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Hunter mobility—its relationship to hunter characteristics and its effect on estimated waterfowl harvest distribution

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Introduction

This study arose from the need to examine recreational patterns of waterfowl hunters. Few studies of the spatial distribution of waterfowl and hunters have been done, possibly because standard survey questionnaires do not allow for detailed descriptions of hunter characteristics and of their selection of hunting areas. In 1974–75 Filion (1976) conducted a survey to find whether changes in mailed harvest questionnaire format and wording affected the rate and quality of hunter responses. This in turn would affect estimates of waterfowl harvest and hunter activity. The study consisted of six different questionnaires (treatments) that were sent to six sample groups, each consisting of 700 hunters, who were selected from the 1972 Canada Migratory Game Bird Hunting Permit (MGBHP) file. Each sample group was evenly divided between two geographic areas: (1) Nova Scotia and New Brunswick (to be referred to as the Maritimes) and (2) Alberta. Filion concluded that the wording of questions and the response burden had a substantial effect on harvest survey estimates, and that questionnaires requiring the more detailed replies yielded lower response rates than the simpler ones.

The present study uses the same data base as Filion but concerns itself only with responses by hunters in two sample groups—treatments 3 and 4 (see Appendix 1). After four mailings, the sample sizes for groups 3 and 4 were respectively 620 and 610 (the remainder were undeliverable) with response rates of 85.5% (530) and 85.6% (522). These two treatment groups received the most difficult to complete of the six questionnaires, requiring good understanding, time and ability to recall on the respondent's part. However, they provide the most detailed temporal and geographical distributions of hunter activity and success for analysis of hunting patterns.

Objectives

The National Harvest Survey (NHS) questionnaire allows for only one hunting location to be reported, that is, the place where the most hunting was done (see Appendix 1). By establishing the number of locations in which a hunter hunts, we hope to assess the biases the NHS introduces into estimation of waterfowl harvest and hunter activity.

Therefore, to establish hunting patterns, we consider the following questions:
(1) How many waterfowl hunters report hunting in one or more different locations during one season? How is this related to their success, days hunted and residency?
(2) If a hunter's entire bag is assumed to have been harvested at only one location (where most of the hunting was done), what effect does this assumption have on the estimated geographic distribution of kill and hunters?

Results and discussion

Filion's (1976) survey indicated that many hunters do not hunt all season in the same location. This led to the study of characteristics which distinguish those hunting in only one location from those using several. Table 1 presents the number of responses to treatments 3 and 4 with responses for several hunter sub-groups by number of hunting locations for the two geographical areas. As less than 12% of the hunters used more than three hunting locations, they were put into one category. For simplicity, the number of hunting locations used will be represented by mobility groups as follows:

Mobility group	No. of hunting locations
1	1
2	2
3	3
4	>3

Mobility of hunters

Residency

As seen in Table 1, there were significantly more urban than rural hunters ($\chi^2 = 67.18$, df=1, $p < 0.005$). The proportion of urban hunters in the Maritimes (82.3%) was significantly higher than in Alberta (56.8%) ($\chi^2 = 34.44$, df=1, $p < 0.005$).

Urban hunters were defined as those residing in metropolitan Edmonton, Calgary, Saint John and Halifax. A more detailed description is given in Filion (1976).

Despite the different composition, as Table 1 shows, in both the Maritimes and Alberta the proportion of rural hunters did not change significantly as the number of hunting locations increased (Maritimes: $\chi^2 = 3.57$, df=3, $p < 0.25$; Alberta: $\chi^2 = 3.61$, df=3, $p < 0.25$). In the Maritimes, 34 ($\pm$6.2%) of all active hunters used more than one location. In Alberta, significantly more hunters (58 $\pm$ 6.3%) used several locations ($\chi^2 = 27.48$, df=3, $p < 0.005$). (The figures in parentheses represent 1.96 standard errors from which 95% confidence intervals are evident.)

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Total waterfowl kill

Tables 1 and 2 suggest that the proportion of active hunters who were successful may increase as the number of hunting locations increases. A test for linear trend in proportions (Snedecor and Cochran 1967) verified this for Alberta ($z = 5.27$, $p < 0.001$) but not for the Maritimes ($z = 1.05$, $p = 0.29$).

Table 3 shows the distribution of hunters with respect to season bag totals and mobility groups. I found in both Alberta and the Maritimes a significant difference between hunters in group 1 and those in the other three groups ($\chi^2 = 18.79$, df=7, $p = 0.001$ in the Maritimes; $\chi^2 = 33.64$, df=9, $p = 0.01$ in Alberta). Duncan multiple-range tests found the mean kills for groups 2 and 3 to be similar. The most marked difference between mean kills occurred between hunters using three or fewer locations and those using more than three.

Days spent hunting

The number of days hunted by a hunter was generally not related to the number of hunting locations used. Table 4 summarizes the number of days hunted per hunter for various sub-groups. Duncan multiple-range tests for each sub-group and region showed no significant differences for Alberta and only a few for the Maritimes, but without a recognizable pattern.

Sixty-two per cent of the hunters in the Maritimes and 42% in Alberta hunted in only one location and for 10 or fewer days (Table 5). The proportion of hunters using more than one location increased significantly as days hunted increased ($\chi^2 = 35.48$, df=8, $p < 0.01$ in the Maritimes; $\chi^2 = 40.82$, df=8, $p < 0.01$ in Alberta).

Table 4 reveals unexpectedly that successful hunters average fewer days hunting than all active hunters, and thus fewer than the unsuccessful ones. Although it is speculation, two possible explanations are: (1) unsuccessful hunters hunt more days hoping for success, or (2) if bagging a bird is of minor importance in the hunting experience, they may spend many days outdoors with little effort directed toward the kill.

