Understanding our rivers – a Ngā Awa perspective.

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DOC's Ngā Awa river restoration programme commenced in 2019, targeting 14 catchments. As of 2026 we are working in 12 catchments. As intended, the catchments vary widely in their state and the type of river. The readiness of the catchment community, particularly mana whenua, to engage in restoration with DOC is a significant factor shaping the programme. Each catchment differs in physical and biological state, the priorities of the catchment community and thus the opportunities for, and challenges of, restoration available to DOC and partners.

Monitoring has been a significant challenge for the programme. A comprehensive national monitoring campaign was proposed early on but not fully realised, due in part to lack of resourcing. The design required approximately a day of sampling effort per site by 3 to 4 people, and significant analytical costs, which together limited the number of sites per catchment that could be resourced annually. In the meantime, each catchment has independently undertaken more focussed surveys to understand the current state, and where appropriate, to support engagement and collaborative development of a restoration plan. eDNA sampling, habitat assessment, macroinvertebrate surveys, īnanga spawning surveys, fish spotlighting, trapping and electric-fishing surveys, and fish passage assessment have all been widely deployed – often in collaboration with, or by partners. Multi-year 'saline wedge' surveys have been pursued in several catchments. LIDAR surveys have been co-funded with partners in several catchments that lacked coverage. Mātauranga Māori-based cultural assessments have been completed by mana whenua in several catchments. Engagement monitoring has also informed our work with partners. Geomorphic analyses, both desktop- and field-based have supported community engagement and guided further monitoring, research and restoration activities. Finally, restoration actions such as fencing length, numbers of plants, wetland & riparian areas protected can be enumerated. A logic model approach to restoration monitoring proposed by Clapcott et al (2021) for Ngā Awa and the Jobs For Nature projects demonstrates that restoration actions completed, provide a useful indicator of progress toward outcomes in the short-term (i.e., 1-5 years) doc-j4n. Freshwater biodiversity responses are expected to take 5-10 years or longer and generally require more specialised and costly analysis.

The Ngā Awa team is considering a revised, two-part approach to monitoring with a stripped back, standardised national component, and related, but separate catchment-driven monitoring. The national programme would prioritise coverage, consistency and cost-effectiveness over intensity, which is important when catchments vary longitudinally, laterally and temporally. Secondly catchment-driven monitoring will continue to address local catchment priorities and will evolve as the programme progresses from baseline surveys, to designing and implementing a restoration plan, then adaptive monitoring to track effectiveness and progress.

Following the Tide: Exploring Potential Effects of Sea Level Rise on Īnanga Spawning Habitat in the Wellington Region

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Īnanga spawning habitat is concentrated within a dynamic zone where freshwater and tidal influences interact. These habitats are already subject to a range of pressures, and climate-driven sea level rise is likely to further influence the environments in which spawning occurs. Understanding these potential changes is increasingly relevant for the management and restoration of coastal waterways.

This project investigates the relationship between known inanga spawning habitat and future sea level rise in the Wellington Region. Drawing on existing information and spatial analysis, the project seeks to explore potential implications for habitat location, protection, and restoration at a regional scale.

The poster will present a conceptual assessment of possible future habitat change and discuss opportunities for incorporating climate adaptation considerations into īnanga spawning management and identify priorities for future investigation rather than provide definitive predictions.

Build it and they may not come: linking macroinvertebrate dispersal and establishment to freshwater restoration success

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Restoration efforts are often built on a key assumption: if we improve a degraded ecosystem, target species will return. However, restoration outcomes remain highly variable, and biological recovery oftens lags habitat improvements. Recovery of biological communities depends on two linked but distinct ecological processes. First, taxa must disperse to the restored area, and second, successfully establish. If either step is constrained, restoration efforts may not succeed in recovering the target species. We present a practical framework for identifying whether community recovery is limited by dispersal, establishment, or both, using freshwater macroinvertebrates as an illustrative example. Macroinvertebrate communities are an apt focus given their broad distribution and diversity of life cycles and dispersal modes. Invertebrates disperse instream predominantly via downstream drift, using the water flow as a dispersal mechanism. Upstream and lateral movement also occurs; however, this is less common and typically less effective. Moreover, many taxa have a terrestrial aerial adult phase, including notably sensitive insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies), which afford them the ability to disperse through multiple mechanisms. Our framework guides practitioners through a sequence of monitoring questions and steps across restoration planning, implementation and evaluation. By combining conventional community sampling with more targeted approaches such as drift sampling, oviposition assessment, and surveys of aerial adults, it is possible to distinguish between taxa that have not arrived, have arrived but not established, and those that have successfully established. This diagnosis is critical because the management responses will differ. Dispersal constraints may indicate the requirement for improved connectivity to nearby source populations, riparian corridor management or, in some cases, translocation of source populations. Establishment constraints instead suggest that attention should remain focused on improving such things as local habitat, flow, water quality, or food-web and biotic interactions. While we present a macroinvertebrate example, this framework has wider applicability for restoration ecology. The framework advances freshwater management by shifting from asking not only, “what is present?” to also asking “what is preventing recovery?” For managers, scientists and restoration practitioners, application of this framework will ensure monitoring efforts are diagnostic, actions more targeted, and restoration expectations more realistic.

