Hunter's Bag Surveys: 2014 and 2015 Victorian duck hunting seasons

Daniel Purdey and Peter Menkhorst

July 2015

Arthur Rylah Institute for Environmental Research

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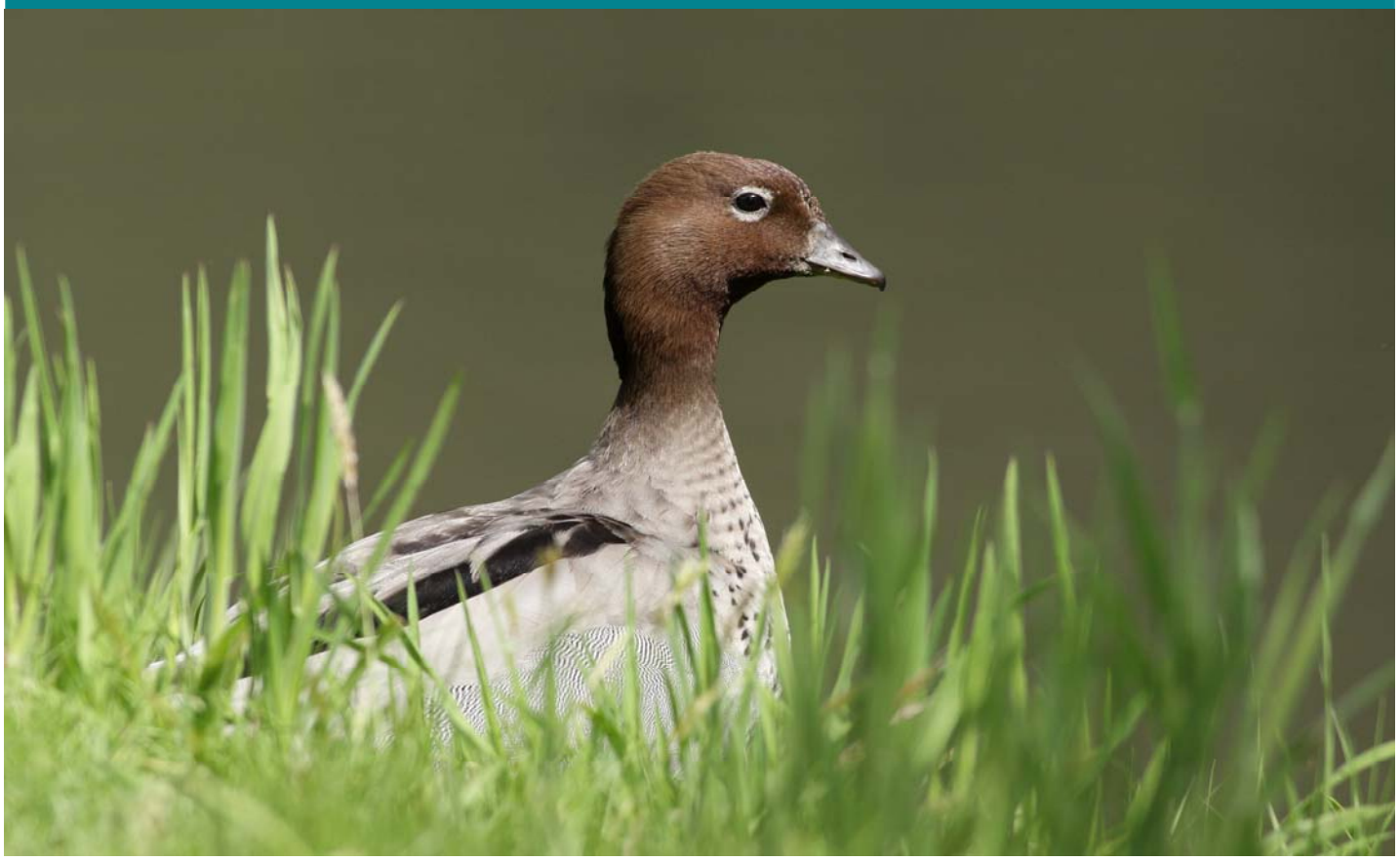

Arthur Rylah Institute for environmental research

Department of Environment, Land, Water & Planning

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Front cover photo: Male Australian Wood Duck. Photo Peter Menkhorst.

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Summary

Surveys of duck hunter's bags were conducted on the opening weekends of Victoria's 2014 and 2015 duck hunting seasons (Saturday 15 and Sunday 16 March 2014 and Saturday 21 and Sunday 22 March 2015).

Regional coordinators from DELWP were responsible for the administration and coordination of local surveys. Sites where extensive data collection had been undertaken previously were identified, and coordinators were asked to ensure that hunters were surveyed at these 'long-term' sites, as well as at wetlands that had been surveyed in the preceding Summer Waterbird Count. Procedures closely followed those used in Victorian surveys since 1972. Surveyors interviewed individual hunters at wetlands in mid- to late-morning, after most shooting had ceased for the day. Details regarding numbers and species of birds bagged, and the time birds were taken, were obtained during interviews. In addition, some bagged birds were examined for the presence of wing (primary) moult, and categorised as either 'adult' or 'immature'. Details regarding the shooting of protected species were obtained by examination of bags as well as by shoreline surveys.

2014 surveys

On the 2014 opening weekend the contents of hunter's bags were examined at 14 public wetlands on Day 1 (Saturday, 15 March) and repeated on seven of those wetlands on Day 2 (Sunday, 16 March). On Day 1, 1592 ducks were recorded as taken by 702 hunters (mean bag = 2.7 ducks) and on Day 2, 239 ducks were recorded as taken by 139 hunters (mean bag = 2.1 ducks).

