Victorian Duck Season Priority Waterbird Count, 2023

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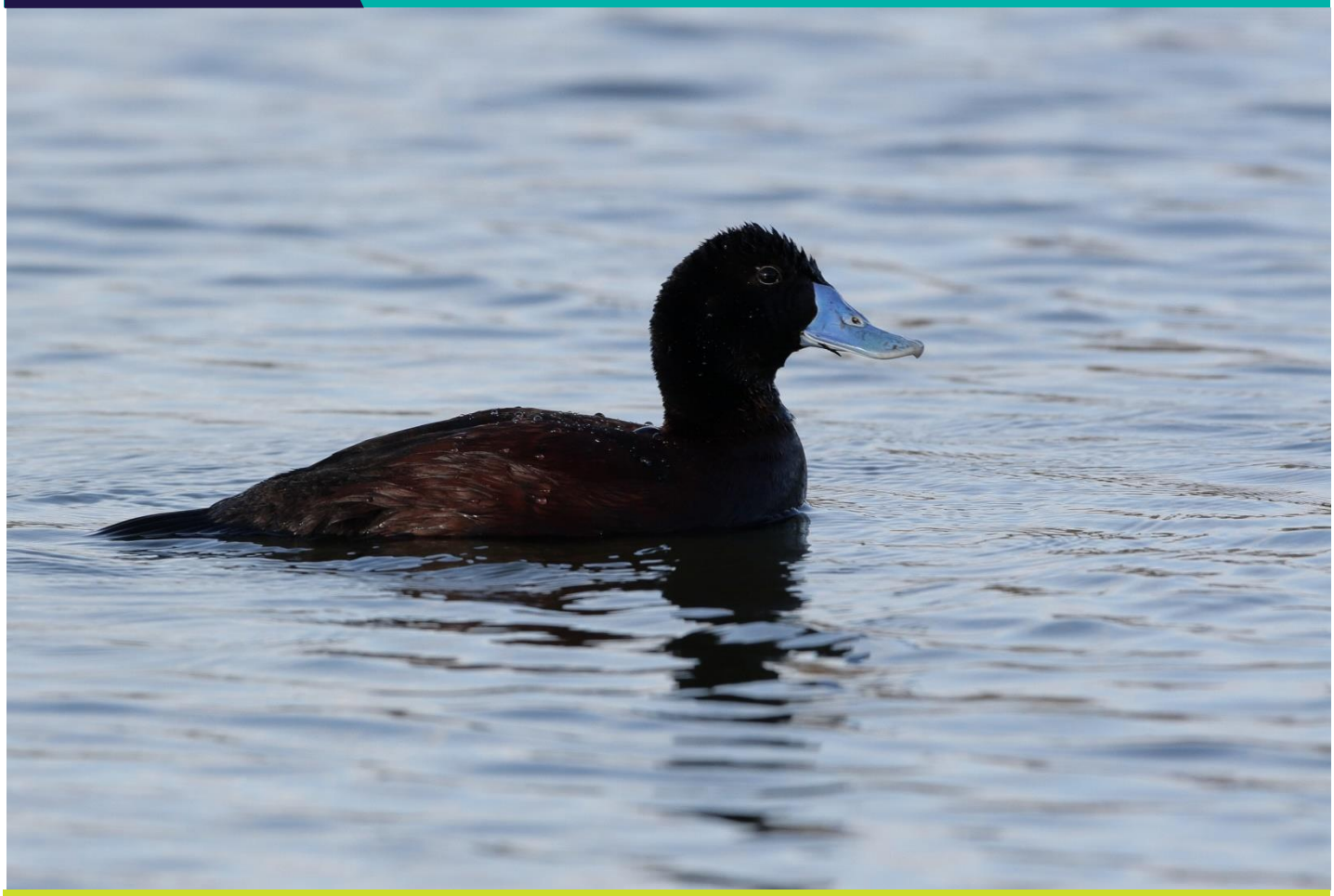

Arthur Rylah Institute for Environmental Research
Unpublished Client Report

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Acknowledgment

We acknowledge and respect Victorian Traditional Owners as the original custodians of Victoria's land and waters, their unique ability to care for Country and deep spiritual connection to it. We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

We are committed to genuinely partner, and meaningfully engage, with Victoria's Traditional Owners and Aboriginal communities to support the protection of Country, the maintenance of spiritual and cultural practices and their broader aspirations in the 21st century and beyond.

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Front cover photo: Adult male Blue-billed Duck. Photo P. Menkhorst

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Summary

Context

The Victorian Duck Season Priority Waterbird Count is a state-wide survey of game duck species and other selected waterbird species on popular duck hunting wetlands. It is conducted each year in the lead up to the Victorian duck hunting season. Based on the usual duck season start date of mid-March, a count was carried out between 7 and 20 February 2023. However, the announcement that a hunting season would be held, and its duration, was not made until early March, with the start date set at 26 April, necessitating revisits to a subset of wetlands during mid–late March.

Aims

The Duck Season Priority Waterbird Count gathers numerical, locational and breeding data about game ducks and threatened waterbirds to inform management decisions regarding the forthcoming duck hunting season. Specifically, the aims are:

- to identify wetlands that are open to hunting and are holding large numbers of significant, non-game waterbirds (to inform consideration of further regulation of hunting, including closure of individual wetlands to hunting).
- to identify cases of local breeding by waterbirds, particularly colony-breeding species (for consideration of further regulation, including closure to hunting).
- to provide details on the distribution and numbers of game and priority non-game species of waterbirds on wetlands open to hunting.
- to collect data to inform the Interim Harvest Model which is used to inform decisions about duck hunting arrangements in subsequent years.

Key results

In 2023 the total count of ducks belonging to the eight game species was 28% of the long-term mean, reflecting the low numbers of ducks present in the state at the time. The low numbers of ducks in Victoria is presumably a result of extensive floods in northern New South Wales and southern Queensland which created breeding habitat that is assumed to have attracted waterbirds from throughout south-eastern Australia, including most of Victoria.

The number of Freckled Ducks encountered during the DSPWC was very low (17), continuing the low count from the previous year. However, a large aggregation of at least 246 Freckled Duck was subsequently found at Lake Buloke in early May 2023.

Conclusions and implications

The 2023 Duck Season Priority Waterbird Count was efficiently conducted within the time frames stipulated by the season opening date. The continuing La Niña climate conditions again resulted in relatively low numbers of game ducks being present in Victoria in February–March 2023. Based on data collected during the count, ten wetlands were identified as warranting extra management attention during the 2023 duck hunting season.

