



NIWA

Taihoro Nukurangi

KĀKĀHI

WHAT DOES SCIENCE TELL US ABOUT
NEW ZEALAND FRESHWATER MUSSELS?



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Cover image: These kākahi have radio transponder tags attached that allow scientists to track each individual to better understand the differences between kākahi species preferred habitat and movement.

Cover photo by Michele Melchior.

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Taonga species such as tuna (freshwater eel), kōura (freshwater crayfish) and kākahi (freshwater mussels) are central to the identity and wellbeing of many Māori.

For generations these species have sustained communities and helped transfer customary practices and knowledge from one generation to the next.

However, many communities are reporting that both the abundance and size of these freshwater taonga are declining.

Te Kūwaha, NIWA's National Centre for Māori Environmental Research, has been working with whānau, hapū and iwi for more than a decade to co-develop methods for the protection, restoration and economic development of these species.





WHAT'S A KĀKAHI AND WHERE CAN YOU FIND IT?

Kākaahi (also known by the names kāeo and torewai) are a native species of freshwater mussel found in Aotearoa.

There are three species of kākaahi identified so far. All three species look slightly different and are found living together, or on their own, in different regions of Aotearoa. Kākaahi live in freshwater environments ranging from small fast-flowing streams to large lakes. Kākaahi are long-lived, with

one species (*Echyridella menziesii*) estimated to live on average between 12 -30 years, but can live as long as 50 - 60 years. Unlike marine mussels that attach themselves to surrounding rocks or other substrates, kākaahi use their foot to move around, anchor themselves and burrow into sediment.



Streams



Lakes

Echyridella menziesii

This species is found in New Zealand's lakes and streams from Cape Reinga in the North Island to Lake Hauroko in the South Island. It can grow up to 11cm long and is often found in fine sand or silt.



Echyridella menziesii

Echyridella onekaka

This special species was discovered in 2006 in a man-made pond in Lake Onekaka, West Nelson. They are only found in the northwest of the South Island. They are very similar in size and shape to *E. menziesii*.



Echyridella onekaka

Echyridella aucklandica

Echyridella aucklandica is mainly found in the North Island, from Waikato northward. They are also found in Whanganui, Lake Wairarapa and Lake Hauroko in Southland. This unusual distribution may be due to translocation by Māori. The adult mussel can grow up to 11 to 13cm long.



Echyridella aucklandica

WHY ARE KĀKAHI IMPORTANT?



Kākahi are a bioindicator in freshwater environments, and are important for the water quality of freshwater environments for many reasons.

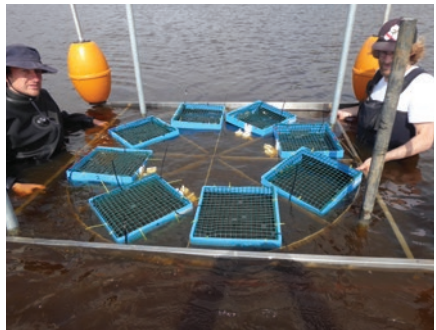
Juvenile kakahi live within the sediment bed of streams, rivers and lakes for at least five years before they emerge.

Young kakahi require a healthy environment to live in, including clean water and substrate that is not too silty and won't clog their gills. This makes them a good indicator of the quality of an ecosystem.

CAN KĀKAHI HELP CLEAN OUR LAKES?

Research is under way to develop and test bioremediation rafts to harness the filter-feeding capacity of native freshwater mussels.

Scientists are studying whether the kākahi on these rafts can assist lake restoration through biofiltration. If so these kākahi rafts could become part of the solution to return degraded, turbid, shallow lakes towards their original clear, native aquatic plant dominated state.

