



EASTERN REGION

Ohau Channel Diversion Wall Trout Monitoring
2017-18

Prepared for Fisheries Panel Meeting 21st November 2018

The following report is split into 2 sections

1. Lake Rotoiti Trout Fishery Survey Data (Opening Day and Summer Creel reports)
2. Ohau Channel Creel Survey

1. LAKE ROTOITI TROUT FISHERY SURVEY DATA

Trout Season Opening Day Survey data.

- Angler and fish data is collected on October 1 each season.
- Opening Day 2017. Data from Lake Rotoiti trout, approximately 9.25 years after diversion wall was completed.

Summer Survey Data

- Continuous summer survey from November to April each year
- Trout characteristics collected from all fish measured –9.3 to 9.75 years post wall completion

Possible impacts of the diversion wall on the trout fishery?

A) It might be expected that effects to the trout fishery may be seen through affecting the smelt food supply in Lake Rotoiti – Changes may subsequently be seen in trout growth? Declining condition factor (weight loss) may precede a decline in trout length.

- Data from the 2011-2017 Opening period (Table 2 and figure below) illustrates a decline in condition factor compared to the pre-wall and immediate post wall period.
- This decline may have started post the 2000 opening day?

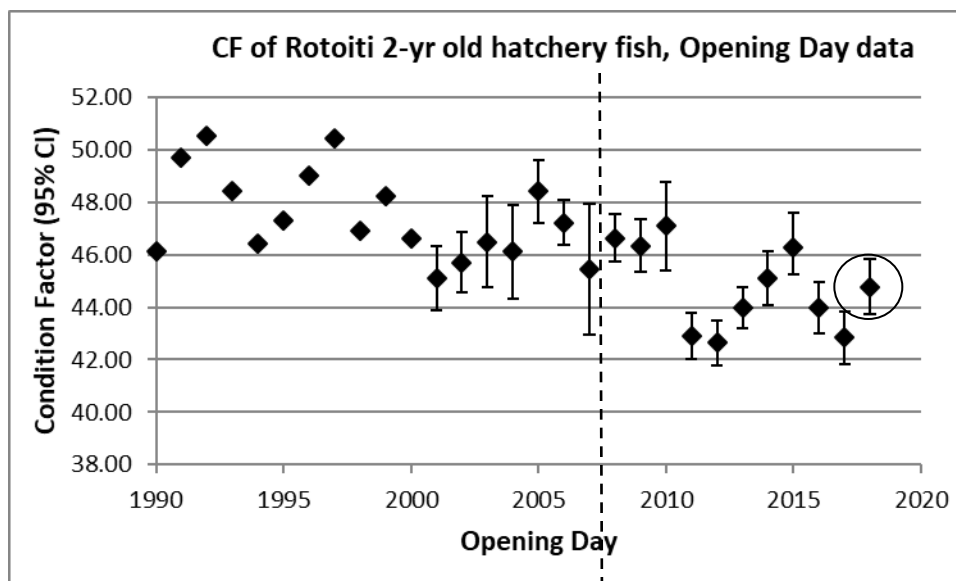


Figure 1.1 Condition factor of Lake Rotoiti 2-year-old trout on Opening Day

- The summer survey data for Lake Rotoiti (Table 1) shows that average rainbow trout condition over the 2017-18 summer was significantly poorer than the fish surveyed from the 2016-17 summer (P=0.012) and behind the last ten-year average.

Table 1. Summer Survey Comparison of overall average rainbow trout lengths and weights. Significant differences between years are shown in bold (P<0.05).

Lake	Feature	AVG	17-18	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07
Rotoiti	Length (mm)	520	515	514	550	518	523	522	516	525	501	512	520	518
	Weight (kg)	1.79	1.69	1.76	2.14	1.80	1.80	1.79	1.71	1.83	1.68	1.83	1.75	1.71
	Cond' Factor	44.01	43.73	45.49	45.29	45.48	44.23	42.11	43.33	43.47	44.51	46.32	42.00	42.14
Rotoiti	Wild L	491	482	477	508	480	507	490	492	491	478	476	500	513
	% WILD	32%	26%	25%	19%	26%	23%	39%	39%	45%	37%	26%	44%	38%
	Hatch L	533	526	526	560	532	527	540	531	552	515	526	536	520
	N (all fish)	168	109	159	128	195	243	165	390	128	159	161	86	89
Tarawera	Length (mm)	517	486	507	509	503	499	532	541	516	536	529	532	516
	Weight (kg)	1.56	1.27	1.52	1.49	1.42	1.42	1.63	1.87	1.49	1.71	1.70	1.63	1.57
Rotorua	Length (mm)	453	460	455	456	439	455	443	431	436	456	460	485	465
	Weight (kg)	1.08	1.00	1.21	1.08	0.99	1.23	0.98	0.88	0.80	1.10	1.10	1.36	1.21
Okataina	Length (mm)	531	520	523	508	539	515	529	537	553	552	545	534	522
	Weight (kg)	1.80	1.56	1.86	1.65	1.83	1.70	1.79	1.97	2.00	2.05	1.98	1.70	1.56
Rrua FF L		468	490	-	456	455	456	492	464	449	428	460	495	500
Rrua FF Wt		1.20	1.08	-	1.10	1.12	1.10	1.49	1.13	1.09	0.80	1.29	1.46	1.59
Rrua Tr L		448	453	455	433	453	433	449	440	429	445	455	457	477
Rrua Tr Wt		1.03	0.97	1.21	0.96	1.04	0.96	1.18	0.97	0.86	0.81	1.15	1.07	1.23

Possible impacts of the diversion wall on the trout fishery?

B) Affect on trout migration/impact on wild fishery – Change in % wild fish in catch?

- Opening Day data shows a drop in the opening day catch (excluding fly fishing) of wild trout in the 2008-2012 openings compared to the pre-wall catch. A further drop is recorded in the 2013 to 2015 data (Table 2).
- The Summer creel survey data (Table 1) shows that the percentage of wild trout in the catch measured since the 2013-14 summer creel survey averaged 22.6%. This is compared to the 37.2% since the wall was constructed in 2008 up to the 2013-14 summer, and 41.6% in the 2005 to 2008 period.
- Liberations of hatchery trout into Lake Rotoiti increased slightly during 2010-2011 and this would be expected to have the effect of slightly decreasing the wild percentage in the catch (assuming wild recruitment was consistent).

It is possible that a low percentage of wild trout recorded may be an effect of the diversion wall, or may have been influenced by an increase in hatchery liberations since 2009 to meet angling pressure.

We know that there is passage of adult trout between the lakes from the acoustic tagging done to monitor trout moving into cold water flows. Of the 30 adult trout tagged in Lake Rotorua at least three (?) were recorded as having moved into or through the Ohau Channel at some stage during the study.

Mature adult trout are known to migrate into the channel in autumn and early winter and pass through the channel to spawn in the channel or further afield in Lake Rotorua tributaries. After spawning these fish will return to the lake (October-December?) to recover.

At some time juvenile trout will emigrate downstream out of the Lake Rotorua tributaries and Lake Rotorua and travel back into Lake Rotoiti. We know from trout otolith micro-chemistry that juvenile trout from Lake Rotorua tributaries contribute to the wild Rotoiti fisheries.

If downstream migrating wild trout were diverted by the wall and travelled down the Kaituna River - as immature sub-adults or post spawned recovering mature adults – this would reduce the percentage of wild fish seen in the lake Rotoiti catch in years after the diversion.

The percentage of wild fish (excluding fly fishing) has been steadily around the 30% mark for openings in the 2008-2012 period which was similar to the 2001 Opening Day percentage. The 2013-2015 openings showed a wild percentage (excluding trout caught fly fishing) averaging 23%.

It might also be expected to observe a decline in the younger wild: older wild fish ratio if the returning immature fish have been differentially affected. This data from previous Opening Days has been compiled in Table 3 and shows that the percentage of younger trout in the wild catch has in past years been as low as 24%, and averages approximately 50%. Since the 2013 opening, the percentage of younger class wild trout has averaged near 60%.

