

# Annual Report 2015-16



**Arthur  
Rylah  
Institute**  
for environmental  
research



Environment,  
Land, Water  
and Planning

The Arthur Rylah Institute for Environmental Research (ARIER) is a branch within the Biodiversity Division and Energy, Environment and Climate Change Group of the Department of Environment, Land Water and Planning.

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More information on the activities of the ARIER can be found at [www.delwp.vic.gov.au/ari](http://www.delwp.vic.gov.au/ari)

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# Director's Foreword



Kim Lowe - Research Director - ARI

This year, the Institute's 46<sup>th</sup>, was a significant one for ARI.

We were able to consolidate our efforts on working with the community, building on our client driven service improvements, significantly strengthening our science capability and outputs and further refining our administration and management processes.

We have continued to build a high-performing culture, based on great team work, quality science, service excellence, delivery and achievement.

It was a year that confirmed the Institute's role as the pre-eminent ecological advisor to Government in Victoria.

At ARI, we have a highly qualified, resilient and dedicated team of scientists, providing ecological research that informs policy, provides crucial science for Government and our external clients, and makes a valued contribution to the environmental science sector.

We continue to influence biodiversity outcomes by undertaking high quality, applied, ecological research. Highlights include:

- The successful delivery of over 570 milestones across 198 projects for both DELWP and our external clients and collaborators;
- The publication of 53 peer-reviewed scientific journal papers and 66 ARI Technical Series or Client Reports;
- The presentation of 27 ARI seminar presentations from ARI staff or external scientists. This year also saw the introduction of webinar capability, allowing live participation over the web. Over 1000 people attended these seminars, either in person or online;
- The continued implementation of ARI's Research Strategy and Science Review;
- Celebrating an ARI scientist publishing in Nature, the world's most respected scientific journal;
- Staff involved in teams that won (2015) and were shortlisted (2016) for the Eureka Prize for Environmental Research, Australia's premier community science awards;
- Successfully establishing the Applied Aquatic Ecology Research Hub with DELWP's Water and Catchments Group, the Victorian Environmental Water Holder and CMAs.

The past two years have also seen a strengthening of relationships with the research academic community, especially with La Trobe University via the joint appointment of a Professor of Ecology and two post-doctoral research fellows, ensuring our science staff can do what they do best – deliver great science.

I look forward to building on this foundation in coming years.



# The Future



Jo Kearns (2<sup>nd</sup> from right) from ARI and Landcare Members at a Macquarie Perch spawning site

The Arthur Rylah Institute had a highly successful 2015-16.

We significantly raised our profile across DELWP and the environmental and research sectors more broadly, through initiatives such as taking a leading role in the DELWP Science Forum. A focus on improved science and collaboration confirmed the Institute's position as the premier ecological research body in Victoria.



Little Pygmy Possum (*Cercartetus lepidus*)

The coming year brings some challenges, but many opportunities:

Work will start on a refreshed ARI Research Strategy, led by the Professor of Ecology and the Science Committee;

ARI staff will explore how Citizen Science can contribute to research and datasets;

We will also start work on developing a data collection strategy to build on the extensive datasets held by the Institute;



Wayne Koster and Justin O'Connor taking measurements in Boyles Creek

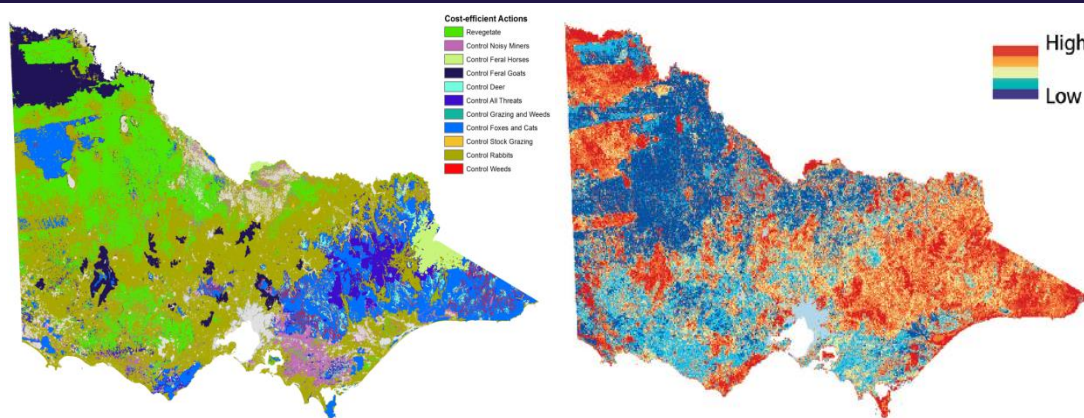
The Institute will also work to consolidate its publications, making as many as possible available to the public via the DELWP website;

We are also looking forward to a suite of building improvements which will substantially boost our energy, efficiency and continue to grow ARI as a vibrant, contemporary workplace;

This, along with a continued focus on a high performing culture means there is much to look forward to in coming years at ARI.

# 2015-16 Highlights

## Decision support tools for biodiversity conservation



Deciding how and where to protect, restore, and manage Victoria's diverse array of species and ecosystems is not a simple task. ARI has been the key technical developer for NaturePrint, which is a suite of computer-based decision-support tools designed to help make smart choices about actions to conserve Victoria's biodiversity.

**Strategic Management Prospects (SMP)** is one such tool, which has been developed in collaboration with our colleagues in Biodiversity Division. It is designed to systematically integrate complex spatial information on expected benefits and costs of management actions for thousands of native plant and animal species across Victoria. It will **support conservation decision-making at various scales**, including investment in **on-ground actions**, application of **regulatory controls**, and the relative **cost of implementation**. The **outputs are spatially explicit**, and inherently dynamic - there is no final or correct answer - only the best synthesis of current information for biodiversity investment decisions.

ARI's Spatial Analysis team have successfully developed the technical software for the SMP decision support tool. It is now well developed for some threats (e.g. rabbit control, predators), partially developed for others (such as fuel reduction burning below tolerable fire interval) and only scoped out for waterway based actions (such as riparian restoration). There is also still significant work to do in terms of refining and testing of outputs.

The two Strategic Management Prospects maps - best management regime (left above) and relative values (right above) - are example outputs from this decision-support tool, and these need be considered together to understand the priority for doing a particular action in a location. For example, implementing fox and cat control (blue on the best management regime map) in high priority areas in East Gippsland (red on the values map) would be the most cost-effective management regime for that area.

The team has also developed a series of dynamic **land cover products for the South Australian Government**, that allows the tracking of **changes in native vegetation** as well as **anthropogenic activities** across a 30 year time period. They provide the first comprehensive models of vegetation systems for South Australia, based upon field data. This provides important information for land management in South Australia, and the methods developed have added significantly to modelling capacity for Victoria.

Spatially explicit models of **fire-fuel attributes** have been developed for Victoria. These include: a new fuel characterisation scheme; a higher quality spatial database for fuel-specific information; and a dynamic model of fuel types that will assist the prediction of the behaviour of wildfires.

A video detailing this work (The Ecological Time Machine) can be found on the DELWP YouTube channel at [www.youtube.com/watch?v=5PBb2V5qd-Y](http://www.youtube.com/watch?v=5PBb2V5qd-Y)



# 2015-16 Highlights

## Applied Aquatic Ecology Research Hub



ARI has initiated an Applied Aquatic Ecology Research Hub (AAER Hub) to support Victoria's aquatic research needs and improve coordination. The AAE Hub is a **collaborative partnership** between divisions within the Department of Environment, Land, Water and Planning (DELWP), the Victorian Environmental Water Holder (VEWH) and Victorian Catchment Management Authorities (CMAs).

In the current development phase, the AAE Hub will :

- Create and share aquatic knowledge research from across Victoria;
- Identify and align strategically important research needs for managers;
- Ensure that the best available evidence is used to inform decision making, and
- Maximise the value, reach and uptake of research outputs.



David Dawson downloads fish tracking data on the Goulburn River

In the future, it is likely that other key stakeholders in the management of Victoria's waterways will also join the Hub



The recent creation of Fishways News Vic (<https://fishways.wordpress.com>) represents one effective example of how we have begun to share aquatic research and management outputs in Victoria. This site, primarily aimed at those involved in managing fish passage in Victoria, provides a platform to access current relevant information and research, as well as exchange ideas, seek advice and connect with others. This includes a blog to receive email updates and follow conversations.

# 2015-16 Highlights

## Tracking the Trends: European rabbits in Victoria



The European rabbit (*Oryctolagus cuniculus*) is one of Victoria's most significant agricultural and environmental pests. We are undertaking an analysis of trends in the abundance of introduced European rabbits in Victoria. The monitoring program, with up to 18 years of data from 21 sites, **is the state's key tool for understanding changes in rabbit populations**. State-wide rabbit monitoring program was established in 1998 to measure the impacts of Rabbit Haemorrhagic Disease Virus (RHDV; which established in 1995-96) and large-scale warren ripping on rabbit populations in Victoria. Every year, in both autumn and spring, rabbit populations are monitored at sites across Victoria. Rabbits were counted at night from vehicles driven along fixed transects. During the day, warrens are assessed.

So far, it is clear that coordinated, large-scale warren ripping conducted during 1998–2005, following the establishment of RHDV, has resulted in sustained low densities of rabbits. Large-scale warren-ripping programs have been very successful in reducing rabbit density for up to 18 years, whereas rabbit populations that were not ripped have returned to near pre-RHDV levels. The most effective warren ripping programs reduced rabbit densities by 99%.

