vations on hunting in n Canada 8 and 1969

by H. Boyd

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Observations on duck hunting in eastern Canada in 1968 and 1969

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Canadian Wildlife Service
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Abstract

Observations of hunter performance provide information on specific differences in crippling losses and on factors governing the choice by hunters of what ducks they shot at, how effectively they shot at different times during the season and in various kinds of weather and what proportions of the ducks brought down were retrieved and kept.

Hunters fired at most ducks judged to be in range but showed some reluctance to fire at green-winged teal, redheads and scaup. They fired most readily at large ducks. Only 27 per cent of mallard and black ducks fired at while flying singly were brought down, compared with about half the singles of other species: an average of 7.4 shots were fired for each lone mallard or black duck brought down: the average for all species was 5.5 shots. Body size was more important than generic status in influencing vulnerability.

Groups flying within range showed very little specific variation in size: the modal group was 1, the geometric mean 1.2 and the arithmetic mean 4.4. Nearly 80 per cent of the groups in range contained five birds or less, though these small groups accounted for only 30 per cent of the individuals judged at risk.

No kills at all were made from 65 per cent of the groups fired at. The ratio of birds brought down to birds fired at fell with increasing size of target flock. When groups of several ducks were fired at and at least one was brought down, the likelihood of another bird falling decreased by about half for each additional kill.

Puddle ducks were brought down most easily early in the season, especially on opening day. Those still present in December were also rather vulnerable. Diving ducks were hard to kill early in the season: the proportion bagged showed a marked peak two to three weeks after opening day. Hunter success per hour of effort fell rapidly from opening day in the case of puddle ducks. For diving ducks it was highest in the second half of October.

Perhaps largely because it was warmer early in the season, hunters did better on warm than on cold days. Diving duck hunters did best on windy days, but all hunters retrieved a lower proportion of the kill when winds were strong. Precipitation had no obvious effect on hunting of puddle ducks but hunters of diving ducks did best in dry conditions.

Hunters with dogs fired more often and bagged more ducks than those without dogs, but their skill as marksmen was less. They retrieved almost exactly the same proportions of the ducks they brought down as did the hunters without dogs.

Duck hunters firing over decoys were especially active, although the proportion of birds they hit was unusually low.

Most hunters shot in pairs (52.5 per cent) or trios (31.1 per cent). Their success did not differ from that of lone hunters, in terms of yield per man-hour of effort.

Daily bag limits can have had little immediate effect on the activities of the hunters watched, very few of whom approached the legal limits of five ducks in Ontario or six elsewhere in the east.

Population models for use in managing waterfowl hunting should not be restricted to the mallard, black duck, or any single popular species, because none is of paramount importance and none is typical.

Résumé

L'étude des résultats obtenus par les chasseurs nous fournit des renseignements sur les différences spécifiques dans les pertes de gibier blessé et sur les facteurs qui influent sur le choix de cibles des chasseurs, l'efficacité du tir à différentes périodes de la saison de chasse et dans diverses conditions atmosphériques, ainsi que la proportion d'oiseaux abattus, récupérés et conservés.

Les chasseurs ont fait feu dans la direction de la plupart des canards jugés à portée de tir, mais ils ont manifesté une certaine réticence à l'égard des sarcelles à ailes vertes et des morillons à tête rouge. Ils ont tiré, toutefois, très volontiers sur les gros canards. Ils n'ont cependant réussi à abattre que 27% des canards malards et des canards noirs isolés, en regard de près de la moitié des autres espèces: pour chaque canard malard ou canard noir abattu, ils ont respecté une moyenne de 7.4 coups contre une moyenne de 5.5 coups pour toutes les espèces. La taille de l'oiseau, plus que l'espèce, influait sur sa vulnérabilité.

Les volées à portée de tir ont accusé très peu de variation spécifique de nombre: le groupe modal avait la valeur 1, la moyenne géométrique était de 1.2 et la moyenne arithmétique, de 4.4. Près de 80% des volées à portée de tir comportaient moins de cinq oiseaux, bien que ces petits groupes n'aient compté que pour 30% des oiseaux présumés en danger.

Aucun oiseau n'a été abattu dans 65% des volées vers lesquelles a porté le feu. La proportion entre le nombre d'oiseaux visés et le nombre d'oiseaux abattus a varié inversement avec le nombre d'oiseaux dans la volée. Lorsqu'on visait en direction d'une volée et qu'on réussissait à abattre un oiseau, les chances d'atteindre un autre oiseau diminuaient de moitié à chaque coup en direction de la cible.

Le temps le plus favorable pour chasser les canards barboteurs était au début de la saison, surtout pendant la journée d'ouverture. Ceux qui

restaient encore en décembre étaient aussi plutôt vulnérables. On a éprouvé certaines difficultés à atteindre les canards plongeurs au début de la saison: les prises ont accusé une marge prononcée entre deux et trois semaines après l'ouverture de la saison de chasse. Les résultats obtenus avec les canards barboteurs, en termes d'heures d'efforts, ont marqué une forte baisse après la journée d'ouverture. Les résultats dans le cas des canards plongeurs ont atteint leur point culminant au cours de la deuxième moitié du mois d'octobre.

Sans doute qu'en raison de la grande chaleur au début de la saison, les chasseurs ont tué plus d'oiseaux pendant les journées chaudes que pendant les journées fraîches. Les chasseurs de canards plongeurs également ont abattu plus d'oiseaux alors que le vent soufflait, quoique tous ont récupéré moins de spécimens par les temps de grands vents. La pluie n'a pas semblé nuire à la chasse aux canards barboteurs, mais la chasse aux canards plongeurs a été plus fructueuse par temps sec.

Les chasseurs accompagnés de chiens ont tiré plus souvent et récupéré plus d'oiseaux que ceux qui n'étaient pas accompagnés, mais ils ont fait preuve de moins d'adresse au tir. Ils ont récupéré presque exactement les mêmes proportions d'oiseaux abattus que les chasseurs non escortés de chiens.

Les chasseurs munis d'appelants ont été très actifs, mais ils ont atteint un nombre exceptionnellement faible d'oiseaux. La plupart des chasseurs étaient par groupes de deux (52.5%) ou de trois (31.1%). Les résultats qu'ils obtenaient étaient analogues à ceux des chasseurs solitaires, en termes de production par heure-homme d'efforts.

