2016-17

WATERBIRD CONDITION MONITORING WITHIN BARMAH-MILLEWA FOREST

Office of Environment & Heritage
NSW National Parks & Wildlife Service
Australian Government
MURRAY–DARLING BASIN AUTHORITY

Report Title:	Waterbird Monitoring within Barmah-Millewa Forest 2016-17
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Front cover photo:	Little Black Cormorants nesting in Coppingers Swamp (A.Borrell)

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SUMMARY

The surveys for waterbirds in Barmah-Millewa for 2016-17 recorded a total of 45 species and more than 4 800 individual waterbirds across wetlands in the icon site. In NSW, Moira Lake and Reed Beds had the highest numbers of individuals and in Victoria, Barmah Lake had the most waterbirds. All the sentinel wetlands monitored as part of 'The Living Murray' (TLM) wetland condition monitoring were inundated over the spring/summer period due to a large-scale natural flood, which prevented access to some Victorian sites in spring. The widespread inundation lead to several small-medium breeding events occurring across several Barmah-Millewa wetlands.

- Three Australasian bitterns *Botaurus poiciloptilus* were recorded during the surveys listed as endangered under the *Environmental Protection and Biodiversity Conservation Act, 1999*
- Three species of Egret were recorded, Eastern Great Egret, Intermediate Egret and Little Egret. All three species are listed under the *Flora and Fauna Guarantee Act 1988.*
- No migratory waders were recorded during the current year of monitoring. Wetlands within the Barmah-Millewa forest has provided habitat in the past for migratory waders during their non-breeding period visits to Australia. Migratory species previously recorded include: Double-banded Plover *Charadrius bicinctus*, Marsh Sandpiper *Tringa stagnatilis* and Sharp-tailed Sandpiper *Calidris acuminata*.
- Magpie goose *Anseranas semipalmata* – Incidental sightings recorded two pairs of Magpie Geese in Reed Beds north over the spring/summer period, however breeding was not confirmed. The last record of breeding was during the 1800's and has not been recorded in any surveys since. Magpie geese are listed as vulnerable in the Biodiversity Conservation Act, *2016* and the *Flora and Fauna Guarantee Act 1988*.

Small-medium sized waterbird breeding events were seen across both Barmah and Millewa in wetlands involved in condition monitoring and elsewhere.

Condition monitoring has shown that species diversity overall, is consistent with previous years and waterbird abundances vary across years and seasons, however current abundances and types of waterbirds are somewhat reflective of pre-drought trends.

INTRODUCTION

The current surveys are being undertaken as part of the ongoing condition monitoring program within Barmah-Millewa Forest – a Living Murray icon site. A baseline monitoring survey of waterbirds (1999-2003) was undertaken between 1999 and 2004 (Webster 2004a, b). Follow-up seasonal surveys were conducted during 2008, 2010, 2011/12, 2012/13, 2015/16 (Webster 2008a, b, c, d, 2010a, b, c, d, OEH 2012a, b, c. 2013, 2016).

The aim of the surveys is to monitor waterbird assemblages to provide information on species richness and relative abundance over time and with varying environmental conditions (water availability).

This report presents an overview of the 2016-17 waterbird monitoring results and discussion on long term trends of waterbird diversity and abundance within the Barmah-Millewa Forest icon site. In spring 2016, a 1 in 25 flood year was experienced in the region. At the peak, the flood inundated 90% of the icon site, and water levels were high throughout all the wetlands in October and November. Environmental water was delivered later in the season to ensure that water levels remained stable in the major wetlands where waterbirds had begun breeding. This included Reed Beds, Boals Deadwood, and St Helena.

Three Australasian bitterns *Botarus poiciloptilus* were recorded during the surveys (Endangered, *Environmental Protection Biodiversity and Conservation Act, 1999*). Incidental sightings recorded two pairs of Magpie Geese *Anseranas semipalmata* (Vulnerable, *Flora and Fauna Guarantee Act 1988)* in Reed Beds north over the spring/summer period, however breeding was not confirmed. Three species of Egret were recorded, Eastern Great Egret *Ardea Alba*, Intermediate Egret *Ardea intermedia* and Little Egret *Egretta garzetta*. All three species are listed under the *Flora and Fauna Guarantee Act 1988.* No migratory waders were recorded during the current year of monitoring.

