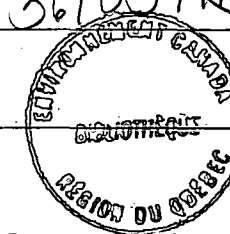




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**Reported daily bags of ducks in Ontario, 1972-82,
and their relationships to bag limits and seasonal
kill**by H. Boyd¹ and J.S. Wendt¹**Abstract**

Reports from respondents to the National Harvest Survey of daily bags of ducks were used to examine the effects of an increase in the daily bag limit from five to six in 1979, and responses to the Species Composition Survey to study apparent compliance with special regulations for individual species. The mean reported daily bag per successful hunter was 2.72 ± 0.11 , and increased significantly after 1979, from 2.68 ± 0.10 in 1972-78 to 2.80 ± 0.08 in 1979-82. The numbers of active and of successful hunters fell from 1978 to 1979, and there has since been a strong correlation between mean bag size and seasonal duck kill. Bags of one duck were the most frequent (29%) but contributed less than 11% of the kill. Bags of five or more contributed 38% of the reported kill in 1972-78, and 40% in 1979-82. The total annual provincial duck kill was not clearly affected by raising the daily limit. Affording mergansers the same protection as that given to other ducks did not reduce the small reported kill. The "bonus" regulation that permitted taking two additional scaup from mid October onwards seems to have been used by nearly one-third of those hunters exceeding the standard limit in 1972-78, and by half of those taking bags of more than six in 1979-82. Increasing the daily bag limit from one to two doubled the reported kill of Redheads, but had no apparent effect on the kill of Canvasbacks. Infractions of the regulations were reported frequently enough to suggest that ignorance of, or contempt for, current regulations is widespread, though the reported illegal kill was less than 2% of the total reported kill.

Introduction

The National Harvest Survey (NHS) elicits responses from current holders of Migratory Game Bird Hunting Permits concerning their waterfowl hunting activity and success, by means of mail questionnaires administered to stratified samples of permit-holders. Cooch *et al.* (1978) describe the survey and discuss its reliability. This report deals with the daily bags of ducks shot and retrieved, as recorded by the permit-holders themselves, and with relationships between daily bag size, the total reported duck kill each season, and the numbers of active and successful hunters ("successful" being defined as "reporting at least one duck retrieved during the season").

The analysis begins with data from the 1972 season, because the sampling scheme in earlier years under-represented inexperienced hunters by sampling only hunters who had purchased permits in the previous hunting season,

and so led to exaggerated estimates of hunters' success. A run of 11 hunting seasons is not long, but fortunately duck-hunting activity in Ontario remained relatively constant from 1972 to 1982, enabling us to focus attention here on the extent to which the seasonal kill may have been influenced by the average daily kill. We pay particular attention to a change made in 1979, when the daily bag limit was raised from five (which it had been since 1961) to six. The analysis is limited to the total kill of ducks and to the kill of those individual species that were the subject of special regulations.

Hunters provide two independent sets of reports on daily bag sizes. Those who complete the "duck calendar" on the NHS questionnaire record their bags on each hunting day, including nil returns for those days on which they hunted but failed to bag a duck. The respondents to the Species Composition Survey (SCS), who are asked to send to CWS one wing from each duck they shoot, provide the second set, which lacks nil returns and is liable to be biased downward should the supply of wing envelopes prove insufficient for the most successful hunters.

Results**Responses**

During 1972-82, the number of permits sold in Ontario averaged 144 300, rising from 131 427 in 1972 to 159 695 in 1978, then falling to 137 661 in 1982. The numbers of current-year and previous-year buyers of permits selected to receive NHS questionnaires were about 4700 in 1972-78, rising with sales to about 7700 in 1979-81. The proportion of responses averaged 57.8%, and 78.6% of the respondents said that they had bought permits in the current years. There were no trends in those two sets of percentages. The proportion of permit-buying respondents who reported success in taking waterfowl averaged 63.8%, rising from 59.9% in 1972 to 66.2% in 1982.

