JOB COMPLETION REPORT

STATEWIDE WILDLIFE SURVEYS AND INVESTIGATIONS

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Federal Aid Project No. W-49-R-27

Study V: Mourning Dove Investigations
Job No. 2. Cooperative Nest Study
Job No. 3. The Effectiveness of Steel Shot for Hunting Mourning Doves
Job No. 4. The Potential for and Incidence of Lead Poisoning of Mourning Doves on a Public Hunting Area

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JOB COMPLETION REPORT

STATEWIDE WILDLIFE SURVEYS AND INVESTIGATIONS

STATE OF ILLINOIS

PROJECT NO.: W-49-R(27) STUDY V JOB NO. 2

OBJECTIVE: To measure late season production of doves on 12 study areas in eastern Illinois.

PROCEDURES: This job is in cooperation with U.S. Fish and Wildlife Service, Office of Migratory Bird Management. Standardized study areas and techniques were developed by this agency.

FINDINGS AND ANALYSIS:

Eighteen dove nests were found on the 12 designated study areas or their alternates in Illinois during late August 1979. These nests met the criteria established by the U.S. Fish and Wildlife Service for this program.

RECOMMENDATIONS:

1979 was the second and final year of this court-ordered study. The results from Illinois and other states will be analyzed and published by the U.S. Fish and Wildlife Service.

Job No. 3. The Effectiveness of Steel Shot for Hunting Mourning Doves

OBJECTIVE: To test the effectiveness of hunters with shotgun shells (2 3/4-inch, 12 gauge) loaded with 1 1.8 oz. #8 lead shot and shells with 1 1/8 oz. #4 steel shot to hunt doves on the Sam Parr Conservation Area.

INTRODUCTION:

The Illinois Department of Conservation's (DOC) program of managing fields for purposes of attracting and hunting mourning doves, Zenaidura macroura, has been well received by the hunting public. Such fields, which are planted to sunflowers, Helianthis, under an intensive cropping plan, were located on 39 state-controlled areas in 1978. Approximately 10,000 sportsmen hunt doves in these fields each year and harvest about 45,000 birds. Because this program is highly popular, there is justification for establishing dove fields on many additional areas in the state. Areas that offer the greatest potential include the large waterfowl refuges and public waterfowl hunting areas such as Union County Refuge, Horseshoe Lake Refuge, Carlyle Lake, Rend Lake, Sanganois, Sangchris Lake, and Lake Shelbyville. Unfortunately, waterfowl are vulnerable to lead poisoning and, as a consequence, the management of dove fields on waterfowl areas has been curtailed in recent years. Thus, there is need for finding a nontoxic shot that is suitable for hunting doves.

The purpose of this study was to test the effectiveness of steel shot relative to lead shot for hunting mourning doves. The testing was conducted on the Sam Parr and Ramsey conservation areas, located in Jasper and Fayette counties, respectively. About 2,000 doves are harvested on these areas

each year. The dove program on each area consists of 3 fields (20-40 acres each) that are planted annually to sunflowers. Only 1 field is hunted each day while the other 2 are rested. A maximum of 50 hunters are allowed to participate each day, and they must report to a check station both before and after hunting. Hunters are allowed in the fields from 12:00 Noon to 4:30 P.M. The dove hunting season in Illinois extends for 70 consecutive days beginning September 1; legal shooting hours are 12:00 Noon to sunset, and the daily bag limit is 12 birds.

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METHODS AND MATERIALS

Shotgun shells used in this study were purchased from Federal Cartridge Corp. in August 1979. The shells were 2 3/4-inch 12 gauge, loaded with 1 1/8-oz. of #8 lead, #6 steel, or #4 steel shot. The lead shells were standard Federal Field loads. Ballistic characteristics and pattern performance of the shells are summarized in Table 1. All 3 shells were look alikes in outward appearance except that the "brass" was slightly longer on the steel loads (0.65 inch) than on the lead load (0.47 inch). All markings were removed from the shells before the test.

The shells were repackaged in lots of 25 of 1 type in shotgun shell boxes of the kind used by hand loaders. Each box was identified with a code number that had been randomly assigned to a specific shell type. The numbered boxes were arranged sequentially and used in the testing mostly in that order. The type of shell in each box was recorded and sealed in an envelope and enclosed with the shells.