METHODS

STUDY SITES

Prior to the initial study in 1999, waterbird monitoring site locations were determined in consultation with staff from Forestry Corporation of NSW and the Victorian Department of Environment, Land, Water and PIanning (DELWP). Twelve wetland sites (Figure 1) within Barmah–Millewa Forest were identified as monitoring sites (Table 1). These sites were chosen as they cover a range of habitat types, have been included in previous monitoring programs (Webster 2004b, unpublished data) and are accessible during both dry periods and floods.

Barmah National Park	**Murray Valley National Park** (precinct)
Pig Hole	Horseshoe Lagoon (Gulpa Is)
Steamer Plain	Reed Beds North (Moira)
Barmah Lake	Reed Beds South (Moira)
Boals Deadwood (last year to be surveyed)	Duck Lagoon (Moira)
Goose Swamp	Moira Lake (Moira)
Bunyip Hole	St. Helena Swamp (Millewa)
Top Island (Boals Deadwood replacement site)	

Table 1: Waterbird monitoring sites

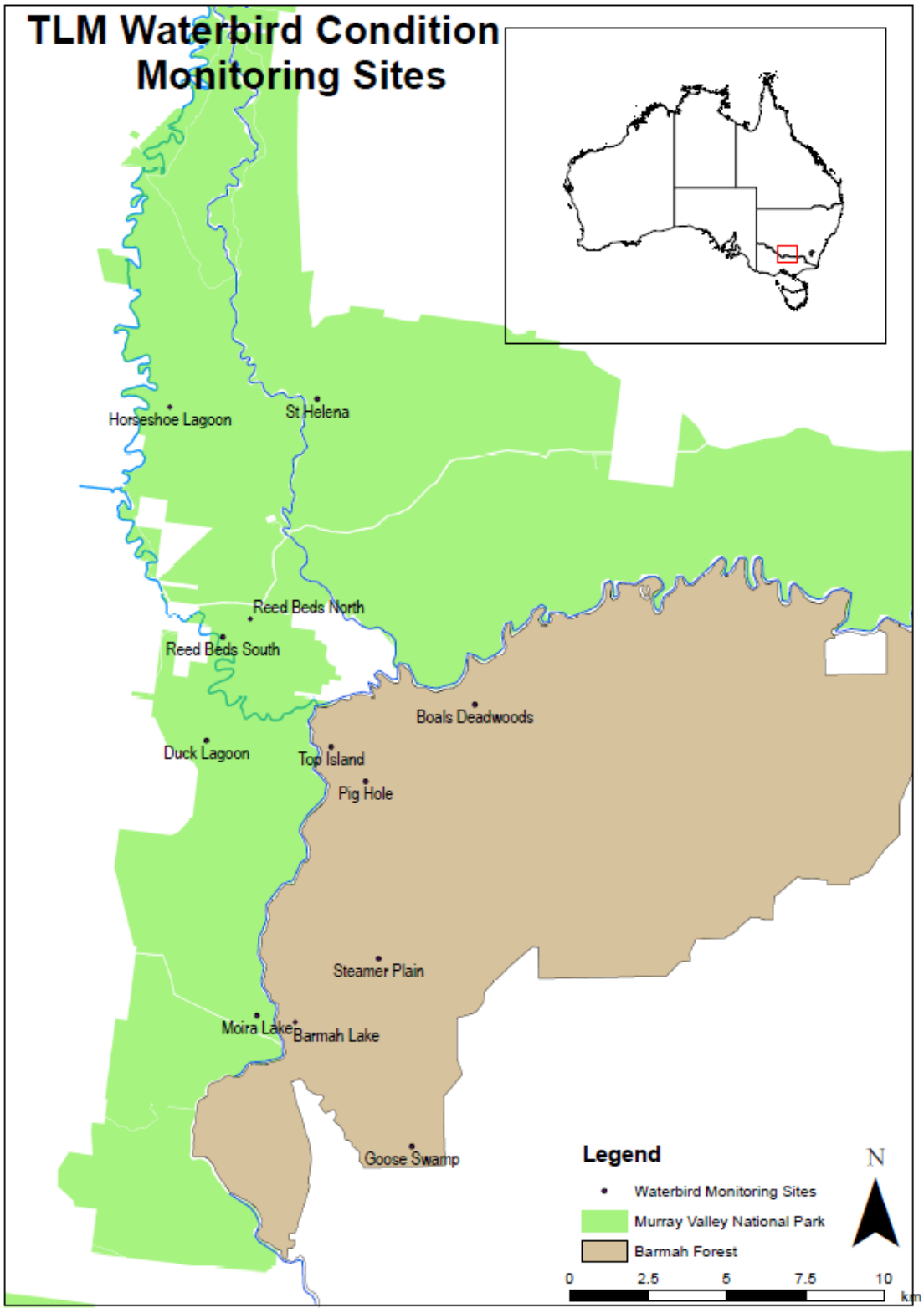

Figure 1: Waterbird Survey sites within Barmah-Millewa Forest

SURVEY METHODOLOGY

A survey transect or point was established on each wetland. Transects were established to survey as much of the wetland as was accessible. If the wetland was flooded or colonial waterbird breeding was occurring, a single traverse of each transect starting and finishing at the survey point was completed. If the wetland was dry or only partially flooded, then the assessment of the wetland was undertaken from the survey point. The group of birds known as waterbirds contains many species. For the purposes of this study, species from the following families were considered waterbirds:

- Anatidae (Swans, Geese, Ducks);
- Podicipedidae (Grebes);
- Anhingidae (Darters);
- Phalacrocoracidae (Cormorants);
- Pelecanidae (Pelicans);
- Ardeidae (Herons, Egrets, Night Herons, Bitterns);
