Concentration and Placement of Lead Shot in a Former Myrick Marsh Trap Shooting Range

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LEAD SHOT CONTAMINATION IN MYRICK MARSH

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ABSTRACT: During the months of January and February random core samples were taken from Myrick Marsh to determine the range and depth of lead shot in a former trap shooting area. The core samples were radiologically scanned with x-ray equipment for traces of lead shot. Core samples were periodically hand sieved to check for accuracy in the x-ray method. Zones of lead shot fallout were determined and hot spots identified. The zone of 100-200 yards from the point of lead shot release was identified as the area of highest concentration of lead shot (greater than 20 lead shot per sample). Further, it was determined that the lead shot could pose a threat of the areas waterfowl through contamination in the form of lead poisoning. This was based on the assumption that the first four inches of strata are accessible for feeding by waterfowl. In the twenty samples taken, 78.2% of the 403 lead shot found were within the first four inches of strata. Of the 205 lead shot found on the range that was intended to be checked, 61% were in the first four inches of strata. A second range was identified, and one sample was taken in its zone of predicted fallout. This sample contained 198 lead shot with 190 of it occurring in the first four inches of strata.

OBJECTIVE: To identify the range of lead shot in the former Myrick Marsh trap shooting range and identify areas of highest concentration. To roughly determine if the lead shot is accessible to the inhabiting waterfowl.

PRIOR KNOWLEDGE: This study is a more detailed follow up to an initial study done by the WDNR (Wisconsin Department of Natural Resources). The initial study indicated that lead shot was present in the area. The first study also indicated that the site was used for trap shooting until 1962.

MATERIALS: Electronic Distance Measuring device (EDM) ~~with~~ Cubic Precision, INC), reflective targets for the EDM to focus on (a stop sign was used), a

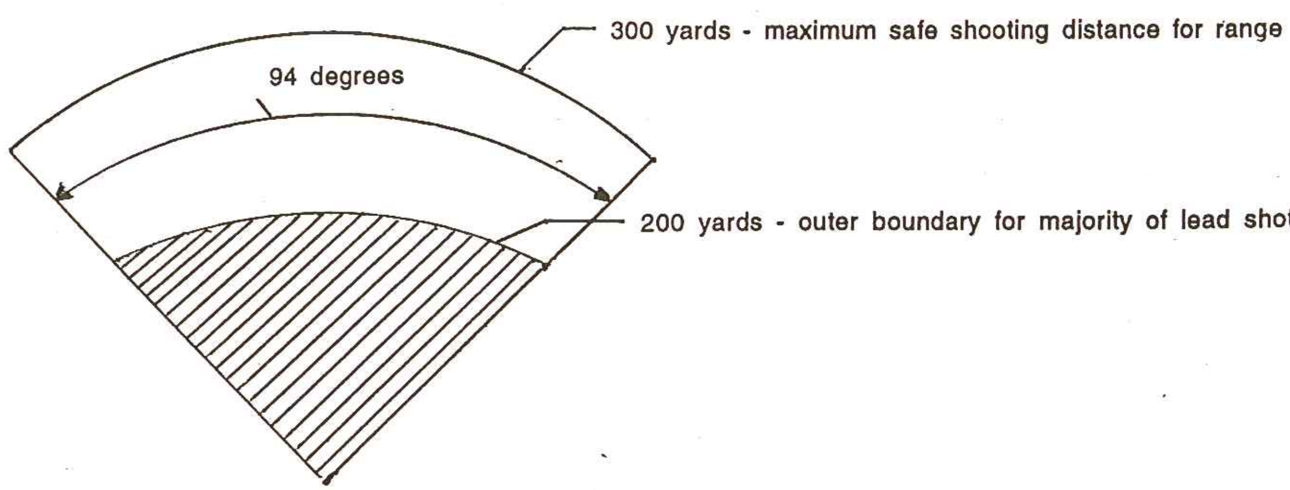
3" ID PVC PISTON CORE 4' 9" LONG
2" ID THIN WALL CONDUIT 10' LONG (USED IN DEEP WATER 4 FT +)

compass, two and three inch coring tubes, site marker flags, 300 foot tape measure, gallon Zip Loc freezer bags, yard stick, ruler, auger, hose, wash pan, series of stacked sieves (2mm, 1mm, 500um openings).

