Hunter Use of Publicly Managed Mourning Dove Fields

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Abstract: We attempted to quantify hunter use in five publicly managed mourning dove (*Zenaida macroura*) fields during the 2007 and 2008 dove hunting seasons on Conoho Farms (CF) in Martin County, North Carolina. Self-administered diary surveys ($n = 845$) were mailed to every individual receiving a special hunt (SH) and point-of-sale (PS) permit during both dove hunting seasons on CF. We used the modified Tailored Design method to collect hunter effort and harvest data for each hunting season. Data were analyzed using the Kruskal-Wallis test to determine differences in hunter effort and harvest between seasons and permit types. The adjusted overall response rate for the survey was 74.7%. Only 141 (22.7%) respondents reported hunting doves at CF. Respondents reported expending 801.75 hours ($\bar{x} = 4.01$, SE 0.13), firing 6782 shots ($\bar{x} = 33.91$, SE 2.25), and harvesting 1331 doves ($\bar{x} = 6.66$, SE 0.36) during the 2007–2008 dove hunting seasons. When estimated to the entire population of permitted dove hunters using CF, hunters would have expended 1092.17 hours, fired 9239 shots, and harvested 1813 doves. Hunters reported firing a mean of 5.68 (SE 0.33) shots per harvested dove. Hunter effort, measured in hours expended and shots fired, and dove harvest per hunting event did not differ between seasons, but were significantly greater for SH permittees than PS permittees. The results of this study demonstrate the benefits of conducting targeted surveys of hunters on local scales and the potential for the use of such surveys in management and conservation.

Key words: harvest, hunter effort, North Carolina, mourning dove, Zenaida macroura

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In North Carolina, mourning doves (*Zenaida macroura*) are the most harvested game species and second only to white-tailed deer (*Odocoileus virginianus*) in the number of hunters that pursue them (Pollock and Wen 2009). The annual mourning dove harvest in North Carolina is approximately 1,503,095 birds (Pollock and Wen 2009). Most dove hunting occurs in the coastal region of North Carolina, containing approximately 51% of the hunters, 58% of the harvest, and 54% of the days hunted (Pollock and Wen 2009).

Since the 1950s, the North Carolina Wildlife Resources Commission (NCWRC) has conducted mail surveys to estimate total harvest and hunter effort (Pollock and Wen 2009). For dove hunting, this survey has only provided statewide or regional estimates for the total number of hunters, hunter effort (in hunter days only), and birds harvested. Data on other hunting characteristics of North Carolina dove hunters, such as weapon or ammunition use or the number of shots fired per harvested bird, have not been collected.

As part of a study aimed at quantifying the effects of habitat management on environmental factors affecting doves, we surveyed dove hunters in five publicly managed mourning dove fields in North Carolina during the 2007 and 2008 dove hunting seasons. Our objectives included: 1) quantifying hunter effort—using the number of hours hunted, shots fired, and doves harvested within (and around) five dove fields in eastern North Carolina, and 2) comparing differences in hunter effort and harvest between permit types and hunting seasons. This allowed us to obtain detailed information on specific characteristics of North Carolina dove hunters which had not been previously published.

Dove Hunting in North Carolina

Season Structure

The U.S. Fish and Wildlife Service determines the framework for all dove hunting seasons in the United States, including the maximum number of hunt days, season date range, daily bag limit, and the number of season splits. Each state wildlife agency establishes specific dove seasons within the federal framework. The NCWRC adopted dove hunting seasons using the maximum allowable hunting opportunity provided by the framework for 2007 and 2008. The season dates, daily bag limits, and possession limits for 2007 and 2008 in North Carolina were: 1 September 2007 – 12 January 2008 (bag: 12; possession: 24) and 1 September 2008 – 10 January 2009 (bag: 15; possession 30). Each season had three splits and allowed a maximum of 61 and 62 hunt days, respectively.

