Analysis of the North Carolina Hunter Harvest Mail Survey 2007- 2008

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1. Survey Description

About every 3 years since the 1950s the North Carolina Wildlife Resources Commission has conducted a mail survey of licensed hunters to estimate population numbers of hunters, hunter effort and hunter harvest. The latest survey was conducted after the 2007-2008 season.

Commission staff mailed questionnaires (See Appendix) to a random sample of 2% of the licensed hunters. The frame included all hunters who had a valid license during one or more days between the period between March 1, 2007 and February 29, 2008, regardless of when the license was purchased. A modified Tailored Design method (Dillman 2000) with three mailings was used to try and minimize non-response. The first full questionnaire was mailed at the end of March with a reminder postcard mailed a week later. Two follow-up questionnaire mailings were sent to non-respondents in mid-April and mid-May. The initial frame size was 482,588 licensed hunters and the initial sample size of potential hunters to be contacted was 9,652 hunters for a target of a 2% initial sample.

2. Data Imputation and Related Issues

Before we could begin the formal statistical analyses to calculate estimates we had to make various adjustments and also resolve some complex data imputation issues. We found that there was an observed rate of deceased and ineligible hunters of 0.0071 in our sample which, when applied to our frame size, gave an adjusted frame size of 479,138 potential hunters. Deducting the ineligibles, deceased and non-deliverables the sample size was 8,385 and of these 4,716 responded for an adjusted response rate of 56.37 % over the three mailings. This is 4% lower than in the previous survey in 2005-2006.

We imputed for item non-response using an adaptation of the cell mean imputation method (Lohr 1999 p.272). This involves replacing the missing value with the mean value over other respondents who responded to the same variable. For example, if a known squirrel hunter left days hunted blank, we imputed the mean number of days hunted based on all the squirrel hunters who did respond to that variable. We also had to include as non-response imprecise response statements such "hunted all season" when an exact number of days were asked for. In addition we found that there were various outliers in the data that had to be treated as non-response such as number of days hunted beyond season length or number killed so large as to clearly be an error. The number of imputations was quite small for a particular variable so we ignored this aspect when computing standard errors of our estimates as described in the next section.

3. Population Estimation Methods

We used standard simple random sampling estimation equations for population totals and their

standard errors (Thompson 2002 p.16). An unbiased estimate of Y, the population total is:

$$\hat{Y} = N\overline{y} \;,$$

with standard error

$$SE(\hat{Y}) = \sqrt{\{N(N-n)s^2/n\}}\;,$$

with N the adjusted frame size and n the sample size of respondents. The sample mean is $\overline{y}$ and the sample standard deviation is s. We included the finite population correction factor in the standard errors although this is only a 2% sample, so that the reductions in the standard errors are very small

We made the standard assumption that our sample of respondents was a random sample despite non-response. We investigate this further in the next section. The adjustments on frame size and sample size made to account for out of frame values (e.g., deceased hunters) were ignored in standard error calculations due to their very small number. We also took the standard approach of assuming that the use of cell mean imputations, for item non-response, for any variables did not significantly affect the standard errors. This is also very reasonable because the number of these imputations was very small (Lohr 1999 p.272).

Tables 1-4 present the estimates of population totals and their standard errors for numbers of hunters, numbers of hunter days, and number of animals harvested first for the State Overall and then for the three regions separately. The estimates in Table 1 seem quite similar to those in the previous survey, but the standard errors are generally larger and we are not sure why despite much checking of our procedures. Our standard errors seem to more closely match those in older reports. Precision (i.e., standard error) of estimates are reasonable except for some species not frequently hunted (e.g., hogs). Regional estimates were not computed for the 2005-2006 survey, but were calculated in past surveys.