The mean opening day bag (2.7) was close to the long-term mean of bag sizes taken since 1972 (2.9). Since 1996, opening day mean bags have mostly ranged between 1.3 and 2.5 with 2011 (4.1) and 2013 (4.06) being notable outliers.

Species	**Count (% of total bag count)**	
	2014 Day 1 (15 March)	**2014 Day 2 (16 March)**
Grey Teal (*Anas gracilis*)	740 (46.9%)	139 (58.2%)
Australian Wood Duck (*Chenonetta jubata*)	369 (23.4%)	35 (23%)
Pacific Black Duck (*Anas superciliosa*)	234 (14.8%)	35 (23%)
Pink-eared Duck (*Malacorhynchus membranaceus*)	124 (7.9%)	18 (7.5%)
Chestnut Teal (*Anas castanea*)	57 (3.6%)	7 (2.9%)
Australasian Shoveler (*Anas rhynchotis*)	40 (2.5%)	4 (1.7%)
Australian Shelduck (*Tadorna tadornoides*)	21 (1.3%)	1 (0.4%)
Hardhead (*Aythya australis*)	7 (0.4%)	
Total Count	**1,592**	**239**

The three most numerous species in bags (Grey Teal, Australian Wood Duck, Pacific Black Duck) comprised 85% of ducks counted in hunter's bags. The high prevalence of Grey Teal in the past five surveys marks a return to the pre-2002 trend for Grey Teal to be the most frequent species taken.

2015 surveys

On the 2015 opening weekend the contents of hunter's bags were examined at 18 public wetlands on Day 1, (Saturday, 21 March) and eight wetlands on Day 2 (Sunday, 22 March), five of which were also surveyed on Day 1. 2,088 ducks were recorded on Day 1, as taken by 1,482 hunters (mean bag = 1.4 ducks) and on Day 2, 176 ducks were recorded as taken by 175 hunters (mean bag = 1.0 ducks).

Species	**Count (% of total bag count)**	
	2015 Day 1 (21 March)	**2015 Day 2 (22 March)**
Grey Teal (*Anas gracilis*)	989 (47.4%)	90 (51.1%)
Pacific Black Duck (*Anas superciliosa*)	283 (13.6%)	39 (22.2%)
Chestnut Teal (*Anas castanea*)	265 (12.7%)	19 (10.8%)
Pink-eared Duck (*Malacorhynchus membranaceus*)	238 (11.4%)	3 (1.7%)
Australian Wood Duck (*Chenonetta jubata*)	238 (11.4%)	19(10.8.0%)
Australian Shelduck (*Tadorna tadornoides*)	39 (1.9%)	2 (1.1%)
Australasian Shoveler (*Anas rhynchotis*)	17 (0.8%)	4 (2.3%)
Hardhead (*Aythya australis*)	4 (0.2%)	
Unidentified (plucked ducks)	15 (0.7%)	
Total Count	**2,088**	**176**

The three most numerous species for opening weekend (Grey Teal, Pacific Black Duck, Chestnut Teal) comprised 74% of ducks counted in hunter's bags.

The mean opening day bag (1.4) was below the long-term mean of bag sizes surveyed since 1972 (2.9). Since 1996, opening day mean bags have mostly ranged between 1.3 and 2.5 with 2011 (4.1) and 2013 (4.06) being notable outliers.

Introduction

Duck hunting is provided for under the Wildlife Act (1975) and further regulated under the Wildlife (Game) Regulations (2012). When environmental conditions require it, the responsible Ministers may further regulate duck hunting to ensure that it remains sustainable (http://www.gma.vic.gov.au/hunting/duck/arrangements-for-duck-season). The regulations set the maximum allowable daily harvest by an individual hunter.

Estimating the actual daily 'take' by hunters is an important component of assessing the impact of the open season on populations of game species. A standard method of sampling the level of 'take' by hunters is to conduct surveys of hunter's bags. Such surveys have been conducted on opening weekend at wetlands in Victoria since 1972, to determine both hunter success and the species involved in opening weekend harvests (Braithwaite and Norman 1974, Loyn 1989, Holmes 1994). These annual surveys are undertaken by staff of the Department of Environment, Land, Water and Planning (DELWP), the Victorian Game Management Authority, Department of Economic Development, Jobs, Transport and Resources (DEDJTR) and Parks Victoria.

This report provides a summary of information obtained during the opening weekend of the 2014 and 2015 duck hunting seasons. Its focus is to quantify opening weekend bag sizes, the species taken and any records of protected waterbirds in the harvest. Details of age class (i.e. immature or adult) of birds harvested and the incidence of wing moult are also summarised.

Note that there was a change in the department's regional boundaries between the two Hunter's Bag Surveys considered here, including the splitting of the former South West Region into two – Barwon South West and Grampians Regions. Thus, two sets of regional names are used, one for 2014 and one for 2015, and the capacity to make comparisons between regions over time has once again been fractured.

Methods

2014 and 2015 hunting periods and restrictions

As prescribed in the Wildlife (Game) regulations (2012), the 2014 duck hunting season in Victoria ran over a twelve-week period running from 15 March through to 9 June. Hunters were allowed to take 10 game ducks per day, of which no more than two were to be Australasian Shoveler.

The 2015 duck hunting season in Victoria ran over an eleven-week period, from 21 March to 8 June. The bag limit on opening day (21 March) was 10 birds, which included a maximum of two Australasian Shoveler. Thereafter, the daily bag limit was five game ducks, with a maximum of one Australasian Shoveler. The daily bag limit after opening day was reduced in response to dry conditions and low game duck populations.

In both years, surveys of hunter's bags took place on the Saturday and Sunday of the opening weekend.

