

Environmental Water Trust Annual Environmental Watering Report 2020-21



Murray Darling
WETLANDS
WORKING GROUP LTD.

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Contents

Acknowledgements	1
Abbreviations.....	3
Executive Summary	4
1. Introduction.....	5
2. Environmental Water Availability and Delivery in 2020-2021	7
2.1 Availability in 2020-2021	7
2.2 Environmental Water Delivery 2020-2021.....	7
3. Ecological Values, Objectives and Targets.....	8
3.1 Wetland vegetation response	9
3.2 Waterbird Abundance and Diversity	10
3.3 Frog Occupancy and Diversity	12
3.4 Small Bodied Fish recruitment (Murray Hardyhead)	13
4. Moving into 2021-2026	14
5. Community Engagement and Partnerships:.....	14
6. References:	15
Appendix 1. Fauna with VIC, NSW or Commonwealth conservation status 2016-2021.....	16
Appendix 2. Cumulative Native Vegetation List 2016-2021.....	17
Appendix 3. Cumulative Woodland bird List 2016-2021.....	19
Appendix 4. Cumulative Waterbird List 2016-2021	20

Abbreviations

BMEET	Barkindji Mauraura Elders Environment Team
CEWH	Commonwealth Environmental Water Holder
CEWO	Commonwealth Environmental Water Office
DPIE EES	NSW Department of Planning, Industry and Environment – Environment, Energy and Science
DPIE B&C SoS	NSW Department of Planning, Industry and Environment – Biodiversity and Conservation, Save our Species
DPIE Water	NSW Department of Planning, Industry and Environment - Water
DPI-Fisheries	NSW Department of Primary Industries – Fisheries
EWT	Environmental Water Trust
MDBA	Murray-Darling Basin Authority
MDWWG	Murray Darling Wetlands Working Group
MHH	Murray hardyhead
SBF	southern bell frog

Executive Summary

The 2020-2021 water season was a significant year with ~1982.3ML of Environmental Water Trust (EWT) water delivered, the highest volume available since inception of the Environmental Water Trust in 2016. Delivery and outcomes have aligned with the EWT 5-year Strategic Plan objectives and desired outcomes

- 1982.3 ML delivered
- Approximately 489 hectares inundated
- 10 priority wetlands in NSW and three in VIC
- Two delivery partnerships with First Nations
- Improved the condition of river red gum, black box, and lignum communities
- Improved and increased extent of aquatic habitat and wetland diversity
- Supported recovery efforts for the nationally endangered Murray hardyhead fish
- Supported recovery efforts for the NSW endangered southern bell frog
- Created and maintained habitat for 42 waterbird species
- Recorded 10 frog species at priority wetlands

Since the commencement of the Murray Darling Basin Balanced Water Fund and Environmental Water Trust (EWT) in 2016-2017:

- approximately 7100 ML has been delivered
- Approximately 630 hectares has been inundated, with repeated inundations on some wetlands
- 20 priority wetlands in NSW and 4 in VIC
- Partnership with 4 First Nations groups for delivery, cultural plans and threatened species programs
- Partnered with DPIE EES, Commonwealth Environmental Water Office, private landholders, DPIE Fisheries and SunRice
- Continued to improve the condition of river red gum, black box, and lignum communities
- Continued to increase extent of aquatic habitat and wetland diversity by increasing number of wetlands able to be watered
- Continued to support recovery efforts for the nationally endangered Murray hardyhead fish
- Continued to support recovery efforts for the endangered southern bell frog
- Continued to improve abundance and diversity of the Basin's waterbird population, by creating and maintaining habitat for 50 waterbird species
- 10 frog species recorded at priority wetlands

1. Introduction

In 2020-2021, the MDWWG delivered approximately 3191 ML of environmental water to 13 wetlands in NSW and Victoria (Table 1). Water was sourced from the Environmental Water Trust (EWT), Commonwealth Environmental Water Holder and NSW environmental water (Table 1). Four of the 13 wetland priorities were new sites which included Middle Wetland on the Billabong Creek (Murrumbidgee) and the Coomealla Lagoons, Grand Junction Wetlands and Thegoa Lagoon situated on the NSW Lower Murray (Table 1).

The Environmental Water Trust contributed 1982.3MLs to the overall volume delivered during 2020-2021. This is the highest volume delivered to date on behalf of the EWT (Table 1) being a 50% increase in volume on the previous three years combined (MDWWG 2020). This success was due to an increase in availability of wetland sites, more experienced staff on ground to deliver events, partnerships with Commonwealth and NSW water holders, and water availability (due being a moderate year).

Monitoring of priority wetlands indicated that the fauna and flora benefited from the environmental water. River red gums and black box communities benefitted and produced growth flushes and increased foliage cover. High diversity and abundances of native wetland plants were also observed at most watered sites, with 125 native species identified to date.

Most sites that received water provided frog breeding and recruitment habitat, which was observed through the detection of calling males, egg masses and tadpoles/metamorphs. Frog surveys recorded reasonably high numbers of frogs in 2020-2021, with ten species observed, comparable to previous years.

The environmental water delivered during 2020-2021 provided suitable habitat across all sites for a diversity of waterbirds, including fish-eaters, deep water foragers, dabbling ducks, shoreline foragers and large waders. Waterbirds were abundant and diverse across all regions with 50 species identified since the inception of the Fund. Breeding was observed at several priority wetlands such as several pairs of black swans and cygnets at Andruco Lagoon and multiple cohorts of pacific wood ducks at Grand Junction.

