Aquatic ecosystems

With around 20,000km of rivers and streams along with numerous lakes and wetlands, our region's waterbodies provide important habitat for a range of insects, fish, birds and plants.

Over the years, land use and industrial and urban activities have resulted in significant loss of freshwater habitat. Stream and wetland reclamation, excess nutrient and sediment inputs from agricultural land use, deforestation and urbanisation have all contributed to loss and degradation of aquatic ecosystems. Improving habitat has and continues to be a strong focus for the Council. While we are making good progress in improving habitat through our riparian, land management and biodiversity initiatives, significant work is required to address the legacy of poorly designed and installed structures in the region.

Many native and non-native fish are migratory, moving between marine and freshwater environments over their life cycle. As hydroelectric schemes were introduced, and roads and farm tracks crossed streams to open up access to land for development, barriers to fish passage grew. We know that the total number of instream structures in the region is likely to be in the tens of thousands however, we don't yet know how many of these structures present a barrier to fish passage.

The Council is taking steps towards improving ecosystem health, and identifying structures for removal and remediation. This section discusses three key aspects of our region's aquatic ecosystems: macroinvertebrates, periphyton (algae) and fish.

45%
Taranaki's native freshwater fish are **at risk of decline**
including inanga and torrentfish

Over the last 10 years
macroinvertebrate community index data shows
38%
of monitored sites are **very likely degrading**

13
periphyton sites
monitored monthly
since July 2017

Culverts & weirs
can prevent fish from accessing important habitat

What we know

Macroinvertebrates

Freshwater macroinvertebrates are small animals without backbones including insects, shrimps, snails and worms that live in streams and rivers. They play an important role in streams as they feed on aquatic plants, algae and dead leaves, and are an important food source for fish. Some macroinvertebrates prefer clean streams, while others are more pollution-tolerant. Because they tend to stay in one place, macroinvertebrates are good indicators of the health of the stream at a particular location.

Macroinvertebrate data has been collected every year since 1995. Data from 2015 to 2020 were assessed to determine the current state at 58 sites where data records were five years or longer. Macroinvertebrate health was assessed against criteria set out in the National Objectives Framework (NOF) of the National Policy Statement for Freshwater Management 2020 (NPS-FM) for three measures: the macroinvertebrate community index (MCI), semi-quantitative MCI (SQMCI), and average score per metric (ASPM). Under the NOF, band A is indicative of pristine conditions, while bands B and C are indicative of mild and moderate organic pollution or nutrient enrichment, respectively. Band D is below the national bottom line and is indicative of severe pollution or enrichment.

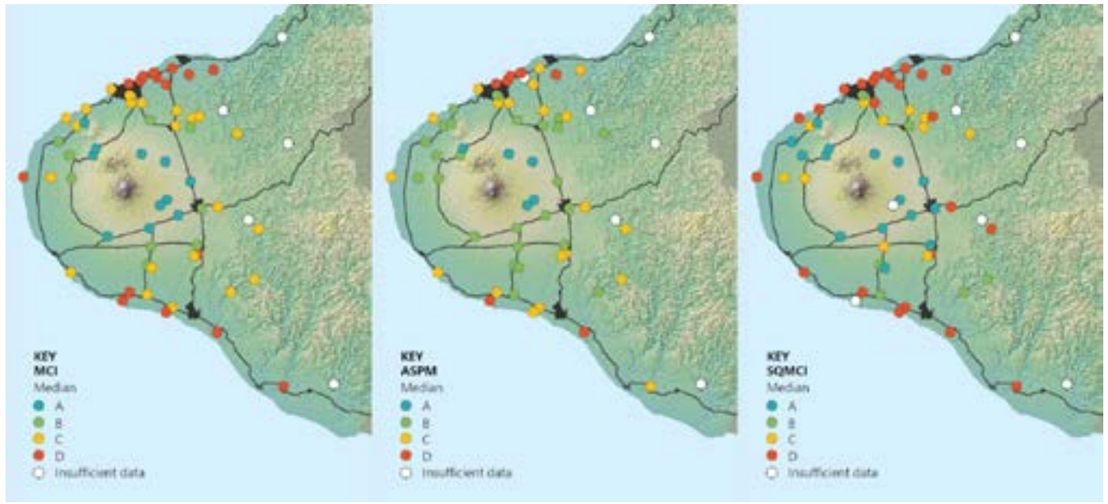
During the past five years 35 (60%) monitored sites fell within either the NOF band A, B or C for all of the three measures, while 23 sites (40%) failed to achieve the national bottom line for one or more measures. Six sites (10%) fell within band A for all three measures.

