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Burrowing Rates and Comments on Host Specificity in the Endangered Mussel *Lampsilis higginsi*

Joseph R. Sylvester, Leslie E. Holland, and Thomas K. Kammer

U.S. Fish and Wildlife Service

National Fishery Research Laboratory

P.O. Box 818

La Crosse, Wisconsin 54601

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ABSTRACT

In preliminary laboratory studies, the endangered mussel *Lampsilis higginsi* was unable to burrow into a rocky substrate, but did burrow into substrates comprised of silt, clay, sand, and/or pebble-gravel. Burrowing times were shortest in silt and longest in pebble-gravel. As judged by longevity of glochidial infection, walleye *(Stizostedion vitreum)* and largemouth bass *(Micropterus salmoides)* may be suitable hosts for the parasitic stage. When glochidia were placed in water ~~without host fish~~, half had died after 48 hours, and all had died after 72 hours.

INTRODUCTION

Nine species of mussels (Pelecypoda) in the upper Midwestern United States are listed as either threatened or endangered by various states and the ~~Federal Government~~ Department of the Interior. Mussels were the mainstay of the pearl button industry, which began about 1891 (Knott 1980). As the demand for mussels increased, their abundance rapidly declined. The detrimental effects of industrial and agricultural development on aquatic ecosystems has caused mussel populations to continue declining. Siltation, pollution, and stream alterations have all had detrimental effects on mussel populations (Engel 1980).

The pearly mussel *Lampsilis higginsi* is one ~~of the mussels~~ Sterki in the upper Midwest that is now considered endangered, as defined by the Endangered Species Act of 1973. Historically, it was found in Pools 3-17 of the upper Mississippi River. However, since 1966 it has been reported only from 14 widely scattered sites (Coon et al. 1977; Larsen and Holzer 1978; Nelson and Freitag 1980). Its greatest ~~known present~~ abundance is now in Pool 10 near the Praire du Chien area of the upper Mississippi River (Havlik 1981; Havlik and Marking 1981).

The U.S. Fish and Wildlife Service Recovery Team for *L. higginsi* has proposed recovery criteria that call for establishing viable reproductive populations ~~of this mussel~~ in five areas of its former range, to help ensure survival of the species. Therefore, critical information is needed on its substrate preference and fish host specificity. We report here on our efforts to establish these criteria in the laboratory.

MATERIALS AND METHODS

Two female and six male *L. higginsi*, collected by Corp of Engineers U.S. Army divers during a survey in the Praire du Chien area of Pool

description of methods is incomplete

10 of the upper Mississippi River in July 1981 were placed in 75-liter aquaria with sand substrates. After the mussels were acclimated at a water temperature of about 25°C, we attempted to determine the rates at which they burrowed into five types of substrates: silt, clay, sand, pebble-gravel, and rock. Mussels were considered ~~buried~~ when 75% of the total shell area was beneath the substrate surface.

We examined both female mussels for reproductive ~~activity~~ and obtained glochidia using the methods of Jones (1950). Glochidia were injected into the opercular cavity of anesthetized fish of nine species. These were all hatchery-reared fish with no previous evidence of glochidial infestation. The fish were then returned to holding tanks, examined daily, and the duration of ~~infestation~~ by glochidia was recorded. We also attempted to determine how long glochidia would survive at 25°C in the absence of suitable host fish.

RESULTS AND DISCUSSION

Burrowing times were somewhat similar in all substrates (except rock, in which mussels were unable to burrow) ranging overall from 5 minutes in silt to 133 minutes in pebble-gravel (Table 1). Therefore, substrate particle size alone may not be a

Table 1. Mean time required for six *Lampsilis higginsi* mussels to burrow in four substrate types[a]. Mussels were considered buried when 75% or more of the shell area was beneath the substrate surface. Approximate substrate particle sizes are given in parentheses. Mussels were unable to burrow into rocks of the size given.

Substrate and particle size (mm)	Time (minutes) Mean	Range
Clay (.003)	33.6	15-63
Silt (.05)	20.9	5-48
Sand (1.5)	32.4	20-60
Pebble-gravel (7.0)	63.3	30-133

[a] A rock substrate was also tested, but no burrowing occurred.

significant limiting factor in the present distribution of pearly mussels. The mussels used in these tests were collected in an area of Pool 10 with a substrate of silt, sand, and frements of mussel shells. Fuller (1980) collected live pearly mussels from a mud and gravel area in 3-4 meters of water.

The presence of a suitable host fish at the appropriate period is a critical factor in the life cycle of the pearly mussel. Saugers (*Stizostedion canadense*) and freshwater drum (*Aplodinotus grunniens*) have been suggested as hosts of the pearly mussel (Coker et al. 1921; Surber 1913; Wilson 1916). We attempted to determine if other fish species could be suitable hosts based on longevity of infection under laboratory conditions. Walleyes and largemouth bass sustained glochidial infections for 35-36 days (Table 2), suggesting that they may be suitable hosts for the mussel. The seven other species tested retained glochidia for only 3 days or less.

Table 2. Length of parasitic infection of nine fish species with glochidia of *Lampsilis higginsi*.

Fish species	Time (days) Mean	Range
Walleye *Stizostedion vitreum*	36	36
Largemouth bass *Micropterus salmoides*	35.5	35-36
Bluegill *Lepomis macrochirus*	2.5	2-3
Green sunfish *Lepomis cyanellus*	2	1-3
Channel catfish *Ictalurus punctatus*	<1	<1
Black bullhead *Ictalurus melas*	<1	<1
River carpsucker *Carpiodes carpio*	<1	<1
White sucker *Catostomus commersoni*	<1	<1
Rainbow trout *Salmo gairdneri*	2.5	1-4

M+M section

Subsamples of 500 glochidia in water without fish were examined at various times up to 72 hours to determine survival. Of the glochidia examined, 80% were alive 5 minutes after removal from the female mussel, about 70% after 24 hours, 50% after 48 hours, and none after 72 hours. These data suggest that the glochidial stage of this species must find a suitable host fish within at least 48 hours to ensure a 50% or better rate of survival.

how was alive determined?

at 25°C

Much ecological and biological work remains to be done to define physical and biological requirements of *L. higginsi*. Fortunately, it may be possible to develop culture techniques for the glochidial stage that make the use of a host fish unnecessary (Isom and Hudson 1982).

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