Potential Effects of the Waitaha Hydro Scheme on Terrestrial Invertebrates

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Contents

1 Executive Summary

This report covers a terrestrial invertebrate survey of the Waitaha Hydro Scheme (the Scheme) project area conducted in February 2013. The survey focused primarily on the riparian zone and utilised a range of manual collecting and trapping techniques. It was found the invertebrate communities in the area are generally typical of South Westland. No invertebrates of known conservation concern were detected. Three undescribed species of stiletto flies were found, but it is not known whether these also occur in adjacent catchments. The impact of the Scheme on terrestrial invertebrate communities is expected to be relatively minor and short-term, with riparian specialists generally adapted to cope with naturally dynamic river systems. The impacts of localised forest clearance on invertebrate communities can be mitigated through revegetation along the edges. Weeds are an existing threat to riparian communities, and weed control would provide mitigation and an offset for the effects of the Scheme, potentially providing a net benefit for riparian invertebrate communities in the area.

2 Background

Westpower Limited contracted Entecol Limited to conduct a survey of terrestrial invertebrates in areas of the lower Waitaha River that are potentially affected by the Scheme.

Westpower Limited are seeking concessions and consents to construct a run-of-river hydroelectric power scheme on the Waitaha River, and are therefore acquiring a range of reports on the ecological values of the project area and the effects of the proposed scheme on those values. This report provides an assessment of potential effects of the Scheme on terrestrial invertebrates, with the exception of *Powelliphanta* land snails that are covered in a separate report (Buckingham, 2014).

3 Introduction

The Waitaha River is situated about 38 km south of Hokitika, and has a catchment that includes the Broomfield and Smythe Ranges, with numerous peaks above 2,100 m. The preferred option for the Waitaha Hydro Scheme is to construct a low intake weir immediately above Morgan Gorge, about 17 km upstream from the SH6 bridge across the Waitaha River. An intake on the true right of the river above the weir will convey up to 23 cumecs of water by penstock down through a tunnel to the powerhouse below the gorge (a fall of about 100 metres). A minimum residual flow of 3.5 cumecs is proposed immediately below the intake Side streams that enter the Waitaha River below the intake will contribute to this flow before full flow is restored to the river below the powerhouse. The abstraction reach would include approximately 2.6 km of the Waitaha River, including the Morgan Gorge. After construction of the weir, at baseflows there will be a temporary backwater effect that might initially extend

some 250-300 m upstream but there will be no permanent formation of a lake, or submergence of vegetation.

This is expected to fill with gravels quite quickly (possibly after a single flood) and end up looking very similar to what it does now. A road will be constructed along the true right bank from the end of the existing Waitaha Rd, across the extensive boulder field at the confluence of Macgregor Creek (below Robinson Slip), and then though an area of regenerating forest on the river flat up to the siting of the powerhouse.

There will be no road constructed up to Kiwi Flat, but rather access for construction vehicles, materials and personnel will be via the tunnel and helicopter. The avoidance of road construction in this area will reduce potential fragmentation effects on slow-moving native terrestrial invertebrates, such as snails, worms, and flightless beetles. Temporary contractor facilities will be built on a high terrace about 250 m upstream from the weir site, and a temporary access road will link the contractor facilities to the intake site and tunnel entrance.

4 Objectives

- Conduct field surveys for terrestrial invertebrates in areas likely to be affected by the Scheme.
- Report on any invertebrate species or communities of specific conservation concern and/or potentially requiring special management.
- Place findings in the context of invertebrate communities found in the surrounding areas.
- Provide an assessment of the effects of the Scheme on terrestrial invertebrate communities.

5 Methods

A search for any existing information on previous terrestrial invertebrate surveys of the Waitaha area was conducted using both the BUGZ database (Bibliography of New Zealand Terrestrial Invertebrates – online) and Google.

Two entomologists conducted the field survey at the Waitaha site over the period 13–17 February 2013. Weather was generally fine with mild temperatures (12 to 20 ºC), with occasional cloudy periods and a few light showers.

