
WATERFOWL AND LEAD SHOT

Author(s): Bruce B. Weyhrauch

Source: *Environmental Law*, Summer 1986, Vol. 16, No. 4 (Summer 1986), pp. 883-934

Published by: Lewis & Clark Law School

Stable URL: <https://www.jstor.org/stable/43265778>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at <https://about.jstor.org/terms>



is collaborating with JSTOR to digitize, preserve and extend access to *Environmental Law*

JSTOR

WATERFOWL AND LEAD SHOT

BY
BRUCE B. WEYHRAUCH*

Hunters use lead shot to hunt waterfowl. Much of the spent shot ends up on the ground where it may be ingested by birds. This lead shot poisons the birds which become prey for animals and eagles, which in turn may die from lead poisoning. Nontoxic or steel shot can be used as an alternative to lead shot. The federal government's response to the problem of lead shot is to implement nontoxic shot zones where lead shot is prohibited for waterfowl hunting. State reactions to lead poisoning of waterfowl are mixed. Some states have their own nontoxic shot zones; some have not responded to lead shot poisoning; two states prohibit lead shot for hunting waterfowl. The author discusses court cases on migratory bird protection and the lead shot issue. The Article concludes that lead shot should be banned for waterfowl hunting and eventually for all hunting. States should act aggressively to eliminate lead shot poisoning in waterfowl, and Congress should repeal the Stevens Amendment, which requires state approval of federally proposed nontoxic shot zones. Private organizations and hunter groups should educate the public regarding steel shot.

I.	INTRODUCTION	884
II.	LEAD IN THE ENVIRONMENT	889
	A. Sources of Lead in the Environment	889
	B. Sources of Lead in the Waterfowl's Environment	890
III.	TOXIC EFFECTS OF LEAD	892
	A. Lead's Toxic Effects on Humans	892

*Attorney I, Alaska Department of Law, Office of the Attorney General, Juneau, Alaska; J.D. 1986, Northwestern School of Law of Lewis and Clark College; B.S. 1979, California State University, Humboldt. I gratefully acknowledge the following individuals who agreed to review earlier drafts of this Article: Professor Michael C. Blumm, Professor James Huffman, Adjunct Professor Gary Meyers, Robert Hogfoss, Dr. H. Barry Holt, all of the Northwestern School of Law of Lewis and Clark College; Tom Roster of Klamath Falls, Oregon; Foundation Professor Paul A. Johnsgard of the University of Nebraska; and Dr. Louis N. Locke, D.V.M., of the United States Fish and Wildlife Service, National Wildlife Health Laboratory. Special thanks to Lenair Mulford and Kevin Jenkins. The views, opinions, and any remaining errors are solely those of the author.

	B. <i>Lead's Toxic Effects on Waterfowl</i>	893
	C. <i>Lead's Toxic Effects on Other Wildlife</i>	896
	D. <i>Other Substances Toxic to Waterfowl</i>	899
IV.	NONTOXIC SHOT AS AN ALTERNATIVE TO LEAD SHOT	900
	A. <i>Hunting with Nontoxic Shot</i>	901
	B. <i>Effects, Ballistics, and Economics of Nontoxic Shot</i>	904
V.	OTHER LEAD SHOT MITIGATION MEASURES	906
	A. <i>Tillage</i>	906
	B. <i>Water Management</i>	908
VI.	LEGISLATION AND REGULATIONS ON WATERFOWL AND LEAD SHOT	910
	A. <i>International Treaties</i>	910
	B. <i>Federal Legislation and Regulations</i>	912
	1. <i>Nontoxic shot zone regulations</i>	915
	2. <i>Regulations to protect bald eagles from lead poisoning</i>	917
	C. <i>State Legislation and Regulations</i>	917
	1. <i>States without laws or regulations</i>	918
	2. <i>States prohibiting lead shot in certain areas</i>	919
	3. <i>States with state-wide bans on lead shot</i>	920
	4. <i>States banning regulations prohibiting the use of lead shot</i>	921
	D. <i>Actions by Flyway Councils</i>	922
VII.	CASES ON MIGRATORY BIRD PROTECTION	923
	A. <i>Seminal Court Tests</i>	923
	B. <i>Lead Shot Regulation Litigation</i>	925
	C. <i>Resulting Regulatory Proposals</i>	930
VIII.	SYNTHESIS	931
	A. <i>Legislative Reforms</i>	931
	1. <i>Federal reforms</i>	931
	2. <i>State reforms</i>	932
	B. <i>Future Litigation</i>	933
	C. <i>Private Organization Actions</i>	933
IX.	CONCLUSION	933

I. INTRODUCTION

Consider the duck.

Hatched from a thick-shelled egg, it begins life in a cool,

soggy marsh in spring. Slowly, the hatchling realizes it is not alone underneath the downy, soft belly of its mother; numerous siblings prove to be rivals for the warmest portions of the nest. When it is clear that the family is growing no more, the mother rises. The secure borders of the nest give way to pandemonium. The ground and air teem with the sight and sound of feathered life. The take-offs, landings, and hoverings of the ducklings' fellow species blotch the skies. The ground waddles with males who remain earthbound with molted feathers, and female ducks with their own broods. The visual impact of a sea of fellow ducks, swans, and geese is highlighted by a din of quacks, caws, and clucks which both startle and soothe the ducklings: a welcome call to celebrate new life.

The mother's first move after rising from the nest is to water. Webbed feet, a light body, a bill, oiled feathers, a nictitating membrane over its eye, and warm down make the duck at one with a marshy, watery environment. Clumsy and slow on land, it is smooth, flowing, and able to thrive in water. The teeming marshes and wetlands provide the duck with life, food, and habitat.

The spring passes to summer. The ducklings feed on small water plants, bugs, seeds, and wild grains. They grow, mature, shed their down, and develop into adults. As the warm summer season wanes and frost begins to tinge the landscape, an ancient discontent wells up within the ducks. They rise to the air, traveling south in long-established migration patterns etched into their genes. Whether guided by the sun, stars, physical landmarks, or the earth's magnetic field, the ducks travel day or night. They migrate over flat lands without distinguishing features and through clouds, unable to see anything, remaining on their path to their ancestral wintering grounds.

Over the course of their journey, the waterfowl stop at ponds, waterholes, marshes, swamps, and uplands to rest, feeding on fruits of the wild and crops of the farmer. Depending upon the migration corridor, species, and weather, the waterfowl may end their journey along the southern edges of North America, or in Central or South America. In North America, the winter home of waterfowl ranges from California's wetlands, through the bayous and sloughs of Texas and Louisiana, up into the bays, inlets, and marshes of the Atlantic seaboard.

Waterfowl spend the winters feeding, molting, and waiting

for winter to break into spring. For as spring brings forth renewal in nature, it beckons the ducks north to the marshlands of their birth: to act out the continuing cycle of their heritage.

Enter the hunter.