Distinguishing characteristics of mobility groups

To this point we have seen how waterfowl kill, days hunted and residency separately were related to mobility groups. Discriminant analysis was conducted using these and five other hunter characteristics—age, success, experience, duck kill and goose kill—to discover whether jointly they might determine the hunter's mobility group. This method takes into account correlations among the discriminating variables which separate analysis does not. Groups 2 and 3 were counted as one group, since previous analyses in this study indicated that their hunter characteristics were very similar.

The analysis verified that in the Maritimes total waterfowl kill best discriminated between the groups, while in Alberta the significant distinguishing characteristic was total duck kill. In both areas, these characteristics significantly distinguished between hunters using three or fewer locations and those using more. Generally, increased kill was related to the latter.

Mobility and geographic distribution

The site where the hunter hunts most is the only one that can be reported in the NHS. The hunter's season kill is then associated with that location, even though the hunter may have bagged waterfowl elsewhere. In Filion's (1976) survey, he asked hunters to report all their hunting locations and the bag totals for each. This section shows whether marked differences exist between reporting only one primary hunting location as in the NHS (method 1) and reporting all locations of kills (method 2), and whether this affects the distribution of waterfowl kill.

As method 1 assigns a hunter's entire kill to one location, it is subject to additional bias. To illustrate this effect on the kill estimates, the data were summarized by degree block. The distributions resulting from each method are depicted in Figure 1 (Maritimes) and Figure 2 (Alberta) separately for ducks, geese and other waterfowl. For a more detailed analysis, the differences between methods 1 and 2 are tabulated for each degree block in the Maritimes (Table 6) and in Alberta (Table 7) and expressed both as a percent of the regional total and as a percent of the degree-block total. The tables indicate that the differences are small relative to the total regional kill, but are sometimes large relative to the degree block kill. Appendix 2 shows the correspondence between degree block numbers in Tables 6 and 7 and the geographic locations in Figures 1 and 2.

Ducks were the dominant waterfowl harvested in both regions. Their kill showed no significant differences between the two methods of reporting (degree-block differences, as a fraction of the regional kill, ranged from −1.10% to 1.12% in the Maritimes, and −1.43% to 0.95% in Alberta). Allocation of kill to associated hunting locations did not appear to affect the geographic distribution of estimated duck kill (Figs. 1 and 2), although slight differences were evident in the frequencies of degree blocks in the intervals (calculated so that the variance of the observations in each interval was minimized. Jenks 1977, Youngman 1972).

Although very few geese and other waterfowl were harvested compared with ducks, the slight changes in their distributions for the two methods should be noted. Figure 1 shows this noticeably in the estimated distribution of goose kill for the Maritimes, with areas of harvest altering degree-block locations. The densities by degree block of the harvest of other waterfowl changed between the two methods.

Analysis of the geographic distribution of hunter use by degree block resulted in similar distributions for the two methods. Waterfowl kill and hunter use exhibited similar patterns of densities, that is, high concentrations of waterfowl kill and hunter use occurring in the same degree-block areas.

Table 1
Number of respondents to treatments 3 and 4 by mobility group and geographic location

Mobility group	Geographic area	Active hunters	Successful hunters	Successful / active	Hunters with experience	Urban dwellers	Rural dwellers	Rural / urban
1	Maritimes	145 (65.9)*	117 (64.3)	0.807	139 (65.6)	118 (65.2)	27 (69.2)	0.186
	Alberta	98 (41.9)	84 (39.8)	0.857	94 (41.4)	59 (44.4)	39 (38.6)	0.398
2	Maritimes	46 (20.9)	39 (21.4)	0.848	44 (20.8)	41 (22.7)	5 (12.8)	0.109
	Alberta	71 (30.3)	63 (29.9)	0.887	68 (30.0)	36 (27.1)	35 (34.7)	0.493
3	Maritimes	17 (7.7)	16 (8.8)	0.941	17 (8.0)	14 (7.7)	3 (7.7)	0.177
	Alberta	38 (16.2)	37 (17.5)	0.974	38 (16.7)	25 (18.8)	13 (12.9)	0.342
4	Maritimes	12 (5.5)	10 (5.5)	0.833	12 (5.7)	8 (4.4)	4 (10.3)	0.333
	Alberta	27 (11.5)	27 (12.8)	1.00	27 (11.9)	13 (9.8)	14 (13.9)	0.519
Total	Maritimes	220	182	0.827	212	181	39	0.177
	Alberta	234	211	0.902	227	133	101	0.432

*Percentage of geographic total.

Table 2
Waterfowl killed by mobility group and geographic location

Mobility group	Geographic area	Total kill	Kill by urban dwellers	Kill by rural dwellers	Kill per active hunter	Kill per successful hunter	Kill per experienced hunter	Kill per urban dweller	Kill per rural dweller	Kill per hunting day	Kill per hunting location
1	Maritimes	874 (50.1)*	744 (51.9)	130 (44.2)	6.02	7.47	6.15	6.30	4.81	0.56	6.02
	Alberta	701 (22.4)	431 (22.3)	270 (22.5)	7.15	8.34	7.29	7.30	6.92	0.59	7.15
2	Maritimes	476 (27.3)	417 (28.7)	59 (20.1)	10.34	12.20	10.43	10.17	11.80	0.93	5.17
	Alberta	955 (30.5)	591 (30.6)	364 (30.4)	13.45	15.15	13.38	16.41	10.40	0.49	6.72
3	Maritimes	149 (8.5)	121 (8.3)	28 (9.5)	8.76	9.31	8.76	8.64	9.33	0.20	2.92
	Alberta	559 (17.9)	349 (18.1)	210 (17.5)	14.71	15.20	14.71	13.96	16.15	0.50	4.90
4	Maritimes	247 (14.1)	170 (11.7)	77 (26.2)	20.58	24.70	20.58	21.25	19.25	1.61	5.14
	Alberta	914 (29.2)	559 (28.9)	355 (29.6)	33.85	33.85	33.85	43.00	25.35	2.05	8.46
Total	Maritimes	1746	1452	294	7.94	9.59	8.24	8.02	7.54		
	Alberta	3129	1930	1199	13.37	14.83	13.78	14.51	11.87		

*Percentage of geographic total.