Hunters were interviewed when they came to the check station. They were asked the gauge of shotgun they intended to use and, if 12 gauge, whether they were willing to take part in the test. Participating hunters were issued red-colored backtags and were told that an observer, with a supply of test shells, would meet them in the field. Non-participants were given green-colored tags.

All of the observers were DOC employees, and most had biological backgrounds and were experienced at dove hunting. Each observer found a participating (red-tagged) hunter in the field, gave him 1 box (25) of test shells, and instructed him to use the shells in the same manner he would use his regular dove loads. To provide a reference in estimating range of shot-at doves, a 6-foot stake equipped with a 4-inch diameter orange-colored ball on the upper end was erected at a distance of 40 yards in front of the hunter. Ranges of doves were recorded at the instance the first shot was fired as $\leq$20 yards, 21-40 yards, or $>$40 yards. The observer, who remained in close proximity to the observer, also recorded data for the number of doves in the flights, number of shots fired at each flight, and number of

doves hit, knocked down, or retrieved. The status of retrieved doves-- i.e., "dead or incapitated" or "crippled"--was also recorded. At the end of the test period, the envelope accompanying the box of shells was opened and the type of shell used was revealed to both hunter and observer. If all 25 shells were discharged, the observer found another participating hunter and repeated the process.

Differences in performances between the 3 shell types were tested for significance ($P < 0.05$) with Student's t-test. Variance was calculated for percentages and ratios with the forumla pq/n.

RESULTS

Hunter Participation and Shotguns

The testing, 75% of which took place on the Sam Parr Area and 25% on Ramsey, was conducted on 16 days from 1-27 September 1979. Of 191 hunters interviewed on 5 separate days at Sam Parr, 67% had 12 gauge, 9% had 16 gauge, 22% had 20 gauge, and 2% had 28 gauge or 410 shotguns. Among 12-gauge users, 54% agreed to participate in the testing. Counting repeaters, there were 100 hunters who participated: 30 used #8 lead, 30 used #6 steel, 36 used #4 steel, and 4 fired no shells. Of the shotguns used, 29% were equipped with cylinder or improved cylinder chokes, 30% were modified, 35% were full, and 6% were double barrels. The number of hours that hunters spent on the test, number of attempts made to bag doves, and number of doves in flocks shot at are given in Table 2.

Effectiveness of Shells

During the entire test, there were 1,866 shells fired. 477 doves bagged, and an additional 203 doves crippled and lost. The majority (58%) of the shells were fired at doves at ranges of 21-40 yards; 28% were fired at >40 yards and only 14% were fired at ≤20 yards. When expressed relative to 100 shells fired, overall effectiveness of the 3 shells in hitting, knocking down, bagging, and crippling and losing doves were similar (Table 2). The small differences that did occur were not statistically significant. However, the number of cripples lost per 100 doves bagged was significantly greater for the #6 steel (50 birds) than for the #8 lead (38 birds). The comparable value for the #4 steel was 41 birds.

Because few shells were fired at doves at ≤20 yards, performance data obtained at these short ranges were combined with data for shells fired at 21-40 yards for purposes of analysis. At ranges ≤40 yards, performances of the 3 test shells relative to 100 shells fired were similar and exhibited no statistical significance (Table 3). However, the number of cripples lost per 100 doves bagged was significantly greater for the #6 steel (44 birds) than for the #8 lead (32 birds). The corresponding value for the #4 steel was 35 birds. At ranges >40 yards, all 3 shells were essentially the same in terms of hitting, knocking down, bagging and crippling doves. Crippling rates per 100 doves bagged were 69 birds for #8 lead, 71 birds for #6 steel, and 66 birds for #4 steel.

Attempts to bag doves with the 3 test shells were classified as doves "hit", "knocked down", "bagged", "crippled and lost", or "missed" and examined relative to ranges of the birds. No significant differences occurred among the test shells with regard to any of these parameters (Table 4). However, ratios of attempts that resulted in losing cripples to attempts that resulted in bagging birds

revelaed conspicuous differences, the #8 lead versus the #6 steel versus the #4 steel. Values were significantly greater for the #6 steel than for the #8 lead or #4 steel at $\leq$40 yards and all ranges combined. Similarly, the crippling values were significantly greater for the #8 lead and #6 steel than for the #4 steel at $>$ 40 yards.

