The Unionid Mussel Fauna of Pymatuning Creek in Ashtabula County, Ohio, Including the Federally Endangered Clubshell (*Pleurobema clava*)[1]

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ABSTRACT. A survey of unionids in Pymatuning Creek in Ashtabula County, OH, was conducted to assess the species present and their relative abundances, with particular attention to the federally endangered Clubshell (*Pleurobema clava*). Sampling the stream bed by hand at 18 locations produced 3,464 living and 501 dead unionids comprising 11 different species. At each site, data were collected for substrata types, and water depth, speed, temperature, pH, and oxygen concentration were measured. The mussel fauna consisted of two dominant species (*Elliptio dilatata* and *Amblema plicata*), three subdominants (*Lasmigona complanata, Anodonta grandis grandis,* and *Lampsilis radiata luteola*), and six uncommon species (*Pleurobema clava, Lasmigona costata, Lasmigona compressa, Anodontoides ferussacianus, Anodonta imbecillis,* and *Villosa iris iris*), listed in order of abundance. Living specimens of *P. clava* were found in habitats that were characterized by shallow water, good oxygenation, little organic debris, moderate current, and substrata consisting mostly of sand with fine pebbles. The relative abundance of mussels averaged 1.783 mussels found per minute of search time and ranged from 0.225 to 4.390, while previous studies of the Cuyahoga River yielded an average relative abundance of 0.469 mussels per minute of searching. The present survey indicates that Pymatuning Creek supports a large and vigorous population of unionids, and that *P. clava* comprises a small but healthy element of that fauna and may constitute Ohio's largest population of this endangered species.

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INTRODUCTION

Pymatuning Creek is a third order stream that has a watershed area of approximately 95 km^2 in Ashtabula County, OH (Fig. 1). Its winding bed consists of a mosaic of clay, silt, sand, pebbles, and small gravel and passes through a variety of habitats including high quality fens, alder seep swamps, swamp white oak forests, and emergent marshes that contain many rare, threatened, or endangered plant species (Hudson 1993, personal communication). Additionally, a single record of two dead specimens of the Clubshell Mussel [*Pleurobema clava* (Lamarck 1819)], which is federally listed as endangered (U. S. Fish and Wildlife Service 1993), was established in 1983 from this stream (Ramey 1993, personal communication), but no living specimens have been reported. In light of a recent Federal recovery plan for the Clubshell (U. S. Fish and Wildlife Service 1993), it was particularly important that the present study determine whether an additional population of *P. clava* existed in Ohio. Recently, land in the study area owned by the Cleveland Museum of Natural History came under the custody of the Department of Natural Resources (ODNR) for the purpose of establishing a protected natural area. It was the intent of the present study to conduct an assessment of the unionid mussel species and their relative abundances in Pymatuning Creek in Ashtabula County, with specific reference to *P. clava,* and to provide the ODNR and other organizations with information to assist their management decisions about this habitat.

MATERIALS AND METHODS

Access to Pymatuning Creek was obtained at seven road crossings that occur between its source and the southern boundary of Ashtabula County (Fig. 1). A small canoe was used to reach points upstream and downstream from the road crossings. Sampling locations were selected

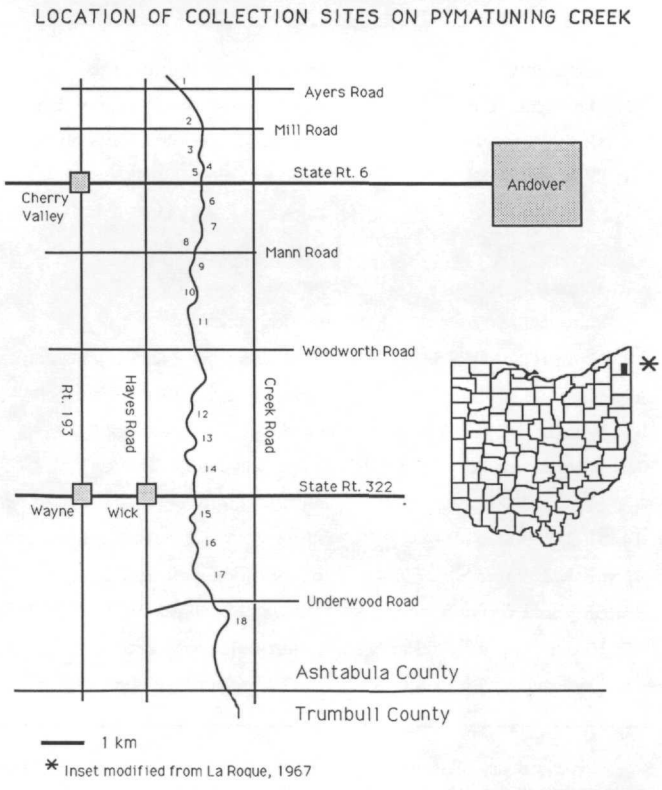

FIGURE 1. Location of collection sites on Pymatuning Creek.