Introduction

Project context

Annual counts of waterbirds in the lead-up to the opening of duck hunting season have been conducted at wetlands across Victoria since 1987. The counts were instigated following a recommendation from a review of the management of duck hunting within the state (Loyn 1989, 1991). Between 1987 and 2014, the purpose of the counts (then referred to as the Summer Waterbird Count) was to count waterbirds at as many wetlands as possible across Victoria, regardless of hunting status, but with an emphasis on eight duck species designated as game species (*Wildlife (Game) Regulations 2012* schedule 11). This information was used to inform management decisions about further regulation of hunting on specific wetlands during the forthcoming duck hunting season.

In 2015, a new approach was introduced that limited survey coverage to wetlands that have been historically important duck hunting sites on public land or are open to hunting and have a history of supporting threatened waterbird species. There has also been an increasing emphasis on broadening the focus of the surveys to include all threatened waterbirds, including species not often recorded during earlier counts. This change reflects a concern that duck hunting could have more nuanced impacts on waterbirds than simply direct mortality (Menkhorst 2019, Menkhorst and Thompson 2022). This changed approach is reflected in the list of target species, as well as the change of name of the count to Duck Season Priority Waterbird Count (DSPWC) and adjusting the layout of the field data sheet accordingly.

Data collected during the pre-duck season counts have also proven to be valuable for other purposes, including informing the development of management plans for Ramsar sites and other individual wetlands, providing critical data for the Interim Harvest Model used to recommend season length and bag sizes (e.g., Klaassen & Kingsford 2021) and monitoring population trends of individual species (e.g., Pacioni et al. 2017).

All count data obtained during these surveys are stored in departmental databases held at the Arthur Rylah Institute for Environmental Research (ARI) and are submitted to the Victorian Biodiversity Atlas. The results of these annual counts have been published in various reports (Martindale 1988; Hewish 1988; Peter 1989–1992; Purdey and Loyn 2008-2011, 2013; Purdey and Menkhorst 2014–2015) or are available as unpublished reports (Price 1993; O'Brien 1994; Pert 1995; Norman 1996–2006; Norman and Purdey 2007; Menkhorst and Purdey 2016; Menkhorst et al. 2017–2022) and since 2014 have been made available on the website of the Game Management Authority, Victoria (https://www.gma.vic.gov.au/research/duck-research).

The objectives of the 2023 DSPWC were to:

1. identify wetlands that are open to hunting and currently support large numbers of significant, non-game waterbirds (to inform consideration of further regulation, including possible closure of individual wetlands to hunting).
2. identify cases of local breeding by waterbirds, particularly colony-breeding species (for consideration of further regulation, including closure to hunting).
3. provide details on the distribution and numbers of game and non-game species of waterbirds on wetlands open to hunting.
4. collect data to inform the Interim Harvest Model which is used to inform decisions about duck hunting arrangements in subsequent years.

Methods

Count organisation

In 2023, the field component of the counts was shared equally by the Department of Energy, Environment and Climate Action (DEECA) and the Game Management Authority (GMA). Staff from Catchment Management Authorities and Birdlife Australia also contributed counts. Within DEECA, five regional coordinators were assigned the task of arranging on-ground logistics and ensuring data sheets were submitted within the timelines. The GMA nominated one staff member to coordinate their surveys and data submission.

Each regional coordinator was responsible for liaising locally with DEECA and GMA officers in their region, distributing instructions and count forms, and ensuring adequate coverage of regional wetlands without duplication. The coordinators acted as a conduit for problems encountered during surveys and were expected to review completed forms before forwarding them to the authors at ARI by a specified date.

Regional coordinators were also required to inform the authors immediately if any of the priority species were detected or significant breeding events by, for example, colony-breeding waterbirds, were found during counts. In cases where a wetland was counted by persons other than government agency staff and significant waterbird values were reported, a government agency staff member was sent to the site to verify the report.

Completed forms, once processed locally, were scanned and emailed to the authors as soon as possible. This allowed preliminary data to be examined for records of rare or threatened non-game species, or any evidence of breeding birds that might require special protection. At ARI, the authors checked all data sheets for accuracy and completeness, queried coordinators or individual observers on unusual or deficient records and entered data into a Microsoft Access© database.

Timing of the count relative to season opening

Dates for the counts are set so that enough time is available to recommend further regulation of duck hunting and for management action to be legally enacted prior to the opening of the hunting season. The period of the count has been reduced to 14 days with the end date being as close as possible to opening day of the duck season while also allowing sufficient time for a review of the data followed by consultation with stakeholders and implementation of the necessary legal mechanisms to allow management actions to be implemented before the season opens. This timing helps to minimise error due to waterbird movements between the count and opening day of the hunting season. Even so, the period between the count and opening day, which is necessitated by requirements to implement legal mechanisms under the Victorian *Wildlife Act 1975*, is roughly three weeks in any given year, an ample period for flocks of waterbirds to change location. This time lag remains a shortcoming in the decision-making process as it is currently structured. To minimise the chance of errors due to waterbird movements, wetlands at which significant values (numbers of a threatened species exceeding the threshold, or significant breeding activity) are identified during the count are monitored by GMA or DEECA staff prior to management decisions being finalised to ensure that the issue still exists at the site. Further targeted monitoring by GMA or DEECA staff may take place throughout the duck hunting season to assess the need for further management intervention, such as further closures or re-openings.

Timing of the 2023 count

The Victorian Government implemented significant changes to the duck hunting season in 2023. The season was short – 36 days – and began late, running from 26 April until 31 May. Formal announcement of the season start date was not received until after the initial DSPWC had been completed, on the assumption of a ‘traditional’ mid-March opening of the season. Thus, the initial Duck Season Priority Waterbird Count took place between 7 and 20 February. Following the announcement of the delayed start, a decision was made to revisit a subset of wetlands between 16 and 28 March 2023. The subset consisted of those wetlands identified in the first DSPWC as warranting consideration for further management action, plus some others that have held significant waterbird values in previous years, such as known Brolga flocking sites.

Wetlands surveyed

The list of priority wetlands for the 2023 season was reduced from that used in recent years to eliminate some wetlands that have problematic access through private land, and to better match staffing capacity. The 121 priority wetlands for 2023 are listed in Appendix 1.

Field methods

Counts were made of targeted waterbird species (see below) on a wetland (or a defined part of a large wetland), using binoculars or tripod-mounted spotting scopes. Observers were asked to record the wetland name, location (using Australian Map Grid reference or nearest town as a guide), date, time, priority species present and number of individuals of each priority species. At each wetland, an estimate of water level was taken (as a percentage of its full supply level) and, if the entire wetland could not be surveyed, an estimate was sought of the proportion of the wetland that was surveyed. Observations of breeding by any waterbird species were also recorded, including numbers of broods or nests (and nest contents where appropriate). Wetlands that were found to be dry, or almost so, were generally not formally surveyed but were simply noted to be not supporting waterbirds.

