Appendix II

Fish survey report

Memorandum

To	Bart Jansma, Scientific Officer
From	Bart Jansma, Scientific Officer
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Fish Survey – Waiaua River

Introduction

Opunake Hydro Ltd operates a hydroelectric power station in Opunake, which diverts water from the Waiaua River, into Opunake Lake, from where it is directed through the station and discharged to the Tasman Sea on Opunake Beach. The scheme holds two resource consents that contain fish passage conditions, with consent 1795-4 licensing the abstraction of water from the Waiaua River, and consent 5581-1 licensing the damming of the Waiaua River. Both consents require that the consent holder shall install and maintain a fish pass that allows the passage of native fish, juvenile trout and adult trout. The weir is shown in Photo 1.

Over time the consent holder (including previous owners) have made modifications to the layout of the scheme, in an effort to provide this fish passage. A fish pass from the Waiaua River to the canal has been operating since 1997 with two channels, catering for swimming fish (i.e., trout, smelt and torrentfish) and climbing fish (many native fish such as the redfin bully and most of the whitebait species). Once the fish have entered the canal, they must then negotiate the intake tunnels where velocities can be high. However, when lake and canal levels are high, this creates a backwatering effect in the canal, and can reduce water velocities during these times. This occurs for short times on a daily basis between times of peak power generation. A fish ladder was also installed in the southern intake tunnel with the intention of providing some lower velocity zones and rest areas for fish that are attempting to pass through the tunnels.

Photo 1 The weir on the Waiaua River associated with the Opunake Hydro intake.

A number of surveys have been undertaken in the Waiaua River in relation to these fish passage requirements. A summary of all results was presented in the last compliance monitoring report (TRC, 2010), and the general conclusion was that although it appeared that all species can negotiate the fish pass into the intake canal, the intake tunnels between the river and the canal still constitute a significant barrier, especially to those poorer swimmers such as inanga and smelt. The survey reported herein was undertaken to further investigate the degree of impact the scheme was having on fish passage, and includes a comparison with a similar stream that flows nearby.

Methods

In this survey, two sites were surveyed in the Waiaua River, and one site was surveyed in the Mangahume Stream. Representative photos of each site are presented in Photo 2. Site 1 was located in the Mangahume Stream, while sites 2 and 3 were located in the Waiaua River, site 2 upstream of the weir, and site 3 downstream of the weir. Details of the sites surveyed are given in Table 1 and the locations of the sites surveyed in relation to the structures are shown in Figure 1. The sites themselves are shown in Photo 2. The Mangahume Stream was chosen as a comparison stream, as from time to time it suffers from sand inundation, similar to that which occurs in the Waiaua River. However, it is a smaller stream, and as a result will contain less habitat, which may impact on the results.

Table 1 Sampling sites surveyed in the Waiaua River and Mangahume Stream in relation to the Opunake Hydro HEP

Site	Location	E	N	Distance Inland (km)	Altitude (MASL)	Electric fishing		Seine netting
						Length surveyed (m)	Approx. area surveyed (m^2)	Approx. area surveyed (m^2)
1	Mangahume Stream	1675805	5631335	2.8	25	8	28	200
2	Waiaua River upstream of weir	1674690	5632262	2.1	20	10	60	295
3	Waiaua River downstream of weir	1674477	5631981	1.7	15	8	80	90

The fish populations were sampled at each site using both the electric fishing method and seine netting method. The electric fishing method used a Kainga EFM300 backpack machine. An area of stream was surveyed, with each site divided into numerous reaches. Starting at the downstream extent of the site, each subreach was fished in a downstream direction, with the stunned fish either collected by the fisher, or collected in a pole net set at the lower end of the sub reach. On this occasion numerous runs were undertaken side by side in some subreaches, to ensure the stream width was surveyed. In most cases only a single pass was undertaken of each area. Once a reach was fished, the fishing team moved upstream to the next reach, until the entire sample area had been surveyed. Those fish captured were identified and counted, where possible. Inevitably some fish eluded capture, although some were identified before reaching cover. Once fish had been identified, they were released.

The length of each fish was estimated, to the nearest 100mm for eels and 10mm for all other species. The length of elvers was not estimated, although any eels longer than 150mm were identified.