As autumn approaches, preparation for the hunt begins. Preparation is mostly hard work and waiting. Hard work: training the dog, building the blinds, looking for the choice hunting spots, cleaning and oiling the gun, boots, and engines. Waiting: for the season to open, for the signs of the first duck, for the alarm to go off in the morning. Shivering in the blind or on a crouch.

Then, the first sign of dawn and the sight of a duck setting its wing against the wind. The forced restraint—waiting for the perfect shot. Suddenly wide awake, as the duck comes into the decoys, adrenaline pumps into every muscle. Jumping up, squeezing the trigger: the barrel flaring along the path of the duck, a quick look around for the chance for a double.

The noise and splash of the dog into the water settle the adrenaline-surged heartbeat. The hunter holds the retrieved bird in his hands with respect for a creature both beautiful and strong. Even in death the hunter honors the duck, which will continue to beckon him long after he hangs up his decoys, building memories of exhilarating mornings in the marsh.

Consider the method.

In his quest for the duck, the hunter uses a shotgun. The shotgun fires a shell containing lead shot. Number six shot is a common size used in duck hunting and is about the size of the letter "O." A shotgun shell consists of 225 to 350 shot. The total weight of the lead shot load is approximately one and one-half ounces and each duck may be fired at one or more times by the hunter.

If the hunter hits the bird, the bird may be killed or crippled and retrieved, or fly away to die and become food for scavengers who eat the bird and ingest the lead shot. If the predator is a mammal, it will usually defecate the lead shot. If the predator or scavenger is another bird, a raptor for example, the lead pellet may be voided along with the regurgitated bones and feathers, or lead can be absorbed into the predator's tissues.

The lead shot that does not hit the duck falls to earth and is

deposited in the hunting area. This "spent" lead shot can enter the substrate, remain on top of the ground, or sink into the waters of a lake, pond, or marsh. On the ground, other ducks and birds can ingest the spent shot, as they do stones and gravel. These ingested lead pellets end up in the bird's gizzard if they are not passed out of the bird. The gizzard uses the pellets, small stones, and pieces of gravel to assist in the grinding of food ingested by the bird.

Lead shot used to hunt waterfowl is toxic when ingested and the elemental lead is absorbed into the bird's body. Lead causes anemia, weakness, susceptibility to disease, emaciation, and death. In areas where there are high concentrations of hunters using lead shot, the spent shot deposited on the ground can be ingested by waterfowl and result in large waterfowl die-offs. The continued use of lead and its concomitant negative impact on waterfowl and on other birds, particularly eagles, focuses attention on the use of lead shot by hunters. The toxic effects of lead have resulted in forced or voluntary measures by hunters, and state and federal agencies, to reduce lead's impact on the environment in general, and on waterfowl and eagles in particular.

This Article considers whether lead shot should be prohibited because of its negative physiological impact on waterfowl and its short and long-term negative impact on the environment. Section II of the Article describes how lead is introduced into the environment principally by the combustion of fuels containing lead. Waterfowl exposure to lead comes primarily from hunters using lead shot. Up to 3000 tons of lead may be deposited annually by waterfowl hunters using lead shot.

Section III connects the presence of lead in the environment to the poisoning of both humans and wildlife. First, the section briefly describes the symptoms of lead poisoning in humans as a point of reference. Next, the section describes the toxic effect of lead poisoning in waterfowl. Estimates of the number of waterfowl dying from lead poisoning caused by lead shot ranges from 1.6 to four million birds per year. Lead shot is also responsible for the poisoning of other wildlife, including bald eagles, upland game, and mammals.

Section IV describes why lead shot is used, discusses the non-toxic alternatives to lead shot, and compares the hunting effectiveness, ballistics, and economics of lead and steel shot. Most

hunting groups oppose the requirement that nontoxic or steel shot be used instead of lead shot. These groups argue that lead shot costs less, cripples fewer ducks, and does not damage shotgun barrels. This section concludes that increased hunter use of nontoxic or steel shot will eventually lead to lower prices, better accuracy through practice, and ultimately fewer cripples. Further, studies indicate shotgun barrel damage from steel shot is a rare occurrence and thus a specious issue.

Other mitigations exist to lead shot poisoning besides requiring the use of nontoxic shot. Section V discusses these mitigations which include tilling the ground where there is a heavy concentration of lead shot, and draining or flooding lands where waterfowl tend to concentrate to prevent access to lead shot. Both of these alternative mitigations are expensive, complex, have several negative environmental side effects, and are difficult to implement in most areas of the county. Compared to banning the use of lead shot, the alternative mitigations are far less desirable.

Section VI gives an overview of the international, federal, and state laws and regulations governing waterfowl management and lead shot. The United States is party to several international treaties which protect migratory waterfowl. Federal laws, principally the Migratory Bird Treaty Act, and regulations give the federal government the right to regulate the protection and hunting of waterfowl. They detail restrictions on the hunting season, the methods of taking waterfowl, and the use of lead shot. In 1978, and every year since, the ability of the United States Fish and Wildlife Service to regulate the use of lead shot has been restricted by the "Stevens Amendment." The amendment prevents the Fish and Wildlife Service from requiring the use of steel shot in any state without that state's approval. This leads to piecemeal, state-by-state solutions, and thwarts a much-needed nationwide approach to lead shot poisoning. The states are mixed in their response to waterfowl lead poisoning. Some have no laws prohibiting lead shot, some establish nontoxic or steel shot zones, but two states have banned the use of lead shot altogether for hunting waterfowl.

Section VII discusses salient court decisions on waterfowl and lead shot. Emphasis is on litigation pertaining to the regulation of lead shot and the imposition of nontoxic shot zones by the Fish and Wildlife Service. As a result of this litigation, recent reg-

ulatory proposals by the Fish and Wildlife Service would ban the use of lead shot in all states, or in the alternative, greatly expand nontoxic shot zones.

Sections VIII and IX conclude that the use of lead shot should be banned for all bird hunting in the contiguous United States and Alaska. Further, the Stevens Amendment should be repealed by Congress as it hampers efforts by the Fish and Wildlife Service to enact federal standards dealing with lead shot poisoning. States should enact strong regulatory measures banning lead shot, first for the hunting of waterfowl, and then for all game. Private wildlife and hunting organizations, in concert with their federal and state counterparts, should educate the hunter and the public on the problems of lead shot and act to diminish hunter opposition to nontoxic shot. The use of lead shot has gone on too long, and the problem of lead poisoning is too great to allow any more regulatory, hunter, or bureaucratic foot-dragging on its prohibition.

