

2003 Fish Survey in Recently Dewatered Western Irrigation District Irrigation Canals

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November 2003

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1.0 Executive Summary

Headwater canals within the Western Irrigation District irrigation system were sampled for fish by AQUALITY Environmental Consulting Ltd. on October 8 and 9, 2003 following the fall canal dewatering. The purpose of this work was to (i) identify species of fish collected in the canals, (ii) quantify fish from pre-selected pools, (iii) comment on the condition of fish, (iv) comment on the significance of the number of fish collected, and (v) suggest potential remediation measures to minimize fish loss. Several sites along canal A and B were inspected downstream of Chestermere Lake, and eight holding locations (pools) were identified.

Of the eight sites identified as potential holding pools, seven were found to be inhabited by fish. Longnose Sucker (*Catostomus catostomus*) was the most abundant fish species found in the canal system, followed by Northern Pike (*Esox lucius*) and both were represented by mostly small size classes. Other fish found in the survey included Mountain Whitefish (*Prosopium williamsoni*), Rainbow Trout (*Oncorhynchus mykiss*), Brown Trout (*Salmo trutta*), Yellow Perch (*Perca flavescens*) and Spottail Shiner (*Notropis hudsonius*).

The majority of fish collected were in good health, with no apparent lesions or ectoparasites. A few of the larger fish had fresh scrapes or bite marks from recent encounters. The numbers and sizes of fish collected in 2003 were much smaller than those collected in 2002. More intensive sampling will be required to determine if the amounts of fish collected accurately reflect the numbers of fish trapped in the system. More study will also be required to determine if the loss of fish has a significant impact on their populations. Some suggested solutions to minimize fish entrapment in the WID canal system are to:

- (i) exclude fish from entering into the canal works,
- (ii) eliminate deep pool habitat within the canal system that fish find favorable,
- (iii) rescue fish from concentrated, predictable locations for re-release back into the Bow River following fall dewatering,
- (iv) provide a flushing process to herd the fish into deeper water bodies, or
- (v) do nothing and monitor the status quo.

2.0 Introduction

The Western Irrigation District (WID) has been providing water to agricultural operators in southern Alberta since 1907. Water is withdrawn by a diversion structure on the Bow River immediately downstream of the Calgary Zoo. Several species of fish also make their way into the WID canal system. Canal waters flow east through Chestermere Lake, then flow southeast to Langdon, Strathmore and Gleichen, and north and east toward Standard and Rockyford. The Bow River water source is world-renowned for its blue-ribbon trout fishery, and boasts over 3000 trout per mile of river (McLennan 1998). The growth of the Bow fishery began with Rainbow Trout stocking efforts in the mid-1920's, which parallels the timelines of irrigation growth. It is not currently known how many fish make their way into the WID diversion and how many of these become trapped in the WID irrigation canal system.

To gain some understanding of the magnitude of potential fish impact, the WID hired *Aquality* Environmental Consulting Ltd. to identify and quantify fish stranded following the normal fall dewatering (i.e. when diversion activities cease and canals are allowed to run dry) in 2002 and again in 2003. Canal dewatering typically occurs around the Canadian Thanksgiving weekend in October, and can take up to a week for the canals to drain. The majority of fish are assumed to move to the safety of deeper waters within the canal system such as Chestermere Lake, Langdon Reservoir and Bruce Lakes during the dewatering process. However, some fish do remain in the deeper pools of the canals. The purpose of this work was to (i) identify the species of fish encountered, (ii) quantify fish encountered, (iii) comment on the condition of stranded fish, (iv) comment on the significance of the amounts of fish stranded, and (v) suggest potential remediation measures. As WID previously hired *Aquality* in 2002 for the same purpose, the four common sites sampled from the 2002 study will be compared to the results from the 2003 sites.

