



CENTRAL SOUTH ISLAND REGION

Sports Fish Harvest and Angler Use Dynamics of the Mackenzie Basin Hydro Canal Fishery During the 2015-2016 Sports Fishing Season

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Summary

The Mackenzie Basin hydro canal fishery incorporates the Tekapo, Pukaki-Ohau, and Ohau canals and according to the 2014/15 National Angler Survey is the most popular freshwater sports fishery in New Zealand. Angler use of the fishery has increased dramatically in recent years and this is attributed to the productivity of the fishery that is supported by inputs from the salmon farms that are present in each canal. The majority of brown and rainbow trout in the canals are wild fish that began life in the headwater tributaries to upstream lakes and migrated downstream through the lakes and into the canals. Salmon originate from within the canals as escapees from the salmon farms.

It is Fish & Game's role to ensure the sustainability of the canal fishery. Therefore to inform decision making around the management of the fishery a survey of sports fish harvest and angler use dynamics of the canal fishery was undertaken during the 2015-2016 sports fishing season. On 58 days during the 2015-2016 sports fishing season Fish & Game Officers counted anglers fishing the canals during daylight hours and interviewed them on 85 days both at the canals and via telephone on the completion of their day's fishing.

It was estimated that approximately 43,800 daily visits were made to the canal fishery by anglers during the 2015-2016 season and this resulted in approximately 44,500 sports fish being successfully caught with approximately 23,400 sports fish being harvested. The surveying method only accounts for angling activity during visible daylight hours therefore the results are likely to underestimate the true total use of the fishery and angler catch.

Salmon dominated the catch and harvest followed by rainbow trout and brown trout. Over half of the catch of rainbow and brown trout was released even with no size limit in place. Salmon and trout grow to extremely large sizes in the canals. This was most evident with rainbow trout as 38% of the rainbow catch was of 'trophy' size (10 lb+). Bait fishing was the most popular method used by anglers and for that reason accounted for most of the fish caught. The majority of canal anglers were not resident to the Central South Island Fish & Game Region, which highlights the appeal of the fishery to anglers throughout New Zealand.

The angler use and angler catch at the canal fishery during the 2015-2016 sports fishing season was directly linked to incidental breakouts of salmon and the inputs of salmon farms operating in the canals. If Fish & Game wish to maintain angler use and catch near 2015-2016 levels it may be helpful to predict a range of salmon farming operational changes, the resulting outcomes for the fishery, and reactionary measures that Fish & Game could employ to counteract the changes. This could be done by maintaining and enhancing relationships with salmon farm managers to help forecast any operational farming changes. Management options would likely need to replicate 'break-outs' of salmon from farm pens and/or beneficial inputs of fish food and by-product from salmon farms.

Introduction

The Mackenzie Basin hydro canal fishery incorporates the Tekapo, Pukaki-Ohau canals and the Ohau canals between the Lake Ruataniwha outlet and Ohau C power station. The 2014-2015 National Angling Survey (NAS) reports that the Mackenzie Basin canal fishery attracted 88,650 angler days for that sports fishing season making it the most utilised sports fishery in New Zealand (Unwin 2016). The use of the canals by anglers has increased dramatically in recent years, the previous NAS, undertaken during the 2007-2008 sports fishing season recorded only 10,730 angler days for the fishery. Between the two most recent National Angling Surveys, angler use of the canal fishery increased more than 8-fold.

The popularity of the canal fishery for anglers can be predominantly attributed to the presence of salmon farms in the canals. The input of salmon food and farming by-products into the fishery allows wild trout growth rates to skyrocket to a level where world record size trout are caught and targeted. Additionally, salmon (*Oncorhynchus tshawytscha*) intermittently escape the farms in a range of sizes and numbers. Salmon are highly valued by anglers for their eating quality. Other factors that are likely to contribute to the fisheries popularity are: accessibility for motor vehicles, the scenic high country setting near holiday destinations and permissive fishing regulations. During the 2015-2016 season, salmon farms were located on four sections of the canals: the Tekapo Canal near the stilling basin, the Pukaki-Ohau Canal near the junction of the Pukaki and Ohau "A" canals, the Ohau "B" Canal next to the SH8 Bridge and on the Ohau "C" Canal between the Ohau B and Ohau C power stations.