METHOD: Initially the site was inspected. From this initial inspection the trap shooting house and cement shooting positions were located.

Next, information was gathered to identify an approximate shooting zone to determine where the lead shot might fall. Initially, this was difficult to find because the best place to get this information was at local gun shops. The maximum safe shooting distance was 300 yards; however, the majority of the lead shot was expected to fall in the first 200 yards in the middle 40 degrees of the zone (NSSA 1994). One study indicated that the majority of lead shot would fall between 25 and 150 yards (Fredrickson *et al. 1977)*. A 94 degree shooting path was the estimated right and left boundaries (ATA 1993).

Figure 1: Zone of predicted fall out



Once the predicted fall out zone was created the distance and coordinates for 20 samples were randomly generated with a calculator. Of the

20 samples to be taken, 16 sample coordinates were randomly generated with the middle 44 degrees of the zone as the only guideline. Of the remaining eight samples, four were dictated to fall within the first 25 degrees (i.e. on the left) and four were dictated to fall within the last 25 degrees (i.e. on the right). In other words, the coordinates for these two sets of four samples were randomly generated with the two outer zones as guidelines (figure 2). Questions may be raised on how representative these samples are for the zone as a whole, but we must keep in mind the objectives of the project: whether the former trap shooting range poses a threat to wildlife in any way and to identify the zones of highest concentrations. Therefore, representative samples were not necessarily sought. The random distances were from the point of shot release (point of gun fire). From each random distance generated, 108 feet was subtracted to compensate for the distance from the shooter to the placement of the EDM device on the ice (i.e. 48 feet from shooter to the trap house and 60 feet from the trap house to the EDM). The random distance was then measured from the EDM. From each sample to be taken, there was at least one alternate distance randomly chosen (see table1). Each random degree coordinate generated was from the EDM and unlike the random distance, no adjustment to the number was needed.

The coordinate system from the EDM deviated from the coordinate system of the gun angels and trap being shot from the trap house. However, by measuring the degree angle from the EDM, only a small area of the total zone of predicted fallout was lost. What was lost near the outside was of less concern compared to the inside of the zone which was where the majority of the lead shot should have fallen (figure 3).

Before trying to interpret the random degree numbers, note that the center of the zone of predicted fall out was true north (0 degrees or 360 degrees).

