environment victoria

JULY 2023

Doomed without a drink

Threatened species at risk of extinction without environmental flows restored in rivers and wetlands

Environment Victoria is located on Wurundjeri land and works across many Aboriginal nations.

We pay our respects to Aboriginal elders past and present, recognise their continuing contribution to caring for country, and acknowledge that sovereignty was never ceded.

Acknowledgements

The database of flow-dependent threatened species was provided by Dr Matthew Colloff (Fenner School of Environment and Society, Australian National University). Slattery & Johnson did initial research and drafts of this report, as well as feedback and revisions on subsequent drafts. Milo Costanza-van den Belt provided research for case studies, checking species and proofreading. Environment Victoria takes full responsibility for the final content of the report and any errors.

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Contents

Executive summary

The Murray-Darling Basin, covering 14% of the Australian continent, is our biggest and most important river system. The combination of a cyclical climate and the extraordinary flatness of the Australian interior has created an enormous floodplain containing over 5.8 million hectares of wetland ecosystems[1]. In a natural cycle, rivers dwindle in drought and swell in flooding rains, rejuvenating wetlands and floodplains and providing vital habitat for native animals and plants. Migratory birds, travelling from as far away as Siberia, stop to feed in crucial wetlands on their journey.

> “Overall, the Victorian Government’s approach to implementing the Basin Plan represents a failure to uphold its obligations to prevent extinction and promote the recovery of 140 Victorian threatened species.

But the ecosystems that support these species have been drastically altered since European colonisation began. Rivers in the southern half of the Basin, including those within Victoria’s borders, have been intensely developed to support irrigation, with major headwater storages, locks, weirs and other impoundments. This has changed the rivers profoundly – reversing seasonal patterns, depriving wetlands and floodplains of water and seriously degrading the habitat of native species that depend on freshwater flows for their survival.

Decades of water reform have attempted to correct this dynamic. Concern about over-extraction of water for irrigation and ensuing damage to the environment was one of the key reasons that the Murray-Darling Basin Cap was introduced in the 1990s, followed by the *Water Act 2007* (Cth) and finally the Murray-Darling Basin Plan 2012. The Basin Plan is now one of the key mechanisms through which state and federal governments aim to fulfil the obligations which stem from international treaties, legislation and policy to prevent extinction and support the recovery of threatened species. More than a decade since the Basin Plan commenced and as key deadlines loom, this report examines whether the approach to implementation in Victoria is consistent with upholding these obligations.

The report finds:

- The recovery of 140 Victorian threatened species is dependent on restoring adequate environmental flows in the rivers, floodplains and wetlands of the Murray-Darling Basin. This list includes 48 animals (fish, birds, frogs and invertebrates) and 92 plants.
- 30 of these species are also classified as threatened at the federal level.
- Examples of these flow-dependent threatened species include the Australasian bittern, Australian painted snipe, Sloane’s froglet, Macquarie perch and Murray cod, which are at very high or extremely high risk of extinction in Victoria in the immediate or near future.
- A number of pieces of legislation, policies, plans and frameworks exist at both the federal and Victorian levels setting out obligations to prevent the extinction of these threatened species and promote their recovery.
- Despite these obligations, the Victorian Government’s approach to implementing the Basin Plan is a major barrier to restoring adequate environmental flows in the rivers, floodplains and wetlands where these species live.

- The Victorian Government's opposition to Commonwealth water purchases is a major concern because, without sufficient water recovery, the delivery of adequate environmental flows is impossible. Alternative water recovery methods are far more expensive and unlikely to deliver sufficient water volumes. As such, they cannot be relied upon to recover water for the environment and improve conditions for flow-dependent threatened species.
- The Victorian Government's slow and reluctant approach to relaxing constraints to the delivery of environmental flows and its preference instead for developing unproven floodplain engineering projects is holding up the effective delivery of existing environmental water to the habitats of threatened species.
- Overall, the Victorian Government's approach to implementing the Basin Plan represents a failure to uphold its obligations to prevent extinction and promote the recovery of 140 Victorian threatened species (fish, birds, frogs, invertebrates and plants).
- It also represents an active obstruction of the Australian Government's ability to uphold its obligations with regard to 30 of these species.

To safeguard the Victorian biodiversity that relies on a healthy Murray River system, this report makes the following urgent recommendations. By the end of 2023:

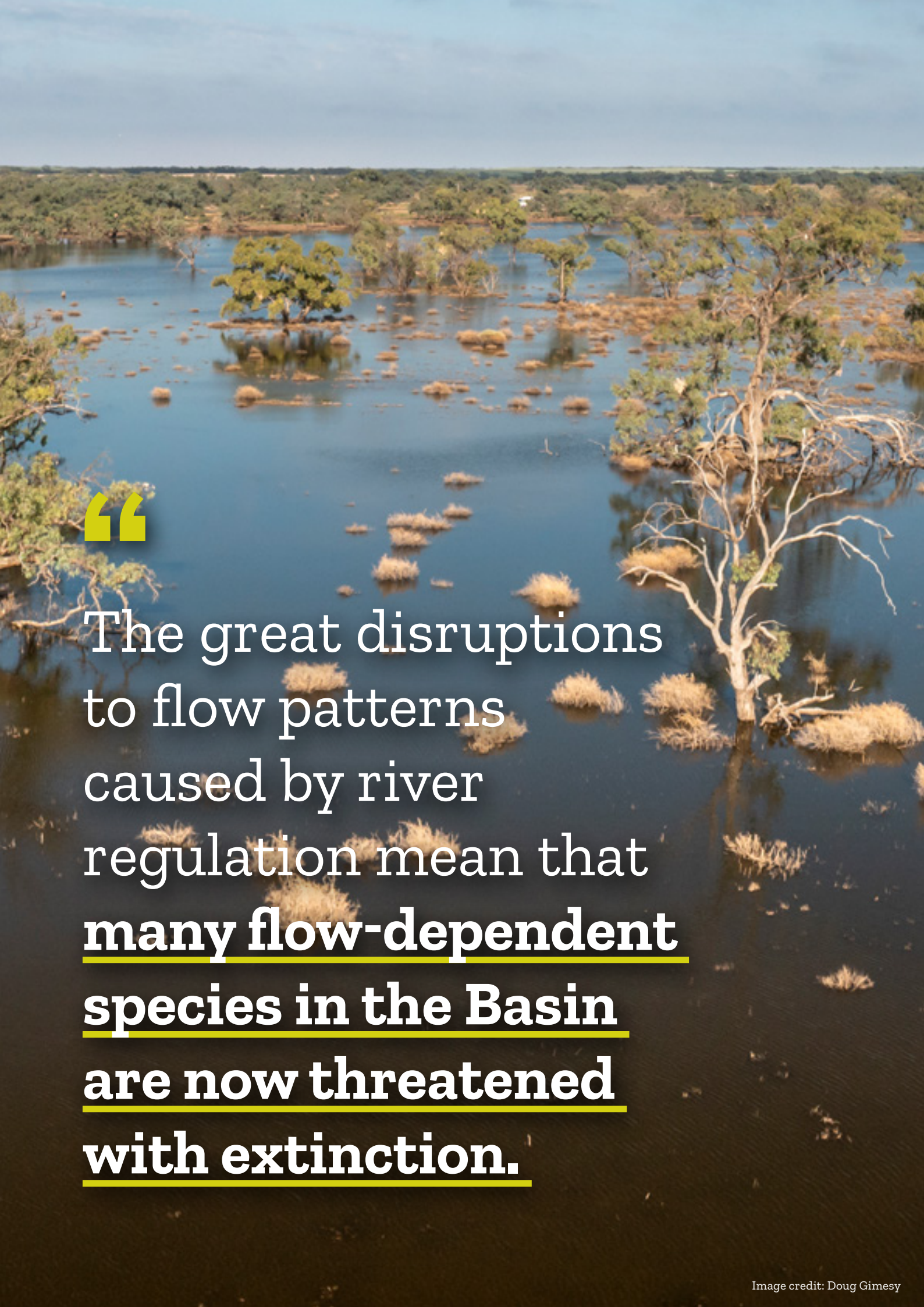
1. The Australian and Victorian governments must work together to identify failing water offset projects in the supply measures program and commit to securing real water in their place.
2. The Victorian Government must stop opposing the Australian Government's intention to purchase water for the environment so that the 450 gigalitres (GL) of additional water for the environment can be recovered. This includes abandoning the inappropriately named and unworkable 'socio-economic test'.
3. The Australian Government must amend the Water Act to remove the 1500 GL cap on water purchases and commit to recovering all remaining water required by the Basin Plan as quickly as possible.
4. The Australian and Victorian governments must agree to a new approach to relaxing constraints that will allow the achievement of managed overbank flows within a reasonable timeframe. A panel of independent experts should be appointed to find a workable pathway, and the Commonwealth must be prepared to assert its power to acquire easements if the states continue to delay.