Species counted and analysed

Species targeted for counting are the eight game duck species plus 12 rare or threatened non-game species that have been identified as being at risk of being shot mistakenly by hunters due to their resemblance or association with game species (e.g., Freckled Duck) or are particularly susceptible to the sorts of disturbance associated with duck hunting (Menkhorst 2019, Menkhorst and Thompson 2022) (Table 1). Other waterbird species are also counted as time permits. This is a significant change from the previous Summer Waterbird Count which targeted the eight game species plus eight specified non-game species, including some abundant species such as Black Swan and Hoary-headed Grebe.

Particular attention is also given to identifying active waterbird breeding colonies where adverse impacts of disturbance by hunters may be amplified by the numbers of birds present in a relatively small area. Waterbird species that may breed colonially at Victorian wetlands open to hunting are listed in Table 2.

Table 1. The priority species for the 2023 Duck Season Priority Waterbird Count.

*Note that two game species, the Australasian Shoveler and the Hardhead, were prohibited from being hunted during the 2023 season.

	English name	Scientific name
Game species		
	Australian Shelduck	*Tadorna tadornoides*
	Australian Wood Duck	*Chenonetta jubata*
	Australasian Shoveler*	*Anas rhynchotis*
	Chestnut Teal	*Anas castanea*
	Grey Teal	*Anas gracilis*
	Hardhead*	*Aythya australis*
	Pacific Black Duck	*Anas superciliosa*
	Pink-eared Duck	*Malacorhynchus membranaceus*
Non-game priority species		
	Australian Painted-snipe	*Rostratula australis*
	Australasian Bittern	*Botaurus poiciloptilus*
	Blue-billed Duck	*Oxyura australis*
	Brolga	*Grus rubicunda*
	Curlew Sandpiper	*Calidris ferruginea*
	Freckled Duck	*Stictonetta naevosa*
	Great Egret	*Ardea alba*
	Intermediate Egret	*Egretta intermedia*
	Latham's Snipe	*Gallinago hardwickii*
	Little Egret	*Egretta garzetta*
	Magpie Goose	*Anseranas semipalmata*
	Musk Duck	*Biziura lobata*

Table 2. Waterbird species that may breed colonially at wetlands open to hunting in Victoria.

	English name	Scientific name
	Australasian Darter	*Anhinga novaehollandiae*
	Australian Painted-snipe	*Rostratula australis*
	Australian Pelican	*Pelecanus conspicillatus*
	Australian White Ibis	*Threskiornis moluccus*
	Caspian Tern	*Hydroprogne caspia*
	Eastern Cattle Egret	*Bubulcus coromandus*
	Fairy Tern	*Sternula nereis*
	Glossy Ibis	*Plegadis falcinellus*
	Great Cormorant	*Phalacrocorax carbo*
	Great Egret	*Ardea alba*
	Gull-billed Tern	*Gelochelidon nilotica*
	Intermediate Egret	*Egretta intermedia*
	Little Black Cormorant	*Phalacrocorax sulcirostris*
	Little Egret	*Egretta garzetta*
	Little Pied Cormorant	*Microcarbo melanoleucos*
	Little Tern	*Sternula albifrons*
	Magpie Goose	*Anseranas semipalmata*
	Nankeen Night-Heron	*Nycticorax caledonicus*
	Pied Cormorant	*Phalacrocorax varius*
	Pied Stilt	*Himantopus leucocephalus*
	Red-necked Avocet	*Recurvirostra novaehollandiae*
	Royal Spoonbill	*Platalea regia*
	Silver Gull	*Chroicocephalus novaehollandiae*
	Straw-necked Ibis	*Threskiornis spinicollis*
	Whiskered Tern	*Chlidonias hybrida*
	Yellow-billed Spoonbill	*Platalea flavipes*

Results

Number of wetlands counted

The 2023 DSPWC contributes to a dataset now spanning the 36 years from 1987. In 2023, counts were made at 121 priority wetlands that held water. A further 6 priority wetlands were dry and were not counted (see Appendix 1) giving a total of 127 priority wetlands assessed (90%). Waterbirds at a further 14 non-priority wetlands were also counted (Appendix 2).

The numbers of priority wetlands in each DEECA region and the number that were surveyed or not surveyed in 2023 are shown in Table 3. Table 4 shows the annual effort since counts began in 1987 and the numbers of game and non-game birds counted.

Table 3. Coverage of priority wetlands in the 2023 Duck Season Priority Waterbird Count by DEECA region.

Dry wetlands were not surveyed but are considered to have been 'assessed'.

DEECA region	Number of priority wetlands	Number of priority wetlands holding water and surveyed (%)		Number of priority wetlands that were dry (%)	Number of priority wetlands not surveyed (%)
		1st count	2nd count		
Barwon South West	31	29	9	0	2
Gippsland	15	14	3	0	1
Grampians	34	26	8	1	8
Hume	16	16	3	5	0
Loddon Mallee	39	36	14	0	3
All	**135**	**121 (90)**	**37**	**6 (4)**	**14 (10)**

Table 4. Summary of Summer Waterbird Counts and Duck Season Priority Waterbird Counts conducted in Victoria from 1987 to 2023.

*Count severely affected by COVID-19 pandemic travel restrictions.

Year	Count period	Number of wetlands surveyed	Total count of game species	Total count of non-game species
1987	17 – 25 January	332	205,000	177,000
1988	6 – 14 February	472	294,108	185,821
1989	4 – 12 February	626	292,598	170,375
1990	18 – 26 February	668	385,148	225,230
1991	16 – 24 February	786	414,417	264,610
1992	22 February – 1 March	659	408,004	219,411
1993	20 – 28 February	534	218,562	107,650
1994	26 February – 6 March	284	292,899	173,887
1995	25 February – 5 March	367	196,955	141,609
1996	24 February – 3 March	234	200,861	197,916

