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A Sampling Method for Conducting Relocation Studies with Freshwater Mussels

ABSTRACT

Low recovery of transplanted mussels often prevents accurate estimates of survival. We developed a method that provided a high recovery of transplanted mussels and allowed for a reliable assessment of mortality.

A 3 x 3 m polyvinyl chloride (PVC) pipe grid was secured to the sediment with iron reinforcing bars. The grid was divided into nine 1-m² segments and each treatment segment, was stocked with 100 marked mussels. The recovery of mussels after six months exceeded 80% in all but one treatment group.

INTRODUCTION

Freshwater mussels are relocated as a part of state and federal conservation and management programs. Frequently, mussels are moved from construction or dredging zones to unaffected sites upstream (Oblad 1980, Harris 1984, 1986, Harris et al. 1992, Jenkinson 1989). Efforts have also been made to reestablish mussels in restored streams (Ahlstedt 1979, Sheehan et al 1989, Hubbs et al 1991). Recently, threatened mussel species were relocated to protect them from the exotic zebra mussel *Dreissena polymorpha* (D. W. Schloesser, U. S. Fish and Wildlife Service, Ann Arbor, MI, personal communication).

Although mussels have been transplanted for more than 20 years, the proper procedures for moving mussels and the long-term effects on the mussels have not been adequately studied. Information on most relocations is found in the gray literature, details of the methods are often unreported, and the methods vary among projects. The survival of mussels at new locations is often undetermined or unreliably underestimated because relatively few organisms are recovered.

As part of research into the effects of relocation on freshwater mussels, we developed a sampling method to evaluate the recovery of transplanted. Our objective was to design a method that would provide a high recovery of transplanted mussels in a large river system with relatively high turbidity.

MATERIALS AND METHODS

A randomized block design was used to measure the recovery of mussels. Specifically, we used a 3 x 3-m grid that was divided into nine 1-m² segments; each three-segment block consisted of one control and two treatment groups (Figure 1). We constructed the grid of 5.08-cm schedule 40-PVC pipe, and sanitation-90° elbows, tees, and double tees. For ease of transport and assembly in the field, the grid was built in two sections and connected with unions. The grid was weighted by filling the pipe perimeter with sand and by drilling 1.27-cm holes into the center piping. Iron reinforcing bars (rebar, 1.27 cm x 1.83 m) were driven through eyebolts at each corner; a clamp was attached to the rebar to prevent the grid from rising off the sediment. Grid segments were uniquely marked with fluorescent paint and a specific number of muffler clamps for identification in turbid water.

Before the transplanted mussels were placed into the grid, the resident mussels in each treatment segment were removed, identified, and counted to determine diversity and density at the site. Resident mussels were left in the three control segments to estimate natural mortality. Mussels were stocked into each treatment segment at a density of 100/m². Densities were similar in areas of the upper Mississippi River that

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support relatively diverse and dense mussel communities (Holland-Bartels 1990). Mussels in each treatment replicate were uniquely marked to determine the degree and pattern of migration inside and outside the study area; the mark was etched onto the shells with a dremel® tool and grinding stone.

The study area was re-examined in six months. All mussels in the nine squares were collected by a diver and taken to the surface for examination. Migration between squares was estimated from the number of marked mussels found outside of the original placement square and the number of unmarked mussels found within the placement squares. The diver also searched a 5 m area immediately outside of the grid for marked mussels.

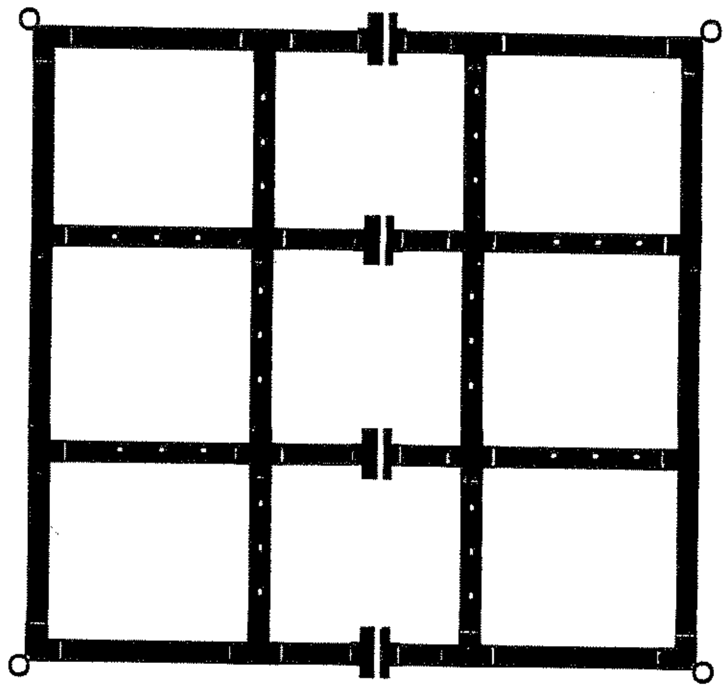

Figure 1. Sampling grid used for the study of transplanted mussels.

RESULTS AND DISCUSSION

The grid was easily transported to the study site and was readily assembled and disassembled in the field by three or four people. The grid remained intact and properly positioned for 12 months and showed no evidence of scouring or deposition of sediment.

Six months after the relocation, the recovery of marked mussels (both live and dead shell) averaged 93% and exceeded 80% in all but one treatment. A single treatment group averaged 61% recovery, which we attributed to mortality of the mussels and displacement of the empty shells downstream of the grid. The high recovery rate of marked mussels enabled us to accurately estimate mussel mortality related to handling.

The percentage of mussels found outside of their original placement squares was relatively low (mean = 5%). Moreover, most mussels inside the grid were found within 1 m of their original placement squares. Other researchers have reported that mussels move only a few meters from their placement location (Sheehan et al. 1989) but that the percentage of migration increases over time (Ecological Specialist 1991). The PVC pipe might have restricted movement of mussels, particularly small individuals. However, there was also immigration of resident mussels into the grid.

The grid and sampling design seem practical for short-term ($\leq$ 6 months) studies but may not be suitable for long-term monitoring because of the potential inhibition of mussel migration. A scaled-down grid may be used in smaller streams or lakes. Additionally, the grid may be used to randomly sample the mussel density of a population.

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