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IMPACTS OF FEEDING FIELDS AND SHOOTING HOURS ON MOURNING DOVES AND DOVE HUNTING IN ILLINOIS

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**IMPACTS OF FEEDING FIELDS AND SHOOTING HOURS ON
MOURNING DOVES AND DOVE HUNTING IN ILLINOIS**

FINAL REPORT

Federal Aid Project W-117-R-5

Submitted by:

Cooperative Wildlife Research Laboratory, SIUC

Presented to:

**Division of Wildlife Resources
Illinois Department of Natural Resources**

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July 1998

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FINAL REPORT

STATE OF ILLINOIS

W-117-R, Study 2

PROJECT PERIOD: 1 July 1995 through 30 June 1998

STUDY 2: Impacts of feeding fields and shooting hours on mourning doves and dove hunting in Illinois

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NEED: Hunters using Illinois public shooting fields harvest approximately 1.5 million mourning doves annually. In 1993, hunting hours for doves were extended to include mornings for the first time in Illinois since 1958. To evaluate the impact of this regulatory change on hunters and doves, 2 basic questions need to be addressed: (1) Has daily hunter success and enjoyment (e.g., the number of quality hunting days) changed as a result of the new hunting hours? and (2) How have the new hunting hours affected the behavior and physiology of mourning doves?

Longer hunting hours may increase hunter satisfaction by providing additional opportunity for harvesting mourning doves. However, this increased opportunity may not be realized if the majority of the hunters still prefer to hunt in the afternoon, if increased hunting activity forces doves to use other feeding sites, or if the shooting fields are "shot out" in a few days. Central to the latter problems is the effect of morning or all day hunting on dove behavior and physiology.

Length of foraging time and migration distance are positively correlated to the fat reserves (stored energy) of some avian species (Carpenter et al. 1993, Young and Moore 1993). Thus, if all day or morning hunting decreases the rate of food acquisition, doves may stay in the local area longer until their energy reserves are replenished. Hatching year mourning doves, although pre-migratory, were faithful to local feeding areas even under heavy gunning pressure

(Losito and Mirarchi 1991). This raises the question, was this exhibition of site tenacity because of some minimum energy reserve that doves must acquire before migration? If this is true, are migratory birds under the same energy constraints during en route foraging as local birds preparing to migrate? Alternatively, fuel replenishment may be so important that doves will simply abandon areas where they are not allowed to feed undisturbed for some minimum time. For example, other migratory birds abandon feeding areas with high predation rates, even when they must give up high quality food (Alerstam and Lindström 1990). These conflicting biological factors make predicting the impact of the new hunting hours on doves in Illinois difficult, at best, without conducting field studies on hunter success and dove ecophysiology.

OBJECTIVES

1. Determine if (1) hunting success and (2) hunter satisfaction differs on IDNR land that is being managed for all day, morning only, and afternoon only hunting.
2. Determine if the behavior of mourning doves using feeding fields varies among the above hunting regimes.
3. Determine if the above hunting regimes affect the local movements of doves.
4. Assess the energetic costs associated with increased hunting time and relate them to the bird's daily energy budget, movements, and energy stores for migration.
5. Provide recommendations to improve harvest management of mourning doves in Illinois.

EXECUTIVE SUMMARY

In 1993, the Illinois Department of Natural Resources (IDNR) extended the noon to sunset hunting day for mourning doves (*Zenaida macroura*) to sunrise to sunset in an attempt to increase hunting opportunities. Major changes to wildlife management strategies such as this may have unforeseen population repercussions and also affect hunter success and satisfaction. The IDNR, Division of Wildlife Resources staff recognized this and planned to carefully monitor the new season. We began a research project designed to assess the potential impacts of extended hunting hours on mourning doves and dove hunting in central and southern Illinois. Because the purpose of extending hunting hours was to provide hunters with more hunting opportunities, the project also investigated hunter use to determine whether hunters used the increased opportunities, and whether hunter satisfaction increased as a result.

The 5 study objectives were addressed in 4 jobs that are summarized below. Methods, results, and conclusions are presented in the job narratives that follow. During Segment 5 we completed all planned activities and tasks to meet the goal and all objectives of this project.

Job 2.1. Hunter success and satisfaction

Objectives were to determine if (1) hunting success and (2) hunter satisfaction differs on IDNR land that is being managed for all day, morning only, and afternoon only hunting. Surveys of dove hunters revealed that the season changes did not provide the expected benefits and hunter hours were less important than other factors in determining hunting success and hunter satisfaction. A majority of hunters (67%) indicated that they would hunt more if all day hunting were permitted. However, there was no evidence that many hunters took advantage of the increased opportunity to hunt more total hours. More hunters (44%) indicated that the experimental hunting hour restrictions we employed had not effected their opportunities to shoot doves than thought the hunting hours increased (30%) or decreased (26%) their hunting opportunities. Overall, 66% of hunters rated their experience as good to excellent, 26% fair to

okay, and only 8% poor to bad. More hunters (31%) chose a hunting site on the day they completed the survey based on the quality of dove fields than for any other reasons; only 2% chose a site because of convenient hunting hours. When hunters were asked to rate, in order of importance, 5 factors important in determining hunting success, 59% of respondents rated hunting hours as least important to neutral; only 15% of hunters ranked shooting hours as the most important factor.

Job 2.2. Dove behavior and movements

The objectives were to determine if (1) the behavior of mourning doves using feeding fields varied among all day, morning only, and afternoon only hunting regimes; and (2) if the different hunting regimes affected the local movements of doves. Behavioral studies using “artificial resource patches” in public hunting fields to indicate energetic “costs” of foraging during hunting season did not indicate that hunting hour regime influenced dove foraging behavior. Also, hunting hour regime did not explain the variance in the number of doves seen, or counted entering state public hunting fields. We concluded that site quality played a more important role in dove use of public hunting fields than hunting hour regime.

Job 2.3. Energetic costs and stress related to hunting

The objective was to assess the relative energetic costs or level of stress associated with each hunting regime. We were able to measure and detect changes in concentrations of corticosterone in plasma collected from both live and harvested mourning doves and conclude that corticosterone radioimmunoassays are a useful tool to detect stress in mourning doves. Hunting elicited a stress response in some mourning doves as evidenced by elevated corticosterone levels. However, although individuals within the sampled population had corticosterone concentrations indicative of stress, mean values were within the range of preseason samples suggesting that population effects were not detected.

Job 2.4. Analysis and Report

The objective was to provide recommendations to improve harvest management of Mourning Doves in Illinois. Following is a summary of our recommendations based on findings and conclusions from Jobs 2.1-3. We recommend that extended hunting hours be continued. However, increases in hunter use of extended hunting hours would necessitate reevaluation. Therefore, we recommend that hunter use of sites be monitored to detect changes in patterns and magnitude of hunter use.

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ACKNOWLEDGMENTS

This study was one that required a great deal of support from a number of Illinois Department of Natural Resources staff to achieve our objectives. Site managers and their staffs helped distribute and collect questionnaires, collected vegetation samples, helped maintain our “artificial resource patches”, and assisted with dove counts to assess field use. Some District Wildlife Biologists provided recommendations, collected and shipped data, and also helped conduct dove counts to monitor field use. Upland Wildlife Program Manager John Cole and Project Manager Larry David were instrumental in obtaining and coordinating assistance from IDNR staff; the study would not have been possible without their unwavering support and encouragement.

STUDY 2. IMPACTS OF FEEDING FIELDS AND SHOOTING HOURS ON MOURNING DOVES AND DOVE HUNTING IN ILLINOIS

STUDY SITES

The majority of dove hunting in Illinois occurs in the central and southern portions of the state, therefore, we selected 21 public hunting fields in central and southern Illinois as experimental study sites (Table 1, Fig. 1). Sites were selected based on records of moderate to heavy hunting pressure and harvest and continuing plans to plant sunflower (*Helianthus* spp.) as the principal dove attracting crop. Selected sites were assigned to triplets (Table 1) based on proximity and similar levels of hunting pressure. Study sites within triplets were assigned to 1 of 3 hunting hour regimes (morning only [MO], sunrise until noon; afternoon only [AO], noon until 1700 hours; and all day [AD], sunrise until 1700 hours) randomly so that each site had a different hunting hour regime (Table 1). Hunting hour regimes were changed annually so that no site had the same regime for more than 1 year. Size, shape, management regulations, and the surrounding habitat matrix differed among some study sites. However, because sites were grouped by regime and regimes were randomly changed the second year (no systematic bias) the interpretation of results among regime and years should not be affected.

Table 1. Experimental hunting sites, grouped by triplet, used during the 1995 through 1997 mourning dove hunting seasons in central and southern Illinois. Site abbreviations, triplet designation, and yearly hunting hour regime are listed for each site. Hunting hours for each hunting hour regime were 0600 - 1700 at all day (AD) sites, 1200 - 1700 at afternoon only (AO) sites, and 0600 - 1200 at morning only (MO) sites.

| Study Sites | Triplet | Abbreviation | Hunting Regime | | |
|---|---------|--------------|----------------|------|------|
| | | | 1995 | 1996 | 1997 |
| Clinton Lake State Recreational Area | 1 | CLSRA | AO | AD | MO |
| Lake Shelbyville Wildlife Management Area | 1 | LSWMA | MO | AO | AD |
| Moraine View State Park | 1 | MVSP | AD | MO | AO |
| Hidden Springs State Forest | 2 | HSSF | AO | MO | AD |
| Fox Ridge State Park | 2 | FRSP | MO | AD | AO |
| Crawford County Fish & Wildlife Area | 2 | CCFWA | AD | AO | MO |
| Randolph State Fish & Wildlife Area | 3 | RSFWA | AO | AD | MO |
| Kaskaskia River Fish & Wildlife Area | 3 | KRFWA | MO | AO | AD |
| Washington County Conservation Area | 3 | WCCA | AD | MO | AO |
| Sam Parr Fish & Wildlife Area | 4 | SPFWA | AO | AD | MO |
| Ramsey Lake State Park | 4 | RLSP | MO | AO | AD |
| Stephen A. Forbes State Park | 4 | SAFSP | AD | MO | AO |

Table 1. Continued

| Study Sites | Triplet | Abbreviation | Hunting Regime | | |
|--------------------------------------|---------|--------------|----------------|------|------|
| | | | 1995 | 1996 | 1997 |
| Mt. Vernon Game Propagation Center | 5 | MVGPC | AO | AD | MO |
| Hamilton County Fish & Wildlife Area | 5 | HCFWA | MO | AO | AD |
| Sam Dale Lake Fish & Wildlife Area | 5 | SDFWA | AD | MO | AO |
| Giant City State Park | 6 | GCSP | AO | AD | MO |
| Mernmet Lake Fish & Wildlife Area | 6 | MLFWA | MO | AO | AD |
| Saline County Fish & Wildlife Area | 6 | SCFWA | AD | MO | AO |
| I-24 Wildlife Management Area | 7 | IWMA | AO | MO | AD |
| Union County Conservation Area | 7 | UCCA | MO | AD | AO |
| Horseshoe Lake Conservation Area | 7 | HLCA | AD | AO | MO |

JOB 2.1 HUNTER SUCCESS AND SATISFACTION

Objectives: Determine if (1) hunting success and (2) hunter satisfaction differs on IDNR land that is being managed for all day, morning only, and afternoon only hunting.

INTRODUCTION

Because dove hunting is a highly traditional sport (Hanson and Kossack 1963), dove hunters may not make use of the increased hunting opportunities available to them, and therefore, no change in hunter satisfaction would be expected. Alternatively, satisfaction may decline if hunters feel compelled to hunt at non-traditional times in order to secure a spot to hunt. Such beliefs may be compounded if hunters perceive a drop in success, whether real or not, from hunting during non-traditional times. In order to ensure that dove management strategies continue to meet the needs of the hunting public, hunter opinions about the IDNR's extension of dove hunting hours were surveyed.

In order to evaluate the efficacy of extending the hunting day, managers must know hunter opinions about the proposed changes, why hunters hold those beliefs, and what aspects of dove hunting contribute most to hunter satisfaction (i.e., will the change affect an aspect of dove hunting that hunters feel is important to their satisfaction?). We monitored hunter opinions during the 1995 through the 1997 mourning dove hunting seasons to determine the effects of extended hunting hours on satisfaction.

METHODS

Hunter opinions were solicited each year using hunter surveys approved by the Human Subjects Committee at Southern Illinois University at Carbondale (SIUC) (Appendix A). The 1995 survey consisted of 5 core items on which subsequent year's surveys were based and expanded (Appendix B). The core items used in 1995 asked hunters when they would hunt the most, when they preferred to hunt, whether they would hunt more under all day hunting, and whether they would hunt the same site again in subsequent years given the existing hunting hour regime. However, a phrasing change in the final question in 1996 prevented comparison for that

question among years. The 1996 survey built on the core questions by asking why hunters preferred certain hunting times, and how their behavior would respond to change in hunting hours (Appendix C). We also solicited basic demographic data in 1996, and asked hunters to rate the site they had hunted. We used the 1997 survey to determine whether satisfaction varied with hunting hour regime, and to determine what factors played the greatest role in hunter satisfaction (Appendix D).

Surveys were completed voluntarily and anonymously by hunters at each study site during each hunting season. In 1995, surveys were available to hunters from 1 September until 31 October; in 1996 from 1 September until 17 October; and in 1997 from 1 September until 14 October. Completed surveys were collected by site staff at the end of the hunting day and were shipped to the Cooperative Wildlife Research Laboratory (CWRL) at the end of the sampling period. Survey data were entered into a database for analyses. We used SYSTAT (Wilkinson 1990) and Statistix (Analytical Software 1996) to complete Chi-square contingency table analyses of hunter responses by hunting hour regime. Independence was determined at an $\alpha = 0.05$ level. Core items were also analyzed by year and across years.

Hunter use and success were determined from hunter check-in sheets. Hunters on Illinois public hunting fields are required to sign-in upon arrival, and to sign-out and record their bag upon departure. We determined hunter compliance by comparing the number of surveys returned per site with the number of hunters signed in. Hunter success was defined as doves harvested per hunter day (1 hunter day = 1 hunter hunting 1 day) and as harvest per day. Hunter use was defined as hunter days. Success and use were compared among hunting hour regimes using Statistix (Analytical Software 1996).

