To: Minister for Outdoor Recreation

RECOMMENDATIONS FOR THE 2025 DUCK SEASON ARRANGEMENTS

Core message

- In response to the Parliamentary inquiry into native bird hunting arrangements in Victoria, Government announced that adaptive harvest management (AHM) would be implemented in 2025 to assist in determining the annual duck season arrangements.
- In the initial stages of implementing AHM, Victorian game duck abundance is determined, a proportional harvest level of 10% is applied and a bag limit to achieve this is identified.
- Victorian game duck abundance was estimated at approximately four million birds, and the seasonal harvest quota was 400,500 (which excluded Blue-winged Shoveler as it cannot be hunted). The modelled daily bag limit that achieved the 10% quota is nine ducks per day.
- The GMA Board reviewed the monitoring and modelling program to collect data and provide the modelled daily bag limit recommendation and considered it was robust, acknowledging the program is in its infancy and will improve in precision as seasons pass. It also considered other comparator indicators as part of its due diligence.
- After thoroughly considering all available information to it, the GMA Board does not consider there is substantive evidence that contra-indicates the identified daily bag limit to achieve the 10% proportional harvest level. Therefore, the GMA Board recommends that a daily bag limit of nine birds is adopted for the 2025 duck season.
- The AHM monitoring and modelling program has been developed by independent expert scientists and the GMA believes it is fit for purpose following interrogation and analysis of the outputs and way in which it delivers the recommended bag limit.
- The GMA is available to brief you on this recommendation in person should you wish.

Due	As soon as possible
Explanation	To allow the broader community, industry, the hunting community and government agencies to make arrangements.

Recommendation

That you:

1. approve the GMA recommendation to adopt a daily bag limit of nine (9) birds for the 2025 duck season.

Recommendation 1 ☐ Endorsed ☐ Not endorsed ☐ Noted ☐ Returned for review

2. note that the GMA will inform the community on the final seasonal arrangements and conduct compliance operations together with its partner agencies.

Recommendation 2 ☐ Endorsed ☐ Not endorsed ☐ Noted ☐ Returned for review

3. advise whether you would like an in-person briefing from the GMA Chair of the Board and staff on the above recommendation.

Recommendation 3 ☐ Endorsed ☐ Not endorsed ☐ Noted ☐ Returned for review

To: Minister for Outdoor Recreation

Minister's Comments

Signed **Hon Steve Dimopoulos MP**
Minister for Outdoor Recreation

Date

Approved by Signature removed

Date 22 January 2025

Chris Rose, Chairperson Game Management Authority ☎ Text removed

Endorsed by: Graeme Ford, CEO Game Management Authority ☎ Text removed

Prepared by: **Text removed**

To: Minister for Outdoor Recreation

From	GAME MANAGEMENT AUTHORITY	**Ref**	
Title	RECOMMENDATIONS FOR THE 2025 DUCK SEASON ARRANGEMENTS	**File**	
		Due	As soon as possible

1. Key Information

Background

Following the Parliamentary Inquiry into Victoria's recreational native bird hunting arrangements, government committed to implementing AHM in order to introduce a more evidence-based approach to setting sustainable duck hunting seasons. The development of AHM has been considered by successive governments since 2016.

In order to set sustainable harvest levels for game duck species, it is necessary to know the size or status of the population. With the move to AHM and a more rigorous monitoring program, we can now accurately estimate the actual number of game ducks in Victoria and the extent of their habitat and apply harvest regulations based on modelled sustainable limits with an understanding of the relationship between hunter numbers, harvest regulation and harvest size.

GMA has worked with independent experts to develop the modelling and monitoring program to achieve the harvest objectives established by government. The Victorian Game Duck Harvest Strategy (Harvest Strategy) recently approved by government sets the annual proportional harvest level at 10% of the total Victorian game duck population. This harvest level considers wounding losses and climate change effects. The Harvest Strategy applies daily bag limits as the primary harvest control mechanism to regulate seasonal harvests.

The approach to modelling game duck abundance was developed in 2017. It was independently reviewed by a government appointed expert panel in 2019 and found to be fit for purpose.

The monitoring program to estimate game duck abundance and the relationship between offtake and harvest regulation was designed in 2020. A pilot abundance survey was conducted in late-2020 and independently reviewed. Improvements recommended by the review have been implemented.

The approach has been reviewed and refined each year and is considered to be contemporary.
The harvest model used to estimate the daily bag limit to achieve the 10% seasonal harvest quota was updated with current data and now has 15 years of data inputs.

From 2025, the modelling and monitoring program will be independently reviewed annually by an expert panel who will provide advice to the GMA on the need for any reform. Stakeholders will also have the opportunity to provide feedback during post-season consultation.

Daily bag limit and due diligence

Victorian game duck abundance and bag limit recommendation
Preliminary results from the 2024 survey of game ducks in Victoria and recommendations for seasonal arrangements (Preliminary Report) has been prepared by the Arthur Rylah Institute for Environmental Research (ARI), Department of Energy, Environment and Climate Action (DEECA) (see **Attachment 1**). It estimates game duck habitat extent, total Victorian game duck abundance, and identifies a bag limit that would achieve the 10% seasonal quota.