Year	Count period	Number of wetlands surveyed	Total count of game species	Total count of non-game species
1997	22 February – 2 March	223	124,914	92,003
1998	21 February – 1 March	309	216,476	152,348
1999	27 February – 7 March	312	206,839	128,969
2000	26 February – 5 March	298	128,021	78,675
2001	24 February – 4 March	336	240,671	102,926
2002	23 February – 3 March	225	231,235	106,191
2003	22 February – 2 March	175	155,623	93,972
2004	21 – 29 February	249	187,139	85,468
2005	19–27 February	272	155,069	81,950
2006	25 February – 5 March	268	182,487	85,887
2007	24 February – 4 March	176	91,210	46,770
2008	23 February – 2 March	191	58,628	41,454
2009	21 February – 1 March	161	78,723	38,283
2010	20–28 February	153	77,649	35,485
2011	19 February – 6 March	201	104,903	16,768
2012	11 February – 4 March	136	212,865	81,848
2013	9 February – 2 March	133	185,507	103,467
2014	10 – 23 February	166	267,055	113,717
2015	16 – 28 February	126	159,666	74,290
2016	15 – 26 February	131	92,168	74,452
2017	13 – 24 February	127	283,430	114,463
2018	12 – 23 February	144	262,397	130,762
2019	11 – 22 February	135	225,733	85,889
2020*	30 March – 12 April & 22 – 30 April	62	3,250	10,093
2021*	19 April – 4 May	84	45,730	20,532
2022	7 – 20 February	139	40,202	10,791
2023	7 – 20 February & 16 – 28 March	127	52,129	24,140
Mean		**270**	**188,602**	**100,968**

Game species

In 2023, the total count of ducks belonging to the eight game species was 52,129, 28% of the long-term mean (Table 4). Considering only recent years, the total count of game ducks was only 25% of the mean count from the eight years of reasonably consistent effort between 2012 and 2019 (i.e., a mean of 211,103 game ducks) (Table 4), despite a return to surveying a similar number of wetlands (121) after the lifting of travel restrictions related to the Covid-19 pandemic in 2020 and 2021. This relative scarcity of game species, and waterbirds generally (~26% of the long-term mean), presumably reflected the La Nina event during years 2020–2023 which generated extraordinary rainfall in eastern Australia, particularly across north-

eastern New South Wales and south-eastern Queensland. These rainfall events have resulted in strong flows in inland rivers, flooding the Channel-country and elsewhere in northern New South Wales and south-western Queensland, likely attracting many waterbirds from southern regions, a pattern supported by long-term waterbird counts from coastal Victoria (Loyn et al. 2014, Clarke et al. 2015).

One species, the Grey Teal, made up 44% of the total game duck count, with the Chestnut Teal contributing a further 19%, Australian Shelduck 14% and Pacific Black Duck 11%, meaning these three species made up 88% of all game ducks counted. Australian Wood Duck accounted for 8% of all game ducks counted and the remaining 3 species (Australasian Shoveler, Hardhead and Pink-eared Duck) made a negligible contribution.

Threatened waterbirds considered sensitive to disturbance

Sightings were made of 9 of the 12 threatened, non-game waterbird species targeted for attention during the 2023 DSPWC (see Table 1). Each is briefly considered below.

Blue-billed Duck

The Blue-billed Duck is a non-game species that is of particular concern because it is listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988.* During the 2023 DSPWC, the Blue-billed Duck was recorded at 22 wetlands with the largest group being 72 at Lake Terangpom. On 5 May 2023, outside the DSPWC period, 752 Blue-billed Ducks were counted at Lake Buloke (D. Rogers and J. Davies, ARI pers comm).

Brolga

The Brolga is a non-game species that is of particular concern because it is listed as Endangered under the *Flora and Fauna Guarantee Act 1988.* An aggregation of 22 Brolgas was present at Greens Swamp (near Glenthompson) on 28 March and 16 were at Bryans Swamp on 24 March. Brolgas were also present in small numbers (up to 9) at Merin Merin Swamp during the count.

Freckled Duck

The Freckled Duck is a non-game species that is of particular concern because it is listed as Endangered under the *Flora and Fauna Guarantee Act 1988*. Freckled Ducks are at risk of being shot during duck hunting season because they can be difficult to distinguish from Pacific Black Duck when flying. During the 2023 DSPWC, the Freckled Duck was recorded only at Lake Natimuk. After the DSPWC period, 246 Freckled Duck were recorded at Lake Buloke, on 5 May (D. Rogers and J. Davies, ARI, pers comm).

Great Egret

The Great Egret is listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988.* This species was present at 24 of the monitored wetlands with a large aggregation at Gaynors Swamp – an estimated 100 individuals were present on 21 March.

Intermediate Egret

The Intermediate Egret is listed as Critically Endangered under the *Flora and Fauna Guarantee Act 1988.* It was recorded as singles or twos at six widely scattered wetlands during the count. The 2021 breeding event at Lake Guyatt in Sale (Menkhorst and Stamation 2021) did not appear to be active in the 2022-23 spring-summer-autumn period.

Little Egret

The Little Egret is listed as Endangered in Victoria. Breeding appears to be confined to several tiny colonies near Geelong, Queenscliff and at Mud Islands. Former breeding colonies at Gunbower Island on the Murray River have been inactive for several decades. Little Egrets were reported at 10 wetlands during the DSPWC, including 15 at Gaynors Swamp on 21 March, a large aggregation for an inland Victorian site.

Latham's Snipe

Although not formally listed as threatened in Victoria, there is concern that Latham's Snipe is declining. It was listed as Vulnerable in the latest Action Plan for Australian Birds (Garnett and Baker 2021). An estimate of 50 birds was made at Merin Merin Swamp on 11 February.

Magpie Goose

The Victorian population of the Magpie Goose is the result of a reintroduction program conducted by the Fisheries and Wildlife Department during the 1960s (Emison et al. 1987). The population of free-flying birds has expanded in recent years and several counts of over 2000 birds were made at Serendip Sanctuary and in the surrounding area between 2013 and 2016 (Morley and Alcorn 2018 pp 12-13). These birds seem to range across western Victoria and into south-eastern South Australia (e.g. Bool Lagoon) (P. Menkhorst unpublished data). During the survey an unprecedented influx of Magpie Geese occurred in the mid-Murray region with an estimated 300 birds present in the Kerang region during February and March. Breeding was recorded at Wirra Lo wetland, on private property north-west of Kerang, in February-March (Damien Cooke pers comm).

Musk Duck

The Musk Duck is listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988.* It was recorded at 32 wetlands during the 2023 count, but numbers were low at all sites.

Breeding and moulting

The Victorian duck hunting season is timed to occur after the main waterbird breeding period (July–January in Victoria) and after game species have completed their post-breeding moult. No active waterbird breeding colonies were recorded during the 2023 count.

Further regulation of hunting activity

In 2023, information collected during the DSPWC contributed to decisions to further regulate hunting activity. This included the complete closure of 10 wetlands due to the presence of significant numbers of a least one threatened waterbird (Table 5), and the partial closure of Reedy Lake near Nagambie due to the presence of a large camp of Grey-headed Flying-foxes (listed as Vulnerable under the *Flora and Fauna Guarantee Act 1988*).

