

Kākahī

Monitoring Guide



**Prepared for the Wairarapa Moana Wetlands Project, a joint initiative
by Greater Wellington Regional Council, Department of Conservation,
South Wairarapa District Council, Kahungunu ki Wairarapa, Rangitane o
Wairarapa, and Papawai and Kohunui marae.**

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PREFACE

Kākahi, or freshwater mussels, are an important part of Wellington's freshwater environment. They are also a valued resource for local Māori. Unfortunately, once abundant populations of kākahi have declined significantly throughout the region. Today, they are threatened by a range of factors, which may include water pollution and loss of 'host' fish. However, the exact reasons for their decline are not clearly understood.

This guide has been developed to provide information about kākahi in Lake Wairarapa, the Wellington region's largest lake, and to assist those who would like to help conserve kākahi by undertaking monitoring there. It has been specifically designed to further coordinated kākahi monitoring efforts by local organisations concerned with the ecological and cultural health of Lake Wairarapa. Nevertheless, the guide may also be used to help direct kākahi monitoring throughout the Wellington region.

If people monitor kākahi in a consistent way we can gain a better understanding of what threatens them. This will help us to better manage them in the future.

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PART ONE: ABOUT KĀKAHI

What are kākahi?

Freshwater mussels are found throughout the world, including New Zealand where they are most commonly known as kākahi. An unfamiliar animal to most New Zealanders, kākahi are 'bivalves', meaning they have two shells attached by a hinge (Fig. 1). Usually around the size of a large pipi or tuatua, kākahi are most commonly found in soft mud in gently flowing areas of lakes and rivers. They have a muscular 'foot' which they use to partially bury themselves for safety. All three species of kākahi are unique to New Zealand. They are all rounded in shape and dark black in colour, sometimes with green or brown tints. They are also very long-lived – the oldest recorded was estimated to be over 50 years old.

Historically, kākahi have been very important to Māori. They were a source of food and their shells were used as tools. In many areas they remain a valued resource and cultural indicator for Maori. Kākahi also play an important ecosystem role as they filter water. In the past, large beds of kākahi probably helped to maintain the clarity and ecological health of New Zealand's waterways.



Figure 1. The common kākahi, *Echyridella menziesii*

Box 1: Kākahi are important to Māori

The kākahi is best considered as a part of a whole ecosystem because of its contribution to other parts of the freshwater environment. While its role has changed over time, the value of kākahi remains rich as a key wheel in its whitua (designated area).

Traditionally the kākahi has been a giver and user of its ecosystem. It has been a giver as food for various creatures, including people, but also birds. The life cycle of the kākahi relies on freshwater fish, especially the kōaro, to widen its living area to places where they both can feed. This is an example of it taking from other components in its habitat. Observing the rhythms of nature, especially in waterways and in the food basket that is Wairarapa Moana, tangata whenua learnt the value of seasonal cycles. The repo (wetlands) was a source of life in which kākahi played a big part, as was the kāuru (headwaters), where much of our whitebait migrate to.

In the bush covered history of our land, the ability of the kākahi to cleanse water of sediment would have been of minor importance. Now, in times of extensive grasslands, kākahi is not a sole panacea, but it performs a natural process that can contribute to clean water. In the heady days to come, where integrated catchment approaches seek to deal with water quality alongside considerations that include indigenous fauna, Māori can look to the humble kākahi as an asset for the whole of a modern New Zealand community.

*Contributed by Rawiri Smith of
Ngāti Kahungunu ki Wairarapa*

Kākahi in the Wellington region

In the past 10 years kākahi have been found in a number of rivers and lakes within the Wellington region. (Fig. 2). Most of these sites are in the Wairarapa area, although populations also exist in parts of the Kāpiti Coast and in Wellington City. There are a few sites in which only shells have been found. These may indicate where a previous population has died out or where live specimens are yet to be found.

Two species of kākahi are found in the Wellington region. These are the **common kākahi** (*Echyridella menziesii*) and the **'Auckland' kākahi** (*Echyridella aucklandica*). To date, most kākahi found in Lake Wairarapa have been the common kākahi, but 'Auckland' kākahi have also been found in a small area at the northern shore of the lake (Fig. 3).