3.0 Methods

Headwater canals within the Western Irrigation District were sampled by *Aquality* Environmental Consulting Ltd. on October 8 and 9, 2003 following the fall canal dewatering. Fish capture was authorized by Fish Research Licence No. 03-1551-FR. Sites immediately downstream of Chestermere Lake were selected along canals A and B. Eight sites were identified by WID operations staff, based on the four sites that had fish in the 2002 survey, plus four additional sites which had deep enough water to hold fish (Figure 1). Deep water was typically found immediately downstream of large drop-structure where a plunge pool was an integral part of energy dissipation.

Seine nets (20m long by 2m deep, mesh size approximately 5mm) were used to block downstream passage of fish (where necessary), while pools were seined with a smaller (5m long by 1.5m deep, mesh size approximately 5 mm) two-man pocket seine net. Seine hauls were made through the sites until fish were no longer collected. Seining was effective at sites that were less than 1m deep, and less effective at increasingly deeper sites.

4.0 Results

4.1 Results Summary

The October 8 and 9, 2003 WID canal sampling locations appear in Figure 1. Sites were visited by Jay White, Wes Sproule and Dwight Gittel (Figure 2). A summary of the number of fish collected appears in Table 1. Fish were collected at seven of the eight sites visited, but the majority of fish were very small (< 10 cm). Of the four sites sampled both this year and last year (Sites 1, 4, 6 and 8), there were 55% fewer fish collected this year (Figure 3 and 4). Three sites immediately downstream of Chestermere Lake (Sites 1, 4 and 8) contained the majority of fish found on canals A and B. One new species, Spottail Shiner, was collected this year that was absent in 2002.

Table 1: Numbers of fish seined by *AQUALITY* on October 8 and 9, 2003 along eight dewatered WID canal headwater sites.

Site	Northern Pike	Mountain Whitefish	Longnose Sucker	Rainbow Trout	Brown Trout	Yellow Perch	Spottail Shiner
1*	25(29)	9(19)	8(7)	4(0)	0(0)	0(0)	0(0)
2	0	0	13	0	0	2	0
3	0	0	5	0	0	0	0
4*	0(0)	13(0)	178(0)	1(0)	0(0)	0(0)	2(0)
5	2	0	2	0	0	0	0
6*	0(0)	0(0)	0(3)	0(0)	0(0)	0(0)	0(0)
7	1	0	0	1	1	0	0
8*	43(139)	2(9)	1(24)	5(23)	0(2)	14(1)	0(0)

*sites marked with an asterisk were also sampled last year (see Table 2 for concordance).

Table 2: Concordance of sites sampled in 2002 and 2003.

