



NIWA

Taihoru Nukurangi



ĪNANGA

WHAT DOES SCIENCE TELL US ABOUT
NEW ZEALANDS' MIGRATORY GALAXIIDS?

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Taonga species such as tuna (freshwater eel), kōura (freshwater crayfish) and īnanga 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.

Through the MBE-funded Cultural Keystone Species programme (2016–2020), a series of iwi engagement booklets have been developed, sharing science knowledge to support species management strategies.

The Taonga Species Series includes booklets on tuna, kākahi, īnanga, kōura, piharau and pātiki. Find out more about the series at [niwa.co.nz/te-kuwaha/CK2020](https://www.niwa.co.nz/te-kuwaha/CK2020)





AOTEAROA-NEW ZEALAND'S FIVE GALAXIID SPECIES

Whitebait fisheries are based on the juvenile, upstream migrant phase of five species of galaxiid fish. The annual whitebait migration is an important mahinga kai resource for Māori all around Aotearoa.

ĪNANGA (*Galaxias maculatus*)



R M McDowell

Identification:

Īnanga are the most common whitebait species. They have a silvery belly and a slightly forked tail. They are the smallest of the five galaxiid species, rarely exceeding 110 mm in length with most only

surviving for one year. Īnanga are also the only galaxiid species that swims in shoals (groups). Altogether, these features make them easy to distinguish from the other galaxiids.

KŌARO (*Galaxias brevipinnis*)



R M McDowell

Identification:

Kōaro can easily be differentiated from the other galaxiid species. They have a more tubular body shape and have large pectoral fins located behind their head on the

sides of their body. They can live up to 15 years or more and usually reach an adult size of 160-180 mm in length.

BANDED KŌKOPU (*Galaxias fasciatus*)



Identification:

Adult banded kōkopu have thin stripes or bands across their backs, hence the name banded kōkopu.

Most grow to around 200 mm long, but they can reach 260 mm.

SHORTJAW KŌKOPU (*Galaxias postvectis*)



Identification:

Shortjaw kōkopu are a grey/olive colour. The feature which makes them easily identifiable is a prominent blue/black splotch behind the gill, and an undercut jaw. Shortjaw kōkopu usually grow to

between 150 and 200 mm, and is the only glaxiid species (of the five mentioned) to be classified as a 'Threatened – Nationally vulnerable' species.

GIANT KŌKOPU (*Galaxias argenteus*)



Identification:

Giant kōkopu are the largest of the galaxiids and grow to typically 300-500 mm in length. Giant kōkopu can be easily identified by their distinct pattern which is thought to resemble a galaxy. They are slow-growing

and can live for more than 20 years. The giant kōkopu is one of the three galaxiids classified as being an 'At Risk – Declining' species along with īnanga and kōaro.

Threat status:



"Not Threatened"

Banded kōkopu



"At Risk - Declining"

Īnanga, kōaro and
giant kōkopu



**"Threatened -
Nationally Vulnerable"**

Shortjaw kōkopu



**Eighty years ago whitebait
used to be so abundant
that people would feed
them to their chickens, and
even spread them over their
gardens as fertiliser!**

WHERE CAN THE WHITEBAIT SPECIES BE FOUND IN AOTEAROA?

Whitebait species can be found throughout Aotearoa but are generally common around coastal areas as part of their life cycle occurs at sea. Some species of whitebait can have a varied distribution to other species based on their climbing ability, habitat preference and other factors.



Īnanga



R M McDowell

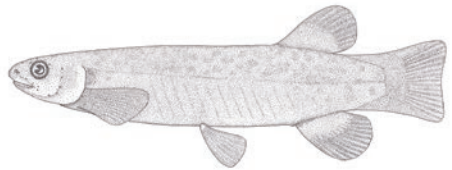
Īnanga are the most abundant whitebait species and are widely distributed in Aotearoa. Īnanga can migrate well inland in some rivers but are normally considered a coastal species. They are the smallest of all whitebait species, usually reaching 100-110 mm. Found in most rivers and streams in Aotearoa they form the bulk of the whitebait catch.



