

Lower Waitaki River Trout Angler Survey for the 2018/19 Season. (J Couper – March 2020)

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Introduction

The lower Waitaki River flows from the Waitaki Dam around 65 km to the Pacific Ocean. The river is large and braided throughout its length and has a strongly altered flow regime due to the Waitaki hydro scheme. The main tributaries of the lower Waitaki River are the Hakataramea and the Maerewhenua rivers situated near Kurow and Duntroon, respectively. The Waitaki River is fished for Chinook salmon, brown trout and rainbow trout and is popular with shore-based and jetboat anglers. Despite the relatively short length of the Waitaki River, it was the most fished river for trout (excluding canals) in the Central South Island (CSI) Region and the fourth most fished river for trout in New Zealand in the 2014/2015 season (Unwin M. J., 2016).

The National Angling Survey (NAS) is run every seven years and provides information on usage of rivers and lakes throughout New Zealand. It does not provide data on catch rates or harvest. Harvest estimates were run by MAF Fish in 1981/82 using posted diaries and in 1974-1983 using aerial surveys. Because of the significance of the Waitaki River trout fishery and the amount of time that has passed since previous surveys, a pilot survey was undertaken to estimate harvest for April 2018. The data gained from the pilot survey provided the information needed to design a survey that would produce a robust harvest estimate for the 2018/19 season.

Method

Survey Design

A phone survey was chosen as it gives up-to-date information with having to worry about the effects of voluntary response bias potentially introduced by using email surveys.

A simple randomised survey of all Fish & Game licence holders could not be used to accurately estimate harvest as the total population is too large and a high proportion of the anglers, particularly North Island licence holders, would be very unlikely to have fished the Waitaki. A random sample of only CSI licences was investigated but was deemed unfeasible due to CSI licence holders only making up 56% of Waitaki River angling activity (Unwin M. J., 2016).

The stratification method used in the 2007/08 Opihi harvest survey was also considered. The Opihi harvest survey stratification was based on people buying their licences at agents close to the waterway. This was shown to be unfeasible, mostly due to a large proportion of licence holders now choosing to purchase their licence online.

The final stratification method was tested in the April 2018 pilot survey and refined for this survey. The stratification is based on the average time it would take an angler to drive from their hometown to the river. The angler's hometowns were sourced from the Fish & Game licence database.

The second most cited reason to choose a freshwater fishery in the South Island is that it was close to where the angler lives (Unwin M. , 2009). The April 2018 pilot survey reinforced that idea showing that for the Waitaki River, people were more likely to fish the river when living close to it. To simplify the process, the drive times from an angler's hometown to Glenavy and Kurow were calculated and then the shortest of the two times was chosen as a proxy for their drive time to the river.

The strata levels were set to maximise surveys from people who were more likely to fish while still getting usable information from a smaller percentage of people who lived further away. Only strata A (drive time under 26 minutes) and B (drive time between 26 minutes and 1 hour, 45 minutes) were surveyed, with the remainder of the activity being estimated using the percentages in Table 1.

Table 1: Strata delineations and their contribution to NAS angling activity in the 2014/15 season.

Strata/sub-strata	Surveyed or Estimated	Average drive time from hometown to fishery (hours: minutes)	Contribution to angler activity (from NAS)
A	Surveyed	Under 0:26	48.7%
B	Surveyed	0:26 to 1:45	28.2%
AB Total	Surveyed	Under 1:45	76.9%
C1	Estimated	Over 1:45	18.5%
C2 - Junior licences	Estimated		3.4%
C3 - Day Licences	Estimated		1.2%
C Total	Estimated		23.1%

Table 1 shows that surveys covered the group that made up almost 77 percent (A+B contribution) of angling activity. The remaining 23 percent of activity was estimated by assuming their contribution percent remained the same as reported in the 2014/15 NAS.

Strata A, B and C1 (drive time over 1 hour, 45 minutes) incorporate all whole season licence types: adult whole season, CSI local area, loyal senior and winter licences. Family licences were also included with the activity of all people on the licence combined to make a licence total.

As there was no surveyed harvest information from the C1 substratum, a linear regression analysis was run to see if the harvest rate varies with distance from the fishery and determine if a factor was needed to account for this.

Substratum C2 (junior anglers) was not surveyed due to its low contribution to overall activity and the difficulties involved with contacting junior anglers by phone. Substratum C2 was given the harvest rate of the combined AB strata, which is likely to slightly overestimate the harvest as it is assumed that young anglers catch less on average than adults.

In NAS years, purchasers of day licences are required to nominate the primary fishery they intend to fish. As 2018/19 was not a NAS year, there were a large number of day licences of which only a low percentage would have fished the Waitaki River. Purchasers of day licences are also far less likely to provide contact details to Fish & Game. Because of these reasons it was decided that it was more accurate and cost efficient to estimate day licence harvest using the harvest rate of the combined AB strata. It was presumed that day licence holders spend a longer time fishing on their nominated day than a typical whole season licence holder does on their day but that their catch rate is lower than anglers that have invested more and are assumed to be keener anglers. These factors potentially balance each other out and are unlikely to significantly influence overall estimates especially due to their small contribution (1.2%) to angler activity (Table 1).