To: Minister for Outdoor Recreation

Key findings in the report include:

a. The number of waterbodies categorised as containing surface water was estimated at 139,440. This was a 34% decrease compared with the estimate from the previous survey in 2023 (212,045). Overall, surface water area in 2024 decreased by 21% compared to that in 2023, resulting in a total surface water area of 183,196 ha (see Figure 1). This is consistent with rainfall records that show large parts of Victoria experienced average to below average rainfall in the 12 months prior to the survey being conducted (see Figure 2).

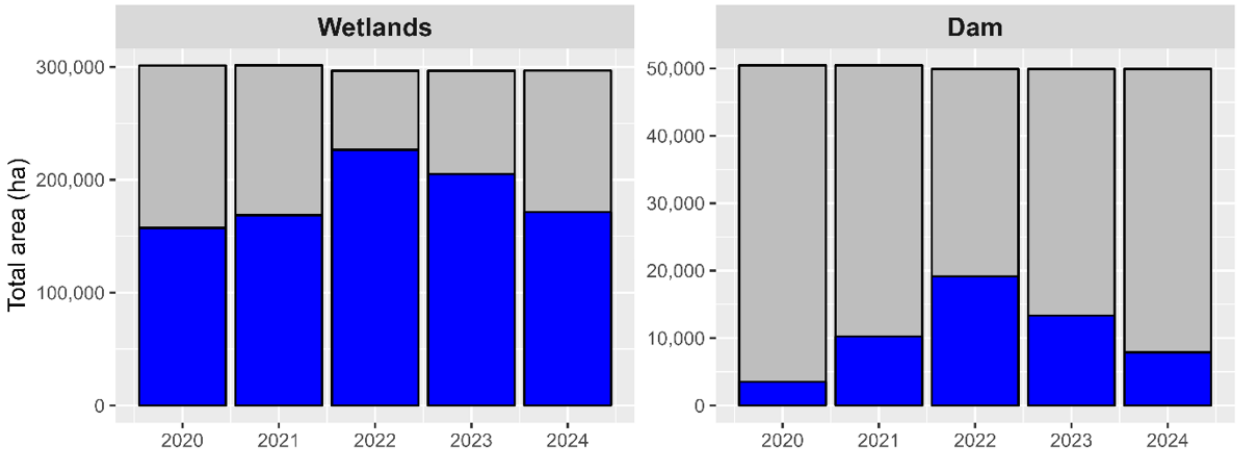

Figure: 1 Temporal pattern in surface water for Victorian waterbodies over the last five years.

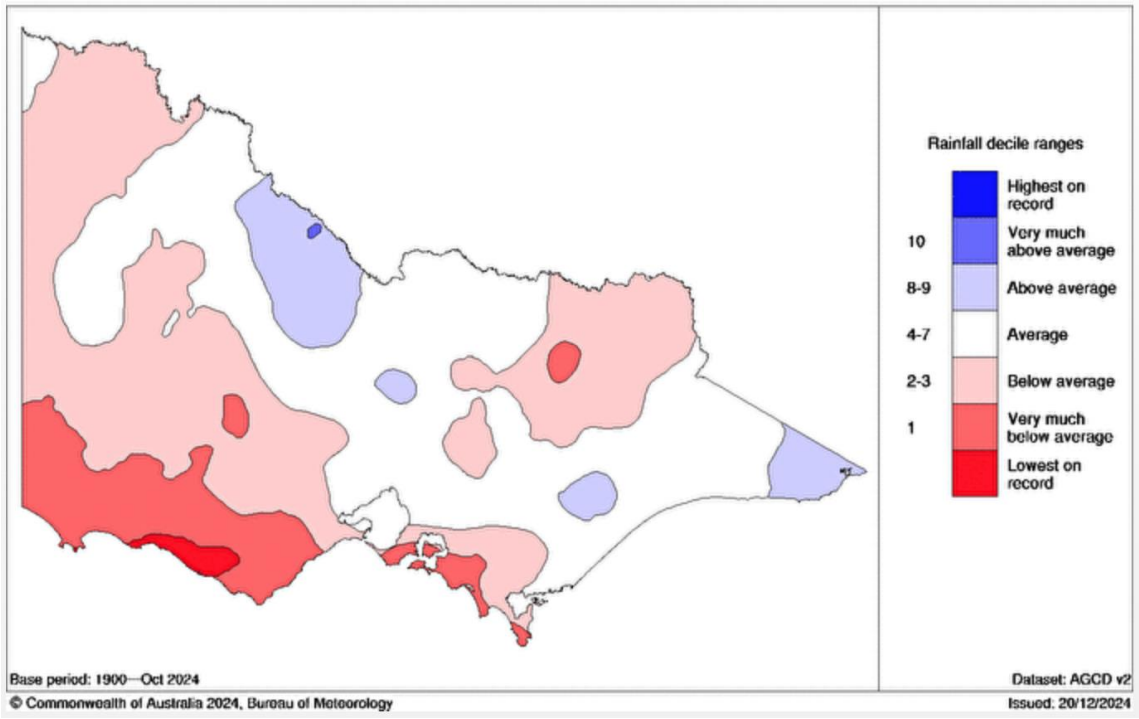

Figure 2: Rainfall in Victoria for the period 1/11/2023 – 31/10/2024

To: Minister for Outdoor Recreation

b. Aerial and ground survey data were considered adequate to estimate abundance for eight species of duck, including the major game species. Estimates indicated that the population of game ducks on dams, sewage ponds, wetlands and streams in Victoria was approximately four million birds. This is an approximate reduction of 44% on the previous year (7.1million) but was greater than abundances recorded during the period 2020-2022, inclusive (see Figure 3). This rise and fall in the population is consistent with game duck "boom and bust" ecology, where populations dramatically increase in response to favourable conditions and decline as conditions return to average or less favourable levels.
c. Wood Duck were the most numerous game species (~1.4 million), followed by Pacific Black Duck (~0.82 million) and Grey and Chestnut Teal (~0.69 million and ~0.80 million, respectively).

