



Can fish fly?

Native freshwater fish of our region



Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help keep it that way.

Our native fish are among the hidden treasures of New Zealand's animal life because they are seldom seen and we know very little about most of them. The more we do find out, the more we and other interested New Zealanders are realising that these animals are a fascinating and intriguing part of our heritage.

Can fish fly?

Can fish fly? No, they can't, but 18 of our 22 native species need to migrate between freshwater and the sea during their lives and their survival depends on it. This characteristic makes them unusual as a group, worldwide – a bit like the way New Zealand's native birds are regarded as unusual because so many of them are flightless.

Migration between freshwater and the sea is not unique to New Zealand freshwater fish, but it's unusual as a life strategy that's widespread for so many species when compared to fish that live on other continents around the world.

To witness the well known whitebait run is to see the young (juveniles) of five species swim upstream from the sea where they will spend their adult lives in our rivers. The life cycle shown on the next page is typical of many native freshwater fish species found in the region.

Some native fish have different life cycles that also involve migration between freshwater and the sea. Adult freshwater eels swim downstream to the sea to spawn (lay their eggs) towards the end of their lives: and longfin eels can live for up to 60 to 80 years!

We're not sure where these spawning grounds are, but the eels are believed to travel north into the subtropical Pacific Ocean to somewhere between Tonga and New Caledonia. The elvers (juvenile eels) return to New Zealand's rivers one to two years after they hatch in the sea. Smelt and lamprey are different again. They spend most of their adult lives at sea and migrate up rivers where they lay their eggs.

They can't jump but they can climb, cling, and burrow.

Migrating native fish don't move upstream by jumping over low barriers like trout and salmon. Some have a more effective alternative – they can climb! Koaro and elvers have climbing perfected. They can get over waterfalls and are found in good numbers above some of the highest weirs in the region's rivers, such as the Kaitoke weir on the Hutt River and the water supply weir on the Orongorongo River.

Koaro usually leave the main areas of water flow and use surface water tension on wet rocks to stay attached and slither their way upwards with surprising ease. People with aquariums know, or soon find out, that koaro can easily scale the glass walls, and without a secure top on the aquarium will soon become dehydrated and die on the floor outside.

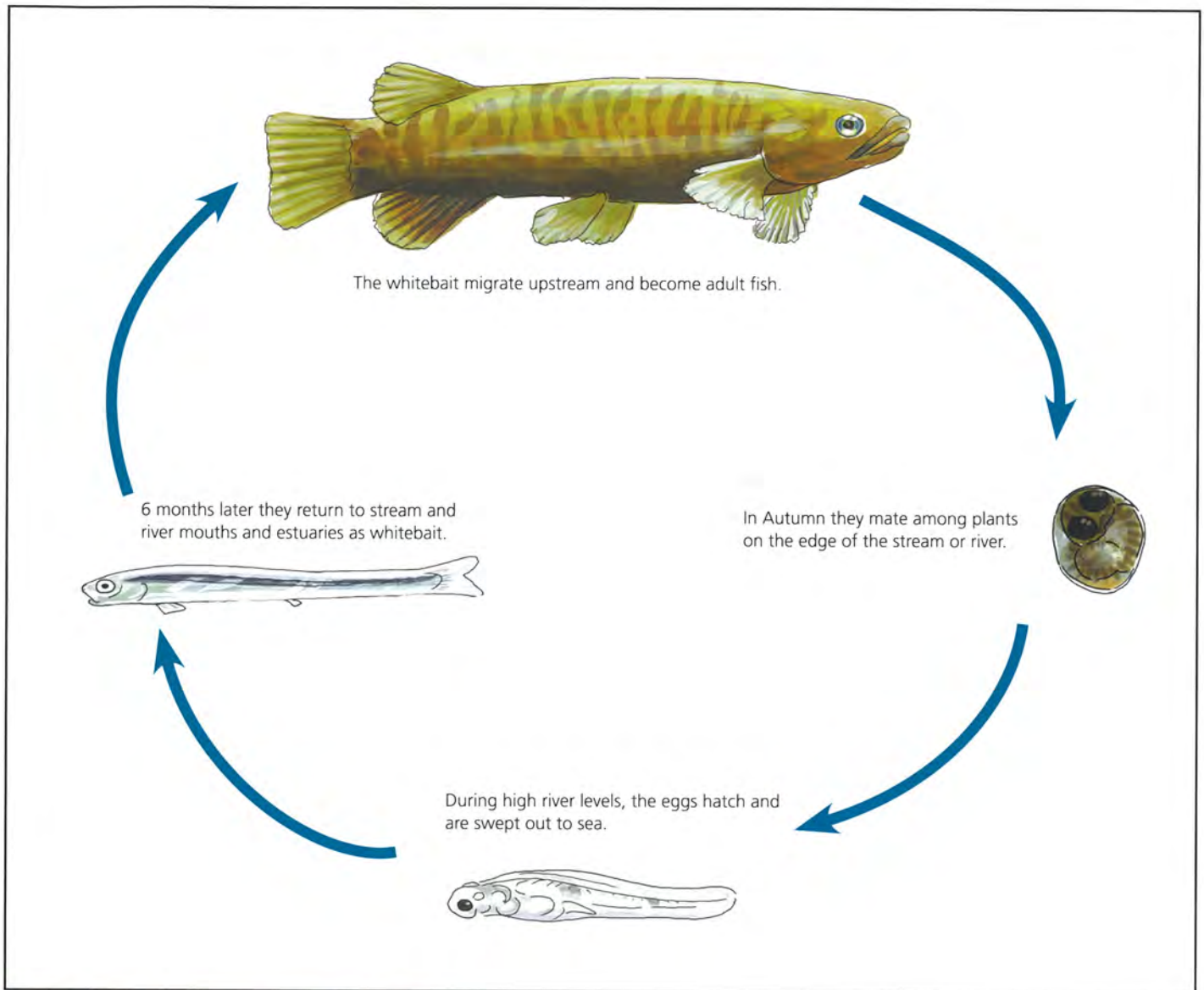
Other native fish with reasonable climbing ability are shortjaw kokopu and banded kokopu.



Inanga is one of five native freshwater fish species whose juveniles migrate upstream as part of the whitebait run.



Koaro uses its pelvic fins like broad, flat arms to help cling to steep surfaces.



Typical life cycle for native fish in the whitebait run.

Not all native fish are such good climbers. Inanga, whose juveniles make up to 95% of the whitebait catch, have trouble getting over barriers with a vertical drop of more than 30 centimetres. This means that poorly installed culverts, weirs or fords can restrict passage and reduce the amount of habitat available to them – therefore, limiting their numbers. Other poor climbers include giant kokopu, torrentfish, most species of bullies, smelt and lamprey.

Some native fish have an amazing ability to live in fast-flowing rivers and streams, and there are plenty of these rivers in the region. Bluegill bullies (see photo on next page) and torrentfish live in the swift white rapids of stony rivers and streams, where even humans would find it hard to stand. They stick to the bottom by clinging onto the gravel with their fins.



Fish passes like this rock ramp built in the Taupo Stream, below the Taupo Swamp near Plimmerton, help native freshwater fish swim upstream past weirs.