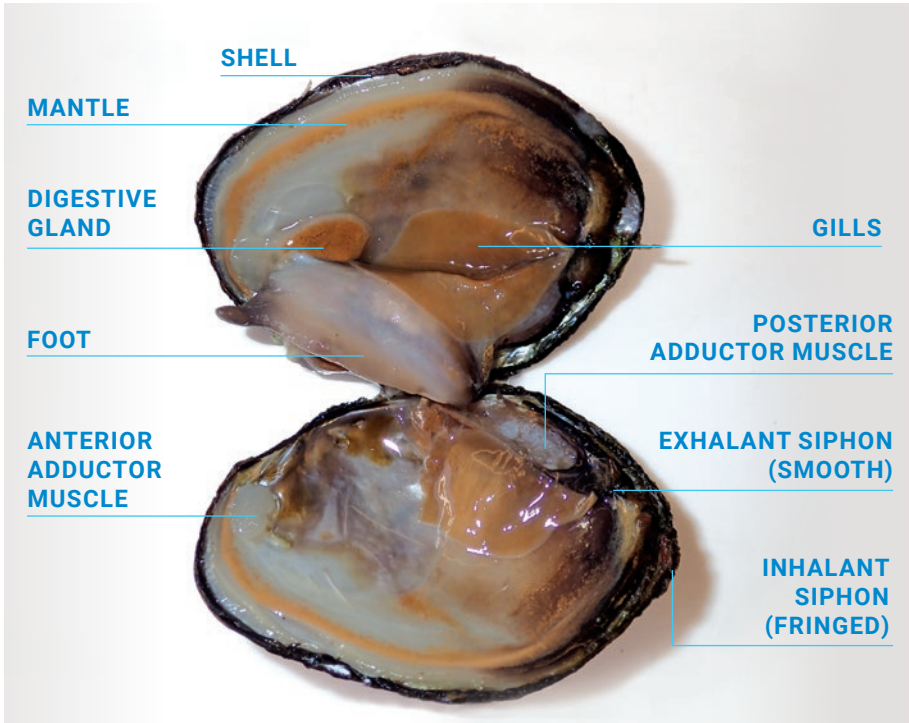


A bioindicator is an organism used as an indicator of the quality of a ecosystem.



Biofiltration is the use of an organism to filter out particles and nutrients.

KĀKAHI ANATOMY





The basic anatomy of a kākahi includes:

Shell

The hard, external part of a kākahi is made mostly of a type of calcium carbonate which offers protection.

Adductor muscles

Large muscles which keep the shell closed.

Mantle

A thin membrane on the inside of the shell which protects the kākahi and secretes the shell.

Visceral mass

The main body (flesh) of the kākahi which contains internal organs such as the heart and intestine.

Gills

Found on each side of the foot is a thin double gill used for the intake of oxygen. This is also where a female kākahi keeps her larvae.

Siphons

There is an inhalant and exhalant siphon. Water for breathing and filter feeding is sucked in through the inhalant siphon, and out through the exhalant siphon. The inhalant siphon of a kākahi is fringed with sensory papillae.

Foot

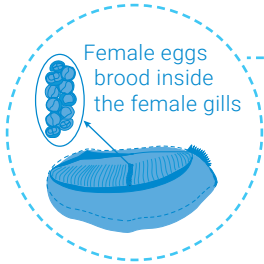
This is a strong muscle that the kākahi uses to move, anchor and burrow. Juvenile kākahi also use their foot to feed.