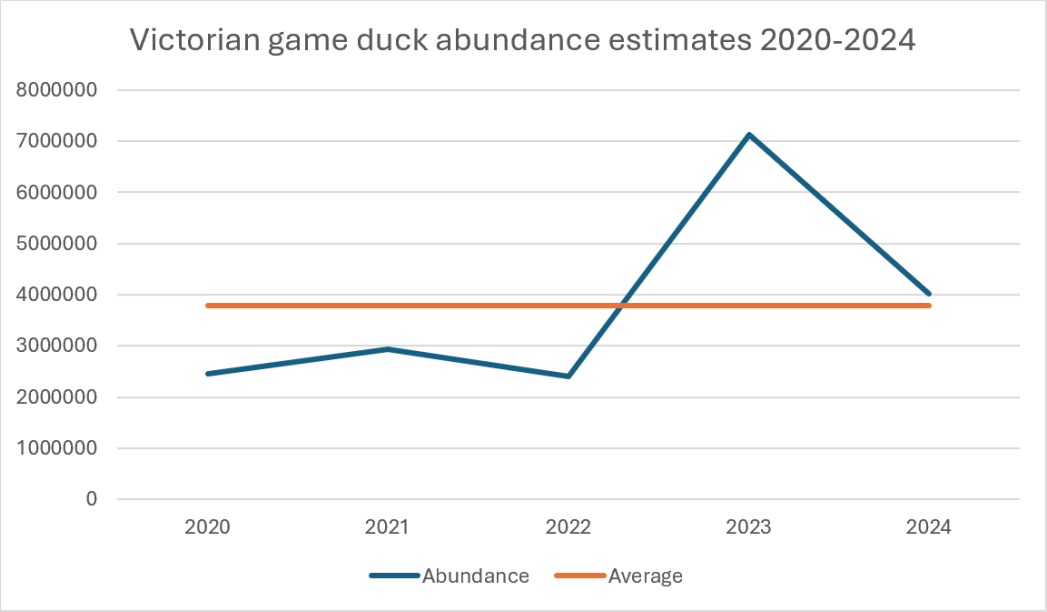

Figure 3: Estimated Victorian game duck abundance 2020 - 2024

d. Precision of the overall estimate of abundance was good, with a 3% (0.03) coefficient of variation, well within the target precision threshold of 15%.
e. A model which considers the relationship between harvest, hunter numbers and seasonal restrictions was used to predict the bag limit that was most compatible with achieving a 10% level of harvest (i.e., 400,500 ducks). This figure was calculated after removing the Blue-winged Shoveler from total abundance as it can no longer be hunted.
f. Analysis revealed that a daily bag limit of nine birds would achieve the 10% quota and result in a total harvest of approximately 416,600 ducks.
g. At the upper level of the 90% confidence interval, the harvest would be 631 000 (15.7% of total abundance). This level of offtake falls within the sustainable limit of 20% as established by Prowse (2023)[1].

The Preliminary Report presents the upper and lower confidence values for the expected harvests for various bag limits in achieving the proposed 10% proportional harvest. For the identified bag limit of nine birds, the spread of values is 255,933 (lower) to 631,303 (upper).

[1] Prowse, T. (2023) Conservation and Sustainable-Harvest Models for Game Duck Species. Report prepared for the Department of Jobs, Skills, Industry and Regions.

To: Minister for Outdoor Recreation

Although this prediction has a degree of uncertainty, it does provide an objective basis for relating total harvest to prevailing seasonal arrangements, and the upper threshold remains below the 20% sustainability threshold as established in the Prowse report. Since total game duck harvests are estimated annually from data derived from surveys of hunters undertaken during the season, it will be possible to evaluate the total harvest predicted by the model with the harvest estimated following completion of the hunting season. Precision in this relationship should improve over time as sample sizes for each set bag limit increases.

While the report and its findings are preliminary in nature and may be revised in the final technical report, experience has shown that any variation in habitat extent and population abundance has not been material. A final technical report will be prepared by the end of March.

Comparator indicators

Both the Eastern Australian Waterbird Survey (EAWS) game duck abundance index and the NSW Riverina waterfowl absolute abundance survey showed declines in waterfowl from at or near record highs in 2023. The increased populations were in response to favourable breeding conditions in 2022. The EAWS, like the Victorian survey, showed a reduction in available game duck habitat.

Eastern Australian Waterbird Survey

The EAWS summary report showed that the wetland area index for eastern Australia declined from the previous recent flood years and was at 50% of its long-term average (LTA) (see Figure 4). EAWS wetland distribution showed that band 2 (northern Victoria) held the second greatest area of wetland availability within the surveyed bands. Band 2 also held the highest concentration of waterbirds (all surveyed species) within surveyed bands.