Hunter and wetland surveys

Regional coordinators from DELWP were responsible for the administration and coordination of local surveys. Regional coordinators allocated resources for executing surveys, trained staff (where appropriate), maintained the accuracy and integrity of the data collected, and ensured that data were submitted to the state-wide coordinator by a nominated date. Sites where

extensive data collection had been undertaken previously were identified, and coordinators were asked to ensure that hunters were surveyed at these 'long-term' sites, as well as at wetlands that had been surveyed in the preceding Summer Waterbird Count conducted in February. Procedures closely followed those used in Victorian surveys since 1972 (Loyn 1991).

Standardised survey forms and instruction sheets were circulated to coordinators. Surveyors interviewed individual hunters at wetlands in mid- to late-morning, after most shooting had ceased for the day, although some hunters may have hunted again in the evening. Interviewers were asked to obtain information from individual hunters where practical, though consolidated data from groups were acceptable as long as group size was recorded. Interviewers were also asked to provide estimates of the total number of hunters present at each wetland surveyed. Details regarding numbers and species of birds bagged, and the time birds were taken, were obtained during interviews. In addition, some bagged birds were examined for the presence of wing (primary) moult, and categorised as either 'adult' or 'immature', based on the presence or absence of notched tail feathers – an indication of a young bird still in immature plumage. When interviewed, hunters were also asked whether they had finished hunting for that day. Where possible, the same survey methods were to be repeated on the second survey day.

Details regarding the shooting of protected species were obtained by examination of bags as well as by shoreline surveys where interviewers would search the water's edge for unrecovered shot birds. Carcasses (or injured birds) were identified and, to avoid duplication, the place and method of disposal of birds was recorded.

Results

2014 Hunter's Bag Survey

On opening day of the 2014 duck hunting season (Saturday, 15 March), 1,592 ducks were examined in 702 hunter's bags on 14 public wetlands across Victoria (Table 1.A). On Day 2 (Sunday, 16 March) of opening weekend, 239 ducks were recorded in 139 hunter's bags on seven public wetlands, all of which had also been surveyed on the Saturday (Table 1.A).

Species composition of bags, 2014

On opening day, Grey Teal was the most numerous species with 740 recorded, amounting to 46.9% of the open day harvest (Table 2.A), followed by Australian Wood Duck (369, 23.4%), Pacific Black Duck (234, 14.8%) and Pink-eared Duck (124, 7.9%). Low numbers of Chestnut Teal (57, 3.6%), Australasian Shoveler (40, 2.5%), Australian Shelduck (21, 1.3%) and Hardhead (7, 0.4%) were found. No unidentified (plucked) birds were recorded.

On Day 2, Grey Teal (139, 58.2%) again dominated the count, followed by Australian Wood Duck and Pacific Black Duck (35, 23% both), with small numbers of Pink-eared Duck (18, 7.5%), Chestnut Teal (7, 2.9%), Australasian Shoveler (4, 1.7%) and Australian Shelduck (1, 0.4%).

Historically, Grey Teal, Australian Wood Duck and Pacific Black Duck have been the dominant species in hunter's bags (Table 3).

Bag sizes, 2014

On opening day, the 702 hunters whose bags were examined had an average of 2.7 ducks per hunter (Table 2.A), close to the mean bag size since 1972 of 2.9 (Table 4). Empty bags were

held by 125 hunters (17.8% of hunters surveyed) at the time they were interviewed. The prescribed bag limit of 10 was reached by 10 hunters (1.4%), all within the South West region. Bags favoured Grey Teal and Pacific Black Duck. On Day 2, 139 hunters were found to have an average bag size of 2.1 (± 2.64 s.d.). Thirty nine hunters (28%) held empty bags and three hunters (2%) reached the legal bag limit of 10 ducks.

There was regional variation in the number of ducks taken and in mean bag sizes (Table 2.A). Survey effort was greatest in the North East (772 birds examined, 49% of opening day Statewide total) and South West Region (670 birds, 42.5%), with fewer recorded in the North West (135, 8.6%). No Hunter's Bag Surveys were undertaken in the Gippsland Region. Mean bag counts were higher in the South West (3.18 ducks per hunter) than the North East (2.27) and North West (1.53), (Table 2.A).

Proportions of surveyed hunters against estimates of total hunters on wetlands, 2014

At some large wetlands, surveyors were unable to estimate the total number of hunters present, preventing an estimation of the total number of birds shot at the wetland (see Table 1). Estimates of total hunters present were provided for 6 of the 14 (43%) wetlands surveyed on the Saturday and 3 of the 7 (43%) surveyed on Sunday. At wetlands for which we received an estimate of the total number of hunters present, the proportion of hunters interviewed was 77% (558 out of 770 hunters present).

Bag limits and species-specific regulations, 2014

There were no reports of infringements in relation to the contents of hunter's bags during the 2014 Hunter's Bag Survey.

Age classes of bagged birds and the incidence of moult, 2014

A total of 881 ducks were examined for age class over the opening weekend (Table 5). Grey Teal (461), Pacific Black Duck (130) and Australian Wood Duck (101), being the most numerous in hunter's bags were similarly represented in this subset of the surveyed harvest. The vast majority of ducks (818, 93%), were considered to be adult with 43 (5%), immature and 20 (2%) unclassified due to being plucked. The highest proportions of immature birds were among Australian Shelduck (8, 38%) and Hardhead (6, 33%), though only small numbers of these species were examined. Among species with greater sample sizes the frequency of immature birds was: Wood Duck 18%, Chestnut Teal 9% and Pacific Black Duck 6%. Active primary moult was evident in six adult Chestnut Teal (14% of total) and five adult Grey Teal (1% of total).