Table 2. Opening Day Data. Lake Rotoiti

Open day	Total lib	Spring lib	Aut lib	% Wild	2yr length	2yr weight	2yr CF	cpue	% Wild exFF	2yr (n)
1998	14500	7500	7000	63	522	1.85	46.92	0.15	61.0	31
1999	14500	3500	11000	54	522	1.90	48.23	0.15	54.0	36
2000	14500	3500	11000	44	517	1.81	46.63	0.17	41.0	30
2001	27000	12500	14500	30	507	1.63	45.01	0.22	28.3	94
2002	25000	10500	14500	44	500	1.60	45.90	0.28	41.9	70
2003	25000	10500	14500	42	505	1.65	46.29	0.22	42.2	35
2004	24500	10000	14500	43	514	1.74	46.06	0.17	41.4	45
2005	15000	7500	7500	42	530	1.96	48.58	0.24	39.2	79
2006	23000	15500	7500	34	514	1.78	47.22	0.20	37.6	176
2007	25000	10500	14500	36	514	1.69	45.57	0.19	36.1	112
2008	25000	10500	14500	33	519	1.80	46.63	0.16	31.9	121
2009	25500	10500	14500	30	518	1.79	46.34	0.25	28.0	87
2010	28500	13500	14500	32	509	1.71	47.09	0.22	30.9	48
2011	29500	14500	14500	31	489	1.40	42.90	0.21	29.9	105
2012	28500	13500	14500	35	506	1.53	42.65	0.22	31.2	107
2013	28500	13500	14500	25	499	1.51	43.98	0.25	21.6	125
2014	28500	13500	14500	22	492	1.50	45.11	0.21	22.0	90
2015	28500	13500	14500	26	491	1.52	46.27	0.20	25.6	138
2016	28500	13500	14500	20	496	1.49	43.91	0.23	17.9	102
2017	28500	13500	14500	18	495	1.43	42.57	0.22	18	111

Table 2.1 Data summary statistics

	% Wild	2yr lgth	2yr wgt	2yr CF	cpue	% Wild exFF
Mean	35.20	508	1.66	45.69	0.21	33.99
Standard Error	2.520	2.648	0.036	0.388	0.008	2.512
Median	33.50	508	1.67	46.17	0.22	31.55
Mode	Multiple	514	Multiple	46.63	0.22	Multiple
Standard Deviation	11.270	11.843	0.163	1.737	0.035	11.233
Sample Variance	127	140	0.027	3.018	0.001	126.18
Kurtosis	0.64032	-1.02241	-1.07951	-0.48538	-0.34027	0.50803
Skewness	0.71316	-0.02905	0.05745	-0.45423	-0.05973	0.69115
Range	45	41	0.56	6.01	0.13	43.10
Minimum	18	489	1.4	42.57	0.15	17.90
Maximum	63	530	1.96	48.58	0.28	61.00
Count	20	20	20	20	20	20
Confidence	5.27	5.54	0.08	0.81	0.02	5.26

Table 3. Composition of Wild trout caught Opening Day by Age Cohort (Lake Rotoiti Surveys)

Season start	AVG	17-18	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07	05-06
Wild 1+	38	27	25	47	27	39	47	59	28	23	27	16	64	51
Wild 2&up	38	13	30	29	19	26	52	27	25	50	32	52	58	53
All Wild	76	40	55	76	46	65	99	86	53	73	59	68	122	104
Wild 1+	51%	68%	45%	62%	59%	60%	47%	69%	53%	32%	46%	24%	52%	49%
Wild 2&up	49%	32%	55%	38%	41%	40%	53%	30%	47%	68%	54%	76%	48%	51%

Table 4. Surveys conducted and anglers interviewed (Ohau Creel Surveys)

	17-18	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	05-06
Survey events	82	82	82	82	82	82	82	82	82	82	82	82
Nil angler encounters	20	19	12	33	32	15	19	28	22	17	3	15
Total Anglers	177	280	274	159	216	270	412	518	373	496	576	270
Anglers per survey*	2.86	4.4	3.9	2.5	4	4	7	10	6	8	7	4

*Anglers per survey =calculated from surveys when anglers present

Table 5. Catch rate data 2005-06, and 2007-08 to 2016-17 seasons. (Ohau Creel Surveys)

	17-18	16-17	15-16	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	05-06
Hrs fished	465.75	509.75	546.25	305.75	472.95	390.75	521.5	826.5	1015.5	728.10	934.15	1099.1
Kept	113	143	161	62	125	73	93	124	390	193	275	349
OSRT	31	15	66	29	83	15	33	89	221	42	24	102
USRT	23	18	17	20	39	14	36	29	14	4	16	34
CPUE(sum)	0.31	0.31	0.42	0.30	0.44	0.23	0.24	0.26	0.60	0.32	0.32	0.41
HPUE(sum)	0.24	0.28	0.29	0.20	0.27	0.19	0.18	0.15	0.38	0.27	0.29	0.32
Avg indiv' cpue	0.30	0.25	0.38	0.32	0.38	0.23	0.20	0.27	0.61	0.30	0.40	0.42

CPUE = catch per unit effort (fish per hour and includes oversized returned)

HPUE = Harvest per unit effort (fish per hour kept)

(sum) is calculated from all fish caught/all hours fished – good for harvest calculations

Indiv' = average of all individual anglers catch rate – good for perception calculations

1.1 Summary of Opening Day/ Summer Creel

The condition of 2-yr-old opening day catch from Lake Rotoiti fish remained relatively stable through the 2001-2010 period with a high point occurring in 2005. During 2011, a significant drop in rainbow trout condition factor was picked up. A further decline in condition was noted at the 2012 opening, though length and weight were superior to the 2011 opening statistics. Opening day surveys over 2013-14, 2014-15 and 2015-16 demonstrated ongoing improvement in 2-yr-old trout condition factor prior to a significant condition decline ($P < 0.001$) at the 2016-17 opening. This significant decline continued through the 2017-18 opening ($P = 0.014$). Theories for the deterioration in condition are listed below.

Fish & Game liberations into Lake Rotoiti began increasing in 2009 with 500 February liberated rainbows (N9 tag). An extra 3000 were liberated in September 2010 to respond to an increase in angling pressure to the lake as illustrated in the NIWA National Angler Survey (NAS). The extra numbers make up a 12% increase to total Rotoiti liberations. The increase in liberation numbers coincides with the drop in Lake Rotoiti 2-year-old condition factor, so is likely a Fish & Game created affect and not associated with the diversion wall. We would expect to have seen a slide in condition factor occurring since construction if that was the case. Further changes to the liberation strategy for Rotoiti began in September 2012 spreading the seasonal liberations over more months. This means the same number of fish released in smaller batches over a wider timeframe instead of the traditional all in one liberation. This was trialled to observe whether increased survival was possible by avoiding releasing yearlings at poor growth times of year. Following three years monitoring a wider spread of size ranges has been recorded, which has affected the opening day, summer creel and winter creel average sizes. During the 2015 spring releases, the November and December months were removed from the liberation schedule. The reason for this was to reduce the spread in fish size and to increase the average size of the fish caught.

The percentage of wild fish in the Lake Rotoiti opening day catch had dropped from the low 40% level to the mid 30% in the two years prior to the walls construction. It hovered at the lower 30% level for 5 years following construction then dropped around 10% to sit at the mid 20% wild level through the 2013-2015 period.

The percentage of young wild rainbow trout in the opening day catch does not appear to have drastically altered since the diversion wall was put in place. Since the 2013-14 opening day, a higher percentage of hatchery fish have been represented in the opening day creel. This may be a result of increased 2-yr-old survival due to the staggered liberation strategy started from the 2012 spring liberations.

