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Pondering microplastics: assessing microplastic contamination of freshwater ponds in Aotearoa New Zealand

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Microplastics are being recognised to negatively impact many organism groups and have been identified in samples from freshwater ecosystems globally, however research on pond environments remain limited. We conducted a national-scale survey of ponds (95 in total) throughout New Zealand's urban areas, to determine the extent and abundance of microplastics in these systems. We collected composite water and benthic sediment samples from each pond. After sample preparation (drying, density separation and digestion), microplastics were identified and classified under a dissecting microscope. The plastic size range of interest was 0.125-5 mm, as a 0.125 mm sieve was used for sample collection. All microplastic particles identified were classified by their shape (fibre, fragment, film, sphere or foam), size and colour. We will present the results from the 55 ponds sampled from Aotearoa's five largest metropolitan areas (Auckland, Tauranga, Wellington, Christchurch and Dunedin). In the water samples, fibres and fragments dominated the samples. The most common size class of plastic was 0.125-0.5 mm, and black was the most frequent colour in these samples. In our study, we compare the plastics from sediment samples to water samples, and more broadly contribute to our understanding of the ubiquity of microplastics in freshwater ponds.

DION: A High-Fidelity Darkwater Inland Observatory Network Supporting Satellite Remote Sensing and Water Quality Modelling in Australia

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The Darkwater Inland Observatory Network (DION) is a purpose-built inland water quality reference site developed under the AquaWatch Australia and AusCalVal initiatives, led by CSIRO. DION is designed to support the development, calibration and validation of satellite remote sensing products for inland water quality, while also generating long-term, high-frequency datasets that are ideal for training artificial intelligence models and validating ecological forecasting systems.

Operational since September 2024 at Googong Dam in New South Wales, DION conducts autonomous water surface measurements every 10 minutes, complemented by routine in-water sampling. These surface samples are laboratory analysed for key water quality parameters, including pigment composition via high-performance liquid chromatography (HPLC), spectrometry-based measurements, and concentrations of chlorophyll-a, phycocyanin, total suspended sediments, and both dissolved and particulate carbon and organic matter.

The observatory is equipped with a comprehensive suite of instruments, including three sets of TriOS Ramses radiometers (measuring downwelling irradiance, sky radiance and water-leaving radiance), each characterised and fully calibrated. These are mounted on a pan-tilt unit with inertial measurement and an electronic compass for precise orientation. Additional sensors include Heitronics KT15.82 thermal radiometers, a weather station, horizontal and hemispherical sky cameras, and water temperature sensors at five depths. A YSI EXO2 multiparameter sonde is also integrated just below the surface for point in-water measurements of conductivity, temperature, depth, dissolved oxygen, turbidity, total algae (via chlorophyll-a and phycocyanin fluorescence), and fluorescent dissolved organic matter (fDOM).

DION is being developed in four stages. Stage 1 (2022–2023) focused on platform deployment, including mooring systems, pontoon acquisition, electronics integration, power management and data logging. Stage 2 (2024–2025) is focused on automating data processing, integrating thermal radiometers, and establishing QA/QC workflows and metadata protocols. Stage 3 (2025–2026) will support product verification and site-specific water quality model development, including a local spectral library and uncertainty tracing. Stage 4 (2026–2028) will expand the platform with additional sensors, including those for inherent optical properties (IOPs), and further automation of data processing and cloud detection QA flagging.

DION meets the Fiducial Reference Measurement (FRM) internationally agreed standards through rigorous calibration, uncertainty budgeting and internationally recognised protocols. This ensures that satellite-derived water quality products—such as chlorophyll-a, CDOM, turbidity and temperature—can be validated with high confidence in optically complex inland waters.

The observatory is also building a high-temporal-resolution database of paired laboratory, in situ and satellite observations. This dataset is invaluable for training and validating AI and machine learning models, and for parameterising and verifying ecological models used in water quality forecasting. As part of AquaWatch Australia, DION contributes to a national-scale capability for water quality monitoring and forecasting. This presentation will provide an update on DION's development, current achievements and early results, highlighting its role in advancing inland water remote sensing and long-term environmental modelling.

Integrated Catchment Management in Bream Bay: A Collaborative Action Plan for Water Quality and Biodiversity Enhancement

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Bream Bay is facing pressing environmental concerns, including declining water quality, biodiversity loss, and reduced fish abundance. In response, the Piroa Conservation Trust (PCT) commissioned a Catchment Action Plan under the Ministry for the Environment's Access to Experts initiative. This plan was developed collaboratively by Mariana Basilio, Dr. Fabio Rosa, Dr. Neil Mitchell (BEnviro, a Babbage Company), and Amy Bazeley (DuneScape Ltd). It provides expert guidance and site-specific recommendations for riparian planting, stormwater management, and ecological restoration, all supported by field assessments, geospatial analysis and robust desktop research.

To engage stakeholders and support informed decision-making, key deliverables were produced: an interactive story map to communicate the plan's vision and priorities, an integrated spatial data dashboard, and a summary report. The dashboard integrates spatial data layers such as HAIL sites, resource consent status, erosion risk, flood-prone areas, fish spawning zones and others.

To explore the story map and dashboard, which will be included as a barcode in the poster, please click here:

<https://storymaps.arcgis.com/stories/d0aba74fd84f4b7aa1611cabb03d5d74>

A tangible outcome of this initiative is Project Bellbird, an ecological corridor along the Waionehu Stream directly inspired by the Action Plan's recommendations. This project successfully connects Waipu Township to the Piroa Ranges, fostering community engagement and achieving significant biodiversity recovery, evidenced by the return of bellbirds after decades of absence. Looking forward, PCT is focusing on securing funding, refining water quality monitoring, and collaborating with Northland Regional Council to address contamination sources from expired consent holders. This case exemplifies how expert-led planning combined with community-driven action can effectively achieve integrated catchment management and enhance ecological resilience.

Effects of two common contaminants, ibuprofen and imidacloprid, on invertebrate and periphyton communities: A field mesocosm study

