ARI Aquatic Quarterly Update – Influence

WINTER 2025

Flathead Galaxias in the conservation hatchery (Photo: Marcia Riederer, DEECA)

This update provides three examples of projects which help managers.

They provide an overview of:

- ARI's role in identifying new species of small-bodied fish, paving the way for better protection in emergency management, threat mitigation and captive breeding.

- A vegetation monitoring program that meets the specific needs of waterway managers at the Corangamite Catchment Management Authority to assess the effectiveness of current and future environmental water programs and revise their vegetation objectives.

- Applying a six-step framework to correct ineffective fishway entrances at Dights Falls, resulting in improved fish passage which is supporting the recovery of diadromous (migrating between fresh and salt water) fish communities.

About us

The Applied Aquatic Ecology section aims to generate and share knowledge, through world-class, applied, ecological research. This research supports and guides sustainable ecosystem policy and management to ensure healthy, resilient ecosystems. We work collaboratively with national, state and local agencies, research institutes, universities, interest groups and the community.

Our focus:

- To undertake high quality, relevant ecological research.
- To interpret research outcomes and communicate these effectively to key stakeholders.
- To guide and support sustainable ecosystem policy and management.

Progressing the conservation of our threatened galaxiids

ISSUE

Understanding the diversity of galaxiids is key to their effective management. It helps clarify their conservation status as a group, and singly, and provides insights about threats and management needs. Until recently, eight non-endemic species of galaxiids were known in Victoria from three genera (*Galaxias, Galaxiella* and *Neochanna*).

ACTION

In 2014, 13 new species were identified after an extensive taxonomic and genetic study of the Mountain Galaxias (*Galaxias olidus*). This 10-year study across south-east Australia by ARI's Dr. Tarmo Raadik revealed that *Galaxias olidus* was a complex of 15 species. Further work on galaxiids over the past 11 years by Tarmo and his team has:

- identified a further five new species in the *Galaxias olidus* complex
- described a second species of *Galaxiella*
- found a non-endemic species in an additional genus (*Lovettia sealii* – Australian Whitebait) inhabiting the state.

RESULTS

Consequently, 25 galaxiid species are now known in Victoria, of which 13 are endemic.

This long-term effort by ARI has increased the overall diversity of native freshwater fish recognised in Victoria, with galaxiids now representing 40% of known species. This work has also refined galaxiid distribution, abundance and threats, with 16 of the 25 species considered threatened and listed under the Victorian *Flora and Fauna Guarantee Act 1988* and 15 listed nationally under *Environment Protection and Biodiversity Conservation Act 1999*.

This further supports the finding that a greater proportion of galaxiid species is of conservation concern worldwide than in most other freshwater fish families. This recognition of a high number of threatened galaxiid species led to Victorian Government funding to support conservation management, and more recently, to significant Commonwealth Government funding to continue and expand this work.

The improved knowledge base has enabled DEECA to take a lead role in the long-term conservation management of galaxiid fishes from their primary threat of predation by introduced trout. Our greater understanding of the vulnerability of small populations of some galaxiids has led to their inclusion in DEECA's emergency biodiversity response, following bushfires (2009), post-bushfire rainfall events (2019-20), and also in response to droughts that threaten fish. This involves: providing strategic advice on appropriate actions; reconnaissance of priority species and sites; emergency extractions; translocations and pioneering ex-situ management; and the return of fish once conditions improve.

Backpack electrofishing to search for galaxtids following a sediment slug after the 2009 bushfire.

Translocation of Dargo Galaxias

Progressing the conservation of our threatened galaxiids (cont')

OUTCOME

This work has also led to some galaxiids being included in the 10inTen program, a captive breeding program at the new conservation hatchery at Snobs Creek. The program aims to breed, release and recover at least 10 threatened species in 10 years. To date, five species have been collected from the wild for breeding trials (Moroka Galaxias, McDowall's Galaxias, Tapered Galaxias, West Gippsland Galaxias, and Yalmy Galaxias).

Moroka Galaxias and McDowall's Galaxias have been successfully bred and released back into the wild, to bolster populations, and all five species are being conditioned in the conservation hatchery for intensive breeding in 2025.

Recent federal funding under the Commonwealth Government's Threatened Species Action Plan 2022-2032 is facilitating the search for predator-free translocation sites which can then be used to establish new populations of threatened galaxiids to reduce extinction threat.