Among doves hit by the test shells, 64-69% fell directly, 21-26% fell indirectly, and 10-12% remained airborne (Table 5). The small differences among the test shells were not significant. There also were no significant differences, #8 lead versus #6 steel versus #4 steel, in the proportion of bagged doves that were categorized as "dead or incapacitated" or "crippled" (Table 5).

Damage to Edible Flesh

When the decision was made to include #4 steel shells in the test, there was concern as to whether such large shot would excessively damage edible flesh from bagged doves. Thus, a sample of doves that had been taken with each type of shell was dressed in the accustomed manner-i.e., the sternum with breast muscles attached was excised--and examined for pellet holes and rated as to damage. Approximately 78% of the breasts from doves bagged with the #4 steel had $\leq$2 pellet holes, whereas only 47% of the breasts from doves bagged with the #8 lead had $\leq$ 2 holes (Table 6). The proportion of breasts with 5-10 pellet holes was 11 and 25%, respectively. All of these differences were statistically significant. Further, 66% of the breasts from doves bagged with the #4 steel were judged to have sustained either no damage or only light damage; comparable values for the other test shells were 67% for the #8 lead and 55% for the #6 steel. None of the breasts from the 55 doves bagged with the #4 steel were rated as totally destroyed. It appears that #4 steel shot does not inflict excessive damage to edible flesh of doves.

DISCUSSION

Findings of this study are regarded as highly tentative because (1) unlike contemporary tests on waterfowl, no previous tests on doves can be regimented for support and (2) the sample sizes are not of sufficient magnitude to manifest self-supporting findings and concrete conclusions. In our opinion, a minimum of 1,000 shells of each type should be fired to adequately test the effectiveness of shotgun shells for hunting doves.

With the above cautions in mind, the present findings suggest that the #6 steel and #4 steel are as effective as the #8 lead for bagging doves at $\leq$40 yards, $>$40 yards, and at all ranges combined (Tables 2 and 3). On the negative side, the #6 steel appeared to cripple relatively large numbers of doves at $\leq$40 yards and at all ranges combined (Tables 2-4). Curiously, the #6 steel did not cripple "excessively" at $>$40 yards. Because of these conflicting findings, we defer judgement of #6 steel for hunting doves until additional tests are conducted.

From an overall point of view, the #4 steel appeared to be reasonably effective for hunting doves and, in fact, may have crippled fewer birds than the #8 lead (Tables 2-4). We therefore recommend #4 steel for hunting doves and urge the use of such shot on dove areas that pose a lead-poisoning hazard to waterfowl.

Before the final evaluation can be made of the effectiveness of steel shot for hunting doves, additional testing is necessary. This testing should employ

Table 1. Ballistic characteristics and patterning performance of 2 3/4-inch, 12-gauge shells tested for effectiveness for hunting mourning doves on Sam Parr and Ramsey conservation areas, Illinois, in September 1979.

Criteria	#8 Lead 0.090-inch	#6 Steel 0.110-inch	#4 Steel 0.130-inch
Ounces of shot	1-1/8	1-1/8	1-1/8
Number of pellets[a]	459	354	210
Nominal 3-ft coil velocity (fps)	1,255	1,375	1,375
Actual 3-ft velocity (fps)[b]	1,255	1,329	1,331
Pattern performance[c]			
20 yards	98%[d] 452 count	97% 354 count	98% 205 count
30 yards	91% 419 count	95% 327 count	96% 202 count
40 yards	60% 274 count	78% 275 count	80% 168 count
50 yards	35% 161 count	51% 182 count	61% 128 count

[a] Mean for 10 shells.

[b] Velocity data provided by Federal Cartridge Corp., Minneapolis, Minnesota.

[c] Mean for 10 shells at each distance. Pattern count and pattern percentage determined by number of pellets registering inside a 30-inch diameter circle drawn around densest portion of pattern. Pattern testing conducted at Urbana, Illinois, in mean temperature of 70 F at 700 feet elevation, under no-wind conditions, through 30-inch full choke barrel.

