EFFECTS OF SMALL BARRIERS ON THE DISTRIBUTION OF SCULPINS (*COTTUS SPP.*) IN PUGET SOUND LOWLAND STREAMS

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ABSTRACT: Barriers to fish passage can prevent the migration of native fish which can have severe implications to their distribution and indirectly affect other components of the ecosystem. This has been recognized by managers in the past and barriers such as antiquated culverts, weirs and dams have been evaluated for passage of salmonids and other game fish, but not for benthic, non-game native fishes. In the Puget Sound lowlands, native sculpins (*Cottus* spp.) are an ecologically important component of stream ecosystems and one of the most numerous types of fish. We examined the distribution and relative densities of sculpins above and below barriers (primarily log or metal weirs) in 14 Puget Sound lowland streams using backpack electrofishing equipment. All species captured were identified, enumerated, and measured to total length (mm, sculpin and lamprey) or fork length (salmonids). Preliminary results indicate there was a precipitous decline in the abundance of coastrange sculpin (*C. aleuticus*) and prickly sculpin (*C. asper*) upstream of the barrier. Both species typically inhabit lower stream reaches and their ability to disperse to upper stream reaches appears to be often restricted by small barriers. Also, the few coastrange sculpin and prickly sculpin that were captured above barriers were larger than sculpins downstream of the barrier. In four streams, other sculpin species (shorthead sculpin [*C. confusus*], torrent sculpin [*C. rhotheus*], and/or riffle sculpin [*C. gulosus*]) were common in upper reaches but were rare below the barrier. This would suggest that barriers not only segregate sculpins species, but also select for larger individuals that can overcome the physical and hydrological effects of the barrier. Our study did not intend to determine specific passage requirements for sculpins, and thus further studies are needed to quantify what is a barrier. However, future management decisions in designing stream restoration projects should consider fish passage of native, non-game species that are ecologically important.

Introduction

King County Department of Natural Resources and Parks, and the U.S. Fish and Wildlife Service conducted a survey examining the distribution and relative density of sculpins above and below small barriers, primarily manmade weirs, in 14 Puget Sound lowland streams. This study was part of a broader status and trends monitoring to help understand the effectiveness of the WRIA 8 salmon recovery plan.

Funding for this study was provided by the Environmental Protection Agency and King County.

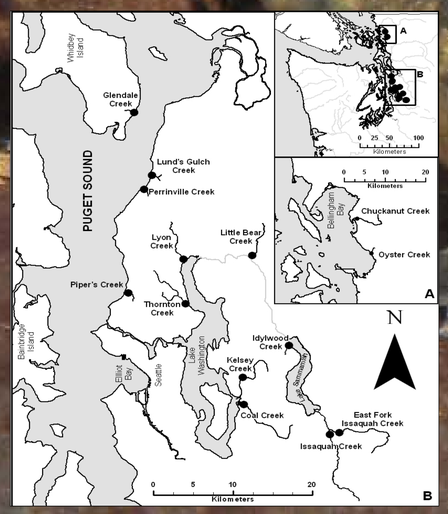


Figure 1: Map of 14 sampling locations

Methods

- Sites were selected using previous data that indicated sculpins were restricted in their upstream distribution
- Each site was composed of 12 to 16 habitat units (3-4 riffles and 3-4 pools directly below and above a barrier)
- Habitat data, i.e., length (m), average width (m), average depth (cm), max depth (cm), crest depth (pools only), and visual substrate percentage was collected at each habitat type
- Length, width, and perch height was collected at each barrier
- One-pass electrofishing was used to collect sculpin and other fish from each habitat unit. Fish collected were identified, measured for total length, and weighed

Results

- We collected fish distribution and density data on 14 sites (Figure 1)
- Five species of sculpin were collected throughout our surveys:
  - Coastrange sculpin; n = 6101
  - Prickly sculpin; n = 497
  - Riffle sculpin; n = 264
  - Shorthead sculpin; n = 1494
  - Torrent sculpin; n = 392
- At ten sites, coastrange and prickly sculpin were the only sculpins present. Upland sculpin (riffle, shorthead, or torrent sculpins) were present at the other four sites.
- Streams with upland sculpin were typically larger streams
- Coastrange and prickly sculpins were the dominant species below barriers while shorthead and torrent sculpins were dominant above
- Average densities of sculpins in both riffles and pools was higher below barriers than above (Figures 2 and 3)
- Many of the barriers were partial barriers; however, the few coastrange and prickly sculpin that were above the barriers were much larger than those below the barrier (Table 1)
- At three sites (Coal Creek, Lunds Gulch Creek and East Fork Issaquah Creek), the barrier was a series of log weirs that were used for stream restoration (Figure 4)

Table 1. Average and total length above and below barriers for five species of sculpin.

	Below		Above	
Species	Average Total Length (mm)	Total #	Average Total Length (mm)	Total #
Coastrange	**54.8**	6038	**89.2**	43
Prickly	**61.9**	484	**111.8**	13
Riffle	66.8	13	64.7	251
Shorthead	54.3	21	54.3	1473
Torrent	77.3	28	62.5	364

Prickly Sculpin

Roger Tabor and prickly sculpin

Figure 2. Average density of sculpins in riffles above and below barriers for 14 sampling sites.

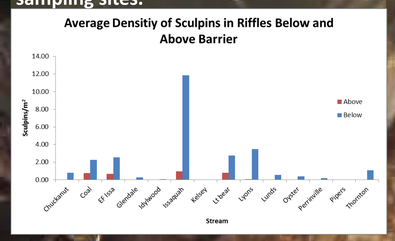


Figure 3. Average density of sculpins in pools above and below barriers for 14 sampling sites.

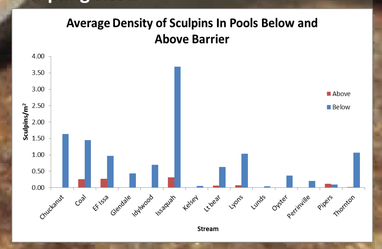
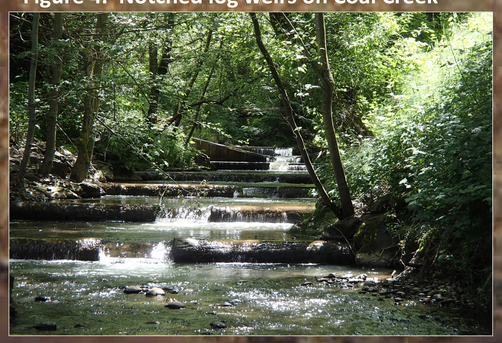


Figure 4. Notched log weirs on Coal Creek



Summary

- The replacement of antiquated culverts with notched log or concrete weirs to create step pool habitats, provide grade control and to allow migrating salmonids to access upstream spawning areas has opened up miles of previously blocked habitat throughout Washington State.
- However, despite our best intentions to reconnect fragmented streams and rivers for native fishes, these structures have had fractious consequences to the populations of native sculpins.
- We have found that where these structures have been placed there is a distinct difference in the population structure of native sculpins above and below.
- Our study also suggests that barriers not only segregate sculpins species, but also select for larger individuals that can overcome the physical and hydrological effects of the barrier.
- Our study did not intend to determine specific passage requirements for sculpins, and thus further studies are needed to quantify what is a barrier. However, future management decisions in designing stream restoration projects should consider fish passage of native, non-game species that are ecologically important.