The improved understanding of threats to our galaxiids has also clarified that trout can represent a threat to particular species with highly restricted distributions. Through building relationships and education, public opinion supporting management of trout in such situations has grown. ARI works collaboratively with the Victorian Fisheries Authority (VFA), fishing clubs, interest groups and catchment management authorities to protect threatened species of galaxiid with highly restricted distributions. A key method to protect galaxiids from trout involves constructing and modifying instream barriers on particular small upper tributaries, and subsequent trout removal upstream to create predator-free habitat. Given the small size of these streams this has negligible impact on trout fishery values but provides a huge conservation benefit for some of our most threatened species.

NEXT STEP

ARI will continue to work with VFA and groups such as the Australian Trout Foundation to collect, breed and release threatened galaxiids to bolster existing populations and establish new populations. ARI will also continue to monitor populations, undertake targeted management actions to mitigate threats and provide advice to government.

FUNDER

DCCEEW (Commonwealth) and DEECA Biodiversity

CONTACT

Dr Tarmo Raadik

Collecting Yalmy Galaxias

Moroka Galaxias fry in the conservation hatchery (Photo: Marcia Riederer, DEECA)

Guiding vegetation monitoring on the Moorabool River

ISSUE

The Corangamite Catchment Management Authority (CCMA) and Wadawurrung Traditional Owners Aboriginal Corporation (WTOAC) need vegetation monitoring data on the Moorabool River (Moorabull Yuluk) to assess the effectiveness of current and future environmental watering programs on key vegetation species and habitats. No existing vegetation monitoring programs were collecting the required data, nor using suitable methods to meet the specific needs of the Moorabool River water managers.

Monitoring is essential to understand the outcomes of management and to guide future decisions.

ACTION

In 2023, ARI designed a new vegetation monitoring program focussed on environmental watering responses. Whilst specific monitoring of other riparian management actions (e.g. livestock grazing, weed control) was not included, the influence of interacting factors was considered within the evaluation and recommendations. The monitoring program is fast, simple and repeatable, providing water managers with the information they need.

RESULTS

In 2024, the CCMA implemented the new CMA-led monitoring program at nine priority sites downstream of the Lal Lal and Bostock reservoirs, providing valuable insights into the current vegetation condition that can be used to guide management:

- The aquatic (instream) zone was dominated by native aquatic and emergent species and is among the best representations of this vegetation type in terms of condition in Victoria.
- The marginal bank zones were highly diverse with many native riparian species that require environmental flows to maintain dominance over invading terrestrial exotic plants.
- There were several examples of the success of management, including environmental flows, weed control and revegetation.
- Flow regulation, high-threat weeds, and livestock grazing continue to be major threats to vegetation communities and need ongoing management to mitigate their impacts.

Following implementation of the new monitoring program, four recommendations were identified to support water managers:

- Use monitoring data within a clear and transparent process to guide adaptive management of flows and on-ground actions.
- Ensure that management plans (e.g. environmental flows, weed control, revegetation and grazing control) are current, fit for purpose and integrated.
- Revise vegetation targets associated with broad objectives to enable clearer evaluation of outcomes and provide management guidance.
- Continue monitoring to establish condition trends and inform management and seek to integrate existing data into a combined dataset across programs to maximise its value and use.

Guiding vegetation monitoring on the Moorabool River (cont')

OUTCOME

This work resulted in the development and commencement of a new CMA-led monitoring program. The results of the first year of monitoring have been used to commence a review of objectives and targets and is directly influencing management actions and effectiveness through a more direct adaptive management cycle. Managers are using this information to prioritise sites for management, prioritise management actions to achieve outcomes, and use information more effectively for stakeholder communication and future actions.

NEXT STEP

ARI is working with the CCMA to revise their vegetation objectives related to environmental water management. This includes integration of the newly developed State and Transition Model framework to describe and predict how ecosystems change over time, to further refine management actions to achieve outcomes.

FUNDER

CCMA

CONTACT

Dr Chris Jones, ARI

A degraded river reach impacted by willows and sheep

Revegetation along the riverbank

Carrying out a vegetation survey along the Moorabool River

A river reach in good condition with diverse instream and riparian native vegetation

Remediating a fishway to allow effective fish passage

ISSUE

Fishways are commonly installed at instream barriers in rivers to improve connectivity for fish populations. Poorly designed fishway entrances can however limit their efficiency in attracting and passing fish upstream and constrain recovery of fish populations.

Dights Falls is a three-metre high fixed crest weir located in the lower Yarra River (Birrarung). In 2012, a dual rock ramp and vertical-slot fishway complex was constructed, including two downstream entrances and one upstream exit. Fish surveys post-construction indicated fish struggled to discover the entrances. Fish attraction greatly decreased at flows of >1000ML/day, with significantly lower catches of Common Galaxias at higher river discharges.