Table 5. Wetlands that received further regulation of hunting based on the information collected during the 2023 Duck Season Priority Waterbird Count.

Wetland name	Action trigger	Management action
Anderson Inlet	Orange-bellied Parrot	Closed to hunting
Bryan Swamp	Brolga	Closed to hunting
Gaynor Swamp	Great Egret	Closed to hunting
Green Swamp	Brolga	Closed to hunting
Lake Elingamite	Magpie Goose, Australasian Shoveler	Closed to hunting
Lake Goldsmith	Australasian Shoveler	Closed to hunting
Lake Muirhead	Brolga	Closed to hunting
Lake Murphy	Magpie Goose	Closed to hunting
Lake Natimuk	Australasian Shoveler	Closed to hunting
Reedy Lake	Grey-headed Flying-fox	Partial closure
Tower Hill	Blue-billed Duck, Australasian Shoveler	Closed to hunting

Discussion

The 2023 duck season was only about a third of the traditional length (36 days rather than about 87 days) with a late opening date of 26 April. The announcement of the commencement date was made after the DSPWC had already been conducted between 6 and 26 February, on the assumption of a standard mid-March opening. Therefore, a subset of 37 key wetlands was resurveyed between 16 and 26 March. The new arrangements of sharing the field work equally between DEECA and the GMA worked well and 90% of the 135 priority wetlands were assessed (only 4% of them were dry in mid- to late-February).

The total count of game ducks in the 2023 DSPWC was 25% of the mean for the past decade (excluding pandemic-affected counts in 2020 and 2021), despite counts occurring at a high proportion of priority wetlands that held water. The degree to which this low count is due to its timing or the exceptional area of flooded ephemeral wetlands to the north of Victoria cannot be determined, but both are likely to have contributed.

Limitations and constraints

The limitations and constraints of the DSPWC need to be appreciated when considering the results. While it is the only long-term, land-based survey of the State's waterbirds, with annual counts since 1987, the number of wetlands surveyed has declined from a peak of 786 wetlands in 1991, to 121–150 in recent years. Regional organisers are now encouraged to focus survey effort on those wetlands that are on public land, are open to hunting and which consistently hold large numbers of game species. This biases the data towards waterbird species that prefer large and more permanent wetlands (such as Hardhead, Blue-billed Duck, Eurasian Coot and Hoary-headed Grebe), and against those species that prefer shallower, ephemeral and more highly vegetated wetlands (such as teal, Australasian Shoveler, Pink-eared Duck and bitterns). Furthermore, as survey coverage decreases, the chances of the survey failing to record aggregations of significant species increases, which compromises the value of the counts as a tool for minimising the impact of duck hunting on wetland values.

The future

The original Summer Waterfowl Count was designed to achieve two main objectives (Loyn 1989, 1991):

1. to locate flocks of threatened waterfowl or breeding aggregations of waterbirds that may warrant additional management during the coming duck hunting season
2. to obtain data on numbers of waterbirds in Victoria for long-term monitoring.

Management of game species requires long-term tracking of changes in species abundance across the state and the continent. The inherent variability of the Australian climate has profound effects on the availability of habitat for waterbirds, and breeding opportunities are typically provided by flood events in disparate parts of the continent (e.g., Frith 1982; Kingsford and Norman 2002).

Long-term datasets are essential to tease out the relative importance of these climatic influences, compared to immediate human impacts, such as hunting and the provision of environmental water. Such datasets are rare in Australia, and many have been discontinued. In Victoria, only Western Port has been monitored long-term for waterbirds, since 1973 (Loyn et al. 1994; Hansen et al. 2015), and the Western Treatment Plant has been intensively monitored since 2000 (Loyn et al. 2014). On a much broader scale, the Eastern Australian Aerial Waterbird Survey (EAAWS), which began in 1983, has provided annual abundance indices of waterbirds and wetland habitats across a standard series of aerial transect lines from Queensland to Victoria and into South Australia (see https://www.ecosystem.unsw.edu.au/content/rivers-and-wetlands/waterbirds/eastern-australian-waterbird-survey). However, the aerial transect lines used in the EAAWS are widely spaced (2 degrees of latitude or approximately 168 km in Victoria) and thus many important Victorian wetlands are not covered.

The DSPWC adds a broad perspective to our understanding of waterbird numbers and distribution within Victoria, with data having been collected from many wetlands (121+ annually, and approximately 1,500 altogether) since 1987. The data summarised here add to the series that is used to assist decision making about duck hunting and wetland management in the state, as envisaged by Loyn (1991). Only a sample of the State's wetlands is surveyed each year, and it should be stressed that most of these counts do not

provide data on absolute numbers of waterbirds or total species diversity. While the primary aim is to identify wetlands that warrant consideration for further regulation of hunting (objective 1), it also has value as an index of abundance for comparisons between years (objective 2), with appropriate recognition of the data limitations as described above. Examples of appropriate use of the DSPWC data include Murray et al. (2012) and Klaassen and Kingsford (2021). DSPWC data have also proved helpful in other waterfowl monitoring programs including monitoring species population trends (e.g., Pacioni et al. (2017), BirdLife Australia's Australian Waterbird Index project) and assessing the success of management to maintain Ramsar values.

References

Emison, W.B., Beardsell, C.M., Norman, F.I., Loyn, R.H. and Bennett, S.C. (1987). Atlas of Victorian Birds. Department of Conservation, Forests and Lands, Royal Australasian Ornithologists Union, Melbourne.

Clarke, R.H., Herrod, A., Loyn, R.H., Carter, M.J., Silcocks, A., Menkhorst, P. and Johnstone, C. (2015). Waterbird fluctuations at coastal wetland refugia in response to Murray-Darling Basin streamflow and rainfall. Monash University, Victoria.

Frith, H.J. (1982). *Waterfowl in Australia*. Angus & Robertson, Sydney.

Garnett, S.T. and Baker, G.B. (2021). *The Action Plan for Australian Birds 2020*. CSIRO Publishing, Melbourne.

Hansen, B.D., Menkhorst, P., Maloney, P. and Loyn, R.H. (2015). Long-term declines in multiple waterbird species in a tidal embayment, south-east Australia. *Austral Ecology* **40**, 515–527.

Hewish, M. (1988). Waterfowl count in Victoria, February 1988. *RAOU Report* No. 52.

Kingsford, R.T. and Norman, F.I. (2002). Australian waterbirds – products of the nation's ecology. *Emu* **102**, 29–46.