Figure 2: Map of site with predicted zone of highest concentration

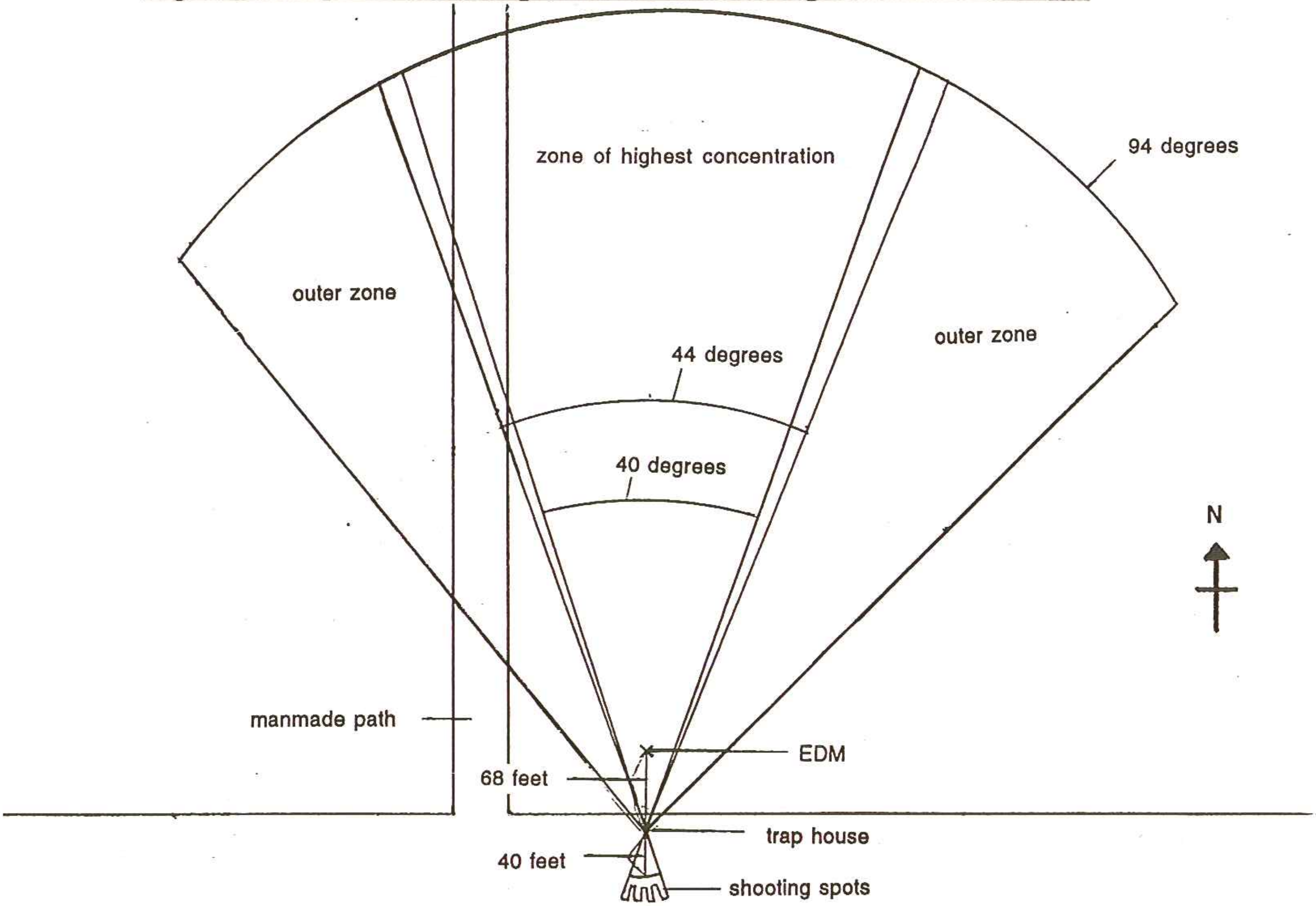


Figure 3: Coordinate zone from the point of shot release versus the coordinate zone from the EDM.

