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Fish Barrier Project

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The Wai Connection initiative in Taranaki presents a unique opportunity to integrate fish passage methods into the agricultural practices of rural farmers. The proposal for this 12-month project includes several key components designed to educate and engage the farming community on the importance of maintaining and enhancing aquatic biodiversity.

The project will kick off with a comprehensive survey of current fish passage barriers within a selected catchment awa from the source to the sea, followed by the development of an educational programme tailored to the needs and challenges of local farmers. This programme will not only highlight the ecological benefits of effective fish passage but also demonstrate the practical solutions available.

To ensure a hands-on learning experience, the project will include the construction of a model fish passage system on a volunteer's property, serving as a tangible example of the methods in action. Throughout the project, data will be collected to assess the effectiveness of these methods, culminating in a detailed report. This report will analyse the outcomes, provide recommendations for future implementations, and serve as a valuable resource for stakeholders.

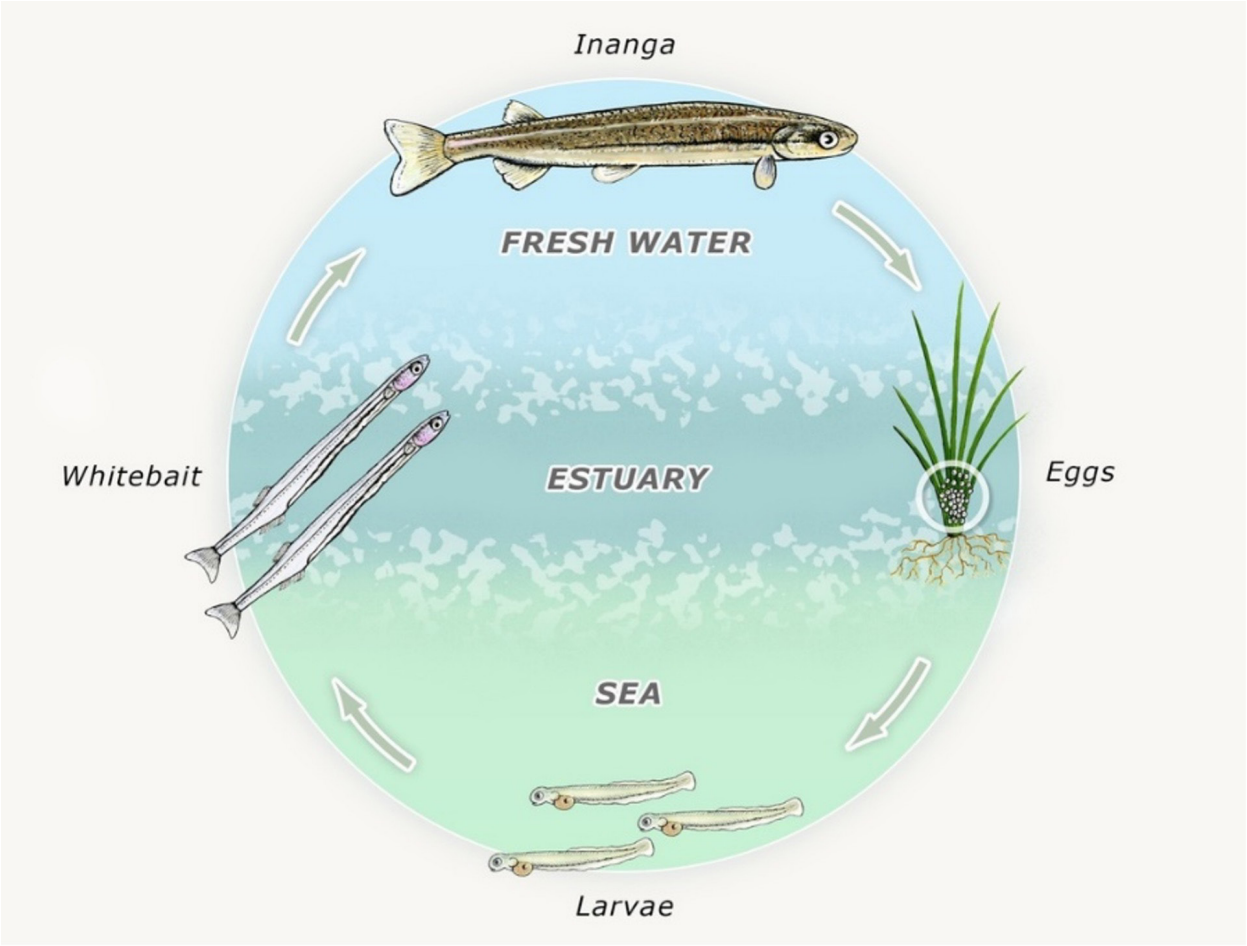
Additionally, a workshop will be organised towards the end of the project timeline. This event will disseminate the findings, allow for the exchange of ideas, and offer hands-on demonstrations of the assessment tools developed by NIWA. These tools will help farmers independently evaluate the suitability and effectiveness of fish passage solutions for their waterways.