	Site Number			
2003	4	1	6	8
2002	1	2	3	7

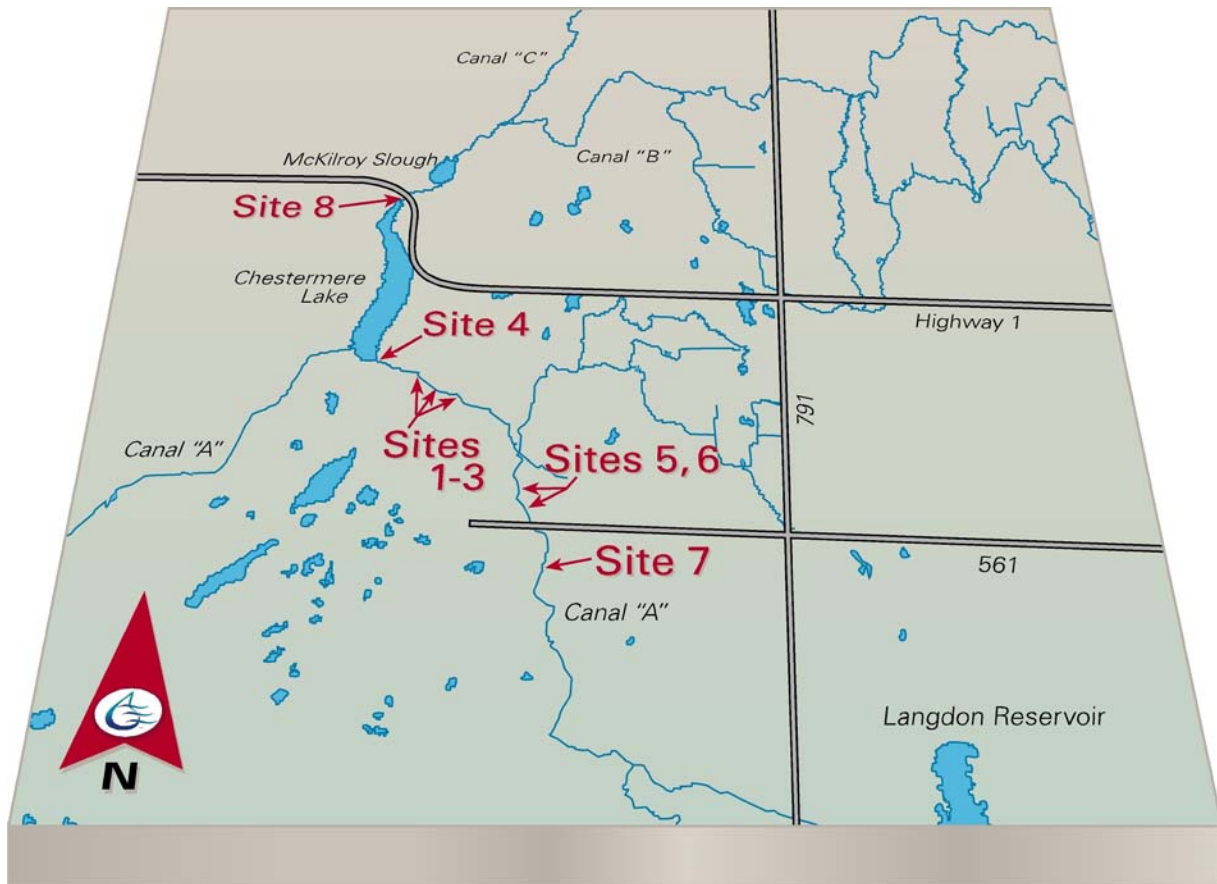
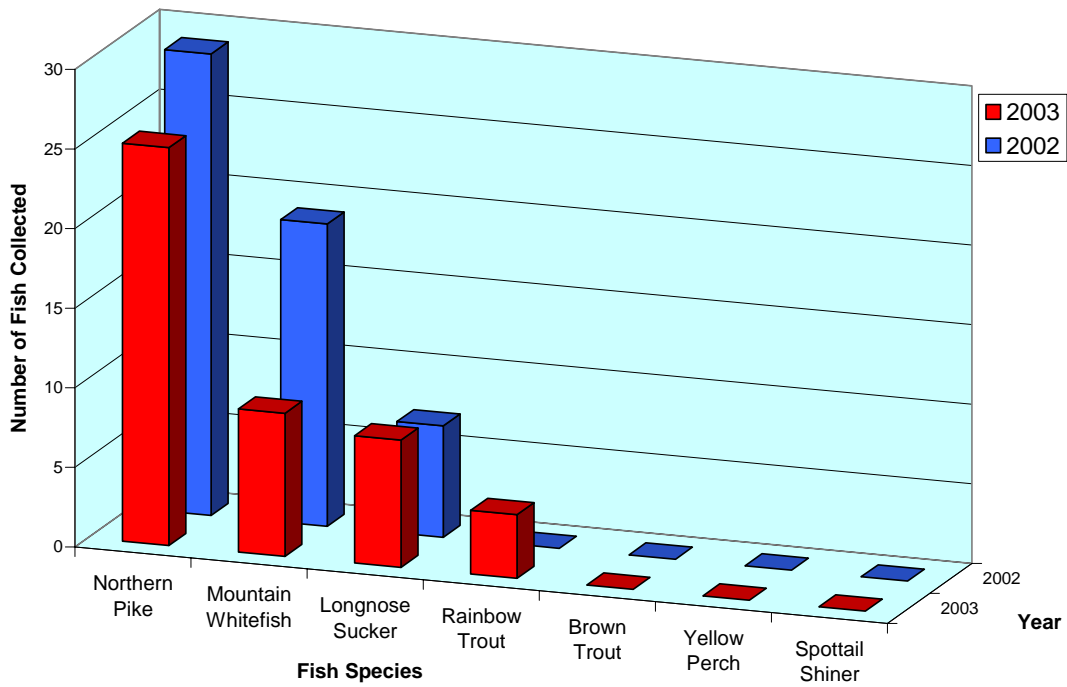


Figure 1: Sites sampled by AQUALITY on October 8 and 9, 2003 along dewatered WID canal headwater sites.