Another native fish found in the region is the brown mudfish. It can survive out of water during droughts. Mudfish live in swamps, drains and forest pools that may dry up in summer. These fish were first discovered curled up in the mud when people dug up wet areas for drainage and cultivation.

When the water disappears, they can be found underneath logs and other debris, or they burrow into holes where tree roots have rotted. They can breathe through their skins and survive in damp places (without any surface water) for weeks, even months. You can find brown mudfish in wetlands in the Wairarapa valley. They once were abundant on the Kapiti Coast but it has been some time since they have been recorded there.



Bluegill bully live in the swift, fast-flowing parts of rivers.

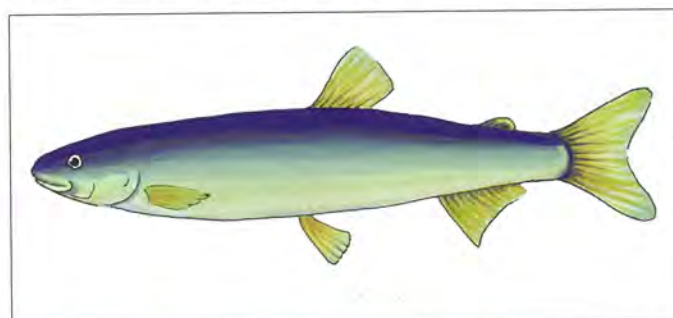
No more extinctions, please!

The grayling is a native fish species last recorded in Wairarapa in the 1920s. It became extinct nation-wide, probably in the 1930s, for reasons we don't understand. It was larger than most of our other native fish, growing to about 40 centimetres long but we know very little else about its life story.

Our other native freshwater fish have survived – so far. They face many pressures from activities like deforestation (the removal of native bush), wetland drainage, construction of culverts and weirs in rivers, pollution, extraction of river water for irrigation, and the introduction of exotic fish species. Some native fish have been reasonably resistant to these pressures, while others are now regarded as threatened.

The following five species found in the region are classified as nationally “threatened” by the Department of Conservation:

- giant kokopu
- shortjaw kokopu
- dwarf galaxias
- brown mudfish
- longfin eel.



A drawing of the extinct New Zealand grayling.

Commercial fishing is probably mostly to blame for the decline of the longfin eel, while a nationwide reduction in natural habitat is responsible for the decline of the others. Fortunately, our region has plenty of suitable places where the shortjaw kokopu prefers to live - in the Tararua, Rimutaka, and Haurangi Ranges – and they are reasonably easy to access. Dwarf galaxias also thrives in a few parts of the region, such as in the Pakuratahi River, the upper reaches of the Wainuiomata River, and the Waihora Stream in the Wairarapa.

The giant kokopu and brown mudfish are both lowland species and a lot of their habitat has already been lost. We can protect them by limiting further modifications to lowland rivers, streams and wetlands. We can also help by restoring wetlands and increasing streamside plantings beside our lowland streams.

For more information contact us.

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Eels (tuna)

Native freshwater fish of our region

Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help

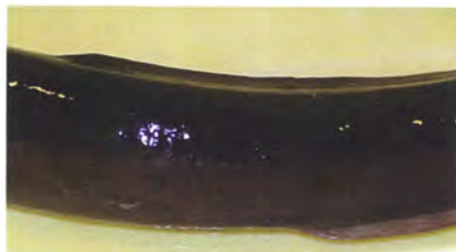
Eels are a familiar sight to many New Zealanders. Some people find them revolting because of their snake-like appearance and slimy bodies, while others consider them a delicacy. For Maori, eels have great cultural significance and they are an important food source. Whatever you think, eels are fascinating creatures.

There are about 16 different species of freshwater eel in the world, with three in New Zealand. The native shortfin eel and the longfin eel can be found throughout the country, while the Australian longfin eel (whose arrival was confirmed in 1997) has not yet been recorded in our region.



The shortfin and longfin eels look very similar but you can tell them apart by their dorsal fins. The dorsal fin is on the top of the eel's body.

In the top photo, the shortfin eel's dorsal fin is the same length as the ventral fin on the eel's underside.



In the bottom photo, the longfin eel's dorsal fin is longer than its ventral fin and extends towards the head.



Longfin eel

The eel life story

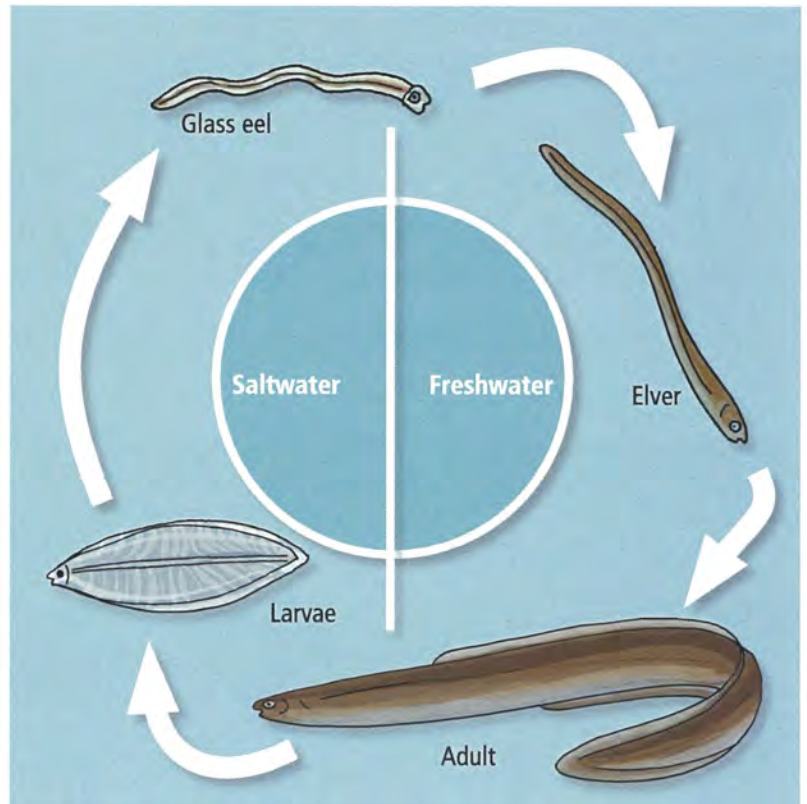
Shortfin and longfin eels have a fascinating life cycle. In autumn or early winter male and female eels migrate downstream to the sea to breed. The timing depends on their species and sex – for example, shortfin females are mature and migrate at around 23 years, while longfin females usually don't mature and migrate until they are around 34 years old.

After breeding, the adults die. The fertilised eggs float to the surface and hatch into leaf-shaped larvae, which then drift with the ocean currents, feeding on plankton.

When they leave freshwater and enter the sea, eels stop feeding. Nobody knows for sure where they go to spawn (lay their eggs), but it could be as far away as the Tonga Trench between Tonga and New Caledonia.

When breeding is over, the adults die. Their fertilised eggs float to the surface at sea and hatch into leaf-shaped larvae, which then drift with the ocean currents, and feed on plankton.