- Threskiornithidae (Ibises Spoonbills);
- Accipitridae (Hawks, Harriers);
- Gruidae (Cranes);
- Rallidae (Crakes, Rails, Gallinules);
- Scolopacidae (Snipe, Godwits, Curlews, Sandpipers, Stints, Phalaropes);
- Recurvirostridae (Stilts, Avocets);
- Charadriidae (Plovers, Dotterels, Lapwings);
- Laridae (Gulls, Terns)
- Halcyonidae (Sacred Kingfisher *Todiramphus sanctus)*
- Alcedinidae (Azure Kingfisher *Alcedo azurea*); and
- Slyviidae (Old World Warblers).

All waterbird species observed on the wetland or flying over were recorded. In the event of breeding the number of nests, eggs and chicks were also recorded were possible.

Conservation status of waterbird species differs between NSW and Victoria. In this report, listings that are referred to are taken from the Flora and Fauna Guarantee Act 1988 (FFG 1988) and the advisory list from the Victorian Department of Sustainability and Environment 2013 (DSE 2013) for Victoria. The relevant legislation in NSW is the *Biodiversity Conservation Act 2016* (NSW). Federal listings are under the *Environmental Protection and Biodiversity Conservation Regulations* (EPBC Act, 1999). Species will only be noted as threatened if recorded on the corresponding side of the border to which the listing is relevant.

RESULTS

SPRING 2016

The spring 2016 surveys for waterbirds were conducted between the 24th of October and the 28th of November. The average daytime temperature in spring was 21.6 degrees Celsius. A total of 29 species and 1190 individuals were recorded at the survey sites (Appendix 1). Only 9 of the 13 sites could be accessed due to flooding. The majority (92%) of the waterbirds were found in Millewa, with most being colonial nesting waterbirds present in Reed Beds. Large numbers of colonial nesting waterbirds were also present in Victoria, however none of the sites surveyed represented these areas.

