

Bounce-back after dry times—a welcomed and strong response from the Macquarie Marshes

Tim Hosking and Dr Stephanie Suter, NSW Office of Environment and Heritage

When the rain started to fall in the Macquarie catchment in mid-June 2016 after three years of near-drought conditions, it got a lot of interest. Four months later and Burrendong Dam spilled and a series of high flows extended along the length of the river system and into the Barwon River. The rain was doubly welcome because parts of the Macquarie Marshes in Northern NSW are listed as internationally important wetlands under the Ramsar Convention, and are known as a significant site for colonial waterbird breeding.

While some people with businesses and residences on the floodplain have been impacted by crop losses, infrastructure damage and access constraints, the news was more favourable for the Macquarie Marshes wetland system. Inundation of this scale—thought to be in excess of 150,000 ha—has not been seen in the Marshes since early 2012.

Despite the best efforts of environmental water managers and land managers of the Marshes, the past three very dry years had taken a toll on the condition and resilience of the system. However, the invigorating flows have meant the majority of the flow-dependent

vegetation throughout the Marshes, including river red gum, lignum and coolabah, have had a much needed drink.

Waterbirds also profited greatly from increased inundation. Even with challenging site access conditions due to the inundation, over 130 bird species were recorded during the spring 2016 NSW Office of Environment and Heritage (OEH) ground surveys throughout the Marshes, including threatened blue-billed ducks, freckled ducks, magpie geese and the cryptic Australasian bitterns, heard booming through the reeds.



An internet-enabled RM-Cam remote camera observing straw-necked ibis nests, Macquarie Marshes, October 2016
(Tim Hosking, OEH)



Paul Keyte and Dr Stephanie Suter (NSW OEH) during installation of remote cameras in a straw-necked ibis colony, Macquarie marshes, October 2016 (Tim Hosking, OEH)

In addition to the benefits to the resident and nomadic waterfowl, the notable 2016 flows allowed colonially-nesting waterbirds to breed in the Marshes. Initial observations indicated the presence of over 30,000 Straw-necked Ibis nests in two main colonies, plus several Egret colonies of up to 300 nests in size, which included four egret species, nankeen night herons and up to five species of cormorants.

In collaboration with CSIRO and University of NSW researchers, supported by the Commonwealth-funded Environmental Water Knowledge and Research (EWKR) program and the Commonwealth Environmental Water Office, a range of monitoring actions in the Marshes began in spring. Colony visits were scheduled to collect information for water management, with the specific aim of supporting the nesting birds through their breeding cycle to produce fledged young. Remote cameras were installed which

will allow the collection of post-event data on fledging rates, feeding, predators and other nest disturbance. Satellite tracking of a small number of adults during and after the nesting event was also undertaken.

These monitoring activities and new technologies will allow water managers and EWKR researchers to learn valuable lessons, which may assist with the success of future colonial waterbird breeding events. We'll then be in a better position to make the best of these opportunities in wet years, and to hopefully see future generations of ibis and egrets continue to thrive in the Marshes.

For further information, contact Tim Hosking at tim.hosking@environment.nsw.gov.au, or visit www.environment.nsw.gov.au/environmentalwater/macquarie.htm

Monitoring waterbird recruitment to inform environmental flow management: A pilot study at Reed Beds wetland, Millewa Forest, NSW

Heather McGinness and Freya Robinson, Commonwealth Scientific and Industrial Research Organisation

Wetlands within the Murray-Darling Basin provide important waterbird habitat however recent declines and abandonment of nesting colonies is concerning. Data collected on ibis and spoonbill breeding success within the Millewa Forest will inform the management of environmental flows for maximising waterbird breeding success within the Basin.

Environmental water within the Murray-Darling Basin is used to support the nesting and foraging habitats of waterbird populations. Maintaining the quality and availability of waterbird habitats is essential to maximising the recruitment of juvenile birds into the adult population. Managing environmental water flows is therefore key to maximising waterbird recruitment. Evaluating, modelling and predicting the effects of water management decisions on waterbird recruitment is however difficult as basic waterbird demographic and movement data is scarce. Little is known about waterbird survival and mortality rates (either in the nest or out of it) or about movements associated with foraging and dispersal between nesting events.

The Waterbirds Theme of the Murray-Darling Basin Environmental Water Knowledge and Research (MDB EWKR) Project is filling these knowledge gaps on the movements and demographics of colonial-nesting waterbirds in the Murray-Darling Basin.

