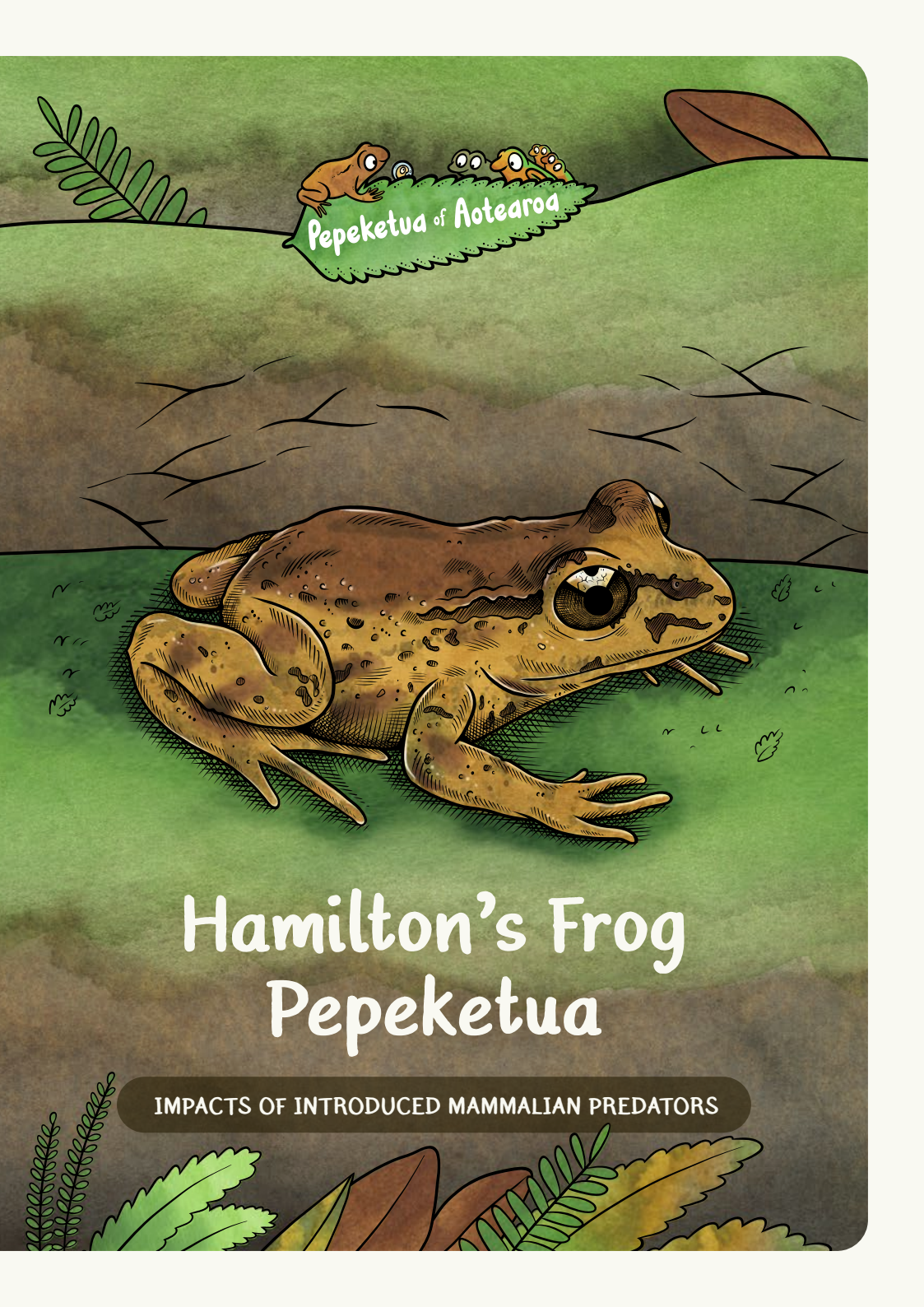




Pepeketua of Aotearoa

Hamilton's Frog Pepeketua

IMPACTS OF INTRODUCED MAMMALIAN PREDATORS

NZFrogs is a charitable trust which aims to help people of all backgrounds and abilities learn about, engage with and support the conservation of New Zealand's native *Leiopelma* frogs.