[d] The percentage is based on the mean number of pellets registering inside a 30-inch circle, divided by the mean number of pellets found in 10 shells of the type being tested)e.g., 452 ÷ 459 = 98%).

Table 2. Efficiency of steel shot and lead shot in 2 3/4-inch, 12 gauge shells for hunting mourning doves, hunting effort, and flight characteristics of doves, Sam Parr and Ramsey conservation areas, Illinois, September 1979. Comparable values underscored by the same type of line differ significantly ($P < 0.05$).

Category	#8 Lead	#6 Steel	#4 Steel
Hunter trips	30	30	36
Hours on test ($\bar{x}\pm SE$)	2.1±1.26	3.1±1.15	2.6±1.17
Flights shot at	442	419	500
No. of doves per flight ($\bar{x}\pm SE$)[a]	1.5±0.95	1.7±1.50	1.6±1.15
No. of shells fired	602	558	706
Results per 100 shells			
Doves hit	37.0	38.4	34.4
Doves knocked down	33.4	33.7	31.0
Doves bagged	26.9	25.6	24.4
Cripples lost	10.1	12.7	10.1
Cripples lost per 100 doves bagged	37.7	49.7	41.3

[a] 67.5% were 1 dove flights.

Table 3. Efficiency of steel shot and lead shot in 2 3/4-inch, 12 gauge shells for hunting mourning doves at ≤40 yards and at >40 yards, Sam Parr and Ramsey conservation areas, September 1979. Comparable values underscored by the same type of line differ significantly ($P<0.05$).

Category	#8 Lead	#6 Steel	#4 Steel
		≤40 yards	
No. of shells fired	435	396	509
Results per 100 shells			
Doves hit	41.1	41.9	36.3
Doves knocked down	37.7	36.4	32.6
Doves bagged	31.3	29.0	26.9
Cripples lost	9.9	12.9	9.4
Cripples lost per 100 doves bagged	31.6	44.3	35.0
		>40 yards	
No. of shells fired	167	162	199
Results per 100 shells			
Doves hit	26.3	29.6	29.1
Doves knocked down	22.2	27.2	26.6
Doves bagged	15.6	17.3	17.6
Cripples lost	10.8	12.3	11.6
Cripples lost per 100 doves bagged	69.2	71.4	65.7

Table 4. Percent of attempts to bag doves that resulted in hitting, knocking down, bagging, or crippling and losing 1 or more birds during testing of steel shot and lead shot in 2 3/4-inch, 12-gauges shells for hunting mourning doves, Sam Parr and Ramsey conservation areas, September 1979. Sample sizes are in parentheses. Comparable values underscored by the same type of line differ significantly ($P < 0.05$).

Range	#8 Lead	#6 Steel	#4 Steel
	Hit		
≤ 40 yards	53.0(317)	55.2(290)	50.9(344)
> 40 yards	34.4(125)	35.7(129)	36.5(156)
All ranges	47.7(442)	49.2(419)	46.4(500)
	Knocked Down		
≤ 40 yards	48.6	47.6	46.5
> 40 yards	29.6	32.6	34.0
All Ranges	43.2	43.0	42.6
	Bagged		
≤ 40 yards	42.0	39.0	38.4
> 40 yards	20.8	21.7	23.7
All ranges	36.0	33.7	33.8
	Cripples Lost		
≤ 40 yards	13.6	17.6	14.2
> 40 yards	14.4	15.5	11.5
All ranges	13.8	16.9	13.4
	Cripples lost relative to doves bagged[a]		
≤ 40 yards	32.3	45.1	37.1
> 40 yards	69.2	71.4	48.6
All ranges	38.4	50.4	39.6

[a] Number of attempts that resulted in crippling and losing doves per 100 attempts that resulted in bagging doves.

Table 5. Responses of doves hit by steel shot or lead shot during testing of 2 3/4-inch, 12 gauge shells for hunting mourning doves, Sam Parr and Ramsey conservation areas, September 1979. Sample sizes are in parentheses. None of the differences among comparable values were statistically significant ($P > 0.05$).