RESULTS

We received 3,187 completed surveys over the 3 years of the study; 1,285 surveys were returned in 1995, 1,005 in 1996, and 897 in 1997. The compliance rate was 50% in 1995 and 59% in 1996, but declined to only 36% in 1997.

Hunter Demographics

Data were collected on gender, age, and the number of miles traveled one-way between hunting site and residence in 1996 and 1997. Mean (\pm SE) hunter age for both years combined was 36.2 ± 0.3 ; years; hunters averaged 36.4 ± 0.5 years of age and 35.9 ± 0.5 years in 1996 and 1997, respectively. Most dove hunters completing questionnaires who identified gender were male (1,803), but in 1996, 4 females completed surveys and 14 women did so in 1997. Hunters traveled a mean one-way distance between their residence and the hunting site of 65.5 ± 2.1 km; the longest reported distance (1,609 km reported by a group of hunters from Texas) was not included in the mean. Distance traveled did not vary among hunting hour regimes ($F_{2,1860} = 2.37$, $P = 0.0916$).

Hunter Surveys 1995 - 1997

Aspects of Hunter Harvest.—Self-reported hunter harvest over the 3 years of the study averaged 6.0 ± 0.1 doves/hunter (4.0 ± 0.1 doves/hunter in 1995, 5.9 ± 0.2 doves/hunter in 1996, and 8.9 ± 0.2 doves/hunter in 1997). Harvest differed among hunting hour regimes ($F_{2,3147} = 29.74$, $P < 0.001$), and among years ($F_{2,3141} = 148.75$, $P < 0.001$). There also was a significant year by hunting hour regime interaction ($F_{4,3141} = 44.71$, $P < 0.001$). Fewer doves were harvested at MO sites than at AO or AD sites. Only 1.3 ± 0.1 doves/hunter were reported crippled during this study (0.9 ± 0.1 cripples/hunter in 1995, 1.2 ± 0.1 in 1996, and 1.9 ± 0.1 in 1997). Crippled losses were 22% of the retrieved harvest over the 3 years of the study.

Hunters reported firing an average of 28.0 ± 0.5 shots while hunting doves between 1995 and 1997 (18.1 ± 0.7 shots in 1995, 29.4 ± 0.9 shots in 1996, and 40.6 ± 1.0 shots in 1997). The number of shots fired accounted for 52% of the variance in harvest ($F_{1,3116} = 3,321.3$, $P < 0.001$). Hunters fired 5.7 ± 0.1 shots/dove for every dove retrieved. The number of shots fired per retrieved dove differed by hunting hour regime and year ($F_{2,2403} = 3.82$, $P = 0.0217$; $F_{2,2403} = 10.98$, $P < 0.0001$, respectively). More shots per dove were fired at AO sites than at AD sites,

but there were no differences between MO and AO sites. Furthermore, more shots were fired per dove in 1995 than in 1996 or 1997.

Time spent hunting averaged 3.6 ± 0.04 hours; 3.2 ± 0.1 in 1995, 4.5 ± 0.1 in 1996, and 3.1 ± 0.1 hours in 1997. Hunting hours differed by both hunting hour regime and year ($F_{2,3074} = 152.73$, $P < 0.0001$ and $F_{2,3074} = 39.76$, $P < 0.0001$, respectively). Morning only hunters spent less time hunting than hunters at AO or AD sites. Hunters also hunted longer in 1996 than in 1995 or 1997. The amount of time spent hunting accounted for only 2% of the variance in harvest ($F_{1,3064} = 64.99$, $P < 0.001$). One-way distance between a hunter's residence and the hunting site accounted for <1% of the variance in time spent hunting ($F_{1,1802} = 6.21$, $P = 0.0128$), in 1996 and 1997. Hunters averaged 13.2 ± 0.2 years of experience hunting doves, and reported experience did not vary among years (13.0 ± 0.3 in 1995, 13.3 ± 0.4 in 1996, and 13.4 ± 0.4 years in 1997).

Hunters in 1997 were asked whether they had completed dove hunter surveys in either of the past 2 hunting seasons (1995 and 1996). Most hunters had not completed hunter surveys (58%) in either the 1995 or the 1996 dove season, and there was no effect of hunting hour regime on responses ($\chi^2 = 3.37$, $df = 2$, $P = 0.1855$). Of those hunters that had completed surveys in the past, 6% had completed one in 1995 only, 49% had completed one in 1995 and 1996, and 45% had completed one in 1996 only. Responses were dependent on hunting hour regime ($\chi^2 = 15.24$, $df = 4$, $P = 0.0042$), but this was due to differences at AD sites only.

Hunter Use.—One method of evaluating extended hunting hours was to monitor hunter use of the 3 hunting hour regimes. Increasing the length of the hunting day should increase the number of hunting opportunities for dove hunters. However, there was no difference in hunter days, obtained from hunter sign-in sheets, among hunting hour regimes for any year of the study (Table 1). Harvest, also determined by hunter sign-in sheets, did not differ among hunting hour regime any year of the study (Table 1).

Core Questions 1995 - 1997. –Given the choice of only hunting one time of day, 40% of surveyed hunters indicated that they would hunt most frequently in the morning and 30% would hunt most frequently in the afternoon; 29% indicated that they would hunt the same amount of time under either option (Table 2). Response was not independent of hunting hour regime ($\chi^2 = 70.05$, $df = 6$, $P < 0.0001$; Table 2). Afternoon only hunters differed from MO and AD hunters in that 40% of AO hunters would hunt more often given afternoon hunting, whereas only 33% and 26% of MO and AD hunters, respectively, preferred afternoon hunting.

A majority of hunters (67%) indicated that they would hunt more if all day hunting were permitted (Table 3). Hunter response was independent of hunting hour regime ($\chi^2 = 3.43$, $df = 4$, $P > 0.05$). More hunters preferred hunting morning and afternoon (36%) than preferred hunting morning only (30%) or afternoon only (30%), and there was an effect of hunting hour regime on response ($\chi^2 = 55.71$, $df = 6$, $P < 0.001$; Table 4). A vast majority of hunters (85%) indicated that they would continue to hunt the same site the following year if the hunting times remained the same as the current year (Table 5).

The 1996 Hunter Survey. –The purpose of the 1996 dove hunter survey was to determine why dove hunters held certain opinions about extended hunting hours. Details of that survey were reported by Woolf and Roseberry (1997). Following are highlights of that report.

When questioned why they would hunt more often either mornings or afternoons, 59% of respondents indicated that dove hunting was better during that time of day and 25% percent indicated that either afternoons or mornings were more convenient. Responses differed among regimes ($\chi^2 = 17.28$, $df = 6$, $P = 0.0083$).

Fifty-eight percent of respondents indicated that they would hunt more days and longer per hunting trip, 18% percent would hunt more days only, and 24% would hunt longer per trip only, if AD hunting were allowed. Of those hunters indicating that they would not hunt more often if AD hunting were permitted, 71% indicated that either the extra hours were not needed (34%), or that AD hunting caused faster shoot-out (37%). Only 13% cited traditional AO hours

as the reason for not hunting more if AD hunting were allowed. The reasons reported for not hunting more often or longer if AD hunting was allowed were not influenced by regime ($\chi^2 = 10.20$, $df = 8$, $P = 0.25$).

Twenty-one percent of respondents believed that the hunting hour restrictions increased their opportunities to shoot doves, and 29% thought the restricted hours improved the overall quality of the dove hunt. Conversely, 38% and 31%, respectively, believed that the hunting time restrictions decreased opportunities to shoot doves, or lowered the overall quality of the dove hunt. Regime influenced both the perceived number of shooting opportunities and perceived quality of the hunt ($\chi^2 = 66.11$, $df = 4$, $P = 0.0000$, and $\chi^2 = 28.82$, $df = 4$, $P = 0.0000$, respectively).

The most often cited (57%) reason for a perceived decrease in shooting opportunities was that the restrictions prevented hunting when the most doves were in the field. Seventeen percent of hunters also said that time restrictions were inconvenient or conflicted with their work schedules. Interestingly, when the analysis is broken down by regime, MO and AD sites had a higher proportion of respondents indicating that the hours were inconvenient or conflicted with work (20% and 24%, respectively). Only 10% of hunters at AO sites indicated the hours were inconvenient. Not surprisingly, responses to this item were dependent on hunting regime ($\chi^2 = 30.70$, $df = 8$, $P = 0.0002$).

Of those hunters who indicated an increase in hunt quality, 54% cited an increase in the number of doves to shoot as the reason for the increase and 27% of hunters believed that the restrictions maintain dove populations. Responses were influenced by regime ($\chi^2 = 19.08$, $df = 8$, $P = 0.0144$).

Fifty-one percent of respondents who thought that time restrictions decreased the quality of dove hunting believed that doves were not in the area at the time of day to which hunting was restricted. Seventy-one percent of AO hunters believed that time restrictions prevented them from hunting at a time when doves are in the field. Only 38% of MO hunters and 31% of AD

hunters believed similarly. Responses to this question were dependent on hunting hour regime ($\chi^2 = 55.26$, $df = 4$, $P = 0.0000$).

Overall, hunter respondents in 1996 showed no clear preference for AD, AO, or MO hunting regimes. However, response was dependent on regime ($\chi^2 = 55.26$, $df = 4$, $P = 0.0000$). Morning only hunters preferred hunting AD (47%), whereas 46% of AO hunters preferred AO. All day hunters were more evenly split among their preferences. The most common reason cited (44%) for this preference was that hunting was better and/or more successful at that particular time of day, 23% cited convenience, and 20% believed the preferred hours offered a more enjoyable hunting experience. As was the case with hunter preferences, reasons for preferences were influenced by the regime being hunted ($\chi^2 = 19.03$, $df = 6$, $P = 0.0041$).

An overwhelming majority of hunters (80%) said they would hunt the same site again next year if the hunting hours remained the same, but response was dependent on which regime the hunter was hunting that day ($\chi^2 = 40.48$, $df = 4$, $P = 0.0000$). Similarly, 82% of respondents would hunt the same site if site hours were switched to AO, 77% if switched to MO, and 79% if switched to AD. Only the response for switches to AD were independent of regime ($\chi^2 = 8.33$, $df = 4$, $P = 0.08$).

Hunters were asked to rate the quality of the site they hunted. We expected that these responses were site dependent and related to the hunters estimation of dove presence, the quality of crops, and dove harvest success. However, we can not rule out the possibility that hunting regime may influence 1 or more of these factors, and, therefore, contribute to a hunter's site rating. Site ratings were regime dependent ($\chi^2 = 172.05$, $df = 10$, $P = 0.0000$). Most (77%) respondents rated the site they hunted as "fair" or better, and only 23% rated their site as "okay" or worse.

The 1997 Hunter Survey.—Our intent in designing the 1997 hunter survey was to better define and/or clarify relative importance of hunting hour regime and other factors to hunter satisfaction. More hunters (44%) indicated that the experimental hunting hour restrictions we

employed had no effect on their opportunities to shoot doves than indicated the hunting hours increased (30%) or decreased (26%) their hunting opportunities (Table 6). However, response was strongly dependent on the hunting hour regime to which the respondent was referring ($\chi^2 = 53.00$, $df = 4$, $P < 0.0001$). Responses from MO and AD regimes did not differ much from the mean response across regimes, however 53% of AO respondents believed that afternoon only hours decreased their hunting opportunities (Table 6). Only 14% thought that the hours increased hunting opportunities and 33% thought the hours had no effect (Table 6). Similar to overall responses to the previous item, 46% of hunters did not think that hunting hour regime had any effect on the quality of dove hunting (Table 7). Only 18% of hunters indicated that hunting hours decreased the quality of dove hunting and 36% indicated the hours increased hunting opportunities (Table 7). Although responses to this question were more consistent among hunting hour regimes (Table 7), responses were not independent of regime ($\chi^2 = 17.66$, $df = 4$, $P = 0.0014$). Again respondents hunting at AO sites seemed to be the source of the lack of independence since 31% of AO hunters believed that afternoon only hours decreased the quality of hunting whereas the overall average was 18% (Table 7).

Before assessing which components were important, we determined whether hunters were satisfied. The hunting experience has many components that contribute to hunter satisfaction (Hendee 1974). Three questions investigated the issue of hunter satisfaction. The first item of the series asked hunters to rate their overall hunting experience. The hunting experience encompasses the entire hunting trip from preparations before hand to relaying stories of the hunt to compatriots afterwards (Decker et al. 1980, Hammitt et al. 1989, Hammitt et al. 1990, Hendee 1974, Hazel et al. 1990, Langenau et al. 1981, Potter et al. 1973, Stankey et al. 1973). Overall, 66% of hunters rated their experience as good to excellent, 26% fair to okay, and 8% poor to bad (Table 8). However, there was an effect of hunting hour regime ($\chi^2 = 72.98$, $df = 10$, $P < 0.0001$). Again, AO hunters differed from MO and AD hunters (Table 8). Only 44% of AO hunters rated their experience as excellent to good compared to 75% and 63% for MO and AD

hunters, respectively. Also more AO hunters rated their hunting experience as poor to bad (23%) than did MO (5%) or AD (7%) hunters.

The next item asked hunters to rate the quality of dove hunting at their site. Dove hunting is a subset of the hunting experience which deals with harvest success and ratings of the hunt may differ from ratings of the hunting experience (Hendee 1974). However, on our survey, hunters rated the quality of hunting similarly to how they rated their hunting experience. Overall, 69% of hunters rated hunting quality as good to excellent, 23% as okay to fair, and 8% bad to poor (Table 9). There was also an effect of hunting regime on response ($\chi^2 = 72.29$, $df = 10$, $P < 0.0001$). Again, hunters at AO sites rated hunting quality lower than hunters at AD and MO sites. Whereas 79% of MO respondents and 67% of AD respondents rated hunting quality as good to excellent, only 43% of AO respondents agreed. More AO hunters also rated hunting quality as bad to poor (21%) than hunters at MO (5%) and AD (7%).

The final item in the series asked hunters to rate the quality of the hunting site with respect to its ability to attract doves. We specified field quality to prevent respondents from rating overall site management (e.g., hunting hours). Hunters again overwhelmingly rated hunting field quality as good to excellent (79%), with only 17% rating sites as okay to fair and 4% rating sites as bad to poor (Table 10). The effect of hunting hour regime was again evident and AO sites again appeared to be the source of the differences ($\chi^2 = 97.22$, $df = 10$, $P < 0.0001$; Table 10), albeit to a lesser degree than previously. Eighty-nine percent of respondents at MO sites and 74% at AD sites rated hunting fields as good to excellent, but only 62% of AO sites were rated similarly. Again, there was a higher percentage of unfavorable ratings from AO sites than from MO and AD (13% bad to poor at AO, 1% and 3% at MO and AD, respectively).