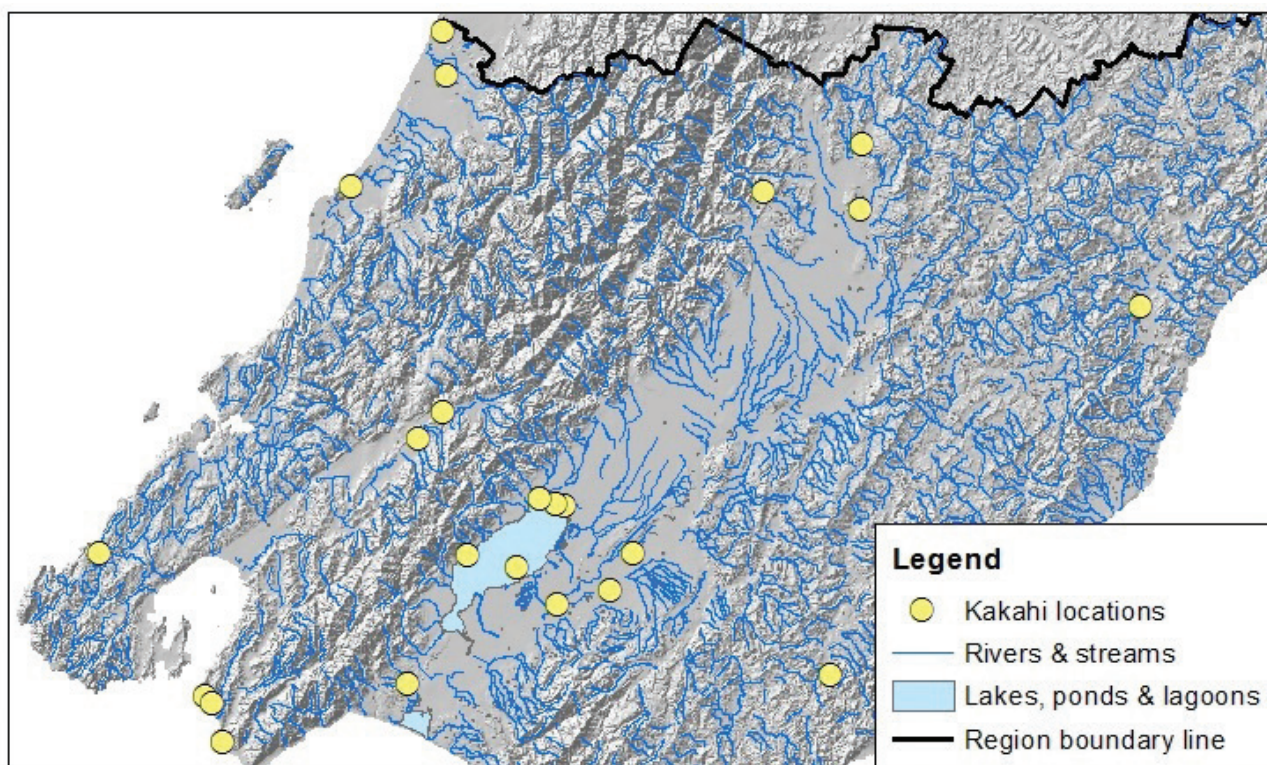


Figure 2. Known kākahi locations within the Wellington region

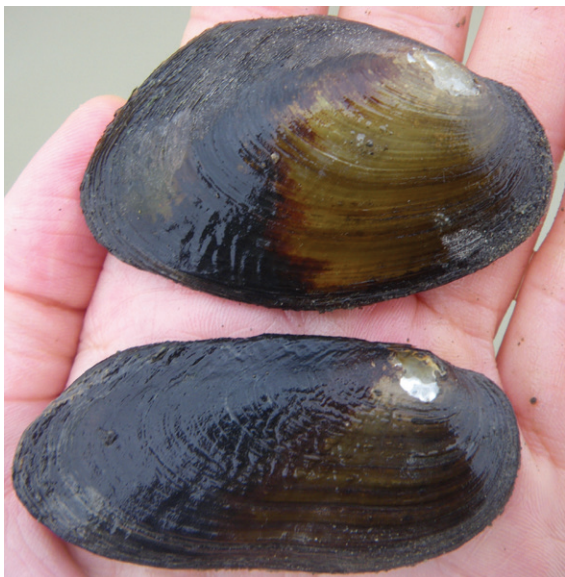


Figure 3. The two kākahi species present in the Wellington region. Top: the common kākahi; bottom: the 'Auckland' kākahi



Figure 4. A kākahi living in the muddy bed of a lake - a distinct track through the mud shows that this kākahi has been quite mobile!

Where kākahi live

Kākahi usually live partially buried in mud and sand in the beds of lakes and rivers (Fig. 4), but they are also found in areas with cobbly or stony bottoms such as at Lake Pounui in the Wairarapa. Kākahi are found in a range of water depths and temperatures.

Very little is known about what determines the waterways in which kākahi choose to live. Some research has indicated that kākahi distributions may be influenced by factors such as wave action, oxygen availability and the presence of toxins. If they don't like where they currently live they can move elsewhere using their muscular 'foot'.