Response	Percentages		
	#8 Lead	#6 Steel	#4 Steel
Initial reaction			
Direct fall	69.0	64.5	63.8
Indirect fall	21.1	23.4	26.3
Remained airborne	9.9 (223)	12.1 (214)	9.9 (243)
Status of bagged doves			
Dead or incapacitated	80.3	74.8	78.5
Crippled	19.7 (157)	25.2 (135)	21.5 (163)

Table 6. Damage to edible flesh (breast) of mourning doves bagged with 2 3/4-inch, 12-gauge shells loaded with steel shot or lead shot, Sam Parr Conservation Area, Illinois, September 1979. Sample sizes are in parentheses. Comparable values underscored by the same type of line differ significantly ($P < 0.05$).

Criteria	Percentages		
	#8 Lead	#6 Steel	#4 Steel
No. of pellet holes[a]			
0	21.3(61)	11.8(51)	34.5(55)
1 - 2	26.2	45.1	43.7
3 - 4	23.0	23.5	10.9
5 - 10	24.6	19.6	10.9
>10	4.9	0.0	0.0
Damage to flesh[b]			
0	23.0(61)	13.7(51)	34.6(55)
1	44.3	41.2	30.9
2	26.2	41.2	20.0
3	6.5	3.9	14.5
4	0.0	0.0	0.0

[a] Includes entrance and exit holes on exterior surface of breast.

[b] Rated as: 0 = no damage, 1 = light, 2 = medium, 3 = heavy, and 4 = totally destroyed.

the same general procedures and essentially the same types of shells that were used in the present study--i.e., 2 3/4-inch 12 gauge loaded with 1 1/8 oz of #8 lead, #6 steel, or #4 steel. We also believe that the testing of other sizes of steel shot--e.g., #5, 6 1/2, 7--should be given serious consideration. The goal of such testing should be the firing of 2,000 shells of each type being used.

Job No. 4. The Potential for and the Incidence of Lead Poisoning of Mourning Doves on a Public Hunting Area in Illinois.

OBJECTIVE: To measure the incidence of lead shot in fields before and after hunting and in samples of dove gizzards harvested on the Sam Parr Conservation Area.

INTRODUCTION:

Lead poisoning has long been known to be a significant cause of annual mortality to Illinois waterfowl. Research concerning this problem is ongoing. Mixed feelings about the severity of the problem have arisen among hunters, managing agencies, and manufacturers of sporting ammunition. The subject has become extremely controversial, presently resulting in a softening of steel shot regulations in Illinois and many other states.

Illinois is presently expanding its dove field management program. The program is popular with the hunting public, allowing hunters ready access to the sport, and in many areas an excellent opportunity to fill their limit.

As the dove management program expands into new geographical areas, as its popularity increases, and as fields are hunted year after year, the result is accumulations of spent shot. The potential for substantial losses of upland game and non-game birds to lead poisoning is in turn a result of these accumulations.

In soil sampling a Tennessee dove field after 2 days of hunting, Lewis and Legler (1968) found an accumulation of 43,560 spent lead shot per acre in the top 3/8 inch of soil. A similar study currently being conducted by the IDOC also indicates significant amounts of accumulated spent shot in the upper layer of the soil at Sam Parr State Park dove fields.

This availability of shot in the upper soil layer indicates a potential lead poisoning problem. In determining the ingestion level of shotgun pellets by doves at Sam Parr, this study addresses the magnitude of this potential.

METHODS AND MATERIALS:

A total of 709 mourning dove (Zenaidura macroura) gizzards were removed from doves harvested by public hunters at Sam Parr State Park between 1 September 1979 and 3 September 1979. Collected gizzards were packaged in large plastic bags and frozen for storage.

X-ray examination of the samples was conducted in April 1980 at the Large Animal Clinic, School of Veterinary Medicine, University of Illinois (Urbana, IL). Techniques included (1) air drying of gizzards for 48 hours to ease handling and reduce size (2) fluoroscopy of gizzards spread into a single,

uniform layer to prevent overlapping of images and to improve resolution (3) radiography of all samples in which fluoroscopy indicated the presence of extremely dense materials.