More hunters chose a hunting site on the day they completed the survey based on the quality of the dove fields (31%) than for any of the other reasons (Table 11). The convenience of the hunting hours was cited as the reason for choosing the site among only 2% of the survey respondents. Lack of alternative hunting areas (26%) and proximity to residence (23%) were the

2 next most cited reasons. Although dove hunting is often thought of as a traditional sport, only 4% of hunters cited tradition as a reason for hunting a particular site. Responses were not independent of hunting hour regime ($\chi^2 = 70.25$, $df = 12$, $P < 0.0001$; Table 11). Fewer AO hunters selected hunting fields based on site quality (12%) than hunters at MO (37%) and AD (31%) sites. Instead, AO hunters selected their sites based primarily on its proximity to their homes (36%). Only 22% of MO hunters and 20% of AD hunters selected sites based on its closeness to their homes.

Only 5% of hunters cited convenience of hunting hours as a factor in making their hunting experience the best possible (Table 12). The opportunity to shoot at doves was ranked the most important factor by 40% of hunters. However, only 19% cited harvesting the limit as playing the greatest role in making the hunting experience the best possible. The next most important factor according to hunters was being outdoors (16%). Response was not independent of hunting hour regime ($\chi^2 = 31.08$, $df = 14$, $P = 0.0054$; Table 12). Responses of AO hunters again differed in 2 main areas. Fewer AO hunters thought harvesting the limit was the most important factor in good hunting experiences (10%) than MO (20%) and AD (21%) hunters, but more AO hunters thought being outdoors was most the important (26%) in contrast to MO (13%) and AD (17%) hunters.

Finally, we asked hunters to rate, in order of importance, 5 factors important in determining hunting success (Table 13). Factors were rated on a 5 point scale with 1 being most important, 2 important, 3 neutral, 4 unimportant, and 5 least important. Again, hunting hours were not important. Only 15% of hunters rated time of day that hunting is permitted as most important and 26% as important. However, 59% of respondents rated hunting hours as least important to neutral. The most important factor was quality of the dove fields. Sixty-six percent of hunters rated site quality as most important and 20% as important. Only 15% of respondents rated site quality as least important to neutral. Hunter responses to this item were independent of hunting hour regime ($P > 0.05$).

DISCUSSION

Hunting hour regime did not appear to play a major role in hunter success or satisfaction. Two lines of evidence from survey responses lead to this conclusion. First, hunters generally did not believe that hunting hour regime had any impact on their opportunities to shoot at doves, or on the quality of dove hunting. Extending hunting hours was intended to increase hunting opportunity, but there was no evidence that hunters took advantage of the increased opportunity.

The second line of evidence is the high levels of satisfaction hunters reported. Hunters were satisfied with their overall hunting experience, with the quality of the hunt, and with the quality of the hunting fields. Furthermore, hunters were satisfied with their hunt whether it was morning, afternoon, or all day, although AO hunters tended to have lower satisfaction than the other groups. A majority of dove hunters, regardless of hunting hour regime, said they would continue to hunt the same site in subsequent years if the hours they hunted during their current hunting trip remained the same.

Site quality was the most important factor hunters used to make selection decisions; the convenience of hunting hours (i.e., when the hours occurred during the day) was most important for only 2% of the respondents. Lack of alternative hunting sites and distance from residence were more important determining factors than hunting hours. Finally, when asked to rate 5 factors in order of their importance in determining hunting success, a majority of hunters rated hunting hours as either neutral to hunting success, or unimportant to least important.

What about the effects of hunting hours on hunter success? From survey response data and hunter sign-in/out sheets, hunter success does not appear to have been affected by the time of day hunting was permitted. If harvest success was adversely affected by hunting hour regime, or was perceived by hunters to be affected, we would expect this decline in success to be reflected in hunter satisfaction, since success is an important aspect of a satisfying hunting experience (Decker et al. 1980, Hammitt et al. 1989, Hammitt et al. 1990, Hendee 1974, Hazel et al. 1990, Langenau et al. 1981, Potter et al. 1973, Stankey et al. 1973). However, the high level of

satisfaction reported is evidence that hunters did not perceive a decline in hunting success that they could attribute to hunting hours. Second, one measure of success is hunter harvest. If extended hunting hours affected hunter success, we would expect to see differential success among hunting hour regimes. However, IDNR estimates of hunter harvest did not differ among hunting hour regimes during any year of the study.

Overall hunter satisfaction was high, but there was a significant affect of hunting hour regime on hunter responses, due almost exclusively to AO hunters. Hunters at AO sites rated their hunting experience, the hunt itself, and the quality of the hunting fields significantly lower than hunters at MO and AD sites. Furthermore, AO hunters indicated low ratings more often than MO or AD hunters. More AO hunters also believed that AO hours decreased their opportunities to shoot at doves. These results are interesting in light of the fact that AO hunters were hunting the traditional hunting hours in Illinois. Could these low ratings indicate that hunters are dissatisfied with the traditional hunting hours? This is a possibility, but one which our data cannot answer. We can only say that hunters did not rate hunting hours as an important contribution to high-quality dove hunting experiences.

An unexpected result of the dove hunter surveys was the apparent low influence of tradition in the dove hunting experience. Few hunters in 1996 selected tradition as a reason for their hunting hour preference, and in 1997 only 4% of respondents selected their hunting site based on tradition. This is unexpected because dove hunting is considered to be a highly tradition based sport (Hanson and Kossack 1963). It may be that site selection and hunting hours are not traditional aspects of the sport. As we have already demonstrated, site selection was mostly governed by site quality, which influences the number of doves using the site; dove hunters select sites based on potential success. We had assumed that hunting times may have had a traditional basis. Our results, however, show that hunting hours are not based in tradition. This may help explain why there was no differential use of hunting hour regimes; hunters simply hunted when they were allowed.

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Table 1. Hunter use summary for each hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]) during the 1995 through 1997 mourning dove hunting seasons, obtained from hunter sign-in sheets. Hunting hours are as in Table 1, Study 2. Mean and SE are reported for each measure of hunter use. Sample size and *P*-value are reported for each Kruskal-Wallis ANOVA comparison.

| Variable/year | Hunting Regime | | | <i>n</i> | <i>P</i> -value |
|---------------|----------------|-------------|--------------|----------|-----------------|
| | MO | AO | AD | | |
| Hunter Days | | | | | |
| 1995 | 11.8 ± 9.9 | 18.3 ± 15.6 | 9.3 ± 13.3 | 151 | 0.87 |
| 1996 | 6.7 ± 1.8 | 7.7 ± 2.0 | 8.9 ± 2.0 | 213 | 0.76 |
| 1997 | 10.3 ± 2.9 | 10.4 ± 2.8 | 14.1 ± 3.0 | 164 | 0.72 |
| Harvest | | | | | |
| 1995 | 21.0 ± 8.7 | 42.6 ± 9.7 | 33.2 ± 19.5 | 139 | 0.34 |
| 1996 | 24.1 ± 9.4 | 40.5 ± 14.8 | 57.1 ± 19.0 | 213 | 0.71 |
| 1997 | 84.5 ± 29.0 | 61.6 ± 22.9 | 118.1 ± 31.4 | 164 | 0.61 |

Table 2. Hunter responses to core question 1 “If allowed to hunt doves only one time of day, when would you hunt most frequently?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours same as in Table 1, Study 2) from surveys collected during the 1995 through 1997 mourning dove hunting seasons (3173 usable for this question). Percent of total respondents for each regime is given for each response and the number of respondents is given in parentheses. Responses are lumped among years. Response was dependent on the hunting hour regime being used by the respondent ($\chi^2 = 70.05$, $df = 6$, $P < 0.001$).

| Response | Hunting Regime | | |
|-----------------|----------------|------------|------------|
| | MO | AO | AD |
| A. ^a | 41.8 (428) | 32.8 (321) | 44.2 (517) |
| B. ^b | 24.6 (252) | 39.6 (388) | 26.4 (309) |
| C. ^c | 32.0 (327) | 26.4 (259) | 28.0 (328) |

^a Morning.

^b Afternoon.

^c Does not matter.

Table 3. Mourning dove hunter response to core question 2 “Would you hunt more frequently if all day hunting were permitted?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) from 3173 usable surveys collected during the 1995 through 1997 mourning dove hunting seasons. Percent total respondents per hunting regime is given for each response and the number of respondents is given in parentheses. Responses were lumped among years. Hunter response was independent of the hunting regime used by the respondent ($\chi^2 = 3.43$, $df = 4$, $P = 0.488$).

| Response | Hunting Regime | | |
|----------|----------------|------------|------------|
| | MO | AO | AD |
| Yes | 67.6 (691) | 67.9 (665) | 65.2 (763) |
| No | 30.5 (312) | 29.5 (289) | 32.1 (375) |

Table 4. Mourning dove hunter response to core question 3, “When would you rather have hunted?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours as in Table 1, Study 2) from 3173 surveys collected during the 1995 through 1997 mourning dove hunting seasons. Percent total response for each regime is given and the number of respondents is given in parentheses. Responses are lumped among years. Response was dependent on the hunting regime being used by the respondent ($\chi^2 = 55.71$, $df = 6$, $P < 0.001$).

| Response | Hunting Regime | | |
|---------------------|----------------|------------|------------|
| | MO | AO | AD |
| Morning | 32.7 (334) | 22.2 (218) | 34.3 (401) |
| Afternoon | 27.8 (282) | 37.5 (367) | 26.6 (311) |
| Morning & Afternoon | 35.9 (367) | 37.0 (363) | 36.3 (425) |

Table 5. Mourning dove hunter responses to core question 4, “Would you hunt this site again next year if the hunting times stayed the same?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) from 3173 surveys collected during the 1995 through 1997 mourning dove hunting seasons. Percent total response by hunting regime is given for each response and the number of respondents is given in parentheses. Responses were lumped among years. Response was dependent on the hunting hour regime used by the respondent ($\chi^2 = 32.67$, $df = 6$, $P < 0.001$).

| Response | Hunting Regime | | |
|-----------|----------------|------------|-------------|
| | MO | AO | AD |
| Yes | 84.7 (866) | 81.0 (794) | 87.7 (1026) |
| No | 8.0 (82) | 8.0 (78) | 3.8 (44) |
| Undecided | 5.2 (53) | 8.3 (81) | 5.8 (68) |

Table 6. Mourning dove hunter responses to the question, “Do you feel that hunting time restrictions at this site decreased or increased your opportunities to shoot doves?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) from 872 usable 1997 dove hunter surveys. Percent total response by hunting hour regime is given and the number of respondents is given in parentheses. Response was dependent on the hunting regime used by the respondent ($\chi^2 = 53.0$, $df = 4$, $P < 0.0001$).

| Response | Hunting Regime | | |
|-----------|----------------|-----------|------------|
| | MO | AO | AD |
| Increased | 30.7 (122) | 14.2 (17) | 33.5 (119) |
| Decreased | 23.9 (95) | 52.5 (63) | 20.0 (71) |
| No Effect | 45.3 (180) | 33.3 (40) | 46.5 (165) |

Table 7. Mourning dove hunter responses to the question, “Do you feel that the hunting time restrictions at this site increased or decreased the quality of dove hunting?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) for 866 usable 1997 mourning dove hunter surveys. Percent total response by hunting hour regime is given and total number of responses is given in parentheses. Response was dependent on the hunting hour regime being used by the respondent ($\chi^2 = 17.66$, $df = 4$, $P = 0.0014$).

| Response | Hunting Regime | | |
|-----------|----------------|-----------|------------|
| | MO | AO | AD |
| Increased | 36.8 (146) | 24.4 (29) | 38.3 (134) |
| Decreased | 15.9 (63) | 31.1 (37) | 16.9 (59) |
| No Effect | 47.4 (188) | 44.5 (53) | 44.9 (157) |

Table 8. Mourning dove hunter responses to the question, “How would you rate your overall hunting experience at this site today?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) for 880 usable 1997 mourning dove hunter surveys. Percent total response by hunting hour regime is given and the total number of respondents is given in parentheses. Response was dependent on the hunting hour regime being used by the respondent ($\chi^2 = 72.98$, $df = 10$, $P < 0.0001$).

| Response | Hunting Regime | | |
|-----------|----------------|-----------|------------|
| | MO | AO | AD |
| Excellent | 38.9 (155) | 15.8 (19) | 33.2 (120) |
| Good | 36.4 (145) | 28.3 (34) | 29.6 (107) |
| Fair | 12.3 (49) | 18.3 (22) | 20.2 (73) |
| Okay | 7.0 (28) | 14.2 (17) | 10.5 (38) |
| Poor | 3.5 (14) | 14.2 (17) | 5.3 (19) |
| Bad | 1.8 (7) | 9.2 (11) | 1.4 (5) |

Table 9. Mourning dove hunter responses to the question, “How would you rate the overall quality of dove hunting at this site today?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) for 878 usable 1997 mourning dove hunter surveys. Percent total respondents per hunting regime is given and the total number of respondents is given in parentheses. Responses were dependent on the hunting hour regime used by the respondent ($\chi^2 = 72.29$, $df = 10$, $P < 0.0001$).

| Response | Hunting Regime | | |
|-----------|----------------|-----------|------------|
| | MO | AO | AD |
| Excellent | 38.9 (155) | 20.0 (24) | 34.2 (123) |
| Good | 39.7 (158) | 23.3 (28) | 32.5 (117) |
| Fair | 11.8 (47) | 20.0 (24) | 16.9 (61) |
| Okay | 4.8 (19) | 15.8 (19) | 9.4 (34) |
| Poor | 3.5 (14) | 12.5 (15) | 5.3 (19) |
| Bad | 1.3 (5) | 8.3 (10) | 1.7 (6) |

Table 10. Mourning dove hunter response to the question, “How would you rate the quality of this hunting site in terms of its ability to attract doves for hunting?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours as in Table 1, Study 2) for 878 usable hunter surveys returned at the end of the 1997 mourning dove season. Percent total response by hunting hour regime is given and the total number of respondents is given in parentheses. Responses were dependent on the hunting hour regime used by the respondent ($\chi^2 = 72.29$, $df = 10$, $P < 0.0001$).