Summer harvest over the 2017-18 summer was in line with the the past 10-yr-average of 0.27 fish per hour on Lake Rotoiti. During the 2018 winter, the average catch rate surveyed was reduced compared to the 2017 winter. The data from the 2018 winter has not been fully analysed so no comparison of 2018 catch can be made. The fish presented for weighing by Rotoiti anglers during the 2017 winter were significantly smaller ($P = 0.042$), significantly lighter ($P = 0.008$) and in poorer condition than the 2016 winter fish. Since the 2007-08 season when the wall was constructed, Lake Rotorua creel

surveys have shown a decline in condition of rainbow trout. This may have been caused by warmer summer temperatures, lack of successful smelt spawning and/or algal blooms through this period.

Both the 2012-13 and 2013-14 summer surveys showed consecutive improvements in size, weight and condition of rainbow trout, before condition deteriorated again over the 2014-15 and 2015-16 summers. The latter two summers had particularly warm lake temperatures forcing fish to seek thermal refuge for at least part of the summer.

The 2016-17 summer was cooler and windier allowing the Lake Rotorua trout population to remain in the main lake body rather than seeking thermal refuge for extended periods. The average size of trout caught during the 2016-17 summer was 1mm shorter, but significantly heavier ($P < 0.001$) than the average 2015-16 summer fish.

Over the 2017-18 summer, fish were drawn to the cooler inflows. However, the duration of this event was not as prolonged compared to the 2014-15 and 2015-16 summers.

2. OHAU CHANNEL TROUT FISHERY SURVEY DATA

Fisheries Surveys at the Ohau Channel were completed under contract by a MSc. student in 2005-06, and subsequently by Aquatek Consultants in 2007-08 to 2012-13. JFB Consultants surveyed during the 2013-14 season. Aquatek were contracted to continue the surveys during 2014-15 to 2017-18. The data collected provides 2 years of fisheries statistics pre-wall construction and 9 years following completion.

EXECUTIVE SUMMARY

- A total of 82 angler creel surveys were conducted at the Ohau Channel over the 2017-18 angling season. Anglers were encountered (fishing) during 62 of the survey events. One third less anglers were interviewed compared to the 2016-17 survey.
- The 2017-18 angling season at the Ohau Channel produced a higher average catch rate than the 2016-17 season. The 0.30 fish per hour recorded was just behind the average of the twelve completed Ohau Channel creel surveys.
- The average brown trout caught during the 2017-18 season was smaller, lighter and in poorer average condition compared to those from the 2016-17 survey. A total of 22 brown trout were measured compared with 17 during the 2016-17 season, 20 during the 2015-16 season, 6 during the 2014-15 season and 16 during 2014-15. The average rainbow trout caught was smaller, lighter but in similar condition than those caught during the 2016-17 season.
- Anglers interviewed during the 2017-18 season perceived their catch rate to be marginally poorer, but size of fish was considered slightly improved compared to the 2016-17 season. Overall, angler's satisfaction levels were also slightly raised compared to those fishing during the 2016-17 season.
- Over the course of the 2017-18 survey, 72% of anglers stated they were either satisfied or highly satisfied with their seasons fishing.
- A total of 40 detractions were logged with surveyors over the 2017-18 season. The most common detraction to Ohau Channel angling related to poorly conditioned fish were being caught (18% of stated detractions). The next most regular detraction was that few fish were being caught (16%). Third and fourth highest scoring detractions related to a lack of smelt being present and the weather conditions (both 5%) followed by snags in the Channel (4%) and pollution (3%).

2.1 Data Collection

A total of 62 survey events were undertaken at the Ohau Channel over the 2017-18 season when anglers were present. Angler contacts encountered per survey (when anglers present) were the 2nd lowest over the history of the Ohau Creel surveys (Table 4).

2.2 Angler catch rates

Angler catch rate information (CPUE = fish per rod hour) gathered during the surveys during the 2005-06 and 2007-08 to 2017-18 seasons is summarized in Table 5.

The average individual catch rate (0.30 fish/hr) was improved from the 2016-17 season and represents the 4th lowest equal catch rate monitored since the Ohau creel surveys began. This catch rate is slightly below the average recorded in the 12 seasons surveyed in the Ohau Channel but above the average catch rate of the Rotorua lakes fisheries.

In contrast, the 2015-16 average angler catch rate was the second highest equal recorded since the diversion wall's construction with one fish caught for slightly greater than every 2.6 hours angling effort. This was ahead of the 2014-15 season catch rate (one fish per 3.1 hours effort) though not significantly. The average catch rate over the 2014-15 season was lower than the 2013-14 season though not significantly.

The 2013-14 season was significantly higher than the 2012-13 catch rate ($P=0.007$). Mann Whitney tests of the average individual anglers catch rate showed a non-significant statistical difference between the 2012-13 and 2011-12 season ($P=0.936$). There was also a non-significant difference between the 2011-12 and the 2010-11 seasons ($P=0.879$). There was a significant difference between the 2010-11 and 2009-10 seasons ($P<0.001$) and between the 2009-10 and 2008-09 seasons ($P<0.001$). There was no significant difference between the 2007-08 and 2008-09 seasons catch rates ($P=0.52$) whereas there was just a significant difference noted between the 2005-06 and 2007-08 catch rates ($P=0.049$). This type of difference is typically due to the spread of catch rates between anglers although Figures 2.2-2.6 suggest little difference was apparent. Angler experience (Figure 2.8-2.13) may account for differences seen in catch rates as inexperienced anglers have lower catch rates generally. The frequency of individual anglers visiting the Ohau Channel during the 2012-13 season differed from the general trend seen in the 2011-12 season as there was a great reduction in the number of anglers who visited only once, similar numbers in the 20-29 and 30-39 brackets and also an increase in the number of anglers that visited between 100-120+ times in the season.

2.3 Seasonality of Catch Rates

The opening day and average October individual catch rates for the 2017-18 season can best be described a 'middle of the road' opening period since Ohau Channel Surveys were implemented. The best opening to an Ohau Channel angling season witnessed during surveys is the 2009-10 season. The 2015 opening was the 2nd equal best start

along with the 2013-14 opening just ahead of the 2007-08 opening immediately prior to the diversion wall's construction. Having large smelt densities in the channel coinciding with the trout fishing season opening is an aspect that the 'good' openings have in common and the poorer openings lack.

October resulted in the highest angling effort recorded as per other survey years. November produced some good angling whereas December had nil angling hours recorded. Angling intensity and catch rates increased from March toward the end of the season (June). April provided the best catch rate figures for the season though low hours were recorded.

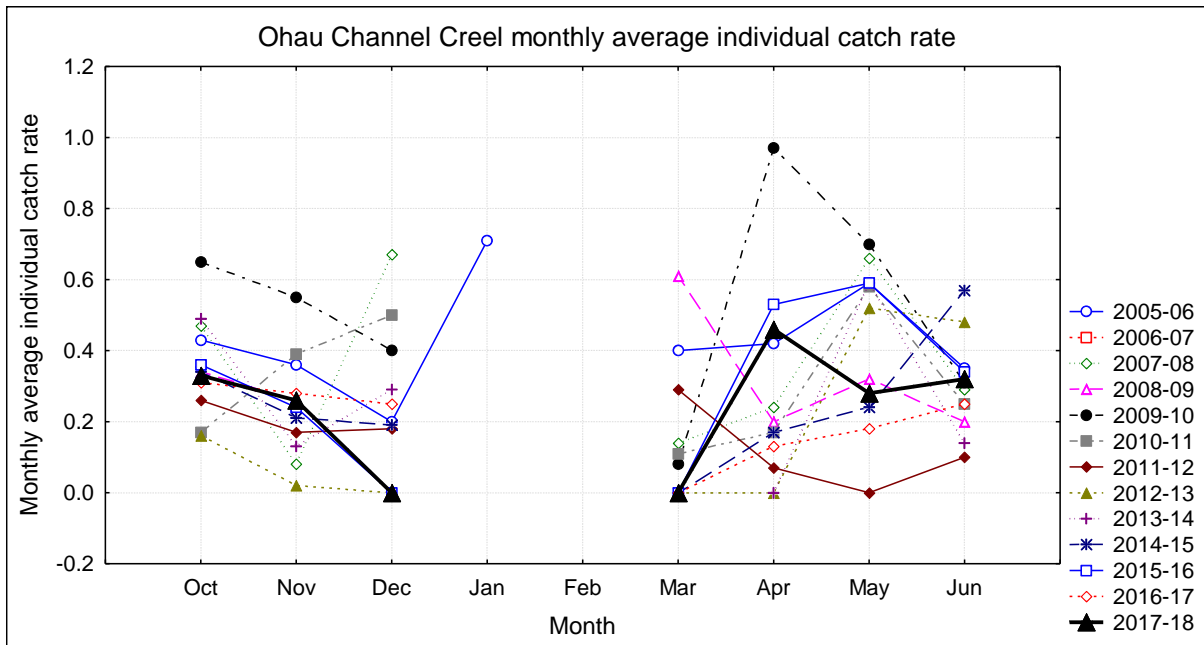


Figure 2.1 Angler catch rates by year during the season

Table 6. 2017-18 Catch rates during the season (other season tables in appendix)