Given the Victorian Government's current policy position and track record, the chance of these recommendations being implemented voluntarily does not appear overly high. If so, it is incumbent on the Australian Government to use the full force of its powers to achieve a satisfactory outcome for Victoria's threatened species.

Prime Minister John Howard introduced the Water Act and assumed responsibility for recovering environmental water precisely because of the failure of state governments to do so themselves. Announcing the package, he stated plainly that:

> *This is the Commonwealth assuming responsibility for a problem created by the states. We are willing to address the chronic over-allocation of water in the Basin and to carry the entire cost of doing so… All parties must recognise that the old way of managing the Murray-Darling Basin has reached its use-by date. The tyranny of incrementalism and the lowest common denominator must end.*[2]

Now, one and a half decades later, with all parties acknowledging that critical Basin Plan implementation deadlines will be missed and the future of 140 threatened species at risk in Victoria alone, a similar resolve may be required from the Albanese Government.



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The great disruptions to flow patterns caused by river regulation mean that **many flow-dependent species in the Basin are now threatened with extinction.**

Image credit: Doug Gimesy

Background and context

The Murray-Darling Basin covers a large area featuring diverse climate conditions, with rivers that are highly variable by world standards. Most of the Basin is arid or semi-arid, with a band of higher rainfall in the east and south. The highest rainfall region is in southern NSW and Victoria, containing the headwaters of some of the Basin's largest rivers, including the Goulburn, Murray and Murrumbidgee.

The southern Murray-Darling Basin has long been a major focus of government-sponsored irrigation development, including major headwater storages, locks, weirs and other impoundments. This intense development has changed southern Basin rivers profoundly. Flows are controlled in ways that have reversed seasonal patterns, now lower in winter and spring and higher during summer. River regulation infrastructure has resulted in the loss of flowing water habitat, with long reaches of once-flowing rivers sitting still in weir pools and impoundments. Small and medium floods have been greatly reduced, separating floodplains from main river channels. This process has been exacerbated by levees, banks and asset protection works. Meanwhile, high, sustained summer flows have eroded banks and tested the survival of juvenile fish and platypus. This dramatically altered rhythm of seasonal flows is significant. Links between up and downstream, and between main river channels and their floodplains, have been severely altered. Reversed seasonality of flows, lost variability and less-regular smaller floods have caused serious degradation of the habitat of most flow-dependent native species, depending as they do on all parts of a river linking together.

Flow variability is the driver of the ecological conditions that these species require. The great disruptions to flow patterns caused by river regulation mean that many flow-dependent species in the Basin are now threatened with extinction. Because of the intensity of development, this has been especially serious in the southern Basin, including Victoria, which now has few large unaltered riverine, floodplain and riverine ecosystems.

This trend has been evident for decades. By the 1970s Murray-Darling Basin rivers were already showing clear evidence of ecological decline. The Victorian *Flora and Fauna Guarantee Act 1988* (the FFG Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) list many freshwater flow-dependent species as threatened.

The Australian Government introduced water reforms to address widespread concern for the health of the Murray-Darling Basin, beginning with the introduction of the Murray-Darling Basin Cap in 1997. The Cap was followed by the Commonwealth Water Act in 2007 and the Basin Plan in 2012.

Image: Australasian shoveler, vulnerable in Victoria. Credit: Adam Fry

Commonwealth and Victorian flow-dependent threatened species in the Murray-Darling Basin

This section names the threatened species listed under Victorian and Commonwealth legislation whose recovery is dependent on the restoration of environmental flows. The database was provided by Dr Matthew Colloff (Fenner School of Environment and Society, Australian National University) based on selection criteria in Ryan et al (2021),[3] namely: 1) dependent on the Murray River, floodplains and wetlands; 2) listed as threatened in the EPBC Act; 3) listed as threatened in the Victorian FFG Act; 4) found predominantly in the low-lying regulated catchments of the Southern Basin; 5) found in floodplain, wetland and river habitats and; 6) have particular freshwater requirements for breeding and habitat that can only be now met by managed environmental flows. In addition, the list was further refined to include only species that have been recorded in Victorian parts of the Murray-Darling Basin.

Species listed under the Victorian *Flora and Fauna Guarantee Act 1988*

The Victorian *Flora and Fauna Guarantee Act 1988* classifies threatened species as Critically Endangered, Endangered, Vulnerable and Threatened. The Act provides the following definitions:

- **critically endangered** means 'facing an extremely high risk of extinction in the wild in the immediate future'
- **endangered means** 'facing a very high risk of extinction in the wild in the near future'
- **vulnerable means** 'facing a high risk of extinction in the wild in the medium-term future'[4]

At least 140 species dependent on the restoration of environmental flows in the Murray-Darling Basin are on the Threatened Species list in Victoria. This includes 48 animals (see Table 1 below) and 92 plants (listed in the Appendix). Of these species, 30 are also classified as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

Image: Southern purple-spotted gudgeon, critically endangered in Victoria.
Credit: Doug Gimesy

List of flow-dependent Victorian threatened fauna in the southern Murray-Darling Basin

Table 1. Flow-dependent Victorian threatened species in the southern Murray-Darling Basin under the *Flora and Fauna Guarantee Act 1988*

