BEFORE THE COMMISSIONERS ON BEHALF OF THE OTAGO REGIONAL COUNCIL

Consent No. RM16.093.01

BETWEEN	**CRIFFEL WATER LIMITED**
	Applicant
AND	**OTAGO REGIONAL COUNCIL**
	Consent Authority

EVIDENCE OF RICHARD MARK ALLIBONE

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Introduction

1. My name is Richard Mark Allibone.

2. I am the Director and Principal Ecologist of Water Ways Consulting Limited. I hold the following tertiary qualifications; a BSc (Zoology and Geology), an MSc (Zoology) and PhD (Zoology), all from the University of Otago. My research has centred on New Zealand's native fish with a focus on the New Zealand galaxiids, their taxonomy, life history and threats to these species.

3. I specialise in freshwater ecological research and management for native freshwater fish. I have been a researching native fish for over thirty years. Initially my research between 1990 and 2001 was conducted as a post-graduate student and then as a freshwater fisheries specialist for the Department of Conservation, a Post Doctoral Fellow and fisheries scientist at NIWA, and a Species Protection Officer in the Department of Conservation's Biodiversity Recovery Unit. During 2002-2004 I was the National Services Manager at the QEII National Trust. Since 2004 I have worked as a consultant; firstly for Kingett Mitchell Limited, then Golder Associates (NZ) Ltd. In November 2014 I formed the company Water Ways Consulting Limited where I am a director and the principal ecologist.

4. My MSc thesis investigated the population structures of three migratory galaxiids (whitebait), koaro (*Galaxias brevipinnis*), banded kokopu (*G. fasciatus*) and inanga (*G. maculatus*) and two non-migratory galaxiids, common river galaxias (*G. vulgaris*) and alpine galaxias (*G. paucispondylus*) using population genetics techniques. In this study I also examined the population structure effects of landlocking of migratory galaxiids (Allibone 1990, Allibone & Wallis 1993) by determining whether genetic differences (via genetic drift) indicated populations of koaro in Lakes Wanaka, Wakatipu and Kaniere showed evidence of isolation from migratory koaro populations. This study also provided the evidence that the non-migratory, common river galaxias, was in fact more than one species.

5. My PhD studies followed the confirmation that common river galaxias was not a single species but rather a 'species flock' comprised of 8-10 separate species. This study conducted the first research into the ecology, distribution and conservation threats of four of non-migratory galaxiids, Taieri flathead (*G. depressiceps*), Central Otago roundhead galaxias (*G. anomalus*), Eldon's galaxias (*G. eldoni*) and Clutha flathead (*G. spD*) found in the Taieri River, Otago (Allibone 1997). During this time, I also conducted the first ecological research on the dusky galaxias (*G. pullus*) that is found in the Waipori and Clutha River catchments (Allibone & McDowall 1996).

6. I am a recognised expert with regard to the conservation management of New Zealand's freshwater fish. I have been a member of the expert panel that conducts the conservation status assessments (threat rankings) for freshwater fish since 2001, including being the chair of this panel in 2009. While I was working for the Department of Conservation I was the lead author on three freshwater fish recovery plans (DOC 2003, 2004, 2005) and while these plans have now lapsed they are still the only recovery plans written and only guidance the Department of Conservation has produced for threatened fish management in New Zealand.

7. I have also investigated the effects of salmonids, hydro-electric developments and water abstraction on galaxiids in Otago and elsewhere in New Zealand. This work includes presenting the Department of Conservation's ecological submission for the Contact Energy Clutha Rive hydro electric scheme consent hearing in 2001. The submission included evidence on issues associated with Lake Dunstan and the expected expansion of the koaro population and the expected impacts this would have on Clutha flathead galaxias.

8. I have been engaged by Criffel Water Limited, Luggate Irrigation Company Limited and Lake McKay Station Limited to provide evidence regarding the fish species in Luggate Creek, the interactions amongst native fish species and with introduced species and an assessment of the koaro management in the vicinity of Lake Dunstan.