| Response | Hunting Regime | | |
|-----------|----------------|-----------|------------|
| | MO | AO | AD |
| Excellent | 47.7 (189) | 24.2 (29) | 37.2 (134) |
| Good | 41.4 (164) | 37.5 (45) | 36.4 (131) |
| Fair | 4.8 (19) | 12.5 (15) | 16.9 (61) |
| Okay | 5.1 (20) | 12.5 (15) | 6.4 (23) |
| Poor | 0.8 (3) | 7.5 (9) | 2.8 (10) |
| Bad | 0.2 (1) | 5.8 (7) | 0.3 (1) |

Table 11. Mourning dove hunter responses to the question, “What attribute of this state public hunting field most influenced your decision to hunt here today?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) for 851 usable surveys returned at the end of the 1997 mourning dove hunting season. Percentage of total responses by regime is given and total number of respondent for each response is reported parenthetically. Hunter responses were dependent on the hunting hour regime used by the respondent ($\chi^2 = 70.25$, $df = 12$, $P < 0.0001$).

| Response ^a | Hunting Regime | | |
|-----------------------|----------------|-----------|------------|
| | MO | AO | AD |
| A. | 24.7 (96) | 26.1 (31) | 26.7 (92) |
| B. | 21.7 (84) | 36.1 (43) | 20.1 (69) |
| C. | 36.9 (143) | 11.8 (14) | 31.1 (107) |
| D. | 0.0 (0) | 1.7 (2) | 4.4 (15) |
| E. | 1.0 (4) | 10.1 (12) | 5.2 (18) |
| F. | 4.4 (17) | 4.2 (5) | 2.3 (8) |
| G. | 11.3 (44) | 10.1 (12) | 10.2 (35) |

^a Responses were as follows:

- A. Lack of Alternative areas/sites to hunt doves
- B. Near to my home
- C. Quality of dove fields
- D. Convenience of hunting hours
- E. Low hunter numbers / Site less crowded
- F. Tradition; I always hunt here
- G. Other (open response)

Table 12. Mourning dove hunter responses to the question, “What factor plays the greatest role in making your dove hunting experience the best possible?” by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2) for 857 usable surveys returned during the 1997 mourning dove hunter survey. Percent of total responses by hunting hour regime is given and the total number of respondents is given in parentheses. Hunter responses were dependent on the hunting hour regime used by the respondent ($\chi^2 = 31.08$, $df = 14$, $P = 0.0054$).

| Response ^a | Hunting Regime | | |
|-----------------------|----------------|-----------|------------|
| | MO | AO | AD |
| A. | 19.7 (77) | 9.8 (12) | 21.2 (73) |
| B. | 5.9 (23) | 9.0 (11) | 7.3 (25) |
| C. | 4.1 (16) | 7.4 (9) | 4.6 (16) |
| D. | 45.6 (178) | 38.5 (47) | 34.8 (120) |
| E. | 12.8 (50) | 26.2 (32) | 16.5 (57) |
| F. | 1.5 (6) | 1.6 (2) | 2.9 (10) |
| G. | 3.9 (15) | 3.3 (4) | 3.8 (13) |
| H. | 6.4 (25) | 4.1 (5) | 9.0 (31) |

^a Responses were as follows:

- A. Harvesting the limit
- B. Interaction with other hunters
- C. Convenient hunting hours
- D. Being able to shoot at doves
- E. Being outdoors
- F. Absence of other dove hunters
- G. Accessibility of site
- H. Other (open response)

Table 13. Mourning dove hunter rating of 5 factors based on how the hunter perceived their importance in determining hunter success, arranged by hunting hour regime (morning only [MO], afternoon only [AO], and all day [AD]; hunting times are as in Table 1, Study 2) from 348 usable surveys returned at the end of the 1997 mourning dove hunting season. Most important factors were rated as 1 and least important factors as 5. Ratings of 1 or 2 indicated that the factor was important to hunter success, a rating of 3 indicated the factor was neutral in determining hunter success, and ratings of 4 or 5 indicated that the factor was not important to hunter success. Percent of hunters giving a particular rating is reported. All ratings were independent of the hunting hour regime used by the hunter as determined by a Chi-square test ($P > 0.05$).

| Factor ^a /Regime | Hunter Rating | | | | |
|-----------------------------|---------------|-----------|-----------|-----------|-----------|
| | 1 | 2 | 3 | 4 | 5 |
| A. | | | | | |
| MO | 10.9 (28) | 26.1 (67) | 24.1 (62) | 21.0 (54) | 17.9 (46) |
| AO | 19.1 (17) | 28.1 (25) | 23.6 (21) | 13.5 (12) | 15.7 (14) |
| AD | 18.6 (38) | 24.0 (49) | 19.6 (40) | 19.1 (39) | 18.6 (38) |
| B. | | | | | |
| MO | 70.4 (181) | 17.9 (46) | 7.8 (20) | 2.0 (5) | 2.0 (5) |
| AO | 64.0 (57) | 21.4 (19) | 6.7 (6) | 5.6 (5) | 2.3 (2) |
| AD | 60.8 (124) | 21.1 (43) | 12.3 (25) | 3.4 (7) | 2.5 (5) |
| C. | | | | | |
| MO | 5.5 (14) | 9.3 (24) | 23.7 (61) | 30.4 (78) | 31.1 (80) |
| AO | 2.3 (2) | 9.0 (8) | 25.8 (23) | 36.0 (32) | 27.0 (24) |
| AD | 3.9 (8) | 11.8 (24) | 29.9 (61) | 30.4 (62) | 24.0 (49) |
| D. | | | | | |
| MO | 5.8 (15) | 22.6 (58) | 24.5 (63) | 25.7 (66) | 21.4 (55) |
| AO | 11.2 (10) | 18.0 (16) | 18.0 (16) | 21.4 (19) | 31.5 (28) |
| AD | 7.8 (16) | 14.7 (30) | 18.6 (38) | 27.0 (55) | 31.9 (65) |
| E. | | | | | |
| MO | 7.4 (19) | 24.5 (63) | 19.8 (51) | 20.2 (52) | 28.0 (72) |
| AO | 4.5 (4) | 22.5 (20) | 25.8 (23) | 23.6 (21) | 23.6 (21) |
| AD | 9.3 (19) | 27.9 (57) | 19.6 (40) | 20.1 (41) | 23.0 (47) |

^a Factors are as follows:

- A. Time of day that hunting is permitted
- B. Quality of dove field crops
- C. Length of time spent hunting
- D. Weather conditions bring doves into area
- E. Number of hunters / hunting pressure per day

JOB 2.2 DOVE BEHAVIOR AND MOVEMENTS

Objectives: Determine if (1) the behavior of mourning doves using feeding fields varies among all day, morning only, and afternoon only hunting regimes; and (2) if the different hunting regimes affect the local movements of doves.

INTRODUCTION

In an effort to improve hunter success and satisfaction in response to increasing demand, the IDNR changed hunting hours in 1993 to allow all day hunting. However, adverse effects may result from longer hunting days. For example, increased hunting pressure (one possibility of increased hunting hours) may cause local dove populations to be “hunted out” more rapidly. As a result, fewer quality hunting opportunities would be available over the entire season. Such a decrease in season long hunting opportunities could have implications for hunter satisfaction, since 55% of hunting days spent afield under afternoon hunting occur after the first 7 days of the hunting season (Anderson and David 1994).

Whereas increasing the number of hunters does not necessarily result in a higher probability of being killed (McNamara and Houston 1994), the new hours extend hunting so that doves are exposed to potential harvest for a longer period of time. Doves can respond to increased exposure by 1) shifting their foraging site use; 2) foraging for shorter amounts of time and leaving larger amounts of food un-harvested; 3) increasing vigilance, trading energy gain for safety; or 4) continuing to forage as before, trading safety for energy gain. The effects of hunting pressure, therefore, should be detectable within and between sites.

Within site use, mostly foraging, should reflect optimal behavior. Time spent foraging and the relative amount of resource removed can be predicted using optimal foraging theory. An optimal forager makes decisions based on whether the expected gains exceed the expected costs (Stephens and Krebs 1986). The decision to use or abandon a particular site is governed by foraging economics and Brown’s (1988) model demonstrates that resource exploitation will cease when the energetic, predation, and missed opportunity costs equal the benefits gained by continued exploitation. This model is an extension of Charnov’s (1976) marginal value theorem in that it includes the possibility of alternate activities.

We could predict from these models that: (1) as the costs of foraging on public hunting fields increases, the marginal value of the site's resources should decrease; (2) if the costs of foraging at an alternative site are lower than the costs of foraging on public hunting fields, then doves will abandon public sites in favor of lower cost alternatives; and (3) if the costs of foraging exceed the expected benefits prior to site choice, foragers will select alternate sites, since foraging in the costly site will reduce fitness. Therefore, dove use of public hunting fields should decrease with the advent of the hunting season. Because mourning doves feed heavily early in the morning and again late in the afternoon (Schmid 1965), morning only and afternoon only hunting hour regimes, which allow foraging during one of these intervals, may not be as costly as all day hunting. Schmid (1965) also suggested that the afternoon feeding period may be more important than the morning period; therefore, doves should respond to the differential costs of hunting hour regime by using all day sites least, followed by afternoon only, and morning only sites should have the highest dove use during the hunting season.

Site quality, in terms of food resource density, influences many of the patch and site use decisions faced by an optimal forager. As site quality increases, the marginal value of the resource increases, thus altering the balance between costs and benefits. For example, Kotler and Blaustein (1995) report that for desert rodents, patches in risky habitats need to be 4 - 8 x richer than in safe patches for the patches to be of equal value and receive equal use. Dove responses to the effects of hunting and to hunting hour regime are influenced by the resource density of the site. Sites with high resource levels should have higher levels of dove use. Resource density should also influence dove use among hunting hour regimes, in a manner dependent on the level of hunting at the site (i.e., costs).

METHODS

Behavior

During the 1995 dove season, vigilance behavior was used to determine if any hunting hour regime disrupted dove behavior more than another (Woolf and Roseberry 1997). Personnel limitations and the potential for observer bias warranted development of an observer independent

method for the 1996 dove season. We used the artificial resource patch (ARP) method to study foraging behavior. Controlled field experiments with ARPs allow the animal to remain in its natural habitat where it is subject to the same competitive interactions and predation risk, and where it has the same alternative activities to foraging (Brown 1988). Artificial resource patches measure the giving-up density [GUD; the amount (g) of resource left in the patch when abandoned (Brown 1986, 1988)] and provide a quantitative and a relativistic measure of how foragers view the environment (Bowers and Breland 1996). If a patch has higher associated costs, as from higher predation risk, foragers should abandon the patch at a higher resource level resulting in a higher GUD.

We modified the basic method of Brown (1988) to fit the objectives of the current study. Artificial resource patches consisted of aluminum trays filled with 800 ml of sifted sand into which 30 g of un-husked sunflower seeds were thoroughly mixed. Artificial resource patches were placed at each participating site (Table 1, Study 2) by CWRL personnel. Four patches were placed at each site; 2 patches were placed within 1 m of the field edge and at least 10 m from each other (peripheral patches). Another patch was placed 4 m from each peripheral patch, toward the center of the field (interior patches), and also were 10 m from each other. Interior and peripheral patches were placed within 4 m of each other to control for missed-opportunity costs (Brown 1988). Missed opportunity costs are incurred when doing something else is more productive than foraging, resulting in earlier patch abandonment and higher GUDs. By placing patches near each other, ARPs should have the same missed opportunity costs. The pairs of interior and peripheral trays provided a level of replication. Placing patches in the same habitat types at each site controlled for differences at the microhabitat level within a site (Brown 1988). However, between site climatic conditions differed and potentially could affect dove behavior, therefore, temperature (°F) and weather class (sunny, partly cloudy, cloudy, rainy) data were collected.

Patches were opened to mourning doves at ~0630 hours on 26, 28-30 August, and 1-5 September 1996 by pouring a pre-mixed container of sand and seeds into the tray. At ~1730

hours each day, the remaining seeds and sand were poured back into an appropriately marked container and stored for pick-up. At pick-up, the remaining sunflower seeds were sifted out, another 30 g of sunflower seeds were mixed into the sand, and replacement sand was added in order to return the container to its original volume. Concurrent with ARP data collection, visual observations were made to confirm dove use of the ARPs. The trays were also inspected for dove sign pre-season. Samples from ARPs were cleaned of debris, and weighed to determine the GUD.

Dove Counts

To monitor the influences of hunting hour regime on dove field usage, the number of doves using each site was counted and weather class (sunny, partly cloudy, cloudy, or rain) and temperature (°F) data were collected. Observers counted doves entering, leaving, returning to, and passing over public hunting fields from a fixed location at each site. Location of the count stations at each site was determined by the district wildlife biologists and was restricted to actively hunted fields using sunflower seeds to attract doves and to fields providing the best vantage point for counting doves. Count stations remained the same each year of the study unless fields were rotated out of use, or if sunflowers were not planted. Counts were made on 22, 27, 30, and 31 August, and 1-10, 17, 24, and 30 September in 1995 ($n = 17$); on 26, 28-30 August, and 1-10, 17 September in 1996 ($n = 15$); and on 27-31 August, and 1-5 September in 1997 ($n = 10$). Sampling sessions were 20 minutes in duration with 5-minute sampling intervals. Counts provided an estimate of the number of doves using a public hunting field and the number of doves in the area.

Seed Production

Seed production was chosen as an indicator of site quality and seed dry mass was used to measure seed production. Seed samples were obtained from sites between 28 and 31 August 1995, between 19 and 30 August 1996, and between 24 - 30 August 1997. Sunflower seed heads were collected from 3 1-m² quadrats placed systematically throughout each field. The sampled field was the same used for dove counts. Seed heads from sunflower plants that fell within the

quadrat, but were rooted outside the quadrat also were collected. Because weed production may also influence site quality by lowering seed production and by providing unfavorable, obstructive cover, weed samples were collected from the same quadrats as sunflowers. Site personnel clipped all weeds in the quadrat down to ground level. All collected samples were placed in individual boxes and shipped to our laboratory, or were stored for pick-up by CWRL personnel. Seeds were separated from the seed heads and dried at 50° C for 24 hours to determine dry mass (Chambers and Brown 1983). Weed samples were cut into 3-cm lengths using a paper cutter and dried at 50° C for 24 hours to determine dry mass (Chambers and Brown 1983). In some cases, it was necessary to sub-sample large weed samples before drying. In such cases, total sample weight was obtained before sub-sampling. Percent moisture was calculated for the sub-sample and this value was used to estimate the dry mass of the entire sample. Data on weed and seed dry mass were compared to dove use of public hunting fields.