The study indicates that **large-scale warren ripping provides immediate, substantial and sustained reductions in rabbit density** and should be considered **the primary tool for managing rabbits** to low densities in Victoria. The efficacy of RHDV in regulating rabbits to low densities in Victoria has diminished, but it is hoped that the proposed release of the rabbit calicivirus K5 strain (RCV-K5) in spring 2016 will further reduce rabbit populations, particularly in cooler, high-rainfall areas.

Continued monitoring of these sites will contribute to our knowledge of the efficacy and spread of the proposed release of RCV-K5 in spring 2016, as well as of the longer-term effects of the warren ripping that was conducted during 1998–2005.

*This study was funded by the Biosecurity Branch, Department of Economic Development, Jobs, Transport and Resources.*



# 2015-16 Highlights

## Targeted research to support Leadbeater's Possum



ARI is undertaking extensive targeted surveys to locate new colonies of Leadbeater's Possum, Victoria's faunal emblem for the Victorian Government. All new colonies found in State Forest receive a 200 m radius timber harvesting exclusion zone to protect them and their habitat from timber harvesting. As a result, this directly assists in improving the conservation of this critically endangered species.

**Remote Cameras:** ARI scientists work with specialist arborists to install heat-and-motion sensing cameras opposite bait stations within the tree canopy or tall understorey where the possums are most likely to be moving or feeding throughout their tall, wet forest habitat. Being able to identify and target this vegetation layer has been a key factor in the success of these surveys, with **148 new colonies located to date** at over half of the 289 sites sampled.

**Models:** The use of sophisticated spatial models predicting where Leadbeater's Possums are most likely to be found has helped focus survey effort and has also contributed to its success. Detailed habitat assessments have been undertaken at each site, recording key habitat features such as the number and type of hollow-bearing trees and the density of the mid-storey layer. This information will be analysed and new models developed to further improve our understanding of suitable habitat for the species and where this habitat occurs.

**Artificial Hollows:** The lack of suitable hollows that shelter Leadbeater's Possums is considered to be a key threat to the population. ARI scientists, in collaboration with VicForests and skilled arborists, are investigating the feasibility of using mechanical means to create nesting hollows for the possum to provide additional habitat, supplementing natural hollows. Hollows have been designed to suit the species with a small entrance leading to a large internal cavity. Hollows have been created in 72 trees across 18 sites where possums have been found during the surveys. They have been monitored three times over the last 12 months to assess whether Leadbeater's Possums use the new hollows. Photographs are obtained from heat-and-motion cameras set opposite half of the hollows, and direct inspection for signs of animals or the characteristic nests made from strips of bark. Early results are very promising with over **half of the hollows now occupied** by Leadbeater's Possums, with some hollows used within a month of installation. Photographs show animals carrying nesting material in their tails into the hollows - evidence that the hollows are being used for breeding. This approach has great potential to further assist the long term conservation of this species.

# 2015-16 Highlights

## Waterbird Monitoring at the Western Treatment Plant



ARI has monitored waterbirds at the Western Treatment Plant (WTP) near Werribee since 2000. This 11,000 ha site is operated by Melbourne Water to treat over half of Melbourne's sewage and waste water. Its system of ponds, wetlands, grasslands, saltmarsh and intertidal habitats is internationally recognised as supporting significant numbers of waterbirds.

Since waterbird monitoring began, there have been major changes in WTP treatment processes and land use, including a requirement to reduce nutrient discharge into Port Phillip Bay. Data collected on population trends and habitat use in three groups of waterbirds (waterfowl, shorebirds and ibis) have been used annually to track their responses to these changes and to guide WTP management.

A recent synthesis of 12 years of data examined the role that season, climate (including the impact of a long drought which ended in 2009) and changes in sewage processing had on waterbird numbers.

**For waterfowl**, it was found that season and climate were the dominant drivers of fluctuations in overall numbers. Their distribution within the site however, appeared to be influenced by differences in nutrient levels within treatment ponds; **older, higher nutrient ponds were favoured over those with lower nutrient levels** (the decommissioned and upgraded lagoons). Since this finding, Melbourne Water has built a series of pipelines to deliver partly treated sewage to selected decommissioned ponds which now **maintain the nutrient levels** required to support waterfowl foraging. This challenging management action necessitates a delicate balance between providing sufficient nutrient levels within a flow-through system, while not exceeding limits on discharge.

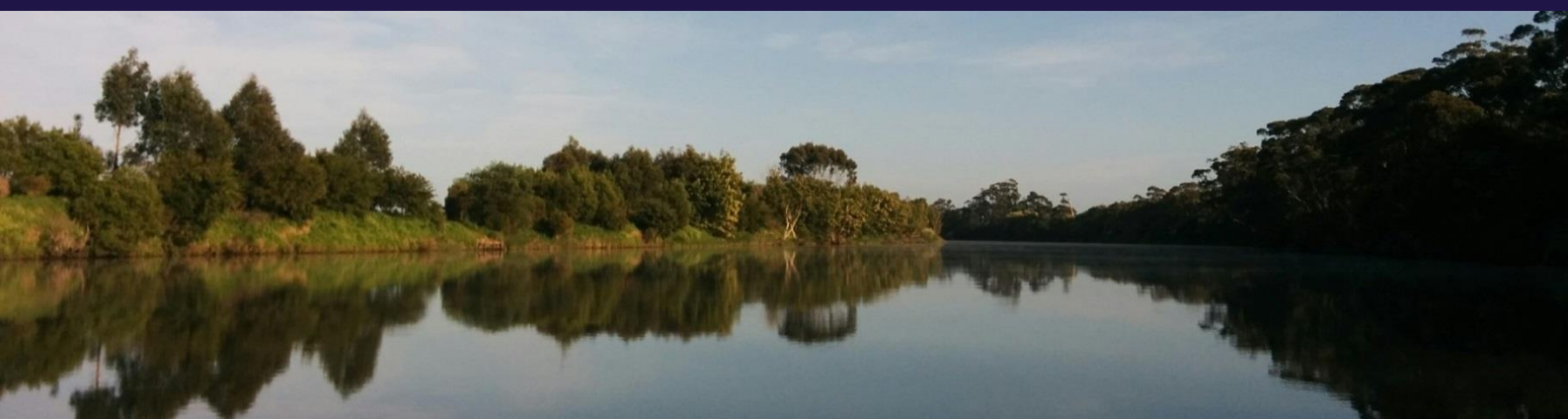
**This Shorebird** research has also led to **active manipulation of water levels to provide increased foraging opportunities**. This is particularly important for migratory species e.g. the Curlew Sandpiper, that need to increase body weight to a level that will enable their survival on the long (16,000 km) journey north. Our long-term data directly influenced the recent listing of several shorebird species as threatened.

**Ibis** use the WTP paddock system as **foraging habitat**, attracted in part by irrigation cycles. Reduced ibis numbers in recent years has coincided with upgrades to sewage treatment, conversion of pasture to crops, and changes in irrigation schedules. Habitat use by ibis is being studied to inform management of the paddock system to support this important ibis population.

Overall, numbers of **waterbirds at the WTP remain high** and demonstrate the importance of this site, particularly as a permanently **wet refuge during dry periods**. ARI continues to work closely with Melbourne Water to help ensure the environmental values of the WTP are maintained.

# 2015-16 Highlights

## Snowy River Environmental Flows



The iconic Snowy River in south-eastern Australia has its headwaters on the slopes of Mt Kosciuszko in New South Wales, before flowing south through Victoria and into Bass Strait.

The Snowy Mountains Hydro-electric Scheme brought major changes to the system, diverting the river and altering natural flows. In the late 1990s, the declining health of the Snowy River led to a reassessment of flow releases for the system and the establishment of a major flow study.

ARI's study has explored several questions: What are the effects of the altered flow regime on the ecological condition of the Snowy River in Victoria? How do these flows affect recruitment and growth of Estuary Perch (*Macquaria colonorum*) in the River? Could environmental flows be delivered to benefit these fish? What types of flow (volume, timing, duration, frequency and quality) are most important for estuary perch?

### Estuary perch in the Snowy River

The study revealed that:

- Most of the estuary perch sampled were born in 1985, 1995, 1996 and 2008;
- Growth of young Estuary Perch benefit from cooler average water temperatures and higher average annual flows; opposite conditions benefit growth of adult estuary perch;
- High winter and spring flows, and cooler spring and summer water temperatures within the estuary are particularly important for successful spawning and hatching (recruitment) of estuary perch;
- As the cooling effect of flows on the estuary is greatest at times when air temperatures are also cool, it is recommended that environmental flows be delivered in September (i.e. early spring) for the benefit of recruitment of estuary perch;
- Whether these environmental flows would likely be sufficient to substantially increase recruitment of estuary perch on their own is, however, unknown;
- It is nevertheless likely that large recruitment events will remain dependent on good rainfall. Environmental flows coinciding with such events may, however, amplify the effects of these natural flow events, and in doing so benefit recruitment of estuary perch.

*The project was funded and overseen by the East Gippsland Catchment Management Authority.*



# 2015-16 in Review

## ARI in the Community

In line with the DELWP Community Charter, our staff are committed to being available, to listening, to talking and to taking action to actively work with the community. ARI's activities take our staff all across Victoria. As well as interacting with local people through our field work, we work with the wider community in a range of ways – informing, consulting, collaborating and empowering. This work takes place in urban, inland and coastal areas.

For example, in the 'Coastal Fish Habitat Hotspots' project, ARI collaborated with Victorian coastal CMAs, recreational fishers and Landcare groups to deliver a large suite of events at five key 'habitat hotspots' along Victoria's coast. Funded by the Australian and Victorian Governments, the project engaged with people to raise awareness and encourage involvement in actions to improve waterway condition for healthy fish populations at Warrnambool, Gellibrand, Tarwin Lower, Werribee and the Gippsland Lakes. Events included information nights, field visits, electrofishing demonstrations, forums, film screenings and community tree planting days.