Name	Status in Victoria
INVERTEBRATES	
Murray spiny crayfish	Threatened
FROGS	
Sloane's froglet	Endangered
Southern bell frog	Vulnerable
BIRDS	
Australasian bittern	Critically endangered
Australian little bittern	Endangered
Freckled duck	Endangered
Blue-billed duck	Vulnerable
Musk duck	Vulnerable
Australasian shoveler	Vulnerable
Hardhead	Vulnerable
Magpie goose	Vulnerable
Lewin's rail	Vulnerable
Little egret	Endangered
Intermediate egret (plumed)	Critically endangered
Brolga	Endangered
Caspian tern	Vulnerable
Gull-billed tern	Endangered
Black-tailed godwit*	Critically endangered
Bar-tailed godwit*[5]	Vulnerable
Australian painted snipe	Critically endangered
Whimbrel*	Endangered
Eastern curlew*	Critically endangered
Marsh sandpiper*	Endangered
Common greenshank*	Endangered
Wood sandpiper*	Endangered
Terek sandpiper*	Endangered
Great knot*	Critically endangered
Red knot*	Endangered
Common sandpiper*	Vulnerable
Ruddy turnstone*	Endangered
Curlew sandpiper*	Critically endangered
Pacific golden plover*	Vulnerable
Grey plover*	Vulnerable
Lesser sand plover*	Endangered
Greater sand plover*	Vulnerable
Inland dotterel	Vulnerable
FISHES	
Barred galaxias	Critically endangered
Flat-headed galaxias	Vulnerable
Freshwater catfish	Endangered
Macquarie perch	Endangered
Murray cod	Endangered
Murray hardyhead	Critically endangered
Murray-Darling rainbowfish	Endangered
Silver perch	Endangered
Southern purple-spotted gudgeon	Critically endangered
Southern pygmy perch	Vulnerable
Trout cod	Endangered
Yarra pygmy perch	Vulnerable
TOTAL	**48**

* Migratory shorebird species listed under agreements with Japan, China and Korea that use the East Asian-Australasian Flyway. While once considered primarily coastal species, they require wetlands along migratory routes to stop and feed. Loss of wetlands due to river regulation is a significant contributor to the drastic decline in shorebird numbers in Australia.[6]

Species also listed under the Commonwealth EPBC Act

Table 2. Flow-dependent threatened species in the southern Murray-Darling Basin in both the EPBC Act 1999 and the FFG Act 1988

Name	Status in Commonwealth	Status in Victoria
FROGS		
Sloane's froglet	Endangered	Endangered
Southern bell frog	Vulnerable	Vulnerable
BIRDS		
Australasian bittern	Endangered	Critically endangered
Australian painted snipe	Endangered	Critically endangered
Curlew sandpiper	Critically endangered	Critically endangered
Eastern curlew	Critically endangered	Critically endangered
Great knot	Critically endangered	Critically endangered
Red knot	Endangered	Endangered
Lesser sand plover	Endangered	Endangered
Greater sand plover	Vulnerable	Vulnerable
FISHES		
Barred galaxias	Endangered	Critically endangered
Flat-headed galaxias	Critically endangered	Vulnerable
Macquarie perch	Endangered	Endangered
Murray cod	Vulnerable	Endangered
Murray hardyhead	Endangered	Critically endangered
Silver perch	Critically endangered	Endangered
Southern pygmy perch	Vulnerable	Vulnerable
Trout cod	Endangered	Endangered
Yarra pygmy perch	Vulnerable	Vulnerable
PLANTS		
Mueller daisy, claypan daisy	Vulnerable	Endangered
Dwarf yellow-heads	Vulnerable	
Winged peppercress	Endangered	Endangered
Chariot wheels	Vulnerable	Endangered
Turnip copperburr	Endangered	Critically endangered
Slender Darling-pea, Murray Swainson-pea	Vulnerable	Endangered
Red Darling-pea	Vulnerable	Endangered
Lowly greenhood	Endangered	Endangered
Ridged water-milfoil	Vulnerable	Critically endangered
Austral pipewort, southern pipewort	Endangered	Endangered
Lowly greenhood	Endangered	Endangered
TOTAL	**30**	

AUSTRALASIAN BITTERN

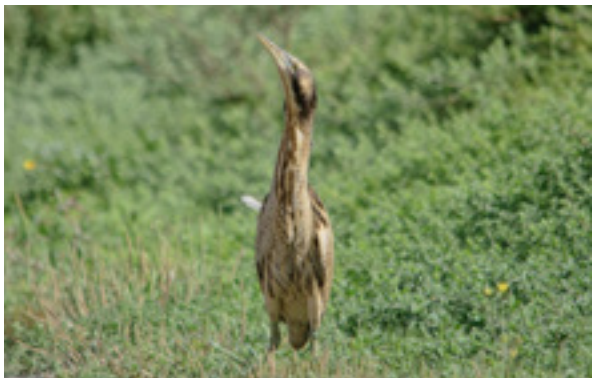
Critically endangered in Vic

Flow-dependent Victorian threatened species in the southern Murray-Darling Basin under the *Flora and Fauna Guarantee Act 1988*

Case Studies

AUSTRALASIAN BITTERN

The Australasian bittern is a stocky, heron-like bird with a prominent black-brown stripe running down the side of the neck. It lives mainly in freshwater wetlands and eats small fish, frogs, freshwater crayfish, spiders, insects and small reptiles.[7] Australasian bitterns are critically endangered throughout their range, including Victoria. It is estimated that only about 1300 Australasian Bitterns remain. The Barmah-Millewa wetland is considered the most important site for the species in Victoria. Major threats to its survival are loss of habitat caused by the diversion of water away from wetlands, and wetlands being drained and isolated from rivers.[8] The Australasian bittern is critically endangered in Victoria, meaning it faces an extremely high risk of extinction in the immediate future.



AUSTRALIAN PAINTED SNIPE

The Australian painted snipe is a small, secretive wading bird that prefers to stay under dense vegetation including when feeding. It is picky with its breeding conditions, needing shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. The population has declined by more than 90 percent in the Murray-Darling Basin. Threats include a reduction in the frequency of flooding and loss of shallow swampy margins in floodplains and wetlands. Few remaining wetlands provide suitable habitat. The Australian painted snipe is critically endangered in Victoria, meaning it faces an extremely high risk of extinction in the immediate future.

RIDGED WATER-MILFOIL

Ridged water-milfoil is an annual aquatic herb with submerged comb-like leaves and whorls of wider, waxy leaves above the surface. It is endemic to north and north-western Victorian billabongs and shallow ephemeral wetlands.[12] It grows and reproduces following autumn and early winter inundation. Ridged water-milfoil is critically endangered in Victoria, meaning it faces an extremely high risk of extinction in the immediate future.

Image credits clockwise from top left: Australasian bittern (Adam Fry); Australian painted snipe (patrickkavangh, Flickr CC); Murray cod (Guo Chai Lim, Flickr CC); Macquarie perch (Arthur Mostead); Southern bell frog (Callie Nickolai Flickr CC); Sloane's froglet (Matt Clancy); Ridged water milfoil (Richard Hartland Flickr CC).

MURRAY COD

The Murray cod is one of the largest freshwater fish in the world and an iconic species in the Murray-Darling Basin. It uses a range of habitats across the Basin and acts as the top aquatic predator. The species is in decline throughout the Murray-Darling Basin. Changed volume, timing and variability of flows, an increase in the area of still water behind impoundments, and barriers to movement reduce feeding conditions and hinder spawning. Dams and weirs block migratory routes, meaning that large stretches of rivers no longer provide suitable habitat.[9] Recent fish kills in the Barwon-Darling River are an additional cause for concern, increasing the importance of the Victorian populations as well as Victorian spawning and nursery habitat. The Murray cod is endangered in Victoria, meaning it faces a very high risk of extinction in the near future.

MACQUARIE PERCH

Macquarie perch form schools in clear, deep water with lots of cover and migrate upstream to spawn in small streams as the weather gets warmer around mid-spring. They used to be one of the most abundant fish species in the upper reaches of the southern Murray-Darling, but populations have dramatically collapsed in recent decades. Instream barriers have limited their migration to and from spawning areas, and river siltation has filled in the deep rocky holes that Macquarie perch relies on for bottom-feeding. The Macquarie perch is endangered in Victoria, meaning it faces a very high risk of extinction in the near future.

