

A SURVEY OF FRESHWATER MUSSELS (MOLLUSCA: BIVALVIA: UNIONIDAE)
AT WEYAUWEGA HYDROELECTRIC PROJECT LOCATED ON THE WAUPACA RIVER
AT WEYAUWEGA, WISCONSIN

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MAY 1994

ABSTRACT: A freshwater mussel survey at two sites was conducted both upstream and immediately downstream of the Weyauwega dam located on the Waupaca River in Weyauwega, Waupaca County, east central Wisconsin. This surveys' objectives were to determine the presence or absence of endangered and threatened mussels as well as the determination of any biological barrier effect and habitat fragmentation from the Weyauwega dam. The state endangered and federal category 2 snuffbox mussel (*Epioblasma triquetra*) was found dead only which indicated its former presence in the tailwater and is present local extirpation. Five other species were found dead and not living in the tailwater. Reasons for local extirpation are unknown. Downstream fauna was richer than upstream indicating that the dam does have an effect on upstream species richness. A total of 10 living and 6 additional dead species were found downstream while only 7 species were found living upstream. Run-of-river operations are recommended to protect existing benthic habitat. With further water quality and habitat investigations, the tailwater may serve as a good snuffbox reintroduction site.

INTRODUCTION

The Weyauwega hydroelectric plant is located at Waupaca rivermile 5.65 in the City of Weyauwega, Waupaca County, Wisconsin. This facility is presently undergoing FERC (Federal Energy Regulatory Commission) licensing. As part of this licensing, the applicant should provide a description of wildlife and fishery resources of the project and conduct reasonable studies on these resources to aid FERC in the license application process. This document summarizes information collected during a May 1994 freshwater mussel survey conducted both upstream and downstream of the hydroelectric facility and provides related natural resource management options. The completion of this survey was committed to by the WDNR (Wisconsin Department of Natural Resources) (Stranz, 1993). The survey's purpose was to determine presence or absence of listed freshwater mussels and to determine if any populations were geographically restricted due to the presence or operation of the hydroelectric dam.

The Weyauwega dam has a 12.3 foot head (N.E.W Hydro, Inc. 1993) and a hydraulic capacity of 500 cfs. Mean monthly flow at the dam site is 246 cfs. The dam forms Weyauwega Lake, a 1.5 mile-long 251 ac impoundment. The nearest dam is located at the City of Waupaca, approximately 15 rivermiles upstream of Weyauwega Lake. Downstream 5.6 miles from the Weyauwega dam, the Waupaca River enters the largely unimpounded Wolf River.

The Waupaca River near Weyauwega was targeted for freshwater mussel surveys because of the occupance of several rare mussel species in the Wolf River. It was hypothesized, that populations of rare Wolf River mussels were geographically connected to Waupaca River populations due to their close proximity. It was also hypothesized that downstream rare mussel populations were prohibited from upstream colonization due to the presence and operations of the Weyauwega dam which may serve as an effective biological barrier.

METHODS

A total of 2 sites were sampled near the Weyauwega project area during May 18 and 20 1994. Site locations were chosen in order to evaluate the potential effect of the project on mussel distribution and were chosen in the best available riverine mussel microhabitat. One site was located immediately downstream of the dam (WRM 5.65) and the other immediately upstream of the impoundment at WRM 10.1. Sampling methods followed the ENDANGERED, THREATENED AND SPECIAL CONCERN AQUATIC INVERTEBRATE SURVEY GUIDELINES FOR WISCONSIN FERC PROJECTS (Appendix 1). Dead mussels were recorded for only the rarest species although thousands of shells of common species were mentally noted.

RESULTS AND DISCUSSION

One state endangered and two state special concern mussels were found among the 446 living and 56 dead mussels recorded (Table 1). A total of 17 mussel taxa (11 living, 6 dead only) was recorded.

The state endangered snuffbox (*Epioblasma triquetra*) was found dead only downstream of the dam. The state special concern elktoe (*Alasmidonta marginata*) was found living both upstream and downstream of the dam. The state special concern creek heelsplitter (*Lasmigona compressa*) was found living only upstream.