The primary focus for this survey were the riparian margins of the Waitaha River, as these habitats exist as narrow ribbons across the landscape so are relatively very small areas, and yet contain a variety of terrestrial invertebrate species that are specially adapted to live within them. Riparian specialists include stiletto flies (Diptera: Therevidae), with some species thought to be restricted to specific areas or catchments, or are known from just single individuals and listed as "Data Deficient" in the Department of Conservation's threat classification system. Tiger beetles are another characteristic element of riparian margins

(and other open habitats) with potential for rare species. The riparian habitat is also the most likely to be affected by the Scheme, through direct disturbance and potential changes in river flow and sediment deposition dynamics. In contrast, the surrounding native forest habitats are extensive and contiguous in this part of South Westland and the extent of disturbance predicted to be relatively small.

Manual collection techniques included sweep-netting, beating vegetation, and lifting rocks, logs and other refuges to search for invertebrates. A night search with headlight was undertaken in an area of forest at Kiwi Flat.

Five Malaise traps (Fig. 1) were deployed to intercept both flying insects and some insects crawling across the ground. These were set up on the first day of the trip and collected in again after 3 days. They were positioned on old boulder fields near Macgregor Creek, in regrowth forest to the south of the Macgregor and Waitaha confluence, on the riparian/forest margin at the preferred powerhouse site, on riparian/forest margin directly above Morgan Gorge, and amongst low vegetation of the Kiwi Flat flood plain (Fig. 2).

Ultra-violet light traps were set up to attract nocturnal flying insects at 7 locations (Fig. 2). Two traps were positioned on the western margins of the lower Robinson slip area, two to the south of the Macgregor confluence, in forest to the east of Kiwi Flat hut, on a raised area over-looking Kiwi Flat (immediately west of the hut) and amongst the toe toe (*Austraderia* spp.*)* and *Carmichaelia* flood plain vegetation at the confluence of Whirling Waters.

Figure 1: Malaise trap positioned to the south of Macgregor Creek, on old boulder fields adjacent to forest.