Distribution of daily bag sizes

Just over half of the 144 000 reports of daily bags recorded no ducks taken (Table 1). The mean daily bag of successful hunters was 2.72 ± 0.11 . When the daily limit was raised from five to six ducks in 1979, the mean bag increased from 2.68 ± 0.10 per successful hunter in 1972-78 to 2.80 ± 0.08 in 1979-82, the difference being statistically significant.

Bags of one duck were the most frequent (29% of all successful records) and contributed 10.6% of the total kill. The proportion of bags of one to four changed very little over the entire period. The change in the daily bag limit made a great difference to the proportion of the kill made up of bags of five and six. Reported bags of five accounted for more than 29% of the kill in 1972-78, but for only 18% in 1979-82. Bags of six contributed 4.0% of the kill in 1972-78 and 16.6% from 1979. The share of the kill made up of bags of five and more rose from 38.2% in 1972-78 to 40.3% after 1979, a comparatively small change.

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Relationship of daily bag size to seasonal hunting activity and kill
The increase in mean daily bag after the daily limit was raised might be expected to have affected the total seasonal kill and the average seasonal kill per hunter. Table 2 summarizes the NHS information on seasonal activity and kill. Apart from the mean daily bag per successful hunter, none of the other measures shows a clear difference between 1972-78 and 1979-82, nor a trend over the whole period. Before the increase in the daily limit, the numbers of active and successful hunters had both been rising (correlations with years, $r = 0.898$ and 0.901 respectively, $p \leq 0.001$). They fell from 1978 to 1979 and fluctuated thereafter well below the number reached in 1977-78. It is hard to imagine that the change in bag limit was responsible for this decline in effective demand.

There was significant correlation between the mean daily bag and the total seasonal kill during 1972-78 ($r = 0.753$) and after 1979 (0.998), though for the entire period, $r = 0.523$, $0.1 > p > 0.05$. This suggests that a closer relationship between demand and supply may have been developing in recent years, which will warrant careful monitoring in future.

The annual mean daily bags were not directly related to the numbers of active or successful hunters, but were positively correlated with the mean seasonal kills per active hunter ($r = 0.600$, $p < 0.05$) and per successful hunter ($r = 0.645$, $p < 0.02$). Yet the mean seasonal kill did not increase after the daily bag limit was raised.

Effects on kill of changes in special bag limits for individual species
Although the taking of the great majority of ducks is subject only to the standard daily bag limit, for a few species it is not. Within the period 1972-82, changes affecting these exceptions were infrequent and mostly slight, but it is worth examining whether they produced perceptible and intended results (Table 3).

Until 1970, mergansers of all three species could be taken without daily limit. In 1971, the hunting of Hooded Mergansers was brought under the standard limit of five, and in 1977 the Common and Red-breasted Mergansers were also afforded that protection. Had appreciable numbers of hunters been taking advantage of their freedom to take mergansers without limit, and if after 1977 they came to respect the new limitation, the reported kill of mergansers might be expected to have fallen in recent years. The estimates of mean annual kill of Common Mergansers were 4100 ± 1100 in 1972-76, and 5100 ± 1200 in 1977-82. For Red-breasted Mergansers the means were 2000 ± 1200 in 1972-76, and 1400 ± 800 in 1977-82 (Table 3).

Thus the Common Merganser seems not to have benefited from protection. The Red-breasted Merganser may not have done so either, because its kill had been falling prior to 1976 (in which year there was an exceptionally high estimated kill of 4700). The much higher Ontario kill of Hooded Mergansers ($21\ 500 \pm 3200$) showed no trend during the decade.