Klaassen, M. and Kingsford, R. (2021). Using duck proxies and surface water to inform hunting arrangements. Unpublished report to the Victorian Game Management Authority available at https://www.gma.vic.gov.au/__data/assets/pdf_file/0008/828494/Using-duck-proxies-and-surface-water-to-inform-hunting-arrangements.pdf

Loyn, R.H. (1989). *The management of duck hunting in Victoria – a review*. Arthur Rylah Institute of Environmental Research Technical Series No. 70. Department of Conservation, Forests and Lands, Melbourne.

Loyn, R.H. (1991). Assessing and managing the impact of duck hunting in Victoria – a new approach. *Wildfowl* **42**, 155–61.

Loyn, R.H., Dann, P. and Bingham, P. (1994). Ten years of waterbird counts in Western Port, Victoria, 1973–83. I. Waterfowl and large wading birds. *Australian Bird Watcher* **15**, 333–350.

Loyn, R.H., Rogers, D.I, Swindley, R.J., Stamation, K., Macak, P. and Menkhorst, P. (2014). Waterbird monitoring at the Western Treatment Plant, 2000–12: the effects of climate and sewage treatment processes on waterbird populations. Arthur Rylah Institute for Environmental Research Technical Report Series No. 256. Department of Environment and Primary Industries, Heidelberg.

Marchant, S. and Higgins, P. J. (eds) (1990). *Handbook of Australian, New Zealand and Antarctic Birds, Volume 1 (B)*. *Ardea intermedia* Intermediate Egret. Pp 978-986. Oxford University Press, Melbourne.

Martindale, J. (1988). Waterfowl count in Victoria, January 1987. *RAOU Report* No. 37.

Menkhorst, P.W. (2019). Waterbird susceptibility to disturbance from duck hunting in Victoria. *Arthur Rylah Institute for Environmental Research Technical Report Series* Number 305.

Menkhorst, P.W. and Thompson, L. (2022). Waterbird susceptibility to disturbance from duck hunting in Victoria (2020 update). *Arthur Rylah Institute for Environmental Research Technical Report Series* Number 338.

Menkhorst, P. and Purdey, D. (2016). Victorian Summer Waterbird Count 2016. Arthur Rylah Institute for Environmental Research. Unpublished Client Report. Department of Environment, Land, Water & Planning, Heidelberg, Victoria.

Menkhorst, P. and Stamation, K. (2021). Victorian Duck Season Priority Waterbird Count, 2021. Unpublished report to Regulatory Strategy and Design Branch, Department of Environment, Land, Water and Planning, Arthur Rylah Institute for Environmental Research, Heidelberg.

Menkhorst, P. and Stamation, K. (2022). Victorian Duck Season Priority Waterbird Count, 2022. Unpublished report to Regulatory Strategy and Design Branch, Department of Environment, Land, Water and Planning, Arthur Rylah Institute for Environmental Research, Heidelberg.

Menkhorst, P., Brown, G. and Stamation, K. (2017). Victorian Summer Waterbird Count 2017. Arthur Rylah Institute for Environmental Research. Unpublished Client Report. Department of Environment, Land, Water & Planning, Heidelberg, Victoria.

Menkhorst, P., Brown, G. and Stamation, K. (2018). Victorian Summer Waterbird Count 2018. Arthur Rylah Institute for Environmental Research. Unpublished Client Report. Department of Environment, Land, Water & Planning, Heidelberg, Victoria.

Menkhorst, P., Stamation, K. and Brown, G. 2019. Victorian Summer Waterbird Count 2019. Unpublished report to Regulatory Strategy and Design Branch, Department of Environment, Land, Water and Planning, Arthur Rylah Institute for Environmental Research, Heidelberg.

Menkhorst, P., Stamation, K. and Eketone, T.A.M. (2020). Victorian Duck Season Priority Waterbird Count, 2020. Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Victoria.

Morley, C. and Alcorn, R. 2018. Geelong Bird Report 2013-2016. Geelong Field Naturalists Club, Geelong. Available at https://www.dropbox.com/s/qy13k9srany042v/Geelong%20Bird%20Report%202013-2016%20P.pdf?dl=0

Murray, C.G., Loyn, R.H., Kasel, S., Hepworth, G., Stamation, K. and Hamilton, A.J. (2012). What can a database compiled over 22 years tell us about the use of different types of wetlands by waterfowl in southeastern Australian summers? *Emu* **112**, 209–217.

Norman, F.I. (1996). *A report on some results of the 1996 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (1997). *A report on some results of the 1997 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (1998). *A report on some results of the 1998 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (1999). *A report on some results of the 1999 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (2000). *A report on some results of the 2000 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (2001). *A report on some results of the 2001 Summer Waterfowl Count in Victoria*. Unpublished Report, Parks, Flora and Fauna Branch.

Norman, F.I. (2002). *A report on some results of the 2002 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

Norman, F.I. (2003). *A report on some results of the 2003 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

Norman, F.I. (2004). *A report on some results of the 2004 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

Norman, F.I. (2005). *A report on some results of the 2005 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

Norman, F.I. (2006). *A report on some results of the 2006 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

Norman, F.I. and Purdey, D.C. (2007). *The 2007 Summer Waterbird Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch.

O'Brien, M. (1994). *Summer Waterfowl Count 1994*. Unpublished Report, Arthur Rylah Institute for Environmental Research, Department of Conservation and Natural Resources, Melbourne.

Pacioni, C., Ramsay, D.S.L. and Menkhorst, P. (2017). Assessment of the status of the Australasian (blue-winged) shoveler (*Anas rhynchotis*) in south-eastern Australia. Unpublished report to Game Management Authority, Arthur Rylah Institute for Environmental Research, Heidelberg.

Pert, P. (1995). *Results of the 1995 Summer Waterfowl Count in Victoria.* Unpublished Report, Arthur Rylah Institute for Environmental Research, Department of Conservation and Natural Resources, Melbourne.

Peter, J. (1989). Waterfowl count in Victoria, February 1989. *RAOU Report* No. 57. RAOU, Moonee Ponds, Victoria.

Peter, J. (1990). Waterfowl count in Victoria, February 1990. *RAOU Report* No. 72. RAOU, Moonee Ponds, Victoria.

Peter, J. (1991). Waterfowl count in Victoria, February 1991. *RAOU Report* No. 79. RAOU, Moonee Ponds, Victoria.

Peter, J. (1992). Waterfowl count in Victoria, February 1992. *RAOU Report* No. 85. RAOU, Moonee Ponds, Victoria.

Price, R. (1993). 1993 *Summer Waterfowl Count*. Unpublished Report, Arthur Rylah Institute for Environmental Research, Department of Conservation and Natural Resources, Melbourne.

