Freshwater Mussel Surveys of the Vermilion River (Wabash) and Tributaries

Report from 2006 IDNR / IEPA Basin Survey

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Introduction

As part of an ongoing effort to assess and monitor the status of Illinois streams, the Illinois Department of Natural Resources (IDNR) and Illinois Environmental Protection Agency (IEPA) have cooperated in conducting stream basin surveys. Survey reports summarize the current status of Illinois streams through collection of physical and biological information from established stations basin-wide.

This report describes and summarizes the 2006 freshwater mussel surveys of the Vermilion River (Wabash drainage) and tributary stations performed in conjunction with IDNR/IEPA basin surveys efforts. Inclusion of mussels into these basin surveys fills the final void in completing comprehensive basin monitoring programs that reflect the entire spectrum of abiotic and biotic stream resources.

The goals of integrating freshwater mussels into IDNR/IEPA basin surveys are:

1. Provide reliable and repeatable techniques for assessing qualitative and quantitative composition of the freshwater mussel community in sampled streams, and
2. Provide data for monitoring of freshwater mussel populations on a local, regional, and basin/watershed basis.

Methods and Materials

During the 2006 survey, freshwater mussel data was collected at 23 stations throughout the Vermilion River basin (Figure 1). Locations of sampling sites are listed in Appendix 1. Mussel survey locations were the same as IEPA stations in all but one case (Whippoorwill Branch, BPE-01). At Whippoorwill Branch, the mussel sampling station was ¾ mile downstream of the IEPA station. Prairie Creek (BPKL-01) was visually sampled because it was almost completely dry and likely an intermittent stream. Willow Creek (BPZA-01) was visually sampled due to probable intermittence. Boneyard Creek (BPJCA-UC-D1) was not sampled. Finally, Vermilion River – Catlin (BP-04) and Salt Fork – Oakwood (BPJ-08) were not sampled due to weather conditions and high water levels.

Past and current freshwater mussel populations were assessed by collecting shell material at each sample station. Shell material was classified as dead or relic based on condition of best shell found. Live mussels were surveyed by hand grabbing and visual detection. Efforts covered substrate types traditionally found to be preferred mussel habitat. All live mussels found were placed in mesh divers bags or equivalent and held in the stream until processing. A species was considered extant at a station if it was represented by live individuals or dead shell material.

Effort was recorded as man-hours per station (Appendix 2). At least 1.0 man-hour was spent at each station except those that were solely visually sampled (Willow Creek, BPZA-01, and Prairie Creek, BPKL-01). Typically effort was higher. Effort ranged from 1.0 – 4.0 man-hours with a total of 56.3 man-hours of in-stream sampling. Based on site conditions, survey efficiency was estimated as fair, good, or high, though no station in the 2006 survey was rated fair.

All live mussels and shell material were identified to species and shell material was kept as voucher specimens. While the intent was to retain at least one voucher per species, if no dead or relic shell was found to represent a live species, no voucher was retained. Vouchers were deposited in the Illinois Natural History Survey Mollusk Collection. For each live individual, we recorded gender, where possible, shell length (mm), and number of growth rings. All non-vouchered live mussels were returned to the stream reach where they were collected. Common and scientific names follow Turgeon, et al. (1998) (Appendix 4).

Parameters recorded included extant and total species richness, presence of rare or listed species, and abundance estimates expressed as catch-per-unit-effort (CPUE). Recruitment for live species was determined by the presence of individuals with three or fewer growth rings. Smaller (i.e. younger) mussels are harder to locate by hand grab methods and large sample sizes can be needed to accurately assess population reproduction. However, a small sample size can provide evidence of recruitment if it includes individuals that possess few growth rings. Alternatively, a sample consisting of very large individuals with numerous growth rings suggests a senescent population.

Mussel resources were classified as unique, highly valued, moderate, limited, or restricted based on the above parameters and following criteria outlined in Szafoni (2001) and subsequently refined (Szafoni ???). General category characteristics are described in Table 1 below.

Table 1. Freshwater mussel resource categories based on species richness, abundance, and recruitment.

Unique Resource	Very high species richness (10+ species) &/or abundance (CPUE > 61); listed species present; evidence of recruitment common.
Highly Valued Resource	High species richness (7-9 species) &/or abundance (CPUE 31-60); rare species present; evidence of recent recruitment likely
Moderate Resource	Species richness (4-6 species) &/or abundance (CPUE 11-30) typical for stream of given location and order. May be a resource of local significance of recovering from degradation.
Limited Resource	Low species richness (1-3 species) &/or abundance (CPUE 1-10). May be recoverable or recovering with improved conditions.

