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Author(s): L. N. Locke, S. M. Kerr, D. Zoromski

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Case Report—

Lead Poisoning in Common Loons (*Gavia immer*)

L. N. Locke,^A S. M. Kerr,^{A,B} and D. Zoromski^C

^AU.S. Fish and Wildlife Service
National Wildlife Health Laboratory
6006 Schroeder Road
Madison, Wisconsin 53711

^CCentral Animal Health Laboratory
6101 Mineral Point Road
Madison, Wisconsin 53705

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SUMMARY

Two emaciated common loons (*Gavia immer*) were believed to have died of lead poisoning when fragments of fishing lines and lead sinkers were discovered in their stomachs. Later a third emaciated loon, which had only the remnants of fishing line in its stomach, was suspected of being a possible lead-poisoning victim when all other test results were negative. The liver lead levels in the first two loons were 20.6 ppm and 46.1 ppm (wet weight), and the level in the third was 38.52 ppm (wet weight). Thirteen common loons dying of other causes had liver lead levels of less than 1 ppm (wet weight).

INTRODUCTION

Lead poisoning in waterfowl following the ingestion of spent lead shotgun pellets has occurred at many sites in the United States (1,2) and Europe (3,5,6). However, cases of lead poisoning among wild birds caused by other sources of lead have been reported only occasionally. A whistling swan (*Olor columbianus*) in Maryland (9), mute swans (*Cygnus olor*) in Michigan (J. N. Stuh, personal communication) and England (10), and a trumpeter swan (*Olor buccinator*) in Washington State (unpublished data, National Wildlife Health Laboratory) died of lead poisoning after ingesting fisherman's sinkers. Piscivorous birds occasionally may be exposed to lead intoxication by ingesting escaped fish carrying hooks, fragments of fishing lines, and sinkers or by picking up sinkers with stones from the bottoms of lakes and ponds. This

^BNow in private veterinary practice in Gering, Nebraska.

paper reports findings in three common loons believed to have died of lead poisoning following ingestion of fisherman's lead sinkers.

CASE REPORT

Common loons were collected in the field, frozen, and shipped to the National Wildlife Health Laboratory for necropsy. Livers and organs required for toxicological and bacteriological studies were removed at necropsy. Tissues for chemical analysis were macerated and subsampled to obtain representative 5-g samples. Samples were dried in a 100 C oven overnight, cooled, then placed in a muffle furnace at 450–500 C and ashed. The ashed sample was cooled and then digested by adding 15 ml of 25% (vol/vol) HCl plus a few drops of HNO₃ and placing it in a boiling water bath for 45 min. After digestion, the sample was filtered through a Reeve-Angel #202 filter and diluted to volume with water. Samples were measured with a Perkin-Elmer model 303 atomic absorption spectrophotometer, and values were calculated. All levels are expressed in wet weight unless otherwise stated.

Case 1. The first loon (*Gavia immer*) was first observed on 6 September 1976 lazily swimming about a cove on Squam Lake, Center Harbor, New Hampshire. The loon was observed for 2 hours (10:00 to 12:00 a.m.), after which it appeared to be merely floating on the surface. At 2:00 p.m., the loon was found dead.

The loon was an adult female weighing 3.215 kg; no subcutaneous or abdominal fat was present, and the pectoral muscles were moderately atrophied. The sternal keel was palpable. The vent feathers were stained slightly with greenish feces. Internally the lungs were normal, the liver and kidneys were congested, and the heart was normal except for lack of coronary fat. The spleen was normal in size: 35 mm long, 7 mm wide, 5 mm thick. Seven crayfish — some entire, others partially digested — were found in the esophagus and proventriculus. A lead fishing sinker and about a dozen stones were present in the ventriculus.

Routine bacteriological cultures of the liver, spleen, heart blood, kidney, and lung were negative for pathogenic bacteria. Mouse toxicity tests were negative for both type C and type E botulism. Virus-isolation attempts were made with swabs of the brain, trachea, and the cloaca, and all test results were negative. Liver, kidney, lungs, spleen, heart muscle, heart blood, femur,

Table 1. Lead levels in adult loons dying of lead poisoning.