Comparison of bird numbers at wetlands surveyed during the Summer Waterbird Count and estimates of take from bag surveys, 2014

There were five wetlands surveyed during the 2014 Hunter Bag Survey at which birds had been surveyed during the 2014 Summer Waterbird Count (SWC): three in the South West (Lake Connewarre, Lake Lonsdale and Lake Bolac) and two in the North East (Lake Hume and Green Lake). A direct comparison of the two 2014 surveys is compromised because relevant data was incomplete; either no estimate of total numbers of hunters could be obtained or wetlands were incompletely surveyed in the SWC. Therefore, no comparison has been undertaken in this report.

Unrecovered and illegally shot birds, 2014

A single report of a wounded and unretrieved duck was recorded at Loddon Weir in the North West, the only wetland on which a shoreline count was completed. Shoreline surveys designed to identify game that have been shot, but not retrieved by hunters are rarely undertaken and therefore do not provide a useful index of the level of unretrieved or injured birds.

2015 Hunter's Bag Survey

On opening day of the 2015 duck hunting season (Saturday, 21 March), 2088 ducks were examined in 1497 hunter's bags (Table 2.B) on 18 public wetlands across Victoria. On Day 2 of opening weekend (Sunday, 22 March), 176 ducks were recorded in 165 hunter's bags on eight public wetlands, five of which had also been surveyed on opening day.

Species composition of bags, 2015

Grey Teal was the most numerous species found in hunter's bags on opening day (989, 47.3% of the open day harvest) (Table 2.B). All other species were much lower in number: Pacific Black Duck (283, 13.5%), Chestnut Teal (265, 12.7%), Pink-eared Duck (238, 11.4%) Australian Wood Duck (238, 11.4%), Australian Shelduck (39, 1.9%), Australasian Shoveler (17, 0.8%), Hardhead (4, 0.2%) and unidentified (plucked) ducks (15, 0.7%).

Grey Teal (90, 51.1%) also dominated the Sunday count, followed by Pacific Black Duck (39, 22.1%), Chestnut Teal (19, 10.7%) and Australian Wood Duck (19,10.7%). Three other species occurred in very low numbers – Australasian Shoveler (4, 2.3%), Pink-eared duck (3, 1.7%), and Australian Shelduck (2, 1.2%).

Historically, Grey Teal, Australian Wood Duck and Pacific Black Duck have been the dominant species in hunter's bags (Table 3).

Bag sizes, 2015

On opening day, bag details were obtained from 1497 hunters (Table 1) with an average bag of 1.4 ducks per hunter (Table 2.B). The overall mean of bag sizes taken since 1972 is 2.9 (Table 4). Empty bags were held by 166 hunters (11.1% of hunters surveyed) at the time they were interviewed. The prescribed bag limit of 10 was reached by 4 hunters (0.27%), all within the South West Region. On Sunday, 165 hunters were found to have harvested an average bag size of 1.0. Thirty-one hunters (19%) held empty bags. No wetlands were surveyed in the Loddon Mallee Region on Sunday.

There was little regional variation in the number of ducks taken and mean bag sizes (Table 2.B). Within the sample of hunters interviewed, most ducks were harvested from the Gippsland Region (588, 28.2% of the opening day's take). The Hume and Grampians Regions had similar proportions of the opening day's take (455, 21.8% and 391, 18.7% respectively), as did Barwon South West and Loddon Mallee region (329, 15.7% and 325, 15.6%).

Proportions of surveyed hunters against estimates of total hunters on wetlands, 2015

As in previous years, interviewers were unable to estimate the total number of hunters present on all wetlands, particularly larger waterbodies. An estimate of the proportion of hunters present who were actually interviewed could be made at only 50% of wetlands surveyed (nine of 18 wetlands) (see Table 1), preventing any accurate Statewide analysis. At those nine wetlands, 90% of the estimated number of hunters were interviewed (758 out of 841), a very high proportion.

Bag limits and species-specific regulations, 2015

There were no reports from interviewers of infringements in relation to the contents of hunter's bags in 2015. exceeding the bag limit.

Age classes of bagged birds and the incidence of moult, 2015

A total of 781 ducks were examined for age class over the 2015 opening weekend (Table 5). The most numerous species examined for age class were Grey Teal (304), Pacific Black Duck (142), Pink-eared Duck (114) and Australian Wood Duck (90). Adult ducks numbered 655 (80%) with 137 (17%) immature. The age class of twenty-three birds (3%) could not be determined due to having been plucked[1]. The highest proportions of immature birds were among Chestnut Teal (29%), followed by Pacific Black Duck (19%), Pink-eared Duck (18%) and Grey Teal (15%). Active primary moult was evident in 26 adult Pacific Black Duck, 25% of adults of this species, one adult Grey Teal as well as two immature Pacific Black Duck (7.4%).

Comparison of bird numbers at wetlands surveyed during the Summer Waterbird Count and estimates of take from bag surveys, 2015

Fourteen of the wetlands surveyed during the 2015 Hunter's Bag Survey were included in the preceding 2015 Summer Waterbird Count (SWC); Five in the Hume Region (Lake Buffalo, Lower Ovens, Lake Eildon, Lake Nillahcootie and Greens Lake), three in Loddon Mallee Region (Lake Elizabeth, Lake Murphy and Racecourse Lake), three in Barwon South West Region (Lake Connewarre, Pine Lake and Lake Taylor), two in Grampians Region (Lake Bolac and Toolondo Reservoir) and one in Gippsland Region (Dowds Morass). As in previous years, a direct comparison of the two 2015 surveys is compromised because relevant data was incomplete; either no estimate of total numbers of hunters could be obtained or wetlands were incompletely surveyed in the SWC. Therefore, no comparison has been undertaken in this report.