Purdey, D.C. and Loyn, R.H. (2008). *A report on some results of the 2008 Summer Waterfowl Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch, Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D.C. and Loyn, R.H. (2009). *The 2009 Summer Waterbird Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch, Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D.C. and Loyn, R.H. (2010). *The 2010 Summer Waterbird Count in Victoria*. Unpublished Report, Biodiversity and Natural Resources Branch, Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D. and Loyn, R. (2011). *The 2011 Summer Waterbird Count in Victoria*. Arthur Rylah Institute for Environmental Research Technical Report Series No. 231. Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D. and Loyn, R. (2013). *The 2012 Summer Waterbird Count in Victoria*. Arthur Rylah Institute for Environmental Research Technical Report Series No. 242. Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D. and Menkhorst, P. (2014). *The 2013 Summer Waterbird Count in Victoria*. Unpublished Report to Game Victoria. Arthur Rylah Institute for Environmental Research, Department of Sustainability and Environment, Heidelberg, Victoria.

Purdey, D. and Menkhorst, P. (2015). *Victorian Summer Waterbird Counts: 2014 and 2015*. Unpublished Report to the Ecological Policy Branch, Department of Environment, Land, Water and Planning. Arthur Rylah Institute for Environmental Research, Heidelberg, Victoria.

Appendices

Appendix 1. List of priority wetlands and whether counted or dry

DEECA region	Wetland name	Latitude	Longitude	Dry	Counted	
					1st	2nd
Barwon South West	Brown Swamp	-38.27	144.13	N	✓	
Barwon South West	Bryans Swamp	-37.56	142.27	N	✓	✓
Barwon South West	Bullrush Swamp	-37.77	142.23			
Barwon South West	Carter Swamp	-38.24	143.30	N	✓	
Barwon South West	Cundare Pool	-38.09	143.59	N	✓	✓
Barwon South West	Deep Lake (Nerrin Nerrin)	-37.79	143.04	N	✓	
Barwon South West	Deep Lake (Derrinallum)	-37.93	143.17	N	✓	
Barwon South West	Eurack Swamp	-38.13	143.70	N	✓	
Barwon South West	Hospital Swamp	-38.23	144.41	N	✓	✓
Barwon South West	Lake Balkil Narra	-38.13	143.37	N	✓	
Barwon South West	Lake Bookar	-38.13	143.12	N	✓	✓
Barwon South West	Lake Colac	-38.30	143.59	N	✓	
Barwon South West	Lake Colongulac	-38.17	143.16	N	✓	
Barwon South West	Lake Connewarre	-38.23	144.45	N	✓	
Barwon South West	Lake Coradgill	-38.11	143.36	N	✓	
Barwon South West	Lake Elingamite	-38.35	143.01	N	✓	
Barwon South West	Lake Gherang	-38.25	144.06	N	✓	✓
Barwon South West	Lake Kariah	-38.17	143.21	N	✓	
Barwon South West	Lake Kooreetnung	-38.18	143.24	N	✓	
Barwon South West	Lake Linlithgow	-37.75	142.22	N	✓	
Barwon South West	Lake Martin	-38.07	143.58	N	✓	✓
Barwon South West	Lake Murdeduke	-38.17	143.89	N	✓	
Barwon South West	Lake Punpuna	-38.13	143.37			
Barwon South West	Lake Round	-38.13	143.21	N	✓	
Barwon South West	Lake Struan	-38.01	143.42	N	✓	✓
Barwon South West	Lake Terang Goodwich	-38.12	143.37	N	✓	
Barwon South West	Lake Terangpom	-38.13	143.32	N	✓	✓
Barwon South West	Lake Weering	-38.08	143.68	N	✓	
Barwon South West	Lough Calvert	-38.18	143.69	N	✓	
Barwon South West	Reedy Lake (Geelong)	-38.21	144.42	N	✓	
Barwon South West	Tower Hill	-38.32	142.36	N	✓	✓

DEECA region	Wetland name	Latitude	Longitude	Dry	Counted	
					1st	2nd
Region total	**31**			**0**	**29**	**9**
Gippsland	Blond Bay SGR	-38.01	147.52	N	✓	
Gippsland	Clydebank Morass	-38.04	147.22	N	✓	
Gippsland	Dowds Morass SGR	-38.14	147.23	N	✓	✓
Gippsland	Freshwater Swamp SGR	-38.56	146.96	N	✓	
Gippsland	Heart Morass	-38.12	147.20	N	✓	✓
Gippsland	Hollands Landing (Lagoon)	-38.06	147.45	N	✓	
Gippsland	Jack Smith SGR	-38.50	147.00	N	✓	
Gippsland	Lake Coleman	-38.16	147.33	N	✓	
Gippsland	Lake Corringle	-37.78	148.49	N		
Gippsland	Lake Curlip	-37.75	148.57	N	✓	
Gippsland	Lake Kakydra	-38.07	147.20	N	✓	
Gippsland	Lake Wat Wat	-37.76	148.52	N	✓	
Gippsland	Macleods Morass	-37.84	147.63	N	✓	✓
Gippsland	Morleys Swamp	-38.09	147.44	N	✓	
Gippsland	Victoria Lagoon	-38.04	147.45	N	✓	
Region total	**15**			**0**	**14**	**3**
Grampians	Black Swamp (Balmoral)	-37.22	141.83	N	✓	
Grampians	Booroopki Swamp	-36.73	141.22			
Grampians	Bradys Swamp	-37.59	142.45	N	✓	
Grampians	Dock Lake	-36.77	142.30	N	✓	
Grampians	Green Swamp	-37.00	141.78	N	✓	✓
Grampians	Jacka Lake	-36.80	141.81		✓	
Grampians	Lake Albacutya	-35.75	141.97	Y		
Grampians	Lake Batyo Catyo	-36.52	142.94	N	✓	
Grampians	Lake Bolac	-37.72	142.88	N	✓	✓
Grampians	Lake Buninjon	-37.48	142.78	N	✓	
Grampians	Lake Burrumbeet	-37.50	143.64	N	✓	
Grampians	Lake Carpolac	-36.85	141.32	N	✓	
Grampians	Lake Clarke	-36.87	141.86	N	✓	
Grampians	Lake Coorong	-35.73	142.40			
Grampians	Lake Fyans	-37.14	142.63	N	✓	
Grampians	Lake Goldsmith	-37.54	143.36	N	✓	✓
Grampians	Lake Hancock	-36.54	142.93			
Grampians	Lake Hindmarsh	-36.04	141.91	N	✓	✓