The NCWRC also has the authority to limit hunting activity on publicly owned and managed lands (hereafter game lands) in North Carolina. To hunt on the Roanoke River Wetlands Game Land (RRWGL), any licensed hunter must obtain a special permit

from the NCWRC through the Permit Hunt Opportunities Program (PHOP). On the RRWGL, a special hunt (SH) permit, limited to five days, must be obtained to hunt mourning doves during the first two weeks of the season. After the first two weeks of the season, a point-of-sale (PS) permit for small game must be obtained to hunt doves on any legal day during the remainder of the season. The administrative fee for both permit applications during our study was US$5. A daily hunter quota of 50 hunters per day was established for the five SH days; the number of hunters on RRWGL was not limited during the PS days (i.e., no quota).

For the 2007 season, legal shooting hours for doves were from 1200 until sunset for the first week (1–8 September 2007) and 0.5 h before sunrise until sunset for the remainder of the season. For the 2008 season, legal shooting hours were from 1200 until sunset for opening day (1 September 2008) only, and 0.5 h before sunrise until sunset for the remainder of the season.

Permitting System

Application deadlines for SH permits to hunt doves on RRWGL were 10 August in both years. The PS permit did not have an application deadline; hunters could begin applying for PS permits 1 July for the upcoming season and could continue to apply until the end of that season. Hunters applying for the SH permit were allowed up to five hunt choices (i.e., hunt days; hereafter SH days), which had to be listed in preferential order. Permit quotas for the five SH days were met both years. The NCWRC used a permit-draw system to randomly draw applicants for each of the five SH days. After all random draws occurred for the five SH days, hunters were mailed a permit for the specific SH days for which they were drawn within three days of the draw. SH permits for the RRWGL allowed hunters to harvest only mourning doves. Permittees were allowed to use any of the five designated fields at RRWGL to hunt doves.

Given the absence of a permit quota, any hunter who applied for a PS permit during the 2007 and 2008 hunting seasons obtained a permit for that year. PS permits became valid at the time of purchase, and remained valid for the rest of that season. PS permits allowed hunters to harvest small game species, including eastern cottontails (*Sylvilagus floridanus*), eastern gray squirrels (*Sciurus carolinensis*), fox squirrels (*Sciurus niger*), American woodcock (*Scolopax minor*), northern bobwhite (*Colinus virginianus*), and mourning doves, although not all PS permittees may have purchased the permit to specifically hunt doves. Any hunter who applied for a SH or PS permit was required to provide their Customer Identification Number with the NCWRC, which was linked to their hunting license information: full name, address, date of birth, gender, phone number, and county of residence (for North Carolina residents only) in the NCWRC licensing database.

The NCWRC uses hunter information entered into the permitting system to conduct an annual harvest survey of all hunters who obtain a permit through the PHOP in North Carolina. The annual harvest survey, mailed to successful applicants with their permit, is designed to obtain information from hunters on their overall hunt experience, including the total number of days and hours they hunted game lands, the total number and species of game harvested, their overall satisfaction with the hunt, and the factors influencing their satisfaction. Using the same hunter information in the PHOP permitting system, we mailed an additional, more-detailed questionnaire to individuals permitted to hunt doves on the RRWGL in eastern North Carolina.

Study Area

This study was conducted at Conoho Farms (CF), a segment of the RRWGL. RRWGL is publicly owned and managed by the NCWRC and consists of 16,985 ha in Bertie, Halifax, Martin, and Northampton counties, North Carolina. RRWGL is a permit-only hunt area for hunting white-tailed deer, wild turkey (*Meleagris gallopavo*), small game, mourning dove, and waterfowl.

The NCWRC manages five fields in the RRWGL specifically for mourning dove hunting; all are located <1 km from each other within CF in Martin County, North Carolina. These fields have been managed intensively for dove hunting since 1997 and range in size from 1.5 ha to 13.4 ha. These dove fields were chosen for this study because they were: 1) concurrently being used for other research in which hunter effort needed to be quantified (Douglass 2011); 2) reported as having heavy hunter use; 3) managed consistently by the same NCWRC employees each year; and 4) were located within a permit-only hunt area.