Trout populations in the canals are maintained by the downstream migration of brown trout (*Salmo trutta*) and rainbow trout (*Oncorhynchus mykiss*) from Lakes Tekapo, Pukaki and Ohau through the power generation and water control structures. Trout spawning in the Upper Ohau River and escapement or release of chinook salmon from salmon farms operating within the canals also contribute stock to the canals. Trout and salmon spawning occurs within the canals but the hatching success of these redds is predicted to be low due to the ever fluctuating canal flows and suboptimal substrate sizes.

Maintaining the popularity of the canal fishery is reliant on wild trout populations being harvested at sustainable levels, the regular capture of large fish and the availability of relatively easy to catch salmon that have escaped from the salmon farms. Both the capture of salmon and large trout are reliant on the inputs from salmon farms operations into the canals. If the salmon farms cease to operate or significantly reduce their inputs then the canal fishery we have today will reduce accordingly.

For trout in particular, Fish & Game have a responsibility to ensure that the populations are not at risk of over-harvest. There is no existing evidence, scientific or anecdotal, to suggest that the current levels of angler use and the resultant sports fish harvest is unsustainable. However, should the popularity of the fishery continue to increase, and the frequency of salmon 'break-outs' from the farms decrease, it is possible that issues of over-harvest could arise.

The sports fishing regulations in place for the canal fishery during the 2015-2016 sports fishing season were: Open season- 1 October to 30 September; Methods - Fly, spin and bait; Bag Limit- 4 sports fish of which no more than 2 to be trout, no person shall in any one day take or be in possession of more than two salmon greater than 500mm and a minimum size limit 300mm for salmon only.

To make informed decisions relating to setting of sports fishing regulations that ensure the sustainability of the fishery, a survey of angler harvest and fishery use was undertaken during the 2015/2016 sports fishing season. This report summarises the survey effort involved and the findings.

Survey Programme

During the 2015/2016 sports fishing season beginning on October 1 2015, and finishing on September 30 2016, angler interviews and angler counts were undertaken by Fish & Game Officers on the Mackenzie Basin Canal fishery on selected dates.

Angler interviews were undertaken as part of regular licence and regulation compliance checks by the officers. Anglers were asked if they wished participate in a survey, which the majority of anglers (~95%) agreed to. Questions were asked at the time of the compliance check and a phone number was collected so that the angler could be interviewed the next day, once their current day's fishing had been completed. Additional interview dates were collected where an angler could provide a completed daily angling report from the day prior to the Officer interview or if during the phone conversation the following day, the angler had completed that day's fishing. The interviewers collected information relating to: the anglers primary method, fishing location, time spent fishing, and fish species caught (successfully landed), whether that fish was kept or released and the estimated weight of each fish.

Angler counts were undertaken to estimate the total number of anglers fishing the canals on each survey day. 1-4 counts were completed daily during visible light hours. The full length of the canals were driven continuously and all anglers observed from the road side were counted. Binoculars were used at times for assistance. Angler counts were undertaken throughout the day and each individual count was represented by the middle minute of the duration of the count (1-1.75 hours). The angler counts were spread throughout the day to capture the variability of angling use as a result of traditional angler behaviour or as a reaction to changing weather. Beyond the view of binoculars the section of the Tekapo Canal without vehicle access was not included in the angler counts. From experience, this section is believed to be fished by the occasional anglers only. Due to staff resourcing and perceived angler detectability issues, no night time angler counts were completed. Therefore the survey only estimated harvest from approximately dawn until dusk (visible day-light hours). The section of the Tekapo Canal between Tekapo A power station and SH8 was only surveyed on approximately 50% of angler counts, therefore a factor was calculated from known data and applied to the other 50% of counts.

Surveys were undertaken on randomly selected dates throughout the sports fishing season with additional survey days occurring when staff had available time while working in the Mackenzie Basin. Survey effort was stratified into 20 strata, to target periods or days of either known or perceived increases in fishery use by anglers, under the rationale that a greater number of anglers have a greater potential to harvest a higher number of fish. Bi-monthly variation in angler effort at the canal fishery was established by NIWA when undertaking the 2014/2015 NAS and this was incorporated into survey design. Bi-monthly periods were designated letters with 'A' to 'F'. Within the bi-monthly survey periods survey effort was further stratified to account for anglers reasons to have time to fish. For example public holidays and weekends within the school holidays were considered different strata to a non-holiday weekday. Reason to fish were allocated a number from '0' to '3'. So the resulting 20 strata are identified by period and number e.g. A0 or B2, etc.

