Summary of Rotoiti Diversion Wall Fisheries Review Panel

4 November 2015

Bay of Plenty Regional Council (BOPRC) was granted resource consents on 20 December 2006 to construct a sheetpile wall on the bed of Lake Rotoiti to channel waters from Lake Rotorua (Ohau Channel) towards the Kaituna River to reduce mixing with the larger body of Lake Rotoiti. Construction of the wall was completed in 2008. This resource consent expires 31 October 2017.

Resource consent 63209 requires the establishment of a Fisheries Review Panel.

The Rotoiti Diversion Wall Fisheries Panel was established with three members and a number of technical specialists acting in an advisory capacity. A list of panel members is appended to this summary along with a copy of resource consent 63209.

Resource Consent 63209 provides the terms of reference for the Fisheries Review Panel. The panel formulated a monitoring programme and meets annually to review the previous year's data and cumulative results. All of the annual reports and meeting minutes are available on the BOPRC website via the Fish Panel login.

Resource Consent conditions 12.1-12.4 detail the requirements to establish an independent expert fisheries review panel and conditions 13.1-13.13 provide the terms of reference for the panel including the scope for a monitoring programme. Conditions 14.1-14.7 outline annual reporting requirements.

Conditions 12.2 states that at the end of the 5 years monitoring the review panel will review the full 5 years of data and recommend to the Bay of Plenty Regional Council what ongoing level of monitoring is considered necessary.

Comments in italics are from the Fisheries Panel members.

1. Smelt

The population dynamics of smelt in Lake Rotoiti is not known but it is expected that, if anything, the improvement of water quality in the lake (the prime purpose of the wall) will result in an increase in smelt abundance.

Smelt continue to migrate up the Ohau channel, however, we still don't know if there has been a significant change in total abundance.

Smelt still congregate downstream of the weir.

Due to the lack of pre-wall data, it is not possible to identify if a real change in trend has been caused by the wall

2. Trout

A. ROTOITI TROUT FISHERY

The data in Figure 1 and Table 1 have been provided by Eastern Region Fish and Game (EFGC) and are from their Lake Rotoiti opening day angler creel survey.

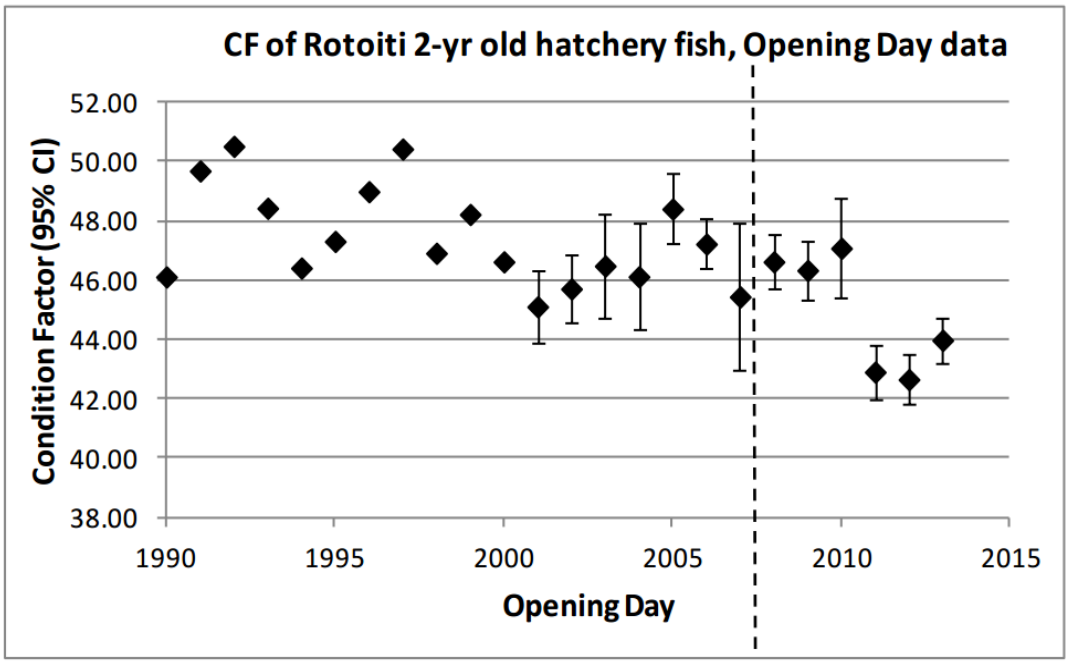

Fig 1 Condition Factor (CF) of Lake Rotoiti 2- year-old Trout on Opening Day. The vertical bars indicate 95% confidence limits and are only available from 2001 on.

