EASTERN REGION

Ohau Channel Diversion Wall Trout Monitoring 2014-15

Prepared for Fisheries Panel Meeting 6th November 2015

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 2014. Data from Lake Rotoiti trout, approximately 75 months after diversion wall was completed.

Summer Survey Data

- Continuous summer survey from November to April each year
- Trout characteristics collected from all fish measured – 76 to 81 months post wall completion

Possible wall Impacts?

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 drop in trout length.

- Data from the 2015 Opening Day (Table 2 and figure below) showed that trout condition from the hatchery 2-year-old group was similar to the pre-wall and immediate post wall period.
- Improvements in condition factor have been noted in the Lake Rotoiti 2-yr-old fish since the 2012 Opening Day.

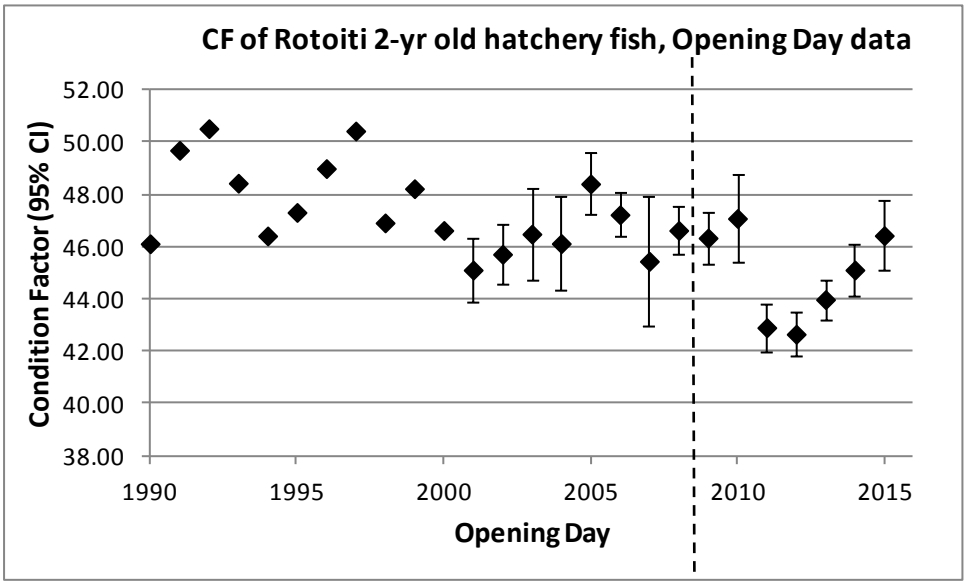


Figure 1.1 Condition factor of Lake Rotoiti 2-year-old trout on Opening Day

- The summer survey data for Lake Rotoiti (Table 1) shows that average rainbow trout condition over the 2014-15 summer was better than the fish surveyed from the 2013-14 summer and just ahead of 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***	**14-15**	**13-14**	**12-13**	**11-12**	**10-11**	**09-10**	**08-09**	**07-08**	**06-07**	**05-06**	**04-05**
Rotoiti	Length (mm)	*518*	518	523	522	**516**	**525**	501	512	520	518	527	**517**
	Weight (kg)	*1.82*	1.80	1.80	1.79	1.71	1.83	1.68	1.83	1.75	1.71	1.98	**2.12**
	Cond' Factor	*44.21*	**45.48**	**44.23**	**42.11**	43.33	43.47	**44.51**	**46.32**	42.00	**42.14**	45.76	46.96
Rotoiti	Wild L	*490*	480	507	490	492	491	478	476	500	513	492	466
	% WILD	*42%*	26%	23%	39%	40%	45%	37%	30%	44%	62%	57%	54%
	Hatch L	*530*	532	527	540	531	552	515	526	536	520	539	516
	N (all fish)	*175*	195	243	165	390	128	159	161	86	89	90	218
Tarawera	Length (mm)	*519*	503	**499**	532	**541**	**516**	536	529	532	516	510	498
	Weight (kg)	*1.59*	1.42	**1.42**	**1.63**	**1.87**	**1.49**	1.71	1.70	1.63	1.57	1.54	1.49
Rotorua	Length (mm)	*455*	**439**	**455**	443	431	436	456	**460**	**485**	465	466	472
	Weight (kg)	*1.12*	**0.99**	**1.23**	0.98	0.88	**0.80**	1.10	**1.10**	**1.36**	1.21	**1.2**	1.49
Okataina	Length (mm)	*539*	539	515	529	537	553	552	545	534	522	533	571
	Weight (kg)	*1.84*	1.83	1.70	1.79	1.97	2.00	2.05	1.98	1.70	1.56	1.54	2.16
Rrua FF L		*475*	456	492	464	449	**428**	**460**	495	500	502	483	499
Rrua FF Wt		*1.34*	1.10	1.49	1.13	**1.09**	**0.80**	**1.29**	1.46	1.59	1.73	1.52	**1.50**
Rrua Tr L		*452*	433	449	440	429	445	455	**457**	**477**	464	460	460
Rrua Tr Wt		*1.09*	0.96	1.18	0.97	0.86	0.81	1.15	**1.07**	1.23	1.20	1.**09**	1.48

Possible wall Impacts?

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

- Opening Day data from 2014 Opening (1st October 2014) showed 22% of the opening day catch (excluding fly fishing) was made up of wild trout (Table 2). This is a low percentage (for the seventh successive opening) and the lowest wild percentage recorded in opening day surveys.

- The Summer creel survey data (Table 1) shows that the percentage of wild trout in the catch measured during the 2014-15 summer creel survey was 26%. This is compared to the 23% during the 2013-14 summer, 39% measured in the 2012-13 summer, 40% in the 2011-12 summer, and 45% during the 2010-11 survey.

- Liberations of hatchery trout into Lake Rotoiti increased slightly during 2010-2011 and we would expect this to have a slight effect of 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 affect of the diversion wall, or may have been affected 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 the last openings in the period 2008-2012 and which was similar to the 2001 Opening Day percentage. The 2013 opening showed a wild percentage excluding trout caught fly fishing of 22%

We might also expect a decline in the ratio of younger wild fish to older wild fish 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 or younger trout in the wild catch has in past years been as low as 24%, and averages 49%. During the 2013 opening, the percentage of younger class wild trout was 59%.

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)
1997	14500	8500	6000	57	522	1.99	**50.44**	0.22	57.8	17
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	37	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

Table 2.1 Data summary statistics

	% Wild	*2yr lgth*	*2yr wgt*	*2yr CF*	*cpue*	*% Wild exFF*
Mean	38.89	511	1.71	46.20	0.21	37.56
Standard Error	2.578048	2.61403	0.038848	0.450282	0.008625	2.651072
Median	37	514	1.73	46.32	0.22	36.85
Mode	44	522	#N/A	46.63	0.22	#N/A
Standard Deviation	10.93773226	11.09038917	0.164817189	1.910385873	0.036590831	11.2475473
Sample Variance	119.634	122.9967	0.0272	3.6496	0.0013	126.5073
Kurtosis	0.125449	-0.362994	-0.64753	0.664834	-0.508332	0.00923
Skewness	0.697505	-0.452316	-0.144536	0.05708	-0.001267	0.708721
Range	41	41	0.59	7.79	0.13	39.4
Minimum	22	489	1.4	42.65	0.15	21.6
Maximum	63	530	1.99	50.44	0.28	61
Count	18	18	18	18	18	18
Confidence	5.05	5.12	0.08	0.88	0.02	5.20

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

Season start	*AVG*	14-15	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07	05-06
Wild 1+	38	27	39	47	59	28	23	27	16	64	51
Wild 2&up	39	19	26	52	27	25	50	32	52	58	53
All Wild	78	**46**	**65**	**99**	**86**	**53**	**73**	**59**	**68**	**122**	**104**
Wild 1+	49%	59%	60%	47%	69%	53%	32%	46%	24%	52%	49%
Wild 2&up	51%	41%	40%	53%	30%	47%	68%	54%	76%	48%	51%

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

	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
Nil angler encounters	33	32	15	19	28	22	17	3	15
Total Anglers	159	216	270	412	518	373	496	576	270
Anglers per survey*	3	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 2013-14 seasons. (Ohau Creel Surveys)

	14-15	***13-14***	***12-13***	***11-12***	***10-11***	***09-10***	***08-09***	***07-08***	***05-06***
Hrs fished	305.75	472.95	390.75	521.5	826.5	1015.5	728.10	934.15	1099.1
Kept	62	126	73	94	125	394	212	371	349
OSRT	31	83	15	33	90	221	42	24	102
USRT	20	39	14	36	29	14	4	16	34
CPUE(sum)	0.30	**0.44**	0.23	0.24	**0.26**	**0.60**	0.35	0.42	0.41
HPUE(sum)	0.20	0.27	0.19	0.18	0.15	0.39	0.29	0.40	0.32
Avg indiv' cpue	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 was fairly stable through the 2001-2010 period with a high point occurring in 2005. In 2011 a significant drop in rainbow trout condition factor was noted. A further decline in condition was picked up at the 2012 opening, though length and weight were better that the 2011 opening figures yet well behind the 2010 figure. The 2-yr-old fish at the 2013-14 opening were smaller, lighter but in better condition that the fish from the 2012-13 opening. Possible reasons for size difference are noted 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. We are trialling this to see if we can increase survival by avoiding the majority of fish being released at poor growth times of the year. From this we know that we are getting a wider spread of size ranges, which will affect the opening day, summer creel and winter creel average sizes.

Wild percentage has hovered at around 30% since the wall put in after an initial 10% drop coinciding with construction of the wall, but the percentage of wild fish in the catch had been sliding for a couple of years prior to construction.
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. The 2013-14 opening day showed a higher percentage of hatchery fish being caught and weighed in. This may be a result of increased 2-yr-old survival. We will monitor the wild percentage at the 2014-15 opening to see if a similar percentage is picked up.

Summer harvest was fairly high over the 2013-14 summer and better than the past 10-yr-average of 0.25 fish per hour on Lake Rotoiti. Winter catch rate has yet to be calculated, though indications are that it was just behind if not on a par to a very good 2013 winter catch rate. During the 2013 winter, the average catch was much improved compared to the 2012 winter and the best recorded since the 2007 winter. The fish caught by Rotoiti anglers during the 2013 winter were smaller and slightly lighter than those caught in 2012 and at 587mm FL were smaller than the past 10-year average (598mm). Since the 2007-08 season when the wall was constructed, Lake Rotorua creel surveys have shown a drop 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. The average Rotorua trout caught during the

2013-14 summer was significantly larger (P=0.037), heavier (P=0.001) and in better condition (P=0.01) than fish caught during the 2012-13 summer.

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, 2008-09, 2009-10, 2010-11, 2011-12 and 2012-13 and JFB Consultants during the 2013-14 season. The data collected provides 2 years of fisheries statistics pre-wall construction and 6 years following completion.

EXECUTIVE SUMMARY

- A total of 82 angler creel surveys were conducted at the Ohau Channel over the 2014-15 angling season. Anglers were encountered (fishing) during only 49 of the surveys. A lower number of anglers were interviewed during the course of the 2014-15 survey than had been seen in the eight previous creel surveys.
- The 2014-15 angling season at the Ohau Channel produced a lower average catch rate than the 2013-14 season. The 0.32 fish per hour recorded was the fifth highest documented during the nine completed Ohau Channel creel surveys.
- The average brown trout caught during the 2014-15 season was smaller, lighter and in poorer condition compared to those from the 2014-15 survey. A total of 6 brown trout were measured compared with 16 during 2014-15, 4 during 2012-13, 12 during 2011-12, 5 during 2010-11, 34 during 2009-10, 20 during 2008-09, 38 during 2007-08 and 48 during the 2005-06 survey. The average rainbow trout caught was larger, lighter and in significantly poorer condition (P<0.001) than those caught during the 2013-14 season.
- Anglers interviewed during the 2014-15 season perceived their catch rate (P=0.048) and the size of the fish they were catching (P=0.001) to be significantly poorer compared to the 2013-14 season. Anglers overall satisfaction levels were significantly lower (P<0.001) than anglers fishing during the 2013-14 season.
- Over the course of the 2014-15 survey, a total of 33% of anglers stated that they were either satisfied or highly satisfied with their seasons fishing. This was a significant drop from the 2013-14 season when 68% of fishers interviewed stated they were satisfied with their angling (P=0.001).
- Over the 2014-15 season, just two comments were received by surveyors seeking detractions to angling at the Channel. These comments related to not enough time to spend fishing.