We assumed “dryer” seeds were better dove attractants because sunflower seeds fell more easily from dry seed heads than from less mature, “wet” seed heads. Furthermore, doves are ground feeders and feed on highly visible and readily obtainable foods (Lewis 1993). Several sites returned vegetation samples in 1996 with high seed biomass, but which were relatively immature and not suitable for attracting doves to shooting fields. To correct for immaturity, we multiplied the dry biomass of each sample by its percent moisture. This value was then subtracted from the dry biomass (i.e., dry mass - (dry mass * % moisture)). Therefore, our transformation weighted dry biomass by attractiveness.

RESULTS

Behavior

Giving-up density (GUD) did not vary between stations ($F_{1,106} = 0.29, P = 0.59$), therefore, they were averaged between stations within sites. Giving-up density differed among days and regime and there was a significant day by regime interaction. There was no significant difference between GUDs of afternoon only (AO) and all day (AD) sites, but morning only (MO) sites differed from both. Pre-hunting and hunting season GUDs did not differ ($t = 0.249, df =$

104.8, $P = 0.804$). However, the number of doves migrating through may have impacted observed GUDs. When total doves counted was included as a covariate in an ANCOVA, there were still no differences between pre-hunting and hunting season GUDs, but counted doves influenced the percent resource consumed ($F_{1,51} = 2.31$, $P = 0.14$; $F_{1,51} = 10.40$, $P = 0.002$, respectively). Weather class affected GUD ($F_{3,84} = 6.12$, $P = 0.001$). Giving-up densities on days classified as “rainy” differed from those classified as “sunny” and “partly cloudy,” but not from those classified as “cloudy.” Temperature, however, accounted for only 2% of the variance in GUD ($R^2 = 0.02$, $F_{1,106} = 2.01$, $P = 0.16$). In a full model regression, hunter days, dove harvest, dove harvest per hunter day, and total doves counted per census did not predict GUD ($R^2 = 0.12$, $F_{4,16} = 0.54$, $P = 0.71$).

Dove Use

Total number of doves counted per sampling interval (total doves) differed among years (Kruskal-Wallis [KW] = 78.7, $P < 0.0001$), therefore, we were unable to combine data across years to analyze for hunting hour regime effects. In 1995, an average of 29.9 ± 3.2 (\pm SE; $n = 289$) total doves were counted, in 1996, 57.5 ± 5.6 ($n = 304$), and in 1997, 177.5 ± 19.9 ($n = 210$). Total doves also differed among years within sites for most study sites ($P < 0.05$). However, because hunting hour regime changed annually, we could not differentiate year from hunting regime effects.

Total doves differed among hunting hour regimes in 1995, 1996, and 1997. In 1995, more doves used MO sites than AD sites, but neither differed from AO sites (Table 1). However, in 1996 dove use of MO only sites was lower than use of both AO and AD sites, but use of AO and AD sites did not differ. The 1997 results follow those of 1996, with AD sites used more than either MO or AO sites. Total doves did not vary by weather class any year of the study ($P > 0.05$). Total doves was greater before hunting than during hunting seasons 1995, 1996, and 1997 (Table 2).

Hunting hour regime did not explain the variance in the number of doves counted entering state public hunting fields (dove entry) in 1995, but did in 1996 and 1997 (Table 1).

Doves entered MO sites less than both AO and AD sites in 1996, but dove entry did not differ between AO sites and AD sites. In 1997, more doves entered AD sites than either MO sites or AO sites (Table 1). Dove entry was higher prior to hunting than during hunting season counts each year of the study (Table 2). Weather class influenced dove entry in 1995 ($P = 0.0145$), but not in 1996 or 1997 ($P > 0.05$).

Total doves counted was positively correlated with site quality measured as seed biomass in 1995 (g seed/m²; $r_{\text{spearman}} = 0.35$), 1996 ($r_{\text{spearman}} = 0.49$), and 1997 ($r_{\text{spearman}} = 0.59$). Weed biomass (g weed/m²) was weakly, positively correlated with mean total doves in 1995 ($r_{\text{spearman}} = 0.17$), but was negatively correlated in 1996 and 1997 ($r_{\text{spearman}} = -0.41$ and $r_{\text{spearman}} = -0.23$, respectively). After weighting seed biomass by maturity, seed biomass positively correlated with the mean total doves ($r_{\text{spearman}} = 0.38$), and with weed biomass ($r_{\text{spearman}} = 0.17$) in 1995. The weighted biomass was positively correlated to the number of doves seen ($r_{\text{spearman}} = 0.60$) and negatively correlated with weed biomass ($r_{\text{spearman}} = -0.52$) in 1996. In 1997, weighting seed biomass by maturity did not affect the correlation with dove use ($r_{\text{spearman}} = 0.57$).

Hunter Use

Hunter use was defined as hunter days and hunter success as harvest, harvest per hunter day, and harvest per hunter hour. Hunter days did not differ among hunting hour regimes in any year (Table 2, Job 2.1). Dove harvest also did not differ ($P = 0.34$) among hunting hour regimes in 1995, 1996 ($P = 0.71$), or 1997 ($P = 0.60$; Table 2, Job 2.1). Harvest per hunter day did not differ among hunting hour regime in 1995 ($P = 0.17$), or in 1997 ($P = 0.51$); however, harvest per hunter day did differ in 1996 ($P < 0.01$). Harvest per hunter hour should be more sensitive than harvest per hunter day because it accounts for differences in the amount of time spent hunting at each site. However, harvest per hunter hour did not differ among hunting hour regimes in any year.

DISCUSSION

Behavior

Hunting hour regime could alter the balance between the costs and benefits of foraging and may lead to reduced patch use times. Morning only GUDs were lower than both AO and AD sites indicating a potentially higher cost for doves foraging at AO and AD sites. Although GUDs may accurately represent a forager's cost-benefit assessment (Kohlmann and Risenhoover 1996), harvest, hunter days and harvest per hunter day were not significant contributors to the variance in GUD.

If GUD was not sensitive to hunting pressure variables in this study, then what factor(s) differed among the 3 hunting hour regimes? Our findings suggest that site quality was influential. The number of doves counted at each site reflected the seed biomass for that site. The site with the highest seed biomass had the highest dove counts. The more doves that are in an area, the more potential foragers there were to exploit the patch, and the higher the likelihood that the patch forager would be a dove.

An alternative explanation may be that high quality sites had average resource densities in excess of those in the ARPs. We used the average resource density of the ARP sites in 1995 as a basis for selecting the resource density for the ARPs in 1996. These values may have been lower than the resource densities at the sites. Patches with lower resource densities than the surrounding environment could have higher GUDs because harvest rate is an increasing function of resource density and foragers could spend their time more efficiently and profitably by foraging outside the ARP trays (Brown 1988, Schmidt and Brown 1996, Valone and Brown 1989). Therefore, differences in site quality among regimes may have resulted in different GUDs. The sites with the highest site qualities also had the highest GUDs, whereas the lowest quality site had the lowest GUD.

Hunting is a form of predation. However, because it is a novel form of predation in evolutionary time, doves may not yet have evolved responses to it. Hunting is also a disruption and gunfire may be the sensory cue to which doves respond. In any case, doves did respond to

hunting by changing both their behavior and field use after hunting began. Vigilance observations obtained for this study in 1995 were recorded approximately 30 minutes after the conclusion of hunting each sample day and should have reflected reduced predation risk and negative energy budgets caused by hunting disrupting feeding (Lusk 1997). However, ARPs were available to foragers during the hunting day and should reflect increased predation risk and energetic requirements. This is exactly what the results indicate, vigilance levels decreased with the advent of the hunting season (Lusk 1997) and GUDs increased while percent consumed decreased.

Dove Use

Although dove use of fields differed among hunting hour regimes every year, the pattern of difference was not consistent among years. In 1995, dove use was higher at MO sites than at AD sites, but this pattern was reversed in subsequent years. Furthermore, since hunter use did not differ among regimes during this study, some other factor (such as site differences) must have been responsible for the observed differences. In 1995, several sites planted crops other than sunflowers, principally wheat and millet that may have altered dove site use decisions. In these cases, doves select sites based on crop type and not hunting hour regime (Brown and Morgan 1995) because these alternative crops could possibly have been of higher value to doves than sunflower seeds even at lower seed dry masses. Shuman et al. (1988) determined the metabolic efficiencies of several dove foods and reported that maximilian sunflowers had lower metabolizable energies than cracked corn, proso millet, and wheat, all of which were planted at dove study sites in 1995.

Alternatively, differences among years may have resulted from flooding effects. In 1995, severe flooding along the Mississippi and other Illinois rivers may have resulted in low dove use of study sites. This flooding delayed planting of sunflower fields and in some cases prevented the planting of fields entirely. Delayed planting results in sunflower fields that are too immature to attract significant numbers of doves. In 1996, conditions were not as severe and overall dove use increased over that of 1995. However, high levels of soil moisture still delayed planting at

some sites. No delayed plantings were reported in 1997 and overall dove use was the highest of the 3 years of the study.

Foragers use their assessment of resource quality in making site selection decisions (Valone and Brown 1989), but this is balanced by the costs associated with each site option (Brown 1988). As hunting pressure increases, the marginal value of the food resource decreases, reducing the profitability of foraging at that site. Site quality may counter the effects of hunting pressure to some extent resulting in high quality sites retaining doves longer than low quality sites under similar hunting pressure.

We found that site quality played a more important role in dove use of public hunting fields than hunting hour regime, predicting both total doves and dove entry during the hunting season. We assessed dove site entry as an indicator of site selection of state hunting fields. Dove entry was greater prior to the start of the hunting season than after it began. As hunting commenced, dove site selection shifted away from public hunting fields, presumably to areas of lesser hunting pressure. As a generalist granivore, the mourning dove has a broad range of suitable habitat types from which to choose (Lewis 1993). However, we did not assess dove use off of study sites. Hunting hour regime did not affect dove entry in 1995, but did affect dove entry in 1996 and 1997, but the pattern of differences was not consistent for either year. Again differences in site quality may have been the determining factor of dove site selection.

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Table 1. Mean (\pm SE) total number of mourning doves counted at counting stations per sampling session (Total Doves) and mean (\pm SE) number of doves counted entering public hunting sites (Dove Entry) among hunting hour regimes (morning only [MO], afternoon only [AO], and all day [AD]; hunting hours are as in Table 1, Study 2). Means were compared using a one-way ANOVA and differences were determined using Scheffé's multiple comparison procedure ($\alpha = 0.05$).

| | 1995 | | 1996 | | 1997 | |
|--------------------|--------------------|-----|-----------|------|-----------|------|
| | \bar{x} | SE | \bar{x} | SE | \bar{x} | SE |
| Total Doves | | | | | | |
| MO | 37.3A ^a | 4.8 | 34.1A | 6.5 | 158.6A | 27.1 |
| AO | 24.1AB | 3.8 | 71.6B | 11.5 | 146.9AB | 30.6 |
| AD | 29.2B | 8.1 | 70.5B | 10.6 | 226.9B | 43.1 |
| Dove Entry | | | | | | |
| MO | 12.8A ^b | 1.9 | 11.0A | 2.8 | 47.8A | 9.2 |
| AO | 9.9A | 2.0 | 26.6A | 5.2 | 46.4AB | 11.9 |
| AD | 13.1A | 4.1 | 22.2B | 4.2 | 88.0B | 20.1 |

^a Mean Total Doves with the same letter are not different within years ($P > 0.5$).

^b Mean Dove Entries with the same letter are not different within years ($P > 0.5$).

Table 2. Mean (\pm SE) number of mourning doves counted per sampling session (Total Doves) and mean (\pm SE) number of doves counted entering experimental public hunting sites (Dove Entry) before and during the hunting season (1995 - 1997). Means were compared using a one-way ANOVA and differences were determined using Scheffé's multiple comparison procedure ($\alpha = 0.05$).

| | 1995 | | 1996 | | 1997 | |
|--------------------------|-----------|-----|-----------|------|-----------|------|
| | \bar{x} | SE | \bar{x} | SE | \bar{x} | SE |
| Total Doves ^a | | | | | | |
| Before | 57.0 | 9.1 | 112.7 | 16.1 | 259.1 | 34.4 |
| During | 20.7 | 2.6 | 34.7 | 4.1 | 95.9 | 16.6 |
| Dove Entry ^b | | | | | | |
| Before | 22.1 | 4.3 | 39.2 | 7.1 | 90.6 | 14.9 |
| During | 8.3 | 1.3 | 12.2 | 1.7 | 30.9 | 6.8 |

^a Total Doves before and during the hunting season differed within years ($P < 0.05$).

^b Dove Entries before and during the hunting season differed within years ($P < 0.05$).

JOB 2.3 ENERGETIC COSTS AND STRESS RELATED TO HUNTING

Objective: Assess the relative energetic costs or level of stress associated with each hunting regime.

INTRODUCTION

Physiological stress was assessed by corticosterone assays to determine the effects of extended hunting hours on mourning doves. Corticosterone is released in response to a variety of stressors including food deprivation, exercise, and severe environmental conditions. However, the response is nonspecific, therefore, the specific source of stress (i.e. foraging restriction, gunfire noise, and/or predation pressure) cannot be identified by corticosterone concentrations alone. This study was designed to determine whether extended hunting pressure is stressful and whether additional research is necessary.

Because this was the first investigation of corticosterone levels in mourning doves, we collected requisite information of mourning dove stress responses and natural daily corticosterone cycles. We used captive doves to 1) determine whether mourning dove corticosterone levels change in response to food deprivation and 2) determine whether mourning dove corticosterone levels and responses vary during daylight hours. This information was used in conjunction with data from harvested doves. We hypothesized that if extended hunting pressure is stressful to mourning doves, corticosterone levels would increase.