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by their ability to support bivalves judging from the amount of decaying vegetation, benthic conditions, water speed and depth, and by preliminary random sampling. Although a broad range of habitats was sampled, attention was given to areas with those environmental conditions favored by *P. clava* (Parmalee 1967, LaRoche 1967), which consisted of habitats in or near riffles with sand, pebble, or gravel substrata. Once a sample site was selected, it was located and marked on a United States Geological Survey 7.5 minute topographic map. In an effort to obtain potentially important habitat information about the Clubshell, water temperature, oxygen concentration, current speed, and pH were measured with a YSI 54 Oxygen Meter, a Teledyne-Gurley Pygmy Current Meter, and a Corning 610A pH Meter, respectively. Additionally, water depth and stream width were recorded, as were general observations of aquatic and riparian vegetation and adjoining terrestrial environments. Sampling was done by searching the stream bed by hand and placing captured specimens in nylon mesh collecting bags. Length of sampling sessions varied (Table 1) from 31 min. to 100 min., with two persons collecting each time. At the conclusion of each collection period specimens were sorted by species, counted, measured, noted living or dead, and the data were recorded on a standardized waterproof form. Calculation of the relative abundance of mussels at each collection site (Table 2) was determined as a catch per unit effort value derived by dividing the number of mussels encountered by the number of minutes taken to locate them. Representative specimens (dead shells only were taken for *P. clava*) were placed in plastic specimen bags in an insulated cooler for later inspection and confirmation, and the remaining mussels were returned to the stream. Living *P. clava* found were photographed and individually returned to their discovery site. Representative mussel specimens were deposited in the Ohio State Museum of Biological Diversity. The identity of the collections was verified by Dr. David Stansbery.

RESULTS

Collection sites varied in their physical characteristics and ranged from mud bottomed pools to shallow riffles (Table 1). At most sites north of #13, loose sediments accumulated in varying thickness over a bed of frequently exposed hard clay, while sites south of #13 possessed extensive sediments with no hard clay exposure. Riffles were common downstream from site #13, and oxygen concentrations were consistently high or at times supersaturated in spite of warmer water at these sites. The 18 sites examined yielded 3,464 living and 501 dead unionids which comprised 11 different species (Table 2). Abundance and species distribution varied considerably

TABLE 1

Pymatuning Creek collection site characteristics.

Collection Site Location	Bottom Characteristics	Stream Width (m)	Stream Depth (m)	Current (MPS)	pH	O_2 (mg/l)	Temp. (° C)
1. Ayers Road	anaerobic mud, odiferous	–	–	stagnant	*	*	*
2. Mill Road, 50 m N, S	mucky, anaerobic, organic debris, SV	1.2-3.0	0.3-0.6	0.02	6.9	2.7	20
3. SR 6, 500 m N	clay, sand, pebbles, few cobbles, OD	1.3-4.8	0.1-0.6	0.35-0.4	†	6.9	24
4. SR 6, 200 m N	small cobbles, gravel, sand, silt	3.0-9.0	0.3-0.5	0.35-0.4	†	6.2	22
5. SR 6, 100 m N	thick mud, sticks, SV	7.0-12.0	0.3-1.0	0.00	†	6.3	21
6. SR 6, 500 m S	hard clay, mud, sand, pebbles, OD	1.0-3.0	0.1-0.6	0.01-0.56	7.5	6.4	27
7. Mann Rd., 500 m N	pebbles, sand, EV	8.0-9.0	0.3-0.7	0.02	7.3	5.6	26
8. Mann Rd., 50 m N	muddy sand, EV	7.0-10.0	0.3-0.8	0.00	7.2	6.7	28
9. Mann Rd., 300 m S	mud, sand, pebbles on hard clay	2.5-10.0	0.1-0.8	0.04-0.20	7.3	6.7	27
10. Mann Rd., 700 m S	mud, sand, pebbles on hard clay	2.5-9.0	0.1-0.7	0.03-0.20	7.2	6.7	27
11. Woodworth Rd., 400 m N	sand, pebbles, mud, logs, EV	3.5-6.0	0.1-0.4	0.04-0.20	7.3	6.6	25
12. Woodworth Rd., 1,000 m S	thick, soft mud; much OD	10.0	0.3-0.7	0.00-0.02	6.6	5.6	26
13. SR 322, 700 m N	muddy, sandy gravel over hard clay	10.0-15.0	0.3-0.7	0.03	7.2	6.1	25
14. SR 322, 500 m N	riffle; silt, sand, pebbles, gravel, SV	6.0-10.0	0.1-0.2	0.28-0.42	7.5	9.1§	26
15. SR 322, 300 m S	pools/riffles; pebbles, sand, silt	6.0-10.0	0.1-0.3	0.00-0.19	7.2	7.1	26
16. SR 322, 1,200 m S	sand, pebbles, gravel	10.0-12.0	0.3-0.6	0.02-0.03	7.4	6.4	26
17. Underwood Rd., 700 m N	riffle/pool; sandy gravel, silt, mud, SV	3.0	0.2-0.5	0.12-0.24	7.2	7.9	25
18. Underwood Rd., 600 m S	run/riffle; sand, pebbles, SV	2.0-3.0	0.1-0.5	0.17-0.33	7.4	9.1§	26