2.1 Data Collection

A total of 49 survey events were undertaken at the Ohau Channel over the 2014-15 season when anglers were present. Angler contacts encountered per survey were the second lowest recorded during the Ohau Creel surveys (Table 4).

2.2 Angler catch rates

The angler catch information (CPUE = fish per rod hour) gathered during the surveys during the 2005-06 and 2007-08 to 2014-15 seasons is summarized in Table 5.

During the 2014-15 season (7 years post wall construction) the average individual catch rate was the third highest recorded since the diversion wall's construction with one fish caught for slightly greater than every 3.1 hours angling effort. This was lower than the 2013-14 season catch rate (one fish per 2.6 hours effort) though not significantly.

The average catch rate over 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 2014-15 season were the 5th highest recorded since Ohau Channel Surveys were implemented. The best opening to an Ohau Channel angling season witnessed during surveys is the 2009-10 season. The 2nd best start was 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.
Both November and December had low numbers of anglers surveyed and catch rates of around one fish caught per five hours effort. Very low angling pressure was recorded at the channel during March with no success. Similar hours were recorded over April/May

and June (approximately 30hrs) and success rates built each month with highest average catch rates for the season recorded in June (Table 6). The hours reported were the second lowest recorded for June since Ohau creel surveys were established, the lowest being June of the 2012-13 season.

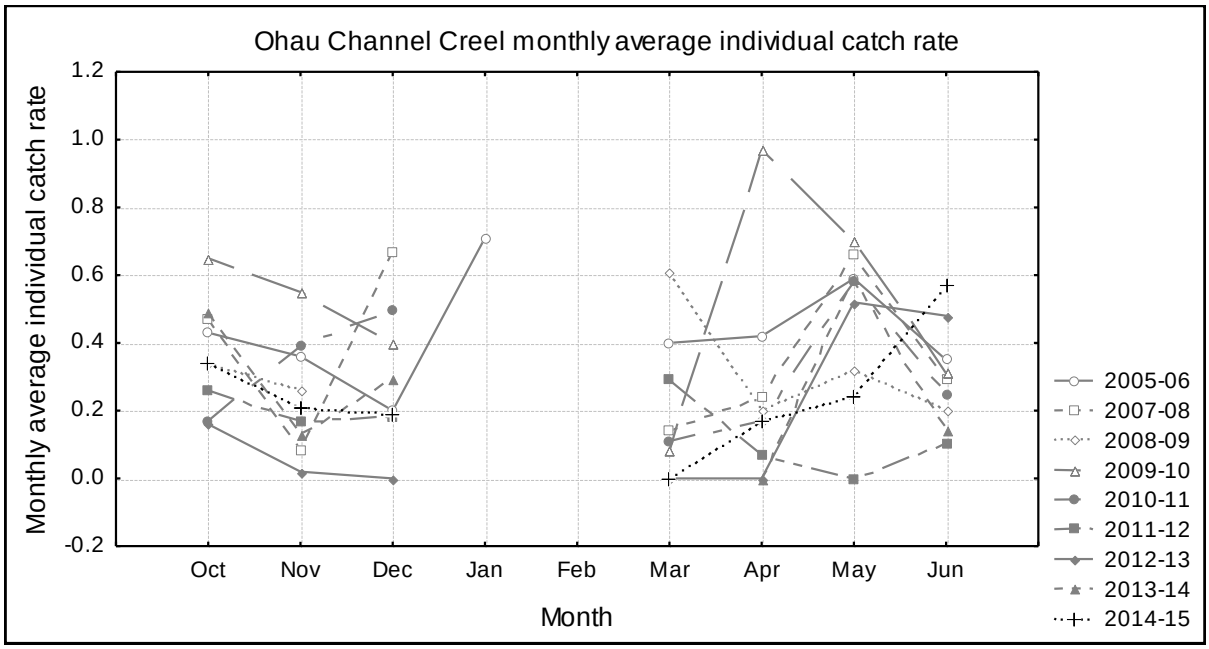


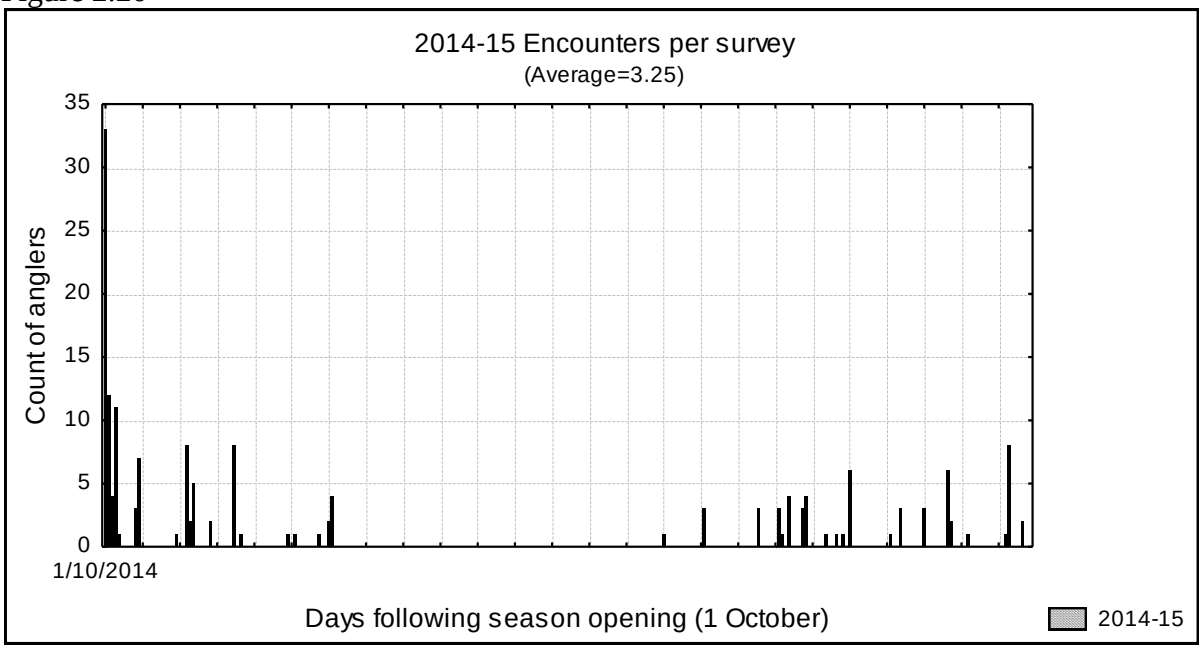
Figure 2.1 Angler catch rates by year during the season

Table 6. 2014-15 Catch rates during the season (other season tables in appendix)

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	96.25	15	6	12	0.22	0.30
All October	187.75	38	22	18	0.32	0.34
November	13	1	2	0	0.23	0.21
December	10.75	2	0	0	0.19	0.19
Jan & Feb						
March	5	0	0	0	0.00	0.00
April	32	4	3	1	0.22	0.17
May	26.75	4	1	1	0.19	0.24
June	30.50	13	3	0	0.53	0.57

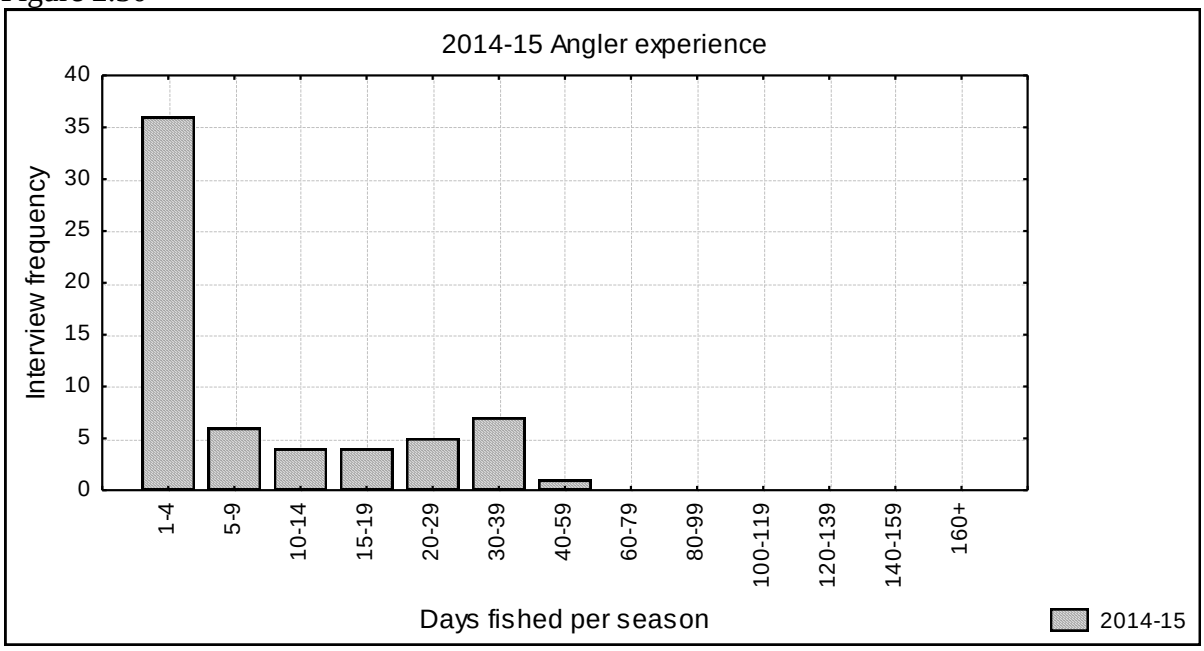
This seasonality of catch rates in past seasons tends to mirror the encounter rate during the season (Figure 2.20 and Figures 2.21-2.28 in appendix). Basically if catch rates were higher, the interviewers tended to encounter more anglers, when they were lower, they encountered less anglers. During the 2014-15 season angler encounter rates peaked as with other years at the start (early October) but did not culminate with a definite peak at 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



Changes in catch rate can often be related also to a change in the level of experience of anglers. Anglers were asked about their experience and this varied little between the four surveys (Figure 2.30 and Figures 2.31-2.38 in appendix).