Table 3
Distribution of hunters with respect to season bag

Season bag	Mobility group 1	2	3	4	Hunter total
Maritimes*					
0	40	9	1	3	53
1–10	124	31	12	3	170
11–20	16	8	4	3	31
21–30	4	2	2	2	10
31–40	4	2	0	1	7
>40	1	2	1	2	6
Total	189	54	20	14	277
Alberta†					
0	17	8	1	0	26
1–10	82	39	22	5	148
11–20	25	18	11	6	60
21–30	4	8	3	4	19
31–40	0	3	3	4	10
41–50	1	0	1	3	5
50–70	0	2	0	4	6
>70	0	1	1	3	5
Total	129	79	42	29	279

*Chi-square = 34.75, df=15, p = 0.005.
†Chi-square = 88.62, df=21, p = 0.005.

Table 4
Days hunted by mobility group and geographic location

Mobility group	Geographic area	Total days	Days by urban dwellers	Days by rural dwellers	Days per active hunter	Days per successful hunter	Days per experienced hunter	Days per urban dweller	Days per rural dweller
1	Maritimes	1548	1474	74	10.67	9.87	11.04	12.49	2.74†
	Alberta	1184	813	371	12.08	11.45	10.46	13.77	9.51
2	Maritimes	507	273	234	11.02	12.05	11.43	6.65	46.80†
	Alberta	1926	793	1133	27.13	17.80	28.11	22.02	32.37
3	Maritimes	712	679	33	41.88*	25.93	41.88*	48.50	11.00
	Alberta	1107	459	648	29.13	21.89	29.13	18.36	49.84
4	Maritimes	153	111	42	12.75	9.90	12.75	13.87	10.50
	Alberta	445	342	103	16.48	16.18	16.48	26.30	7.35
Total	Maritimes	2920	2537	383	13.27	11.76	13.77	14.02	9.82
	Alberta	4662	2407	2255	19.92	15.82	20.53	18.09	22.33

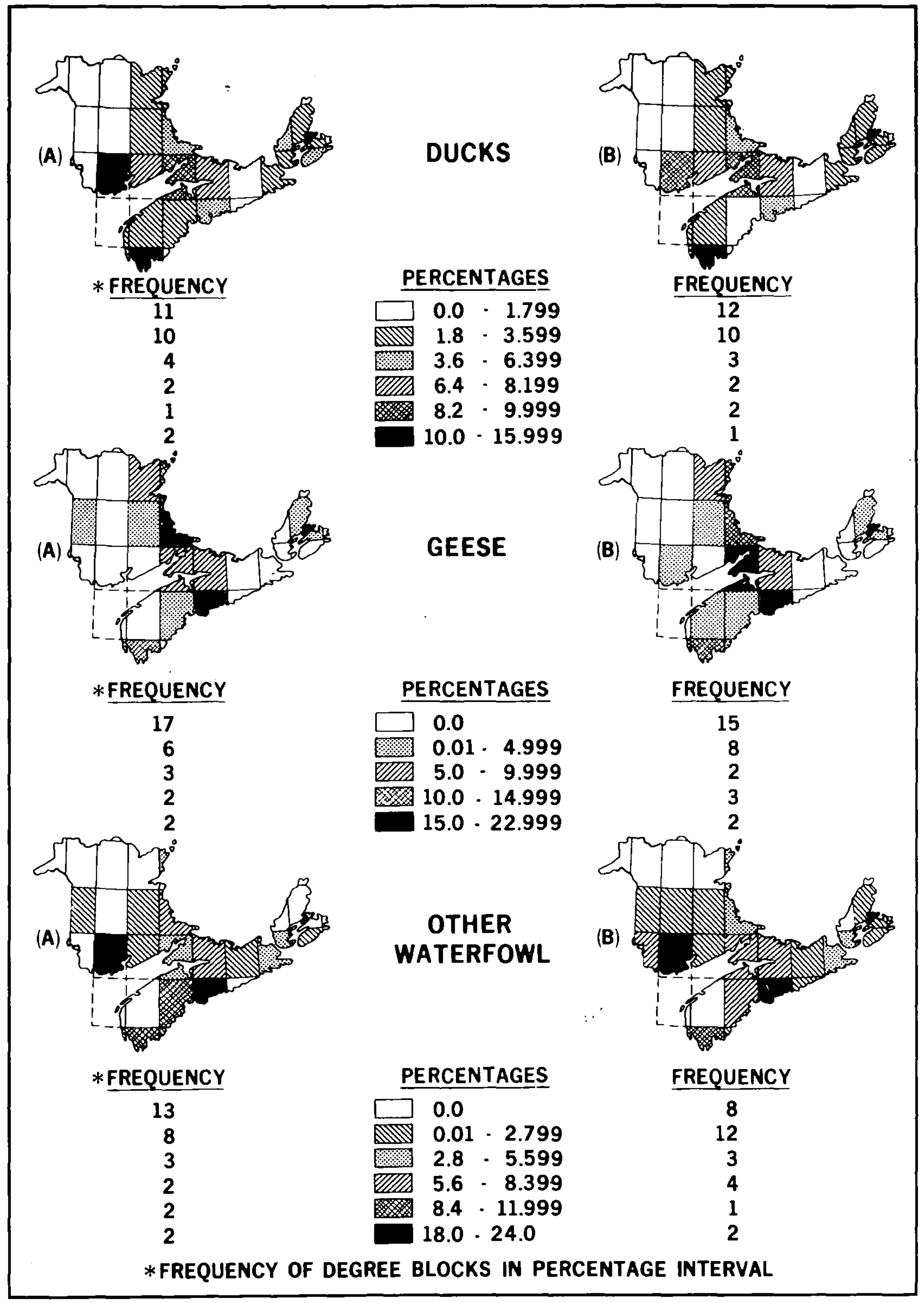
*The mean for mobility group 3 is significantly different ($p < 0.05$) from the means for the other groups.
†The means for mobility groups 1 and 2 are significantly different ($p < 0.05$).