II. LEAD IN THE ENVIRONMENT

A. Sources of Lead in the Environment

Lead is an element and commonly exists in certain rock formations. As an environmental contaminate, however, lead is introduced into the environment principally from three sources: (1) internal combustion engines using fuels containing lead; (2) burning coal and fuel oils containing lead; and (3) lead ore mining and refining, lead smelters, and battery reprocessing.¹ The National

1. Corrin & Natusch, *Physical and Chemical Characteristics of Environmental Lead*, in *LEAD IN THE ENVIRONMENT* 7 (W. Boggess ed. 1977). For a general abstract of the literature on lead see *WHAT'S NEW IN FORENSIC SCIENCE IN 1971*, at 214-15, 221-22 (A. Moenssens ed. 1972). Although lead is beneficial to society and is used extensively in art, industry, and recreation, its harmful effects and its hazards to human health have long been recognized. Lead may have contributed to the downfall of the Roman Empire because the Romans' wine vessels and water pipes were made of lead, and as they drank, they slowly poisoned themselves. Keate, DiPietrantonio & Randleman, *Occupational Lead Exposure*, 51 *INS. COUNS. J.* 425 (1984) [hereinafter Keate]. Similarly, the ancient Egyptians used lead containers to sweeten and preserve wine that slowly poisoned and killed them. *Id.* Lead is still a modern-day health problem when used in water pipes and whiskey stills. See Whitfield, Chien & Whitehead, *Lead Encephalopathy in Adults*, 52 *AM. J. MED.* 289-98 (1972). Gasoline combustion fumes account for 80% of all lead emissions in the United States. Cannon, *Blood Lead Levels, Catalysts*

Academy of Science estimates that auto exhausts account for ninety-eight percent of the particulate lead in the environment.² Lead emissions accumulate in vegetation and leaf litter in forests.³ During decomposition, the litter generates acids which act to dissolve lead and other metals. The dissolved metals then enter the soils or streams. The concentration of metals in algae and stream sediments gradually decreases as distance from the source of lead emissions increases.⁴

B. Sources of Lead in the Waterfowl's Environment

Waterfowl generally do not frequent the urban environment, and therefore do not ingest significant quantities of the lead present in urban areas.⁵ Thus, lead shot used by waterfowl hunters is the major source of lead in the waterfowl's environment. Estimates of the amount of lead deposited by hunters vary. One

Behind EPA Concerns, ENVTL. F., Nov. 1984, at 42. Lead emissions (primarily from autos and lead smelters) disperse in the air and settle on all parts of the earth. These emissions have been increasing in recent years. For example, moss recently tested in Sweden had a lead content four to seven times higher than moss tested during the Industrial Revolution. M. HOLDGATE, A PERSPECTIVE OF ENVIRONMENTAL POLLUTION 85 (1979). Dated snow samples from Greenland show large increases in lead content, with the greatest gains coinciding with the Industrial Revolution and the introduction of tetraethyl lead as an antiknock gasoline additive. *Id.* at 86. See Corrin & Natusch, *supra*, at 19.

2. NATIONAL ACADEMY OF SCIENCE COMM. ON BIOLOGIC EFFECTS OF ATMOSPHERIC POLLUTANTS, NATIONAL ACADEMY OF SCIENCE, LEAD: AIRBORNE LEAD IN PERSPECTIVE (1972). The National Academy further estimates that 184,000 tons of lead are emitted into the atmosphere of the United States annually. *Id.* at 60.

3. Corrin & Natusch, *supra* note 1, at 16. See Ward, Warran & Tiller, *The Distribution and Effects of Metals in the Marine Environment Near a Lead-Zinc Smelter, South Australia*, in ENVIRONMENTAL IMPACTS OF SMELTERS 68 (J. Nriagu ed. 1984); Proctor, *Heavy Metal Additions to the Environment Near Mines, Mills, and Smelters, Southeast Missouri*, in ENVIRONMENTAL IMPACTS OF SMELTERS 114 (J. Nriagu ed. 1984). Jennett, Wixson, Lowsley, Purushothaman, Bolter, Hemphill, Gale & Tranter, *Transport and Distribution from Mining, Milling and Smelting Operations in a Forest Ecosystem*, in LEAD IN THE ENVIRONMENT 135, 138 (W. Boggess ed. 1977) [hereinafter Jennett].

4. Procter, *supra* note 3, at 114. See DeCrosta, *How Heavy Metals Pollute Our Soils*, 8 CURRENT MUN. PROBS. 164 (1981) (plants accumulate fewer heavy metals as soil pH increases above 6.5). See Comment, *Acid Rain and Tall Stack Regulation Under the Clean Air Act*, 15 ENVTL. L. 711, 716-19 (1985) for a discussion of pH and its general role in the environment.

5. Ducks and geese would not seem to be as prone to eating lead based paint as would urban children. But waterfowl are exposed to atmospheric lead.

writer described several million hunters annually expending more than 6000 tons of lead shot into marshes, lakes, and estuaries.⁶ Other writers have indicated that two million waterfowl hunters shoot more than 3000 tons of lead shot in the United States annually.⁷ A 1976 Environmental Impact Statement (EIS), prepared by the Fish and Wildlife Service (FWS) on the proposed use of steel shot, estimated that waterfowl hunters deposited about 3000 tons of lead pellets on the ground each year.⁸ In a 1985 update of the EIS, the FWS continued to use this figure, and further calculated that hunters deposited an additional 14,000 tons of lead shot by shooting at birds other than waterfowl.⁹

6. White & Stendell, *Waterfowl Exposure to Lead and Steel Shot on Selected Hunting Areas*, 41 J. WILDLIFE MGMT. 469 (1977). Total U.S. refined lead consumption in 1975 was 1,417,000 tons. 10 ENCYCLOPEDIA BRITANNICA 730 (1983). In 1968, total U.S. consumption of lead was 1,200,000 metric tons. MASSACHUSETTS INST. OF TECHNOLOGY, *MAN'S IMPACT ON THE GLOBAL ENVIRONMENT: REPORT OF THE STUDY OF CRITICAL ENVIRONMENTAL PROBLEMS* 261 (1970).

7. Stendell, Smith, Burnham & Christensen, *Exposure of Waterfowl to Lead: A Nationwide Survey of Residues in Wing Bones of Seven Species, 1972-73*, FISH AND WILDLIFE SERVICE SPECIAL SCI. REP., WILDLIFE No. 223 (1979) [hereinafter Stendell].

8. FISH AND WILDLIFE SERV., U.S. DEP'T OF INTERIOR, *FINAL ENVIRONMENTAL STATEMENT, PROPOSED USE OF STEEL SHOT FOR HUNTING WATERFOWL IN THE U.S.* 18 (1976) [hereinafter EIS].

9. FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR, *DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT, USE OF LEAD SHOT FOR HUNTING MIGRATORY BIRDS IN THE UNITED STATES III-15* (1985) [hereinafter DRAFT EIS]. This quantity was calculated by estimating that six rounds were fired per bagged bird. *Id.* at 18. The Illinois Department of Conservation conducted lead deposit studies along fencerows and in woody areas to determine the impact of lead on pheasants. The Department estimated that hunters fired 3.7 rounds per bagged pheasant. Anderson, *Spent Shotgun Pellets in Soil on the Pheasant Put-and-Take Hunting Area At Rend Lake in 1983*, ILL. DEP'T OF CONSERVATION, DIVISION OF FISH AND WILDLIFE RESOURCES PERIODIC REP. No. 40, at 2 (1983). There is good reason to believe that the total amount of lead shot deposited in recent years is significantly higher than the figures above indicate. The EIS lead shot deposit figure was based on 16,569,000 waterfowl hunter-days. EIS, *supra* note 8, at 14. In 1980 the Fish and Wildlife Service estimated 42,910,000 migratory bird hunter-days, more than twice the figure used in the EIS. FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR AND BUREAU OF THE CENSUS, U.S. DEP'T OF COMMERCE, *1980 NATIONAL SURVEY OF FISHING, HUNTING, AND WILDLIFE-ASSOCIATED RECREATION* 48 (1982) [hereinafter SURVEY].

III. TOXIC EFFECTS OF LEAD

A. *Lead's Toxic Effects on Humans*

Lead is an environmental contaminant and a known biological poison. When humans ingest lead, it is concentrated in the liver, kidneys, and the body's soft tissues, while steadily increasing levels collect in the bones.¹⁰ Lead adversely affects the functioning of the nervous system, the reproductive system, the gastrointestinal tract, and the body's soft tissue.¹¹ Children with high levels of lead in the body suffer vomiting, anorexia, severe anemia, kidney disorders, abdominal pain, altered behavior, decreased learning capacity and ability to conceptualize, and significant nerve dysfunction.¹² Lead interferes with two enzymes critical to heme synthesis which leads to anemia.¹³ Lead also decreases the reproductive capacity in men, is associated with malformations in offspring, and may cause stillbirth or miscarriage in women.¹⁴ The best treatment for lead poisoning is removing the

10. Ninety-five percent of total body lead is deposited in bones. NATIONAL ACADEMY OF SCIENCE, *supra* note 2, at 170.

11. See Keate, *supra* note 1, at 426. See also Hammond, *Human Health Implications*, in LEAD IN THE ENVIRONMENT 195 (W. Boggess ed. 1977). Impacts on the nervous system include memory loss, headaches, irritability, and potential encephalopathy with mania, delirium, and dulled reflexes and responses. Keate, *supra* note 1, at 426. Symptoms of lead poisoning are a generally weak body condition causing "wrist drop" or "foot drop." *Id.* Gastrointestinal problems include nausea, weight loss, loss of appetite, and dyspepsia. *Id.* Lead excretion through the kidneys causes advancing renal failure, and fibrotic or granular kidney. *Id.* at 427. While injury to the kidneys is apparently reversible, injury to the central nervous system is not; 25% of the survivors of acute lead encephalopathy suffer permanent brain damage. NATIONAL ACADEMY OF SCIENCE, *supra* note 2, at 174.

12. Cannon, *supra* note 1, at 40 (these are children with blood lead levels of 70 micrograms of lead per deciliter of blood). Ingested lead paint and atmospheric lead deposited as house dust are the major sources of high lead concentrations in children's blood. COUNCIL ON ENVTL. QUALITY, FIFTH ANN. REP. 155 (1974). See Niyogi, *Tissue Distribution of Lead in Cases of Poisoning in Children*, 3 FORENSIC SCI. 199 (1974). See also Cole, *The Lead in Gasoline Issue and EPA's Lack of Scientific Objectivity*, ENVTL. F., Nov. 1984, at 41; Wilson, *Lead—A Clear-Cut Issue?*, ECOLOGIST, May-Jun 1982, at 121.

13. NATIONAL ACADEMY OF SCIENCE, *supra* note 2, at 170. The hemoglobin synthesis process is reduced at blood lead levels of 30 to 40 micrograms per deciliter, with synthesis reduction observed at levels as low as 15 micrograms per deciliter. Cannon, *supra* note 1, at 40-42.

14. Keate, *supra* note 1, at 427. There is no evidence to indicate biomagnification of lead in the food chain (i.e., lead accumulating in species of animals

source of contamination.¹⁵

B. Lead's Toxic Effects on Waterfowl

Lead is toxic to waterfowl.¹⁶ As waterfowl feed, they pick up spent lead shot pellets along with grit from marsh bottoms. The incidence of waterfowl mortality from ingesting lead shot has been extensively studied and was documented as early as 1874.¹⁷ Lead shot is retained in the bird's gizzard where the shot is subject to a combination of grinding and low pH (from 2.0 to 3.5).¹⁸

higher up in the food chain). Ward, Warran & Tiller, *The Distribution and Effects of Metals in the Marine Environment Near Lead-Zinc Smelter, South Australia*, in ENVIRONMENTAL IMPACTS OF SMELTERS 68 (J. Nriagu ed. 1984).

15. Keate, *supra* note 1, at 427-28. Symptoms of mild lead intoxication have been alleviated by removing an affected individual from an inadequately ventilated environment (indoor firing range). Removal from exposure is the best therapy for those manifesting minimal symptoms and biochemical abnormalities. Treatment is recommended for high blood lead levels. Because lead is used in industry, commerce, and art, and is primarily introduced into the adult body by respiration, lead poisoning is usually associated with the work place. See Keate, *supra* note 1. See also 13 ENCYCLOPEDIA BRITANNICA 844 (1970). See *Stegall v. St. Joseph Lead Co.*, 465 S.W.2d 855 (Mo. Ct. App. 1971) for a discussion of the symptoms associated with lead poisoning. Lead in the work place is heavily regulated. See 29 C.F.R. § 1910.1025 (1986). Persons from industrialized countries usually have greater concentrations of lead in their bodies than persons from less developed countries. NATIONAL ACADEMY OF SCIENCE, *supra* note 2, at 170.

16. Anderson & Havera, *Blood Lead, Protoporphyrin, and Ingested Shot for Detecting Lead Poisoning in Waterfowl*, 13 WILDLIFE SOC'Y BULL. 26 (1985) [hereinafter Anderson]; Longcore, Locke, Bagley & Andrews, *Significance of Lead Residues in Mallard Tissues*, U.S. DEP'T OF THE INTERIOR, FISH AND WILDLIFE SERV. REP. No. 182 (1974) [hereinafter Longcore]. For a bibliography of literature on lead poisoning in the environment generally and on waterfowl in particular, see OFFICE OF MIGRATORY BIRD MANAGEMENT, FISH AND WILDLIFE SERV., U.S. DEP'T OF THE INTERIOR, STEEL SHOT/LEAD SHOT: A SELECTED BIBLIOGRAPHY OF DOCUMENTS ON LEAD POISONING IN WATERFOWL AND OTHER WILDLIFE (1984); see also Feierabend, *Steel Shot and Lead Poisoning in Waterfowl*, NAT'L WILDLIFE FED'N SCI. AND TECH. SERIES 8 (1983). Unless stated otherwise, the general terms "waterfowl" and "ducks" include ducks, geese, swans, coots, and rails.