Nina Sarah Batucan

Emerging organic contaminants (EOCs), including pharmaceuticals and pesticides, are increasingly detected in freshwater systems worldwide. There is a need to understand their complex and often unpredictable effects on ecosystem structure and function to inform the development of environmentally protective policies and regulations concerning the management of these contaminants. We conducted a 30-day multi-stressor field mesocosm experiment using 64 circular flow-through stream channels, where we exposed benthic invertebrate and periphyton communities to the pharmaceutical ibuprofen (0 vs. 32 $\mu\text{g/L}$), the neonicotinoid insecticide imidacloprid (0 vs. 0.7 $\mu\text{g/L}$), and fast vs. slow flow velocity (to simulate different habitat conditions). Ibuprofen addition had no negative effects on the invertebrate communities and even led to a 15 %–increase in the densities of grazers relative to the control treatment. By contrast, imidacloprid addition resulted in increased drift of pollution-sensitive taxa such as EPTs. In the benthos, imidacloprid caused a reduction in Simpson's diversity and a change in community structure driven by declines in the densities of several common taxa, including *Deleatidium* spp., Chironomidae, Ostracoda and Nematoda. Similarly, ibuprofen had largely benign effects on the periphyton community, with the lowest mean algal biomass (chl α) and total cell density occurring in ibuprofen channels, likely due to the higher grazer densities in these channels. Imidacloprid caused the thickening of periphyton mats, probably due to a 41% reduction of grazers, which were largely comprised of leptophlebiid mayflies. Both contaminants had variable effects on pollutant-tolerant and -sensitive algal taxa, indicating that these trophic-based sensitivity indices may not be useful for evaluating ecological effects of these EOCs. The combined exposures of ibuprofen and imidacloprid generally led to antagonistic multiple-stressor effects, possibly because ibuprofen had a positive stimulatory effect on the grazer populations that mitigated the adverse effects of imidacloprid. The toxic effects of imidacloprid were more apparent in fast-flow channels, likely because pollution-sensitive taxa tended to be more abundant under fast-flow conditions. The largely benign effects of ibuprofen could be due to the insensitivity of the biological models used in our study. This may risk underestimating the true hazards of ibuprofen and related EOCs, especially to fish and other vertebrates—for which pharmaceuticals are generally designed—which were not used in our study. This limitation highlights the importance of using appropriate biological models for ecotoxicological testing. Compared to ibuprofen, the neonicotinoid imidacloprid caused more pervasive negative effects that were mainly driven by the invertebrate responses, pointing towards the prioritisation of regulating these pesticides.

Investigating the effects of freshwater acidification on individual and community level responses in microalgae in Te Awa o Waikato

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Te Awa o Waikato, Aotearoa New Zealand's longest river, flows from Lake Taupō in the central volcanic zone, through eight hydroelectric dams, before entering the Tasman Sea at Port Waikato. Along its course, geothermal inputs elevate pCO₂ and lower pH, creating a natural gradient that closely mirrors conditions projected under future freshwater acidification. This PhD project will use the river as a large-scale natural analogue to investigate how rising CO₂ levels influence eukaryotic algae and cyanobacteria, with a focus on growth rates, photophysiology, carbon uptake, and community composition. The field component will survey sites spanning a range of geothermal influences, combining metagenomics to catalogue species abundance with transcriptomics to identify the presence and expression of genes linked to CO₂ tolerance. These data will help predict future phytoplankton assemblages and identify traits that may confer resilience under changing conditions. Laboratory experiments will then expose monocultures and mixed communities to controlled CO₂ and pH treatments, enabling direct tests of physiological thresholds, competitive interactions, and the potential for CO₂/pH effects to be amplified or offset by other factors such as nutrient availability, temperature, and turbidity. By integrating field observations with manipulative experiments, the project will provide a robust framework for understanding the drivers of community change in freshwater systems. The findings will inform targeted restoration, biosecurity measures, and adaptive water-management strategies for the Waikato, a river of national significance for hydroelectric generation, agriculture, mahinga kai, taonga species such as kākahi (freshwater mussel), and recreational use. Situated within the cross-disciplinary 'Emerging Climatic Pressures' programme, this research will deliver urgently needed, locally relevant evidence on ecosystem vulnerability to climate-driven acidification, while contributing to the global understanding of freshwater resilience and guiding the development of strategies to safeguard Aotearoa's rivers for future generations.

Relationships between periphyton, land-use and environmental variables in Aotearoa, New Zealand: Patterns, drivers and implications

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Periphyton are key primary producers in freshwater ecosystems, forming the base of food webs and responding rapidly to changes in water quality. The level of periphyton abundance and community composition is the product of multiple environmental variables interacting in complex ways. This study investigates the relationships between periphyton metrics (percent cover of different algal types and chlorophyll-a), water quality variables, and land-use. Datasets of monthly periphyton metrics and water quality variables were obtained from four regional councils in key dairying regions (Waikato, Horizons, Canterbury, and Southland). The assembled dataset spanned 7 years and was analysed using a mixture of statistical techniques, including linear regression and random forest models to identify relationships. Increased knowledge of current patterns and drivers of periphyton in rivers and streams across Aotearoa, New Zealand, will lead to more effective management decisions and healthier freshwater ecosystems as a result.

Alum dosing Lake Moawhitu, Rangitoto ki te Tonga (D'Urville Island)

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Lake Moawhitu is a 37-hectare coastal dune lake with high ecological and cultural value, located on the western side of Rangitoto ki te Tonga (D'Urville Island) in the Marlborough Sounds. Rangitoto ki te Tonga has a long and rich history of Māori occupation and use, with Lake Moawhitu and wetland providing valuable mahinga kai. Ngāti Koata are mana whenua iwi and were the last Māori landholders at the site. The Greville Harbour Farm, including the lake, adjacent wetland and surrounding catchment was purchased in 2005 with funding from the Nature Heritage Fund and vested in the Department of Conservation (DOC). Subsequently, substantial restoration work has been carried out in the catchment involving destocking, replanting and raising water levels in the wetland. However, historic use of fertiliser and erosion following deforestation has resulted in a legacy of elevated phosphorus levels in lake sediments. The lake is super-trophic with low water clarity and frequent algal blooms during summer periods due to the re-mobilisation of phosphorus. The nature of the nutrients in the lake means that algal blooms are recurring, and the lake is in a perpetual cycle of low health and mauri. In spring, we plan to treat areas of the lake greater than six metres deep with Alum (aluminium sulphate) to bind the high internal phosphorus load within the lake. Alum chemically binds phosphorus and deactivates it before settling to the lakebed, creating an inactive layer. The effectiveness of Alum dosing to address water quality issues of this type has been demonstrated at many sites internationally and several in New Zealand. It is expected that this will result in a major improvement in water quality, and in conjunction with the ongoing catchment restoration works, greatly advance the restoration of the mauri and ecological values of Lake Moawhitu.

Germination requirements and hydrochory of semi-arid floodplain-wetland forbs

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Floodplain-wetlands in semi-arid regions of Australia experience highly variable hydrological regimes, with plant life histories adapted to these irregular patterns of hydrological exposure. These ephemeral wetland systems rarely receive rainfall in significant volumes to cause widespread flooding, with non-local rainfall flowing into the system causing inundation. The natural flow regime of ephemeral wetlands in Australia has been affected by the building of water infrastructure in major river systems, reducing the frequency and duration of inundation events in most semi-arid floodplain-wetlands. To supplement this natural flow regime, environmental flows are released to achieve ecological goals within these systems. In these semi-arid regions, select common species have had their life histories studied, with species such as forbs having minimal research conducted on their life history requirements for germination. To investigate this area further, seeds were recovered from forbs in the lower Lachlan River system, with a glasshouse germination experiment conducted on *Alternanthera denticulata*, *Centipeda minima* and *Glinus lotoides*. This experiment aimed to determine how hydrological exposure affected the germination of these species, along with the potential for hydrochory of their seeds. Seeds from each species were tested with five different hydrological regimes, simulated rainfall, soaked soils, and inundation for a duration of 20, 40 and 60 days. Over the course of the experiment germination counts were taken for the species daily. For flooded treatments, floating seed counts were taken daily to determine their potential for hydrochory. Preliminary data indicates that prolonged water exposure results in higher germination rates, along with seeds floating for substantial durations. The results of this experiment will inform our understanding of the life histories and germination requirements of these species, furthering the understanding of forb responses to hydrological conditions in semi-arid floodplain-wetlands.