9. On the 3 October 2019 I fished the Alice Burn along a 100 m reach starting approximately 100 m downstream from the Lake McKay Station water intake. The purpose of this investigation was to respond to criticisms made by DoC personnel that not enough work had been done by the applicants to establish that fish were are not present in the reach downstream of the Lake McKay Station take in the upper Alice Burn. The absence of data was being advanced as the basis for adopting a "conservative" approach to residual flow and fish screening requirements for the Lake McKay station take. The reach length investigated was restricted to a relatively gentle slope reach between to steeper sections that were not fishable due to their gradient (Figures 1 and 2). In this reach we found no fish or koura present. That result is consistent with Figures 1 and 2 (maps from the New Zealand Freshwater Fish Database) reproduced in Dr Dean Olsen's report dated 23 September 2019 attached as Appendix 4 to the section 42A report. Note the small and rather hard to see brownish dots in the catchment head waters indicating records of observations identifying "no species". I discuss this further in paragraph 16 below.

10. I undertook fish sampling in June 2016 at two sites in Luggate Creek, one site upstream of the Criffel Water intake and one site downstream of the Criffel Water intake. At both these sites we collected rainbow trout (*Oncorhychus mykiss*) and no other fish species.

11. Rainbow trout have been reported as far upstream as the site we fished above the Criffel Water intake weir. They have also been reported in the lower Alice Burn and in the lower reaches of Luggate Creek (NZFFD, Figure 3).

12. The New Zealand Freshwater Fish database (NZFFDB) records two other species present in Luggate Creek, koaro and brown trout (*Salmo trutta)*. Brown trout are restricted to the lower reaches of Luggate Creek (Figure 2) but do penetrate upstream to at least the Alice Burn confluence. The restriction on upstream movement in Luggate Creek is reported to be due to a barrier waterfall in the gorge area upstream of the Alice Burn confluence.

13. Two of the four koaro records report koaro were rare and the other two collected only a single fish on each occasion. The size range of three koaro caught is reported to be between 50-65 mm indicating they a year or so old. One record reports a single koaro at 120 mm which would be large enough to be a mature adult and the last record also reported the koaro were rare but individuals caught were large (M Hickey pers com).

14. The rainbow trout records from areas upstream of the brown trout distribution report rainbow trout are common or abundant. In my sampling below the Criffel Water intake weir we collected 49 rainbow trout. Upstream of the weir the rainbow trout also appeared common although water depth and site access difficulties prevented the capture of the majority fish observed.

15. There is only one record of rainbow trout in lower Luggate Creek, this being the record from 1990 when 7 rainbow trout were collected. Since that date no rainbow trout have been collected in the lower reaches of Luggate Creek.

16. The lack of rainbow trout in the lower Luggate Creek indicates that the Clutha River rainbow trout may not use Luggate Creek for spawning. The presence of rainbow trout upstream of a barrier that excludes brown trout in the lower Luggate Creek and above the Criffel Water intake weir, another fish passage barrier, indicates that the rainbow trout at are present due to an introduction, probably into the weir pond.

17. There are eight NZFFD records for the upper reaches of Luggate Creek. All these sites are at over above 1300 m altitude and record no fish present. This is not unusual, the NZFFD has 141582 records (as of 1 October 2019) and only 58 are for sites over 1300m altitude and only thirteen report fish are present, seven of these sites have brook char (six of seven are from the Roaring Meg), one brown trout and five koaro. The five koaro sites are all lake tributaries in North West Nelson.

18. Both for Luggate Creek and Alice Burn there are no fish survey records for much of the stream lengths. For Luggate Creek there are none

from just upstream of the Criffel Water intake weir to the 1300 m altitude, a distance of approximately 16 km. For the Alice Burn there are no fish records from the lower 6 km upstream to the Lake MacKay Station intake. For both streams the long unsampled reaches occur along steep side steep stream gradient sections. I would expect these reaches to have waterfalls that would be impassable to salmonids.

19. Longfin eel (*Anguilla dieffenbachii*) has not been recorded in Luggate Creek but is present further upstream in Lake Wanaka and its tributaries. Given sufficient recruitment getting past Roxburgh Dam some longfin eels would be present in Luggate Creek.

20. The Cardrona River and Sheepskin Creek, tributaries of the Clutha River either side of Luggate Creek have populations of the *Nationally Critically* threatened species Clutha flathead galaxias (Dunn et al 2018). Key threats for the Clutha flathead galaxias are the salmonids (brown trout, rainbow trout and brook char) and then koaro, all of which are predators of small non-migratory galaxiids.

