

Extended Monitoring of Mussels (*Bivalvia: Unionidae*) in the Rockcastle River at Billows, Kentucky, an Historical Site

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ABSTRACT

Surveys of unionid mussels in 1985, 1991, 1993, and 1994 in the Rockcastle River at Billows, Kentucky, yielded 18 live species. *Elliptio dilatata* was the most numerous, followed by *Amblema plicata* and *Actinonaias ligamentina*. Combined, those species represented 62% of the individuals collected in all surveys. The 1991 survey showed declines (25% to 40%) in 12 of 16 species observed when compared to the 1985 survey. Those declines were sequential to increased mining activities in the Billows quadrant. During that time, *Actinonaias ligamentina*, *Quadrula pustulosa*, and *Villosa taeniata* remained stable with slight increases above 1985 numbers and appear to be more tolerant of intermittent sedimentation. *Villosa trabalis* was not collected live at this location. Compared with historical data, these surveys indicate that changes in species composition and shifts in abundances will continue in response to changes in habitat conditions at the Billows site.

INTRODUCTION

One of the objectives of the Biological Monitoring Program for the Division of Water (DOW) is to gather biological information through time. This resulted in a database that began in 1976 and continues presently, for selected stream sites across the state. In 1982, the Rockcastle River at Billows, Kentucky, was added to the program. This particular site had prior historical mussel data that began with the Neel and Allen survey of 1947-1949 (1). Most of the mussel collections in the drainage afterwards excluded the Billows site until the Thompson study in 1985 (2). Her study was the most thorough assessment of the Rockcastle River mussels; however, her collections were above and below the DOW site. More recently, collections from this site by Layzer and Anderson (3), yielded 8 live species. Also, Cicerello (4), observed 10 live species at Billows, as part of an effort to document rare and threatened species for the United States Forest Service (USFS) in the Daniel Boone National Forest (DBNF), and for the Kentucky State Nature Preserves Commission (KSNPC) state inventory.

The objective of the DOW surveys at Billows was to document the resident mussel community on a continuing basis, so that changes in the community can be used (along with other components) in the evaluation of present water-quality conditions and to help

characterize future trends in water quality of the Rockcastle River.

STUDY SITE

The DOW study site at Billows is located downstream of the SR 1956 bridge. The study site extends from the bridge to a few meters downstream of the canoe launch. This area is the upper boundary of the Rockcastle Wild River segment. A long straight reach allowed bed load materials to be deposited across the width of the river, which created a long shallow run and a partially exposed shingle bar that extends the length of the study site (approximately 75 m). The substrate is dominated by rubble and cobble-sized flat rocks mixed with larger boulders, gravels, pebbles and sands that create ample mussel habitats.

METHODS

All surveys were conducted between mid-June and mid-July. Instream observations and identifications were made by both authors, while one person served as the data recorder for both observers. Mussel searches were made easier by visually striking transects from bank to opposite bank across the stream. Starting from opposite banks, each observer waded toward the other on the same transect. At a meeting point about mid-stream, one observer stepped around the other on the downstream side, allowing each to continue along the transect. In effect, each transect was vi-

TABLE 1. Species abundances and survey years for Rockcastle River at Billows.

	DOW				*L&A	RRC	N&A
	1985	1991	1993	1994	1992	1993	1964
<i>Actinonaias ligamentina</i>	61	66	46	72	—	2	—
<i>Actinonaias pectorosa</i>	2	5	—	5	—	6	C
<i>Amblema plicata</i>	104	66	47	53	L	8	A
<i>Cyclonaias tuberculata</i>	27	17	21	24	L	—	A
<i>Elliptio dilatata</i>	150	102	139	142	L	30	C
<i>Lampsilis cardium</i>	12	20	26	5	L	10	C
<i>Lampsilis fasciola</i>	9	17	7	6	—	5	C
<i>Lampsilis ovata</i>	5	2	—	—	L	—	—
<i>Lasmigona costata</i>	1	2	4	—	—	—	C
<i>Ligumia recta</i>	23	14	16	12	L	—	C
<i>Obovaria subrotunda</i>	—	1	—	—	—	—	—
<i>Pleurobema coccineum</i>	7	4	5	8	—	—	C
<i>Potamilus alatus</i>	1	1	—	1	—	3	C
<i>Ptychobranhus fasciolaris</i>	74	44	39	32	—	6	C
<i>Quadrula pustulosa</i>	12	9	11	19	—	3	—
<i>Strophitus undulatus</i>	1	—	—	2	—	—	—
<i>Tritigonia verrucosa</i>	—	—	—	1	L	—	—
<i>Villosa taeniata</i>	19	15	31	31	L	5	C
<i>Villosa trabalis</i>	—	—	—	—	—	—	C
Totals	507	371	393	412			