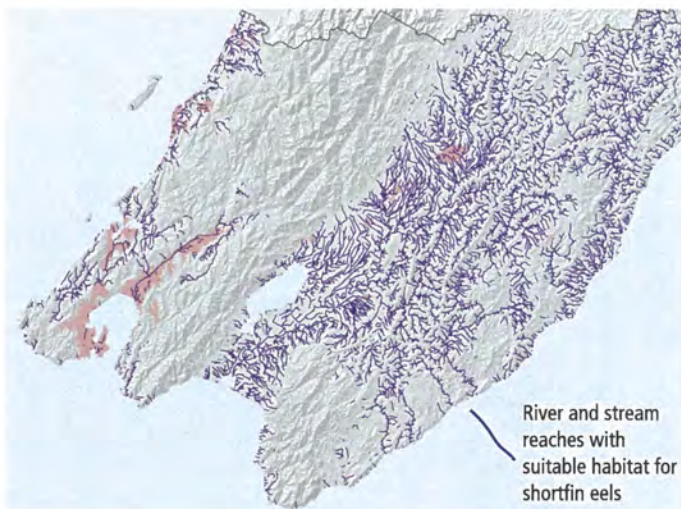
When the larvae reach the New Zealand continental shelf, they change into miniature transparent eels (glass eels), which enter New Zealand's rivers, coastal streams and wetlands. At this stage they change again and the elvers (juvenile eels) develop the familiar eel grey colour.



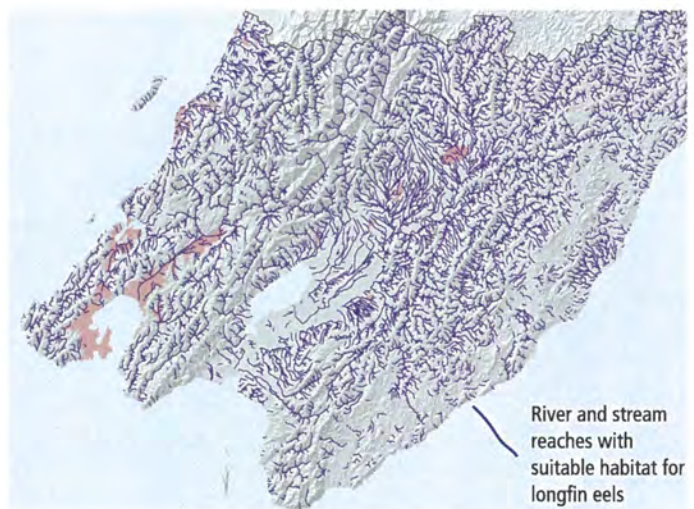
The life cycle of eels

Commercial fishing

Eels are fished commercially, and some people are concerned that commercial catches are depleting eel numbers too drastically. Shortfin eel is the main species fished commercially, but the longfin eel is the greater problem. Their numbers are now reduced and they are considered a nationally threatened species, in gradual decline.



River and stream reaches with suitable habitat for shortfin eels



River and stream reaches with suitable habitat for longfin eels

Shortfin and longfin eel habitat in the region. Shortfin eels usually live in wetlands, lakes and rivers at low altitudes, while longfin eels live in rivers at all altitudes. Longfin eels are particularly good climbers when they are juveniles (elvers), with a legendary ability to get past natural barriers or structures. There are few rivers in the region they can't travel up.

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Inanga — more than just a fritter

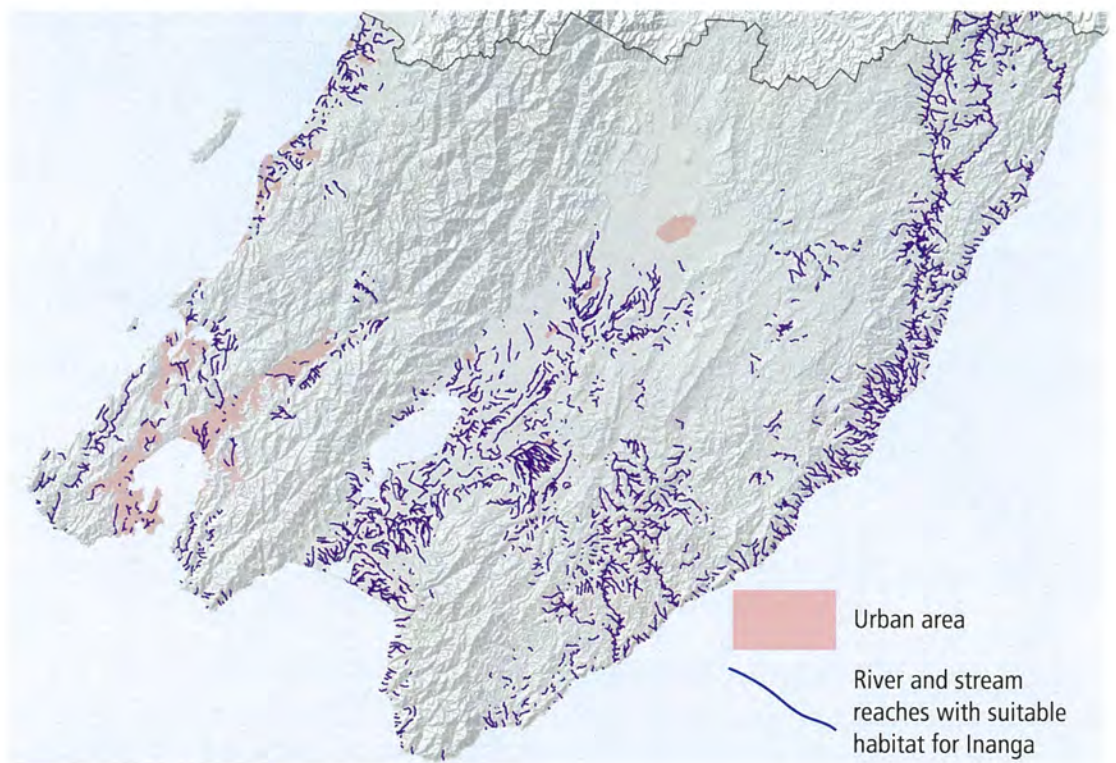
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Inanga

The inanga is well known to New Zealanders as one of five native freshwater fish species whose juveniles (young) make the whitebait run, swimming upstream from the sea to spend their adult lives in rivers. Inanga make up about 95% of the total whitebait catch. The adult grows to around 10 centimetres long and can be easily distinguished from the adults of other fish found as juveniles in the whitebait run by its silver belly and forked tail.



Inanga habitat in the region.

Where do inanga live?

You can find inanga throughout New Zealand and its offshore islands, and in South America and Australia. They live in open rivers, streams, lakes and wetlands and can often be seen shoaling in open water, especially at breeding time.

We've found inanga in larger rivers like the Ruamahanga, Pahaoa, Hutt, Otaki and Waikanae. They are poor climbers, which is why they don't travel too far inland unless the river has a gradual slope. The greatest distance inland we've found them is in the lower Mangatarere Stream in the Ruamahanga River catchment. They're also found in our smaller rivers and streams, like the Waitohu, Wharemauku, Pauatahanui, Makara, Pounui and Putangarua.

The inanga life story

Inanga has a similar life cycle to other whitebait species, which is described in the information sheet *Can fish fly?* that is part of this series. However, we know more about its breeding habitats than other native freshwater fish because we see it more often.

In late summer and autumn inanga swim downstream to estuaries, where they spawn (lay eggs) during high tides and high river flows.

