Monitoring of Fish Movement, Condition, Community Structure and Invertebrate Communities Following Modification of Two Streambed Grade Control Structures in Turkey Creek, Cass County, Iowa

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Goals and Objectives:

- To determine if a 1:15 back slope design will allow upstream and downstream passage of fishes.
- To determine if there are differences in the condition and community structure of fish in proximity to weirs with 1:15 back slopes, 1:4 back slopes, and not associated with weirs.
- To determine if macroinvertebrate abundance and diversity differ at weirs, and in areas both near and far from weirs.
- To provide demonstration sites of successful structures to HCA members and other potential stakeholders.

Progress:

Project is complete. Products include an M.S. thesis, final reports to each funding agency, a presentation at the American Fisheries Society national meeting, and two manuscripts submitted for publication in peer-reviewed journals.

Conclusions and Recommendations:

Nearly 400 rock rip-rap grade control structures (hereafter GCS), were recently placed in streams of western Iowa, USA to reduce streambank erosion and protect bridge infrastructure and farmland. In this region, streambeds are dominated by silt and sand substrates and normally support low macroinvertebrate abundance and diversity. Therefore GCS composed of rip-rap may provide critical habitat for benthic macroinvertebrates. Macroinvertebrate abundance and diversity were greatest at sites with coarse substrates (cobble/boulder), including GCS sites and one natural riffle site. Densities of several families in the orders Ephemeroptera (Baetidae, Heptageniidae, Isonychiidae, Tricorythidae), Trichoptera (Hydropsychidae, Hydroptilidae), Diptera (Chironomidae, Empididae, Simuliidae), Coleoptera (Elmidae), and Acariformes responded positively to increased substrate particle size (adj. $r^2 > 0.19$, $P < 0.031$) and were abundant on GCS riprap. With possible exception of flow velocity and depth that were highly correlated with particle size, no other measured environmental variable was significantly related to macroinvertebrate assemblage characteristics ($P > 0.05$). Local increases in macroinvertebrate density, biomass, and diversity at GCS may increase efficiency of ecological processes (e.g., rates of physical and chemical destruction of organic matter) in streams, and provide enhanced food resources for aquatic vertebrates. Grade control structures (GCS) may restrict fish passage and affect fish assemblage structure. We used mark-recapture methods to evaluate fish passage over a total of five GCS ranging in slope (run:rise) from 13:1 to 18:1. Three structures, over which limited fish movement was documented from 2002–2004, were modified in the winter of 2004–2005 to facilitate fish passage. Channel catfish *Ictalurus punctatus*, yellow bullhead *Ameiurus natalis*, black bullhead *Ameiurus melas*, and creek chub *Semotilus atromaculatus*, were documented passing over at least one structure, with the majority of movements (92%) over GCS in the upstream direction. In addition, we evaluated differences in fish assemblages and habitat variables in reaches immediately downstream from GCS and reaches at least 1 km from any GCS, and investigated longitudinal changes in fish assemblages in this GCS fragmented stream. Reaches downstream from GCS were characterized by greater proportion of pool habitat, higher maximum depth, greater total fish biomass, and greater abundance of Centrarchidae, specifically largemouth bass *Micropterus salmoides*. Index of biotic integrity scores were fair (<43 on a 0–100 scale) and were not significantly different between GCS and non-GCS sites ($P > 0.117$). While 13 fish species were present from downstream of the furthest downstream GCS to the most upstream sampling location (a distance of 18 km fragmented by five GCS), 15 additional species exhibited truncated distributions not extending to the most upstream sampling location. The presence of GCS in streams of western Iowa is pervasive, with nearly every low order stream containing at least one in-stream structure. To sustain fish populations, management efforts should focus on constructing or modifying GCS to allow fish passage.