In 2024, NZFrogs received funding through the Unlocking Curious Minds Contestable Fund to develop a series of educational booklets and accompanying posters. The goal for these resources is to provide engaging, bilingual resources that communicate years of scientific research, to a wide age range. Hopefully, you will find these resources are useful in your community and classrooms, and appealing to anyone interested in learning more about native *Leiopelma* frogs.

The *Pepeketua of Aotearoa* series includes four booklets with accompanying posters. Additionally, there are two special topic posters: *What makes our Pepeketua special?* and *Protecting our Pepeketua*. You can find out more about NZFrogs and the *Pepeketua of Aotearoa* series at nzfrogs.org

NZFrogs worked alongside a talented team to bring *Pepeketua of Aotearoa* to life:

Illustrator	Sarah Greig
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Translator	Te Ngaru Wehi
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Graphic designer	Lucy Arnold

We would also like to acknowledge the following iwi for their contributions to these resources: Pare Hauraki, Ngāti Kuia, and Ngāti Koata.

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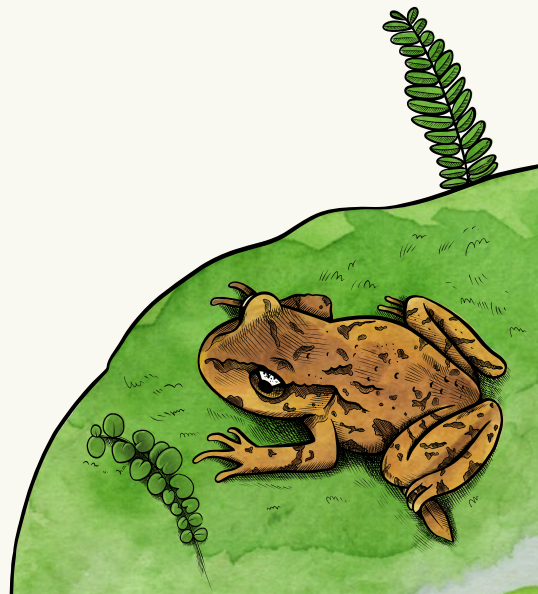


