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Estimate of duck and Stubble Quail harvest in Victoria for 2025

Results from surveys of Victorian Game Licence holders in 2025

P.D. Moloney and J.S. Flesch

Game Management Authority

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 partnering with Victorian Traditional Owners and Victoria's Aboriginal community to progress their aspirations.

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Front cover photo: Chestnut Teal provided by Ron Waters.

Estimate of duck and Stubble Quail harvest in Victoria for 2025

Results from surveys of Victorian Game Licence holders in 2025

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Context

To effectively manage game species, it is important to quantify the number of individuals harvested. Since 2009, the Victorian State Government game management agency has commissioned a series of regular telephone surveys of randomly selected Game Licence holders to help quantify the harvest. Three sets of telephone surveys are conducted each year during the various game harvest seasons for deer, duck and Stubble Quail (*Coturnix pectoralis*). This report focuses only on the duck and Stubble Quail harvests for 2025.

In 2025, the duck season was the prescribed 12 weeks. The daily bag limit for ducks was reduced to nine down from the prescribed 10 birds. The Stubble Quail season was as prescribed, 12 weeks in length and a daily bag limit of 20 birds per day.

Aim

The aim of this report is to provide estimates of the total harvests of ducks and Stubble Quail by Victorian Game Licence holders during the 2025 hunting seasons.

Methods

Game Licence holders for each game type were randomly sampled and interviewed by telephone at intervals during their respective game seasons. In all surveys, respondents were asked whether they had hunted during the period for which the survey applied, and (if applicable) the number and species of birds harvested. Additional information was obtained on hunting methods, locations and experience. Data collected during these telephone interviews was analysed to estimate the total harvest and days spent hunting for ducks and Stubble Quail. Additional metrics related to hunter effort and efficiency were also estimated.

Results

The total estimated duck harvest in 2025 was 487,800 (95% confidence interval (CI) = 429,200–554,500) which was 46% greater than the long term average (334,200). The total estimated number of duck hunting days was 108,600 (95% CI = 95,100–124,100) which was 22% above the average annual duck hunting days in previous surveys (89,200). The three most commonly harvested species were Pacific Black Duck (*Anas superciliosa*) (which comprised 36% of the total harvest), Grey Teal (*Anas gracilis*) (29%) and Australian Wood Duck (*Chenonetta jubata*) (24%). The remaining ducks harvested were Chestnut Teal (*Anas castanea*) (5%), Pink-eared Duck (*Malacorhynchus membranaceus*) (3%), Mountain Duck (*Tadorna tadornoides*) (2%) and Hardhead (*Aythya australis*) (1%).

Game Licence holders endorsed to hunt ducks who actively hunted ducks during the 2025 duck season harvested an average of 49 ducks (95% CI = 41.7–57.6), over an average of 10.9 days (95% CI = 9.2–12.9).

The total estimated Stubble Quail harvest in 2025 was 48,000 (95% CI = 29,600–78,000), which was 72% lower than the average annual Stubble Quail harvest from previous surveys (170,300). The total estimated number of Stubble Quail hunting days was 8,100 (95% CI = 5,000–13,100), which was 63% less than the annual average from previous surveys (22,000 days).

Game Licence holders endorsed to hunt Stubble Quail who actively hunted Stubble Quail during the 2025 Stubble Quail season harvested an average of 22.8 (95% CI = 13.3–38.9) quail over an average of 3.8 (95% CI = 2.3–6.6) days.

The total number of hunter days during the 2025 hunting season for ducks and Stubble Quail was estimated to be 116,700 (95% CI = 101,700–131,700).

Conclusions and implications

1. The duck harvest in 2025 exceeded the long-term average by 46%, even though the daily bag limit was reduced to nine from the prescribed 10. This can be partially explained by:
    - total hunting days being 24% higher than average;
    - hunter efficiency being 25% higher than average;
    - the proportion of active duck hunters was average (50% compared to 52%).
2. The Stubble Quail harvest in 2025 was 72% lower than the long-term average harvest recorded. The decrease can be partially explained by:
    - total hunting days being 63% lower than average;
    - hunter efficiency being 13% lower than average;
    - the proportion of active Stubble Quail hunters was 2% lower than average.
3. The number of Game Licence holders who are endorsed to hunt Stubble Quail but do not hunt Stubble Quail is affecting the accuracy of the activity indices. With the change to licencing (licence holders can now just be endorsed for just duck and separate education models required for duck, and Stubble Quail and introduced game birds) the accuracy may change. Once the changes are complete (they started in February 2025) the number of Stubble Quail licence holders surveyed may need to change depending on the new accuracy.
4. Performing telephone surveys throughout the hunting season is likely to minimise memory bias and non-response bias. However, sources of bias will remain (due to over- and under-reporting), and the estimates of total harvest must be interpreted with care.

1 Introduction

To effectively manage game species, it is important to quantify the numbers of animals harvested. Since 2009, the Victorian State Government game management agency (currently the Game Management Authority, GMA) has commissioned a series of regular telephone surveys of randomly selected Game Licence holders. Telephone surveys were conducted during the various game harvest seasons for deer, ducks and Stubble Quail (*Coturnix pectoralis*). However, this report focuses only on the duck and Stubble Quail harvests. Deer harvests are addressed in a separate report.

The 2025 duck season was 12 weeks as prescribed, running from 19 March to 9 June (Game Management Authority, 2025). Seven species could legally be hunted in 2025: Pacific Black Duck (*Anas superciliosa*), Australian Wood Duck[1] (*Chenonetta jubata*), Mountain Duck[2] (*Tadorna tadornoides*), Grey Teal (*Anas gracilis*), Chestnut Teal (*Anas castanea*), Pink-eared Duck (*Malacorhynchus membranaceus*) and Hardhead[3] (*Aythya australis*). Hunting of Blue-winged Shoveler[4] (*Anas rhynchotis*) is no longer permitted due to the species threatened status. The bag limit for the 2025 season was nine game ducks per hunter per day under adaptive harvest management arrangements.

The 2025 duck hunting survey used a similar method (i.e. telephone surveys) as those followed during the 2005, 2006 and 2009 - 2024 duck hunting seasons (Barker, 2006; Gormley and Turnbull, 2009-2011; Moloney and Flesch, 2021-2024; Moloney and Hampton, 2020; Moloney and Powell, 2019; Moloney and Turnbull, 2012-2018). Additional hunting experience and club affiliation questions were asked in the 2024 telephone surveys. The 2025 Stubble Quail hunting season ran for the prescribed 12 weeks, from 5 April to 30 June (Game Management Authority 2025). The daily bag limit for the 2025 season was 20 Stubble Quail.

The 2025 Stubble Quail hunting survey used a similar method (i.e. telephone surveys) as those conducted during the 2009 - 2015 and 2017 - 2019 and 2021 to 2024 Stubble Quail-hunting seasons (Gormley, 2009; Gormley and Turnbull, 2009-2011; Moloney and Flesch, 2021-2024; Moloney and Powell, 2019; Moloney and Turnbull, 2012-2018). Due to a clerical error, the 2016 Stubble Quail-hunting survey used a slightly different method (Moloney and Turnbull, 2016). Due to the COVID-19 restrictions in 2020, the surveys of Game Licence holders endorsed to hunt Stubble Quail started on the first weekend that hunting was allowed on public land (i.e. 16 May) and surveys were then conducted at the end of the month for the remainder of the season (i.e. 3 surveys in total) (Moloney and Hampton, 2020).

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[1] Australian Wood Duck is also referred to as Wood Duck, Maned Duck and Maned Goose.

[2] Mountain Duck is also referred to as Australian Shelduck.

[3] Hardhead is also referred to as White-eyed Duck.

[4] Blue-winged Shoveler is also referred to as Australasian Shoveler.

2 Method

2.1 General methodology

All surveys were conducted by the telephone survey company Marketing Skill Pty Ltd (Mt Eliza, Victoria) on behalf of the GMA (see Appendices 1 and 2). Estimates of total harvest by Game Licence holders were based on the hunting activities reported by the survey respondents[5].

A slightly different methodology was used for estimating duck and Stubble Quail harvests for 2025 compared to other years (e.g. Moloney and Flesch (2021). For ducks, surveys were performed after the end of the first week of the season (the season opened on a Wednesday) and from then on with an increased frequency of fortnightly throughout the 12-week season. The main difference is that historically, the season started on a Saturday and there was a specific "Opening weekend" survey and the remaining surveys were performed at the end of each month for the rest of the season. For Stubble Quail, surveys were performed after the opening weekend (as previously) and then with an increased frequency of fortnightly for the rest of the season, whereas typically, after the opening weekend, they were performed at the end of each month for the rest of the season. Each survey involved telephoning a random sample of Game Licence holders and asking them to report their hunting activities for the periods covered by that survey only. Therefore, although a respondent may have hunted during the periods covered by Surveys 2 and 3, if they were contacted as part of Survey 3, then only information that pertained to the period covered by Survey 3 was collected. An additional random sample of 400 and 600 Game Licence holders were surveyed immediately after the conclusion of the duck and Stubble Quail hunting seasons respectively. The number of active hunters was estimated using the survey question in the final survey on whether they had hunted at any stage of the 2025 duck hunting season and Stubble Quail hunting season, respectively. The number of post-Stubble Quail season surveys was increased from 400 to 600 in an attempt to increase the accuracy of the activity index.

Survey responses were used to generate a harvest estimate for the whole population of Game Licence holders for each game type. Estimates of harvest were determined for each of the survey periods and were summed to give an estimate of the total season harvest. For each survey period, the proportion of respondents that hunted was used as an estimate of the proportion of Game Licence holders who hunted. The proportion of the Game Licence holders surveyed who had hunted during each survey period was multiplied by the total number of Game Licence holders, yielding the estimated total number of active hunters for that survey period.

For each survey period, the average harvest per hunter[6] was estimated from the total reported harvest divided by the number of respondents who hunted. The total harvest for each survey period was estimated by multiplying the average harvest per hunter by the previously estimated total number of active hunters for that survey period. Finally, the total season harvest was estimated from the sum of the survey-specific total harvests.