River mouth of the Rangitāiki River, Bay of Plenty

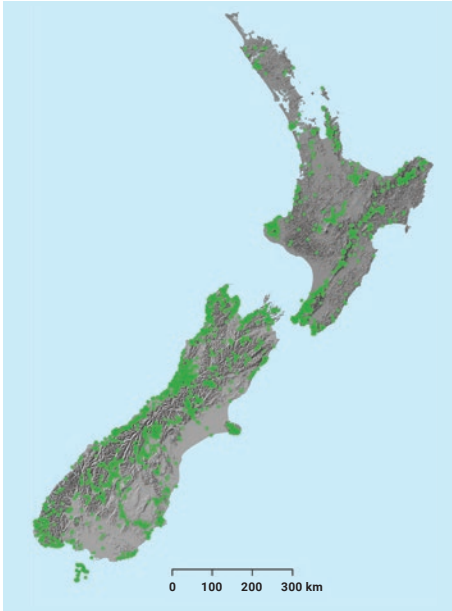


Shortjaw kōkopu

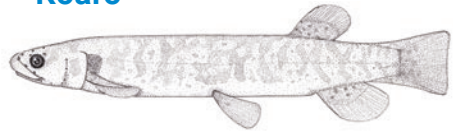


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Shortjaw kōkopu are only found in Aotearoa. They are the rarest of the whitebait species and have the most restricted distribution. Shortjaw kōkopu are mostly found along the west coast of the South Island, the top of the South Island and the Taranaki region. They do not occur on Stewart or Chatham Islands.



Kōaro

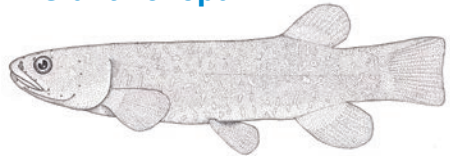


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Kōaro are found in freshwaters at higher elevations in Aotearoa such as mountainous streams. They are also found on Chatham, Stewart, Campbell and Auckland Islands. Kōaro prefer clear, swiftly flowing streams of small to moderate size that flow through native forest.



Giant kōkopu



R M McDowell

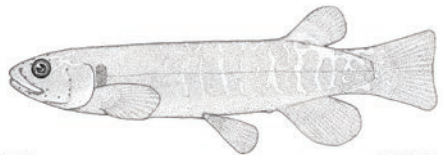
Giant kōkopu are only found in Aotearoa but have a fragmented distribution. They are mostly found along the west coast of the North and South Island as well as major offshore islands. However, they are absent from Fiordland and the east coast of the South Island. Giant kōkopu prefer coastal freshwater habitats and are not usually found far inland.



