

4.1 WĀTAKIRIHI TE HUAKITA O TE WĀTAKIRIHI BACTERIAL QUALITY OF WATERCRESS

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THE IMPORTANCE OF WĀTAKIRIHI

Wātakirihi, or watercress (also called kōwhitiwhiti, *Nasturtium officinale* and *N. microphyllum*) is a highly prized food source for tangata whenua (indigenous people) in Aotearoa New Zealand. An aquatic or boggy ground plant associated with drains, small creeks, wetland streams, and the calmer edges of rivers, wātakirihi is a vigorous plant, provided there is a good level of water quality (i.e. lack of sedimentation). It is a member of the mustard family and is highly regarded for its medicinal properties as well as its taste in many cultures across the world. As avid botanists and gardeners, tangata whenua were quick to identify its properties, and it now forms a major component of many traditional dishes. Harvest sites are highly coveted and sometimes known only to whānau (family/ies).

Since the onset of intensified land use – such as farming, and associated practices of draining – harvesters of wātakirihi comment that populations and the quality of wātakirihi have fluctuated dramatically at most sites. Farm drains associated with farming can have populations of the plant, but there is a higher risk of pollution and bacterial infection (such as *Escherichia coli*), which can make it unsuitable for consumption.

Wātakirihi is also a very good accumulator of nitrogen, and has been used in some instances for nitrogen 'scrubbing' (removal via plant uptake into roots and leaves) in freshwater feeder systems adjacent to farmland. Discussions with tangata whenua across the motu (country) indicate that areas once used for harvest are becoming fewer, possibly due to sedimentation and also pugging of habitat. Sedimentation is where high loads of silts, clays, and other soil components (often loaded with high concentrations of nitrogen, phosphorus, potentially pathogenic microbes, and other nutrients) are deposited on the plants as the waterbody settles out in the calmer areas.

Like other plants, wātakirihi makes its food via photosynthesis in leaf cells, so heavy sediment deposits can greatly affect this process by smothering leaves and blocking sunlight. Pugging is caused by the movement of stock along a riparian margin, which can also create small slips that fall onto wātakirihi beds and smother them.



Wātakirihi (*Nasturtium officinale*). Photo: © Jon Sullivan, some rights reserved (CC BY-NC)



Wātakirihi (*Nasturtium microphyllum*). Photo: Trevor James



Wātakirihi (*Nasturtium microphyllum*). Photo: Trevor James

NATIVE WĀTAKIRIHI

Among the earliest botanical surveys conducted by the first settlers are references to a 'native cress' – probably *Rorippa palustris* and *R. divaricata* (now a threatened plant). *Rorippa palustris* is the more widespread cress found in repo (wetlands) across the motu. These native watercress were identified as wātakirihi or kōwhitiwhiti, but may also be known as panapana, ponui, and matangaoa. They can colonise similar habitats to the more common exotic wātakirihi (*N. officinale*, *N. microphyllum*), although this does not necessarily mean the exotic wātakirihi has outcompeted them.

All the native cresses are recognised as being edible, and have been suggested as a great addition to 'indigenous summer salads', along with Cook's scurvy grass (traditional name of 'Nau'), native celery, and native spinach (traditional names include kōkihi, rengamutu, tūtae-ika-moana). All these indigenous summer salad plants are usually also associated with coastal and estuarine wetlands.



Kōwhitiwhiti (*Rorippa palustris*). Photo: Jeremy Rolfe

IMPACTS OF WĀTAKIRIHI LOSS ON TRADITIONAL PRACTICES

Wātakirihi is more than simply a foodstuff. Tikanga (values and practices), the correct cultural way of doing things, are handed down to each new generation. Embedded in these practices are stories and broader environmental management systems unique to the whānau, hapū (subtribes), and iwi (tribes), and their respective rohe (region).

One of the easiest impacts to measure is the decline in the use of traditional names for our valued plant and animal species across each generation. This decline in turn can generate a gradual decline in the knowledge of the origin and purpose of the name. In some cases, the name of a plant, for example, provides clues to a whakapapa (connections between and within species) that can also become hidden as the name disappears from the local reo (language).

Traditional names, such as those associated with wātakirihi, can be lost for a range of reasons including localised extinction or increased rarity of the plants due to:

- other plants (especially invasive wetland and riparian plants) outcompeting them
- browsing and trampling by mammalian herbivores, e.g. deer, goats, sheep and cattle
- pollution and sedimentation
- insect pests: our native cresses are from the same family (Brassicaceae) as cabbages, broccoli, and cauliflower, and so are prone to attack from the same insects and diseases
- habitat loss caused by human-induced land changes.

A second cultural impact to measure is the changes in harvesting and other practices associated with the species, particularly harvesting by our younger generations. Localised extinction or rarity can lead to a decrease in the application of knowledge and understanding of the plant. This is exacerbated by large decreases in populations within one human generation that can cause a very quick 'out of sight, out of mind' response. Losing a valued species, no matter how insignificant at the time, can hugely affect the relationship people can have with that organism, which in turn, impacts directly on the cultural, spiritual, and economic health and wellbeing of the people.