21. It is likely that Clutha flatheads galaxiids were present in the lower reaches of Luggate Creek prior to the arrival salmonids. Whether they survive today in the unsurveyed mid-reaches of Luggate Creek and Alice Burn will depend on their ability to ascend the waterfalls and steep gradients in these sections of stream and then to maintain viable populations in the steep gradient streams. The absence of fish survey records for the areas upstream of salmonids and in the mid-reaches of both Luggate Creek and Alice Burn means there is the possibility this fish is present in the Luggate Creek catchment.

22. If Clutha flatheads are absent there is also the opportunity to use the fishless reaches of Luggate Creek and Alice Burn as areas to introduce Clutha flathead galaxias to. The steep gradient will continue to exclude salmonids and provide protection to a population if established. Furthermore, the high altitude upper reaches have a lower gradient and will become more suitable habitat as climate change makes these areas more hospitable for fish.

23. The Department of Conservation has, in its submission, indicated that higher flows are required to provide for koaro, a threatened species. Koaro is ranked as *At Risk Declining*, the lowest threat category. It also has the qualifier of partial decline (PD). This indicates the threat panel considered that koaro are only declining in some parts of their geographic range. In my experience coastal migratory populations have declined but inland landlocked populations have expanded.

24. To understand why inland populations have increased it is important to understand the life cycle of koaro. Adults commonly reside in streams, and rivers, using riffle, cascade and torrent habitats. Adult females lay 1000s of eggs and the small larval fish that hatch from these eggs travel downstream to the sea or lakes to feed on planktonic items until they migrate back upstream to adult habitat as whitebait. While there is still some debate whether koaro that rear in lakes all migrate upstream or whether some move downstream, life history studies indicate that by far the majority of koaro juveniles move upstream.

25. Tagging studies I have conducted indicate that koaro reach maturity at 3 or 4 years old and can live for at least twenty years. Older individuals grow very slowly increasingly length just 2-5 mm a year. University of Otago researchers think the majority of their energy intake is directed to developing eggs each year rather than to growth.

26. One reason for the increase in inland koaro populations is the creation of hydro-electric storage lakes that have provided new habitat for koaro to use for larval rearing. Fish surveys around Lake Mahinerangi found koaro were abundant in the lake tributaries and where also migrating upstream along water diversions to adjacent catchments. (McDowall & Allibone 1994, Allibone 1999). The increase in koaro abundance and their distribution was associated declining populations of two non-migratory galaxiids, dusky and Eldon's galaxias. Koaro are known to predate on smaller non-migratory galaxiids.

27. To mitigate this impact at Lake Mahinerangi Trustpower agreed as part of the consent renewal programme to the Department of

Conservation's request to install a fish passage barrier on one stream to protect a significant population of dusky galaxias.

28. In the upper Waitaki, koaro that are utilising Lake Benmore as larval rearing habitat are common and increasing in the Tekapo River and its tributaries. Last summer I conducted fish surveys of the Tekapo River and koaro was one of the more abundant native fish in the river (Figure 5), yet without the presence of Lake Benmore they would be almost absent from the river.

29. The Department of Conservation at Twizel conducts a conservation management programme to protect the *Nationally critical* threatened fish lowland longjaw galaxias (Waitaki) and the *Nationally vulnerable* bignose galaxias. The most active part of this programme has installed a fish passage barrier on Fraser Spring and trout have been removed. Following trout removal the two galaxiids began to increase in abundance. However, after two years the populations crashed and it was found that koaro, that could climb the fish passage barrier were increasing in abundance following the removal of trout and where now preying upon the smaller galaxiids. The Department then removed the koaro and modified the barrier to exclude koaro from Fraser Springs (Figure 6).

30. At Lake Mahinerangi I found while survey the catchment as a Department of Conservation staff member that koaro were excluding dusky galaxias from a stream. This stream had a weir that excluded brown trout, but koaro juveniles could climb. In 1996 we installed a barrier on this weir to stop koaro climbing the weir and began koaro removal operations. The initial barrier has had to be improved several times (Figure 7) to successful exclude koaro and koaro removals have continued to be conducted in attempt to restore the dusky galaxias population.

31. With respect to Lake Dunstan and the koaro population in the tributaries of the lake it is likely the population is increasing and will continue to do so until the larval rearing capacity of Lake Dunstan is reached. The submission I gave during the Contact Energy Clutha

hydro-scheme consent process in the early 2000s included a section of likely koaro impacts on Clutha flathead galaxias as the koaro population expanded upstream of Lake Dunstan and the submission sought the construction of fish passage barriers (as was done at Lake Mahinerangi) to protect Clutha flathead populations.