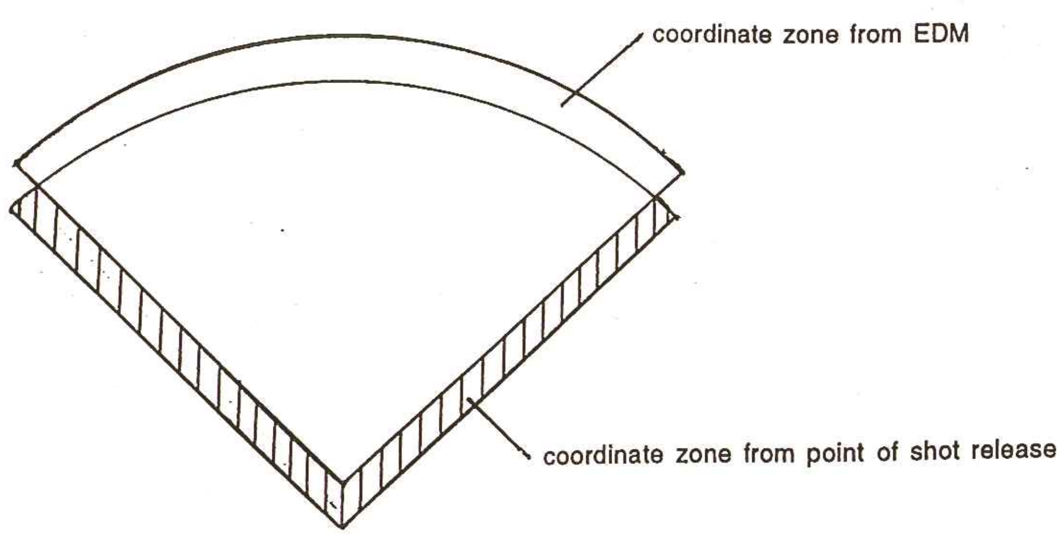


Table1: Table of sites for random samples

Core number	Degree	Distance (ft)	Back up distances
1	316	84	80 608 467
2	329	468	746 200 680
3	336	699	542 458 794
4	339	~~132~~	~~320 476 680~~
5	347	738	677 710 68
6	348	780	682 662 557
7	348	~~468~~	**130** 108 236
8	352	195	368 266 708
9	354	570 + 20	440 605 92
10	357	63	93 608 161
11	1	138	410
12	2	654	410
13	9	192	655
14	11	174	524
15	16	654	182
16	16	600	200
17	21	84	527
18	29	360	671
19	32	60	609
20	45	186	458

With the random points generated, the samples were taken. Each sample spot was located using the EDM. A hole was drilled through the ice at the measured distance using the auger and the site was marked with its sample number using small flags.

From here, a standard procedure was used for taking each sample. The hole was cleared of ice fragments, the depth of the hole was measured and recorded (table 2), and the core sample was taken using the three inch core tube unless otherwise stated. When the core tube was pulled from the hole, the sample was released on the ice/snow at the site. The total sample length was measured, the sample was divided into the two measured segments (top four inches marked "A" and remaining sample marked "B"), and the samples were placed into Zip Loc freezer bags marked with the sample/site number, date, and whether it was the top four inches or lower sample half (see table 2).

The only deviation from this standard procedure was if a sample could not be taken at the randomly selected site. In these instances, a back up plan was used. If the sample could not be taken at the random coordinates, the sample was taken in a two foot radius from that spot at the experimenter's discretion. If a sample could not be taken there, another sample within the two foot radius was taken. If this failed a second time, there were two options. The first option was to try at the alternate distance (as seen in table 1) for that degree coordinate. The second option was to take the sample at plus or minus twenty feet from the sample mark on the same degree coordinate. If these two options failed, another random degree and distance were generated and the sample was taken there.

Of the twenty samples taken, four deviations from the standard procedure were made. First, the hole at sample six was redrilled two feet to the left (when facing due north) due to vegetation preventing the sample from being taken. Second, the hole for sample seven was taken at the first alternate distance because the original distance fell on a manmade path that passed through the zone of predicted fallout (see table 1). The third deviation was sample nine, where the mark fell on solid ground in the marsh. There was inadequate equipment to take a dry ground sample, so the alternate plan was used. The sample was taken twenty feet further down the same degree coordinate as noted in table 1. The last deviation occurred with sample four. Sample four initially fell on dry ground so the alternate plan was applied. However, in conversing with a local passerby it was learned that there was another trap shooting range to the west of the one being checked. Consequently, sample four was placed in what was projected to be an area of high activity for the alternate range (i.e. straight out from the alleged trap house, about half the distance of the area of actual predicted lead shot fall out (one half of 200 yards)). Note in table one that all of the distances for sample four are crossed out. The starting point for the distance of sample four was a point 270 degrees (when facing due north) from the EDM to the middle of the manmade path. From that point a distance of 340 feet was measured due north. Sample four was then taken 175 feet west at a right angle to the north end of the 340 foot line.

Next, each sample was radiologically scanned using X-ray equipment to determine the amount of lead shot in the sample (table 3). To test the accuracy of this method, an initial sample was taken from the marsh. An X-ray was taken of this sample. Then, the sample was spiked with a known number of lead shot and x-rayed again. According to the X-ray there was approximately 22 lead shot in the sample. Now, the sample was hand sieved and 19 lead shot were found. The two numbers were comparable, so the method was deemed accurate at this time. This sample also served a second purpose: to determine how the lead shot would show up on the X-ray film. Later, ten of the actual experiment core samples were hand sieved and the number of lead shot found were compared to the number of lead shot counted on the X-ray (table 4). The number of lead shot found by hand was either less then or equal to the number of lead shot counted on the X-ray. Because these numbers correlated very closely, the X-ray method was again deemed accurate.

Table 2: Table of site depth and sample lengths.