Examining macroinvertebrate distributions in the Waikato River: interacting effects of CO2-driven acidification and Gold Clam invasion

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Examining macroinvertebrate distributions in the Waikato River: interacting effects of CO2-driven acidification and Gold Clam invasion

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Macroinvertebrates are an important component of freshwater ecosystems, with distributions controlled by a variety of biotic and abiotic factors. We investigated the current and predicted future impacts of elevated CO2 on the distributions and abundances of macroinvertebrates in New Zealand, focusing on the Waikato River.

Elevated CO2 levels decrease the pH of water through reactions to form carbonic acid. This can have strong impacts on some macroinvertebrate taxa, in particular gastropods and bivalves, which possess a calcium carbonate based shell. This shell is in a constant flux with the environment, being rebuilt by the animals at the cost of energy that could be devoted to survival and reproduction.

A further pressure on New Zealand's freshwater ecosystems is invasions, including that of the recently established Gold Clam (Corbicula fluminea) in the lower Waikato River. This invasion may interact with pressures brought about through climate change. This clam has a variety of probable impacts on the chemistry and ecological communities of these freshwater bodies, including stripping the water of the carbonate that native molluscs require to build their shells. We predicted that sites with established Corbicula populations would show reduced gastropod/native bivalve abundance due to carbonate competition.

Duplicate macroinvertebrate samples were collected from eleven sites within Lake Karāpiro and Lake Ōhākurī using a D-net over a 5 x 5 m area for 5 minutes. Abiotic factors were measured at each site, including pH, dissolved oxygen, temperature, substrate composition, chlorophyll a and heavy metal concentrations. Lake Ōhākurī had elevated CO2 levels due to the influence of geothermal inputs, providing a proxy for how the ecosystem may look in the future. Differences in the abundances and diversity of macroinvertebrates were found among sites. The majority of sites were dominated by the amphipod Paracalliope fluviatilis, with over 80% of animal counts made up of this species. Other dominant taxa included chironomids, flatworms, caddisflies (particularly Paroxyethira and Oxyethira) and odonates such as Xanthocnemis. Gastropods typically comprised a smaller proportion of the total animal numbers, while Gold Clams were present in most of the Karāpiro sites. This poster will discuss possible future scenarios for the Waikato River macroinvertebrate community based on future predictions of CO2 levels in concert with the Corbicula invasion.

From data to understanding: a new national resource to support interpretation of community-based stream monitoring data

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In 2024, the national community-based monitoring (CBM) framework, Make your stream data count!, was released to support catchment and community group coordinators in the design and implementation of fit-for-purpose stream monitoring programmes. However, years of engagement with and feedback from many of the now hundreds of catchment groups across Aotearoa New Zealand have consistently highlighted that collecting data is only one part of the monitoring journey. Interpreting results, understanding relationships between indicators and communicating findings with confidence remain significant challenges for many catchment coordinators and others supporting community groups.

To address this need, a new guidance resource has been developed to complement the existing national CBM framework by focusing on interpretation of stream monitoring data. Designed primarily for catchment and community group coordinators, the guidance aims to improve freshwater science literacy and confidence in interpreting and communicating stream monitoring results through a 'train-the-trainer' approach. Development of the guidance was funded by the Ministry for the Environment's A2E Fund, with document design funded by Greater Wellington Regional Council and the New Zealand Freshwater Sciences Society.

The guidance is structured in three parts. The first introduces five guiding principles for interpreting stream health data, together with an overview of relevant guidelines and how to apply them appropriately, recommended summary statistics and graphs, and existing national resources such as the River Environment Classification and the Land Air Water Aotearoa (LAWA) website. The second part comprises concise two-page information cards covering over 20 stream health indicators in the national CBM framework. Each card describes what the indicator measures, the key factors that influence it, expected measurement ranges across New Zealand streams draining major land cover types, practical interpretation tips and relevant guideline values. The final part contains an urban and a rural case study to demonstrate how multiple indicators can be combined to build an overall picture of stream health while highlighting the importance of recognising uncertainty and avoiding over-interpretation of monitoring data.