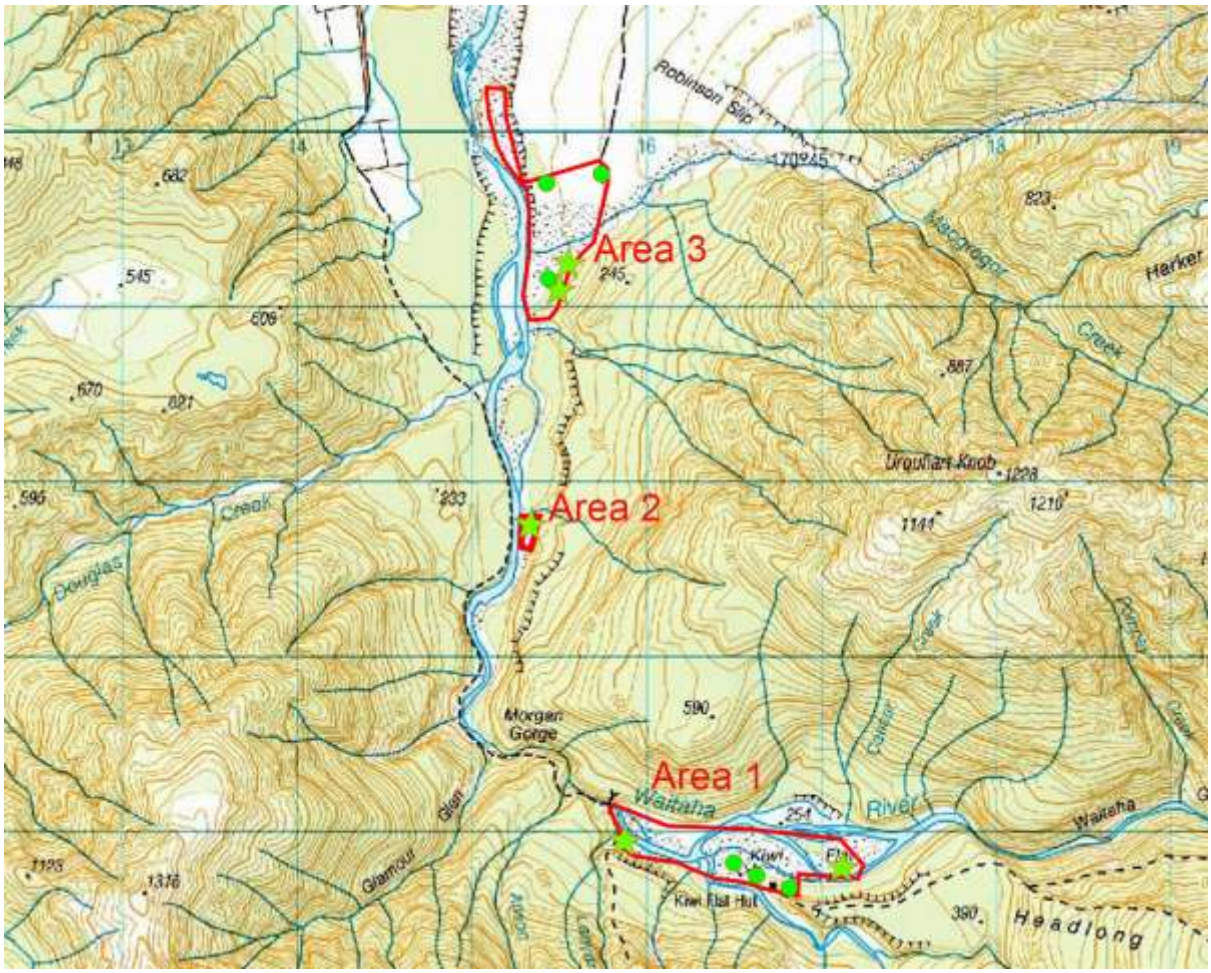

Figure 2: The three main areas of activity for terrestrial invertebrate surveys on the riparian margins of the Waitaha River shown outlined in red (the areas are numbered to align with the table of invertebrates identified in Table 1 of the appendix). Green stars show the specific locations of Malaise traps, while green circles mark positions of UV light traps. A fourth riparian area was surveyed immediately upstream of the highway bridge (manual collecting techniques only).

The UV traps consist of a set of clear plastic cross-vanes with a string of UV LEDs around the central crossing point. The vanes are set up over a bucket containing water with a little detergent. The UV light attracts various groups of night-flying insects, especially moths, small flies and small wasps, which encounter the vanes and fall or fly into the bucket. Those that contact the water sink due to the detergent reducing the surface tension. The traps had light sensors to turn them on at dusk, and were left for one night at each location.

On 17 February, manual collecting of invertebrates was undertaken on a riparian area of shingle and sand immediately upstream from the State Highway bridge in an attempt to get a comparison of key riparian insects, particularly stiletto flies and tiger beetles, found at these lower reaches of the Waitaha River.

The specimens collected were sorted to species, family or order depending on available taxonomic resources and expertise, and on the ability of the particular taxonomic group to provide useful comparative information on distribution. Juvenile stages are often difficult to

identify to lower levels using morphology and we made no attempt to utilise very small taxa, such as mites (Acari), springtails (Collembola) and booklice (Psocoptera), as these are difficult and time-consuming to identify and there is insufficient background knowledge of these groups in New Zealand. Samples were labeled and stored in 75% alcohol.

6 Results

A literature search for previous information on the terrestrial invertebrates of the Waitaha area found nothing beyond a couple of collection records for widespread species. Over 4,200 invertebrate specimens were collected during the field survey, and 218 taxa identified (Table 1 of Appendix). Although the survey was primarily focused on riparian zones and of a limited time period, the light traps in particular were successful at drawing numerous species from the surrounding forest habitats and conducted during a time of year with good levels of invertebrate activity, so a healthy diversity of species was to be expected.

Three species of stiletto flies (Therevidae) were collected from the riparian margins of the Waitaha River. Preparation and analysis of the specimens indicate that all three are undescribed species in the genus *Anabarhynchus*. One of these was only collected in the Kiwi Flat area (6 specimens), another found on the boulder fields of Robinson slip/Macgregor Creek (1 specimen), and the third was found both on sand banks at Kiwi Flat and just upstream of the State Highway bridge (1 at each location). It is possible that some or all three of these species are restricted to the river margins of southern Westland, but a lack of comparative surveys in adjacent catchments means we can make no conclusions about the distribution of these species.

A large tanyderid crane fly, *Mischoderus forcipatus*, was collected in a light trap at Kiwi Flat. The larvae of this very primitive lineage of flies are found in submerged rotten wood, so the adults are usually collected in areas close to water bodies.