Eggs in bankside grasses, Golden Bay



Banded kōkopu

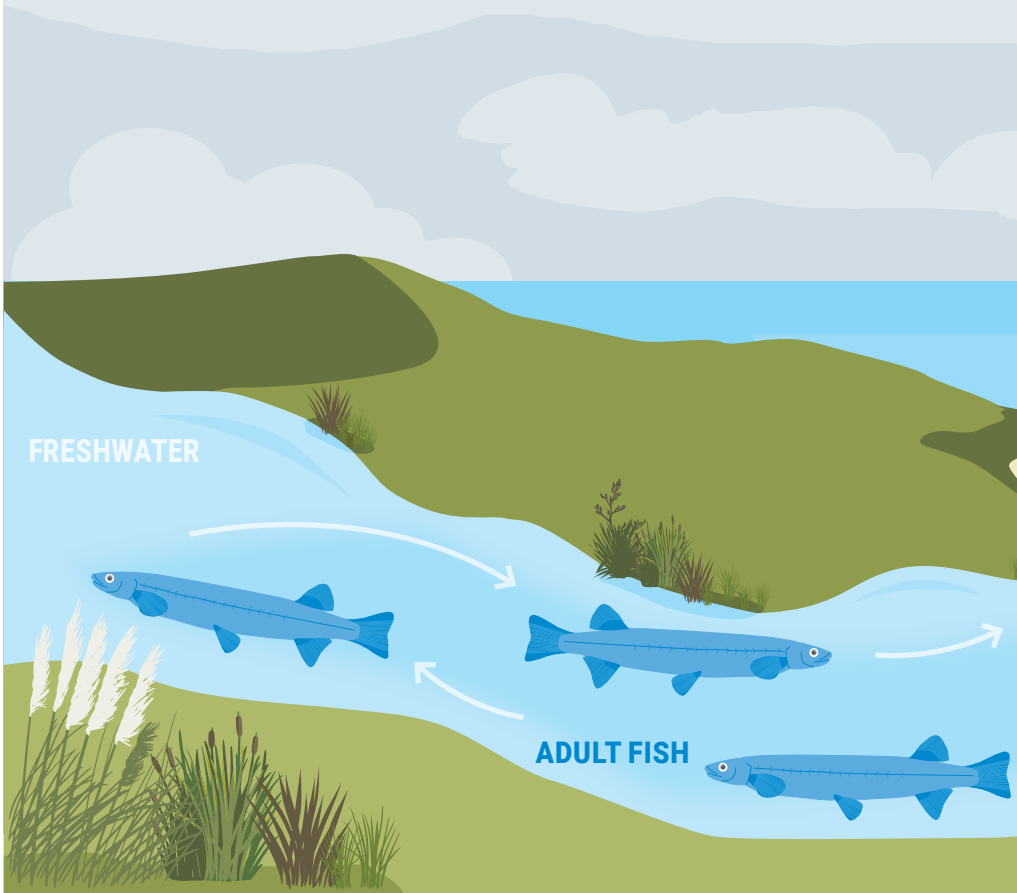


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Banded kōkopu are primarily a coastal species and prefer forested streams with pools and undercut banks. They are found throughout Aotearoa especially on the west coast of the North and South Islands. However, they are rare along the east coast of both islands with few observations from East Cape.

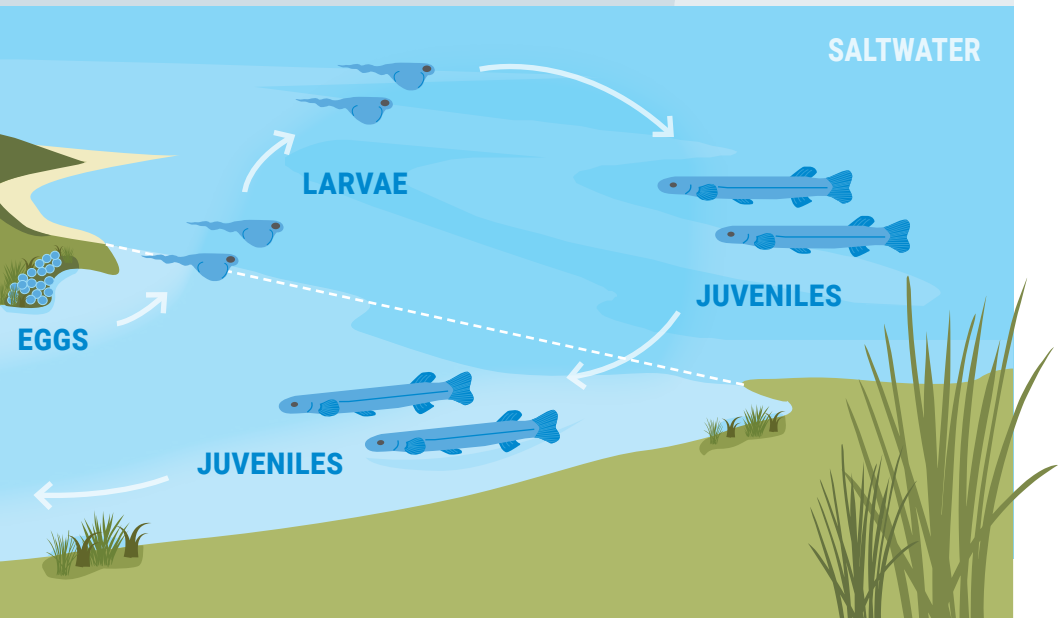
ĪNANGA LIFE CYCLE

Īnanga have a diadromous life cycle meaning they use the marine and freshwater environment to complete their development.

