6.2 IMPACTS OF WILLOW AND WILLOW CONTROL ON ZOOPLANKTON

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WORKING WITH WHĀNAU

While working for Ngā Runuku hapū (subtribe) in Turangi on their Environmental Enhancement programme (2008–2009), we became aware of the intensive grey willow (*Salix cinerea*) control regime occurring throughout the South Taupō Wetland. As kaitiaki (guardians), hapū members wanted to investigate further the impacts of willow and willow control on aquatic life in their reporepo (swamp). With the support of Ngā Runuku and financial contribution from the Ngāti Tūwharetoa Genesis Energy Committee, I (Yvonne) enrolled in a Master of Science programme to explore this kaupapa (topic) further. The research was undertaken with supervision by Ian Duggan, specialist in zooplankton ecology and senior lecturer at the University of Waikato.

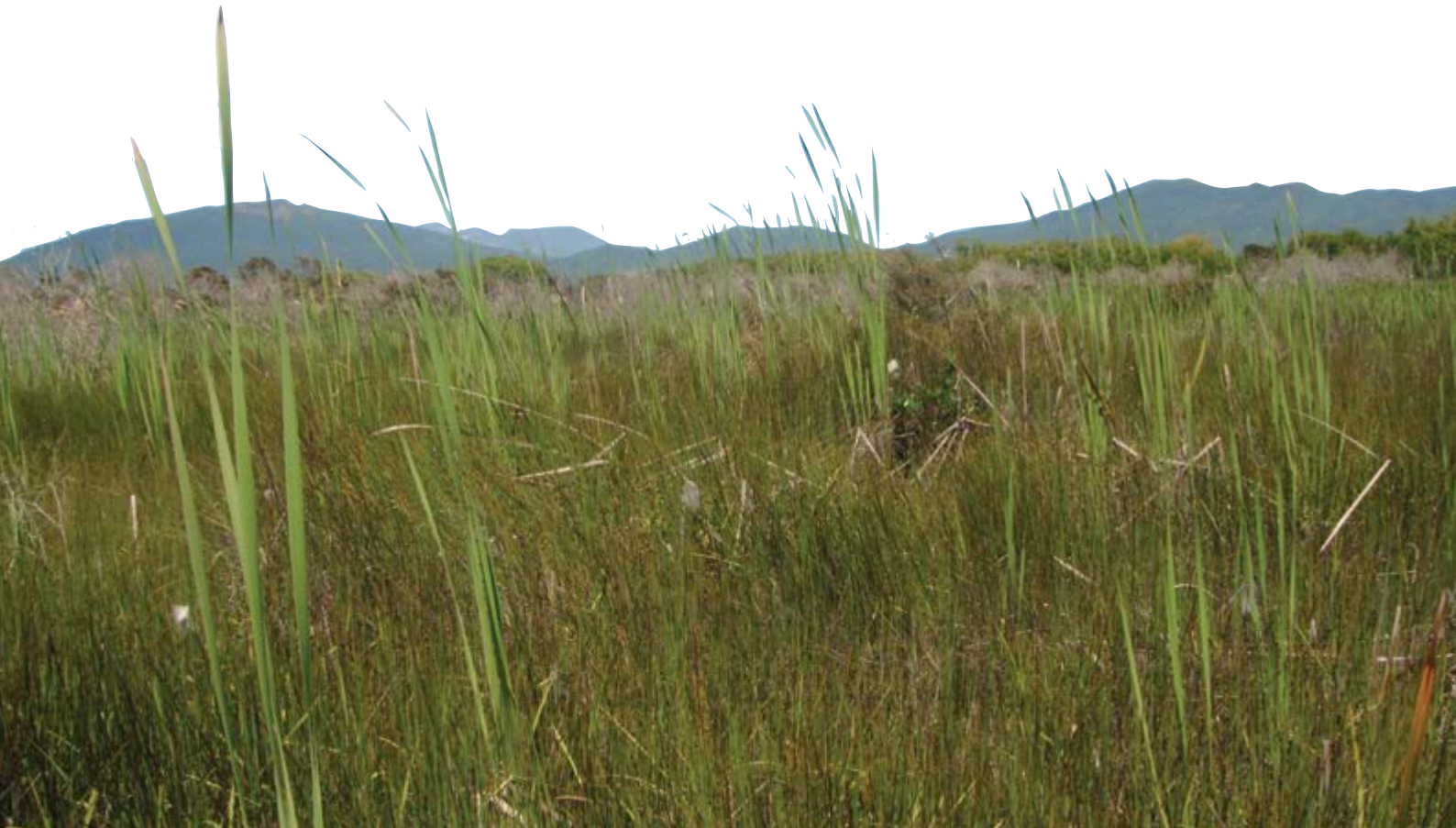
In the Whangamarino Wetland, studies were already underway examining the impacts of grey willow control on terrestrial (land) invertebrates. We decided to examine a different invertebrate group, investigating the responses of zooplankton communities living under live willows, and under those subject to willow control treatment, compared with those living among native vegetation.