Figure 1 shows an estimation of the boundaries of the strata; stratum A is shown in red, stratum B is shown in green and stratum C is uncoloured. The towns and cities on the map are shown in their correct strata while the areas are approximated based on the road layout.

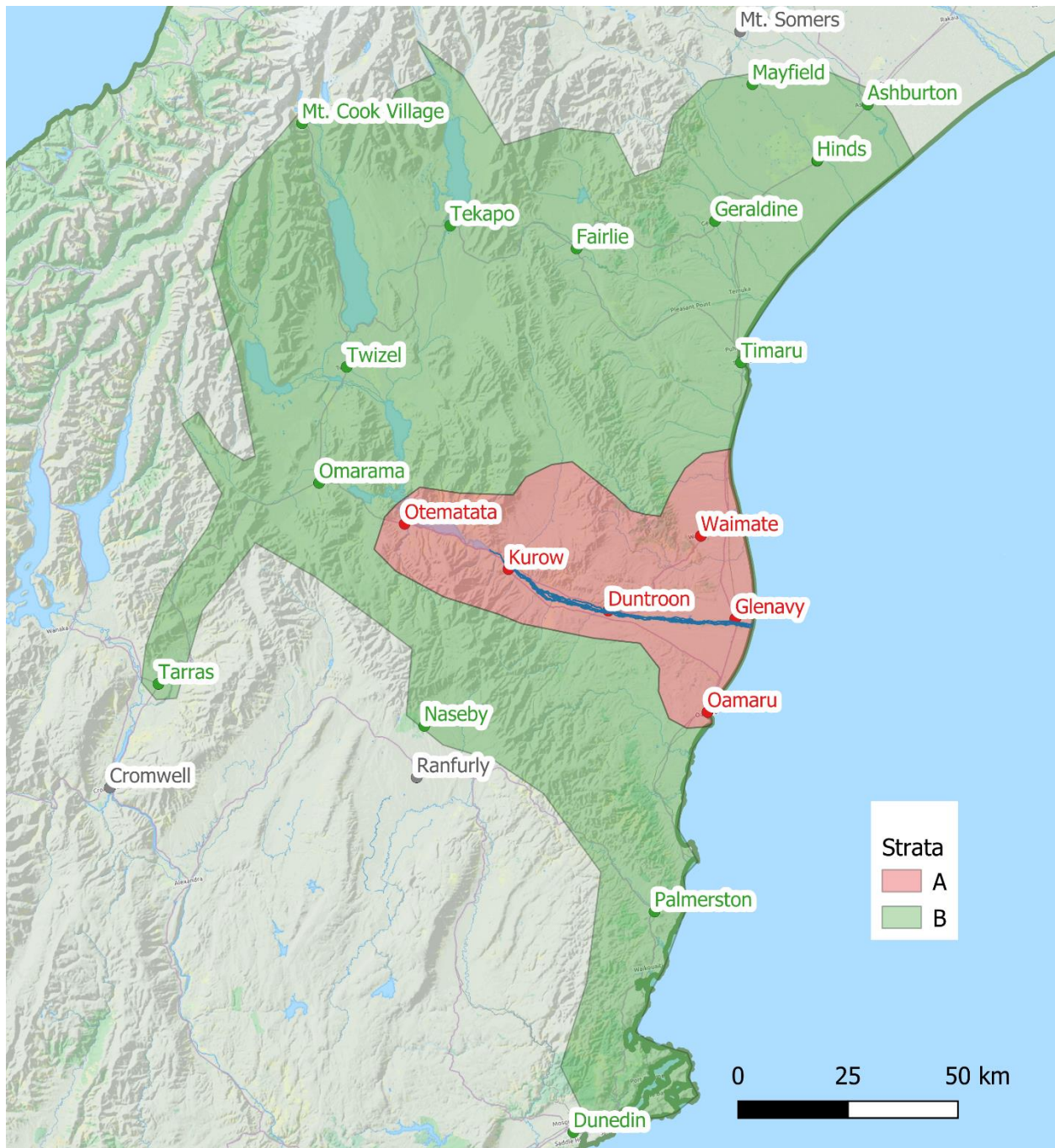


Figure 1: Map showing towns and cities in each stratum and the approximate stratum boundaries.

Call Schedule

Anglers were called at the end of each month and asked for their angling activity for the preceding month except for the winter season (June, July and August), which was only surveyed once in early September as angler activity on the Waitaki River is lower during the winter season (H Stevens, personal comms). Anglers were asked for their total number of trout fishing visits to the river, the total number of hours spent fishing for trout and the total number of brown and rainbow trout harvested and released. Monthly calls were chosen as people's ability to accurately recall fishing activity has been shown to markedly decline after 2-3 months (Unwin & Brown, 2003). Strata totals were taken from the Fish & Game database using 'year to date' sales for each stratum at the end of each survey period. The number of calls made and the total number in the database for each strata and period are outlined in Table 2.