Following X-ray examination, gizzards were further examined. Gizzards indicating dense material on the radiographs were opened and their contents were washed into a large (24 cm. diameter) plastic bowl with a gentle stream of water. At this time, the gizzard itself was examined for shot holes penetrating the muscle and the gizzard lining. Inspection was also made for discoloration or malformation of the lining. If shot holes were evident but no pellets were found after a cursory examination of the contents (usually revealing relatively large shot-in pellets), the muscular tissue was sectioned with a scalpel in an attempt to find any lodged pellets. All information obtained during these examinations was carefully noted. Gizzard contents (food, grit, shot pellets, etc.) were then transferred to a Nalgene #60 U.S. Standard Sieve (.250 mm mesh opening) to drain off as much water as possible. The contents were then carefully removed from the sieve and spread onto white absorbent paper towels to air dry for 72 hours. With the aid of a 32 watt, 2X Luxo magnifier, contents were visually examined for incidence of shotgun pellets. Throughout the examination, results were continuously compared with the radiographs.

Pellets located during examination were scrutinized for (1) deformations caused by compression of the shot column as the shotgun was fired (indicating the pellet was shot-in) and (2) surface erosion caused by the chemical and grinding digestive actions of the gizzard (indicating the pellet was ingested). This information, combined with the information obtained during opening and washing, provided the criteria for determining whether the pellet was shot-in or ingested.

A magnet was then passed over each pellet to determine if it was ferrous. Pellets (non-spherical, low-density, ferrous "rocks" not included) responding to the magnet were determined to be steel shotgun pellets. Non-ferrous pellets were probed with a sharp scalpel. Pellets which were soft and easily cut were determined to be lead shotgun pellets. All pellets were then returned to the contents and packaged for storage in small numbered glass vials. A paper label with a corresponding sample number was also included in each vial.

Illinois Department of Conservation personnel collected soil samples during July 1979 at a Sam Parr State Park public dove hunting field. Sampling sites were selected with the exact location of each site determined from a table of random numbers (Fig. 1). One hundred samples 12" by 12" by ½" deep were taken, using an angle iron frame, shovel and ruler. After pacing to each sampling location, the angle iron frame was pushed flush to surface and a trench was dug around it. The frame was then removed, the top ½" of soil was skimmed off with the shovel, samples were deposited in plastic bags and individually marked.

Using the same procedure, 50 samples were collected from the north half of the same field on 4 October 1979, after the hunting was approximately 95% completed. Because the south half was disced to control weeds after the first sample was taken (also after some hunting), it was not sampled at this time.

These soil samples were analyzed during the summer of 1979 and spring of 1980. Samples were poured into large plastic tubs (44cm. diameter by 27cm. deep) marked with a corresponding sample number, and soaked in water. Floating

organic material was then carefully poured off into a 1.27 mm. mesh opening sieve and inspected visually for shotgun pellets that may have "rolled" out. In no case did this inspection yield a pellet. Organic material was washed from the sieve, and the remainder of the sample was poured in and washed under high pressure. This process removed essentially all the fine soil particles, leaving small stones and shot pellets if present. The 1.27 mm. mesh readily recovered all shot pellets commonly used in dove hunting (#9 shot have a diameter of approximately 2.03 mm.). After washing, samples were transferred back to the numbered tubs and allowed to air dry. Air dryed samples were carefully poured into clear plastic containers marked with the sample number (9cm. diameter by 5cm. deep), and placed in a drying oven at 40° C. for 24 hours. Each sample was then placed in a stacked series of sieves, #4, #8, and #12 and shaken. The mesh opening of the #12 sieve is 1.52 mm., which easily caught pellets as small as #9. As each sample was processed, contents of the #12 sieve were individually packaged and numbered in small plastic bags (8cm. by 12cm.). Bags were then taped to a 43 cm. by 34 cm. sheet of cardboard. Total contents of both the #8 sieve and particles passing the #12 sieve were packaged for later examination.

X-ray analysis of the samples was conducted at the Small Animal Clinic, School of Veterinary Medicine, University of Illinois, Urbana. After "shaking" the cardboard sheets to evenly distribute the sample throughout the plastic bags, samples were radiographed at machine numbers of 100 mA, 38 KVP, 0.6 focal spot, and 1 sec. exposure. In addition, the total #8 sieve contents as well as all particles passing the #12 sieve were radiographed to check the selection of sieve sizes.