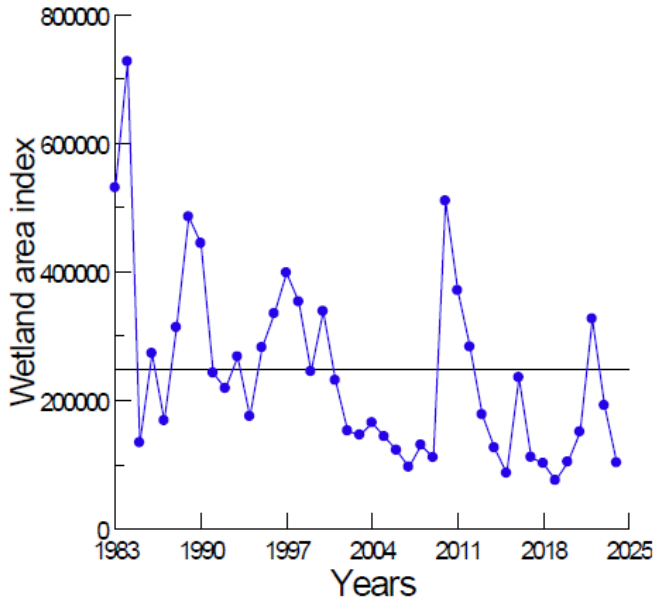

Figure 4: EAWS wetland area index

The EAWS game duck abundance index declined from the previous year and was 76% of the long-term average (LTA) (see Figure 5). Importantly however, key species that consistently make up approximately 90% of the annual harvest (Grey Teal, Pacific Black Duck, Wood Duck) had populations that were close to average (89%, 88% and 88%, respectively). Chestnut Teal (a significant game species in its usual coastal range) was at 97% of its LTA.

To: Minister for Outdoor Recreation

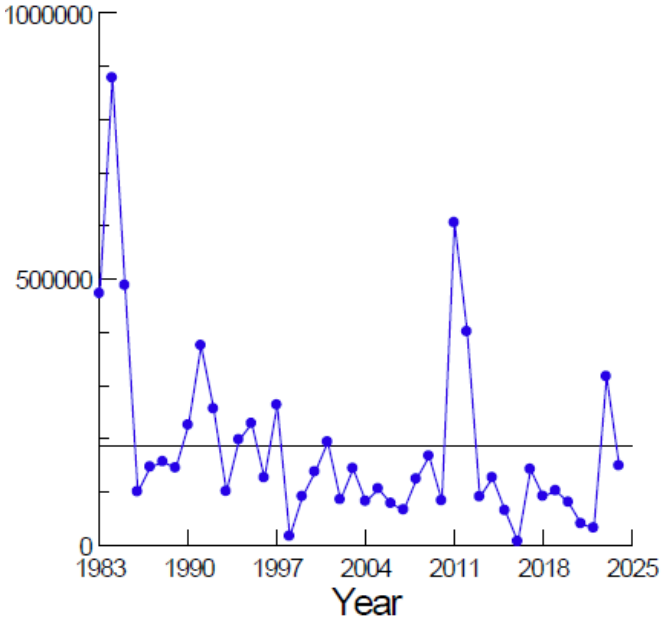

Figure 5: EAWS game duck abundance index

Less common species (Hardhead) or species for which Victoria is on the fringe of their range (Pink-eared Duck) had reduced abundances (34% and 52% of LTA, respectively). Mountain Duck were at 34% of the LTA. These species generally make up 10% combined of the total annual seasonal harvest in Victoria and harvesting is considered to have a reduced impact on their status.

NSW Riverina waterfowl abundance surveys

The NSW Department of Primary Industries waterfowl quota report showed that game duck abundance decreased from the previous year (highest recorded) by 56%, from 4.295 million to 1.89 million. However, abundance was greater than the LTA of 1.21 million (see Figure 6).

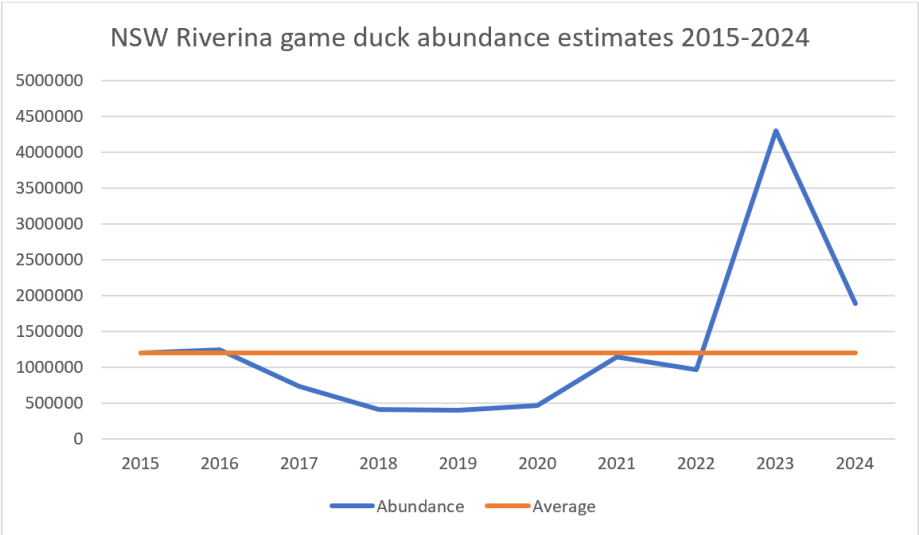

Figure 6: NSW Riverina game duck abundance 2015 – 2024 (includes Plumed Whistling Duck, a non-game species in Victoria)