Open day	Total lib	Spring lib	Aut lib	*% Wild*	*2yr length*	*2yr weight*	*2yr CF*	*cpue*	*% Wild exFF*	2yr (n)
1996	13000	6500	6000	57	536	2.10	**49.00**	0.26	58.0	42
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

Table 1 Catch composition from the opening day creel survey, Lake Rotoiti.

From these data EFGC conclude:

- Trout condition on opening day 2013 from the hatchery 2-year-old release group was well below the long term average and suggests two distinct clusters.

***Comment**; Fish condition seems highly autocorrelated from year to year meaning that if condition is high in one year it also tends to be high in the following year and if low in one year it also tends to be low in the following year. There also appears to be an overall decline in condition factor over the*

period examined. For the first 3 years following the installation of the wall condition factor was similar to that for the preceding 6 or 7 years but has been low in the last 3 years.

- An improvement in condition factor was noted between the 2013-14 and 2012-13 surveys

***Comment**; This difference does not appear to be significant as the confidence intervals are overlapping.*

Summer survey data for Lake Rotoiti (Table 2) shows that average rainbow trout condition over the 2013-14 summer was better than it was from the fish surveyed from the previous summer (2012-13) and just behind the last eleven-year average.

Lake	Feature	*AVG*	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07	05-06	04-05	03-04
Rotoiti	Length (mm)	*516*	523	522	**516**	**525**	501	512	520	518	527	**517**	491
	Weight (kg)	*1.81*	1.80	1.79	1.71	1.83	1.68	1.83	1.75	1.71	1.98	**2.12**	**1.74**
	Cond' Factor	*44.69*	**44.23**	**42.11**	43.33	43.47	**44.51**	**46.32**	42.00	**42.14**	45.76	46.96	**50.80**
Rotoiti	Wild L	*487*	507	490	492	491	478	476	500	513	492	466	448
	% WILD	*44%*	23%	39%	40%	45%	37%	30%	44%	62%	57%	54%	50%
	Hatch L	*525*	527	540	531	552	515	526	536	520	539	516	476
	N (all fish)	*163*	243	165	390	128	159	161	86	89	90	218	60
Tarawera	Length (mm)	*521*	**499**	532	**541**	**516**	536	529	532	516	510	498	518
	Weight (kg)	*1.62*	**1.42**	**1.63**	**1.87**	**1.49**	1.71	1.70	1.63	1.57	1.54	1.49	1.72
Rotorua	Length (mm)	*459*	**455**	443	431	436	456	**460**	**485**	465	466	472	**480**
	Weight (kg)	*1.17*	**1.23**	0.98	0.88	**0.80**	1.10	**1.10**	**1.36**	1.21	**1.2**	1.49	**1.54**
Okataina	Length (mm)	*544*	515	529	537	553	552	545	534	522	533	571	593
	Weight (kg)	*1.91*	1.70	1.79	1.97	2.00	2.05	1.98	1.70	1.56	1.54	2.16	2.55
Rrua FF L		*484*	*492*	500	*464*	500	*485*	500	**428**	500	**460**	500	495
Rrua FF Wt		*1.41*	*1.49*	1.59	*1.13*	1.59	*1.44*	1.59	**0.80**	1.59	1.29	1.59	1.46
Rrua Tr L		*463*	*449*	477	*446*	477	*462*	477	445	477	455	477	**456**
Rrua Tr Wt		*1.14*	*1.18*	1.23	*1.02*	1.23	*1.18*	1.23	0.81	1.23	1.15	1.23	**1.07**

Table 2 Summer Survey Comparison of overall average rainbow trout length and weights. Significant differences between years are shown in bold (P<0.05).