Results

Over the season a total of 1,698 individual anglers were interviewed and these interviews provided 2,261 records of daily activity. Sixty-one scheduled survey days produced 85 days for which daily interview data was collected. One hundred and seventy-six angler counts were completed on 58 of the 61 scheduled survey dates.

Angler use of the canal fishery

Total daily angler counts (daily fishery visits) were estimated by using an 'area under curve' (AUC) method. This method predicts a pattern or 'curve' of angler counts over a specified day length from actual angler counts recorded at specific times. The counts are measured as total AUC minutes/hours. AUC hours were then divided by the actual average number of hours that angler, fishing within the associated strata, fished for and the result is a predicted total daily angler fishery visit count that represents 1 day within the strata.

As no angler counts were completed in darkness hours the method assumes there were no anglers fishing at night, therefore, angler counts represent visible daylight hours only. The data presented in Table 1 below displays a summary of daily, period and seasonal angler visits to the canal fishery. Refer to Appendix A for a full breakdown of angler counts to stratum level.

Table 1. Estimated angler fishery visits during the 2015-2016 sports fishing season.

Period	Days in period	Approx. daily visits	Total period visits	% seasonal effort
October - November	61	140	8,513	19
December - January	62	167	10,340	24
February - March	60	156	9,361	21
April - May	61	104	6,355	15
June - July	61	77	4,678	11
August - September	61	75	4,576	10
15-16 season Total	366		43,823	

Inter-canal angler use

Anglers fishing the canals were observed to be mobile and across the survey all areas within each canal were fished, however there were specific areas that received far more use. These areas include those: adjacent to salmon farms, power station intake penstocks and tailrace outflows, and canal intake control gates.

Anglers also moved between canals within a day's fishing. Seventy-six percent of anglers only fished one canal daily, 21% of anglers fished two canals daily, 3% of anglers fished three canals daily, while less than 1% of anglers fished all four of the canals on a daily basis. By applying the multiple canal daily visit percentages to the total season daily fishery visits (43,823), seasonal daily canal visits was estimated to be 56,186.

Sports fish harvest

Sports fish catch and harvest for each sports fish species were estimated for each of the 20 strata within the six bi-monthly periods (Appendix A) and then combined to calculate total bi-monthly period values and total season values (See Table 2). Refer to appendix A for a full break down of the catch and harvest result.

As only a proportion of possible days in each stratum was surveyed, individual stratum data were averaged to estimate the 'representative' daily stratum values, which included angler fishing hours, harvest rate and catch rate of each sports fish species. These figures were then multiplied by the number of days within the stratum and the angler count as estimated using an area under the curve 'AUC' calculation method. The data presented in Table 2 below displays a summary of period and seasonal angler catch and harvest and includes small rounding errors. Appendix B provides a full breakdown of results to stratum level and includes the calculated statistical error for each estimate.

Table 2. Estimated sports fish catch and harvest at the Mackenzie Basin canal fishery during the 2015-2016 sports fishing season.

Period	Brown trout		Rainbow trout		Salmon	
	Caught	Harvested	Caught	Harvested	Caught	Harvested
October - November	355	180	1,822	1,028	7,929	5,305
December - January	921	410	1,450	1,084	4,551	2,700
February - March	769	628	1,506	892	3,325	1,749
April - May	770	132	2,687	826	4,350	2,134
June - July	496	20	1,496	399	6,728	3,961
August - September	582	308	1,179	438	3,579	1,221
Season Total	3,893	1,678	10,139	4,666	30,461	17,070

In total it is estimated that approximately 44,500 sports fish were successfully landed (caught) by anglers during 2015-2016 sports fishing season at the canal fishery. Approximately 23,400 of these fish were harvested by anglers and approximately 21,100 were released. Salmon made up 68% of total sports fish catch and 73% of total harvest. Rainbow trout made up 23% of the total catch and 20% of the total harvest. Brown trout made up approximately 9% of total catch and 7% of total harvest.