Unrecovered and illegally shot birds, 2015

At Lake Connewarre in Barwon South West Region, 20 ducks were recorded as being shot and not retrieved by hunters, as were small numbers at Toolondoo Reservoir in the Grampians (three birds) and Lake Murphy in Loddon Mallee (one). Shoreline surveys were only carried out at these three wetlands.

[1] It is a requirement of the Wildlife (Game) Regulations 2012 that a fully-feathered wing remain on all harvested game ducks until the hunter reaches their place of residence, or immediately prior to consumption.

Table 1. Wetlands at which Hunter's Bag Surveys were conducted on the opening weekends of the 2014 (1.A) and 2015 (1.B) waterfowl hunting seasons in Victoria. Data are shown for individual DEPI (2014) and DELWP (2015) Regions, and as state-wide totals. * indicates that an estimate was provided of the number of hunters present on the wetland.

Table 1.A 2014

Day	Wetland Name	DEPI Region	Bags counted
Saturday	Lake Buffalo	North East	27
	Lake Cooper*	North East	46
	Lake Hume, Mitta Mitta Arm,	North East	77
	Lake Hume, Murray Arm	North East	86
	Green Lake*	North East	18
	Lake Stewart*	North East	15
	Parolas*	North East	61
	Heywood Lake	North West	9
	Little Murray	North West	31
	Gunbower Creek (Cohuna – Koondook)	North West	22
	Loddon Weir	North West	21
	Lake Connewarre	South West	74
	Lake Lonsdale*	South West	89
	Lake Bolac*	South West	126
Total			**702**
Sunday	Lake Buffalo	North East	3
	Parolas	North East	39
	Heywood Lake*	North West	33
	Gunbower Creek (Cohuna – Koondook)	North West	4
	Lake Connewarre*	South West	19
	Lake Lonsdale*	South West	17
	Lake Bolac	South West	24
Total			**139**

Table 1.B 2015

Day	Wetland Name	DELWP Region	Bags counted
Saturday	Dowds Morass*	Gippsland	220
	Heart Morass*	Gippsland	67
	Loch Sport (Victoria Eel Farm)*	Gippsland	65
	Lake Buffalo*	Hume	37
	Upper Murray	Hume	60
	Lake Hume	Hume	69
	Lake Eildon*	Hume	35
	Nillacootie*	Hume	126
	Greens Lake & Goulburn River*	Hume	30
	Lake Elizabeth	Loddon Mallee	65
	Lake Murphy	Loddon Mallee	244
	Little Murray	Loddon Mallee	100
	Racecourse	Loddon Mallee	26
	Lake Bolac*	Grampians	82
	Toolondoo Reserve	Grampians	109
	Lake Connewarre	BSW	93
	Pine Lake*	BSW	49
	Lake Tayor	BSW	20
Total			**1497**
Sunday	Mcleods Morass	Gippsland	26
	Loch Sport (Victoria Eel Farm)	Gippsland	40
	Lower Ovens	Hume	27
	Upper Murray	Hume	11
	Lake Eildon	Hume	8
	Goulburn River	Hume	5
	Lake Bolac	Grampians	15
	Pine Lake	BSW	33
Total			**165**

Table 2. Summary of individual game species found in hunter's bags on the opening weekends of the 2014 (2.A) and 2015 (2.B) waterfowl hunting seasons in Victoria. Data are shown for individual DEPI Regions (DELWP Regions for 2015) and as state-wide totals.

Table 2.A 2014

Day and DEPI region	Number of hunters surveyed	Species										Average bag size
		Australian Shelduck	Pacific Black Duck	Grey Teal	Chestnut Teal	Australasian Shoveler	Pink-eared Duck	Hardhead	Australian Wood Duck	Unidentified	Total identified	
SATURDAY												
Gippsland	0											-
North East	330	13	126	328	13	6	33	1	252	0	772	2.27
North West	83	0	3	37	0	0	3	0	107	0	150	1.53
South West	289	8	105	375	44	34	88	6	10	0	670	3.18
Totals	**702**	**21**	**234**	**740**	**57**	**40**	**124**	**7**	**369**	**0**	**1592**	**2.70**
% of all birds		1.3%	14.7%	46.5%	3.6%	2.5%	7.8%	0.4%	23.2%	0.00%		
SUNDAY												
Gippsland	0											-
North East	42	0	6	2	0	0	0	0	6	0	14	0.24
North West	37	0	4	13	0	0	0	0	29	0	46	1.24
South West	60	1	25	124	7	4	18	0	0	0	179	2.97
Totals	**139**	**1**	**35**	**139**	**7**	**4**	**18**	**0**	**35**	**0**	**239**	**2.13**
% of all birds		0.0%	21.6%	23.0%	0.0%	0.0%	0.0%	0.0%	55.4%	0.0%		
Weekend total	841	22	269	879	64	44	142	7	404	0	1831	2.45
% of total birds		1.2%	14.7%	48.0%	3.5%	2.4%	7.8%	0.4%	22.1%	0		