We considered the deer hunter population in more detail. The estimated numbers of hunters killing 1, 2, 3, 4, 5 , 6, or more total deer (bucks and does) in Table 5a, does in Table 5b, and bucks in Table 5c are considered statewide. Approximately 47% of deer hunters killed neither a doe nor a buck while 65% killed no does and 60% killed no bucks. We then broke the state down by region and presented the corresponding tables of similar form: Coastal Region (Table 6a-6c); Mountain Region (Table 7a-7c); (Table 8a-8c); Table 9 presents a categorization of mean total deer killed for hunters that hunted for varying numbers of days. As expected, the more avid hunters are harvesting deer at a higher rate than the less avid hunters.

4. Investigation of Complex Frame Structure

The sampling frame used to draw the sample of hunters to contact consisted of all of the hunter license files available to the Wildlife Commission. There are many types of licenses ranging from lifetime licenses

to 1-year licenses and short term 6-day licenses purchased by non-residents of NC.   The period covered by the survey is from March 1, 2007 to February 29, 2008. The license frame for the survey consisted of 482,588 unadjusted and 479,161 hunters after adjustment for ineligibles and deceased hunters. Table 10 shows a general breakdown by license type based on length of license validity with the percentage of the potential hunters in the contacted sample of 9,652 belonging to each type. Notice that the 6-day license type is only a tiny percentage (1.24 %) of the total, whereas there are 60.87 % and 37.89% in the 1-year and Lifetime categories, respectively.

Many licenses can be purchased on any day of the year and run for a year (with the exception of the short term licenses). This means that there are hunters in the frame who only have small parts of the year when they could legally hunt even if they bought a long-term license. This could occur if they bought a license for the first time late in the year or if they failed to renew a license first purchased in the previous year. In addition, some hunters only have a short non-resident 6-day license. Table 11 shows a breakdown based on percentages for days of eligibility for all hunters in the contacted sample. Notice that there is only a very small percentage of hunters that have very small numbers of days of eligibility (i.e., about 2% less than 50 days) and that close to 81% have 365 days of eligibility

Early in our evaluations of different analysis options we did consider post stratification (Thompson 2002 p. 124) based on either license type or days of eligibility. However, we found such options complex and beyond the scope of our analysis. Further the numbers of hunters having either a short 6-day license or having very low number of days of eligibility were so small that they would have had to have been "over sampled" which would have required a stratified random sample at the design stage. We return to this when we discuss future surveys.

5. Investigation of Non Response and Non-Response Bias

Mail surveys are a very cost efficient method of obtaining survey information, but they often suffer from substantial non-response (Cochran 1978 p. 359, Lohr 1999 p. 255, Dillman 2000). Non-response may cause bias in the population estimates of harvest and effort because perhaps the more avid members of any group (here hunters) are probably more likely to respond (Cochran 1978, Dillman 2000). This mail survey followed the general tailored design method of Dillman (2000) to attempt to reduce the effects of non-response bias. One key element of the approach is to design the survey to use multiple mailings (three) to increase the response rate.

With this approach, we expected a total response rate over all three mailings of 60-65% based on past surveys. The response rate actually achieved was a bit lower this time at 56% over the three mailings. We also considered various analysis approaches for looking at the non-response issue. First we considered the non-response rates for the different types of licenses (last column in Table 10). We found that the

response rate of lifetime license holders was 68% while for 12- month license types it was only 49% and for the short term non-resident licenses it was a perhaps surprising 61%. We expected that the non-residents would be likely to respond at a lower rate. We noted, however, that the non-resident hunters with the 6-day licenses are only a tiny fraction of the sample.

We considered how the selected sample and the actual responding sample differed by age and sex (Table 12). We found that there was some change in distribution which reflected that older men and women were responding at a higher rate than younger ones. For example, men over 60 moved from 21.22% of the initial sample of males to 26.54% of the male respondents, whereas women over 60 moved from 15.33% of the initial sample of females to 17.05% of the female respondents. However, we decided not to weight responses as there was not very much change in almost all categories.