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	116.5	35	3	0	0.33	0.33
All October	256.25	74	7	5	0.28	0.33
November	50.5	8	6	1	0.34	0.26
December	1	0	0	0	0.00	0.00
Jan & Feb						
March	5.25	0	0	0	0.00	0.00
April	15.25	5	1	4	0.39	0.46
May	50.75	9	9	4	0.36	0.28
June	86.75	17	8	9	0.29	0.32

This seasonality of catch rates in past seasons tends to mirror the encounter rate during the season (Figure 2.20 and Figures 2.21-2.29 in appendix). Basically, if catch rates were higher, the interviewers tended to encounter more anglers, when they were lower, they encountered less anglers. During the 2017-18 season, angler encounter rates peaked as

with other years at the start (early October) and built again toward the end of the season (late June) when expectations of catching fish are usually very high. The start of the season usually has high catch rates after being rested for three months and the end of the season traditionally sees fish move into the channel when Lake Rotorua’s temperature, that feeds the channel, cools.

Figure 2.20

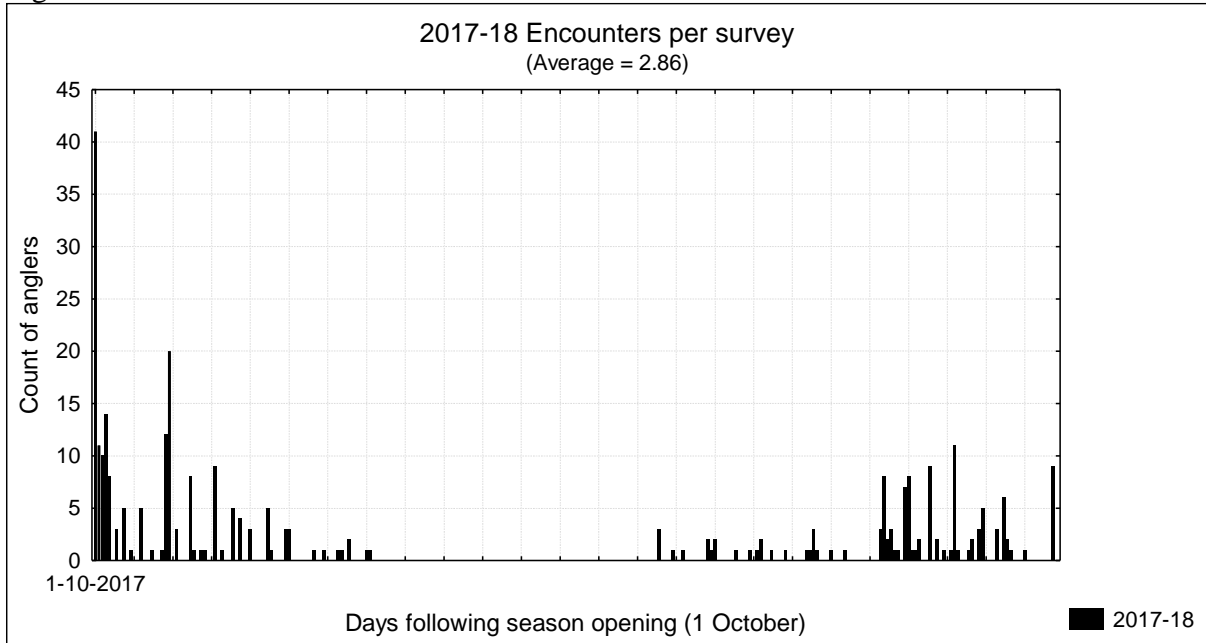
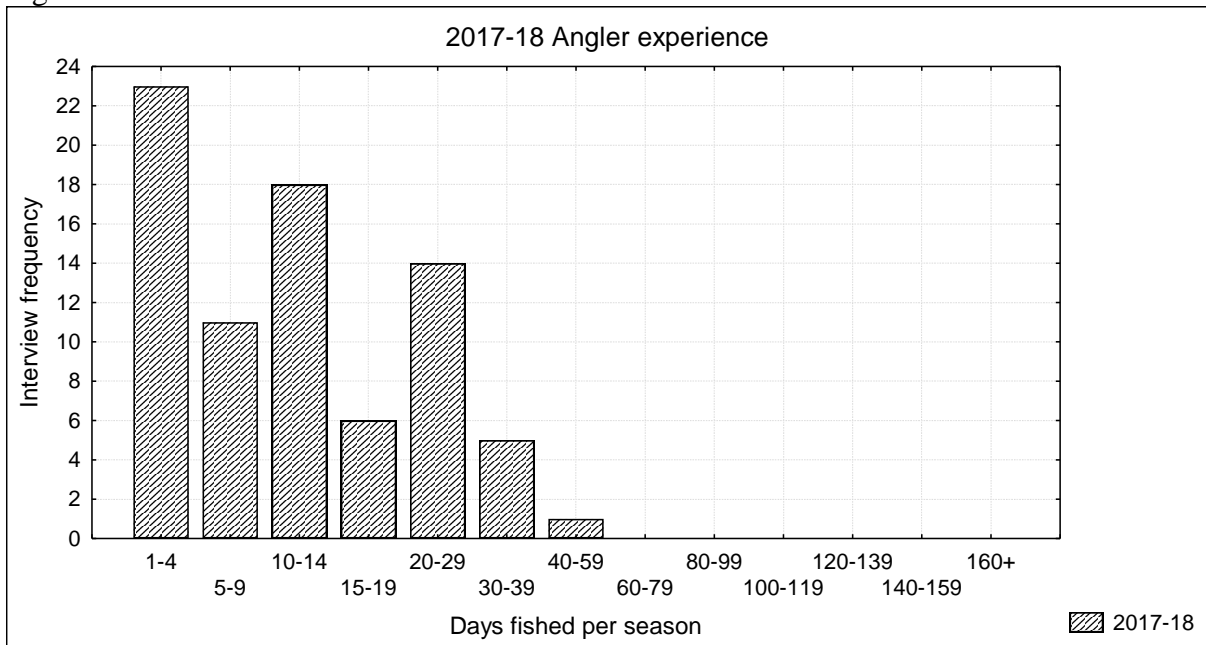