HOW DO WE RESTORE WĀTAKIRIHI?

STEP 1: Build relationships with the local community to get a better understanding about:

- the socio-cultural value of the plant. Is it important to bring it back as a mahinga kai/hauanga kai (food gathering site), and as a nitrogen-scrubber?
- pinpointing and mapping where wātakirihi populations used to be, and still are
- identifying how those populations have changed
- what may have caused decline: the 'cause' may need to be addressed first, e.g. sediment loads upstream or pugging in the immediate area, before any new populations can be reintroduced to the area.

STEP 2: Consider the ecological and environmental whakapapa of the system to get a better understanding about:

- the best areas to restore wātakirihi. Consider sites that have good fertility, high water quality, adequate water flow, sufficient light, and no weed competition (or weeds are easily maintained)
- adjacent land use and how you can mitigate any adverse impacts where possible, e.g. pollutant run-off
- benefits for other organisms – fish species (i.e. tuna (freshwater eels), inanga (whitebait), porohe (smelt), kanae (grey mullet)); water invertebrates (i.e. caddis flies, mayflies, beetles)
- habitat vegetation: a vegetation survey of what is there now is a good way of building a baseline to help monitor change over time.



Wātakirihi bordered by Carex wetland. Photo: Yvonne Taura

STEP 3: Building a monitoring and restoration framework

Key actions that we can take to build our understanding of wātakirihi (both the commonly harvested *Nasturtium* spp., and the lesser known native *Rorippa* spp.) based on our collective mātauranga (knowledge):

1. **Kōrero (speak) with local kaumātua (elders) and other whānau (family) members about their memories and current interactions with their wātakirihi:**
 - **What does their wātakirihi look like, smell like, sound like, and taste like?** Our senses (eyes, nose, ears, and taste buds) are very good at picking up changes, provided we pay attention to them! Recording these sensory changes are just as important as collecting scientific-type information on population densities, plant sizes, and water quality:
 - i. A change in colour, size and form (shape of the plant) might suggest that the essential nutrient levels are changing (potentially declining or increasing to toxic levels), or that there may be pollutants in the water. It might also provide clues to an invasive insect or virus affecting the plants
 - ii. A change in smell might suggest pollutants in the water
 - iii. Changes to the sound that the wātakirihi makes when you snap the stem provide important clues as to plant health, e.g. that the plants are being weakened by some unknown environmental factor; or, that you have missed the harvesting period – particularly if stems are hard to snap and have turned purple. Depending on how other plants in the population are affected, further work might be needed to establish what is causing any changes to stem structure, and if harvesting programmes should be implemented with the whānau
 - iv. Changes in taste might suggest changes to the water, soil or plant chemistry, or that the harvesting period has occurred at the wrong time (which may indicate a shift in uptake of practices, and a shift in local climate).
 - **What are the practices associated with harvest and preparation of wātakirihi, and have these changed?** Also consider whether whānau have any thoughts about the reasons why harvest practices may have changed (if they have). Include here the calendars of harvest for the areas, which is usually late spring to summer but can vary slightly between harvest areas.
 - **What are the local names (if any) for the wātakirihi, and what other species are they connected to (whakapapa)?** This is key to building a bigger, more holistic picture of connections and associated health and wellbeing of the whole system. For example, paru (dyeing muds), insects, fish and other plants, and place names may provide a clue.

Note: Many national databases hold examples of Māori names for plants, but they are often sourced from only a small sample of Māori dialects. It is important then, that restoration of wātakirihi accommodates and supports restoration of the local dialect and names, and also considers return of the wider whakapapa associated with those plants.

2. Identify your own monitoring areas based on what you have learnt from your people. Think about:

- where the populations of wātakirihi were in the past compared with the present
- monitoring your aspirations for wātakirihi, including relevant knowledge for future use. Note that some whānau may not wish to share the exact location of their harvesting areas, so consider instead asking if the populations have decreased and disappeared; and if there are any changes to the habitat, or adjacent land use that they feel may be affecting the plants.

A warning – ensure you understand the system in which you are going to grow wātakirihi. There are areas along the upper Waikato River, for example, that are known as no-go harvest areas for wātakirihi due to high arsenic loads. Wātakirihi is very effective at taking up heavy metals to toxic levels, making them unsuitable for consumption. This also applies if restoring wātakirihi as a nitrogen-scrubber – it is best not to harvest wātakirihi in this circumstance because of the potential for nitrogen loads in the plant to be above those considered safe for eating.

- 3. Who to talk to?** Talk to scientists and other communities with additional experience in wātakirihi ecology and restoration, and work with them to help build a restoration framework that best meets the needs of your local community and the plant.