Table 2: Number of calls and strata totals for each survey period.

Period	Month(s)	Strata A		Strata B	
		Number of calls made	Total in database	Number of calls made	Total in database
1	October 2018	129	1,112	143	4,726
2	November 2018	88	1,279	216	5,635
3	December 2018	110	1,588	244	7,016
4	January 2019	84	1,690	267	7,545
5	February 2019	94	1,725	247	7,719
6	March 2019	81	1,748	185	7,796
7	April 2019	65	1,771	137	7,919
8	June to August 2019	100	1,807	271	8,069

Zones

For the purposes of the survey the river was divided in to four zones as follows:

Zone 1: Surf to State Highway One bridge (3.8km).

Zone 2: State Highway One bridge to Ferry Road (6.2km).

Zone 3: Ferry Road to Bortons Pond power pylons (19.2km).

Zone 4: Bortons Pond power pylons to Waitaki Dam (36km).

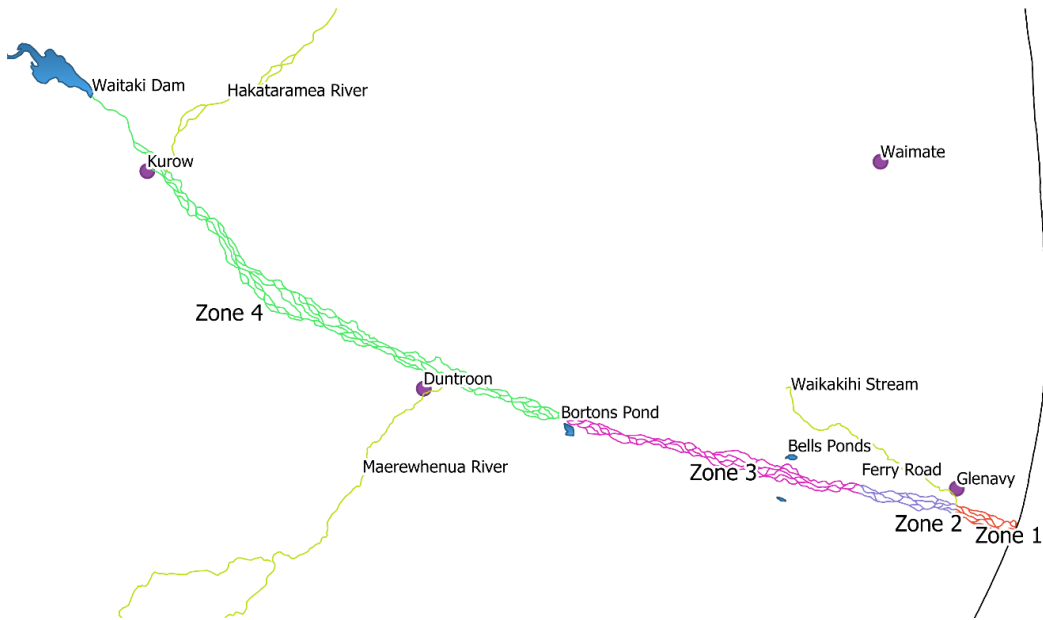


Figure 2: Waitaki River map, showing zones used in survey.

The zones outlined were chosen to line up with previous harvest surveys. Pierce (1989) included a fifth section that encompassed the Kurow bridges to the Waitaki Dam. Although the information would be interesting and potentially useful for management purposes, it was deemed impractical for our survey as most respondents fishing the upper reaches only specified that they fished the “Kurow area”.

Results

Effects of Travel Time on Catch Rate

A linear regression analysis was performed to determine whether the time it took to drive to the Waitaki influenced the hourly trout catch rate. The analysis showed that the time taken to drive to the Waitaki from home had no effect on the hourly trout catch ($p=0.97$). The relationship is shown below in Figure 3.

