BIOMETRICS SECTION
CANADIAN WILDLIFE SERVICE

MANUSCRIPT REPORTS

1976 number 13

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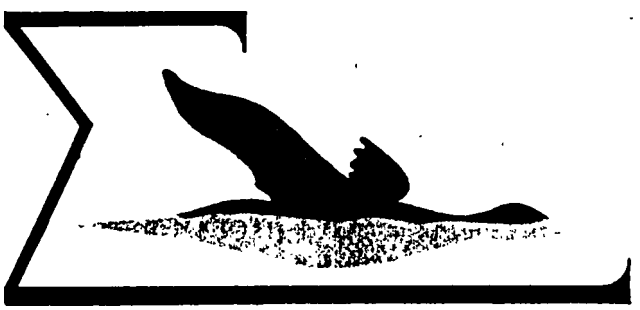

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EFFECTS OF CHANGES IN HARVEST QUESTIONNAIRES ON SURVEY ESTIMATES

F. L. Filion

ABSTRACT

In 1973-74 an experimental study on response errors in mailed harvest survey questionnaires was conducted among 4200 Migratory Game Bird Permit purchasers in eastern and western Canada. The effects of six different questionnaires on response rates, quality of questionnaire completion, estimates of recreational hunting days and game harvests by species groups were measured. The survey results indicate the significant effect of questionnaire format and content on these variables. Questionnaires with short and simple questions induced the highest response rate and reduced nonresponse to individual questions. Questionnaires with longer and more detailed tabular questions provided the lowest estimates of hunter activity and success.

RÉSUMÉ

En 1973-1974, une étude sur les erreurs comises dans les réponses aux questionnaires postaux sur les prises a été réalisée auprès de 4,200 détenteurs d'un permis canadien de chasse aux oiseaux migrateurs considérés comme gibier. Les effets de six questionnaires différents ont été mesurés à divers points de vue: le nombre et la qualité des réponses ainsi que l'estimation des jours de chasse sportive et des prises de gibier pour chaque espèce. Les résultats de l'enquête démontrent l'influence marquée du fond et de la forme des questionnaires sur ces diverses variables. En effet, ceux dont les questions étaient courtes et simples ont été mieux remplis et ont obtenu un taux de réponses plus élevé; par contre, ceux dont les questions étaient plus longues et détaillées ont donné les estimations les moins élevées concernant l'activité et le succès des chasseurs.

INTRODUCTION

In 1974 the Biometrics Division of the Canadian Wildlife Service in Ottawa conducted an experimental study on response errors in mailed game harvest questionnaires. The study was conducted among Canada Migratory Game Bird Permit purchasers in three provinces. Six different questionnaires were designed in an attempt to measure whether changes in questionnaire content and format would affect estimates of the number of birds harvested by species and the number of recreation days spent hunting.

This report summarizes the background and objectives of the study, outlines the experimental design and survey procedures and presents the results of the first phase of the analysis. The analysis compares the treatments with regards to response rates, amount of missing data, hunter activity and mean harvests by species groups. This first phase explores an important source of errors of harvest survey research that has received very little attention in the past.[1]

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1. Several treatments provide a considerable amount of harvest data by place and date of hunting. For example, there is a need to examine the number of different places in which a permittee hunts, the distance between these places and, the proximity of duck and goose hunting areas. The current analysis does not attempt to evaluate the contribution of this additional data to migratory game bird management. It is felt that a second report dealing exclusively with these issues can best tackle the complexities of the analysis. This second report would likely complement some of the earlier work iniated by the Biometrics Division dealing with hunter movement and resultant bias in estimates of game harvests and also serve as a means of comparing the results of the treatments with similar data obtained in the Migratory Game Bird Species Composition Survey.

BACKGROUND AND OBJECTIVES OF THE STUDY

The need for this study arose primarily from the fact that the requirements of federal and provincial governments for migratory game bird harvest data differ significantly. The current federal migratory game bird surveys are primarily intended to estimate annual harvests for Canada as a whole and for several geographic sub-areas; the data are used in continental waterfowl management under the terms of the Migratory Birds Convention of 1916 between the United States and Canada. On the other hand, provincial and regional wildlife offices often require more detailed harvest data by date of harvest and by subprovincial game management areas; this was revealed in surveys of the needs of provincial wildlife agencies conducted by J.B. Gollop (1973) and S.G. Curtis (1973).

The current national Migratory Game Bird Harvest Survey has been conducted annually since 1967. The format and content of the survey questionnaire could not be modified to accommodate the special requirements of provincial and regional wildlife offices without examining the effects these changes might have on harvest estimates and the comparability of estimates with those of preceding years.

A summary of the needs of the provincial and regional federal wildlife agencies was prepared by Gollop and Curtis (1973). This report suggested that the following changes be

considered in the national Migratory Game Bird Harvest Survey questionnaire:

a) Combining duck and sea duck harvest categories
b) combining Canada Geese and other geese harvest categories
c) obtaining a temporal distribution of hunter activity and harvests by species groups and place of hunting
d) obtaining a detailed geographic distribution of hunter activity and harvests by species groups and date of hunting.

A study was designed to measure the effects of these important changes on the national Migratory Game Bird Harvest Survey questionnaire data. It is hoped that the study will also provide useful information on the feasibility of adopting a new harvest questionnaire.

EXPERIMENTAL DESIGN

A) Design of experimental questionnaires

Following extensive discussions between members of the Biometrics Division, the Migratory Bird Populations and Surveys Division and J.B. Gollop of Saskatoon, it was agreed to conduct the study using six experimental questionnaire designs. Each design is referred to as a "treatment". They are numbered from 1 to 6 and are shown in Appendix 1. The

differences in content between the six questionnaires are summarized in Table 1. Treatment 6 is identical to the current national Migratory Game Bird Harvest Survey questionnaire and may be referred to as the "control" treatment.

Treatments 1 and 6 respectively may be considered the easiest questionnaires to complete. They are practically identical to the current national Migratory Game Bird Harvest Survey questionnaire which is familiar to a very large number of migratory game bird hunters across Canada. The majority of questions in both treatments are short and relatively simple. Treatments 4 and 3 respectively may be considered the most difficult questionnaires to answer since they place the heaviest burden on the respondent's understanding, time and memory. They provide the most detailed temporal and geographic distributions of hunter activity and success using a single tabular question. Treatments 2 and 5 would fall somewhere between these extremes of difficulty. Although treatment 5 is the longest questionnaire of the experiment the majority of questions are short and relatively simple to answer.

Table I Differences in Content of Experimental Questionnaires

Variable	Treatments 1	2	3	4	5	6
Harvests						
a) Sea ducks and other ducks combined	Question #8	Question #7 (weekly temporal distribution)	Question #3 (weekly temporal and geographic distribution)	Question #3 (daily temporal and geographic distribution)	Question #8	Question #9 (summation of ducks and sea ducks)
b) Canada Geese and other geese combined	"	"	"	"	Question #16	Question #9 (combine Canada Geese and other geese)
c) Other migratory game birds	"	"	"	"	Question #24	Question #9
d) All migratory game birds	Question #8 (summation)	Question #7 (summation)	Question #3 (summation)	Question #3 (summation)	Questions #8, #16, #24 (summation)	Question #9 (summation)
e) Temporal distribution	Question #9 (daily for ducks)	Question #7 (weekly for each species)	Question #3 (weekly for each species and for place of hunting)	Question #3 (daily for each species and for place of hunting)	Questions #9, #17 (daily for ducks or geese)	Question #10 (daily for ducks)

TABLE I (continued)

Differences in Content of Experimental Questionnaire

Variable	Treatments 1	2	3	4	5	6
Days of Hunting						
f) Ducks or geese	Unavailable	Unavailable	Unavailable	Question #3 (daily temporal and geographic distribution)	Questions #7, #15 (summation)	Question #7
g) Other game birds	Unavailable	Unavailable	Unavailable	Question #3 (daily temporal and geographic distribution)	Question #23	Question #8
h) All migratory game birds	Question #7	Question #7 (weekly temporal distribution)	Question #3 (weekly temporal and geographic distribution)	Question #3 (daily temporal and geographic distribution)	Questions #7, #15, #23 (summation)	Questions #7, #8 (summation)
i) Temporal distribution	Question #9 (daily for Ducks)	Question #9 (weekly for all species combined)	Question #3 (weekly for all species combined and place of hunting)	Question #3 (daily for each species and for place of hunting)	Questions #9, #17 (daily for ducks only and for geese only)	Question #10 (daily for Ducks)

TABLE I (continued)

Difference in Content of Experimental Questionnaire

Treatments

Variable	1	2	3	4	5	6
Days of Hunting						
j) Geographic distribution	Questions #3, #4, #5, #6 (one place for all species combined)	Questions #3, #4, #5, #6 (one place for all species combined)	Question #3 (several places for all species combined)	Question #3 (several places for all species combined)	Questions #3, #4, #5, #6; #11, #12, #13, #14; #19, #20, #21, #22 (one place for ducks, one for geese and one for other birds)	Questions #3, #4, #5, #6 (one place for all species combined)

1) Game Harvests

Game harvests for species groups are determined by variables "a" to "e" in Table 1. Treatment 6 is the only questionnaire asking for separate harvests of sea ducks and other ducks and harvests of Canada Geese and other geese. All other treatments combine these categories into ducks and geese. Treatments 1, 5 and 6 only deal with total harvest by species groups whereas treatments 2, 3 and 4 expand the questions to ask for a temporal and geographic breakdowns, (i.e. by date and place of hunting). Temporal distributions of harvests (variable e) are available for ducks only in Treatments 1 and 6, for ducks and for geese in Treatment 5 and for any harvested species group in Treatments 2, 3 and 4.