32. In relation to the present application by LIC/LMS, the submission the Department of Conservation has made with respect to the significance of Luggate Creek as koaro habitat, is in my opinion contrary to previous positions the Department as taken with respect to koaro and does not reflect the threat ranking that notes that koaro's decline is limited, nor does it consider the conservation concern koaro creates for non-migratory galaxiids and it ignores the conservation action being taken elsewhere that includes the removal of koaro.

33. The recently released Environment Court decision for Plan Change 5A for the Lindis River notes the following agreed position of all freshwater fish experts with regard to Clutha flathead and koaro

> Clutha flathead galaxias, found only in tributaries of the Clutha above the Benger Burn, is classified as "nationally critical", the highest threat classification under the New Zealand Threat Classification System. In the Lindis catchment, the range of Clutha flathead galaxias has declined to now be mostly confined to tributaries upstream of water takes, mostly as a consequence of predation by trout (I.e., the species are rarely found to co-occur), although they can also be adversely affected by interactions with the native, migratory galaxiid, koaro.

34. The Department of Conservation submission also ignores several issues. Firstly, the fish survey data indicate koaro are rare in Luggate Creek and this would indicate a recruitment limitation rather than a habitat limitation. Increasing the flow in Luggate Creek will not resolve the present day recruitment issue. The submission also ignores issues that arise if koaro do overcome the recruitment limitation. Luggate Creek is a potential refuge for Clutha flathead galaxias and an increase in koaro in Luggate Creek would threaten any Clutha flathead present. Furthermore, as koaro climb waterfalls that exclude salmonids from upstream reaches the effect of koaro on non-migratory galaxiids extends further upstream than the salmonid impact zone.

35. Finally, the Department of Conservation submission with respect to koaro has not considered the wider implication of an increasing koaro population in Luggate Creek. Koaro present in Luggate Creek or in any other tributary of the Clutha River between Lake Wanaka and Lake Dunstan and in Lake Dunstan tributaries contribute larval koaro to the rearing habitat in Lake Dunstan. These larval fish (as whitebait) then migrate back to tributary streams around lake Dunstan and can enter streams such as Packspur Creek, Sheepskin Creek and the Cardrona River where populations of do Clutha flathead exist. The factors that limit the growth of the koaro population around Lake Dunstan are the small initial koaro population, the planktonic food resource for larval koaro in Lake Dunstan and predation of koaro by salmonids. Deliberately attempting to increase adult koaro habitat and increase their abundance in streams increases the potential for the loss of Clutha flathead populations.

36. The submission of Aukaha seeks to provide higher flows to increase the habitat available for longfin eel. This in conjunction with an elver release programme has the objective of creating a longfin eel population in Luggate Creek. From a restoration perspective the return of longfin eels to Luggate Creek and elsewhere in the upper Clutha River is a reasonable objective that I would support.

37. The habitat modelling analysis provided by Jowett Consulting (2019) shows that for the lower Luggate Creek area a minimum flow of 180 L/s will provide 83% of the habitat present at the natural 7dMALF. Given the minimum flow will not occur through out the year and fish will tolerate some crowding during low flow period the proposed minimum flow and flow regime proposed by the applicants will provide habitat for a healthy longfin eel population that is similar to the population that would have been present prior to fish passage being lost. It is also important to note given the slow growth rate of longfin eels, that it will take 30-50 years for eels to reach lengths of 600-1000 mm and even if a large scale stocking programme is undertaken soon the eels are unlikely to be habitat limited due to their size for the length of the 35 year consent term requested.

38. However, they also seek to provide more habitat for koaro and an increase in the koaro population. I do not consider this appropriate for the reason set out above.

39. In addition, in my opinion the combined objectives are not readily compatible. Longfin eels once they reach a length of 30 -40 cm become piscivorous and koaro are prey items. Together with colleagues I conducted a freshwater fish survey of an un-modified Stewart Island river- Maori River. In this study we found that koaro were restricted to riffle habitat in areas where eels and kokopu were present. In an upstream reach where only koaro were present they occupied pools, runs and riffle habitat (Chadderton & Allibone 2000). I do not expect koaro to become abundant in Luggate Creek in areas where eels and trout are present as koaro would face two significant predators and competitors.

