Endangered Species Foundation

Protecting New Zealand's rarest of the rare

Canterbury knobbled weevil

Hadramphus tuberculatus Pascoe, 1877

Conservation Status: Nationally Critical

The safety of speargrass

Canterbury knobbled weevil. Mike Bowie, Lincoln University

Quickfacts

Large flightless weevil

Inhabited Canterbury plains and foothills and thought extinct until rediscovered at Burkes Pass in 2004

Survival dependent on heathy speargrass populations and reduced numbers of predators

The knobbled weevil world

Ancient New Zealand was inhabited by a range of large, flightless weevils that each had a different lifestyle and food source. These types of weevil (the Molytini weevil tribe) have probably lived in New Zealand for 60 million years and the 12-16mm long heavily armoured Canterbury knobbled weevil is one of the smaller species in the group. The adult knobbled weevil specialises in feeding on the tough spear-like leaves of speargrass plants and the grub-like larvae avoid competing with the adults by feeding on the speargrass' parsnip-like root for probably 12 months until they metamorphose into a pupa and then an adult weevil. The weevils generally infest large groups of speargrass (rather than isolated individuals), and feeding by weevil larvae eventually kills the speargrass plant, hence limiting the number of speargrass plants in an area. They compete for food with the larvae of several moth species which also specialise in feeding on speargrass roots. Large adult weevils are slow moving and are hunted by predatory birds, the unpalatable body cases often found discarded under the feeding sites of morepork owls, falcon and the extinct laughing owl. Predation by birds and lizards could be a reason why the adult knobbled weevil evolved to be heavily

TE KAUPAPA TIAKI KARAREHE, TIPU MŌREAREA O AOTEAROA

armoured, and to drop to the ground when startled by sudden movement.

The size of knobbled weevil populations are tied to the population size of their host plants: the speargrasses, in particular the golden spaniard *Aciphylla aurea*, the needle-leaved speargrass *Aciphylla subflabellata* and the blue speargrass *Aciphylla glaucescens*, all of which inhabit open grassland sites along rivers and stream terraces, surrounding wetlands, and in forest clearings created by lightning strike-induced fires. Speargrasses (*Aciphylla* species) are plants in the carrot-like Apiaceae family. They are endemic to New Zealand, and have evolved tough sharp spear-like leaves, which would have made eating them very difficult for plant-eating moa. Although these speargrass species are found throughout the eastern South Island, the knobbled weevil is not known from anywhere outside the Canterbury plains and foothills (and possibly on Banks Peninsula). Needle-leaved speargrass is itself now an endangered species, and blue speargrass is now rare in lowland Canterbury, so any population of knobbled weevil inhabiting these two speargrasses are also likely to be very rare themselves.

The loss of the knobbled weevil

The knobbled weevil was likely to have been locally common – with populations moving between patches of speargrass – but although golden spaniard became very common in Canterbury following burning of lowland forest (first by Maori to make hunting moa easier, then by European settlers creating farms), the knobbled weevil slowly died out and was thought to be extinct. It is likely that predation by rats (first introduced by Maori, then further species by Europeans), mice, cats, possums and hedgehogs were the cause of adult Canterbury knobbled weevil extinction, as similar weevil species have disappeared following invasion of their island homes by rodents. The last living knobbled weevil was seen in 1922, near Waimate.

The knobbled weevil refound

Eighty two years after the knobbled weevil was last seen, Laura Young, a University of Canterbury student, found one adult weevil on a golden spaniard plant at Burkes Pass (between Geraldine and Tekapo) in 2004. A small population (less than 200 adult weevils) was found to be present at this site, and a second, smaller group was found nearby. How the weevil managed to survive in these sites is unknown - but it is likely to be a combination of luck, and the protection from predators provided by the fiercely spiky speargrass leaves. Worryingly, recent monitoring indicates that the number of weevils in the reserve is decreasing. There is a slim possibility that the knobbled weevil could be discovered in other areas of lowland Canterbury, but this will require some dedicated (and prickly!) searching of areas containing a high density of speargrasses.