Two species of tiger beetles were also collected from the riparian areas: *Neocicindela garnerae* and *Zecicindela helmsi halli*. The former species was collected from the Kiwi Flat area and is found in open habitats throughout the South Island. The latter species was collected from both the Macgregor Creek area and upstream of the highway bridge. Records indicate that the *halli* subspecies of *Z. helmsi* is primarily a riparian specialist of West Coast rivers (Larochelle & Larivière, 2013). Another ground beetle encountered that is likely to be present over much of the length of the Waitaha riparian zone is *Actenonyx bembidioides*, a common and widespread species of river margins. A large *Mecodema metallicum* ground beetle was collected from sand banks at Kiwi Flat, but was already dead when collected and likely to have been a recent flood victim from surrounding forests. This species is common on the West Coast of the South Island.

Flood events prior to our survey may also have been responsible for the discovery of a very large sheetweb spider (*Cambridgea* sp.) in a native broom plant at Kiwi Flat (Figure 3). These spiders are typically forest-dwellers and usually well hidden during the day, only

coming out from their hiding spots to rest under their large webs at dusk. Other large spiders that are common to New Zealand river margins that were found along the Waitaha are the water spider (*Dolomedes aquaticus*) and closely related nurseryweb spider (*D. minor*).

A total of 88 lepidopteran taxa were identified from the Waitaha survey. The moth fauna collected was typical of the West Coast region with most larval feeding guilds represented and none thought to have a restricted distribution. A fern-feeding geometrid moth, *Paradetis porphyrias*, was of interest because it is taxonomically isolated and not often collected, although thought to be widespread in high-rainfall forested areas, such as the West Coast. A North Island understory leafroller, *Epalxiphora axenana* (Tortricidae) was an interesting find from the Macgregor Creek area. It is thought to have been transported to the South Island, probably on leafy horticultural stock and garden shrubs. It was discovered in the Taramakau Valley in the mid-1980s, and later confirmed in Golden Bay, and West Coast localities from Karamea to Westport. The Waitaha Valley record is the most southerly to date, and extends its known range even further.

The Lepidoptera collected from Kiwi Flat included a range of species that are specifically associated with toe toe (*Austroderia* spp.) and native broom (*Carmichaelia odorata*), which are dominant plant species on the riparian zones in this area. This includes two *Dipaustica* species and *Tmetolophota arotis* (Noctuidae), *Anisoplaca ptyoptera* (Gelechiidae), and *Pseudocoremia melinata* (Geometridae). Two psyllid bug species, *Psylla carmichaeliae* and *Trioza subvexa* are also associated with the native brooms of the area. Butterflies in the area include the glade copper (*Lycaena feredayi* complex, pictured on cover) and boulder copper (*L. boldenarum*), both of which breed on *Muehlenbeckia* species.

We did not detect any tree weta (*Hemideina* sp.) during the surveys, and a discussion with the farmer that runs the adjacent dairy farm, indicates a very low abundance of weta, as he could not remember ever seeing one in firewood or elsewhere on that property. However, the Waitaha is within the known range of the Wellington tree weta (*H. crassidens)*, so it is quite probable that more dedicated searching of the forest environments would have found them. The West Coast bush weta (*H. broughi*) is not thought to occur as far south as the Waitaha.

One large forest insect that was found in good numbers in the area was the huhu beetle (*Prionoplus reticularis*). Dozens were collected in light traps at Kiwi Flat. Bush giant dragonflies (*Uropetela carovei*) were seen on forest margins of the Macgregor Creek area. The larvae live in holes in wet soils on shaded banks, rather than in bodies of water as other dragonflies do.

Notable by their absence in a February survey were European wasps, *Vespula vulgaris.* These invasive social insects are major pests in many areas of the South Island, but the lack of honeydew beech forest in the Waitaha area would not be favourable for supporting large populations of wasps. Some other common introduced species (e.g. bumblebees) were also in relatively low abundance.

Figure 3: A very large sheetweb spider (*Cambridgea* sp.) was found in a *Carmichaelia* shrub at Kiwi Flat. It is thought this spider is normally associated with the surrounding forests.

7 Discussion

7.1 General findings

None of the terrestrial invertebrates identified during the survey are known to have a threat status under the Department of Conservation's threat classification system (Townsend et al, 2008). In general, the invertebrate fauna surveyed is typical of wet, western South Island locations, and strongly related to the vegetation types present.