Figure 2: The author poses with one of the largest Rainbow Trout captured during the study.

Site 1 Comparison of Species Collected 2002-2003



Site 8 Comparison of Species Collected 2002-2003

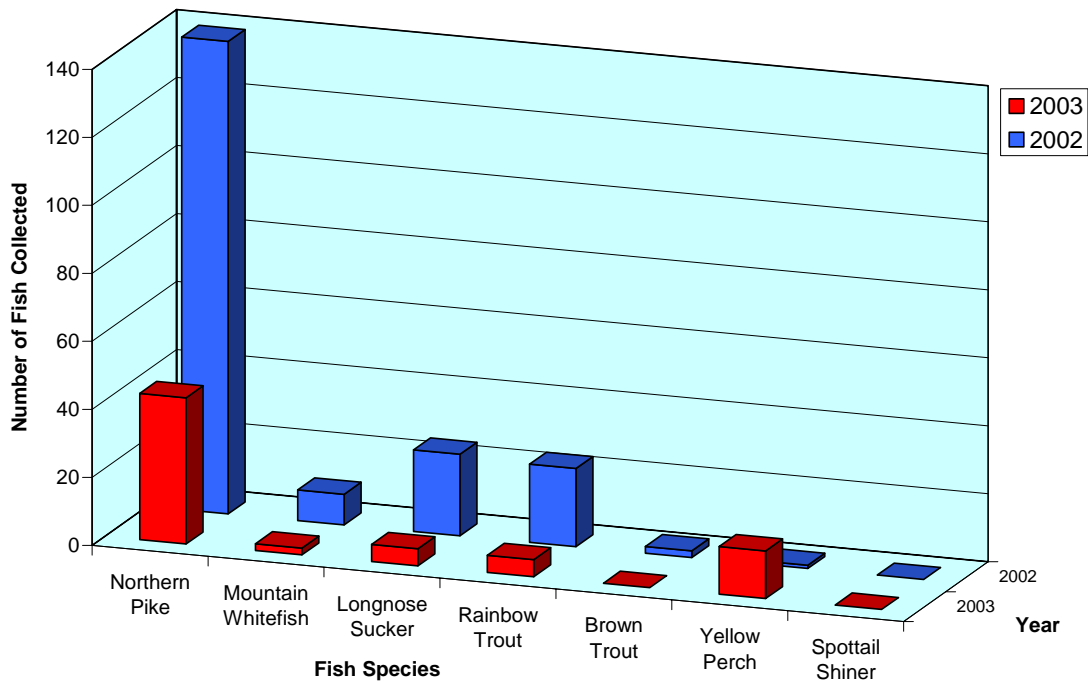


Figure 3: Comparison of numbers and fish species collected in 2002 versus 2003 for Sites 1 and 8.

4.2 Detailed Site Results

Site 1: Seine samplings were limited to upstream of the deepest waters, where nets were effective and could touch bottom. The large, deep pool under the railway tracks was inaccessible to seine netting. Gill nets were used under the railway crossing bridge, and fish were removed from the nets immediately to minimize fish mortality.

Site 2: Seine sampling occurred downstream of Site 1, in a 100m long haul of the canal. Rocks along the canal bottom may have impaired our ability to thoroughly sample this site.

Site 3: Seine sampling occurred upstream of Site 1, in a 100m long haul of the canal. Rocks along the canal bottom may have impaired our ability to thoroughly sample this site.