Les limites de prises quotidiennes n'ont pas eu beaucoup d'effets immédiats sur les activités des chasseurs surveillés, dont très peu ont atteint le nombre limite de cinq canards en Ontario et de six canards ailleurs, dans l'Est du pays.

Les modèles de population conçus pour l'administration de la chasse à la sauvagine ne devraient pas être réservés aux populations de canards malards, de canards noirs ou de toute autre espèce "populaire", puisque aucune population n'est essentielle ni typique.

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Introduction

The existing population models used in North American waterfowl management, of which that for the mallard has received most attention, seem to be unsuitable for Canadian purposes. If, as seems likely, they cannot be developed very much further, it may be more profitable to devise new models than to tinker with old ones. This analysis of a small collection of hunter performance data is a contribution to a wider search for potentially relevant variables, of which there are far too many, and for useful generalizations, of which there are nothing like enough.

The results help to confirm that despite the obvious practical and theoretical difficulties the long-term aim of research on Canadian waterfowl and the impact of hunting should be the development of many-species, rather than single-species, models. It is improbable that the most effective models will be built from the prevailing combination of breeding indices, winter inventories, kill surveys and assorted adjustments based on recoveries of banded birds, despite the apparent utility during the last decade of the mallard model used by the U.S. Bureau of Sport Fisheries and Wildlife (Geis, Martinson and Anderson 1969).

Though Canada produces most of the ducks in North America, Canadian hunters take only about a quarter of those killed in any year. At the present levels of exploitation the regulations imposed upon American hunters have far greater immediate effects upon the number of ducks surviving from one summer to the next than do the regulations set for Canadians. The dilemma of federal waterfowl managers in Canada is how to satisfy the demands of Canadian hunters in ways that will not increase American demands, so as to prevent more ducks being killed than the breeding stocks can produce.

There are various reasons for believing that models incorporating many species are more likely to be appropriate as guides to management than those that have been developed for the mallard and black duck, even though those species make up about two-fifths of the harvest at present.

The first and fundamental reason is that the requirements of different species are different. Maintaining good conditions for the breeding and rearing of mallards will not automatically promote or sustain the production of other species. The maintenance of fall staging areas primarily for one species will not necessarily optimize the total waterfowl hunting opportunities of Canadians. Nor will regulations set on the basis of predictions of the numbers and movements of the most abundant species. We need to learn how to take advantage of the intrinsic elasticity of diverse populations, without embarking on elaborate and costly data gathering programmes or promulgating more complex, and hence less readily enforceable, hunting regulations.

Three main topics are discussed in this paper:

1. The effects of some characteristics of ducks themselves, including species, body size and flock size, upon their vulnerability to hunting;
2. The effects of the time of year and of local weather upon the success of hunters; and
3. The effects of some hunting practices (including the use of decoys and dogs, and the number of hunters in a party) upon performance.

The data were not collected with any of these purposes in mind. In 1968, at the request of the Eastern Migratory Bird Technical Committee, Dr. F. G. Cooch, of the Canadian Wildlife Service, devised and introduced a national hunter performance survey, based largely on similar exercises undertaken during the previous decade by the U.S. Bureau of Sport Fisheries and Wildlife and other American agencies. The objectives of the Canadian survey are "to measure the degree to which hunters abide by the various regulations established to govern their activities during hunting seasons and to better evaluate the magnitude of crippling loss" (Cooch, 1968). The term *crippling loss* is most often applied to the number of ducks shot down but not retrieved by hunters, though Bellrose (1953), the leading student of the subject, extended his inquiries to include estimating the proportion of knocked-down cripples that recover and the nature of the disabling injuries.

Knowledge of crippling losses is sometimes held to be important for two reasons. First, in determining the numbers of birds killed by hunters and in studying the relationships between the kill and other causes of death, it is misleading to ignore the often substantial numbers of birds killed but not retrieved. Second, a hunter who kills but fails to retrieve a duck is permitted to continue shooting ducks, until he has his legal quota in hand. Management seeks to minimize the numbers of unretrieved birds.

Materials and methods

The observers in the hunter performance survey are "requested to observe and record a representative cross section of waterfowl hunting. Where possible, the observations should be made from a hidden location" (Cooch, 1968, in the introduction to the detailed instructions provided). The data are recorded on a standard card, including whenever possible the numbers and species of ducks judged to be within range, even if the hunters do not fire. The organizers of the survey do not consider it essential to watch a party for the entire period of their hunt.

The data used in this paper were collected in Ontario and the other eastern provinces of Canada during the hunting seasons of 1968 and 1969. Most observations were made by CWS staff, helped in Ontario by staff of the Department of Lands and Forests. The scale of the study was small, particularly in relation to the magnitude of waterfowl hunting in eastern Canada. Benson (1970) records that in 1969-70 nearly 216,000 migratory game bird hunting permits were sold in Ontario, Quebec and the four Atlantic Provinces. He estimates that waterfowl afforded 1.24 million man-days of recreation there and that the harvest of ducks (other than sea ducks) in those provinces in that season was nearly 1.6 million birds. In 1968-69 the numbers of hunters and of the birds they bagged were of similar magnitude. The 461 hours of observations contributing to this study (156 hours in 1968 and 305 in 1969) related to 378 hunters and 1,028 hunter-hours of activity; observers reported 410 ducks brought down. The fact that the hunting observed was such a small part of the activity as a whole obviously limits the inferences that may be drawn from the data. However, large scale sampling of duck hunters would require many more observers than are likely to be available, so first we need to learn as much as we can from very small samples.

The practical difficulties encountered by the observer are sometimes considerable. It is perhaps even harder for the observer than for the hunters themselves to decide whether a group of ducks is within effective range and to identify the species in question. Sometimes it is hard to be sure how many shots are fired in one burst by one party. Often it is difficult to keep track of birds which are seen to be hit but do not fall at once (sailers) and to verify whether they are retrieved and included in the bag. Analysis may also be complicated by the fact that many Canadian hunters operate in small parties, rather than singly, often pooling their kills. If several people fire several shots at several ducks it is neither possible to regard the events as independent nor rigorously to elaborate the relationships between them.

