	60	38
71	64	42

By gently prying the valves apart, it was observed that soft tissues were healthy looking and certainly not moribund.

### Discussion

This gravel bar was dominated both in numbers and biomass by *Corbicula*; evidently this had no effect on the unionids or *P. cooperianus*. In addition, it appears that requirements for food, water quality, and substrate for adult *P. cooperianus* must differ very little from the 25 other unionids inhabiting this bed. In a study of 21 species in Michigan streams, Strayer (1983) concluded that microhabitat differences were not discernible for 21 of the unionids. In addition, two other species, the fairly uncommon

*Cumberlandia monodonta* and the endangered *Lampsilis higginsii*, have also been collected from very diverse and densely populated mussel beds in the Upper Mississippi River. *Cumberlandia monodonta* was usually taken in samples where 50% of the sites had at least 20 species of common or wide-ranging mussels. *Lampsilis higginsii* was in association with 17 or more common unionids at 50% of the reported sites in the upper Mississippi River (Nelson and Freitag 1979).

Wilson and Clark (1914) judged *P. cooperianus* to be "not rare" during their survey of the Cumberland River. However, Neel and Allen (1964) were unable to locate this species during a follow-up study on the same river. It is apparent that the historical range of *P. cooperianus* has diminished and the species is in danger of becoming extinct. Some of the reasons often cited for the loss of mussels in large rivers include: sedimentation, navigation activities, pollution, reservoir construction (many with deoxygenated, low pH, and cold water releases), and loss of fish hosts (Fuller 1974).

Conversion of large, free-flowing rivers such as the Ohio to navigable waterways altered the habitats of many benthic organisms. However, some extensive areas with suitable substrate, flow, water quality, and nutrients still exist which support recruiting unionid communities. For the endangered *P. cooperianus*, the studied gravel bar on the Ohio River appears to meet requirements necessary for maintenance of adults.

The range reduction for *P. cooperianus* is probably related to species-specific problems of reproduction or recruitment. Conversion of the Ohio River from a freely-flowing river to a controlled waterway probably modified the available habitats and could have had detrimental effects on host fish. However, it is also possible that this species is slightly more sensitive to altered habitats than the other thick-shelled unionids at the mussel bed. Perhaps conditions have degraded to a point that *P. cooperianus* can maintain itself but does not possess energy reserves necessary for production of adequate numbers of glochidia.

Similar problems may also be blamed for loss of species in the genus *Dysnomia*, which were once commonly collected in riffles or shoals in

large rivers (Stansbery 1970). Riffle and shoal habitats are now almost non-existent in large rivers in North America; their disappearance could be blamed for loss of recruiting populations of *Dysnomia* and *Plethobasus*.

A possible solution for long-term maintenance of *P. cooperianus* is artificial propagation (Isom and Hudson 1982) and translocation of immature forms to suitable habitats. Projects such as these will be important for separating direct effects of habitat alteration from indirect effects such as reduction in the availability of the host fish.

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## CHARACTERIZATION OF A BIVALVE COMMUNITY IN THE TANGIPAHOA RIVER, MISSISSIPPI

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### ABSTRACT

*On 5 July 1983 a quantitative collection of bivalves was made at the Tangipahoa River in southern Mississippi. Although the river water was extremely soft and the substrate and water quality were good, a diverse and healthy mollusk community was found. In addition to the Asian Clam, Corbicula, five species of unionids (Fusconaia flava, Quadrula pustulosa, Elliptio crassidens, Tritogonia verrucosa and Villosa sp.) were taken. Numerically, Corbicula ( $8.93/m^2$ ), outnumbered total unionids ( $1.24/m^2$ ). However the dominant feature of the benthic biomass were the unionids with a total tissue dry mass of  $1704.5 mg/m^2$  as compared with  $1015.0 mg/m^2$  for Corbicula.*

Mississippi bivalves were first investigated by Hinkley (1906), later by Grantham (1969), and then Stern (1976) who concentrated on the unionids of the Lake Maurepas-Pontchartrain-Borgene drainage system. Recent mollusk studies in Mississippi include an investigation of mussels in the Big Black River (Hartfield and Rummel 1984), distribution of *Corbicula* (Hartfield and Cooper 1983), and a discussion of diversity and abundance of mussels in the southwest portion of the state (Hartfield and Ebert 1984). The above-cited studies, while providing useful information on species composition and ecology, have been directed toward qualitative assessments of the molluscan fauna. Quantitative unionid studies, either in Mississippi or other parts of the country, are relatively uncommon. The primary reason for this is the difficulty of collecting significant numbers of live mussels from a measured area. Benthic grab samplers usually do not retrieve enough substrate to provide reliable population estimates; in addition, they do not function well in gravel

habitats. The purpose of this research was to characterize, using quantitative field and laboratory techniques, a bivalve community in the Tangipahoa River in southern Mississippi.

### Study Area

The Tangipahoa River originates in Lincoln County, flows south through Amite and Pike counties, then enters Lake Tangipahoa approximately 4 miles southeast of McComb in southern Mississippi. Below Lake Tangipahoa the river flows in an easterly direction into Louisiana and ultimately enters Lake Pontchartrain near New Orleans. The study site (latitude  $31^{\circ}07'15''N.$ , longitude  $90^{\circ}29'25''W.$ , elevation 85.3 M, McComb S, Miss., US Geological Survey Quadrangle) was located south of Lake Tangipahoa and 2 miles south of the town of Magnolia. In this area the river consisted of pools, riffles, and runs with steep, partially eroding banks. Canopy cover was usually complete and surrounding land was either undeveloped riparian forest or pasture. At the time of collection the

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