***Comment**; The decline in fish condition factor over the last 10 years (Figure 1 and Table 2) could be due to a number of factors e.g. increased trout numbers (more hatchery liberations), decreased primary production due to improving water quality, or just natural variation. The trend is more important than the numbers.*

Possible wall Impacts?

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

- Opening Day data from 2013 Opening (1st October 2013) showed 21.6% of the opening day catch (excluding fly fishing) was made up of wild trout (Table 2). This is a low percentage (for the sixth successive opening) and the lowest wild percentage recorded in opening day surveys.
- Summer creel survey data (Table 1) shows that the percentage of wild trout in the catch measured during the 2013-14 summer creel survey was 23%. This is compared to the 39% measured in the 2012-13 summer, 40% in the 2011-12 summer, 45% during the 2010-11 survey, and the 37% recorded over the 2009-10 summer.

***Comment**; There appears to have been a general decline in the percentage of wild fish captured on opening day in Lake Rotoiti since the implementation of the Ohau Channel Diversion wall. However, this is confounded by a significant increase in the numbers of hatchery reared trout released by the EFGC into Lake Rotoiti since 2009. If EFGC management has been effective this is exactly the result we would expect to see. That is, the change in catch composition should be attributed to the increase in hatchery fish released and not construction of the wall.*

- 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).

***Comment**: The natural variations in annual recruitment of wild trout in Lake Rotoiti are unknown preventing discerning between natural trends and possible effects of the wall.*

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

***Comment;** This is possible but at the moment there is on data to verify this hypothesis. The panel recommends asking EFGC if the increases in hatchery releases in other lakes (e.g. L. Tarawera) resulted in similar changes in wild fish recruitment.*

- 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 move 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.

Comment; *This all seems highly speculative. EFGC changing the number of releases seems a much more plausible explanation. The Okere Arm below the wall is just a big pond with minimal flow, so the hypothesis explained in the last bullet point above is doubtful.*

The percentage of wild fish (excluding fly fishing) has been steady at 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 young wild percentage excluding fly fishing of 21.6%

We might also expect a decline in the ratio of younger wild fish to older wild fish if the returning immature fish have been affected differentially. 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 48%. During the 2013 opening, the percentage of younger class wild trout was 60%.

Table 3. Composition of Wild trout caught Opening Day by Age Cohort

Season start	*AVG*	13-14	12-13	11-12	10-11	09-10	08-09	07-08	06-07	05-06
Wild 1+	39	39	47	59	28	23	27	16	64	51
Wild 2&up	42	26	52	27	25	50	32	52	58	53
All Wild	81	**65**	**99**	**86**	**53**	**73**	**59**	**68**	**122**	**104**
Wild 1+	48%	60%	47%	69%	53%	32%	46%	24%	52%	49%
Wild 2&up	52%	40%	53%	30%	47%	68%	54%	76%	48%	51%

Comment; *The last paragraph above and Table 3 clearly show that the inter-annual variability of wild fish recruitment of every age group is high both before and after the construction of the Wall. The panel can conceive of all sorts of reasons why the wall might have changed the composition of the catch however, the effects of the increase in the number of liberated fish remain unknown preventing proving that the wall had any impact on the composition of the catch in Lake Rotoiti.*

B. OHAU CHANNEL TROUT FISHERY SURVEY DATA

Fisheries Surveys at the Ohau Channel were carried out from 2005-06 to 2013-14 seasons. 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 2013-14 angling season. Anglers were encountered (fishing) during only 50 of the surveys. A lower number of anglers were interviewed during the course of the 2013-14 survey than had been seen in the seven previous creel surveys.

- The 2013-14 angling season at the Ohau Channel produced a significantly improved average catch rate than the 2012-13 season (P=0.007). The 0.38 fish per hour recorded was the fourth highest documented during the eight completed Ohau Channel creel surveys.
- On average, brown trout measured during the 2013-14 season were larger, heavier and in better condition than those measured in the 2012-13 survey. A total of 16 brown trout were measured compared with 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.
- Onaverage, the rainbow trout measured were larger (P=0.011), heavier (P=0.025) and in better condition than those caught during the 2012-13 season.
- Anglers interviewed during the 2013-14 season perceived their catch rate (P<0.001) and the size of the fish they were catching (P<0.001) to be significantly better compared to the 2012-

13 season. Anglers overall satisfaction levels were significantly improved (P<0.001) from the 2013-14 season.

