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A Survey of the Freshwater Mussels (Bivalvia:Unionidae) of the Green River Basin, Illinois

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ABSTRACT

The freshwater mussel fauna of the Green River and its tributaries in Illinois has not been investigated previously. During the present study 29 mainstem and tributary stations were sampled, resulting in the collection of 19 species of mussels, 13 of which were represented by live individuals. Only one species included on the Illinois threatened/endangered list was collected during the survey.

INTRODUCTION

The Green River originates approximately four miles west of the village of Steward in Lee County, Illinois. It flows generally west-southwest for 91.2 miles and drains an area of 1131 square miles (Healy, 1979) before emptying into the Rock River near Carbon Cliff in Henry County (Figure 1). The Green River occupies the Green River Lowland Section of the Grand Prairie Natural Division of Illinois (Schwegman, 1973).

The Green River basin was characterized in early settlement times by vast areas of marshlands drained by "Inlet Creek", as the Green River was then known (McClain, 1992). Two areas of marsh, Inlet Swamp and Great Winnebago Swamp, encompassed some 30,000 acres each in the upper portions of the drainage in Lee County. Separating the two was an area of limestone ledges (the "Inlet") located near the present-day town of Amboy. This geological feature caused waters from Inlet Creek to spread, "forming a two to three mile wide, shallow wetland whose waters flowed slowly toward the Rock River to the west".

In 1887 a drainage district was formed which, in 1901, completed the excavation of a series of ditches and blasted a channel through the limestone ledges, effecting the drainage of Inlet Swamp. The Great Winnebago Swamp was similarly drained soon thereafter. In recent years, much of the Green River and virtually all of its tributaries have been maintained by local drainage districts, resulting in periodic dredging and the perpetuation of highly disturbed habitat conditions. Currently, much of the Green River basin consists of little more than a network of straightened channels hemmed in by agricultural levees.

This study was undertaken to determine the species of freshwater mussels currently inhabiting the Green River and its tributaries, not only to secure information concerning

the health and distribution of existing mussel populations within the basin, but also to serve as a basis for comparing the Green River with other stream systems in Illinois and the Midwest.

MATERIALS AND METHODS

A total of 29 mainstem and tributary stations were sampled during the summers of 1991-1992 (Table 1; Figure 2). Most of these stations were also sampled during the Illinois Department of Conservation's Green River fisheries survey (Day et al., 1992). Additional stations were established on tributaries such as Mud Creek and Main Union Special Ditch to insure thorough coverage of the basin.

Mussels were collected by hand picking for four collector-hours at each station, and all available habitats (e.g. riffles, pools, areas of differing substrate, etc.) were searched. Typically, the mussels were identified to the species level in the field, their numbers recorded, and one or two voucher specimens of each species retained for deposition in the mollusk collection of the Illinois Natural History Survey, Champaign, Illinois. If identifications could not be made in the field, the specimens in question were retained for positive identification in the laboratory. Any remaining mussels were returned to the stream.

A photographic record was made of each station and the mussels collected there. Estimates were also made of stream width, average depth, and average rate of flow, and a site map sketched for future reference. Finally, the mussels to be retained as vouchers were bagged and labeled by site number and/or location.

Nomenclature in this report follows that of the Committee on Scientific and Vernacular Names of Mollusks of the Council of Systematic Malacologists, American Malacological Union (Turgeon et al., 1988), except that subspecies are not recognized.

RESULTS AND DISCUSSION

There has been little historical effort to investigate and document the freshwater mussel fauna of the Green River basin. Visits to the major malacological collections in the United States revealed only three specimens from the Green River - one *Actinonaias ligamentina*, one *Lampsilis cardium* and one *Lasmigona complanata* - all collected by Clayton Hoff of Quincy (Illinois) College in October, 1934 (K.S. Cummings, INHS, pers. comm.). These specimens currently reside in the collections of the Illinois State Museum.

During the current study, nineteen species of freshwater mussels were collected, of which thirteen species were represented by living specimens totalling 163 individuals (Table 2). One hundred sixteen collector-hours were spent in sampling, with an average of less than two mussels collected per hour.