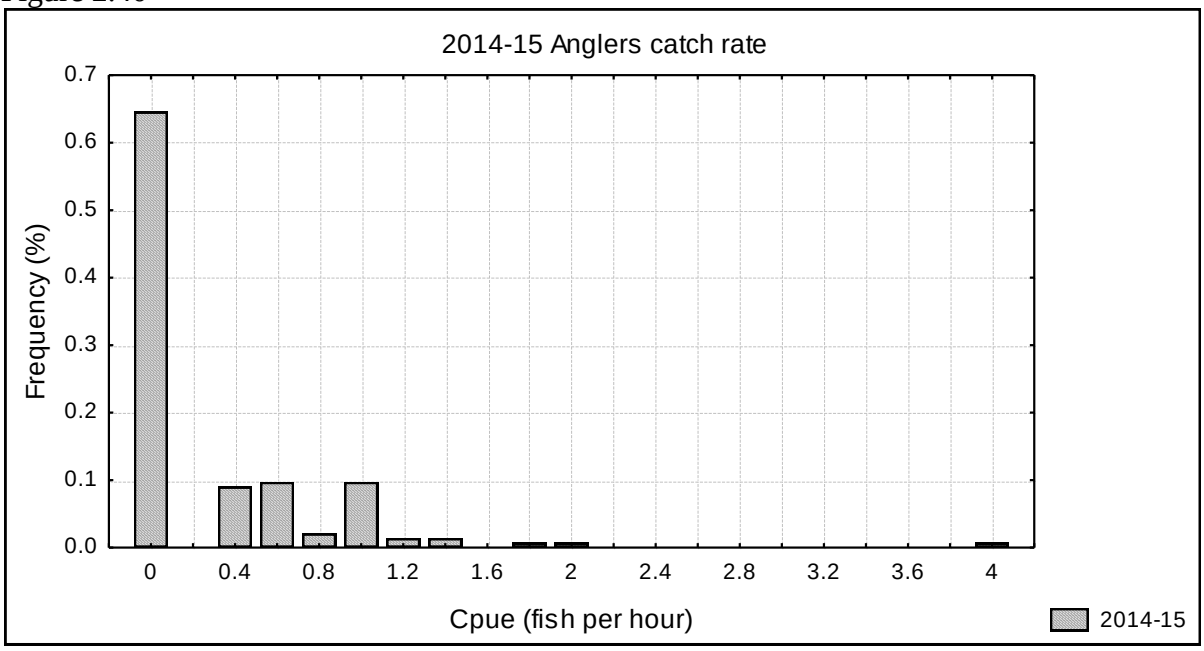
Figure 2.30



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 60% of anglers not having caught a fish when interviewed. (Figure 2.40 and Figures 2.41-2.48 in appendix)

Figure 2.40



2.5 Characteristics of fish caught

The average brown trout caught during the 2013-14 season was smaller, lighter and in poorer condition than the average brown measured during the 2013-14 survey. A total of 6 brown trout were measured compared with 16 during 2013-14, 4 during 2012-13, 12 during 2011-12, 5 during 2010-11, 34 during 2009-10, 20 during 2008-09, 38 during 2007-08 and 48 during the 2005-06 survey. The average rainbow trout caught was larger, but lighter and in significantly poorer condition ($P<0.001$) than those caught during the 2013-14 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 summers 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 2014-15 seasons. Significant differences shown in bold.

	14-15	***13-14***	***12-13***	***11-12***	***10-11***	***09-10***	***08-09***	***07-08***	***05-06***
Brown length	623	645	614	669	672	**650**	702	675	662
Brown weight	2.93	3.75	**2.68**	3.94	3.91	4.12	4.63	4.71	4.32
Brown c.f.	42.21	50.36	**39.20**	46.87	45.45	53.49	**47.79**	53.63	52.96
Rainbow length	519	**512**	**492**	516	**507**	**541**	**554**	543	541
Rainbow weight	1.55	**1.69**	1.51	1.58	**1.56**	2.11	2.22	2.30	2.25
Rainbow c.f.	**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)

	14-15	***13-14***	***12-13***	***11-12***	***10-11***	***09-10***	***08-09***	***07-08***	***05-06***
Cpue	**3.68**	**3.19**	**4.74**	**4.37**	**4.06**	**2.23**	**3.89**	2.94	2.9
Size	**3.76**	**3.01**	**4.74**	**4.38**	**4.05**	**2.32**	**3.87**	**2.98**	2.28
Satisfaction	**2.92**	**2.34**	**3.84**	3.31	**3.16**	**2.02**	**3.28**	**2.44**	1.75
% satisfied	**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)

Figure 3.0 Angler Perceptions of catch rate and fish size

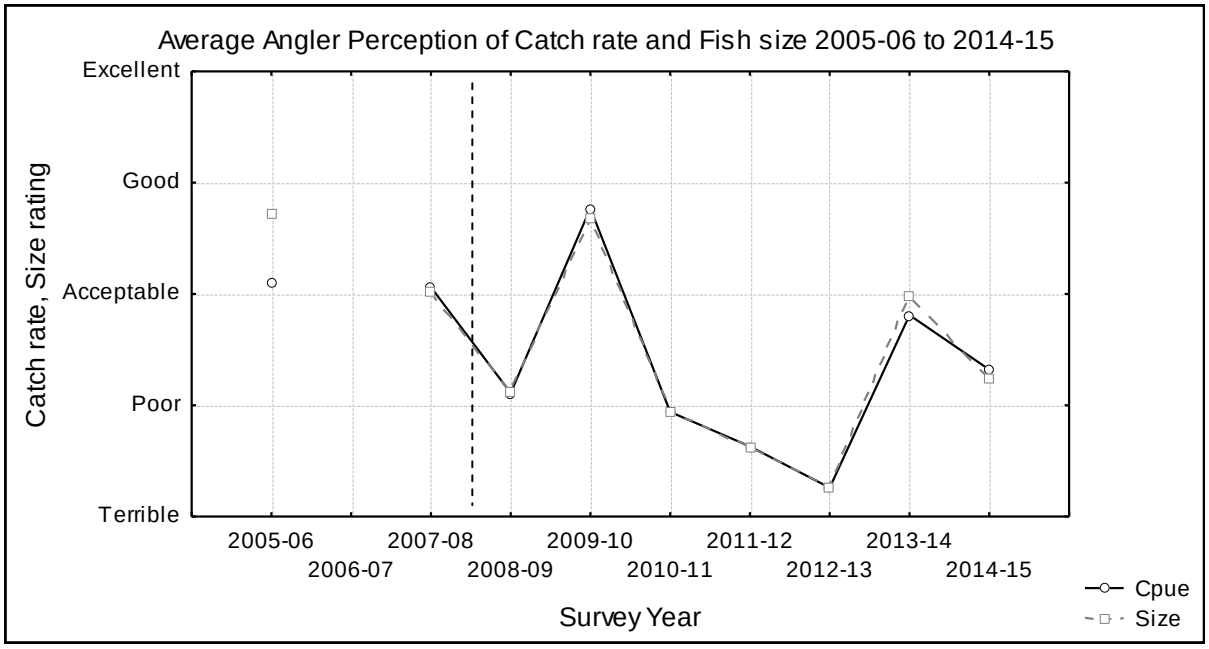
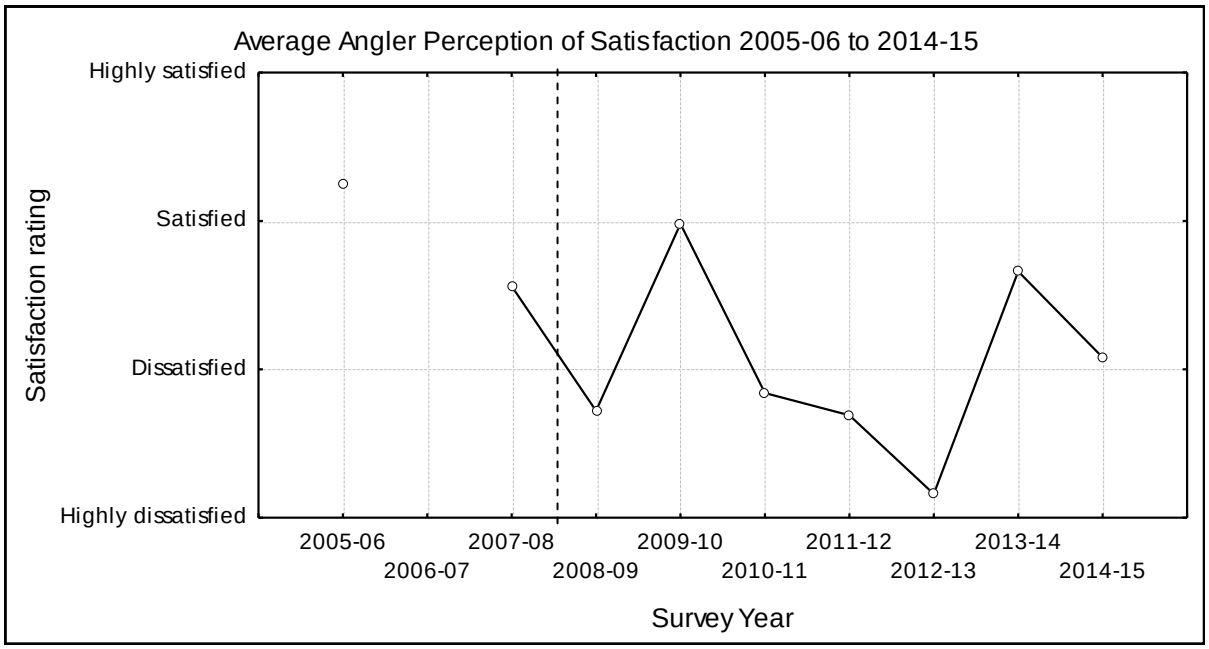


Figure 3.1 Angler Perceptions of Satisfaction



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 6 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 of 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 ($P<0.001$)

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 2014-14 surveys are shown in Table 10.

No detractions to angling at the Ohau Channel were stated to surveyors when prompted over the course of the 2014-15 season. Fish & Game received very few calls about poaching at the channel over the 2014-15 season (as with the 2013-14 season).

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

Table 10. Stated detractions to angling experience

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

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 side (true left) and Takinga St (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.

Excepting the 2009-10 season, 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. An anecdotal perception of the 2013-14 Opening (just completed) points toward an improvement in this seasons 2-year-old catch. The summer creel undertaken annually on Lake Rotorua has also shown a decline in fish condition since 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. The 2012-13 summer creel indicated an improvement in rainbow trout size and condition, along with anecdotal reports of smelt appearing in numbers. This was the best rainbow trout condition noted since the 2009-10 summer creel.

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 seven 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'.
Two of the seven seasons surveyed since the diversion wall construction (2009-10 and 2013-14) has 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.

Over the 2013-14 season, an increased percentage (14.7%, n=10) of anglers pointed to the wall as being a major contributor to their lack of satisfaction.

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

Angling clubs and 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.

Seven years after construction of the diversion wall, BOPRC is investigating options for a fish pass to be built into the wall. An Ohau Channel Fishery Liaison Group has been set up to be a liaison between BOPRC and the users of the channel. The group is looking into designs and potential areas where a pass/passes may be best sited. A fish pass would provide the opportunity to monitor whether any changes occur within the Ohau fishery given just two years fishery monitoring were possible prior to the walls construction..

Appendix/ Additional Figures

Seasonality of catch rates (*Figures 6.1 – 6.8*)
Catch rate distribution (*Figures 2.41 – 2.48)*
Angler Experience (*Figures 2.31 – 2.38*)
Seasonality of Interviews (*Figures 2.21 – 2.28*)

Seasonality of Catch Rates (figures 6.1-6.8)

Table 6.1. 2005-06 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	238.5	88	11	3	0.42	0.44
All October	536.95	173	46	6	0.41	0.43
November	177.25	46	25	8	0.40	0.36
December	71.25	10	5	7	0.21	0.20
Jan & Feb	12.75	7	2	0	0.71	0.71
March	49.45	11	6	0	0.34	0.40
April	130.95	52	7	6	0.45	0.42
May	100.75	43	11	5	0.54	0.59
June	19.75	7	0	2	0.35	0.35

Table 6.2. 2007-08 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	226.5	95	3	2	0.43	0.64
All October	433.65	230	8	5	0.55	0.47
November	100.0	13	0	1	0.13	0.08
December	5.25	2	0	0	0.38	0.67
Jan & Feb						
March	10.0	1	0	0	0.10	0.14
April	80.0	17	0	0	0.21	0.24
May	173.0	83	16	9	0.57	0.66
June	132.25	25	0	1	0.18	0.29

Table 6.3. 2008-09 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	186.3	100	4	0	0.56	0.55
All October	408.6	141	12	0	0.37	0.34
November	66.75	14	5	1	0.28	0.26
December						
Jan & Feb						
March	27.0	10	5	1	0.56	0.61
April	41.0	2	6	0	0.20	0.20
May	67.0	25	10	2	0.52	0.32
June	117.75	20	4	0	0.20	0.20

Table 6.4. 2009-10 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	304.25	198	24	0	0.73	0.67
All October	596.25	307	103	2	1.87	0.65
November	137	27	38	1	0.48	0.55
December	12.5	7	0	0	0.56	0.40
Jan & Feb						
March	25.5	1	0	1	0.04	0.08
April	56	11	40	2	0.91	0.97
May	56	21	18	7	0.70	0.70
June	132.25	20	22	1	0.32	0.31