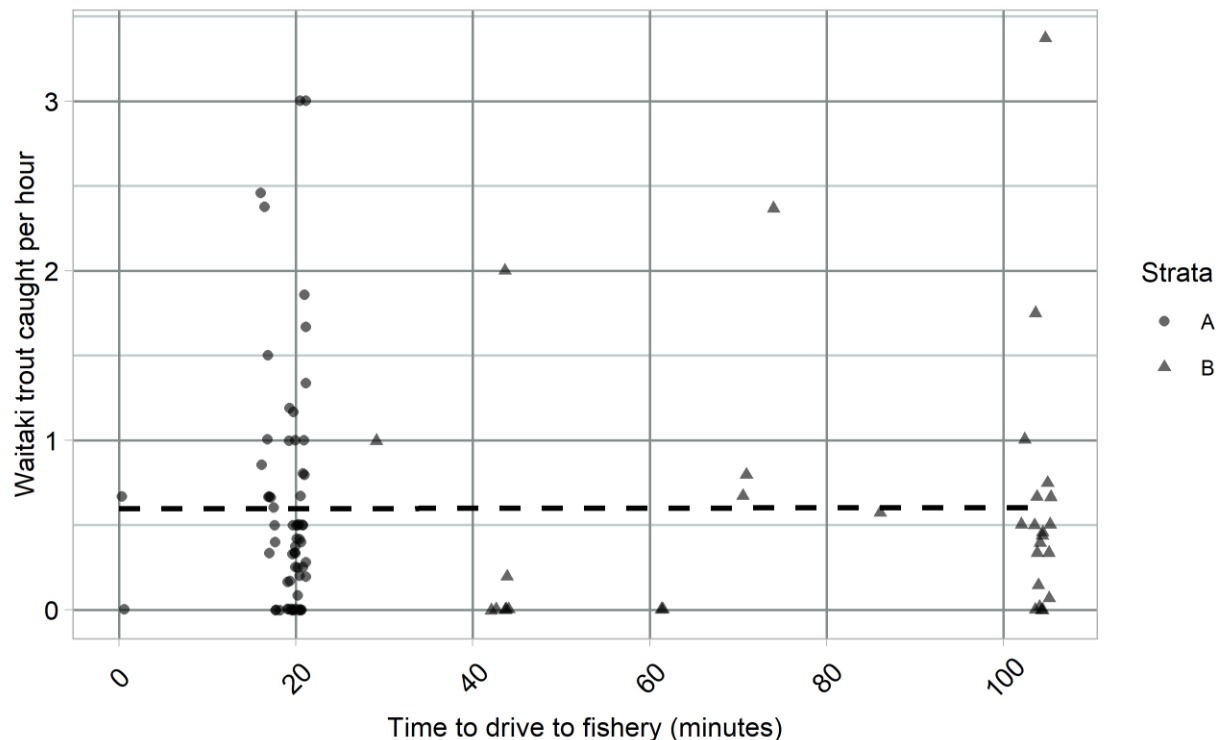


Figure 3: Time to drive to the Waitaki River plotted against the trout catch rate. Dotted line shows the least squares linear model between trout caught per hour and distance from the fishery. Points have been made semi-transparent and given a small random “jitter” to better show overlapping points.

As there was no significant effect of travel time on the catch rate, it was decided to assume the catch rate in stratum C would follow the same pattern and could be estimated using the average catch rates of the A and B strata.

Survey Totals

Table 3 shows the estimated angler use and catch (kept plus released) of trout anglers on the lower Waitaki River for the 2018/19 season. Angler days refers to the number of unique days an angler visited the fishery regardless of how long they spent. Anglers spent an average of 3.6 hours every time they visited the river. Anglers caught an average of 1.7 trout per trip, which works out to 0.48 trout per hour spent fishing. Anglers kept almost 30% of the trout they caught meaning they kept around 0.14 trout per hour.

Table 3: Estimated whole season trout angler use and number of trout kept, released and total catch for the Waitaki River with 90% confidence intervals.

Angler days	7,570	±	1,830
Angler hours	27,430	±	7,840
Trout kept	3,960	±	1,380
Trout released	9,260	±	3,760
Trout catch (kept plus released)	13,220	±	4,850

Seasonal Variation

Angler use in terms of angler days was at its highest in October and March (Table 4). As the winter season is for a three-month period, the average monthly angling activity over this period was lower than any month in the main season. Although comparatively few anglers took advantage of the winter season, the total number of angler days and angler hours were relatively high, suggesting that the anglers returned to fish more often in winter and fished for longer.

Table 4: Number of anglers and angler use in angler days and hours by survey period with 90% confidence intervals.

Period	Month	Anglers	Angler days	Angler hours
1	October	550 ± 200	1,400 ± 690	4,120 ± 2,350
2	November	350 ± 160	830 ± 520	4,240 ± 3,650
3	December	460 ± 190	990 ± 480	3,170 ± 1,760
4	January	260 ± 150	880 ± 680	2,240 ± 1,530
5	February	260 ± 150	730 ± 500	2,820 ± 1,960
6	March	380 ± 190	1,420 ± 840	5,400 ± 3,460
7	April	250 ± 210	450 ± 410	1,490 ± 1,390
8	Winter	120 ± 90	860 ± 900	3,960 ± 4,410

Monthly totals of trout kept varied significantly through the 2018/19 trout fishing season (Figure 4). There is a general trend that a number of fish are kept at the start of the season and that number generally declines over time. The main outlier to this trend was March that was significantly higher than the surrounding months. A proportion of trout kept in March is potentially by-catch from people on salmon-focused fishing trips. The monthly average number of trout kept for the winter period was approximately 150 trout, slightly above the number kept in February.

Total trout caught (kept plus released) showed no obvious pattern throughout the year. Total catch was high in October, December, February and March and lower in November, January, April and the winter months (average monthly trout catch over the winter period was 560 trout). The percentage of trout kept also showed no obvious pattern.