To investigate non-response bias in more detail we considered mailing by mailing responses of six of the more common game species. We used the species deer, doves, ducks, quail, rabbits and squirrels. We examined, across the three mailings, the mean days hunted and the mean animals killed (Table 13).   We suspected that there might be a pattern of more avid hunters responding sooner (i.e., in an earlier mailing) than less avid hunters. Our results show that, for most species, there is not a strong pattern in this direction over the three mailings for days hunted which is one measure of avidity. This supports comments made in the previous survey report.

Of course weak patterns in non-response over mailings does not guarantee that there is no non-response bias as the non-responding hunters could still be very different from the respondents. As it is impractical to try to follow-up non-respondents with a different survey method (Cochran 1978 p. 370) there is no way this can be determined directly, and indirect methods like these are all we can use. We concluded that, while there may be some non-response bias in our estimates, we suspect it is reasonably small and decided, as in past surveys, not to attempt to adjust for non-response bias. We return to this point when we discuss future survey design and analysis.

6. Suggestions for Future Survey Design, Data Imputation, and Estimation

The response rate in this survey was 56% which is not as high as that reported in past surveys. If this drop continues in the future then non-response bias is likely to become an even more serious issue. The need for use of incentives to increase response rate may need to be considered.

The precision of the estimates in this survey vary a lot but appear to be adequate except on some of the rare species like wild hogs suggesting that sample size does not need to be increased. (Adequate precision here would be the standard error less than 20% of the estimate and good would be less than 10%). Notice the standard error of the statewide harvest on hogs is almost 50%). Using an overall license file survey is not optimal for sampling rare species, but this is not a new problem. The only

solution would be to have special permits for these species so that a smaller specialist frame would be available. Unfortunately this is very unlikely to be practical for the agency due to the high cost.

In future surveys both the license type and the number of days of validity of any license could be considered as stratification variables. There are pluses and minuses of such an approach which would need to be discussed and considered in detail. We would be happy to do this with agency staff if they so desire.

We are concerned about the need to change the question on number of days hunted. In the current survey there were imprecise answers on number of days hunted where some respondents said that they hunted all season. We did not really know how to handle long seasons for this variable when hunters stated their response this way. The mean imputation method may underestimate their hunting activity, but using the season length seemed a gross over estimate because that would imply they hunted coyotes every day of a 312-day season, for example. Perhaps a better alternative would be to ask hunters to answer in large blocks of days from 1 up to the season length as this would likely be more accurate in their memories of the past year. It is practically impossible for a hunter to remember exactly how many days they hunted if the seasons are long and thus responses are likely to have serious measurement errors even if they did give a number rather than a vague response.

Literature Cited

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Tables

Table 1: Estimated numbers of hunters, total days, and total harvest for game species, with standard errors (SE), in North Carolina 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Overall State Estimates.

Species	Hunters	SE	Days	SE	Harvest	SE
Bear	18,393	904	132,031	14,882	3,148	613
Canada Geese	16,888	1,264	80,193	9,604	70,890	11,612
Coyotes	23,967	1,487	200,003	22,829	36,144	6,039
Bucks	--	--	--	--	149,877	4,862
Does	--	--	--	--	163,965	7,143
Deer	239,366	2,266	3,662,832	79,822	313,842	10,168
Doves	100,216	2,595	331,994	15,964	1,503,095	80,314
Ducks	41,664	1,898	567,219	221,169	469,227	43,565
Foxes	6,068	772	40,712	7,859	6,472	1,468
Grouse	8,393	904	43,383	7,698	8,745	2,709
Hogs	8,292	899	47,389	8,568	13,970	7,727
Quail	27,608	1,586	147,159	16,322	228,964	31,150
Rabbits	62,395	2,229	418,716	25,381	382,407	29,293
Raccoons	19,012	1,336	264,660	35,161	92,053	14,236
Squirrels	77,160	2,402	468,191	26,770	567,431	35,750
Turkeys	72,609	2,353	400,489	17,789	28,161	3,597
Woodcock	2,832	530	17,863	4,780	4,871	1,500

Table 2: Estimated numbers of hunters, total days and total harvest for game species, with standard errors (SE), in the Coastal Region of North Carolina 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in Spring 2008.