The average season harvest per Game Licence holder was also estimated. For each survey period, the average harvest per survey respondent was estimated by multiplying the average harvest per hunter by the proportion of respondents who hunted. The sum of these estimates across the season provided an estimate of the total season harvest per Game Licence holder.

Respondents who hunted were also asked to provide information on whether hunting was conducted on private land or public land (such as State Game Reserves), the name of the town nearest to where they hunted, the number of days on which they hunted during the survey period, their self-reported level of hunting experience, and if they belonged to a hunting club. Regional harvest estimates were calculated by summing the reported harvest for each town, then aggregating these for the corresponding Victorian Catchment Management Authority (CMA) region.

[5] Respondent refers to a Game Licence holder who was contacted and agreed to take part in the survey.

[6] Hunter refers to a Game Licence holder who actually went out and hunted (successfully or unsuccessfully) at some point during the period with which the survey was concerned.

There were differences in the number and length of survey periods between the duck and Stubble Quail surveys, as indicated in the following sections. Additional details of the methods, as well as examples of the calculations, are provided in Appendix 3. Information relating to describing and interpreting boxplots is provided in Appendix 4.

2.2 Duck

Samples were drawn from hunters who held a Game Licence endorsed to hunt ducks during the 2025 season. An independent random sample of 200 licence holders was interviewed by telephone immediately after the first week (Duck Survey 1), and this was followed up by surveys of independent random samples of licence holders at 2-week intervals for the remainder of the duck season (Duck Surveys 2–7). Respondents were also asked to report the number of each species harvested. An additional independent random sample of 400 Game Licence holders endorsed to hunt ducks were surveyed immediately after the conclusion of the duck hunting season. They were asked if they had hunted duck at any stage during the season.

2.3 Stubble Quail

Samples were drawn from hunters who held a Game Licence to hunt Stubble Quail during the 2025 season. A random sample of 200 licence holders was interviewed by telephone after the opening weekend (Quail Survey 1), and this was followed up by surveys of independent random samples of licence holders at 2-week intervals for the remainder of the Stubble Quail season (Quail Surveys 2–7). The size of the random sample per survey was decreased in 2024 from 300 (prior to 2023) to 200, but surveys were conducted fortnightly rather than monthly. In 2023, 480 surveys were conducted weekly in an effort to maintain the typical precision in a year with a reduced season length (5 weeks instead of 12). Respondents were asked to report the number of Stubble Quail harvested, the type of habitat where hunting occurred (native or introduced grassland, stubble), and whether or not dogs were used. An additional random sample of 600 Game Licence holders were surveyed immediately after the conclusion of the Stubble Quail hunting season. Respondents were asked if they had hunted Stubble Quail at any stage during the season.

Prior to February 2025, when a Game Licence holder was endorsed for duck, they were automatically endorsed for Stubble Quail (licence holders could be endorsed for just Stubble Quail but not duck). The new licensing arrangements will require Game Licence holders to be endorsed specifically to hunt duck, Stubble Quail or both. Game Licences are for the calendar year, with renewal letters being posted at the end of the year (typically November). So many Game Licence holders endorsed for duck renewed for the 2025 duck season prior to the changes in licencing. Therefore, the number of Game Licence holders endorsed to hunt Stubble Quail was not representative of the number of self-reported Stubble Quail hunters[7]. In the 2025 Stubble Quail hunter survey, all respondents were asked whether they hunt Stubble Quail, even if they did not necessarily hunt Stubble Quail during the 2025 Stubble Quail Season. This information was used to increase the precision of the estimates for the total Stubble Quail harvest and number of hunting days. These new licensing arrangements mean that for the 2026 Stubble Quail season it will be possible to separate those hunters specifically licensed to hunt Stubble Quail. Going forward, once each licence is specific to duck or Stubble Quail (or both) then the issue of non-Stubble Quail hunters being endorsed to hunt Stubble Quail should be reduced.

[7] Self-reported Stubble Quail hunters are Game Licence holders endorsed to hunt Stubble Quail who say that they may actually hunt Stubble Quail, regardless of whether they hunted Stubble Quail this season.

3 Results

3.1 Duck

In total, 1,803 duck hunters were surveyed; 1,403 during the season and 400 after the season closed. The number of Game Licence holders endorsed to hunt ducks remained relatively constant throughout the season (Table 1). In order to achieve the required sample size of respondents, slightly more than 200 licence holders were contacted for each survey, with typically 98% of those contacted being willing to take part in the survey.

Table 1. Summary of responses for duck surveys in 2025.

Duck survey	Period	Licence holders	Respondents	Respondents who hunted	Days hunted[8]	Ducks harvested[9]
1	19-23 March	19,544	201	73	190	879
2	24 March-6 April	19,544	201	79	233	1,109
3	7-20 April	19,922	201	54	175	630
4	21 April-4 May	19,922	200	50	136	573
5	5-18 May	20,102	200	48	165	681
6	19 May-1 June	20,102	200	38	106	601
7	2-9 June	20,102	200	32	93	459

The proportion of duck Game Licence holders who hunted in each survey period varied over the season. During the initial 5 days 36% of licence holders hunted, corresponding to approximately 7,100 hunters (Table 2). After a similar level of activity during the second survey the proportion of active hunters declined first about a quarter of licence holders to eventually less than a fifth for the last two survey periods.

Table 2. Proportion and corresponding total number of duck licence holders who hunted in each survey period in 2025.

			95% CI		Total		95% CI	
Period	Proportion	SE	Lower	Upper	hunters	SE	Lower	Upper
19-23 March	0.36	0.034	0.30	0.44	7,100	660	5,900	8,500
24 March-6 April	0.39	0.034	0.33	0.47	7,700	670	6,500	9,100
7-20 April	0.27	0.031	0.21	0.34	5,400	620	4,300	6,700
21 April-4 May	0.25	0.031	0.20	0.32	5,000	610	3,900	6,300
5-18 May	0.24	0.030	0.19	0.31	4,800	610	3,800	6,200
19 May-1 June	0.19	0.028	0.14	0.25	3,800	560	2,900	5,100
2-9 June	0.16	0.026	0.12	0.22	3,200	520	2,300	4,400

[8] Days hunted indicates the combined number of days on which duck hunting took place by respondents.

[9] Ducks harvested indicates total number of ducks harvested by respondents.

The reported harvest of ducks per hunter (i.e. per Game Licence holder who hunted) was greatest in the final month of the season (15.8 ducks per hunter). Some hunters harvested more than 20 ducks in a survey period, whereas some did not harvest any ducks (Figure 1). The average number of ducks per hunter per survey period was fairly consistent throughout the season (~14 ducks per hunter) (Table 3).

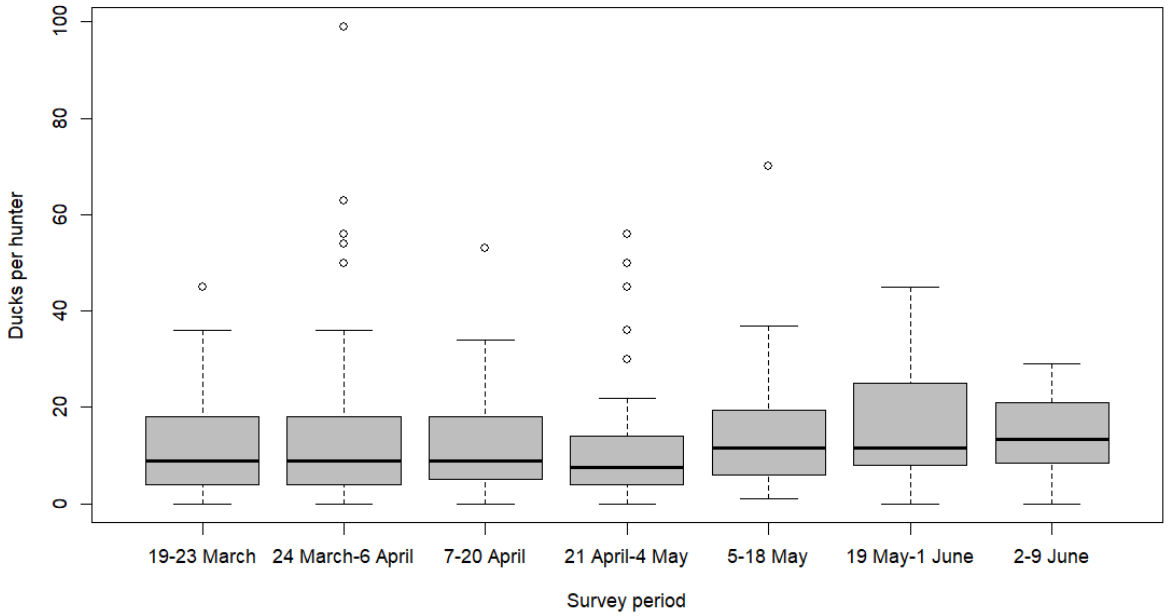

Figure 1. Boxplot of the number of ducks reported harvested by individual hunters for each survey period in 2025.

The bottom and top of each 'box' indicate the 25th and 75th percentiles, respectively, with the black horizontal line indicating the median (50th percentile) reported value.

Table 3. Average harvest of ducks per hunter (Game Licence holders who hunted) for each survey period in 2025.

			95% CI	
Period	Average harvest per hunter[10]	SE	Lower	Upper
19-23 March	12.04	1.29	9.77	14.84
24 March-6 April	14.04	1.81	10.91	18.06
7-20 April	11.67	1.38	9.26	14.70
21 April-4 May	11.46	1.73	8.53	15.39
5-18 May	14.19	1.71	11.22	17.94
19 May-1 June	15.82	1.93	12.47	20.07
2-9 June	14.34	1.41	11.84	17.38

[10] Average harvest per hunter = Ducks harvested divided by Respondents who hunted (Table 1).