Environmental water also supported a range of terrestrial fauna including woodlands birds, reptiles and mammals, demonstrating that outcomes reached beyond the localized wetlands.

Table 1: Wetland priorities, volumes delivered, and hectares inundated in 2020-2021 by the MDWWG using environmental water

Wetland priority	Volume delivered and source in 2020-2021 (ML)	Area inundated (ha)
Yambuna Lagoon	79.7 (EWT)	11
O’Kane’s Swamp	120 (EWT)	3
The Plain Paddock	141.2 (EWT)	15
Lake Henry (Wingillie Station)	235 (EWT)	44
Little Frenchmans Creek	40 (CEWH)	20
Lucerne Day	80 (EWT)	7
Andruco Lagoon	281.9 (EWT)	20
Fletchers Creek	100.5 (60.5 EWT; 40 DPIE EES)	20
Coomealla Lagoons	14 (EWT)	4
Thegoa Lagoon	240 (EWT)	80
Grand Junction	200 (EWT); 700 (DPIE EES)	73
Middle Wetland	500 (EWT); 480 (CEWH)	190
Restdown Wetland	50 (EWT)	2
Total	3191.3 (1982.3 EWT)	489

2. Environmental Water Availability and Delivery in 2020-2021

2.1 Availability in 2020-2021

2020-2021 was predicted to be Dry, according to resource accessibility scenarios presented by the Murray Darling Basin Authority (MDBA, 2020). This triggered a 20% (+5%/-5%) water donation to the Environmental Water Trust of approximately 1537ML as required under the Murray Darling Basin Balance Water Fund rules (MDWWG 2021). Carryover from 2019-20 of 306 ML and an additional 260 ML EWT donation brought forward in June 2021, brought EWT water availability to approximately 2103ML (Table 2). Subsequently Strategy 3, pertaining to dry year environmental water management, was adopted from the EWT Five Year Watering Plan Strategy (MDWWG 2021a):

From the Five-Year Strategic Plan: Strategy 3: During a dry year scenario with low river flow, small diversions of environmental water can be made if required to maintain target species or provide refugia. Any residual environmental water allocation that cannot be use for these purposes may be traded into the temporary transfer market.

2.2 Environmental Water Delivery 2020-2021

In 2020-2021, approximately 3191 ML of environmental allocation was delivered to 13 priority wetlands in NSW and Victoria (Table 1). The MDWWG delivered approximately 1982.3 ML of Environmental Water Trust (EWT) water and 760 ML and 520 ML (Table 1; Table 2) respectively of environmental water to four wetlands (Middle, Fletchers creek, Grand Junction, LFC) on behalf of our delivery partners which included the Commonwealth Environmental Water Office (CEWO), the Department of Planning Industry and Environment - Energy, Environment and Science (DPIE EES).

Four of the 13 wetlands were new sites which included Middle Wetland on the Billabong Creek (Murrumbidgee) and the Coomealla Lagoons, Grand Junction Wetlands and Thegoa Lagoon situated on the NSW Lower Murray Table 1; Figure1). The total area inundated during 2020-2021 was 489 hectares (Table 1), an increase of 410 ha when compared to 2019-2020 and an increase in cumulative area of ~160 ha since inception of the EWT program in 2016-2017 (MDWWG 2020).

Table 2: Summary of environmental water sources, volumes available and delivered in 2020-2021.

Water source	Volume available 2020-2021 (ML)	Volume used in 2020-2021
EWT including carryover from 2019-20	2103	1982.3
DPIE-EES	760	760
CEW	520	520
Total	3383	3262.3