METHODS

Captive Doves

Capture.—A scientific collection permit (PRT-831246) was obtained from the U.S. Fish and Wildlife Service. We trapped 34 doves with Kniffin modified funnel traps (Reeves et al. 1968) on the SIU Farms, between 16 July and 14 August 1997. Traps were baited with sunflower seeds, corn, and feed wheat. Doves were sexed and aged by plumage characteristics, banded with U. S. Dep. of Interior size 3A aluminum butt-end leg bands (Permit #20755), and transported to the CWRL Wildlife Annex. Thirty-two birds were acclimated to outdoor cages for

2-6 weeks prior to experiments in accordance with a protocol approved by the SIUC Animal Care and Use Committee.

General Husbandry.—Doves were maintained in 2.44 x 1.22 x 1.22 m outdoor cages 60 cm above ground. Cages were constructed of 1 cm wire mesh with a wooden frame for structural support. They were sheltered from the wind on the north, east, and west sides by corrugated fiberglass, with half of the total area partially shaded from direct sunlight. Multiple perch sites were provided. Doves were caged individually to minimize disturbance during experiments and to keep social variables constant. Additionally, cage design reduced the ability of doves to see each other.

Doves were fed dove chow (Purina Dove Chow Checkers[®], Ralston Purina Co., St. Louis, MO) and grit ad libitum. Birds were weighed to the nearest gram each time they were handled. All doves maintained body mass and were used in both experiments. Doves were not disturbed for ≥ 1 hr before each experiment.

Blood Collection.—We punctured the brachial vein with a 26 gauge needle and collected < 200 μ l of blood into heparinized capillary tubes (Wingfield et al. 1992). Blood was stored on wet ice for ≤ 1.5 hrs until centrifuged for 5 min in a low speed hematocrit centrifuge. Hematocrit was determined for each blood sample to ensure that sampling procedures did not result in anemia.

Food Deprivation Experiment.—Twenty-six birds were tested under 3 treatments (CONTROL, DEPRIVED, and REFED) to test the null hypothesis of no differences in corticosterone levels among groups. Food deprivation was expected to raise corticosterone levels; and refeeding was expected to initiate declines from fasting levels, although not necessarily to prefasting levels.

CONTROL doves were fed ad libitum, prior to blood sampling. DEPRIVED birds were food deprived for ~ 23 hrs before sampling. We chose this deprivation interval to approximate the duration of hunting pressure after the natural evening fast at all day sites. Food was removed at 1750 hrs the evening before blood collection. REFED birds also were food deprived for ~ 23

hrs beginning at 1750 hrs; however, they were provided food for 30 mins before blood collection and weighing. REFED birds helped determine whether corticosterone levels returned to baseline after food consumption, or if a decline of lesser magnitude resulted. Doves were weighed and blood was collected at 1700-1720 hrs under all treatments to minimize diurnal variation.

Tests in each dove were 1 week apart to allow recovery and to ensure independence of samples. Doves were sampled in the control group first. The following week, doves were divided equally between DEPRIVED and REFED groups. The third week, assignments were reversed so that each dove was sampled under each treatment. This design allowed increased sample sizes and comparisons within individuals. This experiment was completed in 21 days with 4 doves sampled each day.

Diurnal Variation Experiment.—We tested for differences in corticosterone levels and/or responses among 3 periods of the day to determine whether mourning doves have daily periods of increased vulnerability to stress, or diurnal variations in corticosterone. Twenty-seven doves were weighed and blood sampled during 3 time blocks, (0700-0900, 1200-1400, and 1700-1900 hrs). Each day, blood was collected from 6 doves, 2 in each time block. Blood was drawn at 1, 5, 10, 30, and 60 mins from cage approach (Wingfield et al. 1992). Every 2 weeks, doves were sampled during a different time block until each dove had been sampled during each block. The 2-week interval permitted complete healing of venapuncture sites. This experiment was completed in 42 days.

Harvested Doves

Blood samples were obtained from doves harvested before and after the start of hunting season to test for differences in corticosterone levels among hunting regimes. Corticosterone levels were expected to be higher in regimes restricting foraging or causing other physiological stress.

A permit (PRT-831246) was obtained from the U. S. Fish and Wildlife Service to harvest doves before 1 September. Sites were chosen after sunflower crops had been planted, to ensure that crops from each regime were of similar quality. Cooperative Wildlife Research Laboratory

personnel harvested 32 mourning doves at Horseshoe Lake Conservation Area (HLCA), Union County Conservation Area (UCCA), and I-24 Wildlife Management Area (WMA). Blood was collected between sunrise and noon at the MO site (HLCA) and between noon and 1700 hrs at the AO site (UCCA) and AD site (I-24 WMA). We chose to collect blood from all day sites during the afternoon to ensure that doves were harvested following extended hunting pressure. Blood was collected during similar periods from 208 doves harvested 1-3 September from HLCA, UCCA, and Kaskaskia River Fish and Wildlife Area (KRFWA). Doves were harvested from KRFWA during hunting season instead of I-24 WMA because the lottery system for hunting access excluded CWRL personnel from I-24 WMA. Activity of the crop gland, crop content, age, sex, time harvested, and weight information were collected for each harvested dove.

We manually decapitated shot doves and collected blood from the jugular vein in 12 x 75 mm test tubes. The time shot was recorded and samples were obtained from doves <1 min after shooting. Samples obtained \geq 1 min were not included in analyses. Blood was kept on wet ice and/or refrigerated until centrifuged in a Hermle[®] Centrifuge (Model 2360K) for 5 min at 10°C, <15 hrs after collection.

Corticosterone levels were compared for differences in basal levels. We assumed that response to food deprivation in wild birds would be similar to that in captive birds, however, magnitude of response might differ to an unknown degree.

Corticosterone Assays

Plasma was collected and stored in 1.5 ml centrifuge tubes at -80° C until corticosterone assays were performed. All samples were assayed using ImmuChem[®] Double Antibody Corticosterone ¹²⁵I radioimmunoassays (RIAs) (ICN Biomedical, Costa Mesa, CA), following validation for use with mourning dove plasma/serum. Due to low concentrations of corticosterone in mourning doves, dilution factors of 5 and 10 were used instead of the dilution factor of 200 indicated in the protocol. Samples for a given experiment were assayed together if possible, or divided equally among as few assays as possible. All serial samples collected for a

dove were assayed together and in duplicate unless volumes did not permit duplication. The coefficient of variation within assays ranged from 2.9-4.7, and was 8.0 between assays.

RESULTS

Captive Doves

Food Deprivation Experiments.—Corticosterone levels in DEPRIVED doves were greater than CONTROLS ($F_{1,22} = 9.55, P = 0.0058$), and REFED doves had lower levels than CONTROLS ($F_{1,22} = 5.24, P = 0.0331$) (Table 1). However, data plots revealed 2 different response types (Figs. 1-3); CONTROL concentrations differed between response groups ($F_{1,20} = 18.31, P = 0.004$), but DEPRIVED and REFED concentrations did not. Food deprivation in doves with low control levels (Type I; Figs. 1,3) resulted in greater corticosterone levels than CONTROLS ($F_{1,14} = 35.44, P = 0.0001$), and food consumption resulted in a return to CONTROL levels ($F_{1,14} = 0.13, P = 0.7292$). In doves with high CONTROL levels (Type II; Figs. 2,3), food deprivation did not result in further increases in corticosterone concentrations ($F_{1,7} = 6.82, P = 0.0401$), but refeeding caused declines ($F_{1,7} = 54.14, P = 0.0003$).

Doves in captivity for longer periods had lower control levels than those captive for shorter periods ($F_{1,20} = 9.34, P = 0.0065$) and tended to exhibit the Type I response ($F_{1,20} = 4.22, P = 0.0540$). Duration of captivity was negatively related to CONTROL levels ($R^2 = 0.3295$), but this relationship was not observed for DEPRIVED ($F_{1,20} = 1.96, P = 0.1778; R^2 = 0.0934$), and REFED doves ($F_{1,20} = 0.44, P = 0.5162; R^2 = 0.0225$).

Diurnal Variations.—There were no differences in 1 hr corticosterone stress responses among 3 time blocks [0700-0900 hrs (AM), 1200-1400 hrs (Noon), and 1700-1900 hrs (PM)] ($F_{2,374} = 0.44, P = 0.6431$). Additionally, concentrations did not differ ($P > 0.05$) among time blocks for 1, 5, 10, 30, and 60 min samples (Fig. 4).

Harvested Doves

Composition of Harvest.—Active crops glands were evident in 15.8% ($n = 171$) of after-hatching-year (AHY) birds sample. Hatching-year (HY) doves comprised 28.8% of harvested

doves (Table 2). The sex ratio of HY harvested doves was 170:100 (males:100 females); while AHY ratios were 143:100 (Table 3).

Effect of Hunting Season on Crop Contents and Weight.—Fewer harvested doves had empty crops preseason (25.8%) than during the first 3 days of hunting season (54.1%), ($\chi^2 = 8.64$, $df = 1$, $P = 0.0033$; Table 4). More dove crops contained sunflower seeds preseason (45.1%) than during hunting season (22.2%), ($\chi^2 = 7.52$, $df = 1$, $P = 0.0061$). Further, other seed types were found more frequently in crops preseason (58.0%) relative to after 1 September (30.9%), ($\chi^2 = 8.80$, $df = 1$, $P = 0.0030$). Comparisons among sites revealed that at morning only (MO) and all day (AD) sites, fewer doves had sunflower seeds in their crops than expected during hunting season ($\chi^2 = 8.04$, $df = 3$, $P = 0.0452$), whereas at the afternoon only (AO) site observed values were greater than expected. Mourning dove weights were greater preseason than during days 2 and 3 of hunting season ($F_{3,202} = 3.95$, $P = 0.0091$; Fig. 5).

Effect of Hunting Season on Corticosterone Levels.—Mourning dove corticosterone levels were greater during hunting season ($\bar{x} = 1.87$ ng/ml; CI = 1.71-2.03) than preseason ($\bar{x} = 1.35$ ng/ml; CI = 1.11-1.64; $t = -2.7522$, $df = 207$, $P = 0.0064$). Data collected on 28 August from the AO and MO sites did not differ from data collected from the AD site on 29 August ($F_{1,26} = 1.23$, $P = 0.2771$), therefore, data were combined as preseason samples (day 0) to increase sample size. Comparisons between day 0 and samples taken 1-3 September (day 1-3) revealed that corticosterone levels increased each successive day of hunting (Fig. 6). Corticosterone levels on day 1 did not differ from day 0 levels ($F_{1,103} = 0.75$, $P = 0.3888$), but corticosterone levels in doves harvested on day 2 were greater than day 0 and day 1 ($F_{2,151} = 5.60$, $P = 0.0045$). Further, corticosterone levels on day 3 were greater than days 0-2 ($F_{3,208} = 14.59$, $P = 0.0001$). Differences between days within sites were not detected at AO and AD sites. However, at the MO site, concentrations on day 3 were greater than days 0-2, and day 2 concentrations were greater than on day 0 ($F_{3,101} = 13.69$, $P = 0.0001$) (Fig. 7).

Corticosterone concentrations did not differ between sites by day, so days were combined to increase sample size. Still no differences were detected among the sites for all days combined.

Relationships Between Age, Sex, Crop Milk, Crop Content, Time Harvested, and Weight with Corticosterone Levels.—Hatching-year and AHY mourning doves had similar ($P = 0.1855$) pre-season corticosterone levels ($\bar{x} = 1.76$ and 1.27 ng/ml, respectively). However, during hunting season, HYs had greater corticosterone levels ($\bar{x} = 2.22$ ng/ml) than AHYs ($\bar{x} = 1.72$ ng/ml). However, increases with hunting were significant ($P = 0.01$) only in AHYs. No differences in corticosterone levels were detected between males and females both pre-season ($t = -1.51$, $df = 23$, $P = 0.14$) and during hunting ($t = 0.45$, $df = 176$, $P = 0.65$). Birds with crop milk had similar corticosterone levels to birds without milk ($P = 0.5999$).

Doves with empty crops had similar corticosterone concentrations to doves with food in their crops ($P = 0.6970$). Also, doves with sunflower seeds in their crops had similar corticosterone concentrations to doves that did not ($P = 0.2529$).

Harvest time did not predict corticosterone levels ($F_{1,208} = 1.618$, $P = 0.2048$), but weight was a predictor ($F_{1,208} = 7.592$, $P = 0.0064$). Weight was negatively related to corticosterone levels, but accounted for little variance ($R^2 = 0.0354$).

DISCUSSION

Use of Corticosterone to Detect Stress in Mourning Doves

We were able to measure and detect changes in mourning dove corticosterone concentrations with radioimmunoassay kits from ICN Biomedical[®]. Although we did not compare concentrations obtained with these kits to concentrations obtained with other methods, both validation techniques provided evidence of concentration reliability.

Corticosterone was less variable among harvested doves than among captive birds as reflected by confidence intervals. Differences in sample size may partially explain this observation. However, concentrations were more variable among doves in food deprivation experiments than in 1 min samples from diurnal variation experiments, despite similar sample sizes. Further, precision among doves decreased steadily throughout the capture stress series. These observations may be explained by individual differences in stress perception, experience, and physiology, emphasizing the subjectivity of the stress response.

Corticosterone radioimmunoassays may prove to be a sensitive tool for stress detection in mourning doves and other wildlife. Although chronic physiological effects can not be determined by corticosterone concentrations alone, this method offers a relatively inexpensive way to determine whether further research is warranted.

Requisite Knowledge of Corticosterone Responses from Captive Doves

Food Deprivation Experiments.—Corticosterone levels increase in response to food deprivation in several avian species (Freeman et al. 1980, Harvey and Klandorf 1983, Harvey et al. 1983, Wingfield 1988); this study provides evidence of similar responses in mourning doves. Providing food to deprived doves resulted in corticosterone declines in <30 minutes, suggesting that food consumption alleviated the stress of food deprivation.

The Type I response observed was similar to food deprivation responses reported for other species. However, the Type II response we observed was not anticipated. Perhaps doves with high control levels (Type II response) were maximally stressed during sampling, and therefore, further increases were not possible in response to additional stressors. Captivity may have been a source of stress for doves with high control levels. If doves acclimated to captivity with increased time, then we would expect the duration of captivity to be inversely related to corticosterone concentrations. Doves that were captive for shorter periods (64-78 vs. 79-95 days) tended to have higher control levels and exhibited the Type II response. However, this relationship was not consistent among doves. Therefore, if the duration of captivity affected corticosterone levels, individuals differed in their sensitivity. Condition at time of capture, maturity, previous experience, and migratory preparedness may all affect a dove's response to captivity and the amount of time necessary for full acclimation.