Restricted Resource	No live mussels present; only weathered dead, sub-fossil, or no shell material found.

Results

Basin-wide Totals

A total of 924 live individuals and 25 species were recorded. Eight species were noted only as relic shell material. Three of these species, creek heelsplitter, mucket and pondhorn, were found live in the IDNR 2001 survey and are likely still live in the basin. The presence of clubshell and purple lilliput are more problematic, as they have not been found live for several years. Thirty species are likely extant in the Vermilion River basin. Out of these, eight are listed as endangered or threatened in Illinois and one, the clubshell, is federally endangered (FE). The only known populations of four of these species (rainbow, wavy-rayed lampmussel, clubshell, and rabbitsfot are in the Vermilion River basin.

North Fork Vermilion River and Tributaries

A total of 20 species of freshwater mussels were observed in the North Fork Vermilion River stations; 14 were represented by live individuals, one by dead shell (cylindrical papershell), and five more were represented by relic shell (clubshell, creek heelsplitter, giant floater, mucket, purple lilliput) (Appendix 3). The number of extant species per site ranged from 3-12.

The most abundant species recorded in the North Fork Vermilion River were Wabash pigtoe, plain pocketbook, fatmucket, threeridge, purple wartyback, and wavy-rayed lampmussel making up 89% of all mussels. The abundance of purple wartyback, a state threatened species (ST), and wavy-rayed lampmussel, a state endangered species (SE), is highly notable.

The most widespread species were cylindrical papershell, fatmucket, plain pocketbook, Wabash pigtoe, wavy-rayed lampmussel, and white heelsplitter, all recorded extant from 75% of all North Fork stations.

Five state-listed species were recorded extant from the North Fork Vermilion River, the purple wartyback, wavy-rayed lampmussel, rabbitsfoot, little spectaclecase, and rainbow. Additionally, the clubshell and purple lilliput were found though only as relic shell. One site in particular, the Middle Branch (BPGE-02), boasted four state-listed species. **Wavy-rayed lampmussel** (SE) was recorded live at three of four stations – North Fork-Gundy (BPG-09), Jordan Creek (BPGC-01) and the Middle Branch (BPGE-02). It was common only at the Middle Branch. **Purple wartyback** (ST) was recorded live at two stations – North Fork-Gundy (BPG-09) and Jordan Creek (BPGC-01) and was common at the North Fork site.

Wavy-rayed lampmussel, **rainbow**, and **rabbitsfoot**, all state-endangered, are only known from the Vermilion drainage. Rainbow and rabbitsfoot were both found live only at the Middle Branch (BPGE-02) though relic shell of the rainbow was also found at Jordan Creek (BPGC-01). The **little spectaclecase** (SE) was found live at one station, the Middle Branch (BPGE-01) and relic shell was found at the North Fork at Hoopeston (BPG-97).

Clubshell was recorded as relic at North Fork-Gundy (BPG-09) though it has been recorded live in the watershed within the last 10 years. It was thought to have been extirpated from Illinois though is now known only from the Vermilion River drainage. **Purple lilliput** was recorded as relic shell at the North Fork-Hoopeston (BPG-97) and Jordan Creek (BPGC-01).

One rare species in Illinois, the fluted shell, was recorded live at two of four stations and relic shell at the other two. At one site, Middle Branch (BPGE-02), it was fairly common. This species is local in distribution and restricted to streams with stable sand and gravel substrates and high water quality.

A total of 385 mussels were collected during the 13.0 man-hours of sampling on the North Fork Vermilion River with a mean of 29.6 mussels/man-hour. The number of live individuals per site ranged from 15-292.

Mussel abundance at individual stations ranged from low to high (CPUE 9.3 – 73.0 individuals/man-hour) (Appendix 3). Sampling efficiency ranged from good to high suggesting that the data reflect mussel communities and stream conditions.

Recruitment was low at all sites except the Middle Branch (BPGE-02) where it was moderate.

Middle Fork Vermilion River and Tributaries

A total of 18 species were observed in the Middle Fork Vermilion River stations; 14 were represented by live individuals and four others by relic shell material (fragile papershell, giant floater, lilliput, and round hickorynut) (Appendix 3). Extant species richness per station ranged from 0-14 with a total of 14.

The most abundant species recorded in the Middle Fork Vermilion River were creeper, fatmucket, pimpleback, plain pocketbook, round pigtoe and Wabash pigtoe, making up 76% of all mussels.

The most widespread species were creeper, cylindrical papershell, elktoe, fluted shell, plain pocketbook, wavy-rayed lampmussel, though all of these were only recorded at two out of four stations.