Three threatened species were identified across the survey period:

- Australasian bitterns *Botaurus poiciloptilus,* 2 recorded calling in Reed Beds North and 1 in Reed Beds South (endangered Federal *Environment Protection Biodiversity Conservation (EPBC) Act* 1999);
- White-bellied Sea Eagle *Haliaeetus leucogaster,* 1 recorded in St Helena Swamp, sitting near a large stick nest (*Vulnerable*, BCA 2016), 1 recorded above Barmah Lake (*Threatened,* FFG 1988)
- Intermediate Egret *Ardea intermedia,* 3 recorded in Pig Hole (*Threatened*; FFG 1988)

SUMMER 2016/17

The summer surveys were carried out between the 16th of January and the 3rd of February. The average day time temperature in summer was 32 degrees Celsius. A total of 33 species were identified, which was the highest seasonal diversity recorded for the year. 2681 individuals were recorded with most of these recorded in NSW (91%). Again, it appears that the Barmah wetland sites do not represent the abundance of waterbirds present in Barmah wetlands. All the wetlands remained inundated throughout summer. The two major wetlands where most waterbirds were recorded in Millewa were Reed Beds and Moira Lake. Water levels in Moira Lake had begun to recede, exposing mud flats and providing shallow water environments. This provided foraging habitat for over 1200 waterbird. Throughout January and early February, there were still active rookeries present in Reed Beds, with all nesting stages, from eggs through to fledging's present.

Three threatened species were identified in the summer surveys:

- Little Egret *Egretta garzetta nigripes* recorded in Pig hole (*Threatened,* FFG 1988)

- Eastern Great Egret *Ardea Alba,* 17 recorded on Barmah Lake, 3 in Pig hole and 5 on Steamer Plain (*Threatened,* FFG 1988). The Eastern Great Egret is also listed on migratory bird agreements between the Federal Government and the national governments of China and Japan.
- Intermediate Egret, 2 recorded in Top Island (*Threatened,* FFG 1988)
- Musk duck *Biziura lobata,* 4 recorded on Barmah Lake (*Vulnerable*, DSE 2013).

Autumn 2016

Autumn surveys were conducted between the 3rd of April and the 3rd of May. The average temperature for autumn was 24.5 degrees Celsius. A total of 30 species were identified and 844 individuals were recorded, with 71% recorded in Millewa. There was an increase in waterbirds on Barmah Lake, with 86% of the individuals recorded in Barmah foraging on lake as drops in water levels exposed mud flats for foraging.

One threatened waterbird was identified in the autumn surveys:

- Eastern Great Egret; 3 birds were recorded at Barmah Lake (*Threatened,* FFG 1988)

Winter 2016

The winter surveys were conducted between the 15th of June and the 7th of July. The average daytime temperature during the winter survey period was 15.3 degrees Celsius. A total of 18 species were identified and 115 individuals were recorded. Duck Lagoon was not surveyed. 62% of the waterbirds were recorded within Barmah, with Barmah Lake having the highest number of individuals (52) across the whole icon site.

Two threatened species were identified in the winter surveys:

- White-bellied Sea-Eagle, 1 recorded at Barmah Lake, 1 at Reed Beds North and 1 at St Helena (*Vulnerable* BCA, 2016; *Threatened,* FFG 1988)).
- Eastern Great Egret; 2 birds were recorded on Barmah Lake (*Vulnerable,* DSE 2013)

Across the Year:

Duck Lagoon recorded the highest species diversity across the year, with 33 species. Moira Lake recorded the highest abundances with 1200 waterbirds recorded foraging in Summer (). In Barmah, Barmah Lake was the wetland which recorded the highest abundances, with 397 waterbirds across the year. Species diversity per wetland across the year ranged from 5 species (Boals Deadwood) to 33 species (Duck Lagoon). The highest species count for a single visit was at Duck Lagoon with 16 species in spring. The higher species diversity at Duck Lagoon could be accounted to the range of habitats present, as there is open water, dense reed beds, diverse understorey aquatic vegetation and shallow littoral zones.