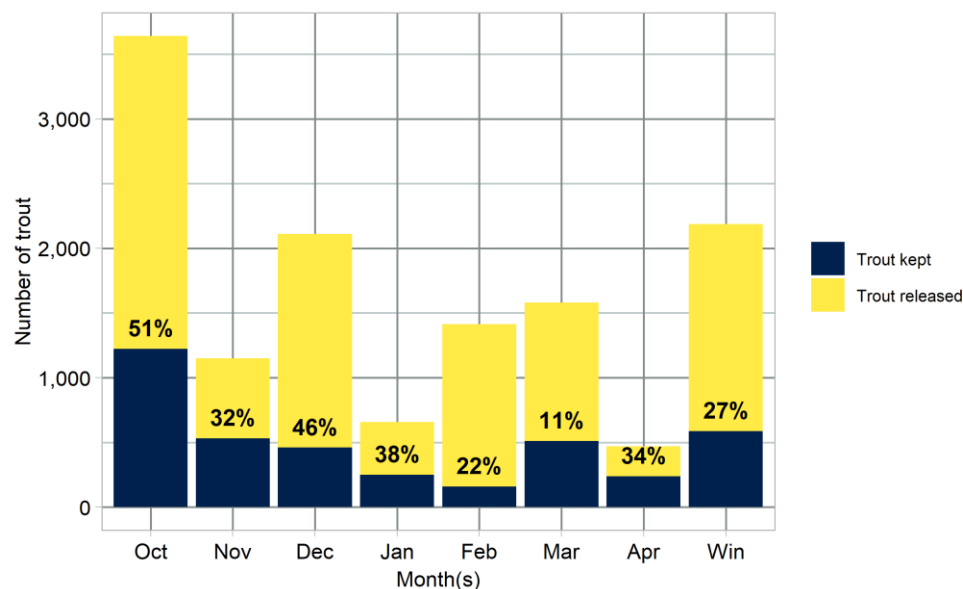


Figure 4: Trout catch through the season and whether the trout were kept or released. Percent of trout kept shown in black.

Geographic Variation

Table 5 shows the cities and towns in the survey area that contributed the most trout angling use on the Waitaki River for the 2018/19 season. Due to the way the analysis was performed, small towns often thought of as separate entities are listed under larger towns. The places most significantly affected by this are likely to be Duntroon and Glenavy being included in Oamaru and Waimate, respectively.

Dunedin was a significant contributor to angling use despite being outside the CSI Region. Besides Christchurch and Dunedin, places outside of the CSI Region only add significantly to angling activity and catch in aggregate.

Table 5: Top six cities/towns contribution to Waitaki River angling activity and trout catch with 90% confidence intervals.

City	Number of angler days	Trout Caught
Oamaru	2,040 ± 810	3,740 ± 2,760
Dunedin	1,950 ± 930	3,360 ± 2,030
Waimate	850 ± 486	1,940 ± 1,300
Christchurch ¹	850	1,450
Timaru	460 ± 390	200 ± 250
Ashburton	190 ± 270	170 ± 200

¹ Due to Christchurch being outside the A/B strata area, its contribution to activity was estimated from its relative contribution to NAS activity and its harvest was estimated using the overall average per day harvest.

River Zone Breakdown

Angler activity was relatively equal across zones 1, 2 and 4 and markedly lower in zone 3 (Table 6). Zone 3 was relatively unpopular for trout fishing despite it making up almost 30% of the rivers' length (Figure 2). Zone 1 activity is likely to be slightly higher than expected as fishing over the winter period is limited to zone 1. Angler activity in the "unidentified" zone is from respondents who chose not to tell the surveyor where they had fished or told them they had fished the "whole river" usually in a jetboat.

Table 6: Angler activity by river zone with 90% confidence intervals.

Zone	Anglers		Angler days	
1	450 ±	220	1,720 ±	1,060
2	330 ±	170	1,290 ±	1,040
3	90 ±	90	250 ±	310
4	720 ±	320	1,530 ±	840
Unidentified	420 ±	220	1,030 ±	630

Harvest varied throughout the river and was not proportional with the river lengths identified in Figure 2. Catch in zone 2 was particularly high (Figure 5) especially considering it only accounts for around 10% of the river's length (Figure 2). Anglers in zone 2 also showed a strong tendency to catch and release. Zone 3 harvest was significantly lower than the other zones but roughly in proportion with the lower number of angler days spent there. Zone 1 catch is increased slightly by the winter season and possibly has an inflated harvest rate due to the higher presence of sea-run brown trout, which are often targeted for their eating qualities.