LIFE CYCLE

Kākahi depend on native fish, because by attaching themselves to the gills or

Eggs

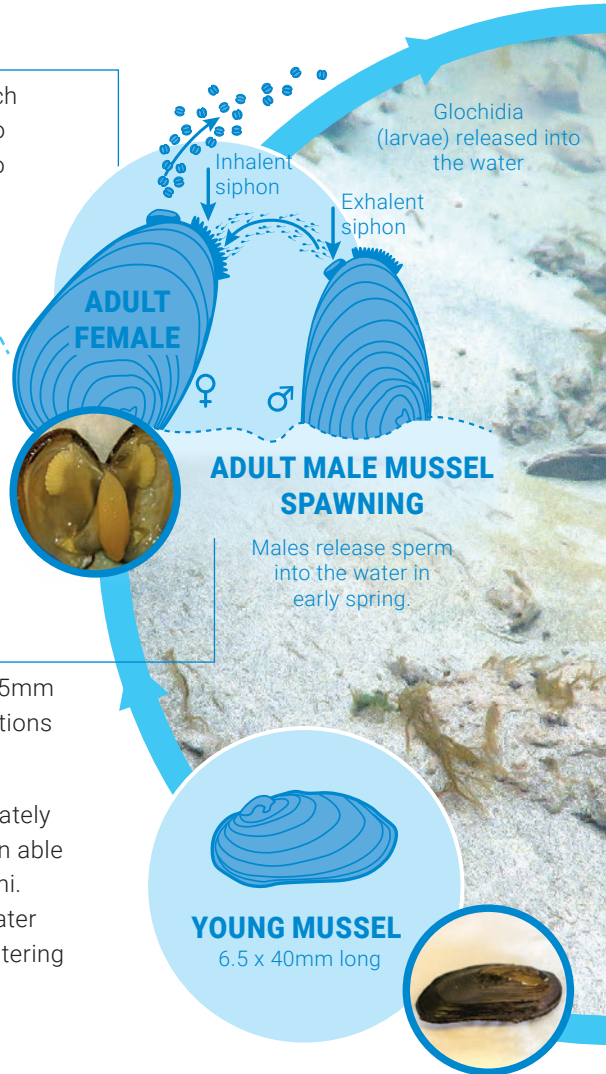
The eggs are fertilised in the gill pouch of the female where they develop into larvae. The female releases them into the water when they are mature – possibly in response to the presence of a fish.