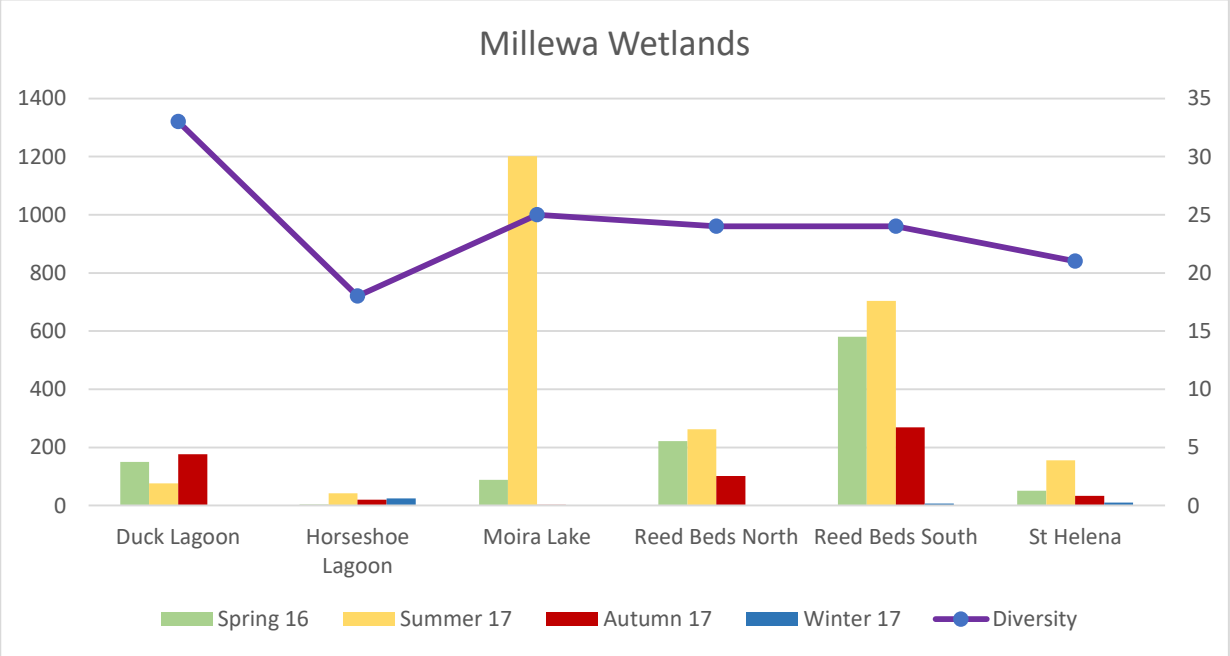

Figure 3: Millewa Individuals per wetland per site for the year and the species diversity recorded.