To: Minister for Outdoor Recreation

Other considerations – additional sources of mortality

To date, state and national monitoring agencies have not detected high pathogenic avian influenza (HPAI) in Australian wildlife populations. Advice received suggests that the chance of the disease being transported into Australia after the main spring shorebird migration period is low. Should an outbreak of HPAI occur in wild animal populations, the management response will be led by DEECA and consider duck hunting.

The Bureau of Meteorology has predicted above average rainfall for much of Australia over the January to March seasonal outlook period (see Figure 7). If this occurs, there is no risk of additional drought-induced above average mortality between the survey and start of the duck season.

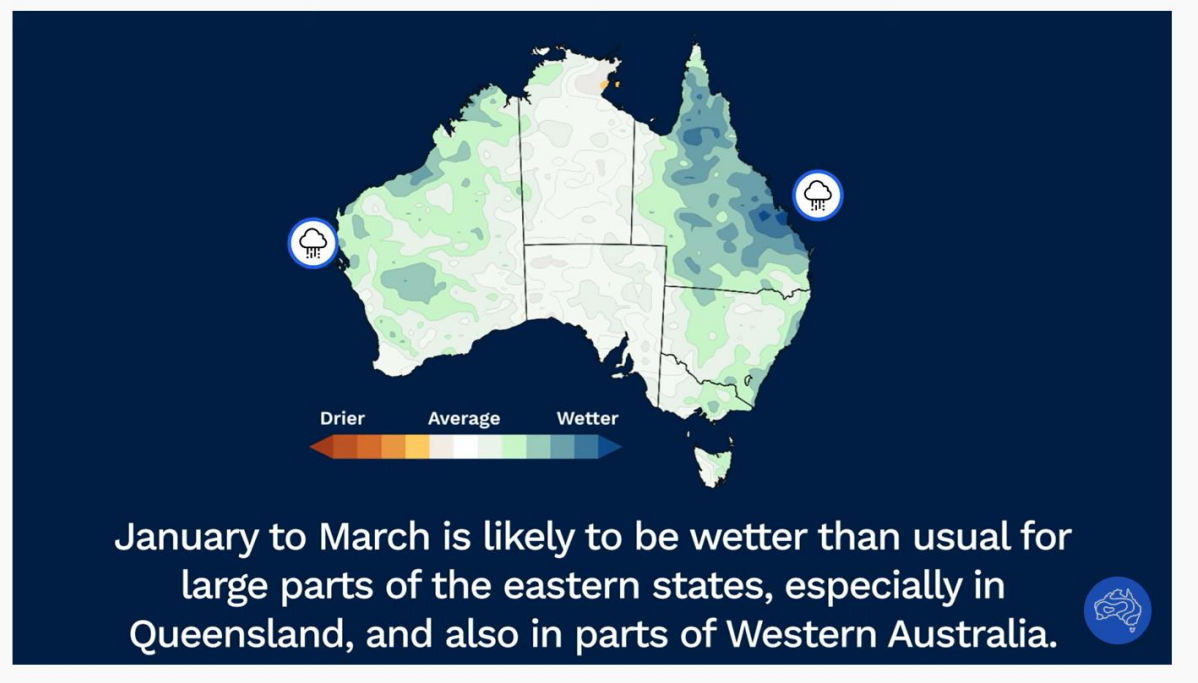

Figure 7: Rainfall outlook for Australia for January to March 2025 (source Bureau of Meteorology)

Duck hunting arrangements in adjacent states

South Australia

The South Australian government has announced there will be a 13-week duck season (22 March – 29 June) with a six-bird bag limit. Blue-winged Shoveler, Hardhead and Pink-eared Duck will not be available for hunting and there will be a limit of two Mountain Duck per day. Hunting will be permitted between sunrise and sunset.

New South Wales

The New South Wales government adopts a low risk, conservative approach when setting its cull quotas for the waterfowl damage mitigation program. The New South Wales government estimates the total abundance of ducks in the Riverina district and sets its damage mitigation quota at 10% of the total abundance.

New South Wales Riverina game duck abundance declined by 56% from 4.295 million to 1.89 million birds but was still above the long-term average of 1.21 million. As a consequence, the New South Wales 2024-2025 quota for this rice growing season was reduced from 429,482 in the previous season to 188,801.

To: Minister for Outdoor Recreation

Tasmania
The Tasmanian Department of Natural Resources and Environment's website advises that season open dates are 8 March – 9 June, inclusive, that there is a 10-bird daily bag limit, and that Pacific Black Duck, Grey Teal, Chestnut Teal, Mountain Duck and Wood Duck may be harvested.