Life History Variation in Landlocked and Diadromous Common Smelt on the Chatham Islands

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Landlocking represents a major life history transition for facultatively diadromous fishes, yet its effects on reproductive investment and life history evolution remain poorly understood. Common smelt (Retropinna retropinna) provide an ideal model for investigating these effects because populations can either complete their entire life cycle in freshwater or migrate between freshwater and marine environments. The Chatham Islands (Rēkohu) present a unique natural system in which diadromous smelt and multiple landlocked populations occur in close geographic proximity, allowing comparisons that minimise confounding effects associated with latitude and other large-scale environmental gradients.

This research investigates how landlocking influences the life history and reproductive traits of common smelt across Chatham Island. Field sampling was completed seasonally from October 2025 - August 2026, with smelt collected from six landlocked and two diadromous populations. Population characteristics, including age structure, growth, and length-weight relationships, will be compared alongside reproductive traits such as size and age at maturity, gonadosomatic index (GSI), hepatosomatic index (HSI), spawning timing, fecundity, egg size, and larval size. Study lakes encompass a broad productivity gradient and include systems both with and without predatory tuna (eels). This design enables the effects of resource availability and predation pressure on life history trade-offs to be examined alongside the influence of landlocking.

This work will contribute to a broader understanding of how migratory life histories evolve following freshwater isolation and provide new insights into the ecological drivers of reproductive variation in common smelt.

Preliminary analysis suggests that landlocked and diadromous populations have different spawning times and that diadromous populations had a larger egg size and lower relative fecundity.

The role of catchment groups in wetland restoration

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A great number of catchment groups have formed throughout Aotearoa NZ over the last 15 years, often in response to concerns about declining water quality. These groups have driven community-led riparian and wetland planting projects, secured funding from government and industry sources, and appear to have generated strong enthusiasm for leaving a proud environmental legacy for future generations. However, little research has explored the ecological and social outcomes of these groups for wetland restoration.

Working with members of a South Otago catchment group, we assessed water quality, soil health, vegetation community composition, and overall condition of wetland restoration projects, alongside group members' motivations, challenges and views via an online survey and informal interviews. Planted wetlands (n=7) were compared to remnant wetlands (n=3) and control sites (waterlogged areas in pasture; n=4).

Planted wetlands showed promising improvements, with results falling in an intermediate range of values between control and remnant wetland condition for several parameters including WCI score, native wetland vegetation cover and diversity, soil organic matter and bulk density. Water quality results were more ambiguous, with no significant change in any parameter from inflow to outflow, whereas remnant wetlands significantly reduced both TN and DIN. Phosphorus appears to be a challenging issue in the catchment and likely requires additional mitigation strategies.

A low survey response rate (n=8) limited analysis of social outcomes, but identified a small group of highly engaged individuals in the catchment strongly motivated to improve water quality and biodiversity, with all respondents undertaking wetland restoration projects on their own land. Cost, labour, and navigating funding and consent applications were identified as common barriers, but all respondents agreed that the formation of the catchment group had improved access to funding and resources. Committee members described the development of a sense of collective identity and empowerment in the catchment following the formation of the group, but also pointed to the complexity and volatility of freshwater regulations as a threat to the group's momentum.

These findings suggest that catchment groups play a role in lowering practical barriers to on-farm wetland restoration efforts, while building community cohesion and social capital through shared goals. Outcomes from wetland restoration work so far show positive overall trends in wetland health, however further improvement depends on the time and goodwill of a core group of engaged landowners, requiring ongoing support from relevant stakeholders.

Where are the bullies? Gobiomorphus distribution patterns and co-occurrence dynamics in New Zealand

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Gobiomorphus species are a core constituent of the New Zealand freshwater fish community. These charismatic fish are found throughout the country, but the specifics of their distributions are poorly detailed. We used the New Zealand Freshwater Fish Database (NZFFDB) combined with the River Environment Classification database (REC) to evaluate observed patterns in bully distribution, habitat use, and co-occurrence dynamics. Distribution follows two primary patterns: species which are found nation-wide, primarily migratory species with a concentration along the coast, but also including the non-migratory upland bully; and the non-migratory species that occupy a more limited range. Co-occurrence of bullies is common, with assemblages of up to five species being observed. In every instance, bullies display a use of habitat that is significantly different from the available proportions of habitats for each REC variable assessed. Habitat preferences also differed significantly among species, with multiple habitat variables being attributable to these differences. While the patterns observed are themselves informative, we present this research as a 'leaping off point' to highlight an array of knowledge gaps and interesting trends which could be explored further to improve our understanding of this important group of fish.