SLOANE'S FROGLET

Sloane's froglet is a small ground-dwelling frog endemic to the Murray-Darling Basin. Males have a distinctive sharp 'eahh' call, usually heard coming from shallow areas of wetland. It is threatened by habitat loss caused by changes to the natural flow regimes of rivers, streams, and wetlands. Conservation Advice for the species states specific factors likely to impact the frogs includes loss of wetlands associated with removal of water for irrigation and lowered water tables.[10] Sloane's froglet is endangered in Victoria, meaning it faces a very high risk of extinction in the near future.

SOUTHERN BELL FROG

The southern bell frog is one of Australia's largest frogs, capable of moving up to one kilometre in a day. However, it mostly spends its time at the edges of still or slow-flowing water bodies basking in the sun.[11] Since they need permanent freshwater lagoons with complex vegetation structures to breed, the draining of wetlands and reduced flood frequencies are their primary threats. The southern bell frog is vulnerable in Victoria, meaning it faces a high risk of extinction in the medium-term future.

Summary of Victorian Government obligations to protect biodiversity within the Murray-Darling Basin

LEGISLATION

Flora and Fauna Guarantee 1988[13]

The *Flora and Fauna Guarantee Act 1988* is the main piece of Victorian legislation for the conservation of threatened species and communities and for the management of threatening processes. The Act aims to conserve all of Victoria's native plants and animals.

The objectives of the Act are to guarantee that Victoria's flora and fauna can persist and improve in the wild and adapt to environmental change; prevent Victoria's flora and fauna from becoming threatened, and improve their conservation status, protect, restore and enhance biodiversity, and identify and mitigate threatening processes.

The Act was amended in 2019, giving effect to a consistent national approach to reduce duplication of effort between jurisdictions.[14]

The Water Act 1989[15]

The Water Act 1989 aims to ensure that water resources in Victoria are managed sustainably, with reference to improvements in the environment of waterways. Under the Act, water allocated to the Victorian Environmental Water Holder may be delivered with the aim of 'improving the environmental values and health of water ecosystems, including their biodiversity, ecological functioning and water quality'.

OTHER PLANS, GUARANTEES, COMMITMENTS AND FRAMEWORKS

Protecting Victoria's Environment – Biodiversity 2037[16]

Protecting Victoria's Environment – Biodiversity 2037 is a plan to stop the decline of native plants and animals and improve the natural environment and the outlook for threatened species. It commits the government to ensuring that no vulnerable or threatened species becomes endangered. This includes addressing the underlying causes of biodiversity threats and stressors, to improve the outlook of threatened species by protecting species and ecosystems. It has the following goals:

- No vulnerable or near-threatened species will have become endangered
- All critically endangered and endangered species will have at least one option available for being conserved ex-situ or re-established in the wild (where feasible under climate change) should they need it.
- We achieve a net gain of the overall extent and condition of habitats across terrestrial, waterway and marine environments.

Victorian Catchment Management Framework[17]

This Framework aims to provide for a healthy environment, including to sustain water for human use in the long term. Its targets include maintaining or improving the health of waterways and catchments while conserving and building the resilience of natural ecosystems.

Water for Victoria 2016 water plan[18]

The Water for Victoria plan aimed to invest in the health of waterways and catchments. The Victorian Government made commitments to protect and restore waterway health, and to work with Traditional Owners to better incorporate Aboriginal water interests into water planning and management.

Summary of Australian Government obligations to protect biodiversity within the Murray-Darling Basin

LEGISLATION

Environment Protection and Biodiversity Conservation Act 1999[19]

The Objects of the EPBC Act 1999 include working with First Nation's people to protect environmental and cultural values on matters of national environmental significance. It aims to conserve biodiversity, strengthen intergovernmental cooperation to protect native species, prevent their extinction and promote the recovery of threatened species, recognise ecological communities, protect ecosystems, and identify threats to biodiversity and address these threats.

Water Act 2007[20]

The Water Act aims to ensure that the Murray-Darling Basin is managed in the national interest. It was introduced by the Howard government in 2007 to address the historic overallocation of water to consumptive uses – primarily irrigated agriculture – and the environmental degradation that has resulted. Its objects include ensuring the return to environmentally sustainable levels of extraction and protecting, restoring and providing for the ecological values and ecosystem services of the Murray-Darling Basin.[21] The Act requires that this is done using the 'the best available scientific knowledge and socio-economic analysis'.[22]

Murray-Darling Basin Plan 2012[23]

The Basin Plan provides a framework for water management throughout the Basin and sets legally binding limits to water consumption in each river valley. Set in 2012, these limits reflect a significant reduction in the amount of water historically taken for consumptive use and the reallocation of that water to the environment. Basin Governments have until 2024 to complete that reallocation through programs such as water purchase. According to the Water Act, the Basin Plan must 'promote sustainable use of the Basin water resources to protect and restore the ecosystems, natural habitats and species that are reliant on the Basin water resources and to conserve biodiversity'.[24]

OTHER PLANS, GUARANTEES, COMMITMENTS AND FRAMEWORKS

Threatened Species Strategy Action Plan 2022-2032[25]

This plan sets out the Australian Government's pathway to conserve and recover threatened species for a ten-year period. It has four objectives: reducing the risk of extinction for all 'priority' species, improving the condition for all 'priority' places, preventing any new extinctions of plants or animals and protecting and conserving at least 30 percent of Australia's land mass. The priority species include the Australasian bittern and the Murray hardyhead, which are flow-dependent with habitat in the Murray-Darling Basin.[26]

Image credit: Doug Gimesy

The need to restore environmental flows

The preceding sections outline the overarching obligations on, and commitments by, the Commonwealth and Victorian governments with regard to preventing extinction and promoting the recovery of at least 140 Victorian threatened species in the southern Murray-Darling Basin. Delivering managed environmental flows is currently the only way to provide for the breeding opportunities, habitat maintenance and connectivity needs of these species,[27] and as such it must be considered a pre-requisite for their recovery.[28]

In simple terms, restoring environmental flows requires two elements:

- **Water recovery**: sufficient volumes of water must be 'recovered' from consumptive users and set aside permanently for environmental use.
- **Water delivery**: this water then needs to be delivered in the right location, at the right time of year, depth and duration to benefit specific ecosystems and species.[29]

In many parts of the Murray-Darling, delivering flows requires initiatives to remove or relax certain 'constraints' that currently prevent managed environmental flows from reaching particular wetlands. Examples include removing redundant levee banks that prevent water from moving across the floodplain; relocating or protecting flood-prone infrastructure (for example by raising low-lying bridges); and acquiring easements to compensate landholders for increased frequency of inundation to low-lying areas of the floodplain (although it is noteworthy that landholders also derive benefits from such inundation, for example through improved soils, pasture growth and timber production).[30] In some cases new infrastructure may be necessary to deliver environmental flows to particular ecosystems that are now more or less impossible to reach through managed overbank flows. However, these methods rarely deliver the full suite of ecological benefits and come with potential unintended consequences. As such they should only be considered as an option of last resort.