State	Sex	Lead in ppm (wet weight)		
		Liver	Kidney	Sinker
N.H.	Female	20.6	61.4	+
Wis.	Male	46.1	15.7	+
Maine	Male	38.52	Not done	-

cerebellum, and cerebrum were submitted for lead analysis. The femur contained 39.22 ppm lead; heart muscle, 0.91; lung, 2.34; spleen, 3.24; cerebrum, 1.40; and cerebellum, 1.02. The blood clot from the heart contained 9.91 ppm lead. Values for liver and kidney are shown in Table 1.

Case 2. The second loon was washed up on the shore of Little Lake near Butte des Morts in Winnebago County, Wisconsin, on 13 May 1980. The loon was an adult male with a prominent sternal keel and moderate atrophy of the pectorals, and it weighed 3.0 kg. No obvious traumatic lesions were observed. Subcutaneous fat deposits were reduced to small strands of adipose tissue at the thoracic inlet and near the patellae. Grossly, the right lung was normal; there was an area of consolidation in the posterior border of the left lung. The liver and heart appeared normal. The kidneys were light purple. The ventriculus contained rocks, fragments of fishing line, and an oval lead sinker (5×4 mm narrowing to 2.5 mm and weighing 0.5891 g). No other abnormalities were noted. Table 1 shows lead levels in the liver and kidney. Results of bacteriological tests, including tests for type C and type E botulism, were negative.

Case 3. The third loon was found dead on a nest at Indian Lake, Maine, 16 July 1979. The loon was an adult male weighing 3.450 kg. There was no subcutaneous fat, and the pectoral muscles were markedly atrophied. No obvious traumatic lesions were observed. Internally, there were no gross lesions in the lungs, liver, spleen, heart, or alimentary canal. The kidneys were tan, and urates were present in the collecting tubules and the ureters. The stomach contained three pieces of fishing line but no lead sinkers or lead fragments. The liver was removed and subsequently analyzed for lead content (Table 1). Bacteriological and virological test results were essentially negative; only *Escherichia coli* was

isolated from the liver. Test results for type C and type E botulism were negative.

For comparison, the livers of 13 common loons dying of other causes were analyzed for lead. Each liver contained < 1.0 ppm lead (Table 2).

DISCUSSION

Although no experimental work has been done with loons to establish the tissue levels of lead indicative of lethal exposure, the levels in the livers of these loons suspected to be lead-poisoned are within the range of levels reported in lead-poisoned waterfowl (1,3,4,5) and lead-poisoned bald eagles (*Haliaeetus leucocephalus*) (7). Canada geese (*Branta canadensis*) (4) experimentally poisoned with lead shot given by gavage had liver levels of 5–32 ppm; in field cases of Canada geese dying of lead poisoning, the liver lead values have ranged from 6 to more than 50 ppm (1).

Sixteen of 17 mute swans found dead or dying on the River Trent, Nottingham, England, died of lead poisoning following the ingestion of fisherman's lead sinkers. Their livers had a mean of 67 ppm lead (dry weight) (10). The liver of a whistling swan from Maryland that had ingested a lead sinker contained 40 ppm lead (wet weight) (9).

Table 2. Liver lead levels in loons dying of causes other than lead poisoning.

State	Sex	Age ^A	Cause of death	Pb in ppm (wet weight)
Maine	M	Ad	Trauma	<1.0 ppm
Maine	M	Im	Trauma	<1.0 ppm
Maine	M	Ad	Aspergillosis	<1.0 ppm
Maine	F	Ad	Trauma	<1.0 ppm
Maine	F	IM	Shot	<1.0 ppm
Mich.	M	Ad	Type E botulism	<1.0 ppm
Mich.	F	Ad	Type E botulism	<1.0 ppm
Mich.	F	Ad	Type E botulism	<1.0 ppm
Mich.	F	Ad	Type E botulism	<1.0 ppm
Mich.	F	Ad	Type E botulism	<1.0 ppm
Wis.	M	Ad	Trauma	<1.0 ppm
Del.	M	Im	Not determined	<1.0 ppm
Tex.	M	Ad	Oil pollution	<1.0 ppm

^AAd = adult; Im = immature.

Although the majority of the cases of lead poisoning in birds are sequelae to the ingestion of spent shotgun pellets, some birds have been poisoned after ingesting lead-based paint (8), solder (6), or fisherman's lead sinkers (9,10).

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