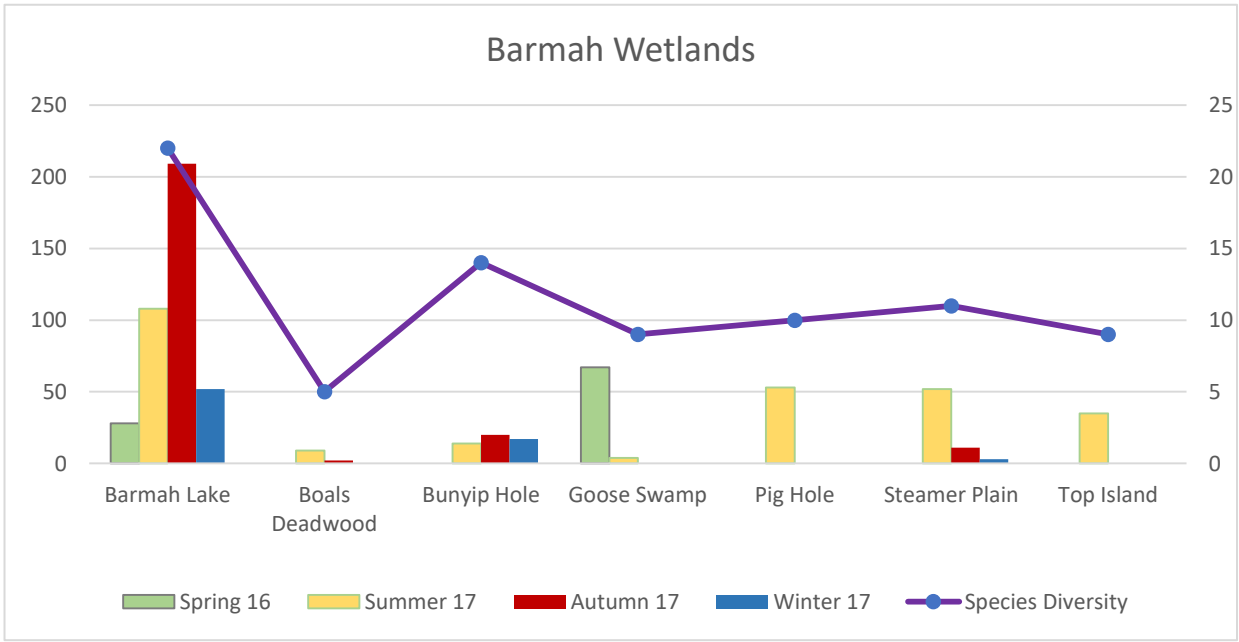

Figure 2: Barmah Individuals per wetland per site across the year and the species diversity recorded.

A total of 45 waterbird species were recorded, the third highest diversity over the eleven survey years. The yearly average of species found since 1999 is 40 waterbird species. Summer has recorded the highest diversity across seasons, with an average of 32 species. Species diversity across all seasons can be seen in **Figure 4**.

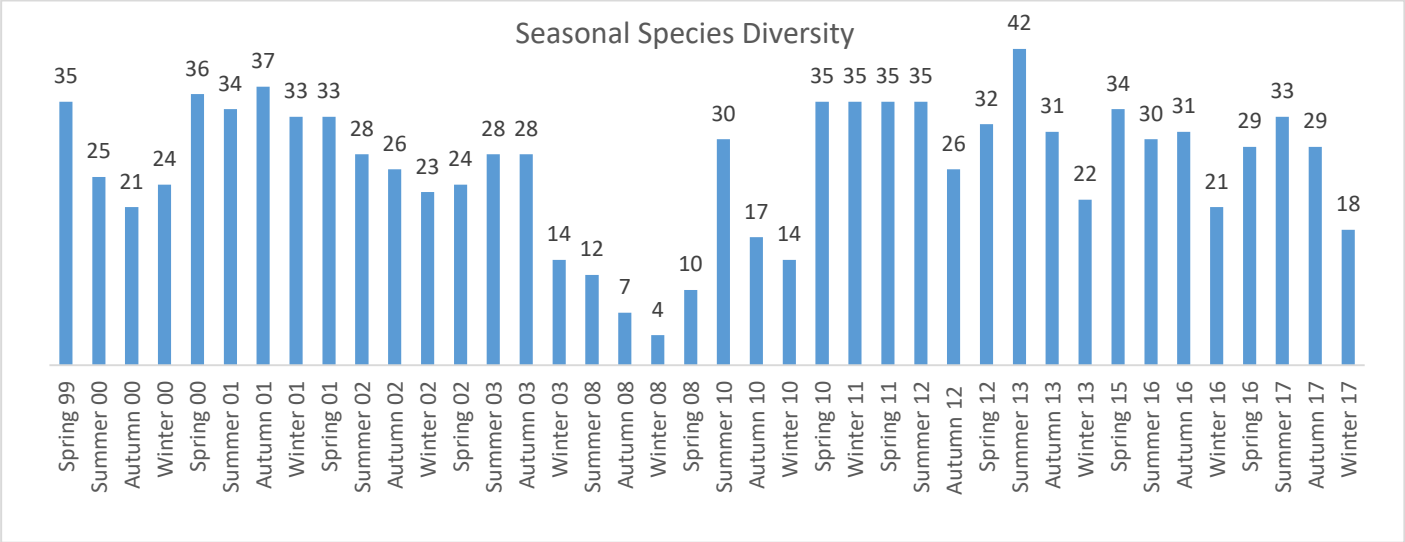

Figure 4: Species Diversity for the Icon Site per Season from 1999 to 2017

Waterbird abundance across the year had the sixth highest abundance, out of eleven years of condition monitoring. Since 2000, 2016-17 was the 10th wettest across the whole year, in terms of overbank (>10,600ML/d) flows into Barmah-Millewa. However, it had the largest peak volume flow in the same eighteen years (Figure 5) and spring had the highest average seasonal flow over the whole survey period.