They prefer areas in the upper parts of the estuaries, and can be seen squirming onto the wet river banks where they lay their eggs among the riverside vegetation. You can sometimes tell inanga are spawning by the milky colour in the water near the river bank.



A spawning site for inanga in the Oterei Stream in the Wairarapa. We found eggs in the vegetation marked with the white dotted line.

We have identified where inanga spawn in 27 estuaries in the region and we recognise that we need to look after these places if we want to maintain a good whitebait fishery. We also work with care groups and local communities throughout our region to help re-establish suitable habitat for inanga spawning.

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Koaro — the climber

Native freshwater fish of our region

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The koaro is one of five native freshwater fish species whose juveniles (young) are part of the whitebait run, swimming upstream from the sea to spend their adult lives in our rivers. The adult koaro, like the one in the photograph, can live for more than six years and grow to 25 centimetres long. Its sides and back are covered in a mixed pattern of golden blotches and bands that gleam and glitter in the sun, making the koaro a very attractive fish.

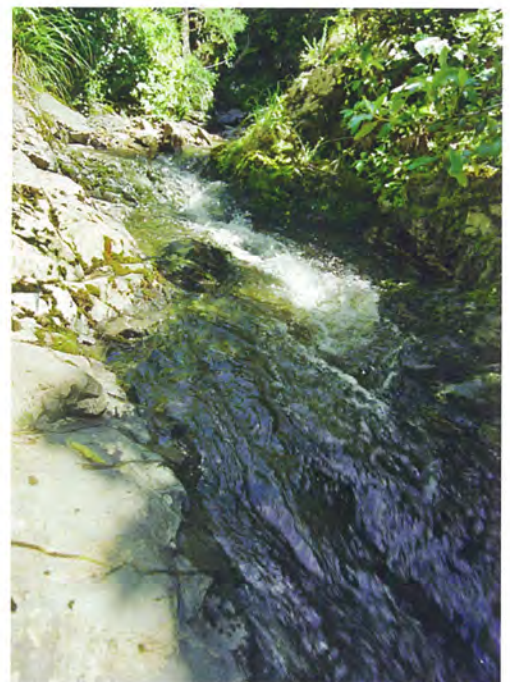


Koaro

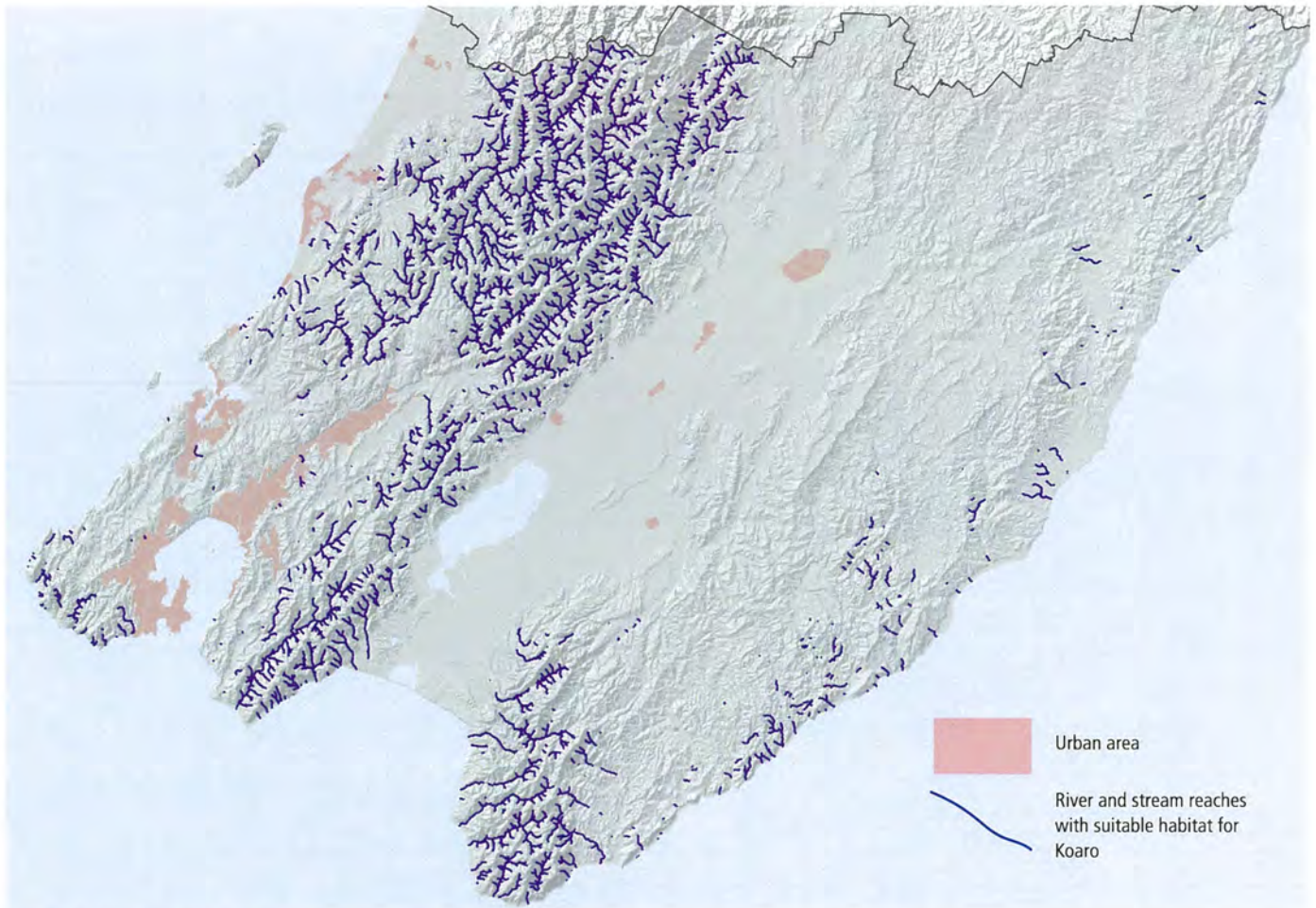
Where do Koaro live?

You can find koaro throughout New Zealand and its outlying islands, and in Australia. They prefer to live in clear, fast-flowing, rocky streams surrounded by native bush. Koaro travel further upstream than other whitebait. We've found them in the eastern parts of the Tararua Ranges, so they must have migrated more than 120 kilometres up the Ruamahanga River from the sea!

In our region, koaro can be spotted in the rivers and streams of the Tararua Ranges, the Rimutaka Ranges and the Haurangi Ranges in south-east Wairarapa. We've also found them in good numbers close to sea-level in the small streams of the Wellington peninsula, such as the Oterahanga and Karori Streams.



Koaro are usually found in clear, fast-flowing, rocky streams, surrounded by native bush.



Koaro habitat in the region.

The life history of koaro

The koaro has a similar life cycle to other whitebait species, which is described in the information sheet *Can fish fly?* that is part of this series. During the autumn and early winter, when the streams are flowing strongly, koaro lay their eggs along the stream edges.

When the water flow slows down, the eggs are left stranded. There they develop over the next few weeks, until the water flows are once again high enough to cover them, when they hatch into larvae and are carried out to sea. They live in the sea for several months before returning as whitebait to freshwater, and begin their journey upstream for their adult life.