17. For the seminal study on the problem of lead poisoning in waterfowl, see Wetmore, *Lead Poisoning in Waterfowl*, U.S. DEP'T OF AGRIC. BULL. No. 793 (1919), cited in Clemens, Krook, Aronson & Stevens, *Pathogenesis of Lead Shot Poisoning in the Mallard Duck*, 65 CORNELL VETERINARIAN 248 (1975). See also 1 A. BEST, LIFE HISTORIES OF NORTH AMERICAN WILD FOWL ORDER ANSERES 42-43 (1951); Bellrose, *Lead Poisoning as a Mortality Factor in Waterfowl Populations*, 27 ILL. NAT. HIST. SURV. BULL. 235-88 (1959), cited in Anderson, *supra* note 16.

18. Carlson & Neilsen, *Influence of Dietary Calcium on Lead Poisoning in*

The shot is either broken down and absorbed into the body, or passed out in the feces.¹⁹

While lead poisoning in waterfowl is well documented, it is difficult to pinpoint exactly how much lead shot waterfowl must ingest before they are poisoned.²⁰ Some lead-poisoned waterfowl have had only one pellet in the gizzard, while others have died from lead poisoning with up to twenty-five shot in their gizzards.²¹ Mortality seems to revolve more around the factors of diet, weather, season, and general health than the number of lead pellets ingested. Even though there are variations in mortality factors associated with lead poisoning in waterfowl, the physiolog-

Mallard Ducks (*Anas platyrhynchos*), 46 AM. J. OF VETERINARY RESOURCES 276 (1985) [hereinafter Carlson]. Low pH assists in dissolving the lead shot pellet and freeing the lead for absorption into the body.

19. *Id.* See generally J. STURKIE, AVIAN PHYSIOLOGY (2d ed. 1965). Environmental factors influence the levels of lead necessary to produce toxic effects in waterfowl. Toxicity is enhanced by deficiencies of protein, calcium, phosphorus, iron, zinc, and vitamin E. See Carlson, *supra* note 18, at 281. Corn diets increase lead's toxic effect. *Id.* See also Sanderson, *Lead and Soil: A Saving Combination?*, DUCKS UNLIMITED, Sept.-Oct. 1979, at 26. In contrast, ducks with free access to the soil to augment their diets exhibit substantial resistance to lead poisoning symptoms. *Id.* Similarly, calcium in the diet has an ameliorating effect on the toxicity of ingested lead. See Carlson, *supra* note 18, at 281. Overall, nutritional factors and diet significantly affect absorption of lead from the waterfowl's gut and concomitant toxic effects upon waterfowl. Stendell, *supra* note 7, at 10.

20. The prevalence of lead poisoning in waterfowl increases during the hunting season, particularly in areas where hunting is concentrated, as lead shot accumulates on the ground. Stendell, *supra* note 7, at 11. Most sampling for lead poisoning takes place during or just after the hunting season because predators rapidly dispose of dead ducks left in the field. Gender has no significant effect upon the accumulation of lead in waterfowl bones except during the breeding season when females may have higher lead residue in their bodies. *Id.* at 10.

21. See Bagley, Locke & Nightingale, *Lead Poisoning in Canada Geese in Delaware*, 11 AVIAN DISEASES 601 (1967) [hereinafter Bagley]; Clemens, Krook, Aronson & Stevens, *Pathogenesis of Lead Shot Poisoning in the Mallard Duck*, 65 CORNELL VETERINARIAN 248 (1975) [hereinafter Clemens]; Dieter, *Blood Delta-Aminolevulinic Acid Dehydratase (ALAD) to Monitor Lead Contamination in Canvasback Ducks* (*Aythya valisineria*) in ANIMALS AS MONITORS OF ENVIRONMENTAL POLLUTANTS 177 (National Academy of Science 1979) [hereinafter Dieter]. All waterfowl do not react similarly to lead poisoning, not only because of environmental factors, but because of variation between the species. Waterfowl range in size from the diminutive pygmy goose, weighing 10 ounces, to the trumpeter swan, weighing 30 pounds and with a wingspan of 100 inches. P. JOHNSGARD, WATERFOWL 1 (1968). The family *Anatidae* (ducks, geese, and swans) consists of 146 species and inhabits every continent except Antarctica and every major island in the world. *Id.* at 2, 13.

ical effects are well documented.

Lead poisoning in waterfowl adversely affects the digestive, muscular, circulatory, and nervous systems, eventually causing death.²² Waterfowl with lead poisoning exhibit a generally weak, lethargic, and emaciated condition.²³ Weakness progresses gradually through the body, first influencing the leg muscles, then the wing²⁴, and ultimately affecting mobility and reaction time.²⁵ As waterfowl ingest lead, the lead accumulates in the bones, which can be an indication of either an acute high-level exposure,

22. Stendell, *supra* note 7, at 1.

23. Clemens, *supra* note 21, at 254. In conjunction, birds exhibit green diarrhea, anorexia, and flaccid paralysis. *Id.*

24. Hunter & Webster, *Encephalopathy and Peripheral Neuropathy in Lead-Poisoned Mallard Ducks*, 24 AVIAN DISEASES 169, 171 (1979) [hereinafter Hunter].

25. *Id.* at 173. Lead-poisoned ducks exhibit numerous focal microhemorrhages within the cerebellum, impairing the birds' ability to react. Lesions may occur in the peripheral nervous system characterized by swelling and fragmentation of the myelin sheaths of nerve fibers. *Id.* at 174-75. Canada geese that died of lead poisoning were emaciated, exhibited cephalic edema, edema of the eyelids, and suffered discharges from the eyes and nares. Bagley, *supra* note 21, at 603. An additional effect of lead is the inhibition of delta-aminolevulinic acid dehydratase (Δ -ALAD), an enzyme essential to heme synthesis and maintenance of hemoglobin content in red blood cells. Depending upon diet, one lead pellet may be enough to disturb this cellular function but generally not enough to cause mortality. Dieter & Finley, *Aminolevulinic Acid Dehydratase Enzyme Activity in Blood, Brain, and Liver of Lead-Dosed Ducks*, 19 ENVTL. RESEARCH 127 (1979). When the Δ -ALAD enzyme activity in the blood, liver, and brain is reduced, the result is brain damage and other symptoms of lead poisoning (weakness, lethargy, diarrhea). Anderson, *supra* note 16, at 26.