Much of the information collected has deliberately been omitted from consideration here. No attention is given to shooting at geese or shore birds, to the effects of differences in habitat or land ownership, or to conformity to law, the principal objective of the national hunter-performance survey.

Comparatively little of the immediately relevant data collected by the observers in 1968 and 1969 had to be disregarded in the analyses which follow. The greatest losses resulted from uncertainty about the species of ducks being fired at. However, it was usually possible to decide whether the birds were of the tribe Anatini (puddle ducks), or Aythyini (pochards) or Mergini (goldeneyes, mergansers, scoters, old squaw) and so classify them.

Results

Effects of characteristics of ducks upon their vulnerability

Table 1 summarizes most of the information used in subsequent analyses. The nomenclature and sequence of species follow Scott (1961). Uncounted or wholly unidentified ducks have been omitted.

Perhaps the most striking feature of Table 1 is that nearly all the specific samples are very small, only five species providing more than ten individuals bagged. The occurrence of 17 species in so small a sample is remarkable too. Such diversity is dealt with here in several ways, by lumping into genera or tribes, by concentrating solely on the larger specific samples and by using non-parametric ranking methods that are not much affected by erratic minor values.

Estimates of crippling losses

In studies depending upon data provided by hunters, it is standard practice to request the number of ducks knocked down but unretrieved, in addition to the number bagged, and to use the proportion of unretrieved birds as a measure of crippling loss (Bellrose, 1953). In this study the data derive from observations by biologists and technicians, not from statements by hunters. A few ducks retrieved by hunters but subsequently discarded have been included in the unretrieved category, since birds rejected by hunters are as much wasted as those hit but not picked up.

The proportion of all ducks brought down but not kept, 24.8 per cent (Table 2), is effectively the same as the 22.5 per cent reported in the

Table 1
Summary of observations in eastern Canada, 1968 and 1969, on hunter activity and success in relation to different species of ducks.

Tribe	Species	Total birds fired at 1	Occasions when fired at 2	Total shots fired 3	Birds brought down			Retrieved and kept 7
					Direct 4	Sailers 5	Total 6	
Anatini	Pintail *Anas acuta*	38	6	13	3	5	8	6
	Green-winged teal *A. crecca*	204	36	124	37	9	46	39
	Mallard *A. platyrhynchos*	1,100	192	481	51	12	63	46
	Black duck *A. rubripes*	5,410	102	308	57	18	75	58
	American wigeon *A. americana*	14	5	18	1	1	2	2
	Blue-winged teal *A. discors*	89	25	83	18	7	25	21
	Unidentified teal	25	9	26	3	2	5	3
	Unidentified *Anas* sp.	154	25	93	12	1	13	11
Aythyini	Redhead *Aythya americana*	190	16	41	12	3	15	10
	Ring-necked duck *A. collaris*	33	5	17	4	1	5	4
	Scaup *A. affinis* or *marila*	833	82	306	84	23	107	80
Cairinini	Wood duck *Aix sponsa*	21	10	23	5	1	6	5
Mergini	Scoters *Melanitta* spp.	17	5	10	6		6	3
	Oldsquaw *Clangula hyemalis*	10	3	9	4		4	1
	Goldeneye *Bucephala clangula*	136	24	80	12	4	16	9
	Bufflehead *B. albeola*	21	7	20	5	1	6	5
	Hooded merganser *Mergus cucullatus*	24	8	17	1	1	2	1
	Others (*M. serrator* or *merganser*)	40	12	18	5		5	4
	Unidentified diving ducks	51	18	23	2	1	3	2
	Total	3,410	590	1,710	322	90	412	310

massive U.S. sample of 82,861 ducks assembled by Bellrose (*loc. cit.*), and remarkably close to the arbitrary figure of 25 per cent used in both the U.S.A. and Canada to adjust national estimates of kill. Yet the proportions not retrieved differ significantly between species, from as low as 15-16 per cent for teal to over 40 per cent of goldeneyes and other larger Mergini. These results have been anticipated in other studies, as noted by Cooch (1969) who warned of the need to allow for specific and regional variations.

Body size and vulnerability

Earlier studies of crippling emphasized the effects of shot wounds on the survival of ducks and, later on, fluoroscopic examination of living ducks to detect embedded shot. Elder (1955) found body shot more often in larger ducks than in smaller ones, including more in males than females of the same species and more retained shot per bird in the larger species. He argued that these results were to be expected because "the larger a bird the greater its chance of acquiring body shot when fired upon from any given distance." He tested the hypothesis by computing an average target size for each species, from the formula $A = W^{2/3}$ in which A is the relative area of the silhouette and W is the average adult weight. The assumption that within such a closely related group as the sub-family Anatinae the specific gravity and shapes are so similar that relative silhouettes can be estimated in that way seems reasonable at the level of accuracy appropriate here, although there are appreciable differences in flying performance between the surface-feeding ducks and the diving ducks (Aythyini and Mergini). Mr. J. E. Bryant has commented that it also seems probable that there will be proportionately fewer small live birds carrying pellets if it requires fewer pellets to kill a small bird than to kill a large one.

Table 2
Rates of crippling loss for different species and tribes based on observations of birds brought down and birds retrieved and kept.

Tribe	Species	Rate* %
Anatiui		21.5
	Pintail	25.0
	Green-winged teal	15.2
	Mallard	27.0
	Black duck	22.7
	Blue-winged teal	16.0
Aythyini		26.0
	Redhead	33.3
	Ring-necked duck	20.0
	Scaup	25.2
Cairinini	Wood duck	16.7
Mergini		41.0
	Scoter	50.0
	Goldeneye	43.8
	Bufflehead	16.7
All ducks		24.8

*From data in Table 1: $\frac{\text{column 6} - \text{column 7}}{\text{column 6}} \times 100 =$ per cent loss

One simple way of comparing the vulnerability of different species is by examining the proportion of birds brought down while flying singly. Table 3 records the outcome for the nine species of which ten or more singles were shot at: the species are listed in descending order of size. Although six samples are very small, the regression coefficient ($b = -0.338$) indicates that the proportion brought down tends to be lower for the larger ducks. The observed trend is unlikely to be due to chance. Partitioning the value of χ^2 (chi-square), using a method described by Maxwell (1961), nearly half the total value is attributable to the linear regression of vulnerability on target size. When the samples are grouped taxonomically, the important difference is between the proportion of mallard and black duck brought down (26.6 per cent) and the proportion of all other groups (50.0–52.4 per cent).