The ultimate goal of this proposal is not only to promote the adoption of fish passage methods but also to foster a community of environmentally conscious farmers who recognise the value of protecting our waterways for future generations. By combining scientific research, practical demonstrations, and community engagement, the Wai Connection project aims to create a sustainable model for rural farming that harmonises agricultural productivity with ecological stewardship.

Wai Connection have chosen Īnanga as the highlight species as they play a crucial role in New Zealand’s freshwater ecosystems. They are an essential part of the food web, serving as prey for larger fish and birds. Their presence in waterways is an indicator of healthy freshwater ecosystems, as they require clean, well-vegetated habitats to thrive.

TCC, in particular the Awatuna/Auroa Catchment, have already carried out eDNA and freshwater testing in their catchment for almost three years, so have a good baseline of data to work with to see any improvements to the fish passage of Īnanga with barrier mitigation using the guidelines outlined in this report.

Īnanga: A Vital Part of New Zealand's Waterways



Īnanga, also known as common galaxias (Galaxias maculatus), are a small, slender fish native to New Zealand and other parts of the Southern Hemisphere. They are typically about 10 cm long when fully grown and have a distinctive mottled, spotty pattern along their bodies.

Īnanga are one of the five species that make up the whitebait catch in New Zealand. They have an unusual lifecycle, beginning life as eggs laid in vegetation beside streams, spending the first six months at sea, and then migrating upstream as whitebait in the spring.

Importance to New Zealand Waterways

Risks to Īnanga

Īnanga face several threats that have led to their decline. These include:

- **Habitat Disturbance and Modification:** Drainage of swamps and wetlands, land use changes, and flood control works have significantly reduced their spawning habitats.
- **Predation:** Natural predators like herons and eels, as well as introduced species such as trout, pose a threat to Īnanga.
- **Pollution:** Poor water quality due to agricultural runoff, sedimentation, and other pollutants can negatively impact Īnanga populations.
- **Migration Barriers:** Structures like culverts, weirs, and dams can impede their migration routes, preventing them from reaching suitable spawning and adult habitats.

Why Īnanga Need Protection

Protecting Īnanga is vital for maintaining the health and biodiversity of New Zealand's freshwater ecosystems. By safeguarding their habitats and ensuring unimpeded access to spawning sites, we can help sustain their populations and, in turn, support the broader ecological balance. Conservation efforts, such as restoring riparian vegetation and improving water quality, are essential to protect Īnanga and other native fish species.

The 2018 New Zealand Fish Passage Guidelines

The 2018 New Zealand Fish Passage Guidelines, developed by NIWA, provide best-practice approaches for designing and restoring instream infrastructure to ensure effective fish passage. Here are the key points:

Purpose and Scope

- **Purpose:** To assist infrastructure designers, waterway managers, environmental officers, iwi, and local communities in understanding and promoting better management of fish passage requirements.
- **Scope:** Focuses on structures up to 4 metres in height and provides guidelines for both new installations and the retrofitting of existing barriers.

Key Objectives

- **Efficient and Safe Passage:** Ensuring the upstream and downstream movement of all aquatic organisms with minimal delay or injury.
- **Diversity of Conditions:** Providing a variety of physical and hydraulic conditions to support diverse passage opportunities.
- **Minimal Impediment:** Structures should not create greater barriers to fish movement than the natural stream reaches.
- **Geomorphic Continuity:** Maintaining natural processes such as sediment and debris movement.
- **Durability and Maintenance:** Structures should require minimal maintenance and be durable.

Design Principles

- **Hydraulic Design:** Ensuring appropriate water velocities and depths to accommodate different fish species and life stages.
- **Structural Design:** Incorporating features like baffles, weirs, and fish ladders to facilitate fish movement.
- **Monitoring and Maintenance:** Regular monitoring and maintenance to ensure the continued effectiveness of fish passage structures.

Legislative Requirements

- Compliance with relevant legislation and policies to protect freshwater fish and their habitats.

Examples of fish passage structures based on the New Zealand Fish Passage Guidelines (NZFPG)

- **Culverts:** These are often used for road crossings over streams. Properly designed culverts maintain habitat continuity and provide diverse movement pathways for fish.
- **Weirs:** Rock-ramp fishways are preferred for raising headwater levels. They create a hydraulically diverse flow environment with low velocity margins and resting areas.
- **Ramp Fishways:** These structures help fish overcome vertical drops. They typically consist of a series of transverse rock ridges with pool sections between them.
- **Bypass Structures:** Nature-like fishways mimic natural stream characteristics and are suitable for a wide range of fish species and life stages. They generally require more space than technical fishways.

An example of a rock-ramp style weir that also has a fish pass along the true left bank.