Species	Hunters	SE	Days	SE	Harvest	SE
Bear	11,023	1,032	54,604	6,865	1,934	463
Canada Geese	8,899	930	42,170	7,369	31,754	8,297
Coyotes	5,764	753	41,097	8,469	4,045	1,024
Bucks	--	--	--	--	70,066	3,865
Does	--	--	--	--	73,864	5,351
Deer	98,902	2,586	1,634,509	65,746	143,930	7,878
Doves	51,170	2,065	179,095	12,163	864,836	70,855
Ducks	28,922	1,619	453,653	220,747	344,740	37,315
Foxes	2,528	501	14,326	4,374	3,641	1,279
Grouse	809	284	2,730	1,252	1,315	759
Hogs	4,146	640	17,860	4,925	11,225	7,644
Quail	13,955	1,155	74,227	12,033	106,589	17,423
Rabbits	26,192	1,548	182,721	17,746	190,832	23,767
Raccoons	6,978	826	85,711	19,527	27,810	8,370
Squirrels	27,001	1,570	154,032	16,042	182,837	19,646
Turkeys	19,619	1,356	96,234	9,024	11,284	3,219
Woodcock	708	266	5,865	3,116	910	811

Table 3: Estimated numbers of hunters, total days and total harvest for game species, with standard errors (SE), in the Mountain Region of North Carolina 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008.

Species	Hunters	SE	Days	SE	Harvest	SE
Bear	7,584	861	73,686	11,797	1,214	348
Canada Geese	708	266	4,045	2,181	5,562	3,733
Coyotes	7,584	861	71,090	14,740	15,579	4,355
Bucks	--	--	--	--	20,904	1,768
Does	--	--	--	--	22,253	2,366
Deer	53,900	2,108	517,755	30,438	43,157	3,576
Doves	7,686	866	23,774	3,523	85,906	15,155
Ducks	2,326	481	13,045	4,761	17,495	9,394
Foxes	708	266	6,573	3,403	405	246
Grouse	7,382	849	39,237	7,471	7,026	2,583
Hogs	2,225	470	17,697	5,581	202	142
Quail	4,450	663	19,247	4,313	17,721	5,448
Rabbits	12,641	1,102	78,209	10,764	48,836	8,136
Raccoons	6,775	815	111,901	23,434	36,709	9,461
Squirrels	20,630	1,388	123,675	13,763	134,061	15,798
Turkeys	22,956	1,458	124,082	10,353	6,881	975
Woodcock	809	284	6,472	2,837	1,719	823

Table 4. Estimated numbers of hunters, total days and total harvest for game species, with standard errors (SE), in the Piedmont Region of North Carolina 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008.

Species	Hunters	SE	Days	SE	Harvest	SE
Bear	910	301	3,742	1,561	0	0
Canada Geese	7,989	883	33,979	5,692	33,574	7,249
Coyotes	11,731	1,063	87,816	14,661	16,520	3,276
Bucks	--	--	--	--	58,907	2,917
Does	--	---	--	--	67,848	4,544
Deer	107,801	2,641	1510568	58,111	126,755	6,506
Doves	43,687	1,936	129,125	10,407	552,353	37,274
Ducks	13,248	1,127	100,520	13,378	106,992	20,030
Foxes	3,135	557	19,813	5,131	2,427	681
Grouse	405	201	1,416	739	405	318
Hogs	2,124	460	11,832	3,739	2,543	1,128
Quail	11,023	1,032	53,685	8,775	104,654	24,148
Rabbits	27,102	1,573	157,786	14,438	142,740	14,706
Raccoons	6,978	826	67,047	14,715	27,534	5,226
Squirrels	32,158	1,697	190,484	17,304	250,533	26,048
Turkeys	33,271	1,723	180,173	12,323	9,996	1,315
Woodcock	1,517	389	5,526	1,960	2,242	959

Table 5a. Frequency of hunters killing various numbers of deer in North Carolina 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Overall State Estimates.