Sample number	Depth at site (ft)	Total sample length (in.)	Lower half sample length (in.)
* 1	4.3	15	11
2	1.4	6	2
3	2.8	9	5
4	1.0	7.5	3.5
5	2.7	1	6
* 6	4.0	9	5
7	2.5	13	5
8	3.0	9	5
9	1.75	12	8
10	1.6	12	8
11	1.6	11	7
12	0.5	11	7
13	1.5	11	7
14	1.7	13	9
15	1.4	9	5
16	2.4	8	4
17	2.3	10	6
18	2.2	12	8
19	2.2	13	9
20	2.6	12	8

* TAKEN WITH 3" CORE ?

J.F.S.

When the X-rays were read for lead shot, the lead shot was easily detected and separated from other debris. The lead shot on the X-ray film appeared slightly larger than the actual size of the lead shot, and the shape of lead shot was completely round and uniform. There was some size variation in the appearance of the lead shot. Whether this was due to the different sizes of lead shot, or whether it had to do with the relation of the distance of the lead shot from the film surface is unknown.

Table 3: The amount of lead shot per sample when x-rayed "A" is bag containing upper 4 inches and "B" is bag containing the remaining inches of the collected sample.

Sample number	Number of lead shot	Other
1A	0	
1B	0	foreign fragment, first 8 inches of second section
1C	1	section c last 3 inches
2A	59	
2B	3	
3A	0	
3B	0	
4A	190	~ 970 / FT^2 ~ 10,440 / m^2 [illegible]
4B	8	
5A	0	
5B	0	
6A	0	
6B	0	
7A	0	

Sample Number	Number of lead shot	Other
7B	1	possible 2nd shot
8A	12	
8B	15	
9A	0	
9B	7	
10A	1	clay pigeon fragments
10B	1	clay pigeon fragments
11A	1	
11B	0	
12A	1	
12B	0	lots of stones or debris
13A	1	
13B	1	
14A	11	
14B	0	
15A	0	vegetation
15B	0	
16A	0	vegetation
16B	0	
17A	0	clay pigeon fragments
17B	0	
18A	38	
18B	50	
19A	0	clay pigeon fragments
19B	1	
20A	1	
20B	0	

A simple method was used to hand sieve the samples. A wash pan was placed into the sink. Three sieve screens were stacked with the smallest diameter mesh on the bottom and placed inside the pan. A hose of running water was used to wash the sample through the screens. After the sample had been washed through, the screens were checked for lead shot. All lead shot was removed and counted (table 4). Often to get down to the actual screen level, vegetation had to be removed and carefully checked for lead shot. The number of lead shot found was compared to the number counted on the X-ray (table 4). If the numbers did not match, the screens were checked again and any removed vegetation was rechecked (dissecting the vegetation if necessary). The set of screens was completely cleared before each new sample was run through them. All removed shot, debris and vegetation was saved for further analysis if necessary.

Table 4: Lead shot per sample when X-rayed verses hand sieved.

Sample number	Number of shot when X-rayed	Number of shot when sieved	Other
1A	0	0	
1B	0	0	misc. fragment
1C	1	1	
4A	190	190	1 in 2nd sieve (1mm)
4B	8	8	
8B	15	14	3 in 2nd sieve (1mm)
12B	0	0	lots of stones
17A	0	0	clay pigeon fragments
18A	38	35	8 in 2nd sieve (1mm)
19A	0	0	clay pigeon fragments

DISCUSSION: A few things should be noted with respect to the sieving process. One, when there was no vegetation present, the shot sat directly on the screen surface. Two, when vegetation was present, lead shot was often found intertwined within the vegetation. However, the majority of the shot was once again on the screen surface. Last, the majority of the lead shot was found on the 2mm screen with some on the 1mm screen and none on the 500um screen.

The lead shot removed from the samples did not look like normal lead shot. The external surface color of each lead shot found was a light gray/white color. When the shot had dried the external color was white. This external white coating could be scratched off of the surface of the lead shot revealing its normal darker gray color.

