



Mt. Taika Forest Freshwater Insect Survey 2022

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Introduction

There is an increasing mandate for Councils to improve the knowledge and management of native biodiversity within their administrated regions. Recently, during biodiversity assessments in the Mt Taika (Tiger) Forest, Northland Regional Council (NRC) staff recorded with environmental DNA (eDNA) the possible presence of the mayfly *Zephlebia* aff. *pirongia* sp. 1 (Tong, 2022), an undescribed species listed as Nationally Critical by the Department of Conservation (Grainger et al., 2018). *Zephlebia* aff. *pirongia* sp. 1 was first discovered in Pukenui Forest, Whangārei in 2011, and again in 2013, but was not reported until more recently (Pohe et al., 2018, Pohe, 2019). It was recorded again in Pukenui Forest in December 2019 (authors pending publication) but to date it has not been confirmed elsewhere. Based on the tentative environmental DNA detections from Mt Taika, NRC contracted Pohe Environmental to undertake six biodiversity surveys to 1) attempt to confirm the presence of *Zephlebia* aff. *pirongia* sp. 1 within Mt Taika Forest, and in doing so 2) provide a preliminary biodiversity assessment of the aquatic insect fauna occurring there.

Methods

Ultraviolet light trapping (4 hours/trap), supplemented by ad hoc benthic hand-net sampling, was undertaken from 22–29 December 2022 during warm stable weather from seven stream sites. Weather conditions were ideal for insect surveys, with no wind and air temperature 17–20°C at times of sampling (9pm–1am). For more details of sampling protocols and equipment used see Pohe et al. (2020). Sampling was done within headwater tributaries of the Waimahanga Stream (Figure 1), within the native forest fragment where NRC had previously taken eDNA samples (identified as Sample 4 & Sample 5 by Tong, 2022). Sites were positioned at a range of habitat features targeting likely suitable habitat (Table 1). Samples were preserved in the field with strong ethanol (~80%). In the laboratory specimens were pre-sorted under a 3-Diopter magnifying light (22W) to taxonomic family. Identification to genera or species was done by microscopic examination with a Leica M205C dissecting microscope (3.9–80x magnification) following relevant identification keys and original species descriptions.

In addition to light trapping and hand-net sampling, a hard-bottomed benthic macroinvertebrate sample was collected (8 pooled subsamples from gravel/pebble, leaf detritus, trailing vegetation and vertical rock faces using a 0.5 mm mesh triangular net) from a 150 m stream reach at Site 1, following the national environmental monitoring standards (NEMS 2022). The sample was processed in the laboratory, following those same protocols. This was done to enable an MCI score to be calculated for council records. To compare 2022 eDNA results with these biodiversity survey results, eDNA results of NRC Sample 4 and Sample 5 were combined, as they run in parallel through the same fragment of native forest (Figure 1).

Finally, a number of specimens collected during the assessment were considered of potential interest but required further investigation (not all life stages can be confidently identified to species level). Tissue samples (insect legs) were sent to Manaaki Whenua Landcare Research's EcoGene laboratory and DNA sequences of the CO1 gene were produced. Sequences were then matched against Pohe Environmental's reference aquatic insect DNA sequence library to confirm their identity.