Table 5
Distribution of hunters with respect to number of days spent hunting

Days hunting	Mobility group 1	2	3	4	Hunter total
Maritimes*					
1–5	126	29	7	1	163
6–10	36	15	6	7	64
11–15	7	6	4	2	19
16–20	1	2	0	3	6
>20	2	2	3	1	8
Total	172	54	20	14	260
Alberta†					
1–5	100	51	22	7	180
6–10	11	13	13	11	48
11–15	0	2	2	9	13
16–20	2	1	2	1	6
>20	1	12	3	1	17
Total	114	79	42	29	264

*Chi-square = 64.63, df=12, $p < 0.01$
†Chi-square = 94.73, df=12, $p < 0.01$.

Figure 1.
Percentage distributions of kill by degree block in New Brunswick and Nova Scotia.
(A) Assumes all waterfowl were shot at primary hunting location. (B) Makes use of all hunting locations.



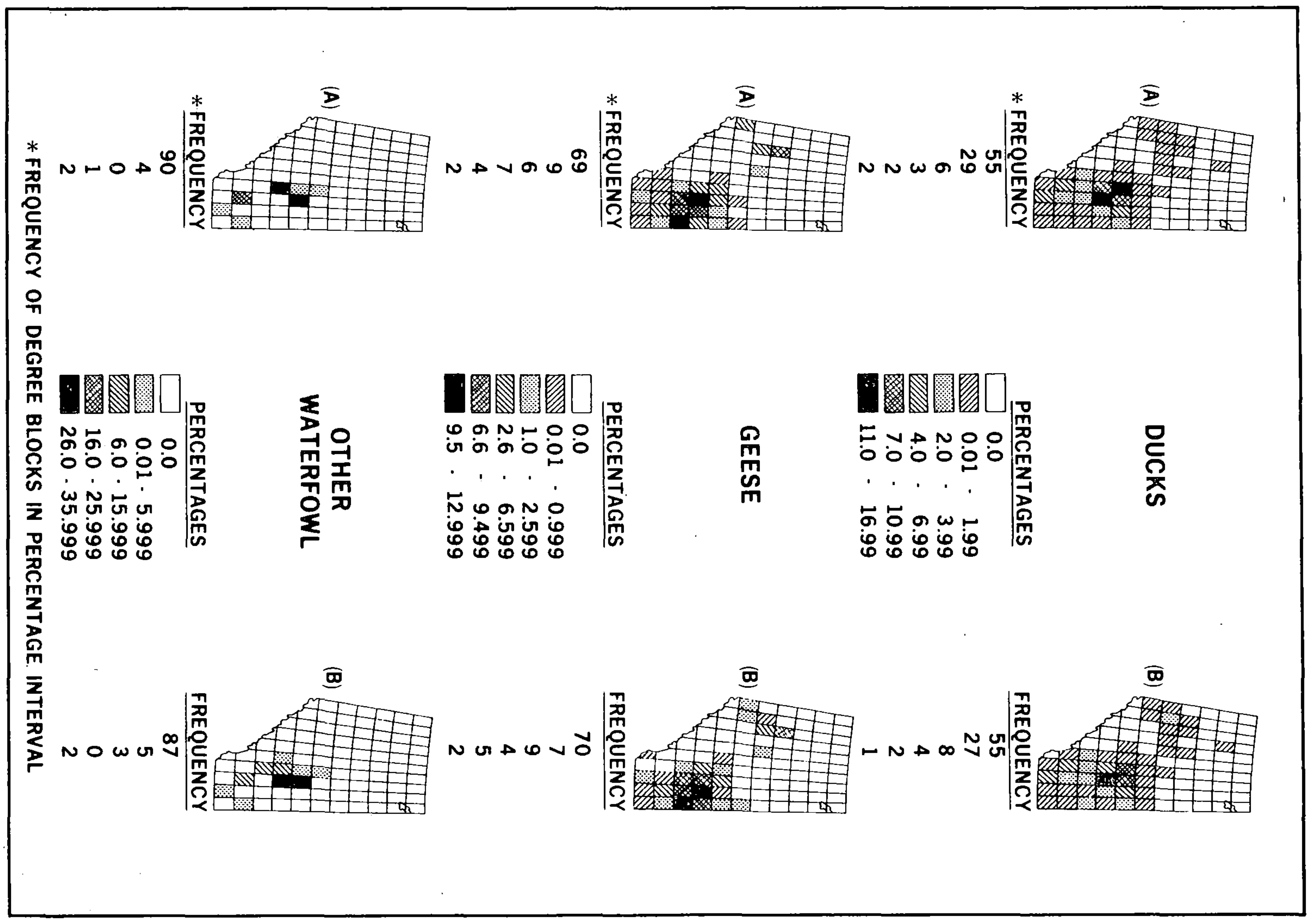


Figure 2.
Percentage distribution of kill by degree block in Alberta.
(A) Assumes all waterfowl were shot at the primary hunting location. (B) Makes use of all hunting locations.