Table 2.B 2015

Day and DELWP region	Number of hunters surveyed	Species										Average bag size
		Australian Shelduck	Pacific Black Duck	Grey Teal	Chestnut Teal	Australasian Shoveler	Pink-eared Duck	Hardhead	Australian Wood Duck	Unidentified	Total identified	
SATURDAY												
Gippsland	352	8	76	371	112	3	3	0	0	15	588	1.98
Hume	357	6	50	239	6	0	2	1	151	0	455	2.03
Loddon Mallee	435	1	15	44	38	1	173	1	52	0	325	0.86
Grampians	191	14	64	266	9	12	24	2	0	0	391	1.85
BSW	162	10	78	69	100	1	36	0	35	0	329	1.91
Totals	1497	39	283	989	265	17	238	4	238	15	2088	1.77
% of all birds		1.9%	13.9%	47.6%	13.0%	0.8%	11.7%	0.2%	10.0%	0.7%		
SUNDAY												
Gippsland	66	2	11	64	17	4	0	0	0	0	98	1.53
Hume	46	0	28	10	1	0	0	0	16	0	55	1.80
Loddon Mallee	0	0	0	0	0	0	0	0	0	0	0	0.00
Grampians	15	0	0	3	0	0	2	0	0	0	5	0.33
BSW	33	0	0	13	1	0	1	0	3	0	18	0.78
Totals	165	2	39	90	19	4	3	0	19	0	176	1.30
% of all birds		0.9%	17.0%	47.8%	8.3%	1.7%	1.3%	0.0%	23.0%	0.0%		
Weekend total	**1662**	**41**	**322**	**1079**	**284**	**21**	**241**	**4**	**257**	**15**	2264	1.89
% of total birds		1.8%	14.2%	47.7%	12.5%	0.9%	10.6%	0.2%	11.3%	0.7%		

Table 3. Species composition (% of birds examined) of hunter's bags on opening days or weekends of Victorian duck hunting seasons, 1987– 2015.
(Data from Holmes (1994), Purdey and Loyn (2010, 2011), Purdey et al. 2013), and this study)

Species	1987[a]	1988[a]	1989[a]	1990[a]	1991	1992	1993	1994	1996	1997	1998[b]	1999	2000	2001	2002[c]	2004[d]	2005[e]	2006	2009[d]	2010	2011	2012	2013	2014	2015
Australian Shelduck	5.5	7.9	3.3	3.3	5.4	4.9	5.4	3.4	5.7	9.9	13.8	8.8	22.3	1.8	3.6	2.0	1.4	1.6	1.9	0.8	0.4	0.7	0.1	1.3	1.7
Pacific Black Duck	22.7	25.3	16.7	28.9	21.1	22.4	27.4	31.4	17.0	20.4	22.9	14.4	22.0	12.8	29.5	18.2	16.1	12.9	29.9	18.3	12.9	16.4	8.7	14.8	15.4
Grey Teal	29.3	30.7	40.9	42.3	44.9	31.6	37.4	36.2	43.7	44.5	34.5	45.5	21.1	54.7	36.0	25.9	27.8	17.2	14.1	12.7	51.1	31	32.6	46.9	47.1
Chestnut Teal	3.3	4.1	5.2	6.1	5.5	5.3	8.0	7.1	13.9	9.3	7.2	14.6	13.7	10.3	7.0	5.4	5.4	14.4	10.1	17.0	12.3	9.7	9.2	3.6	13.3
Australasian Shoveler	4.5	1.8	3.6	2.6	2.2	3.5	3.9	5.8	3.0	4.9	1.8	3.9	4.3	2.3	5.7	0	<0.1	1.5	0.1	0.3	0.4	1.2	1.1	2.5	0.9
Pink-eared Duck	12.1	15.4	18.5	7.9	9.5	12.6	8.1	9.0	6.3	3.7	6.3	7.2	0.2	8.3	4.8	1.3	4.1	14.7	0.0	0	8.1	8.5	24.8	7.9	12.1
Hardhead	0.2	0.2	0.6	0.5	0.4	0.7	1.2	0.5	0.9	0.3	1.8	0.2	0.1	0.2	1.7	0.3	0.2	0.2	0.0	0	1.5	3.1	0.7	0.4	0.2
Australian Wood Duck	22.5	14.5	11.2	8.5	9.6	16.9	8.5	6.5	9.2	6.9	11.7	5.5	16.2	9.5	11.6	46.7	45.1	37.3	43.0	51.0	13.3	29.2	22.7	23.4	0.8

Hunting regulations

Data indicates opening Saturday unless otherwise stated;

a Opening weekend
b Legal possession regulations were varied considerably in this season
c An additional five Australian Wood Duck were allowed
d Only five game species (Hardhead, Pink-eared Duck and Australasian Shoveler excluded). Bag limited to two of any species, plus an additional three Australian Wood Duck per day, or five Wood Duck only per day
e Five game ducks plus five additional Australian Wood Duck per day during opening weekend

Table 4. Mean bag size obtained by hunters on the opening day of the duck hunting season, 1972 to 2015, calculated from data collected during Hunter's Bag Surveys (data from Norman and Nicholls (1991), Holmes (1994) and ARI unpublished data).

Year	Mean bag size	Year	Mean bag size
1972	1.3	1994	4.4
1973	1.3	1995	no season
1974	2.5	1996	3.6
1975	5.9	1997	2.0
1976	2.4	1998	1.4
1977	4.3	1999	2.2
1978	2.4	2000	1.3
1979	2.0	2001	2.2
1980	4.4	2002	1.3
1981	3.2	2003	no season
1982	3.6	2004	2.0
1983	no season	2005	2.5
1984	3.7	2006	1.6
1985	6.2	2007	no season
1986	no data	2008	no season
1987	2.0	2009	1.4
1988	2.4	2010	1.8
1989	3.9	2011	4.2
1990	4.5	2012	2.3
1991	4.2	2013	4.0
1992	2.5	2014	2.7
1993	4.4	2015	1.4
		Mean	**2.9**