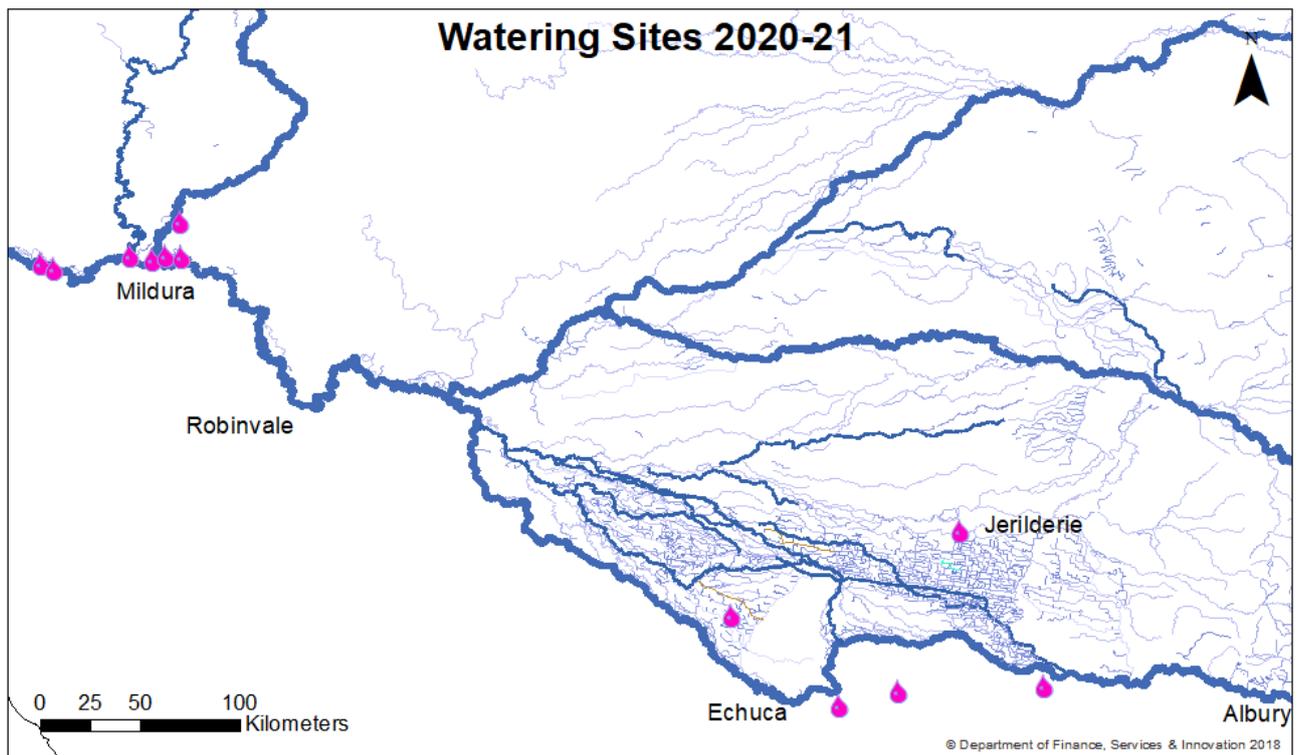


Figure 1: Location map of priority wetlands for 2020-2021

3. Ecological Values, Objectives and Targets

The environmental outcomes identified for priority wetlands align with ecological targets identified in the Basin-wide Environmental Watering Strategy (MDBA 2014) and state Long Term Water Plans:

- ‘Maintain and improve the condition and promote recruitment of forests and woodlands.’
- ‘Improve the condition and extent of Lignum shrublands.’
- ‘Improve abundance and diversity of the Basin’s waterbird population.’
- ‘Other species: frogs’

Long-term ecological objectives were also established for the EWT program which are consistent with the Murray-Darling Basin Plan and include:

- Improve river, floodplain and wetland habitats.
- Improve and increase extent of aquatic habitat and wetland diversity.
- Improve condition, diversity, extent and contiguousness of native water-dependent vegetation.
- Improve recruitment and populations of native water-dependent species, including vegetation, birds, fish and macroinvertebrates.

The MDWWG Team also focused on specific outcomes including:

- Maintaining the health and recruitment opportunities of culturally significant plants and trees
- Providing habitat for threatened waterbirds (including brolga, Australasian bittern and blue-billed and freckled ducks)
- Supporting recovery efforts for the nationally endangered Murray Hardy Head fish
- Supporting recovery efforts for the nationally vulnerable southern bell frog

3.1 Wetland vegetation response

Environmental water delivered in 2020-2021 has inundated 389 hectares of wetlands to improve riparian tree health, with a focus on river red gum (*Eucalyptus camaldulensis*) and black box (*Eucalyptus largiflorens*) communities. Mature trees typically exhibited fresh flushes of growth and a thickening of the canopy within months of been inundated (Figure 2). This is consistent with findings from Val et al (2007) and MDWWG (2020). Lignum (*Duma florulenta*) condition also generally improved with leaves and flowering occurring within months of receiving water which is consistent with observations by Freestone et al (2017) and Campbell et al (2021). Wetland dependent vegetation diversity and abundance across all the priority wetlands increased over time with 125 native plant species identified to date (Appendix 2). Wetland vegetation response is highly variable over space and time, thus individual wetlands are generally unique, exhibiting different plant community composition and contribute to wetland diversity across the Murray Darling Basin (Campbell et al 2013) (Figure 3). Plant species, including cane grass (*Eragrostis australasica*) and jerry jerry (*Ammannia multiflora*), were observed in patchy abundances at several priority wetlands.



Figure 2: Mature river red gums exhibiting thickening of canopy and growth flushes at Grand Junction wetland, NSW. Photo: Sascha Healy



Figure 3: Six priority wetlands inundated in 2020-2021 and their diverse and variable aquatic vegetation response

3.2 Waterbird Abundance and Diversity

Environmental water in 2020-2021 provided suitable habitat for 42 waterbird species including threatened species blue-billed duck (*Oxyura australis*), freckled duck (*Stictonetta naevosa*) and the white-bellied sea eagle (*Haliaeetus Leucogaster*). Nine waterbirds observed to date are listed in NSW, Victorian or Commonwealth legislation as vulnerable, endangered, or migratory (Appendix 1). There is also evidence suggesting that the environmental water may provide important habitat for other fauna including woodland

birds, with 45 species recorded across all sites to date, including the vulnerable listed (NSW) white-fronted chat (*Epthianura albifrons*) (Appendix 3).

The most abundant waterbird species recorded in 2020-2021 (and since inception of the EWT Program) were grey teal (*Anas gracilis*) and the pacific black duck (*Anas superciliosa*). The wetland that recorded the highest diversity was Middle Wetland (Murrumbidgee) followed by The Plain Paddock (Mid-Murray). Six guilds were represented in the waterbird diversity; with ducks the highest represented guild, followed by large waders, and herbivores. The highest number of shorebirds were recorded at Middle Wetland, followed by the Plain Paddock and Andruco Lagoon.