Mike Bowie and his Lincoln University ecology students have been searching places where the weevil was historically seen, but so far with no luck.

Knobbled weevil conservation

In 2012, the Canterbury knobbled weevil was classified as Nationally Critical (with the qualifier of being only found in one location) and in imminent danger of becoming extinct. Previously in 2007 it had been classified as Nationally Endangered, meaning it had a high risk of becoming extinct. The future of the knobbled weevil in its two tiny current sites depends mainly on two things: the density of speargrass plants, and the numbers of predatory mammals. Speargrasses are pioneer plants and are among the first plants to colonise new areas, but they require high light levels, and are displaced by the longer lived snow tussock grasses and shrubs. Their regeneration is also often hindered by the dense swards formed by exotic pasture grasses which invade natural sites. Wallabies (which have recently infested the Burkes Pass area) and hares chew the outer portions of speargrass leaves, and pigs uproot plants to eat the root, killing the speargrass. The numbers of predatory mammals is driven by the amount of food such as seeds, rodents and rabbits in the area. The small reserve could also be severely damaged by an accidental fire, as happened in 2007 when a fire spread into the reserve. Adult knobbled weevils have been kept in captivity for part of their lifecycle, including mating and they ate both needle-leaved speargrass and Chatham Island soft speargrass *Aciphylla dieffenbachii* as well as golden spaniard with no clear favourite between these three species.

Knobbled weevil conservation centres on a DOC reserve at Burkes Pass where cats, mustelids (including a surprisingly high number of ferrets) and hedgehogs were regularly trapped. Examination of the stomach contents found no knobbled weevils, but this is unsurprising given the very low numbers of knobbled weevils. The trapping has been stopped because the number of traps was considered insufficient, and DOC is now planning to test protective cages over $4m^2$ of speargrass plants and physically moving knobbled weevils into these cages. These cages, if well designed, should result in some knobbled weevils being better protected, but there is some risk as it will leave much of the population at increased risk from predators. Keeping adult knobbled weevils in captivity has been trialled, with most adults surviving over the four month trial, and with some mating being observed.

What next?

The threats to the survival of knobbled weevil are:

1. Only being found at one site.
2. A very low total population.
3. Rats, mice, cats, possums and hedgehogs eating adult weevils (probably when they walk between speargrass plants).
4. Changes to their habitat at Burkes Pass because of invasion by wallabies, plant succession, weed invasion, or fire.
5. Low diversity of food plants. Only golden spaniard presently occurs at Burkes Pass,

but needle-leaved speargrass and blue speargrass were likely to have been present in the past.

6. Lack of information on the extent and size of the Burkes Pass population.
7. No clear decision maker directing conservation efforts.
8. Little money to pay for conservation efforts and few people with the time to dedicate to knobbled weevil conservation.
9. Loss of genetic diversity (the Burkes Pass population has only some of the same genetic variation of knobbled weevils (museum specimens) that have been collected from other sites in Canterbury).

Little owls and red-back spiders (who both specialise in feeding on beetles) may also be threats to the survival of knobbled weevils.

Successfully protecting knobbled weevils from these threats must be achieved in order for the existing knobbled weevil conservation programme to succeed. Ideally, this should be done by:

1. Appointing an action group and leader to coordinate and direct conservation efforts.

A successful conservation programme needs to do the right thing. Doing the right thing is easier to achieve when there is a group of talented people involved who are enabled to make good decisions. These decisions often need to be made when there is very little (and often conflicting) information. The group's decisions must also be converted into action.

Participation in this group is likely to require 20 hours of each member's time.