Two state-listed species, the wavy-rayed lampmussel and round hickorynut were recorded from the Middle Fork Vermilion River basin. **Wavy-rayed lampmussel** (SE) was recorded live at the Middle Fork-Kickapoo (BPK-07) and the Middle Fork-Penfield (BPK-13). The wavy-rayed lampmussel is only known from the Vermilion River station. The **round hickorynut** was recorded at the Middle Fork-Kickapoo (BPK-07) as relic shell.

One rare species in Illinois, the fluted shell, was recorded at two stations, the Middle Fork at Kickapoo (BPK-07) and at Penfield (BPK-13). This species is local in distribution and restricted to streams with stable sand and gravel substrates and high water quality.

A total of 190 mussels were collected during the 11.3 man-hours of sampling on the Middle Fork Vermilion River with a mean of 16.9 mussels/man-hour. The number of live individuals per site ranged from 0-157. Two stations, Middle Fork at Kickapoo (BPK-07) and Penfield (BPK-13) accounted for 97% of all mussels found.

Mussel abundance at individual stations ranged from low at all stations but Middle Fork-Penfield (BPK-13) which was (is a 4 a high or a moderate-high?). Sampling efficiency ranged from good to high suggesting that the data reflect mussel communities and stream conditions.

Recruitment ranged from low to very high at all sites (Appendix 3). Given the difficulties in assessing recruitment through detection of small individuals, this is a significant finding and suggests that the Little Vermilion River not only supports abundant and diverse freshwater mussel faunas but also that many species' populations appear to be viable.

Salt Fork Vermilion and Tributaries

A total of nine extant and 11 total species were recorded from the Salt Fork Vermilion and five tributary sites (Appendix 3). All but lilliput, cylindrical papershell, and pondhorn were represented by live individuals. The number of extant species per site ranged from 0-6.

The most abundant species in this watershed were fatmucket and little spectaclecase, representing 94% of all individuals recorded, though these species were only found live at one station, Jordan Creek (BPJA-02) The abundance of little spectaclecase, a state endangered species (SE), is highly notable.

No species was particularly widespread in this sub-basin, perhaps due to the number of stations that exhibited few or no live individuals.

One state-listed species was recorded from this sub-basin. **Little spectaclecase** was found live at Jordan Creek (BPJA-02) and was notably common. It was also found as relic shell at Spoon River (BPJD-02).

A total of 288 individuals were collected during 13.5 man-hours of sampling on the Salt Fork Vermilion River and its tributary stations with a mean of 21.3 mussels per man-hour. The number of live individuals per site ranged from 0-274. Live mussels were notably absent in the Salt Fork mainstem and absent or rare in the tributaries save one station, Jordan Creek (BPJA-02) where 274 live mussels were recorded. Ninety-five percent of individuals recorded in this sub-basin were recorded at Jordan Creek (BPJA-02). Not including this station, the number of live individuals per site ranged from 0-12 and the abundance drops to 1.2 individuals/man-hour.

Mussel abundance at individual stations ranged from very low to very high (CPUE 0 – 137.0 individuals/man-hour). Sampling efficiency ranged from good to high suggesting that the data reflect mussel communities and stream conditions.

Recruitment appeared to be very low at all Salt Fork and tributary stations (Appendix 3).

Vermilion River

A total of 17 species were recorded from one station on the Vermilion and two tributaries (Appendix 3). The number of extant species per site ranged from 0-5.

There were no abundant species in this watershed. Only four species were represented live and each only by one individual.

Not surprisingly, there were also no widespread species. Live individuals and identifiable shell were found only at one station, the Vermilion at Forest Glen (BP-03). While relic shell was also found at Grape Creek (BPE-03), they were unidentifiable beyond genus.

Five state-listed species, **black sandshell** (ST), **clubshell** (FE,SE), **purple wartyback** (ST), **rabbitsfoot** (SE), and **round hickorynut** (SE), were recorded in this watershed all as relic shell. All of them were found at Vermilion River at Forest Glen (BP-03). Clubshell and rabbitsfoot are only known from the Vermilion drainage.

A total of four individuals were collected during 7.5 man-hours of sampling with a mean of 0.5 mussels per man-hour. The number of live individuals ranged from 0-4.

Mussel abundance at individual stations was very low (CPUE 0-1.0 individuals/man-hour). Sampling efficiency ranged from good to high suggesting that the data reflect mussel communities and stream conditions.

Recruitment was very low at all sites (Appendix 3).

Little Vermilion River

A total of 13 species were recorded from three stations on the Little Vermilion River (Appendix 3). All but two species were represented by live individuals. The mucket and giant floater were recorded as relic shell material. The number of extant species per site ranged from 0-10.