Table 3
Vulnerability (V′) of ducks shot at when flying singly related to their target size ($A = W^{2/3}$).

Species	Target size (A)	Brought down	Flew on	Total fired at	% brought down (V′)
Mallard	1.91	13	45	58	22.4
Black duck	1.88	12	24	36	33.3
Goldeneye	1.81	6	5	11	54.5
Redhead	1.76	2	5	7	28.6
Scaup	1.43	19	13	32	59.4
Wood duck	1.28	3	3	6	50.0
Blue-winged teal	0.94	7	4	11	63.6
Bufflehead	0.88	4	1	5	80.0
Green-winged teal	0.85	2	5	7	28.6
Total		68	105	173	39.3

Regression coefficient b_{va} −0.3380 var. (b_{va}) 0.0114

Source of variation	d.f.	χ^2	probable level
Due to linear regression of V′ on A	1	10.0175	$0.01 > p > 0.001$
Departure from regression (by subtraction)	7	11.0960	$0.20 > p > 0.10$
Total value of χ^2	8	21.1135	$0.01 > p > 0.001$

Table 4
Vulnerability (V′) of ducks shot at while flying singly related to their gross target size (from Table 3).

	Gross target size		
	large (1.91–1.76)	medium (1.48–1.28)	small (0.94–0.85)
Shots/birds brought down	6.7	5.9	4.0
Shots/birds fired at	2.0	3.4	2.3
Brought down	33	22	13
Flew on	79	16	10
Total fired at	112	38	23
% brought down (V′)	29.5	57.9	56.5

Table 5
Comparative vulnerability of ducks of different tribes shot at while flying singly.

	Mallard & black duck	Other Anatini	Aythyini	Mergini	Wood duck	Total
Fired at	94	27	42	22	6	191
Brought down	25	14	22	11	3	75
% brought down	26.6	51.9	52.4	50.0	50.0	39.3
Total ducks	186	64	110	40	15	415
Shots/ducks brought down	7.44	4.57	5.00	3.64	5.00	5.53
Shots/ducks fired at	1.97	2.37	2.62	1.82	2.50	2.17

Table 6
Preferences shown by hunters in firing at ducks flying past singly.

Species	Shot at	Left alone	% left alone
Mallard	58	6	9.4
Black duck	36	3	7.7
Pintail/wigeon	6	1	14.3
Blue-winged teal	11	1	8.3
Green-winged teal	7	6	46.2
All Anatini*	118	17	12.6
Scaup	32	10	23.8
Other Aythyini	10	4	28.6
Goldeneye	11	1	8.3
Other Mergini	11	1	8.3
Unidentified	38	2	5.0
Total	223	42	15.8
Grouped by target size†			
Large (1.91 – 1.76)	114	12	9.5
Medium (1.55 – 1.28)	17	3	15.0
Small (0.94 – 0.85)	23	8	25.8

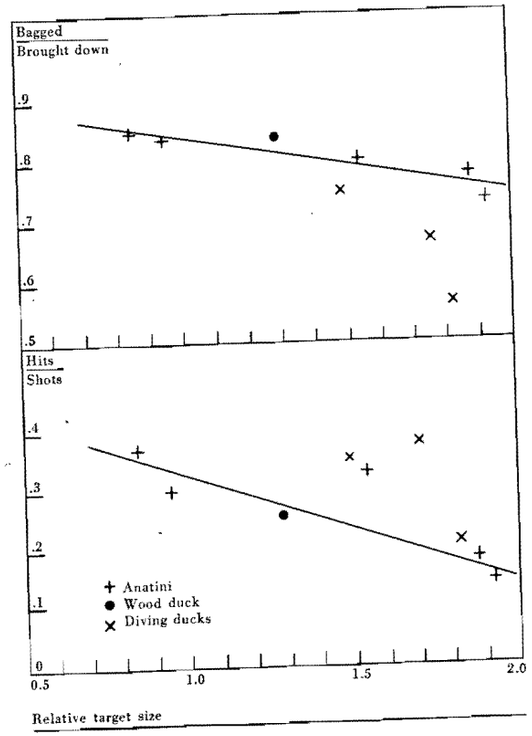
*includes 10 *Anas* sp.
†includes only targets identified to species

The average number of shots fired on any given opportunity was lower for the large ducks than for most of the others (Tables 3, 4 and 5). Comparing the preferences shown by hunters by looking at the occasions when they might have fired at a duck and chose not to (Table 6), it is clear that there was no great reluctance to fire at any species other than diving ducks of the genus *Aythya* and green-winged teal. Abstention from killing those diving ducks presumably reflects an awareness of the regulations governing the hunting of redheads and canvasbacks in Ontario in 1968 and 1969, when the daily bag limit was only one of either species and the possession limit two. Whether the tendency not to fire at teal is due simply to their small size is not known.

Another index of vulnerability, again confounded with hunter performance, is provided by the varying proportions of each species brought

Figure 1. The ratio of ducks bagged to ducks brought down relative to target size, and the ratio of ducks hit to shots fired relative to target size.

Figure 1



down that were retrieved and kept. For this purpose there is no need to limit the sample to birds fired at when flying singly, so that the rates of crippling loss already presented in Table 2 provide the best measures given by the data. Figure 1 relates the observed ratio, birds bagged to birds brought down, to specific target size. An inverse relationship with size again appears, suggesting that the small species brought down most readily are also easiest to retrieve, with diving ducks recovered less often than surface-feeders.

Effects of group size on vulnerability

While for some analytical purposes it is convenient to pay particular attention to the responses of hunters to single ducks, much of the time the birds do not fly alone but in small parties. The associations we are dealing with are those occurring on flights that bring the ducks within range of hunters, which may be termed *target groups*. The survey records provide no data on the total numbers and groupings of waterfowl living in the vicinity of the hunter. It is unlikely that the target groups closely reflect local waterfowl abundance and distribution, because there are obvious differences between species in their feeding habits and other daily and seasonal activities: large flocks of ducks, whether flying or on the water, may be under-represented in the sample because hunters are reluctant to spoil their chances by scaring off too many birds at a time.