There were an estimated 85,500 ducks harvested during opening 5 days (95% CI = 64,800–112,800), which constituted 18% of the total seasonal harvest (Table 4). The harvest in the second survey period (8 days) of was the largest (107,800), accounting for 22% of the total seasonal harvest. The total season harvest estimate was 487,800 (95% CI = 429,200–554,500; Table 4).

Table 4. Estimates of the total duck harvest in Victoria in 2025 by holders of a Game Licence endorsed for duck.

			95% CI	
Period	Total harvest[11]	SE	Lower	Upper
19-23 March	85,500	12,170	64,800	112,800
24 March-6 April	107,800	16,870	79,500	146,300
7-20 April	62,400	10,400	45,200	86,300
21 April-4 May	57,100	11,170	39,000	83,400
5-18 May	68,400	11,960	48,700	96,200
19 May-1 June	60,400	11,540	41,700	87,500
2-9 June	46,100	8,770	31,900	66,700
Total	**487,800**	**31,910**	**429,200**	**554,500**

The total harvest was estimated for each species by multiplying the total estimated duck harvest by the percentage of the total harvest for that species (Table 5). The most frequently harvested species was Pacific Black Duck, comprising 36% of the total reported harvest, followed by Grey Teal (29%) and Australian Wood Duck (24%). The remaining four species comprised 11% of the total harvest.

Table 5. Reported numbers of ducks harvested by hunters, proportions of the total harvest, and estimates of total 2025 harvest for each duck species.

						95% CI	
Species	Reported harvest	Proportion of harvest	SE	Estimated harvest	SE	Lower	Upper
Pacific Black Duck	1,770	0.36	0.007	175,100	11,900	105,800	289,600
Grey Teal	1,442	0.29	0.006	142,600	9,900	85,900	236,700
Australian Wood Duck	1,167	0.24	0.006	115,400	8,100	69,300	192,300
Chestnut Teal	268	0.05	0.003	26,500	2,300	15,000	46,900
Pink-eared Duck	160	0.03	0.003	15,800	1,600	8,600	29,100
Mountain Duck	98	0.02	0.002	9,700	1,200	5,000	18,700
Hardhead	27	0.01	0.001	2,700	500	1,200	6,200

Using a telephone survey immediately after the 2025 duck season ended, it was estimated that 50% (95% CI = 45%–55%) of Game Licence holders endorsed for ducks hunted for ducks during the 2025 duck season (Table 6). That equates to an estimate of 10,000 (95% CI = 9,000–11,000) active duck

[11] Total harvest = Harvest per hunter (Table 3) × Total hunters (Table 2). Numbers may differ slightly due to rounding of average harvest per hunter.

hunters in the 2025 duck season. The average duck harvest per active duck hunter was estimated to be 49 (95% CI = 41.7–57.6). The average number of duck hunting days per active duck hunter was estimated to be 10.9 (95% CI = 9.2–12.9).

Table 6. Estimates of the overall average active duck hunter[12] in Victoria in 2025 by holders of a Game Licence endorsed for duck.

Statistic	Annual estimate	SE	95% CI	
			Lower	Upper
Proportion active	0.50	0.02	0.45	0.55
Estimated active hunters	10,000	500	9,000	11,000
Average harvest per active hunter	49.02	4.05	41.70	57.63
Average hunting days per active hunter	10.91	0.92	9.25	12.88

Game Licence holders hunted an average of 5.5 days during the 2025 duck-hunting season (Table 23). When multiplied by the total number of Game Licence holders in each survey period, this equalled a total of 108,600 hunter days (95% CI = 95,086–124,052; Table 7).

Table 7. Total hunter days for ducks in 2025.

Period	Days hunted	SE	95% CI	
			Lower	Upper
19-23 March	18,500	2,660	14,000	24,500
24 March-6 April	22,700	3,280	17,100	30,000
7-20 April	17,300	3,220	12,100	24,900
21 April-4 May	13,500	2,770	9,100	20,100
5-18 May	16,600	3,310	11,300	24,400
19 May-1 June	10,700	2,310	7,000	16,200
2-9 June	9,300	1,510	6,800	12,800
Total hunting days	**108,600**	**7,380**	**95,100**	**124,100**

During the survey period, greater duck hunting effort was expended on public land (53.9%) than on private land (46.1%), with similar proportions to those for the ducks being harvested solely on public land (51.3%) and private land (48.7%) (Table 8). In 2025, similar amounts of hunting on public land occur at State Game Reserves as outside State Game Reserves.

[12] Active duck hunter is defined as a Game Licence holder endorsed to hunt ducks who hunted for ducks at least once during the 2025 duck season.

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Table 8. Percentage of days hunted and associated duck harvest by land tenure in 2025.

Land tenure	Days (%)	Duck harvest (%)
Private land only	46.1	48.7
Public land only (total)	53.9	51.3
State Game Reserve	*26.0*	*23.9*
Public land excluding State Game Reserve	*28.0*	*27.4*
Total	**100.0**	**100.0**

The overall demographics show that the majority of hunters believe that their duck hunting experience is advanced, while less than 10% identify as a novice or beginner (Table 9). The advanced duck hunters dominate the statistics. Their activity rate was nearly double the other hunters. They accounted for 70% of the total hunting days, and 78% of the total harvest. The time spent per active hunter was similar to the other groups, but their efficiency (and subsequently harvest) was much higher.

Table 9. Overall demographic data from duck hunter surveys in 2025.

Experience	Club member	Percentage of Respondents	Proportion of respondents that were active hunters	Percentage of overall active hunters	Total hunting days (%)	Total harvest (%)	Mean days per active hunter	Mean harvest per active hunter	Hunter efficiency
Novice	No	1.9	0.15	1.1	0.9	0.8	2.3	9.5	4.2
	Yes	1.6	0.18	1.1	1.1	0.3	2.8	3.8	1.4
Beginner	No	2.6	0.14	1.3	0.9	0.4	1.8	4.0	2.2
	Yes	1.6	0.23	1.3	0.9	0.3	1.8	3.2	1.8
Intermediate	No	21.3	0.16	12.6	10.7	7.1	2.3	7.5	3.3
	Yes	18.4	0.21	14.7	15.2	12.8	2.8	11.5	4.2
Advanced	No	22.2	0.31	25.9	26.2	27.9	2.7	14.2	5.3
	Yes	30.4	0.37	42.0	44.1	50.3	2.8	15.8	5.7

Total harvest was estimated to be greatest in the West Gippsland CMA, followed by the North Central CMA and the Goulburn Broken CMA (Figure 2). The top five towns for the total reported number of ducks harvested were (in descending order) Sale, Boort, Kerang, Shepparton and Horsham. The top five towns for the total number of reported duck hunting days were (in descending order) Sale, Boort, Kerang, Shepparton and Horsham.

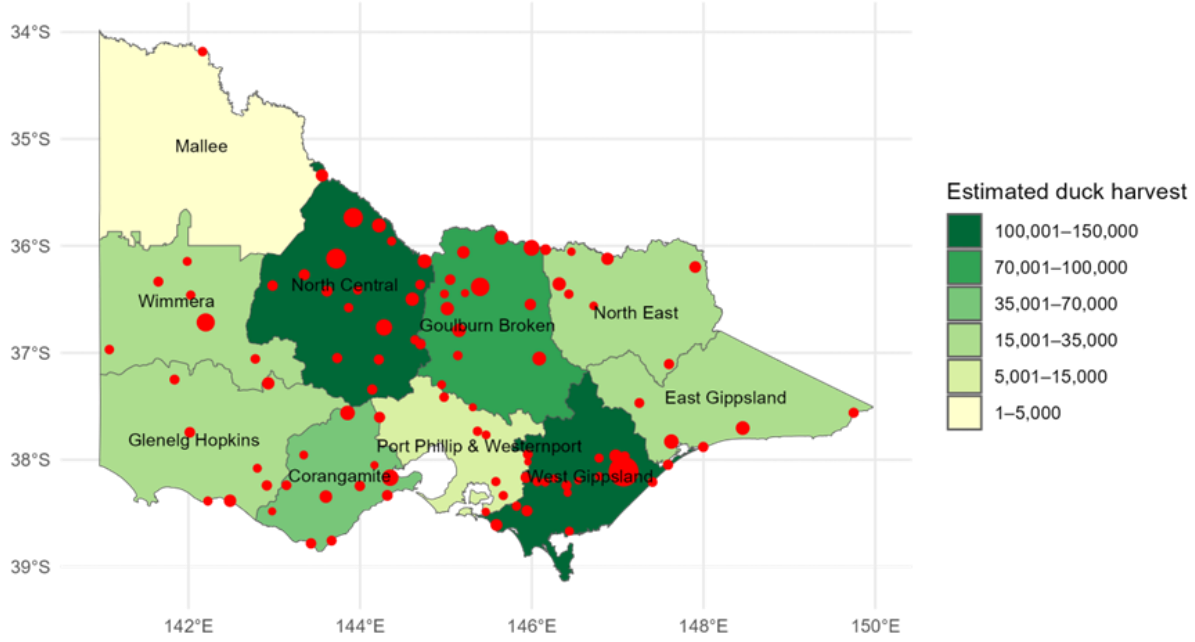

Figure 2. Estimates of total duck harvest in 2025 by CMA region.

Red circles indicate the nearest town to harvest locations, with symbol size proportional to reported harvest.

Ducks were reported shot but lost on 8% of duck hunting trips (29 out of 651) for a total of 53 ducks in the survey. The estimated season total of ducks shot and lost in 2025 is 5,254 (95% CI = 3,471–7,955), which would increase the harvest by 1.1%.

In 2025 at least 14% of duck hunting trips reported reaching their daily bag limit (9). 10 respondents (or 2.7% of active hunters) reported average daily harvests exceeding the 2025 daily duck bag limit of 9. They accounted for 1.7% of duck hunting trips.