Throughout my studies I was strongly supported to undertake and complete my MSc.

My inspiration was drawn from the mentorship of my uncles, Te Rangituamatotoru Tamaira and Rakato Te Rangiita. Their passion for pūtaiao, kaitiakitanga, our reporepo, and teaching our people the importance of our environment was the main reason I became a freshwater ecologist and kairangahau. A big mihi to the Ngāti Tūwharetoa Genesis Energy Committee for funding the study, and to those iwi and hapū who, through their financial contributions, believed this mahi was important.

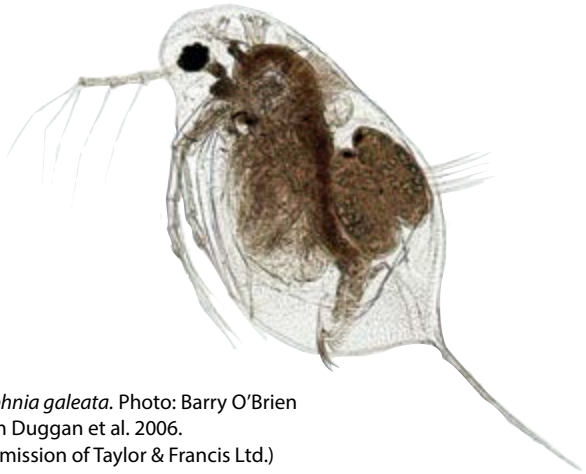
– Ngā mihi Yvonne

Previous page and below: Waiotaka Scenic Reserve.
Photo: Yvonne Taura



WHAT ARE ZOOPLANKTON, AND WHY ARE THEY IMPORTANT?

Zooplankton are small (<5 mm) aquatic animals that feed on algae and bacteria in freshwater systems, including awa (rivers), moana (lakes), and reporepo (wetlands), which in turn provide food for aquatic insects and small fish. Three major zooplankton groups are commonly found in Aotearoa New Zealand: cladocerans, copepods, and rotifers. Many zooplankton species are sensitive to changes in water quality, and as such, can provide important biological indicators for identifying changes in wetlands, and may thus indicate whether the growth of willows or willow control have detrimental impacts on food webs and water quality in wetlands.



Daphnia galeata. Photo: Barry O'Brien from Duggan et al. 2006. (Permission of Taylor & Francis Ltd.)

ABOUT THE WAIOTAKA SCENIC RESERVE

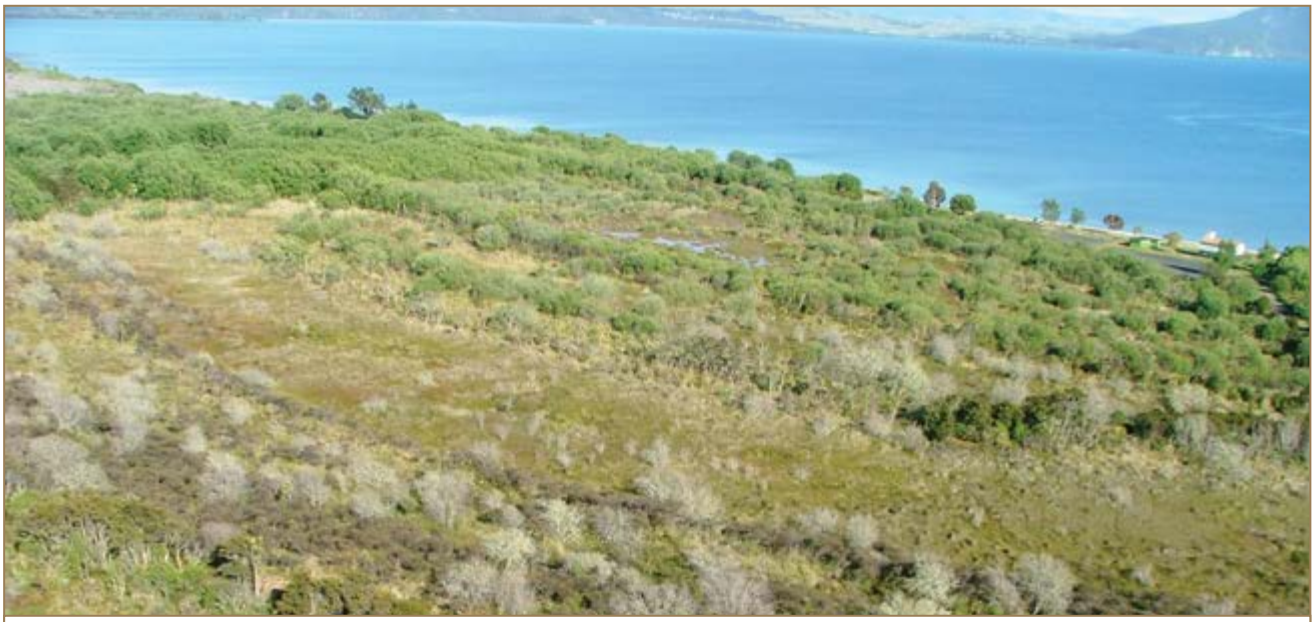
Waiotaka Scenic Reserve is in the eastern section of the South Taupō Wetland, bordering the shore of Lake Taupō. It covers an area of 29.18 ha situated between State Highway 1, the Waiotaka River, and Stump Bay. Water levels (hydrology) in the wetland are influenced by the Waiotaka River, the artificial management regime of the Lake Taupō water levels, and periodic flooding from the floodplain. The reserve consists of two blocks divided by a sandbar, which are known to Te Papa Atawhai – Department of Conservation (DOC) as Blocks 1 and 2.