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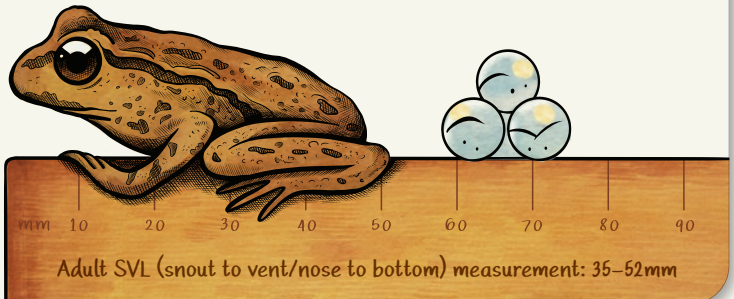
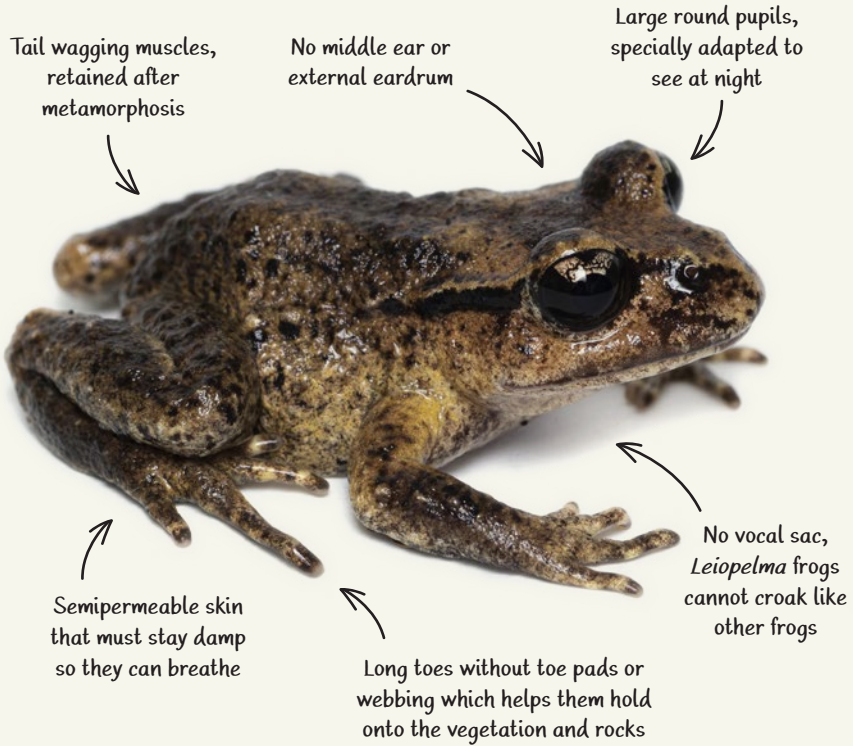
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CREATURE CARD

Hamilton's frog is **terrestrial**, shows parental care, and doesn't have an aquatic tadpole stage. Check out the other booklets in the *Pepeketua of Aotearoa* series or nzfrogs.org to learn more about New Zealand's native frogs.



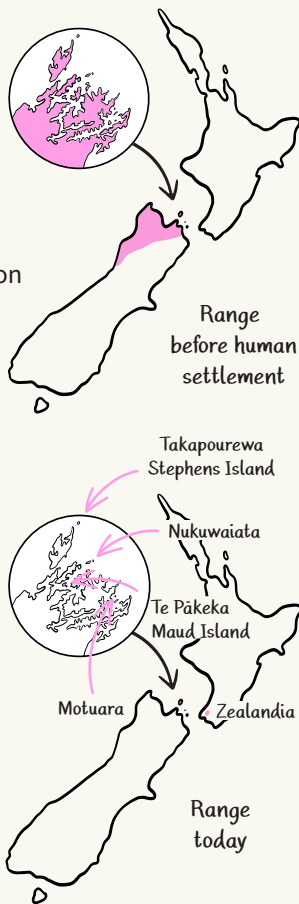
Range contraction

Before human arrival, over 80% of New Zealand was covered in dense native forest. New Zealand's plants and animals thrived without any invasive mammals. Hamilton's frog was historically found across the northern South Island, including Westland.

Since human arrival, Hamilton's frogs' distribution has shrunk massively! Hamilton's frogs are only found naturally on two small islands in the Marlborough Sounds: Takapourewa Stephens Island and Te Pākeka Maud Island. **Translocated** populations are found on Nukuwaiata, Motuara Island, and at Zealandia Ecosanctuary.

Hamilton's frogs are **terrestrial**, which means they live on land. Originally, it was believed that Hamilton's frogs preferred to live only in rock piles. However, we now know these frogs will often climb vegetation. It can be hard to understand the best conditions for Hamilton's frogs as their distribution is extremely restricted and their habitat preferences and behaviours may have needed to change.

Predation is one of the greatest threats to the remaining **fragmented** frog populations! Understanding what has happened in the past can help us figure out how to be better kaitiaki, ensuring their future survival.