Renae Ayres from ARI informs local anglers about fish populations and the importance of fish habitat at the 'Fish 'n' Snags' event on the Gellibrand River estuary



The BioBlitz bat walk and talk at Westgate Park

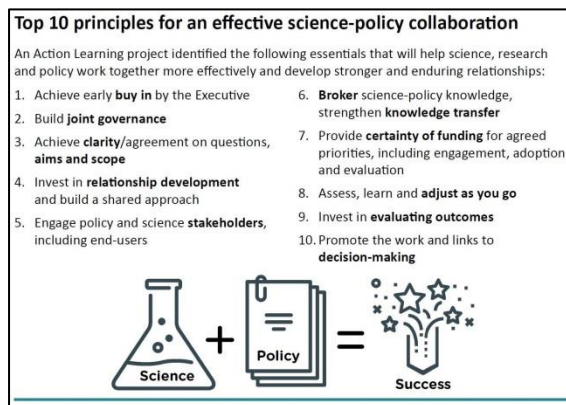
We are increasingly interested in the role of citizen science and identifying relevant opportunities to integrate this in our work, or to support other projects. In one example, two ARI scientists contributed to the 2016 Melbourne BioBlitz initiative. Dr Lindy Lumsden led a bat 'Walk & Talk' at Westgate Park, and set up harp traps and bat ultrasound detectors, to the delight of a large audience. Dr Steve Sinclair led a botany 'Walk and Talk' at the Royal Botanic Gardens.

Other ARI community engagement activities in 2015-16 included electrofishing demonstrations, presentations to Landcare group, fishways tours and several talks and demonstrations on issues such as the re-introduction of Macquarie Perch into the Ovens River and carp removal.

# 2015-16 in Review

## Communication & Collaboration

At ARI, we want to make a difference. We conduct applied ecological research to help improve our understanding and management of our natural environment. We believe this research is most effectively delivered and shared when it is a collaborative process, and when there are close connections between people and agencies seeking to resolve a question, scientists exploring that question, and end users keen to improve their practice.



Key principles from the Action Learning Project

An important example of our efforts to support these connections is our substantial contribution to the ‘Science-Policy Connect’ DELWP Action Learning Project. This project collated seven case studies of collaboration across the department and identified the key principles which supported effective science-policy collaboration. The results have been shared amongst staff in a variety of ways and we continue to actively support positive collaborative processes.

ARI works closely with our clients and with many different, relevant ‘communities’. We recognise that our work can only become truly ‘applied’ when it is

shared and known. Communicating our work and collaborating with others has become an increasingly important focus at ARI and a host of activities in 2015/16 reflect this.

Staff have continued to publish their work in scientific journals, Technical Reports and Client Reports . and news about ARI projects and their impact has been regularly shared through our quarterly electronic ARI-eNews, Aquatic Quarterly Updates, Terrestrial Quarterly Updates, and updates on our webpages. Staff have also delivered presentations at many workshops and conferences (including International events such as the American Fisheries Society Conference in Portland Oregon, the International Congress for Conservation Biology in Montpellier France, the International Conference on River Connectivity in the Netherlands, the International Orchid Congress in Hong Kong, the International Association of Landscape Ecology World Congress in Portland Oregon, and a Bayesian Integrated Population Modelling workshop in Cape Town, South Africa). We have been actively involved in co-organising several conferences and events, such as the 11th International Symposium on Ecohydraulics, the 2016 Australasian Bat Society Conference, and the VicNature ‘Our Changing Landscapes’ Symposium.

We have continued to build our ARI Seminar program, through increasing the number of presentations (27 in 2015/16) and increasing our reach to well over 1000 people. The availability of remote on-line access to the seminars has been very well received and has further contributed to substantial growth in our audience.

ARI has also produced a number of short videos that been shared widely online. We will continue to build our effective, genuinely collaborative relationships and strive for powerful, great communication of our work.

# 2015-16 in Review

## ARI Client Survey

As a service provider, the ARI Management Committee identified the need for reliable feedback from clients to address any specific delivery issues, drive improvement in project delivery and gather information for Key Performance Indicators. The first survey was conducted in September 2013, with a follow up in 2014.

The most recent survey was sent to a list of 100 clients in September 2015, spread across DELWP and external clients.

*“...the last two years have seen a radical improvement in the level of 'service' .... I would now rate ARI as one of the very best consultants to use in terms of communication and delivery of results (as well as their usual excellent science, of course).”*

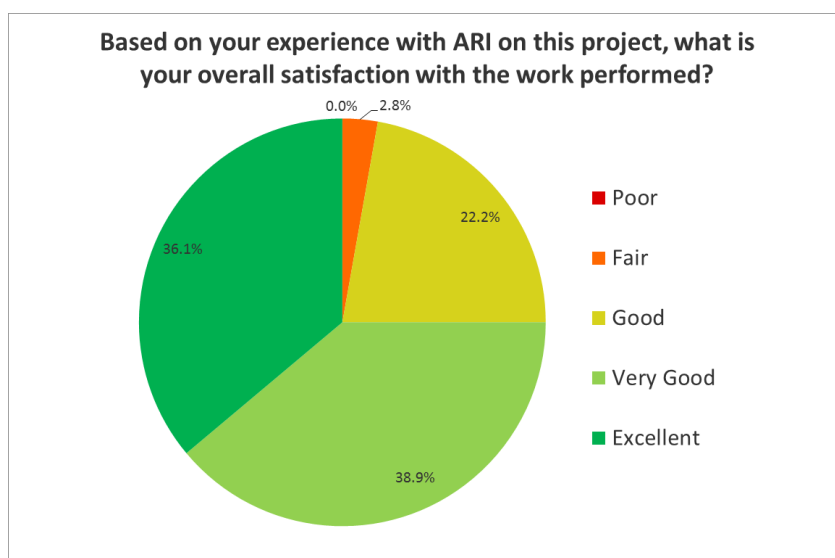
Comments were highly favourable

The ARI client survey is designed to capture information regarding levels of satisfaction, relationships with ARI staff, types of research required and the impact of the research on the client's decision making, policy development or on ground actions. Performance information was broken down into key areas. Level of Innovation was added to the 2015 survey, following a review of ARI's Value Proposition. Verbatim comments were captured from each client

### Satisfaction Levels

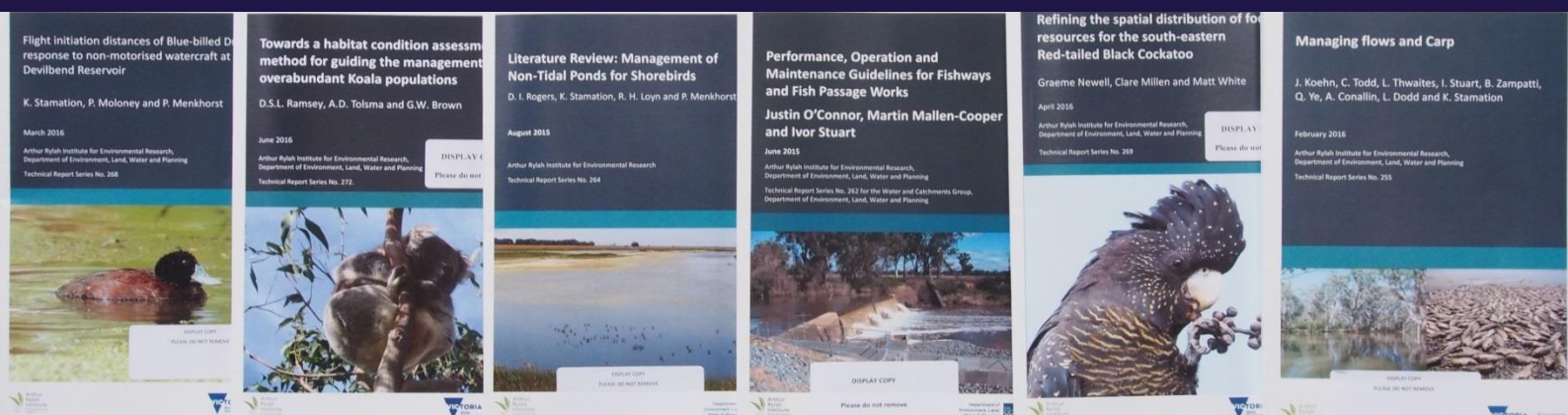
Satisfaction levels remained high in the 2015 survey, with over 97% of clients rating their overall satisfaction as good or better.

This was consistent with ratings for individual performance areas such as communications, responsiveness, quality of outputs, scientific rigour and thinking, and understanding of client needs.





# 2015-16 in Review



## Science Leadership

The joint appointment in 2015 of Professor Andrew Bennett as Professor of Ecology at LaTrobe University and at ARI and more recently, jointly appointing two research fellows in areas of common interest have significantly enhanced the scientific profile and skills at ARI. A second biometrician was also appointed this year, allowing the Institute to revamp and deliver our in-house statistical training program and offer a broader range of biometric support for ARI staff.

ARI continues to build on its unique role as a scientific institute that conducts high quality applied environmental research and provides authoritative advice and information to governments, other agencies and the community. Science at ARI is strongly focussed on applied ecological research, in line with the vision in the ARI Research Strategy 2012-2016, *“Our science underpins high-quality, evidence-based decision making by governments and communities.”*

Core strengths of ARI lie in the expert knowledge by staff of the state’s flora and fauna; technical survey skills; rigorous data analysis; and world-class skills in spatial analysis, decision analysis and modelling.