2) Hunter Activity

Recreational hunting days for species groups are determined by variables "f" to "j" in Table 1. Questionnaires 4, 5 and 6 are the only treatments asking for the number of days spent hunting ducks, geese and other migratory game birds separately. Estimates of days of hunting for all migratory game birds combined are available from all treatments. To facilitate comparisons with Treatment 6 recreation day categories have been collapsed and are defined as variables "f", "g" and "h" in Table 1. It might be

argued, for example, that the summation of answers to questions #7 and #15 in Treatment 5 to obtain an estimate of recreational waterfowl hunting days is not a valid procedure since some hunters may hunt both ducks and geese on the same day. Although it is felt that this method should tend to overestimate waterfowl hunting activity this has not been previously documented or proven. A comparison of Treatments 5 and 6, for example, should reveal the existence and extent of an inherent bias associated with the estimation of recreational waterfowl hunting days by addition.

Temporal distributions for hunter activity are available for ducks in Treatments 1, 4, 5 and 6, for geese in Treatments 4 and 5 and for all species groups combined in Treatments 2, 3 and 4. Treatments 1, 2 and 6 ask only for one geographic area where most of the hunting occurred for all species groups combined. Treatment 5 asks for three such areas: one where most of the duck hunting occurred, another for geese and another for the remaining migratory game birds. Treatments 3 and 4 respectively ask for the one location where most hunting occurred for each week or day of hunting.

3) Questionnaire Format

The treatment formats are based largely on the design of the current national Migratory Game Bird Harvest Survey questionnaire. Treatments 2, 3 and 4 differ most from the national questionnaire because they make use of a

detailed tabular calendar. Each questionnaire is printed on white 8.5 by 14 inch bond paper using blue ink. The French and English texts are printed on opposite sides of the sheet. The methods of answering the structured schedules are standardized and limited to the use of simple check marks (✓) and filling in blanks. All answer spaces are shaded in 10% blue to facilitate question completion, editing and keypunching.

B) Sample Selection

For convenience the sample was selected exclusively from the previous year's list of permittees. Six samples, each consisting of 700 members, were selected from the 1972 Canada Migratory Bird Permit file. Each sample was evenly divided between two replicates as follows:

1) Alberta - a region of high goose kill
2) Nova Scotia and New Brunswick - a region of high sea duck kill.

For brevity we will henceforth refer to Alberta as the west and Nova Scotia and New Brunswick as the east. Selections within provinces were stratified by zone and experience (i.e. permit renewal or nonrenewal). The selection criteria are summarized in Table 2).

C) Survey Procedures

Questionnaire were first mailed out on December 6, 1973. Follow-ups of nonrespondents were sent on January 9 (1974),

Treatment Sample Size used in 1973-74 Experimental Study[1]

TABLE 2

Province	Zone	Renewals	Nonrenewals	Total
Nova Scotia	1	94	26	120
	2	33	12	45
New Brunswick	1	104	34	138
	2	32	15	47
Subtotal (East)		263	87	350
Alberta	1	103	37	140
	2	146	64	210
Subtotal (West)		249	101	350
Total		512	188	700

1. Based on previous year's (1972-73) permit file for Canadian residents only. Sampling rate for East is 0.0187 and for West is 0.00617. Total sample size (all treatments) of study is 4200.

Sample design prepared by Dr. G.E.J. Smith, C.W.S. Headquarters, Ottawa.

January 30 and February 19 respectively. Each questionnaire was accompanied by a covering letter and a postage paid return envelope. Questionnaires in the final follow-up were sent by registered mail instead of the usual first-class mail. Follow-ups and special postage were used as part of a special effort to maximize the rate fo returns and minimize nonresponse bias. The address labels which were affixed to the questionnaires showed the permit number of the recipient and were precoded to indicate the appropriate treatment number and mailing wave.

Survey returns were manually edited, coded and checked for completeness and consistency by one clerk in accordance with written editing instruction[1]. Detailed keypunching instructions and field codes were prepared to minimize data processing errors. Special edit programs were created to verify the data captured on magnetic tape. The data were analysed for the most part with the aid of the "Statistical Package for the Social Sciences" (Nie et al. 1975).

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1. In view of the complexity of the questionnaires and the number of treatments used, a booklet of editing criteria was prepared for each treatment. The booklet for Treatment 1 is shown in Appendix 2 as an example of the coding procedure followed.

ANALYSIS OF THE DATA

The present report is concerned mainly with the comparability of treatment samples, response rates by treatment, the quality of questionnaire completion and the variability in responses to questions related to hunter activity and harvests. The analysis of recreational hunting days and game harvests is presented in sections D and E below. The data is shown for the west and the east and for both regions combined. It should be recalled that the sampling rate as described in Table 2 is the same within each province by zone. Consequently there is no need to apply extrapolation factors by zones within provinces during the analysis of the data. Since the objective of the analysis is to compare the effects of treatments on recreation days and game harvests it is permissible to combine data from provinces without weighting. The reader should bear in mind that the statistics presented are valid estimates of treatment parameter values but may not depict actual provincial or regional values.

The "classical experimental approach" in analysis of variance (ANOVA)[1] has been used to detect significant differences in the main effects (i.e. treatments, regions, waves) and to measure possible interactions. In order to conduct analysis of variance several basic assumptions must be met. These are outlined in Scheffé (1959: 331). In the

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1. See Nie et al. (1975: 398-433)

case of recreational days and harvests it is apparent that the mean and variance are interrelated and that treatment variances are unequal. In order to correct for this analysis of variance was conducted on the untransformed as well as on the logarithmically transformed data. Unless otherwise specified, significance tests based on the transformed data did not reveal additional significant differences at the .10 confidence level and the results based on the untransformed data have been presented.

Results from significance tests which reject the null hypothesis at confidence levels of .10, .05 or .01 are referred to as statistically "significant differences". Test results showing a higher probability of falsely rejecting the null hypothesis are referred to as "nonsignificant differences".

A) Comparability of Treatment Samples

The treatment samples were examined using data available from the Migratory Game Bird Permit file to ensure that they were comparable to each other. The samples were compared with respect to age, permit renewal, province and zone of permit sale and rural-urban residence. No significant differences were found among Treatments.[1]

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1. Most significant value using overall chi-square tests for significant differences between proportions was: $p\ (\chi^2=4.7,\ 5\ d.f.)<.50$

B) Response Rates by Treatment

The overall response rate in the survey was about 86%. This relatively high rate of participation in the study is a reflection of the effectiveness of the three follow-ups of nonrespondents and the use of registered mail in the final wave. The response rates by treatment for cumulated mailing waves are presented in Table 3 and illustrated in Figure 1.

The response rates by treatment were compared to determine which questionnaire design was most appealing to recipients. Relatively large differences in response rates were found in the first and second mailing waves. Statistically significant differences were observed among treatments in mailing wave I ($p[X^2=13.31, 5 \text{ d.f.}]<.05$) and in cumulated mailing waves I + II ($p[X^2=20.31, 5 \text{ d.f.}]<.01$). However, these differences are attenuated in the third and fourth waves.

