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Constructing a weka-proof fence to protect native land snails from predation

Project Janszoon constructed a weka-proof fence around two exclosures to assess the impact of weka predation on endangered land snails in the Abel Tasman National Park

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Background

The Abel Tasman National Park is home to two endangered land snail species: *Rhytida oconneri* and *Powelliphantya hochstetteri*. Both species are carnivorous and nocturnal. Project Janszoon's mark-recapture monitoring documented a steep decline (app. 70% p.a.) of both populations since the arrival of weka. Shell surveys and shell damage patterns confirmed weka as the predominant predator on snails. A decline of such a magnitude can result in local extinction within a few years. Rats are also known to predate on snails, however, only a minority of shells exhibited signs of rat predation. Possums are potential predators of snails, but they are kept in low numbers and are not considered a major pressure for snails in the park.

Objectives

The objective is to investigate if the exclusion of weka alone is adequate to facilitate the recovery of snail populations. Indirectly, this serves as an indicator to establish whether Project Janszoon's rat control is effectively protecting snails from rat predation, thus the fence is designed to deliberately allow rats to access the sanctuary.

Two sanctuaries were built, the aims being to protect a greater genetic variety of snails, to cover two different habitats and to investigate the impact of local conditions on results. The sanctuaries (also called WekEx) were built as a proof of concept. If they are shown to be effective in enhancing the recovery of snail numbers, the enclosures can be enlarged to achieve an ecologically meaningful size.

Fence design

The enclosures cover just under half a hectare (70x70 m) with an overall length of 280m. Data from previous nocturnal surveys were used to identify two suitable locations in the upper part of the park. The fence was built with manual labour only and construction had minimal impact on the habitat.

Weka can jump straight up to 90 cm height. As the ground is uneven and featuring slopes, bumps, and roots, the fence height was raised to 1.2 meters.

The fence is constructed of three layers (Fig. 1): 1. Y-posts and four rows of high-tensile wire, 2. Sheep netting and 3. Hex-netting.

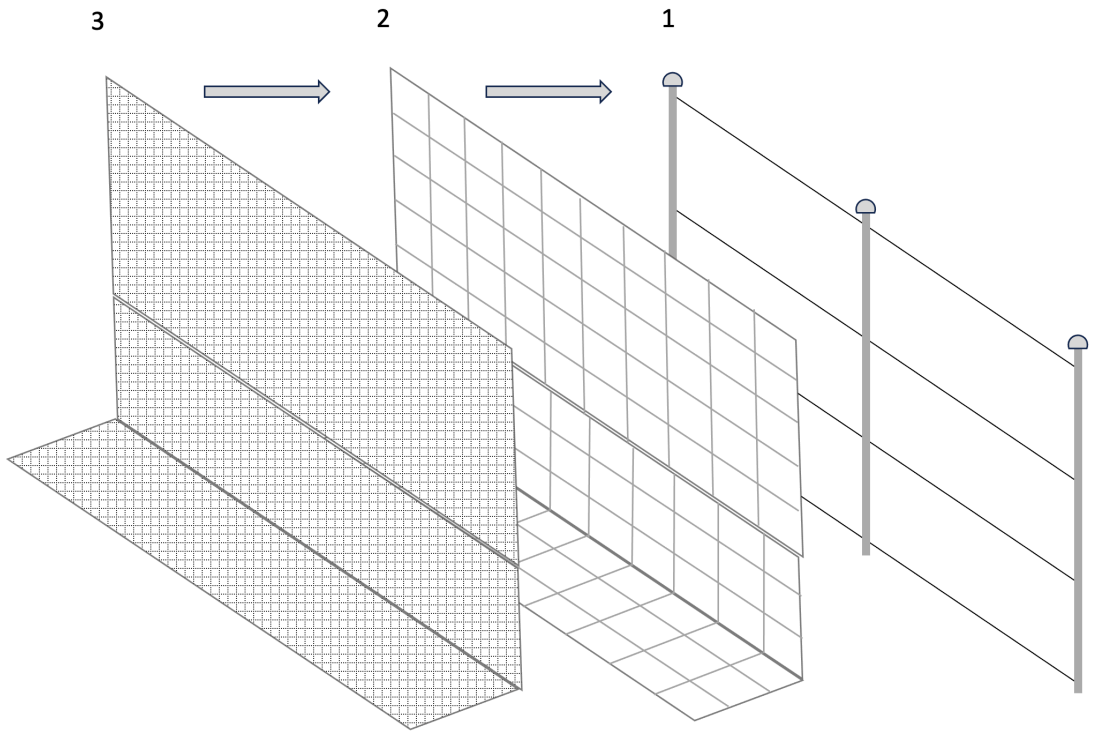

Figure 1: *Layer 1 is the backbone of the fence: Y-posts with 4 rows of high tensile wire. Layer 2 is made of 2 rows of sheep netting that were stitched together to achieve a 60 cm skirt and a fence height of 1.2 m. Layer 3 is the hex-netting, as for layer 2, we used two rows of 90 cm stitched together.*

The fence is intended to be leaky for snails to allow for geneflow and migration. The hex-netting has a mesh size of 41 mm, allowing mid-sized snails to pass through the fence. Snails have often been seen to climb up trees, thus snails of any size can theoretically climb across the fence.

The fence excludes goats, pigs, hedgehogs, rabbits, and hares, whereas deer can jump across. To exclude deer, the height of the fence must be raised to 2m (excluding deer adds the benefit of increased habitat quality for snails). Pig rooting is discouraged by two rows of barbed wire, one row directly at the base of the fence, a second row at 20-30 cm height.