2. Determining the full extent of the Burkes Pass knobbled weevil population.

Some conservation actions that could be very beneficial may also have a high risk of failure which would result in negative consequences for the few animals left alive. For example, moving a group of 10 animals from one place (the donor site e.g. where there are 100 animals left alive) to a new site decreases the number of animals at the donor site by 10, with the possible benefit of increasing the number at the new site by 10, plus any that are born at the new site. But if this doesn't work (e.g. the animals all leave or die because the new place is not suitable), then moving those 10 animals has reduced the population to just 90 animals. The decision to use a high risk technique is based on balancing the potential benefits against the potential negative consequences. As the severity of a negative consequence is usually less in a large population, knowing the size of the knobbled weevil population is very important and to date, no full survey has been conducted to find out this important piece of information. Setting pitfall traps (small plastic containers buried up to their lip in the ground into which knobbled weevils

fall when they are walking along the ground), searching for adult weevils at night (ideally using a red-coloured light that disturbs insects less) and searching for the marks made by adult knobbled weevils feeding on the edge of speargrass leaves (though other insects can leave similar marks) have proven to be the most successful ways of discovering if knobbled weevils are present at a site.

Conducting this survey is likely to cost $10,000.

3. Test caging areas of speargrass in order to protect the knobbled weevils that inhabit them from predators.

The number of knobbled weevils in the Burkes Pass area has not increased, despite predators being trapped in recent years by both DOC and Environment Canterbury (ECan). It is planned to enclose some of the speargrass plants, together with some of the knobbled weevils, in wire mesh to exclude predators and safeguard at least some of the knobbled weevils while other conservation techniques are being developed.

Constructing nine 4-9m^2 exclosures is likely to cost $7,600.

4. Replanting open areas within the knobbled weevil population with groups of golden spaniard, needle-leaved speargrass or blue speargrass and regularly checking these plants for signs of colonisation by knobbled weevils.

Speargrasses provide both food for knobbled weevils and protection from predators such as cats, possums and hedgehogs (and possibly rats). Therefore, increasing the number and density of speargrasses by planting dense groups of 20-30 speargrasses should result in an increase of the knobbled weevil population. We only know of knobbled weevil feeding on golden spaniard, but it is thought they may actually prefer needle-leaved speargrass or blue speargrass. Planting groups of each of these species will allow the preference of knobbled weevils to be tested. Plants may need to be protected from wallabies by enclosing them in mesh cages.

Growing speargrasses and planting them into the reserve is likely to cost $18,200.

5. Preventing fires spreading into the Burkes Pass reserve.

In the past fires have ravaged part of the Burkes Pass reserve and could have caused the extinction of knobbled weevil had they spread further. Creating a fire break around the reserve and removing the parking area would reduce the risk of a fire burning into the reserve.

The cost of creating and maintaining a firebreak around the reserve is unknown.

6. Controlling major weeds at Burkes Pass.

The invasion of the Burkes Pass area by wildling pine trees and Russell lupin shrubs will shade-out the habitat of knobbled weevil. This weed invasion can be stopped by

accurately spraying the weeds with an appropriate herbicide.

The cost of spraying weeds in the reserve is unknown.

7. Continuing to search speargrass colonies in Canterbury to find new populations of knobbled weevils.

Knobbled weevils have been found (a long time ago) at other places in Canterbury, and there are also patches of speargrasses that persist at a few places. This raises the possibility that another population might be present somewhere else and could be found if potential places are searched closely.

Searching of potential places (three surveys per year for three years) is likely to cost $26,300.

8. Developing captive breeding techniques using a similar weevil species.

Breeding animals in captivity can increase the number of individuals of a species, and these additional individuals can then be used for other conservation purposes, such as moving them into a new safe home. However, little is known on the ability to keep and breed New Zealand's insects in captivity, and this means that beginning a captive breeding project for such a rare species as the knobbled weevil would be very risky. One way to learn how to breed knobbled weevils in captivity is to try and breed a closely related commoner species, such as the Chatham Island knobbled weevil Hadramphus spinipennis.