Figure 1 Location of the three sampling sites in relation to Opunake Lake and the weir.

Photo 2
Top right – Site 1, Mangahume Stream
Bottom left – Site 2, Waiaua River
Bottom right – Site 3, Waiaua River

Results and Discussion

The Mangahume Stream had a substrate dominated by cobbles, with some coarse gravels and boulders, with a small proportion of fine gravel and sand also present. The two Waiaua River sites had a similar substrate composition, and were also dominated by cobble. All sites contained pool and riffle habitat, with the pool habitat targeted for seine netting, and the riffle habitat targeted for electric fishing. All sites had a clear uncoloured flow, and were relatively unshaded, and consequently algal cover was very similar, with patches of algal mats and filamentous algae observed at all three sites. The only differences noted between the sites was that site 1 in the Mangahume Stream included some undercut bank habitat and patchy growths of aquatic moss, whereas the Waiaua Stream sites contained no undercut banks, and supported no moss. The difference in undercut banks is directly related to the other difference, being bank stability. Site 1 had stable banks, while site 2 had mostly stable banks, and site 3 highly unstable banks.

The full results of the fish survey are shown in Table 2.

Table 2 Results of the electric fishing and seine netting surveys undertaken in relation to the Opunake Hydro HEP.

Survey method	Site:	Site 1		Site 2		Site 3	
	Area fished: Electric fishing Seine netting	28 200		60 295		80 90	
	Species	No.	No. per m^2	No.	No. per m^2	No.	No. per m^2
Electric fishing	Longfin eel (*Anguilla dieffenbachii*)	-	-	3	0.05	1	0.01
	Juvenile eel (*Anguilla* sp.)	9	0.32	22	0.37	13	0.16
	Redfin bully (*Gobiomorphus huttoni*)	2	0.07	2	0.03	18	0.23
	Juvenile bully (*Gobiomorphus* sp.)	-	-	-	-	45	0.56
	Torrentfish (*Cheimarrichthys fosteri*)	2	0.07	-	-	3	0.04
	Inanga (*Galaxias maculatus*)	-	-	-	-	1	0.01
	Common smelt (*Retropinna retropinna*)	-	-	-	-	-	-
	Brown trout (*Salmo trutta*)	-	-	1	0.02	-	-
	Shrimp (P*aratya curvirostris*)	-	-	-	-	Present	
Seine netting	Inanga (*Galaxias maculatus*)	-	-	-	-	1	0.01
	Common smelt (*Retropinna retropinna*)	39	0.20	-	-	72	0.8
Total number of species		4	-	3	-	6	-
Total number of fish		52	0.23	28	0.47	154	0.91

Photo 3 Common smelt, recorded at site 1 in the Mangahume Stream

Site 1

Four species were recorded at site 1, three by electric fishing (eel, redfin bully and torrentfish) and one by seine netting (common smelt). Common smelt were easily the most abundant, with 39 individuals recorded, with elvers being the next most common. The common smelt recorded are shown in Photo 3.

Both the abundance and species richness recorded in the Mangahume Stream was lower than expected for a site at this altitude and distance from the coast. Although only a small number of redfin bully and torrentfish were recorded, this is likely to be a reflection of the area of habitat sampled, which was the smallest of this survey, and also the limited amount of habitat available, due to this being a smaller stream.

Site 2

This site, located in the Waiaua River upstream of the weir, contained the lowest number of species (3) and the lowest abundance (28) of the three sites surveyed. Elvers were the most abundant, with 22 individuals recorded. Two redfin bully were also recorded, as was one brown trout, the latter not necessarily a migrant species. It is known that both redfin bully and eels are capable of climbing the weir. No fish were recorded when seine netting, despite that fact that 295m^2 of stream was surveyed at this site. When compared with the Mangahume Stream, there was a reduction in the number of migrant species recorded, but most significantly, no fish were recorded by seine netting. Seine netting is the most effective survey method for common smelt, and could potentially also record inanga, and bully species. The area surveyed by seine net, 295 m^2, was the largest area surveyed of the three sites, and it is reasonable to conclude that the density of common smelt in the river above the weir was extremely low, with this species possibly even being absent from the upper river.