The climber

Koaro have a legendary ability to climb! They can climb waterfalls and are found in large numbers above the highest weirs in rivers around Wellington. Koaro usually leave the main water flows and use surface water tension on wet rocks to attach themselves and slither upwards, with surprising ease. People with aquaria know, or soon find out, that koaro can easily scale the glass walls and, without a secure top on the aquarium, would soon escape and die on the floor outside.

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Giant kokopu

Native freshwater fish of our region

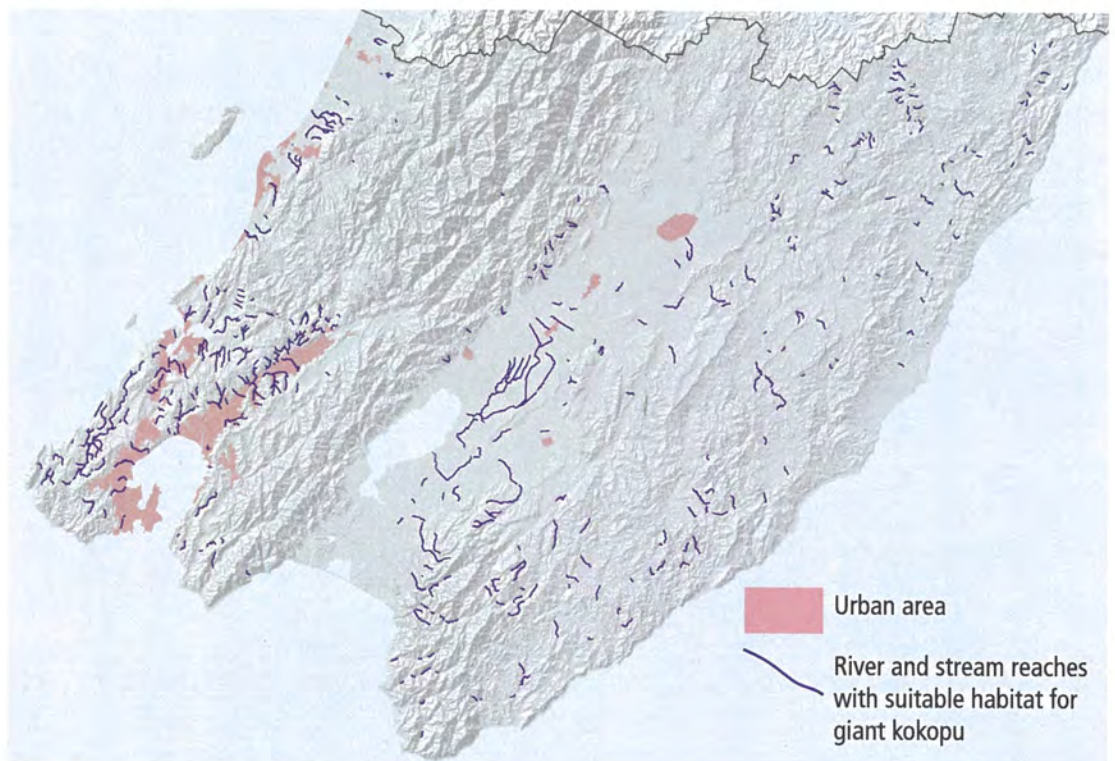
Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help keep it that way.

The giant kokopu is sometimes known as the native trout. It's one of our larger native fish and can grow up to 40 centimetres long – but it's more common to find them half that size.

The giant kokopu is one of five native freshwater fish species whose juveniles (young) make up the whitebait run, swimming upstream from the sea to spend their adult lives in rivers. However, don't expect to catch too many if you're whitebaiting, because they're hard to find! Their numbers are gradually declining and they are considered 'threatened' throughout New Zealand.



Giant kokopu



Giant kokopu habitat in the region.

Where do giant kokopu live?

You'll only find giant kokopu in New Zealand, usually in slow-flowing water and sometimes in lowland wetlands and lakes. They've been recorded on the Kapiti Coast, in rivers around the Porirua and Pauatahanui Inlets, in rivers around Wellington Harbour and in the lower Wairarapa valley's rivers. Giant kokopu don't usually migrate very far inland and are not good climbers, so barriers like weirs can prevent them moving upstream. They like to hide in places with in-stream cover, like overhanging plants or logs.

The giant kokopu life story

The giant kokopu has a similar life cycle to other whitebait species, which is described in the information sheet *Can fish fly?* that is part of this series. Eggs have not yet been observed in their natural habitat, so we can't say for sure exactly where they breed. When giant kokopu are found, it's usually only in small numbers, so we still have a lot to learn about this elusive species.

This photograph of a giant kokopu in its natural habitat was taken in a tributary of the Porirua Stream.



The adult giant kokopu has a distinctive profusion of golden lines, spots, crescents and rings on its skin. It was the first fish in the Galaxiidae family to be named by scientists; so its colour pattern led them to call its genus (a classification grouping) 'Galaxias', referring to the stars in the galaxy. All the other native species in the whitebait run are members of the Galaxiidae family.



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Photo of giant kokopu in Porirua Stream tributary, John Pocock. Other photos copyright Angus McIntosh, Natural Sciences Image Library.

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Banded kokopu — an urban legend

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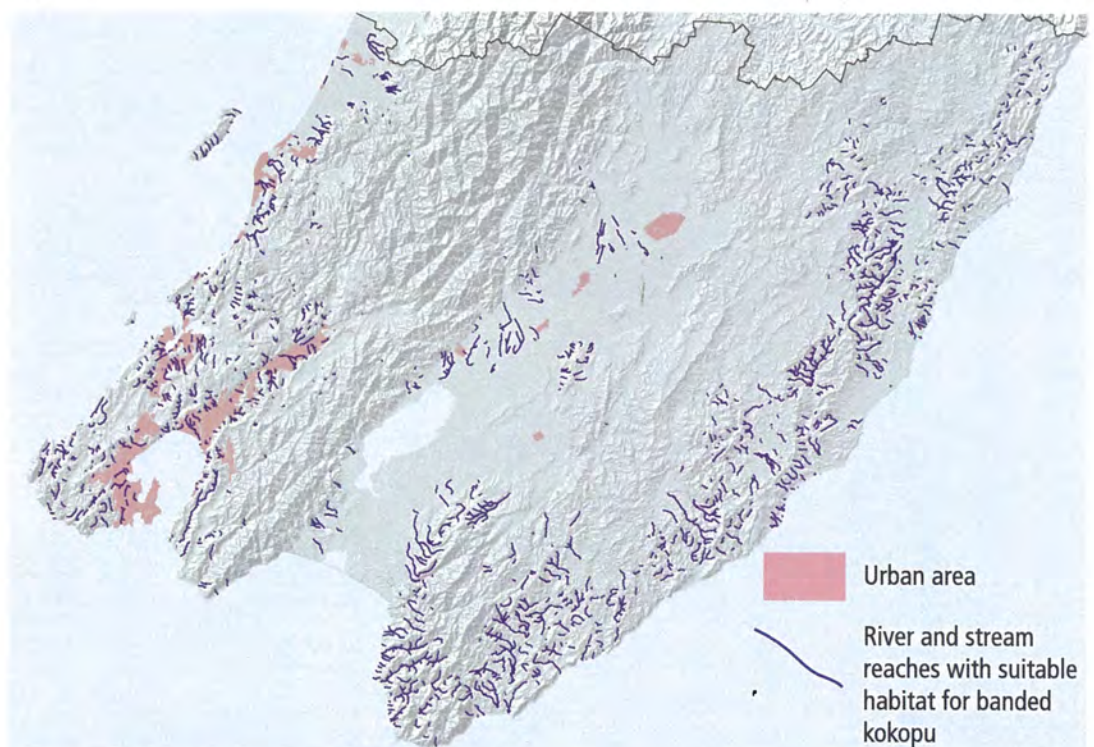
Banded kokopu is one of five native fish whose young (juveniles) are part of the whitebait run, swimming upstream from the sea to live their adult lives in rivers. It grows to 25 centimetres long and is easily identified by the thin, pale, vertical bands along its sides and over its back.