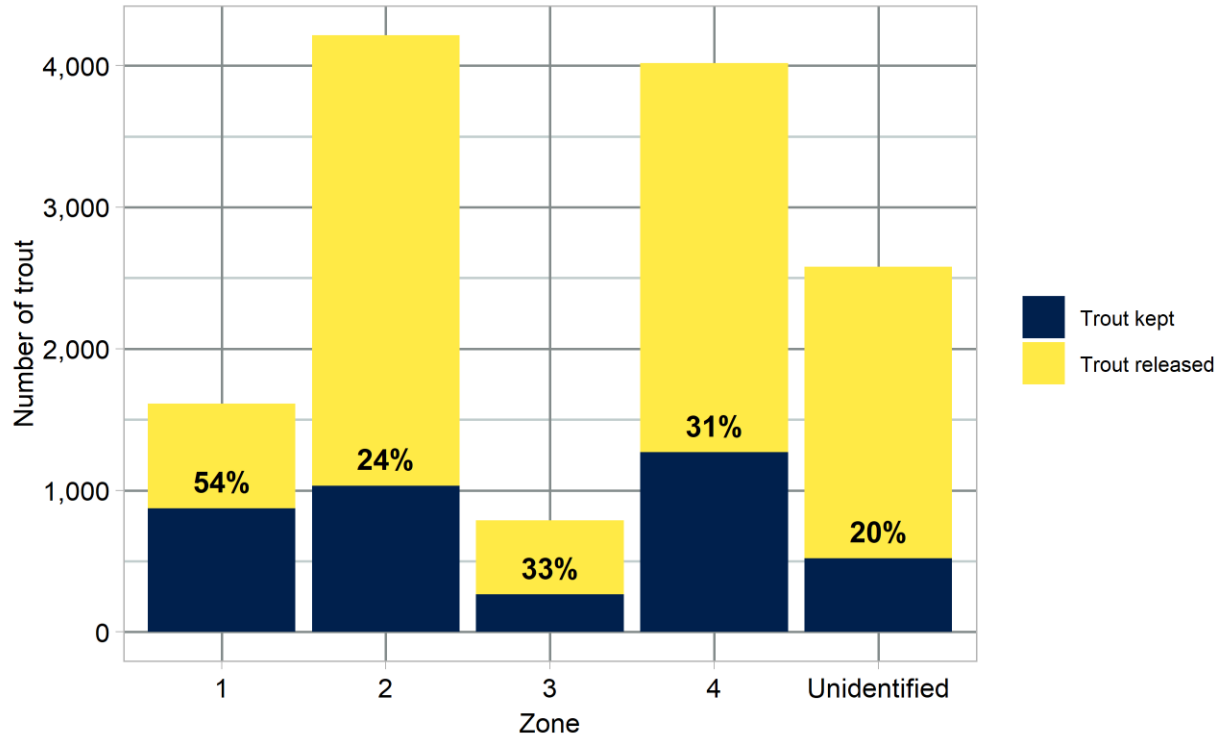


Figure 5: Total trout caught broken down by area caught and whether they were kept or released. Percentage of trout kept shown in black.

Species Composition

The species composition varied throughout the catchment. In general the proportion of rainbow trout increased heading up the catchment (Figure 6), although there were more caught in zone 1 than in zone 2. Overall, 45% of trout caught in the lower Waitaki River this season were rainbows.

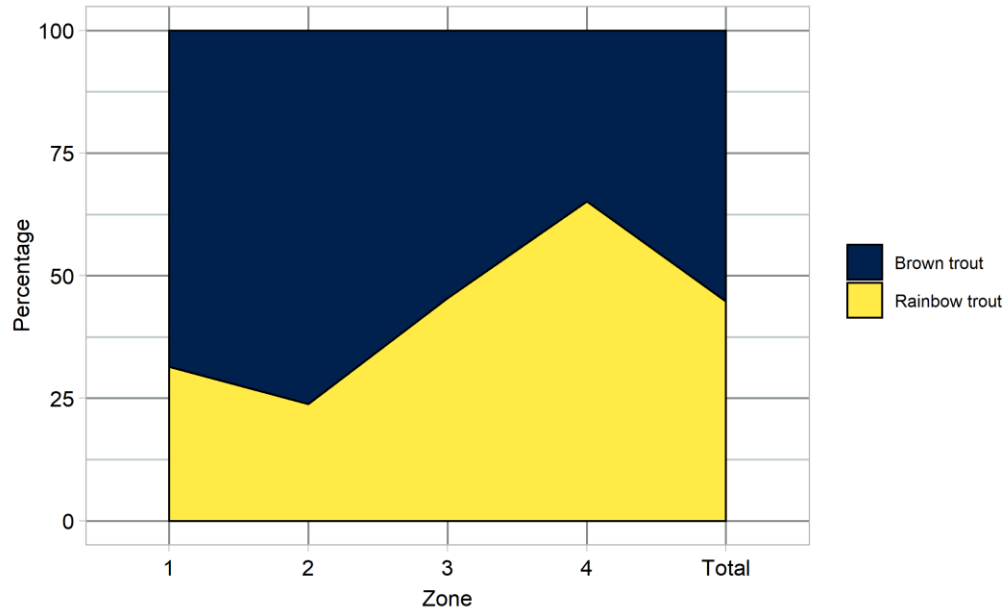


Figure 6: Proportional stacked area chart showing relative proportions of rainbow and brown trout catch in different zones of the river.