* Layzer & Anderson (L&A), R.R. Cicerello (RRC), Neel & Allen (N&A). Abundant (A), Common (C), Live (L), Absent (—).

sually searched for mussels twice, once by each observer moving from opposite directions. That particular feature was useful because it helped discover mussels that were missed in one direction by the other observer, either by being overlooked or because of sun glare and/or wind action on the water surface. When undisturbed mussels were located, the mussels were removed from the substrate, identified, and cleaned before replacement, so as to prevent recounting by the observer searching from the opposite direction. Starting at the downstream edge of the study site, a total of 75 transects were visually searched in an upstream direction. The transects were approximately one meter wide and varied from 34 to 12 meters in width across the stream. A few mussel shells were retained in the DOW Mollusc Collection.

RESULTS AND DISCUSSION

Eighteen species have been collected alive at this site since 1985 (Table 1). In the 1991 survey, 12 of 16 species reflected 25–40% declines in numbers observed (see Table 1), which correlated with the bulk (24 of 30) of permitted mining sites that began operations between 1985–1991 (5). *Elliptio dilatata*, the most abundant species at the site, showed a decline in 1991. *Actinonaias ligamentina* has

steadily increased, replacing *Amblema plicata* as the next most numerous species. Combined, those species represented 62% of the total numbers of individuals collected in all surveys. *Cyclonaias tuberculata*, *Pleurobema coccineum*, *Quadrula pustulosa*, and *Villosa taeniata* populations have remained stable, with slight increases since the declines of 1991. Examples of *Lampsilis ovata* have been infrequent and were not observed in the last 2 DOW surveys; however, Layzer and Anderson (3) noted its occurrence at Billows, as well as *Tritigonia verrucosa*, which appeared only in the 1994 DOW survey. *Villosa trabalis* was not observed during the DOW surveys. *Actinonaias pectorosa*, *Quadrula pustulosa*, *Ligumia recta*, and *V. taeniata*, although low in numbers, were observed in each survey and have shown signs of recruitment in this area.

When comparing DOW data with the original Neel and Allen (1) survey, it can be concluded that changes in species composition and shifts in abundances have occurred. For instance, *Actinonaias ligamentina* and *Quadrula pustulosa* have become well established at Billows, and other species, such as *Lampsilis ovata*, *Obovaria subrotunda*, *Strophitus undulatus*, and *T. verrucosa*, have been infrequently observed. *Actinonaias pectorosa*, *P. coccineum*, *Potamilus alatus*, and *Lasmigona*

costata, originally considered common to the site, were observed in very low numbers. Explanations for those declines include natural cycles and the effects of habitat alterations from sedimentation. The most obvious effects to the mussel community at Billows are severe shell erosion (sand blasting) in some species, and alterations in substrate compositions (excessive sands). Surface mining in the headwaters (south and middle forks) were noted by Thompson (2) Layzer and Anderson (3), and Cicerello (4), but, much farther downstream and adjacent to the Billows site, (Hawk Creek drainage) there have been 30 permits issued for surface mining since 1985 (5). The permits range from 1.99 to 646 acres, totaling nearly 2,500 acres. Presently, only 5 permits are active, with disturbed lands about 1,600 acres and on the increase. If mining continues at the same rate, it could continue in the Billows quadrant (USGS) for another decade with existing permits.

Vannote and Minshall (7) reported that an influx of sediments appeared to be responsible for a shift in species dominance in the Salmon River Canyon, Idaho. Neel and Allen noted that *E. dilatata* became dominant in the Cumberland River system sometime after Wilson and Clark's survey (6) in 1911. Table 1 shows that *E. dilatata* was the most abundant species in all DOW surveys, while *Actinonaias ligamentina* made slight increases in numbers observed each survey. Houpp (8) previously documented that *E. dilatata* replaced *Alasmodonta marginata* as the most abundant mussel in the Wild River segment of the Red River, while *Actinonaias ligamentina*, and *Pleurobema coccineum* increased in abundances after the onset of coal mining in the headwaters of that eastern Kentucky stream. The above species, common to both stream systems, as well as *Quadrula pustulosa* and *Villosa taeniata*, of the Rockcastle River surveys, appear to be more tolerant to the effects of intermittent sedimentation than other mussel species in those drainages. Certainly, the timing of innate behavioral mechanisms (burrowing, and reproductive cycles) are central to individual species tolerances or intolerances of sedimentation.

Nearly all the mussel species previously recorded from this historical site are still pres-

ent. Although several species were few in number and infrequently observed, our work does validate their existence at this site and in the drainage.

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