

Alberta Conservation Association 2015/16 Project Summary Report

Project Name: Swan River Arctic Grayling: A Stock and Watershed Connectivity Survey

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Partnerships

Alberta Environment and Parks

Key Findings

- Nearly one-quarter of fish habitat in the Swan River watershed has been fragmented by culverts, creating barriers to fish passage.
- We captured a total of 431 Arctic grayling, most of which were immature; only six were adult fish.
- Catch rates were lowest in streams that had the highest levels of fragmentation.

Introduction

Arctic grayling populations have experienced drastic declines, some up to 90%, in Alberta since the 1950s (ASRD 2005). Declines in Arctic grayling abundance have largely been attributed to habitat degradation and fragmentation, as well as overfishing. Because stream and river connectivity are vital for this highly migratory species, poorly installed crossings (i.e., culverts and bridges) negatively impact grayling populations by impeding upstream fish passage and degrading fish habitat. The Swan River grayling population has been adversely affected by an extensive road network and a high stream crossing density associated with industrial development throughout the watershed. Previous surveys showed that 74% of culverts in the Swan River watershed act as barriers to fish passage and prevent fish from accessing 20% of the headwaters (Tchir et al. 2004). In 2015, we reassessed the distribution, relative abundance and population structure of Arctic grayling (≥ 150 mm fork length; FL) and the level of fragmentation due to stream crossings in the Swan River watershed. These data will aid in the development of the provincial Arctic grayling Fish Sustainability Index and will also be used to support the development of regulatory actions to remediate the effects of industrial activities on Arctic grayling stocks and their habitats.

Methods

From June 28 to July 31, 2015, we conducted stream crossing assessments throughout the Swan River watershed using the Government of Alberta Watercourse Crossing Inspection Protocol (Government of Alberta 2015). We assessed crossings by structure type, erosion potential, debris blockages, and pool depth, and by whether culverts were damaged, sloped or perched. To determine the degree of habitat fragmentation, we analyzed crossing data to identify fish barriers that isolate upstream reaches and measured the total distance of fragmented streams.

We sampled fish using fly fishing and spin-cast angling gear. In crews of two, we angled each site in all habitat types, in an upstream direction for 90 minutes. We measured lengths (FL) of all fish and released them. We expressed relative abundance as catch-per-unit-effort at each site.

Results

We assessed 218 stream crossings in the Swan River watershed, 176 of which were in flowing streams. Of the 176 crossings, we identified 131 culverts that impede fish passage. These barriers resulted in 737 stream-kilometres of fragmented habitat, which prevent migrating fish from accessing 24.8% of the watershed (Figure 1). The proportion of habitat fragmentation was greatest in small-order streams (Table 1).

Table 1. Severity of habitat fragmentation as a result of watercourse crossing barrier in the Swan River watershed in 2015.

Stream	Total (km)	Fish barrier		
		Connected (km)	Fragmented (km)	Habitat reduction (%)
1	1,559.5	1,114.4	445.1	28.5
2	626.3	443.7	182.7	29.2
3	366.7	291.6	75.1	20.5
4	227.3	193.5	33.8	14.9
5	101	101.0	0.0	0.0
6	86.2	86.2	0.0	0.0

Across 62 sites, we captured 431 Arctic grayling, ranging in size from 60 to 315 mm FL and averaging 167 ± 56.5 mm. Catch rates for immature grayling (150–282 mm FL) ranged from 0 to 13.5 fish/h and averaged 1.48 fish/h ($n = 280$) (Figure 2). Low catch rates of adult fish ($n = 6$) prevented us from calculating adult catch rates. We did not capture grayling at 13 (21%) of the sampled sites, 6 of which had associated fish barriers downstream. Catch rates were highest in fourth- and fifth-order streams and lowest in third-order (i.e., most fragmented) streams.