Diet and feeding

Kākahi eat very small pieces of organic matter that are suspended in the water, such as algae and bacteria. They pump a steady stream of water through two tube-like siphons extending out through the gap in their two shells (Fig. 5). Small edible particles are filtered out of the water and eaten. Inedible material is clumped together and ejected as 'pseudofaeces' (or false poos!). This 'filter-feeding' lifestyle means that kākahi pump enormous quantities of water through their siphons. A study in a South Island lake estimated that the local kākahi population was filtering the entire volume of the lake every 32 hours!



Figure 5. Kākahi (covered in dense algal growth), showing tube-like siphons through which they collect food particles and eject wastes.

Predators and parasites

Apart from humans, known predators of kākahi include wading birds and kōura (freshwater crayfish). Tuna (eels) and other fish species may also prey on kākahi and land-dwelling animals such as rats probably eat them too. A type of insect larvae is a parasite for some kākahi populations (Fig. 6). The larvae burrow in between the kākahi's two shells, sometimes causing shell deformities.



Figure 6. Kākahi with shell deformation which may have been caused by parasitic insect larvae

Kākahi lifecycle

The kākahi lifecycle (Fig. 7) is complex and not all of it is understood. However, some aspects of their lifecycle are well known. While most saltwater mussel species expel eggs and sperm for external fertilisation in the water, kākahi keep their eggs inside their shell to develop. The female kākahi takes in the male kākahi's sperm through one of her siphons, and her fertilised eggs are then held internally until they develop into larvae called 'glochidia'.

About the size of a grain of sand, these glochidia are then 'sneezed' out of another of their mother's siphons, whereupon they latch onto a passing fish using a hook at the tip of their shell. Native kōaro (a galaxiid fish) are thought to be important 'hosts' for these glochidia, but they have also been found on tuna, bullies (a type of freshwater fish) and trout. The glochidia live on the fish for a few weeks, after which they drop off. A developmental strategy like this provides a useful means of transport for kākahi — allowing population growth while avoiding overcrowding. It also means that kākahi can move upstream in flowing waterways.