The Waterbirds Theme is using on-ground surveys and motion-sensing and time-lapse cameras focused on nests to collect demographic data including egg and chick survival, and to assess impacts of predation, habitat characteristics and weather. It is also assessing waterbird diets during nesting and the locations and characteristics of their foraging habitats. Satellite GPS tracking devices will be deployed on adults and juveniles to track movements during and after nesting.



Left: Motion-sensing time-lapse image of straw-necked ibis on nests with chicks. Millewa Forest NSW, 2015–16 (CSIRO)

*Right: Royal spoonbills *Platalea regia* in their breeding plumage on trampled rushes during the summer 2015–2016 pilot study in Millewa Forest NSW (Heather McGinness)*

During the summer of 2015–2016, the Waterbirds Theme conducted a pilot study at Millewa Forest NSW, designed to:

1. Collect new waterbird breeding success data, taking advantage of the breeding event occurring in Barmah-Millewa Forest; and
2. Develop, test and improve survey methods and equipment for future quantification of breeding success and the impacts of associated threats and pressures, such as predation and competition for food.

The pilot study focused on one particular sub-colony of three species in Reed Beds wetland in Millewa Forest, where approximately 660 birds were observed nesting.

Australian white ibis started nesting in October 2015, adding new nests and nest clumps throughout November and December. Straw-necked ibis started nesting in mid-late November 2015 and only nested once in the study area. Royal spoonbills were courting, establishing territory and trampling rushes for several weeks before starting to nest, and most laid their eggs in late November or early December 2015.

While hatching rates were low (30–55%) because of predation on eggs, survival of chicks once hatched was very high, with chick fledging rates well above 80% for all three species. Royal spoonbill chick hatching, chick survival and chick fledging rates were higher than the two ibis species, with Australian white ibis having the lowest averages.

Using lessons learned from this pilot study, the Waterbirds Theme has modified survey methods and equipment for field research commencing in the 2016–2017 summer.

For more information about the exciting new research being undertaken by the Waterbirds Theme, visit our website:

<https://research.csiro.au/ewkrwaterbirds/>

The Murray-Darling Basin Environmental Water Knowledge and Research Project is funded by the Australian Government Commonwealth Environmental Water Office. The Waterbird theme is a collaboration between CSIRO, University of New South Wales and University of Canberra.



Motion-sensing time-lapse image of a juvenile white-bellied sea eagle feeding on Australian white ibis eggs. Millewa Forest NSW, 2015–16 (CSIRO)



Motion-sensing and time-lapse cameras set up facing an Australian white ibis nest during the summer 2015–2016 pilot study in Millewa Forest NSW. (Heather McGinness)

Supporting important ecosystems at Toorale National Park

Adrian Clements, Local Engagement Officer, Commonwealth Environmental Water Office

Located at the junction of the Warrego and Darling Rivers, the 91,000 hectares of floodplain and seasonal wetlands of Toorale National Park and State Conservation Area in western New South Wales offer an abundance of birdlife, with ibis, pelicans, as well as iconic brolgas, a unique array of aquatic invertebrates, frogs, and fish, when the rivers are flowing. This park lies within the traditional lands of the Kurnu-Baakandji People.

The amount and nature of flows of the Warrego and Darling Rivers are influenced by upstream structures while the delivery of water to and within the Junction of the Warrego and Darling rivers is dependent on rainfall and natural flows (unregulated) rather than from specific water releases from dams.

Since its purchase in 2008 by the Commonwealth and NSW governments, Toorale, a former sheep station, has received over 100 billion litres of environmental water. This water has provided native fish species, such as Hyrtl's catfish (*Neosilurus hyrtlui*) and spangled perch (*Leiopotherapon unicolor*) with increased habitat including access to waterholes used as refuge during drought. Environmental water has also benefited the lower Warrego and Darling Rivers.

Monitoring of environmental watering, through the Commonwealth Environmental Water Holder's Long Term Intervention Monitoring program, has shown that up to 98 per cent of fish in the Warrego at Toorale were native fish species with spangled perch and Hyrtl's catfish the most common species. There was also a low abundance of european carp (*Cyprinus carpio*). In 2015–16, fish sampling in the Warrego River also showed golden perch (*Macquaria ambigua*) and bony herring (*Nematalosa erebi*) recruitment events occurred.



Brolgas with chicks on the Western Floodplain (Lachlan Copeland)



An inundated Western Floodplain at Toorale in 2016 (Adrian Clements)

Inundation of the Western Floodplain with environmental water has been shown to increase biodiversity of aquatic invertebrates, frogs, waterbirds, and vegetation while also increasing persistence of drought refuge pools in dry times. 87 species of bird, including 34 waterbirds were recorded in 2015–16, including internationally listed species such as the eastern great egret (*Ardea modesta*), wood sandpiper (*Tringa glareola*) and common sandpiper (*Actitis hypoleucos*).