The response rates in mailing I and in cumulated mailings I + II are highest for Treatments 1 and 6 and lowest for Treatments 2 and 4. Based on data in column (2) of Table 3 Treatments 1 and 6 yield a response rate which is about 20% higher than that of Treatments 2 and 4. This difference is significant at the .05 confidence level. These data reveal the important effect of questionnaire format and content on participation rates in mail harvest surveys having not more than one follow-up of nonrespondents.

The rate of response to each treatment by region was examined to determine if some questionnaire designs were

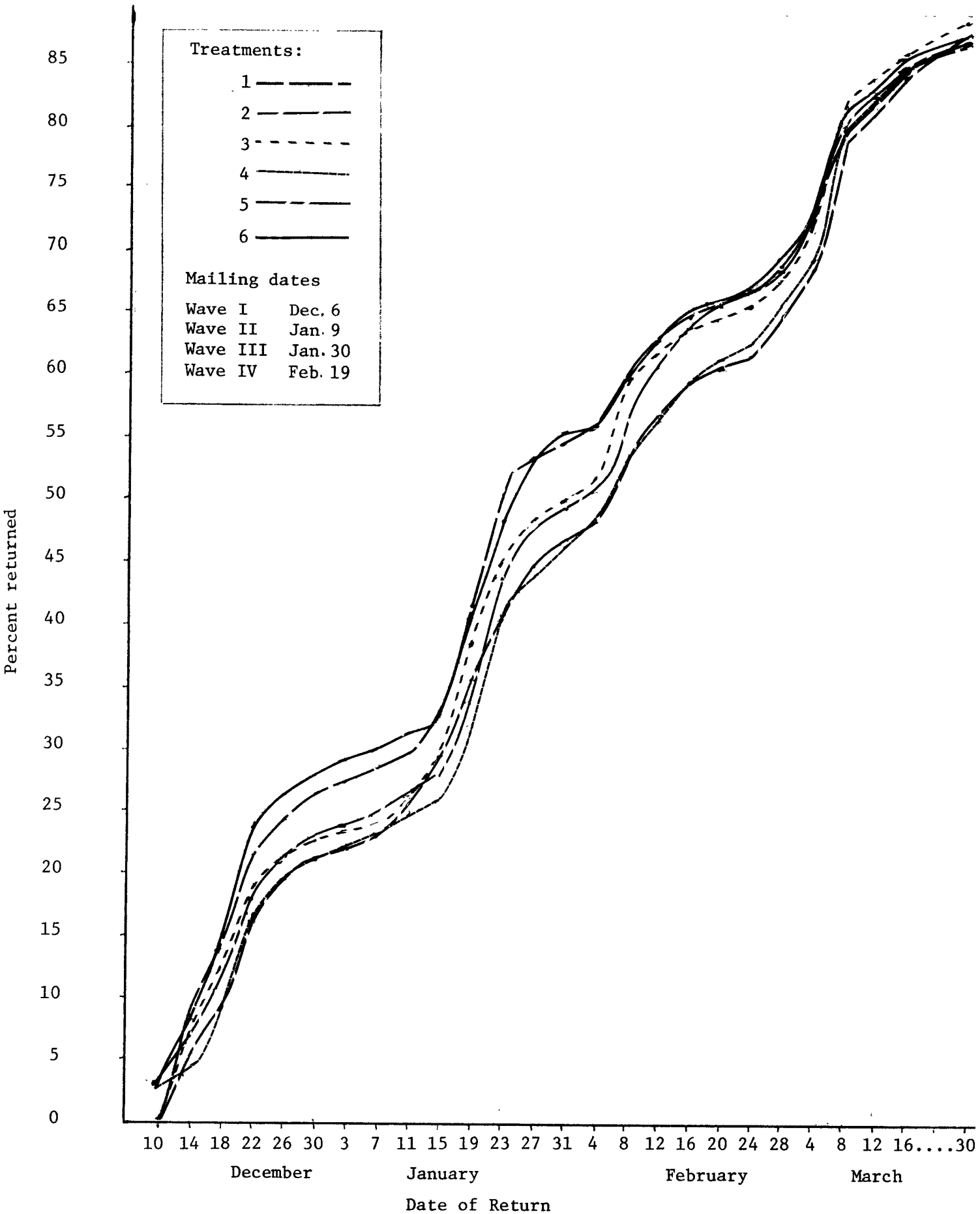
TABLE 3

Response rates[7] by Treatment for cumulated mailing waves

Treatment	MAILING WAVE (1)[1] I	(2)[2] I + II	(3)[3] I + II + III	(4)[4] I + II + III + IV	(5) sample size	(6) undeliverables	(7) sample selection
1	.302	.555[5]	.665	.862	632	68	700
2	.249	.471	.621	.853	614	86	700
3	.252	.498	.650	.855	620	80	700
4	.248	.457	.616	.856	610	90	700
5	.261	.499	.662	.862	631	69	700
6	.313	.551[6]	.668	.860	630	70	700
TOTAL	.271	.506	.647	.858	3737	463	4200

1. Overall chi-square for significant differences between Treatments : $p(X^2=13.31, 5d.f.) < .05$
2. " " " " : $p(X^2=20.31, 5d.f.) < .01$
3. " " " " : $p(X^2= 7.17, 5d.f.) < .21$
4. " " " " : $p(X^2= .40, 5d.f.) < 1.00$
5. Using Yate's corrected chi-square test the proportion is significantly different from Treatments 3, 2 and 4 at level .05
6. Using Yate's corrected chi-square test the proportion is significantly different from Treatments 3, 2 and 4 at level .05
7. Based on column (5) excluding undeliverables.

Figure I - Cumulative Percentage Response by Treatment



better suited than others to elicit responses in areas with different ecological and sociological characteristics. No significant differences were observed after two cumulative mailings or after four cumulative mailings.[1]

The remainder of the analysis is based on responses to all four mailing waves combined. This procedure was adopted in order to: a) maximize the total number of observations in the analysis and to more readily detect significant differences between treatments by minimizing the variance: b) minimize nonresponse bias and ensure that respondents by treatment are comparable based on sampling criteria as discussed in section A above; c) ensure that observed significant differences are due to the effect of treatment designs themselves and not to replies which may be unrepresentative because of varying response rates. It should be noted in Table 3 that the response rates after four waves do not differ by more than 1% among treatments, whereas the rates after two waves differ significantly by as much as 17%. As seen from Tables 9 and 10 in Appendix 3 there is no significant interaction effect between response wave and treatment for hunting activity and success.

C) Missing Data by Treatment

The questions dealing with days of hunting and harvests in various treatments were compared to determine if the proportion of questionnaires with missing data (i.e. unknowns) varied

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1. Most significant value using overall chi-square tests for significant differences between proportions was: $p\ (X^2=3.6,\ 10\ d.f.)<.98$.

significantly. This is an important aspect to consider since missing data which results in the loss of valuable records needed for statistical computations may bias survey estimates. For the purpose of this study, missing data was defined as a question which was judged to be answered incorrectly or deliberately left unanswered. Examples of the criteria used in determining missing values is presented in Appendix 2. Although wildlife managers are primarily concerned with recreational hunting days and harvests for individual species groups the data presented in Table 4 deals only with migratory game bird hunting in general. Results should be interpreted as an overall statistical indicator of the quality of the replies by treatment.

Treatments with missing data concerning the number of days[1] spent hunting migratory game birds are compared in Table 4. Statistically significant differences ($p<.01$) were found among treatments based on the overall chi-square test. The highest rate of unknowns (7.5%) was detected for treatment 4. This rate is significantly higher[3] ($p <.01$) than that of any other treatment. All other treatments had fewer than 3% unknowns. Treatment 5 was significantly lower[2] ($p <.05$) than treatment 1. No other significant differences were revealed at the .10 confidence level.

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1. The number of days spent hunting migratory game birds is described as variable (h) in Table 1.

2. Treatments 5 and 6 respectively have three and two questions dealing with days of hunting. A questionnaire was declared unusable if missing data was observed in any category of days.

3. Based on Yates' corrected chi-square test for significant differences.

Proportion[1] of Missing Values for M.G.B. Recreational Days and Harvests by Treatment

TABLE 4

Variable	Treatment					
	1	2	3	4	5	6
Days[2]	.028	.013	.021	.075	.009	.018
Harvest[3]	.004	.013	.021	.075	.004	.018
Total Observations	545	524	530	522	544	592

1. Proportion of questionnaires which cannot be used to compute recreational days or harvests for migratory game birds.

2. Overall chi-square test for significant differences between proportions: $\rho\ (\chi^2=57.54,\ 5\text{d.f.})<.01$

3. Overall chi-square test for significant differences between proportions: $\rho\ (\chi^2=86.05,\ 5\text{d.f.})<.01$

The treatments were also contrasted to determine if the proportion of questionnaires with missing data concerning the number of migratory game birds killed and retrieved[1] varied significantly. Table 4 reveals that significant differences ($p < .01$) were found among treatments. Treatment 4 had a 7.5% rate of unknowns and was significantly higher ($p < .01$) than any other treatment. All other treatments had fewer than 2% unknowns. Treatments 1 and 5 had the lowest proportion of unknowns and were both significantly lower ($p < .05$) than Treatments 6 and 3[2].