The Tiaki Maniototo Project, a Jobs for Nature initiative in the Upper Taieri Catchment

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Almost 70% of New Zealand is in private land ownership. Protecting and restoring biodiversity on private land is critical to reversing the decline of indigenous biodiversity. This PhD research analyses the outputs from The Tiaki Maniototo Project, a Jobs for Nature initiative in the Upper Taieri Catchment, using this as a case study to investigate how successful wetland restoration can be achieved on private land.

The research began with a review of private wetland restoration projects in the South Island which served as a baseline to identify successful strategies and common barriers. Ecological outputs within the project were analysed, however the findings show that ecological outputs aren't enough on their own to define success. Measuring the success of wetland restoration on private land requires social data as well. Community engagement and landowner participation impacted ecological outcomes and were crucial indicators of the Tiaki Maniototo Project's wetland restoration success.

Returning Home by the Sea: A Study into the recruitment of *Galaxias Maculatus*

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Galaxias maculatus (īnanga) is an amphidromous fish species that inhabits various waterways across New Zealand and serves as the cornerstone of the culturally and economically significant whitebait fishery. While amphidromy usually facilitates extensive connectivity through marine larval dispersal, emerging research indicates that *G. maculatus* may demonstrate more restricted dispersal patterns and greater site fidelity than previously recognized. To explore the spatial and temporal variations in dispersal and natal origins, we undertook a national-scale otolith microchemistry investigation, analyzing post-larval specimens gathered from 24 river mouths that span all major regions of Aotearoa New Zealand during two distinct sampling periods in October and November 2023. Utilizing laser ablation-inductively coupled plasma mass spectrometry (LA-ICP-MS), we derived elemental fingerprints from a range of trace elements sensitive to local water chemistry: Li, B, Mg, Al, Mn, Ni, Cu, Rb, Sr, and Ba. Our analysis revealed significant spatial structuring on both regional and national levels. Notably, individuals from the Coast sites displayed unique, localized chemical profiles when compared to those from the West Coast.

The East Coast's rugged geomorphology, characterized by headlands and embayments, combined with complex current systems, may restrict larval transport and encourage local retention. In contrast, the West Coast environments feature long, low-gradient beaches with more consistent coastal hydrodynamics, showing greater elemental similarity across sites indicative of wider larval dispersal. Moreover, latitudinal distinctions were evident, as northern and southern regions exhibited recognizable chemical signatures, pointing to limited larval exchange between these areas. Importantly, these spatial patterns remained remarkably consistent between our October and November samples, suggesting temporal stability in otolith chemistries and reinforcing the inference of geographically constrained dispersal. Though our data do not directly track larval trajectories or fidelity to spawning sites, the strong correlation between otolith signatures and geographic origin in early life stages suggests that a considerable number of individuals may recruit close to their natal habitats. This aligns with accumulating evidence that amphidromous species, including *G. maculatus*, may not be as demographically open as once thought. Despite some modest temporal variation in certain element concentrations, likely attributable to environmental or oceanographic fluctuation, this did not obscure the prevailing spatial structuring.

This study represents the first comprehensive and temporally replicated analysis of *G. maculatus* connectivity at a national scale. Our findings carry significant implications for the management of whitebait fisheries, highlighting the necessity to incorporate localized population dynamics and regional recruitment processes into conservation strategies. Management frameworks that presuppose panmixia may overlook the vulnerabilities of discrete subpopulations, especially in areas where local retention is pronounced and dispersal is limited.

Swim like nobody's watching: Using remote underwater videography to observe fish behaviour in wooded stream pools

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Instream wood is increasingly discussed as both an essential feature of healthy freshwater systems and a potential tool for fish habitat restoration. However, it remains unclear how native fish utilise this habitat, and whether their use differs from that of salmonid species for which many wood reintroduction techniques were originally developed. Current fish survey methodologies, such as spotlighting and electrofishing, fail to capture natural fish occupation and behaviour in proximity to instream wood, limiting our understanding of these interactions. To address this, we are developing a novel remote underwater videography (RUV) protocol for use in New Zealand freshwater systems. This method aims to improve detection of both fish presence and behavioural interactions with instream habitat. The study, located on the West Coast of New Zealand's South Island, will test the efficacy of RUV in small, forested stream pools. GoPro cameras will be deployed for six-hour periods across both day and night over five consecutive days. Recorded footage will be analysed for species presence, activity patterns, and habitat use, and results compared to other fish survey methods. This approach may offer a non-invasive, cost-effective alternative for gathering information on our native freshwater fish taonga. As freshwater ecosystems remain among the most degraded globally, access to accurate, species-specific data is essential in guiding effective restoration design.

The problem with PFAS

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Per- and polyfluoroalkyl substances (PFAS) pose a growing environmental challenge in New Zealand. These synthetic compounds are valued for their resistance to heat, water, and oil. Due to its resistance to degradation, and strong adherences to surfaces such as concrete, steel, and car tyres, PFAS can remain a source of potential contamination long after initial use.

PFAS have been detected in surface waters and soils across New Zealand, particularly near sites where firefighting foams were historically used such as industrial sites, fire training grounds, airports and military bases. PFAS can remain in soil and water for decades, slowly leaching into and conveying through moving groundwater and affecting freshwater ecosystems.

New Zealand lacks comprehensive national guideline values for PFAS in surface waters. Instead, authorities rely on international standards and site-specific assessments. PFOS and PFOA have been banned since 2006, and a broader phase-out of PFAS-containing firefighting foams is set to be completed by December 2025 prompting research into its environmental persistence and effects. However, most of the research to date has only focused on short chain PFAS (4-6 carbons).

Current treatment options for surface waters are limited with biochar and activated carbon can be used for point-source mitigation. However, once carbon or biochar has been used, it then becomes a contaminated material, limiting disposal options.

The sheer number of different compounds contained under the PFAS umbrella, including more highly environmentally persistent long-chain PFAS has made development of guideline values and environmental treatment extremely difficult. Further guideline values for PFAS compounds in freshwaters are required. PFAS use challenges New Zealand's environmental management efforts and will continue to do so for many years.

Investigating soil health markers as indicators for wetland restoration success.

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New Zealand has lost an estimated 90% of its original wetland extent for land development.

Restoration of these ecosystems aim to revitalise biodiversity, enhance climate resilience, uphold cultural values and improve water quality. However, the ability for ecosystems to return to their pre-human condition remains disputed and raises important questions for measuring restoration success.

My research explores quantifying restoration success via soil health of Te Pouaruhe, a partially modified wetland adjoining Lake Ōnoke, Wairarapa.

Once a productive mahinga kai for local hapū, half of the wetland was separated by a stop bank then drained for cropping and grazing in 1944. Restoration of the drained section began 2018. In this study, restoration progress will be measured using soil carbon (Dumas Combustion & LOI) and microbial composition (eDNA) for comparison with the unmodified zone. Temporal shifts in soil carbon and microbial composition will also be assessed within the unmodified zone, using radiometric dating to establish chronology.

Findings will indicate whether current restoration efforts are returning Te Pouaruhe to a pre-modified condition or progressing towards a distinct modern condition. Using a combination of paleo and eDNA markers to understand wetland soil health could provide metrics to inform setting of restoration goals and monitoring progress.