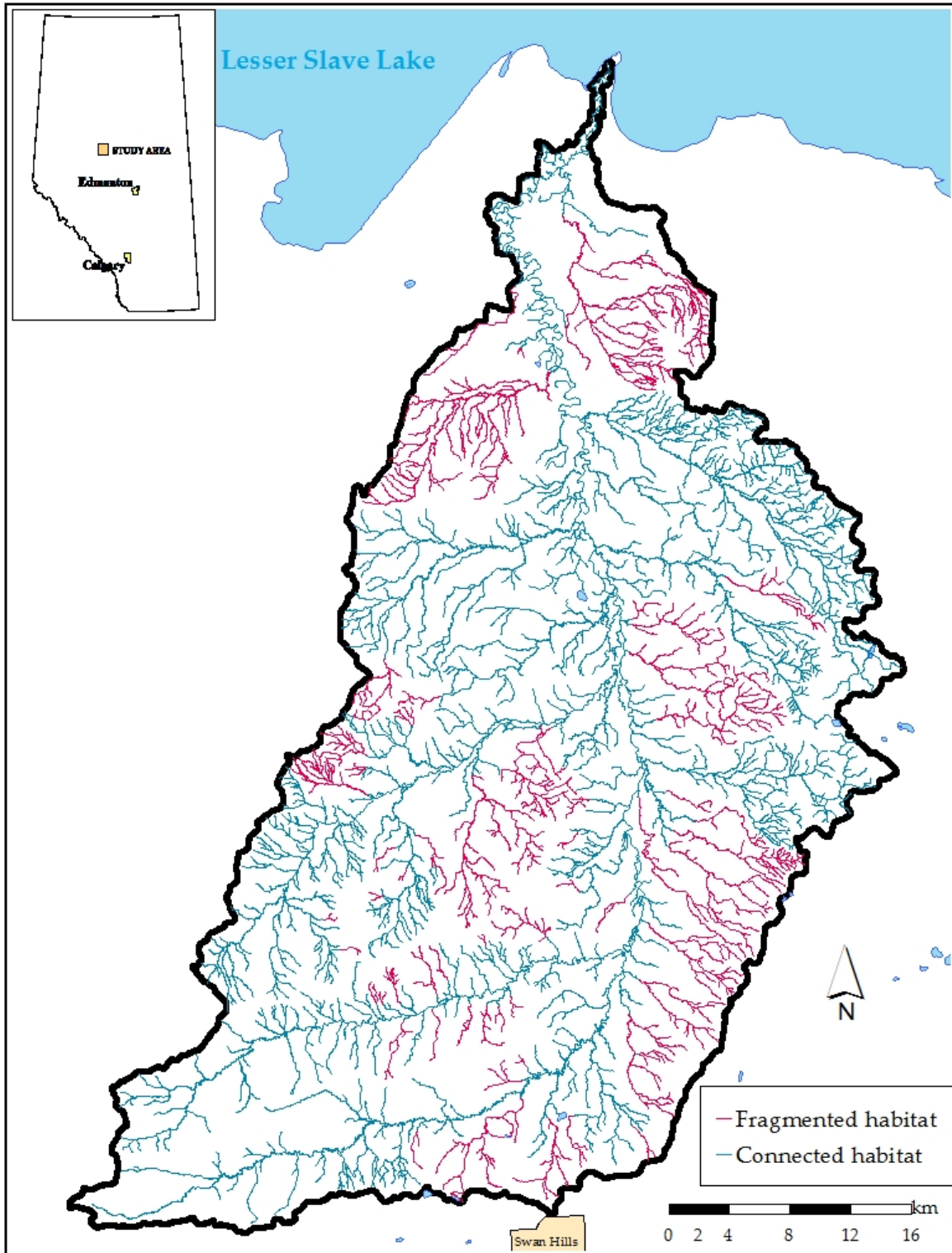


Figure 1. Stream fragmentation as a result of fish barriers identified in the Swan River watershed in 2015.

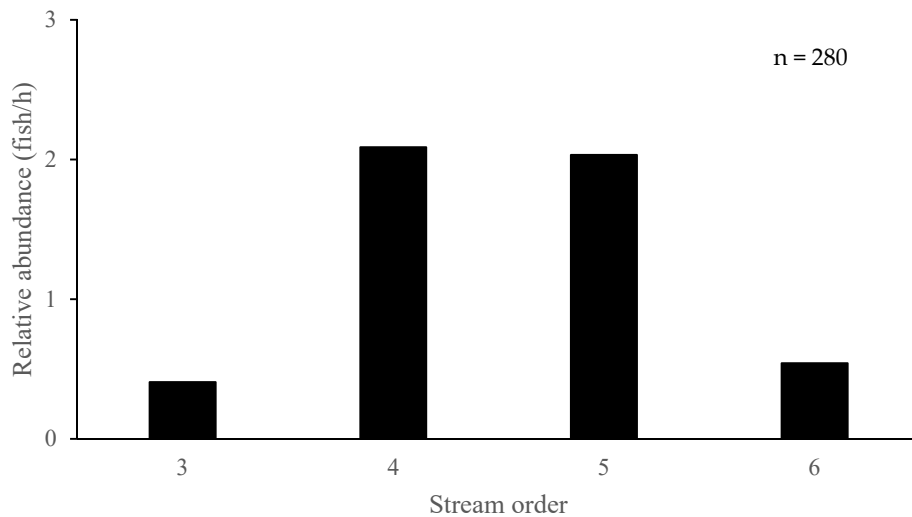


Figure 2. Relative abundance of immature Arctic grayling (150–282 mm FL) captured by angling in streams in the Swan River drainage in 2015.

Conclusions

Stream crossings have had a widespread impact on the Swan River Arctic grayling population. We found that most crossings in this watershed are creating barriers to fish movement. The effects of severe fragmentation in the watershed are evident from our catch rates, which were significantly lower in more fragmented streams than in non-impeded streams. Similarly, only a small number of adult fish were encountered in mainstem streams. Restoring connectivity within the Swan River watershed could contribute to maintaining Arctic grayling populations in this region.

Communications

- Prepared final data report.

Literature Cited

Alberta Sustainable Resource Development (ASRD). 2005. Status of the Arctic grayling (*Thymallus arcticus*) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 57, Edmonton, Alberta. 57 pp.

Government of Alberta. 2015. Roadway watercourse crossing inspection manual. Available online at <http://esrd.alberta.ca/lands-forests/land-management/documents/RoadwayWatercourseCrossManual-Mar13-2015.pdf>.

Tchir, J.P., P.J. Hvenegaard, and G.J. Scrimgeour. 2004. Stream crossing inventories in the Swan and Notikewin river basins of northwest Alberta: resolution at the watershed scale. Pages

53–62. *In*: G.J. Scrimgeour, G. Eisler, B. McCulloch, U. Silins, and M. Monita, editors. Forest–Land–Fish Conference II – Ecosystem Stewardship through Collaboration. Proceedings of the Forest–Land–Fish Conference II, April 26–28, 2004, Edmonton, Alberta.

Photos



Adult Arctic grayling captured in the Swan River in 2015. Photo: Brad Hurkett



An example of one of many perched culverts that fragment fish habitat in the Swan River watershed. Photo: Troy Furukawa



Andrew Clough (Alberta Conservation Association) angling for Arctic grayling in a small stream
Photo: Dave Jackson