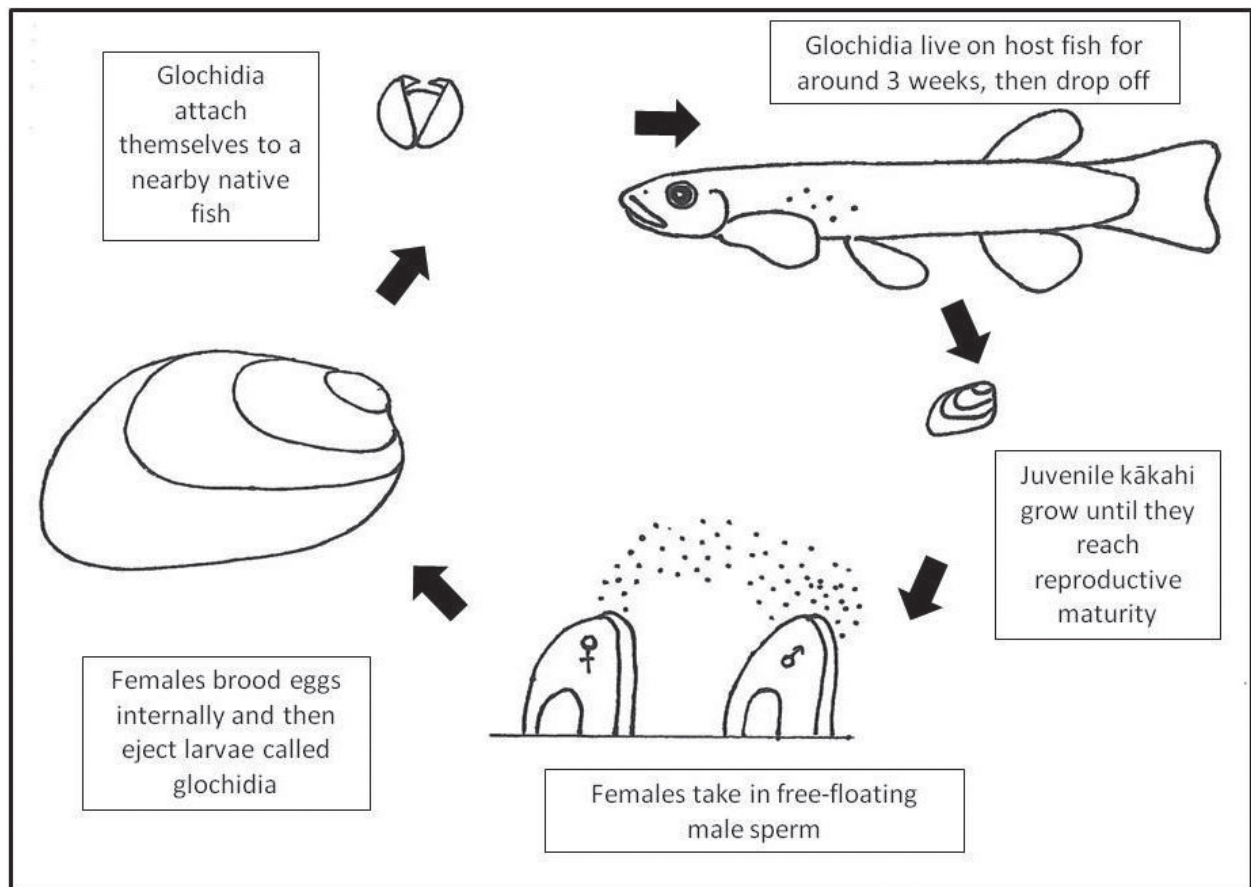


Figure 7. The lifecycle of the kākahi

The next stage of the kākahi life cycle is a mystery. No one knows for sure how, when or where the glochidia develop into adults. The smallest wild kākahi on record was about 5 millimetres long. Where kākahi smaller than this live is currently unknown. An absence of juvenile kākahi sightings may be due to a scarcity of small kākahi, or related to different environmental requirements between adults and juveniles. However, as kākahi are so long-

lived, populations of adults will live on in an area for many years after juveniles last joined the population. This makes it hard to know when a population is in trouble. Recent research in Lake Wairarapa found only older kākahi. The report warned that without effective intervention kākahi could decline to extinction in the lake within 50 years.

Threats to kākahi

Kākahi populations are in decline throughout the Wellington region. Although no one knows for sure, this decline has been attributed to a number of causes including sedimentation, nutrient and chemical pollution, water abstraction and a lack of 'host' fish species. These factors are all evident in Lake Wairarapa and explained briefly below.

- **Sedimentation**

A large quantity of small rock and soil particles (known as 'sediment') is suspended in the water in Lake Wairarapa. This makes the appearance of the lake cloudy in colour. The sediment results from erosion of soil on surrounding land which has been cleared of its vegetation cover. The beds of aquatic plants that used to grow in the lake have also died off so their roots no longer hold the sediment in place. Some of this sediment may be clogging the delicate feeding mechanisms of juvenile kākahi.

- **Pollution**

Kākahi are sensitive to a range of pollutants. Some of these can enter waterways through human wastewater discharges, and from fertiliser and farm animal waste runoff; both of which are current issues in Lake Wairarapa. Increased nutrient levels in the lake have also promoted the growth of dense weed beds which may take over the areas available for kākahi to occupy.

- **Water abstraction**

Water is removed (or 'abstracted') from some water bodies due to the diversion of rivers, or for the irrigation of surrounding land. These changes can lead to the drying out of the areas in which kākahi like to live. They can also lead to shallower, warmer water in places that might otherwise be suitable for kākahi. Irrigation and diversion have both affected Lake Wairarapa. The diversion of the Ruamahanga River in the 1960s reduced the level of the lake and water levels have been further reduced by ongoing abstractions for irrigation.

- **Lack of host native fish species**

Kākahi glochidia are dispersed on the gills, fins and skin of passing fish. Although many fish species act as 'hosts' for these glochidia, the native kōaro may be a particularly important host (Fig. 8). Unfortunately, kōaro are now very rare in Lake Wairarapa. This may make it harder for kākahi to move into new areas in the lake or to replenish existing areas.

Kākahi conservation

It is likely that the main problem facing kākahi populations is a lack of native host fish species to facilitate successful reproduction. Big changes need to be made in order to restore kōaro (and other galaxiid fish) populations to Wairarapa Moana. It is possible that, in the meantime, captive breeding and reseedling of kākahi may prevent population extinction.

Individuals can help kākahi populations throughout the Wellington region by raising awareness of their existence and threats, advocating for sustainable land use practises, and by joining a community group to help with kākahi population monitoring.



Figure 8. The native kōaro (*Galaxias brevipinnis*) a host species of the kākahi

PART TWO: HOW TO HELP MONITOR KĀKAHI

Introduction

This guide has been designed to assist coordinated kākahi monitoring efforts by local organisations concerned with the ecological and cultural health of Lake Wairarapa. However, the guide may also be used to help direct kākahi monitoring throughout the Wellington region. Results from monitoring will help us to learn more about kākahi and contribute to informed decisions about how to conserve them in future.