No. of Deer Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	113,666	47.49	113,666	47.49
1	50,361	21.04	164,027	68.53
2	31,754	13.27	195,781	81.79
3	17,394	7.27	213,174	89.06
4	11,630	4.86	224,804	93.92
5	6,068	2.53	230,871	96.45
>=6	8,495	3.55	239,366	100.00

Table 5b Frequency of hunters killing various numbers of does in North Carolina 03/01/2007-02/29/2008, Based on a mail survey of licensed hunters in North Carolina in spring 2008. Overall State Estimates.

No. of Does Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	156,746	65.48	156,746	65.48
1	44,496	18.59	201,241	84.07
2	22,147	9.25	223,388	93.32
3	7,584	3.17	230,973	96.49
4	4,247	1.77	235,220	98.27
5	1,618	0.68	236,838	98.94
>=6	2,528	1.06	239,366	100.00

Table 5c: Frequency of hunters killing various numbers of bucks in North Carolina 03/01/2007-02/29/2008, Based on a mail survey of licensed hunters in North Carolina in spring 2008. Overall State Estimates.

No. of Bucks Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	143,195	59.82	143,195	59.82
1	59,361	24.80	202,556	84.62
2	27,810	11.62	230,366	96.24
3	6,068	2.53	236,433	98.77
4	2,225	0.93	238,658	99.70
5	202	0.08	238,860	99.79
>=6	506	0.21	239,366	100.00

Table 6a: Frequency of hunters killing various numbers of deer 03/01/2007-02/29/2008, Based on a mail survey of licensed hunters in North Carolina in spring 2008. Coastal Region Estimates.

No. of Deer Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	43 485	43.97	43 485	43.97
1	21 540	21.78	65 025	65.75
2	13 349	13.50	78 373	79.24
3	7 180	7.26	85 553	86.50
4	6 068	6.13	91 621	92.64
5	3 236	3.27	94 857	95.91
>=6	4 045	4.09	98 902	100.00

Table 6b: Frequency of hunters killing various numbers of does 03/01/2007-02/29/2008, Based on a mail survey of licensed hunters in North Carolina in spring 2008. Coastal Region Estimates.

No. of Does Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	62800	63.50	62800	63.50
1	17798	18.00	80598	81.49
2	10922	11.04	91520	92.54
3	3135	3.17	94655	95.71
4	2124	2.15	96778	97.85
5	1112	1.12	97891	98.98
>=6	1011	1.02	98902	100.00

Table 6c: Frequency of hunters killing various numbers of bucks 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008.   Coastal Region Estimates.

No. of Bucks Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	57339	57.98	57339	57.98
1	23866	24.13	81205	82.11
2	11326	11.45	92531	93.56
3	4247	4.29	96778	97.85
4	1719	1.74	98497	99.59
5	101	0.10	98599	99.69
>=6	303	0.31	98902	100.00

Table 7a: Frequency of hunters killing various numbers of deer 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Mountain Region Estimates.

No. of Deer Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	32 866	60.98	32 866	60.98
1	10 416	19.32	43 282	80.30
2	6 472	12.01	49 754	92.31
3	1 820	3.38	51 574	95.68
4	1 112	2.06	52 686	97.75
5	607	1.13	53 293	98.87
>=6	607	1.13	53 900	100.00

Table 7b: Frequency of hunters killing various numbers of does 03/01/2007-02/29/2008, Based on a mail survey of licensed hunters in North Carolina in spring 2008. Mountain Region Estimates.

No. of Does Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	40 450	75.05	40 450	75.05
1	9 506	17.64	49 956	92.68
2	2 528	4.69	52 484	97.37
3	809	1.50	53 293	98.87
4	202	0.38	53 495	99.25
5	202	0.38	53 698	99.62
>=6	202	0.38	53 900	100.00

Table 7c: Frequency of hunters killing various numbers of bucks 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Mountain Region Estimates.