Methods

Study Design

Self-administered diary questionnaires were mailed to every individual receiving a SH or PS permit to hunt doves on CF during the 2007 and 2008 dove hunting seasons. We used the modified Tailored Design method (Dillman 2000) to collect hunter effort and harvest data for each hunting season. Each permittee was contacted multiple times via mail with personalized letters (signed by hand), printed on NCWRC letterhead, accompanying each questionnaire. The survey instruments and letters were worded carefully to reduce confusion, appear friendly, and emphasize the importance of responding. Each mailing included a letter, survey instrument, map of the study area, and a postage-paid business reply envelope.

Twelve 25.4- × 30.5-cm plastic signs were placed at the entrance to and along the edges of each field to identify them in relation to the survey. Two 43.2- × 74.9-cm metal signs were attached to

10.2- × 10.2-cm wooden posts behind plastic mailboxes at each of the two parking lots to remind hunters to complete the questionnaire. Blank questionnaires were left in the mailboxes for hunters to keep track of their hunt as it occurred or to complete in lieu of the questionnaire mailed to them. For this study, we assumed that: 1) survey participants told the truth and kept track of the specific information requested; 2) non-respondents would not have answered differently than respondents; and 3) each portion of each field had an equal chance of being hunted.

Mailings

Four mailings were sent to the SH permittees and six mailings to the PS permittees. All mailings were sent via regular postage, except the final mailing to the PS permittees which was sent via priority mail both years. Mailings to SH permittees included: 1) initial survey sent to all permittees two weeks prior to the opening of the dove season, 2) postcard reminder sent to all permittees two days after the hunter's last permitted SH day; 3) survey re-mailed to all non-respondents two days after the last SH day; and 4) survey re-mailed to all remaining non-respondents two weeks after the third mailing. Mailings to PS permittees included: 1) initial survey sent on the second week of the dove season (i.e., one week prior to the start of the PS season) to all hunters purchasing a permit prior to the season and three times per week throughout the remainder of the season for hunters as they purchased a permit, 2) postcard reminder sent to all permittees on the last day of the first split in the season; 3) postcard reminder sent to all permittees on the last day of the second split in the season; 4) survey re-mailed to all non-respondents one week after the end of the dove season; 5) survey re-mailed to all remaining non-respondents three weeks after the end of the dove season; and 6) survey re-mailed to all remaining non-respondents five weeks after the end of the dove season. We included two extra mailings for PS permittees because they had more days available to hunt doves than SH permittees.

Continuous data collected from permittees included the number of hours hunted, shots fired, and doves harvested. Categorical data included the firearm (including gauge for shotguns), shot size, and shot weight primarily used each day (specific date); and the specific field(s) hunted each day. Multiple hunts within a day by a single hunter, regardless of which field they used, were recorded as individual hunting events. Gender, age, and residency were also obtained for each permittee from the NCWRC licensing database.

Statistical Analysis

Statistical analyses were completed using SAS software (Version 9.2 of the SAS System for Windows, SAS Institute, Inc., Cary, North Carolina). We used the χ^2 goodness of fit test to examine differences in response by gender, age group, and residency, and we compared mean age of respondents and non-respondents using the Wilcoxon rank sum test ($P \leq 0.05$). We used the Kruskal-Wallis test to evaluate differences in hunting effort and harvest between seasons and permit types ($P \leq 0.05$). Estimates for the total number of hours hunted, shots fired, and birds harvested were calculated using an adaption of the cell mean imputation method where the missing values for survey items from non-respondents are replaced with the mean value of respondents for the corresponding survey items, and using the percent of respondents who reported hunted for the non-respondents as well (Pollock and Wen 2009).