- Over the course of the 2013-14 survey, the perceived improvement in the fishing compared to recent seasons influenced a total of 68% of anglers to state they were either satisfied or highly satisfied with their seasons fishing. This was a significant improvement from the 2012-13 season when only 3% of fishers interviewed stated they were satisfied with their angling (P<0.001).
- Over the 2013-14 season, 43% of surveyed anglers *(93 out of 216)* voiced detractions to their angling experience in the Ohau Channel when prompted.

Comment *This is a high level of detraction, were some of the anglers sampled more than once?*

- Of these, 26% of respondents stated that a lack of fish was the largest detracting feature of fishing at the channel.

Comment; *This is despite the fact that the average CPUE increased from the previous year. This indicates that the satisfaction of anglers doesn't rely fully on the CPUE.*

- 8% of respondents replied that other users of the channel were detractions such as boats passing through, swimmers or other anglers. 4% mentioned directly the weir was a detraction - this is likely a combination of the Rotorua-end weir and the Rotoiti-end
- wall? 3% mentioned pollution which was both discarded litter and water quality. Snags in the channel and trout poachers each provided detractions to 1% of anglers.

3. Kōura

Kōura have been monitored in the Ōkere Arm and Lake Rotoiti since December 2005 using a traditional Māori fishing method, the tau kōura (Kusabs and Quinn 2009; Kusabs, et al. 2015) . Kōura are still abundant in Lake Rotoiti and the Ōkere Arm seven years after the installation of Ohau Channel diversion wall (July 2008). However, there appears to have been a general decline in the relative abundance of kōura in Lake Rotoiti and the Ōkere Arm. The reasons for these declines are unknown, however, they may be related to improving water quality particularly in the Okere Arm/Te Ākau area (Western Basin). Since 2005 there has been a steady improvement in water quality in both lakes Rotoiti and Rotorua, with a decrease in algae production and an increase in water clarity. Reduced primary production may have resulted in a decrease in food supply for kōura in Lake Rotoiti. Studies overseas have shown that crayfish in productive lakes generally have high abundances, growth rates and fecundity which has been attributed to an increase in the primary consumer density, i.e., higher prey availability for crayfish in eutrophic lakes.

Improving water quality has also resulted in an increase in water clarity which has coincided with a noticeable increase in hornwort production, particularly at Te Ākau and in the Okere Arm. Hornwort is a brittle, poorly attached plant (anchorage is by buried, modified leaves) and is prone to dislodgement by water currents, wave action and other disturbances. Because it is easily dislodged, hornwort can smother the whakaweku, not only restricting kōura access to the whakaweku but also leading to the rapid decay of the fern itself. In addition, weed proliferation and accumulation of decaying organic matter can markedly degrade the habitat quality of the surrounding lake bed

4. Kākahi

Kākahi have been monitored at six shoreline sites in Lake Rotoiti since June 2005. Kākahi transects were located at each of three sites along the area between Ohau channel and the Rotoiti delta and at

three reference sites in Lake Rotoiti that were outside the area of influence of the diversion wall. Kākahi were more numerous in the Ōkere Arm sites and at Ōkawa Bay than in the control sites. Although, kākahi abundance has varied markedly over the study period, kākahi densities have generally increased over the study period. Sediment type is an important determinant of mussel density in lakes. Since the diversion wall has been in place there has been a noticeable accumulation of silt in the Ōkere Arm monitoring sites. Interestingly, in recent years this silt has been colonised by extensive growths of low growing turf species which has resulted in the consolidation of the lake bed, creating habitat more suitable to kākahi. It is possible that the establishment and proliferation of these turf plants is due to the shelter provided by the diversion wall which has markedly reduced easterly wave action. The Ōkere Arm is a dynamic environment and future changes in kākahi abundance are expected.