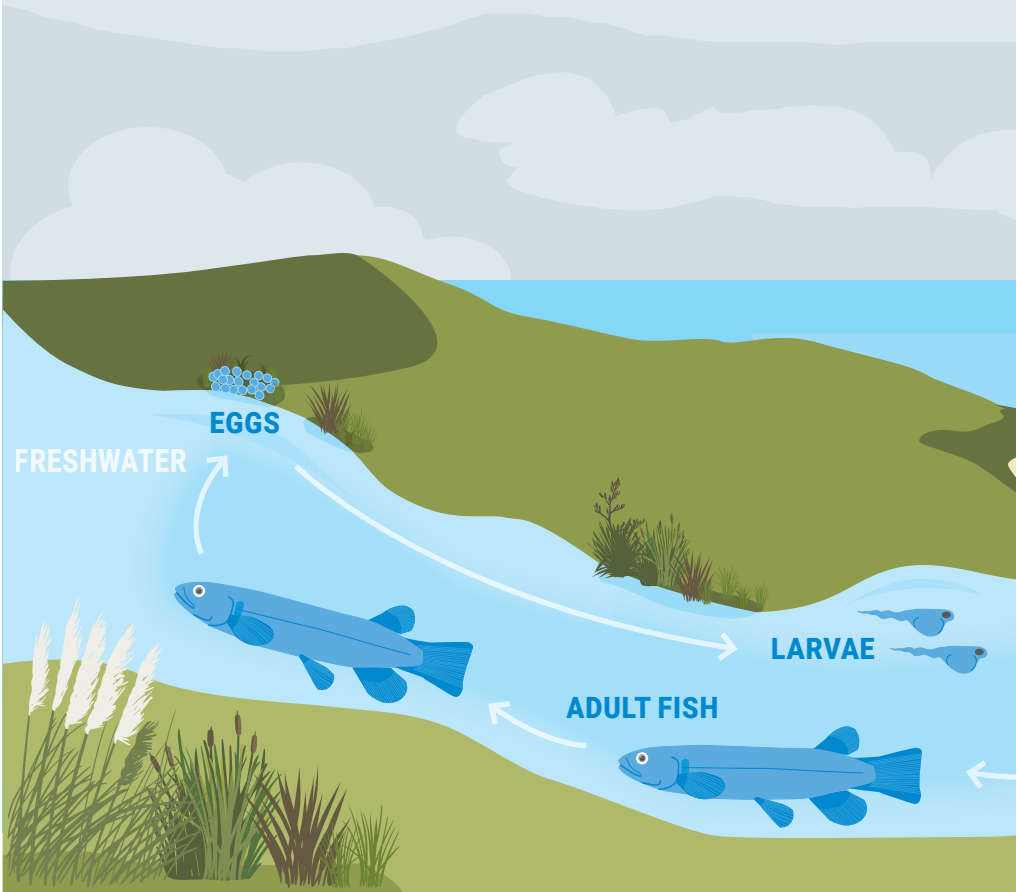


Spawning occurs in freshwater and the larvae develop in the marine environment. This specific type of diadromy is called amphidromy. Once īnanga reach maturity in freshwater, they move downstream to their spawning sites. Spawning occurs on bankside grasses where the saltwater wedge penetrates fresh waters at high tides. The eggs are laid during high spring tides in the intertidal vegetation and develop out of water for 2-4 weeks. The vegetation protects

the eggs from drying out but also protects them from predators. The following spring tide stimulates the eggs to hatch and larvae are carried to the sea to feed and grow. After about six months, īnanga migrate back into freshwater as juveniles (whitebait). They remain in the lower parts of rivers while they adapt to their new freshwater environment and change into the adult form. They then move further upstream in search of suitable adult habitat for rearing.