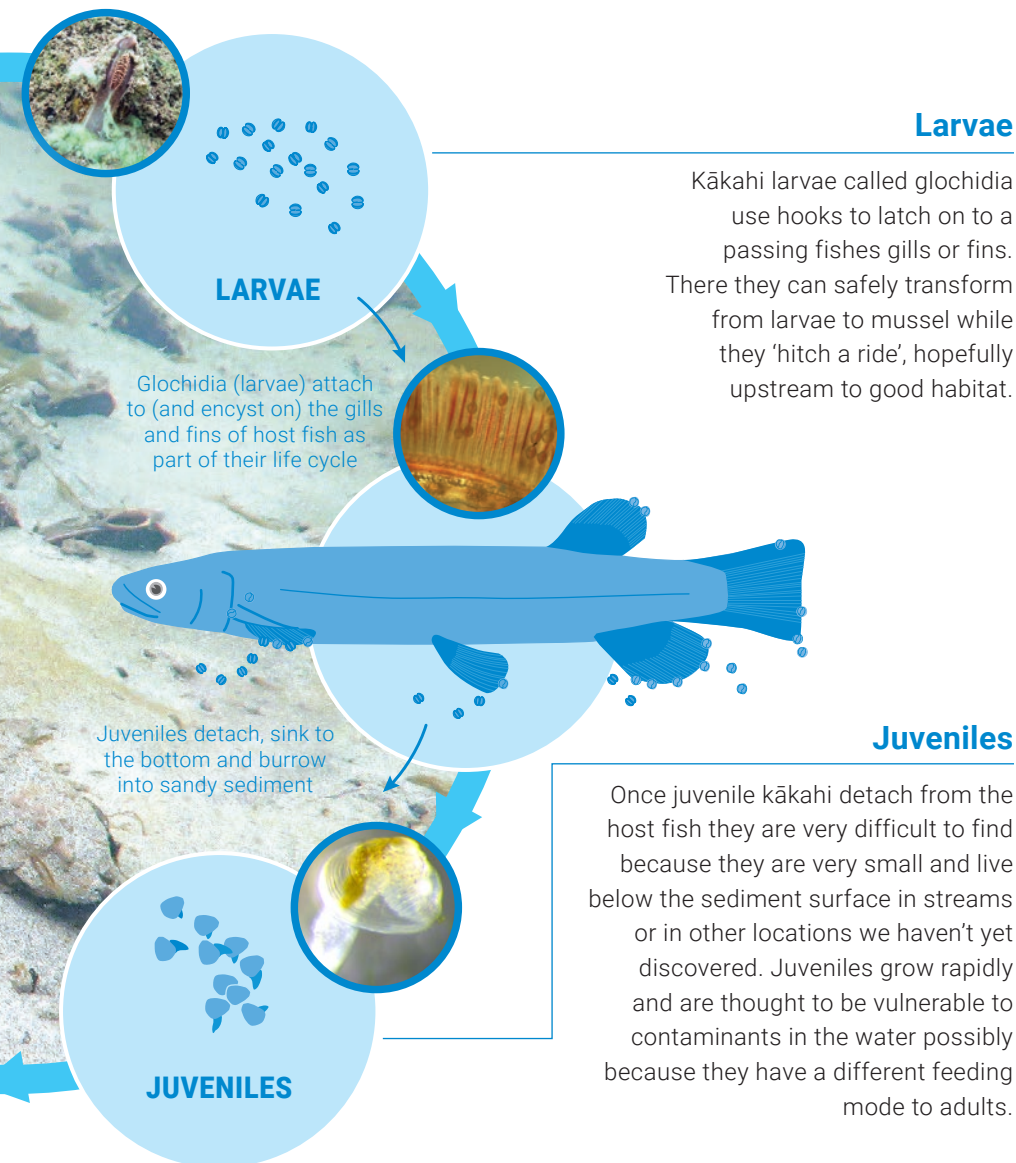
Adult kākahi

Once juveniles have reached about 25mm length, they move into the same locations as adult mussels.

At about four years of age (approximately 40mm long) they mature and are then able to reproduce with neighbouring kākahi. Males release their sperm into the water and nearby females collect it while filtering to fertilise their eggs.



for part of their unusual lifecycle they become fish parasites
fins of the host fish.



Larvae

Kākahi larvae called glochidia use hooks to latch on to a passing fishes gills or fins. There they can safely transform from larvae to mussel while they 'hitch a ride', hopefully upstream to good habitat.

Juveniles

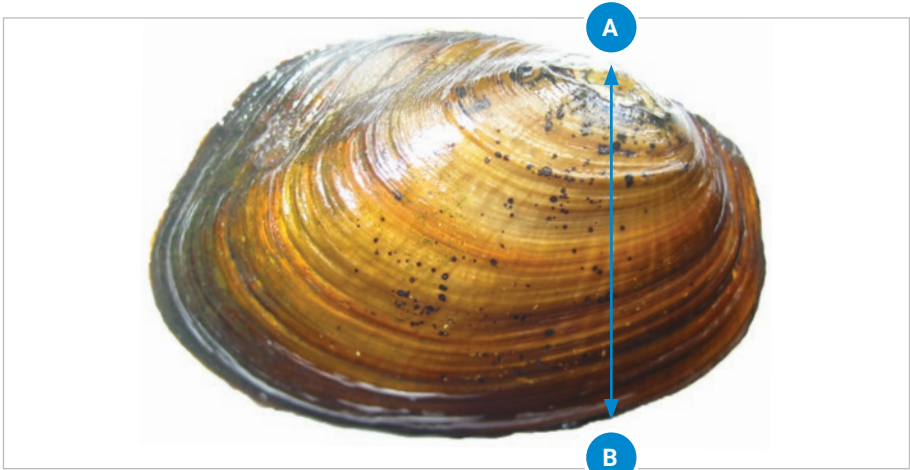
Once juvenile kākahi detach from the host fish they are very difficult to find because they are very small and live below the sediment surface in streams or in other locations we haven't yet discovered. Juveniles grow rapidly and are thought to be vulnerable to contaminants in the water possibly because they have a different feeding mode to adults.