In general, sites in the upper catchment were in better ecological health than sites further down the catchment towards the coast. This pattern is commonly seen across New Zealand, with the impacts of land use and discharges often increasing as rivers and streams make their way through the landscape and down the catchment. We know that higher concentrations of nutrients and sediment contribute to the excess growth of algae and fine sediment deposition, and that these in turn affect freshwater ecosystems.

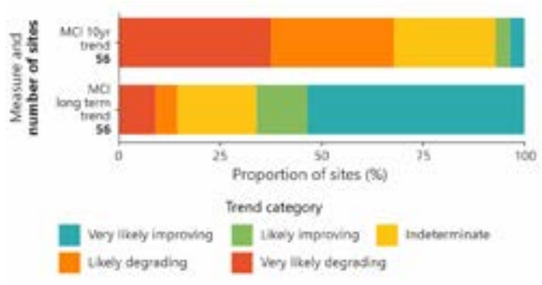
Lowland streams are less able to deal with pollution, as they tend to be warmer and naturally muddier, with lower dissolved oxygen levels. Larger, wider rivers also occur lower down the catchment and these rivers generally have less shading that also helps promote algae and aquatic plant growth. Pollution-tolerant macroinvertebrates favour rivers with excessive algae and aquatic plant growth. When present in high numbers, they provide an indication of the level of pollution a stream or river is likely experiencing. We assessed changes in macroinvertebrate communities over two time periods: short-term trends were assessed for the 10-year period from 2011 to 2020. Long-term trends were assessed for those sites with more than 10 years of data.

For sites with long-term records, macroinvertebrate health was very likely improving at the majority of sites (30 sites, 54%). Only a small percentage of sites were found to be very likely degrading (five sites, 9%). For at least one site, this was likely due to natural erosion events within Te Papakura o Taranaki.

Over the 10-year period from 2011 to 2020, the minority of sites were very likely improving (two sites, 4%), while over a third of sites (21 sites, 38%) were very likely degrading and 17 sites (30%) were likely degrading.



MCI (left), SQMCI (right) and ASPM (middle) five-year medians displaying colour-coded bands.

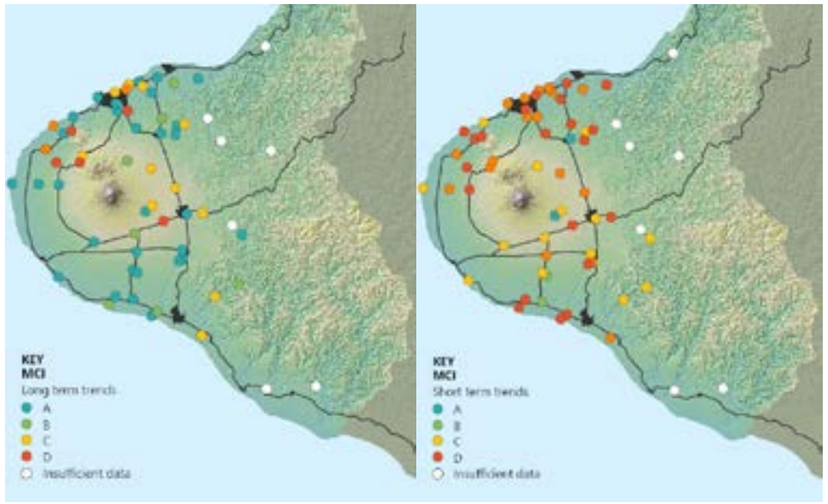


Proportion of improving, indeterminate and degrading 10-year (top) and long-term (bottom) trends for macroinvertebrate sampling sites.