Site 4: Three samples were taken at the bottom of the drop structure of canal A at the main gate (the outfall at the southeast corner of Chestermere Lake). The pool was isolated, shallow and sampled thoroughly.

Site 5: Samplings were taken 3 km downstream of canal A headgates, downstream of the rock weir using a seine net. The pool was not isolated and the water depth was 1-1.5 m throughout.

Site 6: Samplings were taken 3 km downstream of canal A headgates at the rock weir using a 4" gill net. Thick aquatic vegetation prevented the use of seine nets. The pool was not isolated, and the water depth was 1-2 m throughout.

Site 7: Samplings were taken 6 km downstream of canal A headgates at drop structure 1, 1 km south of Glenmore. The pool was not isolated and the water depth was 1-1.5m throughout.

Site 8: Samplings were taken immediately downstream of canal B between drop structure 1 and Highway 1. The deepest pool was found below a large culvert draining into the canal on the east side. The pool was not isolated, and the water depth was 1-2 m throughout. Large rocks on the canal bottom may have prevented us from thoroughly sampling this site.

5.0 Conclusions and Recommendations

5.1 Summary of fish collections

Seven of eight pre-selected sites along the upper headwaters of the Western Irrigation District canal system downstream of Chestermere Lake were inhabited by fish. Fish species collected (in order of abundance) were Longnose sucker minnows (*Catostomus catostomus*), Northern Pike (*Esox lucius*), Mountain Whitefish (*Prosopium williamsoni*), Rainbow Trout (*Oncorhynchus mykiss*), Yellow Perch (*Perca flavescens*), Spottail Shiner (*Notropis hudsonius*) and Brown Trout (*Salmo trutta*). All fish collected were in good condition, and had no obvious lesions or ectoparasites. A few of the larger fish had fresh scrapes or bitemarks from recent encounters.

5.2 Significance of findings

Assuming that all of the fish collected in this survey will die throughout the winter months, then it follows that the species and proportions of fish collected in this survey represent the species and proportions of fish removed from the system yearly (i.e. mostly Longnose Sucker, some Northern Pike, Mountain Whitefish and to a much lesser extent Rainbow Trout, Brown Trout Yellow Perch and Spottail Shiner). Overall numbers of fish collected in 2003 were fewer than from 2002 for all species at duplicated sites, except for Rainbow Trout gillnetted from Site 1 and Yellow Perch minnows seined from Site 7. However, the deep pool at Site 1 was not gillnetted in 2002.

Our repeated seine samplings of isolated pools < 1m deep were quite effective in removing fish, however deeper sites were less effectively sampled. Further, it is quite possible that the majority of fish that are stranded in the WID canals are in the deeper pools that were the most difficult to sample. If this is true, then the number of fish trapped in deeper pools is underestimated. Some of the deep pools may provide for winter survival for some species, and so we cannot confirm that all fish are lost. Salvage licences from Sustainable Resource Development allow fish harvesting on some canal waters, which provides the local community with fish for a food source. Although the irrigation system lands are on private property, the sites are remote and the public are not bound to inform the WID of their activities.

To properly determine how many fish may be trapped in WID canals, future studies should identify how many deep pools exist in canals A, B, and C, and should quantify how many fish there are on average within each pool (by performing mark-recapture studies within these pools). With this information, the number of fish stranded in deep pools of the WID system could be more accurately quantified. Larger (deeper) seine nets, mixed-mesh gill nets, backpack

electroshocking and boat electroshocking should be considered for future sampling undertakings. The estimated total number of fish trapped along the entire canal network could then be compared to the source populations. To assess whether or not the loss of fish would have a significant impact on the population, each species will have to be addressed individually.

The Northern Pike collected in this study are likely to have originated from Chestermere Lake, which has an established pike fishery (Council 2001). This may explain why we saw many small pike in this study downstream of the lake. As well, due to the multiple age-classes of pike in Chestermere Lake (Council 2001), we assume that pike must also be safely overwintering there. Because of the suitability of shallow water in the canals for pike habitat, this species will likely be the most impacted by canal dewatering. By not including a measure of the abundance of these fish, we are likely to underestimate fish stranding. In this case, the underestimate is potentially very high because there are very long stretches of shallow water. Although pike were not caught at every site in this study, there existed suitable habitat for pike at every site visited.