Three undescribed species of *Anabarhynchus* stiletto flies (Therevidae) were collected from the riparian areas of the project area. Stiletto flies have a tendency to have highly specialised habitat requirements (e.g. Holston, 2005) and a number of New Zealand species are currently known from single catchments or very restricted localities (Harris, 2006; Lyneborg, 1992). However, the discovery of new species of *Anabarhynchus* is not unexpected (three new species were also identified from the Rakaia river bed recently) and probably reflects the lack of targeted collecting of therevids on the southern West Coast and New Zealand generally.

At least one of the undescribed *Anabarhychus* species also occurs on riparian habitats well downstream from the project area. Other good riparian habitats for stiletto flies occur

upstream of the project area and in adjacent river catchments. Further survey work specifically targeting stiletto flies in other river systems of the region could well find that these undescribed species have a wider West Coast distribution. For now, they would simply be considered data deficient.

The native invertebrate communities around the Scheme project area appear to have a relatively high degree of natural integrity, with invasive species at low abundance. This would be typical of South Westland, with extensive areas of wet native forest.

7.2 Potential effects on terrestrial invertebrate communities

The Scheme is expected to have a relatively low level of effect on invertebrate communities in the area. There will be some direct disturbance and removal of habitat as a result of road and facility construction. Although there will be some limited forest clearance, the invertebrate communities affected by this have extensive areas of contiguous habitat to support their ongoing survival. The actual effect of habitat clearance will extend beyond the area of clearance due to edge effects. This is especially likely where taller forest is abruptly exposed to an open edge. This will cause an increase of daily fluctuations in climatic variables such as wind speed, temperature and humidity in the exposed forest, the extent depending in part on the degree of exposure to climate of the new edge (Norton, 2002).

There have been few studies in New Zealand on the effects of edges on forest invertebrates and those that have been undertaken have usually considered functional groups, rather than individual species. Nonetheless, even within these large groupings, impacts such as a reduced number of species have been detected up to 40m into the forest from the edge (Norton, 2002). In a major study where individual beetle species were considered, Ewers and Didham (2008) found evidence for edge effects as much as 1km into forest fragments.

However, the forest clearance indicated for the Scheme is relatively minor and is taking place next to an existing natural edge (i.e. the river margin itself). As indicated in the vegetation report (TACCRA, 2014), this will allow for rapid regrowth of vegetation consisting of species already present in the area (including many edge species). The remediation measures recommended in the vegetation report will enhance the rapid development of a suitably armoured edge to ensure there are no long-term edge effects beyond those that are natural to the area.

Clearing of vegetation within the project footprint is also likely to increase the quantity of dead wood lying on the edges of adjacent habitats. This will lead to an increase in invertebrate species specialising in the use of dead wood in the short to medium term. This effect occurs naturally in indigenous forests after such events as major windfalls and/or snow damage and the invertebrate community will ultimately adjust back to a more normal makeup as the available resource is used up.

The primary effect of the Scheme is expected to be on the riparian communities, at least in the short term. This will be through habitat destruction and modification caused by construction of roads and facilities, temporary backwater effect on habitat at Kiwi Flat, and changed water flow regimes affecting sediment deposition dynamics in riparian zones

downstream of the weir. However, impacts of changed water flow regimes are not expected to have substantial impacts on riparian specialists, as the important sand and gravel deposition events will continue during floods. River systems are naturally dynamic and subject significant changes, and the riparian invertebrates that live adjacent to them are generally well adapted to cope with change. The changes in flow regimes caused by the Scheme are well within the natural scope of a dynamic river system, and there is no reason to believe that the riparian invertebrate communities present alongside the Waitaha River will suffer any long-term effects from the Scheme.

The old boulder fields in the Macgregor Creek area represent an unusual and potentially important habitat for some invertebrates, as it is generally more stable than true riparian margins. The construction of a road through this area will affect some of the habitat but extensive areas of this habitat will remain undisturbed.

The open sand banks at Kiwi Flat are important habitat for a range of riparian specialists, such as the stiletto flies, and are maintained through regular flood events. One potential risk to these communities are if they become too stable and support permanent plant growth, which has the effect of binding the sand. Weed invasion is a particular threat to them (with or without the Scheme), and there is already an area of extensive Canada thistle (*Cirsium arvense*) growing on riparian sand banks near the confluence of Whirling Waters and Waitaha River. Weed control on these riparian margins offers a good way to offset impacts of the project on riparian invertebrate communities, potentially offering a net benefit to riparian communities.