Another result of lead's toxic effect in waterfowl is increased protoporphyrin (PP) in the circulating blood. *Id.* at 2. PP is an intermediary metabolite in the cellular manufacture of heme and because of the tying up of another essential enzyme by lead, the PP accumulates. Letter from Dr. Louis N. Locke, D.V.M., Wildlife Pathologist/Training Officer, Fish and Wildlife Service, National Wildlife Health Lab, Madison, Wisconsin, to author (May 15, 1986) [hereinafter Locke]. An increase in PP in the blood is a specific response to lead poisoning in ducks, geese, and humans. PP measurements are used to monitor children for toxic exposure to lead. Anderson, *Lead Poisoning in Illinois Waterfowl, 1979 Through 1982: Ingested Shot, Blood Chemistry, and Die-Offs*, 18 ILL. DEP'T OF CONSERVATION, DIV. OF FISH AND WILDLIFE RESOURCES PERIODIC REP. No. 35, at 2 (1982). The threshold determination for lead poisoning in waterfowl is when the blood contains 0.5 parts per million (ppm) of lead, and 40 micrograms of PP per deciliter. Longcore, *supra* note 16, at 4. Lead concentrations in the brain of three to six ppm could indicate an advanced state of lead poisoning. *Id.*

chronic low-level exposure, or both.²⁶ Elevated lead in bones does not necessarily indicate that waterfowl have ingested lead shot; it means the bird has been exposed to lead.²⁷ Lead in the soft tissues and blood indicates current exposure. Bone, however, stores the lead and usually indicates exposure over a long period of time. The rate of uptake by bone is fairly rapid while loss is slow.²⁸

Estimates of the number of waterfowl killed each year from lead poisoning vary. An early study estimated that the total loss of waterfowl of all species ranged from two to three percent of the fall population.²⁹ Another study concluded that four percent of the mallard ducks in the Mississippi Flyway die from lead poisoning.³⁰ Dabbling, or puddle ducks, such as mallards and pintails are the major victims of lead poisoning although geese, swans, and diving ducks also suffer significant mortality.³¹ For example, one study estimates that two and one-half percent of the Canada geese migrating in the Atlantic Flyway die from lead poisoning.³² The United States Fish and Wildlife Service (FWS) estimates that between 1.6 million and 2.4 million ducks die from lead poisoning each year.³³

C. Lead's Toxic Effects on Other Wildlife

Lead shot has harmful effects on wildlife other than waterfowl. Ducks hit but not retrieved by hunters frequently retain lead shot in their tissue. This embedded shot may be ingested by predators when they feed on these crippled or dead waterfowl.

26. Longcore, *supra* note 16, at 5.

27. *Id.*

28. Stendell, *supra* note 7, at 9.

29. Bellrose, *Lead Poisoning as a Mortality Factor in Waterfowl Populations*, 27 *ILL. NAT. HIST. SURV. BULL.* 235 (1959), cited in G. WOBESER, *DISEASES OF WILD WATERFOWL* 151 (1981). The 1981 duck-breeding population in North America was 37.3 million. This population ranged from 47.0 million in 1956 to 31.2 million in 1965. COUNCIL ON ENVTL. QUALITY, *ENVTL. QUALITY* 1981, at 225 (1981).

30. Bellrose, *Lead Poisoning: A Tragic Waste*, FISH AND WILDLIFE SER., U.S. DEP'T OF THE INTERIOR, FLYWAYS 471, 473 (1984) [hereinafter FLYWAYS].

31. Trainer, *Lead Poisoning of Waterfowl*, in *NONINFECTIOUS DISEASES OF WILDLIFE* 24 (G. Hoff & J. Davis ed. 1982).

32. Clemens, *supra* note 21, at 249.

33. EIS, *supra* note 8, at 4, 41; see Feierabend, *supra* note 16, at 2; Madsen, *American Waterfowl: Troubles and Triumphs*, 166 *NAT'L GEOGRAPHIC* 562, 586, 590 (1984).

Nineteen percent of the ducks shot by hunters, and fifteen percent of the geese may not be retrieved. Additionally, healthy waterfowl which eat lead pellets and slowly die of lead poisoning are susceptible to predation and subsequently poison the animals which feed on them.³⁴

Raptors in particular are exposed to secondary lead poisoning. Autopsies of bald eagles have shown that their stomachs contained waterfowl feathers and lead shot.³⁵ Eagles generally regurgitate a "cast" containing bones of their prey, so the lead that poisons the eagles probably derives from soft tissue.³⁶ Lead in bald eagles accumulates primarily in their liver and kidneys.³⁷

34. Lead poisoning can occur when other birds and animals consume lead-bearing materials. For example, loons ingesting fish which have swallowed lead sinkers, or ingested the sinkers found on lake bottoms; sandhill cranes ingesting lead-based paint; and animals eating electrical solder containing lead. Locke, Kerr & Zoromski, *Lead Poisoning in Common Loons* (*Gavia immer*), 26 *AVIAN DISEASES* 392 (1982) [hereinafter Locke, *Lead Poisoning*]. Kennedy, Crisler, Smith & Bush, *Lead Poisoning in Sandhill Cranes*, 171 *J. AM. VETERINARY MED.* A. 955 (1979), cited in Locke, *Lead Poisoning*, *supra*, at 396. Upland game such as doves, quail, and pheasants, are all susceptible to lead poisoning from ingesting lead shot. See Lock & Bagley, *Lead Poisoning in a Sample of Maryland Mourning Doves*, 31 *J. WILDLIFE MGMT.* 515 (1967); Anderson, *supra* note 9, at 1 (discussion of lead poisoning in quail and pheasant). Raccoons and pigeons living in urban environments also suffer from lead poisoning. Urban-dwelling pigeons typically have a much higher blood lead content than their rural counterparts (330 parts per billion (ppb) compared to 29 ppb). Finley & Dieter, *Sublethal Effects of Chronic Lead Ingestion in Mallard Ducks*, 1 *J. TOXICOLOGY & ENVTL. HEALTH* 929, 936 (1976). See Deters & Nielsen, *Lead Poisoning of Raccoons in Connecticut*, 14 *J. WILDLIFE DISEASES* 187 (1978). Other authorities discuss the impact of lead on various organisms. See Tornabene, Gale, Koeppel, Zimdahl & Forbes, *Effects on Microorganisms, Plants and Animals*, in *LEAD IN THE ENVIRONMENT* 181 (W. Boggess ed. 1977); Ward, Warren, Tiller, *The Distribution and Effects of Metals in the Marine Environment Near a Lead-Zinc Smelter, South Australia*, in *ENVIRONMENTAL IMPACTS OF SMELTERS* 68 (J. Nriagu ed. 1984); P. DAVIES and W. EVERHART, *EFFECTS OF CHEMICAL VARIATIONS IN AQUATIC ENVIRONMENTS: VOL. III, LEAD TOXICITY TO RAINBOW TROUT AND TESTING APPLICATION FACTOR CONCEPT* (1973).

35. Dieter, *supra* note 21, at 190.

36. *Id.* However, this has not been definitely proven. It is believed "that raptors such as the bald eagle, obtain most of the exposure to lead by actually ingesting lead shot that was embedded in the prey's tissues or lead shot that was still present in the gizzard of lead-poisoned birds taken as prey. To date, there is no experimental evidence to show that the tissue-borne lead of the lead-poisoned duck can poison the eagle." Locke, *supra* note 25.