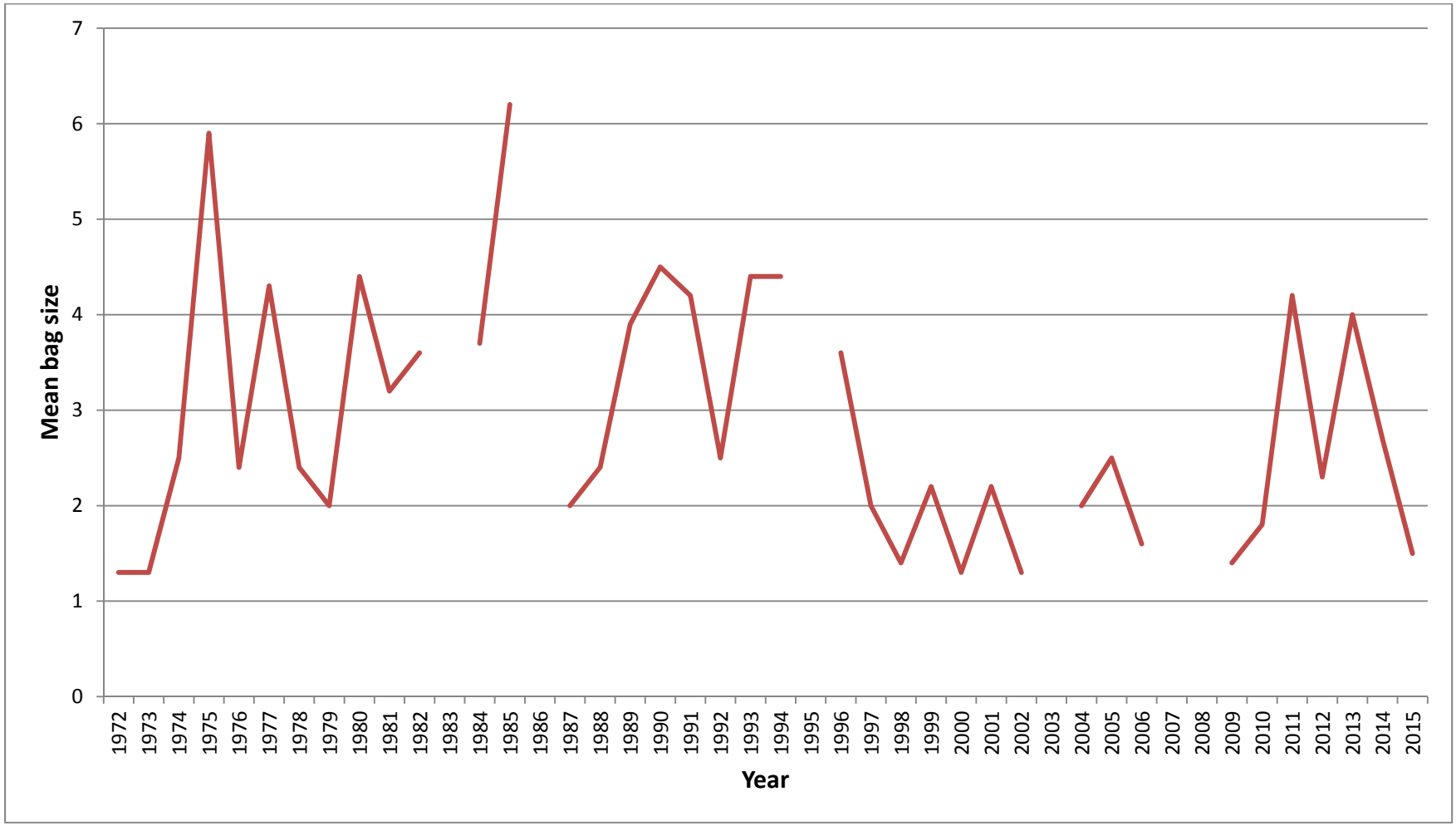

Figure 1. The data from Table 4 presented graphically – mean bag size obtained by hunters on the opening day of the duck hunting season, 1972 to 2015, calculated from data collected during Hunter's Bag Surveys. Gaps represent years in which no hunting season was declared.

Table 5. Summary of age classes of ducks examined during the 2014 and 2015 opening weekend Hunter's Bag Surveys (all sites combined).

Species	Year	Total immature	Total adult	Unsure	Total	% immature	% adult
Australian Shelduck	2014	3	5	0	8	38%	63%
	2015	1	13	0	14	7%	93%
Pacific Black Duck	2014	8	121	0	129	6%	94%
	2015	27	104	3	142	19%	73%
Grey Teal	2014	8	444	9	461	2%	96%
	2015	46	275	12	304	15%	90%
Chestnut Teal	2014	4	43	0	47	9%	91%
	2015	32	91	2	109	29%	83%
Australasian Shoveler	2014	0	36	0	36	0%	100%
	2015	0	5	0	5	0%	100%
Pink-eared Duck	2014	0	92	1	93	0%	99%
	2015	20	92	2	114	18%	81%
Hardhead	2014	2	4	0	6	33%	67%
	2015	0	3	0	3	0%	100%
Australian Wood Duck	2014	18	73	10	101	18%	72%
	2015	11	72	4	90	12%	80%
Totals	**2014**	**43**	**818**	**20**	**881**	**5%**	**93%**
	2015	**137**	**655**	**23**	**815**	**17%**	**80%**

Discussion

The 2014-2015 results and a comparison with previous years

Annual surveys of the contents of hunter's bags on opening weekend aim to provide an index of the annual estimated harvest of waterfowl in Victoria on opening weekend. It is intended to examine underlying trends in harvest size and in the representation of species and age classes within it. The focus on opening weekend is arguably appropriate because about 30% of the annual harvest (and hunting effort) has been shown to occur at this time (e.g. Norman and Powell 1981, Loyn 1991, Moloney and Turnbull 2015).

Opening weekend data taken from six years of an annual telephone surveys (Gormley and Turnbull 2009, 2010, 2011, Moloney and Turnbull 2012, 2013, 2015) found the average number of ducks taken per active hunter ('bag size') to be approximately two to three times that recorded in hunter's bag counts of the same years. Data from the two surveys are not directly comparable because of the different methods employed, and because the telephone survey operates across both private and public land, and shooters on private land could have greater success because their numbers can be controlled by the land holder. Never-the-less, the results have followed a similar inter-annual trend of increases and decreases for opening weekend, suggesting that both are sensitive to broad, annual changes in bag size, but vary in their accuracy as measures of actual bag size.