Assessing the influence of extreme weather on lake functions using high-frequency buoy monitoring

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Lakes are important indicators of climate change impacts. With their global distribution, varying physical structure, trophic status, and species diversity, lakes provide comparable records of climate change impacts throughout space and time. One way to study climate change through lakes is by looking at the effects of extreme weather events on lake function. Extreme weather events, such as intense rainfall, windstorms, and droughts, are shifting in their intensity, frequency, and duration in response to climate change. Each event type will have varying effects on lakes depending on individual lake characteristics, antecedent conditions, and individual event attributes. Some previously documented effects of extreme weather on lakes include disturbing the thermal stratification, nutrient loading, and metabolism rates. However, the understanding of lake-specific resistance, resilience, and recovery time remains limited, particularly from high-resolution continuous datasets.

This project aims to quantify the influence of extreme weather events on the physical, chemical, and biological dynamics of lakes across the North Island of New Zealand and other regions worldwide. It will investigate: (1) the impact of Cyclone Gabrielle on the recovery time of physical, biological, and chemical processes in lakes from two regions of New Zealand with varying rainfall patterns; (2) how extreme weather events affect the temporal cohesion of lake functions between New Zealand lakes from various regions over multiple years; (3) changes in primary production of New Zealand lakes with varying storm conditions using Aquatic Ecosystem Modelling for the Environment (AEME); (4) the effects of extreme weather events on global lakes with varying lake characteristics, land catchments, and ecotypes. This study will utilize high frequency meteorological and biological data collected from on-lake buoys, and novel statistical applications (e.g., wavelet analysis and ensemble modelling).

By characterizing both immediate and delayed lake responses, this research will enhance understanding of how lakes withstand and adapt to extreme events, informing predictions of ecosystem vulnerability under a changing climate.

Cold-water pollution: how hypolimnion releases from large dams alter thermal regimes and downstream ecosystems

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There are more than 57,000 large dams in the world. The majority of these exist in warmer climates where, for large parts of the year, thermal stratification occurs, resulting in bottom waters significantly colder than surface waters. When this cold hypolimnion water is released, thermal (or cold-water) pollution can occur where downstream river temperatures are drastically different to natural conditions. Here we present data investigating the dynamics of thermal pollution in the Severn River, NSW, Australia. Thermal pollution occurred in the river from Spring through to Autumn, closely following the formation and breakdown of thermal stratification within the upstream dam and was discernible up to 75 km downstream of the dam. Thermal pollution was most severe during summer, with temperatures up to 13°C colder in the river downstream of the dam compared to reference sites. We also recorded instances of 'cold-shock', where release depths from the dam changed and downstream temperatures dropped by 10°C within a matter of hours. Coldwater pollution has caused widespread changes in the downstream ecosystem, including altering benthic algae biomass, zooplankton and macroinvertebrate community structure and impeding fish recruitment. Our results demonstrate the clear need for mitigation efforts to restore the natural temperature regime and reduce impacts on ecosystem health.

What's in a name? The need to develop grouping terms that reflect the different life history strategies of Aotearoa galaxiids

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There has been a lack of consensus for what to call galaxiids with differing habitat usage and life history strategies. The inconsistencies in the terminology used is an increasing source of confusion for local practitioners and detracts from the international accessibility of research on these fish. Traditionally, the freshwater galaxiid species of Aotearoa were grouped into two broad categories: the five 'diadromous' or 'migratory' species share the common trait of a marine larval stage and inclusion in whitebait runs (the two terms are essentially used interchangeably); and the remaining galaxiids without a marine life stage were collectively grouped as 'non-diadromous' or 'non-migratory.' However, we argue that these terms do not adequately reflect the extent of habitat use, migration, and life history diversity present in galaxiids. While some subsetting terms for wholly freshwater galaxiids have been proposed (e.g., 'river-resident galaxiids'), they do not capture all available freshwater habitats occupied by galaxiids (e.g., lakes and wetlands). We examine the benefits and limitations of the current terminology used to group galaxiids. Using examples across Aotearoa galaxiids, we suggest new and alternative grouping terms that may better represent galaxiids according to their habitat use, life history, and plasticity. We invite the feedback of conference delegates on these terms and welcome recommendations for other terms as well, in the pursuit of appropriate and consistent categorizing of these important fish. Redefining the grouping terms used for Aotearoa galaxiids to better reflect our current understanding of these species will help to synchronise the terms used by local freshwater practitioners. This will make the categorisation of Aotearoa freshwater fish more accessible to the international scientific community and could help streamline the description of galaxiid life histories throughout the Southern Hemisphere.

Groundwater -surface water connectivity and river health in the Lower Darling Baaka River

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Groundwater–surface water interactions are fundamental to the ecological integrity of semi-arid river systems. In the lower Darling Baaka, these interactions appear important for hydrological processes that sustain baseflows, support refuge habitats during dry periods, and influence biogeochemical cycling. Despite their importance, groundwater contributions have historically been underrepresented in hydrodynamic models and river health assessments, with groundwater chemistry and biological processing often overlooked.

As part of the Darling Baaka River Health Program, a 2-year study into the health and recovery of the river undertaken by DCCEEW, a comprehensive update of existing hydrological models was completed to explicitly incorporate groundwater–surface water exchange processes. This involved integrating regional hydrogeological data, refining boundary conditions, and calibrating model parameters using observed flow records and groundwater level datasets. Water chemistry, levels and biota from the shallow alluvial aquifers were studied at 18 sites, with data contributing both to the model as well as an assessment of groundwater health, using the Groundwater Health Index (GHI) framework (Korbel & Hose 2017).

The updated hydrological models revealed gaining and losing sections of the river. Losing reaches are predominantly located north of Main Weir, with gaining sections revealed in the southern portion of the catchments. Groundwater chemistry indicated generally good water quality, although nutrient levels were very high in a number of groundwater bores, particularly those downstream of Weir 32 and on the Great Darling Anabranch. Several species of stygofauna were found in the region and are likely to be new to science. The new hydrological model captures spatial and temporal variability in groundwater inflows with greater resolution, allowing for more accurate mapping of flow permanence, cease-to-flow zones, and subsurface contributions to the in-channel river.

Modelling indicated groundwater inputs likely play a role in maintaining ecological connectivity, particularly during extended dry spells. These inputs are likely to help sustain macroinvertebrate populations, support riparian vegetation, and buffer water quality against salinity and temperature extremes. Importantly, the integration of groundwater dynamics into modelling has provided a more reliable hydrological stress indicator for assessing river health. Together with the assessment of groundwater health (using water chemistry and biological indicators) investigations into how groundwaters play a role in determining overall river health are being conducted. By bridging hydrological modelling with ecological assessment, we demonstrate the value of interdisciplinary approaches in capturing the complexity of river systems and advancing sustainable river health frameworks.