Samples collected before the hunting season were analyzed visually before radiography, and results from this analysis were compared to radiographical results. In cases of disagreement, the sample was opened and re-examined visually. Four additional pellets were found by radiography, resulting in three additional incidences. Radiographs did not indicate any pellets that were not present (no false positives).

Samples collected after the hunting season were X-rayed first, as this technique proved to be superior to visual analysis. Each sample in which the radiograph indicated dense material was opened and the result was verified visually with the aid of a 32 watt, 2X Luxo magnifier.

Pellets found during examination were checked with a magnet to determine if they were steel shotgun pellets. In many cases, non-spherical, low-density ferrous "rocks" would cling to the magnet which were obviously not shotgun pellets. These were returned to the sample but not noted as pellets. Non-magnetic pellets were probed with a scalpel, and those which were soft and easily cut were determined to be lead shotgun pellets.

RESULTS:

Of the 709 gizzards examined, 3 were determined to contain ingested pellets (0.42%)(Table 1). Eighteen of the gizzards had shot-in pellets in the gizzard cavity. Ten of the gizzards positively identified during X-ray as having shot pellets had pellets embedded in the gizzard wall. All but one incidence of pellets being shot-in were found in association with a penetrating shot hole.

A sample of 287 gizzards was collected from Field #1 on 1 September 1979. One case of ingestion (2 pellets) and 8 incidences of pellets shot in to the gizzard cavity were found. The resulting ingestion and shot-in levels were 0.35% and 2.79% respectively. All pellets were lead.

Field #3 was sampled 2 September 1979, and 300 gizzards were collected. A single incidence of ingestion (1 pellet) was discovered, indicating an ingestion level of 0.33%. In 6 cases, shot-in pellets lodged in the gizzard cavity, indicating a shot-in level of 2.00%. All pellets were lead.

On 3 September 1979, 122 gizzards were collected from Field #2. One incidence (7 pellets) of ingestion indicated an ingestion level of 0.82%. In four cases, shot-in pellets were found in the gizzard cavity, giving a shot-in legel of 3.28%.

Percent incidences of ingested and shot-in pellets were found to be 0.42% and 2.54% respectively for the entire sample. A total of 10 ingested pellets were found in 3 gizzards containing ingested shot. Twenty shot-in pellets were found in the 18 gizzards containing pellets in the gizzard cavity. In all cases, the shotgun pellets were lead.

RESULTS:

Of the 100 samples collected before the hunting season, 46 contained a total of 65 lead shotgun pellets. No steel pellets were found. Samples from the north ½ of the field were found to contain 27 pellets, indicating 58,123 pellets/hectare (23,522 pellets/acre). Thirty-eight pellets were found in the south ½ of the field, indicating a concentration of 81,805 pellets/hectare (33,106 pellets/acre).

After the field was hunted for most of the season, 50 samples collected in the north ½ of the field yielded 84 pellets. Five of these pellets were #4's, found through radiography and visual verification of the #8 sieve contents. Four of these pellets were steel. Similar examination of the particles that passed the #12 sieve revealed no additional pellets.

The 84 pellets found in the north ½ of the field indicate a concentration of 180,830 pellets/hectare (73,181 pellets/acre). Therefore, pellet concentration increased by 122,707 pellets/hectare (49,659 pellets/acre), or 211%, during the hunting season.

RECOMMENDATIONS:

The present levels of ingestion do not indicate a serious problem at Sam Parr. However, continued accumulation of spent shot, the possibility of non-lethal physiological impairment, and the unknown potential for lead poisoning of many other upland game and non-game birds point to the need for continued monitoring of Illinois dove fields.

The use of non-toxic shot should be further considered and explored. Alternative farming and management methods should also be investigated to help alleviate the problem of spent shot accumulation.