Social and economic impact

The GMA uses the current policy settings as prescribed in the Wildlife (Game) Regulations 2024 as the base line for assessing the social and economic impacts of any recommendation to vary from the prescribed arrangements. Given the Harvest Strategy focusses on adjusting the daily bag limit as the key harvest control, there are no recommendations to vary the prescribed season length. For this season, there are also no recommendations to regulate the species available for hunting or set species-specific bag limits.

The AHM modelled bag limit to achieve the 10% seasonal quota of nine birds per day is one less than the prescribed 10 birds per day. This reduction will affect few hunters as most cannot achieve such a daily limit. Therefore, it is unlikely that a nine-bird bag limit will act as a disincentive for the majority of hunters to go hunting.

For those people, businesses or sections of the community who oppose or who are negatively impacted by duck hunting, adoption of the recommended daily bag limit does not increase nor decrease impacts over the current prescribed arrangements.

Animal welfare

The current extent of wounding in duck hunting is unknown, although historic levels have been estimated. Through its RESPECT Hunt Responsibly and REDUCE wounding programs, the GMA works with hunting organisations to raise hunter awareness, improve skills and encourage responsible hunting behaviours to reduce wounding and improve animal welfare outcomes.

Government has committed to implementing the Waterfowl Wounding Reduction Action Plan (WWRAP) under the government's Sustainable Hunting Action Plan and response to the Parliamentary Inquiry. The WWRAP contains a number of measures to increase hunter awareness of the wounding issue, educate hunters on ways to reduce wounding, introduces a knowledge test for new and existing hunters and explores the merits of hunter proficiency testing. A program to monitor trends in wounding levels has already commenced and research into identifying wounding rates in Victorian duck hunting will commence next year.

Reducing impacts on non-game wildlife

All duck hunters are required to pass the Waterfowl Identification Test before being allowed to hunt duck in Victoria. The test seeks to ensure that hunters have the necessary skills to distinguish between game and non-game waterbirds when hunting. The requirements for passing the test have been increased in recent years. The GMA works with hunting organisations to raise hunters' awareness and the community is encouraged to report illegal hunting to the GMA.

To further minimise the risk of non-game species being illegally destroyed or unduly disturbed, the Minister can close wetlands to duck hunting or additionally regulate hunting (e.g. prohibiting hunting from boats) where significant concentrations of threatened or breeding waterbirds are detected. In conjunction with DEECA, wetlands are surveyed in February and, where numbers of birds exceed trigger-levels established in a report prepared by ARI, a recommendation will be made to you after consultation with key stakeholders. The GMA and DEECA also respond to community reports which are verified and considered for recommendation for closure or further regulation. Closed or further regulated wetlands are advertised, promoted by GMA and land managers, signposted and enforced to maximise compliance.

To: Minister for Outdoor Recreation

Recommendation

The GMA Board has interrogated the science on which the government's independent panel endorsed in 2019 as a sound approach to Adaptive Harvest Management and which has been refined and updated based on the expertise of ARI, an independent review of the monitoring and modelling program and the expert panel formed by the GMA.

The GMA Board accepts that the game bird abundance modelling provides a sound basis on which to assess the Victorian population of game ducks.

The GMA Board acknowledges that there is a level of uncertainty in modelling the daily bag limit to achieve the proportional harvest level established in the Victorian Game Duck Harvest Strategy. However, this uncertainty does not suggest that there is a risk that the harvest will exceed the sustainable threshold of 20% of established in the Prowse report.

The AHM is a 'learning by doing' system that will be refined and become more precise over time and the GMA supports government's decision to set the harvest threshold at the conservative end of the sustainable harvest window. A thorough review of the performance of AHM will be conducted annually by a panel of independent experts to identify data and modelling approaches to improve precision. The GMA will inform you of the outcomes of these reviews.

Considering the above, the GMA recommends that a daily bag limit of nine (9) birds is adopted for the 2025 duck season.

Context

Duck hunting in Victoria

Duck hunting is permitted under the *Wildlife Act 1975*. The season length, species composition, bag limits and hunting methods are prescribed under the Wildlife (Game) Regulations 2024. Under these regulations, a duck hunting season occurs annually, commencing on the third Wednesday in March and concluding on the second Monday in June each year. Seven duck species may be hunted. Public land classification determines whether hunting is allowed or not and hunting on private property is at the discretion of the landowner.

There are approximately 22,000 licensed duck hunters who, on average, harvest 324,500 game ducks annually.

Modifying a duck hunting season

Under section 86 of the *Wildlife Act 1975*, the Minister, by notice in the Government Gazette, may further regulate the duck hunting season where there is a need to alter the prescribed seasonal arrangements.

Under a Supplement to the General Order for the Administration of Acts dated 1 December 2023, section 86 of the *Wildlife Act 1975* is jointly administered by you, as Minister for Outdoor Recreation and as the Minister for Environment.

Role of the Game Management Authority in setting duck season arrangements

Under section 5(a) of the *Game Management Authority Act 2014* (GMA Act), an objective of the GMA is to 'promote sustainability and responsibility in game hunting in Victoria.'

Under section 6(h), the GMA is to 'monitor, conduct research and analyse the environmental, social and economic impacts of game hunting and game management' and under section 6(i), the GMA may make recommendations to relevant Ministers in relation to:

(i) game hunting and game management, and

(iii) open and closed seasons and bag limits.