The most common species collected live were *Lasmigona complanata* and *Anodonta grandis*, which constituted 25.15% and 20.25%, respectively, of the total sample (Table 2). Two additional species represented fifteen percent or more of the live sample:

Strophitus undulatus at 17.18% and *Lampsilis cardium* at 15.95%. Six species were represented by only one live individual each and included *Anodonta imbecillis*, *Lasmigona compressa*, *Potamilus ohiensis*, *Quadrula pustulosa*, *Toxolasma parvus* and *Tritogonia verrucosa.*

The number of live specimens collected at a given station ranged from 0 to 28, with an average of approximately 6, and the number of species represented by live and/or dead material ranged from 0 to 9, with an average of less than 3 (Table 3). Station 20 on Coal Creek in Bureau County had the greatest species richness, with 9 species. Station 13 on Walnut Special Ditch in Bureau County supported the highest abundance, yielding 28 live individuals (23 of which were *Lasmigona complanata*).

The Green River mainstem produced 14 of the 19 total species collected. Species that were not found in the Green River proper, but only in its tributaries, included *Elliptio dilatata*, *Lampsilis siliquoidea*, *Quadrula nodulata*, *Quadrula pustulosa* and *Tritogonia verrucosa*. Only one species included on the Illinois endangered and threatened species list (Herkert, 1992) was collected during the present study: a single *Lasmigona compressa*, currently listed as threatened, taken at station 3 on the Green River mainstem.

The relative paucity of freshwater mussels in the Green River basin is most likely a result of its agricultural history. As was noted earlier, much of the basin consists of channels that were artificially created for drainage purposes or, in the case of pre-settlement drainageways, have since been straightened, deepened and maintained by local drainage districts. Day et al. (1992) found the Green River to hold "diverse sport fishing opportunities" which were attributed to its high base flow, cool water temperatures, and favorable dissolved oxygen levels. The absence of significant instream structure and floodplain habitat caused by agricultural practices in the basin were considered limiting to its fish production.

No doubt the same practices that limit the availability of instream structure (e.g. dredging, channelization) are similarly limiting to the recruitment and survival of freshwater mussel populations. The high incidence of loose sand substrates on the Green River mainstem downstream from Station 4 and on many of the tributaries (e.g. Willow Creek, Winnebago Ditch) is also undoubtedly a negative factor affecting mussel populations (Parmalee, 1967).

The Illinois Department of Conservation's investigations in the Green River basin (Day et al., 1992) were primarily aimed at evaluating the basin's fishery and, based on a variety of factors including species richness, abundance, disease, etc., rating the stations sampled using Karr's Index of Biotic Integrity or IBI (Karr, 1981; Karr et al., 1986). Stations within the basin received IBI ratings ranging from "Limited Aquatic Resource" to "Highly Valued Aquatic Resource". Interestingly, the IBI data do not appear to correlate well with the mussel collection results.

Although some stations that ranked highly based on the fisheries data also supported relatively diverse and abundant mussel populations (e.g. Stations 2 and 3), others hosted few or no live mussels (e.g. Stations 1 and 4). Station 20, which had the greatest mussel species richness, received an IBI score of only 28 (Limited Aquatic Resource) based on the

fisheries data. One may conclude that some factor or factors particularly limiting to sedentary organisms - perhaps substrate type or frequency of artificial disturbance - has caused these discrepancies, since parameters such as high base flow, cool water temperatures and high dissolved oxygen could be expected to benefit both fish and mussels.

ACKNOWLEDGMENTS

We wish to thank Ed Anderson, David Day, Dan Holm, Jean Karnes, Randy Nÿboer and Randy Sauer of the Illinois Department of Conservation for assisting with sampling activities. David Day also contributed several mussel specimens collected during the Green River fisheries survey. Kevin Cummings of the Illinois Natural History Survey provided information concerning Green River mussels housed in other institutional collections and also, with assistance from Christine Mayer, curated the specimens collected during the study. He is also thanked, as is Dr. Richard Sparks, for reviewing the manuscript and providing many helpful comments.

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Figure 1. The Green River and its major tributaries.

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Figure 2. Collection sites in the Green River basin, 1991-1992.

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Table 1. Collection sites in the Green River basin, and date of sampling, 1991-1992.