The imposition of the standard daily bag limit on the taking of mergansers brought about no appreciable change

in reported bag sizes, because bags of more than three birds of any of the mergansers were infrequent at any time: only 2.5% of 1269 bags of Hooded Mergansers, 2.2% of 267 Common Mergansers, and 4 of 101 of Red-breasted Mergansers. The only improperly large bags reported were two of six Hooded Mergansers in 1976. Before limits on the taking of the larger mergansers were introduced in 1977, a single bag of nine Common Mergansers was reported in 1973, with no bags of Red-breasted Mergansers larger than six. Although there seems to have been no measurable response by hunters to the change in regulations that resulted in mergansers being treated in law like other ducks, the removal of an anomaly that put mergansers "outside the law" was surely justified.

Scaup, of both species, are subject to the regulatory peculiarity that after a date in October (i.e. when large numbers of scaup have arrived in southern Ontario), a bonus of two over the standard daily limit of ducks may be taken. In 1972-75, the date on which the bonus came into effect was 10-12 October. From 1976 onwards it was 18 October, so that the kill of scaup might have been expected to fall. The annual kills of both species are unusually variable, so it is not surprising that the effects of the delayed bonus on the total kill were not detectable (Table 3).

An analysis of daily bags with and without scaup suggests that the "bonus scaup" regulation has been used extensively by the minority of hunters in a position to exploit it (Table 4). In daily bags of 1-5 ducks, less than 9% contained any scaup, and less than 4% were made up wholly of scaup. Yet scaup were reported in more than 25% of all bags of 6-10 ducks. The striking change in the percentage of scaup in bags of six, before and after the increase in the limit in 1979, shows that when the standard limit was raised, hunters concentrated on using scaup to increase their take beyond the new limit.

For many years the daily bag limits in Ontario on the Redhead and Canvasback, the diving ducks most highly prized by hunters, have been very small. During the period for which daily bag data are available, the limit changed from one Canvasback or Redhead in 1969-71 to three Redheads in 1972, one in 1973-75, and two from 1976 to 1982; and one Canvasback in 1972-75, and two from 1976 onwards. The response of hunters of Redheads was as intended, the estimated kill being high (24 100) in 1972, low in 1973-75, and nearly doubling after the bag limit was increased to two. By contrast, increasing the bag limit on Canvasbacks from one to two did not increase the reported kill.

Table 5 summarizes reports of 610 bags of Canvasbacks and 1198 bags of Redheads in 1972-82. During the years in which the limit was one, 18/274 (6.6%) of successful Canvasback hunters said that they exceeded the limit, as did 32/307 (10.4%) of successful Redhead hunters. When the daily limit was two, 7/336 (2.1%) of Canvasback and 26/714 (3.6%) of Redhead hunters claimed to have exceeded the limit. In 1972, when the Redhead limit was three, only 3/177 (1.7%) of successful Redhead hunters reported exceeding that limit. The general result, that

reported infractions were more frequent when bag limits were lower, might be expected, though it is somewhat surprising to find how freely hunters reported their own infractions or demonstrated their lack of awareness of special bag limits for these species.

If we assume that opportunities to take one, two, and three or more Redheads in a day occurred in all years in proportion to the relative frequency of bag sizes in 1972, when the daily limit was three (i.e. 0.706:0.198:0.096), we can compare the recorded frequencies in years with limits of one or two with those expected under "more liberal" regulations. In 1976-82, with a limit of two, the ratio of reported to expected was 508/504.1 bags of one, 180/141.4 bags of two, and 18/68.5 bags of three. That is, bags of one were much as expected, bags of two more frequent, and bags of three much less frequent. Even so, perhaps 32% of hunters in a position to take an illegal third Redhead reported doing so. In 1973-75, when the limit was one Redhead, 37% of the hunters in a position to exceed the limit may have done so (reported/expected: 30/61.7 bags of two and 2/24.7 bags of three).

If opportunities to take two or more Canvasbacks were as great in 1972-75, when the Canvasback limit was only one bird, as in later years, with a limit of two, the 18 reports of over-limit bags represented 26% of hunters expected to have had the opportunity to exceed the limit.