Death by a thousand (head)cuts? Alluvial gullies and geomorphic condition of the lower Darling Baaka

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The lower Darling Baaka River, in far western NSW, is under stress from a range of local and catchment-scale pressures which are manifesting in marked declines in river health. A key biophysical threat to the Darling Baaka is the ubiquity of alluvial floodplain gullies which are thought to be significant source of sediment to the river causing within-channel habitat degradation and infilling of waterholes. Significantly elevated suspended sediment concentrations are a persistent water quality concern for the Darling Baaka. Understanding the key sources of this excess sediment is critical in order to guide management practices to reduce sediment loads in the river. Alluvial floodplain gullies are a poorly understood source of sediment to the river and have not been investigated in detail in the lower Darling Baaka. Other biophysical threats identified were a lack of river red gum recruitment (affecting bank stabilisation and habitat provision) and river regulation and impoundments/weirs (reducing geomorphic diversity in impounded reaches).

Geomorphic condition of the lower Darling Baaka was assessed using the River Styles framework in conjunction with novel mapping and analysis of geomorphic features including alluvial gullies (i.e. headcuts in the banks). Overall, the lower Darling Baaka and its major anabranches are in moderate to good geomorphic condition, although legacy impacts associated with historical overgrazing, de-snagging and river regulation have left an imprint on the system, including elevated erosion rates and reduced geomorphic diversity. Mapping highlighted that alluvial gullies are abundant in the study area, though their density and size vary significantly. Two main types of gullies exist with differing formative processes and implications for sediment delivery to the Darling Baaka. Gullies formed in the black clay floodplains are generally associated with the waning stages of flooding and return flows to the river. In contrast, gullies that extend from higher elevated red, sandy soils are caused by relatively high energy runoff during localised storms.

Between Wilcannia and Weir 32, alluvial gully densities range from ~3.2 to 7 gullies/km of river. The downstream reaches of the Darling Baaka River have substantially lower alluvial gully densities ranging from ~0.8 to 1.5 gullies/km of river. Previous work on the upper Barwon-Darling showed densities ranging from ~3.1 to 3.8 gullies/km. Altogether, it is clear that alluvial gullies are now a ubiquitous feature of the Darling Baaka that require further investigation to understand the factors controlling their formation and development, as well as the impacts on sediment loads, water quality, and aquatic ecosystem function.

The Darling Baaka River Health Project was delivered by the NSW DCCEEW Science and Insights Division in partnership with the NSW EPA between September 2023 and June 2025. The project aimed to measure the health of the lower Darling Baaka and inform on the river recovery extensive flooding in 2023. The project integrated modelling, spatial analyses, and an intensive field sampling campaign to assess the overall health of the river from Wilcannia to Wentworth, including the Great Darling Anabranch.

From Wetlands to What's Left: Giant Kōkopu (*Galaxias argenteus*) in a Fragmented Freshwater Landscape

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Freshwater ecosystems across Aotearoa New Zealand are undergoing rapid change, with wetland loss, land-use intensification, and climate variability threatening the integrity of native fish populations. Among the species impacted is the giant kōkopu (*Galaxias argenteus*), the largest galaxiid species. Giant kōkopu are a taonga (treasured) species for Māori, contributing to the culturally and commercially significant whitebait fishery.

Although widespread throughout the country, giant kōkopu are typically found in small, fragmented populations, and are currently listed as Vulnerable by the IUCN.

Giant kōkopu population declines are thought to be driven by a combination of recruitment failure, habitat degradation and predation by introduced fish, but many knowledge gaps remain. A significant knowledge gap is the role of non-diadromous (landlocked) populations and the influence of wetland and lake presence on population persistence.

In early 2024, a survey of the Lake Tuakitoto catchment in South Otago revealed that adult giant kōkopu were present primarily in Frasers and Lovells Streams, but juvenile fish were virtually absent, suggesting poor recruitment into the population. To investigate further, I conducted follow-up surveys from February to April 2025, combining spotlighting, fyke netting, and electrofishing across a wider area of the catchment, targeting known adult sites and potential juvenile habitats.

Across seven weeks of sampling, 14 adult giant kōkopu were recorded at various sites, but only two juveniles were detected. These findings reinforce earlier findings of a population skewed towards large, older fish, with limited recruitment of new individuals. This raises concerns about population sustainability, although it is not clear whether the population is recruitment-limited or habitat-limited.

Ongoing otolith microchemistry work will determine whether sampled fish from this area are diadromous or non-diadromous, providing crucial insight into the population's reproductive dynamics in a landscape with unimpeded access to both lake/wetland environments and the sea. In addition to this, I am using the New Zealand Freshwater Fish Database and freshwater ecosystem data to model the role of wetland and lake presence in driving giant kōkopu occurrence across the landscape. Given the association of giant kōkopu with lowland, wetland-rich environments, this analysis will help identify key landscape-scale habitat features that support recruitment and persistence.

My work highlights both the vulnerability and resilience of native fish in degraded landscapes and underscores the importance of integrated habitat protection, especially of wetlands. As freshwater ecosystems continue to shift, innovative, multi-scale approaches that blend fieldwork with spatial analysis and chemical tracers offer a promising path forward for science, management, and conservation.

Smart catchment planning for a changing freshwater future

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Freshwater ecosystems, despite their global ecological importance and critical contribution to human well-being, are experiencing unprecedented biodiversity loss and degradation. The complexity and diversity of these systems, ranging from largely intact historical ecosystems to hybrid and heavily altered novel systems, require nuanced, context-specific management responses. In this poster, we present a strategic framework developed by Erős, Hermoso, and Langhans (2023) categorizing freshwater ecosystems into three types: historical, hybrid, and novel. Each type presents different constraints and opportunities for biodiversity conservation and the provision of ecosystem services. This typology can support decision-makers in planning more effective, efficient, and realistic management strategies.

The three-tier framework recognizes that historical ecosystems maintain high ecological integrity and are best suited for strict conservation; hybrid systems offer restoration potential and multifunctionality; while novel ecosystems, often designed for human use for example reservoirs or irrigation channels, can still deliver services and biodiversity benefits through targeted nature-based solutions. By aligning management goals with the current state of freshwater ecosystems, the framework avoids unrealistic restoration targets and helps identify priority areas for conservation, restoration, or continued sustainable use.

Relevance to freshwater management in Aotearoa New Zealand is particularly high. Much of Aotearoa's landscape reflects hybrid and novel ecosystem characteristics due to land-use change, agricultural intensification, hydrological modifications, and urban development. At the same time, the country still retains a number of high-integrity freshwater systems of exceptional biodiversity and cultural value. The proposed framework is agnostic to policy and pragmatic, meaning it can be used to guide planning response and priority under a variety of overarching policy regimes. By incorporating ecological status into spatial planning, it enables freshwater managers to prioritize efforts where they will be most effective - whether that means protecting high-value headwaters, restoring connectivity in modified rivers, or designing multifunctional wetlands in urban areas.

Furthermore, the approach emphasizes the need for coordinated catchment-scale planning that explicitly considers trade-offs between competing water uses, ecological objectives, and community values. This is aligned with popular concepts such as integrated freshwater management and co-governance. By incorporating ecological indicators and spatial optimization techniques, the framework helps balance competing demands while preserving or enhancing ecosystem health.

Ultimately, the three-tier framework offers a structured pathway to align freshwater policy, science, and practice in Aotearoa and beyond. It encourages governments and regional councils to embrace flexible, system-specific planning strategies that reflect both the challenges of the Anthropocene and the unique opportunities afforded by Aotearoa's freshwater heritage. We propose that adopting such a framework could play a central role in ensuring the long-term sustainability of freshwater ecosystems and services under increasing pressure from climate change, development, and societal needs.