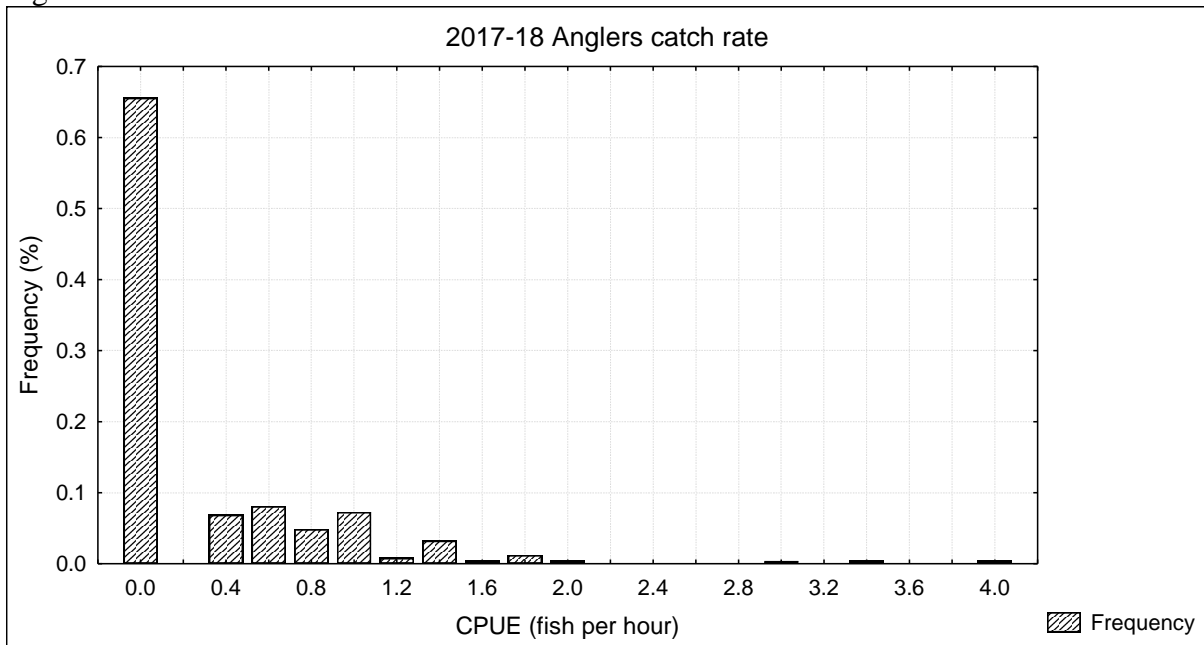
Figure 2.30



2.4 Catch Rate Distribution

Plots of catch rate distribution across anglers from one year to the next have shown little real difference with typically 65% of anglers not having caught a fish when interviewed. (Figure 2.40 and Figures 2.41-2.49 in appendix)

Figure 2.40



2.5 Characteristics of fish caught

The average brown trout caught during the 2017-18 season was smaller (22mm), lighter (406g) and in poorer condition than the average brown measured during the 2016-17 survey. A total of 22 brown trout were measured compared with 17 during 2016-17, 20 during 2015-16, 6 during 2014-15 and 16 during 2013-14. The average rainbow trout caught was smaller (7mm), lighter (80g) and in similar condition compared to those caught during the 2016-17 season.

2.6 Anglers perceptions and Satisfaction

Anglers were asked to rate (Table 8) how they felt about their catch rates and the size and condition of the fish they were catching this summer compared to previous summers. Anglers were also asked to rate their level of satisfaction with the summers fishing.

Table 8. Rating scales for assessing angler perceptions and satisfaction.

Ratings for CPUE and Size.		Rating for level of Satisfaction.	
Value	Description	Value	Description
1	Excellent	1	Highly satisfied
2	Good	2	Satisfied
3	Average/Acceptable	3	Dissatisfied
4	Poor	4	Strongly dissatisfied
5	Terrible		

The average rating used in the following tables and figures is the average calculated from all anglers perceptions on catch rate, fish size and condition, and satisfaction. The

average rating should be considered to be the answer given by a hypothetical "average angler". Size and condition are grouped into the same question as past surveys have found anglers most often group these characteristics together. Satisfaction is also assessed by the percentage of anglers who responded that they were satisfied (highly satisfied or satisfied) with their fishing.

The rating for the average angler for catch rate (cpue), fish size and angler satisfaction, including percentage of satisfied anglers is shown in Table 9. and Figures 3.0, 3.1.

Table 7. Brown trout and rainbow trout average length and weight data surveyed from Ohau Channel during 2005-06 and the 2007-08 to 2015-16 seasons. Significant differences shown in bold.

	<i>17-18</i>	<i>16-17</i>	<i>15-16</i>	<i>14-15</i>	<i>13-14</i>	<i>12-13</i>	<i>11-12</i>	<i>10-11</i>	<i>09-10</i>	<i>08-09</i>	<i>07-08</i>	<i>05-06</i>
Brown length	604	626	612	623	645	614	669	672	650	702	675	662
Brown weight	2.86	3.26	2.83	2.93	3.75	2.68	3.94	3.91	4.12	4.63	4.71	4.32
Brown c.f.	45.60	47.34	43.93	42.21	50.36	39.20	46.87	45.45	53.49	47.79	53.63	52.96
Rainbow length	499	506	503	519	512	492	516	507	541	554	543	541
Rainbow weight	1.50	1.58	1.62	1.55	1.69	1.51	1.58	1.56	2.11	2.22	2.30	2.25
Rainbow c.f.	43.36	43.37	44.76	39.81	44.57	44.06	40.39	41.55	47.19	46.1	50.98	50.09

Table 9. Angler perceptions (1=excellent, 5=terrible)

	<i>17-18</i>	<i>16-17</i>	<i>15-16</i>	<i>14-15</i>	<i>13-14</i>	<i>12-13</i>	<i>11-12</i>	<i>10-11</i>	<i>09-10</i>	<i>08-09</i>	<i>07-08</i>	<i>05-06</i>
Cpue	2.55	2.48	2.82	3.68	3.19	4.74	4.37	4.06	2.23	3.89	2.94	2.9
Size	2.49	2.51	2.82	3.76	3.01	4.74	4.38	4.05	2.32	3.87	2.98	2.28
Satisfaction	2.30	2.32	2.37	2.92	2.34	3.84	3.31	3.16	2.02	3.28	2.44	1.75
% satisfied	72%	67%	68%	33%	69%	3%	19%	19%	88%	16%	66%	98%

A decline in angler perceptions was noted between the 2005-06 season and the 2007-08 season for catch rate, and a significant decline for fish size and satisfaction ($P < 0.001$).

Perceptions were further lowered during the 2008-09 season when angler perceptions for all three characteristics (catch rate, fish size and satisfaction) were again significantly lower compared with the 2007-08 season ($P < 0.001$). Where anglers believed fish size was significantly poorer, fish measured by surveyors were larger, although brown trout were slightly lighter and rainbows significantly lighter meaning trout condition was poorer.

Anglers interviewed during the 2010-11 season felt that their catch rate, the size of the fish they were catching and their overall level of satisfaction were all significantly poorer ($P < 0.001$) than during the 2009-10 season. The marked decline in angler perceptions was supported by measured catch rate and by fish characteristics. Measured catch rate during the 2010-11 season was significantly worse ($P < 0.001$) than the catch rate surveyed during the 2009-10 season.

Anglers interviewed during the 2011-12 season perceived their catch rate and the size of the fish they were catching to be significantly poorer than during the 2010-11 season ($P = 0.033$ and 0.031 respectively). The overall level of satisfaction was also reduced and provided the lowest satisfaction ranking recorded over the six years surveyed. The marked decline in angler perceptions was supported by measured catch rate, but only partially by fish characteristics (rainbow condition was slightly lower). Measured catch rate during the 2011-12 season was lower than the catch rate data collected during the 2010-11 season.

Over the course of the 2012-13 season anglers perceived their catch rate to be significantly poorer than during the 2011-12 angling season ($P = 0.01$). These perceptions matched the measured results from the October to April period though the end of the season (May/ June) had elevated catch rates which lifted the average 2012-13 cpue above the 2011-12 average cpue. Fish size and condition was also perceived to be significantly poorer ($P = 0.02$). Perceptions of fish size and condition matched the measured brown trout characteristics and largely the rainbow statistics (length and weight decline) although the condition of the rainbows was improved. Overall satisfaction was also significantly lowered (See 2.61 below).

A significant improvement in both perception of catch rate and fish size/condition along with anglers satisfaction was noted during the 2013-14 creel survey ($P < 0.001$ for all three variables). These were the best ratings given by anglers for fishery statistics and satisfaction since the 2009-10 season. A total of 69% of anglers were satisfied or highly satisfied with their Ohau Channel angling over the 2013-14 season. This was a significant improvement from 2012-13 ($P < 0.001$).