My range on Takapourewa is a small, 600m² area with around 300 frogs





Polynesian settlement

Polynesians were the first humans to settle in New Zealand. They brought with them many exotic plants and animals including kiore, a small rat. Scientists believe kiore caused the extinction of three species of *Leiopelma* frogs. Kiore heavily preyed on many small-bodied animals including giant weevils, *Powelliphanta* snails, reptiles, and small birds.

Hamilton's frog and other *Leiopelma* species were not **adapted** for mammalian predators. *Leiopelma* frogs are **cryptic** in order to avoid native predators which rely mainly on sight to find prey. Mammals hunt using smell, so frogs would've been an easy snack for kiore.

Polynesians also changed New Zealand's forested landscape. Large areas were cleared using fire, forming areas of scrubland and grassland. Fires likely caused habitat loss in some regions, and **fragmented** *Leiopelma* frog populations.



Te Pākeka Maud Island was both a farm and military base before it was restored as a predator-free island reserve in 1974.





European arrival

Once Europeans arrived they too cleared native forest, but over much larger areas. European settlers also brought many more mammalian predators like mice, ship rats, Norway rats, mustelids, and pigs. European arrival led to accelerated changes across New Zealand's environment.

Europeans also introduced herbivores such as deer and goats. Herbivores trample native vegetation and browse native undergrowth. Without undergrowth or young trees, native forests become drier. Dry forests are not ideal for *Leiopelma* which need a cool, humid environment with lots of vegetation to survive.

Following two waves of human arrival, *Leiopelma* frog populations declined. Hamilton's frogs became extinct on the mainland.

New Zealand's other *Leiopelma* frogs, Archey's and Hochstetter's frogs, persist on the mainland but are limited to restricted areas.

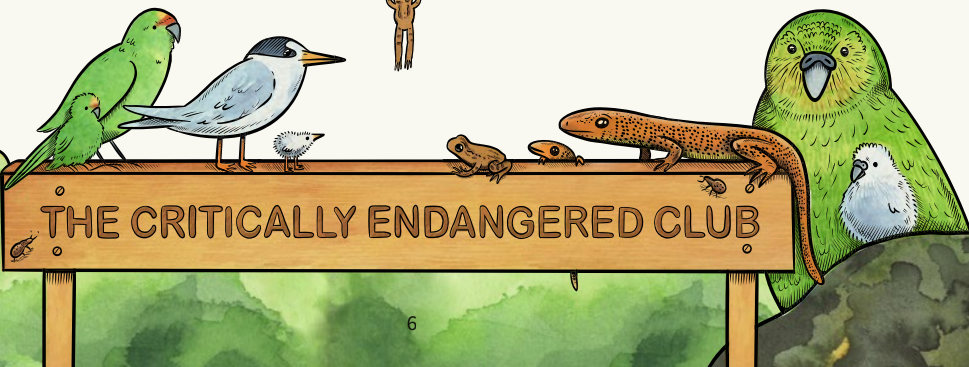
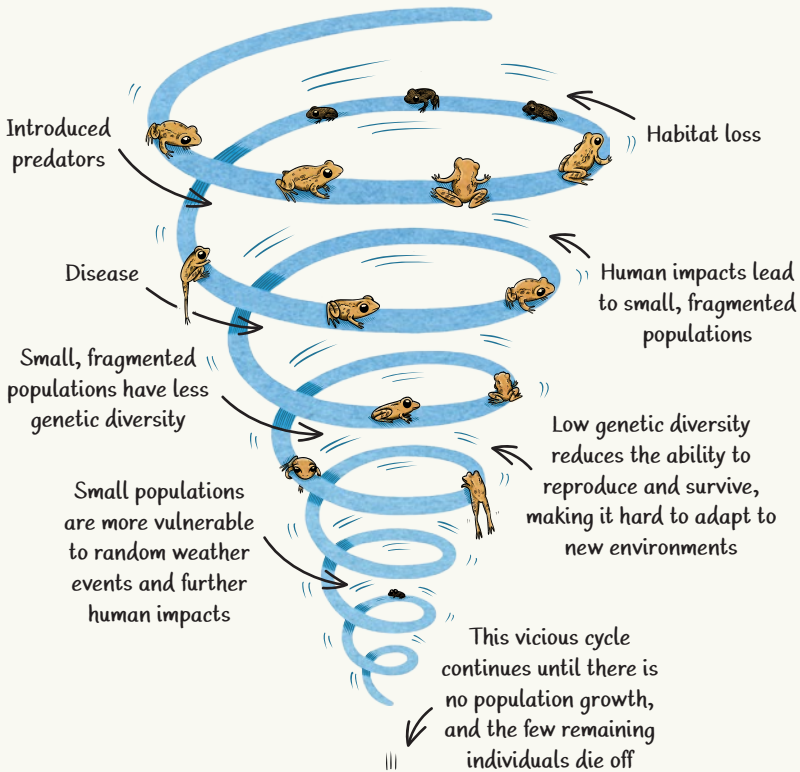


