Preliminary results from the 2023 survey of game ducks in Victoria.

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1.1 Preamble

Aerial surveys of game ducks were undertaken between 16th October and 3rd November 2023. Ground counts were undertaken from 17th October – 6th November 2023. Monitoring was undertaken for different types of water bodies including wetlands, dams, sewerage treatment ponds, rivers and streams, which were also categorised according to size class (< 6 ha, 6-50 ha, >50 ha). Waterbodies were further stratified into four broad geographic regions in the state (North, South, East and West).

Total abundance estimates were calculated for each game species across all waterbodies within Victoria of the types specified above (the sampling frame). Estimates of the number of waterbodies of each type containing surface water were based on analysis of recent satellite imagery (Landsat and Sentinel-2). The following report provides preliminary results from the analysis of the 2023 survey data. A more comprehensive analysis and presentation of methods and results will be made available in the final report.

1.2 Methods

1.2.1 Surface water availability

Surface water availability was estimated from analysis of Landsat and Sentinel-2 satellite imagery using the most recent images obtained prior to the survey dates, mostly within the Spring period (September – November). Estimates of surface water used the same methodology as detailed in Ramsey and Fanson (2021) with calibration of Sentinel-2 images undertaken to improve classification accuracy. Calibration used actual observations of surface water within each sampled waterbody obtained during the aerial and ground surveys.

1.2.2 Sampling of game ducks

A total of 865 waterbodies were sampled during the 2023 survey (Table 1). Of these, 802 were monitored from a helicopter (Squirrel AS-350) and 63 monitored from the ground. Both aerial and ground surveys were conducted with two observers conducting counts of game ducks at each waterbody independently. For some large wetlands subject to aerial surveys, counts were obtained from a portion of the waterbody, usually 50% (selected at random), which was then used to impute the count for the entire waterbody. A similar method was used for ground counts where only a portion of the waterbody was monitored.

Counts of Chestnut teal on waterbodies surveyed from the ground were partitioned separately into adult male and females. These counts were then used to determine the mean ratio of male/female Chestnut teal. This ratio was subsequently used to adjust the counts of Chestnut teal counted from the helicopter, which only included observations of males.

A total of 738 of the 802 waterbodies subject to aerial survey were observed with surface water (92%). No waterbodies were observed to be completely dry during ground surveys (Table 1).

Table 1. Waterbodies sampled by aerial and ground surveys during 2023. The number of these waterbodies observed with surface water are given in parenthesis.

Waterbody type	Aerial	Ground	Totals
Dams	209 (197)	17 (17)	**226 (214)**
Sewage ponds	5 (5)	33 (33)	**38 (38)**
Wetlands	497 (445)	13 (13)	**510 (458)**
River/Streams	91 (91)	0	**91 (91)**
Total	**802 (738)**	**63 (63)**	**865 (801)**

1.2.3 Abundance estimation

The two independent replicate counts of ducks at each sampled waterbody were used to estimate the abundance of ducks at each waterbody, corrected for imperfect detection (birds missed by the observers) using a N-mixture model approach (Ramsey and Fanson 2021). Parameters for abundance and probability of presence were estimated separately for each duck species with a common set of parameters for the detection probability component. Models were fitted in a Bayesian framework using `Stan` (Carpenter *et al.* 2017).

Prediction of game duck abundance for the entire sampling frame (i.e. waterbodies containing water within Victoria) were estimated using a design-based approach (Thompson 1992). Design-based estimates of total abundance used a Horvitz-Thompson estimator, based on the stratum-level, selection probabilities calculated for each waterbody (Horvitz and Thompson 1952). Model-based estimates of abundance are currently also being investigated and will be detailed in the final report. Further details of the abundance estimators and their variance are given in Ramsey and Fanson (2021).

1.3 Results

1.3.1 Surface water availability

Overall, surface water availability in 2023 has declined slightly since 2022 for both wetlands and dams but was still higher than in either 2020 or 2021 (Figure 1).

