



Returning animals after fires

Bushfires over the summer of 2019/2020, particularly in East Gippsland and north-east Victoria, significantly impacted biodiversity. For freshwater aquatic species, rainfall after bushfires can be lethal, with ash, debris and sediment washing into waterways, suffocating and burying animals. Since many aquatic species in the fire affected areas in East Gippsland are listed as threatened, with very restricted distributions, some animals were extracted from the wild and temporarily housed at the ARI aquarium. This included five galaxiid species, one blackfish species, four spiny crayfish species and three mussel species. The Glenelg Freshwater Mussel was also extracted from south western Victoria.

This September, the animals were returned to the wild, since their habitats had recovered sufficiently to now support them. Importantly, the Gippsland Blackfish and galaxiids will be able to contribute to this year's spawning season, helping sustain the species in East Gippsland. The Glenelg Freshwater Mussels were welcomed back onto Country in south western Victoria by Gunditjmarra Traditional Owners (see [ABC South West Vic](#)).

We've learnt many lessons regarding how best to maintain these threatened species in captivity. Guidelines are being written to guide future captive maintenance programs, as well as returning animals after extractions.

ARI has been closely involved in many aspects of the Victorian Government's bushfire response ([Victoria's bushfire emergency: biodiversity response and recovery](#)). See [ARI website](#) for further info.

▶ About us

The Applied Aquatic Ecology section aims to generate and share knowledge, through world-class, applied, ecological research, which 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.



Threatened fish, crayfish and mussels were recently returned to the wild (Photos: Darryl Whitaker)

Please note that this Update incorporates activities prior to and during the COVID-19 pandemic. Any fieldwork undertaken by ARI during this time has aligned with government protocols.

News

VEFMAP – Managing water to help fish and plants

VEFMAP (Victorian Environmental Flows Monitoring and Assessment Program) is a large-scale and long-term monitoring program in regulated Victorian rivers receiving environmental water. ARI led Stage 6 (2016–2020) of the program which focussed on demonstrating the ecological outcomes of environmental water management for fish and plants; filling knowledge gaps to improve planning, delivery and evaluation of this water and collecting data to report under the Murray–Darling Basin Plan.

[Stage 6](#) used a rigorous scientific approach, strong communication (particularly with waterway managers) and the timely sharing of findings to support and inform improved management. There were many collaborations with researchers in universities and other organisations. Many final products have been produced including a [final report](#), a [brochure](#), 17 supplementary reports, many journal articles and fact sheets. Planning for Stage 7 of VEFMAP has commenced.



Bringing fish ecological information together

Two important papers, for both scientists and managers, have just been released in Marine and Freshwater Research, led by ARI's John Koehn:

- [A compendium of ecological knowledge for restoration of freshwater fishes in Australia's Murray-Darling Basin \(MDB\)](#). With 26 scientists as co-authors (including nine other ARI staff), this work can help support the restoration of native freshwater fishes, recognising their many life-history strategies and values.
- [What is needed to restore freshwater fishes in Australia's Murray-Darling Basin?](#) This paper represents a call to action and includes 30 priority actions to restore native fishes of the MDB.

This work has already garnered media interest, including in the [Cosmos](#) newsletter.



How effective are management interventions for riparian plants?

The Riparian Intervention Monitoring Program ([RIMP](#)) aims to provide strong scientific evidence of the response of riparian vegetation to management interventions (e.g. weed control, revegetation and livestock exclusion). Almost 30 'paired' sites (control and intervention) have been surveyed twice so far (2014-17 and again in 2017-20). Many attributes are monitored relating to plant cover, composition and recruitment, and changes in plant structure, bare ground and bank stability.