3.2 Stubble Quail

In total, 1,999 game bird hunters were surveyed; 1,399 during the season and 600 after the season closed. The number of Game Licence holders endorsed to hunt Stubble Quail remained relatively constant throughout the season, increasing marginally from 20,773 at opening weekend to 20,828 at the end of the season (Table 10). In order to achieve the required sample size of respondents, slightly more than 200 licence holders were contacted each survey, with typically 98% of those contacted being willing to take part in the survey.

Table 10. Summary of responses for Stubble Quail surveys in 2025.

Stubble Quail survey	Period	Licence holders	Respondents	Stubble Quail hunters[13]	Respondents who hunted	Days hunted[14]	Quail harvested[15]
1	5-6 April	20,773	200	116	8	10	74
2	7-20 April	20,773	200	91	12	20	78
3	21 April-4 May	20,773	200	63	8	17	149
4	5-18 May	20,828	199	58	6	10	34
5	19 May-1 June	20,828	200	71	4	6	47
6	2-15 June	20,828	200	68	3	9	67
7	16-30 June	20,828	200	60	2	6	13

The percentage of endorsed Game Licence holders who hunted Stubble Quail was consistent over the first few weeks of the season, before reducing from mid-May. The early season rate was over 6%, while the later season rate was 1%, corresponding to 1200 hunters or under 300 active hunters respectively (Table 11).

[13] Respondents who self-report as Stubble Quail hunters.

[14] Days hunted indicates the combined number of days on which Stubble Quail hunting took place by respondents.

[15] Stubble Quail harvested indicates total number of Stubble Quail harvested by respondents.

Table 11. Proportion and corresponding total number of Stubble Quail licence holders who hunted in each survey period in 2025.

Period	Proportion	SE	95% CI Lower	95% CI Upper	Total hunters	SE	95% CI Lower	95% CI Upper
5-6 April	0.04	0.014	0.02	0.08	800	290	400	1,600
7-20 April	0.06	0.017	0.04	0.10	1,200	350	700	2,100
21 April-4 May	0.04	0.014	0.02	0.08	800	290	400	1,600
5-18 May	0.03	0.012	0.01	0.06	600	250	300	1,300
19 May-1 June	0.02	0.010	0.01	0.05	400	210	200	1,000
2-15 June	0.01	0.009	0.01	0.04	300	180	100	900
16-30 June	0.01	0.007	0.00	0.03	200	150	100	700

Within each survey period, there was large variation in the reported harvest of Stubble Quail per hunter (i.e. per Game Licence holder who hunted). The average number and range of Stubble Quail per hunter varied throughout the season (Figure 3, Table 12). In the opening weekend, the average harvest per hunter was 9.2 (95% CI = 3.7–23.1) Stubble Quail, while in the second to last survey the average was double that amount (22.3, with 95% CI = 8.7–57.1).

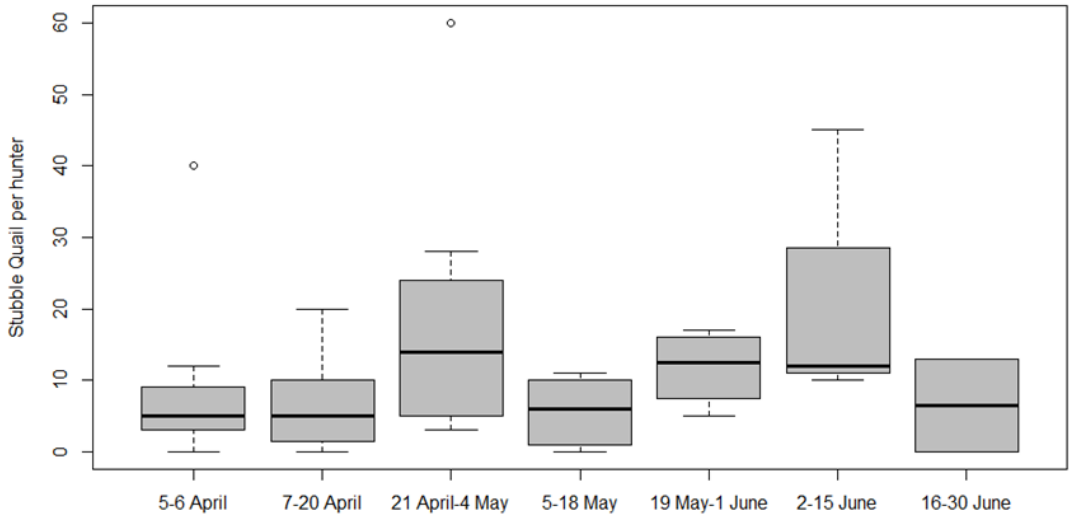

Figure 3. Boxplot of the number of Stubble Quail reported harvested by individual hunters for each survey period in 2025.

The bottom and top of each 'box' indicate the 25th and 75th percentiles, respectively, with the black horizontal line indicating the median (50th percentile) reported value.

Table 12. Average harvest of Stubble Quail per hunter (Game Licence holders who hunted) for each survey period in 2025.

			95% CI	
Period	Average harvest per hunter[16]	SE	Lower	Upper
5-6 April	9.25	4.57	3.70	23.13
7-20 April	6.50	1.85	3.76	11.23
21 April-4 May	18.62	6.73	9.38	37.00
5-18 May	5.67	1.84	3.05	10.53
19 May-1 June	11.75	2.69	7.55	18.30
2-15 June	22.33	11.35	8.73	57.13
16-30 June	6.50	6.50	1.27	33.24

There were an estimated 48,000 Stubble Quail harvested by all holders of a Game Licence for Stubble Quail during the 2025 Stubble Quail season (95% CI = 29,600–78,000). During the opening weekend the Stubble Quail harvest was 16% of the total season harvest (Table 13). The third survey period accounting for a third of the total season harvest.

Table 13. Estimates of the total Stubble Quail harvest in Victoria in 2025 by holders of a Game Licence endorsed for Stubble Quail.

			95% CI	
Period	Total harvest[17]	SE	Lower	Upper
5-6 April	7,700	4,820	2,500	23,800
7-20 April	8,100	3,300	3,800	17,400
21 April-4 May	15,500	7,980	6,000	40,100
5-18 May	3,600	1,900	1,300	9,500
19 May-1 June	4,900	2,730	1,800	13,600
2-15 June	7,000	5,720	1,700	28,400
16-30 June	1,400	1,910	200	10,500
Total	**48,000**	**12,050**	**29,600**	**78,000**

Stubble Quail were reported shot but lost on 11% of Stubble Quail hunting trips (7 out of 69) for a total of 26 Stubble Quail in the survey. The estimated season total of Stubble Quail shot and lost in 2025 is 2,700 (95% CI = 900–7,900), which would increase the harvest by 5.6%.

In 2025 no respondents reported a harvest that exceeded the daily Stubble Quail limit.

A telephone survey immediately after the 2025 Stubble Quail season ended estimated that 10% (95% CI = 8%–13%) of suitably licensed Game Licence holders hunted during the 2025 Stubble Quail season (Table 14). The estimated number of active Stubble Quail hunters in the 2025 Stubble Quail

[16] Average harvest per hunter = Stubble Quail harvested divided by Respondents who hunted (Table 10).

[17] Total harvest = Harvest per hunter (Table 12) × Total hunters (Table 11). Numbers may differ slightly due to rounding of average harvest per hunter.

season is 2,100 (95% CI = 1,700–2,700). The average active Stubble Quail hunter was estimated to have harvested 22.8 Stubble Quail (95% CI = 13.3–38.9) over an average of 3.8 hunting days (95% CI = 2.3–6.6) during the Stubble Quail hunting season.

Table 14. Estimates of the overall statistics for active Stubble Quail hunters[18] in Victoria in 2025.

Period	Annual estimate	SE	95% CI Lower	95% CI Upper
Proportion active quail hunters	0.10	0.01	0.08	0.13
Estimated active quail hunters	2,100	260	1,700	2,700
Average harvest per active hunter	22.76	6.35	13.31	38.93
Average hunting days per active quail hunter	3.84	1.07	2.25	6.56

Stubble Quail hunters had a total of 8,100 hunter days (95% CI = 5,000–13,100) days during the 2025 Stubble Quail hunting season (Table 15).

Table 15. Total days on which Stubble Quail were hunted for 2025.

Period	Days hunted	SE	95% CI Lower	95% CI Upper
5-6 April	1,000	540	400	2,700
7-20 April	2,100	900	900	4,700
21 April-4 May	1,800	980	600	4,900
5-18 May	1,000	670	300	3,300
19 May-1 June	600	480	200	2,400
2-15 June	900	940	200	4,800
16-30 June	600	700	100	3,600
Total hunting days	**8,100**	**2,020**	**5,000**	**13,100**

Most Stubble Quail hunting was conducted on private land (91.0% of the hunting days) with the remaining hunting occurring on public land (Table 16). Nearly all (97.2%) of the Stubble Quail were taken on private land according to the telephone surveys. The percentage of Stubble Quail hunting days where dogs were used (70%) was greater than the percentage of Stubble Quail harvested using dogs (59%). The majority of Stubble Quail hunting and Stubble Quail harvesting took place on stubble (59% and 79%, respectively, Table 17).

[18] Active Stubble Quail hunter is defined as a Game Licence holder endorsed to hunt Stubble Quail who hunted for Stubble Quail at least once during the 2025 Stubble Quail season.

Table 16. Percentage of days hunted and associated Stubble Quail harvest by land tenure and dog usage in 2025.

	Days (%)			Harvest (%)		
Land tenure	No dogs	Dogs	Total	No dogs	Dogs	Total
Private land only	29.5	61.5	91.0	41.1	56.1	97.2
State Game Reserves only	0.0	9.0	9.0	0.0	2.8	2.8
Total	**29.5**	**70.5**	**100.0**	**41.1**	**58.9**	**100.0**

Table 17. Percentage of hunting days and associated Stubble Quail harvest per grassland type in 2025.