Various initiatives to improve stream health in Taranaki continued since our last report in 2015. These included addressing hill country erosion, fencing and planting of waterways, and removal of dairy pond discharges to water. Identifying further actions that we can take to maintain and improve freshwater ecosystems will be required as we develop catchment action plans – a requirement of the NPS-FM.

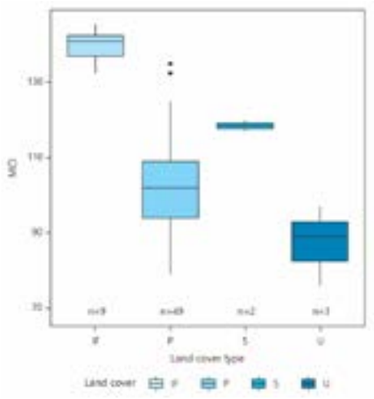
A number of factors help explain the variability in macroinvertebrate health across the region. Of these, land cover type had the greatest influence on the MCI score. In New Zealand, sites in the indigenous forest land cover class can generally be considered pristine therefore the streams that flow through them are very healthy. This is also the case in Taranaki, where sites with predominately indigenous forest upstream had MCI scores significantly higher than sites in scrub, pasture and urban environments. Sites with urban land cover had the lowest MCI scores, reflecting the various water quality, habitat and hydrological impacts such as contaminated stormwater discharges, occasional sewage overflows and culverts. Sites in pasture land cover had the second lowest MCI scores, with nutrient enrichment and sediment inputs more likely causes of decreased macroinvertebrate health at these locations.

Another linked group of factors correlated with macroinvertebrate health is network and catchment position, altitude and distance from the national park. Sites located in smaller streams (lower order) or in the upper (higher altitude) portion of the catchment were in significantly better health than lowland or large streams. This also applied to ring plain streams close to, or within, Te Papakura o Taranaki. Typically, streams grow in size and have higher numbers of smaller streams flowing into them as they progress down the catchment, so all four of these factors can be related to one another.



Long term (left) and 10-year (right) trends for macroinvertebrate sampling sites across the region.

There are likely to be a number of different reasons for the poor short-term trend results and the reasons for the decline are typically site-specific. At least one site appears to be affected by natural erosion events. Other sites may have been affected by activities such as poor waste management from businesses/industry located upstream, as has been occasionally identified through consent compliance monitoring. Other factors that may be affecting short-term trends include climatic variation, in particular having hotter, drier summers and, in some areas of the region, more intensive agricultural production.



Boxplots of MCI scores for four land cover types (IF = indigenous forest, P = pasture, S = scrub and U = urban) sampled in the Taranaki region.

Periphyton (algae)

Periphyton is the 'slime' on riverbeds. It is mostly algae, but also fungi and bacteria that grow on the beds of our rivers, lakes and streams. Periphyton forms the base of the food web in rivers, turning dissolved nutrients into nutritious food for invertebrates, so some periphyton is needed to support a healthy ecosystem. Too much periphyton however, can decrease the habitat available to freshwater macroinvertebrates and make rivers and streams unsightly and less desirable for people to swim in. Excessive periphyton can also cause fluctuations in water quality, which in extreme cases may impact on other freshwater life.