Wātakirihi growing in a puna. Photo: Yvonne Taura

TRADITIONAL VERSUS NON-TRADITIONAL HARVESTING METHODS AND BACTERIAL QUALITY OF WĀTAKIRIHI

Because wātakirihi can and does grow in waterbodies that are at risk of pollution from adjacent land use and run-off, there is a risk that the plants will be exposed to harmful pathogens and bacteria associated with animal effluent. These impact on the safety of the plant for human consumption, although the symptoms of pathogen exposure are not always easily identifiable without some form of scientific analysis. *Escherichia coli* (or *E. coli*) is a key pathogen associated with effluent, and is used widely as an indicator of effluent pollution in waterways and on foods like wātakirihi.

A study was undertaken to assess the bacterial (*E. coli*) content of wātakirihi harvested by two

methods: (1) traditional: targeted and governed by culturally defined practices; and (2) non-traditional: randomised with no set method or governing practices (Table 1).

Results

Public Health Laboratory System microbial guidelines outline that for every gram of a salad vegetable:

- **Less than 20 *E. coli*** is satisfactory for human consumption;
- **20–100 *E. coli*** represent the minimum standard for human consumption; and
- **Greater than 100 *E. coli*** is unacceptable.

Of the 14 non-traditionally harvested wātakirihi samples, while 9 were satisfactory, 5 were unacceptable as a food. Of the 13 samples harvested using traditional methods, 12 were satisfactory, and 1 was of minimum standard.

Table 1. Traditional compared with non-traditional techniques for wātakirihi harvest (based on tikanga from harvesters in the Huntly region of the Waikato)

Key feature of method	TRADITIONAL (13 samples collected)	NON-TRADITIONAL (14 samples collected)
Area selection	<ul style="list-style-type: none"> • No evidence of grazing animals • Wātakirihi in flowing water close to riparian margins 	<ul style="list-style-type: none"> • Selection of areas where wātakirihi was easy to access • No attention paid to presence of grazing animals • Picked from banks and on riparian margins
Plant selection	<ul style="list-style-type: none"> • Absence of adventitious roots at nodes of plants • Wātakirihi not in flower – youngest shoots are being harvested • There are no green/purple wātakirihi stalks 	<ul style="list-style-type: none"> • No special care taken when plants selected
Picking method	<ul style="list-style-type: none"> • Picked as single stems, approx. 30 cm length • A sample of the plant picked is released to flow downstream and encourage a new population of wātakirihi 	<ul style="list-style-type: none"> • Harvested in bunches and pulled towards harvester • Roots still attached were ripped off and discarded on site • No release of plant material to encourage new populations
Washing method	<ul style="list-style-type: none"> • Submerged as picked bunches in flowing water of stream with leaves facing the current • Submerged bunches agitated gently • Given a shake to remove excess water when removed from stream • Packed upright in a clean plastic bag 	<ul style="list-style-type: none"> • If washed, was washed by submerging in water that had been disturbed by the roughly harvested bunches

What do the results tell us?

- Adventitious roots that grow from nodes along the stem can provide a good habitat for bacteria like *E. coli* to enter and move through a plant to its (edible) leaves. By selecting plants without these roots the traditional harvester reduced the potential to select plants with higher bacterial loads.
- Wātakirihi beds can clog small waterbodies like channels and narrow streams, encouraging deposition of bacteria into the beds. The risk of bacterial contamination is highest in areas of high wātakirihi density, and very low/no water flow such as on the banks and riparian margins of the waterbody.
- Traditional harvesting utilises a common sense approach that preceded the introduction of cattle to Aotearoa. In applying that common sense, our traditions have enhanced the potential to reduce the risk of food borne bacterial diseases such as those caused by *E. coli*.
- Traditional harvesting also adopts a practice that encourages long-term sustainability of the wātakirihi beds by releasing a portion of the material harvested for propagation downstream.
- Protecting and supporting inter-generational transfer of traditional harvest and preparation information are just as important as protecting the presence of wātakirihi in an area.

Full article *Te Huakita o te Waatakirihi/Bacterial quality of purchased and harvested watercress* can be found at: www.researchgate.net/publication/34903534_Bacterial_quality_of_purchased_and_harvested_watercress



Wātakirihi growing in a puna. Photo: Yvonne Taura

WANT TO LEARN MORE?

Note: If you are having problems with the hyperlinks below, try copying and pasting the web address into your browser search bar.

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Useful websites

Māori Plant Uses Database: <http://maoriplantuse.landcareresearch.co.nz/WebForms/default>.

Herb Federation of New Zealand: www.herbs.org.nz/information/watercress.html

Watercress.com: www.watercress.com

Examples of projects restoring and researching watercress can be found at the following websites using the key words 'watercress':

- Naturewatch: <http://naturewatch.org.nz>
- The Ripple Effect: <http://makearipple.co.nz>
- Sustainable Farming Fund ('Earlier Funding Rounds'): www.mpi.govt.nz/funding-and-programmes/farming/sustainable-farming-fund

Author research

Lorraine's Masters research thesis:

Dixon LL 2007. *Microbiological quality of toroi: A Māori food delicacy*. Unpublished MPhil thesis, University of Waikato, Hamilton. <http://researchcommons.waikato.ac.nz/handle/10289/2229>

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