Habitat type	Days (%)	Stubble Quail harvest (%)
Improved Pasture (Non Native)	14.1	2.6
Native Grassland	24.4	14.3
Native and Stubble	2.6	3.7
Stubble	59.0	79.4
Total	**100.0**	**100.0**

The new demographics questions showed that 38% of the licence holders surveyed considered themselves Stubble Quail hunters (Table 18). Of those, 42% self-identify as advanced hunters, with less than 15% considered themselves novice or beginner. Most licence holders (65%) said they did not belong to a hunting club. In general, higher self-reported experience level was associated with higher harvest and efficiency, while being a member of a hunting club did not consistently affect efficiency.

Table 18. Overall demographic data from Stubble Quail hunter surveys in 2025.

Experience	Club member	Percentage of Respondents	Proportion of respondents that were active hunters	Percentage of overall active hunters	Total hunting days (%)	Total harvest (%)	Mean days per active hunter	Mean harvest per active hunter	Hunter efficiency
Does not hunt quail		62.4	-	-	-	-	-	-	-
Novice	No	1.1	0.00	0.0	0.0	0.0	-	-	-
	Yes	0.1	0.00	0.0	0.0	0.0	-	-	-
Beginner	No	2.6	0.08	7.0	7.7	3.5	2.0	5.3	2.7
	Yes	1.3	0.06	2.3	1.3	0.2	1.0	1.0	1.0
Intermediate	No	10.8	0.09	32.6	30.8	26.2	1.7	8.6	5.0
	Yes	5.9	0.05	9.3	9.0	10.4	1.8	12.0	6.9
Advanced	No	8.6	0.09	25.6	21.8	20.8	1.6	8.7	5.7
	Yes	7.2	0.10	23.3	29.5	39.0	2.3	18.0	7.8

Harvest was estimated to be greatest in the North Central CMA, followed by the Wimmera CMA and the Corangamite CMA (Figure 4). The top five towns for the total reported number of Stubble Quail harvested were (in descending order): Horsham, Geelong, Echuca, Ararat and Donald. The top five towns for the total number of reported Stubble Quail hunting days were (in descending order): Geelong, Horsham, Echuca, Ararat and Stratford.

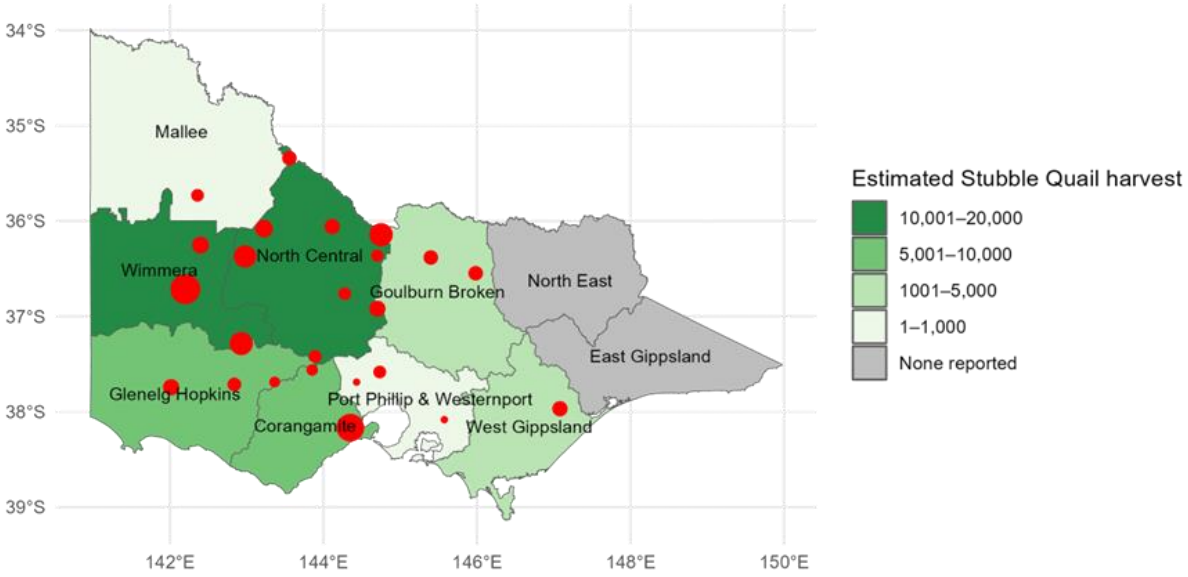

Figure 4. Estimates of total Stubble Quail harvest in 2025 by CMA region.

Red circles indicate the nearest town to harvest locations, with symbol size proportional to reported harvest.

4 Discussion

4.1 Duck

A total of 487,800 ducks were estimated to have been harvested in Victoria during the 2025 season (95% CI = 429,200–554,500), which was the third largest estimate since 2009, 46% above the average annual duck harvest estimates in the previous surveys (334,200) (Figure 5 and Table 19).

The estimated number of total hunting days (fourth highest recorded), duck harvest per licence holder (second highest recorded) and hunting days per licence holder (highest recorded) were all higher than historical levels. Interestingly, the number of hunting days per licence holder in 2025 was effectively unchanged from 2024, even though the 2024 duck hunting season was 3 weeks shorter (9 weeks compared to the prescribed 12 weeks) and the daily bag limit was 3 less (6 ducks per day compared to 9 ducks per day). Hunter efficiency (4.5 ducks per hunting day) was 25% above the average from 2009 to 2025 (3.59 ducks per hunting day, Table 19). This is to be expected given the bag limit in 2025 was 9 ducks per day, up from the average daily bag limit of 6.8 ducks per day (Table 19). Hunter efficiency in 2025 was similar to previous years with the prescribed daily bag limit of 10 ducks per day over a 12 week season (4.6 ducks per hunting day, Table 19). In 2025 the estimated efficiency was 50% of the daily bag limit, with only 14% of trips meeting their daily bag limit. The only years where hunter efficiency was higher than 2025 were when the daily bag limit was at the maximum prescribed daily bag limit of 10 ducks per day.

It was estimated that 50% (95% CI = 45%–55%) of Game Licence holders hunted for ducks during the 2025 duck season. That equates to an estimate of 9,950 (95% CI = 9,013–10,985) active duck hunters in the 2025 duck season. The average duck harvest per active duck hunter was estimated to be 49 birds (95% CI = 41.7–57.6) over 10.9 (95% CI = 9.2–12.9) days. That is the highest recorded and double the average since it could be estimated (23.5).

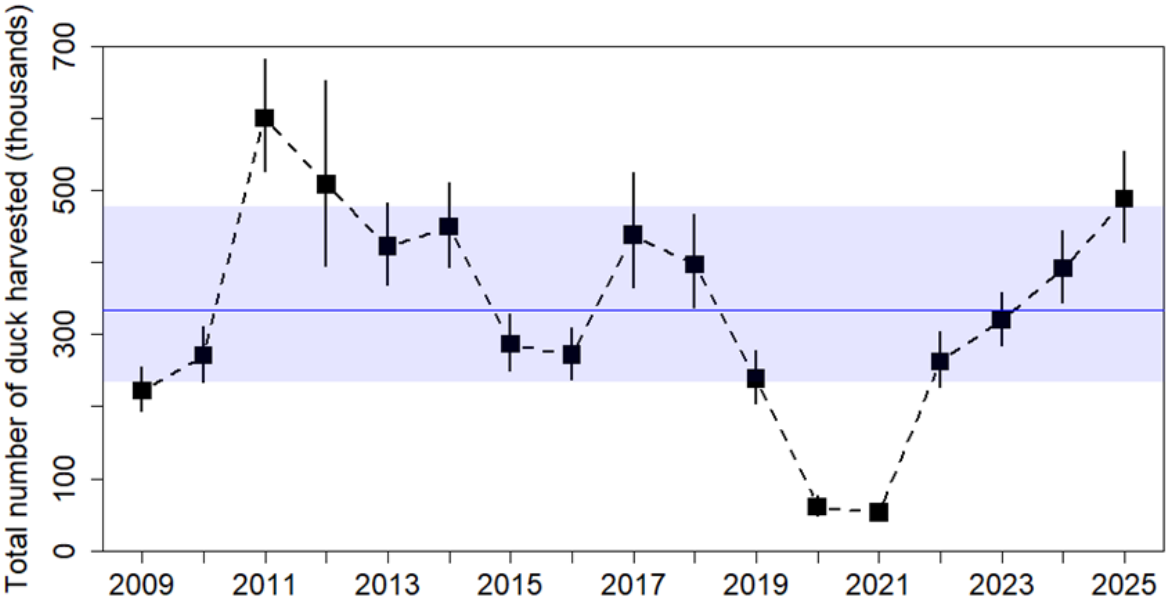

Figure 5. Estimates of total duck harvests (in thousands) from 2009 to 2025.

The square is the estimated total harvest for each season; the solid vertical line indicates the 95% confidence interval; the blue line is the average duck harvest from 2009 to 2025; the shaded area is the 95% confidence interval for the average duck harvest from 2009 to 2025.

Table 19. Comparison of duck harvest statistics of 2009 to 2025.

Year	Total harvest	Hunting days	Ducks per licence holder	Hunting days per licence holder	Ducks per hunting day	Proportion of active hunters	Ducks per active hunter	Season length	Daily bag limit
2009	222,300	76,700	11.10	3.98	2.78	NA	NA	7	5
2010	270,600	85,800	12.54	3.98	3.16	NA	NA	10	8
2011	600,700	103,500	26.02	4.48	5.81	NA	NA	13	10
2012	508,300	109,700	21.19	4.60	4.63	NA	NA	13	10
2013	422,300	91,700	17.24	3.75	4.60	NA	NA	13	10
2014	449,300	118,800	17.29	4.57	3.78	NA	NA	12	10
2015	286,700	90,600	11.35	3.58	3.17	NA	NA	12	5
2016	271,600	100,700	10.73	3.98	2.70	NA	NA	12	4
2017	438,400	96,500	17.36	3.83	4.53	0.66	25.40	12	10
2018	396,700	91,600	15.65	3.62	4.33	0.55	28.10	12	10
2019	238,700	81,000	9.62	3.27	2.94	0.55	17.60	9	5
2020	60,400	29,500	2.58	1.26	2.05	0.32	8.10	5	3
2021	52,500	19,700	2.16	0.81	2.66	0.32	6.90	3	5
2022	262,600	96,100	11.57	4.24	2.73	0.50	23.30	12	4
2023	319,900	99,700	14.60	4.55	3.21	0.65	22.66	5	4
2024	391,900	115,400	18.44	5.43	3.40	0.60	30.29	9	6
2025	487,800	108,600	24.59	5.48	4.49	0.50	49.02	12	9
Average	**334,200**	**89,200**	**14.36**	**3.85**	**3.59**	**0.52**	**23.49**	**NA**	**NA**

The estimated total harvest in 2025 for each available species was at least 20% greater than the average harvest. Pacific Black Duck, Grey Teal, and Pink-eared Duck were around 60% greater than the average harvest (Table 20).