ARI scientists are active in the wider scientific community through conference presentations, contributions to professional societies, membership of editorial boards, and publication in the scientific literature. In 2015, ARI scientists published over 55 papers in national and international peer-reviewed journals, many in collaboration with colleagues at other institutions. A strong relationship with Universities continued in 2015 with ongoing collaborative research, partnership in ARC Linkage Grants (University of Melbourne, Monash University) and supervision of research students. In 2015, ARI staff co-supervised 17 PhD students across nine Universities.

Promoting a vibrant culture of scientific enquiry within ARI is important to ensure we remain at the cutting edge. A regular seminar series featuring local scientists, interstate and international visitors, and our own colleagues at ARI, is a vital source of stimulation. All ARI staff contribute to a peer review process to ensure that client reports, technical reports and journal submissions are critically reviewed to maintain the quality of our science. A Science Capability Initiative was conducted for ARI staff to this year to further enhance the scientific capabilities. Through a competitive bidding process, 10 activities were funded covering 13 staff. These included two scientists undertaking advanced training in structured decision-making at the Patuxent Wildlife Research Centre in Maryland, USA.

We look forward to continued opportunities to contribute high quality science and advice to support evidence-based decision making for the conservation and management of natural resources.

# 2015-16 in Review

As one of many actions to improve the quality of our science, an independent review of science at ARI was conducted in December 2012. This review was important to assess ARI's science quality, to benchmark it against similar institutions and to provide a base line for ongoing improvement.

The review was undertaken by an independent panel of scientists: Emeritus Professor Barry Hart (Chair) - Monash University; Professor Michael Clarke - La Trobe University; Dr Simon Ferrier - CSIRO Ecosystem Sciences; Professor Graham Mitchell - Chief Scientist DSE; and Dr Mark Kennard - Griffith University.

***"...an impressively resilient organisation..."***

***...contributing to high quality, relevant and effective applied research knowledge..."***

Independent Science Review  
(December 2012)

The Review found ARI to be "*...an impressively resilient organisation...*" that delivers research excellence "*...contributing to high quality, relevant and effective applied research knowledge to assist in the conservation of biodiversity in Victoria and southern Australia.*" The Review confirmed the research objective at ARI - *to generate and disseminate knowledge, through world-class, applied, ecological research.*

It provided 18 recommendations to advance science capability and outputs. The ARI Management Committee (MC) accepted the recommendations of the Review Panel and developed an Action Plan to respond to the recommendations with a series of practical activities, defined timelines and assigned responsibilities.



Dr Lindy Lumsden demonstrates a harp trap at an ARI tour during Science Week

A key recommendation was to strengthen the relationship between ARI and the remainder of DSE (now DELWP), and ARI has undertaken a range of activities in response. For example, in 2015 the Institute initiated a series of events in Science week in August. In addition to packed seminars and tours at ARI, science was taken to head office with a foyer display that included electrofishing, camera trapping, artificial hollows, videos and a history of ecological research in Victoria.

In 2016, the ARI Management Committee again reviewed the Action Plan, finding that all 18 recommendations had been acted upon.



# 2015-16 in Review



## Applied Aquatic Ecology – Key Projects

The Applied Aquatic Ecology section comprises aquatic ecologists, technicians, spatial ecologists and ecological modellers. It works across areas including aquatic biodiversity and conservation, wetland ecology, riparian and estuarine ecology, connectivity and fish passage and habitat and flows. Their work informs policy and decision making across. Projects from 2015-16 included:

- The Long-Term Intervention Monitoring (LTIM) project has been monitoring and evaluating the **ecological outcomes** of Commonwealth **environmental water use** (funded by Commonwealth Environmental Water Holder). ARI is monitoring fish and vegetation along the lower Goulburn River, one of seven Selected Areas, from 2014 to 2019. The 2014 monitoring and analysis has been completed, in particular providing useful information on population structure, spawning and movement of Golden Perch (*Macquaria ambigua*).
- The development and application a Carp **population model** relating to flows is now complete (ARI Tech Report 255 - Managing Flows and Carp). A project has also been initiated for the development of population models for eight species of native fish to assist in managing flows to support these species. Both projects have been funded by the Murray-Darling Basin Authority.
- Performance, operating and maintenance **guidelines for fishways** and fish passage works have been developed by ARI and collaborators. This work addresses an action identified under the Victorian Waterway Management Strategy. The report provides a framework for developing site-specific guidelines, given recommendations are unique for particular sites.
- ARI assessed the **outcome of instream habitat enhancement** works conducted across four rivers by the Goulburn Broken CMA from 2000 to 2008. Results indicate these works continue to provide vital habitat for fish communities, particularly Brown Trout and Two-spined Blackfish. This study demonstrates instream habitat enhancement in degraded rivers can provide critical structural habitat for aquatic fauna until natural processes such as riparian input are restored.
- **Post-fire monitoring** of the Orbost Spiny Crayfish, McDowall's Galaxias and River Blackfish was undertaken after the 2014 Orbost fires. While there is evidence of recovery of the galaxiid, and persistence of the crayfish, the blackfish has disappeared from the area of the fire, and declined more broadly across East Gippsland. This highlights the need for a broader assessment of the status of River Blackfish within eastern Victoria.



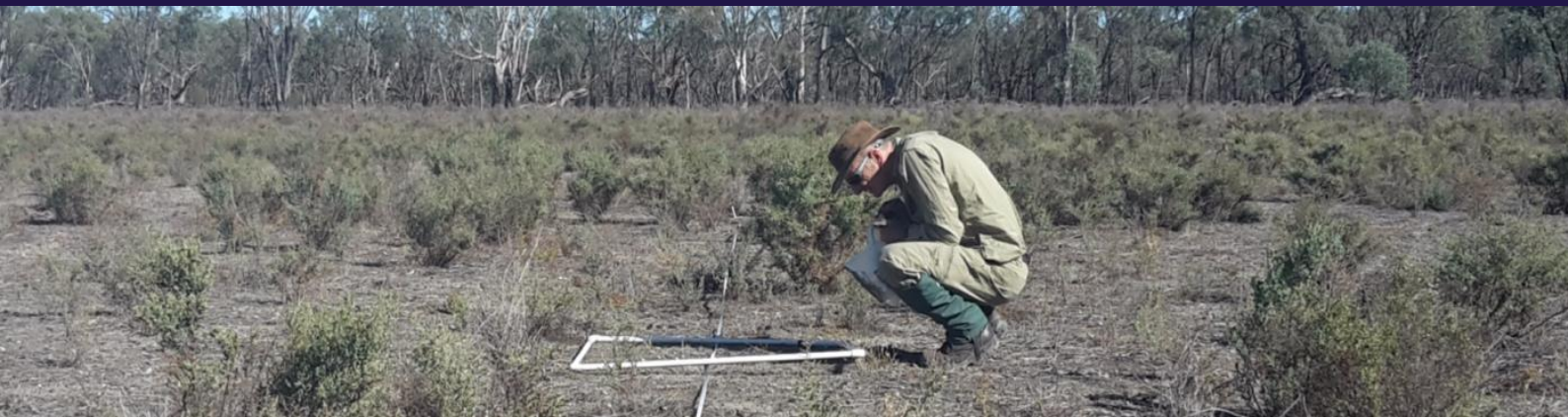
# 2015-16 in Review



## Wildlife Ecology – Key Projects

The Wildlife Ecology Section undertakes high quality ecological research to inform and guide policy and management decisions to improve the conservation of threatened terrestrial species, address difficult wildlife management issues and reduce the impact of invasive species. Key projects this year included:

- A joint project between ARI sections has assessed the **survival of translocated Koalas** in the Otway Ranges. A trial translocation was undertaken using radio-collared Koalas, which are being monitored for up to one year and their fates compared with a sample of animals captured at Cape Otway and not translocated. Early results suggest that the translocation has been successful with a high survival rate observed among the translocated Koalas. Up to 600 Koalas are intended to be translocated to other parts of the Otway Ranges to alleviate impacts on preferred eucalypt trees.
- Under the Melbourne Strategic Assessment agreement between the Victorian and Commonwealth governments, DELWP is responsible for implementing a Biodiversity Conservation Strategy for several nationally significant threatened species and ecological communities that occur in Melbourne's urban growth areas. As part of this strategy, DELWP is constructing artificial wetland habitat for the threatened Growling Grass Frog in conservation zones throughout the growth areas. ARI staff and colleagues from DELWP and the University of Melbourne, developed a **new, world class innovative decision support tool** that built on existing habitat models for the frog to guide the selection of locations for wetland construction based on frog survival rates. The tool allows decision makers to determine where best to construct artificial wetland habitat in order to **maximise** conservation benefits for the Growling Grass frog for a specified budget. DELWP are currently using this tool to plan the future program for wetland construction.
- ARI staff are assisting the Mallee CMA to develop a **feral cat management strategy** for Hattah-Kulkyne National Park. The project identified the density of feral cats, their home range size, body condition, and bait consumption rates. This information was combined with movement models to compare various reduction strategies. It was found that aerial baiting with at least 30 baits/km<sup>2</sup> resulted in simulated high feral cat population reductions
- Projects funded under DELWP's Threatened Species Protection Initiative and through the Loddon Mallee Region include **trapping for the threatened Masters' Snake** in the Big Desert at sites previously trapped over 30 years ago when this snake was common. This trapping failed to record Masters' Snake, and preliminary results suggest that there has been substantial changes in the small terrestrial vertebrate fauna in this area. A second project documented the **arrival and impacts of the devastating Amphibian Chytrid Fungus** on the last (formerly) fungus-free population of the threatened Alpine Tree Frog.