DEECA region	Wetland name	Latitude	Longitude	Dry	Counted	
					1st	2nd
Grampians	Lake Karnac	-36.83	141.51		✓	✓
Grampians	Lake Kennedy	-37.77	142.18			
Grampians	Lake Koynock	-36.82	141.51		✓	✓
Grampians	Lake Lonsdale	-37.03	142.63	N		
Grampians	Lake Muirhead	-37.49	142.61	N		
Grampians	Lake Natimuk	-36.70	141.94	N	✓	
Grampians	Lake Turangmoroke	-37.73	142.89	N	✓	
Grampians	Lake Wongan	-37.61	143.15	N	✓	
Grampians	McGlashins Swamp	-37.09	141.76		✓	
Grampians	Merin Merin Swamp	-37.23	143.80	N	✓	✓
Grampians	Pine Lake	-36.79	142.35	N	✓	
Grampians	Toolondo Reservoir	-37.02	141.95	N	✓	
Grampians	Walkers Swamp	-37.57	142.48	N	✓	
Grampians	Wally Allans Swamp	-36.77	141.48	N	✓	✓
Grampians	Winter Lake	-36.88	141.27	N	✓	
Grampians	Yarrackigarra Swamp	-36.72	141.24			
Region total	**34**			**1**	**26**	**8**
Hume	Big Reedy Lagoon	-35.98	145.92	N	✓	✓
Hume	Black Swamp (Black Dog Creek)	-36.16	146.32	N	✓	
Hume	Black Swamp (Nine Mile Creek)	-36.14	145.45	N	✓	✓
Hume	Buffalo Dam	-36.71	146.66	N	✓	
Hume	Doctors Swamp	-36.62	145.18	Y	✓	
Hume	Dowdle Swamp	-36.10	146.03	N	✓	
Hume	Jubilee Swamp	-36.57	145.76	Y	✓	
Hume	Lake Moodemere	-36.05	146.39	N	✓	
Hume	Lehmann Swamp	-36.56	145.61	Y	✓	
Hume	Loch Garry	-36.23	145.31	N	✓	✓
Hume	McBurney Swamp	-36.58	145.56	Y	✓	
Hume	Moodie Swamp	-36.23	145.79	N	✓	
Hume	Morphett Swamp	-36.54	145.78	Y	✓	
Hume	Reedy Lake (Nagambie)	-36.72	145.10	N	✓	
Hume	Rowan Swamp	-36.29	145.98	N	✓	
Hume	Tungamah Swamp	-36.15	145.92	N	✓	
Region total	**16**			**5**	**16**	**3**
Loddon Mallee	First Marsh	-35.64	143.74	N	✓	✓

DEECA region	Wetland name	Latitude	Longitude	Dry	Counted	
					1st	2nd
Loddon Mallee	Gaynors Swamp	-36.52	144.83	N	✓	✓
Loddon Mallee	Green Lake (north of Lake Cooper)	-36.44	144.84	N	✓	✓
Loddon Mallee	Heywoods Lake	-34.79	143.21	N	✓	
Loddon Mallee	Hird Swamp	-35.86	144.09	N	✓	
Loddon Mallee	Horseshoe Bend Billabong	-34.14	142.06	N	✓	
Loddon Mallee	Johnson's Swamp	-35.82	144.07	N	✓	
Loddon Mallee	Lake Bael Bael	-35.69	143.74	N	✓	✓
Loddon Mallee	Lake Boort	-36.13	143.74	N		✓
Loddon Mallee	Lake Buloke*	-36.27	142.96	N		
Loddon Mallee	Lake Cooper	-36.50	144.81	N	✓	
Loddon Mallee	Lake Cope Cope (Browns Lake)	-36.46	143.03	N	✓	
Loddon Mallee	Lake Cullen	-35.64	143.77	N	✓	✓
Loddon Mallee	Lake Elizabeth	-35.70	143.82	N	✓	✓
Loddon Mallee	Lake Gil Gil	-36.33	143.04	N	✓	
Loddon Mallee	Lake Grassy	-36.46	143.06	N	✓	
Loddon Mallee	Lake Leaghur	-35.98	143.80	N	✓	✓
Loddon Mallee	Lake Meran	-35.88	143.81	N	✓	
Loddon Mallee	Lake Murphy	-35.81	143.87	N	✓	✓
Loddon Mallee	Lake Nurrumbeet	-36.47	143.06	N	✓	
Loddon Mallee	Lake Tutchewop	-35.51	143.75	N	✓	
Loddon Mallee	Lake Wandella	-35.74	143.88	N	✓	
Loddon Mallee	Lake Yando	-36.04	143.78	N	✓	
Loddon Mallee	Little Lake Buloke	-36.32	142.95	N	✓	✓
Loddon Mallee	Little Lake Meran	-35.85	143.82	N	✓	✓
Loddon Mallee	Mansfield Swamp	-36.44	144.88	N	✓	
Loddon Mallee	McDonalds Swamp	-35.70	144.07	N	✓	✓
Loddon Mallee	Meridian Basin	-34.26	141.98			
Loddon Mallee	Racecourse Lake	-35.61	143.79	N	✓	
Loddon Mallee	Richardsons Lagoon	-36.03	144.57	N	✓	
Loddon Mallee	Round Lake 1 (west of Lake Boga)	-35.47	143.61	N	✓	
Loddon Mallee	Round Lake 2 (n. of Lake Meran)	-35.85	143.80	N	✓	
Loddon Mallee	Second Marsh	-35.62	143.74	N	✓	✓
Loddon Mallee	Third Marsh	-35.60	143.73	N	✓	✓
Loddon Mallee	Tobacco Lake	-35.86	143.80	N	✓	

DEECA region	Wetland name	Latitude	Longitude	Dry	Counted	
					1st	2nd
Loddon Mallee	Wallenjoe Swamp	-36.48	144.88	N	✓	
Loddon Mallee	Woolshed Swamp	-36.17	143.72	N	✓	
Loddon Mallee	Wooroonook Lake (Church)	-36.27	143.21	N	✓	
Loddon Mallee	Wooroonook Lake (Main)	-36.27	143.20	N	✓	
Region total	**39**			**0**	**36**	**14**
Overall total	**135**				**121**	**37**

* Lake Buloke was counted on 5 May 2023, after the DSPWC had finished.

Appendix 2: Other wetlands surveyed

DEECA Region	Wetland Name
Barwon South West	Nil
Grampians	Lake Dollanoke, Lake Jarracter, Lake Kemi Kemi, Lake Mullancorrie, Lake Yallakar
Gippsland	Nil
Hume	Wallenjoe Swamp
Loddon Mallee	Lake Lookout, Lake Kelly, Little Lake Kelly, Lake Gilmore, Woorinen North Lake, Tim's Lake, Lake Gilmour, Lake Lyndger