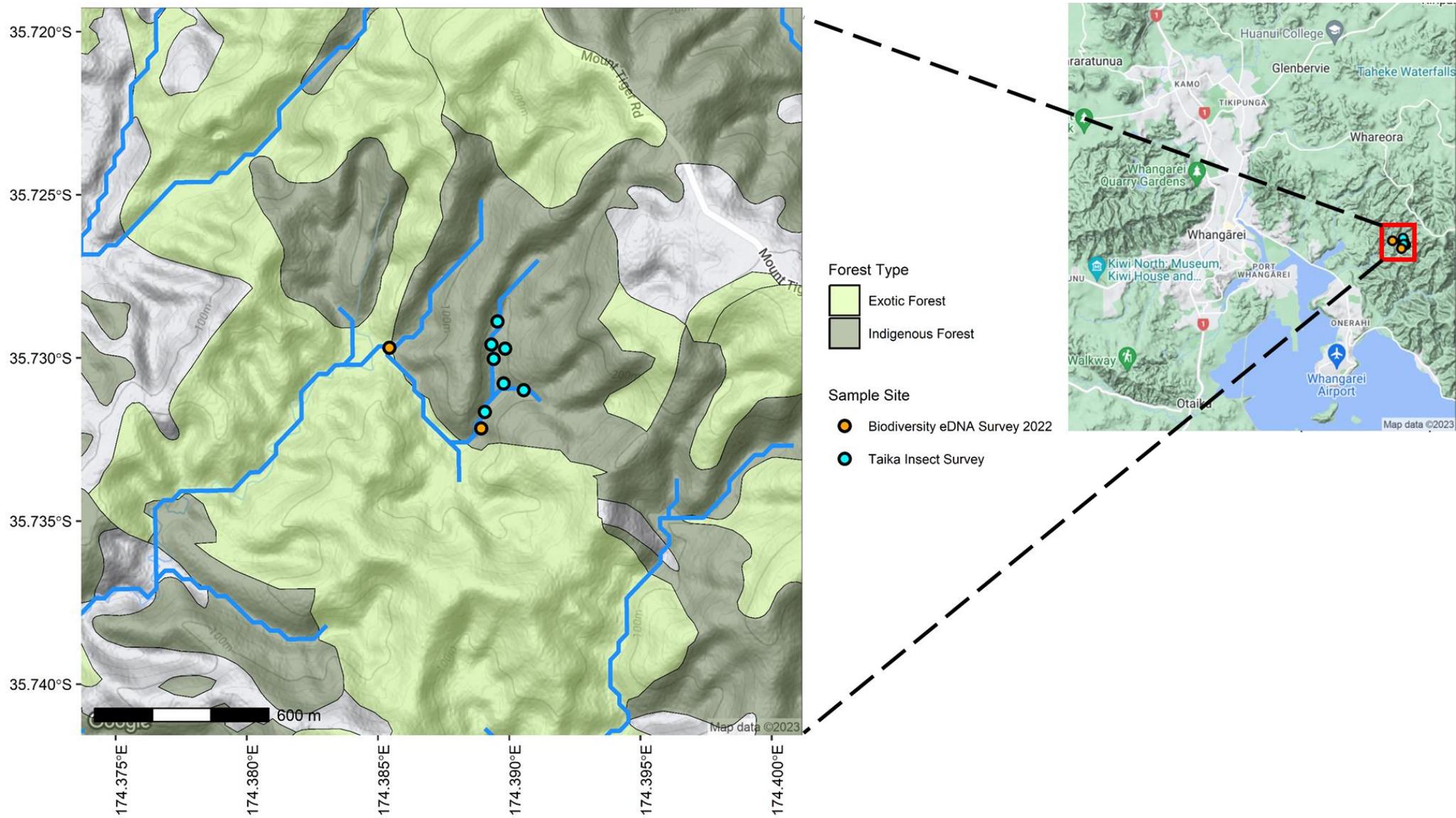


Figure 1 Points show the location of Mt. Taika insect survey sites and eDNA samples taken during NRC's 2022 Biodiversity Survey along tributaries of the Waimahanga stream.

Table 1 Habitat descriptions and positions (in New Zealand Transverse Mercator) of the seven sampling sites.

Sampling site	Habitat description	Easting (NZGD2000)	Northing (NZGD2000)
Site 1	Shallow Gravel/Pebble main channel with leaf packs	1725620	6044924
Site 2	Gentle Cobble/Pebble riffle–run–pools in main channel	1725653	6045104
Site 3	Main channel pool at base of large cascade	1725646	6045153
Site 4	Base of large waterfall trickles in rocky tributary gorge	1725755	6044996
Site 5	Large bedrock cascade–pool sequence in tributary gorge	1725693	6045138
Site 6	Cobble/Pebble riffles and log-jams/leaf packs in main channel	1725668	6045231
Site 7	Deep pool with logs amongst boulders	1725686	6045020

Results

From the biodiversity surveys, 63 discrete aquatic insect taxa were recorded, 61 of which were identified to species, the other two were larvae and adult females that could only be identified to genus. Taxa lists are presented at the end of the summary (Appendix 1). Diversity at the seven sites ranged from 30 to 43 taxa (Figure 2), with a feature of the fauna being 11 species of conservation interest (Table 2). Seven were listed with a conservation threat status, two others were 'Not Threatened' but hold conservation qualifiers (Sparse and Data Poor), and two are potentially new species to science (which by default would also be threat listed).

The primary purpose of the surveys was to attempt to confirm the presence of the Nationally Critical *Zephlebia* aff. *pirongia* sp. 1. Two specimens were collected (a nymph and a subimago life stage) that were suspected to be *Zephlebia* aff. *pirongia* sp. 1, but at present only the adult life stage is known with confidence. DNA barcoding of tissue from these two specimens provided a 100% match to *Zephlebia* aff. *pirongia* sp. 1, confirming its presence in Mt Tiger forest.

Table 2. Species recorded in the surveys of interest to conservation and freshwater management.

