CURRENT STATUS OF THE LEAD SHOT ISSUE

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Abstract. Currently the level of lead poisoning mortalities in waterfowl of the United States is not known. Some birds do die as a result of the ingestion of lead shot. The incidence of ingested shot in California pintails (Anas acuta) and mallards (Anas platyrhynchos) does not indicate a hazardous situation. Analysis of the wing bones and gizzards of ducks is being done but is not completed. The results should give a correlation that can be used to assess the magnitude of the problem. Once the actual impact of lead shot on the waterfowl has been identified the problem still must be solved by some type of management change. Possible changes may involve the type of shot used but other possibilities exist such as change in the types of seed plants cultivated for waterfowl foods, change the water management of the affected marshes, add grit sources in areas that are grit deficient or cultivate the soils to help work the shot deeper into the soil.

INTRODUCTION

Currently there is a great deal of interest in the type of shot used for the hunting of waterfowl. Actually, there is a great deal of controversy over what are the effects of lead shot and what should be done about the future of lead shot for waterfowl hunting.

The controversy centers around lead poisoning which may result when waterfowl ingest spent lead shot. There is no question that ingested lead shot can cause the death of waterfowl particularly when the birds are on a straight grain diet. The questions are: 1) How many ducks die from the effects of ingested lead shot; and 2) Should a lead shot substitute be required for use in waterfowl hunting?

Lead poisoning in waterfowl has been recognized since the middle 1870s. Early records are not accurate because of incomplete or misdiagnoses. Sources of error would be: 1) Confusion of lead poisoning losses with disease-caused mortalities, such as, botulism or fowl cholera or, 2) Assuming the presence of lead shot in the digestive tract of a dead bird to be

the cause of death. It could and frequently does happen that birds dead of other causes contain shot.

The controversy was spurred on by claims that the die-offs could amount to 2-3 million birds annually in the United States (Bellrose 1959). If such catastrophic losses occurred photographs of great piles of dead ducks frequently would be in all of the newspapers along with demands from duck hunters, bird watchers, and other people interested in wildlife to stop the losses now! But, the fact is that not many people have ever seen ducks that died of plumbism.

No one can say exactly what the annual National loss is but in California, which winters about 15 to 25% of the national duck population, we do not have any significant die-offs due to lead shot ingestion. Our losses are estimated to be less than 1,000 birds annually.

A research program with the cooperation of the U. S. Fish and Wildlife Service has been undertaken to update our knowledge of lead poisoning. It is also important to make sure that we are not overlooking significant lead poisoning problems.

Currently research is being directed toward assessing the impact of lead on the birds. Essentially three aspects are being examined: 1) The levels of lead the birds are actually absorbing into their skeletal system; 2) The number of the ducks that are ingesting shot and how many shot are present; and, 3) A search for actual lead caused mortality.

MATERIALS AND METHODS

Waterfowl for fluoroscopy were obtained by live trapping with a modified Ohio funnel trap. Fluoroscopy was done at the trapping site by using a Radafluor 360 fluoroscope with power supplied in the field by a portable generator. In most cases the fluoroscoping was done concurrent with the annual banding operations. All birds having shot in the vicinity of the gizzard were sacrificed and checked to determine if the shot was ingested or fired into the bird tissues.

Wingbone collections were made at the time of trapping and fluoroscoping. The wings were removed at the proximal end of the humerus and placed in a plastic bag along with the gizzard. The wings were then held in frozen storage until the radius and ulna were removed at the laboratory.

The bones were then cleaned of flesh, dry ashed acid digested preparatory to lead analysis by flame atomic absorption in a Varian 1200 unit.

All ducks submitted to the laboratory for autopsy were checked for lead poisoning by standard laboratory procedures.

RESULTS

This paper is a progress report and is not intended to give final results. Fluoroscopic examination of 6,279 live trapped mallards (Anas platyrhynchos) and pintails (Anas acuta) in California revealed an ingested shot incidence of 1.14%. See Table 1 for specific breakdown. The percentage of trapped ducks with two or more shot in 1973 was 0.36 and 1974 was 0.51.

Chemical analysis has been completed on 219 duck wingbone samples. The mg/kg of lead found ranged from less than 1 to 930. At this time the data are not adequate for conclusions to be drawn. Samples were grouped for data analysis by species, age class, and the presence or absen[illegible] ingested shot. A summary of the results of chemical analysis is g[illegible]n Table 2.