Apart from mixtures of mallards and black ducks there were so few observations of groups of more than one species that no useful analysis of them can be made.

Tables 7 and 8 summarize the records of target groups containing only one species. There is a remarkable consistency in the proportions of birds occurring in groups of different sizes, the only significant variation being the relatively large proportions of redheads and scaup flying past, apparently within range, in groups of 25 or more. As Figure 2 shows, when the data from all target groups of a single species are lumped, they yield a frequency distribution of the reversed-J type very often found in studies of the abundance of plants and animals. The observed distribution (although affected by obvious rounding errors at 5, 10, 15, etc.) may be matched quite well by calculated logarithmic or log-normal series. The geometric mean is thus a better statistic of target flock size than the arithmetic mean. The variance is much greater than either mean.

Table 7
Observed frequencies of target groups of different sizes.

Tribe	Species	Size of target group: 1	2	3	4	5	6–14	15–24	25+	No. of groups	Total birds at risk
Anatini	Pintail	2		1		2			1	6	40
	Green-winged teal	11	7	7	1	3	11	1	2	43	204
	Mallard	62	45	25	11	10	20	13	10	196	1100
	Black duck	44	24	17	14	8	13	3	1	124	410
	Wigeon	5					1			6	54
	Blue-winged teal	11	6	6	1	2	4			30	89
Aythyini	Redhead	9	2	3					3	17	192
	Ring-necked duck	2		1			1	1		5	33
	Scaup	37	16	6	5	4	12	1	8	89	833
Cairinini	Wood duck	6	3	1			1			11	21
Mergini	Goldeneye	12	3	3	2		3	3	1	27	136
	Bufflehead	6		1			1			8	21
	Hooded merganser	4	1	1		1	1			8	24
	Other mergansers	5	3	1		3	2			14	50
All ducks		216	110	73	34	33	70	22	26		3207

Table 8
Proportions of ducks recorded in groups of different sizes.

		Size of target group: 1	2	3	4	5	6–14	15–24	25+
% flocks in each class	Green-winged teal	25.6	16.3	16.3	2.3	7.0	25.6	2.3	4.6
	Mallard	31.6	23.0	12.8	5.6	5.1	10.2	6.6	5.1
	Black duck	35.5	19.3	13.7	11.3	6.5	10.5	2.4	0.8
	Blue-winged teal	36.7	20.0	20.0	3.3	6.7	13.3		
	Scaup	41.6	18.0	6.7	5.6	4.5	13.5	1.1	9.0
	Goldeneye	44.4	11.1	11.1	7.4		11.1	11.1	3.7
All species		37.0	18.8	12.5	5.8	5.7	12.0	3.8	4.4
Cumulative sum of individuals (%)	Green-winged teal	5.4	12.3	22.5	24.5	31.9	69.1	76.5	100
	Mallard	5.6	13.8	20.6	24.6	29.2	43.7	63.2	100
	Black duck	10.7	22.4	34.9	48.5	58.3	82.9	93.9	100
	Blue-winged teal	12.4	25.8	46.1	50.6	61.8	100		
	Scaup	4.4	8.3	10.4	12.8	15.3	26.7	28.6	100
	Goldeneye	8.8	13.2	19.9	25.7	25.7	44.9	81.6	100
All species		6.8	13.8	20.7	25.0	30.2	47.8	59.2	100

Figure 2. Frequency distribution of size of target groups: data for all species combined.