No. of Bucks Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	37 922	70.36	37 922	70.36
1	12 438	23.08	50 361	93.43
2	3 236	6.00	53 597	99.44
3	202	0.38	53 799	99.81
4	0	0.00	53 799	99.81
5	0	0.00	53 799	99.81
>=6	101	0.19	53 900	100.00

Table 8a: Frequency of hunters killing various numbers of deer 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Piedmont Region Estimates.

No. of Deer Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	53 395	49.53	53 395	49.53
1	22 551	20.92	75 946	70.45
2	13 450	12.48	89 396	82.93
3	9 910	9.19	99 306	92.12
4	3 742	3.47	103 048	95.59
5	1 820	1.69	104 868	97.28
>=6	2 933	2.72	107 801	100.00

Table 8b: Frequency of hunters killing various numbers of does 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Piedmont Region Estimates.

No. of Does Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	72 103	66.89	72 103	66.89
1	20 731	19.23	92 834	86.12
2	9 000	8.35	101 835	94.47
3	2 730	2.53	104 565	97.00
4	1 719	1.59	106 284	98.59
5	405	0.38	106 689	98.97
>=6	1 112	1.03	107 801	100.00

Table 8c: frequency of hunters killing various numbers of bucks 03/01/2007-02/29/2008, based on a mail survey of licensed hunters in North Carolina in spring 2008. Piedmont Region Estimates.

No. of Bucks Killed	Number of Hunters	Percent of Hunters	Cumulative Frequency	Cumulative Percent
0	65 631	60.88	65 631	60.88
1	28 417	26.36	94 048	87.24
2	12 337	11.44	106 385	98.69
3	1 112	1.03	107 498	99.72
4	202	0.19	107 700	99.91
5	101	0.09	107 801	100.00
>=6	0	0.00	107 801	100.00

Table 9: Partition of total hunter days for mean kill comparison for
deer hunters in the 2007-2008 Hunter Harvest Mail Survey.

Deer Hunter Days	Number Hunters in Sample	Hunter Mean Kill	SE of Mean
0-9	986	0.61396	0.034279
10-19	666	1.23803	0.068252
20-29	345	1.90862	0.125158
30-39	181	2.30886	0.161401
40-49	82	2.94462	0.267632
50-59	39	2.97436	0.426021
>=60	68	3.52547	0.520172
total	2367	1.3111375	0.040829

Table 10: Percentage by type in the sample and then adjusted response rates of general license type categories with different lengths.

License Type Lengths	Initial Sample Size	% of Total Licenses	% Response to Survey
6 days	120	1.24	61.26
12 months	5 875	60.87	48.71
Lifetime	3 657	37.89	68.52
Overall	9 652	100.00	56.37

Table 11: Percentages of all sampled hunters pooled over all license types that have various numbers of days of eligibility to hunt during the year.

Eligible Hunting Days in Year	Number of Sampled Hunters	Percentage of Sampled Hunters
1-6	129	1.34
7-50	44	0.46
51-150	717	7.43
151-200	380	3.94
201-364	573	5.94
365	7 808	80.90
Overall	9 652	100.00

Table 12: Age and sex distribution of actual respondents vs. the initial sample contacted which reflects the proportions in the population.

Sex	Age Group	Initial No.	Initial Sample %	Respondent No	Respondent %
Female	Age <=20	68	16.55	36	13.95
	20< age<=30	78	18.98	49	18.99
	30< age<=40	66	16.06	41	15.89
	40< age<=50	82	19.95	49	18.99
	50< age<=60	54	13.14	39	15.12
	Age >=60	63	15.33	44	17.05
Male	Age <=20	767	9.36	418	8.31
	20< age<=30	1157	14.12	555	11.03
	30< age<=40	1 488	18.16	826	16.42
	40< age<=50	1 690	20.62	1 001	19.90
	50< age<=60	1 355	16.53	895	17.79
	Age >=60	1 739	21.22	1 335	26.54
Female	All	411	4.78	258	4.88
Male	All	8 196	95.22	5 030	95.12

Table 13: Investigation of response effects by mailing, means for days hunted and mean kill for each of the three mailings for six species.