To: Minister for Outdoor Recreation

Also, section 8A 'Guiding principles' requires the GMA to have regard to the following relevant principles when exercising its powers or performing its functions:

(b) the principle of triple bottom-line assessment, which means an assessment of all the economic, social and environmental costs and benefits, taking into account externalities;

(d) the principle of an evidence-based approach, which means considering the best available information when making decisions.

The advice provided by the GMA on the annual duck season relates only to season settings for the forthcoming season. It does not relate to the broader policy of allowing duck hunting per se.

Enforcement of the hunting season

The GMA works closely with its regulatory partners to ensure hunting is conducted lawfully and responsibly. Authorised officers from DEECA and Parks Victoria, together with Victoria Police, support the GMA during periods of greatest hunting activity and at other times during the hunting season. Enforcement operations are targeted according to a risk-based, intelligence-led approach with a focus on public safety, sustainability and compliance with the law. Random patrols are also conducted throughout the season on both public and private waters.

Communication plan to support the hunting season

The GMA will implement a targeted communication plan using appropriate social and traditional platforms to inform the community on the arrangements for the 2025 duck season once decided by government. Communications will also promote safe and responsible behaviour by all involved in duck hunting. The REDUCE wounding campaign will also be promoted to improve animal welfare outcomes.

In recognition of the Parliamentary Inquiry and through continuing to improve sustainable outcomes, the GMA will raise hunter awareness of Aboriginal cultural heritage sites and cultural artefacts and arrangements for reporting damage or destruction to these.

Attachments

Attachment 1 Preliminary results from the 2024 survey of game ducks in Victoria and recommendations for seasonal arrangements. Arthur Rylah Institute for Environmental Research, Department of Energy, Environment and Climate Action.

Preliminary results from the 2024 survey of game ducks in Victoria and recommendations for seasonal arrangements.

Arthur Rylah Institute, DEECA, Victoria.

1.1 Preamble

Aerial surveys of game ducks were undertaken between 14th November and 5th December 2024. Ground counts were undertaken from 6th November and 20th November 2024. 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 2024 survey data including recommendations for seasonal arrangements (daily bag limit) for the forthcoming recreational duck hunting season. 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 – December). 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 883 waterbodies were sampled during the 2024 survey (Table 1). Of these, 822 were monitored from a helicopter (Squirrel AS-350) and 61 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 30% (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. From the ground surveys, a total of 512 Chestnut teal males were observed from 18 waterbodies where at least one male Chestnut Teal was present. The median numbers of male and female Chestnut Teal observed were 17.5 and 32, respectively, with a trimmed mean estimate of the male/female sex ratio of 0.54 (MAD = 0.39). This

meant that, for waterbodies with observations of Chestnut teal males, there were around twice as many Chestnut teal females present.

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 model-based approach (Thompson 1992). Design-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

A total of 638 of the 822 waterbodies subject to aerial surveys and 59 of 61 waterbodies subject to ground surveys were observed with surface water (Table 1). Hence 21% of surveyed waterbodies were observed to be dry.

Table 1. Waterbodies sampled by aerial and ground surveys during 2024. The number of these waterbodies observed with surface water are given in parenthesis.

Waterbody type	Aerial	Ground	Totals
Dams	209 (180)	17 (17)	226 (197)
Sewerage ponds	5 (5)	32 (32)	37 (37)
River/Streams	95 (94)	0	95 (94)
Wetland	513 (359)	12 (10)	525 (369)
Total	**822 (638)**	**61 (59)**	**883 (697)**

The number of waterbodies categorised as containing surface water following calibration of the satellite imagery was estimated at 139,440. This was a 34% decrease compared with the estimate from the previous survey in 2023 (212,045). Overall, surface water area in 2024 decreased by 21% compared to that in 2023, resulting in a total surface water area of 183,196 ha (Figure 1).

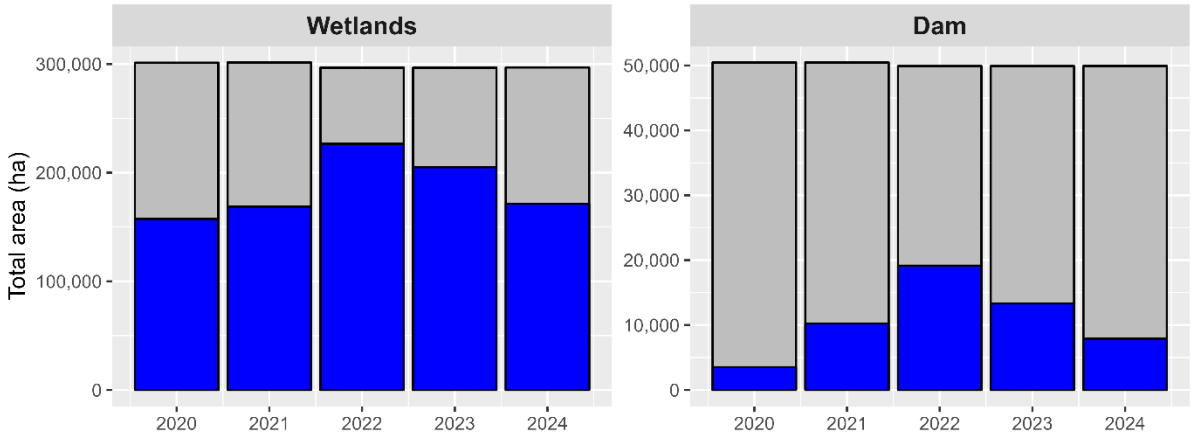

Figure 1: Temporal pattern in surface water for Victorian waterbodies over the last five years.