Figure 2

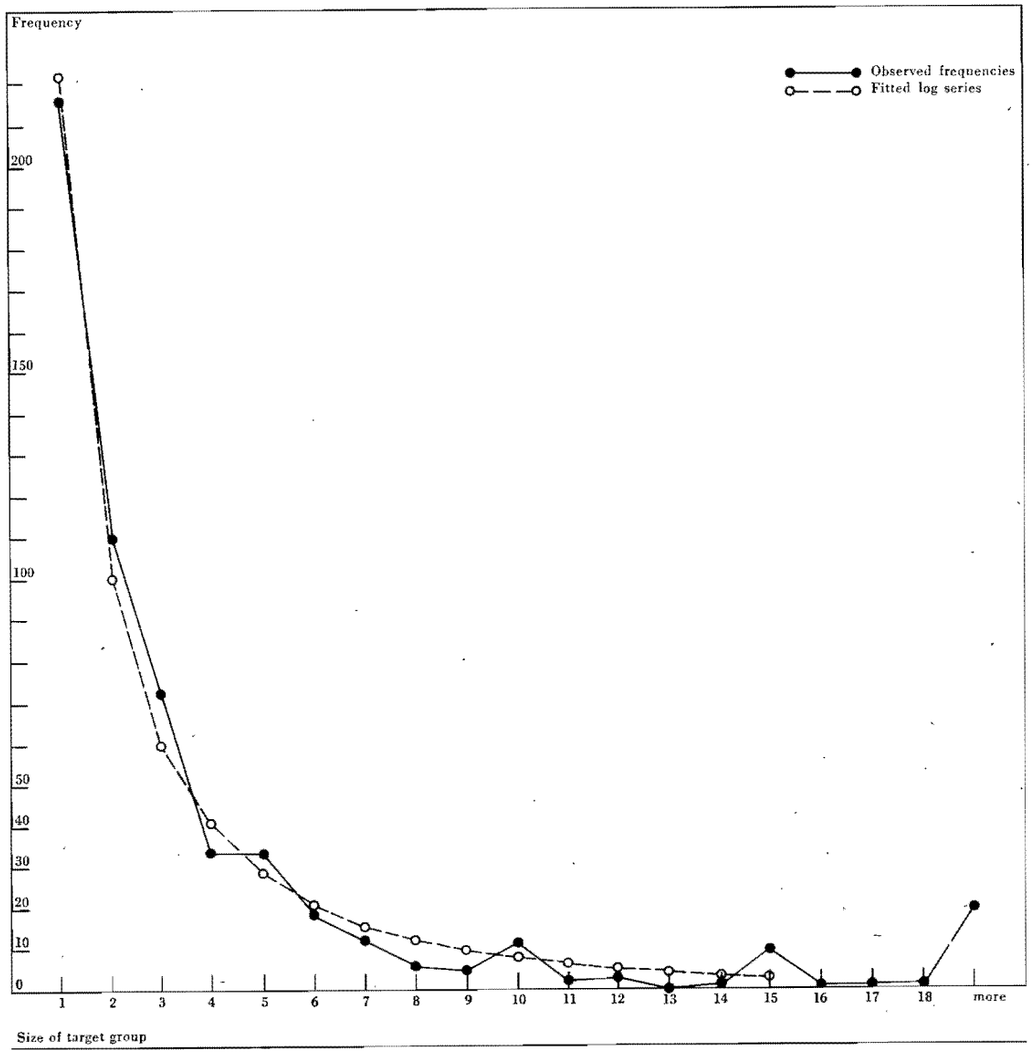


Table 9
Number of ducks brought down as a percentage of ducks fired at, in target groups of different sizes.

Species	Total ducks hit	% brought down in groups of size: 1	2	3	4	5	6–14	15–24	25+	Total
Mallard	59	21	18	8	7	8	6	2	0.2	5.4
Black duck	70	27	17	27	25	19	15	4		17.1
Green-winged teal	51	27	21	38	50		36	7	15	25.0
Blue-winged teal	25	55	17	22	25	30	27			28.1
Scaup	107	51	47	39	25	20	10		8	12.8
Other divers	72	41	30	25	33	12	14	2	6	14.0

Table 10
Probability of being brought down in relation to membership of target groups of one to five puddle ducks (Anatini).

	No. of kill	Size of group 1	2	3	4	5	Sum
K_0	0	102	148	150	96	136	632
K_1	1	44	20	21	9	9	103
K_2	2	x	14	12	6	6	38
K_3	3	x	x	3	9		12
K_4	4	x	x	x		4	4
(ΣK) sum of kills		44	34	36	24	19	159
(R) birds at risk		146	182	186	120	155	759
$K_1/R\%$		30.1	11.0	11.3	7.5	5.8	13.1
$K_2/(R\cdot K_1)\%$		x	8.6	7.3	5.4	4.1	6.5
$K_3/(R\cdot K_1\cdot K_2)\%$		x	x	2.0	8.6		3.0
$K_4/(R\cdot\Sigma_3^4 K_n)\%$		x	x	x		2.9	1.7
$K_0/R\%$		69.9	81.3	80.6	80.0	87.7	80.1
Unscathed groups/all groups %		69.9	70.3	54.8	50.0	58.1	64.7

Table 9 and Figure 3 demonstrate the relationship between risk and target group size for some of the principal species and for the larger taxonomic groupings of the Anatini and the diving ducks. Except for the largest samples, the proportion of hits fluctuates rather wildly, so that we will need more material before specific differences can be demonstrated, but the general picture is clear enough. The larger the group the safer is any individual in it. The risks fall off especially rapidly for the diving ducks, already shown to be much more vulnerable than the larger puddle ducks when flying singly. There is an interesting exception in the apparently increased risk of being in a group of more than 25 scaup: in some hunting situations such flocks, swimming within range or settling with a bunch of floating decoys, may receive a barrage of shots while still on the water, or very close to it.

Looking at the data in another way (Table 10) it appears that 80 per cent of the puddle ducks fired at were not brought down and that no kills at all were made from nearly 65 per cent of the target groups.

Figure 3. The ratio of ducks brought down to ducks fired at related to size of target group.

Figure 4. Proportions of ducks fired at that were retrieved: (upper) in different decades of each month, September-December and (lower) at different intervals from local opening day.

Figure 5. Changes in hunter success measured as ducks bagged per hour: (upper) in different decades of each month, September-December and (lower) at different intervals from local opening day.

Figure 3

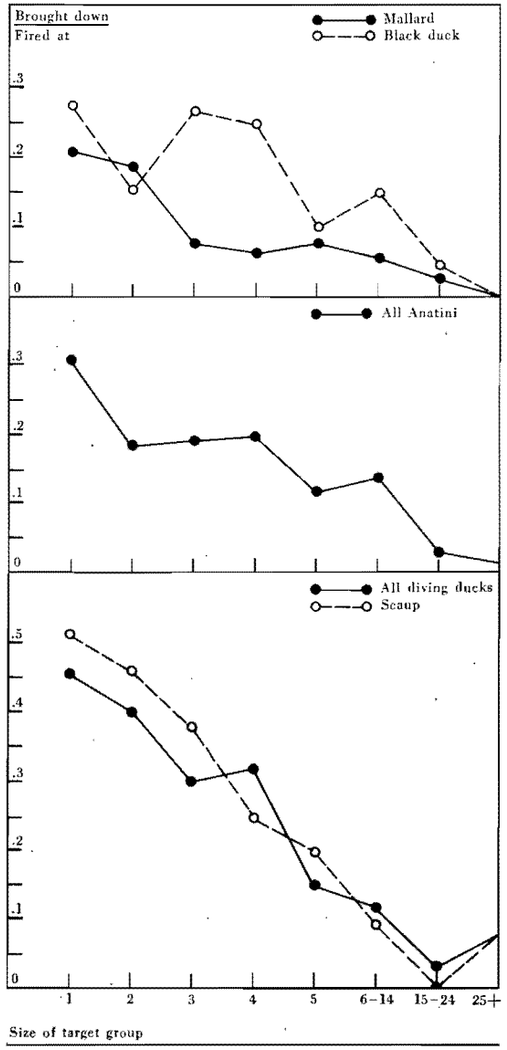
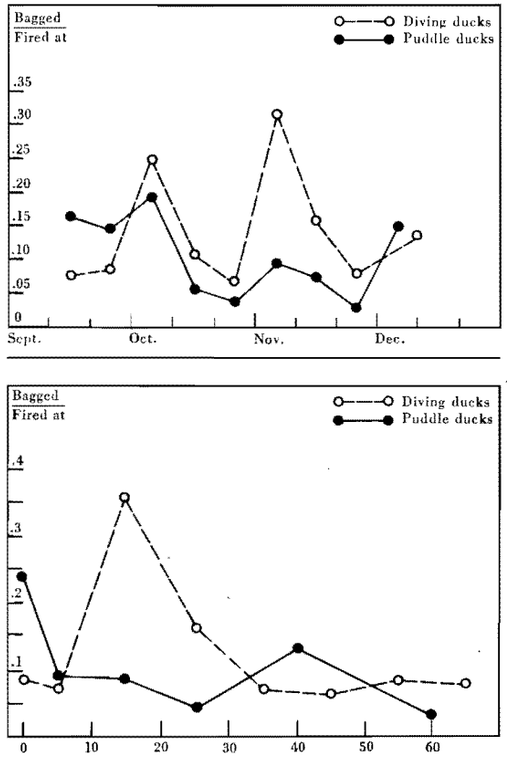
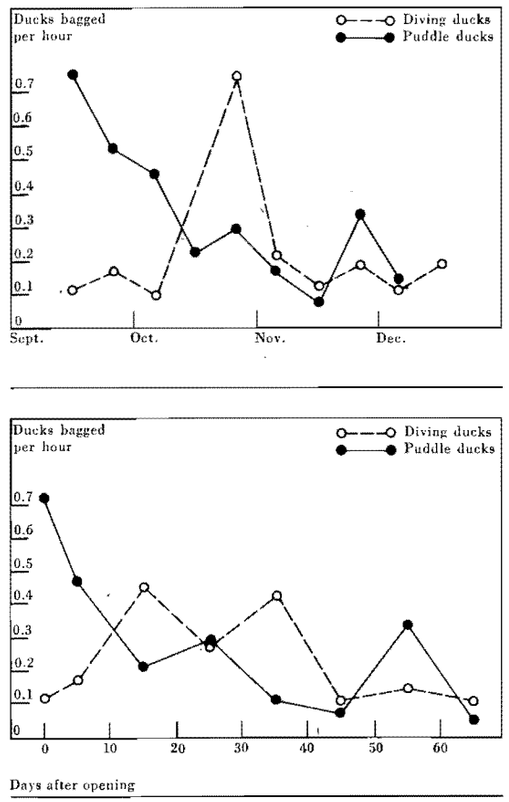