40. An additional concern with the stocking of Luggate Creek with longfin eel is the potential impact on Clutha flathead galaxias. Elvers, like koaro can climb barrier waterfalls that exclude salmonids and eel populations can establish upstream of waterfalls that protect the non-migratory galaxiids. There are two unknowns with regard to Luggate Creek. Firstly, it is unknown if a Clutha flathead population exists in the unsurveyed reaches of Luggate Creek or Alice Burn. Secondly, there has been no investigation on the impact of longfin eel on Clutha flathead populations. Given Clutha flathead are a nationally critical threatened species, this in my opinion requires some caution. This is in line with the position often taken by the Department of Conservation when they advocate for a precautionary approach to issues where outcomes are uncertain and threatened species potentially impacted. Such caution has been exercised before when it was decided not to set up an elver trap and transfer project on the Waipori Power Scheme and eels are currently not transferred to Lake Mahinerangi and upstream to protect the threatened galaxiids upstream of the lake from any possible eel impacts. This issue could be managed if a stocking programme that included limits of the longfin eel numbers was set and

monitoring of their dispersion upstream was conducted if Clutha flathead populations need to be protected.

41. With regard to fish screens I would recommend the following. The Lake MacKay Station take in the upper Alice Burn needs no fish screen as there are no fish present at the take. For the Criffel Water take I would also propose no fish screen. There is a population of rainbow trout above the weir but as noted in the Ryder Consulting (2019) report this population has no fishery value either as a fishery itself or as a spawning stream that supports a fishery in the Clutha River. Therefore, I would consider screen un-necessary and in fact would recommend the removal of these rainbow trout rather than their protection as they have only nuisance value in Luggate Creek. A screen will be required for the lower Luggate Irrigation Company take to minimise entrainment of juvenile brown trout.

42. In summary, I would not support any actions that increase koaro abundance in Luggate Creek, or in any stream that drains to Lake Dunstan due to possible impacts on Clutha flathead populations. I would also note that increasing the flow in Luggate Creek will not address a recruitment limitation that currently limits the koaro population. Furthermore, I would keep Luggate Creek free of koaro and longfin eels until such time that it is as it is known that Clutha flathead do not exist in the stream and the stream is not required for a Clutha flathead translocation.

43. The addition of longfin eel to the fish community of Luggate Creek would reflect the natural (pre-salmonid) fish community, and the applications in this case would ensure that there is abundant suitable eel habitat in the Luggate Creek, but due to concerns over possible impacts on Clutha flathead galaxias I would recommend this is approached with some caution.

Date: 8 October 2019

Richard Allibone

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Figure 1: The upper Alice Burn fishing reach.

Figure 2: The upper Alice Burn just downstream from Lake MacKay Station water take.