Results

Response Rates

Of the survey instruments ($n = 845$) mailed to permitted dove hunters on CF during the 2007 and 2008 dove hunting seasons, 620 (73.4%) were returned (respondents), 210 (24.9%) were not returned (non-respondents), and 15 (1.8%) were returned as undeliverable. An adjusted overall response rate of 74.7% was calculated after undeliverable surveys were removed. All responses within legal limits (e.g., number of doves harvested within bag limits or number of hours hunted within legal shooting hours) were retained for analysis. We censored data that were unrecognizable or unrealistic.

Permit Use and Hunter Effort

Of the 620 respondents, only 141 (22.7%) reported hunting doves at CF. Using the same percentage of respondents who hunted (22.7%), approximately 192 individuals of the 845 permitted individuals would have hunted on or around the five fields at CF during the 2007–2008 dove hunting seasons, based on estimates for the entire population of permitted dove hunters. Permit use for dove hunting was higher for the SH permittees (76.0% and 63.6%) than the PS permittees (0.5% and 2.4%) for 2007 and 2008, respectively.

Overall, 141 dove hunters expended a total of 801.75 hours and fired 6782 shots on or around the fields at CF during the 2007–2008 dove hunting seasons. Hunters reported expending an average of 4.01 hours (SE 0.13, median 4.0) and shooting 33.91 shells (SE 2.25, median 25.0) per hunting event (Table 1). When estimated to the entire population of dove hunters permitted to use CF, approximately 1092.17 hours were expended and 9239 shots fired on or around the fields at CF during the 2007–2008 dove hunting seasons. Hunters reported using one to four fields per day across all seasons and permit types, with the majority (90.2%) hunting only one field per day.

There were no differences in hunter effort between years. The mean number of hours hunted ($P = 0.0854$) and the mean number

Table 1. Comparison of hunting effort per hunting event, between the 2007 and 2008 dove hunting seasons and between the special hunt (SH) and point-of-sale (PS) permittees, as reported by dove hunters using Conoho Farms, a segment of Roanoke River Wetlands Game Land, Martin County, North Carolina.

Category	*n* hunters	*n* hunting events[a]	Total hours hunted by all respondents (%)	Mean hours hunted per hunting event (SE)	Total shots fired by all respondents (%)	Mean shots fired per hunting event (SE)
Year 2007	74	104	440.5 (54.9)	4.24 (0.19)	3175 (46.8)	30.53 (2.59)
Year 2008	68	96	361.25 (45.1)	3.76 (0.18)	3607 (53.2)	37.57 (3.73)
				$P = 0.0854$		$P = 0.5619$
SH permit	136	191	779.25 (97.2)	4.08 (0.13)	6731 (99.2)	35.24 (2.31)
PS permit	6	9	22.5 (2.8)	2.50 (0.16)	51 (0.8)	5.67 (0.82)
				$P = 0.0075$		$P = 0.0003$
Combined	142	200	801.75	4.01 (0.13)	6782 (100)	33.91 (2.25)

a. The number of hunting events for which hunters responded to this question; not all hunters reported information for all days.

of shots fired ($P = 0.5619$) per hunting event did not differ between the 2007 and 2008 hunting seasons (Table 1). There was, however, a difference in the hunter effort between permit types. The mean number of hours hunted ($P = 0.0075$) and the mean number of shots fired ($P = 0.0003$) per hunting event was significantly greater for SH permittees. The most dove hunting occurred during the SH days, with 97.2% of the hours hunted and 99.2% of the shots fired occurring within the first two weeks of the season across both years (Table 1). Hunter effort, measured in the mean number of hours hunted ($P = 0.0042$) per field per hunting event, differed among fields. Whereas the mean number of shots fired ($P = 0.1348$) per field per hunting event did not differ (Table 1).