From stream to bench: assessing efficiency of desiccating filter kits for eDNA preservation

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Water-based environmental DNA (eDNA) sampling using filter capture methods is commonly employed in many applications within freshwater ecology, such as biodiversity monitoring and detection of endangered or invasive species. A crucial step in the eDNA workflow is the preservation of the eDNA concentrated on filters between field collection and molecular analysis to ensure the quality and reliability of results and maximize detection probability of target taxa. Standard preservation approaches - such as freezing, storing in ethanol or buffer - have proven to be effective at preserving eDNA. However, in remote field locations or during shipment of samples to a laboratory, these methods may not be practical or cost-effective. As an alternative, drying of the collected biological material has been demonstrated as a cost-effective preservation method that maintains DNA integrity at room temperature. In this study, we evaluate the effectiveness of drying as a preservation method for eDNA by testing different configurations of fit-for-purpose filter kits with desiccation function using: (i) silica beads alone and (ii) a combination of silica beads and an oxygen absorbent. These were compared to preservation by freezing. Samples were collected from a local stream using a sampling stick pump (PK1, Sequenq) with patent-pending eQuip filter holders (Sequenq). After collection, the filters were stored at room temperature using each desiccation bag configuration for a set of timepoints up to 12 weeks. The efficacy of each method was then assessed by comparing the metabarcoding results generated from eDNA extracted from the filters. In parallel, preservation of a lab-prepared spike-in sample comprising genomic DNA of known concentration was quantified using digital PCR to further evaluate DNA stability. This work will help to inform the further development of robust and practical filter kits for simplified in situ eDNA concentration from water.

Validating age estimation from shell ring deposition in the river mussel *Alathyria jacksoni* (Unionoida: Hyriidae).

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Freshwater mussels, are one of the most imperilled organisms worldwide. In Australia, our ability to assess the conservation risk and population status of the 18 species is hampered by a lack of basic, yet critical biological information, such as longevity and growth rates. The river mussel, *Alathyria jacksoni*, is found in large, perennially flowing rivers throughout the Murray-Darling Basin, but is vulnerable to extended periods of dry. It may live for up to 30 years, however, age validation studies have not been conducted. The aim of this study was to determine if shell rings are deposited annually and can be reliably observed both externally and internally (cross-sections). We investigated the frequency of deposition of growth rings in shells of river mussels from two sites in the Ovens River, Victoria, south-eastern Australia, a free-flowing river, and one of the least regulated rivers in the southern Murray-Darling Basin. At each location in 2017, 50 mussels were collected, measured, individually tagged, their shells scrubbed clean and a 3-4 mm deep triangular notch filed into the ventral margin before being placed back where they were collected. We retrieved a total of 22 marked mussels on several occasions in 2018, 2019 and in 2022. Recovered mussels were euthanised, their left shells were thin sectioned along the dorsal-ventral axis, mounted on glass slides and polished and the cross-sectional layers of deposited shell material beyond the notched mark were examined and counted by 2 readers independently. External rings on the corresponding intact right shells beyond where notch were also counted to determine how well external and internal shell ring counts corresponded. We evaluate and discuss the results of our findings in the context of the conservation of the river mussel in temperate rivers such as the Ovens.

Legacy issues in freshwater fish management in Aotearoa

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Freshwater fish management in Aotearoa is full of paradoxes. The only native fish to receive full legal protection was likely extinct before regulations were introduced; introduced salmon and trout set the standard for freshwater protection; our Department of Conservation oversees the commercial harvest of native species; a treasured, threatened species is commercially harvested; and iwi must engage in tortuous legal processes to manage their native fisheries, a right that was guaranteed in Te Tiriti o Waitangi. So how did we end up here?

Our study examines the history of freshwater fish management in Aotearoa in order to understand how our current fragmented, unjust and unsustainable approach to management came to be. We undertook a thematic analysis of a range of historical sources, including reputable social and environmental histories, Treaty reports, agency reports, policies, and historical images. In analysing these sources, we sought to identify key shifts in freshwater fish governance and management over time, the logics and priorities that were used to rationalise these shifts and critiques made about their outcomes. From this analysis we identified recurring themes that connect biophysical issues such as fish passage with the historical emergence of social and cultural institutions such as property rights and norms like recreation.

In this poster we draw attention to six legacy issues that have arisen from the history of New Zealand's freshwater fish management, that underpin many of its unjust outcomes and help to explain many of its paradoxes. They are 1) the species-specific management of freshwater fish, 2) the social construction of fisher identities, 3) the impacts of landscape modification on freshwater socioecological systems, 4) uneven access to fish and fishing, 5) changes in harvesting and consumption of freshwater fish, and 6) markets for freshwater fish. We argue that the historical embeddedness of these issues means that they have become normalised in our systems of freshwater management and do not receive sufficient attention from communities or environmental management agencies. By highlighting these taken-for-granted ideas, institutions and practices, we can understand how we arrived at our current paradoxical state, as well as opportunities to assemble new, more just approaches to freshwater fish management.

Reporting the full story: Developing a framework to include habitat in state of the environment reporting

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State of the environment (SOE) reporting for riverine ecosystems has generally focused on two key areas; water quality and ecology. Despite being an important driver of ecological functionality, one aspect that has been relatively overlooked in this SOE reporting process is the overall quality of the habitat itself. Between 2019 and 2024, Canterbury Regional Council field staff completed Rapid Habitat Assessments alongside their annual SOE monitoring for macroinvertebrates. This enables us to investigate potential links between physical habitat and aquatic communities, thus providing a more holistic view of ecological integrity when assessing sites. Here, we present the framework we have used to grade habitat quality when reporting on our Aquatic Ecosystem Health programme. The inclusion of habitat quality grades in our reporting allows us to have a greater understanding of what is potentially driving changes in ecological health across our network of 190 riverine sites.

An innovative and practical method to minimise harm to fish in a complex streamworks project

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New Zealand's rivers and streams, and the diverse fish that live in them, are worth protecting. Activities in watercourses have the potential to harm native aquatic fauna, and commonly within consents that involve streamworks, there is a requirement for a Native Fish Management Plan (NFMP). These plans typically involve the isolation of the works reach, the systematic removal and relocation of aquatic fauna through various techniques prior the works. Measures of success are often incorporated in consent conditions.

Over-pumping or diversion is a common practice in streamworks, however, there are occasions where this is not practical or the implementation and maintenance of secure fish stops is not possible for various reasons. The management of native fish can also become more difficult when dredging, requiring standing water to float the barge for weeks at a time.

The management of fish in a dynamic, high flow pond/stream/wetland complex undergoing dredging using a sustained fishing method is explored. We discuss the requirements of the contractors undertaking the physical works and the shared processes. We share data from a complex project using sustained fishing and discuss the implementation, successes and challenges as well as considerations for measures of success and how these can meet consent requirements.