SV = Submergent vegetation, includes *Vallisneria* sp., *Potamogeton* sp., and *Ceratophyllum* sp.
OD = Organic debris consisting of branches, bark, sticks, twigs.
EV = Emergent vegetation, includes *Nymphaea* sp., *Pontederia* sp.

*Measurement not taken.
†Meter malfunction.
§Supersaturation; readings taken below riffle.

TABLE 2

Collection sites and their mussel distributions.

Collection Site	Mussels Live	Mussels Dead	# Mussel Species*	Search Time (min)	Rel. Abund.†
1	0	0	0	0	–
2	0	0	0	62	–
3	16	5	5	120	0.133
4	27	10	5	120	0.225
5	0	0	0	100	–
6	113	33	7	180	0.628
7	176	7	6	100	1.760
8	53	4	5	100	0.530
9	140	16	6	90	1.556
10	243	12	4	100	2.430
11	215	92	8	120	1.792
12	113	10	6	80	1.413
13	144	23	6	150	0.960
14	478	120	7	140	3.414
15	667	68	7	200	3.335
16	221	19	6	80	2.763
17	419	48	6	100	4.190
18	439	34	7	100	4.390
TOTALS	3464	501	11	32:22	1.783¶

*Number of species found at each collection site; total species encountered in all sites = 11.

†A catch per unit effort value calculated as the total number of mussels found divided by total minutes required for capture.

¶Total living mussels/1,942 minutes search time.

among the collection sites (Table 3). Of the 18 sites examined along Pymatuning Creek, the first two (Ayers Rd. and Mill Rd. crossings) were devoid of unionids, nor were any encountered in the deep mud bottom in the dredged channel immediately upstream from the State Route 6 bridge. No search was attempted at the Ayers Road crossing because this environment consisted of deep, anaerobic mud in shallow, stagnant water that was covered with duckweed. The Mill Road site had running water, but a complete canopy of vegetation covered it and significant quantities of organic debris blanketed the bottom. The greatest number of live mussels (64%) was encountered in sites #14-18 (Table 2), and it was at four of these locations that 10 living *P. clava,* all in good condition and between 7.0 and 9.0 cm long, were found (Table 3).

DISCUSSION

Numerical breakdown of the mussel fauna of Pymatuning Creek shows two dominant species (*Elliptio dilatata* and *Amblema plicata*) that occurred in high (over 1,000) numbers, three subdominants (*Lasmigona complanata, Anodonta grandis grandis,* and *Lampsilis radiata luteola*) that occurred in the 100-200 range, and six uncommon species that were each represented by 10 or fewer individuals (Table 3). The dominant and subdominant species were found at nearly every site from #3 through #18 (Table 3). Since these species have broad ecological tolerances and use numerous host fishes (Baker 1928, Fuller 1974, Hoggarth 1992), their abundance in Pymatuning Creek's mosaic of sediment types is not surprising. The most frequently encountered mussel was *E. dilatata,* which reached estimated densities of 50-60 individuals per m^2 in sites #14-16.

Pleurobema clava was the most numerous of the uncommon unionid species in Pymatuning Creek. Living specimens of *P. clava* were found in habitats that were characterized by shallow water, good oxygenation, little organic debris, and substrata consisting mostly of sand with some fine pebbles. These findings concur with Watters (in U.S. Fish and Wildlife Service 1993) who reported that *P. clava* "generally is found in clean, coarse sand and gravel in runs, often just downstream of a riffle," and that it "burrows completely beneath the substrate." Distribution of *P. clava* (and that of *Lasmigona costata*) was limited to the lower area of the creek, from 500 m north of State Route 322 southward, in areas where greatest numbers and relative abundance of all mussels also occurred (Table 2).