Breeding and immature birds were recorded at four wetlands which included Middle Wetland, Andruco Lagoon, Grand Junction and Little Frenchman’s Creek. Young were observed for grey teal, pink-eared duck (*Malacorhynchus membranaceus*), Australasian grebe (*Tachybaptus novaehollandiae*), pacific black duck, Australian shelduck (*Tadorna tadornoides*) and black-fronted dotterel (*Elseyornis melanops*). Black swans and Australasian Grebes were recorded nesting at Andruco Lagoon, with the swans recorded with two nests in August 2021.

Since inception of the watering program, 50 waterbird species have been recorded (Appendix 4). All regions have recorded similar waterbird diversity numbers, although the Lower Murray Darling has recorded the highest abundances (and has also had the most surveys conducted) (Figure 4). Lake Henry (Wingillie Station) has contributed the highest abundances and diversities across all years followed by the Little Frenchman’s Creek (Wingillie Station) with ~15, 000 and 6, 000 individuals recorded respectively (Figure 5). Both these sites have been watered for multiple years with a high survey effort, however they are also highly productive waterbird sites and consistently provide habitat for large numbers of waterbirds (Figure 4; Figure 5).

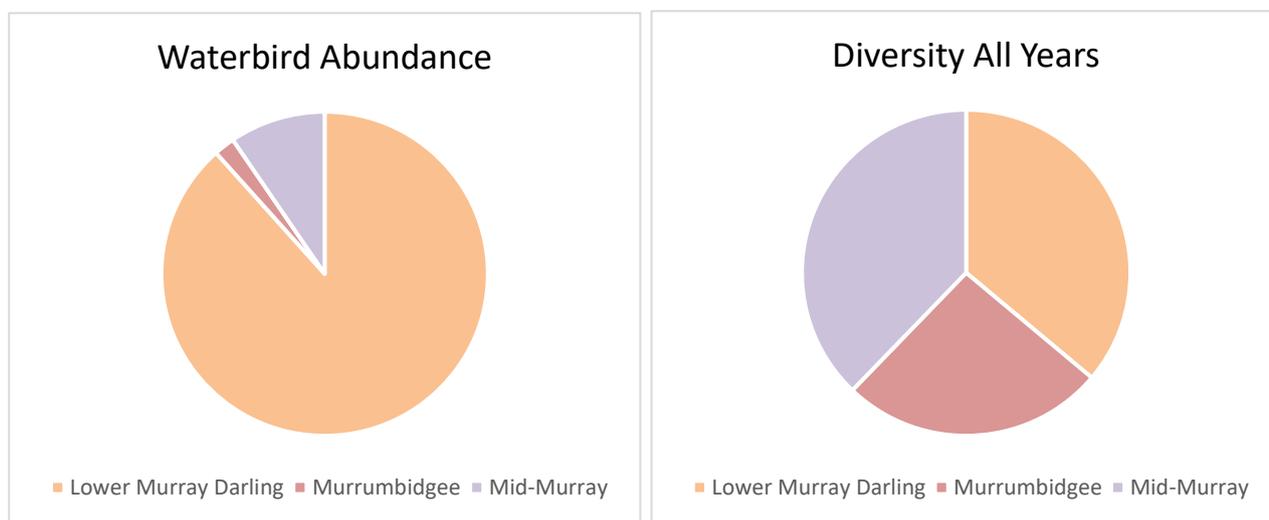


Figure 4: Total diversity and abundance divided between the three regions since inception of EWT program in 2016

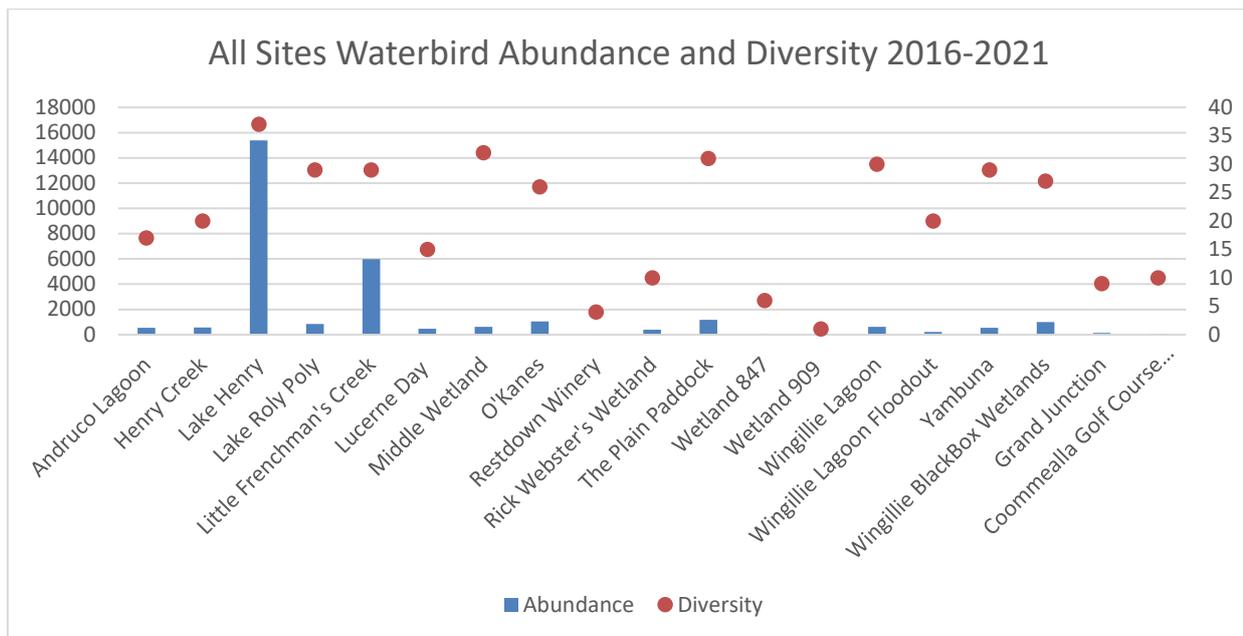


Figure 5: All sites that have been watered through the EWT program since 2016 with the recorded waterbird abundance (left axis) and diversity (right axis).

