



Adoption of Good Practice Fish Screening

Project Summary



Mark Webb, Fish and Game NZ, preparing a fish screening facility for fish trials.

Water intake structures are used throughout New Zealand to supply irrigation, hydro-electric generation, domestic water supply, and industrial needs. If surface water intake structures are not properly screened and/or designed/maintained, they can unintentionally damage or remove fish from rivers through impingement and entrainment. The fundamental purpose of a fish screen facility is to ensure safe passage for all fishes around the facility within or back to the source waterway.

This project aimed to fill key knowledge gaps identified in 'Fish screening: good practice guidelines for Canterbury' (Jamieson et al. 2007, hereafter the 'NIWA 2007 Guidelines') and support good practice by developing guidance and demonstrating examples of fish screen facilities that are considered effective in achieving the overall outcome of protecting fish and fisheries.

Key Project Deliverables¹

- Reviewing regional water intake issues and requirements in New Zealand.
- Laboratory trials to fill knowledge gaps and confirm design criteria that protect fishes from impingement, entrainment, and damage.
- Field trials to assess the effectiveness of fish screen designs compared to the seven key criteria in the NIWA 2007 Guidelines and those adopted into the Canterbury Land and Water Plan Schedule 2.
- Production of an online [Fish Screen Facility Guidance Tool](#).
- Developing a [national policy and practice guidance document](#).
- Workshopping example sites through the Fish Screen Facility Guidance Tool to provide demonstration examples that would be considered effective.
- Production of a guidance document "[Toward National Guidance for Fish Screen Facilities to Ensure Safe Passage for Freshwater Fishes](#)" to supplement the NIWA 2007 Guidelines.
- Training for designers, abstractors, manufacturers, regulators, and consultants working with fish screens.

Progress Highlights

The NIWA 2007 Guidelines provided seven design criteria for effective and efficient fish screening. This project has confirmed the NIWA 2007 seven criteria were key for successful fish screening facility design that prevents entrainment and impingement of fish. Additionally it found design and connection of a suitable bypass, the correct fitting, maintenance, and operation of screens, and consideration of upstream fish passage needs were often overlooked and needed consideration, i.e. an eighth criterion. A balanced design approach for water intakes is needed that gives consideration to all criteria (Table 1) and considers each site solution as a package. The project provides improved explanations of the criteria.



Ministry for Primary Industries
Manatū Ahu Matua



Department of Conservation
Te Papa Atawhai



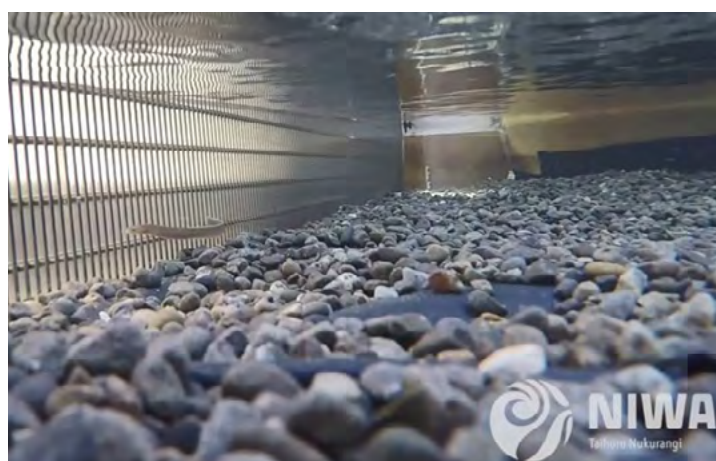
1. All key reports and project outcomes mentioned in this report can be found on the IrrigationNZ fish screen webpage: www.irrigationnz.co.nz/KnowledgeResources/FishScreens

Table 1: Key criteria required for an efficient and effective water intake and fish screen.

Factor	Description
Intake location	The water intake is located to minimise exposure of fish to the screen and minimises the length of stream channel affected while providing the best possible conditions for the other criteria.
Through-screen velocity	The water velocity through the fish screen is slow enough to allow fish to escape entrainment or impingement.
Sweep velocity	The water velocity past the fish screen is sufficient to sweep fish past the intake promptly and into the bypass.
Fish bypass at water intake	A suitable bypass (where needed) is provided so that fish are taken away from the intake and back into the active waterway.
Fish bypass design for connectivity	There is connectivity between any constructed bypass and somewhere safe, usually the active mainstem of the waterway.
Gap openings in intake structure	Screening material and other joins/edges have openings small enough to exclude fish, and a smooth surface to prevent any damage to fish.
Operations and maintenance	The water intake needs to be kept operating to a consistent standard with appropriate operation and maintenance, this includes consideration of debris management.
Upstream fish passage	EITHER the water intake and fish screen does not impede upstream passage of migratory fish species during all flows and does not increase the risk of predation, OR the bypass outlet impedes fish passage into the bypass and keeps fish in the natural waterway but fish moving downstream through the bypass are not harmed while returning to the waterway.

The project identified areas that require New Zealand-specific knowledge, ideally through additional research, to lead to better outcomes in fish screen facility design and management:

- Improving knowledge of water velocities near screens and the effects of turbulence on fish survival to improve fish screen facility designs.
- Understanding fish behaviour at bypasses to improve the overall effectiveness of these facilities.
- Establishing better links within the regulatory processes, including meeting the needs of mana whenua, to improve certainty.
- Promoting innovation and problem-solving in the design and planning processes to allow additional refinement of the Fish Screen Facility Guidance Tool.



Shortfin elver swimming along the screen edge during lab trials – NIWA Dec 2020.

Conclusions

There is no simple recipe for an effective fish screen facility that applies across all situations. The physical conditions (e.g. gradient and flow) and biological conditions (i.e. fish species and life stages present) at every intake are different. The NIWA 2007 Guidelines together with the new guidance document can help identify issues and considerations, and provide good reference information for designers, infrastructure owners, and regulators. However, because each case is different, it is not straightforward to go from that fundamental knowledge to a practical solution.

There are usually several fish screen facility designs that could satisfy the key criteria at a site. Selecting from these alternative designs must take into consideration site-specific characteristics, including existing infrastructure, biological considerations, hydraulic functioning, geographical constraints, and client preferences. All fish screen facility designs require engineering and biological input, including assessment of site-specific fishery information.

The Fish Screen Facility Guidance Tool provides a method to document and support selection of applicant/consultant preferred designs that could then be developed for a conceptual design. Designs that are likely to meet all key criteria have been workshopped for a variety of different intake locations to provide some examples.

For further information on the fish screen project, including access to key reports, the Fish Screen Facility Guidance Tool and the latest guidance document, visit www.irrigationnz.co.nz/KnowledgeResources/FishScreens