Table 1. Incidence of Ingested Shot in Live Trapped Pintails and Mallards from Various Areas in California.

Year	Pintail	% with ingested shot	Mallard	% with ingested shot
1959	1797	1.5	672	1.8
1973	961	0.93	698	2.0
1974	1116	1.25	1035	0.6

Table 2. Average (mg/kg) Lead in Wingbones of Ducks.

	Mallards		Mallard-Hybrids*		Pintails	
	Adults	Immatures	Adults	Immature	Adults	Immature
w/o ingested shot	35.09	14.53	98.18	98.16	15.43	10.45
No. in sample	34	39	14	6	35	5
With ingested shot	103.65	272.69	0	0	23.64	54.36
No. in sample	13	7	0	0	7	9

*From Lake Merritt which had no shot.

DISCUSSION

The low rate of lead shot poisoning of California waterfowl is evidence backed up by fluoroscopic findings. Bellrose (1959) felt that birds with only two or more ingested lead shot might be affected by that lead. Our data show that only 0.5% of the mallards and pintails contain enough shot to be of significance. Whether or not these birds develop lead poisoning depends upon many factors such as time of shot retention, nutrition, etc.

The total number of bone samples analyzed for lead content is admittedly low at 219. Generally most birds contain some lead in their wingbones, those that also have shot in their gizzards have higher bone values than those that don't have lead. Of particular interest are the flightless mallard hybrids taken from Lake Merritt City Park in Oakland, California. These birds have had no access to shot but yet contain lead far in excess of the wild mallards and pintails without shot.

The lead content in these domestic crosses must then be from sources other than shot, i.e. lead from fuel.

Perhaps a great deal of the lead in wild ducks is also from various sources of environmental pollution and not entirely due to shot ingestion as was once thought.

There are no practical means to determine the source of lead once it has been deposited in the wingbones. In an attempt to minimize the confusion of environmental pollution lead and lead from shot the analyses will be done on immature birds only.

Most lead poisoning associated research to date has dealt with the type of shot used and its relative effectiveness and toxicity. Emphasis should also be placed in other methods of control.

Some management actions to eliminate or reduce losses:

1. Change shot type from lead to something that retains ballistic efficiency and does not cause sickness when ingested by waterfowl.
2. Change marsh management practices to prevent access to spent shot, i.e. rotation of hunting areas, and soil cultivation.
3. Emphasize natural food production in marsh areas rather than cultivation of grain crops. Corn is especially prone to produce poisoning in birds which have ingested lead shot.
4. Place gravel for grit in marshes where little or none exists.
5. Adjust water levels to make heavily shot over areas less desirable to feeding waterfowl.

Changing or altering the type of shot has received a great deal of interest in the past 15 years. Lead shot was coated in hopes this would prevent lead sickness--results were unsatisfactory. Copper was substituted for lead but the results were negative since it also caused poisoning.

Steel was substituted and results were mixed--it didn't cause sickness but it could result in 200,000-400,000 additional crippled ducks a year (U. S. Fish and Wildlife Service 1974), if required on a national basis. Various lead alloys were tried such as lead/selenium and lead/magnesium, results were generally negative.

Currently the best substitute appears to be shot made from a mixture of lead and iron. The research with the lead/iron mixture was started by (Irwin, 1972, 1974) the Canadian Wildlife Service and the University of Guelph. They found that lead-iron shot is much less toxic than lead shot and ballistically more efficient than the steel shot. Currently research

on this compromise shot is being carried out in the United States by Illinois Natural History Survey and Winchester-Western.

Marsh management practices can also be carried out that will prevent access to the shot. Flooding, draining, gravel dumping, tilling of marsh soils and changing the type of food plants can all be used to prevent lead poisoning.

The California Department of Fish and Game research has been directed toward fluoroscoping trapped ducks and hunter-killed birds to determine the incidence of ingested shot, and analyzing the wingbones of birds with and without ingested shot. The intent of our research plan is to determine if a relationship exists between ingested shot levels and lead content of wingbones. Future research will also include investigation of marsh management techniques to minimize the effect of spent shot regardless of type used.

LITERATURE CITED

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