Examination of non-game fish passage at road-stream crossing using mark-recapture, genetic, and PIT tag techniques

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INTRODUCTION

Government agencies are inventorying and replacing road-stream crossings, often with a goal to improve aquatic organism passage. Few studies have addressed how movement of non-game species is influenced by road-stream crossings. Agencies need simple, cost-effective techniques to verify aquatic organism passage at road-stream crossings. In early 2010 we initiated mark-recapture and genetic studies to determine movement of non-game fish species, through 20 road-stream crossings on the Daniel Boone National Forest. We also established antenna arrays to continuously monitor movement of PIT tagged fish at 3 crossings.

METHODS

Mark-recapture: In March – April 2010, we backpack electrofished reaches A & B (Figure 2). We marked fish in reach A with a lower caudal clip, and fish in reach B with an upper caudal clip. In July – Aug 2010, we sampled reaches A, B, & C and examined all fish for caudal clips.

Genetics: Fin clips were preserved for genetic analysis. Lab analysis begins in 2011.

PIT antennas: At the 3 PIT antenna study site (Bond et al. 2007) study sites we implanted 12 mm PIT tags into all fish greater than 70 mm. The antennas ran continuously from March – September 2010, with 2 weeks downtime due to flooding) enabling us to detect movement from reach A to reach B, and from reach B to reach C.

RESULTS

Higher numbers of creek chub movements were detected with PIT antennas than with mark-recapture (Table 1). We detected 39% - 49% of PIT tagged chubs moving from reach A to B at all sites. Movement of PIT tagged chubs from reach B through the crossing, and into reach C was highest at the easy crossing (42%), declined at the moderate crossing (20%), and was lowest at the difficult crossing (0%). Most blackside dace were too small to PIT tag, but we documented some movement (Table 1).

SITE SELECTION

We used the National Inventory and Assessment Protocol (Clark et al. 2003) and passage models developed by Coffman (2005) to select sites with easy, moderate, and difficult passage for minnow species of moderate to strong swimming and leaping ability. Study sites were established at 20 crossings (Figure 1). Three sites of varying passage difficulty were chosen for PIT antennas.

DISCUSSION

The PIT antenna data clearly showed fish movement undetected by mark-recapture. Mark-recapture is often attractive to biologists because it can be completed with standard equipment and moderate effort. However, mark-recapture is only capable of detecting fish movement that happens to coincide with recapture sampling.

Installation of PIT antennas requires substantial investment in equipment and time. Maintenance is daunting; however results are easy to interpret, and since monitoring is continuous there is little chance of missing fish passage events.

Genetic sampling requires relatively low effort (Hudy et al. 2010). Processing time and ease of interpretation are the biggest unknowns as we move forward with lab analysis.

REFERENCES


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