Table 6.5. 2010-11 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	270.75	51	11	9	0.23	0.35
All October	449	62	17	11	0.18	0.17
November	55.5	7	10	3	0.31	0.39
December	7.5	1	3	0	0.53	0.5
Jan & Feb						
March	16	2	0	0	0.13	0.11
April	30.75	6	1	3	0.23	0.17
May	98	27	39	2	0.67	0.58
June	165.5	20	18	10	0.23	0.25

Table 6.6. 2011-12 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	198	43	12	6	0.28	0.24
All October	336	74	28	8	0.30	0.26
November	26.75	5	2	1	0.26	0.17
December	15	3	0	0	0.20	0.18
Jan & Feb						
March	11.5	2	1	8	0.26	0.29
April	37	3	0	11	0.08	0.07
May	9.75	0	0	0	0.00	0.00
June	85.5	7	2	8	0.11	0.10

Table 6.7. 2012-13 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	151	23	2	5	0.17	0.15
All October	275.5	42	7	5	0.18	0.16
November	35	1	0	3	0.03	0.02
December	0	0	0	0	0.00	0.00
Jan & Feb						
March	0	0	0	0	0.00	0.00
April	0	0	0	0	0.00	0.00
May	32	12	3	4	0.47	0.52
June	48	18	5	2	0.48	0.48

Table 6.8. 2013-14 Catch rates during the season

	Hrs	Kept	OSRT	USRT	cpue Sum	cpue indi'v
Opening Weekend	119.70	48	10	3	0.49	0.58
All October	306.70	99	69	3	0.55	0.49
November	64.75	5	6	1	0.17	0.13
December	25.50	8	4	1	0.47	0.29
Jan & Feb						
March	0	0	0	0	-	-
April	10.5	0	0	0	0.00	0.00
May	13	5	2	7	0.54	0.59
June	52.50	9	2	27	0.21	0.14

Catch Rate Distribution (Figures 2.41–2.48)

Figure 2.41

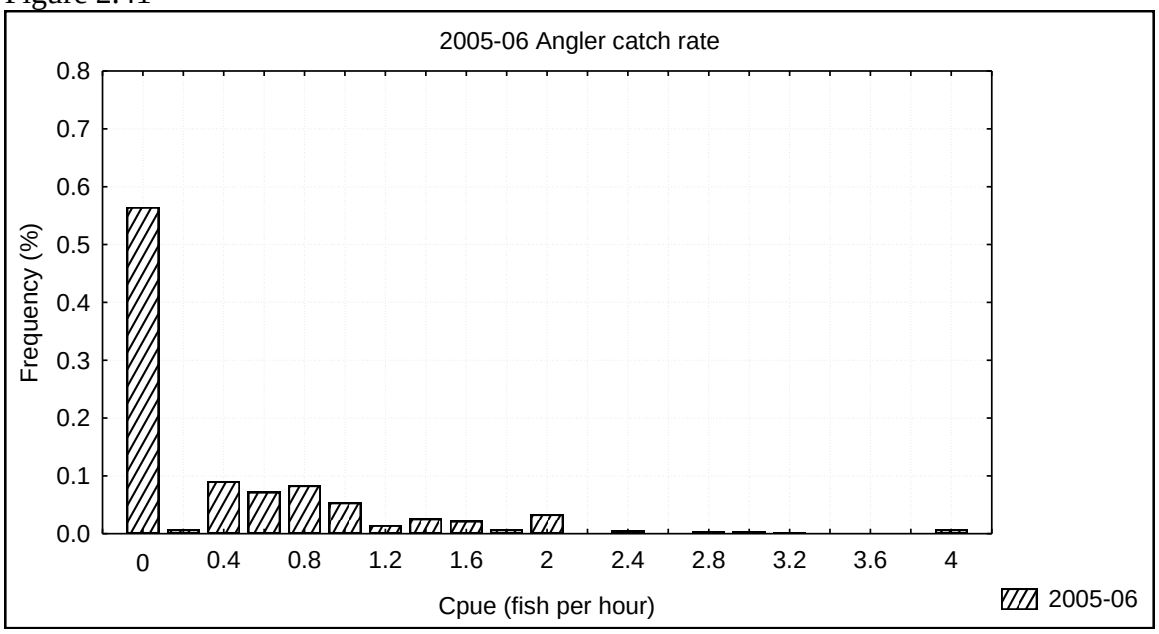
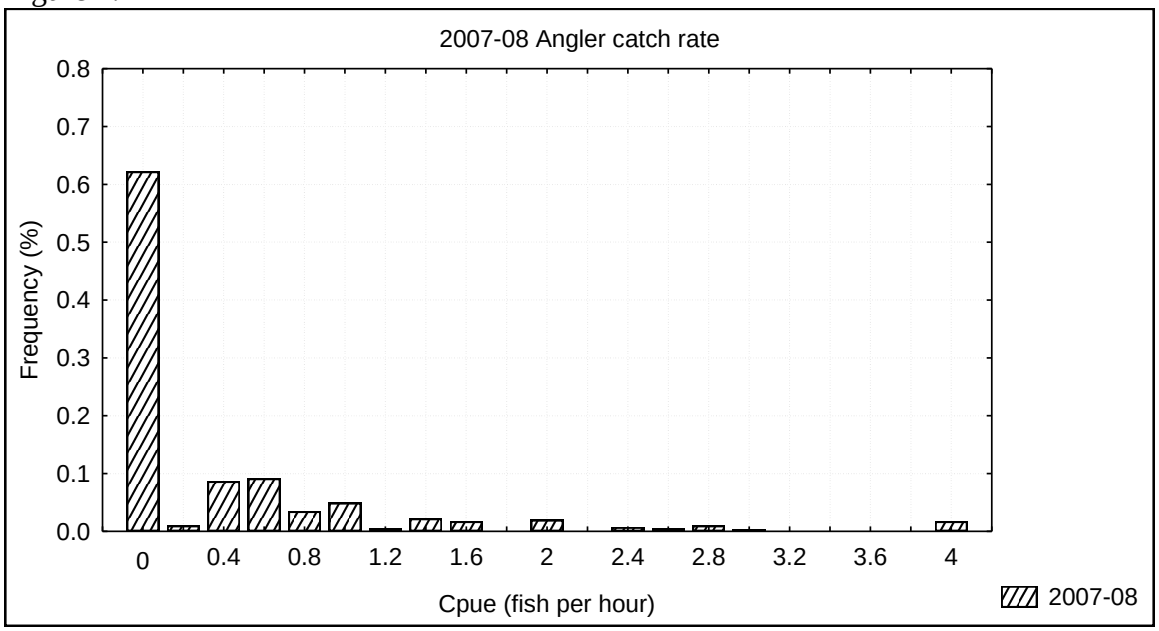


Figure 2.42



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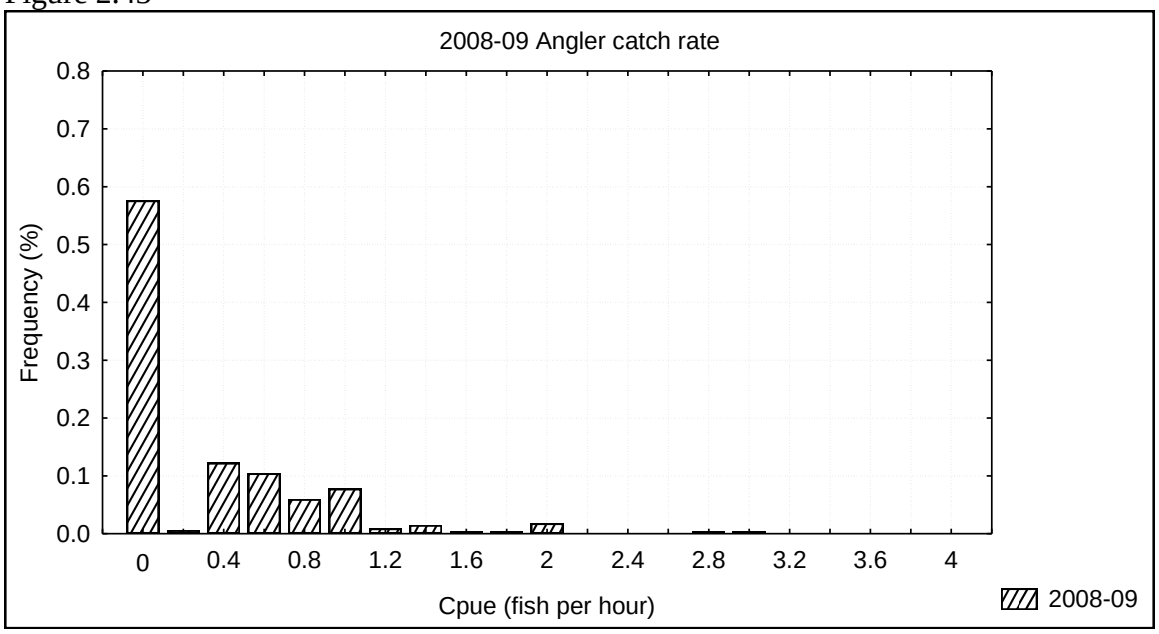

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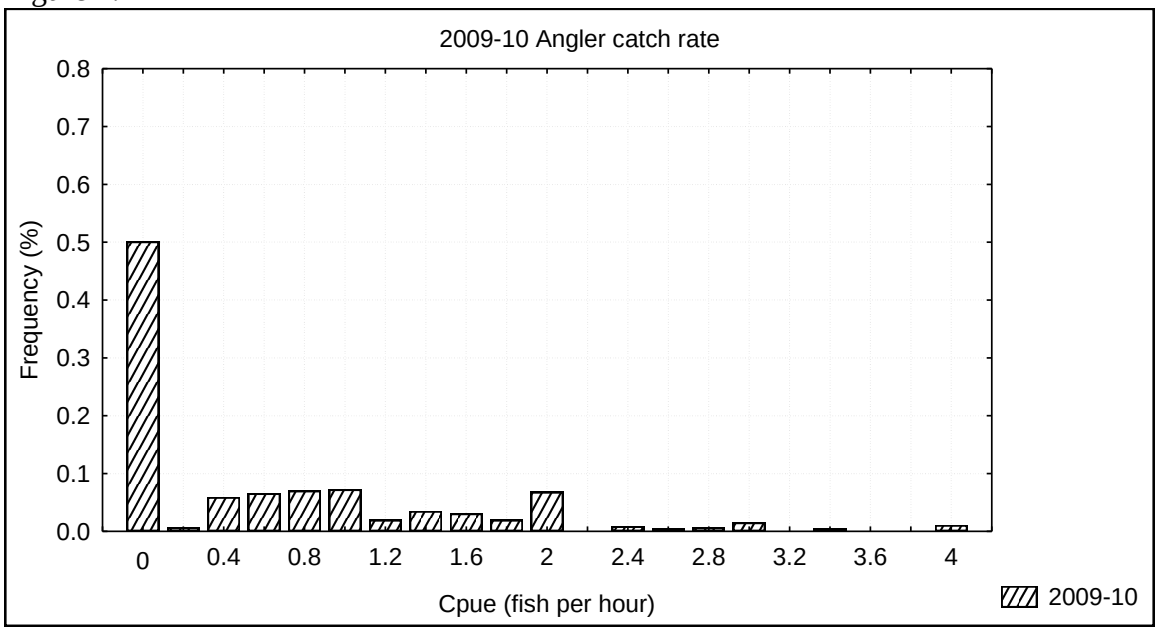

