Before the Southland Regional Council

In the Matter of	the Resource Management Act 1991
And	
In the Matter of	Resource consent application by Alliance Group Limited for water and discharge permits associated with the operation of a hydro-electric power generation system in the Mataura River

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Evidence of Emily Pearl Funnell – Regarding Freshwater Fish

for Director-General of Conservation

Dated 28 November 2018

Department of Conservation
Planning, Permissions and Land
RMA Shared Services
Private Bag 4715
Christchurch 8140
Phone: 03 371 3700
Solicitor: Pene Williams
Planner: Herb Familton

INTRODUCTION

1. My full name is Emily Pearl Funnell.

2. I am employed by the Department of Conservation (the Department), as a Technical Advisor, Freshwater. I have worked for the Department in this position since July 2006.

3. My qualifications are a Bachelor's Degree in Science (Ecology and Zoology), and a Master's Degree in Science (Freshwater Ecology). Both qualifications were achieved at Massey University from 2001-2006.

4. My Master's thesis topic was titled '*Phylogenetics, divergence and morphology of New Zealand Eleotridae (Gobiomorphus Gill)'*. Similar morphologies have led to identification difficulties and problems with classification of fish species. However, genetic studies have contributed to resolving problems with taxonomically difficult groups by detecting diversity between morphologically similar species. Thus, the thesis employed two regions of the mitochondrial DNA (cytochrome *b* region and control region) to resolve issues surrounding species identification, morphological variation, and phylogenetic relationships.

5. Over the last 12 years of employment as a Technical Freshwater Advisor, I have had significant experience with assessing the effects of activities under the Resource Management Act (1991) on freshwater values. Applications I have assessed include;

    5.1. Water permits

    5.2. Discharges to water

    5.3. River activities e.g. gravel extraction

6. During this time, I have carried out a range of freshwater surveys that examine freshwater fish diversity and habitat features. Furthermore, I am the lead for the Department's eel programme.

7. I am presenting this evidence for the Director-General of Conservation (the Director-General) in relation to native migratory fish values in the Mataura catchment, specifically how the water take applied for by Alliance Group Limited (Alliance, the applicant) impacts on native fish migration and mortality. My evidence is based on the following reports:

    7.1. Golder Associates (2007). Assessment of Hydro-electric diversion effects on fish passage. Prepared for Alliance Group Limited by Golder Associates (NZ) Ltd.

7.2. Golder Associates (2016). Mataura River – Ecological summary and assessment. Prepared for Alliance Group Limited by Golder Associates (NZ) Ltd.

7.3. Hay, J. (2018). Review of fish screening monitoring provisions at Mataura Meatworks hydro intake. Review prepared for Department of Conservation, Ngai Tahu, and Fish & Game New Zealand.

7.4. Vaipuhi Consulting (2018). Draft downstream eel monitoring programme for Mataura Falls. Prepared for Alliance Group Limited. Vaipuhi Freshwater Consulting Report No: 201802.

CODE OF CONDUCT

8. I confirm that I have read the code of conduct for expert witnesses as contained in the Environment Court's Practice Note 2014. Although the current hearing is not an Environment Court hearing I confirm that I have complied with the practice note when preparing my written statement of evidence, and will do so when I give oral evidence before the hearing panel

9. The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in the evidence to follow.

10. Unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

SCOPE

11. I concur with most of the comments in relation to Alliance's application provided by the Section 42A report.

12. My evidence will cover the following:

12.1. Native fish values of the Mataura catchment

12.2. Effects of the water take on fish migration and mortality

12.3. Proposed downstream monitoring programme

12.4. Evaluation of the section 42A report

NATIVE FISH VALUES OF THE MATAURA CATCHMENT

13. The Mataura River and its tributaries support 15 indigenous fish species and 2 introduced fish (NZFFD). Of the indigenous species, four are "Threatened: Nationally Vulnerable", and five are considered to be "At Risk: Declining" by the most recent assessment of New Zealand Freshwater fish under the New Zealand Threat Classification System, Dunn (2018).