Reports of bags in excess of limits

We have shown the readiness of some hunters to report taking more ducks than permitted by the regulations. It seems unlikely that all hunters knowingly breaking the law in this respect would report having done so, even though CWS adheres to a policy of not using hunters' responses to NHS questionnaires, or reports of banded birds, as opportunities for investigating potential infractions of the Migratory Birds Convention Act.

The possibility of using scaup to supplement the kill complicates the task of identifying how many improperly taken ducks were voluntarily recorded by respondents to the NHS. In analysing the data, it has been assumed that hunters acted legitimately whenever possible. Even so, in 1972-78, when the standard daily limit was five ducks, 4423 birds reported in bags of 6-10 included at least 1009 (22.8%) that could not have been taken in conformity with the regulations. (In 1969-71, with the same daily limit, 338 of 1599, or 21.1%, were taken improperly.) In 1979-82, after the rise in the daily limit to six, 163 of 1060 birds (15.4%) in bags of 7-10 were taken illegally.

These reported "over-limit" ducks formed a very small proportion of the total reported kill, about 1.9% in 1972-78 and 0.7% in 1979-82. What is significant is that a far from negligible proportion of the hunters who found themselves able to exceed the permitted limits chose to say that they did. Of 2969 daily bags of five or more ducks reported in 1972-78, at least 472 (15.9%) included ducks taken illegally. In 1979-82, 523 bags of six or more included at least 80 (15.3%), with some illegally taken ducks. Thus more than one-sixth of the hunters reporting bags equal to or greater than the standard daily limit also reported

taking one or more ducks that they should not have taken. This suggests that some of the most successful duck hunters were ignorant or contemptuous of the bag limits, at the same time as many others knew enough about the regulations to make effective use of the scaup bonus.

It seems highly probable that, if the daily bag limits were lower, the proportion of hunters able to attain or exceed them would be increased. This suggests that, if it becomes necessary to impose more restrictive regulations on waterfowl hunting in Ontario, increased efforts should be devoted to informing the hunting public of necessary changes and to enforcing the regulations more effectively.

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Reference

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Table 1
Frequencies of daily bags of different sizes reported from Ontario in the NHS before (1972-78) and after (1979-82) the increase in the daily limit from five ducks to six, and the proportions of the reported kill contributed by bags of different sizes

Reported bag	1972-78				1979-82			
	No.	% of bag	Kill	% of kill	No.	% of bag	Kill	% of kill
0	47 445	52.7	0	—	28 834	53.1	0	—
1	12 630	14.0	12 630	11.0	7 223	13.3	7 223	10.1
2	11 048	12.3	22 096	19.2	6 536	12.0	13 072	18.2
3	6 320	7.0	18 960	16.5	3 878	7.1	11 634	16.2
4	4 328	4.8	17 312	15.1	2 720	5.0	10 880	15.2
5	6 746	7.5	33 730	29.4	2 606	4.8	13 030	18.2
6	774	0.9	4 644	4.0	1 981	3.6	11 886	16.6
7-10	670	0.7	5 459	4.8	493	0.9	3 951	5.5
Total	89 961		114 831		54 271		71 676	

Table 2
Seasonal changes in duck hunting and kill in Ontario, 1972-82 from NHS returns