Deer Sample: 2367

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	67.05	15.87	1.36
Mailing 2	22.39	14.26	1.17
Mailing 3	10.56	13.93	1.34

Dove Sample: 991

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	69.12	3.21	14.84
Mailing 2	20.38	3.41	15.43
Mailing 3	10.49	3.79	15.18

Duck Sample: 412

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	74.27	15.56	11.10
Mailing 2	15.78	6.68	8.92
Mailing 3	9.95	10.10	14.44

Rabbit Sample: 617

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	68.07	6.80	5.99
Mailing 2	21.39	6.68	6.67
Mailing 3	10.53	6.21	5.92

Squirrel Sample: 691

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	66.71	6.26	6.69
Mailing 2	22.29	5.98	7.46
Mailing 3	11.00	6.00	7.07

Quail Sample: 207

Mailing	Percentage Response	Means Days Hunted	Mean Kill
Mailing 1	66.18	6.20	6.45
Mailing 2	23.67	4.20	7.43
Mailing 3	10.14	3.10	6.29

Appendix- Survey Instrument
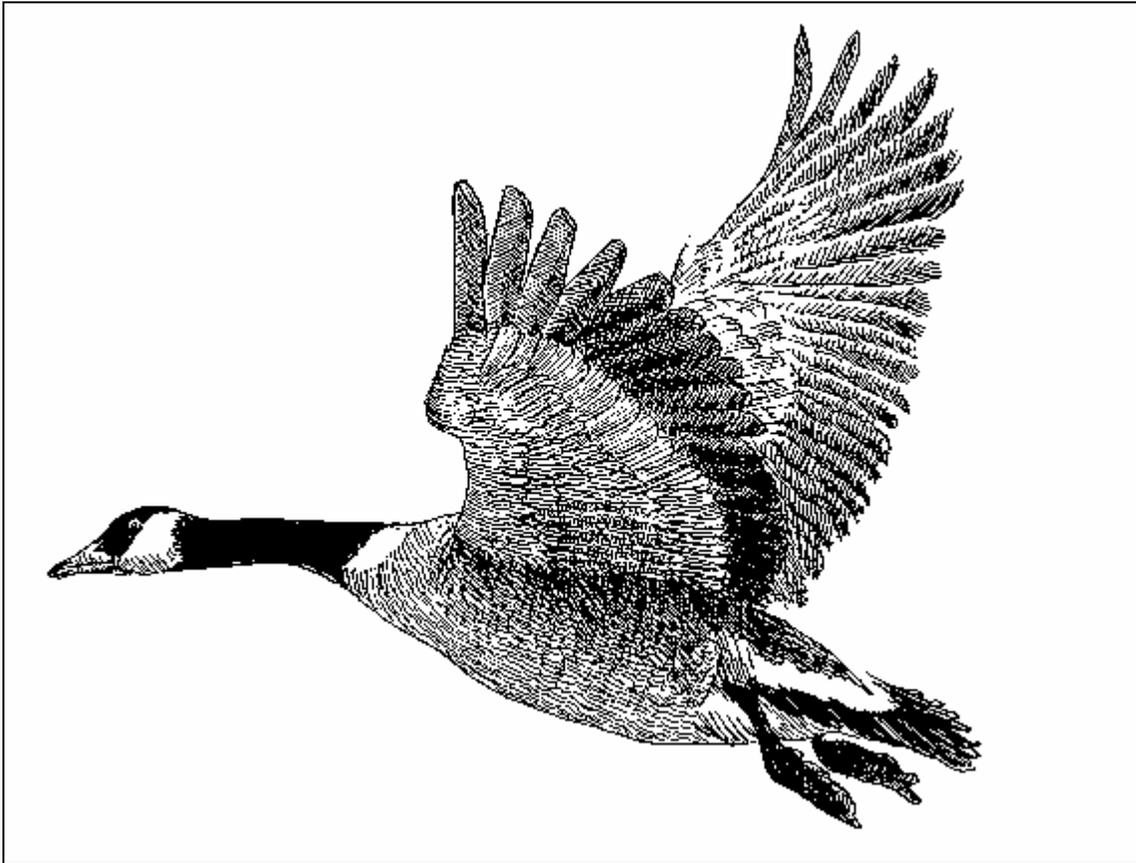
Robert Savannah, U. S. Fish and Wildlife Service