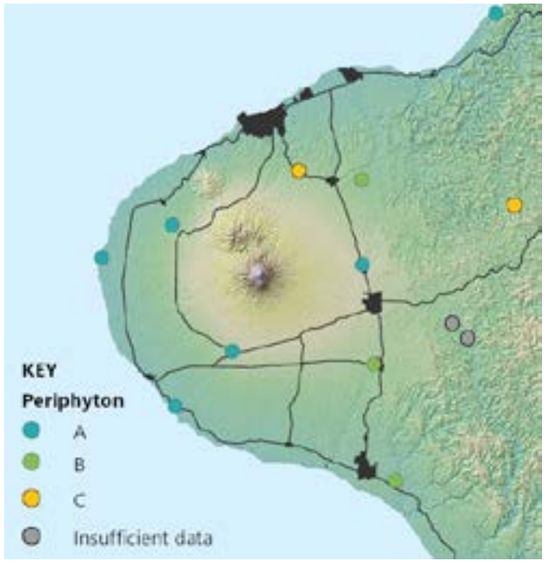
Periphyton appears as slimy mats or as strands (known as filaments). The amount in rivers and streams depends on a range of factors, which vary seasonally and tend to peak in summer or autumn. The most important factors are nutrients, stream flow and light.

Periphyton is measured by the concentration of chlorophyll-*a* per square metre (a pigment that plants use for photosynthesis). Monitoring is carried out where periphyton is likely to grow. This includes sites with rocky or sandy streambeds where periphyton can attach, and where the water is shallow enough for light to penetrate. This means monitoring tends to focus on the ring plain around Taranaki Maunga where most rivers have rocky streambeds.

Periphyton at 13 monitored sites were compared to the NOF attribute criteria. No sites fail to achieve the national bottom line (band D). Two sites (15%) fell within band C, two sites (15%) within band B, six sites (45%) within band A, while a further two sites (15%) had insufficient data to determine current state.

Periphyton is also measured visually at the same 13 sites so that it can be compared to guidelines for ecological health or aesthetic values. Weighted composite cover measures the combined cover of some of the less desirable forms of periphyton, such as long filaments and thick mats. The aesthetic guideline for weighted composite cover is 30% or less. Six of 13 sites have never exceeded this value, while five sites exceeded the guideline between 4% and 15% of the time. The remaining two sites exceeded this value more than 25% of the time.

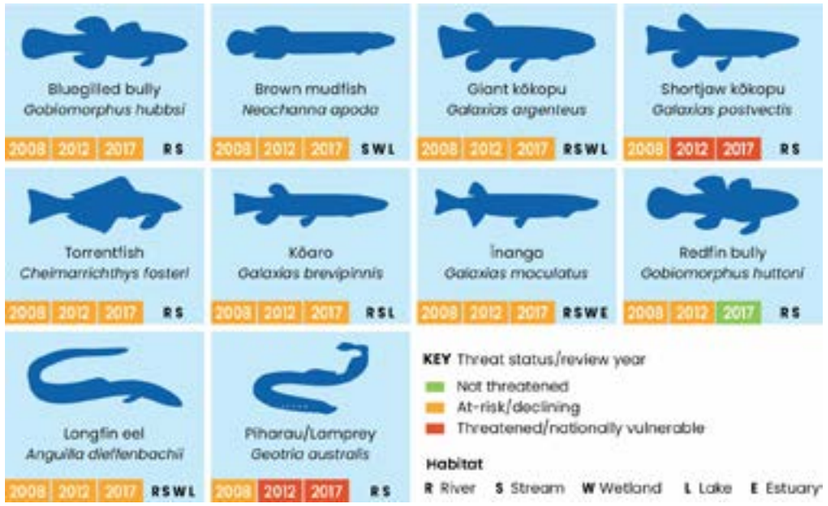
Monthly periphyton monitoring has been running for almost five years. While we are able to assess the current state of periphyton at our monitoring sites, we don't yet have enough data to establish any trends. However, as we collect more data we will be able to assess how periphyton is changing over time.



Periphyton monitoring sites as measured against the National Objectives Framework periphyton attribute criteria.