On Takapourewa Stephens Island the Department of Conservation must do tuatara checks to remove any tuatara that love to eat frogs from the fenced frog bank!



Extinction vortex

Many native species, like Hamilton's frog, were devastated by the changes New Zealand experienced after human arrival. Without early conservation action the critically endangered club will grow and these species will become extinct. We can use an 'extinction vortex' to visualise how humans can trigger a downward spiral towards extinction:



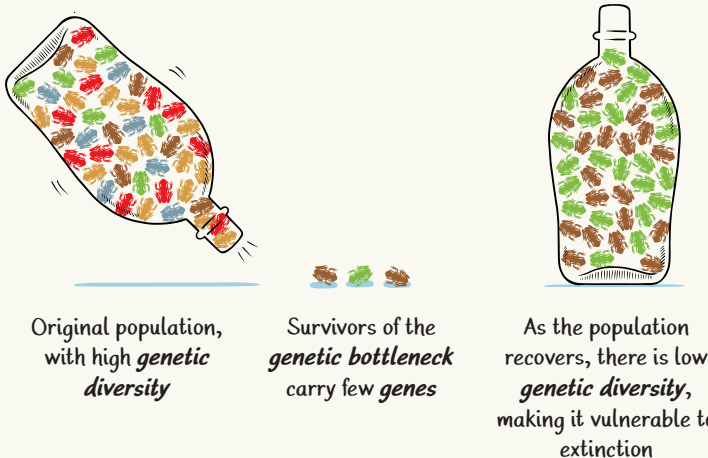
Genetic consequences

An extinction vortex occurs because **genetic diversity** is lost from small populations. This makes them even more vulnerable to extinction. We can use the concept of a '**genetic bottleneck**' to help us understand why **genetic diversity** is so important!

Not all individuals in a species are identical; there are small differences. Hamilton's frogs can have different colour patterns, shorter legs or grow larger than others. These differences are because of many small differences between each individuals' **genes**.

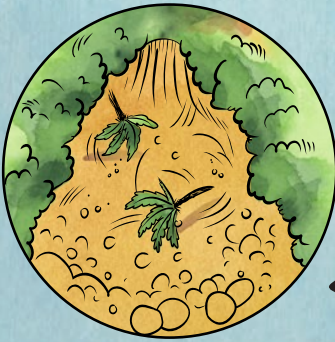
All living things have DNA organised into **genes** which contain the instructions on how to build our bodies. Imagine your DNA as the letters and **genes** as the words in these instructions. The combined differences in the DNA between all individuals of a species make up the **genetic diversity** within that species. High levels of **genetic diversity** in a species mean they can **adapt** to changes in their environment!

Hamilton's frogs used to be widespread across the northern South Island but now they only survive on a few islands. Their population has declined massively! This decline is known as a '**genetic bottleneck**'.