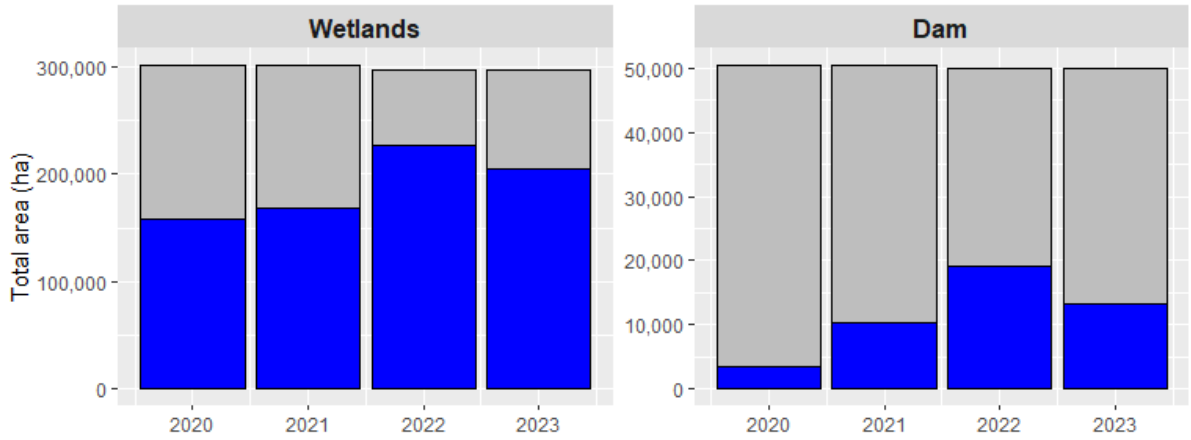

Figure 1: Temporal pattern in surface water for Victorian waterbodies over the last four years.

1.3.2 Game duck abundance estimates for Victoria

Counts of the each of the eight species of game duck revealed that both Chestnut and Grey teal were the most numerous species encountered during the surveys, followed by Black Duck and Wood Duck (Table 2).

Table 2. Total counts of each species by waterbody type. The maximum of the two counts for each waterbody was used to calculate the total. Species codes are: GT = Grey Teal; CT = Chestnut Teal; WD = Australian Wood Duck; PBD = Pacific Black Duck; AS = Australian Shelduck; HH = Hardhead; PED = Pink-eared Duck; BWS = Australasian Shoveler. *n* = number of waterbodies with surface water.

Waterbody type	n	GT	WD	AS	PBD	CT	HH	PED	BWS
Dams	214	1671	1262	317	1300	1084	360	46	34
Sewage ponds	38	6466	808	587	842	1537	3178	3505	194
Streams	91	241	1284	58	750	279	13	0	6
Wetlands	458	33859	3305	3637	9139	39144	3018	2548	554
Total	801	42237	6659	4599	12031	42044	6569	6099	788

Aerial and ground survey data were adequate to estimate abundance for all eight species of game duck, including the major game species (Table 3). Design-based estimates indicated that the population of game ducks on dams, sewage ponds, wetlands and streams in Victoria was approximate 7.1M birds (Table 3). Wood Duck were the most numerous game species (~2.6 M), followed by Pacific Black Duck (~1.4 K) and Grey and Chestnut Teal (~1.4 & 1.2M). Precision of the overall estimate of abundance was good, with a 8% (0.08) coefficient of variation, well within the target threshold of 15% identified by Ramsey and Fanson (2021) as being of adequate precision. Precision of estimates for the main individual game species was variable ranging from 12% for Grey Teal to 23% for Black Duck (Table 3).

Table 3: Summary of design-based estimates of total abundance of seven game duck species in Victoria. SE – Standard error; CV – coefficient of variation; L95 – lower 95% confidence interval; U95 – upper 95% confidence interval.

Species	Estimate	SE	CV	L95	U95
Australian Wood Duck	2,567,300	440,600	0.17	1,838,500	3,585,100
Australian Shelduck	354,400	92,800	0.26	213,900	587,100
Australasian Shoveler	11,600	2,800	0.24	7,300	18,500
Chestnut Teal	1,227,800	185,500	0.15	914,700	1,648,100
Grey Teal	1,401,500	162,300	0.12	1,117,900	1,757,200
Hardhead	156,100	51,400	0.33	83,300	292,600
Pacific Black Duck	1,358,200	310,100	0.23	873,100	2,112,900
Pink-eared Duck	43,600	9,800	0.23	28,200	67,500
Total	7,120,600	602,000	0.08	6,035,100	8,401,400

1.4 Conclusions

The total statewide abundance of game ducks has increased markedly from the previous year, most likely driven by the extensive flooding and presence of surface water driving breeding activity during 2022. It should be noted that the estimates contained with this report are of a preliminary nature only and may be subject to revision in the final report. Further work is also currently being undertaken on model-based estimates of abundance, which will be detailed in the final report, due on the 28th February 2023.

1.5 References

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