Kākahi monitoring involves wading in the shallow water of lakes and rivers and hand-collecting the kākahi living there. Information on these kākahi - such as their species and length - is then recorded on a Kākahi Monitoring Sheet (see Appendix 2) before the kākahi are returned to the water. Monitoring is carried out by pairs who each search a minimum of one area of river or lake bed for kākahi for 30 minutes.

Kākahi monitoring involves three stages: (A) planning, (B) collecting and (C) recording. These are each outlined below. If you are contributing to kākahi monitoring as part of an organised activity each of these stages will be explained to you during training but you should read through them in any case. If you are contributing to kākahi monitoring independently these stages are important to read in advance of monitoring as you have a few important decisions to make.

A. Planning your monitoring

Planning is an important stage of kākahi monitoring. A good plan will ensure that you are able to collect the right information and stay safe.

1. **Decide on a collecting site.** You can monitor kākahi at any publicly accessible freshwater body in the Wellington region. Nevertheless, because kākahi are only known at some locations in the region you will have most luck finding them at, or near to, the sites identified in Figure 2 (p. 3). Identify a potential site on a map

and determine how you will get there (again, ensuring that it is publicly accessible).

2. **Check your site.** Ideally you will return once a year to the same site, so ensure that the site is comfortably accessible and safe. Check that the site has a suitable kākahi searching area that can be safely accessed. Good sites will also have a flat, clear area within easy walking distance to set out your equipment and carry out measurements. Note any hazards at the site and plan how you will manage them. Hazards may include things like fast water currents, stretches of deep water, and steep terrain.
3. **Plan your monitoring day and time.** Monitoring should be done during daylight hours. It is easiest and safest to do during summer months when water temperatures are warmest but, to be SunSmart, avoid midday hours when the sun is at its hottest.
4. **Determine who will be involved.** A minimum of two people is required. The more people involved the greater the level of coordination necessary. If you are intending to have a large group (e.g., eight or more people) then one person may need to work as a team coordinator to ensure that your monitoring effort is well-organised.
5. **Decide how long you will monitor.** It takes about 1¼ hours for a pair to search one 50 metre search area for kākahi and record their findings on a Kākahi Monitoring Sheet. This includes 30 minutes for the survey and about 45 minutes to record the information. This is therefore the minimum time required to complete a kākahi survey. Where possible, four kākahi surveys at each location is recommended as it allows the information collected to be statistically analysed. Four surveys would involve searching a total length of river or lake bed of 200 metres and the completion of four Kākahi Monitoring Sheets, one for each 50 metre search area. This could be completed in about 1¼ hours if four pairs are involved (working simultaneously), or about five hours if only one pair is involved (completing survey areas one after the other)
6. **Pack your kākahi monitoring equipment** (see Box 2) and remember to stay safe (see Box 3).

Box 2: Equipment needed

Very little equipment is required to monitor kākahi. Each pair will need:

1.	Two collection bags (see Appendix 1)
2.	A watch or other timing device
3.	A set of vernier calipers. These can be purchased from hardware stores.
4.	Two stakes
5.	Kākahi Monitoring Sheets
6.	A pencil
7.	Optional: A 50 metre measuring tape
8.	Optional: A handheld GPS

Note: If you are contributing to kākahi monitoring as part of an organised event this equipment may be provided. Please check this with the organiser prior to the event.

B. Collecting kākahi

While kākahi collecting is an easy and enjoyable activity, it is important to follow a defined collecting process. This process ensures that the recorded information is consistent and that kākahi are handled safely.

1. Unpack your equipment and set up for monitoring. Upon arriving at your site, re-check for potential hazards and plan how they will be managed. If any hazards pose a significant and unavoidable risk to your safety move to an alternative location or re-schedule the monitoring.

2. Define a separate search area for each pair. Each search area covers a 50 metre length of river or lake margin. The searchable area includes all of the 'wadeable' (no deeper than your mid-thigh) lake or river bed that can be accessed from that margin. There is no need to measure the length precisely.

Instead, simply place a stake at the start of your intended search area and walk 50 large paces along the river or lake margin (but use a measuring tape if you have it). Place your other stake in there. The area in between the two stakes defines your search area.

3. Begin searching for kākahi. Start timing your 30 minute search period either by noting the current time or by setting a countdown timer on your watch. Wade slowly through the water - it is not a race and there is no need to hurry (Fig. 9). Each pair of collectors should stay together. If the water clarity is good you may be able to spot kākahi, otherwise you will need to search for kākahi by feeling with your feet and hands.