A five year weevil captive breeding project is likely to cost $51,600. The Graham Hirst Kitney Charitable Trust has donated $10,000 towards the cost of specialist invertebrate enclosures for use in this project.

9. Introducing knobbled weevils to another site either by directly moving eggs, larvae or adults to a new site, or by captive breeding knobbled weevils for release.

Creating a second population of knobbled weevils in another, safe site will dramatically reduce the risk of this species becoming extinct, as a catastrophe (such as a fire) is unlikely to occur at two different sites at the same time. Unfortunately there are now few safe sites for knobbled weevils in Canterbury. One possible safe site is Motuariki Island in Lake Tekapo, but moving knobbled weevils to this island would depend on: 1) an analysis of what other uses the island has, for example as a safe site for other endangered species that might conflict with knobbled weevils, and 2) suitable habitat for knobbled weevil being present. Creating a new population of a species by physically moving individuals is termed a translocation and has been used successfully many times for birds such as kakapo, black robin and takahe. Translocations of insects have also occurred in New Zealand and this technique has been successful in creating new populations of two species of giant weta insects, though a translocation to Breaksea Island in Fiordland of the related weevil Hadramphus stilbocarpae in 1991, while initially successful, may not have resulted in a large population of weevils on the island

presently. Translocation of knobbled weevils is likely to be more difficult because they have two life stages: the larval stage in the below-ground roots of speargrasses and the adult stage on the above-ground speargrass leaves. A possible approach could be to catch male and female knobbled weevils and keep them in cages built over speargrass plants (that are growing in large plant pots) until they mate and lay eggs. The speargrass plants, together with the knobbled weevil eggs, could then be moved to the new safe site. A knobbled weevil translocation will need to be approved by DOC by preparing a translocation proposal that fulfils the Translocation Standard Operating Procedure which contains requirements that the translocation is well designed, and the impact of the translocation on both the source population and on the destination site has been carefully considered.

A three year knobbled weevil translocation project is likely to cost $12,900.

10. Undertake detailed research on knobbled weevil biology.

There is much we do not know about the knobbled weevil: their lifespan, food preferences, movements, predator avoidance strategies, breeding system, among others. Better information on these will allow the conservation programme to be fine-tuned and be more effective. This research would ideally be undertaken at PhD level, or as a series of MSc projects.

Three years of PhD research is likely to cost $45,000.

11. Regularly counting the number of knobbled weevils.

It is important to know whether the techniques used in knobbled weevil conservation projects are being successful. If something is not working, then that money and effort can be better used doing something else. The best way of assessing whether the techniques being utilised are working is by regularly counting the number of adult knobbled weevils: if the project is working, then the number of adult knobbled weevils will increase. Counting adult knobbled weevils is best done when they move between speargrass plants, by trapping them in grids of 25 pitfall traps. This should be done every three years over three nights each month over summer at ten sites within the known knobbled weevil population. In 2011, an average of 0.04 knobbled weevils was caught each night per pitfall trap (this is the same as when initially surveyed in 2005/06).

Counting knobbled weevils is likely to cost $13,000 every three years.

12. Monitoring changes in knobbled weevil habitat at Burkes Pass using photographs of the same areas, taken every three years.

The knobbled weevil's speargrass habitat could be slowly lost from the Burkes Pass area due to natural changes in the vegetation. Speargrasses are pioneer plants: they are one of the first to arrive when bare ground is created, but as the surrounding plants, such as snow tussocks and shrubs, grow taller they both shade out the speargrass

plants and smother the open sites that wind-blown speargrass seeds need to germinate. To see if any change is occurring, the speargrass plants can be photographed and then compared with those counted in previous photographs from the same viewpoint.

Photographing speargrass plants every three years is likely to cost $2,800.

More information

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Photos

Canterbury knobbled weevil. Emily Fountain

Burkes Pass. Emily Fountain

Feeding damage on needle-leaved speargrass leaves. Emily Fountain

Golden spaniard. Mike Thorsen

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