Game Management Authority

Table 20. Comparison of duck harvests by species from 2009 to 2025.

NAs represent years where the hunting of that species was prohibited, while 0 was used if they could be harvested, but there were none reported. For species that have been prohibited from hunting in at least one season the average harvest is from seasons in which they could be hunted.

Year	Australian Wood Duck	Blue-winged Shoveler	Chestnut Teal	Grey Teal	Hardhead	Mountain Duck	Pacific Black Duck	Pink-eared Duck
2009	131,100	NA	13,200	20,900	NA	2,200	55,200	NA
2010	112,400	200	14,400	26,000	300	5,900	96,500	0
2011	132,900	4,900	49,800	211,000	25,700	8,100	156,500	12,600
2012	150,200	1,300	23,500	110,600	30,200	9,200	160,700	21,600
2013	106,600	7,100	39,800	135,900	7,300	2,700	92,700	30,100
2014	131,300	4,200	29,900	127,100	6,400	8,400	127,600	14,200
2015	80,200	1,500	19,500	79,900	1,000	6,900	81,900	15,800
2016	78,000	NA	18,100	77,100	500	6,500	89,900	1,600
2017	90,900	NA	13,600	175,000	8,100	12,100	118,500	20,100
2018	89,400	NA	27,100	122,900	4,800	7,000	132,800	12,700
2019	57,600	NA	13,500	63,400	600	8,700	83,000	3,100
2020	18,200	NA	4,400	6,000	0	3,800	27,800	200
2021	14,300	NA	5,200	11,200	100	1,600	19,500	300
2022	68,600	NA	26,000	47,500	NA	20,600	98,700	1,100
2023	58,500	NA	14,200	91,200	NA	2,800	145,000	7,300
2024	94,300	NA	35,900	98,900	NA	7,700	153,100	2,000
2025	115,400	NA	26,500	142,600	2,700	9,700	175,100	15,800
Average	**90,000**	**3,200**	**22,000**	**91,100**	**6,700**	**7,300**	**106,700**	**9,900**

4.2 Stubble Quail

An estimated total of 48,000 Stubble Quail were harvested in Victoria during the 2025 season (95% CI = 29,600–78,000). This is the fourth lowest Stubble Quail harvest since the telephone surveys started in 2009 (Figure 6 and Table 21). The decrease can be partially explained by the reduced number of days spent hunting Stubble Quail.

The estimated number of total hunting days (8,100, third lowest recorded) and Stubble Quail harvested per licence holder (2.31, fourth lowest recorded) were lower than historical averages (21,000 and 6.45 respectively). Hunter efficiency (5.9 Stubble Quail per hunting day) was the below the average recorded between 2009 to 2025 (6.8).

It was estimated that 10% (95% CI = 8%–13%) of suitably licensed Game Licence holders actually hunted for Stubble Quail during the 2025 Stubble Quail season. That equates to an estimate of 2,111 (95% CI = 1,662–2,681) active Stubble Quail hunters in the 2025 Stubble Quail season. The average Stubble Quail harvest per active Stubble Quail hunter was estimated to be 22.8 (95% CI = 13.3–38.9). This estimate is the second lowest recorded.

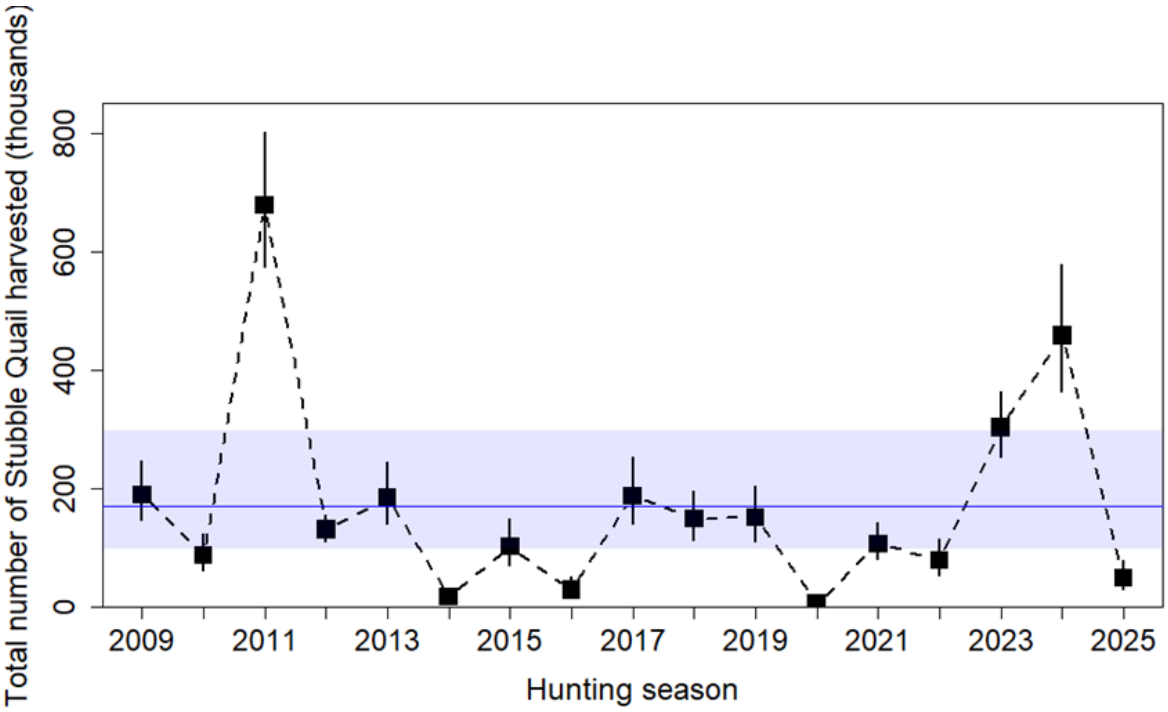

Figure 6. Estimates of total Stubble Quail harvests (in thousands) from 2009 to 2025.

The square is the estimated total harvest for each season; the solid vertical line indicates the 95% confidence interval; the blue line is the average Stubble Quail harvest from 2009 to 2025; the shaded area is the 95% confidence interval for the average Stubble Quail harvest from 2009 to 2025.

Table 21. Comparison of Stubble Quail harvests of 2009 to 2025.

Year	Total harvest	Hunting days	Quail per licence holder	Hunting days per licence holder	Quail per hunting day	Proportion of active hunters	Quail per active hunter	Season length	Daily bag limit
2009	189,200	24,600	7.89	1.03	7.97	NA	NA	12	20
2010	86,300	24,700	3.59	1.03	3.48	NA	NA	12	20
2011	678,400	46,700	26.17	1.80	14.52	NA	NA	12	20
2012	129,700	22,300	4.80	0.82	5.81	NA	NA	12	20
2013	184,100	22,000	6.69	0.98	8.39	NA	NA	12	20
2014	16,200	10,900	0.56	0.38	1.47	NA	NA	12	20
2015	101,200	22,400	3.58	0.79	4.51	NA	NA	12	20
2016[19]	28,000	6,600	1.00	0.23	4.29	NA	NA	12	20
2017	186,700	22,100	6.51	0.77	8.45	0.15	43.7	12	20
2018	148,500	17,800	5.19	0.62	8.36	0.18	28.5	12	20
2019	149,700	22,400	5.30	0.79	6.70	0.08	87.2	12	20
2020	4,800	3,800	0.18	0.14	1.29	0.04	5.1	12	20
2021	106,000	16,400	3.70	0.57	6.49	0.06	59.4	12	20
2022	77,600	10,200	2.84	0.37	7.60	0.09	30.4	12	20
2023	302,800	27,000	11.42	1.02	11.23	0.18	63.6	5	20
2024	457,400	49,200	17.89	1.93	9.29	0.22	79.4	12	20
2025	48,000	8,100	2.31	0.39	5.92	0.10	22.8	12	20
Average	**170,300**	**21,000**	**6.45**	**0.80**	**6.81**	**0.12**	**46.7**		

Due to the structure of Game Licences in Victoria, not every holder of a Game Licence endorsed to hunt game birds (ducks and quail) will hunt Stubble Quail. The price of a Game Licence for game birds including duck is the same as a Game Licence for game birds not including duck. Prior to February 2025, anyone who wants to hunt ducks automatically has Stubble Quail included in their licence. For many hunters, duck hunting will be their primary activity. Hence, a high proportion of Game Licence holders will be permitted to hunt Stubble Quail, even though they may not intend to do so. In 2025 it was estimated that 38% (95% CI = 24–59%) of Game Licence holders endorsed for Stubble Quail self-identified as 'Stubble Quail hunters'. That includes those who did not actively hunt Stubble Quail in 2025. This equates to an estimate of 7,834 (95% CI = 4,965–12,362) 'Stubble Quail hunters' in the 2025 Stubble Quail season. This does not affect the estimates of Stubble Quail harvest, because the calculations explicitly account for the proportion of Stubble Quail Game Licence holders who did not actually hunt Stubble Quail.

[19] The 2016 Stubble Quail surveys were conducted after the season rather than each month of the season. It is assumed that the change in methodology will produce only minor differences.