Common name	**Scientific name**	**Conservation status**
Gollum galaxias	Galaxias gollumoides	Threatened: Nationally vulnerable
Southern flathead galaxias	Galaxias "southern"	Threatened: Nationally vulnerable
Alpine galaxias (Southland)	Galaxias aff. Paucispondylus "Southland"	Threatened: Nationally vulnerable
Lamprey	Geotria australis	Threatened: Nationally vulnerable
Longfin eel	Anguilla diefenbachii	At Risk: declining
Giant kokopu	Galaxias argenteus	At Risk: declining
Koaro	Galaxias brevipinnis	At Risk: declining
Inanga	Galaxias maculatus	At Risk: declining
Torrentfish	Cheimarrichthys fosteri	At Risk: declining
Shortfin eel	Anguilla australis	Not threatened
Common bully	Gobiomorphus cotidanus	Not threatened
Redfin bully	Gobiomorphus huttoni	Not threatened
Upland bully	Gobiomorphus breviceps	Not threatened
Black flounder	Rhombosolea retiaria	Not threatened
Common smelt	Retropinna retropinna	Not threatened
Brown trout	Salmo trutta	Introduced
Rainbow trout	Oncorhynchus mykiss	Introduced

Table 1 – Fish species found in the Mataura River catchment and their conservation status

14. As noted by Golder (2007) the distribution of these fish species can be described by several broad groups; lowland species, widespread species, and restricted species. The lowland species are typically found in the lower reaches of catchments close to the sea. In the Mataura catchment this includes; inanga, black flounder, redfin bully, common bully, smelt, and torrentfish. Mataura Falls forms a natural upstream barrier for these species, as they are unable to swim or climb past the falls (Golder, 2007). There are records in the New Zealand Freshwater Fish Database (NZFFD) of common bully above the falls. However, it is possible that these are misidentifications, or they form landlocked populations.

15. Species that are widespread in the Mataura catchment include; longfin eel, shortfin eel, lamprey, giant kokopu and koaro. These are diadromous[1] species that can migrate long

[1] Diadromous is a general category describing fish that spend portions of their life cycle partially in freshwater and partially in salt water. These represent both anadromous and catadromous fish. Catadromous fish have a marine larval phase with adults maturing in freshwater. Anadromous fish are the opposite with the larval phase occurring in freshwater and maturation in the ocean. To complete their life cycle diadromous fish require fish passage between freshwater and the ocean.

distances inland and traverse substantial barriers due to their excellent climbing abilities (e.g. McDowall 1990). Trout are also able to penetrate inland through their strong swimming abilities. These species are all found upstream and downstream of the Mataura Falls. However, upstream of the falls koaro has only been recorded at two locations (Gordon Stream and Longridge Stream), and giant kokopu at one location (Waikaia River tributary).

16. The eel population upstream of the Mataura falls is dominated by longfin eels, with only a few records of shortfin eels. Gollum galaxias and upland bullies, two non-migratory species are also widespread within the catchment tributaries both upstream and downstream of the falls.

17. Non-migratory species such as Southern flathead galaxias and alpine galaxias are only found in the headwaters and the tributaries of the catchment upstream of the falls (Golder, 2007).

18. The Mataura catchment upstream of the falls supports a large population of longfin eels and supports spawning areas for lamprey. The strength of the lamprey population in the Mataura makes it a significant site nationally from a species conservation perspective.

19. Longfin eels and lamprey are also of great importance to Ngai Tahu. The Falls are one of the few remaining places nationally where lamprey is harvested using traditional methods and tikanga. A Mataitai area covers approximately 10 km of the river in the vicinity of the Falls to provide for customary fishing. The stretch of the river affected by the operation is also part of the Mataura Water Conservation Order 1997 that recognises the nationally significant trout fisheries values. The freshwater values of the river are highly significant.