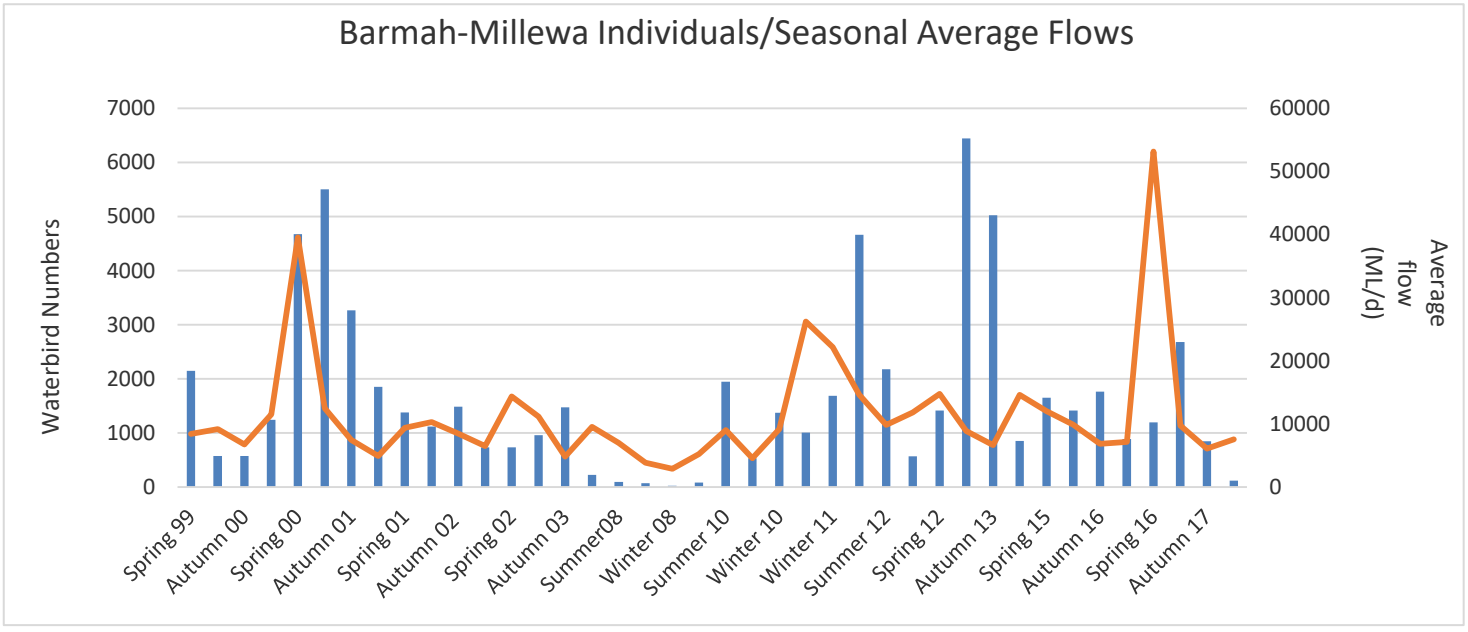

Figure 5: Average seasonal flows and individuals recorded in the icon site from 1999 to 2017

Species notes from 2016-17:

- Magpie goose *Anseranas semipalmata* – Incidental sightings recorded two pairs of Magpie Geese in Reed Beds north over the spring/summer period, however breeding was not confirmed. The last record of breeding was during the 1800's and has not been recorded in any surveys since. Magpie geese are listed as vulnerable in the Biodiversity Conservation Act, 2016 and the *Flora and Fauna Guarantee Act 1988*
- Three Australasian bitterns were recorded during the surveys, A targeted survey program recorded 73 male bitterns calling across 8 Barmah-Millewa wetlands. This is a 50% increase from 2015-16.
- Three species of Egret were recorded, Eastern Great Egret, Intermediate Egret and Little Egret. All three species are listed under the *Flora and Fauna Guarantee Act 1988.*
- No migratory waders were recorded during the current year of monitoring. Wetlands within the Barmah-Millewa forest has provided habitat in the past for migratory waders during their non-breeding period visits to Australia. Migratory species previously recorded include: Double-banded Plover *Charadrius bicinctus*, Marsh Sandpiper *Tringa stagnatilis* and Sharp-tailed Sandpiper *Calidris acuminata*.