From February 2025, new and renewing duck hunters will no longer be automatically permitted to hunt quail and introduced gamebirds in Victoria (Game Management Authority 2025). Game Licence holders will need to be endorsed to hunt duck, Stubble Quail or both. This means that from the 2026 season, we will be able to differentiate between Licence Holders endorsed to hunt Stubble Quail will potentially hunt them, rather than only hunting duck. That means that the Stubble Quail surveys will then be targeted at people who intend to hunt Stubble Quail. This is turn should increase the accuracy of the survey, as half the calls previously were of Licence Holders that never intended to hunt Stubble Quail, which limited the call with active hunters.

It should be noted that the number of hunting days was only an approximate estimate of total effort: someone who hunted for two hours and someone else who hunted for 12 hours were both recorded as having hunted for one day.

4.3 Locations with the most hunting days

The top five towns for the total number of reported duck hunting days in 2025 were (in descending order): Sale, Boort, Kerang, Shepparton and Horsham.

The top five towns for the total number of reported Stubble Quail hunting days in 2025 were (in descending order): Geelong, Horsham, Echuca, Ararat and Stratford.

Combining duck and Stubble Quail, Sale had the most hunting days during the 2025 hunting seasons, followed by Boort, Horsham, Shepparton and Kerang. This assumed that all hunting days were equal in length, even though the time spent hunting on any particular day could vary considerably for each respondent, and for game species.

4.4 Assumptions

The estimates of harvest for each game type were derived with the assumption that the samples of respondents were representative of the entire population of Victorian Game Licence holders. This assumption may have been violated due to several factors, such as the reasons for non-response (e.g. exceeded bag limit, or conversely, did not harvest anything), memory recall (e.g. respondents not remembering their harvest), and deliberate over- or under-reporting (e.g. harvest numbers knowingly being reported incorrectly). Any bias due to non-response is likely to have been negligible, because the response rate for all surveys was generally above 95% (i.e. very high). Memory bias can inflate estimates of total harvest, in some cases by as much as 40% (Barker, 1991; Wright, 1978). It is likely, however, that the sampling strategy of telephone interviews after each two-week period in the case of ducks and Stubble Quail, would have ensured that both memory bias and non-response bias were kept low (compared with postal surveys and complete end-of-season surveys (Barker, 1991; Barker, Geissler, and Hoover, 1992). Nevertheless, some bias likely remains, and the estimates of total harvest should be interpreted with caution.

It needs to be noted that due to a clerical error, the 2016 telephone Stubble Quail survey did not follow the standard methodology, as all surveys happened at the end of the season. That means the results of the 2016 telephone Stubble Quail survey may have increased memory bias and may not be strictly comparable with those of other years.

The methodology used here explicitly accounts for the possibility that not every Game Licence holder hunts in every survey period (see Gormley and Turnbull, 2010). Therefore, the estimate of total season bag per Game Licence holder is the sum of the ‘harvest per Game Licence holder’, not the sum of the ‘harvest per hunter’.

The uncertainty in the estimates of total harvest (as indicated by the confidence intervals) was due to two factors. First, there was variation in the reported numbers of animals harvested between respondents who had hunted (see Figure 1 and Figure 3). For example, within a given survey period for duck hunting, some respondents indicated that they hunted unsuccessfully, whereas others took multiple trips and indicated a total harvest of more than 50 ducks during the same period. The second source of uncertainty was due to sampling the hunters, rather than taking a complete census. However, the degree of sampling uncertainty was reduced by having sample sizes of 200 respondents

per survey for ducks; and 200 - 300 respondents per fortnightly survey for Stubble Quail. Statistically, these sample sizes were considered adequate for providing reasonable estimates.

The spatial distributions of the duck and Stubble Quail harvest should also be interpreted with caution. Grouping the harvest for a relatively large region (CMA) provides a broad-scale view of the distribution of the harvest. Grouping by smaller regions would provide a finer-scale representation, but this would come at the cost of increased bias in many regions. Because the data are from a sample of Game Licence holders rather than a complete census, it is likely that some areas that were actually hunted are shown as having a zero harvest if no respondents that hunted those areas were contacted. This would be increasingly likely at finer spatial scales. Furthermore, respondents were only asked to report the nearest town to where they hunted, not the actual location. It is, therefore, possible that the nearest town was in a different CMA than the hunting location.

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Appendices

Appendix 1: Questionnaire for Game Licence holders endorsed to hunt duck

1. How would you describe your level of hunting experience?
   a. Novice
   b. Beginner
   c. Intermediate
   d. Advanced

2. Are you a member of a hunting organisation? If so which ones?
   a. Sporting Shooters Association of Australia (SSAA)
   b. Australian Deer Association (ADA)
   c. Victorian Hound Hunters (VHH)
   d. Field and Game Australia (FGA)
   e. Prefer not to say
   f. Other _____

3. Have you been duck hunting in the last two weeks? If 'Yes', proceed to question 4.
   If 'No', end the survey and thank them for their time.

4. How many duck hunting trips have you been on in the last two weeks?
   Enter number _____

5. Starting with trip 1, how many days was this hunting trip?
   Enter number _____

6. What was the number of each species of duck you harvested?
   Enter the number of each species harvested.
   a. Australian wood duck _____
   b. Pacific Black Duck _____
   c. Grey teal _____
   d. Chestnut teal _____
   e. Pink-eared duck _____
   f. Hardhead _____
   g. Mountain duck _____
   h. Other (name and no.) _____

7. Did you shoot and lose any animals? If so how many?

   Enter number _____

8. Did you hunt with a gundog on this trip?

   a. Yes

   b. No

9. What was the closest major town to the area you hunted in?
   Enter the name of the town. Please ensure it is a town (eg, Bairnsdale) and not a region (eg, Gippsland)

   Enter town name _____

10. Did you hunt predominantly on private or public land on this trip?

    a. Public

    b. Private

    c. State Game Reserve

Repeat questions 5-10 for each duck hunting trip taken.

Appendix 2: Questionnaire for Game Licence holders endorsed to hunt Stubble Quail

1. How would you describe your level of hunting experience?
   a. Novice
   b. Beginner
   c. Intermediate
   d. Advanced
2. Do you use a gundog when you hunt for quail?
   a. Yes
   b. No

3. Are you a member of a hunting organisation? If so which ones?
   a. Sporting Shooters Association of Australia (SSAA)
   b. Australian Deer Association (ADA)
   c. Victorian Hound Hunters (VHH)
   d. Field and Game Australia (FGA)
   e. Prefer not to say
   f. Other _____
4. Have you been quail hunting in the last two weeks? If 'Yes', proceed to question 5. If 'No', end the survey and thank them for their time.

5. How many quail hunting trips have you been on in the last two weeks?
   Enter number _____

6. Starting with trip 1, how many days was this hunting trip?
   Enter number _____

7. How many quail did you harvest on this hunting trip?
   Enter number _____

8. What type of habitat did you hunt in?
   a. Native grassland
   b. Stubble
   c. Improved pasture (non-native)

9. Did you shoot and lose any animals? If so how many?
   Enter number _____

10. What was the closest major town to the area you hunted in?
Enter the name of the town. Please ensure it is a town (eg, Bairnsdale) and not a region (eg, Gippsland)

Enter town name _____

11. Did you hunt predominantly on private or public land on this hunting trip?

a. Public

b. Private

c. State Game Reserve

Repeat questions 6-11 for each quail hunting trip taken.

Appendix 3: Definitions and calculations

Definitions

SD = standard deviation of the data; it represents the variation in the numbers reported.

SE = standard error of the mean; it represents the variation in the estimated mean.

CV = coefficient of variation; it is calculated as: CV = SE ÷ mean. This provides an indication as to how much uncertainty is in the estimate relative to the mean.

Calculations

For each survey j, we surveyed n_j respondents, of which h_j had hunted. The proportion of respondents who hunted in each period j is given by:

$$p_j = \frac{h_j}{n_j}$$

e.g. for Deer Survey 4 in 2015, we obtained: obtained:

$$\frac{70}{200} = 0.350$$

The total number of hunters for each survey period (H_j) was estimated by multiplying the total number of Licence holders (L) by the proportion of respondents who reported having hunted during that survey period (p_j), as found previously:

$$H_j = p_j L$$

eg. for Deer Survey 4 in 2015, we obtained: 0.35 × 30,908 = 10,818.

The estimated average harvest per hunter (w_j) is the total reported harvest for survey j (y_j) divided by the total number of respondents who hunted (h_j):

$$w_j = \frac{y_j}{h_j}$$

e.g. for Deer Survey 4 in 2015, we obtained: $\frac{215}{70} = 3.07$

The total harvest for each survey period (W_j) was estimated by multiplying the average harvest per hunter (w_j) by the total number of hunters (H_j):

$$W_j = w_j H_j$$

e.g. for Deer Survey 4 in 2015, we obtained:

$$3.07 \times 10{,}808 = 33{,}226.$$

The estimate of the total harvest was calculated as the sum of the estimated harvest for each survey period:

$$W_{TOT} = W_1 + W_2 + W_3 + W_4 + W_5 + W_6 + W_7.$$

Standard errors (SEs) for the proportion of respondents who hunted are given by:

$$\mathrm{SE}(p_j) = \sqrt{\frac{p_j(1-p_j)}{n_j}}.$$

e.g. for Deer Survey 4 in 2015, we obtained:

$$\sqrt{\frac{0.35 \times .65}{200}} = 0.034.$$

Standard errors for the average harvest per hunter are given by:

$$\mathrm{SE}(w_j) = \frac{\mathrm{SD}(w_j)}{\sqrt{h_j}}.$$

e.g. for Deer Survey 4 in 2015, we obtained:

$$\frac{4.55}{\sqrt{70}} = 0.54$$

The standard error for the total estimated harvest per survey period (W_j) was found by determining the coefficient of variation (CV) for each p_j and w_j and then calculating the square root of the sum of their squares to find the combined CV (assuming independence).

$$CV(w_j) = \frac{SE(w_j)}{w_j}, \text{ and } CV(p_j) = \frac{SE(p_j)}{p_j}$$

$$CV(W_j) = \sqrt{\left(CV(w_j)\right)^2 \times \left(CV(p_j)\right)^2 + \left(CV(w_j)\right)^2 + \left(CV(p_j)\right)^2}$$

$$SE(W_j) = CV(W_j) \times W_j.$$

The standard error of the total harvest was calculated by:

$$SE(W_{TOT}) = \sqrt{\left(SE(W_1)\right)^2 + \left(SE(W_2)\right)^2 + \cdots + \left(SE(W_7)\right)^2}.$$

Confidence intervals were computed on the natural logarithm scale and back-transformed to ensure that lower limits were ≥0. A consequence is that the confidence intervals were asymmetric and could not be reported as the estimate plus or minus a fixed value. For some estimates, denoted as $\widehat{\mathrm{X}}$, 95% confidence interval limits were calculated using:

upper limit $= \widehat{\mathrm{X}} \times r$

lower limit $= \widehat{\mathrm{X}} \div r$, where:

$r = \exp\left(1.96 \times \sqrt{\ln(1 + CV^2)}\right)$.