Environmental water from Toorale is also used to benefit ecosystems further downstream. Between February 2009 and August 2010, multiple water shepherding trials were undertaken to transfer environmental water 1300 km from Toorale, through the Menindee Lakes to the Murray River. These trials were a proven success causing overbank flows in the Darling River and contributing to successful golden perch recruitment.

Toorale is open to the public with NSW National Parks and Wildlife Service providing self drive tours and information points.

For further information, visit www.environment.gov.au/water/cewo/catchment/northern-unregulated-rivers/monitoring or contact Local Engagement Officer, Adrian Clements on 02 5852 1206 or at adrian.clements@environment.gov.au



Hyrtil's Catfish caught in the Warrego River during the 2015-16 monitoring surveys (Gavin Butler)

Working together, to get things wetter

Commonwealth Environmental Water Office, Nature Foundation South Australia and
Department of Environment, Water and Natural Resources

Working with local partners to deliver Commonwealth environmental water
in wet times



Mimicking flows to low-lying floodplain at Calperum Station by raising water levels in Lock 5 (Jaimi Smith, Department of Environment, Water and Natural Resources)

The Commonwealth Environmental Water Holder is often asked “what is the role of environmental water when big rain events occur? The rivers flood, channels are cleansed, wetlands are inundated—Can we do more to further improve water outcomes?”

The large amount of rainfall and subsequent flows over winter and spring 2016 provided the opportunity for the Commonwealth Environmental Water Holder to work with local partners to capitalise on nature’s work to further improve environmental outcomes.

As flows in the Murray-Darling Basin are no longer natural, the health of the Basin’s rivers, wetlands and floodplains are highly dependent on intervention. Dams and weirs, along with diverting water for human uses, have reduced the size and frequency of high river flows.

That is why water holders capitalise on large flows, to help water to reach as much of the vast and thirsty floodplain as possible. This encourages growth and reproduction of floodplain plants, the many threatened black box, river red gum and lignum communities, and the animals that depend on them.

The Commonwealth Environmental Water Holder calls on locals to assist with this important task. Partnerships with state government, Indigenous and community groups in South Australia have resulted in working collaboratively to deliver water to the floodplain in conjunction with high flows.

One example is the South Australian Department of Environment, Water and Natural Resources using Commonwealth water to raise weir pool 5, near Renmark, by 45 centimetres. This resulted in over 900 hectares of additional floodplains being inundated, including Ral Ral Creek, Whirlpool Corner and Woolnook Bend at Calperum Station. Raising weir pool 5 has given native trees high on the floodplain a long needed watering and provided habitat for frogs and birds. Salt is also mobilised off the floodplain and flushed through the river channel with high river flows.



Using pumps to flood highly elevated floodplain (Amazon and Merriti) at Calperum Station (Peter Cale, Australian Landscape Trust)

To further extend the benefits, the Nature Foundation SA and the Australian Landscape Trust have pumped Commonwealth environmental water from the raised weir pool onto the higher Amazon, Merretti and Woolpolool floodplains. This would not have been feasible with the weir pool at normal level.

Together these two delivery partners have provided water efficiently to sites that would otherwise miss out due to the presence of dams, locks and weirs. Their work provided five year old river red gums, which germinated in the 2010–11 floods, with a vital watering to encourage further growth. In addition, black box trees that have rarely been inundated have been watered, which also benefits native bird life.

These environmental outcomes, which partners are collectively working towards, are priority objectives in the Murray-Darling Basin Plan. They are exactly the outcomes for which this Commonwealth environmental water was set aside, and have been made possible through local partnerships with the Nature Foundation SA, Australian Landscape Trust and Department of Environment and Natural Resources.

For further information, visit the 'Water for Nature' websites at www.naturefoundation.org.au/ or contact Local Engagement Officer, Michelle Campbell on 08 8595 2120 or at michelle.campbell@environment.gov.au

Collaborative partnerships on Tar-Ru Lands

Murray Darling Wetlands Working Group Ltd, Sunraysia Environmental and Commonwealth Environmental Water Office

Working together to deliver and monitor Commonwealth environmental water on Tar-Ru Lands

Environmental watering on Tar-Ru Lands, near Wentworth in far west New South Wales, has integrated water delivery with a training program in environmental field monitoring for the Barkindji.