Table 1. Summary of mourning dove gizzard examination for ingested shotgun pellets. Sam Parr State Park, 1979. (Number of pellets in parentheses)

Field	Date	n	Incidences of Ingested Pellets	Incidences of Shot-in Pellets	Percentages	
					Ingested	Shot-in
Field #1	9/1/79	287	1 (2)	8 (10)	0.35	2.79
Field #2	9/3/79	122	1 (7)	4 (4)	0.82	3.28
Field #3	9/2/79	300	1 (1)	6 (6)	0.33	2.00
TOTAL		709	3(10)	18 (20)	0.42	2.54

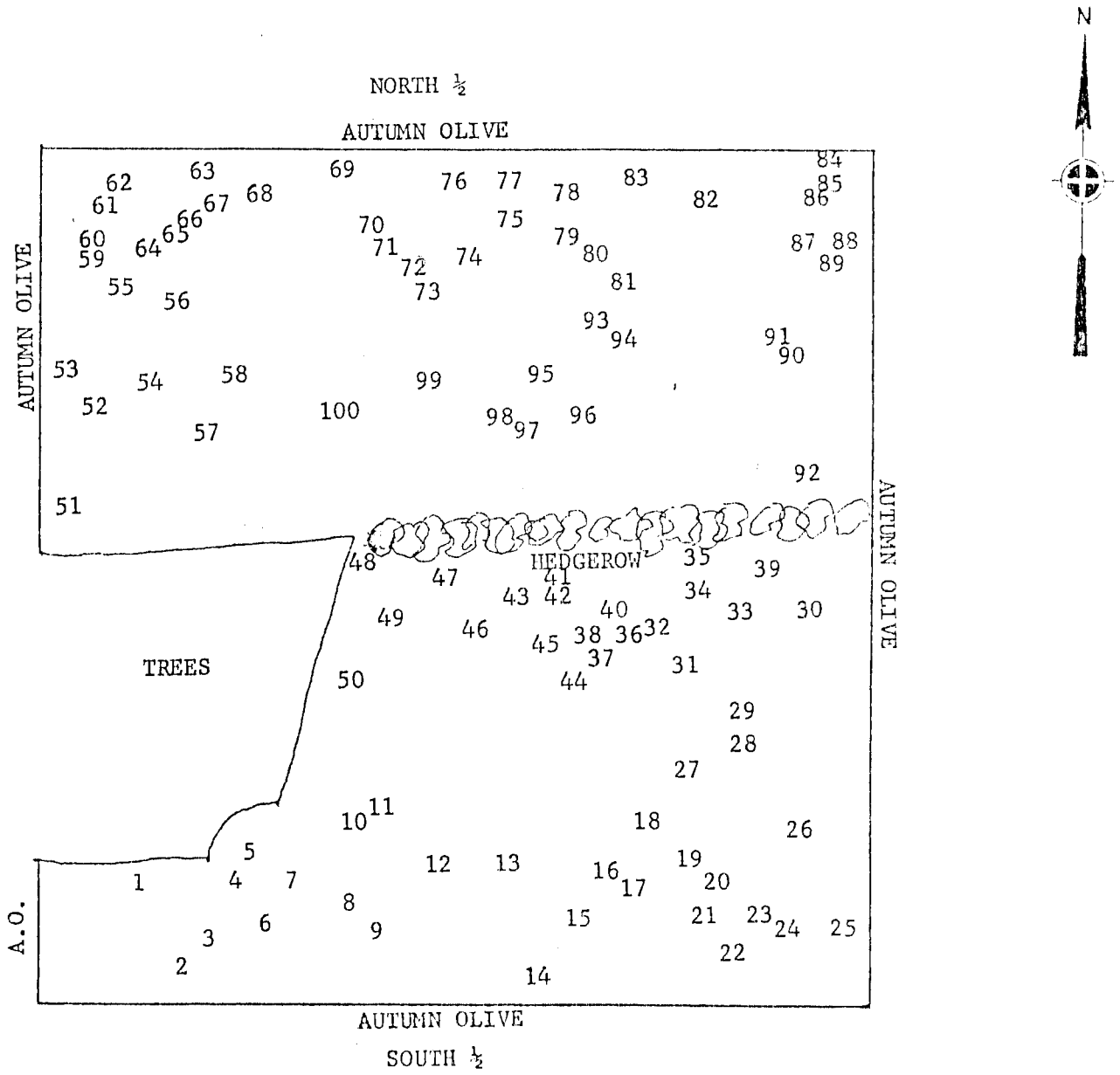

Fig. 1. Soil sampling map of Sam Parr State Park dove field, 1979. Hedgerow separates north ½ from south ½.