During the 2014-15 Ohau creel all three attributes were perceived as being significantly poorer than during the 2013-14 season. Catch rate ($P = 0.048$), Size ($P = 0.001$) and Satisfaction ($P < 0.001$). Just 33% of anglers were satisfied or highly satisfied with their

angling during the 2014-15 season. This was a significant drop in satisfaction levels ($P < 0.001$)

Over the 2015-16 season all three attributes were perceived to be significantly enhanced from the 2014-15 season ($P < 0.001$).

Significant improvements in catch rate ($P = 0.019$) and fish size ($P = 0.033$) were again perceived by Ohau Channel anglers during the 2016-17 season compared to the 2015-16 season. Satisfaction was improved but gains were not significant.

Over the course of the 2017-18 season, anglers considered catch rate to be slightly poorer whilst fish size and condition along with overall rating of satisfaction were perceived as being marginally improved.

Figure 3.0 Angler Perceptions of catch rate and fish size

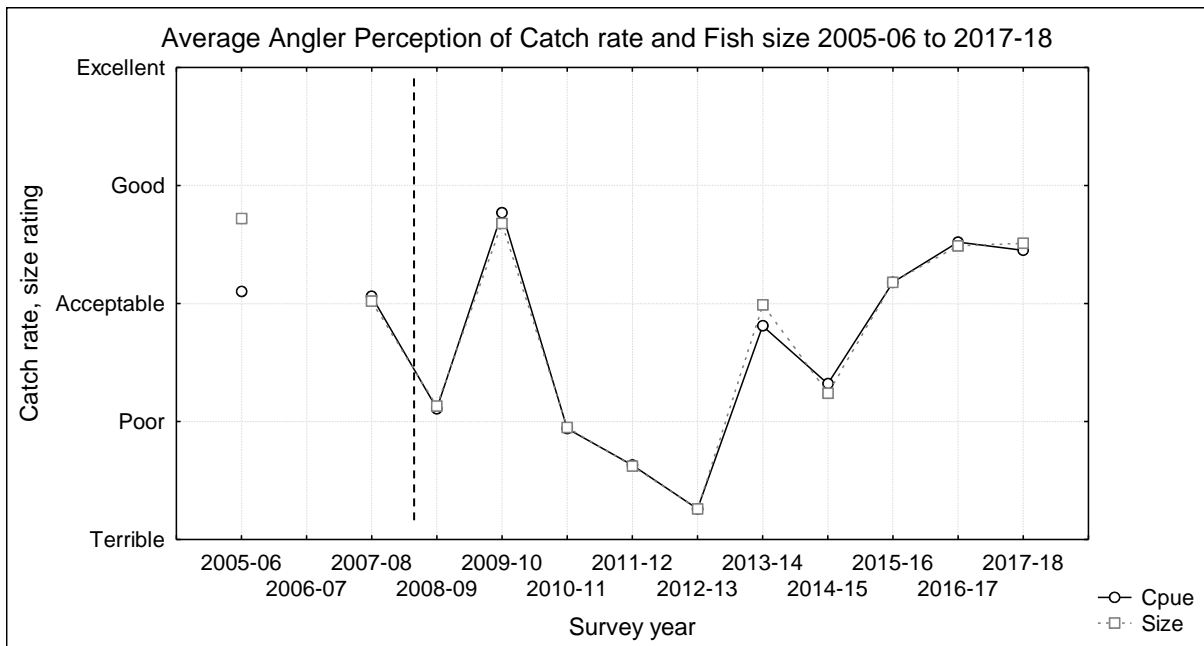
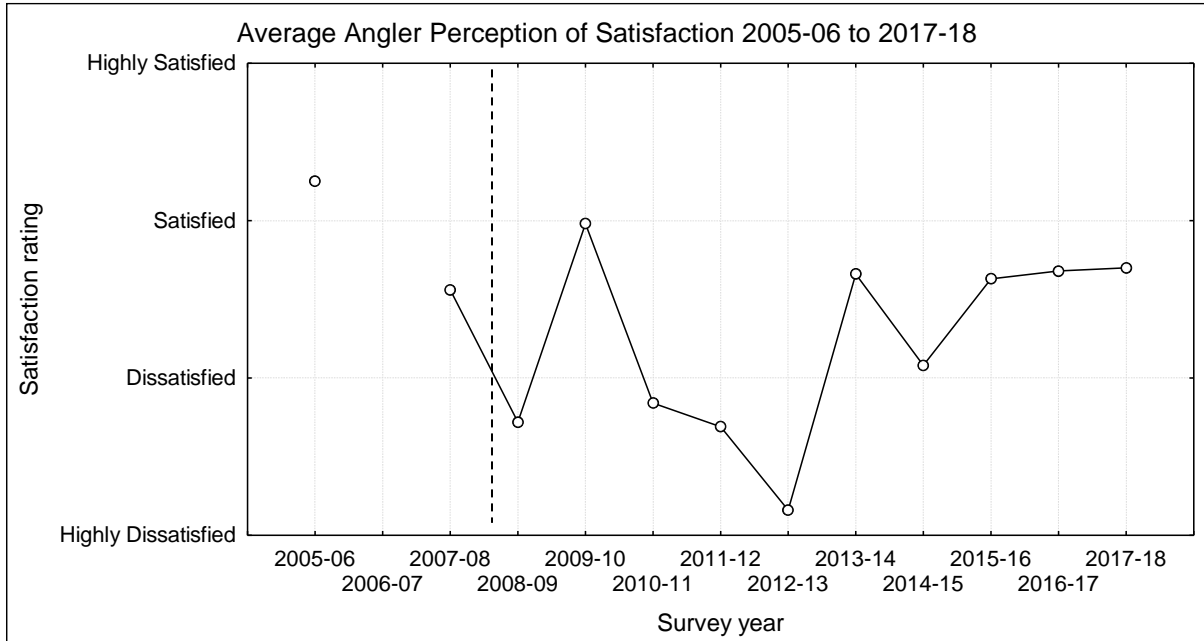


Figure 3.1 Angler Perceptions of Satisfaction



2.61 Percentage of anglers Satisfied

The percentage of anglers that expressed they were either satisfied or extremely satisfied with their angling has changed significantly over the course of the 11 completed surveys (figure 3.0).

In the 2005-06 season, a total of 98% of anglers stated they were satisfied with their seasons angling in the Ohau Channel. This dropped significantly during the 2007-08 season to 66% of anglers ($P < 0.001$).

Throughout the 2008-09 season, only 16% of anglers felt that they were satisfied with their angling experience. This figure had dramatically dropped away over the first 3 seasons surveyed ($P < 0.001$ Binomial Comparative Trial). To have only 16% of anglers saying they were satisfied or highly satisfied was **very low**. Typically, angler satisfaction on Fish & Game surveys gets to a low point of 70%.

During the course of the 2009-10 survey, the perceived improvement in the fishing was such that 88% of anglers said they were either satisfied or highly satisfied with their seasons fishing. This was a significant improvement ($P < 0.001$ Binomial Comparative Trial).

Over the course of the 2010-11 season, poor catch rates and reduced fish size altered anglers perceptions in such a way that a total of 19% of anglers said that they felt they were either satisfied or highly satisfied with their seasons angling in the Ohau Channel.

This was significantly poorer than the level achieved during the 2009-10 season ($P < 0.001$ Binomial Comparative Trial).

During the 2011-12 season, despite the slight increase in size of the rainbow catch and improvement in condition of the browns caught, the worst catch rates recorded over the six years of the Ohau Creel survey resulted in the percentage of satisfied anglers remaining at 19%.

The level of satisfaction recorded during the 2012-13 season was significantly lower than during the 2011-12 season ($P < 0.001$). Just 3% of anglers said they were satisfied or highly satisfied with their angling at the Ohau Channel during the 2012-13 season. This was a significant drop from the 2011-12 season ($P = 0.007$). All of the perception attributes measured produced poorer values than had previously been recorded during the Ohau Channel Creel Surveys.