An alternative explanation for the 2 response types observed is that doves exhibiting the Type II response may have been migratory. Corticosterone stimulates lipid retention and available evidence supports the involvement of corticosterone in migratory fattening (Gwinner 1990). Therefore, we would expect migratory individuals to have higher corticosterone levels than residents. Although resident doves are trapped throughout the season, migratory doves tend

to be trapped later in the season. Differences in migratory preparedness may explain inconsistencies in response types by trapping date.

Additional research is needed to resolve the reasons for 2 response types. Further, the critical food restriction interval for initiation of corticosterone increases has yet to be defined. This study provides evidence that ~23 hrs of food deprivation increases circulating corticosterone levels. However, shorter deprivation intervals were not investigated.

Diurnal Variations.—Although several avian species exhibit diurnal variations in the stress response, we did not find evidence to support variations in mourning doves. Corticosterone concentrations were similar among time blocks for all sampling times. Rintamaki et al. (1986) reported that pigeons (*Columba livia*) maintained outdoors between 30 July and 26 August had peak baseline levels at 1200 hr; however, statistical tests comparing corticosterone levels between sampling times were not reported. The 1200 hr peak was not observed in doves maintained indoors in the same study, and instead higher levels were reported at 1600 hr than at 0800 or 1200 hr. In contrast, Joseph and Meier (1973) reported baseline corticosterone levels higher at 0800 than at 1200 and 1600 hr in indoor pigeons; and Westerhof et al. (1994) reported concentrations similar to mean daily values for samples taken at 0800, 1200, and 1600 hr. Clearly, further research into diurnal corticosterone response patterns is necessary for columbids.

Age, Sex, and Corticosterone Levels in Harvested Doves

Differences in corticosterone levels between age classes have been reported for white-crowned sparrows (Wingfield et al. 1980) and chickens (Siegel et al. 1976). Preseason data sample sizes were too small to detect any age differences that might exist in baseline mourning dove corticosterone levels. However, differences between age classes were detected during hunting, perhaps reflecting differences in sensitivity to hunting stress.

In many species, differences in corticosterone levels between sexes manifest during the breeding season. These differences may be related to the amount of care provided to the young by each parent, with greater parental care resulting in increased attenuation (Wingfield et al. 1995). In most avian species, females provide more care to young than males, but mourning

dove parents share the responsibility. However, only 1.6% of mourning dove nests are initiated 5 August-15 September with fledging 2 September-13 October (Hanson and Kossack 1963).

Therefore, it is not surprising that we did not find differences in corticosterone concentrations between the sexes. This is consistent with findings of other columbid studies involving pigeons (Westerhof et al. 1994) and Inca doves (*Scardafella inca*) (Wingfield et al. 1992).

Effect of Hunting on Weight

Weight was inversely related to corticosterone concentrations and declined 8-9 g during hunting season, whereas corticosterone levels doubled. In a North Dakota study, the weight of crop material after feeding averaged ~8 g during early fall (Schmid 1965). If doves were unable to forage prior to harvest, decreased food intake may have accounted for some weight loss. More doves had empty crops than expected during hunting season supporting this explanation.

Further, the number of doves that had foraged on sunflower seeds was below that expected at AD and MO sites, suggesting that hunting prevented foraging at these sites. Although declines also were observed at the AO site, observed values were greater than expected. More doves may have been able to forage without disturbance during the morning at the AO site prior to afternoon hunting hours.

Additional support for weight loss due to the absence of crop contents was provided by food deprivation experimental data. Observed differences between control and deprived dove weights was ~11.0 g, which was comparable to differences in harvested doves. Further, doves refed for 30 min had similar weights to controls, suggesting that empty crops explained some of the observed weight loss.

Hunting may have prevented foraging and consequently resulted in lower weights. Alternatively, individuals with lower fat reserves may have been more vulnerable to harvest, perhaps as a result of stronger site tenacity. Some doves may adapt to hunting pressure by shifting foraging site use. Illinois is largely agricultural and consequently food availability for doves is great. Oberheu and Klimstra (1961) reported that agricultural foods comprised 60.7% of autumn dove diets in Illinois. Further, all sampled hunting fields in this study were located

within ~2 km of other agricultural fields. Lewis et al. (1982) found that doves flew 3.2-12.1 km to feeding sites in Oklahoma during September and October, so distances between fields in this study were well within normal mourning dove flight distances.

Effect of Hunting on Corticosterone Concentrations

Hunting was a stressor for mourning doves as indicated by elevated corticosterone levels. However, stress is physiologically detrimental only if prolonged or of sufficient magnitude. The corticosterone concentration and duration of stress that result in physiological detriment have yet to be determined in most species, and probably vary considerably among individuals. This study was the first investigation of corticosterone levels in mourning doves and, therefore, relative comparisons within the study were necessary.

Mean values of corticosterone concentrations during hunting season were within the range of pre-season samples, indicating that as a population, mourning doves were not detrimentally affected by hunting. However, individuals within the population had corticosterone concentrations indicative of stress. Use of the 95% upper confidence limit of pre-season samples as a cutoff for unstressed levels permits rough comparisons between high and low corticosterone concentrations. The percentage of harvested individuals with corticosterone levels >4.01 ng/ml was 5.2%, 12.5%, and 15.8% on days 1-3, respectively. Of these "stressed" individuals 0%, 50%, and 67% were harvested at the MO site. For comparison, 50%, 54%, and 45% of doves sampled were harvested at the MO site.

Captive individuals had higher corticosterone levels than harvested doves, therefore, use of the 95% upper confidence limit for captive birds provided a more conservative cutoff for "stressed" individuals. With 7.46 ng/ml as a limit, 0%, 0%, and 7.0% of harvested birds were stressed on days 1-3. Of these "stressed" birds (day 3), 75% were harvested at the MO site. As mentioned previously, 45% of the doves sampled on day 3 were from the MO site.

Although corticosterone levels in doves harvested at the AD site did not show significant increases each day, mean concentrations did increase and may have become significant if

sampling had continued. We emphasize that only 1 bird was harvested on the third day at the AD site and therefore, sample size and power were compromised for this day and site.

Corticosterone levels of doves harvested at MO sites doubled over the first 3 days of hunting season. This increase is similar in magnitude to the response observed in food deprived captive birds. However, doves with food in their crops had similar levels to doves with empty crops, so increases in corticosterone levels during hunting season cannot be completely explained by the doves' ability to forage prior to harvest. However, we did not quantify the amount of material in crops, and therefore, were unable to differentiate between birds with full crops and birds with just a few seeds in statistical tests. Furthermore, birds with empty crops were not necessarily deprived, and therefore, unstressed concentrations may have reduced the mean. These limitations may have masked differences in corticosterone levels if disturbance in hunting fields limited the time spent foraging and amount consumed, or if corticosterone levels varied with the amount consumed. Further, elevated corticosterone levels may have been unrelated to foraging restriction, and instead due to other hunting related stressors (e.g., gunfire noise). Corticosterone is released in response to a variety of stressors, and therefore, elevated levels indicate stress but not information on the stressor.

Further research is necessary to determine corticosterone concentrations beyond the sampling period we studied. Although declines in harvest (69.1%) and hunter numbers (63.9%) were evident by the second day of hunting in 1997 (Lusk, Cooperative Wildlife Research Laboratory, unpubl. data), the most intense period of hunting pressure is during the first week of the season (Hanson and Kossack 1963). Hunter numbers and harvest were similar on days 2-5 of hunting season, and therefore, hunting pressure had not subsided by the fifth day. These declines were observed under all regimes and were similar among them.

We did not sample birds during hunting season in the absence of hunting pressure. We recommend that future researchers investigate corticosterone concentrations from the MO site in the afternoon and the AO and AD sites in the morning, to determine whether corticosterone levels return to baseline after hunter departure.

This study provides evidence that hunting is stressful for doves. However, stress is not always detrimental, and additional research is necessary to determine the long term impact on populations, if any. Further, body condition information should be collected to clarify relationships between elevated corticosterone levels and physiological detriment. Increased hunting pressure will not harm dove populations unless survival and recruitment decrease. Therefore, future studies should examine these variables through bird banding return data, telemetry and/or other markers, or change-in-ratio methods. Further, increases in hunter use of extended hunting hours or harvest would necessitate additional research.

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Table 1. Individual corticosterone concentrations (ng/ml) in captive mourning doves undergoing food deprivation experiments, fall 1997.

| Id # | Treatment | | |
|---------------------------|--------------------|-------------|-----------|
| | Control | Deprived | Refed |
| 1 | 3.70 | 23.72 | 12.02 |
| 2 | 5.13 | 13.66 | 2.44 |
| 3 | 2.93 | 6.72 | 1.47 |
| 4 | 8.78 | 6.71 | 5.04 |
| 5 | 21.67 | 10.15 | 3.00 |
| 6 | 6.77 | 13.55 | 6.52 |
| 7 | 8.80 | 9.79 | 2.47 |
| 8 | 1.14 | 18.21 | 4.00 |
| 9 | 5.29 | 9.27 | 6.41 |
| 10 | 1.63 | 11.07 | 10.98 |
| 11 | 7.84 | 8.98 | 4.00 |
| 12 | 24.99 | 8.37 | 3.60 |
| 13 | 12.06 | 10.86 | 3.14 |
| 14 | 6.15 | 31.18 | 0.96 |
| 15 | 10.46 | 74.57 | 6.49 |
| 16 | 6.01 | 23.20 | 5.70 |
| 17 | 14.74 | 11.21 | 2.93 |
| 18 | 20.35 | 16.29 | 3.79 |
| 19 | 8.52 | 18.43 | 4.73 |
| 20 | 11.88 | 11.97 | 4.40 |
| 21 | 6.11 | 29.41 | 9.97 |
| Pretransformed \bar{x} | 9.28A ^a | 17.49B | 4.96C |
| Backtransformed \bar{x} | 7.21 | 14.33 | 4.18 |
| CI (95%) | 5.05-10.31 | 10.99-18.70 | 3.15-5.54 |

^aMeans with different letters are significantly different ($P > 0.05$).

Table 2. Age composition of mourning doves harvested by Cooperative Wildlife Research Laboratory personnel under 3 hunting regimes preseason (day 0) and during the first 3 days of hunting season (days 1-3).

| Hunting Regime | Day 0 | | Day 1 | | Day 2 | | Day 3 | |
|----------------|------------------|-----------------|-------|----|-------|----|-------|----|
| | AHY ^a | HY ^b | AHY | HY | AHY | HY | AHY | HY |
| Morning Only | 11 | 0 | 35 | 11 | 23 | 7 | 18 | 9 |
| Afternoon Only | 9 | 1 | 25 | 5 | 6 | 9 | 17 | 15 |
| All Day | 7 | 4 | 10 | 6 | 9 | 2 | 1 | 0 |
| Totals | 27 | 5 | 70 | 22 | 38 | 18 | 36 | 24 |

^aAHY = After-hatching-year.

^bHY = Hatching-year.

Table 3. Sex of mourning doves harvested by Cooperative Wildlife Research Laboratory personnel at Morning Only (MO), Afternoon Only (AO), and All Day (AD) sites preseason (day 0) and during the first 3 days of hunting season (days 1-3).

| Hunting Regime | Day 0 | | | Day 1 | | | Day 2 | | | Day 3 | | |
|----------------|----------------|----------------|----------------|-------|----|---|-------|----|---|-------|----|---|
| | M ^a | F ^b | U ^c | M | F | U | M | F | U | M | F | U |
| MO | 6 | 4 | 1 | 30 | 15 | 1 | 16 | 13 | 1 | 16 | 10 | 1 |
| AO | 4 | 6 | 0 | 21 | 9 | 0 | 7 | 8 | 0 | 19 | 12 | 1 |
| AD | 6 | 4 | 1 | 10 | 5 | 1 | 3 | 7 | 1 | 1 | 0 | 0 |
| Totals | 16 | 14 | 2 | 61 | 29 | 2 | 26 | 28 | 2 | 36 | 22 | 2 |

^aM = Male.

^bF = Female.

^cU = Unknown.

Table 4. Crop contents of mourning doves harvested by Cooperative Wildlife Research Laboratory personnel at Morning Only (MO), Afternoon Only (AO), and All Day (AD) hunting sites pre-season (day 0) and during the first 3 days of hunting season (days 1-3).

| Hunting Regime | Day 0 | | | Day 1 | | | Day 2 | | | Day 3 | | |
|----------------|----------------|----------------|----------------|-------|----|----|-------|----|----|-------|----|----|
| | E ^a | S ^b | O ^c | E | S | O | E | S | O | E | S | O |
| MO | 1 | 5 | 6 | 30 | 7 | 10 | 10 | 8 | 13 | 15 | 3 | 10 |
| AO | 3 | 4 | 7 | 17 | 12 | 4 | 9 | 3 | 5 | 17 | 9 | 10 |
| AD | 4 | 5 | 5 | 9 | 0 | 7 | 5 | 3 | 5 | 0 | 1 | 0 |
| Totals | 8 | 14 | 18 | 56 | 19 | 21 | 24 | 14 | 23 | 32 | 13 | 20 |

^aE = Empty.

^bS = Sunflower.

^cO = Other.

JOB 2.4 ANALYSIS AND REPORT

Objective: To provide recommendations to improve harvest management of Mourning Doves in Illinois.

The objectives of this study were achieved and the expected results and benefits attained. The change in mourning dove hunting hours at state sites implemented by the Illinois Department of Natural Resources provided for expanded recreation opportunity and hunter choice. However, hunter surveys did not provide evidence that hunters were taking advantage of the increased opportunity, therefore, doves did not experience a greater level of hunting pressure.

We did find evidence that dove feeding opportunity was restricted during the hunting season, especially at morning only hunting areas, but detrimental effects were not detected. Corticosterone assays provided evidence that hunting was an acute stressor. However, acute stress is not always physiologically detrimental and our study did not detect detrimental effects.

Based on our findings, we conclude that the extended hunting hours do not pose risk to dove populations under the current regimes and level of hunting. Hunter satisfaction is high and should remain so if hunting opportunity exists. Site quality was a more important factor in hunter satisfaction than was hunting hour regime.

In conclusion, we recommend that extended hunting hours be continued. However, increases in hunter use of extended hunting hours would necessitate reevaluation. Therefore, we recommend that hunter use of sites be monitored to detect changes in patterns and magnitude of hunter use.