D) Hunter Activity by Treatment

Question #1 in all treatments ask whether or not the recipient of the questionnaire has purchased a Migratory Game Bird Hunting Permit in 1973. The format and content of this question are identical in all treatments. For all treatments combined, the analysis revealed that 69% of the sample bought a 1973 Permit. No significant differences were observed among treatments[3].

The treatments were then contrasted to determine if the proportion of active permit buyers based on recreational hunting days varied significantly. It should be recalled that

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1. Number of migratory game birds harvested is defined as variable (d) in Table 1.

2. Based on Yates' corrected chi-square test for significant differences.

3. Overall chi-square test for significant differences between proportions: $p\ (X^2=3.7,\ 5\ d.f.)<.60$

TABLE 5

Proportion of Active[1] Permittees by Treatment[2]

Activity	Treatment						
	1	2	3	4	5	6	Total
Active	.513	.559	.526	.470	.575	.545	53.2
Inactive	.487	.441	.474	.530	.425	.455	46.8
Total Observations	530	517	519	483	539	532	3120

1. Proportion of respondents who reported hunting migratory game birds on at least one day in the season; Based on variable (h) in Table 1.

2. Overall chi-square test for significant differences between treatments: $p(X^2=14.20, 5d.f.)<.05$

this question[1] varies in length and difficulty among treatments. Table 5 shows that 53% of all respondents reported hunting migratory game birds on at least one day. The proportion of active hunters by treatment varied significantly ($p<.05$) from 58% to 47%. Treatment 4 was significantly lower[2] than treatments 5, 2 and 6 ($p<.05$) and Treatment 3 ($p<.10$). Treatment 5 also differed significantly[2] from Treatment 1 ($p<.10$).

Estimates of recreation days of hunting were obtained using different types of questions for the following bird categories: waterfowl (ducks or geese), other migratory game birds, all migratory game birds combined[3]. Although these broad categories may not seem detailed enough for game management purposes they are adequate to guage the effect of treatment designs on estimates of reported recreational days in the current analysis. Table 6 which is based on active permittees shows the mean number of days spent hunting by treatment, region and species category.

Treatment 5 was found to yield higher estimates of recreational days for waterfowl and other migratory game bird hunting although these differences are not significant. However, a comparison of total recreation days by treatment for all migratory game birds revealed significant differences ($p<.01$). Estimated means were as high as 10.3 days (Treatment 5)

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1. See variable (h) in Table 1.

2. Based on Yates' corrected chi-square test for significant differences between proportions.

3. See variable (f), (g) and (h) in Table 1.

Table 6

Mean Days of Hunting by Treatment and Region for Active Hunters[1]

Species	Region	Statistic	Treatment					
			1	2	3	4	5	6
Ducks & Geese	East	$\bar{x}$[6]					9.5	8.7
		s.e.[7]	-	-	-	-	.96	.79
		n.[8]					158	141
	West	$\bar{x}$					9.0	7.4
		s.e.	-	-	-	-	.86	.51
		n					152	149
	Total[2]	$\bar{x}$					9.5	8.1
		s.e.	-	-	-	-	.66	.47
		n					310	290
Other M.G.B.	East	$\bar{x}$					8.6	7.0
		s.e.	-	-	-	-	1.68	1.55
		n					32	32
	West	$\bar{x}$					11.2	3.7
		s.e.	-	-	-	-	5.39	.91
		n					5	7
	Total[3]	$\bar{x}$					8.9	6.4
		s.e.	-	-	-	-	2.55	1.30
		n					37	39
All M.G.B.[5]	East	$\bar{x}$	9.6	9.0	6.5	3.8	11.3	10.3
		s.e.	.76	.89	.48	.32	1.04	.97
		n	139	139	138	115	158	141
	West	$\bar{x}$	8.7	6.8	5.4	4.2	9.3	7.6
		s.e.	.85	.54	.45	.31	.97	.52
		n	133	150	135	112	152	149
	Total[4]	$\bar{x}$	9.1	7.9	6.0	4.0	10.3	8.9
		s.e.	.57	.52	.33	.22	.71	.55
		n	272	289	273	227	310	290

TABLE 6 (continued)

1. Dash denotes no data are available. Recreational days for all species groups are available from the source documents of Treatment 4. However, all are not available from the magnetic tape on which the analysis is based. To facilitate the analysis the data in Treatment 4 was collapsed into 13 temporal intervals in a manner similar to the one described under question #9 in Appendix 2.

2. t test for significant differences between means: $p\ (t=1.63,\ 587\ d.f.)<.20$

3. t test for significant differences between means: $p\ (t=1.21,\ 74\ d.f.)<.20$

5. ANOVA treatment effects: $p\ (F=17.9,\ 5 \text{ and } 1649\ d.f.)<.01$
   ANOVA regional effects: $p\ (F=11.4,\ 1 \text{ and } 1649\ d.f.)<.01$
   ANOVA two-way interaction: $p\ (F=1.01,\ 5 \text{ and } 1649\ d.f.)<.50$

4. Anova: $p\ (F=17.8,\ 5 \text{ and } 1655\ d.f.)<.01$
   Means differing by at least 2.9 are significantly different at the .05 confidence level based on the Scheffé (1959: 68-70) multiple comparison confidence interval for significant differences between pairs of means for samples of unequal sizes.

6. Treatment mean

7. Standard error of the mean

8. Number of observations

and as low as 4 days (Treatment 4). Means from Treatments 5, 1 and 6 were each significantly higher ($p<.05$) than means from Treatments 3 or 4. Significant differences were also observed between Treatments 5 and 2 ($p<.10$) and between Treatments 2 and 4 ($p<.01$). As expected, the means for the west and for the east also differed significantly ($p<.01$). However, the direction of these differences tends to be consistent among treatments and no significant interaction effect between treatment and region was observed.

Unlike the national Migratory Game Bird Harvest Survey, the analysis is based on returns from four mailing waves instead of the first two waves. Table 9 in Appendix 3 compares the treatments by species categories and wave of return. Although significant differences were observed between combined waves 1 + 2 and waves 3 + 4 ($p<.10$) no significant interaction effect between treatment and wave of return were found ($p<.30$). Although there exists some nonresponse bias in the data a comparison of treatments based on combined waves 1 + 2 only would have yielded results which are similar to those observed using all four mailing waves combined.

E) Hunter Success and Harvests

The treatments were compared to determine if the proportion of hunters who reported bagging at least one migratory game bird varied significantly. No significant differences in the proportion of successful hunters were

TABLE 7

Mean Harvests by Treatment and Region for Successful Hunters

Species	Region	Statistic	Treatment					
			1	2	3	4	5	6
Ducks[2]	East	$\bar{x}$[8]	10.4	11.4	9.3	7.4	13.5	9.4
		s.e.[9]	1.47	1.23	1.01	.89	1.61	.93
		n[10]	117	116	122	87	130	114
	West	$\bar{x}$	20.6	14.8	13.8	14.6	20.6	16.1
		s.e.	2.56	1.30	1.37	1.75	2.00	1.68
		n	122	130	123	107	129	124
	Total[1]	$\bar{x}$	15.6	13.2	11.6	11.4	17.0	12.9
		s.e.	1.53	.90	.86	1.07	1.30	1.01
		n	239	246	245	194	259	238
Geese[4]	East	$\bar{x}$	3.2	3.2	2.5	4.1	2.6	1.8
		s.e.	.60	.72	.34	1.61	.47	.28
		n	32	16	21	22	19	20
	West	$\bar{x}$	7.5	4.3	5.4	6.0	7.2	4.8
		s.e.	1.63	.66	.63	1.21	1.15	.65
		n	52	53	45	34	40	44
	Total[3]	$\bar{x}$	5.9	4.0	4.5	5.3	5.7	3.8
		s.e.	1.06	.54	.48	.97	.84	.49
		n	84	69	66	56	59	64
Other M.G.B.	East	$\bar{x}$	9.2	9.1	8.6	16.8	13.7	7.4
		s.e.	1.76	2.12	2.05	5.26	3.72	1.68
		n	37	27	28	17	27	30
	West	$\bar{x}$	6.3	4.0	4.2	3.3	22.5	7.2
		s.e.	1.99	1.00	2.93	1.39	5.50	2.48
		n	6	3	4	7	2	5
	Total[5]	x	8.8	8.6	8.1	12.9	14.3	7.4
		s.e.	1.54	1.92	1.84	3.93	3.49	1.47
		n	43	30	32	24	29	35