Figure 4



Restricting attention to incidents when at least one duck fell, it may be noted that the chances of a second, third or fourth puddle duck falling on the same occasion decreased steadily, by about half, from one to the next. Except for the results of firing upon large groups, noted above, kills of more than two diving ducks at a time were so infrequent that no clear picture can be made out.

Figure 5



Changes in the success of hunters during the hunting season

The very large numbers of hunters who are active on the first day of the hunting season and the consequently large kill that day are distinctive features of North American waterfowl hunting. The biological implications of this concentrated assault, which in the case of migratory stocks is often a series of assaults inflicted as the birds travel south, have great practical importance. Variations in hunting effort later in the season are much less important.

One measure of success, closely tied to the concept of vulnerability, is the proportion of ducks fired at that are bagged. A second measure, of as much interest to the hunter if not to the ducks, is the number of ducks bagged per hunter-hour of observed activity (or inactivity). In comparing success at various times no specific samples are adequate and the quarry have been lumped into puddle ducks and diving ducks.

Opening dates differ between provinces, and between zones within some provinces. It is convenient to classify the information both by date and by reference to local opening dates (in the form x days after opening day).

The recorded variations in the proportion of ducks bagged are shown in Figure 4. Given such small samples, the consistency of the trends is more striking than their irregularities. The puddle ducks were easier to bring down early in the season, and especially on opening day, than in the middle. Those that remained (nearly all in the Maritimes) until December apparently then became more vulnerable: they account for the secondary high point at 40 days after opening, since the opening dates in the zones where these ducks were brought down are the latest in Canada. The diving ducks were hard to take early in the season, but the proportion bagged showed a very pronounced peak 2-3 weeks after opening day (corresponding to two peaks on the graph against calendar date).

The graphs of puddle ducks bagged per hunter-hour (Fig. 5) show relatively high success in September and on opening day, with a rapid and fairly steady decline thereafter. The suggested improvement in late November does not coincide with the early December resurgence (Fig. 4) in

Table 11
Observed effects of temperature and estimated wind strength upon the activity and success of hunters in eastern Canada, 1968 and 1969.

		temperature (°F)			wind strength (mph)			
		below 35	36–50	over 50	0–5	6–15	16–25	over 25
Hunting of puddle ducks	Hunter-hours	(155)	(263)	(211)	(159)	(293)	(125)	(51)
	Ducks at risk	(845)	(903)	(559)	(724)	(822)	(559)	(202)
	Shots/hr	2.44	2.01	1.42	1.90	1.61	2.65	2.02
	Bagged/hr	0.22	0.30	0.39	0.28	0.32	0.34	0.29
	Hits/shots %	11.9	19.7	21.7	17.9	23.6	16.6	23.3
	Bagged/hit %	75.6	75.0	86.3	81.5	83.8	76.4	62.5
Hunting of diving ducks	Hunter-hours	(238)	(270)	(12)	(120)	(146)	(205)	(49)
	Ducks at risk	(380)	(962)	(20)	(161)	(291)	(682)	(187)
	Shots/hr	0.87	1.47		1.14	1.24	1.11	1.40
	Bagged/hr	0.14	0.35		0.21	0.16	0.34	0.29
	Hits/shots %	23.2	33.7		21.9	21.0	41.2	32.4
	Bagged/hit %	70.8	71.4		83.3	63.2	73.4	63.6

the proportion of ducks hit. The diving ducks show a low early season yield, a high yield in the second half of October and a poor return again from mid-November onwards.

The most clear-cut of the changes just described do not reveal any unfamiliar truths but their correspondence to what is known from other sources about the high vulnerability of young birds early in the autumn is encouraging. More sophisticated analysis should be attempted when more data are available. To that end, it would be very helpful if the field observers were able to record the age and sex of the ducks judged to be within range, as well as check the status of those bagged. Such additional observations will not often be practicable.

Effects of local weather upon activity and success of hunters

The observers were asked to record the extent of cloud cover, precipitation (including fog), approximate wind speed and temperature during each spell of watching. Most of them did so fairly fully. Only the relevance of these local observations to hunter performance will be considered here, no attempt being made to relate the availability of ducks to weather on a regional or continental scale.