HOW OLD IS THIS KĀKAHI?

You can tell the age of kākahi by looking at the bands produced in their shell.

This is done by cutting the shell from A to B (see photo below) so the bands inside the shell are exposed at right angles.

With the naked eye it is very difficult to see the bands, so they are counted using a microscope like the rings inside a tree trunk.



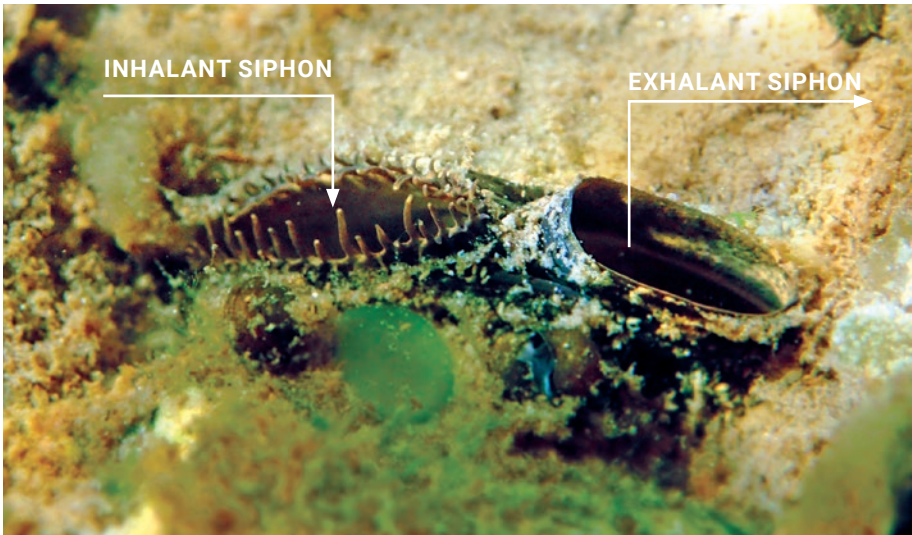
WHAT DO KĀKAHI EAT?

Kākahi are filter feeders and deposit feeders. They feed on algae, zooplankton and other micro-organisms which drift in the water. They also feed on sediment particles covered in bacteria.

Kākahi suck water in through their inhalant siphon and small particles are collected and sorted on the gill. The gill delivers the food to the mouth to be eaten, while wastewater flows out the exhalant siphon.

Adult kākahi are tolerant of some pollutants and will accumulate

metals, organic contaminants and micro-organisms in their flesh and guts. This is why it is important to collect kākahi for eating from clean locations (unaffected by factors like wastewater or stormwater discharges and farming).





KĀKAHI CONSERVATION

Very little is known about the distribution of kākahi, which means that our knowledge of kākahi conservation is likely to be incomplete.

Recent evaluations suggest that all three species of kākahi are under various degrees of threat. Also, there may be more species we haven't discovered yet.



ECHYRIDELLA MENZIESII

! **“At Risk, Declining”**

They occupy a large range (>100km²) but have low to high predicted decline at some locations (estimated at 10 to 70% over 10 years).



ECHYRIDELLA ONEKAKA

! **“At Risk, Naturally Uncommon”**

This is due to their range restriction, however, almost nothing is known about this species.



ECHYRIDELLA AUCKLANDICA

! **“Threatened, Nationally Vulnerable”**

This is due to sparse distribution and failure to produce large numbers of juveniles.



WHAT ARE THE THREATS?

There are several factors that may be causing a decline in kākahi populations.