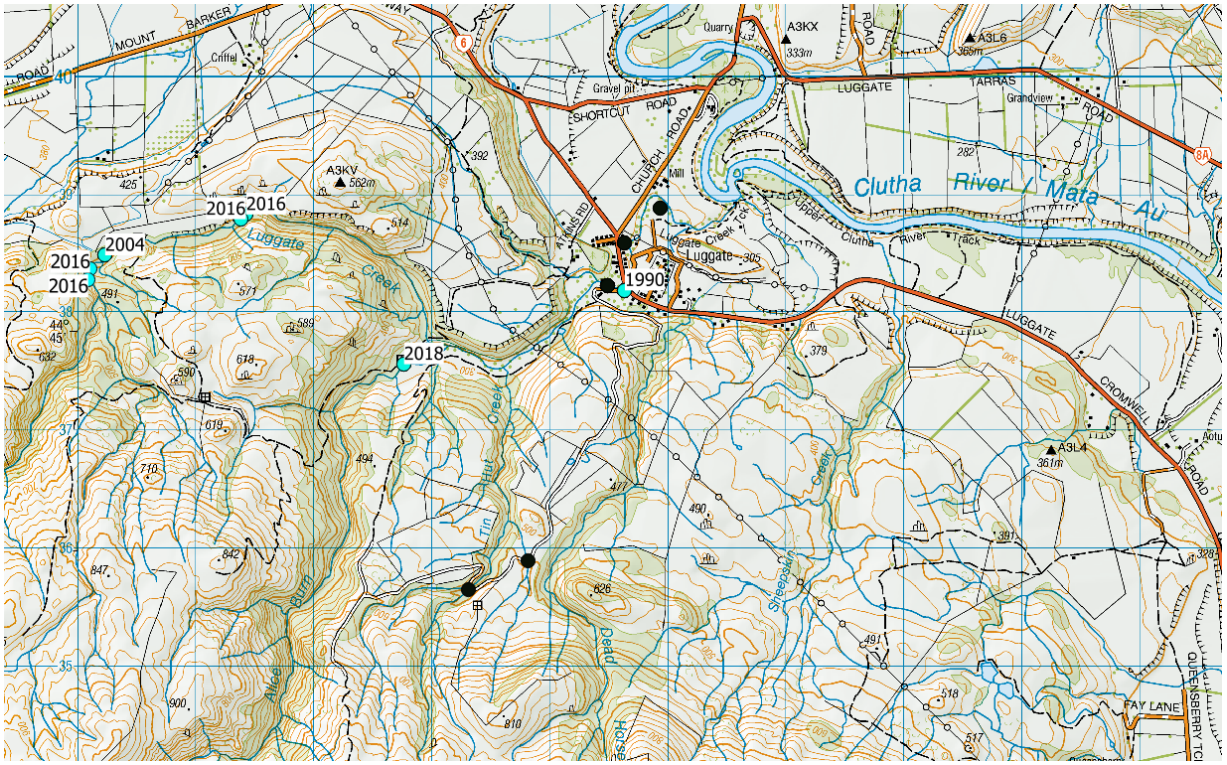

Figure 3: Rainbow trout locations (green circles) and additional survey sites (black circles) in Luggate Creek from the NZFFD with survey year noted beside records brown trout records.