Sample sizes at the two locations were different: 162 mussels were collected downstream while 284 were recorded upstream. Although these sample sizes differ, richness is directly comparable as evidenced by significant richness plateaus given in Figure 1. A total of 10 living species were found downstream and only 7 upstream. Therefore, the downstream segment exhibited greater species richness. Six additional species were found dead downstream indicating their historic downstream presence and present extirpation. These six extirpated species included:

Quadrula pustulosa pustulosa
Amblema plicata plicata
Fusconaia flava
Obliquaria reflexa
Truncilla truncata
Epioblasma triquetra.

The condition of the shells of these six extirpated species, except *F. flava*, and the majority of all downstream empty shells was subfossil. Shells were white, chalky, disarticulated and had no or grey-colored periostracum. Shells of this description typically die approximately 15 to 70 years ago. In addition, nearly all shells appeared uniformly aged suggesting a catastrophic event that eliminated downstream mussels.

In the upstream reach few empty shells were present and therefore historic fauna and extirpations, if any, could not be ascertained. The absence of upstream subfossil shells is due to the presence of unstable sediments. During sampling, sand could be seen moving downstream and areas with stable substrate were uncommon. In these conditions, empty shells become buried and dislodged and are therefore not readily visible. Past community composition could be determined from archeological evidence if midden piles were present and investigated.

Although population densities were not measured, they seemed low at the downstream site and moderate upstream. I visually

estimated a population density of 1 mussel/m² downstream and 4 mussels/m² upstream. In most river systems population densities are higher in tailwaters than elsewhere. The reverse was observed here although there was only a single comparison location. Tailwater population densities are generally higher than elsewhere because of the presence more stable substrates. It is possible that water quality problems affecting downstream and not upstream locations may account for this lower density. It is also possible that fluctuating tailwater levels, which were observed during sampling, may negatively affect mussel beds in the generally shallow tailwater section.

Clearly the Weyauwega dam fragments aquatic habitat in the Waupaca River. Greater species richness occurs in the tailwater compared to an upstream riverine section. It is likely that host fishes carrying mussel larvae are halted from further upstream movements. Mussels are therefore unable to propagate upstream of the dam. This problem may be particularly acute considering the rich fish and mussel fauna that occurs in the Wolf River which is only 5.65 miles downstream of the Weyauwega dam.

Incidental observations were noted. An abundance of decapods were seen consisting of rusty crayfish (*Orconectes rusticus*). A very diverse gastropods fauna occurs in the tailwater including *Campeloma*, *Vivipara*, *Pleurocera*, *Limnaea*, *Helisoma* and *Physa*. The exotic aquatic macrophyte *Potamogeton crispus* is common both downstream and upstream as well as *Sparganium*. The following orders of insects were noted: odonata, ephemeroptera, coleoptera, plecoptera and tricoptera.