2007-2008 North Carolina Hunter Harvest Survey

Conducted by the North Carolina Wildlife Resources Commission

NORTH
CAROLINA
Wildlife
RESOURCES
COMMISSION

1. **Did you hunt in North Carolina during the 2007-08 season (March 1, 2007 to February 29, 2008)?**

☐ **Yes**   ☐ **No**

If you answered *yes* to the above question, please complete the remainder of the questionnaire and return it in the postage-paid envelope.   If you answered *no,* leave the remainder of the questionnaire blank and return it in the postage-paid envelope.   *Your response is important even if you did not hunt.*

2. **Please complete the following table indicating the number of animals killed and number of days hunted in each region of North Carolina during the 2007-08 season (March 1, 2007 to February 29, 2008). Record only your kill(s).   Do not record kills of others with whom you hunted.**

NOTE: If you hunted for but did not kill a particular species, it is important that you place a "0" under the "Number Killed" heading and indicate the number of days you hunted that species.

Hunting by Regions (See map on following page)

Species	Mountain Days Hunted	Mountain Number Killed		Piedmont Days Hunted	Piedmont Number Killed		Coastal Days Hunted	Coastal Number Killed	
Quail									
Rabbit									
Squirrel									
Grouse									
Raccoon									
Turkey (Spring 2007)									
Duck									
Canada Goose									
Dove									
Woodcock									
Deer		Doe	Buck		Doe	Buck		Doe	Buck
Bear									
Coyote									
Fox									
Wild Boar or Feral Hog									

North Carolina Hunting Regions

Mountain

Piedmont

Coastal

ALLEGHANY
ASHE
WATAUGA
AVERY
MITCHELL
YANCEY
MADISON
BUNCOMBE
HAYWOOD
SWAIN
GRAHAM
CHEROKEE
CLAY
MACON
JACKSON
TRANS-SYLVANIA
HENDER-SON
POLK
RUTHERFORD
MCDOWELL
BURKE
CALDWELL
WILKES
SURRY
ALEX-ANDER
CATAWBA
CLEVELAND
GASTON
LINCOLN
IREDELL
YADKIN
STOKES
FORSYTH
DAVIE
DAVIDSON
ROWAN
CABARRUS
MECKLENBURG
UNION
STANLY
ROCKINGHAM
GUILFORD
RANDOLPH
MONTGOMERY
ANSON
RICHMOND
CASWELL
PERSON
ALAMANCE
ORANGE
CHATHAM
LEE
MOORE
SCOT-LAND
GRANVILLE
DURHAM
WAKE
HARNETT
HOKE
ROBESON
VANCE
FRANKLIN
WARREN
JOHNSTON
CUMBER-LAND
BLADEN
COLUMBUS
BRUNSWICK
NORTHAMPTON
HALIFAX
NASH
WILSON
WAYNE
SAMPSON
DUPLIN
PENDER
NEW HANOVER
EDGECOMBE
GREENE
LENOIR
JONES
ONSLOW
GATES
HERTFORD
BERTIE
MARTIN
PITT
CRAVEN
PAMLICO
CARTERET
CHOWAN
WASH-INGTON
BEAUFORT
PER-QUIMANS
PASQUOTANK
CAMDEN
CURRITUCK
TYRRELL
DARE
HYDE

Thank you!

If you have any comments you would like to share with us, please write them below.

Please use the enclosed addressed and postage-paid envelope, or return this survey to:

    Hunter Harvest Survey
    N.C. Wildlife Resources Commission
    1722 Mail Service Center
    Raleigh, NC 27699-1722