3.3 Frog Occupancy and Diversity

Ten species of frog have been identified since inception of EWT program in 2016, including the endangered southern bell frog *Litoria raniformis* (Appendix 1; Figure 6).

Ten frog species were also detected in 2020-2021, including plains froglet (*Crinia parinsignifera*), common eastern froglet (*C. signifera*), eastern banjo frog (*Limnodynastes dumerilii*), barking marsh frog (*L. fletcheri*), inland banjo frog (*L. interioris*), spotted marsh frog (*L. tasmaniensis*), striped marsh frog (*L. peronii*), Peron's tree frog (*Litoria peronii*), and Sudell's frog (*Neobatrachus sudellae*). Most species were common to all regions, except the striped marsh frog which was only identified at Victorian wetlands and the inland banjo frog and southern bell frog were only detected at wetlands on the NSW Lower Murray.

Recruitment of common frogs was observed in 2020-2021 across several priority wetlands following inundation (egg masses and tadpoles). Lake Henry, located on Wingillie Station and the neighboring Frenchman's Creek overflow continued to be a stronghold for the southern bell frog in 2020-2021, supporting high numbers of calling males (Waudby et al 2021). Private landholders continue to be major drivers of bell frog conservation according to Waudby et al (2021), with 29 landholders involved in the NSW Saving our Species Program, two of whom are part of MDWWG projects. Efforts by MDWWG staff will be increased to identify southern bell frog occupancy at priority wetlands in 2021-22 and beyond in partnership with the NSW Saving our Species Program.



Figure 6: the southern bell frog has populations throughout the lower Murray, including Wingillie Station. Photo: Sascha Healy

3.4 Small Bodied Fish recruitment (Murray Hardyhead)

A subpopulation of the threatened small-bodied native fish, the Murray hardyhead (MHH) (Figure 7), was translocated from managed wild locations in the Riverland region of South Australia to Little Frenchman's Creek in far West NSW in 2018 and in 2021. The MDWWG has managed two small environmental flows since EWT program inception to dilute saline water and support fish recruitment in the creek. The successful establishment of a persisting population addresses several key objectives for the species under the National Recovery Plan for the species (Ellis et al 2021; Zukowski et al 2021). The continued successful breeding and recruitment of the endangered Murray hardyhead in 2020-2021 is consistent with the Basin-wide Environmental Watering Strategy (2014) where the Murray Hardyhead is listed as a key species.

Ellis et al (2021) reported that MHH population sizes fluctuated seasonally, however DPI Fisheries staff regularly detected multiple MHH cohorts within Little Frenchman's Creek in 2018-2019, 2019-2020 and 2020-2021 which indicates the translocated fish successfully bred.



Figure 7: Murray Hardyhead captured at Little Frenchman's Creek during 2020-2021 surveys conducted by DPI Fisheries. Source: Iain Ellis, DPI Fisheries August 2021

In 2020-2021, low numbers of other native small-bodied fish were collected, including carp gudgeon (*Hypseleotris sp.*), flat-headed gudgeon (*Philypnodon grandiceps*), dwarf flathead gudgeon (*Philypnodon macrostomus*), unspotted hardyhead (*Craterocephalus stercusmuscarum fulvus*) and bony herring (*Nematalosa erebi*). Pest mosquitofish (*Gambusia holbrooki*) were commonly detected, although their abundance decreased when EC increased to $< 60,000 \text{ cm}^{-1}$ (Ellis et al 2021). Of note no carp were captured during surveys in 2020-2021.

4. Moving into 2021-2026

The EWT program has seen numerous positive outcomes since inception, including social benefits such as an increased interest from private landholders to rehabilitate wetlands. We have observed cultural benefits by partnering with First Nations groups to deliver water, help develop cultural watering plans and to protect threatened species. Environmental outcomes have been achieved through the inundation of hundreds of hectares to benefit waterbirds, vegetation and threatened species such as the brolga, SBF and MHH. In the next five years, the MDWWG aim to:

- Continue to support recovery efforts for the endangered southern bell frog by expanding habitat in partnership with DPIE B&C SoS Program
- Continue to support recovery efforts for the nationally endangered Murray Hardy Head by delivering water to site in partnership and as directed by DPI Fisheries
- Continue to improve the condition of river red gum, black box, and lignum communities by maintaining existing wetlands and expanding wetland networks into far west NSW
- Continue to increase extent of aquatic habitat and wetland diversity by increasing number of wetland priorities to be watered
- Continue to support waterbird breeding (including threatened species) by creating and maintaining habitat and expanding wetland networks in proximity of established sites
- Maintain/ improve regent parrot nesting habitat in appropriate sites in Western NSW
- Continue to increase number of priority wetlands to increase the extent of aquatic habitat available for wetland dependant species and for wetland diversity