Improvements in catch rate and fish size and condition improved the level of angler satisfaction over the 2013-14 season to such a level that 69% of anglers stated that they were either satisfied or highly satisfied with their Ohau Channel angling. This was a significant improvement from the 2012-13 season ($P < 0.001$).

Following the very good 2013-14 season, the drop in recorded catch statistics and size/condition of fish caught resulted in just 33% of anglers stating that they were satisfied with their 2014-15 seasons fishing at the Ohau Channel. This was a significant drop in satisfaction ($P < 0.001$).

The catch rate and size and condition of fish caught resulted in 68% of anglers surveyed stating they were satisfied or highly satisfied with their Ohau Channel angling over the 2015-16 season. This was a significant improvement from the 2014-15 season ($P = 0.002$).

During the 2016-17 season, despite significant perceptions of improvement to catch rate and fish size, the angler satisfaction rating was slightly upgraded from the 2015-16 season. A total of 67% of anglers were satisfied with their Ohau Channel angling over the 2016-17 season. An improvement in average angler satisfaction rate indicates a shift of satisfied to highly satisfied anglers but a consistent number of dissatisfied anglers, keeping the ratio of satisfied to dissatisfied anglers similar.

Over the 2017-18 season, the percentage of satisfied anglers lifted slightly from the past two seasons (2015-16 and 2016-17) with 72% of anglers stating they were satisfied with their Ohau Channel trout fishing.

2.7 Angler Detractions

In order to attempt to quantify what real issues are facing anglers fishing the Ohau Channel they are asked "what, if anything, detracts from their angling experience?" The percentage responses for the 2005-06 and 2007-08 to 2017-18 surveys are shown in Table 10.

Over the course of the 2017-18 season 18% of stated detractions to angling were due to poor size and condition of fish caught. The majority of these (13 out of 14 respondents) related to 'No big fish being caught'. The other high scoring detraction (16% of respondents) reported a lack of fish being caught. 5% said that lack of smelt detracted from their angling whilst another 5% said weather was a major detraction. 4% of respondents to the question blamed snags within the channel to be detracting from their enjoyment. A further 3% said pollution was a detraction.

Fish & Game received very few calls about poaching at the channel over the past four seasons (2013-14 to 2017-18 seasons).

More detractions were highlighted when surveyed anglers were asked why they were satisfied or dissatisfied (2.71).

Table 10. Stated detractions to angling experience

DETRACTION	2017-18	2016-17	2015-16	2014-15	2013-14	2012-13	2011-12	2010-11	2009-10	2008-09	2007-08	2005-06
Crowds		3%	1.4%								2.5%	9%
Shags												5%
Quality Water		3%					1%		3%	3.9%		5%
Boats												4%
Rude anglers											1%	3%
Limited access			1.4%			2%						3%
Weir*		16%	4.3%		4%		1%	2%				2%
Snags	4%				1%					1.3%		2%
Other users					8%						2.5%	2%
Few fish	16%	11%	30.4%		26%		1%	9%	4%			2%
Technology												1%
Lack of smelt	5%	3%										
Poor cond. fish	18%*	11%	4.3%					15%	8%	1.3%		1%
Pollution	3%	5%	5.8%		3%					1.3%		1%
Poachers		1%			1%				7%			1%
No Toilet												1%
No reg. signs												1%
Weather	5%	14%				2%						
Nil	50%	34%	52.2%	100%	57%	96%	97%	74%	78%	92.1%	94%	55%
Total		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

2.71 Why Anglers were Satisfied or Dissatisfied

During the 2008-09 survey, the surveyors noted that “The Wall” was the most common topic of discussion during the survey yet no anglers actually mentioned it as detracting from, or being a detraction to, their fishing. On discussing this with surveyors further, they felt the anglers considered the more immediate detractions when asked this question so responses typically related to what they could see or what was affecting them directly at the time they were interviewed.

Over the course of the 2009-10 interviews, anglers were asked whether they were satisfied or dissatisfied with their summers fishing and then why? This was done to tease out whether anglers felt the wall itself was having a negative (or positive) effect upon the fishery. Only 1 angler out of 55 (1.8% of respondents) said that there were no fish running through the channel perhaps due to the presence of the wall.

During the 2010-11 season 5 anglers out of 226 (2% of respondents) mentioned the wall as a causative factor that led to their poor fishing.

Through the 2011-12 surveys when asked why they were satisfied or dissatisfied, 66% did not provide any reason. 15% of respondents mentioned the lack of fish being caught. 7% mentioned the poor quality of the fish that were caught and another 7% made a direct mention of the wall and this related to stopping fish passage and restricting smelt from entering the channel. A further 2% of the respondents voiced directly that Fish & Game needed to address the problem.

Over the course of the 2012-13 surveys 136 out of 163 respondents gave no comment (83%). 8% of replies stated that they were dissatisfied because of poor catch rate. 4% indicated that something needed to be done to the diversion wall. 2% were dissatisfied because of poor fish size. The lack of smelt present during angling sessions caused dissatisfaction to a further 1% of anglers that voiced opinions. A further 1% of respondents were ‘satisfied’ because the fishing was “not too bad”.

During the 2013-14 Ohau Channel creel survey 10 out of 63 anglers that provided an answer to why a particular factor was detracting from their angling directly mentioned the wall as a factor (14.7%). The reasons stated were 'the wall has made fishing progressively worse', 'No fish seen spawning in channel as was in pre wall times', 'Lack of smelt and fish are small - but good condition', 'It's taken 7 years for smelt to come around the diversion wall', 'have heard wall has had an effect but fishing seems good'.

Through the 2014-15 season, 20 anglers provided a comment as to why they were satisfied or dissatisfied with their angling at the channel. Of these 20 respondents, 50% said they were dissatisfied because of the low catch rate that was being experienced. A further 30% stated that fish were of poor quality/small size. Contrary to these a further 20% said that they were satisfied because they did catch fish and/or the fish were bigger than they had been previously catching.

Over the 2015-16 season, 33 comments were received by surveyors recording detractions to angling at the Channel. 64% of comments received related to the lack of trout caught. 12% of comments were about rubbish entering or around the channel. Poor size and/or condition of fish caught accounted for 9% of comments and a further 9% the diversion wall being thought to directly affect angling. 3 % of anglers thought that a lack of knowledge about the best places to fish affected their ability to catch fish. A further 3% said a lack of other people fishing detracted from their angling.

During the 2016-17 season, a total of 50 detractions were logged with surveyors whilst a further 26 anglers did not comment. The most common detraction to Ohau Channel angling was that 'The Wall' had directly affected angling (16% of stated detractions). The next most regular detraction was that water levels in the Channel made fishing hard (14%). Third and fourth highest scoring detractions related to a lack of fish caught and poor size and condition of fish (both 11%). Then pollution in the Channel (5%), poor water quality (3%), less smelt present (3%) and less anglers present (3%) which may be a description of poorer angling quality compared to earlier years. The presence of poaching/illegal methods was the subject of 1% of detractions.

Throughout the 2017-18 season, following the question 'Are you satisfied with your seasons fishing', surveyors put the question to anglers 'Why?' Of 43 respondents that had stated they were 'just satisfied' with their 2017-18 season at the Ohau Channel 47% said they were satisfied because fish were being caught. 14% said their satisfaction was due to the Channel being a nice place to visit and fish. 12% said that the good condition of fish led to them being satisfied. 9% were satisfied because they were pleased fish passes had been put in the wall. A further 9% had fished at the Channel for years and enjoyed the place. 7 % were satisfied because of easy access to fishing. 2 % enjoyed the challenged of fishing the Channel.

Of the 16 respondents that were dissatisfied, 56% of these reported low catch rates as the driver. 19% said that it was their first trip to the Channel in years. 13% said that their expectations had not been met. 6% said that they fished after work before going home and a further 6% stated that the size and condition of fish was poor.