Does Trophic State Determine Lake Ecosystem Resilience to Extreme Weather?

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Extreme weather events (EWEs) such as storms are projected to change in their frequency, magnitude, and duration under anthropogenic climate change. These pulse disturbances can destabilise lake stratification, flush nutrients and sediment into the water column, and raise the risk of cyanobacterial blooms. At the same time, many Aotearoa New Zealand lakes are already under chronic stress from eutrophication, a press disturbance driven by land-use intensification. While the ecological effects of EWEs and eutrophication have each been studied in isolation, no dataset currently exists to test how these two stressors interact, leaving it unclear whether nutrient-enriched lakes are less able to resist and recover from storm impacts. To address this gap, we hypothesise that lakes with higher nutrient levels will show reduced ecological resistance and resilience to EWEs, meaning the same storm event drives a larger and longer-lasting shift in community composition in already-stressed systems. Paleoecological reconstruction across eight Aotearoa New Zealand lakes spanning oligotrophic to supertrophic conditions was used to evaluate this hypothesis. Chronologies were developed for each sediment core using Pb-210 dating, allowing storm layers, identified using iTrax micro-XRF scanning and grain-size analysis, to be linked to extreme rainfall events in instrumental data. Environmental DNA was extracted from sediment sampled above and below each identified storm event and analysed via metabarcoding across five genetic markers (16S rRNA, Cyano16S rRNA, 18S rRNA, rbcL, and trnL), targeting bacteria and archaea, cyanobacteria, micro-eukaryotes, and plants, respectively. Community composition data were analysed using Principal Coordinates Analysis and a Rate of Change framework to quantify deviation from baseline and determine ecosystem resistance and resilience across the trophic gradient. By spanning a gradient of trophic states, this study aims to determine whether eutrophication acts as a background stressor that preconditions lakes to respond more severely to storms.

The effects of freshwater acidification driven by atmospheric CO_2 on shell strength of the aquatic bladder snail (Physella acuta) under projected future freshwater conditions

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Freshwater acidification, driven by rising atmospheric CO_2 levels due to anthropogenic climate change, has the potential to reduce shell calcification and increase shell weakening in Mollusca, increasing their vulnerability to predation and shell dissolution. We investigated the effect of reduced pH on the shell strength of the freshwater bladder snail (Physella acuta) under controlled laboratory conditions, using pH treatments based on projected declines in both pH and carbonate saturation in Te Awa o Waikato (the Waikato River) over the next century. Ninety snails were randomly assigned to one of three pH treatments representing a control (pH 7.75–8.25), moderate acidification (pH 7.00–7.50), and high acidification (pH 6.50–7.00), with 30 biological replicates per treatment. Following a four-day exposure period at 17°C, shell crushability force (N) was measured and analysed while accounting for variation in shell sizes.

Based on preliminary data, snail shell length was positively associated with crushing resistance across all pH treatments (ANCOVA, $F(1, 86) = 227.3$, $P < 0.001$), with larger individuals requiring greater force to crush. After accounting for differences in shell length, pH treatment remained a significant predictor of shell crush threshold (ANCOVA, $F(2, 86) = 5.0$, $P = 0.009$). Tukey HSD post-hoc comparisons showed that snails exposed to the high-acidification treatment had weaker shells than those in both the control ($P = 0.002$) and moderate-acidification ($P = 0.012$) treatments. However, shell strength didn't statistically differ between the control and moderate-acidification treatments ($P = 0.797$). Acidification reduced shell strength, with snails exposed to the high-acidification treatment requiring, on average, 21.6% less force to crush than control snails (2.55 ± 1.85 N vs. 3.25 ± 1.81 N) and 18.6% less force than snails exposed to moderate acidification (3.13 ± 1.85 N). Overall, shell strength was greatest under control conditions with highest mean shell strength, and declined under increasing acidification, with the greatest reduction occurring in the high-acidification treatment, which consistently exhibited the lowest crushing thresholds.

Our preliminary findings demonstrate that short-term exposure to reduced pH can reduce shell strength in Physella acuta. Although further research is needed to assess the long-term responses, these findings suggest that continued freshwater acidification may increase the vulnerability of calcifying freshwater invertebrates to predation and other environmental stressors. Our results suggest that projected declines in pH and carbonate saturation in Te Awa o Waikato may reduce shell strength in freshwater Mollusca, with potential consequences for predator-prey interactions and the broader functioning of river ecosystems under future climate change.