EFFECTS OF THE APPLICATION ON FISH MIGRATION AND MORTALITY

20. As noted by the section 42A report, the key effect to be considered is on fish passage. The intake infrastructure and associated discharges of the two plants (Mataura Industrial Estate and Alliance), have introduced a complex and confusing environment for upstream and downstream migrating fish. This is superimposed on the natural constraints to fish passage caused by the falls. However, it must be noted that in a pre-modified state, fish passage opportunities would have been presented by wetted margins, and terrestrial vegetation on the river banks. These opportunities are no longer available due to the presence of structures on both river banks. Golder (2007) noted

that native climbing fish species are only able to climb the falls under suitable conditions.

21. Golder (2007, 2016) noted that there are five native fish species of interest regarding the effects of the intake infrastructure on fish passage. These are migratory species that can ascend the falls; longfin eel, shortfin eel, lamprey, giant kokopu, and koaro. Of these species, one is ranked by the NZ threat ranking as “Nationally Vulnerable” (lamprey), three are “Declining”, and one is “Not Threatened” (shortfin eel) (see Table 1).

22. To consider the effects of the intake infrastructure on fish passage, it is pertinent to examine both upstream and downstream passage. Juvenile eel (elvers), juvenile kokopu and koaro (whitebait), and adult lamprey all migrate upstream. To reach the habitat in the upper reaches of the Mataura catchment, they must first navigate the falls and intake infrastructure (the weir).

23. Studies of the timing of elver migrations (MPI dam monitoring data) (e.g. Martin et al. 2009, Martin et al. 2013) have found that it is highly variable and unpredictable. South Island monitoring data at dams found that migrations usually begin in late December or January but can be as early as the start of December (Martin et al. 2013). Adult lamprey migrate upstream from April to November to spawning habitat, which is known to occur upstream of the falls and weir. Juvenile fish or whitebait migrate upstream (September to October for koaro, and October to December for giant kokopu) (Smith 2015)

24. Various reports by: Golder (2007), Ryder (2005), and Holloway (2016) have considered the effects of the falls and weir on upstream migration of the species above. Both flows and climbing ability of the five species were assessed. It was concluded by the Golder (2016) report that the falls and weir are flow-dependent barriers for the species during upstream migration periods. The situation which creates the most difficulty for elver upstream migration over the falls and weir is low flows (80 cumecs or less). This is the trigger for the proposed ‘trap and transfer’ methodology in the consent conditions. ‘Trap and transfer’ of elvers is recognised as the most suitable method for improving the successful passage of elvers.

25. Golder (2016) stated that the water take weir structure was not considered as much of an upstream barrier on adult lamprey migration. This was based on their climbing ability, and observations from the Golder (2007) report that accumulations of lamprey at the weir have been observed to disappear overnight when suitable flows prevail. It is unknown what flows are required to allow lamprey to successfully ascend the weir and

move upstream to spawning habitat. Mortality of lamprey as they congregate below the weir is also unknown. Shags are a natural predator of lamprey and are known to congregate at falls when lamprey are migrating. Therefore, the Department believes that the true effect on lamprey migration is unknown.

26. Adult eels (both species) and juvenile lamprey migrate downstream as part of their life cycle and are reliant on safe passage past the weir and falls. There is potential for these species to be entrained into the Alliance hydro-race, and from there into the turbine as they migrate downstream. The freshwater fish spawning and migration calendar (Smith, 2015) defined the downward migration period for longfin eels as being March to May, and for shortfin eels as being February through to May. Juvenile lamprey (macropthalmia) migrate downstream all year round up to four years from hatching (Smith, 2015).