Fish passage

Twenty native fish species inhabit freshwater ecosystems in Taranaki for all or part of their life cycle, with many migrating between the freshwater and marine environment. These fish include piharau (lamprey), tuna (eels), banded kōkopu, giant kōkopu, kōaro, īnanga and shortjaw kōkopu (migratory galaxids more commonly known as whitebait), the elusive brown mudfish, and a number of other species. Many of these fish are threatened with extinction or population decline because of human pressures. Non-native fish in the region include the sport fish trout and perch and a few pest species, including gambusia and rudd.



Native freshwater fish species in Taranaki that have been classified as 'At Risk' or 'Threatened' since 2008. Note: The Threat Status of the Redfin bully (Gobiomorphus huttoni) has improved in the most recent assessment, after scientists learnt more about the population.

Poorly designed or maintained culverts, weirs and other instream structures can reduce the connectivity between these environments. Where these artificial barriers restrict the upstream passage of fish, it reduces the amount of habitat they can access. Given the sheer number of rivers and streams in Taranaki, there are likely tens of thousands of structures throughout the region. Over the life of the structure, some of these could act as a full, partial, or temporary barrier to fish passage, undermining the hard work of landowners and communities to enhance fish habitat, such as riparian restoration.

Piharau/lamprey (Geotria australis) is one of two native freshwater fish in Taranaki classified as 'Threatened - Nationally Vulnerable'. Evolutionarily, piharau are among the last extant (still living) members of the most primitive group of vertebrates; Agnatha (jawless fish).

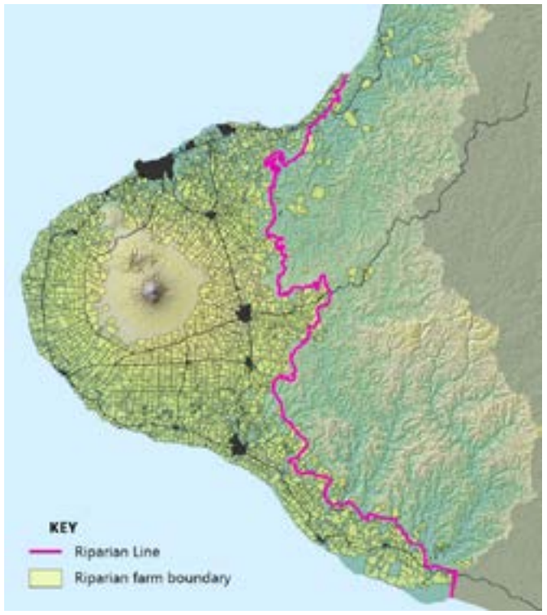
What we're doing

Riparian Management Programme

For more than 25 years, the Council has worked with Taranaki landowners to fence and plant thousands of kilometres of waterways. The Council adopted its riparian management strategy in 1993 to address the adverse effects to waterways of contaminants from overland run-off. Under the resulting voluntary Riparian Management Programme, landowners received customised plans, advice and information. Landowners pay for fencing, plants and planting, while the Council supplies native plants at wholesale rates. The programme covers all areas of intensively farmed land in Taranaki.

Riparian margins are 89.5% fenced and 80.9% planted (or vegetated) as a result of 6,003km of new fencing and 4,575km of planting. More than 7.2 million native plants have been supplied to landowners at cost. This is significant under a voluntary approach and puts Taranaki ahead of the rest of the country with plan preparation and implementation.

Landowners have paid the majority of implementation costs however, for the last three years the Council has participated in two Government grant schemes MfE's Freshwater Improvement Fund (two years), and the Jobs for Nature Fund in 2021. Grants totalling $7 million resulted in 1.07 million native plants being planted to accelerate implementation. Contractors planted most of these as part of the Government's Covid-19 recovery initiative.



Area covered by the Council's riparian management programme.