Habitat loss and change

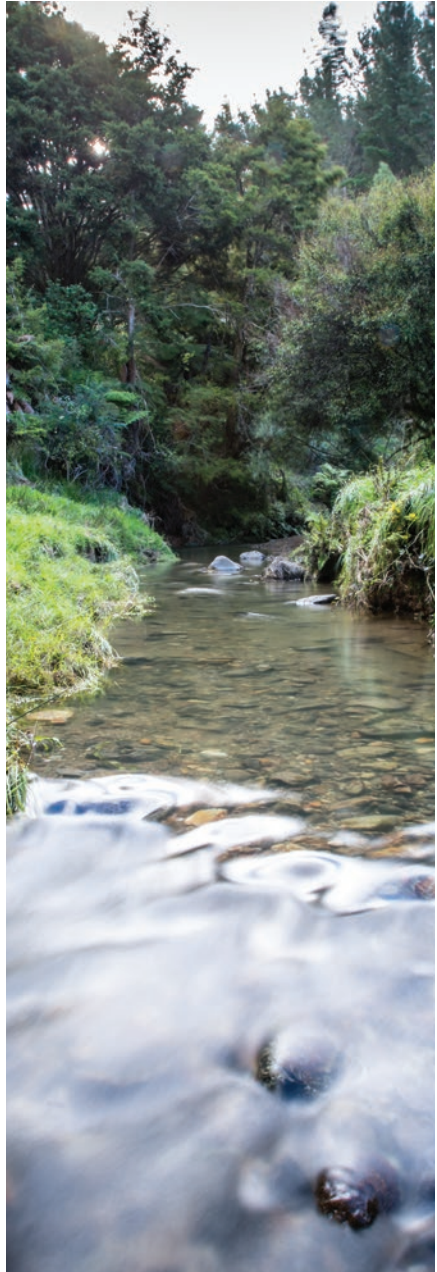
Changes to the natural environment can impact kākahi habitat. This includes the introduction of invasive fish, aquatic plants and rats.

Loss of vegetation-shading streams may increase water temperatures and changes to water flows may reduce kākahi habitat. Less water may dry out habitat, increase water temperatures, and allow smothering algal growth. Sudden increases in water flows can scour away the sandy places where kākahi live.

Pollutants such as excess nutrients, heavy metals, pesticides and sediments can kill kākahi. Juvenile kākahi are especially sensitive to contaminants.

Loss of host fish

The decline of native fish species which are a host for the larval/ glochidia phase of the kākahi life cycle, can decrease juvenile production in kākahi populations.



WHAT CAN YOU DO TO HELP?

The current conservation status is “At Risk” or “Threatened”.

With more information we will be able to better track kākahi populations, and come up with new ways to protect them. If you come across kākahi, please keep records of your observations to the best of your ability by recording:



Location (GPS)



Estimate of abundance



Size and condition



Species



Habitat

All observations can be submitted to the Freshwater Fisheries Database
[https://nzffdms@niwa.co.nz](mailto:nzffdms@niwa.co.nz)



Get involved in kākahi surveys.



Fence and replant the banks of streams and lakes.



Photos are kindly supplied by Stuart Mackay, Michele Melchior, Chris Woods, Karen Thompson, Tracey Burton, Aleki Taumoepeau, Brian Smith, John Clayton, Glenys Crocker, Darcel Rickard, Ngaire Phillips, Bob McDowall and Sue Clearwater.



NIWA

National Institute of Water & Atmospheric Research Ltd (NIWA) is New Zealand's leading provider of climate, freshwater and ocean science. We deliver the science that supports economic growth, enhances human well-being and safety, and enables good stewardship of our natural environment.

Te Kūwaha o Taihoro Nukurangi

Te Kūwaha, NIWA's National Centre for Māori Environmental Research, strives to deliver on Māori research aspirations in a way that reflects Māori values and respects both Māori and scientific knowledge systems. We are working with whānau, hapū and iwi across Aotearoa.

We recognise that whānau and hapū across Aotearoa have an extensive range of names for their freshwater taonga species. In this resource we have drawn on the most commonly used names, but please check with your local hapū for the te reo that is relevant to your area.



For more visit www.niwa.co.nz/te-kuwaha/kakahi

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