Species	Insect type	Reason for conservation interest
<i>Zephlebia</i> aff. <i>pirongia</i> sp. 1	Mayfly	Threatened, Nationally Critical*
<i>Atrachorema mangu</i>	Caddisfly	Threatened, Nationally Vulnerable*
<i>Tiphobiosis kleinpastei</i>	Caddisfly	Threatened, Nationally Vulnerable*
<i>Antipodochlora braueri</i>	Dragonfly	At Risk*
<i>Zephlebia tuberculata</i>	Mayfly	At Risk*
<i>Isothraululus abditus</i>	Mayfly	At Risk*
<i>Pycnocentria</i> n. sp. F	Caddisfly	Data Deficient*

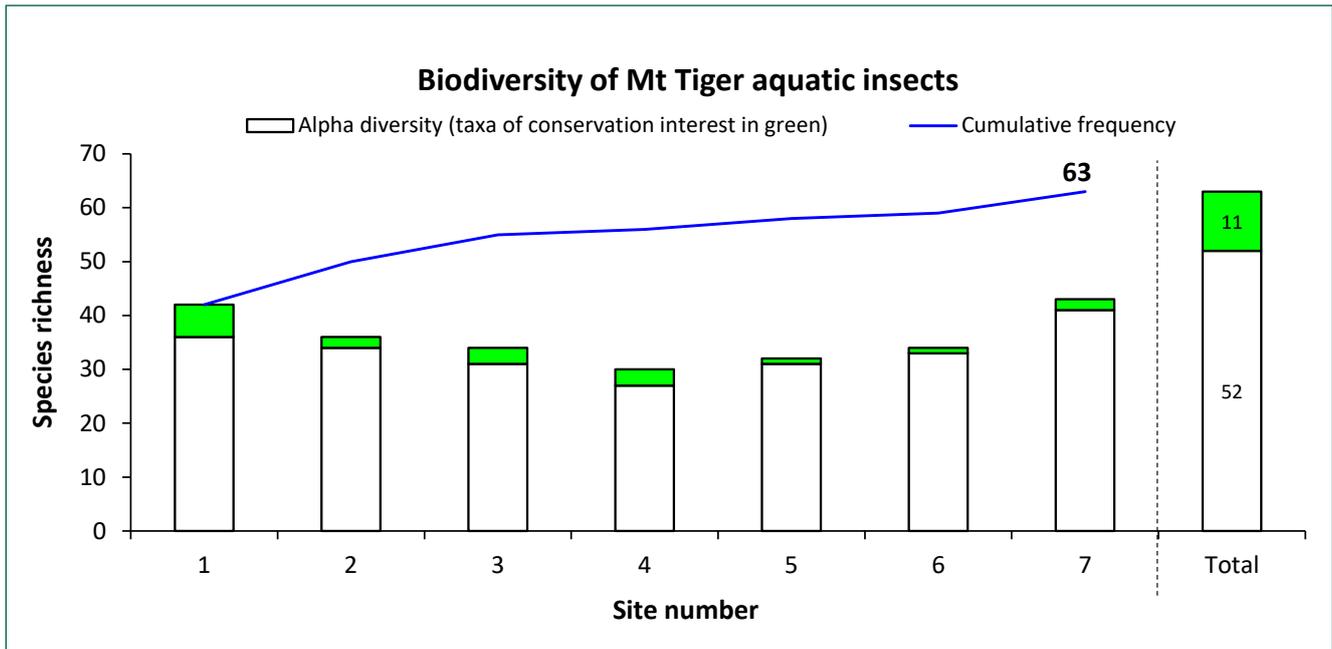


Figure 2. Species richness of aquatic insects found in Mt Tiger streams. Bars indicate the number of species recorded at each survey site (alpha diversity), and at all sites combined (gamma diversity). The green portion of the bars indicates the number of species that were of conservation interest. The blue line represents the cumulative frequency of species as new sites are added.

From two eDNA samples collected previously by NRC, 19 aquatic insect species were recorded, and seven others at the level of genus (26 taxa). The present surveys recorded 61 species, and two others at genus level, and of the 26 taxa recorded by eDNA, all but three were recorded in the present surveys. It is worth noting that at least five other species, all listed as of conservation interest, have been recorded in near-by forest streams similar to those in Mt Taika forest (Matapōuri and Pukenui), and it is likely most of these species will also be in the Mt Taika forest streams.

In addition to the aquatic insect surveys, a benthic macroinvertebrate sample was collected and processed following the national environmental monitoring standards. This sample recorded 36 taxa (with MCI-level taxonomic resolution) and returned EPT and MCI scores of 58.3% and 128.9 respectively, suggesting clean water and healthy invertebrate communities.

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