The Council has encouraged planholders to implement their riparian plans through annual fencing and planting. There is 1,742km of fencing and 2,466km of planting left to do, as the programme addresses all waterways (including drains) of any size. When existing plantings mature to provide bank stability and shading and additional filter strips are created/planted, further improvement in water quality is expected. Native planting will complement improved water quality with enhanced biodiversity as hundreds of hectares of new habitat are created, generating wildlife corridors from Te Papakura o Taranaki to the sea. An independent NIWA study in 2018 found riparian restoration in Taranaki as part of the Riparian Management Programme has had a beneficial effect on water quality (based on *E.coli* concentrations) and the health of aquatic invertebrate communities.

Since 2011, the Council has signalled its intention that regulation will be introduced to complete the riparian programme by 2020 or near thereafter. The NPS-FM requires regional councils to develop regional plans and rules to address water quality issues by the end of 2024.

It is intended that farmers on the intensively farmed ring plain and coastal terraces, who have not made significant progress implementing their riparian plans, will require a resource consent. Additionally, new stock exclusion regulations under the RMA take effect in 2023 but will only apply to 1m wide streams.

The Government intends to introduce compulsory Freshwater Farm Plans towards the end of 2022. These may give effect to recommendations in the Council's riparian management plans, which will help complete the job. To ensure our riparian management plans cover all waterways and wetlands, we will carry out audits over the next few years. These will also collect information required under the NPS-FM.

The Riparian Management Programme shows what can be achieved when there is collective goodwill and collaboration. Landowners can be proud of the work they have done and the difference it has made. This Taranaki spirit will be required as we tackle water quality challenges into the future.

Fencing and planting along riparian margins helps to improve the health of freshwater ecosystems.

Freshwater fish habitat loss and degradation

The way land is used can impact the habitats of our freshwater fish in a variety of ways. Intensive agricultural and industrial land use can lead to nutrient enrichment and the proliferation of algae in waterways, reducing oxygen levels and affecting fish habitat availability and food sources. Urban development and infrastructure, roading and forestry can introduce sediment and other contaminants into waterways through stormwater run-off, earthworks or erosion. Hydroelectric power generation alters the physical nature (flow and temperature) of waterways and can present a significant barrier to fish passage.

Stream and wetland modification continues in the region, both authorised and unauthorised, as people look to develop land. The modification of waterways and removal of instream debris, substrates and vegetation can degrade or remove fish habitat.

Non-compliant stream culverts can prevent the upstream migration of fish due to the swift flows, shallow flows, steep approaches (waterfalls), overhangs (or perches) and by not providing rest areas.