Of the less common species, only *Lasmigona compressa* appeared in the entire length of the stream, although its distribution was sporadic. Specimens of *Anodontiodes ferussacianus* were found only in the upper part of the stream, which conforms with its noted preference for small streams (Baker 1928, Parmalee 1967). The few specimens of *Anodonta imbecillis* found were in quiet, shallow water with a bottom of thick mud, which is usual for this species (Baker 1928).

Much of Pymatuning Creek's course flows over a deposit of hard clay. In many areas this clay body lacks a covering of other sediments and affords a poor foothold for unionids, but occasional accumulations of mud, silt, sand, and coarser sediments occur. Unionids were found concentrated in such areas, which were often not extensive in size. As the creek flows through a glacial deposit of sand and gravel (presently commercially exploited) north of State Rt. 322, considerably more sediments appear in the bed. These areas showed greatest oxygenation, riffles were common, and sediments were thick and seldom interrupted by expanses of exposed hard clay. It is in these last sites (#14-18) that the highest mussel numbers were found (Table 2), and is also where all living *P. clava* occurred (Table 3). Relative abundance of mussels (Table 2) shows a similar increase, with the highest values of the survey in sites #14, 15,17, and 18. Also, all of sites #14-18 were above the survey average relative abundance value of 1.783 mussels found per minute of search time. For comparison, an average relative abundance value of 0.469 mussels per minute of search time for the Cuyahoga River was calculated using data from Huehner (1985). This is significantly lower than the Pymatuning Creek value, especially when one considers the larger size of the Cuyahoga River, and that searches in it were done visually by snorkeling, which covered a greater area in less

TABLE 3

Unionids found at collection sites.

Unionid Species	Live/ Dead	#Found (Total)	Collection Sites and Unionid Numbers Found														
			3	4	6	7	8	9	10	11	12	13	14	15	16	17	18
Elliptio dilatata	L	1,853	0	3	23	133	11	119	185	128	99	101	274	215	101	200	261
Rafinesque (1820)	D	217	0	2	1	0	0	12	6	55	7	15	50	26	6	20	17
Amblema plicata	L	1,133	2	0	2	11	34	11	47	13	7	21	179	361	101	190	154
Say (1817)	D	126	1	0	0	0	1	1	0	1	0	6	48	24	6	23	15
Lasmigona complanata	L	178	3	9	12	14	4	4	5	10	6	13	5	54	14	15	10
Barnes (1823)	D	29	1	4	0	0	0	0	1	3	0	0	2	14	2	2	0
Anodonta grandis grandis	L	164	7	4	53	0	0	3	0	61	0	6	11	11	0	8	0
Say (1829)	D	73	1	1	15	3	1	1	0	30	2	2	2	2	2	2	0
Lampsilis radiata luteola	L	105	1	10	20	18	4	2	6	1	1	2	7	23	0	5	5
Barnes (1823)	D	30	2	3	9	3	2	1	5	0	0	0	2	2	0	1	1
Pleurobema clava	L	10	0	0	0	0	0	0	0	0	0	0	1	2	3	0	4
Lamarck (1819)	D	11	0	0	0	0	0	0	0	1	0	0	7	0	2	0	1
Lasmigona costata	L	7	0	0	0	0	0	0	0	0	0	0	1	0	2	0	4
Rafinesque (1820)	D	2	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Lasmigona compressa	L	6	0	0	2	0	0	1	0	1	0	0	0	0	0	1	1
Lea (1829)	D	11	0	0	7	1	0	1	0	2	0	0	0	0	0	0	0
Anodontoides ferussacianus	L	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Lea (1834)	D	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Anodonta imbecillis	L	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Say (1829)	D	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Villosa iris iris	L	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Lea (1829)	D	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

time. For its small size, Pymatuning Creek supports a surprisingly large and locally abundant mussel population. For example, in the last site (#18, Table 2), the authors encountered 439 mussels of seven species (4.4 mussels with each minute of blind searching) where the stream averaged only 2.5 m wide and 0.3 m deep.

Based on the present findings, it can be concluded that Pymatuning Creek supports a large and healthy population of unionids, and that *P. clava* comprises a small but healthy and very significant element of that fauna. Given its biological significance, every effort should be made to protect the Pymatuning Creek watershed, particularly those areas south of Woodward Road where what may be the largest population of *P. clava* in Ohio flourishes. Previous records (U. S. Fish and Wildlife Service 1993) indicate that another federally endangered unionid, the Northern Riffleshell (*Epioblasma torulosa rangiana*), may also occur in Pymatuning Creek, although the present study produced neither living nor dead shells of this species. Further study is needed to determine the extent of the *P. clava* population between the southernmost site of the present study and the beginning of the Shenango River Reservoir, and to determine whether the Northern Riffleshell occurs there as well.

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