During the observations temperatures ranged from 20° to 68°F and wind speeds from zero to 35 mph. There were very few observations in fog, though appreciable numbers when it was raining or snowing. Most watches were made in cool weather (36° – 50°F) with winds below 15 mph, with a markedly high proportion in conditions that were both dry and calm.

In examining success it seemed best to exclude observation periods in which no shots at all were fired at ducks and to include in the time spent hunting puddle or diving ducks only spells in which at least one of the class was fired at (for example: if in three hours watch the hunters fired at five puddle ducks but no divers, three hours were included in the puddle ducks tabulation and none under diving ducks; when ducks of both types were fired at, the hours were included in both tabulations).

Tables 11 and 12 summarize the results in relation to temperature, wind strength and precipitation considered separately. Duck hunters seemed to do better in warm than in cold weather, but that is undoubtedly confused by the association of higher temperatures with earlier dates. There were few diving ducks available on warm days. Variations in wind strength alone seemed to have little effect on hunters of puddle ducks, except that the proportion of birds hit and retrieved was lower on days of strong winds. Windy weather enhanced the performance of hunters of diving ducks, though they too retrieved less successfully in high winds. Rain or snow had no clear effect on the hunting of puddle ducks but hunters of diving ducks did better in dry conditions.

When combined weather factors are analysed the picture may be altered. The haphazard nature, as well as the limited volume, of the data prevents thorough analysis.

Effects of some hunting practices upon performance

The use of dogs to retrieve ducks

One of the justifications put forward by hunters who take retrievers with them is that the dogs enable them to recover more ducks. Rather surprisingly, the hunters with dogs who were observed in 1968 and 1969 retrieved no more of their kills than those without dogs (Table 13). The men with dogs did, however, show much higher average rates of firing and of birds bagged than did other hunters: not because they were more skilled marksmen (their ratio of hits to shots was only 9.1 per cent) but because they were able to fire 9 shots an hour, compared with a general average of 1.6. Dogs were used less often by hunters of diving ducks than by hunters of puddle ducks because the former hunted proportionately more in offshore situations.

The use of decoys

On the average, hunters using decoys had more opportunities, fired more shots and bagged more ducks per hour than other hunters (Table 14), although the proportion of birds hit was unusually low.

Table 12
Observed effects of wet and dry weather upon the activity and success of hunters in eastern Canada, 1968 and 1969.

	Hunting of puddle ducks		Hunting of diving ducks	
	wet	dry	wet	dry
Hunter-hours	(204)	(425)	(222)	(298)
Ducks at risk	(595)	(1712)	(245)	(1117)
Shots/hr	2.07	1.84	0.91	1.39
Bagged/hr	0.28	0.32	0.14	0.34
Hits/shots %	17.7	21.5	23.9	32.9
Bagged/hit %	77.3	80.5	64.6	74.3

Table 13
Proportions of ducks knocked down that were retrieved by hunters accompanied by dogs and by those without dogs: observations in eastern Canada, 1968 and 1969.

	Hunters with dogs			Hunters without dogs		
	Knocked down	Bagged	% Retrieved	Knocked down	Bagged	% Retrieved
Puddle ducks	118	94	78.3	126	102	81.0
Diving ducks	18	15	83.3	157	110	70.1
Total	136	109	80.1	283	212	75.0

No differences significant at P = 0.05 level

Table 14
Comparative opportunities and success of hunters with and without decoys.

	Quarry			
	Puddle ducks		Diving ducks	
Decoys	with	without	with	without
(Hours of observation)	(68)	(561)	(69)	(451)
Opportunities/hr	2.81	0.37	1.13	0.18
Shots/hr	7.22	1.27	4.27	0.71
Bag/hr	0.77	0.25	1.03	0.13
Hit/fired at %	6.0	15.3	10.3	13.5

Effectiveness of parties of one, two and three hunters

Thirty-five (9.6 per cent) of the 366 hunters observed were alone, 192 (52.5 per cent) in pairs and 114 (31.1 per cent) in trios. Only 25 (6.8 per cent) were in parties of more than three, too small a sample to permit any comment on their performance. There were no well-established differences in the effectiveness of different sized parties when compared on the basis of bag per man-hour, by

Discussion

the ratio of successful to unsuccessful hunters, or in other appropriate ways. The lack of contrast between those shooting alone and those in company is perhaps surprising.

Observed kill in relation to legal bag limits

Though this paper is not concerned with law enforcement, the relationship of the recorded kill to the daily bag limit is worth brief notice, because in North America changes in the daily limit are used as a device for regulating the intensity of hunting. Many of the data are of limited value in this context, since in many cases only part of the hunt was observed: and even when an "entire hunt" was recorded the people observed might have done more hunting elsewhere on the same day. (Similar difficulties have since been encountered in a survey comparing a hunter's recollection of his kill on a particular day with a field check of his bag made on that day.)

In 53 observations of "entire hunts" in which observers noted at least one hit, 113 hunters hit 269 ducks and bagged 206 of them for averages of 2.38 and 1.88 per man respectively. The daily limits for ducks were five in Ontario and six elsewhere in the east. If one case of gross violation, in which three hunters hit 45 ducks and retrieved 33, were to be omitted the average numbers hit and bagged would fall to 2.04 and 1.57. Only five of the 113 hunters certainly took their legal daily limit in these "entire hunts"; it is possible that a few more did so while hunting as one of a party, supposing that their companions bagged few or none.

It was suggested in the introduction that the data of this paper support the view that population modeling designed to improve the management of waterfowl in Canada should be built around many quarry species, not just the mallard and black duck. Although those two species form a large part of the bag, that is due much more to their relative ubiquity and abundance than to deliberate preference for them, as hunters do not forego opportunities to shoot other species. Thus it may well be better, if only because cheaper, to encourage the hunting of other species than to attempt to boost populations of mallards and black ducks or to cut down further the numbers of those two species taken by Canadians.

It will be necessary to replace the haphazard sampling used in 1968 and 1969 by some more carefully planned projects to show that the provisional findings reported here are reliable and before many other topics can be profitably studied. But, hunters, ducks and the weather being as contrary as they are, it is unlikely that more elegantly designed observations can be readily carried into effect.

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