Design Requirements for Remediation of Existing Instream Structures for Fish Passage (Section 5 NZFPG)

5.1 Assessing & Prioritising Structures for Remediation

Objective: Identify and prioritise instream structures that impede fish passage.

Criteria: Ecological importance, severity of barrier, and feasibility of remediation.

5.2 Setting Fish Passage Objectives for Existing Structures

Goals: Ensure fish can move freely through waterways.

Considerations: Species present, life stages, and specific habitat requirements.

5.3 Good Practice Remediation Design

Approaches:

Rock Ramps: Mimic natural streambeds to facilitate fish movement.

Culvert Baffles: Retrofit existing culverts to reduce water velocity and increase depth.

Fish Ladders: Provide steps or pools for fish to navigate over barriers.

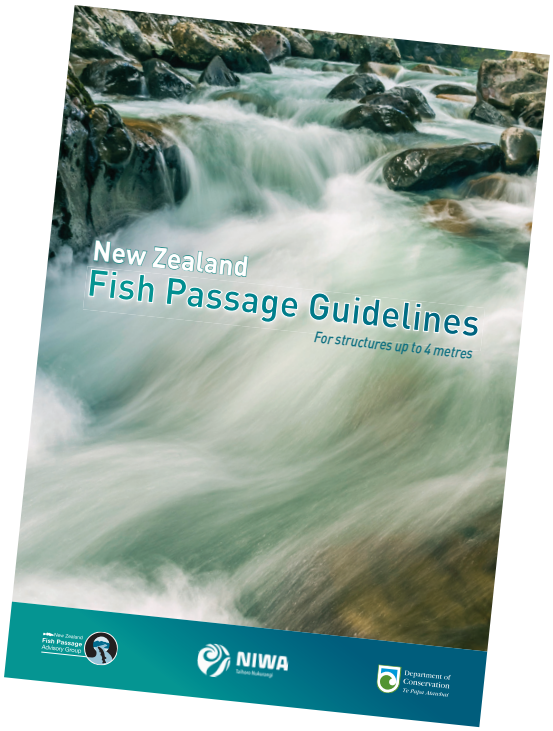
Design Principles: Maintain natural substrate, ensure adequate water depth, and minimise turbulence.

5.4 Monitoring and Maintenance

Importance: Regular monitoring ensures structures remain effective.

Methods: Visual inspections, fish surveys, and flow measurements.

Maintenance: Address any issues promptly to maintain fish passage.



Designing a fish passage structure involves several key considerations:

- **Biological Knowledge:** Understanding fish ecology, behaviour, and swimming capabilities is crucial. This includes knowing the species present, their migration patterns, and their physical abilities to navigate various hydraulic conditions.
- **Hydraulic Design:** Creating suitable water depths, velocities, and turbulence levels that accommodate fish swimming abilities. This must be balanced with the structure's hydraulic capacity and operational requirements.
- **Site-Specific Conditions:** Each site is unique, so the design must account for local conditions, including stream geomorphology and habitat continuity.
- **Performance Standards:** Setting clear objectives and performance standards to ensure the structure meets ecological goals and legislative requirements.

These guidelines aim to reduce waterway fragmentation, improve habitat access, and enhance biodiversity outcomes.

The optimal water flow rates for Īnanga are detailed in the guidelines:

- **Maximum Allowable Water Velocity:** For a 75 mm Īnanga, the highest passable water velocity is 0.35 m/s. However, the design velocity should be set at 0.24 m/s to account for variability in swimming abilities.
- **Stream Conditions:** Water velocities in the culvert should match those in the stream to avoid impeding fish movement.
- **Minimum Water Depth:** Generally, a minimum depth of 150 mm is recommended for adult native fish passage.

These guidelines ensure that Īnanga can successfully navigate through culverts and other instream structures. Appendix E of the New Zealand Fish Passage Guidelines provides detailed information on the design considerations for fish passage structures, specifically focusing on Īnanga (whitebait).

Key points:

- **Ramp Substrates:** Smooth surfaces are generally insurmountable for īnanga, especially at slopes greater than 15°. Gravel, nylon brush, and plastic drainage products like Miradrain™ have shown high passage rates for īnanga at slopes of 15° and 30°.
- **Ramp Length and Slope:** Passage success decreases with increasing ramp length and slope. For example, a 15° Miradrain™ ramp of 1.5 metres length provides high passage success, but doubling the length significantly reduces success rates.
- **Artificial Ramps:** Ramps should have a roughened surface and a V-shaped cross-section to provide low water velocities for swimming fish and a wetted margin for climbing species. The design should maintain a shallow wetted margin across the fish passage design flow range.
- **Rotational Moulded Plastic Ramps:** These ramps, which can be cut to length on-site, offer a cost-effective solution. They have a V-shaped cross-sectional profile and include baffles similar to the Miradrain™ substrate, enhancing passage for īnanga.

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