The main vegetation types and habitats are:

- native indigenous wetland plant species of tī kōuka and kānuka forest on the dune ridges
- sedge peatland
- raupō reedland
- mānuka shrubland
- harakeke flaxland
- toetoe tussockland and
- open water
- a variety of exotic plants, including grey willow scattered throughout

DOC included the Waiotaka Scenic Reserve in their operational plan for weed management of future willow control programmes throughout the South Taupō Wetland.

Ground control of grey willow took place in Block 1 in summer 2007/2008. Block 2 received no willow control before our study.



Aerial view of the Waiotaka Scenic Reserve. Photo: Department of Conservation

RESEARCH OBJECTIVES

The aim of our research

Our aim was to examine the zooplankton communities living in South Taupō Wetland, and determine whether these assemblages are affected by willows and willow control treatment.

Two experiments were designed to examine:

- the composition of zooplankton communities in native vegetation, and under living and dead willow (i.e. long-term effects of willow control)
- the direct effects of the herbicide metsulfuron on zooplankton communities following willow control (i.e. short-term effects of willow control).

Methods

- To determine the long-term effects of willow control on zooplankton communities, seven sites were sampled in both Blocks 1 and 2, which represented indigenous wetland plant species not encroached by willow (native sites)
- A further seven dead willow trees in Block 1 and seven live willow trees in Block 2 were also chosen. These trees were taller than 2 m, and scattered throughout the blocks in permanently wet areas
- Sampling of zooplankton was undertaken in February (late summer), July (winter), and December (early summer) 2011. During these times the grey willow were in late summer bloom, had lost their leaves, or were in early bloom, respectively
- To better understand the short-term effects of willow control, a further eight living willow trees (Block 1 and 2) were selected for herbicidal control and sampled on 1 February 2012 (before treatment). These were treated on 16 February 2012, and sites were re-sampled (after selected treatment) on 14 March 2012. Living willow trees (Block 1 and 2) were used as the control.

Long-term effects of willow control

No significant differences in zooplankton species richness or composition were found between the native, living, and dead willow sites in any of the seasons, indicating willow and willow control have little effect on zooplankton community composition. This experiment did, however, find differences in species composition on either side of the sand bar, suggesting that the hydrology of Blocks 1 and 2 functioned independently, and that hydrology is a more important driver of zooplankton composition than the presence of willows.