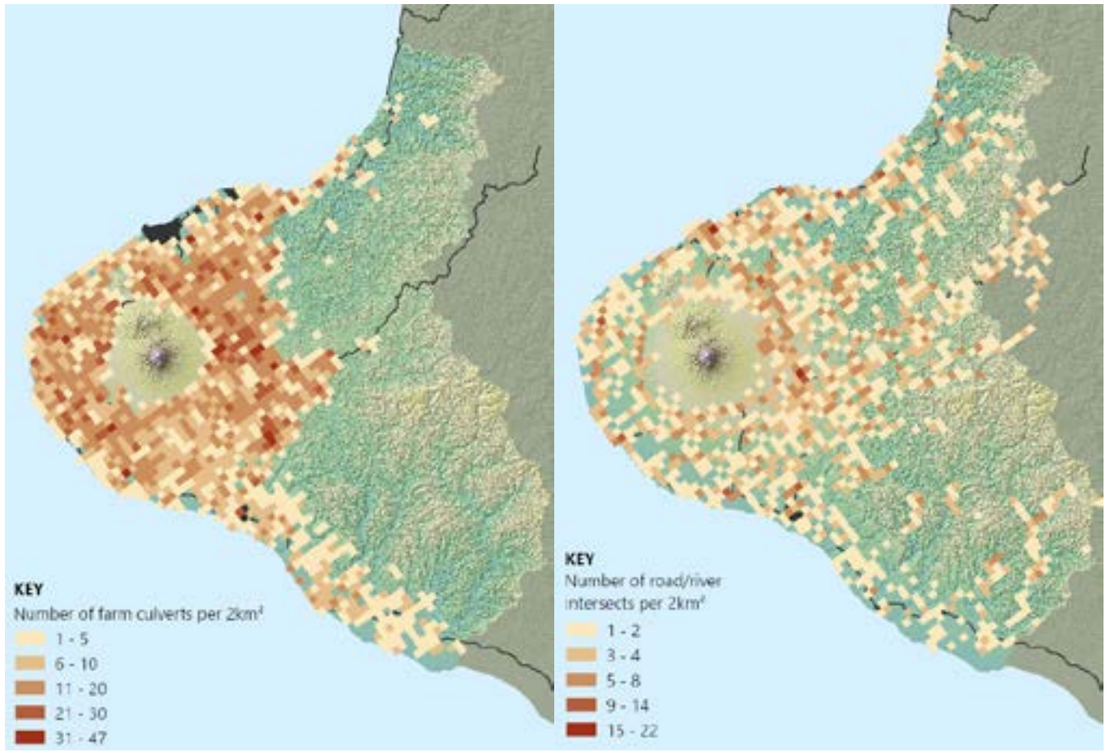
The Council supports and promotes initiatives to remediate some of the damage done by historical activities through our Key Native Ecosystem (KNE) programme and Riparian Management Programmes, which aim to restore degraded habitats. We also monitor a range of consented activities, like those that require discharges of contaminants to land and water, and monitor structures such as culverts to ensure fish passage is maintained. When necessary, the Council will take enforcement action against those responsible for unauthorised activities, for example discharging toxicants to waterways or filling in wetlands and streams, which kill fish and degrade habitat. Occasionally, Council enforcement has resulted in prosecution.

Improving fish passage

The Council has compliance programmes and other initiatives in place to identify potential barriers to fish passage throughout the region. The land management team identifies structures through the riparian programme, with 11,804 structures identified to date. Desktop geospatial analysis has identified where local roads and state highways cross rivers and streams, and where a bridge or a culvert is expected be present. So far, 3,225 crossings have been identified.

Once a structure is identified, it needs to be inspected in order to assess compliance with fish passage requirements. This is a significant undertaking that the Council is beginning to work through. The compliance team is working with a number of landowners to reinstate or improve fish passage where barriers have been identified.

The Council is also exploring opportunities to increase its capabilities with the funding and/or support of fish passage remediation projects. We are working towards the removal of a number of significant barriers, following the successful removal of the Kaūpokonui Weir, a project championed by local iwi and hapū.



Left: Location and density of farm culverts identified on farms in the Riparian Management Programme. Right: Location and density of points where local roads or state highways intersect with rivers, indicative of the presence of bridges or culverts.

Award-winning project a win for region's fish

The removal of the weir was a huge milestone.

Fish can now move freely up and down Kaūpokonui Stream for the first time in 120 years.

Thanks to a project led by Te Korowai o Ngāruahine Trust, with support from Fonterra Kāpuni, Taranaki Fish and Game, South Taranaki District Council and Taranaki Regional Council, a 3m high disused weir in South Taranaki has been removed.

Up to 15 native fish species will no longer have to jump or climb the weir to navigate their way upstream, says Paddy Deegan, the Council's Freshwater Environmental Scientist.

"The weir was preventing access to a significant amount of habitat for many of these species, some of which are threatened or at risk of population decline," Mr Deegan says.

"Many fish aren't great climbers or jumpers, so with the weir removed fish can once again move freely up and downstream.

"Even one of our most athletic fish, the lamprey (piharau), struggled to navigate the weir. We expect that the number of species present in the stream and its tributaries above the old weir will increase, and fish numbers will grow overall."