Table 6
Reported species kill by degree block in the Maritimes

Degree block	Ducks						Geese						Other waterfowl					
	Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to	
	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block
1	7	0.36	15	0.77	0.41	-53.33	—	—	2	1.53	1.53	-100.00	4	0.84	4	0.82	-0.02	0.00
2	298	15.46	293	15.13	-0.33	1.71	17	12.98	15	11.45	-1.53	13.33	51	10.69	51	10.47	-0.22	0.00
3	108	5.60	93	4.80	-0.80	16.13	4	3.05	4	3.05	0.00	0.00	1	0.21	1	0.21	0.00	0.00
4	8	0.41	8	0.40	-0.01	0.00	—	—	—	—	—	—	—	—	5	1.03	1.03	-100.00
5	79	4.10	87	4.49	0.39	-9.20	26	19.85	26	19.85	0.00	0.00	93	19.49	90	18.48	-1.01	3.33
6	35	1.82	33	1.70	-0.12	6.06	3	2.29	2	1.53	-0.76	0.50	57	11.95	37	7.60	-4.35	54.05
7	44	2.28	52	2.68	0.40	-15.38	—	—	1	0.76	0.76	-100.00	—	—	—	—	—	—
8	53	2.75	68	3.51	0.76	-22.06	—	—	—	—	—	—	—	—	—	—	—	—
9	—‡	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	45	2.33	51	2.63	0.30	-11.76	—	—	—	—	—	—	13	2.73	4	0.82	-1.91	225.00
11	59	3.06	59	3.05	-0.01	0.00	—	—	—	—	—	—	25	5.24	25	5.13	-0.11	0.00
12	8	0.41	17	0.88	0.47	-52.94	—	—	—	—	—	—	5	1.05	5	1.03	-0.02	0.00
13	151	7.83	150	7.74	-0.09	0.66	11	8.39	11	8.39	0.00	0.00	30	6.29	38	7.80	1.51	-21.05
14	177	9.18	171	8.83	-0.35	3.51	9	6.87	22	16.79	9.92	-59.09	25	5.24	37	7.60	2.36	-32.43
15	144	7.47	145	7.49	0.02	-0.69	—	—	—	—	—	—	2	0.42	2	0.40	-0.02	0.00
16	206	10.68	191	9.86	-0.82	7.85	—	—	1	0.76	0.76	-100.00	113	23.69	108	22.18	-1.51	4.63
17	26	1.35	31	1.60	0.25	-16.13	—	—	—	—	—	—	—	—	30	6.16	6.16	-100.00
18	15	0.78	16	0.83	0.05	-6.25	—	—	—	—	—	—	—	—	4	0.82	0.82	-100.00
19	35	1.82	57	2.94	1.12	-38.59	4	3.05	4	3.05	0.00	0.00	—	—	1	0.21	0.21	-100.00
20	70	3.63	49	2.53	-1.10	42.86	—	—	—	—	—	—	—	—	—	—	—	—
21	59	3.06	59	3.05	-0.01	0.00	2	1.53	2	1.53	0.00	0.00	4	0.84	4	0.82	-0.02	0.00
22	80	4.15	81	4.18	0.03	-1.23	30	22.90	17	12.98	-9.92	76.47	35	7.34	23	4.72	-2.62	52.17
23	55	2.85	57	2.94	0.09	-3.51	2	1.53	2	1.53	0.00	0.00	2	0.42	2	0.42	0.00	0.00
24	25	1.30	22	1.14	-0.16	13.64	—	—	—	—	—	—	—	—	1	0.21	0.21	-100.00
25	21	1.09	10	0.52	-0.57	110.00	1	0.76	—	—	-0.76	—	3	0.63	1	0.21	-0.42	200.00
26	46	2.39	45	2.32	-0.07	2.22	14	10.69	14	10.69	0.00	0.00	14	2.94	14	2.87	-0.07	0.00
27	55	2.85	52	2.68	-0.17	5.77	8	6.11	8	6.11	0.00	0.00	—	—	—	—	—	—
28	19	0.99	25	1.29	0.30	-24.00	—	—	—	—	—	—	—	—	—	—	—	—
29	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	1928		1937				131		131				477		487			

*Assumes all waterfowl were bagged at the primary hunting location.
†Makes use of all reported hunting locations.
‡Dashes indicates that no waterfowl were reported as bagged in the respective degree block.