In April 2016 the Murray Darling Wetlands Working Group Ltd, acting as project manager, delivered Commonwealth environmental water to the Carrs, Capitts and Bunberoo Creeks system and associated wetlands on Tar-Ru Lands. The watering event aimed to improve the health of drought stressed vegetation such as river red gums and water availability for aquatic habitat for birds and frogs.

The Commonwealth Environmental Water Holder also provided funding to local environmental consultants, Sunraysia Environmental, to train Barkindji in field monitoring techniques. This helped to build capacity locally by providing the opportunity to learn methods for monitoring environmental outcomes such as water quality testing, bird surveys, weed identification and vegetation assessments on country.

New South Wales National Parks and Wildlife is facilitating the hand back of Tar-Ru lands to Traditional Owners, the Barkindji-Mauroro. The hands-on participation in environmental monitoring resulted in an inspiring exchange of knowledge as Traditional Owners imparted cultural knowledge, whilst learning environmental monitoring techniques.



Environmental water enters Pig Swamp (Commonwealth Environmental Water Office)

This environmental watering event was a collaborative effort involving many partners of the Commonwealth Environmental Water Holder. The Murray Darling Wetlands Working Group was the project manager. A pumping contractor was engaged to deliver metered water through siphons, taking advantage of the head difference provided by the Lock 9 weir pool. Sunraysia Environmental facilitated the training program and additional monitoring utilising sound recorders and remote cameras was provided by The Nature Conservancy Australia.

The support of New South Wales agencies including the Office of Environment and Heritage, Local Land Services Western Region and Department of Primary Industries - Water, as well as SA Water and local landholders, was greatly appreciated.

Monitoring indicates that the environmental watering triggered a marked improvement in tree canopy health for both black box and river red gum. An increase in the diversity and abundance in aquatic and shoreline plants, waterbirds and terrestrial birds was also observed.

[A short video produced by ABC Open Sunraysia about the project is available.](#)

For further information, visit murraydarlingwetlands.com.au/ or contact Local Engagement Officer, Richard Mintern on 03 5051 4372 or at richard.mintern@environment.gov.au

Protecting Hattah Lakes during drought and beyond

The Murray–Darling Freshwater Research Centre, Latrobe University and the Mallee Catchment Management Authority

The Living Murray initiative has played an important role in protecting and improving the health of Ramsar wetlands at Hattah Lakes. Through this program, one of Australia's largest environmental works projects has been built to provide a sustainable future for Hattah Lakes. Annual condition monitoring has enabled improvements in health to be detected and has assisted the adaptive management of the system.

Located within the Hattah-Kulkyne National Park in Victoria's northwest, Hattah Lakes contains numerous freshwater lakes, 12 of which are Ramsar listed. The health of these wetlands are threatened by changes to the frequency, size and duration of overbank flows from the Murray River.

A decline in the health of river red gum trees fringing the Hattah Lakes was evident during the millennium drought (2000–2010). From 2005 to 2010, seven instances of environmental water ranging from 1700 and 17,588 megalitres was delivered with the main aim of improving the condition of fringing river red gums and providing refuge habitat for other plants and animals.

To help secure a sustainable future for the Ramsar site in the long-term, one of Australia's largest environmental works projects was built at Hattah Lakes. The \$32 million infrastructure project was designed with the intention of delivering water higher up onto the floodplain, to reach wetlands and floodplains that had been dry for more than 20 years.

In 2013 and 2014, two environmental flows of between 61,000 and 92,000 megalitres were delivered. This water inundated long dry wetlands and the surrounding floodplain. These flows achieved the goal of improving the health of black box trees higher up the floodplain and has increased the occurrence of aquatic plants and improved plant species richness over time.



Aerial view of watering at Hattah Lakes (Mallee CMA)

The delivery of environmental water also provided fish nursery habitats in otherwise 'dry' years. Many fish were then dispersed back into the system when water was returned to the Murray River. Some provided an important food resource for waterbirds.

The infrastructure project and the ongoing monitoring at Hattah Lakes is funded through The Living Murray program, which is a joint initiative funded by the New South Wales, Victorian, South Australian, Australian Capital Territory and Australian governments, coordinated by the Murray–Darling Basin Authority.

To find out more about The Living Murray or the iconic Hattah Lakes please visit www.malleecma.vic.gov.au, www.mdfrc.org.au and/or www.mdba.gov.au/managing-water/environmental-water/delivering-environmental-water/hattah-lakes



Oateys upstream at Hattah Lakes (Mallee CMA)