TABLE 7 (continued)

Species	Region	Statistic	Treatment 1	2	3	4	5	6
All M.G.B.[7]	East	$\bar{x}$	13.0	13.4	11.4	10.8	15.4	10.9
		s.e.	1.79	1.48	1.13	1.55	1.72	1.06
		n	128	121	126	95	141	121
	West	$\bar{x}$	23.9	16.1	15.3	16.3	22.5	16.9
		s.e.	3.01	1.35	1.42	1.85	2.14	1.69
		n	122	135	128	110	133	133
	Total[6]	$\bar{x}$	18.3	14.8	13.3	13.7	18.8	14.0
		s.e.	1.76	1.00	.92	1.24	1.38	1.03
		n	250	256	254	205	274	254

1. ANOVA: P (F=3.9, 5 and 1415 d.f.)<.01
Means differing by at least 5.4 are significantly different at the .05 confidence level.

2. ANOVA treatment effects: p (F=4.3, 5 and 1409 d.f.)<.01
ANOVA regional effects: p (F=49.8, 1 and 1409 d.f.)<.01
ANOVA two-way interaction: p (F=1.2, 5 and 1409 d.f.)<.40. A three-way ANOVA which would include regional effects might show a slighter higher F value.

3. ANOVA: p (F=1.2, 5 and 392 d.f.)<.40
NOTE: significant difference were found on the logarithmically transformed data as shown in footnote 4 below.

4. ANOVA treatment effects: p (F=2.2, 5 and 378 d.f.)<.10
ANOVA regional effects: p (F=40.9, 1 and 378 d.f.)<.01
ANOVA two-way interaction: p (F=1.2, 5 and 378 d.f.)<.40

5. ANOVA: p (F=1.4, 5 and 187 d.f.)<.30

6. ANOVA: p (F=3.79, 5 and 1487 d.f.)<.01
Means differing by at least 5.5 are significantly different at the .10 confidence level.

7. ANOVA treatment effects: p (F=4.2, 5 and 1481 d.f.)<.01
ANOVA regional effects: p (F=35.1, 1 and 1481 d.f.)<.01
ANOVA two-way interaction: p (F=1.4, 5 and 1481 d.f.)<.30. A three-way ANOVA which would include regional effects might show a slightly higher F ratio.

8. Treatment mean

9. Standard error of the mean

10. Number of observations.

observed among treatments[1]. About 89% of the hunters reported being successful. 85% of the hunters bagged ducks while 24% and 10% bagged geese and other migratory game birds respectively.

The data were then examined to disclose any significant differences among treatments with respect to mean bird harvests. Table 7 shows mean harvests by treatment, species groups and region. Significant differences ($p<.01$) were detected among treatments for total duck harvests and total harvests of all migratory game birds combined. Mean goose harvests differed significantly ($p<.10$) based on logarithmically transformed data only. With respect to duck harvests Treatment 5 yielded a significantly[2] higher kill ($p<.05$) than Treatments 3 or 4. For all migratory game birds combined Treatment 5 provided a mean harvest estimate which was significantly[2] higher ($p<.10$) than Treatment 3. There was a tendency for Treatment 6 to have the lowest goose harvest of all treatments.

As expected, harvests for ducks, geese and all migratory game birds combined varied significantly by region ($p<.01$). No significant two-way interaction effect ($p<.30$) was detected between treatment and region. This indicates that any inherent treatment bias is relatively constant regardless of the regional origin of the completed questionnaire.

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1. Overall chi-square test for significant differences between proportions: $p\ (X^2=8.8,\ 5\ d.f.)<.20$.

2. Based on Scheffé' (1959: 68-70) multiple comparison confidence interval for significant differences between means for samples of unequal sizes.

The treatment means were also examined by wave of return to determine the effect of treatment on nonresponse bias. Table 10 in appendix 3 indicates that significant differences by wave were observed for ducks and all migratory game birds combined ($p<.10$). However, no significant two-way interaction effect was found between wave of return and treatment.

DISCUSSION

Results from the experimental study clearly indicate that changes in harvest questionnaire format and content have a major effect on mailed survey results. The design of the questionnaire has a significant effects on response rates, the rate of missing data and estimates of hunter activity and success. A general summary of the study findings is presented in Table 8.

A) Treatment Samples

The fact that no significant differences were found between treatments with respect to age, permit renewal, province and zone of permit sale, and rural-urban residence indicates that the six respondent groups are very similar. Statistically significant differences in responses to specific questions can, therefore, be attributed to the effect of the questionnaires on the respondents. No significant differences were detected with respect to question #1[1] which is identical in content

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1. Proportion of respondent purchasing a 1973 hunting permit.

TABLE 8 General Summary of Significant Differences Between Treatments[1]

Variable	Treatments					
	1	2	3	4	5	6
Response Rate[2] (Table 3)	High	Low	Intermediate	Low	Intermediate	High
Representativeness of Sample (page 14)	-	-	-	-	-	-
Missing Data (Table 4)	Low	Low	Low	High	Low	Low
Proportion of 1973 Permittees	-	-	-	-	-	-
Proportion of Active Permittees (Table 5)	Intermediate	High	Intermediate	Low	High	High

TABLE 8 (continued)

Variable	Treatment					
	1	2	3	4	5	6
Recreation Days (Waterfowl, Table 6)	-	-	-	-	-	-
Recreation Days (Other M.G.B., Table 6)	-	-	-	-	-	-
Recreation Days (all M.G.B., Table 6)	High	Intermediate	Low	Low	High	High

TABLE 8 (continued)

Variable	Treatment					
	1	2	3	4	5	6
Proportion of Successful Hunters	-	-	-	-	-	-
Duck Harvests (Table 7)	High	Intermediate	Low	Low	High	Intermediate
Goose Harvests[3] (Table 7)	High	Low	Low	Intermediate	High	Low
Other M.G.B. Harvests (Table 7)	-	-	-	-	-	-
M.G.B. Harvests (Table 7)	High	Intermediate	Low	Low	High	Intermediate

1. Based on returns to four mailing waves and an overall response rate of 86%. Dash indicates that differences are not significant.

2. Based on waves 1 + 2 only.

3. Results were significant based on logarithmically transformed data only.

and format on all six questionnaires. This suggests that relatively simple and straightforward questions placed at the beginning of the questionnaire tend to yield reliable statistical estimates regardless of the overall length or difficulty of the questionnaire[2].

B) Hunter Activity

It is very interesting to observe that Treatment 4 which has the most detailed question dealing with recreation days yields the lowest proportion of hunters reporting hunting migratory game birds at least one day (Table 5). It can be hypothesized that the extra burden placed on respondents by this treatment discourages some hunters from reporting any hunting activity. This hypothesis is supported by the data on mean days of hunting in Table 6. The lowest estimates of recreation days are obtained from Treatments 4 and 3. These treatments not only ask the respondent to report the number of days on which he went hunting but also ask him to provide the most detailed temporal and geographic distribution of his activity. On the other hand, Treatments 1 and 6 which utilize simpler and less detailed questions to gather this information tend to provide higher estimates. This type of response bias results in serious differences in estimated recreational hunting days. For example, Treatment means 4 and 1 differ by more than 127%.

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2. Assuming that the response rate is not affected by questionnaire length or difficulty.

The data in Table 6 suggests that estimates of total migratory game bird hunting days obtained by summation of activity for individual species groups are upwardly biased. By design, Treatment 5 tends to provide an estimate which is about 14% higher than that of Treatments 1 or 6. The high mean reported in Treatment 5 suggests that some respondents spend a significant amount of time hunting both ducks and geese on the same trip.