Appendix A. Request for Approval of Research Activities Involving Human Subjects.

Appendix B. The 1995 Mourning Dove Hunter Survey.

Mourning Dove Hunting Hours Experiment
Fact Sheet

This shooting field is one of 21 shooting fields throughout central and southern Illinois that have been selected as study sites for a joint research project between the Illinois Department of Natural Resources and the Cooperative Wildlife Research Laboratory at Southern Illinois University , Carbondale.

The purpose of the project is two fold. First, it will determine the effect of different hunting hours on hunting success and enjoyment. In other words, has the daily hunter success and enjoyment changed as a result of the new hunting hours? Secondly, the project will determine the effect of the various hunting times on the dove population.

The mourning dove is the most popular game bird in the United States, with harvests exceeding those of all other migratory game birds combined. At public shooting fields in Illinois, hunters harvest about 60,000 mourning doves each year. Mourning doves in Illinois represent a significant recreational opportunity. Approximately 75,000 hunters hunt mourning doves annually in Illinois.

Wise use of this resource is naturally dependent on sound wildlife management. The results of this study will be used to decide future regulations concerning hunting times for mourning doves. Ideally, longer hunting hours should increase hunter satisfaction by providing more opportunities to harvest mourning doves. Unfortunately, this opportunity may go unrealized if the majority of hunters still prefer to hunt in the afternoon; if increased hunting forces the doves into other areas; or if the shooting fields are shot out in a few days.

It is important to understand how the new hunting hours will effect both the hunter and the dove. Your hunting preferences are being recorded so that state management officials can better meet your needs. You will be helping us determine how hunting hours affect your success and enjoyment of dove hunting. The dove's reaction to the new hunting hours will also be determined to assure there will be plenty of doves for hunters. Most mourning doves return to areas of their birth when returning from winter migration. Excessive depletion of the local population may mean fewer doves for future hunting seasons, leading to a less enjoyable experience for the hunter. As you can see, a better understanding of these issues will lead to better management practices, that, in turn will ensure enjoyable and successful hunting for the future.

Please complete and return the Dove Hunter Questionnaire EACH time you hunt at an experimental site. You will remain completely anonymous. Completion of the questionnaire is voluntary. If you are planning to hunt throughout the entire season, and would like to participate further, please take one of the postcard questionnaires for completion at the end of the season.

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, IL 62901-4709. Phone: (618) 453-4543.

Thank you for participating in managing Illinois' wildlife!

Daily Dove Hunter Questionnaire

Please note: Hunters using shooting fields, at certain IDNR sites, that require a permit and annual harvest report must still complete the harvest report and return it by February 15. Completion of this questionnaire does not remove this obligation!

DATE: __ / __ / __

Place of residence:

City/town: _____, County _____, State: _____

Hunting area: _____

Time started hunting : _____, Ended: _____

Did you hunt continuously during this time? **Yes or No**

If **No**, what times were you not hunting? Out: _____ In: _____

Number of Doves killed _____

Number suspected crippled, or killed and unretrieved: _____

Estimated number of shots taken: _____

Number of years that you have hunted mourning doves: _____

Please circle your answers to the following question

Type of shot used? **Steel or lead**

If you were allowed to hunt one time of day only, when would you hunt **most frequently**?

- A. Morning**
- B. Afternoon**
- C. Does not matter**

Would you hunt **more frequently** if all day hunting were permitted? **Yes or No**

Do you feel that the hunting time restrictions at this site decreased your opportunities to shoot doves?
Yes or No

When would you rather have hunted

- A. Morning**
- B. Afternoon**
- C. Morning and Afternoon**

Would you hunt here next year if the hunting times stayed the same? **Yes or No**

Would you hunt here next year if the hunting times changed? **Yes or No**

If you plan on hunting doves throughout the entire season, and would like to participate further, please take one of the postcard packets for completion at the end of the hunting season.

Thank you for your cooperation in helping manage Illinois' wildlife!

Appendix C. The 1996 Mourning Dove Hunter Survey.

1996 Mourning Dove Hunter Fact Sheet

This public hunting area is again participating in a joint research project between the Illinois Department of Natural Resources and the Cooperative Wildlife Research Laboratory at Southern Illinois University at Carbondale. This hunting area, one of 21 selected hunting areas throughout central and southern Illinois, will be under experimental hunting hours during the 1995, 1996, and 1997, dove hunting seasons. Please consult the site office for correct hunting hours for this site, this year.

There is a two-fold purpose to this project. First, we hope to determine the effects of the different hunting hours on hunter success and satisfaction. Have the changed hours influenced daily hunter success and enjoyment? We also hope to determine the effect of these hunting hours on the mourning dove population.

In order to accomplish this we require your assistance. Your opinions are important to state officials in making management decisions. Effective management must include input from all concerned parties. That is why your participation in this project is so important. The continued implementation of the new hunting hours will depend on the responses received from the attached questionnaire. This year's questionnaire asks more in-depth questions than last year's, and will help state managers better understand your hunting preferences and ideas.

Please take the time to fill out and return the Dove Hunter Questionnaire EACH time you hunt at an experimental doe hunting area. You will remain completely anonymous. Remember, completion of this questionnaire is voluntary, but your participation would be greatly appreciated.

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone: (618) 453-4543.

Thank you for participating in managing Illinois' wildlife!

Daily Dove Hunter Questionnaire

Please note: Hunters using shooting fields that require a permit and annual harvest report, must still complete the harvest and return it by 15 February. Completion of this questionnaire does not remove this obligation.

Date: __/__/1996

General Information

Place of residence: City: _____, County: _____, State: _____

Age: _____ Gender: **Male** **Female**

Name of the site where you hunted doves today: _____

Today's dove hunting times: Starting times: _____:_____, Ending time: _____:_____

Number of doves killed and retrieved: _____

Number of doves crippled, or killed, and unretrieved today: _____

Estimated number of shots taken today: _____

Number of years hunting doves: _____

Number of miles traveled (one-way) from your residence to hunt doves today: _____

Number of years using this site to hunt doves: _____

Do you use this site exclusively for all your dove hunting? **Yes** **No**

Do you hunt state shooting fields exclusively for all your dove hunting? **Yes** **No**

Type of shot used **Steel** **Lead** **Bismuth**

Hunter Opinions

1) If allowed to hunt doves only one time of day, when would you hunt **most frequently?** (Circle one)

- A. Morning**
- B. Afternoon**
- C. Does not matter**

1a) If **A** or **B**, why?

- A. It is more convenient for me**
- B. Dove hunting is better during that time period**
- C. Get better dog work in cooler temperature (mornings)**
- D. Other:** _____

2) Would you hunt **more** if all day hunting were permitted? **Yes** **No**

2a) If **Yes**, would you:

- A. Hunt more days**
- B. Hunt longer per trip**
- C. Both**

2b) If **No**, why? (Circle the one that most applies)

- A. The extra hours are not needed**
- B. All day hunting allows doves to be hunted out quicker, leaving fewer doves to shoot**
- C. I've always hunted afternoons**
- D. Don't like to get up early**
- E. Other:** _____

3) Do you feel that the hunting time restrictions decreased or increased your opportunities to shoot doves?

Increased Decreased No Effect

3a) If **Decreased**, why? (Circle the one that most applies)

- A. They prevent me from hunting when there are the greatest numbers of doves in the field.**
- B. They are inconvenient / conflict with my work schedule**
- C. The site is overcrowded with hunters**
- D. The site is shot out sooner**
- E. Other:** _____

4) Do you feel that the hunting time restrictions at this site increased or decreased the quality of dove hunting?

Increased Decreased No Effect

4a) If **Increased**, why? (Circle the one that most applies)

- A. More doves to shoot**
- B. Doves are easier to shoot**
- C. Restrictions maintain annually huntable populations of doves**
- D. More challenging hunting**
- E. Other:** _____

4b) If **Decreased**, why? (Circle the one that most applies)

- A. No doves to shoot; area shot out**
- B. Doves aren't in the area at that time of day**
- C. Too many hunters at the site**
- D. Other:** _____

5) When would you rather have hunted? (Circle one)

- A. Morning**
- B. Afternoon**
- C. Morning and Afternoon (i.e., All Day)**

5a) Why? (Circle the one that most applies)

- A. More convenient**
- B. Better hunting / More successful hunting**
- C. More enjoyable hunting experience**
- D. Other: _____**

6) Would you hunt this site again next year if the hunting times stayed the same?

- Yes No Undecided**

7) Would you hunt this site again next year if the hunting times changed from the current site rules to:

- | | | | |
|-------------|------------|-----------|------------------|
| Afternoons: | Yes | No | Undecided |
| Mornings | Yes | No | Undecided |
| All day | Yes | No | Undecided |

8) How would you rate the quality of this hunting site?

- Excellent Good Fair Okay Poor Bad**

Appendix D. The 1997 Mourning Dove Hunter Survey.

1997 Mourning Dove Hunter Fact Sheet

This public hunting area is again participating in a joint research project between the Illinois Department of Natural Resources and the Cooperative Wildlife Research Laboratory at Southern Illinois University at Carbondale. This site is 1 of 21 hunting areas throughout central and southern Illinois that has been selected to participate in this project.

There is a two-fold purpose to this project. First, we hope to determine the effects of the different hunting hours on hunter success and satisfaction. Have the changed hours influenced daily hunter success and enjoyment? We also hope to determine the effect of these hunting hours on the mourning dove population.

In order to accomplish this, we require your assistance. Your opinions are important to state management officials in making management decisions. Effective management must include input from all concerned parties. That is why your participation in this project is so important. The continued implementation of the new hunting hours will depend on the responses received from the attached questionnaire.

Please take the time to fill out and return the Dove Hunter Questionnaire when you hunt at an experimental dove hunting area. You will remain completely anonymous. Remember, completion of this questionnaire is voluntary, but your participation would be greatly appreciated.

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, Office of Research Development and Administration, Southern Illinois University, Carbondale IL 62901-4709. Phone: (618) 453-4543.

Thank you for participating in managing Illinois' wildlife!

1997 MOURNING DOVE HUNTER SURVEY

Please note: Hunters using shooting fields that require a permit and annual harvest report, must still complete the harvest report and return it by 15 February. Completion of this questionnaire does not remove this obligation.

DATE: ___/___/1997

GENERAL INFORMATION

Place of Residence: City: _____ County: _____ State: _____

Age: _____ Gender: **Male** **Female**

Name of the site where you hunted today: _____

Site Hours: **Morning only** **Afternoon only** **All day**

When did you start hunting today? _____:_____ AM/PM

When did you stop hunting today? _____:_____ AM/PM

Number of doves you killed and retrieved today: _____

Number of doves you killed and did not retrieve, or crippled today: _____

Estimated number of shots taken today: _____

Number of years you have hunted doves: _____

Number of miles (one way) you traveled from your residence to hunt doves today: _____

Number of years using this site to hunt doves: _____

Number of **consecutive** years you have hunted this site: _____

Do you use this site exclusively for all your dove hunting? **YES NO**

Do you hunt state hunting fields exclusively for all your dove hunting? **YES NO**

Type of shot used: **Steel Lead Bismuth**

HUNTER OPINIONS

1) If allowed to hunt doves only one time of day, when would you hunt **most frequently**?
(Circle **one**)

- A. Morning**
- B. Afternoon**
- C. Does not matter**

2) Would you hunt **more** if all day hunting were permitted? **YES NO**

2a) If **YES**, would you:

- A. Hunt more days**
- B. Hunt longer per hunting trip**
- C. Both**

3) Do you feel that hunting time restrictions at this site decreased or increased your opportunities to shoot doves?

INCREASED DECREASED NO EFFECT

4) Do you feel that the hunting time restrictions at this site increased or decreased the quality of dove hunting?

INCREASED

DECREASED

NO EFFECT

5) When would you rather have hunted? (Circle one)

A. Morning

B. Afternoon

C. Morning and Afternoon (i.e., All Day)

5a) Why? (Circle the one that most applies)

A. More convenient

B. Better hunting experience

C. More enjoyable hunting experience

D. More successful hunting

E. Other: _____

6) Would you hunt this site again next year if the hunting times stayed the same?

YES

NO

UNDECIDED

7) Would you hunt this site again next year if the hunting times changed from the current site rules to:

Afternoons?

YES

NO

UNDECIDED

Mornings?

YES

NO

UNDECIDED

All Day?

YES

NO

UNDECIDED

8) How would you rate your overall dove hunting experience at this site today?

EXCELLENT

GOOD

FAIR

OKAY

POOR

BAD

9) How would you rate the overall quality of dove hunting at this site today?

EXCELLENT

GOOD

FAIR

OKAY

POOR

BAD

10) How would you rate the quality of this hunting site in terms of its ability to attract doves for hunting?

EXCELLENT

GOOD

FAIR

OKAY

POOR

BAD

11) What attribute of this state public hunting field most influenced your decision to hunt here today? (Select the one that most applies)

- A. **Lack of alternative areas/sites to hunt doves**
- B. **Near to my home**
- C. **Quality of dove fields**
- D. **Convenience of hunting hours**
- E. **Low hunter numbers / Site less crowded**
- F. **Tradition; I always hunt here**
- G. **Other:** _____

12) What factor plays the greatest role in making your dove hunting experience the best possible? (Select the one that most applies)

- A. **Harvesting the limit**
- B. **Interaction with other dove hunters**
- C. **Convenient hunting hours**
- D. **Being able to shoot at doves**
- E. **Being outdoors**
- F. **Absence of other dove hunters**
- G. **Accessibility of site**
- H. **Other:** _____

13) Please rate the following factors based on the importance of their role in determining hunting success, where 1 is the most important factor, and 5 is the least important factor:

- A. Time of day that hunting is permitted**
- B. Quality of dove field crops**
- C. Length of time spent hunting**
- D. Weather conditions bring doves into area**
- E. Number of hunters / hunting pressure per day**

14) Did you complete dove hunter questionnaires in 1995 or 1996?

YES **NO**

14a) If **YES**, which year(s)? (Circle **all** that apply)

- A) 1995**
- B) 1996**

14b) If you completed dove hunter questionnaires at site(s) **other** than this one, please indicate the name of the site and the year (1995 or 1996) in which you completed the questionnaire.

1995 _____
1996 _____

Thank you for participating in managing Illinois' wildlife!