Years	Total duck kill	Active hunters	Successful hunters	Mean seasonal kill		Mean daily bag per successful hunter	
				Per active hunter	Per successful hunter	Bag	SE†
1972	822.4*	99.3*	79.8*	8.3	10.3	2.66	0.020
1973	752.7	109.9	86.6	6.8	8.7	2.58	0.024
1974	811.5	106.3	83.5	7.6	9.7	2.62	0.022
1975	938.3	114.9	89.9	8.2	10.4	2.64	0.017
1976	976.4	110.5	87.1	8.8	11.2	2.86	0.017
1977	913.3	122.3	92.2	7.5	9.9	2.66	0.017
1978	943.2	121.5	94.6	7.8	10.0	2.71	0.014
1979	845.4	112.0	86.6	7.6	9.8	2.77	0.017
1980	912.1	112.9	88.5	8.1	10.3	2.86	0.020
1981	850.1	106.3	82.7	8.0	10.3	2.78	0.020
1982	861.2	110.4	87.3	7.8	9.9	2.79	0.022
Mean	875.1	111.5	87.2	7.9	10.0	2.72	
SE	64.1	6.3	4.0	0.5	0.6	0.06	
Mean 1972-78	879.7	112.1	87.7	7.9	10.0	2.68	
SE	77.5	7.6	4.7	0.6	0.7	0.05	
Mean 1979-82	867.2	110.4	86.3	7.9	10.1	2.80	
SE	26.6	2.5	2.2	0.2	0.2	0.04	

* In thousands.
† Standard error.

Table 3
Variations in reported kill in Ontario of species subject to special bag limits

Species	Period	Special restrictions	Mean kill	SE*
Common Merganser	1972-76	No daily (or possession) limit	4 100	1 100
	1977-78	Standard daily limit 5	4 500	700
	1979-82	Standard daily limit 6	5 400	1 300
Red-breasted Merganser	1972-76	No daily (or possession) limit	2 600	1 200
	1977-78	Standard daily limit 5	1 700	1 300
	1979-82	Standard daily limit 6	1 200	350
Greater Scaup	1972-75	Bonus of 2 over limit of 5, after 11 Oct.	34 700	6 700
	1976-78	Bonus of 2 over limit of 5, after 18 Oct.	34 800	11 100
	1979-82	Bonus of 2 over limit of 6, after 18 Oct.	24 500	5 200
Lesser Scaup	1972-75	Bonus of 2 over limit of 5, after 11 Oct.	45 700	7 600
	1976-78	Bonus of 2 over limit of 5, after 18 Oct.	42 600	10 700
	1979-82	Bonus of 2 over limit of 6, after 18 Oct.	47 100	9 600
Redhead	1972	Daily limit of 3	24 100	—
	1973-78	Daily limit of 1	11 100	1 800
	1976-82	Daily limit of 2	20 500	7 700
Canvasback	1972-75	Daily limit of 1	11 100	4 400
	1976-82	Daily limit of 2	11 100	4 100

* Standard error.

Table 4
Proportions of daily bags of ducks in Ontario that contained scaup, 1972-78 and 1979-82

Period	Bag sizes	Bags with			Total bags	% of bags with		
		No scaup	Some scaup	All scaup		No scaup	Some scaup	All scaup
1972-78	1-5	20 985	1016	837	22 838	91.9	4.4	3.7
	6	226	76	19	321	70.4	23.7	5.9
	7-10	206	85	18	309	66.7	27.5	5.8
Total		21 417	1177	874	23 468	91.3	5.0	3.7
1979-82	1-5	9 502	475	387	10 364	91.7	4.6	3.7
	6	322	8	59	389	82.8	2.0	15.2
	7-10	65	57	10	132	49.2	43.2	7.6
Total		9 889	540	456	4 885	90.8	5.0	4.2

Table 5
 Reported daily bags of Canvasbacks and Redheads in Ontario,
 1972-82, in relation to daily bag limits. In 1972 the limits were
 one Canvasback and three Redheads; in 1973-75, one and one;
 in 1978-82, two and two

Reported bag	Canvasback				Reported bag	Redhead			
	72	73-75	76-82	Total		72	73-75	76-82	Total
1	<u>60*</u>	<u>196</u>	251	507	1	125	<u>275</u>	508	908
2	8	7	<u>78</u>	93	2	35	30	<u>180</u>	245
3	2	—	5	7	3	<u>14</u>	1	18	33
4, 5	—	1	2	3	4, 5	3	1	8	12
Total	70	204	336	610		177	307	714	1198

* Underlining denotes observance of daily bag limit.