5. Community Engagement and Partnerships:

The MDWWG continues to enhance the program's outreach, with additional partnerships developed during 2020-2021. Since inception in 2016, the MDWWG has established partnerships with over ten landholders, four First Nations groups including, BMEET, Yarkuwa Knowledge Centre, Nari Nari Tribal Council and Ta-Ru Lands Council. The MDWWG has also enjoyed working with 16 organisations including:

- BMEET
- Commonwealth Environmental Water Holder;
- Coomealla Sporting Club;
- NSW Crown Lands;
- Goulburn Broken Catchment Management Authority;
- Goulburn-Murray Water;
- Hazel L Henry Farmland Nature Refuges;
- Nari Nari Tribal Council;
- NSW National Parks and Wildlife Service;
- NSW DPIE EES;
- NSW DPI Fisheries;
- NSW DPIE Water;
- Parks Victoria;

- SA Water;
- Sunrice Australia
- Tar-Ru Lands Board of Management;
- Trust for Nature (Victoria); and
- Western Local Land Services
- Wetland Revival
- Yarkuwa Knowledge Centre

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Appendix 1. Fauna with VIC, NSW or Commonwealth conservation status 2016-2021

Summary of fauna species with a significant Victorian, NSW or Federal conservation status, recorded at wetland sites as part of the monitoring program delivered since inception of EWT program in 2016

Scientific name	Common name	Group	Victorian Status	NSW Status	National Status
<i>Ardea modesta</i>	eastern-great egret	Waterbird	v		migratory
<i>Artamus cyaneus</i>	dusky woodswallow	Woodland Bird		v	
<i>Aythya australis</i>	hardhead	Waterbird	v		
<i>Calidris acuminata</i>	sharp-tailed sandpiper	Waterbird			migratory
<i>Craterocephalus fluviatilis</i>	murray hardyhead	Fish			e
<i>Daphoenositta chrysoptera</i>	varied sittella	Woodland Bird		v	
<i>Epthianura albifrons</i>	white-fronted chat	Woodland Bird		v	
<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle	Waterbird	v	v	
<i>Litoria raniformis</i>	southern bell frog	Frog	e	e	v
<i>Ninox strenua</i>	powerful owl	Woodland Bird	e		
<i>Oxyura australis</i>	blue-billed duck	Waterbird		v	
<i>Phalacrocorax varius</i>	piebald cormorant	Waterbird	nt		
<i>Platalea regia</i>	royal spoonbill	Waterbird	v		
<i>Plegadis falcinellus</i>	glossy ibis	Waterbird	v		
<i>Polytelis anthopeplus</i>	regent parrot	Woodland Bird	v	e	v
<i>Stictonetta naevosa</i>	freckled duck	Waterbird		v	
conservation status: v – vulnerable, e – endangered, nt – near threatened					

Appendix 2. Cumulative Native Vegetation List 2016-2021

Scientific name	Common name	Scientific name	Common name
<i>Acacia stenophylla</i>	river cooba	<i>Lythrum hyssopifolia</i>	small loosestrife
<i>Alternanthera nodiflora</i>	common joyweed	<i>Marieana pentagona</i>	hairy bluebush
<i>Alternanthera denticulata s.l.</i>	lesser joyweed	<i>Marieana sp.</i>	
<i>Alternanthera sp.</i>	plains joyweed	<i>Marsilea angustifolia</i>	narrow-leaf nardoo
<i>Ammannia multiflora</i>	jerry jerry	<i>Marsilea drumondii</i>	common nardoo
<i>Amphibromus fluitans</i>	river swamp wallaby-grass	<i>Marsilea hirsuta</i>	short-fruit nardoo
<i>Amphibromus nervosus</i>	common swamp wallaby-grass	<i>Mimulus gracilis</i>	slender monkey flower
<i>Asperula conferta</i>	common woodruff	<i>Duma florulenta</i>	lignum
<i>Aster subulatus</i>	aster-weed	<i>Muehlenbeckia horrida</i>	remote thorny lignum
<i>Atriplex leptocarpa</i>	slender fruited saltbush	<i>Myosurus minimus</i>	mousetail
<i>Atriplex lindleyi</i>	eastern flat-top saltbush	<i>Myriocephalus rhozocephalus</i>	woolly mantle
<i>Atriplex semibaccata</i>	creeping saltbush	<i>Myriophyllum crispatum</i>	upright water-milfoil
<i>Azolla filiculoides</i>	azolla	<i>Myriophyllum papillosum</i>	robust water-milfoil
<i>Bothriochloa macra</i>	red-leg grass	<i>Myriophyllum verrucosum</i>	red milfoil
<i>Brachycome heterodonta</i>	lobed-seed daisy	<i>Nymphoides crenata</i>	wavy marshwort
<i>Bracyscome lineariloba</i>	hard-headed daisy	<i>Ottelia ovalifolia</i>	swamp lily
<i>Bromus sp.</i>	soft brome	<i>Paspalidium jubiflorum</i>	Warrego summer grass
<i>Calandrinia calyptrata</i>	pink purslane	<i>Paspalum distichum</i>	water couch
<i>Callitriche stagnalis</i>	common starwort	<i>Persicaria decipiens</i>	slender knotweed
<i>Calotis hispidula</i>	bogan flea	<i>Persicaria hydropiper</i>	water pepper
<i>Carex inversa</i>	knob sedge	<i>Persicaria lapathifolia</i>	pale knotweed
<i>Carex tereticaulis</i>	poong'ort	<i>Persicaria prostrata</i>	creeping knotweed
<i>Centipeda cunninghamii</i>	common sneezeweed	<i>Phyllanthus lacunarius</i>	lagoon spurge
<i>Centipeda minima</i>	spreading sneezeweed	<i>Plantago cunninghamii</i>	sago weed
<i>Ceratophyllum sp.</i>	hornwort	<i>Polygonum plebium</i>	small knotweed
<i>Chara sp</i>	chara	<i>Polygonum prostratum</i>	creeping knotweed
<i>Chenopodium nitrariaceum</i>	nitre goosefoot	<i>Potamogeton sulcatus</i>	Pond weed
<i>Chenopodium pumilio</i>	small crumb weed	<i>Pratia concolor</i>	pratia
<i>Cotula australis</i>	common cotula	<i>Pseudognaphalium luteo-album</i>	jersey cudweed
<i>Crassula colorata</i>	dense stonecrop	<i>Pseudoraphus spinescens</i>	Moira grass
<i>Cynodon dactylon</i>	couch grass	<i>Ranunculus pumilio var. pumilio</i>	fernny small-flower buttercup
<i>Damasonium minus</i>	star fruit	<i>Ranunculus repens</i>	creeping buttercup
<i>Dysphania pumilio</i>	small crumb weed	<i>Ranunculus sessiliflorus</i>	small-flowered Australian buttercup
<i>Eclipta platyglossa</i>	yellow twin heads	<i>Rhagodia spinescens</i>	thorny saltbush
<i>Einadia nutans</i>	climbing saltbush	<i>Ricciocarpus natans</i>	liverwort
<i>Elatine gratioloides</i>	waterwort	<i>Rorippa eustylis</i>	river cress
<i>Eleocharis acuta</i>	common spike-rush	<i>Rumex brownii</i>	slender dock
<i>Eleocharis pusilla</i>	small spiked rush	<i>Rumex tenax</i>	narrow-leaf dock
<i>Elymus scaber var. scaber</i>	common wheat-grass	<i>Rumex sp.</i>	dock
<i>Epaltes australis</i>	creeping nut-heads	<i>Scerolaena sp.</i>	Copper burr
<i>Eriochlamys behrii</i>	woolly mantle	<i>Scerolaena tricuspis</i>	streaked poverty bush
<i>Eucalyptus camaldulensis</i>	river red-gum	<i>Scleroblitum atriplicinus</i>	purple goosefoot
<i>Eucalyptus largiflorens</i>	black box	<i>Sclerolaena brachyptera</i>	hairy bassia