C) Hunter Success

Changes in questionnaire format and content also have a significant effect on the harvests reported by hunters (Table 7). Harvests of ducks, geese, and total migratory game birds are consistently higher for Treatments 5 and 1 than for Treatment 2, 3 and 4. The mean for Treatments 1 and 5 combined differs from that of Treatments 2, 3 and 4 combined by as much as 35% for ducks, 29% for geese and 33% for all migratory game birds. Treatments 1 and 5 use relatively short and simple questions to obtain data on birds harvested whereas Treatments 2, 3 and 4 use a tabular format similar to those often found in interview schedules. While the relatively compact tabular format provides more detailed information on harvests by place and date of hunting, it is more difficult for respondents to understand and takes more time to complete. It can be hypothesized that longer and more detailed tabular questions discourage respondents from reporting large harvests in detail.

Treatment 6 is the only questionnaire which asks for sea duck, duck, Canada Goose and other goose harvests separately. Data in Table 7 suggest that this method of obtaining harvest data tends to provide relatively low estimates for geese and ducks. The mean duck harvest in Treatment 6 tends to be lower than that of Treatments 1 and 5 which are somewhat similar in format to Treatment 6. Similarly, the goose harvest in Treatment 6 tends to be lower than that of Treatments 1 and 5. Although the differences in these paired comparisons are not significant it appears that a breakdown of the duck and goose categories on the questionnaire tends to lower the estimates of hunter harvests. The mean of Treatments 1 and 5 combined differs from that of Treatment 6 by as much as 26% for ducks, 53% for geese and 32% for all migratory game birds.

D) General Evaluation

Although it is not the purpose of this report to recommend one treatment over any other it is apparent that some questionnaires do work better than others for the purpose of self-administered mailed surveys. Treatments 1 and 6, for example, provide a significantly higher response rate than Treatments 2, 3 and 4 in the context of a survey having only two mailing waves (Table 3). High response rates tend to reduce nonresponse bias and increase the accuracy of survey estimates. Treatments 2, 3, 5 and 6 tend to reduce to a minimum the amount of missing data regarding hunter activity and success (Table 4). Although it is observed that the number

of 1973 hunting permit buyers is virtually the same for each treatment it is seen that the number of permittees who report any hunting activity is lowest for Treatment 4 (Table 5).

Based on these criteria it appears that Treatments 6, 5 and 2 are the most appealing to questionnaire recipients. Treatment 5 provides more data on temporal and geographic distributions of hunter activity and harvests than Treatments 2 or 6 but less that Treatments 4 or 3. The length of Treatment 5 does not seem to reduce the response rate significantly nor to discourage respondents from reporting hunting activity and success. The format of the questions used in Treatment 5 bears a considerable resemblance to the format used in the current Migratory Game Bird Harvest Survey questionnaire (Treatment 6). Consequently, it would probably be easier and less expensive to adapt existing electronic data processing software to Treatment 5 than to treatments 2, 3 or 4. Consequently Treatment 5, or a variant thereof, emerges as an attractive alternative to Treatment 6 if more detailed hunting information is required.

Treatment 5 tended to provide the highest estimates of recreational days and game harvests in this study (Tables 6 and 7). Therefore, it is probable that the adoption of Treatment 5 as the new national survey questionnaire, would create discontinuity with the migratory game birds management data collected during previous years. A comparison of Treatments 6 and 5 suggests that national harvest estimates might increase by as much as 32% for ducks, 50% for geese and 34% for all migratory game birds. From the point of view of the

preservationist, however, it would seem preferable for migratory game bird management to adopt a questionnaire which may possibly tend to overestimate harvests and to set hunting regulations accordingly than to run the risk of significantly underestimating game bird kills and to endanger the species.

SUMMARY AND CONCLUSIONS

This report has attempted to emphasize the importance and magnitude of response errors related to the format and content of game harvest survey questionnaires. These and other errors often found in surveys of humans (Deming, 1944) are frequently neglected by researchers who assume that they are insignificant or non-existent. The above analysis casts serious doubts on this assumption.

Several basic conclusions relating to self-administered game harvest questionnaires can be drawn from the current analysis:

(1) Combining the sea duck, other duck, Canada Goose and other goose categories into duck and goose categories only (Treatments 1 and 5) tends to increase estimates of hunter harvests but the effect is not statistically significant. (See Treatments 1, 5 and 6 in Table 7).

(2) Asking for the number of recreational hunting days for individual species categories such as ducks, geese and other migratory game birds (Treatment 5) rather than for species categories combined tends to increase estimates of hunter

activity but the effect is not significant (See Treatments 1, 5 and 6 in Table 6).

(3) Asking sportsmen to provide a detailed temporal distribution of their activities (Treatment 2) for all species groups hunted does not significantly affect estimates of the number of recreational hunting days nor the game harvests they report (See Treatments 1, 2 and 6 in Tables 6 and 7).

(4) Asking sportsmen to provide details of both temporal and geographic distributions of their activities for each species groups hunted (Treatments 3, 4) results in a significant decrease in reported hunter activity and estimated days of recreation. (See Tables 5 and 6). Questionnaires which utilize detailed tabular formats (Treatments 3 and 4) place a heavy burden on respondents and may tend to discourage hunters from reporting their activity. Questionnaires using several relatively short and simple questions (Treatments 1, 5, 6) instead of tabular formats do not provide as much temporal and geographic information but induce respondents to report higher levels of hunting activity.

(5) Questionnaires asking sportsmen for detailed information on their temporal and geographic hunting patterns for many species groups (Treatments 3, 4) provide lower harvest

estimates than questionnaires using relatively short questions and asking for fewer details (See Treatments 1, 5, 3, 4 in Table 7).

(6) In harvest surveys not having more than one follow-up for nonrespondents, questionnaires using relatively short and simple questions (Treatments 1, 6) provide a significantly higher response rate than questionnaires using detailed tabular questions (See Treatments 1, 3, 4, 6 in Table 3).

(7) Treatments using detailed tabular questions (Treatment 4) tend to yield significantly fewer usable data (see Table 4).

Although these findings relate primarily to mailed harvest surveys of migratory game birds hunters it is likely that similar relationships exist in harvest surveys of other game. These results should encourage game managers and researchers who wish to collect detailed harvest data using mailed surveys to give special consideration to the design of the questionnaire itself.

Self-administered questionnaires should be designed in a way to minimize the burden on the respondent. Whenever possible, complicated questions and question formats should be avoided. Relatively short and simple questions will minimize nonresponse and missing data and will tend to provide high estimates of hunter activity and harvests. Game management decisions based on these higher estimates would necessarily favour the preservation of species.

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APPENDIX 1

Experimental Study Questionnaires

(Treatments 1 - 6)

(Printed on white 8.5 by 14 inch
bond paper using blue ink)

Environment Canada Environnement Canada

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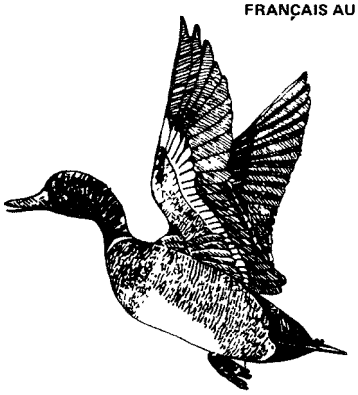
FRANÇAIS AU VERSO

CANADIAN WILDLIFE SERVICE

1973 MIGRATORY GAME BIRD HUNTING SURVEY



TREATMENT 1

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	IN 1972	IN 1971
YES ☐	YES ☐	YES ☐
NO ☐	NO ☐	NO ☐

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

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 migratory game birds. (Ducks, Geese, Coots or Mudhens, Rails, Snipe, Doves, Band-tailed pigeons, Cranes, Woodcock) ☐☐☐ days

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

DUCKS ☐☐☐	GEESE ☐☐☐	COOTS ☐☐☐	SNIPE ☐☐☐
WOODCOCK ☐☐☐	MORNING DOVES ☐☐☐	BAND-TAILED PIGEONS ☐☐☐	SANDHILL CRANES ☐☐☐

9. **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	24	25	26	27	28	29
30						

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	24	25	26	27	28	29
30	31					

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		

10 **BANDED BIRDS:**

How many of the birds you shot this season had metal leg - **BANDS**?

DUCKS ☐☐☐ GEESE ☐☐☐ OTHERS ☐☐☐

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

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

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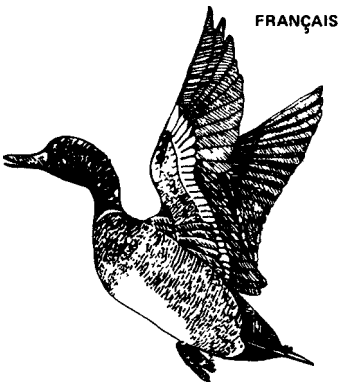
CANADIAN WILDLIFE SERVICE

1973 MIGRATORY GAME BIRD HUNTING SURVEY



TREATMENT 2

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 AND 2 ONLY AND RETURN THE QUESTIONNAIRE

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 MIGRATORY GAME BIRD CALENDAR:

For **EACH WEEK** show the number of different days on which you hunted game birds and the number of birds you bagged.
MARK ZERO (0) for each species you hunted but did not bag. **LEAVE BLANK** all species and weeks 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 bagged 1 Duck and 1 Goose.