The trout species collected in this study are likely to have originated from the Bow River, entering the canal at the WID headworks diversion. The Bow River contains a managed trout fishery, with different regulations for eight different sections of the River (Alberta Sustainable Resource Development 2002). There are specific regulations for catch limits specified for all trout species including Mountain Whitefish. The loss of the small number of fish identified in this survey are likely negligible when compared to the larger Bow River fishery. As well, the impacted fish populations were limited to localized deep pockets downstream of Chestermere Lake. The age of the trout observed (most were mature fish, 2 to 3 years) also raises the question of long-term trout survival within the system. We cannot assume that all fish collected in our study were not in the canal system last year. The apparent lack of smaller, younger trout may be attributed to the abundance of pike preying on these fish throughout the canal system.

5.3 Remediation options

There are several options for remediating the loss of fish in dewatered canals, if it is shown that the loss of these fish causes an adverse effect. For example, remediation measures for Northern Pike will be much more difficult than for any other species, because they were found spread throughout the canal system. Coldwater trout species however, were found concentrated in predictable locations (i.e. the deepest pools). Further, the source of the fish in the canal system is most likely from both outside the canal system (trout from the Bow River) and from within the system (Northern Pike and Longnose Suckers from the reservoirs along the Canal).

The suggested solutions to minimize fish entrapment in the WID canal system would be to:

- (i) exclude fish from entering into the canal works, though a major Provincial investment may not be warranted based upon the apparent fish loss,
- (ii) eliminate deep pool habitat within the canal system that fish find favourable if the structural requirements allow,
- (iii) rescue fish from concentrated, predictable locations for re-release back into the Bow River following fall dewatering if the fish can stand the stress of handling,
- (iv) provide a flushing process to herd the fish into deeper water bodies, or
- (v) do nothing and monitor the status quo.

The three types of fish exclusion structures are physical, behavioural and both. While the most logical place for a fish exclusion structure is at the WID diversion structure at the Bow River, having exclusion screens at the outflows from Chestermere Lake may also be effective at keeping coldwater (trout) species out of the rest of the system. However, these screens may not be effective for cool water (pike, perch and sucker) species.

If deep pool habitats are eliminated below drop structures, it may encourage fish to move to safe deep waters during fall dewatering (i.e. within Chestermere Lake or Langdon Reservoir). Deeper pools could be filled in with rocks to decrease their depths and make them less favourable to fish. However, this cannot be considered at sites where the pool depth is an integral part of energy dissipation. Further, this may need to be reconsidered where it is shown that fish are overwintering in some of the deepest pools.

If the majority of fish trapped in dewatered canals can be identified as originating from a few, predictable pools, then a fish rescue operation may mitigate some fish losses. How such an arrangement would work on WID private lands, for an operation that is outside of its irrigation mandate, would need further discussion.

Chemical astringents used for fish “herding” may be released into the canal headworks at the start of the dewatering phase to move the fish downstream to deeper water bodies. This would work well for Site 7, as the McKilroy slough is immediately downstream. This may also be an effective method to move fish from deeper pools to shallower locations downstream where they would be more easily captured.

Maintaining the status quo is also an option. The number of fish captured in this study and assumed to be lost would not indicate a major problem. Accepting some amount of operational loss has been the practice for the last 90 years. However, the WID intends to continue monitoring fish populations within the canals and to observe year to year variance. This report and the 2002 report will provide a basis to build upon and measure future changes.

6.0 References Cited

Council, T.C. 2001. Investigations into Northern Pike (*Esox lucius*) status in prairie region reservoirs, Alberta. Alberta Conservation Association, Lethbridge, Alberta. 142 p.

McLennan, J. 1998. Blue ribbon Bow. Johnson Gorman Publishers, Red Deer Alberta. 184 p.