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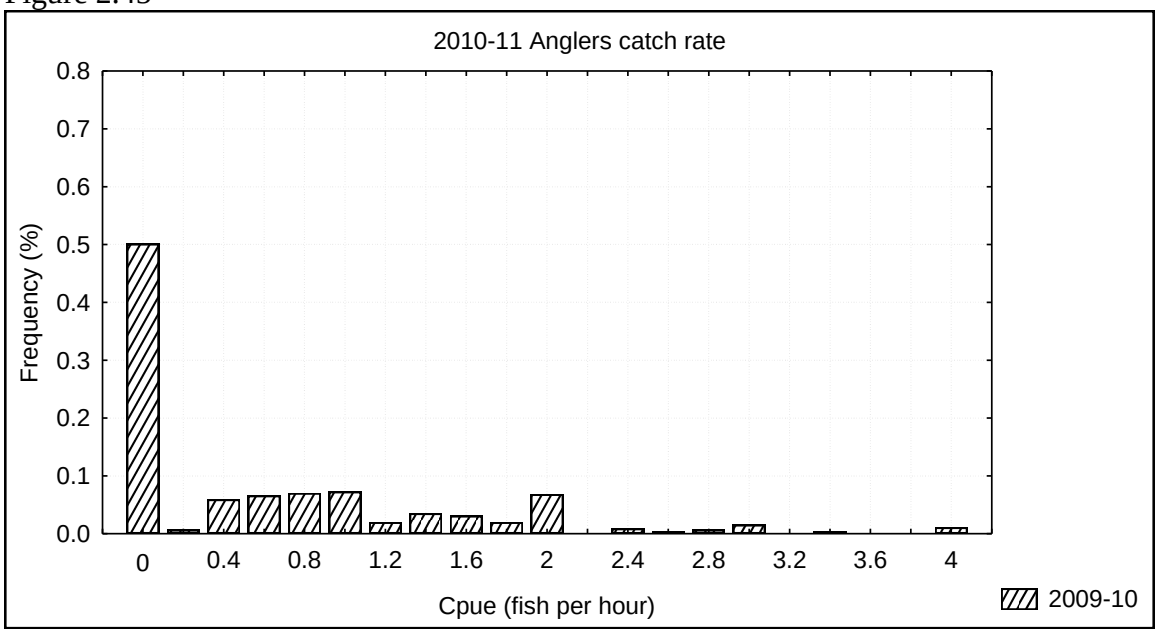
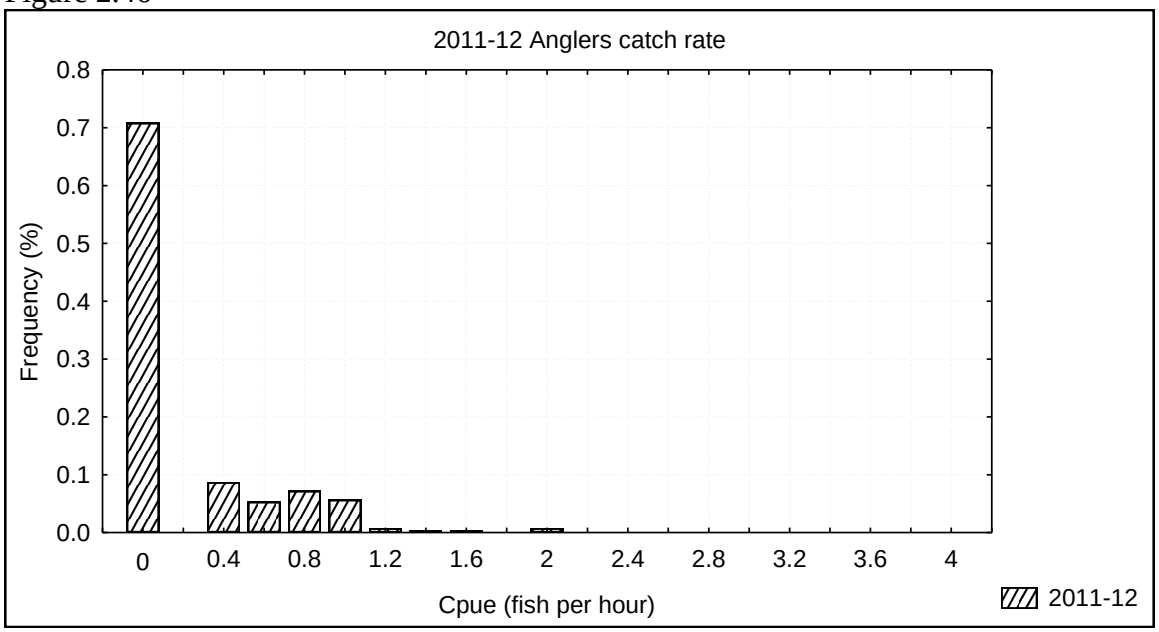


Figure 2.46



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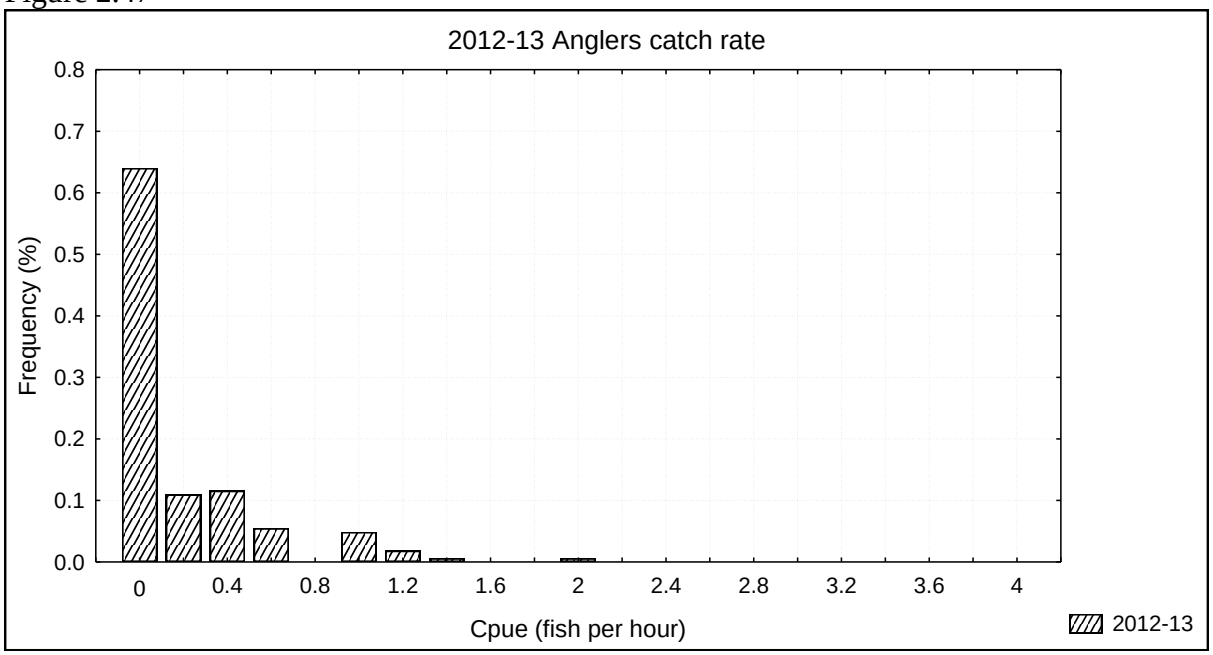

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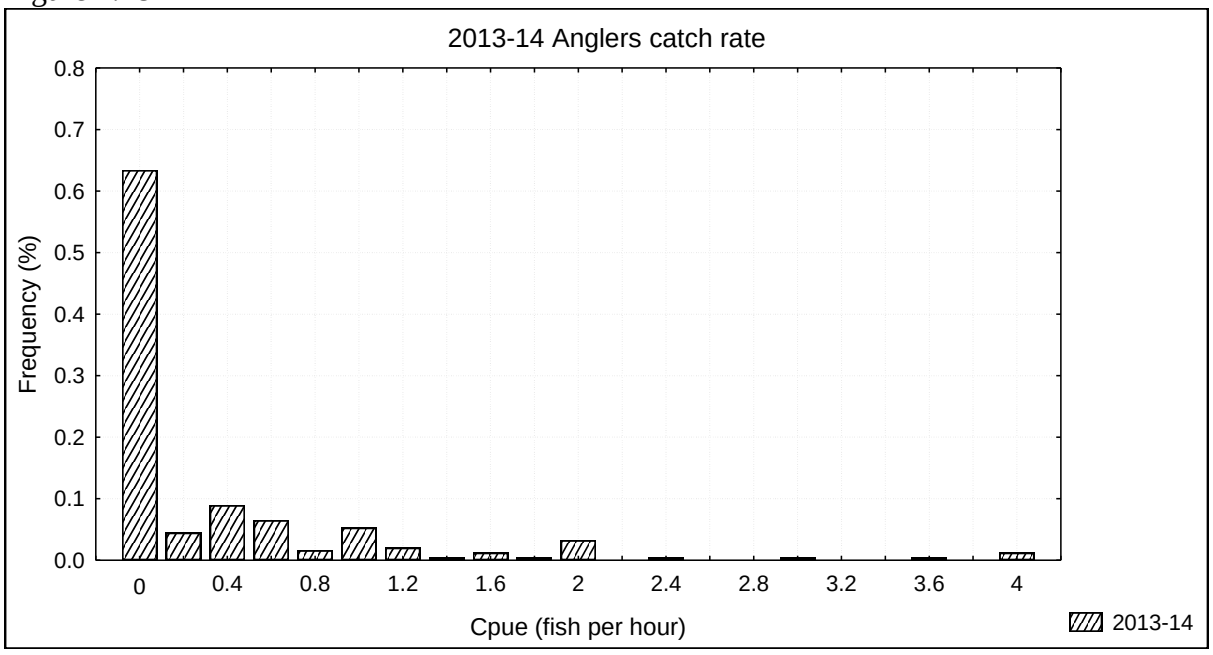


Angler Experience

Figure 2.31 – 2.38 Angler frequency (days fished per season by individual anglers)