4. Collect kākahi. Whenever you encounter a kākahi, gently remove it and carefully place it in the bottom of your collection bag. Do not drop it into the bag as kākahi shells are fragile and could be damaged. The aim is not to cover your area in the time allotted, but simply to move freely throughout the area, collecting as you go. Collect any kākahi you find regardless of its size. It is not a competition to find the biggest. In fact, records of small kākahi may prove to be the most valuable.

5. Take only 50 kākahi. Once your pair has found 50 kākahi in total you can stop counting and return to shore (but note the time you find your last kākahi as this will be recorded later), otherwise keep searching until the 30 minute search period is over. Keep a count of the number of kākahi your pair has retrieved by calling out to your partner when each kākahi is placed in your bag. At this stage just take a mental note if any empty kākahi shells are found, particularly if no live individuals are collected. This will be noted in your records later.

6. Return to shore. At the conclusion of your search time, move back to the river or lake bank. Try to keep the kākahi as cool and wet as possible. Ideally you should leave your bag of kākahi submerged in cool water until you begin your recordings. When you remove the bag from the water for recordings keep it shaded from the sun. Remember to also handle the kākahi shells gently as they are fragile.



Figure 9. A pair searching for kākahi near the northern shore of Lake Wairarapa

Box 3: Remember to stay safe

Although kākahi monitoring is generally a safe activity, some precautions should be taken to ensure the safety of all participants:

- **Always work in pairs.** Remember to check that your partner is comfortable and feels safe throughout monitoring.
- **Stay in the shallows.** Kākahi monitoring is for shallow waters only. You are not expected to have to swim or dive to find kākahi. We recommend going no deeper than your mid-thigh.
- **Strong swimmers only.** Although kākahi monitoring is often undertaken in shallow, slow-moving waters, all participants should be confident swimmers. This is because water depths in lakes and rivers can be unpredictable and searchers can easily find themselves out of their depth. Water currents are also difficult to judge. Any children should be closely supervised regardless of their swimming ability.
- **Wear appropriate clothing.** In addition to togs, we recommend wearing long-sleeved thermal tops and leggings, a sunhat and sunglasses as a minimum. Also bring a towel and a change of clothes.
- **Apply sunblock.** Remember, you can get sun burnt on cloudy days too, especially when working in the water.
- **Watch for signs of hypothermia.** Even on a sunny day you can get surprisingly cold wading in the water for extended periods. If at any point you begin feeling uncomfortably cold or tired leave the water immediately.
- **Pack a first aid kit.** Plasters are particularly handy for tending to minor cuts.
- **Bring plenty of food and water.** Searching for kākahi will work up an appetite!

C. Recording your data

Complete a Kākahi Monitoring Sheet for each 30 minute period searched (see Appendix 1). Nominate one person to handle the kākahi and one person to fill out the sheet. Kākahi will be transferred back to the water after they have been identified, measured, and classified.

Complete a Kākahi Monitoring Sheet whether you find kākahi during your search period or not. Remember, a lack of kākahi found during a survey is as important to record as an abundance.

First, fill in the Details section of the Kākahi Monitoring Sheet as follows:

1. **Date.** Enter the day's date.
2. **Searchers.** Record the names of both kākahi searchers.
3. **Contact person.** Record the name and contact details of the person who will be responsible for the Kākahi Monitoring Sheet. This is the 'Contact Person'. This person does not have to be one of the searchers. Record this person's postal address, primary phone number and e-mail address.
4. **Start time.** Record the time that you began your 30 minute search.
5. **Duration.** If you found 50 kākahi before the end of your 30 minute search period note how long you searched. Otherwise, record the duration as 30 minutes.
6. **Number of kākahi found.** Record the number of kākahi found during your search period.
7. **Name of water body.** Enter the name of the water body you searched for kākahi. For example, 'Lake Wairarapa' or 'Boundary Creek'.
8. **Location.** Describe the location searched (e.g., Lake Domain Reserve). Using an 'X', indicate the approximate location searched on a sketch map. If you have a GPS enter the coordinates of your search area or a nearby street address.
9. **Photo Number.** If you have a camera, take a photo of your site showing the area searched. Note down the photo number from your camera.
10. **Kākahi shells found.** Indicate whether you found empty kākahi shells in your search area or on the nearby stream or lake bank by entering 'Yes' or 'No'. Please complete this column even if you found live kākahi.
11. **Notes.** Enter any kākahi-related information that you believe may be useful for others to know. For example, you might note the type of 'substrate' (e.g., rocks or mud) searched, or any observations of kākahi predators, such as tuna or koura. If you find empty shells with one end bitten off it may be a sign of rat predation. If you find kākahi shells only it would be useful to estimate the range of shell sizes found.