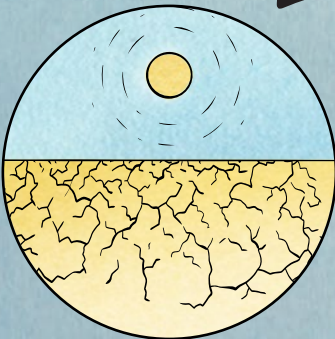


Impact of climate change

Currently, Hamilton's frogs are all in 'one basket.' Almost the entire species is restricted to four islands in the Marlborough Sounds. Hamilton's frogs are not only in danger because of low **genetic diversity**. Being restricted to small isolated islands has its own set of risks!



Extreme weather events or wildfires are another risk. A single extreme weather event could wipe out an entire population! Extreme weather or wildfires are difficult to prepare for as they happen randomly or without warning.



Global warming is a huge threat to Hamilton's frogs now, and into the future. Predator-free islands in the Marlborough Sounds have already become drier and warmer resulting in low soil moisture. In the future, these islands may become unsuitable for Hamilton's frogs!

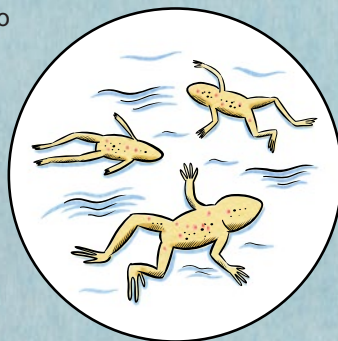




Predator re-incursions are a huge risk to Hamilton's frog. An incursion of mustelids or rodents could entirely wipe out the remaining population on an island. Department of Conservation staff work hard to manage island biosecurity and pest monitoring to prevent re-incursions.



Possible disease outbreaks are a threat to all amphibians. The ***Chytridiomycosis*** disease has caused declines and extinctions of frogs worldwide. Monitoring Hamilton's frog populations includes biosecurity to avoid the accidental transfer of diseases. Testing to find ***chytrid fungus***, which causes the disease, is underway on these islands.

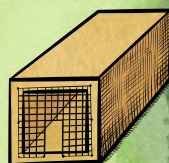


Conservation techniques

All three *Leiopelma* frogs are at risk of extinction. If *Leiopelma* populations are not protected and conserved, they will become extinct. Scientists, conservationists, and iwi work together to protect *Leiopelma* frogs across New Zealand.

Predator control is used in New Zealand to remove or suppress predators to low numbers. This reduces predation pressure and allows native species to recover. There are many clever tools used to control mammalian predator numbers in New Zealand:

Ground based predator control using trapping and bait stations



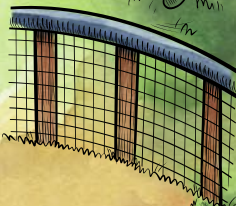
Aerial poison can be used across large areas because it's a cost-effective method to suppress mammalian predators

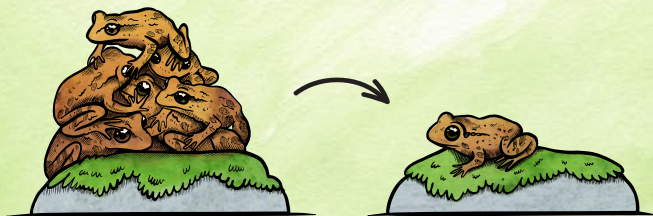


Tracking tunnels and chew cards indicate what predators are present in an area



Predator-proof fences are an amazing tool where possible. They make areas of mainland New Zealand predator-free for conservation