Figure 2.31

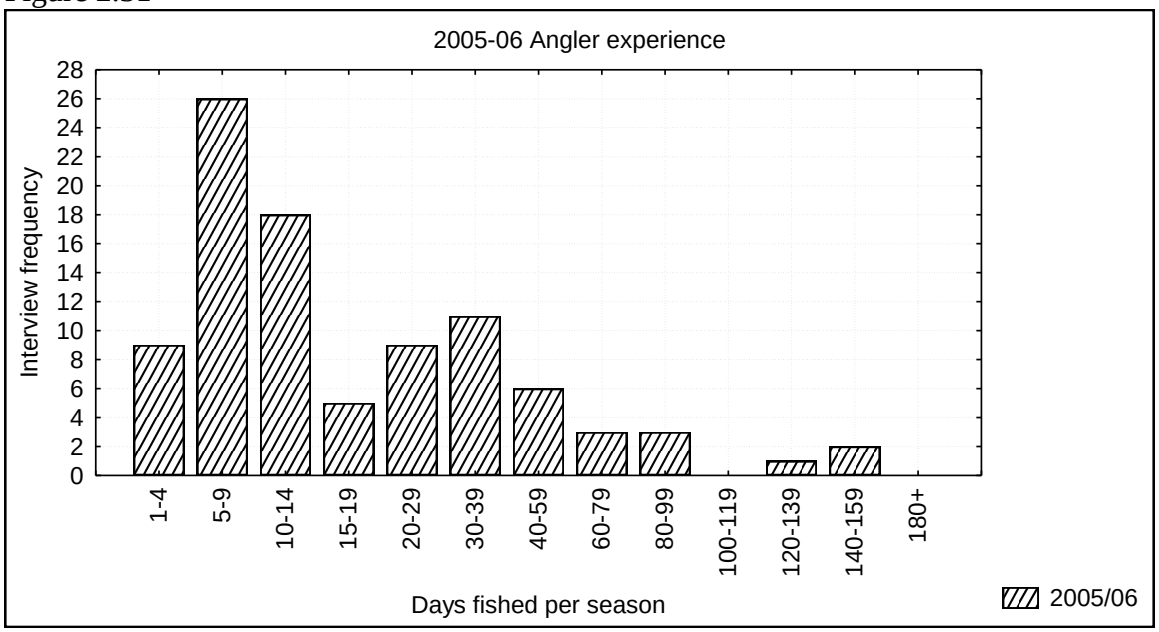


Figure 2.32

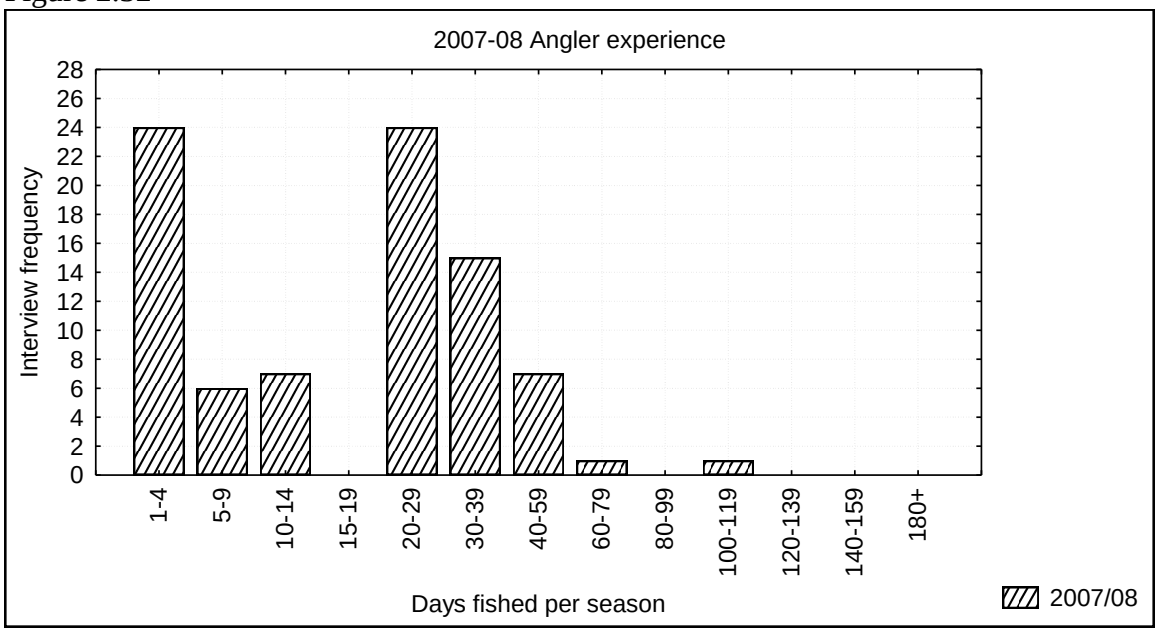


Figure 2.33

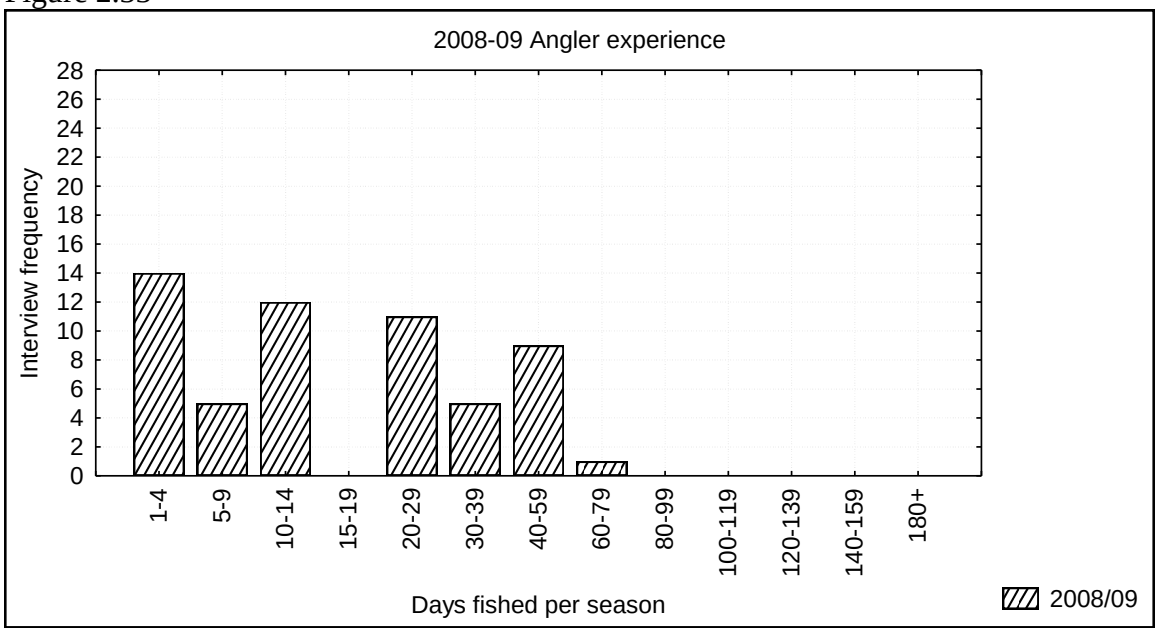


Figure 2.34

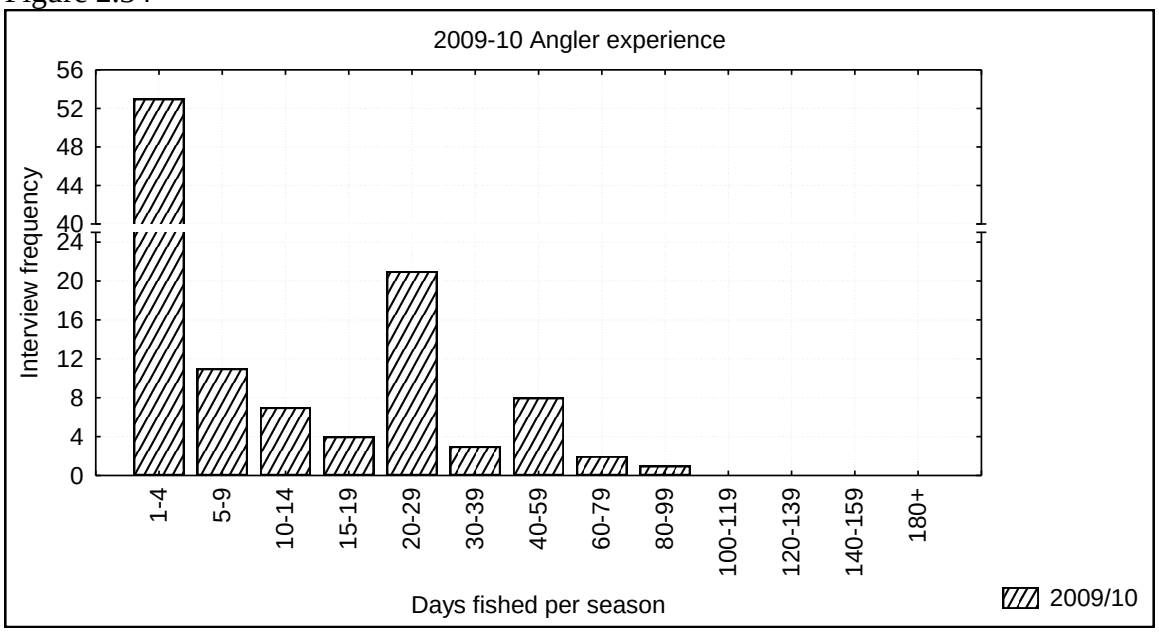


Figure 2.35

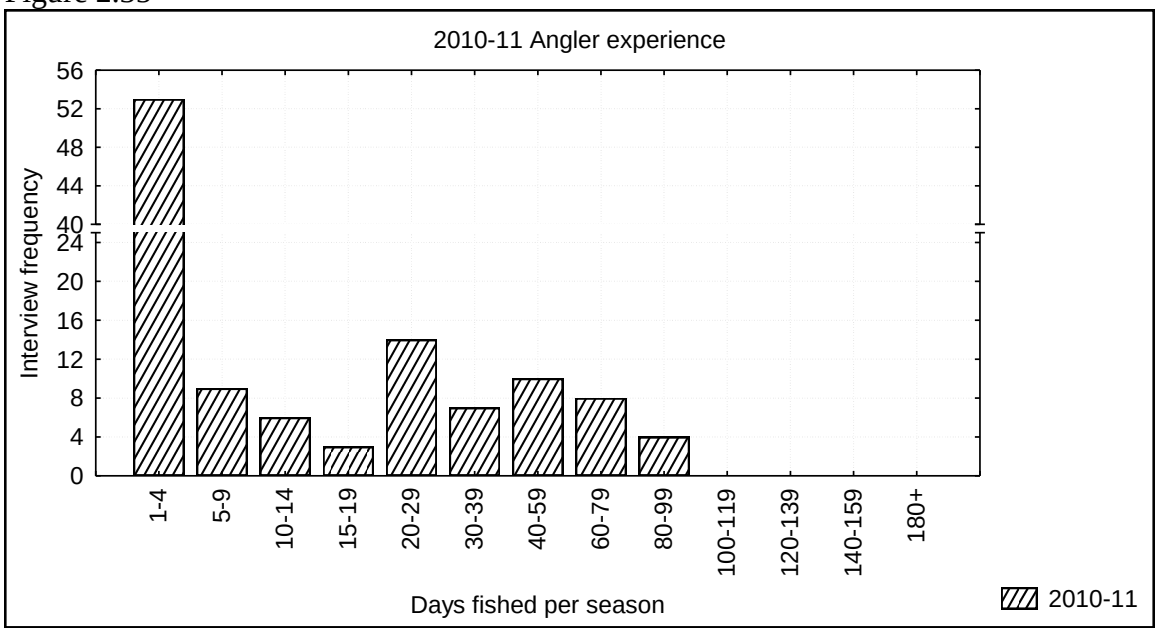
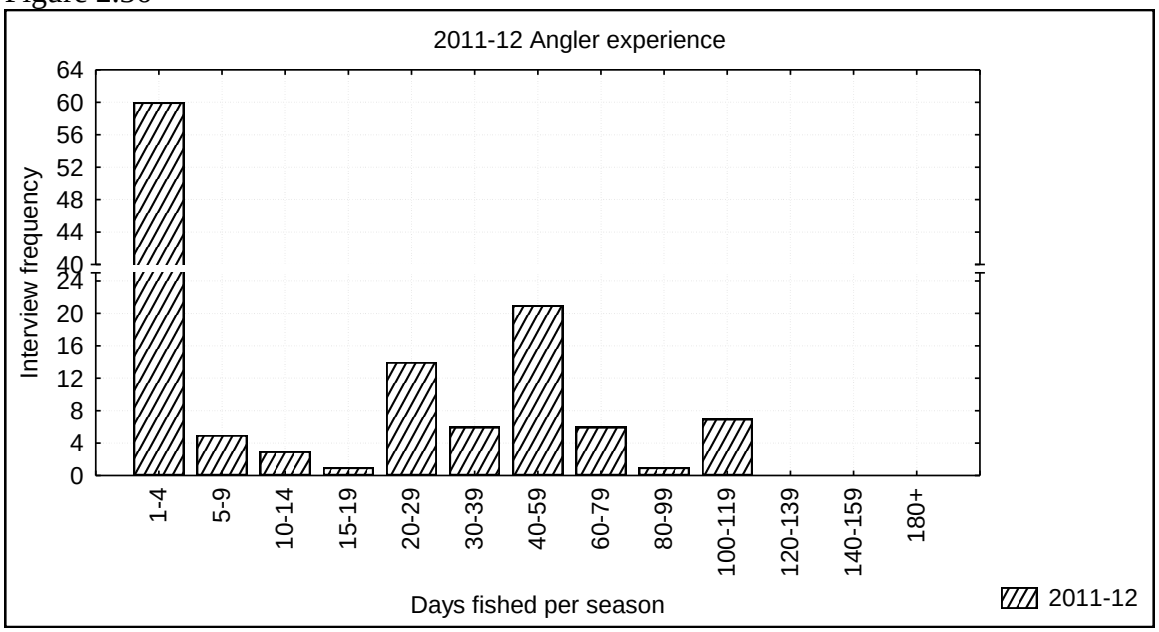