E.g. for the total duck harvest we have

$$CV = \frac{8{,}349}{71{,}142} = 0.117$$

$$\mathrm{r} = \exp\left(1.96\sqrt{\ln 1 + 0.117^2}\right) = 1.26$$

Therefore, upper and lower confidence limits are given by:

$$UL = 71{,}142 \times 1.26 = 89{,}471$$

$$LL = 71{,}142 \div 1.26 = 56{,}567.$$

Appendix 4: Explanation of what goes into a boxplot

A boxplot is a way of displaying key points of the data and is especially good for comparing groups of data. It is sometimes referred to as a box-and-whisker plot. A boxplot shows the following key points:

- outliers, signified by hollow circles
- minimum, signified by the horizontal line below the box (smallest value, excluding outliers)
- lower quartile (Q1), signified by the horizontal line at the bottom of the box (25% of the data is at this point or below)
- median, signified by the thick horizontal line in the box (50% of the data is at this point or below)
- upper quartile (Q3), signified by the horizontal line at the top of the box (75% of the data is at this point or below)
- maximum, signified by the horizontal line above the box (largest value, excluding outliers)
- interquartile range (IQR; difference between the upper and lower quartiles)
- whiskers—the lines that go from the minimum or maximum to the box.

Outliers are values that are very large (or small) compared with the rest of the data. An outlier is defined as any point that is either below Q1 – 1.5 × IQR or above Q3 + 1.5 × IQR, which means that any point that lies more than one-and-a-half times the length of the box outside the box is an outlier.

The boxplot indicates the spread of the data. The data is broken into quarters: approximately 25% of the data are in the range between a whisker and the nearest edge of the box, and approximately 25% of the data are in the range between an edge of the box and the median line. Thus, approximately half the data are contained within the box. Any unusual data are highlighted as outliers. As an example, using duck-hunting data, Figure A4.1 shows a boxplot indicating that most hunters harvested between 5 and 13 ducks, and a quarter harvested between 13 and 27 ducks. A number of outliers harvested more than 27 ducks, including one who harvested over 50 ducks. Sometimes there are no whiskers, because the minimum (or maximum) is the same as the lower (or upper) quartile.

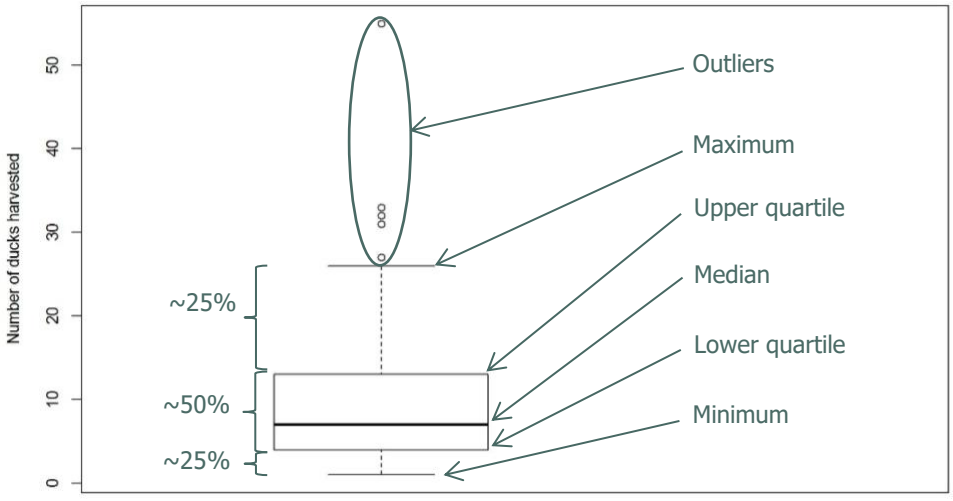

Figure A4.1. Example boxplot, with labels.

Appendix 5: Harvest rates per Game Licence endorsed for hunting duck

Historically (from 2009 to 2016) the data collected only allowed for annual harvest rates to be at the level of Game Licence holder endorsed to hunt duck. Since 2017, when the end of year surveys have been conducted, it has been possible to estimate the annual harvest rate per active hunter. Therefore, the rate per Game Licence holder is not required. It has been included in this appendix to allow comparison between years before 2017.

The total average season harvest per licence holder in 2025 was estimated to be 24.6 birds (95% CI = 21.6–28.0; Table 22). Note that, for each survey period, the average duck harvest per Game Licence holder was lower than the average duck harvest per hunter (Table 3), as the former includes those respondents who did not hunt during the survey period, whereas the latter includes only those who hunted.

Table 22. Estimates of average harvest of ducks per Game Licence holder in each survey period in 2025.

			95% CI	
Period	Average harvest[20]	SE	Lower	Upper
19-23 March	4.37	0.62	3.31	5.77
24 March-6 April	5.52	0.86	4.07	7.48
7-20 April	3.13	0.52	2.27	4.33
21 April-4 May	2.87	0.56	1.96	4.19
5-18 May	3.40	0.59	2.42	4.78
19 May-1 June	3.00	0.57	2.07	4.35
2-9 June	2.30	0.44	1.59	3.32
Total	**24.59**	**1.61**	**21.64**	**27.96**

Each Game Licence holder hunted an average of 5.4 days during the 2025 duck-hunting season (Table 23). When multiplied by the total number of Game Licence holders in each survey period, this equalled a total of 108,600 hunter days (95% CI = 95,100–124,100).

[20] Average harvest per Game Licence holder = Duck harvest divided by Respondents (Table 1).

Table 23. Days on which ducks were hunted per Game Licence holder for 2025.

Period	Days hunted	SE	95% CI	
			Lower	Upper
19-23 March	0.95	0.10	0.76	1.17
24 March-6 April	1.16	0.13	0.93	1.45
7-20 April	0.87	0.12	0.66	1.15
21 April-4 May	0.68	0.11	0.50	0.93
5-18 May	0.82	0.13	0.61	1.11
19 May-1 June	0.53	0.08	0.39	0.72
2-9 June	0.47	0.00	0.47	0.47
Total per licence holder	**5.48**	**0.28**	**4.95**	**6.06**
Total hunting days	**108,600**	**7,380**	**95,100**	**124,100**

Appendix 6: Harvest rates per Game Licence endorsed for hunting Stubble Quail

Historically (from 2009 to 2016) the data collected only allowed for annual harvest rates to be at the level of Game Licence holder endorsed to hunt Stubble Quail. Since 2017, when the end-of-year surveys have been conducted, it has been possible to estimate the annual harvest rate per active hunter. Therefore, the rate per Game Licence holder is not required. It has been included in this appendix to allow comparison between years before 2017.

The total average season harvest per licence holder in 2025 was estimated to be 2.3 birds (95% CI = 1.4–3.7; Table 24). However, if you limit the respondents to only those who say they hunt Stubble Quail, then the total average season harvest per self-reported Stubble Quail hunter is estimated to be 6.3 birds (95% CI = 3.9–10.2). Note that, for each survey period, the average Stubble Quail harvest per Game Licence holder was lower than the average Stubble Quail harvest per hunter (Table 11), as the former includes those respondents who did not hunt during the survey period, whereas the latter includes only those who hunted.

Table 24. Estimates of average harvest of Stubble Quail per Game Licence holder in each survey period in 2025.

			95% CI	
Period	Average harvest [21]	SE	Lower	Upper
5-6 April	0.37	0.23	0.12	1.14
7-20 April	0.39	0.16	0.18	0.84
21 April-4 May	0.74	0.38	0.29	1.93
5-18 May	0.17	0.09	0.06	0.46
19 May-1 June	0.23	0.13	0.08	0.65
2-15 June	0.34	0.27	0.08	1.36
16-30 June	0.06	0.09	0.01	0.51
Total	**2.31**	**0.58**	**1.42**	**3.75**

Each Game Licence holder hunted an average of 0.4 days during the 2025 Stubble Quail-hunting season (Table 25). When multiplied by the total number of Game Licence holders in each survey period, this equalled a total of 8,100 hunter days (95% CI = 5,000–13,100).

[21] Average harvest per Game Licence holder = Stubble Quail harvested divided by respondents (Table 12).

Table 25. Days on which Stubble Quail were hunted per Game Licence holder for 2025.

Period	Days hunted	SE	95% CI	
			Lower	Upper
5-6 April	0.05	0.02	0.02	0.10
7-20 April	0.10	0.03	0.05	0.18
21 April-4 May	0.09	0.03	0.04	0.18
5-18 May	0.05	0.02	0.02	0.12
19 May-1 June	0.03	0.02	0.01	0.08
2-15 June	0.04	0.03	0.01	0.16
16-30 June	0.03	0.02	0.01	0.10
Total per licence holder	**0.39**	**0.07**	**0.28**	**0.55**
Total hunting days	**8,100**	**2,020**	**5,000**	**13,100**

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