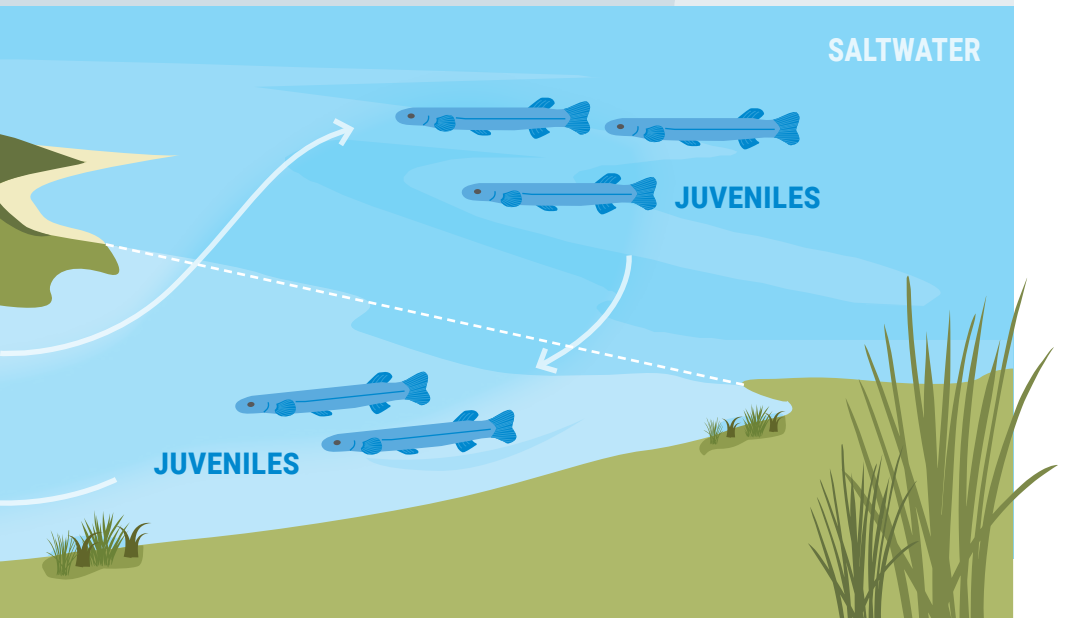
BANDED KŌKOPU, GIANT KŌKOPU, SHORTJAW KŌKOPU AND KŌARO LIFE CYCLE

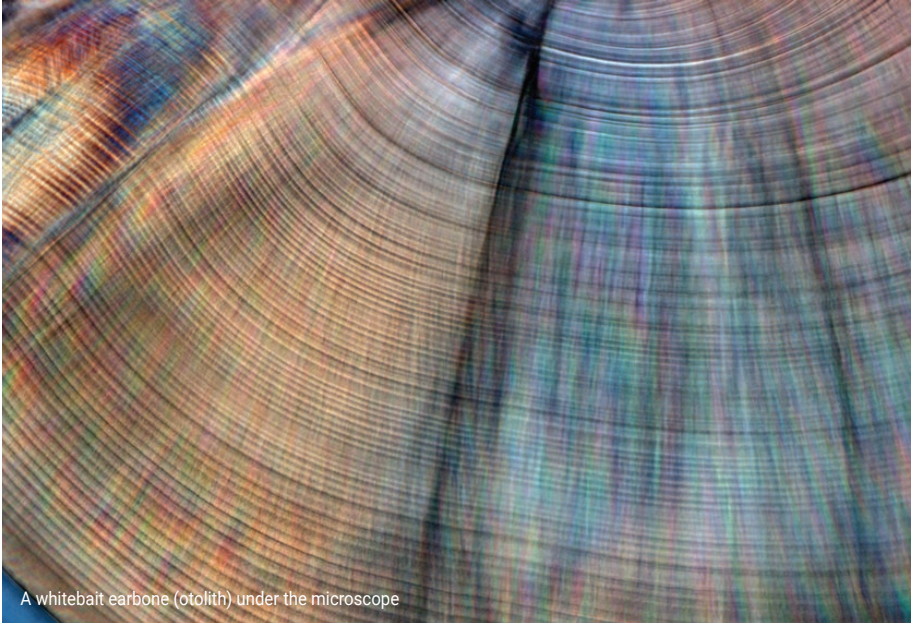


Banded kōkopu, giant kōkopu, shortjaw kōkopu and kōaro have a diadromous life cycle.

Spawning occurs in freshwater and the larvae develop in the marine environment. This specific type of diadromy is called amphidromy. The eggs are laid in vegetation on river banks during flood flows and, like īnanga, develop out of water. They can also lay their eggs within the gravels in streams.

When stream levels rise, and the eggs are covered with water, they hatch and the larvae are carried out to estuaries and the marine environment. They then migrate back into freshwater as juveniles (whitebait) in search of habitat for growth into adulthood.





A whitebait earbone (otolith) under the microscope

GALAXIID MIGRATION

Migratory

A portion of whitebait populations are diadromous meaning their life cycle is completed in the marine and freshwater environment. Scientists can confirm if larvae whitebait have developed in the sea by looking at the

chemistry of their ear bones which take on a unique marine signature. The migrations of the whitebait species occur in all months of the year but there are key differences between the five species.



Unlike other members of the whitebait family, inanga cannot climb. They overcome small barriers by burst swimming.

Migration calendar

Species	Life stage	Direction	Summer			Autumn			Winter			Spring		
			D	J	F	M	A	M	J	J	A	S	O	N
Īnanga	J	↑												
	A	↓												
	L	↓												
Banded kōkopu	J	↑												
	L	↓												
Giant kōkopu	J	↑												
	L	↓												
Kōaro	J	↑												
	L	↓												
Shortjaw kōkopu	J	↑												
	L	↓												

This calendar shows when migration occurs (■ light blue) and peak periods (■ dark blue), migration direction (↑ = upstream, ↓ = downstream) and life stage at the time of migration.