5. Summary

The lack of pre-wall data meant that it wasn't possible to create benchmark levels for comparison with post wall results. The Fisheries Panel concluded that overall the data indicated that construction of the wall could not be shown to have a significant effect of fisheries values. However there is a ***lot*** *of variability between the annual results over the five year period of post wall monitoring. These may be linked to the wall but there are a large number of other contributing factors that could affect monitoring results.*

6. Fish Panel Conclusions and Recommendations*:*

There is no evidence of any change in any of the fisheries that can be attributed to construction of the wall. Certainly we can rule out catastrophic declines. We are unable to rule out subtle changes owing to the lack of sufficient pre-wall data for comparison, but this comment should not be interpreted as suggesting that such changes are present. We simply cannot tell from the data we have.

Furthermore, it is impossible to separate the effects of the wall on fisheries values because there are so many other changes occurring i.e, lake productivity is declining; hatchery trout numbers have been significantly increased, macrophyte shade increased due to improved water clarity – affecting kōura and possibly smelt spawning.

The panel recommends continuation of the current monitoring programme to gain a more accurate understanding of dynamics affecting the fisheries values, particularly the changes that occur to fisheries with a reversal in eutrophication i.e. reduced primary production. Continuation of data collection will be useful in preparing the application to renew the wall resource consent when the current consent expires in 2017.

To date the panel has not considered it necessary to construct fish pass through the wall (which has provision in resource consent 63209). Although the absence of data pre-wall prevents drawing unequivocal conclusions, given that water quality targets have been met in Lakes Rotorua and Rotoiti it is possible to explore if fitting the wall with a fish pass will result in a significant improvement particularly on smelt abundance below the weir that is the key ingredient to sustain a good trout fishery. This could be done on a trial basis to see whether it can enhance smelt migration and ultimately trout abundance in the Ohau Channel. With 7 years of data pre-fish pass a monitoring a similar period of time post-fish pass will lead to a more robust conclusion even though the focus of the monitoring may change. This will also depend on having a fish pass that is effective at passing smelt. This on its own is no easy task as the technology on smelt passage is not well developed.

7. Resource Consent Conditions Relevant to Fisheries Panel Establishment and Operation

The Following Resource Consent Conditions are relevant to the establishment and operation of the Fisheries Review Panel. *Outcomes are added in italics below each condition*

12 **Fisheries Review Panel**

12.1 The consent holder, in consultation with Eastern Region-Fish and Game and Te Runanga O Ngati Pikiao, shall establish an independent expert fishery review panel (referred to in these consent conditions as the "review panel") comprising 3 members to:

a) Review the monitoring programmes proposed by the consent holder; and
b) Advise on any adjustments to the monitoring programmes or additional monitoring required; and
c) Review the results of the monitoring programmes; and
d) Recommend to the Manager Consents & Compliance of the Bay of Plenty Regional Council on appropriate fish passage performance targets, frequency of operation and trigger levels for identifying effects on fishery values; and
e) Recommend to the Manager Consents & Compliance of the Bay of Plenty Regional Council on any mitigation measures that are to be instituted in response to the monitoring undertaken; and
f) Recommend to the Manager Consents & Compliance of the Bay of Plenty Regional Council on any adjustments to the construction and operation of any fish passage structures installed.

The Three member Fisheries Panel and technical support team was established with the following members ;

Fisheries Panel Members	***Technical Advisors***
Richard Barker (Otago University)	*Matt Osborne (ERFG)*
Michel Dedual (DOC)	*Rob Pitkethley (ERFG)*
Ian Kusabs (Fisheries Consultant)	*Dave Rowe (NIWA)*
	Brendan Hicks (UoW)

Condition 12.1a-c
The panel has met annually since 2008. The initial meeting reviewed pre wall fisheries data. The annual meeting minutes address items 12.1a-c.

Condition 12.1d
Minutes of the meeting dated 14 August 2008 raised concerns that there was not enough pre-wall information to reliably set trigger or threshold levels and proposed assessing the data each year as an alternative. This decision impacts a number of resource consent conditions which refer to specific actions in the event that trigger levels are reached.

Condition 12.1e-f
There have been no recommendations for mitigation measures to be taken.

12.2 The review panel will at the end of the 5 years monitoring as required by conditions 13.3 and 13.5 review the full 5 years of data and recommend to the Bay of Plenty Regional Council what ongoing level of monitoring is considered necessary.