Image: Little egret, endangered in Victoria. Credit: Adam Fry

Image credit: Doug Gimesy

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Delivering managed environmental flows is currently the only way to provide for the breeding opportunities, habitat maintenance and connectivity needs of these species

Recovering enough water: the importance of water purchases

THE WATER RECOVERY TARGET

The central purpose of the Water Act and Basin Plan is to address over-extraction by returning to an environmentally sustainable level of take. This means reducing water diversions from a starting point of over-allocation to a level at which the requirements of water-dependent ecosystems can be met. The required reduction is expressed as a 'water recovery target'. Recovered water is made permanently available to the environment, managed through agencies such as the Commonwealth Environmental Water Holder.

The initial Guide to the proposed Basin Plan estimated water recovery of 3000-7600 GL would be required to protect basin ecosystems and biodiversity.[31] The 2750 GL water recovery target settled on by the Murray-Darling Basin Authority was widely considered by the scientific community to be inadequate, while recognised as a considerable improvement on the status quo. Critically, the Authority's own modelling indicated that it would be insufficient to maintain ecological condition at four of Victoria's five Ramsar-listed wetlands in the Basin: Hattah Lakes, Gunbower, Barmah-Millewa and Lake Albacutya could decline beyond the 'limits of acceptable change' mandated under the Ramsar Convention.[32] The inclusion of an additional 450 GL of environmental water, bringing the target to 3200 GL, made the achievement of significantly improved environmental benefits theoretically possible,[33] including for two Ramsar wetlands in the Victorian stretch of the Murray, the Gunbower Forest and the Hattah Lakes.[34] Notably, however, additional and peculiar restrictions were placed on how that 450 GL can be recovered.

OPTIONS FOR ACHIEVING THE TARGET

Options to recover all classes of water required by the Basin Plan (both the 2750GL and the additional 450 GL) have been gradually and deliberately limited at the behest of sections of the irrigation industry and upstream state governments, notably Victoria and New South Wales. Instead of the straightforward and cost-effective method of purchasing water directly from irrigators, current options are largely limited to subsidising the upgrade of irrigation infrastructure to save water that would be otherwise be lost or wasted and returning some of this 'saved water' to the environment. Projects include increasing the water efficiency 'on-farm' (e.g. by installing modern drip or spray systems) and reducing losses from shared infrastructure 'off-farm' (e.g. by lining leaky irrigation channels to stop water from seeping out). These infrastructure upgrades are several multiples more expensive than direct water purchases. Serious doubts have also been raised about whether they result in the return of any significant volume of water to the environment at all.

LIMITATIONS AND UNINTENDED CONSEQUENCES OF WATER RECOVERY THROUGH SUBSIDISING INFRASTRUCTURE UPGRADES

The majority of Commonwealth water recovery funding has now been directed towards such water-saving infrastructure programs, which the Australian Government claims has led to the recovery of around 700 GL. However, there are no adequate site-level measurements to confirm improvements to stream flow as a result. One study suggests the projects may have delivered as little as 70 GL in observable increases to environmental flows.[35] The potential reasons for this include a double-counting effect, through the crediting of 'new' water to the environment that it had already been receiving as 'return flows', and a rebound effect, where increased efficiency enables greater profits to be derived per unit of water, which in turn stimulates increased demand for water, resulting in a net increase in water use.

'Return flows' refers to water that is 'lost' to irrigators through inefficient delivery but in reality, is actually returning to the environment, either by seeping into the ground and recharging aquifers or by flowing directly back into creeks, rivers and wetlands. In this case, 'saving' such water can provide little or no additional benefit to the environment, because what it gains in a paper credit is balanced out by what it loses in return flows. One academic study estimated that this double-counting could amount to an extraordinary 90% or 630 GL of the 700 GL recovered on paper.[36] The authors told the South Australian Royal Commission into the Murray-Darling that infrastructure subsidies had 'at best contributed to no benefit and, at worst, reduced net water availability in the Basin.'[37] An independent review conducted for the Murray-Darling Authority found the problem was likely smaller, though still significant, at around 16% or 121 GL of water that had, on paper, been recovered for the environment.[38]

The 'rebound effect' occurs when farmers benefitting from infrastructure subsidies, rather than using less water, actually increase water consumption in response to the dramatic increase in profit generated from each megalitre used. One study found that recipients of irrigation infrastructure grants increased their water extraction by between 21 and 28%. If state and Commonwealth extraction limits had been functioning effectively, this ought not to have resulted in a net increase in extraction at the Basin scale, because an increase in consumption on one farm would have had to be balanced out by a reduction elsewhere (presumably through the trade of water entitlements). However the same study also found that a range of gaps in the robustness and enforcement of extraction limits made this unlikely. The report concluded that subsidised irrigation infrastructure upgrades 'have not reduced water extractions or water consumption at a Basin-scale'.[39]

While the precise impact of lost return flows and the rebound effect is currently uncertain, it is clearly substantial. There are also many other limitations and unintended consequences associated

with subsidising irrigation infrastructure upgrades as a means of water recovery:

- Off-farm projects are very slow, with some taking more than 14 years to complete, with an average of 5.5 years.[40] [41]
- On-farm projects push up the price of water. As discussed above, on-farm projects enable irrigators to generate higher returns for every drop of water used. The resulting step-up in demand is also estimated to have increased water prices by an average of $72 per megalitre. While any form of water recovery may influence prices, infrastructure programs pushed prices 14% higher than they would have been with straightforward water purchases. ABARES estimates suggest that 'the water allocation price effect of on-farm irrigation infrastructure projects are likely to be around double that of buybacks, per unit of water recovered'.[42]
- On-farm projects have exhibited a strong bias toward corporate agribusinesses, which are 21 times more likely to receive funding than family farms.[43]
- Both on-farm and off-farm projects are relatively fruitless in terms of job creation. Victoria University modelling found that 'each dollar spent on human services creates four times as many jobs within the Basin as infrastructure upgrades spending.'[44]
- Both on-farm and off-farm projects are vastly more expensive than water purchases, at least 2.5 times higher than buying it directly.[45] And if the volume of water actually returned to the environment is as low as some studies suggest, they could be 25 times more expensive.[46] This results in greatly reduced public benefit from every dollar spent, and may exhaust the water recovery budget before Basin Plan targets are achieved.
- In total, the public funds spent on infrastructure upgrades through the Basin Plan have amounted to an average subsidy of $400,000 per irrigator. These large payments have sparked concerns of 'subsidy capture', whereby irrigators 'lobby governments to pay for projects that do not necessarily deliver net benefits to society, but that deliver a major subsidy to landowners'.[47]
- Finally, even if all other challenges with infrastructure subsidies are overcome, there is a physical limit to how much water can be 'saved' through increasing efficiency. Water can only be saved if it is being wasted in the first place. After more than a decade of pumping public money (as well as private) into upgrading Australia's irrigation infrastructure, the amount of water still to be 'saved' at a reasonable cost per megalitre is likely to be negligible.

While it remains critical to minimise social and economic impacts of water recovery, economists have concluded that the 'problem with infrastructure upgrades is they are seeking to address two policy objectives at once, namely to provide water for the environment and to support jobs and incomes within the Basin'. Instead it would be more efficient and equitable to use two separate policies. Straightforward water purchases are relatively cost-effective and efficient means for providing environmental flows while increases in public funding of 'human services within Basin regions will create many more regional jobs than upgrades.'[48]

THE GROWING IMPORTANCE OF WATER PURCHASES

In summary, most alternatives to water purchases are far more expensive and unlikely to deliver the claimed water savings. In future, these methods cannot be relied upon to recover further water for the environment and improve the conditions for threatened species. Water purchases remain the most viable solution to an increasingly urgent water recovery challenge.