A complete list of waterbird species recorded during the waterbird surveys within Barmah-Millewa since spring 1999 is included in Appendix 2.

DISCUSSION

Since surveys began in 1999, 71 species have been identified in the sentinel wetlands included in the condition monitoring program. In 2016-17, the relatively high annual diversity of waterbird species recorded (45) reflects the conditions found across the icon site. At the peak of the event, 90% of Barmah-Millewa was inundated to some extent (Heath & Thomas, 2017), creating a variety of habitats available for waterbirds.

Rookeries were established in several wetlands including Reed Beds north and south, Boals Deadwood, St Helena Swamp and on the Murray around Picnic Point. This contributed foraging colonial waterbirds in most condition monitoring sites. The breeding events are likely to have contributed to higher numbers of birds recorded foraging on Moira and Barmah Lake, however the large area inundated by floods allowed dispersal over a greater area.

2017 displays similar characteristics in terms of waterbird abundances as 2010. Spring 2010 recorded the highest average flow since 2000 and the breaking of the millennium drought. However, this did not induce an immediate spike in waterbird numbers. Spring 2011 went on to record a high abundance of individuals. From there, summer 2013 recorded high species diversity and abundance (the highest since 1999), in a watering year that had low average seasonal flows (**Error! Reference source not found.** & 4). This indicates that a larger response may be seen next year in both the number of species and abundance of individuals.

The average seasonal flow for spring 2016 was the highest of any season since surveys began in 1999 (Figure 5), although the days per year that Barmah-Millewa was inundated was less than the floods in 2010 and 2011. Environmental water held flows up though summer and ensured that successful waterbird breeding occurred in the wetlands.

Flows receded back to within channel in summer which enabled most of the wetlands to dry out once waterbirds had finished breeding. Drying of wetlands during the preceding late summer/autumn period allows aquatic organisms to complete their life cycles. This also gives biotic material an opportunity to break down during the drying phase, releasing nutrients into the wetland bed. The large flood and a complete drying cycle should provide good productivity in wetlands in the next watering year.

The health of the wetlands which support the waterbird populations of Barmah-Millewa appear to have recovered to some extent after the millennium drought. However, wetlands in Barmah appear to not have the same abundances as the early 2000's. This could be due to the changing habitat in wetlands (such as Boal's Deadwood) making it less suitable for certain waterbirds, or by reducing the effectiveness of survey methods due to dense vegetation. More research on waterbirds and their habitat requirements could further inform management actions and management of their environment.

The overarching waterbird objective that has been adopted by the project is defined by the Basin Wide Environmental Watering Strategy (BWS) and is to '*maintain current species diversity, improve breeding success and numbers'.* Condition monitoring has shown that this objective was met in 2016-17, with species diversity showing overall consistency with previous years. A second objective adopted from the BWS is to '*ensure that the current number and type of waterbird species present in the basin will not fall below current observations'.* Condition monitoring has shown that waterbird numbers vary across years and seasons, however current abundances and types of waterbirds are somewhat reflective of pre-drought patterns. However, this is presently not quantified. An index to measure waterbird heath and diversity across years is being developed for the Barmah-Millewa waterbird condition monitoring to further evaluate year to year success and progress and will be adopted in reviewing the next year's results.

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APPENDICES – SEE ATTACHED

APPENDIX 1: 2016-17 WATERBIRD DATA

Waterbird species and the number of individuals recorded from the 12 Barmah-Millewa Forest waterbird monitoring points during 2016-17. Taxonomy follows Christidis and Boles (2008).

APPENDIX 2: COMPLETE WATERBIRD LIST

Bird species list for Barmah-Millewa Forest based on all species identified within Barmah-Millewa Forest during the completion of condition monitoring surveys since spring 1999.

APPENDIX 3: SITE PHOTOS