SITE #	LOCATION
1.	Green River, County Road 2400E bridge, Lee Co. T38N, R1E, sec. 7. September 16, 1991.
2.	Green River, Route 52 bridge at Amboy, Lee Co. T20N, R10E, sec. 22. September 16, 1991.
3.	Green River, Walton Road bridge, Lee Co. T20N, R9E, sec. 34. September 16, 1991.
4.	Green River, Harmon Road bridge, Lee Co. T19N, R8E, sec. 15. September 17, 1991.
5.	Green River, Route 88 bridge, Whiteside Co. T19N, R7E, sec. 33. May 18, 1992.
6.	Green River, 6 mi. WSW New Bedford, Bureau Co. T17N, R6E, sec. 5. September 18, 1991.
7.	Green River, 4.5 mi. NW Atkinson, Henry Co. T17N, R4E, sec. 8. May 19, 1992.
8.	Green River, Route 82 bridge, Henry Co. T17N, R3E, sec. 4. May 19, 1992.
9.	Green River, N-S bridge at Colona, Henry Co. T17N, R1E, sec. 12. May 20, 1992.
10.	Willow Creek, County Road 2400E bridge, Lee Co. T38N, R1E, sec. 18. June 10, 1991.
11.	Winnebago Ditch, 1.5 mi. N Deer Grove, Whiteside Co. T19N, R7E, sec. 15. June 11, 1991.
12.	Walnut Creek, 1.5 mi. W Walnut, Bureau Co. T18N, R8E, sec. 7. June 11, 1991.
13.	Walnut Special Ditch, 2 mi. ENE New Bedford, Bureau Co. T18N, R7E, sec. 27. June 11, 1991.
14.	Fairfield Union Special Ditch, 5 mi. W New Bedford, Bureau Co. T18N, R6E, sec. 33. September 17, 1991.
15.	Fairfield Ditch No. 1, 3 mi. ESE Hoopole, Bureau Co. T18N, R6E, sec. 31. September 17, 1991.
16.	Main Union Special Ditch, Route 92 bridge, Henry Co. T18N, R5E, sec. 18. May 21, 1992.
17.	Coal Creek, 1.25 mi. S Sheffield, Bureau Co. T16N, R7E, sec. 30. June 12, 1991.
18.	Coal Creek, 2.5 mi. E Mineral, Bureau Co. T16N, R6E, sec. 10. June 12, 1991.
19.	Coal Creek, 2.5 mi. NNW Mineral, Bureau Co. T17N, R6E, sec. 31. June 12, 1991.
20.	Coal Creek, 2 mi. NNW Annawan, Henry Co. T17N, R5E, sec. 28. June 13, 1991.
21.	Mud Creek, 4 mi. NNE Kewanee, Henry Co. T15N, R5E, sec. 7. October 6, 1992.
22.	Mud Creek, 2 mi. NW Annawan, Henry Co. T17N, R5E, sec. 33. October 6, 1992.
23.	Mud Creek, 3.5 mi. NE Atkinson, Henry Co. T17N, R5E, sec. 18. June 13, 1991.
24.	Spring Creek, 2.5 mi. WNW Atkinson, Henry Co. T17N, R4E, sec. 30. June 13, 1991 & July 25, 1991.
25.	Spring Creek, 3 mi. NW Atkinson, Henry Co. T17N, R4E, sec. 17. September 18, 1991.
26.	Big Slough Ditch, 5 mi. NE Geneseo, Henry Co. T18N, R3E, sec. 36. September 18, 1991.
27.	Big Slough Ditch, 3 mi. NNE Geneseo, Henry Co. T17N, R3E, sec. 3. May 19, 1992.
28.	Geneseo Creek, Route 6 bridge in Geneseo, Henry Co. T17N, R3E, sec. 21. May 20, 1992.
29.	Mineral Creek, 2 mi. SE Colona, Henry Co. T17N, R2E, sec. 20. May 20, 1992.

Table 2. Total numbers, abundance ranking and percent composition of the mussel species collected in the Green River basin, 1991-1992.

Species	Total	Rank	%Comp.	Cum.%
Lasmigona complanata	41	1	25.15	25.15
Anodonta grandis	33	2	20.25	45.40
Strophitus undulatus	28	3	17.18	62.58
Lampsilis cardium	26	4	15.95	78.53
Quadrula nodulata	13	5	7.98	86.51
Quadrula quadrula	9	6	5.52	92.03
Anodontoides ferussacianus	7	7	4.29	96.32
Anodonta imbecillis	1	8	.61	96.93
Lasmigona compressa	1	8	.61	97.54
Potamilus ohiensis	1	8	.61	98.15
Quadrula pustulosa	1	8	.61	98.76
Toxolasma parvus	1	8	.61	99.37
Tritogonia verrucosa	1	8	.61	99.98
Actinonaias ligamentina	0			
Amblema plicata	0			
Elliptio dilatata	0			
Lampsilis siliquoidea	0			
Lampsilis teres	0			
Potamilus alatus	0			
Total Live Individuals	163			
Total Species (live)	13			
Total Species	19			

Table 3. Station by station listing of all mussels collected in the Green River basin, 1991-1992.

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