Figure 2.36



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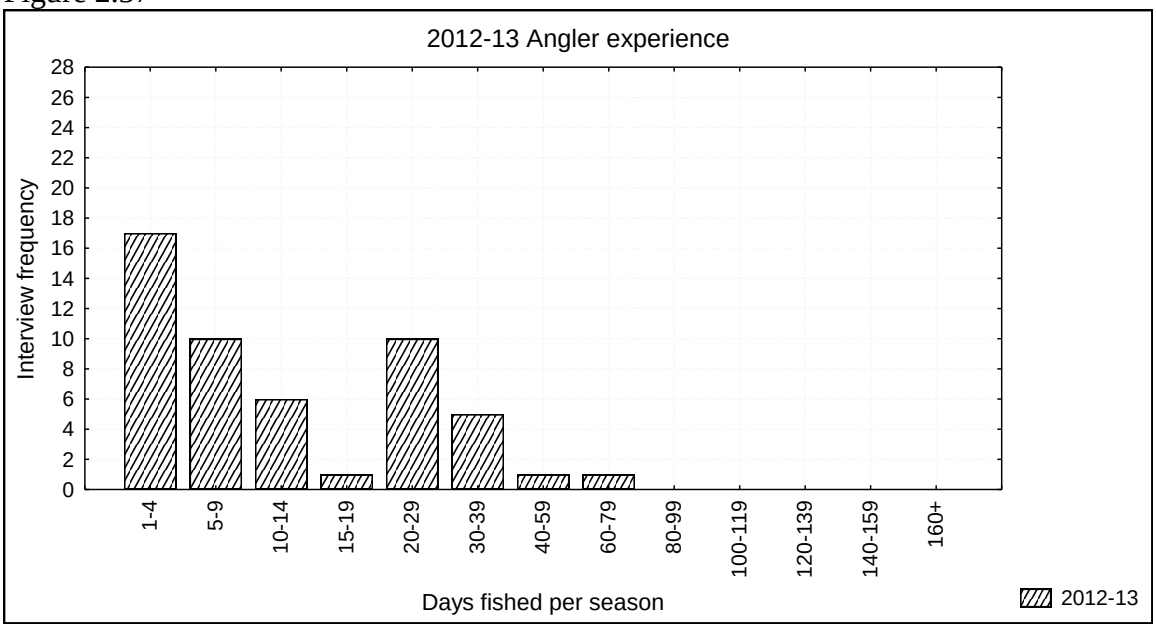
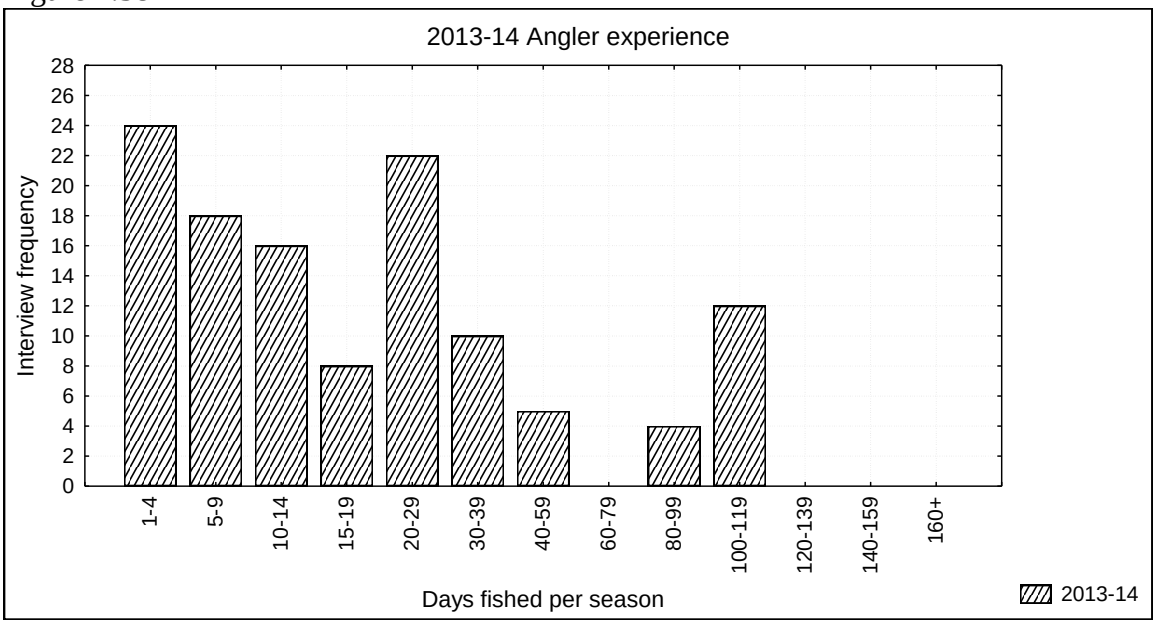
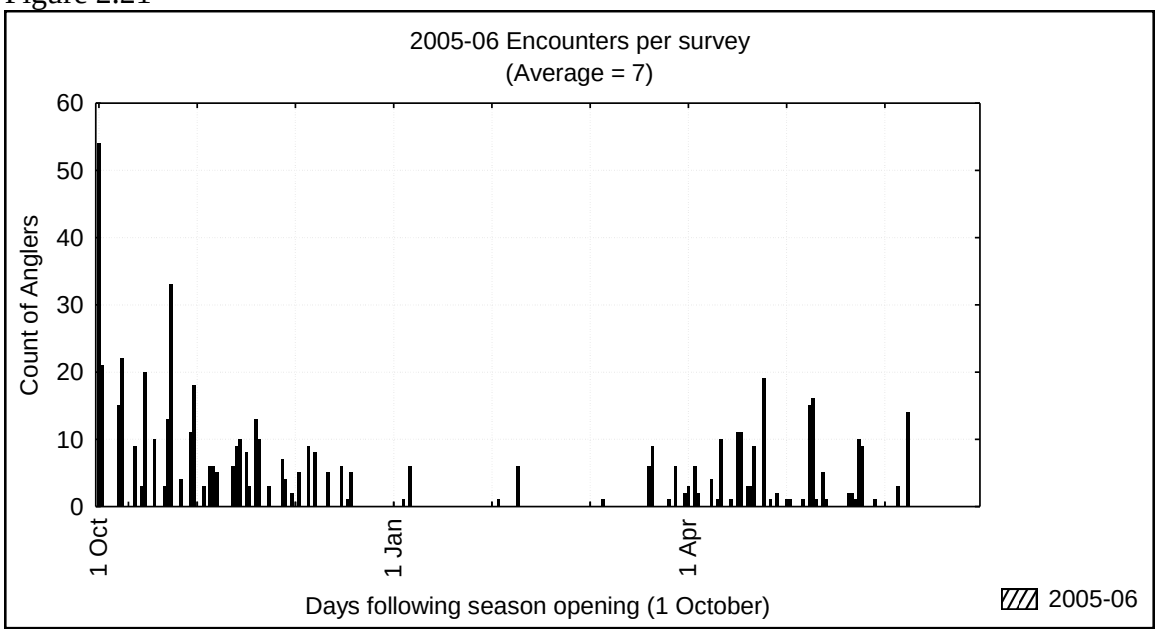


Figure 2.38



Seasonality of angler encounters Figure 2.21-2.28

Figure 2.21



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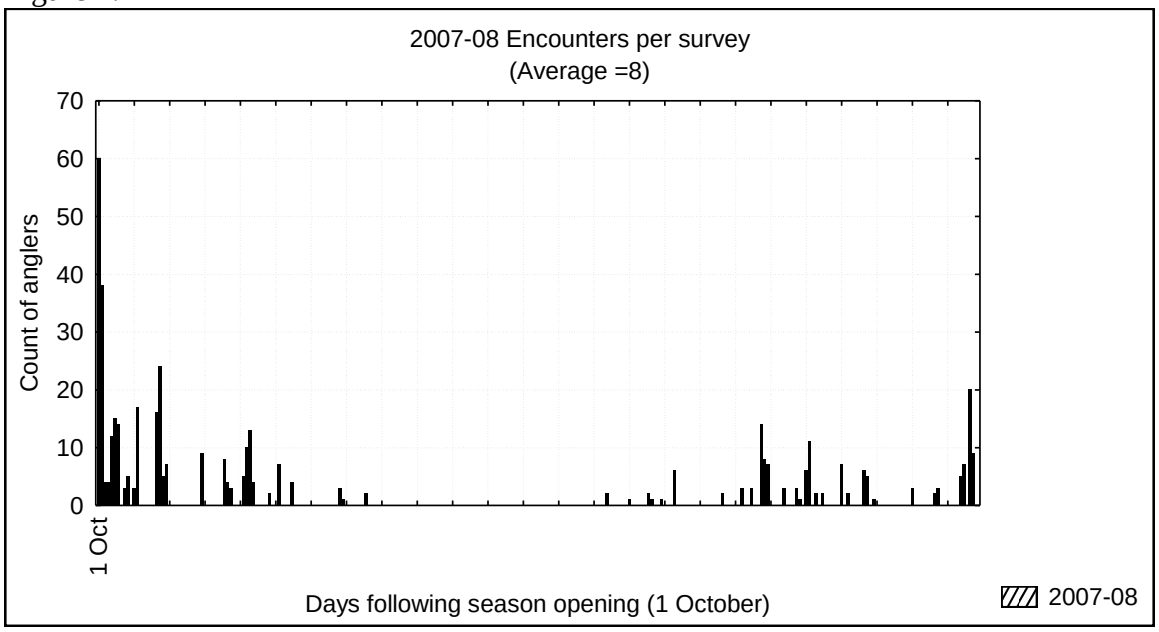