## Community Ecology – Key Projects

The work of scientists in the Community Ecology section encompasses monitoring, research and spatial modelling of the effects of disturbance processes on animals and vegetation. Our outputs help guide biodiversity policy and management actions for a range of organisations in Victoria and nationally. Key projects in 2015-16 included:

- ARI staff worked with agencies including the DELWP Fire Forests and Regions group and the Mallee CMA to conduct a number of investigations on the relationships between vegetation/plant dynamics and a range of management actions. These included planned burning, environmental watering, weed control, and livestock grazing management. This work involved the collection and interpretation of seed production data for plants sensitive to frequent fire to test models of **tolerable fire intervals**; analysis and reporting of **effects of fire regimes on forest plants**; monitoring the effectiveness of **environmental watering** to maintain floodplain vegetation at Hattah Lakes; and evaluating the effectiveness of different **grazing management regimes**, including exclusion, to improve grassland, woodland and Mallee vegetation condition.
- ARI staff, funded through both Victoria and Australia governments, conducted research into the management of a number of threatened species and communities. **Threatened fauna** research included studies of the Heath Skink, Orange-bellied Parrot, Southern Right Whale, Southern Brown Bandicoot, Pink-tailed Worm Lizard and several migratory shorebirds. **Threatened Flora** research included studies of the Alpine Marsh-marigold, Velvet Daisy-bush and several threatened orchid species. **Threatened community projects** studied communities impacted by the expansion of Melbourne's urban footprint within the Melbourne Strategic Assessment area, as well as the Alpine Bog Community (listed under both the Flora & Fauna Guarantee Act 1988 and Environment Protection and Biodiversity Conservation Act 1999).
- The large spatial analysis capacity within the section has been used to develop decision support tools for a range of agencies within Victoria and Australia. The **Strategic Management Prospects (SMP)** tool provides a systematic method of integrating information on expected benefits from different on-ground management options for many thousands of native plant and animal species across Victoria.

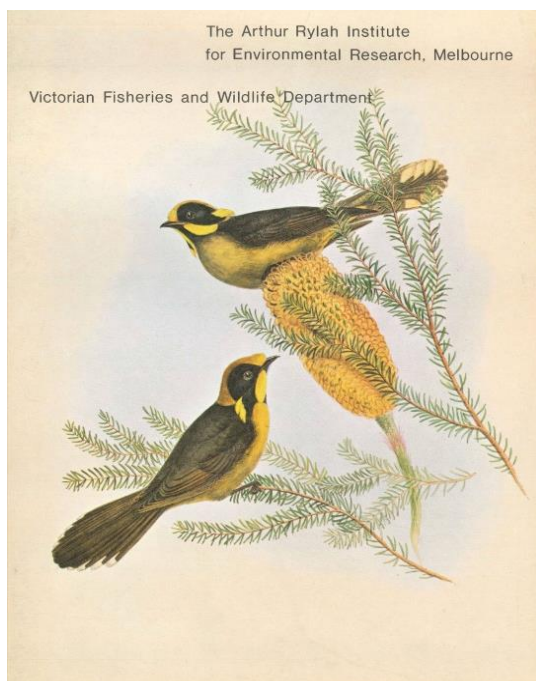


# About ARI



## Then & Now

The Arthur Rylah Institute (ARI) is the Victorian Government's ecological research institute. It was opened by Queen Elizabeth II in 1970 as a purpose built facility and has become one of Australia's leading centres for applied ecological research, with an emphasis on flora, fauna and biodiversity.



Pamphlet created for the opening of the Institute by Queen Elizabeth II in April, 1970

ARI focuses on providing strategic research and management advice to answer key questions affecting ecologically sustainable land or water management and resource use policies.

The Institute has played a major role in Australian biological discoveries including the identification of the first living example of the Mountain Pygmy Possum (by Bob Warneke) and the discovery of the Long-footed Potoroo (by John Seebeck).

The last few years have seen many improvements to the Heidelberg site. It now offers a state-of-the-art conference room, library facilities, video conference equipment, a 200 megabit internet connection and guest Wi-Fi access.

A number of improvements are also planned for 2016-17, including LED lighting, solar panels, upgraded heating and cooling and lift refurbishment.

The Institute maintains a fleet of 18 motor vehicles, including 15 four-wheel drives. These are primarily used for fieldwork and are fitted out with best practice safety and wellbeing and field survey equipment.

ARI also owns and maintains 17 boats, the majority of which have undergone Australian Maritime Safety Authority certification over the past 12 months. Eight of these support electrofishing.



# About ARI

## Leadership

ARI is led by an experienced and capable Management Committee. The Committee meets monthly and oversees science, business and strategic decisions. The Committee members average around 20 years' experience with the Department and a total of over 40 years in the private sector. The Management Committee regularly invites Program and Science staff to its monthly meetings. Management Committee members are as follows:



### **Research Director - Kim Lowe** BSc (Hons), BSc (Ed), PhD (Zoology)

Kim has worked for the Department of Environment, Land, Water & Planning (and its predecessors) since 1990 in various science-based policy, program and research roles relating to biodiversity conservation and natural resource management. Prior to that he held similar positions with the Commonwealth in what is now called the Department of Environment & Energy for 6 years. Kim received a commendation in the Prime Minister's Award for Public Administration in 2011.



### **Principal Research Scientist (Wildlife Ecology) – Lindy Lumsden** BSc, PhD

Lindy began her career at the Museum of Victoria in 1979, and has subsequently worked with DELWP and its predecessors for over 30 years. She has extensive experience in leading large scale fauna surveys and targeted research. She is a recognised expert in bat ecology and was awarded an honorary life member of the Australasian Bat Society in 2012. Most recently the Northern Freetail Bat *Mormopterus lumsdenae* was named in her honour.



### **Principal Research Scientist (Applied Aquatic Ecology) – Jarod Lyon** BSc (Hons)

Jarod began his career at the Murray Darling Freshwater Research Centre, before securing a position at ARI. During his 16 years working as a fish ecologist at ARI, Jarod has held a number of positions, before being appointed in his current position as Principal Research Scientist in 2013. Jarod has particular skills in the biology and management of large-bodied Murray Darling basin fish species, which allow him to lead and participate in large, multi-disciplinary research projects.



### **Science Manager (Community Ecology) – Tim O'Brien** BSc

Tim has worked at ARI since 1984. He worked for several years as a researcher in aquatic toxicology and then in establishing both the Victorian fishways program and the MDBA Living Murray Sea to Hume fishway program. Since 2003, he has managed large science programs at ARI, including 10 years as Aquatic Ecology Section Manager and for the past three years as Manager of the Community Ecology section. Tim is currently the management representative on DELWP's Animal Ethics Committee.

# About ARI

## Leadership



**Professor of Ecology (Science Leadership & Capability) – Andrew F Bennett**  
BSc (Hons) and PhD (Zoology)

Andrew provides and supports the development of scientific leadership through building capability and enhancing the quality of research. Andrew holds degrees and started his career as an ecologist at ARI before spending 18 years at Deakin University. He has built an internationally renowned research group in landscape ecology and conservation biology. In 2015, he commenced a joint appointment with La Trobe University and the Arthur Rylah Institute.



**Science Manager (Collaboration & Communication) – Fern Hames**  
BSc (Hons), Grad Cert Australian Rural Leadership

Fern is responsible for supporting effective communication and for building collaboration both within ARI and externally. Fern has extensive experience in both research and engagement and brings a particularly powerful skill set to this role, including 30 years' experience in project co-ordination, extension, freshwater fish ecology and aquaculture research, policy development and environmental education. She is a Fellow of the Australian Rural Leadership Foundation.



**Manager, Business & Admin Services – Corrinne Wong LLB (Hons)**

Corrinne brings extensive legal, contract and business management experience to the Institute. She has been with the Department since 2010, as Business & Legal Practice Manager, prior to which she was CEO of the Malaysian Bar's Secretariat, where she oversaw a transformation of that organisation. She has extensive expertise in the field of contract management, leadership and change management and has a track record of building highly effective teams and process improvement.



**Principal Research Scientist (Aquatic) – John Koehn BSc, PhD (Zoology)**

John has established an international reputation as one of Australia's leading fish biologists in research and management of Australian freshwater fish. This has resulted in more than 200 scientific publications. His applied research has aimed at providing information to improve management of Australian native fish communities. He received the 1997 Gold Banksia and Catchment Management and Inland Waterways Banksia awards and two Rivercare 2000 awards for scientific research.



**Manager, Strategy Planning & Reporting – Steve Werner**

Steve joined the DELWP in 2006, after 25 years in the private sector and three in local government. He has extensive business management experience in strategic planning, process and system improvement, service excellence and change management. He has expertise in client feedback systems and has overseen a number of change management projects in both the private and public sectors.

## Strategic Framework & Context

ARI directly supports all seven of DELWP's objectives:

1. A quality built environment
2. Healthy, resilient and biodiverse environment
3. Productive and effective land management
4. Safe and sustainable water resources
5. Sustainable and effective local governments
6. Reduced impact of major bushfires and other emergencies on people, property and the environment.
7. A high performing organisation

Most directly, the Institute supports the DELWP Objective '**Environmental policy analysis is informed by the latest economic, biophysical and stakeholder research**' through the strategy '**Invest in and conduct scientific research to inform policy development**'. Indirectly, ARI supports objectives and strategies across the Department relating to fire, water and land management.

At a local level, in 2015-16, the Institute continued to focused on five themes from the ARI Research Strategy 2012-2016:

- Aligning our work to State and Federal Government strategies and priorities;
- Understanding our stakeholders' needs and maximising the value of our work by conducting and bringing together projects of mutual strategic value;
- Raising the profile of our research both nationally and internationally.
- Improving our science leadership and the quality of our science outputs;
- Working collaboratively to share knowledge and resources and to support each other and enhance learning.