Table 7
Reported species kill by degree block in Alberta

Degree block	Ducks						Geese						Other waterfowl					
	Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to	
	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block
1	14	0.43	12	0.38	0.05	16.67	1	0.24	1	0.25	0.01	0.00	—	—	—	—	—	—
2	10	0.31	17	0.53	0.22	-41.18	1	0.24	1	0.25	0.01	0.00	1	2.56	1	2.56	0.00	0.00
3	139	4.32	147	4.60	0.28	-5.44	9	2.12	7	1.72	-0.40	28.57	—	—	—	—	—	—
4	59	1.83	48	1.50	-0.33	22.92	2	0.48	—	—	-0.48	—	—	—	—	—	—	—
5	—‡	—	—	—	—	—	—	—	2	0.49	0.49	-100.00	—	—	—	—	—	—
6	19	0.59	16	0.50	-0.09	18.75	7	1.65	7	1.72	0.07	0.00	1	2.56	1	2.56	0.00	0.00
7	49	1.52	49	1.53	0.01	0.00	26	6.12	13	3.19	-2.93	100.00	—	—	—	—	—	—
8	100	3.10	88	2.76	-0.34	13.64	3	0.72	3	0.74	0.02	0.00	7	17.95	3	7.69	-10.26	133.00
9	200	6.21	171	5.35	-0.86	16.95	2	0.48	—	—	-0.48	—	—	—	—	—	—	—
10	20	0.62	29	0.91	0.29	-31.03	4	0.96	—	—	-0.96	—	—	—	—	—	—	—
11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	55	1.71	85	2.66	0.95	-35.29	42	9.88	50	12.25	2.37	-16.00	—	—	—	—	—	—
13	27	0.84	36	1.13	0.29	-25.00	32	7.53	38	9.31	1.78	-15.79	—	—	—	—	—	—
14	103	3.19	80	2.50	-0.69	28.75	29	6.82	32	7.84	1.02	-9.38	—	—	—	—	—	—
15	97	3.01	119	3.73	0.72	-18.49	8	1.88	8	1.96	0.08	0.00	—	—	4	10.26	10.26	-100.00
16	80	2.48	78	2.44	-0.04	2.56	—	—	—	—	—	—	—	—	—	—	—	—
17-18	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	13	0.40	23	0.72	0.32	-43.48	25	5.88	35	8.58	2.70	-28.57	—	—	—	—	—	—
20	96	2.98	113	3.54	0.56	-15.04	38	8.95	53	12.99	4.04	-28.30	—	—	—	—	—	—
21	518	16.08	518	16.22	0.14	0.00	42	9.88	38	9.31	-0.57	10.53	—	—	11	28.21	28.21	-100.00
22	271	8.41	223	6.98	-1.43	21.52	21	4.94	18	4.41	-0.53	16.67	14	35.90	4	10.26	-25.64	250.00
23	17	0.53	26	0.81	0.28	-34.62	—	—	—	—	—	—	—	—	1	2.56	2.56	-100.00
24-27	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	71	2.20	73	2.29	0.09	-2.74	11	2.58	5	1.23	-1.35	120.00	—	—	—	—	—	—
29	162	5.03	140	4.38	-0.65	15.71	5	1.18	2	0.49	-0.69	150.00	—	—	—	—	—	—
30	325	10.09	312	9.77	-0.32	4.17	14	3.29	11	2.69	-0.60	27.27	14	35.90	11	28.21	-7.69	27.27
31	378	11.74	348	10.89	-0.85	8.62	26	6.12	8	1.96	-4.16	225.00	1	2.56	2	5.13	2.57	-50.00
32	48	1.49	53	1.66	0.17	-9.43	4	0.96	2	0.49	-0.47	16.67	—	—	—	—	—	—
33	4	0.12	4	0.13	0.01	0.00	—	—	—	—	—	—	—	—	—	—	—	—
34-37	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
38	21	0.65	36	1.13	0.48	-41.67	2	0.48	5	1.23	0.75	-60.00	—	—	—	—	—	—
39	4	0.12	3	0.09	-0.03	33.33	—	—	—	—	—	—	—	—	—	—	—	—
40	8	0.25	18	0.56	0.31	-55.56	4	0.96	—	—	-0.96	—	—	—	—	—	—	—

(cont'd)

Table 7 (cont'd)
Reported species kill by degree block in Alberta

Degree block	Ducks						Geese						Other waterfowl					
	Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to		Primary*		All locations†		% change relative to	
	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block	Kill	%	Kill	%	Region	Deg. block
41	21	0.65	39	1.22	0.48	-41.67	—	—	—	—	—	—	1	2.56	1	2.56	0.00	0.00
42	9	0.28	2	0.06	-0.22	350.00	—	—	—	—	—	—	—	—	—	—	—	—
43-45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
46	4	0.12	14	0.44	0.32	-17.43	—	—	7	1.72	1.72	-100.00	—	—	—	—	—	—
47	30	0.93	16	0.50	-0.43	87.50	14	3.29	5	1.23	-2.06	180.00	—	—	—	—	—	—
48-50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
51	15	0.47	15	0.47	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—
52	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
53	11	0.34	11	0.34	0.00	0.00	8	1.88	8	1.96	0.08	0.00	—	—	—	—	—	—
54	63	1.96	50	1.57	-0.39	26.00	—	—	—	—	—	—	—	—	—	—	—	—
55	27	0.84	42	1.31	0.47	-35.71	14	3.29	14	3.43	0.14	0.00	—	—	—	—	—	—
56	64	1.99	72	2.25	0.26	-11.11	—	—	4	0.98	0.98	-100.00	—	—	—	—	—	—
57	5	0.16	5	0.16	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—
58-60	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
61-62	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
63	10	0.31	10	0.31	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—
64	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
65	35	1.09	40	1.25	0.16	-12.50	31	7.29	31	7.59	0.30	0.00	—	—	—	—	—	—
66	8	0.25	2	0.06	-0.19	300.00	—	—	—	—	—	—	—	—	—	—	—	—
67-80	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
81-83	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
84	11	0.34	11	0.34	0.00	0.00	—	—	—	—	—	—	—	—	—	—	—	—
85-97	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	3221		3194				425		408				39		39			

*Assumes that all waterfowl was bagged in primary location.
†Makes use of all reported hunting locations.
‡Dashes indicated that no waterfowl was reported as bagged in the respective degree block.

Conclusion

At the provincial or regional level, the results of this limited study support the NHS method of reporting kill. The simulated NHS method of estimating harvest produced results similar to those obtained by reporting the kill for each location for both the total kill (Tables 6 and 7) and the distribution of kill by degree block. However, in a few degree blocks, where the kill was small relative to total regional kill, differences were large when compared to the kill in the degree block. For example, in Table 6, the reported kills of ducks in the Maritimes, degree block 25, are 21 and 10 for the two methods. But both kills represent a very small fraction of the reported regional harvest. Thus, for areas of low kill, differences can be relatively large. However, the NHS was not designed to provide reliable estimates for such small areas, and these estimates are subject to high sampling error. Further, the present study was not intensive enough to estimate reliably, at the degree-block level, differences between the two methods of reporting harvest.

