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ZEBRA MUSSEL IMPACTS ON ENDANGERED UNIONIDS

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MUSSEL SAMPLING

Qualitative sampling for zebra mussels (*Dreissena polymorpha*) was conducted at all sites during 1998, and additional quantitative sampling (quadrat samples) was conducted near Diamond Island on the Tennessee River. Streams were visually searched with the aid of a view bucket, snorkeling, or with SCUBA. Search time varied depending on the amount of habitat present and water conditions. When the water was turbid, the stream banks and gravel bars were searched for shells. If fresh-dead shells (tissue still present in shell) were found, an attempt was made to feel for live unionids in the substrate. Consequently, live mussels may be present at some sites, but were not observed. At each site, in addition to checking unionids for zebra mussels, all submerged objects (boulders, logs, and debris) were also inspected for infestations of zebra mussels.

Duck River, TN

Thirty-five species were collected at eight sites (Appendix A) on the Duck River (Table 1). Thirty species were found alive, only fresh-dead shells (tissue present in the shells) were observed for four species, and one species (*Epioblasma triquetra*) was represented only by a relic shell (shell without tissue). Two endangered species, *Epioblasma capsaeformis* and *Lemiox rimosus*, were observed at Lillard Mill and fresh-dead shells of *Lemiox rimosus* were also collected upstream of the I-65 bridge (site 7). Zebra mussels were not observed at any of the eight sites on the Duck River.

Buffalo and Elk rivers, TN

Four sites were searched in the Buffalo River (Appendix A) and only two live unionids were found (Table 2). Similarly, only one live mussel was observed (Table 2) in the four streams that were searched in the upper Elk River drainage (Appendix A). Zebra mussels were not observed at any of the eight sites.

Wolf River, TN

Six sites on the Wolf River were surveyed in 1998 (Appendix A). Only three species were observed alive, but fresh-dead shells were collected for two other species. Additionally, shells of four more species contained no tissue, but their nacre was still shiny. Hence, shell condition suggests that at least nine unionid species are extant in the Wolf River (Table 3).

Hiwassee River, TN

Two sites on the Hiwassee River were surveyed during 1998 (Appendix A). Seven species were observed at the Hwy 68 bridge (site 23), including one male *Epioblasma florentina walkeri* (Table 4). *Villosa iris* was the most abundant mussel at this site. Only a relic shell of *Fusconaia barnesiana* was collected at the Powerhouse (site 24). No zebra mussels were observed at either site in the Hiwassee River.

Tennessee River, TN

Twenty quadrat samples were taken at a site near Diamond Island during 1998 (Appendix A). A total of 611 unionids of 18 species were collected in the samples (Table 5). Qualitative sampling for unionids and zebra mussels was also conducted at this site. No zebra mussels were found attached to the ~2,400 unionids that were handled.

Barren and Green rivers, KY

One site on the Barren River and one site on the Green River were visited in 1998 (Appendix B). These two sites could not be adequately searched for unionids due to high water and thus, no live unionids or shells were observed (Table 6). However, shoreline objects were inspected for zebra mussels and no zebra mussels were found at either site in the Barren and Green rivers.

Marrowbone Creek and Nolin River, KY

No unionids or zebra mussels were observed (Table 6) at the site searched in Marrowbone Creek, a tributary to the Cumberland River (Appendix B). A riffle area only yielded the Asian clam and no mussels were visible in the silt-laden pools. Relic shells of four species (Table 6) were found at three sites searched on the Nolin River (Appendix B). Zebra mussels were not observed at any of the Nolin River sites.

Rolling Fork, KY

Three sites on the Rolling Fork (Appendix B) were searched and four live unionid species were collected (Table 6). Site 9 appears to have a diverse population of mussels because many shells of 13 species were observed (Table 6). Turbid water prevented a search of the stream with a view bucket, and hand searching the substrate for live unionids was hampered due to the large amount of shells present. Zebra mussels were not observed at any site in the Rolling Fork.

SUMMARY

Twenty-five sites in Tennessee and nine sites in Kentucky were sampled in 1998 for unionids and zebra mussels. No zebra mussels were collected at any of the sites sampled. Although zebra mussels occur in Kentucky Lake (they were encountered in low numbers during 1997 sampling), the absence of them in samples this year suggests that their numbers are not increasing in the Diamond Island area. Thus, it appears that populations of endangered *Cyprogenia stegaria*, *Lampsilis abrupta*, and *Plethobasus cooperianus* near Diamond Island are under no immediate threat from zebra mussels, and zebra mussels are not an imminent threat to the continued existence of any unionid species in the streams sampled.

Table 1. Numbers and species of unionids collected at each site on the Duck River during 1998. Note: F = only fresh-dead mussels (tissue present) were observed, P = species present, but frequency was not recorded, and R = only relic shells (without tissue) were observed. See Appendix A for site locations.