These themes have continued to drive our operational and strategic planning, and are being supported by our continued leadership development, ensuring a high performance culture and a focus on improved stakeholder management.



*Ctenotus taeniatus* in the Big Desert



# About ARI

## ARI Research Strategy

For the past five years, the Institute has been guided by its 'Research Strategy 2012-2016'. This outlined ARI's research objective:

***"To generate and disseminate knowledge, through world-class, applied, ecological research, which supports and guides sustainable ecosystem policy and management to ensure healthy, resilient ecosystems in south-eastern Australia"***

The Strategy is set in the context of Victoria's Biodiversity Targets and outlines three broad research themes. Each theme is underpinned by research goals that challenge staff to **build ecological knowledge, increase understanding**, and **drive application** of that knowledge and understanding to **improve biodiversity outcomes** across the State.

**Ecological Processes** - Understanding ecosystems and species' biology is the foundation of ecological knowledge and provides a sound basis for interpreting effects of human-induced disturbances, as well as making informed decisions about ecosystem protection and recovery.

**Disturbance Ecology** - Knowledge of ecosystems' disturbances such as response to fire, drought, flood, climate change, habitat loss and degradation, exotic species, harvesting of native species, and impact of invasive species will indicate how to mitigate the adverse effects of these disturbances.

**Protection & Recovery** - Evaluating whether intervention leads to ecological improvements will inform future choices of management and lead to increased knowledge of ecological thresholds, and an increased ability to promote ecosystem resistance, resilience and new, desirable ecosystem-states.

The Research Strategy articulates our research, the standards we set, the innovation we encourage and the way we collaborate.

The Strategy has encouraged further development of our science leadership, a focus on continuous improvement and rigorous evaluation of our research outputs. The Strategy is currently being reviewed to provide strategic direction for the future.

### ARI Research Themes

**Ecological Processes**  
"How healthy systems function"

**Disturbance Ecology**  
"How disturbed systems function"

**Protection & Recovery**  
"How to protect and recover ecosystems"

## Safety & Wellbeing and Risk Management

### Safety & Wellbeing

Our research involves large amounts of field and laboratory work, so it is not surprising that a key focus for ARI is in the area of safety and wellbeing. Systems to ensure the safety of staff involved in activities such as electrofishing, four wheel driving and machinery use are well documented and regularly reviewed and audited. All staff have their responsibilities clearly outlined in annual performance plans.



Jarod Lyon and Justin O'Mahony surgically inserting a radio-tag into a Murray cod

ARI has a Safety & Wellbeing Consultative Committee that meets monthly, regularly consults with staff and management and is charged with the continual review and improvement of systems. Inspections are undertaken routinely at the Heidelberg locations and Site Safety Surveys are conducted in the field. The Committee also ensures safety alerts are disseminated appropriately.

The Institute has an ongoing training agenda, particularly focused on Safety & Wellbeing training. Over 160 person days were invested in training during the year.

Any incidents which do occur are documented in the DELWP incident reporting system and provide the basis for improved processes, systems and equipment.

The Institute's Safety & Wellbeing system is widely acknowledged as Best Practice throughout the Department and across Government.

### Risk Register

The Institute participates in the Department's Risk Management Program. Key risks are identified at project and Institute level as part of the business planning process with mitigation activities built into business plans.

Progress against these activities is monitored monthly through the Sycle® Business Planning, Risk Management & Reporting system implemented across the Department.

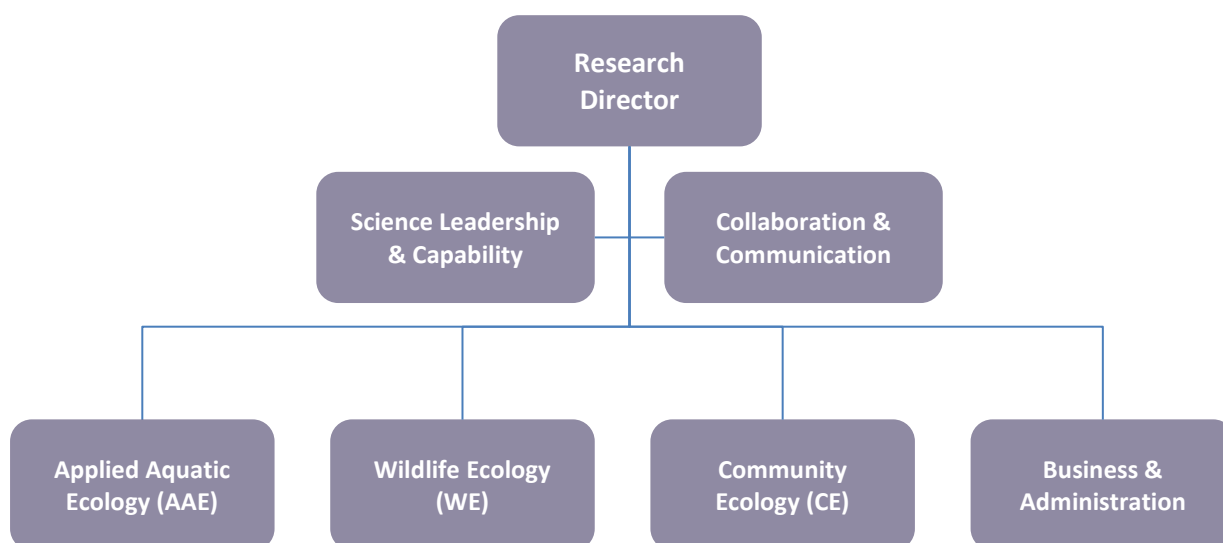
Risk Management is a regular agenda item for the Management Committee.

# About ARI

## Structure, Staffing & Development

### Structure

The Institute operates three science Sections, a Business & Administration team and two oversight roles relating to Science Leadership & Capability and Collaboration & Communication.



### Capability

The Institute has 75 staff (plus around 6 contractors) with 59 of those staff operating in science related roles. ARI staff are highly qualified, with over 20 science staff holding Doctorates and the remainder holding Masters or Bachelor degrees.

The workforce is experienced, with an average of 13.5 years' service. 32% of all staff and 33% of Management Committee are female.

### Leadership & Development

The ARI Management Committee comprises the Research Director, Section and specialist science leaders and the Business Manager. This leadership group has had a strong development program over the past three years based around a high performing culture, strong organisational values and the identification of leadership expectations through a leadership charter.

The results of the annual People Matters survey continue to drive our focus on people. ARI continues to perform well in this survey and its results are the basis of an annual program of reflection, staff engagement and follow up actions.

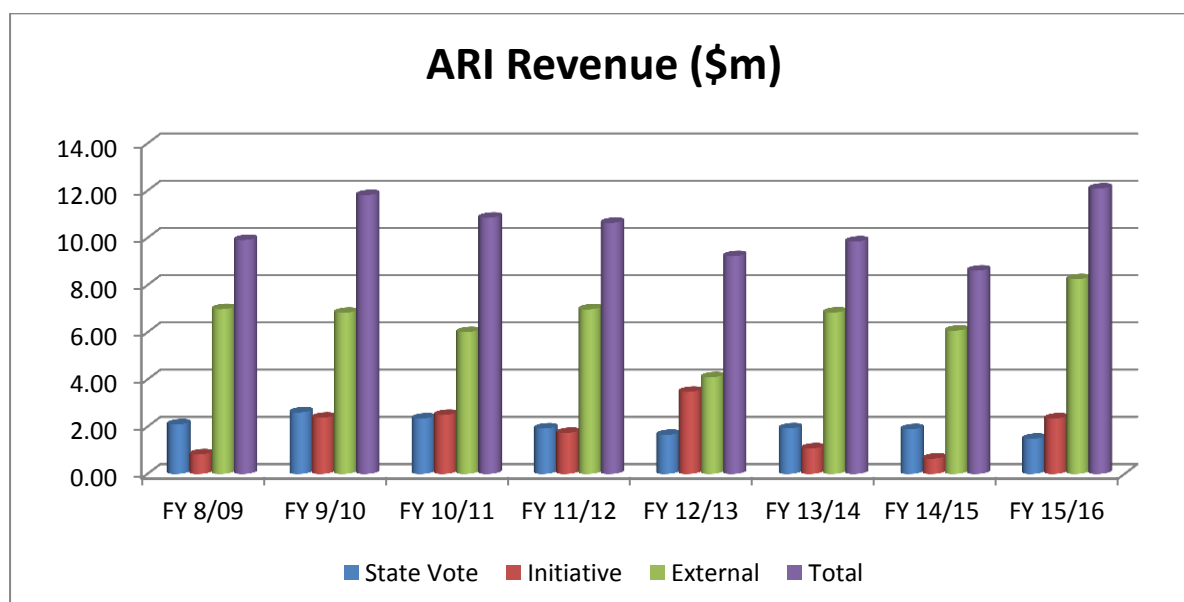
Personal development for all staff continues to be a focus of the Management Committee, especially relating to Safety & Wellbeing.



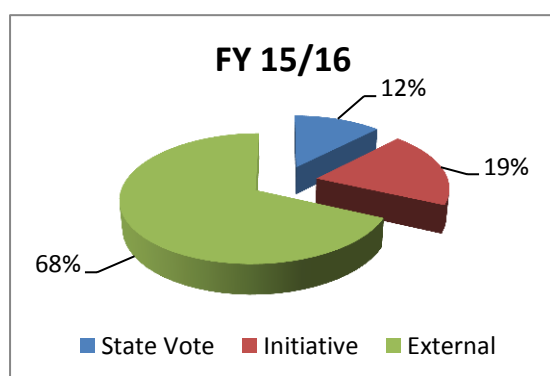
## Funding

ARI secures funding from three main sources. A level of base (State Vote) funding is allocated to the Institute each year. This totalled \$1.5m in 2015/16. Other funding is secured from within other areas of DEWLP (internal) or externally to DELWP (external) through a fee for service arrangement. Within DELWP, this funding model is unique to the Institute.