The most numerous species in bags in 2014 were Grey Teal, Australian Wood Duck and Pacific Black Duck; in 2015, Grey Teal was followed by Pacific Black Duck and Chestnut Teal. Grey Teal and Australian Wood Duck have typically been recorded in high proportions in bag counts (Table 2) as has Pacific Black Duck. Pink-eared Duck, usually less common in bag counts, has increased in proportion since 2013, indicating a higher population in Victoria in recent years. This species, along with Australasian Shoveler and Hardhead, was excluded from hunting in 2009 due to their prior scarcity in waterbird surveys. In the past, Pink-eared Duck has tended to concentrate on wetlands closed to hunting, but in recent years has been taken in high numbers on open wetlands in the west of the state.

Some correlation existed between the 2014 telephone survey and hunter's bag survey in that the three most abundant species in both were Wood Duck (29% & 22.1% respectively), Grey Teal (28% & 48%) and Pacific Black Duck (28%, 14.7%), all other species were below 8%. However these proportions, as well as other results, differ between the surveys. For example Pink-eared Duck has typically comprised a high and often dominant proportion in telephone surveys (20%-36%), but this has not been the case in bag surveys (8.2-30.2%, mean 16.5%). The differing proportions between the two survey techniquesmay relate to habitat preferences of the species concerned. For example, Grey Teal was more commonly encountered in hunter's bag surveys than in the telephone survey, whereas Pacific Black Duck was the other way round. Thgis may reflect the preference of Pacific Black Duck for small private wetlands (Marchant and Higgins 1990), whereas Grey Teal favour larger wetlands that are usually on public land, where hunter's bag surveys take place. The surveys follow very different methods and both represent only a sample of the state harvest, but some congruence is evident in their respective results.

Australian Wood Duck featured strongly in the bag surveys during the drought, probably because a high proportion of hunting was conducted on freshwater wetlands, including farm dams, favoured by this species. The high representation of Australian Wood Ducks may also reflect an often increased bag limit for the species in drought years (2002–2004 and 2009–2010), partly aimed at addressing perceptions about its role as an agricultural pest.

In recent years, requests have been made for increased effort in undertaking hunter's bag surveys on wetlands that are included in the preceding Summer Waterbird Count. However,

due to resource constraints in recent years, both counts occurred at only a small number of wetlands ; 5 in 2014 and 14 in 2015. Further, in both years many of these wetlands were incompletely surveyed in the Summer Waterbird Count and total numbers of hunters on the wetlands could not be estimated during the Hunter's Bag Survey, providing incomplete data and preventing estimates of total take at these wetlands.

Breeding and moult

The duck hunting season is timed to avoid the main breeding seasons of game species and most waterbirds. The proportion of immature ducks in hunter's bags is our only current measure of annual production during the previous breeding season, and we realise that it is an imperfect measure. Both 2014 and 2015 proportions of birds identified as immature were low; 5% and 17% respectively compared with an average of 50% in the 1980s when these measurements were made routinely at large numbers of wetlands (Loyn 1989). While this may suggest that recent breeding seasons have been poor, the sample sizes are low and geographically localised, providing little confidence in these estimates.

Moulting of wing feathers is normally completed before the hunting season begins. Almost one quarter (24.3%) of all 2015 adult Pacific Black Duck examined displayed signs of moult, but otherwise there were few records of moult in either year. Full moults involving flight feathers are only expected in adult birds, and it is adult moulting that has been perceived as a management issue when concentrations of flightless moulting birds present easy targets for hunters. Australian Shelduck, in particular, gathers to moult at specific locations in mid-summer (Frith 1982). Moulting was considered a significant management issue in the 1970s when duck hunting seasons sometimes opened as early as January (Loyn 1989) when moulting in some species is still taking place. However, with the season now opening later (March) moult appears to be of little concern.

Unrecovered and illegally shot birds

A single shoreline survey was carried out in 2014 on Loddon Weir, North West Region with a single shot and unretrieved duck reported. Three shoreline surveys were carried out in 2015 recording a total of 24 shot and unretrieved ducks; Lake Connewarre in Barwon South West Region where 20 ducks were recorded, Toolondo Reserve in the Grampians with three ducks and Lake Murphy in Loddon Mallee with one duck. Though shoreline surveys are infrequently undertaken during open season, wounded or dead ducks are often recorded in such surveys. This may indicate the importance of shoreline surveys as a useful tool for assessing some animal welfare aspects of duck hunting, however, a much larger sample of shoreline surveys is required, along with better quantification of search effort, to ensure that shoreline surveys provide useful information for monitoring both non-target take and the animal welfare implications of hunting.

Conclusion

Numbers of game ducks recorded in hunter's bags during the 2014 and 2015 opening weekends were similar, despite the sample size in 2015 being twice that of 2014. Further, hunters interviewed in 2015 were in similar numbers to those of 2013 when three times as many ducks were harvested. The harvest of 2013 may have represented a return of pre-drought numbers, possibly because of inland breeding of some species in response to flooding in NSW and Queensland during the 2010-2012 period, combined with the replenishment of local wetlands following improved rainfall in Victoria over the previous two years. The 2015 harvest rate, as determined by the Hunter's Bag Surveys, may indicate a reduction in state-wide duck numbers, however, it is based on a small sample of wetlands.

While a greater effort has been made in the last two years, more intensive monitoring is required to provide a robust estimate of levels of take for game and protected species.

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