3,893 ± 900 brown trout were caught and 1678 ± 598 harvested. Brown trout were the least caught sports fish at the canals, and approximately 43% of successfully landed brown trout were harvested. Rainbow trout catch and harvest more than doubled those of brown trout. 10,139 ± 1,446 rainbows were caught and 4,666 ± 798, approximately 45% of successfully landed rainbow trout, were harvested. Salmon catch and harvest were approximately 10 times greater than those for brown trout and 3 times greater than those for rainbow trout. 30,461 ± 2,965 salmon were caught and 17,070 ± 2,019 harvested. Approximately 56% of salmon were harvested.

The size make-up of the catch

To estimate the size distribution of the fish populations the angler-estimated weight of each fish was collected during interview so long as the angler could estimate the weight of every fish of each species they caught on the survey day. The angler-estimated weights of 160 brown trout, 334 rainbow trout and 888 salmon were recorded. The results are presented in Table 3 below and rather than metric kilograms, fish weights are presented in pounds (lb) as that is the most common fish-weight measurement used by sports fishing anglers.

Table 3. Size-class make-up of angler caught sports fish at the Mackenzie Basin canal fishery during the 2015-2016 sports fishing season.

Size class (lb)	Brown trout		Rainbow trout		Salmon	
	%	Est catch 15-16	%	Est catch 15-16	%	Est catch 15-16
Less than 1.5	13	506	14	1457	30	9263
1.5 - 9.9	69	2686	48	4827	63	19,242
10 - 19.9	17	662	29	2914	6	1922
20+	1	39	9	941	1	34
total		3,893		10,139		30,461

In Table 3 size classes have been subjectively selected. The class 'less than 1.5 lb' has been used to represent the size of fish many anglers would consider too small to harvest, therefore likely to release. The class between '10 and 19.99 lb' is used to represent large fish often considered trophy trout size in New Zealand. The class '20 lb+' is used to represent exceptionally large trout, even for canal fishery standards.

Brown trout catch was dominated by fish in the 1.5 to 9.9lb range. Very few brown caught trout were exceptionally large while around 17% of catch was made up by traditional trophy size fish. Around 13% of brown trout caught would be considered small though legally take-able. These small fish were likely to be released due to their small size. With only around 43% of brown trout being harvested, many brown trout considered take-able or of trophy size were released.

Large rainbow trout were commonly caught with around 38% trophy size, with 9% of these being 20lb or bigger. The number of trophy size and 20lb+ rainbow trout caught was estimated at 3,855. Fourteen percent of rainbows caught were considered small. Approximately 54% of rainbow caught were released.

Brown trout, 10 lb or larger, made up approximately 11% of total sports fish catch at the canals and about 15% of total trout catch.

Salmon catch was dominated by fish in the 1.5 to 9.9lb size class (63%) while small salmon made up a significant proportion of catch (30%). A significant feature of salmon catch compared to trout catch was that a large proportion of salmon catch was made up of small fish. Legally, salmon under 300mm must be returned and it is likely that many take-able salmon around 1.5lb were released also.

Salmon harvest is the highest of the sports fish at around 56% of total salmon catch. This statistic combined with the fact that a large proportion of total salmon catch was smaller than the legal limit suggests that any salmon caught of a legal size, and within bag limit is highly likely to be harvested.

The influence of fishing method on catch and harvest

During an interview each angler was asked to name their primary angling method for their day's fishing. The angler's tackle assemblies varied considerably so for the purposes of analysing how method affected catch and harvest, each tackle assembly was assigned to the method it qualified as by definition in the Anglers Notice. For example soft baiting with scented baits was considered "bait fishing" while using 'soft plastic' lures identical in appearance but non-scented were considered "spin fishing". The results of this analysis are presented in Table 4.

Table 4. Primary angling method and catch at the Mackenzie Basin canal fishery during the 2015-2016 sports fishing season.