	FY 8/09	FY 9/10	FY 10/11	FY 11/12	FY 12/13	FY 13/14	FY 14/15	FY 15/16
State Vote	2.10	2.61	2.35	1.93	1.65	1.93	1.89	1.49
Internal	0.83	2.38	2.50	1.74	3.48	1.08	0.65	2.35
External	6.98	6.83	6.01	6.97	4.10	6.84	6.07	8.25
<b>Total</b>	<b>9.91</b>	<b>11.81</b>	<b>10.86</b>	<b>10.64</b>	<b>9.23</b>	<b>9.85</b>	<b>8.61</b>	<b>12.09</b>



### Total Funding (8 year summary)



In 2015/16, base funding represented 12% of total revenue, down from 18% in 2012/13. This means the Institute must continually secure additional non-recurrent funding to maintain its staff and skill base. Funding continues to be an area of focus for the Research Director and the Management Committee, and external revenue has increased from 44% to 68% over that time.

# 2015-16 in Review

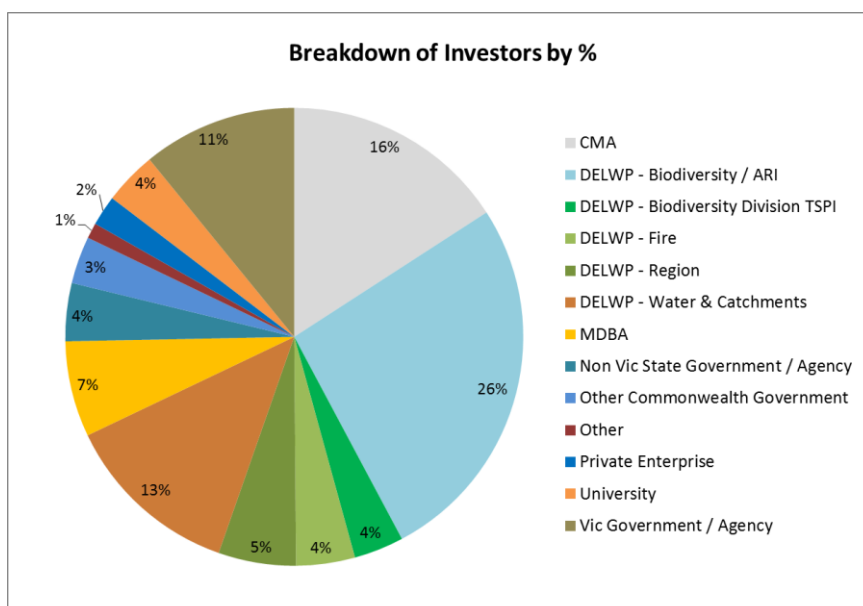
## Project Delivery

Given ARI's tight, 'cost recovery' style funding model, ensuring effective and timely project delivery is crucial to the Institute's success. In 2015-16 the Institute delivered over 550 milestones across almost 200 projects. Nearly 80% of milestones were delivered on or ahead of time.

	Internal Clients	External Clients	Total ARI
# of Projects	74	124	198
# of Milestones	283	294	577
Revenue (\$m)	5.63	6.11	11.74
% of Milestones delivered on or ahead of target month			79%

## Investment Mix

Around 50% of ARI's funding for projects comes through agreements with DELWP divisions, including Water & Catchments and Forest, Fire & Regions. Other funding comes through agreements with other Victorian Government agencies, the Commonwealth (including the MDBA), other research bodies including universities and private enterprise.



## Management Processes and information

Over the financial year, business systems and processes continued to be refined. Improvements were made to tools for project costing, a number of management reports, publication tracking processes and training systems.

# Performance and KPIs

ARI has a KPI listed in the State's Budget Paper 3 (BP3) relating to publications. Being a research institution, this measure is a key indicator of the quality of our science and the way it is received in the global academic community. Performance against that measure has been consistent over a number of years.

Other measures related to client satisfaction, project delivery and staff safety.

Indicator	2015-16 Target	2015-16 Result
Presentations made and scientific publications in peer reviewed journals (BP3)	60	63
External Funding Secured (\$,000)	\$6.50m	\$8.25m
Client Satisfaction - Overall	90% Good or better	97%
Client Satisfaction – Value for Money	90% Good or better	88%
Client Satisfaction – Science Quality	90% Good or better	97%
Project Delivery - Milestones met within 30 days of target	85%	83%
Field Trips conducted with up to date safety plans	100%	100%





# Publications Listing 2015

ARI communicates the results of research projects to clients, government and the community in a variety of ways. These include technical reports, unpublished client reports, refereed scientific papers, popular articles in magazines and newsletters, and information sheets. Listed below are ARI Technical Reports and refereed papers in scientific journals for the 2015 calendar year. ARI authors are highlighted in bold.

## ARI Technical Reports (7)

- Robley, A.** 2015. Hattah-Kulkyne Lakes Ramsar Protection Project: predator control and monitoring program. Arthur Rylah Institute for Environmental Research Technical Report Series No. 258.
- Stamation, K.** and **Hames, F.** 2015. Yarra4Life: Protecting and Connecting EPBC species in the Yarra Ranges - Social Research Component, Phase 1. Arthur Rylah Institute for Environmental Research Technical Report Series No. 261.
- O'Connor, J.**, **Mallen-Cooper, M.** and **Stuart, I.** 2015. Performance, operation and maintenance guidelines for fishways and fish passage work. Arthur Rylah Institute for Environmental Research Technical Report Series No. 262.
- Robley, A.**, **Lindeman, M.**, **Cook, I.**, **Woodford, L.** and **Maloney, P.** 2015. Dingo semiochemicals: towards a non-lethal control tool for the management of dingoes and wild dogs. Arthur Rylah Institute for Environmental Research Technical Report Series No. 263.
- Rogers, D.I.**, **Stamation, K.**, **Loyn, R.H.** and **Menkhost, P.** 2015. Literature review: management of non-tidal ponds for shorebirds. Arthur Rylah Institute for Environmental Research Technical Report Series No 264.
- Peters, G.**, **Morris, K.**, **Frood, D.**, **Papas, P.** and **Roberts, J.** 2015 A guide to managing livestock grazing in Victoria's wetlands. Decision framework and guidelines – Version 1.0. Arthur Rylah Institute for Environmental Research Technical Report Series No. 265.
- Moxham, C.**, **Kenny, S.**, and **Farmilo, B.** 2015. VEPP Stream 3 Native Vegetation: Synthesis Report. Arthur Rylah Institute for Environmental Research Technical Report Series No 267.

## Refereed journal papers (57)

- Allen, R.B.**, **Forsyth, D.M.**, **Allen, R.K.J.**, **Affeld, K.** and **MacKenzie, D.I.** 2015. Solar radiation determines site occupancy of coexisting tropical and temperate deer species introduced to New Zealand forests. *PLOS One* 10(6) e0128924
- Amtstaetter, F.**, **Dawson, D.** and **O'Connor, J.** 2015. Improving our ability to collect eggs of the threatened Australian grayling, *Prototroctes maraena*. *Marine and Freshwater Research* 66: 1216-1219
- Anderson, D.P.**, **Ramsey, D.S.L.**, **de Lisle, G.W.**, **Bosson, M.**, **Cross, M.L.** and **Nugent, G.** 2015. Development of an integrated surveillance system for the management of tuberculosis in New Zealand wildlife. *New Zealand Veterinary Journal* 63: Sup 189-97.
- Atkins, Z.**, **Clemann, N.** and **Robert, K.A.** 2015. Does shelter site selection aid persistence of a threatened alpine lizard? Assessing *Liopholis guthaga* populations a decade after severe fire in southeastern Australia. *Journal of Herpetology* 49: 222-229
- Barron, M.**, **Tompkins, D.**, **Ramsey, D.S.L.**, & **Bosson, M.** 2015. The role of multiple wildlife hosts in the persistence and spread of bovine tuberculosis in New Zealand. *New Zealand Veterinary Journal* 63: Supp 168-76.
- Bond, N.R.**, **Balcombe, S.R.**, **Crook, D.A.**, **Marshall, J.C.**, **Menke, N.** and **Lobegeiger, J.S.** 2015. Fish population persistence in hydrologically variable landscapes. *Ecological Applications* 25: 901-913.