Banded kokopu

Where do banded kokopu live?

Banded kokopu are only found in New Zealand, where it likes small, clean streams and plenty of shade. It has been found in rural and urban streams throughout the region.



Banded kokopu habitat in the region.

In urban areas, banded kokopu can usually be found where the streams are clean and forested, but not in other places where streams are less clean and there is no surrounding vegetation.

For example, we've found them in bush-lined streams behind Naenae and Stokes Valley in the Hutt Valley. To get there, the juveniles have migrated up the Waiwhetu Stream, which is one of the most modified and polluted streams in the region.

Banded kokopu also live in the upper reaches of urban streams like the Owhiro Stream, the Kaiwharawhara Stream and in streams in the Belmont hills behind Porirua.

The banded kokopu life story

Banded kokopu have a similar life cycle to other whitebait species, which is described in the information sheet *Can fish fly?* that is part of this series. It lays its eggs on the edge of its home stream, which then carries the hatched eggs (larvae) out to sea. The larvae are carried around the coast for several months before the juveniles return to freshwater as whitebait and begin their journey upstream to live their adult lives in rivers.

Laboratory trials by NIWA suggest that juvenile migrating banded kokopu are attracted to the smells of the adult fish – so those migrating from the sea to rivers can choose the streams they swim up. If this is the case, banded kokopu are more likely to find their way up streams containing adults than up streams with no adults.

Other research by NIWA also tells us why we aren't likely to find banded kokopu in dirty streams. It seems that the movement of juveniles when they migrate upstream from the sea is strongly influenced by how turbid the stream is. The juveniles will avoid streams that are dirty and select cleaner streams to swim up and live in as adults.



Banded kokopu were found at this site in the Kaiwharawhara Stream in Wellington. We've found them in urban streams around Wellington, Porirua and the Hutt Valley – but only those streams with suitable habitat. The fish avoid parts of streams with a lot of sediment or other pollutants.

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Photo of banded kokopu copyright Angus McIntosh, Natural Sciences Image Library.

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Shortjaw kokopu

Native freshwater fish of our region

Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help keep it that way.

Shortjaw kokopu is a nationally threatened species and one of the rarest of the five native fish whose juveniles are part of the whitebait run. Its most distinguishing feature is its undercut jaw – the lower jaw is shorter than the upper one. Sometimes its fins appear reddish-brown and it has a distinctive dark patch behind its gill openings.



Shortjaw kokopu

Where do shortjaw kokopu live?

Shortjaw kokopu are found in New Zealand's North and South Islands. They travel successfully inland and live in rocky streams surrounded by native bush.

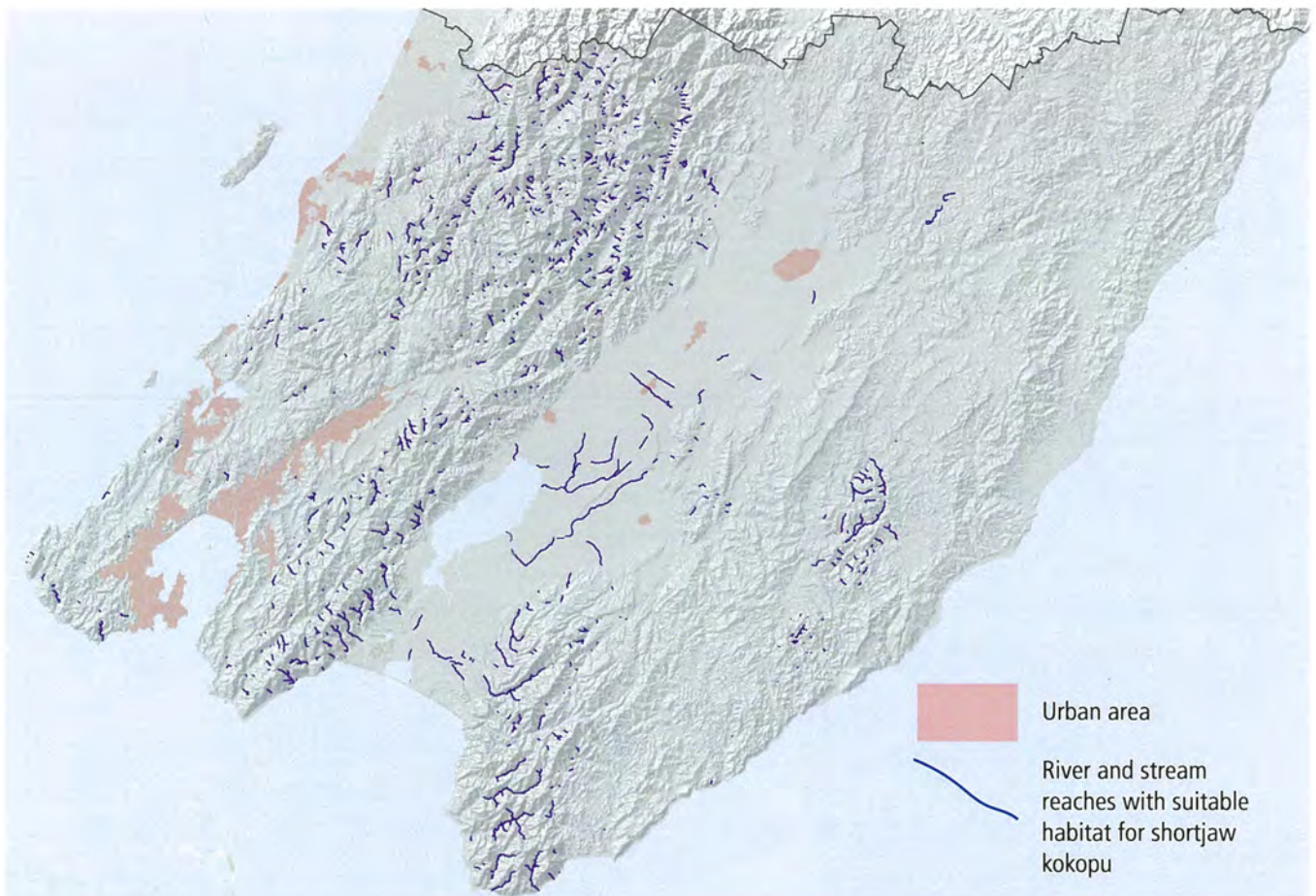
Secretive, elusive and seldom seen, they live under boulders and in the gravel on the stream beds and only come out at night to feed. The best way to find a shortjaw kokopu is to go spotlighting at night.