Method	Sports fish catch rate (hours/fish)	% Angler primary method	Est 15-16 Catch	% Catch	Est 15-16 Harvest	% Harvest
Bait	6.5	68	31,145	70	17,561	75
Fly	3.9	2	890	2	234	1
Spin	6.1	30	12,458	28	5,619	24
Total		100	44,493		23,414	100

The majority of canal anglers' primary method was bait fishing. Although the catch rate was the poorest for bait fishing the sheer volume of anglers using the method meant that total sports fish catch and harvest was dominated by bait anglers. Fly anglers were the most successful in terms of the amount of time it took to catch one fish but the popularity of the method on the fishery was so low that it only contributed approximately 1% of the total season sports fish harvest. Spin fishing was a popular method and accounted for approximately 1 in 4 of all fish harvested for the season.

The effect of 'break-outs' on salmon harvest and angler use

In previous seasons Fish & Game staff have observed an increase of angling activity at a specific canal due to the 'break-out' of sometimes large numbers of farmed salmon from salmon farm pens into the canals. These events have been incidental to farming operations and most likely occur due to holes forming in the pen nets from wear and tear. It is usually the anglers who are the first to find out when these break-out events happen as the fish are usually readily catchable. When word spreads throughout the angling community the angling activity can be intensive until the majority of the fish have been caught.

On the 23rd of June 2016, Fish & Game staff were alerted to a 'break-out' event at the Mt Cook Alpine salmon farm on the Tekapo Canal. Farm staff were unable to accurately identify the number of fish lost to the canal or the exact day the loss occurred. From angler interviews it is believed to have occurred on the 21st or 22nd of June. Angler counts and interviews were completed on the 25th.

To get a 'snap shot' assessment of the affect a break-out has on salmon catch and angler use, an estimate of catch was calculated for the 25th of June. The break-out occurred only in the Tekapo Canal so the Tekapo Canal is compared to the other canals combined.

One hundred and sixty-one anglers fished the Tekapo Canal compared to 120 for the other canals combined. Three hundred and seventy-nine salmon were caught on the Tekapo Canal compared to 8 in total for all other canals combined. On the 25th of June, it took the average angler 1.45 hours to catch 1 salmon at the Tekapo Canal compared to 50 hours in any other canal.

The next survey day from the 25th of June was 10 days later on the 5th of July. By this stage the catch rate had diminished and was not statistically different at the Tekapo Canal to the other canals combined.

Origin of canal anglers

The canals are a fishing destination in their own right and are situated near several holiday destinations. It has been estimated that 51% of fishing effort at the canal fishery was attributed to anglers that purchased their licences in Fish & Game regions other than the Central South Island in

the 2014-2015 season (NIWA 2016). To investigate the origin of individual anglers who fished the canals at least once during the 2015-2016 season, the region of residence and region of fishing licence purchase for 1,208 interviewed anglers who provided the required details, was compiled and compared (Table 5).

Table 5. The origin of individual canal anglers with regard to Fish & Game regions where they live (home region) and region of issue they nominated when purchasing their licence.

F&G Region	Home Region (%)	Licence Purchase Region (%)
Central South Island	27	39
North Canterbury	29	23
Otago	17	17
Southland	11	10
Nelson Marlborough	4	4
West Coast	1	1
North Island Regions	10	6
Non NZ	2	n/a
	100%	100%

Residents of the North Canterbury Region were the most prominent anglers at the canals making up 29% of anglers. Local Central South Island Region residents made up 27% of canal anglers. Approximately 88% of anglers were South Island residents with around 10% travelling from the North Island and 2% from overseas.

Thirty-nine percent of canal anglers purchased a Central South Island Region licence, which was a higher proportion than the proportion who were resident in the region (27%). This suggested that anglers not local to the region, especially North Canterbury, North Island regions and overseas anglers, purchased their licence locally or chose to nominate their primary fishing region as CSI.

This information confirms that the canals are an appealing destination fishery for all New Zealand residents, especially those from neighbouring South Island Fish & Game Regions.

Discussion

This survey has provided a season based ‘snap-shot’ of the Mackenzie Basin hydro canal fishery that highlights angler harvest and angler use dynamics. The survey was designed to gather empirical information on the canal fishery to inform the management and sustainability of the country’s most popular fishery. The survey could be repeated in future sports fishing seasons to provide a basis for quantifying perceived changes in the catch and angler use of the canal fishery.