Week of hunting	Number of days on which you went hunting	SPECIES BAGGED OR HUNTED							
		Ducks	Geese	Coots	Snipe	Woodcock	Mourning Doves	Band-Tailed Pigeons	Sandhill Cranes
EXAMPLE	2	1	1		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									

8 BANDED BIRDS:

How many of the birds you shot this season had metal leg **BANDS?**
DUCKS ☐ 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

Environment Canada Environnement Canada

C. N. ~IAN WIL~ IFE SERVI~

1973 MIGRATORY GAME BIRD HUNTING SURVEY

TREATMENT 3

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 ☐ NO ☐ ▶ IF YES, PLEASE GIVE PERMIT NO. 1973 – ☐☐☐☐☐☐ – ☐☐

2. Did you hunt migratory game birds in Canada?

	THIS SEASON	IN 1972	IN 1971
YES	☐	☐	☐
NO	☐	☐	☐

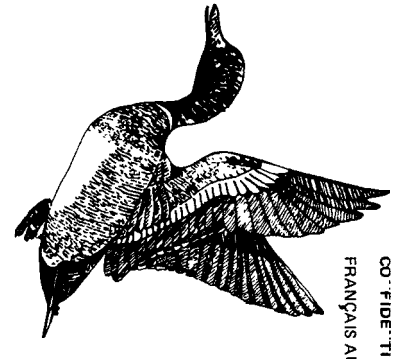
IF YOU DID NOT HUNT THIS SEASON PLEASE COMPLETE QUESTIONS 1 & 2 ONLY AND RETURN THE QUESTIONNAIRE

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

EXAMPLE: 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.

Week of Hunting	Number of Days on which you Hunted	PLACE where you did MOST of your hunting				SPECIES bagged or hunted								Banded Birds			
		Province	Town Near Place of Hunting	Distance of Place from Town (miles)	Direction of Place from Town	Ducks	Geese	Coots	Snipe	Wood-cock	Mourn-ing Doves	Band Tailed Pigeons	Sand-hill Cranes	No. of Banded Birds	Band Number	Did you Report this Band Before? Yes	Did you Report this Band Before? 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																	

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



CO~FIDE~TI~L

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TREATMENT 4

CONFIDENTIAL

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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	IN 1972	IN 1971
YES ☐	YES ☐	YES ☐
NO ☐	NO ☐	NO ☐

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

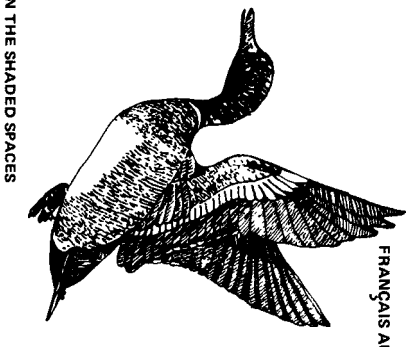
Show each date on which you went hunting game birds, the place where you did **MOST** of your hunting, the number of birds **YOU BAGGED** and the banding data (if bird had metal leg band). **MARK ZERO (0)** for each species you hunted but did not bag. **LEAVE BLANK** all species not hunted.

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
EXAMPLE ▶	2	SEPT.	MAN.	SELKIRK	8	N.W.	1	1		0					0			

(turn page for more space)

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



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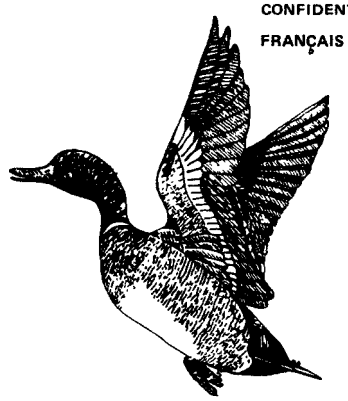

TREATMENT 5

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

IF YOU DID NOT HUNT THIS SEASON PLEASE COMPLETE QUESTIONS 1, 2, 10 AND 18 ONLY AND RETURN THE 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 – ☐ – ☐

DUCK HUNTING

	THIS SEASON	IN 1972	IN 1971
2 Did you hunt **DUCKS** in Canada?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

3 Check (√) one province where you did **MOST** of your hunting for **DUCKS** 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 duck 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 this season. ☐ days

8 Number of ducks **YOU** killed and retrieved this season. ☐ ducks

9 **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	24	25	26	27	28	29
30						

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		

GOOSE HUNTING

	THIS SEASON	IN 1972	IN 1971
10 Did you hunt geese in Canada?	YES ☐ NO ☐	YES ☐ NO ☐	YES ☐ NO ☐

11 Check (√) one province where you did **MOST** of your goose hunting 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 ☐

12 Print the name of a town **NEAR** the place where you did **MOST** of your goose hunting. ☐

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

14 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 ☐

(continued next page)

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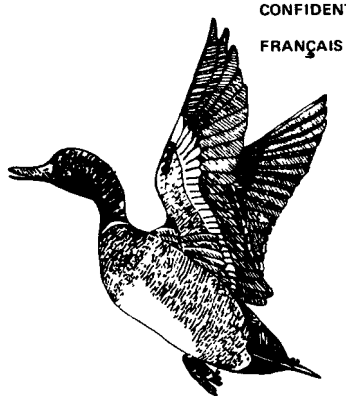

TREATMENT 6

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

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

2 Did you hunt migratory game birds in Canada?

THIS SEASON	IN 1972	IN 1971
YES ☐	YES ☐	YES ☐
NO ☐	NO ☐	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 DAY	MONTH	YEAR	PLACE TAKEN PROVINCE	NEAREST TOWN	HAVE YOU REPORTED THIS BAND BEFORE?
							YES ☐ NO ☐
							YES ☐ NO ☐
							YES ☐ NO ☐

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

Edit instructions for Treatment 1

A DEFINITIONS

Unknowns - a blank which should show an answer which is not available

- an obviously incorrect answer which cannot be imporved

*** Fill each digit space with 9

Blanks - a space interpreted as not applicable to the respondent

*** Leave blank or delete answer

B EDIT (Using Red Felt Pen)

All answers should appear in answer spaces except when instructed otherwise.

ADDRESS LABEL

If questionnaire completed on side having no label enter "label other side" in appropriate space as a reminder for the keypunch operator.

RURAL URBAN

Indicate whether or not hunter resides in a major urban area by examining address on label and placing the following code next to mailing wave code on the label:

- If name of town appears on list of

Metropolitan areas assign code 1

- otherwise assign code 2

*** See Appendix 1 for list.

QUESTION 1

If answered properly go to #2.

If UNANSWERED: examine 1973 permit number space and/or #2 THIS SEASON and answer #1 accordingly. If these provide no clues treat as UNKNOWN (9). DO NOT edit permit number as it will not be keypunched.

QUESTION 2

If completely answered go to next question.

- If blank for 1972 and 1971 treat as UNKNOWNS (9).
- If blank for THIS SEASON look at #7, 8, 9 for hunter activity and answer accordingly; if no indication of activity check (✓) NO.
- If NO for THIS SEASON delete any answer from #3 onwards and go to next questionnaire.

QUESTION 3

If blank or several answers, examine #4 (TOWN) and complete or correct. If #4 not useful check (✓) province indicated on address label.

QUESTION 4

If one legible answer go to next question.

Delete unnecessary data such as province from answer space and correct spelling and legibility when required(use Gazetteer if necessary).

If several answers delete town(s) that appear(s) in second position or outside answer space.

If no answer fill in town from address label, indicate 0 miles in #5 and delete direction in #6.

QUESTION 5

If one legible answer go to next question.

If two answers take average: add and divide by 2. Round off fractions.

If no answer fill in with 00.

QUESTION 6

If two directions check (✓) the direction midway when possible; otherwise flip a coin: keep first answer given if outcome is a head and keep second answer if outcome is a tail.

If no answer leave BLANK.

QUESTION 7

Days hunted do not have to agree with #9.

If two answers take average.

Round off fractions.