Fourteen of the twenty samples contained at least one lead shot. Twenty of the forty-one sections contained at least one lead shot. Three samples contained between three and ten lead shot and seven samples contained more than ten lead shot. Five of the seven samples that contained more than ten lead shot were section "A" samples. The lead shot in the "A" sections comprised 78.2% of all the lead shot found. This 78.2% was found in ten of the twenty "A" sections. This is somewhat alarming if waterfowl can penetrate the first four inches of strata when feeding. One study showed that ingestion of one No. 4 commercial lead shot (200 mg) will kill a mallard duck in two weeks if it's on a corn diet (Dieter 1979). Excluding sample four as being a part of a separate range, 61% of the lead shot found was in the "A" sections of the range being checked. Of all the lead shot found, 95.8% of it occurred in five of the twenty samples.

When all the samples were plotted at their coordinates with the number of lead shot found at the sample, a definite pattern appeared. Only eight lead shot were found beyond 200 yards (samples 9 and 12) which supports the original statement that the majority of the lead shot would fall within 200 yards of shot release. Seven samples were taken at 200 yards or more with the eight lead shot appearing in only two of those seven samples. Only two of the 403 total lead shot were found within 60 yards from the point of shot release which also reaffirms the original statement that the majority of the lead shot would be further out than 50 yards. Originally it was stated that the majority of the lead shot was expected to fall between 50 and 200 yards of shot release. Indeed, 97.5% of the total lead shot found was within these boundaries.

The zone of predicted fallout can be divided into five sections based on the fallout of the lead shot in the samples (figures 4 and 5). Section one is 0-90 yards. In this section less than five lead shot per sample is expected to be found. Section two is 90-100 yards. In this section the number of lead shot expected to be found is 5-20 lead shot per sample. Section three is 100-200 yards. Here no more than 20 lead shot per sample is expected to be found. Section four is 200-250 yards where the number of lead shot found lowers back down to 5-20 per sample. Section five is greater than 250 yards. Here less than five lead shot per sample is expected.