Lifestages: A=adult, J=juvenile, L = larval,

Non-migratory

There are some populations of the whitebait species that complete their entire lifecycle in freshwater and do not need to go to the sea. These populations are known as lacustrine (i.e. lake-based) or landlocked (i.e. they can't access the sea). After the larvae hatch in tributary streams, rather than moving out to sea, they move downstream to lakes and rear there. As juveniles, they move out of the



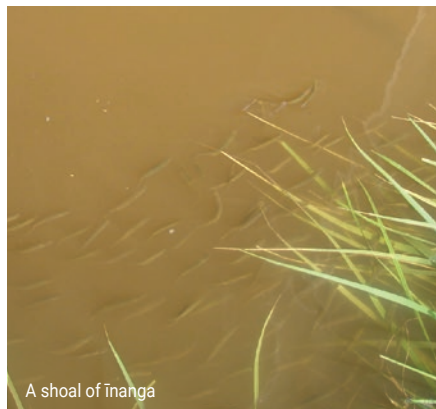
lakes again and into nearby streams where they then grow into adults. This is common for kōaro and kōkopu species.

WHAT DO GALAXIIDS EAT?

During their marine life phase, larval galaxiids likely eat small phytoplankton and zooplankton. Once they have achieved enough growth at sea, they migrate through estuaries and into freshwater.

Whitebait are an important source of marine-derived nutrients for other fish species like kahawai, tuna, and native birds.

Adult galaxiids eat a combination of insects, crustaceans (such as kōura), and sometimes smaller fish. The five galaxiids species have slightly different diets. The three kōkopu species mainly eat insects that fall into the water from overhanging grasses and trees (such as spiders and flies). This is because kōkopu have special sensors on their heads that let them know when and where something has hit the water's surface.



WHAT HABITATS DO THE ADULT USE?

The five galaxiids are found in a diversity of freshwater habitat types such as rivers, streams, wetlands and lakes.

There are differences in the preferred habitats among the galaxiids. For example, shortjaw kōkopu prefer to live in boulder-filled streams in the forest while īnanga can be found in small agricultural streams much closer to the sea.

Kōaro are known for their climbing abilities. They can travel much further inland than the other galaxiid species

and can even be found in mountainous lakes and rivers in the Southern Alps. They can easily overcome obstacles such as waterfalls and use their large fins to help them climb.

Galaxiids like lots of vegetation to protect them from larger predators and to use as camouflage to sneak up on their prey.



All life stages of īnanga prefer to live within a temperature range from 17°C to 20°C, with adults preferring slightly cooler temperatures than juveniles.



īnanga in a lake environment



OUR WHITEBAIT FISHERY

A whitebait fritter could contain the young of all five galaxiids species.

Usually 95% of the whitebait in a whitebait fritter will be īnanga, with the remaining 5% made up of kōaro and banded kōkopu. Giant kōkopu and shortjaw kōkopu are rarely observed in the whitebait catch and they are very difficult to identify.

Whitebait are caught as they are migrating from the sea as juveniles into freshwater to begin adulthood.

It is important to follow the whitebait fishing regulations:

- The whitebait season in New Zealand (except for the West Coast) is between 15th August – 30th November (the juvenile migration phase). The whitebait season for the West Coast of the South Island is 1 September to 14 November.
- You cannot fish for whitebait at night.
- Fishing gear needs to follow the whitebait guidelines.
- Only take the fish you need and return unneeded fish to the waters they were taken from.
- Following regulations is important because it ensures we sustain the galaxiid populations.



For more information on whitebait fishing regulations visit doc.govt.nz/whitebait

WHAT CAN WE DO TO HELP?

Some ways we can help our whitebait populations include:



Protect and restore riparian environments to provide habitat for egg laying



Follow whitebait fishing guidelines and regulations



Restore upstream passages to give whitebait more accessible waterways to live in



Keep waterways clean



Remove pest fish and plants that alter the whitebait's habitat



Get involved in a community project to fence and plant local streams



Follow harvest regulations and any rāhui in place

Photo credits: R M McDowell, Eimear Egan, Rebekah Parsons-King, Stuart Mackay and Brian Smith



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/inanga

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