27. Giant kokopu and koaro are typically diadromous but are known to form landlocked populations where their entire lifecycle occurs within freshwater, i.e. no marine life stage (McDowall, 1990). As identified in Golder (2007), the populations upstream of the falls are likely to be landlocked. Adult or larval life stages of giant kokopu and koaro are unlikely to migrate downstream past the falls. Both species spawn within adult habitat in stream/river margins during elevated flows (Smith, 2015), although downstream migration of adult giant kokopu has been observed (David & Closs, 2002). Any larval fish that do migrate downstream (June to July) are expected to survive passage through the turbines (Boubée, 2003).

28. Downstream migrating macropthalmia are 80 to 120 mm in length. Golder (2016) predicts a mortality rate of 14% for fish 100 mm in length that pass through the turbine. However, Mitchell and Boubée (1992) predicted macropthalmia mortality rates at Matahina Dam of 4%. Therefore, some mortality could be expected of the macropthalmia that enter the hydro-race.

29. Whilst most fish are expected to pass through the water intake screen, larger eels, lamprey and trout, will suffer mortality from impingement on the intake screen.

30. The native fish species of greatest concern and most at risk are the larger mature downstream migrating longfin and shortfin eels attempting to reach the ocean to spawn. In particular, longfin eel that is ranked as “At Risk: Declining” (Table 1).

31. Longfin eels are long lived and semelparous - meaning they only spawn once and then die. They live in freshwater for tens of years (e.g. from 25 years for males, and 40 to over

100 years for females), before migrating out to the Pacific Ocean to breed. Their offspring return to the coast as glass eels, before morphing into elvers (juveniles) and migrating inland.

32. There are several hundred kilometres of habitat suitable for supporting longfin and shortfin eels in the Mataura catchment upstream of the falls. The number of migrant eels that move downstream and potentially enter the turbine is unknown. This may be in the order of several hundred eels annually depending on river flow, and the behaviour of eels as they encounter the weir face.

33. The mortality rates of eels and other fish that become entrained into the hydro-race and subsequently enter the turbines are discussed by Golder (2016). They noted that the high mortality of migrant eels, especially large females, is expected. This is supported by other studies (e.g. Mitchell & Boubée 1992).

34. Enhancing opportunities for the escapement of migratory eels is a key conservation measure for longfin eels.

PROPOSED MONITORING FOR DOWNSTREAM MIGRANTS

35. Alliance has concluded that monitoring should be undertaken to determine the extent of mortality and to assist in the determination of the most appropriate mitigation. Dr Jacques Boubée (Vaipuhi Consulting) has developed a downstream migrant monitoring programme for Alliance (Boubée 2018). In the evidence of Dr Mark James, reasons for the focus of the monitoring plan on eels are given.

36. I consider the focus on eels in terms of the monitoring programme to be appropriate. However, it is important to note the limitations of the monitoring.

37. The proposed monitoring programme is likely to provide useful information on the numbers and condition of large migrant eels and other large fish, e.g. trout, currently being entrained in the turbines over the February to May eel migration period. However, the sampling method is biased towards larger fish and will miss important information on smaller eels and other fish that are able to pass through the modified trash screen (Hay 2018). Smaller migrant males and younger river-resident eels (up to 700 mm) will still be able to pass through a 20 mm screen (Boubée 2018). The sampling programme will not provide any information on the effects of operation of the turbine on other species outside of the monitoring period e.g. upstream migrating adult lamprey that may enter the hydro-race, and resident trout.

38. In addition, the monitoring programme provides possible mitigation options if significant numbers of eels suffer mortality through the turbines. There is uncertainty around the effectiveness of these mitigation options. The most effective mitigation would be installation of a fish screen that prevents entry into the hydro-race and a fish bypass that returns fish to the main stem of the waterway.

SECTION 42A REPORT

39. The section 42A report discusses the actual and potential effects of the application to dam, divert and discharge water. The key effect is identified as being on fish passage, and on longfin eels. The summary of key effects is supported by the Director-General. However, it must be noted that other species such as lamprey and shortfin eel may also be impeded by the water intake structure.

Emily Funnell

28 November 2018

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