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Lead Concentrations in Ruffed Grouse Collected from Southwestern Virginia

Abstract

Sixteen Ruffed Grouse (*Bonasa umbellus*) were collected from mountainous areas in southwestern Virginia by shooting and their livers and tarsometatarsal bones analyzed for lead (μg lead/g, d.w) by atomic absorption spectrophotometry. Liver lead concentrations averaged (±S.E.) 2.27±0.43 μg/g, and no evidence of ingested lead shot was found. Overall, mean (±S.E.) lead concentration in bones was 2.78±0.57 μg/g, and values ranged from 0.44-9.15μg/g. Bone lead concentrations of Ruffed Grouse appear to provide reasonably realistic background values for lead in remote forested areas in Virginia.

Introduction

Lead contamination is a continuing problem for populations of wild avian species either from ingestion of spent lead shot (Bellrose 1959, Westemeier 1966, Lewis and Legler 1968, Kendall and Scanlon 1979) or from exposure to environmental lead contamination (Tansy and Roth 1970, Siegfried *et al.* 1972, Ohi *et al.* 1974, Kendall and Scanlon 1979). There is a paucity of information on background concentrations of lead in avian species collected from relatively undisturbed habitats. Data from such species should better approach "normal" background tissue lead concentrations and thus be useful in evaluation of elevated concentrations. This report is concerned with lead concentrations in Ruffed Grouse (*Bonasa umbellus*), a nonmigratory species inhabiting relatively remote habitats in southwestern Virginia. Scanlon *et al.* (1980) have addressed concentrations of lead and other heavy metals in feathers of Ruffed Grouse; this study addresses lead concentration in livers and skeletal tissue of Ruffed Grouse.

Methods and Materials

Sixteen Ruffed Grouse were collected by shotgun from mountainous areas in southwestern Virginia. Each bird was transferred to the laboratory, where the liver and tarsometatarsal bone were dissected free and frozen for later lead analysis. Tissues from individual birds were dried, ashed, and dissolved in acid. The concentration of lead was determined by atomic absorption spectrophotometry using an Instrumentation Labora-

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tories Model 351 spectrophotometer in the flame mode. Procedures used in preparing samples and in determining heavy metal concentrations are given in Scanlon *et al.* (1980b). Concentrations of lead were calculated in terms of μg/g dry weight (d.w.) in both the liver and tarsometatarsal bone.

Results and Discussion

Overall mean (±S.E.) lead concentration in tarsometatarsal bones of Ruffed Grouse was 2.78 ± 0.57 μg/g, and values ranged from 0.44-9.15 μg/g (Fig. 1). These lead

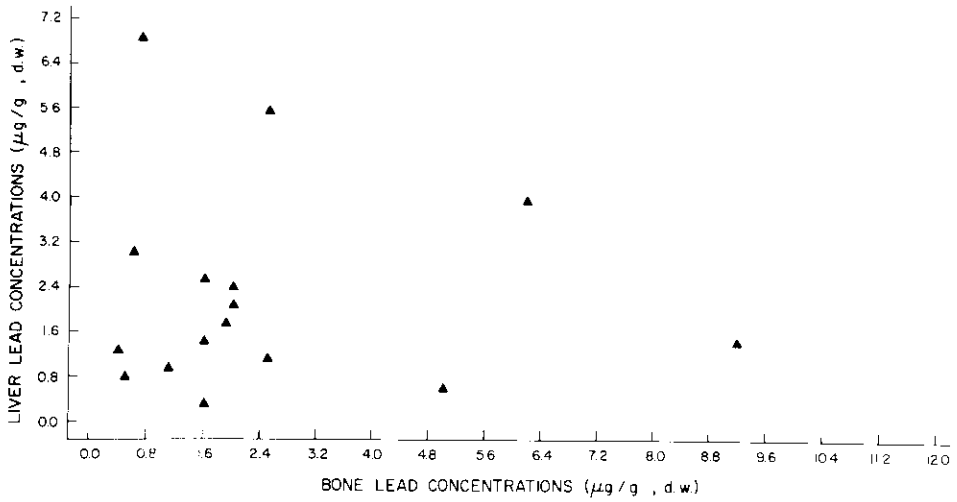

Figure 1. A plot of bone lead and liver lead concentration (μg/g, d.w.) in Ruffed Grouse collected from southwestern Virginia.

concentrations in skeletal tissue were considerably below those found in Mourning Doves (*Zenaida macroura*; range of 1.02-763.65 μg/g bone lead; N = 412) (Kendall and Scanlon 1979) and Rock Doves (*Columba livia*; range of 6.63-727.86 μg/g bone lead; N = 39) (Kendall and Scanlon 1982), although lead in their femurs was determined. Mourning Doves had a mean (±S.E.) bone lead concentration of 43.07 ± 4.44 μg/g in their femurs and represent a species that often inhabits areas of high human population densities with consequent potential for increased exposure to environmental lead (Kendall and Scanlon 1979). In contrast, the Ruffed Grouse is a species occupying more remote, and presumably more pristine, environments. The lead concentrations in tarsometatarsal bone approximate values published for Ruffed Grouse features (Scanlon *et al.* 1980a).

Overall mean (±S.E.) lead concentration in livers of Ruffed Grouse was 2.27 ±0.43 μg/g. No evidence of ingested lead shot was found, as liver lead concentrations were relatively low in grouse when compared with liver lead concentrations ($\bar{X} \pm$S.E. $= 11.4 \pm 3.6$ μg/g) in Japanese Quail (*Coturnix coturnix japonica*) that had ingested one No. 8 lead pellet (Kendall and Scanlon 1981). Mourning Doves had liver lead concentrations that ranged from undetectable up to 76.45 μg/g ($N = 412$) in birds that had ingested lead shot. However, liver lead averaged 2.94 μg/g (d.w.) in doves, slightly higher than in grouse (Kendall and Scanlon 1979). Although Ruffed Grouse and Mourning Doves were collected by shooting, contamination of liver tissue by penetrating lead pellets could be a possibility. However, such lead contamination of livers is unlikely, as Japanese Quail shot through the liver with lead pellets did not have higher liver lead concentrations than those decapitated (Kendall and Scanlon 1981).

Bone lead concentrations of Ruffed Grouse appear to provide reasonably realistic background values for lead in remote forested areas in southwest Virginia. The values for liver lead concentrations appear to be less sensitive in contrasting a remote dwelling avian species, such as the Ruffed Grouse, with a species probably exposed to greater amounts of environmental lead, such as the Mourning Dove. However, liver lead concentrations can provide valuable information on the possible ingestion of spent lead shot by Ruffed Grouse. It appears that Ruffed Grouse collected by hunters are a useful source of tissues for monitoring lead concentration in avian species that inhabit relatively remote ecosystems.

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