In just three years after intervention, many positive changes are already apparent. Overall, intervention sites have less bare ground, more organic litter and a greater increase in native plant cover. Highlights include:

| ATTRIBUTE MEASURED | INTERVENTION SITES | CONTROL SITES |
|---|--------------------|------------------|
| stem density of native woody recruits | increased >1600% | decreased ~66% |
| stem density of native tree or woody shrubs (all age classes) | increased >600% | decreased ~42% |
| number of native species | increased ~76% | remained similar |

**all measures are relative to starting values*



Natural woody recruitment at Koetong Creek Pre intervention condition



Natural woody recruitment at Koetong Creek Post intervention condition - Livestock exclusion and revegetation

Zeb Tonkin wins an award

Dr Zeb Tonkin was recently presented with the [Australian Society for Fish Biology's](#) Early Career Excellence award. This award recognises those who have made an exceptional advance in the study of fish biology and/or fisheries that has fundamentally changed our understanding and/or management of fishes. There's only one a year and the candidate must be of exceptional quality. Zeb currently manages a wide variety of projects relating to recruitment dynamics and migratory behaviour of freshwater fish, environmental flows, floodplain fish assemblages and habitat restoration.



Zeb Tonkin

Influencing Change



Barham River rock ramp fishway. Tim Marsden (Australasian Fish Passage Services)

Celebrating World Fish Migration Day

[World Fish Migration Day](#), on 24th October, is a global day to build awareness of the importance of free-flowing rivers and migratory fish. ARI has a long history of helping improve fish passage across Victoria and within the Murray-Darling Basin, collaborating with DELWP Water and Catchments, many catchment management authorities, water authorities, engineers and consultants.

The Barham River, on the edge of Apollo Bay, is a good example of such a collaboration. Ten years ago, the Corangamite CMA built a rock ramp fishway on this river, with the help of ARI and Tim Marsden (Australasian Fish Passage Services). This was one of the first modern rock ramp fishways built in Victoria and was challenging and dynamic because the site regularly experiences high energy flows. It's exciting to see this fishway still operating well to allow free movement of many native fish species along this beautiful coastal river. Check out Tim's [great video](#) of about 30 adult Australian Grayling (nationally threatened) directly above the fishway.

Other fishway related activities ARI is involved in include: a new cone, vertical slot and elver suite of fishways at the Barwon breakwater/Reedy Lake (Corangamite CMA); modifications to Dights Falls fishways, construction of a new cone fishway on Dandenong Creek and a small rock ramp fishway (Melbourne Water); planning for Cohuna and Koondrook fishways (North Central CMA); and a rock ramp fishway on Cudgewa Creek (North East CMA).

Working collaboratively to benefit Macquarie Perch

Stocking and translocation are important actions used to restore populations of the threatened Macquarie Perch. These actions rely on harvesting fish from existing wild stocks, so careful management of source populations is essential, and research is necessary to inform where and how many fish are released:

- Population models are being used to determine the sustainable numbers of Macquarie Perch which can be taken from Lake Dartmouth for use as broodfish and to translocate to other areas (VFA funded).
- Broodfish will be collected this November and juvenile fish used for translocations will be collected in 2021 (VFA and NECMA funded)
- The upper Buffalo River will be surveyed soon to assess the impacts of the fires in early 2020. Results will help determine suitable numbers, rivers and sites for reintroduction of fish in 2021 (NECMA funded).
- These actions are all being informed by a long-term genetics program (Monash University) that shows clear benefits of gene mixing for the recovery of this threatened species.



Macquarie Perch

Influencing Change

Supporting improved water management in multiple ways

WetMAP (Wetland Monitoring and Assessment Program for environmental water) is assessing the response of wetland vegetation, fish, frogs and waterbirds to natural water regimes that are supplemented by environmental water. The final report for Stage 3 (2016-2020) is close to completion (DELWP Water and Catchments funded).

Fish Population Models – ARI is developing models to help predict how fish populations respond to different management scenarios (i.e. improving fish passage, mitigating cold water pollution and establishing screens on irrigation pumps). This work is part of the MDBA's Northern Basin Toolkit (NSW Department of Primary Industries funded).

Flow-MER – ARI is leading the Fish Theme within Flow-MER (the Commonwealth Environmental Water Office's on-ground Monitoring, Evaluation and Research program). This partnership between scientists, water managers and communities across the Murray-Darling Basin aims to better understand how fish, birds, vegetation and river connectivity respond to Commonwealth environmental water delivery.