This document is the 5 year review summary

12.3 The review panel shall on receipt of the report required pursuant to condition 13.13, recommend to the Bay of Plenty Regional Council whether the results of this review of monitoring data warrant a review of consent conditions, whether any mitigation action is required, and what type of mitigation action would be appropriate.

The panel determined that there was no need to review the resource consent conditions or institute mitigation measures.

12.4 On receipt of the information required pursuant to condition 13.7, the Review Panel (in consultation with Eastern Region – Fish & Game) shall recommend to the Manager Consents & Compliance of the Bay of Plenty Regional Council whether a fish pass should be constructed within the diversion wall.

To date, the Review Panel has not recommended the installation of a fish pass, but this summary report is recommending that the installation of a fish pass can be undertaken (and monitored) on a trial basis to establish if it facilitates smelt and trout movement through the channel .

13 Fisheries Monitoring

13.1 The consent holder shall monitor larval and juvenile smelt in the Ohau Channel and Lake Rotoiti for a period of 12 months prior to commencement of construction of the flow diversion structure. The monitoring programme will be designed in consultation with Eastern Region-Fish and Game and representatives of Te Runanga O Ngati Pikiao.

13.2 The consent holder shall identify where possible the origin or spawning areas of trout, smelt and koaro populations prior to construction of the flow diversion structure and compare these to monitoring results to be undertaken annually for the five years following construction of the flow diversion structure.

Conditions 13.1-13.2
A research programme was established using otoliths to identify the spawning source lake and streams of trout and smelt.

13.3 The consent holder shall monitor larval and juvenile smelt annually for 5 years following construction of the diversion structure and compare with “baseline” data as required in conditions 13.1 and 13.2 to establish what effect, if any, of the flow diversion structure.

Monitoring of larval and juvenile smelt has been undertaken in the 5 year period and reported annually.

13.4 The consent holder shall in conjunction with representatives from Te Runanga O Ngati Pikiao, undertake monitoring of Kākahi and Kōura migration and populations for a period of 12 months prior to construction of the diversion structure.

13.5 The consent holder shall monitor Kākahi and Kōura annually for 5 years following construction of the diversion structure and compare with "baseline" data as required in condition 13.4 to establish what effect, if any, of the flow diversion structure.

Condition 13.4 and 13.5
Monitoring of a number of kōura and kākahi site within the channel and outside control areas have been undertaken in the 5 year period and reported annually.

13.6 The consent holder shall ensure that the wall design is such that the wall can be modified to enable provision to be made for the passage of fish, should monitoring demonstrate that such passage is necessary. Any such modification shall be capable of being undertaken without affecting the integrity of the wall. The design shall be submitted, to the Regional Council, for the approval by the Manager Consents & Compliance of the Regional Council or delegate (after consultation with the review panel or Eastern Region-Fish and Game).

13.7 The consent holder shall monitor the impact and effect on fish migration and fishery values of the flow diversion wall for a period of five years after the installation of the flow diversion structure. The consent holder shall, annually provide the results of the monitoring to the review panel for the previous 12 month period.

Annual summaries of monitoring has been provided to BOPRC

13.8 Following a relevant recommendation from the review panel pursuant to condition 12.4, the Manager Consents & Compliance of the Regional Council or delegate shall direct the applicant to construct a fish passage.

13.9 The consent holder shall, on direction of the Manager Consents & Compliance of the Regional Council, construct fish passage(s) that shall be:

a) designed and constructed to pass no more than a cumulative total of 375 litres per second; and

b) constructed under the direction of a Chartered Engineer; and

c) constructed within three months of the direction of the Manager Consents & Compliance of the Regional Council.

13.10 Within 30 working days of completion of the fish pass, the consent holder shall submit a certificate signed by a Chartered Professional Engineer to certify that the fish passage has been constructed in accordance with good engineering practice, and is consistent with the requirements of condition 13.9(a).

13.11 Following installation of the fish pass the consent holder shall monitor its performance in accordance with the monitoring plan and performance targets

established in consultation with the review panel. Following consultation with the review panel and Eastern Region-Fish and Game and the approval of the Manager Consents & Compliance of the Bay of Plenty Regional Council, the consent holder shall make adjustments to maximise its performance, should the monitoring indicate that such adjustments are required. Any adjustments shall be subject to the provision that the cumulative total of 375 litres per second flow through the wall (pursuant to condition 13.9(a)), is not exceeded.