Scientific name	Common name	Scientific name	Common name
<i>Gamochaeta purpurea</i>	spike cudweed	<i>Sclerolaena muricata</i>	black roly-poly
<i>Geococcus pusillus</i>	earth cress	<i>Sclerolaena stelligera</i>	star copper burr
<i>Glinus lotoides</i>	hairy carpet weed	<i>Sclerolaena tricuspis</i>	streaked poverty bush
<i>Glycyrrhiza acanthocarpa</i>	native licorice	<i>Senecio glossanthus</i>	slender groundsel
<i>Gnaphalium luteo-album</i>	jersey cudweed	<i>Senecio lacunarium</i>	lagoon nightshade
<i>Goodenia sp.</i>	goodenia	<i>Senecio quadridentatus</i>	cotton fireweed
<i>Halogaris heterophylla</i>	raspwort	<i>Senecio runcinifolia</i>	
<i>Juncus aridicola</i>	tussock rush	<i>Solanum lacunarium</i>	lagoon nightshade
<i>Juncus ingens</i>	giant rush	<i>Sporobulus mitchelli</i>	rat's-tail couch
<i>Juncus sp.</i>	rush	<i>Stellaria sp.</i>	starwort
<i>Lachnagrostis filifolia s.l</i>	common blown-grass	<i>Stemodia florulenta</i>	bluerod
<i>Lemna disperma</i>	duckweed	<i>Tetragonia tetragonoides</i>	New Zealand spinach
<i>Lepidium hyssopifolium</i>	peppergrass	<i>Typha sp</i>	cumbungi
<i>Lepidium pseudohyssopifolium</i>	peppergrass	<i>Triglochin procera s.s.</i>	common water-ribbons
<i>Lilaeopsis polyantha</i>	<i>lilaeopsis</i>	<i>Vallisneria australis</i>	ribbon weed
<i>Limosella australis</i>	mudwort	<i>Walhenbergia fluminalis</i>	river bluebell
<i>Lolium rigidum</i>	Wimmera rye-grass	<i>Walwhalleya proluta</i>	rigid panic
<i>Ludwigia peploides</i>	water primrose	<i>Zehneria micrantha</i>	desert cucumber
<i>Ludwigia peploides subsp. montevidensis</i>	clove-strip		