For the 2015-2016 sports fishing season it is estimated that approximately 43,800 daily visits to the canal fishery by anglers resulted in nearly 44,500 sports fish being caught and about 23,400 of those harvested. These figures by nature are underestimates as the survey only accounted for angling during daylight hours. The effort and harvest of anglers related to the hours of darkness was not quantified by this survey. Staff observations were that there was certainly a group of anglers who target night time hours however their effort and total catch is expected to be only a minor component of total effort and catch. If this survey is repeated in future, an additional survey of night time activities would be valuable. The method used in 2015-2016 relied on accurate counts of anglers seen and would not be practical for assessing night time angling.

The importance of salmon to the anglers catch and harvest at the canal fishery has been highlighted in this survey. The availability of salmon to the angler is owed entirely to the existence of the salmon farms. If Fish & Game wish to manage the fishery in its 2015-2016 state then the primary concern would be the sustainability of the salmon population or perhaps more accurately in the context of the canals, maintaining a stock of a specified number of farmed salmon available to the anglers.

Currently, the existence of large numbers of salmon is owed to random events where salmon farm pens perish and allow 'break-outs' of farmed salmon. Considering the high value of salmon and possible impacts salmon farm discharges have to water quality, it is likely that salmon farming practices will change and improve overtime resulting in less inputs and fewer losses. These changes have the potential to alter the availability of salmon to the angler and the productivity of the canal trout fisheries.

The most dramatic change to current canal sports fishery would occur if the salmon farms ceased to operate. Unless there was a new upstream population of salmon to repopulate the canals via downstream migration then it is predicted that the salmon population would diminish in any canal where a farm once operated. The trout population would also be highly impacted in terms of food availability by the loss of "free feed" from wayward salmon feed pellets and edible size escapee salmon becoming unavailable. Additionally, nutrients from fish food pellets and salmon effluent that currently supercharge the existing ecosystem, would be unavailable. It would be predicted that the canal trout would return to pre salmon farming sizes and rarely, if ever, reach 3kg.

Salmon are the bread and butter of the canal fishery and the other drawcard is the opportunity to catch trophy size trout or as currently achieved, world record weight brown trout. With almost a third of all trout caught reaching a size traditionally accepted as trophy class (10lb) and many of those exceeding 20 pounds, there is no other trout fishery in New Zealand able to consistently produce such exceptionally large fish. This productivity is unique to the canals due to the presence of salmon farming operations.

If Fish & Game wish to maintain angler use and catch near 2015-2016 levels, it may be helpful to predict a range of salmon farming operational change scenarios, the resulting outcomes for the fishery, and reactionary measures that Fish & Game could employ to counteract the changes. This could be done by maintaining and enhancing relationships with salmon farm managers to help forecast the outcome of operational farming changes to the fishery or to investigate ways to enhance the fishery by replicating 'break-outs' by stocking salmon or replicating the beneficial inputs of salmon farms to the productivity of the fishery.

In 2005, Fish & Game attempted to replicate a break-out by releasing 125, 1-2kg tagged salmon into the Ohau Canal between the Ohau B and Ohau C power stations. The result proved that planned stocking of salmon in the canals is beneficial to anglers and a viable management option. Angler catches accounted for 77% of the released fish over 43 days. How planned releases like this could be programmed to benefit anglers over a season, and the source of funding for the supplying of the fish could be investigated.

Acknowledgments

This survey would not have been possible without a hard working team of Fish & Game Officer's. The days and hours spent ranging the canals, counting anglers and then completing phone interviews were taxing and exceeded what was initially planned. The data processing and statistical analysis skills of Martin Unwin and Jayde Couper were critical in compiling the survey results.

References

Unwin, M.J. (2016) Angler usage of lake and river fisheries managed by Fish & Game New Zealand: results from the 2014/15 National Angling Survey. *NIWA Client Report 2016021CH*.

Appendices

Appendix A. Daily angler visits at the Mackenzie Basin canal fishery presented at stratum, bi-monthly period, and seasonal level, during the 2015-2016 sports fishing season.