37. This was the result for eagles which died in lead dosing experiments. Pattee & Hennes, *Bald Eagles and Waterfowl: The Lead Shot Connection*, in *TRANSACTIONS OF THE 48TH NORTH AMERICAN WILDLIFE AND NATURAL RESOURCES CON-*

Bald eagles affected with lead poisoning may become weak, thin, and susceptible to disease, blindness, and death.³⁸

The impact of lead poisoning on the bald eagle has precipitated a great deal of concern.³⁹ A National Wildlife Federation report issued in 1984 maintained that at least seventy-seven bald eagles have died from lead poisoning since 1966.⁴⁰ In another study, eagle deaths from lead poisoning ranked as the fourth leading cause of death behind shooting, impact injuries, and electrocution.⁴¹

Eagles are especially exposed to lead poisoning when they roost and feed in the vicinity of concentrations of wintering waterfowl. Although eagles may be tainted by other animals shot by hunters, they are primarily poisoned by dead or crippled waterfowl as waterfowl are a significant staple of the eagle's diet. In castings collected underneath eagle roosts in the Midwest and in Utah, spent lead shot was found in fifty to seventy-one percent of the castings.⁴² Eating tissue with bound lead, imbedded lead shot, or a combination of both, poisons eagles and results in the manifestation of typical lead poisoning symptoms. However, research suggests that ingestion of tissue-bound lead is unlikely the pri-

REFERENCE 230 (1983).

38. *Id.* See Pattee, Wiemeyer, Mulhern, Sileo & Carpenter, *Experimental Lead-Shot Poisoning in Bald Eagles*, 45 J. WILDLIFE MGMT. 806 (1981) [hereinafter Pattee]. These are the same symptoms for ducks and humans; see *supra* notes 10-28 and accompanying text.

39. See Iker, *Lead Shot Takes Its Toll*, NAT'L WILDLIFE, Oct.-Nov. 1984, at 47; Redig, *Lead Poisoning in Raptors*, 18 HAWK CHALK, Aug. 1979, at 1; Redig, *Lead Toxicosis in Raptors*, 177 J. AM. VETERINARY MED. A. 941 (1980); Redig, *An Investigation into the Effects of Lead Poisoning on Bald Eagles and Other Raptors: Final Report*, in UNIVERSITY OF MINNESOTA, ENDANGERED SPECIES PROGRAM STUDY (1983) [hereinafter Redig, *Final Report*]; *Lead Poisoning in Bald Eagles: Proposed Alternative Conservation Measures*, 49 Fed. Reg. 36, 290 (1984) (to be codified at 14 C.F.R. pt. 20) (proposed Sept. 14, 1984).

40. J. Feierabend & O. Myers, *A National Summary of Lead Poisoning in Bald Eagles and Waterfowl* (Aug. 21, 1984) (available from the National Wildlife Federation).

41. Redig, *Final Report*, *supra* note 39, at 2.

42. *Id.* Lead poisoning contributes to eagle mortality by impeding learning, intelligence, and flight. Impaired intelligence and reaction time reduces the eagle's ability to escape predators and capture prey. Because lead poisoning impairs the eagle's natural instincts, the eagle must resort to scavenging trap bait and roadside carcasses for food. The result is death by trapping or collisions with automobiles. See generally Pattee & Hennes, *supra* note 37, at 231.

mary cause of death, with ingested lead shot the more important factor.⁴³

D. Other Substances Toxic to Waterfowl

While a chronic source of mortality, lead is not the only substance lethal to waterfowl. Various bacteria, viruses, industrial chemicals, and metallic elements also pose hazards to waterfowl.⁴⁴ Some waterfowl die-offs are dramatic. For example, a 1976 oil spill at the mouth of the Potomac River may have killed as many as 50,000 waterfowl.⁴⁵ In the late winter of 1952, up to five million ducks died of botulism in the western United States. In 1941, a similar outbreak of botulism killed about a quarter of a million ducks at California's Tulare Lake.⁴⁶ Avian cholera has killed as many as 80,000 birds in one year.⁴⁷ Pesticide and herbicide applications also cause waterfowl deaths.⁴⁸ These pollutants contaminate ecosystems used by waterfowl and contribute to their poisoning and mortality.⁴⁹

43. Pattee & Hennes, *supra* note 37, at 231. Sixty-six percent of the dead or dying geese on a Minnesota refuge had ingested lead shot. *Id.* at 234.

44. For excellent overviews of toxic substances and their effect on waterfowl, see G. HOFF & J. DAVIS, *NONINFECTIOUS DISEASES OF WILDLIFE 3-7* (1982), and G. WOBESER, *DISEASES OF WILD WATERFOWL* (1981).

45. See Madsen, *supra* note 33, at 575.

46. *Id.* at 586.

47. *Id.* at 586-89. See Friend, *Waterfowl Get Sick, Too*, *FLYWAYS*, *supra* note 30, at 478.

48. In 1977 there were 750,000 tons of pesticides used in the United States. COUNCIL ON ENVTL. QUALITY, *ENVTL. QUALITY 1979*, at 149 (1979). Fifty-one million tons of fertilizer were applied in 1979. COUNCIL ON ENVTL. QUALITY, *ENVTL. QUALITY 1980*, at 133 (1980).

49. The toxic residues in waterfowl include DDE (a derivative of DDT), dieldrin, PCBs, and toxaphene. See *ENVTL. QUALITY 1980*, *supra* note 48, at 693. COUNCIL ON ENVTL. QUALITY, *ENVTL. QUALITY 1983*, at 313 (1983) has collected data on toxic residues in waterfowl, by flyway, from 1966 through 1982. Many of these same residues wind up in humans. *Id.* Organic compounds such as DDT, PCBs, and dieldrin are resistant to breakdown in the environment while other organic chemicals may break down rapidly. See G. HOFF & J. DAVIS, *supra* note 44, at 6. Agricultural runoff of naturally occurring, concentrated minerals poses a threat to waterfowl. For a discussion of selenium concentrations harming waterfowl at the Kesterson National Wildlife Refuge near Gustine, California, see Madsen, *supra* note 33, at 588-90; see also [Current Developments] 15 *Env't Rep. (BNA)* 2130 (Apr. 5, 1985); [Current Developments] 15 *Env't Rep. (BNA)* 2014 (Mar. 22, 1985). Other chemicals toxic to waterfowl (such as endrin and heptachlor epoxide) are discussed in Madsen, *Smorgasbord of Poisons Found in Plains Wildlife*, *AU-*

Mercury,⁵⁰ copper,⁵¹ zinc,⁵² and cadmium⁵³ are naturally occurring elements that also contribute to waterfowl mortality, but disease may represent a more important problem than the heavy metals.⁵⁴ Of all the substances toxic to waterfowl, however, lead is the only lethal pollutant continually introduced into the waterfowl's habitat by hunters, and thus represents the least excusable and most easily remedied source of waterfowl death.