“ Most alternatives to water purchases are far more expensive and unlikely to deliver the claimed water savings. In future, these methods cannot be relied upon to recover further water for the environment and improve the conditions for threatened species.

Victorian position on water recovery and delivery

Despite the above evidence, the Victorian Government has a long-standing opposition to recovering water for the environment through purchase. In this regard, the Victorian Government has been significantly less flexible than federal Coalition governments.

Even before John Howard proposed the Commonwealth Water Act, the Victorian Government had consistently refused to relax its approach to water recovery for the survival of the Murray River and its floodplains and the biodiversity that depends on it. As the Basin Plan was developed and implemented, Victoria continued to play a key role in preventing water from going to the environment, including by:

- Insisting on recovering water by subsidising expensive on- and off-farm infrastructure upgrades that have not proven to deliver stated water savings and have been heavily criticised by independent economists going back more than a decade.[49]
- Advocating for higher sustainable diversion limits (i.e. greater extraction from the river) in exchange for unproven floodplain engineering offset works, many of which are still not close to being delivered more than ten years since the Basin Plan commenced. These projects do not recover any water for the environment and can have significant perverse ecological consequences (see further detail below).[50]
- Placing considerable financial and policy barriers to Commonwealth water recovery. This has included supporting a 1500 GL cap on the amount of water the Australian Government can purchase for the environment from willing sellers; insisting that the additional 450 GL not be recovered through water purchase and imposing a so-called 'socio-economic test' on other recovery mechanisms which the South Australian Murray-Darling Basin Royal Commission concluded would make it 'doubtful that much of the 450 GL of water will ever be recovered'.[51]
- Dragging the chain on 'constraints relaxation.' Independent research has noted the slow progress and limited ambition of the Victorian government, attributing this in part to its focus on voluntary negotiation of easements[52] which effectively give landholders a right of veto over restoring environmental flows critical to the recovery of threatened species. It is hard to imagine that the government would take a similar approach when acquiring access to land required for road or rail projects.

The Victorian Government argues that subsidising irrigation infrastructure upgrades will ensure the long-term viability of regional communities while also delivering positive outcomes for cultural and environmental values.[53] As outlined above, these claims privileging infrastructure-based programs instead of water recovery are highly contestable.

Image: Murray River, Victoria. Credit: Doug Gimesy

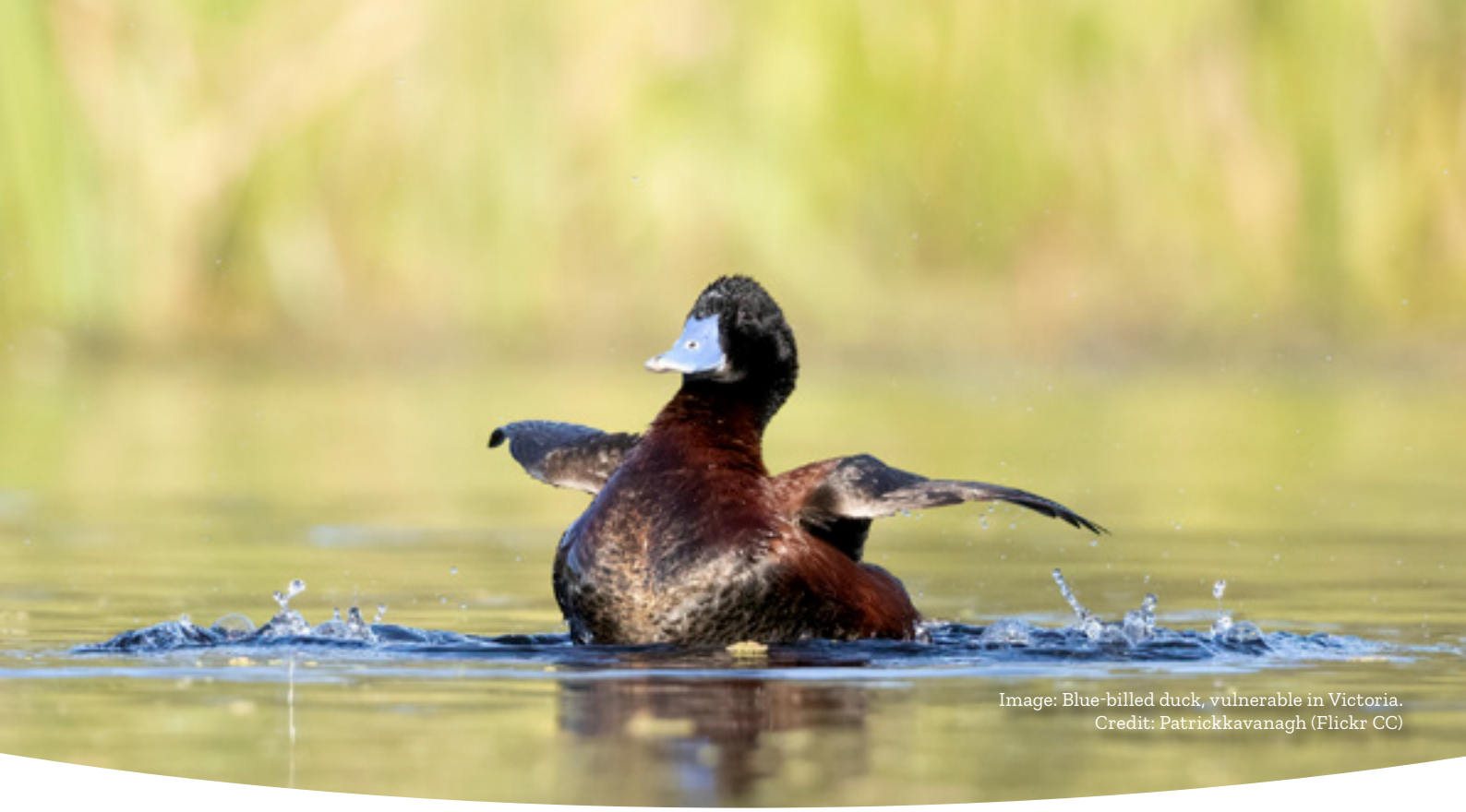

Image: Blue-billed duck, vulnerable in Victoria.
Credit: Patrickkavanagh (Flickr CC)

SPURIOUS ENVIRONMENTAL OFFSETS

More than a decade ago, the Victoria Government proposed the idea that environmental water recovery targets could be offset by interventions that re-engineer wetlands, supposedly making them more 'efficient', as if complex ecosystems can be managed in the same way as irrigated monoculture crops. Despite more than a decade of development, the majority of the offset projects have not been delivered and the Victorian Government now openly admits that many will not be operational in time for the Basin Plan's 2024 implementation deadline.

In the meantime, threatened species have missed out on the benefits of the environmental water that would otherwise have been delivered. Murray-Darling Basin Authority CEO Andrew McConville recently described the projects as 'like a credit to water users, at the expense of the environment. The credit has been banked, but the payment still needs to be delivered.'[54]

These projects supposedly achieve equivalent or better environmental outcomes with less water but the risks of additional infrastructure on floodplains and dubious claims of ecologically equivalent outcomes have been elaborated at length in the final report of the South Australian Royal Commission, describing the approach as 'experimental and unprecedented' with 'alarming shortcomings'. [55]

The practical effect of the Victorian Government advocating for engineering and infrastructure projects is less water for the environment.