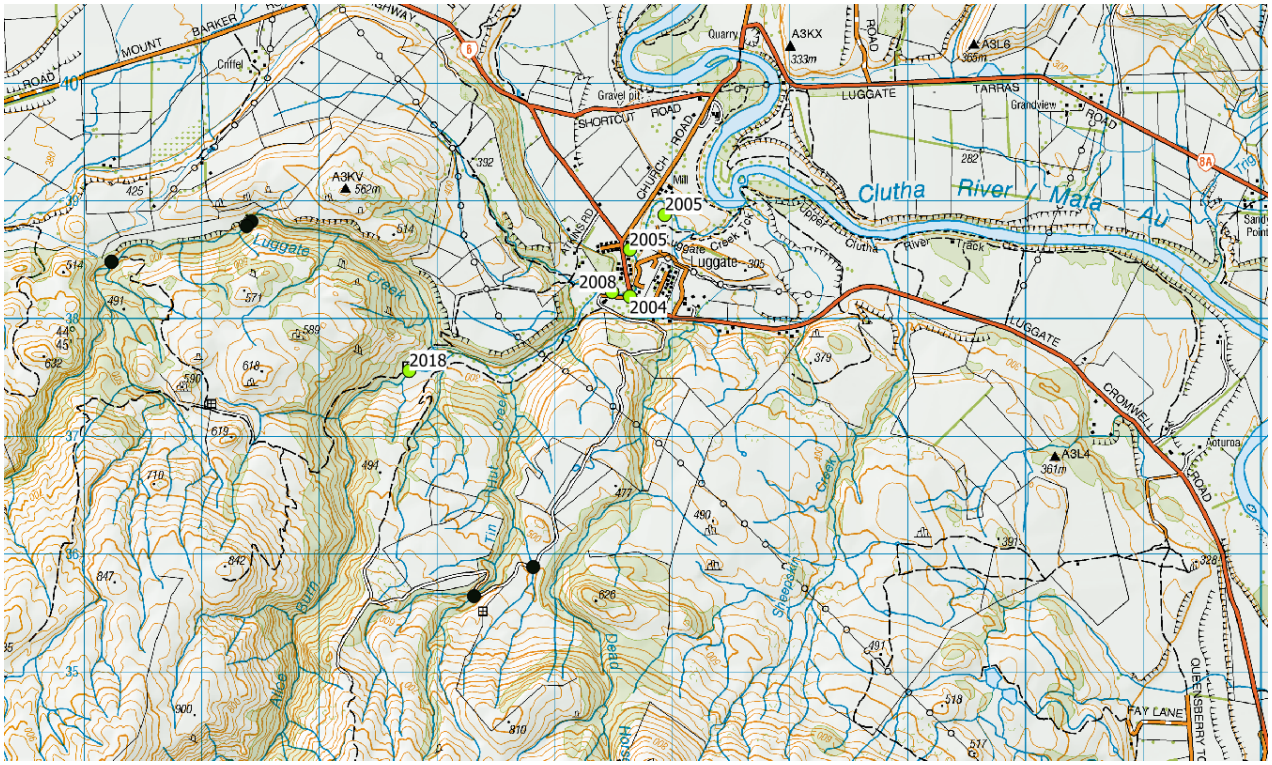

Figure 4: Brown trout locations (green circles) and additional survey sites (black circles) in Luggate Creek from the NZFFD with survey year noted beside records brown trout records.

Figure 5: Koaro from the Tekapo River.

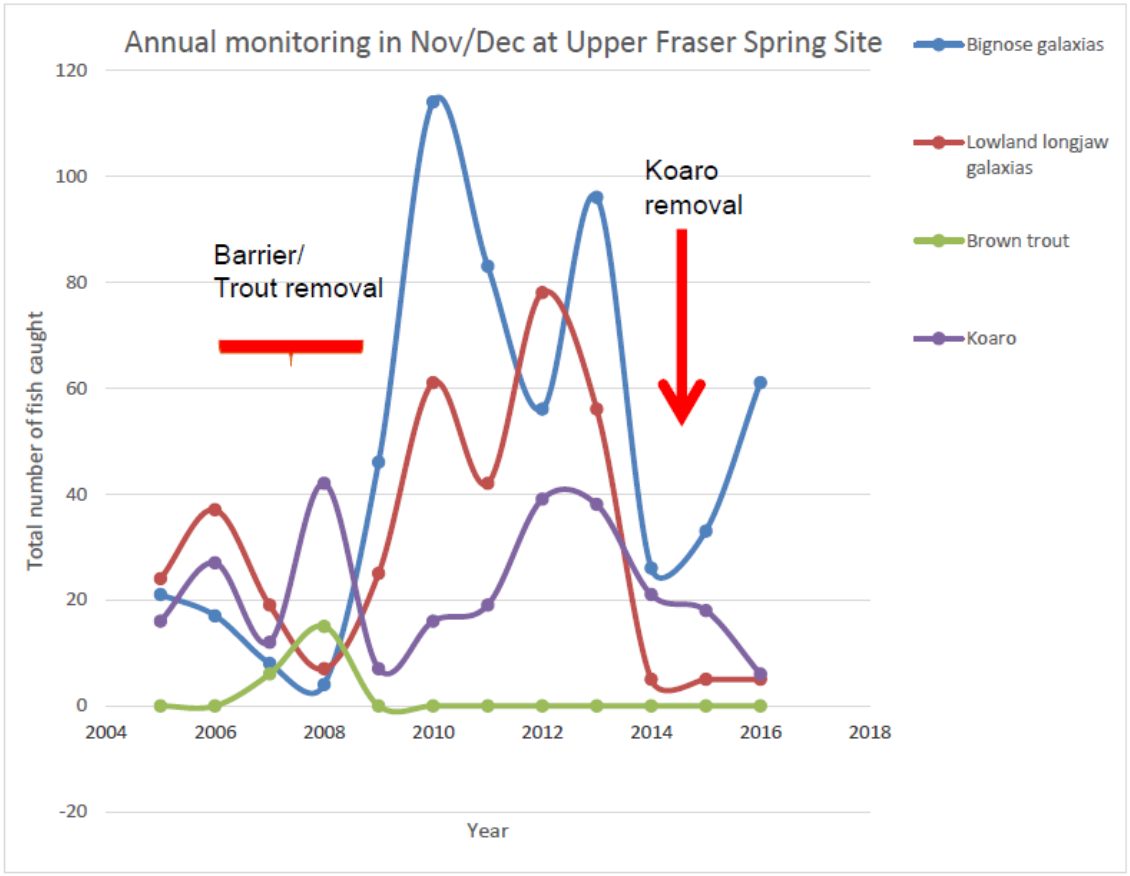

Figure 6: The Fraser Spring, Twizel, fish populations prior to and after fish passage barrier construction and improvements.

Figure X: The final koaro barrier on a weir in the Waipori catchment.

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