If unanswered examine #2, 8, 9 and 10 for hunting activity

- if activity treat as UNKNOWN (999)
- if no activity leave BLANK.

QUESTION 8

Duck kill:

- does not have to agree with kill in #9.
- if zero or unanswered examine #9 and correct;
- if #9 and 10 show no Ducks leave BLANK.

Other kills:

- if zero or unanswered examine #10 for remaining species
- if species treat as UNKNOWN (99)
- if no species leave BLANK

QUESTION 9

Enter the INTERVAL code, number of DAYS of hunting and Duck KILL in the LEFT hand margin next to each CALENDAR (OMIT JANUARY).

The above data takes the form of a 5 digit code [interval code (2 digits), days (1 digit), kill (2 digits)] and is entered ONLY for intervals showing days or kill.

All other intervals are left BLANK.

TEMPORAL INTERVALS (2 digits)

The 13 intervals and corresponding codes are defined on the right →

Sept. 1-8	01
9-15	02
16-22	03
23-29	04
30-6	05
Oct. 7-13	06
14-20	07
21-27	08
28-3	09
Nov. 4-17	10
18-30	11
Dec 1-15	12
Dec 16-JAN. 31	13

TO OBTAIN DAYS (1 digit)

Add number of figures (not figures themselves), zeros or check marks (✓):

- If Calendar is blank examine #8, 10 for Duck hunting activity: If no activity leave BLANK.
- If some or unknown activity mark 999 once in margin (i.e. 99 for interval and 9 for days).
- If hunter reports other birds enter 999 as above.
- If all date spaces filled with 0's or check marks enter 999 as above.
- If numbers of days in interval is greater than 8 see supervisor.

TO OBTAIN KILL (2 digits)

Add figures in the interval.

- If calendar is blank or contains zeros, check marks (✓), or X's examine #8 and 10 for

ducks;

- if any ducks treat as UNKNOWN (99)
- if no ducks leave BLANK

If hunter reports other birds with ducks treat as UNKNOWN (99).

N.B.

- If both days and kill are UNKNOWN indicate 99999 once in margin.
- If there is any reason to believe the data in the calendar is questionable see the supervisor.
- If questions #7 or #8 suggest no Duck activity or success, data in the calendar should be deleted and margins left BLANK.

QUESTION 10

Obtain two photocopies of questionnaires with data in this question, attach metal band(s), if any, to copies and remit to the Migratory Game Bird Populations Unit (Mrs. Laurie Wight).

Examine the three answer spaces for consistency with the table below, correct as required.

- If no birds banded enter ZERO (0).
- If UNKNOWN enter 9.

Transcribe the three figures (Ducks, Geese, Others) to the blank space to the right of Duck Calendar at the top of question #9 and delete #10.

MISCELLANEOUS

- Attached comments and letters showing the name, address, permit # and treatment code should be handed to the supervisor.
- Change all numerical adjectives into integers.
- If you find any conditions that are not covered in these instructions please see supervisor to resolve problem and amend the instructions as required.

Prepared by F.L. Fili
April 197

APPENDIX 2

LIST OF METROPOLITAN AREAS

1971 CENSUS METROPOLITAN AREAS[1]

Province	Metropolis	Incorporated
Alberta	Calgary	Calgary
	Edmonton	Edmonton
		Bon Accord
		Fort Saskatchewan
		Gibbons
		Legal
		Morinville
		St. Albert
Nova Scotia	Halifax	Halifax
		Dartmouth
		Bedford
		Waverly
		Cole Harbour
		Eastern Passage
		Herring Cove
		North Dartmouth
		Sackville
		Windsor Junction
New Brunswick	St. John	St. John
		East Riverside
		Fairvale
		Gondola Point
		Hampton
		Pamdenec
		Quispamsis
		Renforth
		Rothesay
		Westfield

1 Based on paper by F. Ricour-Singh, "Les régions métropolitaines de recensement", Section de géographie, division du recensement Statistique Canada, juillet 1972.

Prepared by F.L. Filion
April 1974

Appendix 3

Hunter Activity and Success by Treatment and Wave of Return.

TABLE 9

Mean Days of Hunting by Treatment and Response Wave for Active Hunters

Species	Wave	Statistic	Treatment 1	2	3	4	5	6
Ducks & Geese[1]	1 + 2	$\bar{x}$					9.0	7.8
		s.e.	-	-	-	-	.75	.59
		n.					188	195
	3 + 4	$\bar{x}$					9.7	8.6
		s.e.	-	-	-	-	1.16	.76
		n.					122	95
Other M.G.B.[2]	1 + 2	$\bar{x}$					7.7	4.7
		s.e.	-	-	-	-	1.78	.69
		n.					27	24
	3 + 4	$\bar{x}$					12.2	9.2
		s.e.	-	-	-	-	3.38	3.12
		n.					10	15
All M.G.B.[3]	1 + 2	$\bar{x}$	8.1	8.2	5.9	3.8	10.1	8.3
		s.e.	.54	.78	.42	.27	.83	.62
		n.	175	161	155	134	188	195
	3 + 4	$\bar{x}$	11.0	7.4	6.1	4.2	10.7	10.0
		s.e.	1.24	.61	.52	.37	1.30	1.09
		n.	97	128	118	93	122	95

1. See Footnote 2 in table 6.

2. See footnote 3 in table 6.

3. - See footnote 4 and 5 in table 6.
   - ANOVA wave effects: p (F=3.1, 1 and 1649 d.f.)<.10
   - ANOVA two-way interaction: p (F=1.4, 5 and 1649 d.f.)<.30. This test does not include regional effects. A three-way ANOVA which would include regional effects might show a slightly higher F value.

Mean Harvests by Treatment and Response Wave for Successful Hunters

TABLE 10

Species	Waves		Statistic	Treatment					
				1	2	3	4	5	6
Ducks[1]	1	2	$\bar{x}$	14.2	14.1	10.4	11.0	15.4	12.7
			s.e.	1.50	1.33	.91	1.26	1.12	1.24
			n.	155	134	139	110	160	157
	3	4	$\bar{x}$	18.3	12.2	13.1	11.8	19.7	13.2
			s.e.	3.33	1.17	1.58	1.86	2.86	1.7
			n.	84	112	106	84	99	81
Geese[2]	1	2	$\bar{x}$	4.6	4.0	4.7	4.9	5.3	3.7
			s.e.	.62	.83	.74	1.16	.80	.49
			n.	55	38	33	28	39	39
	3	4	$\bar{x}$	8.2	4.1	4.3	5.7	6.6	4.1
			s.e.	2.82	.63	.61	1.57	1.94	1.00
			n.	29	31	33	28	20	25
Other M.G.B.[3]	1	2	$\bar{x}$	8.2	8.2	7.6	12.7	14.8	7.8
			s.e.	1.96	2.72	1.46	5.76	4.50	2.37
			n.	28	16	17	15	22	20
	3	4	$\bar{x}$	9.9	9.0	8.5	13.2	12.8	6.9
			s.e.	2.55	2.81	3.62	4.63	3.60	1.45
			n.	15	14	15	9	7	15
All M.G.B.[4]	1	2	$\bar{x}$	16.3	15.5	12.1	12.9	17.6	13.6
			s.e.	1.57	1.42	1.00	1.48	1.33	1.26
			n.	163	140	143	119	170	168
	3	4	$\bar{x}$	22.1	14.0	15.0	14.8	20.9	14.8
			s.e.	4.10	1.40	1.65	2.13	2.92	1.83
			n.	87	116	111	86	104	86

TABLE 10 (continued)

1. See footnotes 1 and 2 in table 7.
   ANOVA wave effects: p (F=3.5, 1 and 1409 d.f.)<.10
   ANOVA two-way interaction: p (F=1.1, 5 and 1409 d.f.)<.40

2. See footnote 3 in table 7.

3. See footnote 5 in table 7.

4. See footnotes 6 and 7 in table 7.
   ANOVA wave effects: p (F=4.4, 1 and 1481 d.f.)<.05
   ANOVA two-way interaction: p (F=.91, 5 and 1481 d.f.)<1.0

ACKNOWLEDGEMENTS

Greatful recognition is extended to Drs. G.E.J Smith, A.R. Sen, F.G. Cooch, (C.W.S. Headquarters) and to Dr. J.B. Gollop (C.W.S., Saskatoon) for their valuable advice and detailed comments during the design and analytical phases of the study. The author is also indebted to Mrs. C.A. Bauer for her assistance during survey operations and to Mr. Serge Bériault for electronic data processing services.