In April 2022, then-opposition leader Anthony Albanese announced federal Labor's election commitments on the Murray-Darling, which include delivering on all water recovery commitments, including the final 450 GL of water for the environment.[56]

Currently, this 450 GL of water for the environment can only be achieved by efficiency measures. However, in August 2022 Environment and Water Minister Tanya Plibersek said 'nothing was off the table' to achieving this target, including water purchases.[57] In October 2022 Minister Plibersek also said that she believes 'voluntary buybacks in a strategic way can be very beneficial.'[58]

In its communique of 12 October 2022, the Murray-Darling Basin Ministerial Council noted that ministers restated their commitment to work together in a spirit of cooperation and collaboration to deliver the Basin Plan:

> *The Commonwealth will work with relevant communities and Basin states on options to bridge the remaining gap in water recovery, including through strategic purchase, and to consider carefully opportunities to achieve the 450 GL.*

Image: Victorian wetlands in the Murray-Darling Basin.
Credit: Doug Gimesy

Discussion

FLOW-DEPENDENT THREATENED SPECIES SUBJECT TO BOTH VICTORIAN AND COMMONWEALTH LAW

There are 30 flow-dependent threatened species listed in both the *Victorian Flora and Fauna Guarantee Act 1988* and the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* whose survival is, at least in part, dependent on environmental watering. Without environmental watering to restore riverine, floodplain and wetland ecosystems their chances of survival as a species are greatly reduced.

These species include:

- Australasian bittern; critically endangered in Victoria, at extremely high risk of extinction in the immediate future
- Australian painted snipe; critically endangered in Victoria, at extremely high risk of extinction in the immediate future
- Sloane's froglet; endangered in Victoria, at very high risk of extinction in the near future
- Murray cod; endangered in Victoria, at very high risk of extinction in the near future
- Macquarie perch; endangered in Victoria, at very high risk of extinction in the near future.

ALIGNMENT BETWEEN COMMITMENTS TO PROTECTION OF THREATENED SPECIES

The federal Labor Government's election promises on water recovery in the Murray-Darling Basin, if fully realised, would make a significant contribution towards achieving targets for biodiversity conservation in the government's Threatened Species Strategy Action Plan 2022-2032. While the water recovery targets in the current Basin Plan are lower than what science suggests may ultimately be required, the Commonwealth's water policy is not in outright conflict with its stated objectives on biodiversity.

In contrast, the Victorian Government's position on water recovery in the Murray-Darling Basin has long been, and appears to remain, in conflict with its legal obligations and commitments to biodiversity conservation. Victoria's opposition to water purchases, reliance on expensive and often ineffective infrastructure subsidies, and lack of commitment to relaxing constraints is not consistent with the stated goals of biodiversity conservation.

Research and accumulating experience show that the Victorian government's reliance on adding infrastructure to floodplains and subsidising the irrigation industry to become more water-efficient are difficult to justify as an adequate response to the aims and objectives of the *Flora and Fauna Guarantee Act 1988*.[59]

The habitat requirements of flow-dependent threatened species are well known. They require a healthy riverine, floodplain and wetland habitat. While flows remain inadequate to maintain this habitat, and policy to restore these flows remains weak and inapt, the Victorian Government's obligations to these species are not adequately met. As a consequence, the Australasian bittern, Australian painted snipe, Sloane's froglet, Macquarie perch, and many others remain at a high or very high risk of extinction in the near or immediate future.

By withholding environmental water or failing to meet deadlines for the implementation of the Basin Plan, the Victorian Government acts in a way that is inconsistent with the biodiversity commitments contained in its own laws and policy.

If water is not delivered in full under the Basin Plan, threatened flow-dependent species will be placed at even higher risk. Both the Victorian and federal governments may be in breach of their legal obligations to protect Murray River-dependent biodiversity.

Image: Swamp diuris, endangered in Victoria. Credit malwel (Flickr CC).

Conclusion

The rivers and floodplains of the Murray-Darling Basin were formed by seasonal patterns of variable flow. These sequences of regular, smaller floods in winter and spring followed by lower flows in summer moulded the channel and the floodplain. Subtle variation in topography leads to a mosaic of vegetation and habitat. Macroinvertebrates, fish, frogs, turtles and birds all depend on these flow patterns. They provide essential connectivity from upstream to downstream and from the channel out over the banks. This gives species the ability to move, feed and reproduce.

River regulation and water extraction dramatically overturned these flow patterns. The radical end of river variability to make way for intensive irrigation meant the degradation of riverine and wetland ecosystems that depend on it.[60 61 62 63]

Flow-dependent native species continue losing critical habitat while these drivers remain unchecked. Infrastructure in rivers is blocking species movement and destroying flowing water habitat. Reduced flow variability to suit irrigation demand perpetuates the disconnection of floodplains and wetlands from rivers.

Restoring natural flow variability in regulated rivers requires a thoughtful balance between water supply and ecosystem management.[64] Achieving this balance has been the aim of water policy since the 1990s, most significantly with the *Water Act 2007* (Cth). But Victoria's regulated rivers continue to be managed primarily for extractive use. Water for the environment is meant to ameliorate and ultimately remedy this damage. But this is not possible while it is shoe-horned into management and operating systems designed to regulate flows primarily for extraction and consumptive use. Until major steps are taken to restore flows to rivers, floodplains and wetlands – thereby restoring connectivity, variability and diversity to riverine landscapes – there is little hope for many of Victoria's threatened species that depend on these environments.

Restoring connectivity requires meeting minimum flow targets while regularly delivering pulses of water to inundate floodplains and wetlands. This cannot be achieved without the allocation of real water. Nevertheless, the Victorian Government's approach to reversing river degradation is biased towards works and infrastructure. It precludes programs capable of restoring the wider river system.

Failing to return necessary water to the rivers of the Murray-Darling Basin harms the recovery of at least 140 Victorian threatened species – fish, birds, frogs, invertebrates and plants – and places them at greater risk of extinction. For these species, increased flow, additional flow paths and longer, more frequent and consistent inundation is essential to sustain populations through their lifecycle. There need to be fewer structures on floodplains and more natural flows to restore the connectivity these species depend on for survival.

Species that are threatened throughout their range, not only in Victoria, are at much greater risk of extinction if Victoria fails its obligations to protect them.

The Victorian Government's position on water recovery appears at odds with the requirements of its own biodiversity and threatened species legislation and policy goals.

> “ Failing to return necessary water to the rivers of the Murray-Darling Basin harms the recovery of 140 Victorian threatened species and places them at greater risk of extinction.

Policy recommendations

TO SAFEGUARD VICTORIAN BIODIVERSITY THAT RELIES ON A HEALTHY MURRAY RIVER SYSTEM, THIS REPORT MAKES THE FOLLOWING URGENT RECOMMENDATIONS.

By the end of 2023:

1. The Australian and Victorian governments must work together to identify failing water offset projects in the supply measures program and commit to securing real water in their place
2. The Victorian Government must stop opposing the Australian Government's intention to purchase water for the environment so that the 450 gigalitres (GL) of additional water for the environment can be recovered. This includes abandoning the inappropriately named and unworkable 'socio-economic test'
3. The Australian Government must amend the Water Act to *remove the 1500 GL cap on water purchases and commit to recovering all remaining water required by the Basin Plan as quickly as possible*
4. The Australian and Victorian governments must agree to a new approach to relaxing constraints that will allow the achievement of managed overbank flows within a reasonable timeframe. A panel of independent experts should be appointed to find a workable pathway, and the Commonwealth must be prepared to assert its power to acquire easements if the states continue to delay.