Species	Site							
	1	2	3	4	5	6	7	8
<i>Actinonaias ligamentina</i>	--	--	--	--	--	--	1	--
<i>Actinonaias pectorosa</i>	--	--	1	--	--	--	1	--
<i>Amblema plicata</i>	--	--	P	6	--	--	--	P
<i>Arcidens confragosus</i>	--	--	--	--	--	--	--	P
<i>Cyclonaias tuberculata</i>	--	--	P	4	2	2	8	P
<i>Elliptio dilatata</i>	--	F	P	2	3	F	2	P
<i>Epioblasma capsaeformis</i>	--	--	P	--	--	--	--	--
<i>Epioblasma triquetra</i>	--	--	--	R	--	--	--	--
<i>Fusconaia barnesiana</i>	--	F	P	--	--	--	1	1
<i>Fusconaia ebena</i>	--	--	--	--	--	--	--	2
<i>Lampsilis cardium</i>	--	--	--	1	4	3	9	P
<i>Lampsilis fasciola</i>	--	1	P	1	6	5	10	P
<i>Lampsilis teres</i>	--	--	--	--	--	--	--	12
<i>Lasmigona costata</i>	--	--	P	5	1	2	2	P
<i>Lemiox rimosus</i>	--	--	P	--	--	--	F	--
<i>Leptodea fragilis</i>	--	--	P	F	--	--	--	P
<i>Lexingtonia dolabelloides</i>	--	--	P	1	--	--	--	P
<i>Medionidus conradicus</i>	--	--	--	--	2	3	1	--
<i>Megalonaias nervosa</i>	--	--	P	3	1	1	1	P

Table 1 continued.

Species	Site							
	1	2	3	4	5	6	7	8
<i>Obliquaria reflexa</i>	--	--	P	--	--	--	--	P
<i>Pleurobema coccineum</i>	--	--	F	--	--	--	--	--
<i>Potamilus alatus</i>	--	--	P	6	--	--	4	P
<i>Ptychobranchnus fasciolaris</i>	--	--	--	--	1	--	--	P
<i>Pyganodon grandis</i>	--	--	1	--	--	--	--	2
<i>Quadrula cylindrica</i>	--	--	P	--	--	1	34	1
<i>Quadrula pustulosa</i>	--	--	P	2	--	--	1	P
<i>Quadrula quadrula</i>	--	--	--	--	--	--	--	P
<i>Strophitus undulatus</i>	--	--	--	--	--	--	--	2
<i>Toxolasma lividus</i>	--	--	--	--	--	--	F	--
<i>Tritogonia verrucosa</i>	--	--	P	--	--	R	1	P
<i>Truncilla donaciformis</i>	--	--	--	--	--	--	--	P
<i>Truncilla truncata</i>	--	--	P	--	--	--	--	P
<i>Villosa iris</i>	--	F	F	--	--	--	--	--
<i>Villosa taeniata</i>	--	F	F	--	--	--	--	--
<i>Villosa vanuxemensis</i>	--	F	P	--	--	--	1	1

Table 2. Numbers and species of unionids collected at each site on the Buffalo and Elk rivers during 1998. Note: R = only relic shells (without tissue) were observed. See Appendix A for site locations.

Species	Site							
	9	10	11	12	13	14	15	16
<i>Fusconaia barnesiana</i>	R	--	--	--	--	--	--	--
<i>Pleurobema oviforme</i>	--	1	--	--	R	--	--	--
<i>Villosa iris</i>	--	--	--	--	R	1	--	--
<i>Villosa taeniata</i>	R	--	--	--	--	--	--	--
<i>Villosa vanuxemensis</i>	1	--	--	--	R	--	--	--

Table 3. Numbers and species of unionids collected at each site on the Wolf River during 1998. Note: F = only fresh-dead mussels (tissue present) were observed and R = only relic shells (without tissue) were observed. See Appendix A for site locations.

Species	Site					
	17	18	19	20	21	22
<i>Alasmidonta viridis</i>	--	--	--	--	--	1
<i>Lampsilis cardium</i>	--	--	R	--	--	--
<i>Lampsilis fasciola</i>	R	R	R	R	R	--
<i>Medionidus conradicus</i>	R	R	R	--	--	F
<i>Pleurobema oviforme</i>	--	--	--	R	--	--
<i>Ptychobranthus subtentum</i>	R	R	1	--	R	1
<i>Toxolasma lividus</i>	--	R	--	--	--	--
<i>Villosa iris</i>	R	R	R	R	--	F
<i>Villosa taeniata</i>	R	1	R	R	R	F

Table 4. Numbers and species of unionids collected from the Hiwassee River during 1998. Note: R = only a relic shell (without tissue) was collected and P = species present, but frequency was not recorded. See Appendix A for site locations.

Species	Site and Season Sampled		
	23		24
	Spring	Fall	Spring
<i>Alasmidonta marginata</i>	9	P	--
<i>Elliptio dilatata</i>	8	P	--
<i>Epioblasma florentina walkeri</i>	1	--	--
<i>Fusconaia barnesiana</i>	19	P	R
<i>Lampsilis fasciola</i>	14	P	--
<i>Villosa iris</i>	60	P	--
<i>Villosa trabalis</i>	5	R	--

Table 5. Numbers and species of unionids collected in quadrat samples from the Tennessee River during 1998. See Appendix A for site location.