The most abundant species in this watershed were plain pocketbook and Wabash pigtoe representing 51% of all individuals recorded.

There were no particularly widespread species in the watershed, though the fatmucket was found live at one site and as relic shell material at one other.

Two state-listed species, little spectaclecase and slippershell, were recorded from this watershed. **Little spectaclecase** (SE) was recorded live from the Little Vermilion-Georgetown (BO-02). The Little Vermilion supports the best known population of this species in Illinois, though surprisingly only one individual was found in this 2006 survey. **Slippershell** (ST) was recorded live from Fayette Creek (BOD-01).

One rare species, fluted shell, was recorded live at Little Vermilion-Georgetown (BO-02). This species is local in distribution and restricted to streams with stable sand and gravel substrates and high water quality.

A total of 57 individuals were collected during 7.0 man-hours of sampling with a mean of 8.1 mussels per man-hour. The number of live individuals per site ranged from 0-56.

Mussel abundance at individual stations ranged from moderate to high (CPUE 0-14.0 individuals/man-hour). At all stations, sampling efficiency was high suggesting that the data reflects mussel communities and stream conditions.

Recruitment ranged from low to moderate (Appendix 3).

Mussel Community Classification

Based on the data collected in the 2006 basin survey, significant freshwater mussel resources can be found throughout the Vermilion River basin (Table 2). Little Vermilion-Georgetown (BO-02), Middle Fork-Penfield (BPK-13), and the Middle Branch (BPGE-02) rank as Unique Mussel Resources. Three Highly Valued Mussel Resources also exist in the basin at the Middle Fork-Kickapoo (BPK-07), Jordan Creek in the Salt Fork (BPJA-02), and Jordan Creek in the North Fork (BPGC-01).

Because all sampling efficiency ratings ranged from good to high, the Mussel Resource Values should be considered reliable.

Stations in the upper reaches of the Salt Fork sub-basin had seemingly fair to good substrates yet support what appears to be much smaller mussel communities than might be expected. This has been noted for many years in the Salt Fork which at one time supported very diverse mussel community with high numbers of species and individuals.

Additionally on the mainstem Vermilion River, numerous relic shells at the Forest Glen site (BP-03) suggests that historically there was a diverse mussel community present.

Table 2. Sampling station classification based on freshwater mussel resources

RATING	SITE	POTENTIAL FACTORS PRESENT
Unique	Little Vermilion – Georgetown (BO-02) Middle Fork – Penfield (BPK-13) Middle Branch (BPGE-02)	Very high species richness &/or abundances; listed species likely present; high to very high recruitment
Highly Valued	Middle Fork – Kickapoo (BPK-07) Jordan Creek (Salt Fork) (BPJA-02) Jordan Creek (North Fork) (BPGC-01)	High species richness and abundance; rare species likely present; moderate to very high recruitment
Moderate	Knights Branch (BPKF-02) Spoon River (BPJD-02) North Fork – Gundy (BPG-09) North Fork – Hoopeston (BPG-97)	Good species numbers and abundances with rare species possibly present; recruitment for some species
Limited	Vermilion – Forest Glen (BP-03) Fayette Creek (BOD-01) Stony Creek (BPJB-03) Saline Branch Drainage Ditch – North Urbana (BPJC-08)	Very low species and abundances; little or no indication of recruitment
Restricted	Grape Creek (BPE-03) Whippoorwill Branch (BPB-01) Yankee Branch (BOB-01) Glenburn Creek (BPKA-01) Salt Fork (BPJ-17) Saline Branch Drainage Ditch – East Urbana (BPJC-09) Saline branch Drainage Ditch – St. Joseph (BPJC-10)	No live species or shell material present

References

Cummings, K.C. and C.A. Mayer. 1997. Distributional checklist and status of Illinois freshwater mussels (Mollusca: Unionacea). pp. 129-145 in Cummings, K.S., Buchanan, A.C., Mayer, C.A., and Naimo, T.J. Conservation and Management of Freshwater Mussels II – Initiatives for the Future. Proc.1995 UMRCC Symp., St. Louis.Upper Mississippi River Conservation Committee, Rock Island, IL.

ESPB. 1999. Checklist of Endangered and Threatened Animals and Plants of Illinois. Illinois Endangered Species Protection Board. Springfield. 20pp.

Szafoni, R.E. 2001. Protocol for integrating freshwater mussel surveys into IDNR/IEPA stream basin surveys. Version 2.0. IDNR/ORC/Natural Heritage, Charleston, IL. 5pp.

Turgeon, D.D. et al. 1998. Common and scientific names of aquatic invertebrates from the United States and Canada: Mollusks. 2nd Edition. American Fisheries Society, Special Publication 26:ix-526.