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	197	2693	2257	1865	2075	4366	1288	487	78
Sewage ponds	37	11767	475	637	1119	2467	4147	8435	101
Streams	94	415	1308	6	1232	276	6	1	6
Wetlands	369	24793	2044	6819	10578	38126	3530	1871	438
Total	697	39668	6084	9327	15004	45235	8971	10794	623

Aerial and ground survey data were adequate to estimate abundance for eight species of duck, including the major game species (Table 3). Model-based estimates indicated that the population of game ducks on dams, sewage ponds, wetlands and streams in Victoria was approximately 4.0 M birds (Table 3). Wood Duck were the most numerous game species (~1.4 M), followed by Pacific Black Duck (~0.82 M) and Grey and Chestnut Teal (~0.69 M and ~0.80 M). Precision of the overall estimate of abundance was good, with a 3% (0.03) 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 individual game species was variable ranging from 17% for Hardhead to 5% for Black Duck (Table 3).

Table 3: Summary of model-based estimates of total abundance for eight species of native duck 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	1,389,400	102,900	0.07	1,206,900	1,582,300
Australian Shelduck	110,900	14,200	0.13	87,800	139,700
Australasian Shoveler*	13,000	3,900	0.30	7,300	22,000
Chestnut Teal	804,800	53,100	0.07	709,200	906,600
Grey Teal	693,200	35,300	0.05	629,900	757,000
Hardhead	149,300	24,600	0.17	109,500	200,500
Pacific Black Duck	815,000	40,200	0.05	742,300	893,000
Pink-eared Duck	42,300	4,200	0.10	35,300	50,800
Total	**4,018,000**	**130,800**	**0.03**	**3,769,600**	**4,282,600**

* Prohibited for hunting

1.4 Seasonal arrangements

The Victorian government has committed to adopting Adaptive Harvest Management (AHM) for the regulation of the annual recreational harvest of game ducks. As part of this process, research was undertaken to identify sustainable levels of harvest that could be used for setting a proportional harvest scheme, being a percentage of the total game duck population that could be harvested each year within sustainable limits (Prowse 2023). This research identified that proportional harvests of between 10% - 20% were sustainable, and were robust to wounding losses of up to 23% (Prowse 2023). Based on this research, seasonal harvest quotas will be set at 10% of the total population of game ducks in Victoria for at least the first three seasons of AHM application in line with the precautionary approach as set by the Victorian Game Duck Harvest Strategy.

Implementing the proportional harvest approach for Victoria's recreational harvest requires that the seasonal regulations regarding the daily bag limit and season length be set to achieve the 10% harvest quota. To determine how bag limits and season length relate to the total number of harvested ducks we analysed 15 years of data that recorded total harvest, daily bag limit, season length and number of game duck licence holders. A model was fitted with these variables with total harvest as the response and the remaining variables as predictors, which also included a variable indicating years when COVID restrictions were in place. We then used this model to predict the bag limit that was most compatible with achieving a 10% level of harvest (i.e., 400,500 ducks), assuming a season length of 83 days and the number of licence holders as of June 2024 (21,383).

Analysis revealed that a daily bag limit of 9 is the smallest value that would result in an expected proportional harvest of at least 10% (10.4% - Table 4). A bag limit of 9 would be expected to result in a total harvest of approximately 416,600 ducks (90% CI: 255,900 – 631,300) (Table 4).

Table 4 Expected total duck harvests under different bag limits, including the expected percentage of the total duck population harvested. Green shading identifies the smallest bag limit that would be expected to achieve at least a 10% quota of 400,500 ducks. These estimates assume a season length of 83 days and 21,383 license holders.

Daily bag limit	Expected duck harvest (90% CI)	Percentage harvested (90% CI)
1	212,727 [117,460, 339,027]	5.3% [2.9%, 8.4%]
2	232,408 [134,754, 368,118]	5.8% [3.4%, 9.2%]
3	252,577 [150,068, 385,143]	6.3% [3.7%, 9.6%]
4	274,183 [163,183, 421,972]	6.8% [4.1%, 10.5%]
5	296,712 [180,682, 443,515]	7.4% [4.5%, 11.1%]
6	323,566 [199,982, 488,755]	8.1% [5%, 12.2%]
7	351,986 [216,802, 525,886]	8.8% [5.4%, 13.1%]
8	381,900 [235,012, 572,311]	9.5% [5.9%, 14.3%]
9	416,582 [255,933, 631,303]	10.4% [6.4%, 15.7%]
10	456,912 [276,240, 686,444]	11.4% [6.9%, 17.1%]

1.5 Conclusions

The total statewide abundance of game ducks in 2024 has decreased by around 44% compared with the abundance estimated in 2023, most likely driven by the concurrent reduction of surface water. Based on the aggregate abundance estimate for the seven game species available for hunting, a daily bag limit of 9 ducks/day under a proportional harvest scheme achieves the target quota of 10%. 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.

1.6 References

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