Dove Harvest

Overall, hunters harvested 1331 doves on or around the fields at CF during the 2007–2008 dove hunting seasons, with a mean of 6.66 doves (SE 0.36, median 6.0) per hunting event (Table 2). When estimated to the entire population of permitted dove hunters using CF, approximately 1813 birds were harvested on or around the fields at CF during the 2007–2008 dove hunting seasons. One hundred thirty (92.2%) of the 141 hunters harvested ≥1 dove during ≥1 hunting event during the 2007–2008 hunting seasons; we considered these individuals successful hunters, for the purposes of this study. The mean number of shots fired per harvested dove ranged from 0.38–31.0, with an overall mean of 5.68 (SE 0.33) shots fired per harvested dove.

Although there was no difference in dove harvest between years ($P = 0.1059$), we did document a difference in dove harvest between permit type ($P = 0.0011$). SH permittees harvested more doves per hunting event than PS permittees (Table 2).

Table 2. Comparison of dove harvest per hunting event, between the 2007 and 2008 dove hunting seasons and between the special hunt (SH) and point-of-sale (PS) permittees, as reported by dove hunters using Conoho Farms, North Carolina.

Category	*n* hunters	*n* hunting events[a]	Total doves harvested by all respondents (%)	Mean doves harvested per hunting event (SE)
Year 2007	74	105	634 (47.6)	6.04 (0.45)
Year 2008	68	96	697 (52.4)	7.34 (0.58)
				$P = 0.1059$
SH permit	136	191	1317 (98.9)	6.90 (0.37)
PS permit	6	9	14 (1.1)	1.56 (0.23)
				$P = 0.0011$
Combined	142	201	1331 (100)	6.66 (0.36)

a. The number of hunting events for which hunters responded to this question; not all hunters reported information for all days.

Firearm and Ammunition Preferences

The two firearms most often used for dove hunting on CF included 12-gauge (85.6%) and 20-gauge (11.4%) shotguns; other gauges (16-gauge, 28-gauge, or unknown) were used <3% of the time. Hunters reported using No. 7 ½ (55.2%) and No. 8 (37.8%) sized shot more often than any other shot size; the other three responses (No. 6, No. 7, and unknown) totaled <7%. Hunters reported using 28.35 g (1 oz; 46.3%) and 31.89 g (1 ⅛ oz; 32.3%) more often than any other shot weight.

Non-response Bias

Given our 74.7% adjusted response rate, we did not quantify non-response bias and assumed that respondents represented all permitted dove hunters on CF. Given the length of the hunting seasons each year, we felt the recall error of responses obtained post-season would have outweighed the benefits of attempting to quantify non-response.

Comparisons of gender ($P = 0.1934$) and North Carolina residency ($P = 0.4281$) post-survey were not different between respondents and non-respondents. However, non-residents ($n = 37$, or 4.5%) and females ($n = 18$, or 2.2%) constituted only a small frac-

tion of the permitted dove hunters ($n = 845$). Mean age ($P \leq 0.0001$) and age group, in 10-year increments, ($P = 0.0004$) differed between respondents and non-respondents. The mean age of respondents ($\bar{x} = 48.07$, SE 1.08; median = 48) was higher than non-respondents ($\bar{x} = 42.65$, SE 0.63; median = 44). Age of permittees ranged from 10 to 77 yr for non-respondents and 6 to 90 yr for respondents ($\bar{x} = 40.54$, SE 1.10).

Discussion

The results of our study demonstrate the value of conducting targeted surveys of hunters on local scales. Through such localized surveys, managers may be able gather more detailed information from a greater proportion of the hunting population of interest. For example, our survey of 845 hunters using CF resulted in an adjusted response rate of 74.7% over four and six mailings. Conversely, Pollock and Wen (2009) only obtained a response rate of 56% over three mailings to 9652 hunters for the North Carolina Hunter Harvest Mail Survey in 2007–2008, and Palmer (2007) also reported a lower adjusted response rate, 60.4% over four mailings to 9518 hunters for the 2005–2006 Harvest Survey of North Carolina Hunters.