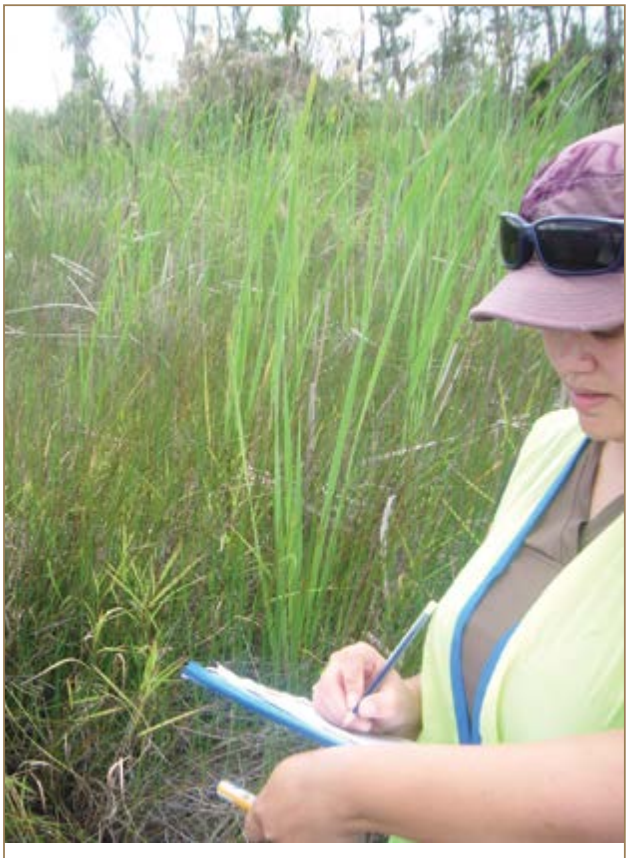
Short-term effects of willow control

Ground control application of metsulfuron resulted in no significant changes in zooplankton species richness or composition before or after treatment. This suggests that the herbicide, and the associated opening of the canopy and leaf fall into the water column post-treatment, do not pose threats to wetland zooplankton.

Overall, our findings indicate that the presence of scattered grey willow has no significant influence on zooplankton composition and diversity. Furthermore, ground control treatment of grey willow using metsulfuron also had no direct or indirect impacts to zooplankton. However, had the study been undertaken under a dense canopy of grey willow, the results might have been different.

What do the results tell us?

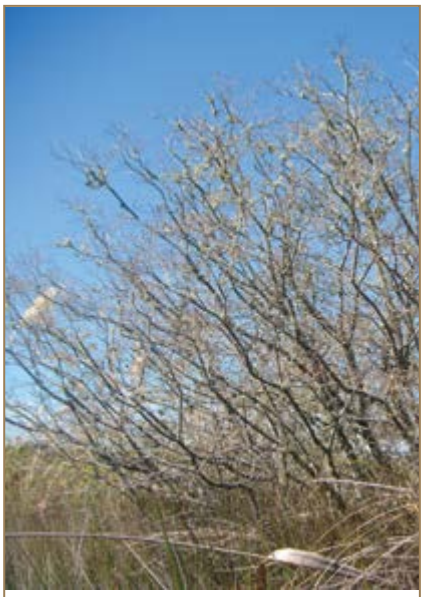
- The presence of grey willow, dead or alive, has little effect on zooplankton communities
- Ground control treatment of grey willow, using metsulfuron, has no apparent impacts on zooplankton communities.



Recording data in the field, Waiotaka Scenic Reserve.

Living willow tree surrounded by native plants and open water. Photo: Yvonne Taura

Drill and Inject method – holes drilled into the trunk of the tree. Photo: Yvonne Taura



Dead willow trees one month post-treatment. Photo: Yvonne Taura

HELPFUL GLOSSARY

Understanding the terminology

Assemblages – zooplankton communities

Diversity – the variety of zooplankton species

Species composition – the identity of all the different species in a community

Species richness – the number of different species found within an ecological community, landscape or region, essentially, the higher the number of different species, the higher the species richness. For this study, species richness refers to each individual species that was counted at each site

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below, try copying and pasting the web address into your browser search bar.

References

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Husted-Andersen D 2002. *Control of the environmental weed Salix cinerea (grey willow) in the South Taupō Wetland, Central North Island, New Zealand.* Unpublished thesis, The Royal Veterinary and Agricultural University, Copenhagen, Denmark.

Watts C, Rohan M, Thornburrow D 2012. *Beetle community responses to grey willow (Salix cinerea) invasion within three New Zealand wetlands.* New Zealand Journal of Zoology 39(3): 1–19.

Wech J, Brady M, Annandale C, Jones K, Kilroy C, Suren A 2016. *Getting rid of wetland willows: what happens to the water beetles and bugs?* National Wetland Symposium, Nelson. www.wetlandtrust.org.nz/Cache/Pictures/2813547/Wech_willow_control_and_beetles.pdf

Useful Websites

Zooplankton description: www.doc.govt.nz/nature/native-animals/invertebrates/zooplankton

Effects of introduced fish on zooplankton: www.lernz.co.nz/uploads/pest-fish-zooplankton.pdf

Willow and alder guidelines: www.landcare.org.nz/Willow-and-Alder-Guide

Image related credit

Zooplankton image: Duggan I C, Green JD, Burger D F 2006. *First New Zealand records of three non-indigenous Zooplankton species: Skistodiaptomus pallidus, Sinodiaptomus valkanovi, and Daphnia dentifera.* New Zealand Journal of Marine and Freshwater Research, 40: 561–569. Copyright © The Royal Society of New Zealand, image granted permission of Taylor & Francis Ltd, www.tandfonline.com

Author research

Yvonne's Masters research thesis:

Taura Y 2012. *The effects of willow and willow control on wetland microfaunal assemblages in South Taupō Wetland.* Unpublished MSc thesis, University of Waikato, Hamilton. http://researchcommons.waikato.ac.nz/handle/10289/7577

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