In our region, shortjaw kokopu are found in many places – the upper reaches of the Waitohu Stream, the Otaki River, the Mangaone Stream, the Waikanae River, the Horokiri Stream, the Hutt River, the Orongorongo River and in streams that flow from the Haurangi Ranges in the Wairarapa.

However, almost all the finds have only been of one specimen. We recently (2004) found shortjaw kokopu in the Kaiwharawhara Stream within Wellington City, the first find in one of our urban streams.

The life story of shortjaw kokopu

The shortjaw kokopu's life cycle is similar to that of other whitebait species and is described in the information sheet *Can fish fly?* that is part of this series. When the flows are high in the streams where they live, shortjaw kokopu lay their eggs along the edges.



Shortjaw kokopu habitat in the region.

When the flows drop, the eggs are left stranded on the stream margins. They develop there, then hatch when the river flows are high enough to cover them again. The stream carries the hatched larvae out to sea where they live for several months. They then return to freshwater as whitebait and begin their journey upstream, where they live as adults.

Shortjaw kokopu are known to be good climbers – probably not quite as good as koaro, but they have been found above some daunting obstacles. For example, they've been spotted above the Kaitoke weir on the Hutt River. At about four metres high, it's one of the tallest obstacles in any of our rivers.



The shortjaw kokopu in this photo was found in a bouldery stream, in native bush.

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Bullies

Native freshwater fish of our region

Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help keep it that way.

Six of the seven species in New Zealand's bully family are found in the region's rivers. They are sometimes referred to as cockabullies but this name is usually reserved for an unrelated common coastal marine species. Bullies live on the bottoms of lakes and rivers and you can usually spot them because of the darting movements they make when they're disturbed. However, apart from the bluegill bully and the redfin bully (described below), it can be difficult to identify the different species. A fish biologist is often needed if you want to distinguish a giant bully from a common bully, or a crans bully from an upland bully.

Like many other native freshwater fish, four of our bully species spend the early stages of their lives in the sea and migrate back to freshwater as juveniles, where they spend their adult lives. The other two, the crans bully and the upland bully, have different life cycles and they spend their entire lives in the rivers where they were born.

The **bluegill bully** has a bright membrane just behind its head. They prefer swift broken river waters – similar to the places where torrentfish live. They have been found in the Waikanae, Makara, Hutt, Wainuiomata and Orongorongo Rivers, and in the lower reaches of the Kaiwharawhara Stream.

With its bright red fins, the **redfin bully** is one of the most attractive of our freshwater fish. Only the males develop this distinctive colouring but the females have the same (uncoloured) diagonal stripes on their cheeks.

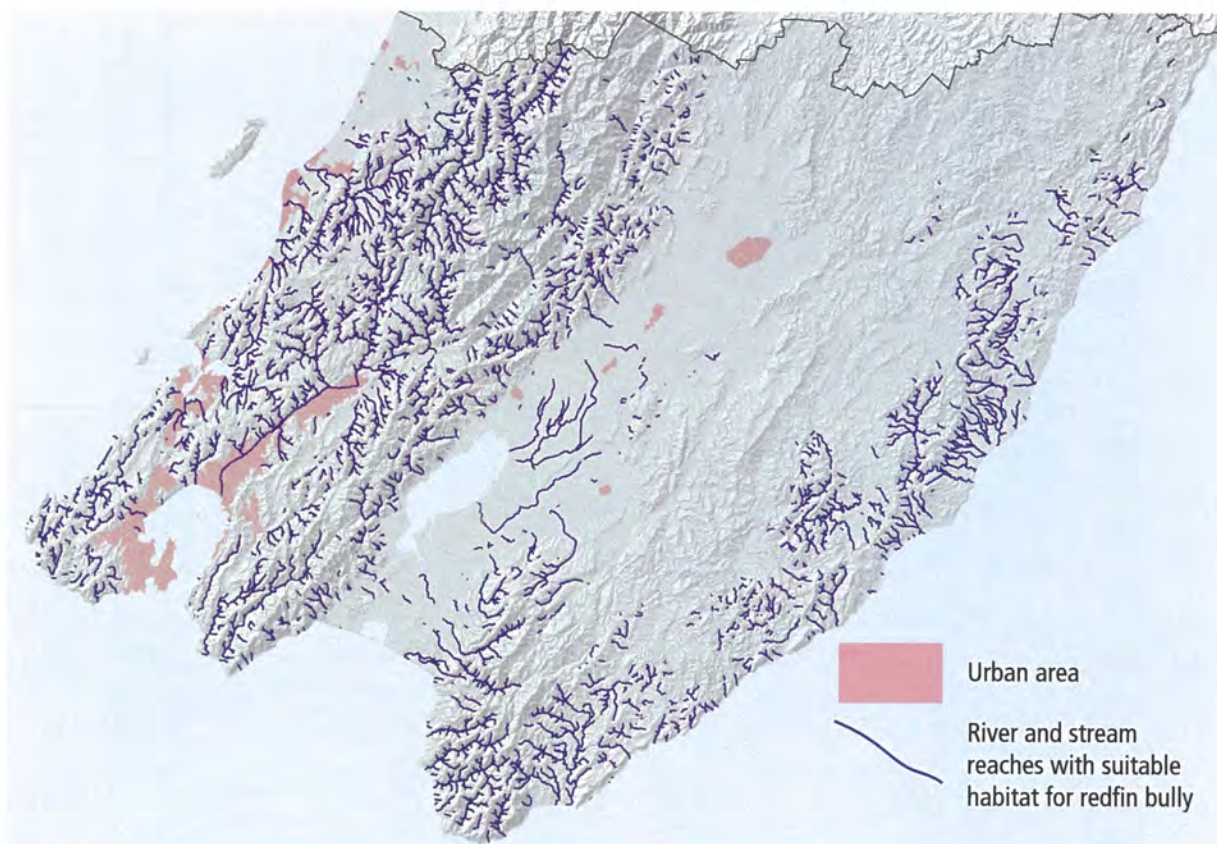
Redfin bullies are the most common of the bully family in the region. They live in many different types of rivers – from large rivers like the Waikanae, Hutt and Ruamahanga to small streams throughout the region. You can also find them in urban streams with reasonably good water quality, such as parts of the Kaiwharawhara Stream in Wellington City and the Wharemauku Stream in Paraparaumu. Redfin bullies also live in streams flowing from Tararua, Rimutaka, and Haurangi Ranges.



Bluegill bully



Redfin bully



Redfin bully habitat in the region.

As its name implies, the **giant bully** is the largest of New Zealand's bully family. Specimens more than 25 centimetres long have been recorded, although 12 to 15 centimetres is more common. Giant bullies always live within a few kilometres of the sea and prefer slow-moving water, such as lowland rivers, before they reach the sea. There are only a few records of giant bullies in the region.