Adult Angler Age Breakdown

Table 7 shows the lower Waitaki River was popular across most adult age classes of anglers. Results from family licences have been calculated using the age of the primary licence holder, which has introduced an undefined bias. The activity of people younger than 20 was not included as most of them hold a junior class licence and their contribution to activity was only estimated using the NAS data.

More anglers in the 60-70 age bracket fished the river than any other age bracket, however, they did not contribute as much time as the 50-60 age bracket, who spent the most time fishing for the season. People in the 30-40 age bracket spent noticeably less time fishing than the other age brackets.

Table 7: Adult angler activity by age of the licence holder with 90% confidence intervals.

Age	Anglers	Number of angler days	Number of angler hours
(20-30)	220± 150	960 ± 810	4,990 ± 4,500
(30-40)	220± 130	510 ± 320	1,150 ± 710
(40-50)	360± 220	720 ± 460	2,700 ± 1,660
(50-60)	570± 220	1,810 ± 870	6,380 ± 3,060
(60-70)	710± 240	1,700 ± 720	4,960 ± 2,100
(70-80)	290± 140	1,050 ± 900	4,280 ± 4,370
(80-90)	210± 140	770 ± 600	2,830 ± 2,410

Trout catch followed a similar pattern to angler activity when broken down by the age of the angler (Figure 7) with anglers in the 50-60 age bracket catching and keeping the most trout.

A linear regression analysis was performed to determine whether the percentage of trout kept was influenced by the age of the angler. The analysis showed that the percent of fish kept had a small but statistically insignificant ($p=0.11$) increase as the age of the angler increased.

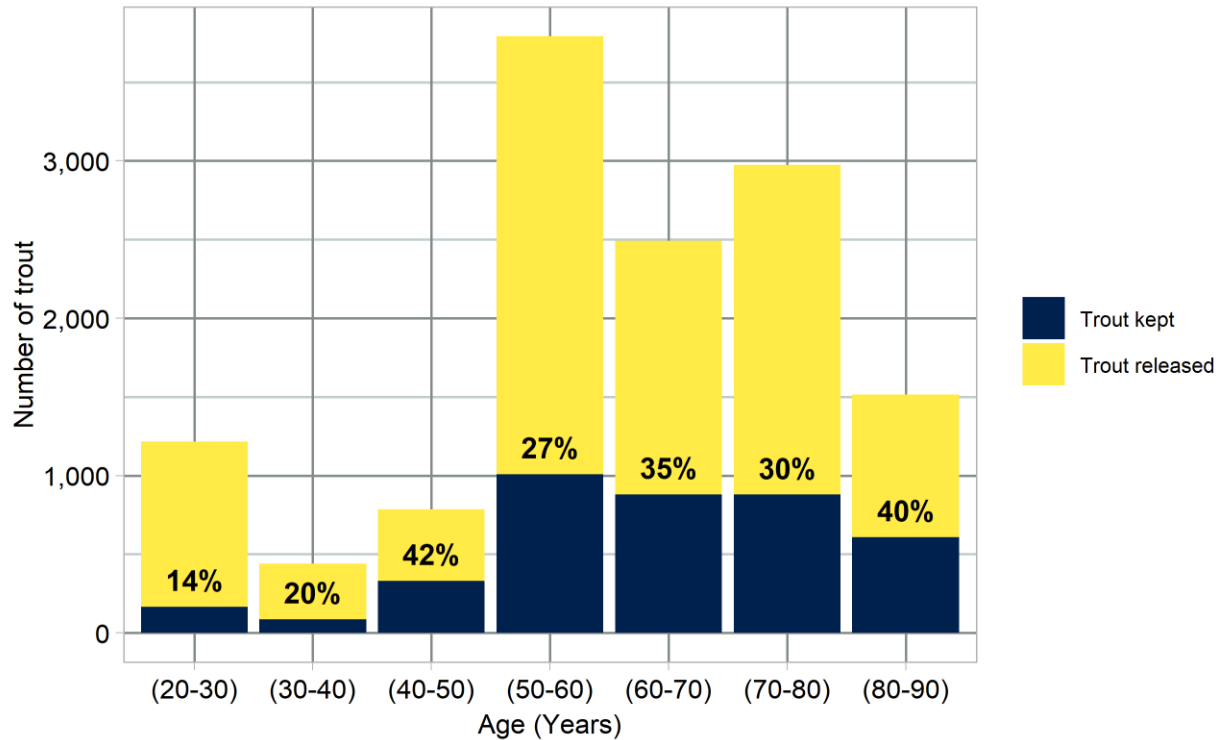


Figure 7: Total trout catch broken down by age of the licence holder and whether they were kept or released. Percentage of trout kept shown in black.

Discussion

At roughly 7,500 angler days, the estimated angler activity on the Waitaki River from this survey was significantly lower than the estimate in the NAS for the 2014/15 season, which was almost 16,700 angler days. This may be partly due to a systematic error in this survey where the activity of the non-primary licence holders on a family licence is underestimated. This is likely to affect the angler activity significantly more than overall number of trout kept.