Cross-realm Spatial Conservation Planning for Diadromous Species

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Diadromous fishes are among the most ecologically distinctive and evolutionarily specialised aquatic taxa. Their ability to migrate between multiple aquatic realms (freshwater, estuary, and marine) enables them to exploit diverse habitats throughout their life cycle, requiring connectivity between these ecosystems. However, dependence on multiple realms makes them particularly vulnerable to threats propagated in any one of these realms. Barriers to movement between realms caused by dams disrupt migratory routes, limiting access to critical habitats. Moreover, coastal catchments where diadromous species inhabit are under pressure from land-use change, urbanisation, climate change, and extreme weather events, further altering hydrological regimes and habitat quality. To address these complex cross-realm challenges, conservation planning for diadromous species requires a framework that accounts for processes affecting species across realms.

Systematic conservation planning (SCP) frameworks have previously been developed to guide investment in restoration and conservation actions in both marine and freshwater systems, but only recently have SCP approaches begun to consider cross-realm challenges. This project uses a cross-realm approach, focusing on the diadromous fishes of New South Wales, Australia, that integrates species distributions across freshwater, estuarine and marine habitats and connectivity across realms to develop a SCP framework for diadromous species.

Building on established SCP methodologies, the project will test how different socio-economic constraints, connectivity scenarios, and climate change projections influence spatial conservation priorities. By explicitly incorporating cross-realm connectivity, real-world socio-economic considerations, and future climate and extreme weather scenarios, this work will advance the frontier of conservation planning for diadromous species. The resulting framework will provide a scalable and adaptable approach for managing multi-realm species under increasing environmental and anthropogenic pressures. Here, I will highlight the key steps involved in implementing a SCP and my approach to incorporating climate-change impacts.

Swimming Upstream: Data-Driven Insights into Fish Passage

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As part of Aotearoa New Zealand's Jobs for Nature programme, the Tasman Fish Passage Project undertook extensive data collection to identify and address in-stream barriers to fish migration. This poster presents the scale, methodology, and outcomes of the regional data collection phase, which has advanced our understanding of freshwater connectivity challenges on private and public land in the Tasman region.

Over 6,500 assessments were completed by trained assessors. Of these, 1,326 barriers were identified with 1,000 remediated to enhance connectivity, particularly fish capable of 'climbing' or swimming through modified habitats. The project invested over 15,500 contractor hours in fieldwork (and desktop analysis), including extensive engagement with landowners and asset managers—achieving over 94% engagement. This outreach facilitated access and proved a valuable opportunity for freshwater education and awareness.

A key outcome was identifying and characterizing previously undocumented private in-stream structures. When combined with historical assessments, the data reveals structural commonalities and regional patterns that can be used to support policy and funding decisions.

The project also faced—and is close to overcoming—a significant challenge in consolidating data from multiple systems. Migrating all records into an internal GIS platform—with consideration to future integration with the Asset and Work Manager system (formerly RAMM)—represents a major step forward in regional environmental data stewardship. This mirrors broader national challenges in environmental data management, as highlighted in a 2025 Parliamentary Commissioner for the Environment report. It also demonstrates how regional projects can contribute to systemic improvements.

Hydrodynamic and Thermal Controls on Sediment-Water Exchange of Nutrients and Trace Elements in Freshwater Reservoirs

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Climate change is altering hydrodynamic regimes and thermal profiles in freshwater ecosystems. These changes have cascading effects on sediment biogeochemistry, where sediment-water exchange processes influence the quality of the overlying water. Understanding these dynamics is critical for managing the release of legacy pollutants, eutrophication risk, and wider ecosystem resilience under climate change. The aim of this study is to investigate how changes in water flow rate and elevated temperature regulate oxygen penetration and solute fluxes across sediment-water interfaces (SWI) in a freshwater sediment. We did this using sediments collected from Te Kārapiro, which were deployed into replicated experimental flowing water mesocosms. The sediments were exposed to three flow rates (0.1-0.3 L s⁻¹) under two different temperatures that seek to replicate current winter (12°C) and warmed winter (16°C) conditions as predicted by IPCC SSP2-4.5 projections. After an equilibration period at the set conditions, depth profiles of dissolved oxygen and redox will be measured in high-resolution (100 - 500 µm) using microsensors and used to confirm steady-state conditions. Diffusive gradients in thin-Films (DGT) will then be used to measure trace element (iron, manganese, and arsenic) and nutrient (phosphorus and nitrogen) fluxes across the SWI. Analyses have confirmed elevated concentrations of arsenic in the sediment (50-60 mg kg⁻¹; 2.5-3 times above ANZ guidelines). Preliminary results suggest that increased flow rates will reduce the length of the diffusive boundary layer and enhance oxygen penetration depth due to improved turbulent mixing. The increased precipitation of iron and manganese associated with this is likely to sequester phosphorus and arsenic into relatively inert species. However, nitrogen fluxes from the sediment may increase due to increased mineralization of organic matter at depth. Warming is expected to elevate respiration rates and increase trace metal and nutrient fluxes from the sediments due to increased reductive dissolution of redox-sensitive metals and organic matter mineralization. This work will provide new mechanistic insights into climate-driven sediment biogeochemistry in New Zealand's riverine reservoirs by clarifying how hydrodynamic and thermal changes interact at the SWI. This can help to inform management of eutrophication risks and contaminant mobility, ultimately supporting evidence-based water governance under Te Mana o te Wai.

Using eDNA to evaluate ecological rehabilitation measures for threatened rheophilic fish: insights from a heavily modified river in North-Western Europe

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The rapid decline of fish diversity in rivers has sparked global efforts towards river rehabilitation, but the crucial task of evaluating the benefits of rehabilitation measures is often performed insufficiently. This is the case for many rivers in North-Western Europe, which belong to the world's most heavily impacted. Among them is the river Meuse, the second largest river in the Netherlands. One of its most severely adapted sections, the 'weir-regulated Meuse' (WRM), is a 70km impounded and navigated river stretch that lacks a natural water flow due to four weirs. These adaptations drastically impacted fish populations, especially native, rheophilic (flow-preferring) fishes. To combat these radical declines, ecological rehabilitation measures have been implemented since the early 1990s, specifically targeting the rheophilic fish species. As the main channel of the WRM is connected to various free-flowing tributaries, potentially offering benefits for rheophilic fish, rehabilitation measures have largely focused on these tributaries, removing excessive gravel and rewetting floodplains. However, little is known about how different life stages of rheophilic fish use the WRM across space and time, which hinders the optimization of rehabilitation. Hence, the objectives of this study are to evaluate the benefits of various rehabilitation measures and assess the distribution of successive life stages of rheophilic fishes in relation to habitat characteristics and connectivity. Our approach is to extensively monitor the distribution and movement of juvenile and adult fish at multiple spatial-temporal scales. Besides conventional net monitoring, we use innovative techniques including acoustic telemetry, otolith microchemistry and environmental DNA (eDNA). The first results of eDNA metabarcoding were based on water samples from 29 sites along a 90km river stretch, including eight tributaries, collected in June and September 2025. The distribution of fish species in the main channel and tributaries was revealed and, through qPCR, we also quantified the abundance of five native rheophilic species: barbel (*Barbus barbus*), European chub (*Squalius cephalus*), ide (*Leuciscus idus*), common dace (*Leuciscus leuciscus*) and nase (*Chondrostoma nasus*). We integrated metabarcoding and qPCR results to obtain a quantitative gradient of fish distribution along the WRM, revealing the function of tributaries. This new knowledge on the distribution of rheophilic fish was linked to historical catch data, potentially informing future rehabilitation efforts in the WRM and across other river systems.