There will be an increased risk of new weeds and invasive invertebrates (e.g. introduced ants and molluscs) establishing in natural habitats as a result of vehicles and equipment being brought into the area for project construction and ongoing maintenance. The vegetation report lists a number of useful mitigation measures for reducing the risk of weed incursions, and measures such as washing dirt and debris from vehicles will also assist in reducing the risk of transporting invasive invertebrates on to the site.

8 Conclusions

- Overall, the invertebrate communities found in the project area are typical for the region.
- No terrestrial invertebrates of known conservation concern were found in the project area.
- The Waitaha riparian areas are currently the only known habitats for three undescribed species of *Anabarhynchus* stiletto flies, although these may well occur in adjacent catchments and suitable riparian habitat for them occurs both upstream and downstream of the Scheme.
- Riparian invertebrates occurring along West Coast rivers are naturally adapted to cope with highly dynamic river systems and their populations along the Waitaha River are unlikely to suffer any long-term decline as a result of the scheme.

- The effect of forest clearance on invertebrate communities will be relatively minor and short-term, and a temporary increase in edge effects can be mitigated through revegetation along exposed edges where required.
- Good biological hygiene practices should be applied to vehicles and machinery being taken into the area to reduce the risk of invasive weeds and invertebrates being transported to natural sites.
- Weed invasion is an existing threat to riparian communities along the Waitaha River, and ongoing weed control of riparian margins will be a useful mitigation/offset for impacts of the Scheme and potentially lead to net benefits for native riparian invertebrate communities.

9 Acknowledgements

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11 Appendix

Table 1: List of terrestrial invertebrates identified from the Waitaha River surveys.

Areas:

1. Kiwi Flat
2. Powerhouse area
3. Macgregor Creek/Robinson Slip
4. Waitaha Bridge

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
Araneae	Lycosidae	*Anoteropsis* sp.			✓	✓
	Pisauridae	*Dolomedes aquaticus*			✓	
		Dolomedes minor	✓		✓	
	Stiphidiidae	*Cambridgea* sp.	✓			
	Tetragnathidae	Indet.	✓		✓	
	Thomisidae	*Diaea* sp.	✓		✓	
		Sidymella sp.			✓	
Coleoptera	Carabidae	*Actenonyx bembidioides*	✓		✓	
		Mecodema metallicum	✓			
		Neocicindela garnerae	✓			
		Zecicindela helmsi halli			✓	✓
	Cerambycidae	*Prionoplus reticularis*	✓			
	Scarabeidae	*Pyronota* sp.	✓			
		Odontria sp.	✓		✓	
		Sericospilus sp.				✓
	Oedemeridae	?*Baculipalpus mollis*	✓			
		Parisopalpus thoracicus	✓			
		?*Thelyphassa nemoralis*			✓	
	Anthribidae	*Phymatus cucullatus*	✓			
Diplopoda	Sphaerotheriidae	*Procyliosoma striolatum*	✓		✓	
Diptera	Agromyzidae	*Cerodontha angustipennis*	✓			
	Anisopodidae	*Sylvicola notatus*	✓		✓	
	Calliphoridae	*Pollenia* sp.		✓		
	Cecidomyidae	Indet.		✓		
	Chironomidae	Indet.	✓	✓	✓	
	Dolichopodidae	Indet.	✓	✓		
	Empididae	Indet.	✓	✓	✓	