Figure 4: Fallout of lead shot in samples taken

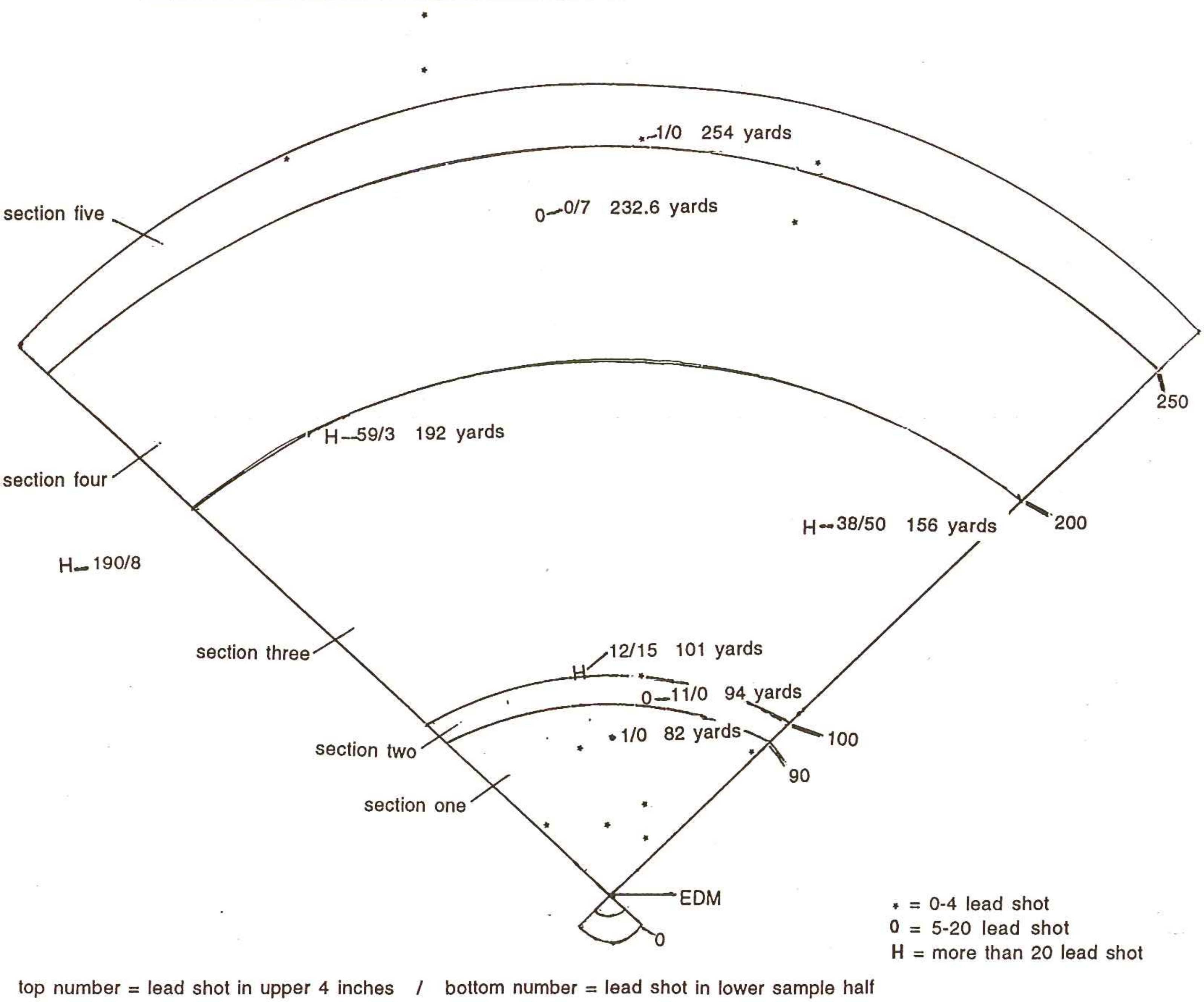
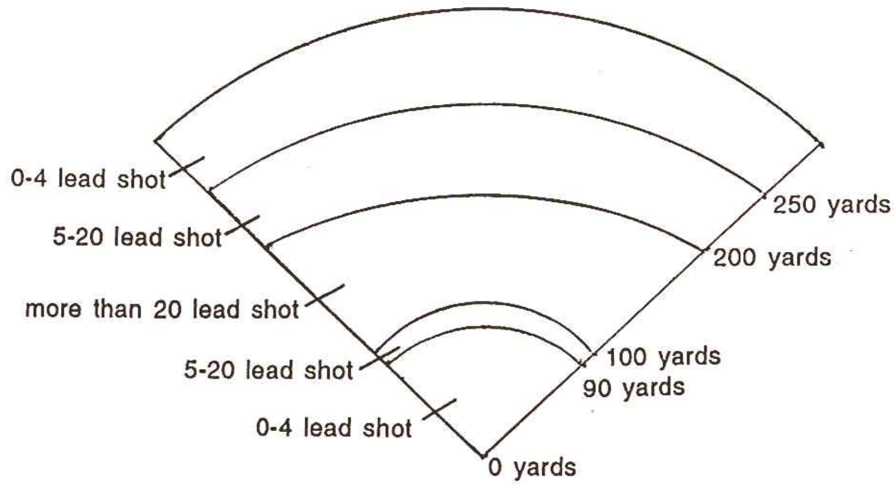


Figure 5: Sectioned zone of predicted fallout



CONCLUSION: The range of lead shot in the former Myrick Marsh trap shooting range was identified to be within 300 yards from the point of shot release. The area of highest concentration was identified as the area between 100 and 200 yards from the point of shot release with higher concentration in the middle of the range. In this area, greater than 20 lead shot in a three inch diameter by 12 inch long sample was expected to be found. The lead shot found in the first four inches of strata comprised 61% of the total lead shot found for the main range identified. This 61% of lead shot poses a threat to waterfowl assuming that they can penetrate the first four inches of strata when feeding. This threat is lead poisoning (both disease symptoms and mortality). A second range to the left of our range when facing north was identified. This second range most likely had more activity based on information from local people and the fact that one sample that was taken in the zone of predicted fallout for the range contained 198 lead shot with 190 occurring in the first four inches.

WATER LEVELS WERE ~1 FT ABOVE "NORMAL" CONDITIONS [initials]

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