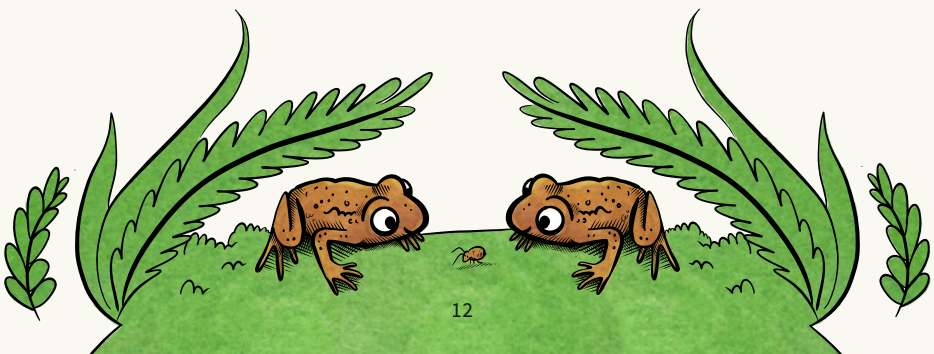
The Hamilton's frog populations on Te Pākeka Maud Island and Takapourewa Stephens Island are monitored during night surveys of standardised grids. This monitoring has been ongoing since the 1970s, providing important information about Hamilton's frogs!

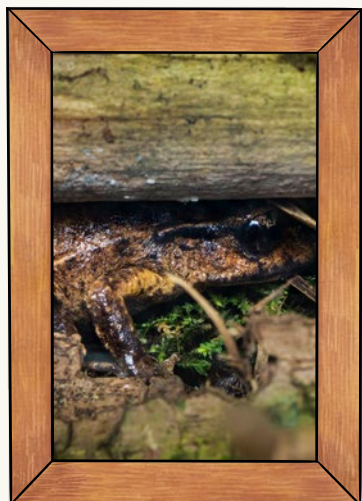
Hamilton's frog has undergone multiple **translocations**. A **translocation** helps protect an endangered species by moving individuals from one location to another, to help restore populations in areas where they've declined or disappeared. The Department of Conservation and iwi have successfully established populations on Nukuwaiata and Motuara Island in the Marlborough Sounds. There's also one mainland population at Zealandia Ecosanctuary in Wellington!



Glossary

<i>Adaptation</i> <i>(adapt)</i>	An evolutionary process by which an organism becomes more suited to its environment.
<i>Chytridiomycosis</i> <i>(Chytrid fungus)</i>	A fungal disease which has devastated amphibian populations globally (pronounced “kit-trid-di-o-my-co-sis”).
<i>Cryptic</i>	An organism is cryptic when it possesses physical or behavioural characteristics that conceal its presence or activity.
<i>Fragmentation</i> <i>(fragmented)</i>	A process where a large continuous, or connected, population is separated into smaller, isolated populations.
<i>Gene</i>	A small segment of DNA that determines a trait; genes are inherited from an organism’s parents.
<i>Genetic bottleneck</i>	A sharp, and sudden reduction in population size which results in a marked loss of genetic diversity.
<i>Genetic diversity</i>	The combined differences, or variation, in the DNA between all individuals of a species or population.
<i>Terrestrial</i>	An organism that lives or grows on land.
<i>Translocation</i>	In conservation, the human-mediated movement of plants or animals from one location to another with the goal of establishing a new, viable population.





How can you help New Zealand's native frogs?

Tell anyone you know everything that you've learnt about Hamilton's frog. The more people that know, the more that people will care!

Keep learning about native frogs. There are three more booklets in the *Pepeketua of Aotearoa* series: *Archey's Frog*, *Hochstetter's Frog*, and *Extinct Native Frogs*. You can also visit the **nzfrogs.org** website.





Hamilton's frog (*Leiopelma hamiltoni*) is one of New Zealand's last remaining native frogs. These special frogs are perfectly adapted to New Zealand's native forest but are struggling! Learn about what threatens Hamilton's frog populations, and how they were affected by human settlement in New Zealand.

With the support of experts and specialists, the NZFrogs team have developed a set of resources to educate, inspire, and help everyone on their journey to become *Leiopelma* native frog kaitiaki!

**CURIOUS
MINDS**

HE HIHIRI | TE MAHARA



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