After testing relationships between hunter characteristics and mobility, I found that, for both regions, the number of hunting locations used by a hunter was most closely related to the amount of waterfowl harvested. Other characteristics such as age, residency, days hunted and hunter experience were found to have little relationship to hunter mobility.

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References

Bishop, Y. M. M. 1969. Pages 383–398 *in* Full contingency tables, logits and split contingency tables. Biometrics 25.

Cooch, F. G.; Kaiser G. W.; Wight, L. 1974. Report on 1973 sales of the Canada Migratory Game Bird Hunting Permit, migratory game bird harvest and hunter activity. Can. Wildl. Serv. Prog. Notes No. 41.

Cooch, F. G.; Kaiser, G. W.; Wight, L. 1974. Species of waterfowl and age and sex ratios of ducks harvested in Canada during the 1973 season. Can. Wildl. Serv. Prog. Notes No. 42.

Filion, F. L. 1976. Effects of change in harvest questionnaire on survey estimates. Can. Wildl. Serv. Biom. Sect. Manuscr. Rep. No. 13.

Goodman, L. A. 1970. Pages 226–256 *in* The multivariate analysis of qualitative data: interaction among multiple classifications. Stat. Assoc. 65.

Goodman, L. A. 1971. Pages 33–61 *in* The analysis of multidimensional contingency tables: Stepwise procedures and direct estimation methods for building models for multiple classifications. Technometrics 13.

Jenks, G. F. 1977. Optimal data classification for choropleth maps. Occas. Pap. No. 2. Dep. Geogr. Univ. Kansas, Lawrence.

Nie, H. H.; Hull, C. Hadlai; Jenkins, J. G.; Steinbrenner, K.; Bent, D. H. 1970. SPSS: Statistical package for the social sciences. 2nd Ed. McGraw-Hill Book Co.

Snedecor, G. W.; Cochran, W. G. 1967. Statistical methods. 6th Ed. Iowa State Univ. Press.

Steel, R. G. D.; Torrie, J. H. 1960. Principles and procedures of statistics. McGraw-Hill Book Co.

Youngman, C. E. 1972. Representational accuracy in multidimensional regionalization and choropleth mapping. Unpubl. Ph.D. Diss. Dep. Geogr. Univ. Kansas, Lawrence.

Appendix 1
Questionnaires

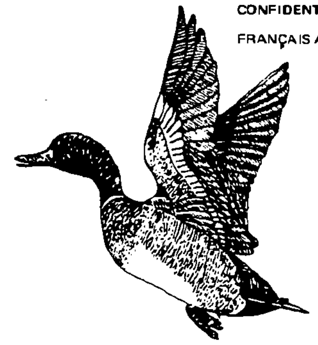
Environment Canada Environnement Canada

CANADIAN WILDLIFE SERVICE

1973 MIGRATORY GAME BIRD HUNTING SURVEY

CONFIDENTIAL

FRANÇAIS AU VERSO



TREATMENT 3

PLEASE ANSWER THIS SHORT QUESTIONNAIRE

1. Did you buy a Canada Migratory Game Bird Hunting Permit at the post office this year? YES ☐ NO ☐ ▶ IF YES, PLEASE GIVE PERMIT NO. 1973 – ☐ – ☐

IF YOU DID NOT HUNT THIS SEASON PLEASE COMPLETE QUESTIONS 1 & 2 ONLY AND RETURN THE QUESTIONNAIRE

2. Did you hunt migratory game birds in Canada? THIS SEASON YES ☐ NO ☐ IN 1972 YES ☐ NO ☐ IN 1971 YES ☐ NO ☐

3. If you hunted game birds in Canada this season please complete the **CALENDAR** below.
For **EACH WEEK** show the number of **DIFFERENT DAYS** on which you hunted game birds, the place where you did **MOST** of your hunting, the number of birds **YOU BAGGED**, and the banding data (if bird had metal leg band). **MARK ZERO** (0) for each species you hunted but did not bag. **LEAVE BLANK** all species and dates not hunted.
The **EXAMPLE** shows that on a certain week a hunter who went out on 2 different days to hunt Ducks, Geese and Snipe, 9 miles Northwest of Selkirk, Manitoba, bagged 1 Duck and 1 Goose and none of the birds had leg-bands.

CHECK (✓) AND FILL IN THE SHADED SPACES

Week of Hunting	Number of Days on which you Hunted	PLACE where you did MOST of your hunting: Province	Town Near Place of Hunting	Distance of Place from Town (miles)	Direction of Place from Town	SPECIES bagged or hunted: Ducks	Geese	Coots	Snipe	Wood-cock	Mourn-ing Doves	Band Tailed Pigeons	Sand-hill Cranes	Banded Birds: No. of Banded Birds	Band Number	Did you Report this Band Before? Yes	No
Example	2	Man.	Selkirk	9	N.W.	1	1		0					0			
Sept. 1-8																	
9-15																	
16-22																	
23-29																	
30-6																	
Oct. 7-13																	
14-20																	
21-27																	
28-3																	
Nov. 4-17																	
18-30																	
Dec. 1-15																	
16-31																	
Jan. 1-31																	

EXAMPLE

PLEASE RETURN THE QUESTIONNAIRE TODAY IN THE PREPAID ENVELOPE – THANK YOU

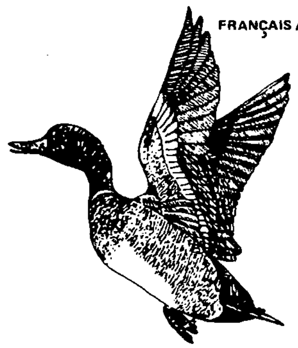
Environment Canada Environnement Canada

CANADIAN WILDLIFE SERVICE

1973 MIGRATORY GAME BIRD HUNTING SURVEY

CONFIDENTIAL

FRANÇAIS AU VERSO



TREATMENT 4

PLEASE ANSWER THIS SHORT QUESTIONNAIRE CHECK (√) AND FILL IN THE SHADED SPACES

1 Did you buy a Canada Migratory Game Bird Hunting Permit at the post office this year? YES ☐ ▶ IF YES, PLEASE GIVE PERMIT NO. 1973 - ☐ NO ☐