Our high response rate is most likely a result of several factors, including the timing of survey mailings, number of survey mailings, and population size. Our survey mailings were sent to permittees throughout the season, serving as a reminder to complete the questionnaire as the hunting activity was occurring, whereas both statewide hunter harvest surveys were mailed to licensees after the hunting season had ended. In addition, we sent four and six survey mailings to the entire population of permitted dove hunters on CF. In both statewide hunter harvest surveys, three and four survey mailings were sent to a random selection of 2% of the licensed hunters in North Carolina. The differences in response rates between hunter surveys conducted on localized and statewide levels reveal the effectiveness of localized surveying with mid-season mailings and persistent follow-ups in retrieving data.

We can further compare certain aspects of our survey with that of the annual harvest survey, using the exact same population of hunters. Unlike the 2005–2006 and 2007–2008 statewide hunter harvest surveys, the annual harvest survey is mailed to every individual obtaining a permit through the PHOP permitting system. Therefore, the individuals we surveyed with a SH permit for RRWGL, for the 2007 and 2008 hunting seasons, also received the annual harvest survey. Because the annual harvest surveys only provided response rate data for dove hunting by the SH permittees (D. R. Palmer, NCWRC, unpublished data), we were unable to compare our results with those of the annual harvest surveys for the PS permittees. The response rates we received for the SH permittees for both years of the study (77.4% and 83.2%, respectively) were almost twice that received for the annual hunter harvest survey (33.9% and 42.7%, respectively). Again, we suspect the difference in response rates is due to differences in the localized nature of this study and the number of survey mailings used, and suggest that multiple survey mailings might be required to achieve larger sample sizes in human dimension studies of hunters.

In addition to higher response rates, localized surveys can also provide high resolution data on hunter use of managed lands. For instance, within our study, permit use by SH permittees was greater than PS permittees for both years. Two possible explanations for higher permit use by SH permittees are more doves are present during the first two weeks of the season and that dove fields at RRWGL continue to be managed specifically for dove hunting during that time. In addition, PS permits are sold after the first two weeks of the dove season and coincide with other game seasons, including white-tailed deer, eastern cottontails, eastern gray squirrels, fox squirrels, American woodcock, and northern bobwhite. Therefore, PS permit holders could have switched to hunting white-tailed deer, the most popular game species in North Carolina (Pollock and Wen 2009), or chose to use their PS permit to hunt other small game species. The concurrent seasons for these species could have impacted the hunter's choice to use their PS permit, or to purchase a PS permit, to hunt doves. In addition, verbal and written feedback received from the PS indicated their lack of awareness that the PS permit for small game allowed dove hunting. More explicit advertisement of the PS permit allowances could result in higher permit use by PS permittees for dove hunting.

Hunter effort also differed by permit type. SH permittees hunted more hours and fired more shots than PS permittees. Differences in hunter effort also translated into differences in hunter harvest. SH hunters were more successful than PS hunters, harvesting more doves per hunting event than PS permittees hunters. Haas (1977) reported temporal reduction in harvest after the first two weeks of the dove season in South Carolina, which he attributed to a reduction in the number of doves present. In addition, changes in dove behavior and activity through the season could also impact hunter effort. Foraging activity by doves in managed fields may vary throughout the hunting season as a result of migration patterns or seed availability due to changes in crop condition (Bonnot et al. 2011). Alternatively, the decrease in hunter effort after the first two weeks of the dove season, from SH to PS permittees, could be a result of conflicting game seasons or a lack of advertisement for dove hunting under the PS permits. While hunter effort may change with permit use, overall hunter harvest does not seem to differ between local and statewide surveys. Overall, 93% and 94% of respondents were successful in harvesting at least one dove,

in 2007 and 2008 respectively, similar to the results of the annual harvest survey for SH permittees (94% and 90%) (D. R. Palmer, NCWRC, unpublished data).

