6.1 IMPACTS OF WILLOW CONTROL ON TERRESTRIAL INVERTEBRATES

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WHY ARE INVERTEBRATES IMPORTANT?

Invertebrates (animals with no backbone) play a very important role in the function of a healthy ecosystem. They maintain the balance of the whakapapa (connections) of a system and undertake a wide variety of roles including:

- 'gardening' roles typical of noke (earthworms) and other soil organisms
- controlling other insects that can cause problems for plants, animals, and humans if left unchecked, such as ladybird beetles preying on aphids
- pollinating a wide range of our native plants, which is done by our many native flies, moths, and short-tongued bees
- providing a food source for our native animals and fish.

Because invertebrates are less obvious and perhaps not as attractive as our birds, bats, and freshwater animals, they tend to be overlooked in the restoration of a native ecosystem. This is true for repo (wetlands) as well.

Previous page: Dead sprayed willows over recovering native sedges at Whangamarino Wetland. Photo: Kerry Bodmin

INVERTEBRATES IN WHANGAMARINO WETLAND

Recent work in the Waikato at Whangamarino Wetland raised a number of concerns for tangata whenua (indigenous people), including the potential impacts of herbicide (glyphosate; the primary ingredient in Roundup®) control of grey willows (*Salix cinerea*), on invertebrates, which are an important food source for tuna (freshwater eels). In response to this, and also to explore the wider effects on invertebrate relationships within the wetland, Manaaki Whenua – Landcare Research researchers investigated the response of the wetland invertebrates in the canopy (tree tops) to glyphosate spraying of the willows. This was part of a larger project looking at the effects of the spray for broad-scale willow control in the wetland.

A baseline survey was conducted in the wetland to gather information about the invertebrate population 1 year before spraying (before spray). Responses were then measured at three key intervals: (1) at spray; (2) short-term (27 days after spraying); and (3) longer-term (2-years after spraying). We collected the data from plots where grey willow had been sprayed and from plots where no spray had been applied (i.e. control). Beetles are routinely selected as 'bio-indicators' as they represent a large component of the invertebrate biodiversity, have representatives in all trophic groups, and have a wide range of habitat preferences.

An aerial view of the Whangamarino Wetland highlighting the spread of the invasive tree, grey willow, into the native vegetation in the wetland interior. Photo: Department of Conservation

RESULTS

Initially (at spray), there were no obvious signs that the spraying had caused death in the invertebrate populations in the canopy (Table 1).

However, 27 days after herbicide application there were huge losses in the canopy foliage of the grey willow. At the same time, there were decreases in the abundance of invertebrates in the glyphosate-treated plots compared with the unsprayed plots.

One year after spraying, the plant community of the plots changed from weedy plants (like the grey willow) to native species including pūrei and Baumea. After 2 years, natives became more dominant in the plant community (Table 2).

As the vegetation changed, the abundance of invertebrates began to increase. At 2 years, all beetle categories apart from detritivores showed increases compared with pre-spray levels (Table 1).

Table 1. Reponses of the beetle community to willow control compared with before spray baselines

— no significant change ↓ decrease ↑ increase

	At spray	27 days after spray	2 years after spray
Abundance	—	↓	↑
Species richness	—	↓	↑
Native beetles	—	↓	↑
Introduced beetles	—	↓	↑
Herbivores	—	↓	↑
Predators	—	↓	↑
Detritivores	—	—	—

Table 2. Habitat changes over time in the Whangamarino Wetland

Before or no spray	1 year after spray	2 years after spray
• Thick willow canopy • Native vegetation present in understorey	• No willow canopy (dead trunks) • Sparse native vegetation • Influx of weedy annuals	• No willow canopy (dead trunks) • Native vegetation recovery • Fewer weedy annuals
	→	
Photo: Danny Thornburrow		Photo: Danny Thornburrow

WHAT DO THE RESULTS TELL US?

- Using glyphosate at the recommended concentrations does not appear to have a direct effect on canopy invertebrates. In other words, the spraying did not kill the beetles and other invertebrates.
- Instead, the invertebrates appeared to be more sensitive to changes in vegetation structure. For example, the loss of leaves in the willow canopy reduced the available invertebrate habitat, which likely forced them to leave the plots to find new habitats in the surrounding wetland.
- Restoration via invasive plant control can promote the re-establishment of invertebrate communities typical of native wetlands. But, to meet long-term sustainability of the whakapapa, it is important that:
  - i grey willow reinvasion is prevented; and
  - ii re-establishment of the native plant habitat is well planned for and supported.

Pāpapa, also known as tātaka, a native ground beetle (*Physolaesthus insularis*) common in Whangamarino Wetland. Photo: Stephen Thorpe

HELPFUL GLOSSARY

Understanding the terminology

Abundance – this refers to the number of individuals of each species. In this research, this was about finding out the total number of individuals within each invertebrate taxon, including beetles found in the wetland

Detritivores – organisms that feed on and break down dead plant or animal material, and recycle essential nutrients back into the ecosystem (see 5.1 Noke/earthworms)

Herbivores – organisms that eat plant material

Predators – organisms that eat other animals

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 experiment, it is referring to the number of different invertebrates recorded in the plots

Trophic group – organisms, based on their mode of feeding

A tent trap for collecting flying insects in Whangamarino. Photo: Danny Thornburrow

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

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: 1–19.

Watts C, Ranson H, Thorpe S, Cave V, Clarkson B, Thornburrow D, Bartlam S, Bodmin K 2015. *Invertebrate community turnover following control of an invasive weed*. Arthropod Plant Interactions 9: 585–597.

Useful documents

Taranaki Regional Council. 2009 (rev. edn). *A photographic guide to freshwater invertebrates of Taranaki's rivers and streams*. Available online from: https://www.trc.govt.nz/assets/Documents/Research-reviews/Freshwater/Photographic-Guide-sm.pdf

Wetland Restoration Handbook – Native Fauna (Chapter 12): www.landcareresearch.co.nz/__data/assets/pdf_file/0013/41422/Chp_12_Native_fauna_2012.pdf

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