Given the Victorian Government's current policy position and track record,the chance of these recommendations being implemented voluntarily does not appear overly high. If so, it is incumbent on the Australian Government to use the full force of its powers to achieve a satisfactory outcome for Victoria's threatened species.

Image: Freckled duck, endangered in Victoria. Credit: Adam Fry

Appendix

Flow-dependent plant species in the southern Murray-Darling Basin listed under the current Victorian *Flora and Fauna Guarantee Act 1988* [65]

Common name	Scientific name	Category of threat
Glaucous flax-lily	*Dianella longifolia var. grandis*	Critically endangered
Riverine flax-lily	*Dianella porracea*	Critically endangered
Black-fruit daisy	*Brachyscome melanocarpa melanocarpa*	Critically endangered
Cut-leaf burr-daisy	*Calotis anthemoides*	Critically endangered
Small nut-heads	*Haegiela tatei*	Critically endangered
Slit-wing bluebush	*Maireana georgei*	Critically endangered
Turnip copperburr	*Sclerolaena napiformis*	Critically endangered
Spiny lignum	*Duma horrida horrida*	Critically endangered
Yarran	*Acacia melvillei*	Critically endangered
Weeping myall	*Acacia pendula*	Critically endangered
Three-nerve wattle	*Acacia trineura*	Critically endangered
Native scurf-pea	*Cullen australasicum*	Critically endangered
Silver cassia	*Senna artemisioides subsp. artemisioides*	Critically endangered
Hairy Darling-pea	*Swainsona greyana*	Critically endangered
Small darwinia	*Darwinia micropetala*	Critically endangered
Clumping leek orchid	*Prasophyllum* sp. aff. *Occidentale E*	Critically endangered
Downs flat-sedge	*Cyperus bifax*	Critically endangered
Annual flat-sedge	*Cyperus nervulosus*	Critically endangered
Cane grass	*Eragrostis australasica*	Critically endangered
Buloke mistletoe	*Amyema linophylla subsp. orientalis*	Critically endangered
Toothed raspwort	*Haloragis odontocarpa f. octoforma*	Critically endangered
Ridged water-milfoil	*Myriophyllum porcatum*	Critically endangered
Nealie, Broken Hill gidgee	*Acacia loderi*	Critically Endangered
Buloke	*Allocasuarina luehmanni*	Critically Endangered
Large adder's-tongue	*Ophioglossum polyphyllum*	Endangered
Slender water-ribbons	*Cycnogeton dubium*	Endangered
Six-point arrowgrass	*Triglochin hexagona*	Endangered
Long eryngium	*Eryngium paludosum*	Endangered
Darling lily	*Crinum flaccidum*	Endangered
Yellow-tongue daisy	*Brachyscome chrysoglossa*	Endangered

Common name	Scientific name	Category of threat
Mueller daisy, claypan daisy	*Brachyscome muelleroides*	Endangered
Reader's daisy, southern daisy	*Brachyscome readeri*	Endangered
Purple burr-daily	*Calotis cuneifolia*	Endangered
Tall sneezeweed	*Centipeda pleiocephala*	Endangered
Fleshy minuria	*Kippistia suaedifolia*	Endangered
Button immortelle	*Leptorhynchos waitzia*	Endangered
Rasp daisy-bush	*Olearia picridifolia*	Endangered
Squat picris	*Picris squarrosa*	Endangered
Dwarf yellow-heads	*Trichanthodium baracchianum*	Endangered
Wavy marshwort	*Nymphoides crenata*	Endangered
Winged peppercress	*Lepidium monoplocoides*	Endangered
Dwarf amaranth	*Amaranthus macrocarpus var. macrocarpus*	Endangered
Long tails	*Ptilotus polystachyus*	Endangered
Pop saltbush	*Atriplex holocarpa*	Endangered
Spiny-fruit saltbush	*Atriplex spinibractea*	Endangered
Silver saltbush	*Atriplex rhagodioides*	Endangered
Chariot wheels	*Maireana cheelii*	Endangered
Wooly copperburr	*Sclerolaena lanicuspis*	Endangered
Dwarf myall	*Acacia ancistrophylla* var. *lissophylla*	Endangered
Hoary scurf-pea	*Cullen cinereum*	Endangered
Small scurf-pea	*Cullen parvum*	Endangered
Spreading scurf-pea	*Cullen patens*	Endangered
Slender Darling-pea, Murray Swainson-pea	*Swainsona murrayana*	Endangered
Red Darling-pea	*Swainsona plagiotropis*	Endangered
Doubah	*Marsdenia australis*	Endangered
Australian broomrape	*Orobanche cernua var. australiana*	Endangered
Small monkey-flower	*Elacholoma prostrata*	Endangered
Dwarf brooklime	*Gratiola pumilo*	Endangered
Bignonia emu-bush	*Eremophila bignoniiflora*	Endangered
Small water-fire	*Bergia trimera*	Endangered
Plains spurge	*Euphorbia planiticola*	Endangered
Lagoon spurge	*Phyllanthus lacunarius*	Endangered
Desert lantern	*Abutilon otocarpum*	Endangered

Common name	Scientific name	Category of threat
Sand sida	*Sida ammophila*	Endangered
Pin sida	*Sida fibulifera*	Endangered
Twiggy sida	*Sida intricata*	Endangered
Limestone sida	*Sida spodochroma*	Endangered
Williamson's rice-flower	*Pimelea williamsonii*	Endangered
Jerry-jerry	*Ammannia multiflora*	Endangered
Pink gum	*Eucalyptus fasciculosa*	Endangered
Salt paperbark	*Melaleuca halmaturorum*	Endangered
Swamp diuris	*Diuris palustris*	Endangered
Lowly greenhood	*Pterostylis despectans*	Endangered
Lax flat-sedge	*Cyperus flaccidus*	Endangered
Button rush	*Cyperus leptocarpus* (= *Lipocarpha microcephala*)	Endangered
Dwarf flat-sedge	*Cyperus pygmaeus*	Endangered
Tiny bog-sedge	*Schoenus nanus*	Endangered
Austral pipewort, southern pipewort	*Eriocaulon australasicum*	Endangered
Club spear-grass	*Austrostipa nullanulla*	Endangered
Silky umbrella-grass	*Digitaria ammophila*	Endangered
Brown beetle-grass	*Diplachne fusca fusca*	Endangered
Purple love-grass	*Eragrostis lacunaria*	Endangered
Bristly love-grass	*Eragrostis setifolia*	Endangered
Slender water milfoil	*Myriophyllum gracile* var. *lineare*	Endangered
Desert bindweed	*Convolvulus clementii*	Endangered
Austral pipewort, southern pipewort	*Eriocaulon australasicum*	Endangered
Hydrilla	*Hydrilla verticillata*	Vulnerable
Spreading cress	*Phlegmatospermum eremaeum*	Vulnerable
Coral saltbush	*Atriplex papillata*	Vulnerable
Spear-fruit copperburr	*Sclerolaena patenticuspis*	Vulnerable
Flycatcher	*Drosera finlaysoniana*	Vulnerable
Curly flat-sedge	*Cyperus rigidellus*	Threatened
TOTAL	**92**	

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