A 60 cm-wide skirt additionally protects the base from pig rooting and weka digging a passage underneath the fence.

The sheep netting supports the fence and makes it more resilient against windfalls and pigs.

Materials

List of materials (for one 70x70m WekEx)

Item	**Amount**
Wooden corner posts (2.4 m, 200-225 mm)	4 (one per corner, will be more if shape of enclosure is not square)
Strainer posts for corner posts (2.4 m, 75-100 mm) + long screws	8
Y-post 1.8 m	140 (2 m spacing)
Y-post caps	140
High-tensile wire 25 kg	2
Fencing ties, galvanized 15 cm	3000
Sheep netting (90 cm high, 50 m rolls)	12 (2 rows, 1.2 m fence + 60 cm skirt)
Hex netting (41 mm mesh size, 1.4 mm gauge, 90 cm height, 50 m rolls	12 (2 rows, 1.2 m fence + 60 cm skirt)
Fence staples	200
Barbed wire 25 kg	3
Y-posts 45 cm	50
Hog rings	1000
Wire strainers	16
Ladder	Alternative: gate (add 2 corner posts & strainers)
Builders string	

List of tools

Spinning Jenny	Hog ring fastener	Wire tie tool (Alternative: battery drill fitted with a hook)
Y-post slammer (+ earmuffs)	Chain strainer wire tensioner	Heavy duty straight crowbar (for smashing rocks)
Hammer	Chainsaw	Gloves
Grubber/ pick	Handsaw/Silky saw	Axe
Post hole spade	Secateurs	Drill
Spade	Pliers	Wire cutter
Grubber	Ratchet handle	Sledge hammer

Image – Powelliphanta on tree ©Ruth Bollongino/Fern Photos

Construction

Prior to construction, the area was checked by arborists for dead trees that could be expected to fall across the fence line within the next decade, and the identified trees were felled.

Due to the remote location, no machinery could be used for fence construction. All fence materials were flown in by helicopter. Nevertheless, it was important to keep all materials, especially fence netting, to a weight that people could carry. Sheep netting rolls of 100 m length were not practical, using 50 m rolls instead was the better choice.

Fence lines were lain out using builder's string, and a minimum of vegetation was cleared along this line. Corner post holes were dug to app. 1.2 m depth.

Hog rings were of limited value, as they were not big enough to tie together all layers of the fence. They were only used to hold the sheep netting in place during construction. Using looped wire ties and a wire tie tool was the most efficient way to tie all fence layers together while the hex-netting was installed.

To protect living trees, we chose not to cut roots along the fence line. This caused only minimal extra work to adjust and tie down the skirt.

Figure 2: *The finished fence. Right: logs were used to initially hold down the skirt until it was naturally covered by leaf litter and soil. ©Ruth Bollongino/Fern Photos*

We initially planned to use ground staples to hold the skirt in place but discarded the idea as ground staples do not provide any protection from rooting pigs and tension on the skirt would be enough to lift the staples. Sunken waratahs and a wire woven through the skirt netting also proved to be impractical, as the tension on the wire lifted the skirt and friction was too high to pull the fire through the netting. The skirt is now held down by branches and logs, in places where pits, cavities and roots were present, sunken waratahs were used to tie the skirt down (Fig. 2). Fence staples were also used to attach the skirt to stumps and roots.

Figure 3: *Tree stump wrapped in hex-netting (left) and additional screen to increase fence height (right) to prevent weka from using elevated points to jump across the fence. ©Ruth Bollongino/Fern Photos*

Before the fence line was closed, the team walked through the area to chase out any weka that might have been inside the fenced area.

Once the fence was constructed, tree stumps, rocks and any other structures that might serve as a base for weka to jump across the fence were either wrapped up with hex netting, or the fence height was locally increased accordingly (Fig. 3).

Inside the fenced area, long branches were leant up against the corner posts to allow any weka on the inside to find an escape route.

A team of five to six people was most efficient and allowed for multiple tasks to be completed in parallel (e.g. two people to set up corner posts while two set up Y-posts and one or two people cleared the vegetation). Construction time per fence was approx. five to six workdays. As the construction took place during wintertime when snails were inactive, it was convenient to have a larger team and get the job done quickly.

Costs

Cost vary with time, however, the costs of building two sanctuaries including materials, helicopter hours, arborists and labour was approx. NZD 62,000.

Performance

Camera traps and mayonnaise lures (ZIP motolures) were used to monitor potential weka intrusion. WekEx 2 was free of weka from the beginning, whereas WekEx 1 had regular visits by multiple weka, even after removal of intruding birds with live traps. Eventually we discovered a narrow tunnel system under the roots of a tree that allowed the birds to travel underneath the fence. The holes were hardly visible, and we recommend close inspection of all tree bases, rabbit and bird burrows etc. for potential weka intrusion routes. After blocking the tree tunnel with rocks and netting no weka were encountered within the fenced area.

We did not observe any weka trying to pass underneath the skirt. However, weka were running up and down the fence line at the base of the fence on top of the skirt, trying to push their heads through the netting. The skirt was rapidly covered by leaf litter and soil and became barely visible.

Snail numbers are monitored along line transects inside and outside the WekEx. After 1.5 years, monitoring is already indicating a higher number of snails and other invertebrates inside the sanctuary.