One angler who stated they were highly dissatisfied claimed lack of fish was the causative factor of their level of satisfaction.

2.8 Ohau Creel Summary

Prior to the wall being built, anglers could fish at two major publicly accessible points of the channel. The first being the start of the channel by the weir from Marama Resort (now Ramada Resort) side (true left) and Takinga Street (true right). The other area was where the channel entered Lake Rotoiti known as the Ohau Channel Delta. Both of these areas had deep water drop offs where trout would congregate and hold. The remainder of the channel is largely privately owned where general public do not have access. Since the diversion wall was built, the area that was previously known as the 'Delta' has

gradually filled in and become a poor angling area as fish no longer hold in that zone. Extra pressure has since been placed on the Lake Rotorua end of the channel as most anglers moved to the area that had legally permitted angler access and the best opportunity to catch trout.

The 2009-10 season aside, angler catch rate has been lower than pre-wall totals and has been deteriorating. The number of anglers fishing the channel has also been lower, particularly over the 2011-12, 2012-13 and 2014-15 seasons.

The condition factor of trout caught within the channel has declined compared with pre-wall measurements since the wall was built. The 2009-10 season noted a slight improvement in both rainbow and brown condition before a drop in condition through 2010-11 and 2011-12 particularly in the rainbow trout measured. The 2012-13 season saw a significant drop in brown trout condition, but with only 4 fish measured is too few to make a decent comparison. The rainbows improved significantly in terms of condition, but length was significantly reduced. Lake Rotoiti opening day creel surveys noted a significant drop in rainbow two-year-old condition factor during 2011-12 and a further depression for the 2012-13 two-year-olds before recovering through the 2013-14 to 2014-15 period. The summer creel undertaken annually on Lake Rotorua also recorded a decline in fish condition around and following 2007-08 when the wall was constructed. This may be a consequence of lack of smelt in Lake Rotorua and/or warm summer lake temperatures and algal blooms affecting the lake from this period. Lake Rotorua monitoring indicated an improvement in rainbow trout size and condition during the 2012-13 and 2013-14 seasons, along with anecdotal reports of smelt appearing in numbers. Subsequent decline in condition was then noted in Rotorua catch from the 2014-15 season with very warm summer water temperatures.

In the two seasons surveyed prior to the wall being in place, anglers perceptions of catch rate, fish size and satisfaction were rated acceptable to good/satisfied.

In five of the eight angling seasons surveyed since the diversion wall was constructed, angler's perceptions of catch rate and fish size have been rated 'poor' to 'terrible' and anglers satisfaction has been classed 'dissatisfied' to 'highly dissatisfied'. Three of the eight seasons surveyed since the diversion wall construction (2009-10, 2013-14 and 2015-16) have produced acceptable to good perception ratings for catch rate and fish size and produced satisfied Ohau Channel anglers.

In response to what detracts from their angling experience, fishers have over the course of the surveys identified three main areas of detractions. The quality of the water (which also encompasses the water level), the number of fish caught and the quality of the fish caught. These are all immediately in line of anglers sight and the first things that come to mind, such as 'I haven't caught any fish', 'my fish are terrible' or 'the water is low and filthy'.

The fishery advisory panel wished to get more in-depth information on the drivers of angler satisfaction or dissatisfaction so asked why anglers were satisfied or dissatisfied. In response to this, few anglers have mentioned the wall as a causative factor. Only 1.8%

of respondents in 2009-10, 2% in 2010-11 and 7% in 2011-12 mentioned the wall (one, five and nine anglers respectively). Two anglers during the 2011-12 survey also stated that Fish & Game needed to address the problem. It is possible that the anglers when asked why they were dissatisfied simply replied 'because I haven't caught any fish' or 'because the fish are in terrible condition'. Without asking a particularly leading question, the anglers may have again picked the most visible factor affecting them.

During the course of the 2012-13 season, 4% (n=7) of anglers who made a comment mentioned that the wall was directly influencing their dissatisfaction. This was elevated to 14.7% of anglers attributing their dissatisfaction due to the wall's presence during the 2013-14 season (n=10).

During the 2014-15 season, the wall was not mentioned to surveyors when prompted for detractors to angling or causative factors for satisfaction levels.

The 2015-16 season resulted in 16% of respondents to the question "Why are you satisfied/dissatisfied" mentioned the wall as adding to or detracting from their satisfaction. Amongst these, 3% said they couldn't blame the wall any more as the fish had returned. 13% said they still felt the wall was to blame for the poor fishing they were experiencing by stopping fish coming up the channel.

Angling clubs and some individuals have commented negatively on the angling in the Ohau Channel since the construction of the diversion wall, except for the 2009-10 season, when the opening was described as very good to excellent. A number of letters from the Ohau Angling Club and phone calls from anglers have been received by Fish & Game over the seasons since the diversion wall has been in place. A lack of information provided to public on the progress of the wall consenting process did not assist anglers coming to terms with changes that they perceived to be occurring in the fishery whether factual or otherwise. Information pamphlets detailing the Ohau Diversion Wall consent and monitoring to date were produced by Bay of Plenty Regional Council during the 2012-13 angling season. Unfortunately, these were not made available till after the closing of the Ohau channel fishing season at the end of June. They were handed out to many anglers prior to and at the start of the 2013-14 season. There has been a definite reduction in correspondence coming back to the Eastern Fish and Game Council since this was provided.

Just after the 2015-16 season opening, it was discovered through aerial photography that a hole had scoured underneath the diversion wall at the site of the old delta. Over the 2015-16 season there were good numbers of smelt observed in the channel over a lengthy period and good fishing was recorded. It is not known whether the wall undermining played an important role in the smelt appearance or angling improvements seen.

When questioned why they were satisfied or dissatisfied, anglers during the 2016-17 season made the following statements. 23 anglers that stated they were dissatisfied also gave an explanation as to why. 30% said that they were dissatisfied but had good catch rates. 22% were dissatisfied but said it was a nice place or had heard good things. 13% of

dissatisfied anglers said the Ohau Channel fishery was close to home. Another 13% of anglers stated that they were dissatisfied because of poor catch rates. A further 13% said they were dissatisfied because of hard or challenging fishing. 9% of dissatisfied anglers responding to the question said that easy access was the reason they were dissatisfied. Some of the answers may have been responding to a question of why are you fishing here if you are dissatisfied rather than why are you dissatisfied?

52% of anglers that had stated they were satisfied (n=46 satisfied anglers) said that plenty of fish were visible or being caught. 11% said that they were satisfied because they heard that fish passes were being put into the wall. 9% said easy access was why they were satisfied. 7% were satisfied that more brown trout were being caught. Another 7% said they liked the fact that the channel was close to their home. A further 7% made no comment. 4% were satisfied because they felt fishing was finally improving since the wall was built. 4% were satisfied because they had witnessed smelt present in high numbers.

Two fish passes were retrofitted into the wall during the first week of October 2017. Further monitoring will be required to ensure that the pass arrangement is providing the desired effect. This is largely dependent on water velocity being low enough to allow burst swimming for juvenile smelt, and monitoring of whether smelt and juvenile bullies are using the pass arrangement.

From the data collected during the 2017-18 season, a total of 16 anglers who expressed dissatisfaction provided an explanation when asked. 56% of these said their dissatisfaction was due to poor catch rate. 19% mentioned it was because it was their first visit in years. 13% said that the angling did not meet their expectations. 6% said the poor size and condition of fish led to their dissatisfaction whilst a further 6% said they only fished on their way home from work.

A total of 46 anglers gave a reason to why they were satisfied with their Ohau Channel angling experience. 47% of these said they were satisfied because fish were being caught. 14% said the Ohau Channel was a nice place to visit and fish. 12% said they were satisfied because the fish they caught were in good condition. 9% said their satisfaction was because the 'fish passes' had been installed. A further 9% said that they had fished there for years and that provided satisfaction. 7% felt that easy access was a major drawcard. A further 2% enjoyed the challenge of fishing the Ohau Channel.

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