Next, record the species, length and erosion class of each kākahi in your bucket in the Data section of your Kākahi Monitoring Sheet:

1. **Species.** Determine whether the kākahi is an 'Auckland' or common species (see Fig. 3). The common species is far more common than the 'Auckland' species. If your mussels all look the same as each other then you have probably found only common kākahi. When you have the two species together they look quite different. The 'Auckland' kākahi has two roughly parallel sides and is typically more 'tubular' than the common species. If you are not sure of the species that you have collected then record it as 'unknown'.
2. **Length.** Using your vernier calipers, measure the length of the kākahi to the nearest millimetre (see Fig. 10).

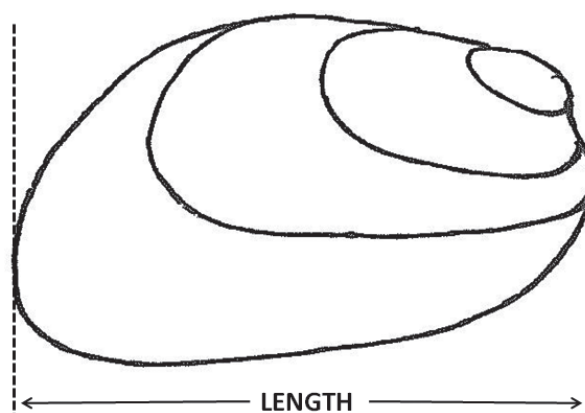


Figure 10. How to measure a kākahi shell

3. **Erosion class.** Classify the kākahi into one of four classes based on the presence of erosion on each of its four visible shell sections (see Figs. 11 and 12). If no erosion is noticeable record it as 'None'.

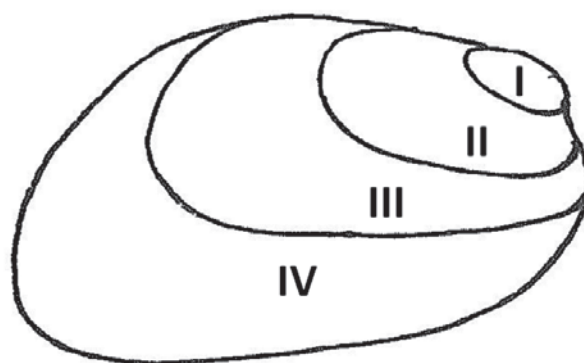


Figure 11. The four major sections of a kākahi shell

Your Kākahi Monitoring Sheet is complete when all the kākahi you have collected have been identified, measured, classified and recorded.

Finally, return the kākahi to the section of river or lake bed they were collected from. Remove the kākahi from the bag by hand and gently place them on the bed of the lake or river. Do not upturn the bag or throw the kākahi back into the water as this can damage their shells.