Scientists and First Nations people working in partnership to undertake monitoring and research on environmental flows in the Mid-Murray River

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First Nations people have a deep and lasting connection to their lands and waters in the Murray-Darling Basin (MDB). They have enduring cultural, social, environmental, spiritual, and economic connection to the rivers, wetlands, and floodplains. Their knowledge and science developed and maintained over 65,000 years is crucial to caring for Country. Since European colonization, First Nations people have been excluded from managing and making decisions about their Country.

Environmental flows are a component of many river restoration programs worldwide. In Australia, environmental flows are being delivered to protect and restore water dependent ecosystems in the MDB. Monitoring and evaluation of the outcomes of environmental flows in the MDB is undertaken through a number of programs including the Australian Federal Government's Long-Term Intervention Monitoring Program (LTIM, 2014-2019) that transitioned into the Flow-MER (2019-2024) and Flow-MER2.0 Programs (2024-2029). Over the past five years there has been increasing involvement of First Nations peoples in the monitoring and research of environmental flows in the Mid-Murray River. Under the Flow-MER2.0 program there is dedicated funding to support research and monitoring activities that is important to First Nations people. In this presentation we discuss an example of scientists and First Nations people working together as part of the Flow-MER project in the Mid-Murray River, one of the ten river systems in the MDB that are the focus of the Flow-MER2.0 Program.

The Mid-Murray River system is a complex socio-ecological system. There is a rich and diverse Indigenous history and continuing care of Country by First Nations people of the Mid-Murray. The river system supports a wide range of native plants and animals, including unique and endangered species, and also supports a productive and diverse agricultural community. The Flow-MER program is an opportunity for scientists and First Nations people to share knowledge and experiences and work together on Country. In this presentation we describe examples of collaborative projects undertaken through the partnership of researchers from Charles Sturt University and the Kolety Werkul River Rangers from Yarkuwa Indigenous Knowledge Centre, one of many First Nations organisations in the Mid-Murray Area. Through this partnership the Kolety Werkul River Rangers have worked with scientists to monitor and undertake research on freshwater turtles, native vegetation, native fish, water quality, and the delivery of environmental flows. We will describe the governance arrangements that have facilitated the partnership and reflect on our personal experiences of the collaboration. The partnership has provided opportunities for the River Rangers to gain new skills whilst working on Country, and to share and increase their traditional and cultural knowledge. Through the collaboration scientists have increased their understanding of Traditional Owners' perspectives and knowledge of river and floodplain ecosystems. The partnership of scientists with the Kolety Werkul River Rangers and with other First Nations people in the Mid Murray continues to grow. Together we will contribute to new knowledge, informed decision making, the adaptive management of environmental flows, and improved environmental outcomes.

Assessing the impacts of land use change and introduced perch on biodiversity and food webs in Lake Denny, Ōtūwharekai

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Lake Denny is a shallow, supertrophic lake in a predominantly agricultural catchment. It is part of the Ōtūwharekai (Ashburton Lakes) complex and is highly significant to mana whenua Te Rūnanga o Arowhenua. Decades of land-use change and the introduction of perch (*Perca fluviatilis*) are likely contributing to significant ecological stress. Perch removal has been proposed as an in-lake mitigation tool to improve water quality in Ōtūwharekai lakes and benefit native biodiversity. This research aims to evaluate whether an investment in perch removal could be a worthwhile restoration step.

Over 2500 mainly juvenile perch were caught over three days in March 2025, along with a single tuna (eel) and eleven upland bullies, confirming that perch dominate the fish population. Initial stable isotope data from Lake Denny indicate substantial dietary overlap between juvenile perch and bullies. This, along with very low benthic invertebrate diversity, suggests the introduced fish may be altering native ecosystems by both predation and competition. To better understand the role of perch, data from Lake Denny are compared to nearby Lake Emily. This lake has similar size, depth and land-use history but no record of perch introduction.

This study also uses paleolimnological techniques to investigate the timing and impacts of introducing perch and intensifying land-use on lake biodiversity and food webs. In this poster I present the stable isotope and environmental DNA (eDNA) results to compare the current biodiversity and food web structure of Lakes Denny and Emily.

Fish germ cell cryobanking and transplanting for conservation in Aotearoa-New Zealand?

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The conservation of biodiversity requires an interdisciplinary and coordinated strategy operating across multiple temporal and spatial scales, encompassing genetic to ecosystem levels. Central to this approach is the recognition of the cultural significance of species, particularly those of importance to Indigenous Peoples.

In Aotearoa New Zealand, approximately 76% of native freshwater fish species are classified as threatened or at risk of extinction. Notably, 82% of these species belong to the family Galaxiidae (e.g., whitebait, non-migratory galaxiids, mudfish). The decline of these species is attributed to factors such as habitat destruction, predation, and competition with introduced species. Many of these fish are considered taonga by Māori, underscoring the importance of culturally sensitive conservation efforts.

Recent advancements in fish germ cell cryopreservation and transplantation—collectively referred to as ‘broodstock surrogacy’—present promising tools for biodiversity preservation across marine and freshwater species. Despite their potential, these techniques remain underappreciated and underutilised. The endemic taiwharu (giant kōkopu; *Galaxias argenteus*), a large-bodied species of New Zealand, emerges as a promising candidate for surrogacy applications. However, the development and implementation of such biotechnologies for culturally significant species involve complex methodological, ethical, and cultural considerations related to the collection, utilisation, and storage of biological samples.

This project employs a multidisciplinary team to explore the development of a holistic framework aimed at safeguarding threatened freshwater species in New Zealand. The framework integrates biotechnological innovations, conservation genomics, and Indigenous perspectives to ensure culturally appropriate and effective conservation strategies.

Cutting out the host to determine freshwater food webs: Using CRISPR-Cas9 to improve prey detection in diet metabarcoding analysis.

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Freshwater ecosystems are strongly influenced by the ecological interactions between species—interactions which are largely manifested via trophic linkages in interconnected food webs. Including trophic interactions in freshwater research and management is critical for our understanding of ecosystem resilience and ensuring conservation success. However, aquatic food webs are especially problematic to monitor, due to the difficulties in making direct observations and challenges in accurately identifying prey items in stomach content. Akin to the recent ‘eDNA revolution’ for biodiversity monitoring, metabarcoding of stomach contents provides an excellent opportunity to accurately and rapidly identify prey species and reconstruct food webs. One major hurdle for this method, however, is the large amount of host DNA present in the stomach lining which can overwhelm prey DNA during amplification, leading to a diminished and incomplete representation of prey species. Here we present a novel method to eliminate host DNA from stomach content samples from three fish species using the CRISPR-Cas system. The design of species-specific guide RNAs enables the cleaving of host DNA in the region of the targeted PCR amplicon. This significantly diminishes host signal and allows greater amplification of prey sequences in subsequent metabarcoding analysis. Comparisons with existing techniques, such as blocking primers, shows the viability of using CRISPR-Cas9 as highly accurate approach to identifying prey from stomach contents, paving the way for advanced molecular methods in freshwater food web research and assessment.