Common bullies live throughout New Zealand and in the region have been seen in the Waitohu Stream, Waikanae River, Horokiri Stream, Hutt River, and Wainuiomata River. In the Wairarapa, you'll find them in the Ruamahanga catchment, in tributaries of Lake Wairarapa, and in Lake Wairarapa itself. The bullies living in and around Lake Wairarapa are likely to be landlocked, so the young aren't washed out to sea; instead they stay in the lake for the early parts of their lives. This isn't unusual – many of New Zealand's lake systems are home to landlocked common bully populations.

Crans bully and **upland bully** are non-migratory, so they don't need to go to sea as part of their life cycles. The two species can be difficult to tell apart and the types of rivers where they live can overlap. In the western part of the region, non-migratory bullies have only been recorded in the Hutt River catchment, but they have been found throughout the eastern Wairarapa hill country and in the tributaries of the middle and upper Ruamahanga River.



Upland bully

For more information contact us.

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This information sheet is one of a series about freshwater fish living in the region. To find out more, visit our website at www.gw.govt.nz or the National Institute of Water and Atmospheric Research website at www.niwa.co.nz.

Photos of bullies copyright Angus McIntosh and Peter E Smith, Natural Sciences Image Library .

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Torrentfish

Native freshwater fish of our region

Our rivers, lakes and wetlands are home to 22 species of native fish, which makes the freshwater fishery of the region one of the most diverse in New Zealand – and the Greater Wellington Regional Council wants to help keep it that way.

The closest living relative of torrentfish is the blue cod – a marine species familiar to many people. With this lineage, it's not surprisingly that they look quite different from our other native freshwater species. They're easy to identify because of their flattened head, large pectoral fins, and dark bands along their sides.



Torrentfish

Where do torrentfish live?

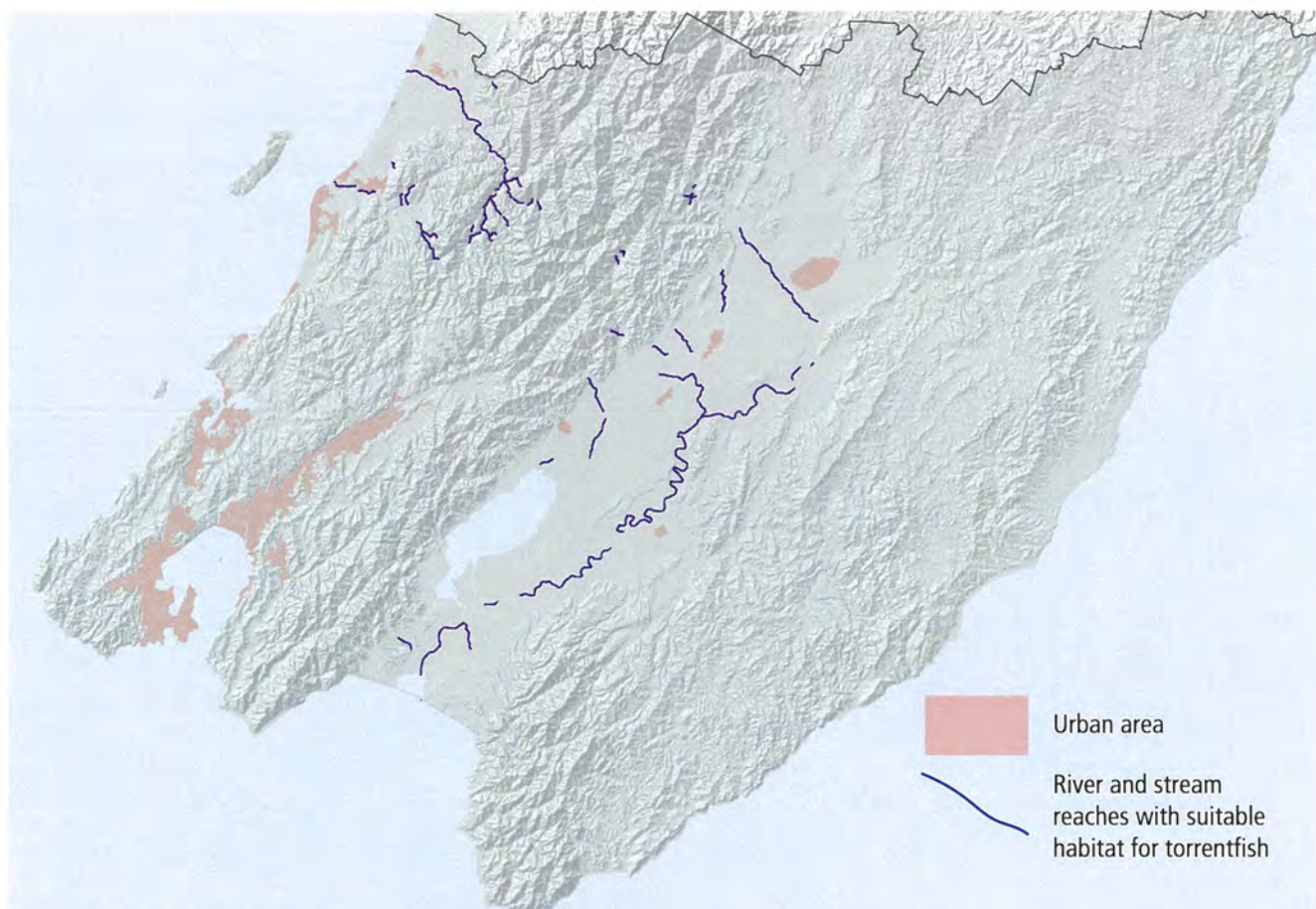
Torrentfish are only found in New Zealand. They live in the swift white rapids of stony rivers and streams, where even humans would find it hard to stand. With the help of their aerodynamic shape, they can anchor themselves to the river beds, clinging on with their fins.

Although torrentfish are one of the most common fish in New Zealand's open stony rivers, we don't have many records of them in our region. We've found them in rivers and streams such as the Waitohu, the Otaki, the Waikanae and the Ruamahanga, with the furthest inland sighting in the Waingawa River, which is a tributary of the Ruamahanga near Masterton.

The life story of torrentfish

Like many of New Zealand's freshwater fish, torrentfish migrate between the sea and fresh water as part of their life cycle. Looking like tiny replicas of the adults, juvenile torrentfish enter fresh water in spring and autumn, and after a few weeks in the estuaries begin moving upstream to the river habitats where they will live as adults. We know little about their breeding habits, except that the females tend to live upstream and the males downstream. How and when they breed is a mystery still to be solved.

Despite their ability to live in swift water, torrentfish are poor climbers and only go inland where the river bed has a low gradient. Weirs usually prevent them moving upstream. The Waikanae River above and below the Waikanae water supply weir offers good habitat for torrentfish to live in. However, they've only recently been recorded immediately above the weir, probably because of the recent efforts to enhance fish passage.



Torrentfish habitat in the region.

The two photos shown below were taken before and after work to improve fish passage at the Waikanae water supply weir. There was a vertical drop of about 1.5 metres over the original weir. The photo of the weir as it is now shows the rocks that were placed against the downstream side to provide a “ramp” that fish can swim up.

A series of grade control structures made out of rock rip-rap were also constructed downstream (not shown in the photo). Each raised the river bed by about a third of a metre and, together, they have helped reduce the drop over the weir. Overall, it's now a lot easier for torrentfish migrating upstream to get past the weir.



The original Waikanae water supply weir.



The weir as it is now.

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