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
	Keroplatidae	*Macrocera antennalis*	✓		✓	
		Pyrtaula cf. *agricola*		✓		
		Pyrtaula punctifusa		✓		
		Rypatula brevis		✓		
	Muscidae	Indet.	✓		✓	
	Mycetophilidae	*Allocotocera crassipalpis*			✓	
		Aneura nitida			✓	
		Brevicornu sp.		✓	✓	
		Exechia cf. *biseta*	✓			
		Manota sp.			✓	
		Mycetophila colorata		✓	✓	
		Mycetophila crassitarsis		✓		
		Mycetophila fagi		✓	✓	
		Mycetophila filicornis		✓		
		Mycetophila furtiva		✓		
		Mycetophila nitens grp.			✓	
		Mycetophila phyllura			✓	
		Mycetophila subspinigera		✓		
		Mycetophila sp.	✓			
		Platurocypta sp. 1		✓	✓	
		Tetragoneura sp.	✓	✓	✓	
		Zygomyia sp.		✓	✓	
	Phoridae	Indet.		✓	✓	
	Psychodidae	Indet.			✓	
	Sciaridae	Indet.	✓	✓	✓	
	Simulidae	*Austrosimulium* sp.	✓	✓	✓	✓
	Syrphidae	*Melanostoma fasciatum*	✓	✓	✓	
	Tachinidae	*Pales* sp.	✓			
		Procissio valida			✓	
		Protohystricia cf. *gourlayi*			✓	
	Tanyderidae	*Mischoderus forcipatus*	✓			
	Tephritidae	*Tephritis plebeia*		✓		
	Therevidae	*Anabarhynchus* nov. sp. 1	✓			
		Anabarhynchus nov. sp. 2	✓			✓
		Anabarhynchus nov. sp. 3			✓	
	Tipulidae	*Amphineurus* sp.	✓		✓	
		Aurotipula sp.	✓			
		Austrolimnophila argus		✓	✓	
		Discobola dohrni			✓	

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
		Gynoplista sp.	✓		✓	
		Leptotarsus sp.	✓		✓	
		Limonia (Dicronomyia) sp.	✓			
		Molophilus pulcherrimus			✓	
		Molophilus sp.	✓	✓	✓	
		Paralimnophila skusei	✓			
		Rhabdomastix sp.			✓	
		Zelandoglochina huttoni			✓	
Hemiptera	Psyllidae	*Psylla carmichaeliae*	✓			
		Trioza subvexa	✓			
Hymenopter	Apidae	*Bombus terrestris*			✓	
	Braconidae	*Aleoides*		✓		
		Aphidiinae sp.			✓	
		Archaeoteleia novaezealandiae			✓	
		Ascogaster elongata		✓		
		Aspilota		✓	✓	
		Blacinae sp. 1	✓			
		Blacinae sp. 2			✓	
		Doryctinae sp.			✓	
		Glyptaplanteles sp. 1	✓	✓	✓	
		Glyptaplanteles sp. 2	✓			
		Helconinae sp.			✓	
		Hormiinae sp. 1		✓		
		Hormiinae sp. 2			✓	
	Colletidae	*Leioproctus* sp.	✓			
	Crabronidae	*Tachysphex nigerrimus*			✓	
	Diapriidae	*Spilomicrus* sp.	✓			
	Figitidae	*Anacharis zealandica*			✓	
		Kleidotoma			✓	
	Formicidae	*Monomorium antarcticum* complex	✓		✓	✓
		Prolasius advena	✓		✓	
	Gasteruptiidae	*Pseudofoenus*	✓			
	Halictidae	*Lasioglossum maunga*	✓	✓	✓	
	Ichneumonidae	*Aclosmation*			✓	
		Aucklandella sp.1		✓		
		Aucklandella sp.2		✓		
		Aucklandella sp.3		✓		

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
		Aucklandella sp.4			✓	
		Aucklandella sp.5		✓		
		Aucklandella sp.6	✓			
		Campoletis			✓	
		Campoplex sp.1		✓	✓	
		Campoplex sp.2		✓		
		Cryptinae genus C?		✓		
		Diadegma			✓	
		Helictes			✓	
		Lissonota		✓	✓	
		Mesochorus	✓	✓	✓	
		Netelia ephippiata	✓		✓	
	Pompilidae	*Priocnemus conformis*		✓		
		P. monachus		✓		
		P. carbonarius female	✓			
		P. ordishi male		✓	✓	
		P. crawi? male		✓		
		Sphictostethis fugax		✓		
	Proctotrupidae	sp			✓	
	Trichogrammatida	sp			✓	
	Chalcidoidea	sp.1			✓	
		sp.2			✓	
		sp.3	✓			
		sp.4		✓		
		sp.5		✓		
		sp.6	✓			
		sp.7			✓	
		sp.8			✓	
		sp.9			✓	
Lepidoptera	Noctuidae	*Agrotis ipsilon*			✓	
		Aletia moderata	✓		✓	
		Aletia virescens	✓		✓	
		Dipaustica epiastra	✓		✓	
		Dipaustica sp. ‘reddish’			✓	
		Feredayia graminosa	✓			
		Graphania agorastis	✓			
		Graphania mutans	✓		✓	
		Graphania nullifera	✓			