Period/Stratum	Days in strata	AUC hours	Average angler hours	Total anglers	Daily anglers
A0	34	20,853	5.9	3,523	104
A1	17	15,804	5.8	2,712	160
A2	10	9,249	4.1	2,277	228
A total (October - November)	61	150,543		8,513	
B0	14	5,826	5.7	1,022	73
B1	31	28,145	5.4	5,242	169
B2	11	12,754	4.9	2,613	238
B3	6	6,951	4.8	1,463	244
B total (December - January)	62	225,811		10,340	
C0	41	29,398	6.0	4,931	120
C1	12	11,030	4.6	2,383	199
C2	7	11,652	5.7	2,047	292
C total (February - March)	60	198,045		9,361	
D0	33	10,620	6.4	1,668	51
D1	21	15,064	5.3	2,843	135
D2	4	3,875	5.7	683	171
D3	3	5,546	4.8	1,161	387
D total (April - May)	61	235,248		6,355	
E0	32	12,165	5.5	2,232	70
E1	20	7,425	5.5	1,344	67
E2	9	5,625	5.1	1,103	123
E total (June - July)	61	83,962		4,678	
F0	42	11,227	5.4	2,087	50
F1	16	11,214	5.4	2,077	130
F2	3	2,142	5.2	412	137
F total (August - September)	61	102,619		4,576	
15-16 season Total	366			43,823	

Appendix B. Sports fish catch and harvest at the Mackenzie Basin canal fishery during the 2015-2016 sports fishing season presented to stratum level (90% confidence intervals).

Period/Strata	Browns Caught		Browns Harvested		Rainbows caught		Rainbows Harvested		Salmon Caught		Salmon harvested	
A0	222	± 202	156	± 190	852	± 389	560	± 348	3,289	± 929	2,059	± 612
A1	67	± 98	8	± 13	848	± 399	397	± 157	3,348	± 1,072	2,263	± 802
A2	67	± 72	16	± 19	122	± 70	70	± 57	1,291	± 417	983	± 359
A Total	355	± 236	180	± 192	1,822	± 562	1,028	± 386	7,929	± 1,478	5,305	± 1,071
B0	103	± 80	90	± 78	243	± 148	96	± 63	720	± 310	410	± 193
B1	506	± 292	102	± 77	519	± 200	477	± 187	1,874	± 531	1,351	± 393
B2	257	± 220	181	± 198	467	± 271	318	± 163	1,147	± 528	452	± 189
B3	54	± 55	37	± 47	221	± 141	193	± 138	810	± 371	487	± 220
B Total	921	± 378	410	± 231	1,450	± 394	1,084	± 290	4,551	± 891	2,700	± 525
C0	275	± 214	275	± 214	597	± 334	440	± 316	2,170	± 784	879	± 335
C1	481	± 490	339	± 285	499	± 295	224	± 163	808	± 515	696	± 507
C2	13	± 21	13	± 21	410	± 287	228	± 162	346	± 293	174	± 149
C Total	769	± 535	628	± 358	1,506	± 531	892	± 390	3,325	± 982	1,749	± 626
D0	548	± 275	21	± 25	691	± 286	347	± 247	1,927	± 800	1,180	± 614
D1	108	± 90	55	± 66	1,439	± 866	138	± 131	1,006	± 688	396	± 247
D2	77	± 70	29	± 35	400	± 312	253	± 299	930	± 414	398	± 168
D3	36	± 36	27	± 33	156	± 88	88	± 63	487	± 194	161	± 114
D Total	770	± 300	132	± 85	2,687	± 968	826	± 414	4,350	± 1,150	2,134	± 692
E0	263	± 138	-	± -	1,058	± 406	290	± 171	2,820	± 1,028	1,302	± 577
E1	213	± 160	-	± -	339	± 187	109	± 88	3,238	± 1,265	2,142	± 1,129
E2	20	± 32	20	± 32	99	± 98	-	± -	671	± 293	517	± 252
E Total	496	± 214	20	± 32	1,496	± 458	399	± 192	6,728	± 1,657	3,961	± 1,293
F0	327	± 250	86	± 71	483	± 226	232	± 170	1,577	± 531	651	± 260
F1	216	± 355	216	± 355	602	± 370	122	± 99	1,528	± 636	478	± 203
F2	39	± 43	6	± 10	93	± 63	83	± 61	474	± 302	92	± 63
F Total	582	± 436	308	± 362	1,179	± 438	438	± 206	3,579	± 882	1,221	± 336
Season Total	3,893	± 900	1,678	± 598	10,139	± 1,446	4,666	± 798	30,461	± 2,965	17,070	± 2,019