Figure 2.23

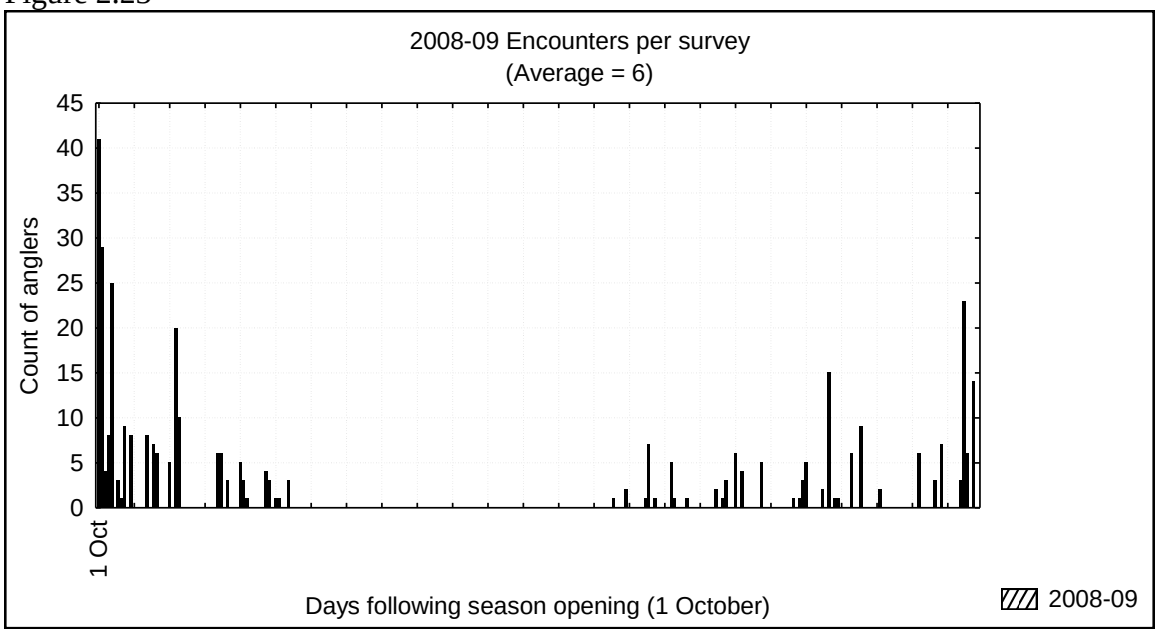


Figure 2.24

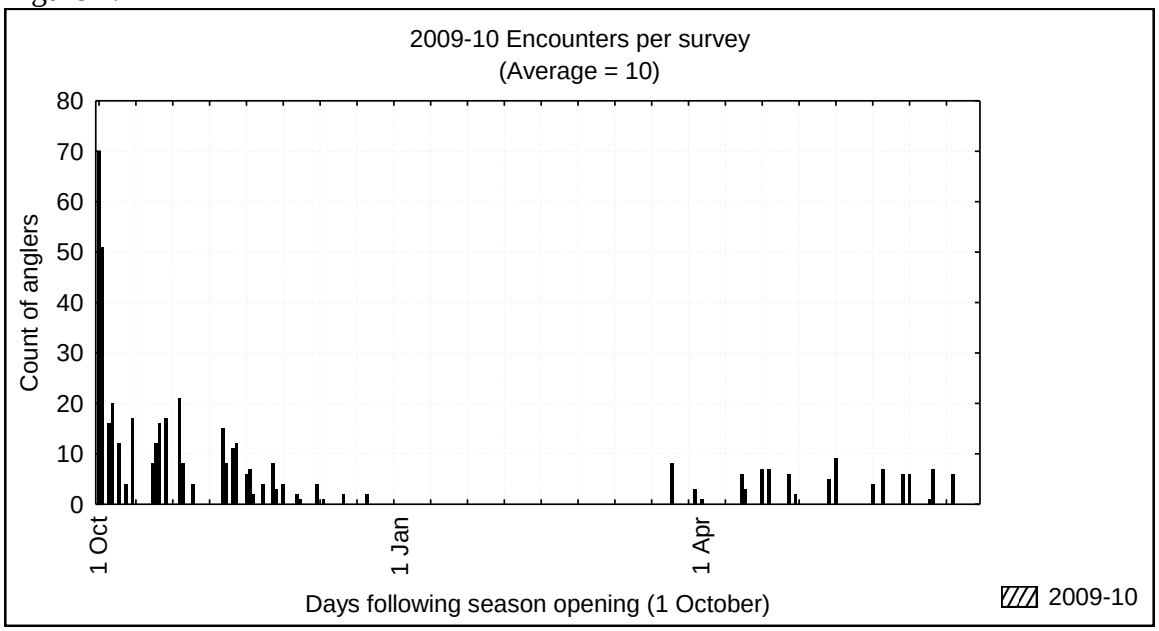


Figure 2.25

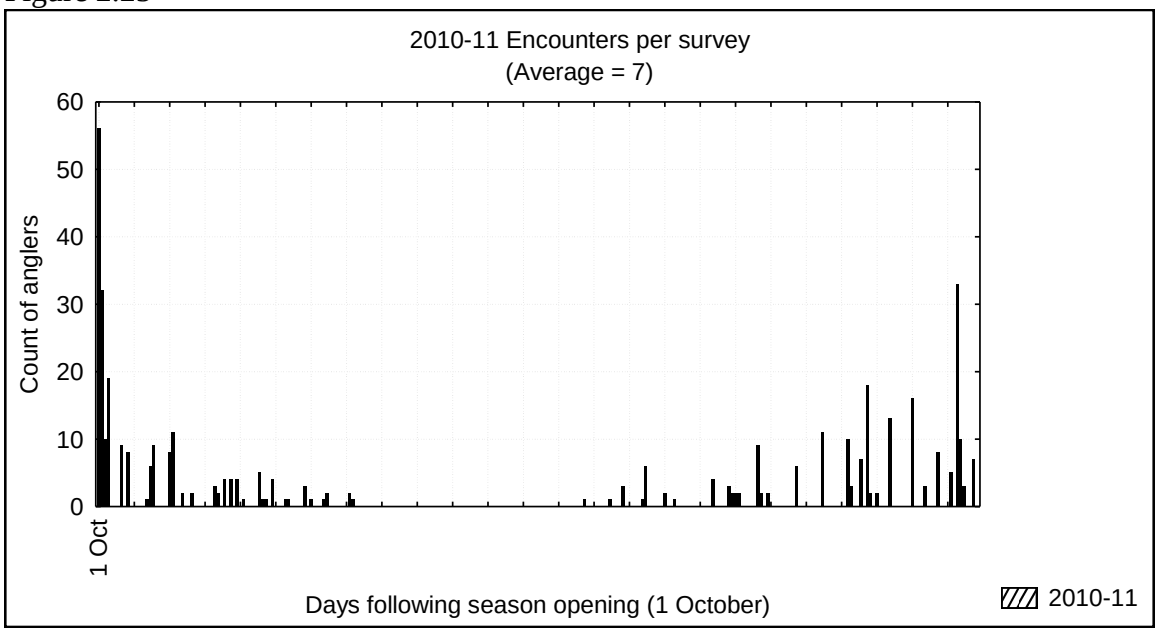


Figure 2.26

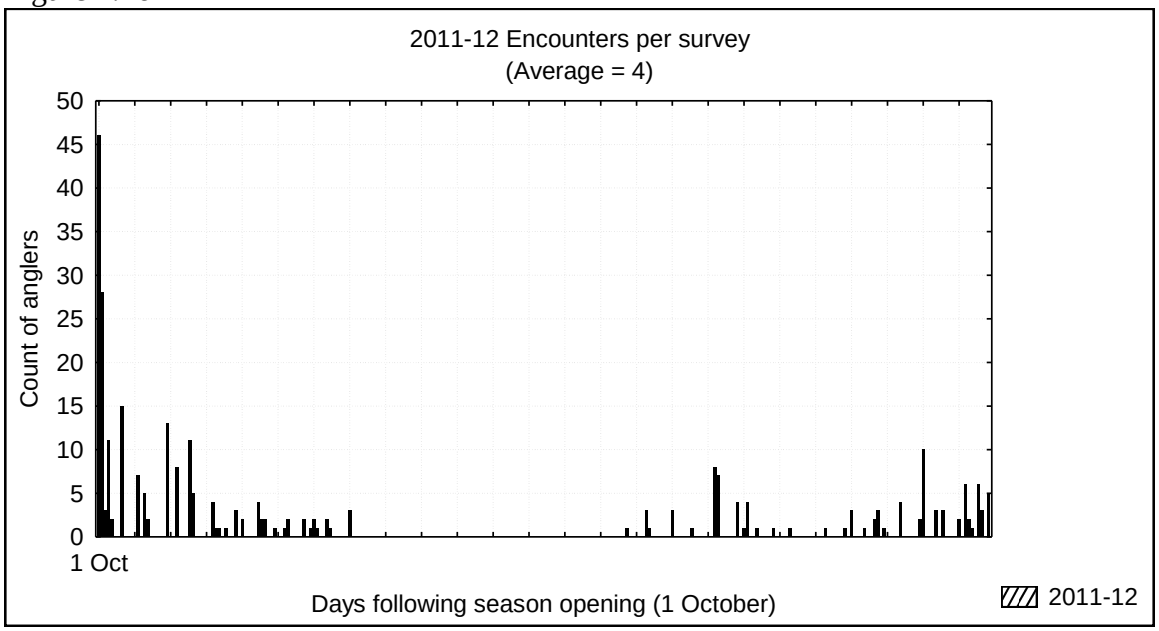


Figure 2.27

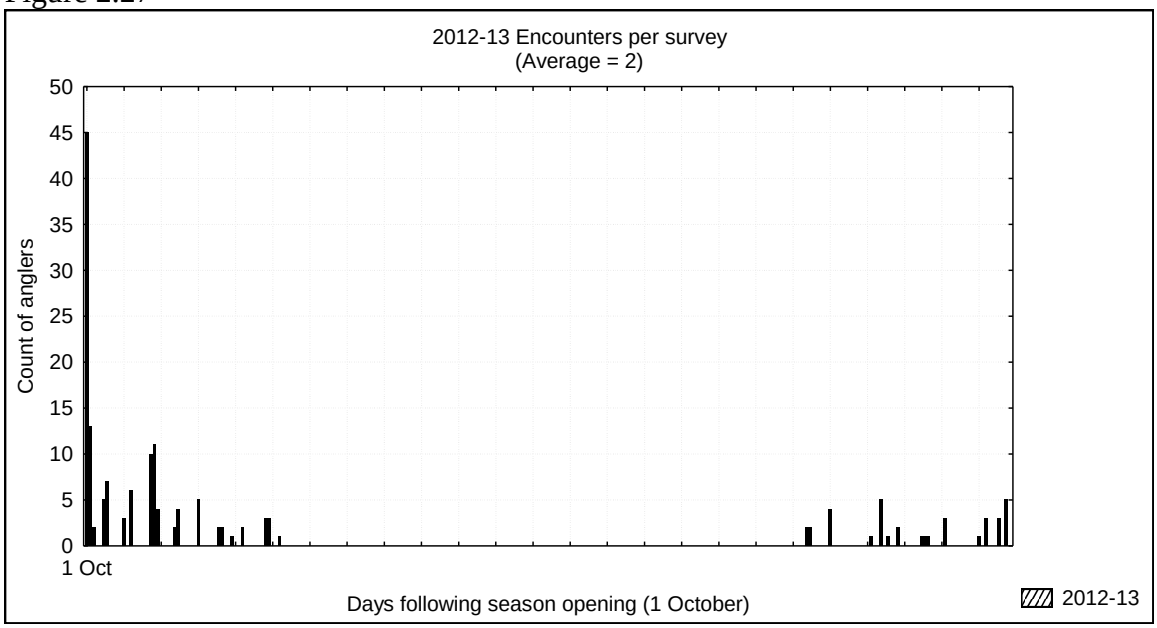
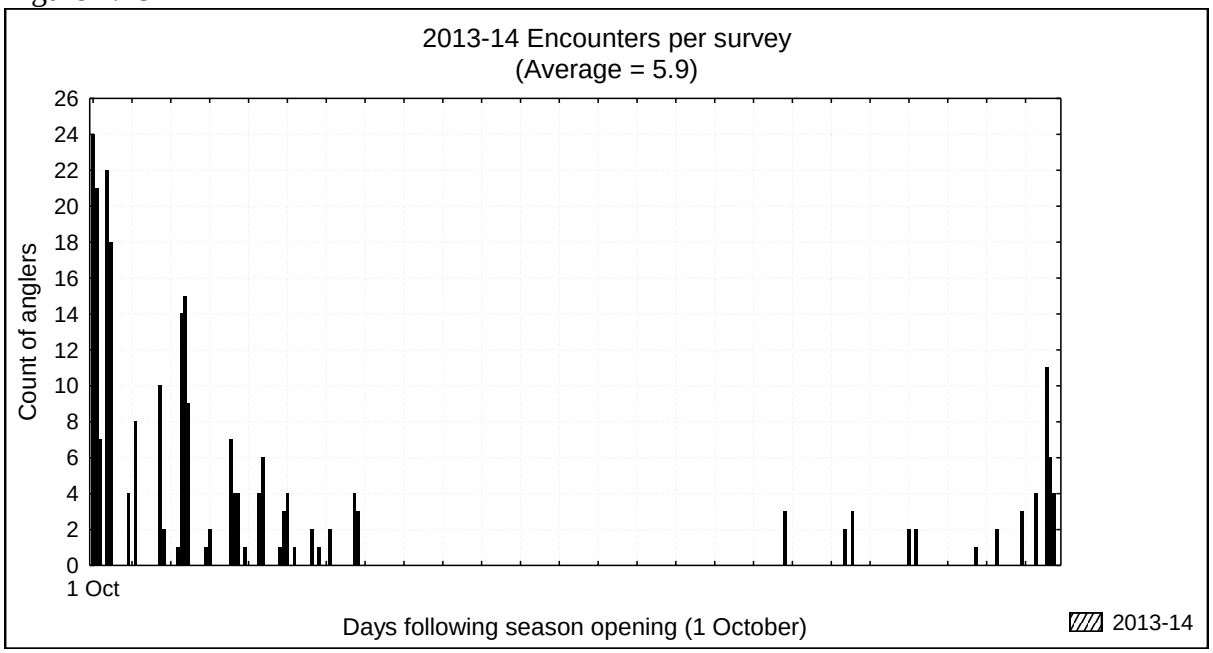


Figure 2.28



Acknowledgements

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