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
		Graphania oliveri	✓		✓	
		Graphania cf *pelanodes*			✓	
		Graphania plena			✓	
		Graphania rubescens	✓		✓	
		Graphania sequens			✓	
		Meterana cf *ochthistis*	✓			
		Tmetolophota arotis	✓			
		Tmetolophota atristriga	✓			
		Tmetolophota micrastra	✓			
		Tmetolophota purdii	✓			
		Tmetolophota semivittata	✓			
	Erebidae	*Rhapsa scotosialis*			✓	
		Schrankia costaestrigalis			✓	
	Geometridae	*Asaphodes camelias*			✓	
		Asaphodes sp.	✓			
		Austrocidaria anguligera	✓		✓	
		Austrocidaria callichlora	✓		✓	
		Austrocidaria cedrinodes	✓			
		Chloroclystis filata	✓		✓	
		Chloroclystis inductata	✓			
		Chloroclystis sp.	✓			
		Cleora scriptaria	✓		✓	
		Declana floccosa	✓		✓	
		Declana junctilinea	✓			
		Elvia glaucata	✓			
		Epiphryne undosata	✓		✓	
		Epyaxa rosearia	✓		✓	
		Gellonia dejectaria	✓		✓	
		Gellonia pannularia	✓		✓	
		Helastia cinerearia	✓		✓	
		Helastia corcularia	✓		✓	
		Homodotis megaspilata			✓	
		Hydriomena purpurifera			✓	
		Hydriomena rixata			✓	
		Ischalis fortinata	✓		✓	
		Ischalis nelsonaria			✓	
		Ischalis variabilis			✓	
		Paradetis porphyrias			✓	
		Pasiphila bilineolata	✓			

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
		Pasiphila dryas	✓			
		Pasiphila melochlora	✓			
		Pseudocoremia melinata	✓			
		Pseudocoremia productata			✓	
		Pseudocoremia rudisata			✓	
		Pseudocoremia suavis	✓		✓	
		Sestra flexata	✓		✓	
		Sestra humeraria			✓	
		Xyridacma alectoraria	✓			
		Unidentified Geometridae spp.	✓			
	Crambidae	*Orocrambus flexuosellus*			✓	
		Orocrambus ramosellus	✓			
		Orocrambus siriellus	✓		✓	
		Orocrambus xanthogrammus	✓		✓	
		Scoparia pura			✓	
		Scopariinae species (>5 species)	✓		✓	
	Pyralidae	*Diplopseustis perieresalis*	✓			
		Patagoniodes farinaria	✓		✓	
	Lycaenidae	*Lycaena boldenarum*			✓	
		Lycaena feredayi complex	✓			
	Tortricidae	*Apoctena conditana*			✓	
		Capua intractana	✓		✓	
		Cryptaspasma querula			✓	
		Ctenopseustis herana	✓		✓	
		Cydia succedana			✓	
		Epalxiphora axenana			✓	
		Leucotenes coprosmae			✓	
		Planotortrix notophaea			✓	
		Pyrgotis plagiatana			✓	
	Elachistidae	*Elachista* sp.			✓	
	Oecophoridae s.s.	sp.	✓		✓	
	Oecophoridae s.l.	*Hierodoris illita*			✓	
		Izatha acmonias	✓			
		Izatha huttonii			✓	
	Gelechiidae	*Anisoplaca ptyoptera*	✓			
	?Gelechiidae	sp.			✓	
	Glyphypterigidae	sp.			✓	
	Yponomeutidae	*Kessleria copidota*			✓	
	Gracillariidae	*Caloptilia linearis*			✓	

			Areas			
Order	**Family**	**Genus + Species**	**1**	**2**	**3**	**4**
	Tineidae	*Sagephora phortegella*			✓	
	Hepialidae	*Wiseana copularis*	✓		✓	
		Wiseana umbraculata	✓		✓	
Odonata	Petaluridae	*Uropetela carovei*			✓	
Orthoptera	Acrididae	*Phaulacridium marginale*			✓	