Inter Valley Water Transfers (IVTs) – through IVTs, high volumes of water are delivered through the Goulburn and Campaspe rivers during summer-autumn for irrigation needs. A study has commenced to assess the influence of IVTs on early life stages of native fish species in the Goulburn River, and the key mechanisms driving any such impacts (DELWP Water and Catchments and VFA funded).



Lauren Johnson and Annique Harris surveying fish on one of ARI's electrofishing boats.



White-bellied Sea Eagles' (Photo: Damien Cook)



Data recording during fish survey



Golden Perch eggs collected in the lower Goulburn River

Outputs

- [Amtstaetter and Suter](#) (2020) Environmental flow releases trigger spawning of a threatened fish: Research insights and publication enhance management, credibility and relationships. *Aquatic Conservation: Marine and Freshwater Ecosystems* 30:1723–1726
- [Brown et al.](#) (2020) Testing the adaptive advantage of a threatened species over an invasive species using a stochastic population model. *Journal of Environmental Management* 264.
- [Koster et al.](#) (2020) Environmental influences on the juvenile migration of the threatened amphidromous Australian grayling (*Prototroctes maraena*), *Marine and Freshwater Research*.
- [Raymond and Todd](#) (2020) Assessing risks to threatened crayfish populations from sex-based harvesting and differential encounter rates: A new indicator for reproductive state. *Ecological Indicators* 118.
- [Stoessel et al.](#) (2020) Captive breeding of two rare non-migratory galaxiids for species conservation. *The Royal Society of Victoria* 131.
- [Stoessel et al.](#) (2020) Population genetic structure of estuary perch in south-eastern Australia. *Marine and Freshwater Research*.
- [Tonkin et al.](#) (2020) Quantifying links between instream woody habitat and freshwater fish species in south-eastern Australia to inform waterway restoration. *Aquatic Conservation: Marine and Freshwater Ecosystems* 30 (7).
- [Tonkin et al.](#) (2020) Linking flow attributes to recruitment to inform water management for an Australian freshwater fish with an equilibrium life-history strategy. *Science of the Total Environment* 752.
- [Vivian et al.](#) (2020) Responses of grasses to experimental submergence in summer: implications for the management of unseasonal flows in regulated rivers. *Aquatic Ecology*

Check out some of our recent videos, which use 360-degree VR (virtual reality) for an immersive experience!

[A Virtual Electrofishing Tour](#) and [Fieldwork Showcase](#).



Knowledge transfer

Please note that during COVID-19 restrictions, presentations have been given remotely via online platforms.

DELWP Science Symposium 2020 (45 3-minute talks available on DELWP YouTube) including [Cross border rescue and translocation of freshwater catfish](#) (Renae Ayres), [Using experiments to investigate the impacts of unseasonal flow scenarios on river plants](#) (Lyndsey Vivian), [Maximising the benefits of environmental flows for native vegetation](#) (Chris Jones).

[Flow MER](#) Fish workshops – Murray Cod, Golden Perch and Bony Bream modelling (Charles Todd), Fish population modelling to inform NSW constraints project NSW Environmental Water Governance (Charles Todd), MER Fish Evaluation Basin Scale Update to Annual Forum (Ivor Stuart)

SWIFFT seminar - [Of Fire and Mud: post-fire extraction of threatened aquatic fauna 2020](#) (Tarmo Raadik)

Melbourne Water Waterwatch webinars - Carp: history and management in Australia (Ivor Stuart), the life-history strategy of some of Victoria's native fish species and the effects of barriers and river flow (Frank Amtstaetter)

MDBA, Goulburn Murray Water and community meeting - Movement and recruitment dynamics of Murray Cod in the Mitta Mitta River (Zeb Tonkin); Campaspe Environmental Water Advisory Group meeting - VEFMAP results (Zeb Tonkin); VRFish State Council meeting - Fish and bushfires - (Jarod Lyon); Victorian Fisheries Authority - Women in fisheries research - reflecting on my experience (Renae Ayres); Lower Barwon Community Advisory Group meeting - Lower Barwon fish passage (Ivor Stuart); SA Water and NSW DPI meeting - Lock 8 & 9 fish ecology for Sustainable Diversion Limits Adjustment Mechanism project (Ivor Stuart)

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