Site 3

Located downstream of the weir, this site experiences much lower flows than upstream of the weir, and consequently there is likely to be a change in habitat, suiting slower water species such as bullies. The results support this, with bullies being more abundant at this site than at any other site surveyed. As with site 1, common smelt were the most abundant, with 72 individuals recorded, at a density of 0.8 fish per square metre surveyed. This indicates that smelt are very common in the lower Waiaua River, and if the weir and intake tunnels did not constitute a barrier to fish passage, there should be little difference in smelt density between sites 2 and 3. This is not the case, indicating that the scheme does constitute a barrier. This is supported by the difference in redfin bully abundance, which went from a high of 0.23 fish/m^2 downstream, to 0.03 fish/m^{2}upstream. Although this species is capable of climbing over the weir, it must still present a formidable barrier to this species.

Summary and conclusions

On 26 February 2014, three sites were surveyed for freshwater fish. Two sites were located in the Waiaua River, upstream and downstream of the Opunake Hydro intake weir, while a third was located in the Mangahume Stream, at a similar altitude and distance inland as the Waiaua River sites. The survey methods employed included electric fishing and seine netting, with the latter method being particularly effective for pelagic species such as common smelt and inanga, species less frequently recorded by electric fishing.

The Mangahume Stream recorded a relatively low species richness and fish abundance for a site so close to coast and at a low altitude. This may reflect the amount of habitat available, as this is a smaller stream, that at times can experience sand inundation. However, it is also likely to be a reflection of the area surveyed, which was relatively small.

The two Waiaua River sites were clearly different to each other, with six migrant species recorded downstream (including one migrant invertebrate), and only two recorded upstream. Redfin bully, which was recorded at both sites, was much more abundant downstream (0.23 fish/m^2) than upstream (0.03 fish/m^2). Although this species is capable of climbing over the weir, it is apparent that the weir is still a formidable barrier to this species.

The seine netting had similar results, with this method recording 72 common smelt downstream of the weir, at a density of 0.8 fish/m^2, but recording no fish upstream, despite the area surveyed upstream being approximately 150% of that surveyed downstream.

These results support the conclusions made previously, that the weir and intake tunnels constitute a significant barrier to the passage of some native fish, including common smelt, and inanga. It is apparent that passage into the canal is adequate, however, the intake tunnels present quite an impediment, most likely due to flow velocities. The maximum water velocity in which inanga will swim freely is between 0.30 and 0.34 metres per second (Department of Conservation, 1999). Water velocities suitable for smelt are similar. These velocities have been assessed twice prior to the current monitoring period, with velocities ranging from 1.1 to 2.0 meters per second. They were reassessed on 11 January 2011, and found to range from 0.5 to 1.3 m/sec. Therefore it is concluded that water velocities in the tunnels are frequently (if not always) too high for inanga and smelt to move through. Individuals of other fish species such as torrentfish may also be restricted in their ability to move through the tunnels, although previous surveys confirm that some torrentfish have successfully migrated upstream.

During the 2004-2005 monitoring period, the Company retrofitted one of the intake tunnels with a fish ladder which was hoped to provide rest areas and create a slower flowing boundary layer on the inside edge of the culvert which may improve the passage of fish through this area. Unfortunately it appears that this fish ladder has done little to improve the passage of native fish.

The results of this survey support the conclusion that the weir and intake tunnels constitute a barrier to fish passage, and as such, Opunake Hydro ltd are non-compliant with resource consents 1795-4 and 5581-1. The consent holder will need to investigate options for remediating fish passage at this location, and it is recommended their investigations include consultation with the Department of Conservation and Fish and Game NZ.

These investigations should as a minimum, consider the following:

- Trap and transfer at the head of the fish pass, possibly in conjunction with a local school(s)
- Installation of an additional fish pass that bypasses the intake tunnels
- Installation of a new fish pass, at the weir, bypassing the canal entirely

It is expected that the consent holder should have a plan ready for implementation by the end of the 2014-15 monitoring period (30 June 2015).

References

McDowall, R.M., 2000: The Reed Field Guide to New Zealand Freshwater Fishes. Reed books, Reed Publishing (New Zealand) Ltd. 224pp.

TRC, 2010: Opunake Hydro Limited Waiaua Hydroelectric Power Scheme Monitoring Programme Biennial Report 2008-2010. Technical Report 2010–48.