Appendix 3. Cumulative Woodland bird List 2016-2021

Scientific name	Common name	Scientific name	Common name
<i>Acanthiza chrysorrhoa</i>	yellow-rumped thornbill	<i>Haliastur sphenurus</i>	whistling kite
<i>Acanthiza lineata</i>	striated thornbill	<i>Hirundo neoxena</i>	welcome swallow
<i>Acanthiza uropygialis</i>	chestnut-rumped thornbill	<i>Lichenostomus penicillatus</i>	white-plumed honeyeater
<i>Accipiter cirrocephalus</i>	collared sparrowhawk	<i>Malurus cyaneus</i>	superb fairy-wren
<i>Aquila audax</i>	wedge-tailed eagle	<i>Malurus lamberti</i>	variegated fairy-wren
<i>Cacatua galerita</i>	sulphur-crested cockatoo	<i>Malurus leucopterus</i>	white-winged fairy-wren
<i>Cacatua sp.</i>	corella sp.	<i>Manorina melanocephala</i>	noisy miner
<i>Cincloramphus mathewsi</i>	rufous songlark	<i>Ninox novaeseelandiae</i>	southern boobook
<i>Coracina novaehollandiae</i>	black-faced cuckoo-shrike	<i>Northiella haematogaster</i>	blue bonnet
<i>Corcorax melanorhamphos</i>	white-winged chough	<i>Ocyphaps lophotes</i>	crested pigeon
<i>Corvus coronoides</i>	Australian raven	<i>Pachycephala pectoralis</i>	golden whistler
<i>Corvus mellori</i>	little raven	<i>Pardalotus striatus</i>	striated pardalote
<i>Cracticus nigrogularis</i>	piebald butcher bird	<i>Petrochelidon nigricans</i>	tree martin
<i>Cracticus tibicen</i>	Australian magpie	<i>Platycercus elegans flaveolus</i>	yellow rosella
<i>Dacelo novaeguineae</i>	laughing kookaburra	<i>Platycercus eximius</i>	eastern rosella
<i>Dromaius novaehollandiae</i>	emu	<i>Plectorhyncha lanceolata</i>	striped honeyeater
<i>Entomyzon cyanotis</i>	blue-faced honeyeater	<i>Pomatostomus temporalis</i>	grey-crowned babbler
<i>Eolophus roseicapillus</i>	galah	<i>Psephotus haematonotus</i>	red-rumped parrot
<i>Epthianura albifrons</i>	white-fronted chat	<i>Rhipidura leucophrys</i>	willie wagtail
<i>Falco cenchroides</i>	nankeen kestrel	<i>Smicronis brevirostris</i>	weebill
<i>Geopelia striata</i>	peaceful dove	<i>Strepera graculina</i>	piebald currawong
<i>Grallina cyanoleuca</i>	magpie lark	<i>Struthidea cinerea</i>	apostlebird

Appendix 4. Cumulative Waterbird List 2016-2021

Scientific name	Common name	Scientific name	Common name
<i>Anhinga novaehollandiae</i>	Australasian darter	<i>Aythya australis</i>	hardhead
<i>Tachybaptus novaehollandiae</i>	Australasian grebe	<i>Poliiocephalus poliocephalus</i>	hoary-headed grebe
<i>Anas rhynchotis</i>	Australasian shoveler	<i>Phalacrocorax sulcirostris</i>	little black cormorant
<i>Porphyrio porphyrio</i>	purple swamphen	<i>Megalurus gramineus</i>	little grassbird
<i>Pelecanus conspicillatus</i>	Australian pelican	<i>Microcarbo melanoleucos</i>	little pied cormorant
<i>Acrocephalus australis</i>	Australian reed-warbler	<i>Vanellus miles</i>	masked lapwing
<i>Tadorna tadornoides</i>	Australian shelduck	<i>Nycticorax caledonicus</i>	nankeen night-heron
<i>Porzana fluminea</i>	Australian spotted crake	<i>Anas superciliosa</i>	pacific black duck
<i>Threskiornis moluccus</i>	Australian white ibis	<i>Phalacrocorax varius</i>	pied cormorant
<i>Chenonetta jubata</i>	Australian wood duck	<i>Malacorhynchus membranaceus</i>	pink-eared duck
<i>Ceyx azureus</i>	azure kingfisher	<i>Merops ornatus</i>	rainbow bee-eater
<i>Cygnus atratus</i>	black swan	<i>Charadrius ruficapillus</i>	red-capped plover
<i>Elsyornis melanops</i>	black-fronted dotterel	<i>Erythronys cinctus</i>	red-kneed dotterel
<i>Tribonyx ventralis</i>	black-tailed native-hen	<i>Recurvirostra novaehollandiae</i>	red-necked avocet
<i>Himantopus leucocephalus</i>	black-winged stilt	<i>Myiagra inquieta</i>	restless flycatcher
<i>Oxyura australis</i>	blue-billed duck	<i>Platalea regia</i>	royal spoonbill
<i>Hydroprogne caspia</i>	Caspian tern	<i>Todiramphus sanctus</i>	sacred kingfisher
<i>Anas castanea</i>	chestnut teal	<i>Calidris acuminata</i>	sharp-tailed sandpiper
<i>Gallinula tenebrosa</i>	dusky moorhen	<i>Threskiornis spinicollis</i>	straw-necked ibis
<i>Ardea alba</i>	eastern great egret	<i>Chlidonias hybrida</i>	whiskered tern
<i>Fulica atra</i>	Eurasian coot	<i>Haliastur sphenurus</i>	whistling kite
<i>Stictonetta naevosa</i>	freckled duck	<i>Haliaeetus leucogaster</i>	white-bellied sea-eagle
<i>Plegadis falcinellus</i>	glossy ibis	<i>Egretta novaehollandiae</i>	white-faced heron
<i>Phalacrocorax carbo</i>	great cormorant	<i>Ardea pacifica</i>	white-necked heron
<i>Anas gracilis</i>	grey teal	<i>Platalea flavipes</i>	yellow-billed spoonbill