2 Did you hunt migratory game birds in Canada? THIS SEASON YES ☐ NO ☐ IN 1972 YES ☐ NO ☐ IN 1971 YES ☐ NO ☐

IF YOU DID NOT HUNT THIS SEASON PLEASE COMPLETE QUESTIONS 1 & 2 ONLY AND RETURN THE QUESTIONNAIRE

3 If you hunted game birds in Canada this season please complete the **CALENDAR** below:

Show each date on which you went hunting game birds, the place where you did **MOST** of your hunting, the number of birds **YOU BAGGED** and the banding data (if bird had metal leg band). **MARK ZERO** (0) for each species you hunted but did not bag. **LEAVE BLANK** all species not hunted.

The **EXAMPLE** shows that on the second day of September a hunter who hunted Ducks, Geese and Snipe 8 miles Northwest of Selkirk, Manitoba, bagged 1 Duck and 1 Goose and none of the birds had leg-bands.

DATE of hunting		PLACE where you did MOST of your hunting				SPECIES bagged or hunted								BANDED BIRDS			
Day	Month	PROVINCE	TOWN near place of hunting	DISTANCE of place from town (MILES)	DIRECTION of place from town	Ducks	Geese	Coots	Snipe	Woodcock	Mourning Dove	Band Tailed Pigeons	Sandhill Cranes	No. of Banded Birds	BAND NUMBER	Did you report this Band before Yes	No
2	SEPT.	MAN.	SELKIRK	8	N.W.	1	1		0					0			

EXAMPLE

(turn page for more space)

PLEASE RETURN THE QUESTIONNAIRE TODAY IN THE PREPAID ENVELOPE – THANK YOU

Environment Canada Environnement Canada

CANADIAN WILDLIFE SERVICE

1973 MIGRATORY GAME BIRD HUNTING SURVEY

CONFIDENTIAL

FRANÇAIS AU VERSO

STANDARD NHS QUESTIONNAIRE

PLEASE ANSWER THIS SHORT QUESTIONNAIRE CHECK (√) AND FILL IN THE SHADED SPACES

1 Did you buy a Canada Migratory Game Bird Hunting Permit at the post office this year? YES ☐ ▶ IF YES, PLEASE GIVE PERMIT NO. 1973- ☐ - ☐ NO ☐

IF YOU DID NOT HUNT THIS SEASON PLEASE COMPLETE QUESTIONS 1 & 2 ONLY AND RETURN THE QUESTIONNAIRE

2 Did you hunt migratory game birds in Canada? THIS SEASON YES ☐ NO ☐ IN 1972 YES ☐ NO ☐ IN 1971 YES ☐ NO ☐

3 Check (√) one province where you did **MOST** of your hunting for migratory game birds this season. 1 NFLD. ☐ 2 P.E.I. ☐ 3 N.S. ☐ 4 N.B. ☐ 5 QUE. ☐ 6 ONT. ☐ 7 MAN. ☐ 8 SASK. ☐ 9 ALTA. ☐ 10 B.C. ☐ 11 N.W.T. ☐ 12 YUKON ☐

4 Print the name of a town **NEAR** the place where you did **MOST** of your hunting this season. ☐

5 How far is the hunting place from that town? ☐ miles

6 Indicate the direction of the hunting place **FROM** that town. ▶ 1 NORTH ☐ 2 EAST ☐ 3 SOUTH ☐ 4 WEST ☐ 5 NORTH EAST ☐ 6 NORTH WEST ☐ 7 SOUTH EAST ☐ 8 SOUTH WEST ☐

7 Number of different **DAYS** on which **YOU** hunted Ducks or Geese this season. ☐ days

8 Number of different **DAYS** on which **YOU** hunted other migratory game birds. (Coots or Mudhens, Rails, Snipe, Doves, Band-tailed pigeons, Cranes, Woodcock) ☐ days

9 Number of birds **YOU** killed and retrieved.

DUCKS ☐ CANADA GEESE ☐ COOTS OR MUDHENS ☐ WOODCOCK ☐ BAND-TAILED PIGEONS ☐

SEA DUCKS ☐ OTHER GEESE ☐ SNIPE ☐ MOURNING DOVES ☐ SANDHILL CRANES ☐

10 **DUCK CALENDAR:**

Indicate on this calendar the number of ducks you killed and retrieved for each day you hunted

MARK ZERO (0) on days when you hunted but retrieved no ducks.

LEAVE BLANK all days not hunted.

SEPTEMBER 1973

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24	25	26	27	28	29

OCTOBER 1973

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

NOVEMBER 1973

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

DECEMBER 1973

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23/30	24/31	25	26	27	28	29

JANUARY 1974

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

11 **BANDED BIRDS:**

How many of the birds you shot this season had metal leg - **BANDS?** DUCKS ☐ CANADA GEESE ☐ OTHER GEESE ☐ OTHERS ☐

SPECIES	BAND NUMBER	DATE TAKEN			PLACE TAKEN		HAVE YOU REPORTED THIS BAND BEFORE?			
		DAY	MONTH	YEAR	PROVINCE	NEAREST TOWN				
							YES		NO	
							YES		NO	
							YES		NO	

PLEASE RETURN THE QUESTIONNAIRE TODAY IN THE PREPAID ENVELOPE – THANK YOU

Appendix 2
Division of provinces into degree blocks