Species	Number
<i>Amblema plicata</i>	1
<i>Cyclonaias tuberculata</i>	28
<i>Ellipsaria lineolata</i>	33
<i>Elliptio crassidens</i>	8
<i>Fusconaia ebena</i>	398
<i>Fusconaia flava</i>	1
<i>Lampsilis abrupta</i>	1
<i>Leptodea fragilis</i>	2
<i>Ligumia recta</i>	2
<i>Megalonaias nervosa</i>	1
<i>Obliquaria reflexa</i>	20
<i>Pleurobema cordatum</i>	1
<i>Potamilus alatus</i>	1
<i>Quadrula metanevra</i>	16
<i>Quadrula pustulosa</i>	84
<i>Quadrula quadrula</i>	6
<i>Truncilla donaciformis</i>	5
<i>Truncilla truncata</i>	3
TOTAL	611
Density (#/m ²)	122.2

Appendix A. Locations surveyed in Tennessee for zebra mussels during 1998. Road names were taken from: Tennessee Atlas & Gazetteer (DeLorme Mapping, 1992).

Site	Stream	Location	County
1	Duck River	Three Fork Bridge Road bridge, ~ 12 km E of Shelbyville	Bedford
2	Duck River	along Haskins Chapel Road, ~ 7 km SE of Henry Horton State Park	Bedford
3	Duck River	Lillard Mill off Milltown Road, ~ 8 km W of Henry Horton State Park	Marshall
4	Duck River	downstream of Hwy 431 bridge, ~ 19 km E of Columbia	Maury
5	Duck River	at Sowell Ford Road ford, ~ 14 km E of Columbia	Maury
6	Duck River	Sowell Mill Pike bridge, ~ 16 km SE of Columbia	Maury
7	Duck River	upstream of I-65 bridge, ~ 13 km SE of Columbia	Maury
8	Duck River	downstream of Old Columbia Dam at Columbia	Maury
9	Buffalo River	Hwy 99 bridge at Oak Grove, ~ 26 km NE of Waynesboro	Lewis
10	Buffalo River	Sickler Road bridge at Voorhies, ~ 23 km NE of Waynesboro	Lewis
11	Buffalo River	Topsy-Hohenwald Road bridge, ~ 14 km NE of Waynesboro	Wayne
12	Buffalo River	Hwy 13 bridge, ~ 15 km N of Waynesboro	Wayne

Appendix A continued.

Site	Stream	Location	County
13	Bradley Creek	Miller Crossroad Road bridge, ~ 2 km NW of Prairie Plains	Coffee
14	Beans Creek	Betsy Willis Road bridge at Prairie Plains	Coffee
15	Henley Creek	Hwy 41 bridge, ~ 4 km NW of Monteagle	Grundy
16	Caldwell Creek	unnamed road, ~ 1 km S of Bells Mill	Grundy
17	Wolf River	Hwy 295 bridge, ~ 1 km N of Byrdstown	Pickett
18	Wolf River	Molly-Larry Road, ~ 1 km N of Etter	Pickett
19	Wolf River	S Ford Road, ~ 2 km E of Etter	Pickett
20	Wolf River	Burntmill Ford Road (road sign, unnamed in TN Atlas), ~ 2 km W of Red Hill	Pickett
21	Wolf River	Hwy 325 bridge, ~ 1 km N of Red Hill	Fentress
22	Wolf River	Hwy 127 bridge (below grist mill) at Wolf River	Fentress
23	Hiwassee River	Hwy 68 bridge near Apalachia	Polk
24	Hiwassee River	at Apalachia Powerhouse, ~ 6 km E of Reliance	Polk
25	Tennessee River	TRM 197.7 near Diamond Island	Hardin

Appendix B. Locations surveyed in Kentucky for zebra mussels during 1998. Road names were taken from: Kentucky County Maps (Thomas Publications, LTD, Lyndon Station, WI).

Site	Stream	Location	County
1	Barren River	at Martinsville Road ford, ~13 miles SE of Bowling Green	Warren
2	Green River	Hwy 88 bridge, ~4 miles NW of Greensburg	Green
3	Marrowbone Creek	Hwy 691 bridge, ~3 miles W of Burkesville	Cumberland
4	Nolin River	Hwy 1868 bridge, ~8 miles SW of Elizabethtown	Hardin
5	Nolin River	Star Mills Road bridge at Star Mills, ~9 miles SW of Elizabethtown	Hardin
6	Nolin River	at White Mills by 1-lane bridge, ~14 miles SW of Elizabethtown	Hardin
7	Rolling Fork	Hwy 49 bridge, ~6 miles SE of Lebanon	Marion
8	Rolling Fork	Hwy 208 bridge at Calvary, ~4 miles S of Lebanon	Marion
9	Rolling Fork	alongside Wayne-Ennis Road, ~7 miles SE of Hodgenville	Larue