To date, the Review Panel has not recommended the installation of a fish pass, but this summary report is recommending that the installation of a fish pass can be undertaken (and monitored) on a trial basis to establish if it facilitates smelt and trout movement through the channel .

13.12 The consent holder shall engage an appropriately qualified expert to review the trout fishery information held by Eastern Region-Fish and Game to determine appropriate threshold trigger values where the trout fishery would be considered to be significantly impacted. Following consultation with the review panel and Eastern Region-Fish and Game and with the approval of the Manager Consents & Compliance of the Bay of Plenty Regional Council, these trigger levels shall be incorporated into their ongoing fish surveys / monitoring programmes as thresholds beyond which mitigation actions will be required. The consent holder shall also identify any gaps in the monitoring data and following consultation with the review panel and Eastern Region-Fish and Game and with the approval of the Manager Consents & Compliance of the Bay of Plenty Regional Council, the fish surveys / monitoring programmes shall be adjusted to address any gaps that are relevant to assessing the effects of the diversion structure.

13.13 The consent holder shall annually review the fishery monitoring data and smelt research in relation to the monitoring programme objectives and whether the trigger values have been reached, and shall report to the review panel, Eastern Region-Fish and Game, Te Runanga O Ngati Pikiao and the Bay of Plenty Regional Council.

Conditions 13.12 and 13.13
Minutes of the meeting dated 14 August 2008 raised concerns that there was not enough pre-wall information to reliably set trigger or threshold levels and proposed assessing the data each year as an alternative. This decision impacts a number of resource consent conditions which refer to specific actions in the event that trigger levels are reached. Following each annual review of monitoring, the programme for the following year was formulated. Over the 5 year period the programme was slightly modified based on the cumulative data. Technical advisors to the panel (listed above) were present at the annual meetings.

14 Reporting

14.1 The consent holder shall, at four yearly intervals, prepare, publish and make available to the public, a review of the performance of the structure in improving water quality in Lake Rotoiti.

A summary of the Fish Monitoring Programme was produced after 4 years this can be viewed at

http://www.rotorualakes.co.nz/vdb/document/300

14.2 The consent holder shall, by June 30 of each year, provide a written report to the Regional Council on the results of water quality sampling and analyses carried out, for the previous annual period, pursuant to condition 10.1 and shall provide a copy of the report to the Tapuika Iwi Resource Management Unit and Nga Tangata Ahi Kaa Roa o Maketu.

14.3 The consent holder shall, by June 30 of each year, report to the Regional Council on the results of blue-green algae sampling and analyses carried out, for the previous annual period, pursuant to condition 10.2 and shall provide a copy of the report to the Tapuika Iwi Resource Management Unit and Nga Tangata Ahi Kaa Roa o Maketu.

14.4 The consent holder shall report to the Regional Council, within one month of the completion of the flow diversion structure, the results of the suspended solids sampling and analyses carried out pursuant to condition 10.3.

14.5 The consent holder shall, by June 30 of each year, report to the Regional Council on the results of the suspended solids sampling and analyses carried out, for the previous annual period, pursuant to condition 10.4.

14.6 The consent holder shall, by June 30 of each year, report to the Regional Council on the results of the avifauna monitoring carried out, for the previous annual period, pursuant to condition 10.7

14.7 The consent holder shall, by June 30 of each year, report to the Regional Council on the results of the erosion monitoring carried out, for the previous annual period, pursuant to condition 10.8.

Conditions 14.2-14.7
All Annual reports were provided to BOPRC Compliance department

References

Kusabs, I.A., Hicks, B.J., Quinn, J.M. and Hamilton, D.P. 2015. Sustainable management of freshwater crayfish (kōura, *Paranephrops planifrons*) in Te Arawa (Rotorua) lakes, North Island, New Zealand. Fisheries Research **168**, 35-46.

Kusabs, I.A. and Quinn, J.M. 2009. Use of a traditional Māori harvesting method, the tau kōura, for monitoring kōura (freshwater crayfish, *Paranephrops planifrons*) in Lake Rotoiti, North Island, New Zealand. New Zealand Journal of Marine and Freshwater Research **43**, 713-722.