Our estimate of 3.6 hours per trip is the same as the estimate for 1980 to 1982 (Pierce & Smith, 1989). This means that the main changes to overall catch come from a reduction in the number of anglers, the number of days spent fishing and the hourly catch rate.

Previous surveys on the lower Waitaki River have relied on either postal surveys at the end of the season or a combination of postal surveys and aerial counts. All methods to estimate the number of trout kept for the lower Waitaki trout fishery including the method outlined in this report have limitations. One of the key limitations of previous surveys is that it is possible anglers exaggerated their activity, catch and number of trout kept to try and stop future power schemes, which is unlikely to be an issue for this survey. The highest estimated total of trout kept was 24,000 in the 1981/1982 season (Pierce & Smith, 1989) although this was acknowledged to likely be an overestimate by a factor of 2-3. The annual number of trout kept on the Waitaki River between 1974 and 1983 was estimated to average 7,900 (Pierce L. , 1989). Our estimate of 3,960 trout kept is significantly less than previous surveys. This is due at least partly to our suspected underestimate of angler activity outlined above. The other key reason for the discrepancy between the estimates in this report and the previous studies is a probable change in anglers choices. It is assumed there has been a change in behaviour since the 1980's and that anglers now choose to release a greater proportion of the fish they catch. Unfortunately, previous surveys did not record released fish, but anglers would have to be twice as likely to keep a trout in the 1980s than now to reach a similar level of total trout kept. Similarly, the historical estimates of 0.2 trout kept per hour sits between this year's estimated rate of 0.14 trout kept per hour and 0.48 trout caught per hour.

Other behavioural changes may have also influenced angler activity, catch and number of trout kept on the lower Waitaki River. Anglers targeting salmon may also spend part of the day trout fishing, so a comparatively poor salmon run may lead to less trout anglers on the river. Pierce (1989) also recorded high numbers of people camping and picnicking on the riverbanks. Pierce's study noted that a lot of these other river users often chose to go trout fishing. Numbers of people camping and picnicking at the river is anecdotally a lot lower now, so the fishing activity associated with these activities has also likely declined.

The largest change in the lower Waitaki River since it was last surveyed has been the invasion of didymo, which has likely limited the amount of time anglers choose to spend on the river and reduced their catch rates.

This survey also gives information on when and where on the Waitaki River people choose to fish. Anglers were relatively well spread throughout the river with the exception of zone 3 (Ferry Road to Bortons powerlines). The lack of angling in this section is probably due to a lack of easy access that has also been noted in an ongoing review of Waitaki River access. There is potential to improve the overall appeal of the river and spread anglers out more by maintaining and enhancing access to this section.

This survey also showed the time of year when trout were caught and kept and gives us good data on the utilisation of the winter season. This survey showed the winter season was utilised by a smaller number of anglers who chose to spend a larger amount of time fishing but did not keep a large number of trout. At the current time the winter season appears to be a sustainable and important fishery for the anglers that take advantage of it.

Estimates from this survey, especially those for subcategories such as monthly or by-zone fishing come with relatively wide confidence intervals. This suggests that surveying more licenceholders would have benefitted this survey. The lower Waitaki River is fished by a large range of people from all around the country, so designing a survey to account for this proved difficult. The estimates are believed to give a fair picture of angler activity and catch but on average appear to underestimate the true figures. The limiting factor on receiving enough information was not having access to enough survey callers with the ability to call cell phones. If Fish & Game decide to run future surveys using this or a similar method, the data set for this survey should be further interrogated to create a power analysis to determine the required number of samples. If more precise estimates are required Fish & Game should consider using calling agencies to handle the increased number of calls although this will significantly increase the funding required to run a survey of this magnitude.

The Hakataramea and Maerewhenua rivers were originally also part of this survey however very few of the licence holders that were called fished these rivers in the survey period. The Hakataramea and Maerewhenua results were excluded from the report as they did not stand up to statistical scrutiny.

Acknowledgments

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References

- Pierce, L. (1989). Aerial surveys of angling on the lower Waitaki River, 1974-1983. *MAF Fisheries, New Zealand Freshwater Fisheries Report No. 113*.
- Pierce, L., & Smith, J. (1989). Angling postal questionnaires schemes on the lower Waitaki River, 1980/81 and 1981/82. *MAF Fisheries New Zealand Freshwater Fisheries Report No. 106*.
- Unwin, M. (2009). Attributes characterising river fisheries managed by Fish & Game New Zealand: a pilot survey of the Otago and Nelson/Marlborough regions. *National Institute of Water & Atmospheric Research Ltd, NIWA Client Report No. CHC 2009-090*.
- Unwin, M. J. (2016). Angler usage of New Zealand lake and river fisheries; Results from the 2014/15 National Angling Survey. *National Institute of Water & Atmospheric Research Ltd, NIWA Client Report No. 2016021CH*.
- Unwin, M., & Brown, S. (2003). The Geography of Freshwater Angling in New Zealand - A Summary of results from the 1994/1996 National Angling Survey. *National Institute of Water & Atmospheric Research Ltd, NIWA Client Report No: CHC98/33*.