Investigation into removal of the weir began in 2001, so the March 2021 removal (following a site blessing the previous month) was a huge milestone celebrated by all involved.

Monitoring since the weir's removal indicate the intervention has had an immediate positive impact. Sampling in the Kaūpokonui has detected piharau, smelt, īnanga, torrentfish, kōaro, and tuna (both longfin and shortfin eel) above the old weir.

Council staff consider this to be a good sign, and hope to see a big migration upstream in 2022 and successful spawning throughout the upper catchment in the years to come.

Council-Director Operations, Dan Harrison, says the weir demolition was probably the biggest single intervention to improve outcomes for the catchment's native fish.

"We were happy to work alongside iwi and hapū to support removal of this weir. It will have a massive positive impact on the number and types of fish seen in this and surrounding streams in years to come."

Te Korowai o Ngāruahine Trust representative, Kawarau Ngaia, acknowledged the efforts of the Trust's Environmental Policy Advisor Bart Jansma, saying his contribution to the success of the project was significant.

The project saw the Trust win a Taranaki Regional Council Environmental Award in 2021. It was also recognised on a national level, earning second place in the Cawthron New Zealand River Awards 'River Story' category.

The Te Korowai o Ngāruahine Trust team celebrating the weir removal.

Where we're heading

Responding to changes in national monitoring requirements

New national and regional directives, which have resulted in changes to regional policies and rules, increase the focus on protecting fish and their habitat. The NPS-FM, the National Environmental Standards for Freshwater (NES-F) and the National Environmental Standard for Plantation Forestry (NES-PF), all set out requirements for councils and communities to provide for better outcomes for fish.

The monitoring of fish and fish passage will grow significantly in the coming years to align with national objectives and to meet reporting requirements on NPS attributes. This will include assessing fish populations using the Fish Index of Biotic Integrity (Fish IBI), a measure of the condition of fish communities.

Environmental DNA (eDNA) is increasingly being used to identify fish populations throughout waterways in New Zealand. eDNA is a relatively new tool that allows us to identify nearly all of the different living organisms that exist within, or have come in contact with, a waterbody. By collecting a sample of water, genetic material can be extracted and cross-referenced against a library of genetic markers that are unique to different organisms. While we are not yet able to estimate the population size of specific species, eDNA can provide an idea of relative abundance. Although it may currently have some shortcomings, eDNA is nevertheless an exciting new technique to include in our monitoring toolbox. Councils are increasingly using eDNA to complement traditional survey techniques such as electric fishing, trapping and spotlighting.

Another change introduced by the NPS-FM requires that macroinvertebrates are monitored annually between December and March (inclusive), using particular methods. Traditionally, we have undertaken two surveys for macroinvertebrates: one in spring and one in summer.

In the future, our monitoring programme will align with these requirements and ensure we have good coverage of a variety of stream and river types. We will also look at different ways to analyse data to better determine what factors are the most important for creating healthy stream communities.

Work is underway to review the Council's periphyton monitoring programme, with plans to establish additional sites in areas of the region where conditions might support excessive periphyton growth. We will conduct a desktop analysis of environmental factors, followed by a survey of areas likely to support conspicuous periphyton growth. Work is underway to align our periphyton monitoring methodology with new National Environmental Monitoring Standards (NEMS). This will ensure we can compare results with other regions, as we do for a range of other water quality indicators.

Once enough data is collected, we can look at relationships between periphyton and the factors that impact periphyton growth, such as nutrients, light and stream flow. This will help us better target actions to improve water quality throughout the region. This will include setting nutrient limits as required by the NPS-FM.

NEMS are a series of documents providing guidance on sampling procedures for various types of environmental monitoring. A regional council initiative, NEMS assist in ensuring consistency in the application of work practices specific to environmental monitoring and data acquisition throughout New Zealand.

Monitoring of fish and fish passage will grow significantly in coming years to align with national objectives.