One advantage of the more targeted survey is the ability to collect more detailed hunter use information. For instance, we collected information on the number of shots fired per harvested dove, which was not available through statewide harvest surveys in North Carolina. Our results on the mean number of shots fired per harvested dove falls within the range of shooting rates reported by Lewis and Legler (1968), Haas (1977), and Schulz et al. (2002). Lewis and Legler (1968) reported a range of 5.4 to 8.3 shells fired per harvested dove over two days in a field in Tennessee. Haas (1977) reported an average of 8.6 shots fired (range of 7.3 to 9.5) per bird bagged from observations of 1230 dove hunters across north-central South Carolina. Schulz et al. (2002) documented a range of 6.3 to 6.6 shots fired per harvested dove as reported by 788 dove hunters on two fields in Missouri. Variation in the number of shots fired by SH and PS permittees could be a function of shooting skill or hunting experience, which may be explained by the wide variation in age of the permittees and timing of the season.

Management Implications

Localized surveys can prove to be an effective tool for managers of public hunting lands, allowing the collection of detailed information on hunter effort, harvest, and success. Such high resolution data could be important in fine tuning management strategies for game species. For instance, the current permitting system in North Carolina for the PHOP allows any hunter purchasing a PS permit to hunt small game, including mourning doves, on the particular game land for which they applied. However, PS hunters may not be aware they may legally harvest doves after the second week of the season, as indicated by the minimal amount of hunter effort expended by PS hunters for dove hunting, and as a result, may divert their hunting effort to other game species. If increased participation in dove hunting after the second week of the dove season is of interest, the NCWRC may consider a more clear and direct advertisement of which species may be legally harvested under a PS permit for small game.

With the majority of hunter effort and dove harvest occurring during the first two weeks of the season, dove hunting opportunities in North Carolina may be expanded by increasing the number of SH hunt days available. Increasing the bag limit would most likely increase harvest, as evident by our study results, but the bag limit regulations are specified within the federal framework and cannot be changed by the NCWRC. The NCWRC could, however, effectively increase the season length by increasing the number of SH days available on game lands, while adhering to the federal framework, which may also increase the harvest given the high hunter effort and harvest during the current SH days. We believe that dove hunting regulations may be used to maximize hunting opportunity, in North Carolina and in other states with similar permitting programs, while maintaining the current dove harvest in the Atlantic Flyway by regulating the amount of hunter activity within the first two weeks of the current season structure.

The ability to collect detailed information on certain aspects of hunter effort, such as shots fired, can also provide valuable data for other studies. For example, permitted dove hunters reported firing 6782 shots over the five managed dove fields at CF, resulting in the potential deposition of 2,558,529 shot pellets in this area over a two-year period. Whether variation in hunter effort affects environmental variables such as shot concentrations is yet unknown; however, detailed survey results in combination with manipulative field experiments could help state wildlife agencies better manage public lands for the conservation of natural resources.

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Literature Cited

Bonnot, T.W., J.H. Schulz, and J.J. Millspaugh. 2011. Factors affecting mourning dove harvest in Missouri. Wildlife Society Bulletin 35:76–84.

Dillman, D.A. 2000. Mail and internet surveys: the tailored design method. John Wiley and Sons, Inc, New York, New York.

Douglass, K.E. 2011. The effects of tillage on shot concentrations in publicly managed mourning dove fields in North Carolina. Thesis, North Carolina State University, Raleigh.

Haas, G.H. 1977. Unretrieved shooting loss of mourning doves in North-Central South Carolina. Wildlife Society Bulletin 5:123–125.

Lewis, J.C. and E. Legler. 1968. Lead shot ingestion by mourning doves and incidence in soil. Journal of Wildlife Management 32:476–482.

Palmer, D.R. 2007. 2005–2006 Harvest survey of North Carolina hunters. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Pollock, K.H. and Z. Wen. 2009. Analysis of the North Carolina Hunter Harvest Survey 2007–2008. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Schulz, J.H., J.J. Millspaugh, B.E. Washburn, G.R. Wester, J.T. Langian III, and J.C. Franson. 2002. Spent-shot availability and ingestion on areas managed for mourning doves. Wildlife Society Bulletin 30:112–120.