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- Boon, P.I., Allen, T., Carr, G., Frood, D., Harty, C., McMahon, A., Mathews, S., Rosengren, N., **Sinclair, S., White, M.** and Yugovic, J. 2015. Coastal wetlands of Victoria, south-eastern Australia: providing the inventory and condition information needed for their effective management and conservation. *Aquatic Conservation: Marine and Freshwater Ecosystems* 25: 454-479.
- Caley, P., **Ramsey, D.S.L.** & Barry, S. 2015. Inferring the distribution and demography of an invasive species from sighting data: the red fox incursion into Tasmania. *PLoS One* 10(1): e0116631
- Chia, E.K., Bassett, M., Nimmo, D.G., Leonard, S.W.J., Ritchie, E.G., Clarke, M.F., and **Bennett, A.F.** 2015. Fire severity and fire-induced landscape heterogeneity affect arboreal mammals in a fire-prone environment. *Ecosphere* 6(10): 190.
- Clemann, N.** 2015. Cold-blooded indifference: a case study of the worsening status of threatened reptiles from Victoria. *Pacific Conservation Biology* 21: 15-26.
- Coates, F.** 2015. Comparative changes in *Eucalyptus pauciflora* (Myrtaceae) stand structure after bushfires in Victoria. *Cunninghamia* 151-11.
- Coleman, R.A., Hoffman, A.A. and **Raadik, T.A.** 2015. A review of *Galaxiella pusilla* (Mack) (Teleostei: Galaxiidae) in south-eastern Australia with a description of a new species. *Zootaxa* 4021: 243-281.
- Davis, N.E., **Forsyth, D.M.**, Triggs, B., Pascoe, C., Benshemesh, J., **Robley, A.**, Lawrence, J., Ritchie, E.G., Nimmo, D.G. and **Lumsden, L.F.** 2015. Interspecific and geographic variation in the diets of sympatric carnivores: dingoes/wild dogs and red foxes in south-eastern Australia. *PLoS ONE* 10(3): e0120975.
- Forsyth, D.M., Scroggie, M.P.**, Arthur, A.P., **Lindeman, M.**, **Ramsey, D.S.L.**, McPhee, S.R., Bloomfield, T. & Stuart, I.G. 2015. Density-dependent effects of a widespread invasive herbivore on tree survival and biomass during reforestation. *Ecosphere* 6(4): 71.
- Forsyth, D.M.**, Wilson, D.J., Easdale, T.A., Kunstler, G., Canham, C.D., Ruscoe, W.A., Wright, E.F., Murphy, L., **Gormley, A.M.**, Gaxiola, A. and Coomes, D.A. 2015. Century-scale effects of invasive deer and rodents on the dynamics of forests growing on soils of contrasting fertility. *Ecological Monographs* 85: 157-180.
- Gillespie, G.R.**, Howard, S., Stroud, J.T., Ul-Hassanah, A., Campling, M., Lardner, B., **Scroggie, M.P.** & Kusri, M. 2015. Responses of tropical forest herpetofauna to moderate anthropogenic disturbance and effects of natural habitat variation in Sulawesi, Indonesia. *Biological Conservation* 192: 161-173
- Glass, R., **Forsyth, D.M.**, Coulson, G. and Festa-Bianchet, M. 2015. Precision, accuracy and bias of walked line transect distance sampling to estimate eastern grey kangaroo population size. *Wildlife Research* 42: 633-41.
- Godinho, L.N., **Lumsden, L.F.**, Coulson, G. and Griffiths, S.R. 2015. Network analysis reveals cryptic seasonal patterns of association in Gould's wattled bats (*Chalinolobus gouldii*) roosting in bat-boxes. *Behaviour* 152: 2079-2105.
- Gormley, A.M., Forsyth, D.M.**, Wright, E.F., Lyall, J., Elliott, M., Martini, M., Kappers, B., Perry, M. and McKay, M. 2015. Cost-effective large-scale occupancy-abundance monitoring of invasive brushtail possums (*Trichosurus vulpecula*) on New Zealand's public conservation land. *PLoS One* 10(6): e0127693.
- Gwinn, D.C., Allen, M.S., Johnston, F.D., Brown, P., **Todd, C.R.** and Arlinghaus, R. 2015. Rethinking length-based fisheries regulations: the value of protecting old and large fish with harvest slots. *Fish and Fisheries* 16: 259-281.
- Hale, R., **Reich, P.**, Johnson, M., **Hansen, B.**, Lake, P.S., Thomson, J., Mac Nally, R. 2015. Bird responses to riparian management of degraded lowland streams in southeastern Australia. *Restoration Ecology* 23: 104-112.
- Hansen, B.D., Menkhorst, P., Moloney, P.** and **Loyn, R.H.** 2015. Long-term declines in multiple waterbird species in a tidal embayment, south-east Australia. *Austral Ecology* 40: 515-527.
- Hansen, B.D., Reich, P.**, Cavagnaro, T.R. and Lake, P.S. 2015. Challenges in applying scientific evidence to width recommendations for riparian management in agricultural Australia. *Ecological Management and Restoration* 16: 50-57.

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- Heard, G.W., Thomas, C.D., Hodgson, J.A., **Scroggie, M.P.**, **Ramsey, D.S.L** and **Clemann, N.** 2015. Refugia and connectivity sustain amphibian metapopulations afflicted by disease. *Ecology Letters* 18: 853-863.
- Ingram, B.A., Hunt, T.L., **Lieschke, J.** and Krusic-Golub, K. 2015. Field detection of calcein in marked fish – a cautionary note. *Fisheries Management and Ecology* 22: 265-268.
- Johnston, M.**, Herrod, A., Little, N., Bould, L. and Gigliotti, F. 2015. An opportunistic observation of Ghost Bat (*Macroderma gigas*) predation on six bird species within Karijini National Park. *Journal of the Royal Society of Western Australia* 98: 89-91.
- Jones, C. S., **Duncan, D.H.**, Rumpff, L., Thomas, F.M., Morris, W.K. and Vesk, P.A. 2015. Empirically validating a dense woody regrowth 'problem' and thinning 'solution' for understory vegetation. *Forest Ecology and Management* 340: 153-162.
- Keith, D.A., Rodriguez, J.P., Brooks, T.M., Burgman, M.A., Barrow, E.G., Bland, L., Comer, P.J., Franklin, J., Link, J., McCarthy, M.A., Miller, R.M., Murray, N.J., Nel, J., Nicholson, E., Oliveira-Miranda, M.A., **Regan, T.J.**, Rodriguez-Clark, K.M., Rouget, M. and Spalding, M.D. 2015. The IUCN Red List of ecosystems: motivations, challenges and applications. *Conservation Letters* 8: 214-226.
- King, A.J.**, Gawne, B., **Beesley, L.**, **Koehn, J.D.**, Nielsen, D.L. and Price, A. 2015. Improving ecological response monitoring of environmental flows. *Environmental Management* 55: 991-1005.
- Koehn, J.** 2015. Managing people, water, food and fish in the Murray-Darling Basin, south-eastern Australia. *Fisheries Management and Ecology* 22: 25-32.
- Koster, W.F.**, **Dawson, D.R.**, **Clunie, P.**, **Hames, F.**, McKenzie, J., **Moloney, P.D.** and **Crook, D.A.** 2015. Movement and habitat use of the threatened freshwater catfish (*Tandanus tandanus*) in a remnant floodplain wetland. *Ecology of Freshwater Fish* 24: 443-455.
- McAlpine, C., Lunney, D., Melzer, A., **Menkhorst, P.**, Phillips, S., Phaleng, D., Ellis, W., Foley, W., Baxter, G., de Villiers, D., Kavanagh, R., Adams-Hosking, C., **Todd, C.**, Whisson, D., Molsher, R., Walter, M., Lawler, I. and Close, R. 2015. Conserving koalas: A review of the contrasting regional trends, outlooks and policy challenges. *Biological Conservation* 192: 226-236.
- Menkhorst, P** and Ryan, E. 2015. C.H. McLennan ('Mallee Bird') and his aboriginal informant Jowley: the source of early records of the Night Parrot *Pezoporus occidentalis* in Victoria? *Memoirs of the Museum of Victoria* 73: 107-115.
- Nicholson, E., **Regan, T.J.**, Auld, T.D., Burns, E.L., Chisholm, L.A., English, V., Harris, S., Harrison, P., Kingsford, R.T., Leishman, M.R., Metcalfe, D.J., Pisanu, P., Watson, C.J., **White, M.D.**, Williams R.J., Wilson, B and Keith, D.A. 2015. Towards consistency, rigour and compatibility of risk assessments for ecosystems and ecological communities. *Austral Ecology* 40: 347-363.
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## Photograph Acknowledgements

Photograph / Image	Page	Source
Katie Howard with a Murray River Turtle ( <i>Emydura macquarii</i> )	Cover	DEWLP File Photo
Growling Grass Frog ( <i>Litoria raniformis</i> )	Cover	Geoff Heard (Melbourne Uni)
Lauren Dodd with a Murray Cod ( <i>Maccullochella peelii</i> )	Cover	Jason Lieschke
Post fire regrowth	Cover	Fern Hames
Using Radio Telemetry to track catfish	Cover	Fern Hames
The nationally threatened Alpine She-oak Skink ( <i>Cyclodomorphus praealtus</i> )	Cover	Nick Clemann
ARI staff with Landcare members at a Macquarie Perch spawning site	5	Fern Hames
Little Pygmy Possum ( <i>Cercartetus lepidus</i> )	5	Nick Clemann
Taking measurements in Boyles Creek	5	Frank Amtstaetter
Best Management regime map / Relative Values map	6	DELWP
Fieldwork Electrofishing boat	7	Di Crowther
Downloading fish tracking data on the Goulburn River	7	Lisa Duncan (GBCMA)
Rabbit warrens prior to ripping	8	Ivor Stuart
Artificial Hollow immediately after construction	9	Lindy Lumsden
Two Leadbeater's Possums carrying nesting material curled up in their tails into a mechanically created hollow	9	DELWP Remote Camera
Arborist installing a heat-and-motion sensing camera	9	Jenny Nelson
Waterbirds at the Western Treatment Plant	10	Danny Rogers
The Snowy River	11	Dan Stoessel
'Fish 'n' Snags' event on the Gellibrand River estuary	12	Di Crowther
The BioBlitz bat walk and talk at Westgate Park	12	BioBlitz Melb
ARI Publications	15	Michele Kohout
Demonstrating a harp trap at an ARI tour during Science Week	16	Michele Kohout
Werribee River rock ramp fishway	17	Renae Ayres
Mitchells short-tailed snake ( <i>Parasuta nigricps</i> ) – Big Desert	18	Nick Clemann
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