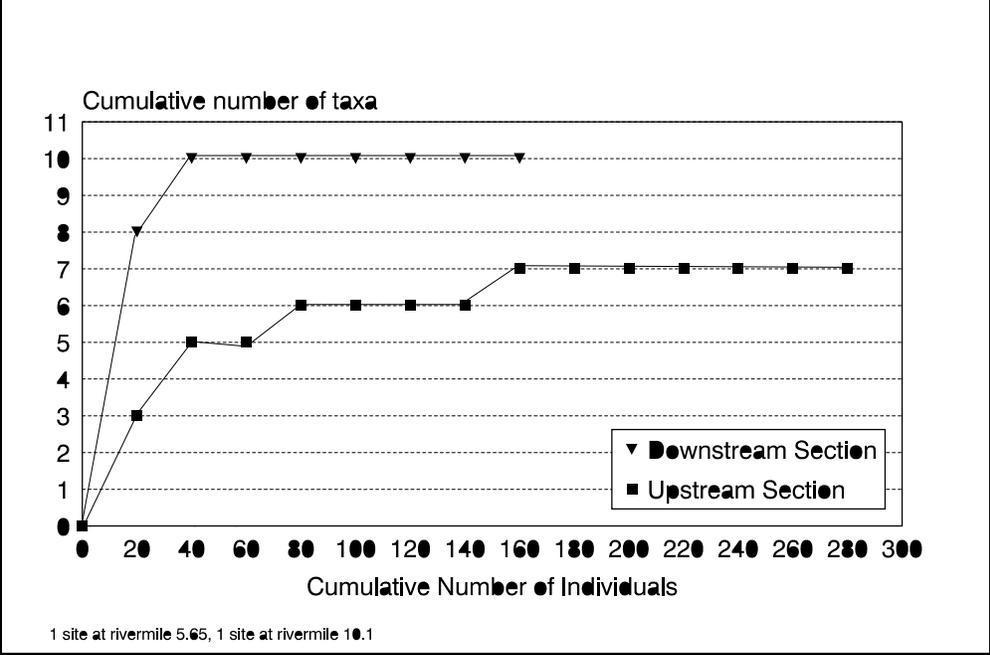
MANAGEMENT CONSIDERATIONS

- 1) Since no state or federally listed mussels occur in locations sampled, it appears no immediate threat from hydroelectric project operations toward listed mussels exists.
- 2) The former presence of the state endangered and federal category 2 snuffbox mussel (*E. triquetra*) indicates former and possible present habitat suitability. This suggests that the tailwater may be a candidate for active species reintroduction. It is unlikely that natural reintroduction will occur since any substantial snuffbox population occurs 70 miles upstream of the confluence of the Wolf and Waupaca rivers in the Wolf River.
- 3) Run of the river hydroelectric operations are recommended for protection of benthic habitat and organisms. The tailwater area is very shallow, average depth during this May 1994 investigation was about 2 ft. The Waupaca River here is generally wide and shallow and is susceptible to negative effects from quickly

TABLE 1. DISTRIBUTION AND ABUNDANCE OF WEYAUWEGA RIVER FRESHWATER MUSSELS IN THE VICINITY OF THE WEYAUWEGA DAM, WAUPACA COUNTY, WISCONSIN. MAY 1994. () are numbers found dead, **SSC**= State of Wisconsin Special concern, **SE**=State of Wisconsin endangered, **C2**=Federal category 2 (a pre-listing category). Only for *E. triquetra*, *Q. p. pustulosa* and *O. reflexa* were all dead encountered recorded.

TAXON	DOWNSTREAM		UPSTREAM		STATUS
<i>Strophitus undulatus undulatus</i> (Say, 1817)	15	(1)	26	(2)	
<i>Alasmidonta marginata</i> Say, 1818	12	(1)	13	(1)	SSC
<i>Lasmigona costata</i> (Rafinesque, 1820)	44	(1)	7	(1)	
<i>Lasmigona compressa</i> (Lea, 1829)			3	(1)	SSC
<i>Quadrula pustulosa pustulosa</i> (Lea, 1831)	0	(1)			
<i>Amblema plicata plicata</i> (Say, 1817)	0	(9)			
<i>Fusconaia flava</i> (Rafinesque, 1820)	0	(1)			
<i>Elliptio dilatata</i> (Rafinesque, 1820)	6	(1)	1	(1)	
<i>Obliquaria reflexa</i> Rafinesque, 1820	0	(2)			
<i>Actinonaias ligamentina carinata</i> (Barnes, 1823)	1	(8)			
<i>Truncilla truncata</i> Rafinesque, 1820	0	(5)			
<i>Leptodea fragilis</i> (Rafinesque, 1820)	10	(1)			
<i>Potamilus alatus</i> (Say, 1817)	5	(1)			
<i>Ligumia recta</i> (Lamarck, 1819)	1	(4)			
<i>Lampsilis siliquoidea</i> (Barnes, 1823)	37	(1)	1	(1)	
<i>Lampsilis cardium</i> (Raf., 1820)	31	(1)	233	(1)	
<i>Epioblasma triquetra</i> (Rafinesque, 1820)	0	(10)			SE, C2
Total	162	(48)	284	(8)	
Total Number of Taxa	10	(16)	7	(7)	

Figure 1. Waupaca River Mussel Species Richness Downstream and upstream of the Weyauwega Dam, Waupaca Co., Wisconsin.



fluctuating water levels from ongoing hydro peaking operations. Although no listed mussels presently occur in the tailwater, it still contains a fairly rich fauna. Run-of-river operations would also provide protection to abundant aquatic insect, crustacean, gastropod and fish fauna.

REFERENCES

N.E.W. Hydro, Inc. 1993. Draft License application. Weyauwega Hydroelectric Project, Waupaca River, Waupaca County, Wisconsin. FERC # 2550.

Stranz, Al. 1993. 7 June 1993 letter to the FERC. Wisconsin Department of Natural Resources.

APPENDIX 1

ENDANGERED, THREATENED AND SPECIAL CONCERN AQUATIC INVERTEBRATE SURVEY GUIDELINES FOR WISCONSIN FERC PROJECTS.