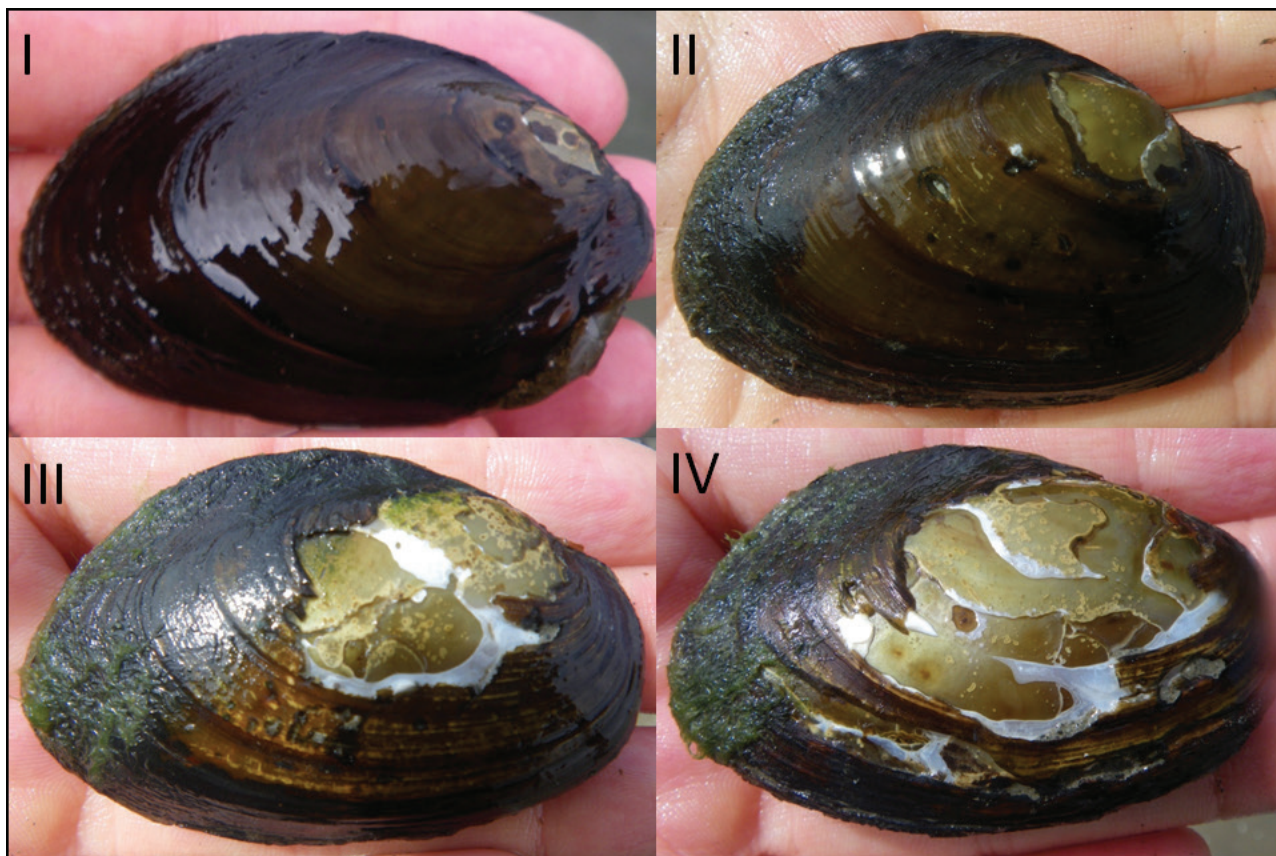


Figure 12. Examples of the four different levels of shell erosion used to classify kākahi

What to do with your monitoring sheets

If you are contributing to kākahi monitoring as part of an organisation, submit your completed Kākahi Monitoring Sheets to the group facilitator. If you are undertaking monitoring independently then you should nominate one person to keep track of your completed Kākahi Monitoring Sheets. This person should keep them in a safe place. If you have taken photos of your site/s then these should also be stored safely, ideally in digital format (e.g., on a home computer).

If you would like to contribute your information to region-wide studies on kākahi you can send your completed Kākahi Monitoring Sheets to the Greater Wellington Regional Council. There are two ways of sending in your information. Either,

- 1) Post them to:

**Biodiversity department
Greater Wellington Regional Council
PO Box 11646
Manners Street
Wellington 6142**

If you have taken photos, please include prints of these. On the reverse of each print write the photo number that corresponds with that identified on each respective Kākahi Monitoring Sheet.

Or,

- 2) Scan and e-mail them to:

biodiversity@gw.govt.nz

If you have taken photos, please attach digital copies of these to your e-mail. Ensure that the photo numbers on those copies correspond with those identified in your Kākahi Monitoring Sheets.

Thank you for contributing to the management and restoration of our freshwater ecosystems – we are inspired by community involvement. If you have any suggestions about how to improve this monitoring, please let us know.

APPENDIX 1. How to make a collection bag

A collection bag can be improvised from a number of different materials. The design below is one option. Other suitable options are the use of plastic baskets or flax kete (kits).

1. Use a regular-sized, breathable cotton tea towel.



2. Fold in half and sew as shown in the picture.



3. Make a handle using a 'garden tie' – stretchy fabric string available at most garden centres.



4. Sew the middle of a one metre length of garden tie to the outside top corner of the bag, adjacent to the opening. Knot the ends of the ties.



5. The finished bag. When worn tied around the waist or shoulders, it will keep kākahi wet and will protect them from the sun if the bag is out of water for a short time. The tall, floppy shape of the bag will help ensure that kākahi do not fall out once they are placed inside.



APPENDIX 2. Kākahi Monitoring Sheet

DETAILS

SEARCHERS: _____

CONTACT PERSON: _____

Address: _____

Phone no: _____

E-mail: _____

DATE: _____

START TIME: _____

DURATION: _____

NUMBER OF KĀKAHI FOUND: _____

NAME OF WATER BODY: _____

LOCATION:

PHOTO NUMBER: _____

EMPTY KĀKAHI SHELLS FOUND IN SEARCH AREA (CIRCLE ONE): YES NO

EMPTY KĀKAHI SHELLS FOUND ON STREAM/LAKE BANK (CIRCLE ONE): YES NO

NOTES: _____

DATA KĀKAHI MEASUREMENTS

No.	Species (common, Auckland or unknown)	Length (in millimetres)	Erosion class (I, II, III, IV, or None)
1			
2			
3			
4			
5			
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No.	Species (common, Auckland or unknown)	Length (in millimetres)	Erosion class (I, II, III, IV, or None)
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NOTES

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Please recycle
Produced sustainably