Flows of >1000ML/day occur regularly (>40% of the time), including during spring/summer when juvenile diadromous fish migrate into freshwater. Therefore, the upstream movement of fish within the Yarra River catchment was significantly hampered by the poor design of the fishway entrance.

ACTION

To enhance fishway design and fish attraction, an integrated six step framework was developed. This involved:

- creating a multi-disciplinary team of engineers, ecologists, river managers and operators
- setting clear ecological objectives and hydrological operational range
- developing computational or physical models to predict fishway entrance hydraulics over the target flow operational range
- identifying the optimal entrance location(s) for the target flow range
- developing performance and evaluation criteria including hydraulic and biological components
- conducting field evaluation and make additional changes as required.

The fishway was modified and a third downstream entrance was built. The framework enabled identification of the problem and potential solutions, testing using computational fluid dynamic (CFD) models, installation of the new entrance and wet commissioning (*in situ* testing of the fishway hydraulics at different flows) and fish surveys.

Common Galaxias captured in a fishway trap during a survey

Preparing to monitor the fishway using a fishway trap

Dights Falls

Remediating a fishway to allow effective fish passage (cont')

RESULTS

Fish surveys showed the number of fish that entered the fishway from pre- modification flows of 1000ML/d to post-modification flows of 6600ML/d increased 27% per 1000ML. Thus, the fishway is working efficiently at high flows.

OUTCOME

Since first construction (2012) and subsequent remediation (2020) of the Dights Falls fishway complex, the diadromous fish communities in the Yarra River have recovered upstream of the weir.

Over 200 km of the Yarra River has been reopened to these fish communities, allowing juveniles of several fish species, such as Australian Grayling and Tupong, to access upstream habitats following marine recruitment. These species are now more commonly observed in these upstream areas.

The integrated design framework enabled correction of ineffective fishway entrances to promote fish passage and support the recovery of many species of diadromous fish.

FUNDER

Melbourne Water

CONTACT

Justin O'Connor, ARI.

O'Connor et al. (2025) Remediating a fishway entrance to improve fish attraction: a framework for success. Journal of Ecohydraulics.

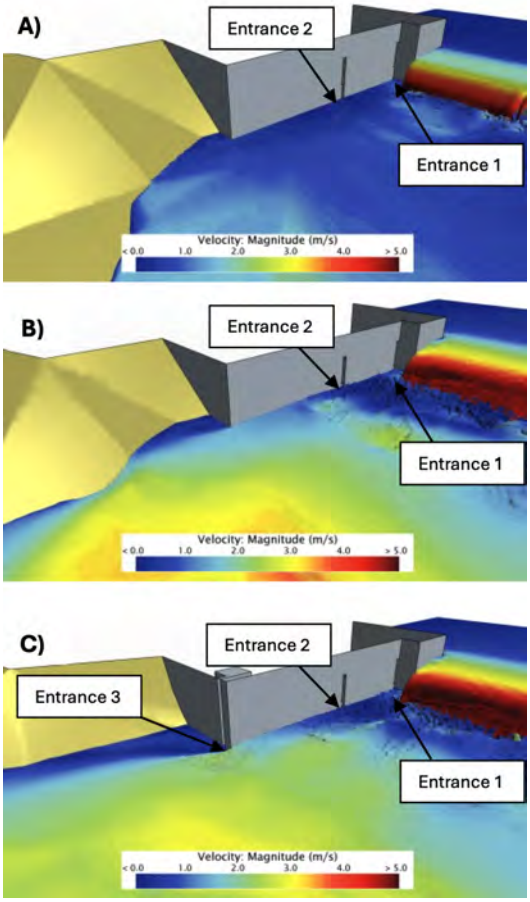

Figure 1. CFD modelled velocities along the existing vertical-slot fishway entrances A) (#1 and #2) at a simulated river flow rate of 650 ML/d showing low approach velocities (i.e., <0.5 m/s). B) the existing vertical-slot fishway entrances (#1 and #2) at a simulated river flow rate of 5000 ML/d showing high approach velocities (i.e., >2.0 m/s). And C) the new entrance (#3) at a simulated river flow rate of 5000 ML/d showing low approach velocities along the river bank (i.e. <0.1 m/s).

We acknowledge Victorian Traditional Owners and their Elders past and present as the original custodians of Victoria's land and waters and commit to genuinely partnering with them and Victoria's Aboriginal community to progress their aspirations.

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