Compiled by the Wisconsin Department of Natural Resources (Nov. 1991).

- I. Identify state and federal endangered, threatened and special concern species that may be present based on historic records and zoogeography. The Natural Heritage Inventory Program of the WDNR Bureau of Endangered Resources in Madison or the FERC Endangered Resources Coordinator can help provide this information. This preliminary species screening will provide a list of anticipated bird species.
- II. Record all field and laboratory data on standard survey forms. These data should include: date, exact location (to quarter of quarter section), habitat description (include substrate, current, water and air temperature), USGS quadrangle name, county, copy of map with location that contains listed species, number of listed invertebrates observed, any evidence of threats to population, name of taxon, whether or not specimens were collected, and the museum at which specimens were deposited.
- III. Conduct field survey at times of the year and day and under conditions when animals or their remains are likely to be present and are the most easily identified. For most insects, this would be during May and June prior to emergence or during the hatching time if exuviae are collected. If more than one listed species is potentially present and are most easily identified at different times of the year, the project will have to be surveyed multiple times during the year.
- IV. The survey should be conducted using a qualified invertebrate zoologist who is familiar with local fauna and can recognize listed and common invertebrates in the field.
- V. All invertebrates should be identified to species where possible and those that are of uncertain identification and could be listed species should be preserved using standard techniques for later laboratory identification. One voucher specimen of each listed fish species should be kept for museum deposition if its removal will not permanently harm the population.
- VI. Any listed species observed incidentally should be recorded.
- VII. Secure any endangered resource or Scientific Collectors permits that are needed. Contact WDNR Bureau of Endangered

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Resources, Madison Wisconsin.

VIII. Additional Survey Guidelines for Aquatic Insects.

- 1). For the collection of nymphs and other listed aquatic invertebrates, a net of mesh size appropriate for target organisms should be used. A 3/16" or 1/8" bar mesh should be used for odonates. Smaller (500 or 600 microns) should be used for smaller invertebrates. Hand picking of rocks is needed for some insects (some coleoptera, tricoptera).
- 2). Kick net samples should be taken in a number of different microhabitats but microhabitats that are preferred for listed species should be sampled the most. A total of at least 200 members of each listed group (dragonflies, mayflies etc.) should be collected if possible.
- 3). Samples of exuviae are the easiest way to sample and provide the most information per unit effort. This method should be use where ever possible and should be done at the time of the year and under conditions that exuviae are present. The entire shoreline of the tailwater from the dam downstream 2 miles and at least 5% of the suitable habitat of the reservoir shoreline should be searched. Emergence time of each listed species that could be potentially present should be taken into account when designing a survey. In addition, previous weather conditions that do affect exuviae preservation should be considered. For example, exuvial samples should not be collected during August for a species that emerges in early June and should not be surveyed for immediately after a rain storm or high water which destroys exuviae.

IX. Additional Survey Guidelines for Mussels.

- 1). The entire shoreline of the reservoir should be surveyed for shell accumulations. The entire shoreline of the tailwater extending from the dam downstream 2 miles should be thoroughly searched. These shoreline searches should be conducted during low or normal water levels to ensure that shell remains are not inundated.
- 2). Collections of living and dead mussels using SCUBA, snorkeling gear or wading should be done

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within the reservoir and tailwater. The technique used depends on water conditions. Within each of the tailwater and reservoir, at least three sampling stations should be established based on results of the shoreline surveys. Within each station, mussels should be gathered incrementally.

Incremental collections are defined as collections of mussels of all species present in groups of 20 individuals. The collection of all mussel species as opposed to just collecting listed species, will provide community information. It will also assure that specimens are identified to the species level out of the water where it is easier than making identifications underwater. Mussels should be gathered at a station until a plateau of six points is reached when the cumulative number of mussels is plotted against the cumulative number of species for each station. Exceptions to this amount of collection effort include: a) the total absence of any mussels and b) the inability to secure the required amount of specimens in one-half person day of collecting effort.

- 3). During both shoreline and in-stream collecting, any living or dead mussels or any other listed species should be noted if observed incidentally.

- 4). All listed mussels should be measured by total length, total height and externally aged. Gravidity should be determined by examination of the marsupia. The purpose of collecting this information is to collect data on presence or absence of reproduction to determine population viability.