IV. NONTOXIC SHOT AS AN ALTERNATIVE TO LEAD SHOT

Lead is used as shot in shotgun shells for several reasons. It is an abundant, inexpensive element, and can be easily molded into various shapes and sizes. Lead is also a very dense, heavy metal. When used as a shotgun pellet, lead's weight and inertia render it more efficient than lighter materials. Additionally, lead pellets expand on impact, enhancing the lethal impact of the shot.

There are several alternatives to lead shot, all of which are less toxic to waterfowl. The term nontoxic means that the shot, when ingested by waterfowl, will not poison or impair them. Studies show that lead-induced mortality is proportional to the amount of lead in the shot.⁵⁵ Two practical shot alternatives are

DUBON, Jan. 1983, at 121-22.

50. Waterfowl ingest mercury primarily from seed grain treated with mercurial seed dressing (a rodenticide), or through the food chain from industrial or natural mercury sources. G. WOBESER, *supra* note 44, at 159. Mercury concentrates in the egg and tends to be the major cause of mortality in the embryonic stage. *Id.* at 160. See Fleming, *Environmental Metal Residues in Tissues of Canvasbacks*, 45 J. WILDLIFE MGMT. 507, 510-11 (1981).

51. Copper may cause poisoning in waterfowl but the evidence is weak. G. WOBESER, *supra* note 44, at 162.

52. Waterfowl fed zinc displayed a loss of motor control, anorexia, nervous disorders, and death (signs similar to lead poisoning); however, there is a lack of documentation concerning zinc toxicity in wild waterfowl. *Id.* at 162-63.

53. Cadmium is a toxin that in blood concentrations of 20 ppm can cause reduced egg production, renal damage, and testicular atrophy in mallard ducks. *Id.* at 163.

54. For example, a disease which causes no mortality but lowers reproductive ability by 10% represents a more significant effect upon a population than a disease causing sporadic die-offs, even if thousands of birds die. T. WOBESER, *supra* note 44, at 1.

55. Finley, Dieter & Locke, *Lead in Tissues of Mallard Ducks Dosed with Two Types of Lead Shot*, 16 BULL. ENVTL. CONTAMINATION AND TOXICOLOGY 261 (1976) [hereinafter Finley].

lead-iron combinations,⁵⁶ and steel.⁵⁷ However, due to lead's toxicity in any amount, the best option to date has been steel.

Opponents of nontoxic shot contend that it damages shotguns, represents a hazard to hunters, and costs more than lead shot. Moreover, it is argued that steel shot causes more cripples than lead shot. This section discusses these arguments and concludes that any shortcomings arising from the use of steel shot are significantly outweighed by the harmful effects of lead in the environment.

A. *Hunting with Nontoxic Shot*

One of the most controversial aspects of substituting steel shot for lead shot is the suggestion that steel shot cripples more birds. Opponents argue that steel shot, due to less retained energy at hunting ranges, is more apt to wound birds, causing their slow death or capture by predators.

Steel pellets are harder and about thirty percent lighter than lead pellets.⁵⁸ Due to these physical differences, hunting with steel shot differs from hunting with lead shot.⁵⁹ Because of steel's lighter weight, for example, the velocity of steel shot falls off at a higher rate than lead shot.⁶⁰ Also, steel shot's lower density and

56. *Id.* This shot contained 47.5% lead, 47.5% iron, 4.0% copper, and 1.0% zinc.

57. See FEDERAL CARTRIDGE CORP., STEEL SHOT—1984 (available from the Federal Cartridge Corp.) [hereinafter *Information Sheet*].

58. *Id.* at 1. As measured by the Diamond Pyramid Hardness (DPH) test, lead shot seldom exceeds 30 DPH and steel shot is about 90 DPH (ball bearings are 270 DPH). In a 1.5 ounce 12-gauge shotgun shell, there are roughly 225 number six lead shot compared to 315 number six steel shot. *Id.*

59. Smokeless gunpowder is the propellant in all modern shotshells. Steel shot wads are thicker than lead shot wads to prevent bore scratching. Wads include integral plastic "sleeves" which surround the shot load in the shell. The wad is cushioned to prevent pellets from becoming deformed when the shell is fired, and the sleeve protects the gun barrel from scratches. When the shotgun is fired, the shot and wad move out of the barrel as one. After exiting the barrel, the lighter wad falls just beyond the hunter while the shot continues on its trajectory.

60. In tests, lead shot loads with three and three-fourths dram equivalents (D.E.) of powder and one and one-quarter ounces of lead shot had a muzzle velocity of 1,330 feet per second (fps). A steel shot load with the same amount of powder and one and one-eighth ounces of steel shot had a higher muzzle velocity of 1,365 fps, but lost velocity at a greater rate than lead shot. *Information Sheet*, *supra* note 57, at 3.

faster velocity loss results in reduced energy at hunting range. These ballistic facts require hunters using steel shot to increase their compensation in front of waterfowl in flight, and possibly to switch to a larger steel shot size.⁶¹ Hunters should also calculate on a loss of about ten yards of effective range. If hunters do not adapt accordingly, or do not practice their shotgun shooting using steel loads, their performance in downing waterfowl when actually hunting in the field will likely decline.⁶² This would reinforce the unsubstantiated perception that steel shot is inferior to lead shot and that it increases waterfowl crippling rates.⁶³

A study in Louisiana indicated that under similar field hunting conditions (that is, using a duck blind and a twelve-gauge shotgun), thirteen percent fewer ducks would be hit per hunter-day by hunters using number four size steel shot than with number six size lead shot.⁶⁴ The conclusions were that fewer ducks would be taken home by hunters, and that a slightly higher per-

61. For example, a duck hunter accustomed to number four lead shot might switch to number two steel shot. Steel shot leaves the shotgun's muzzle faster than lead shot, but also slows down faster. Thus the compensation used for ducks in flight at distances under 30 yards would be about the same for steel and lead shot. At 30 to 50 yards, the hunter would have to shoot further ahead of the duck because of steel's lighter weight. Experts recommend against shooting at game beyond 50 yards. See Sherwonit, *Pros and Cons of Steel-Shot Pellets*, Anchorage Times, Oct. 6, 1985, at L-1, col. 3.

62. Locke, *supra* note 25. In other words, the hunter must learn that while there is a ballistic difference between lead shot and steel shot, it is a difference that can be overcome. *Id.* "[T]here are major differences between lead and steel shot ballistically and . . . hunters will need to be retrained to use steel shot. Once hunters have learned to adjust their hunting to steel [shot] . . ., their crippling rate should go down." *Id. Accord*, Telephone interview with Tom Roster, Ballistician, Klamath Falls, Oregon (May 1, 1986) (switching to steel shot takes education to be effective; there have to be education programs on ballistics).

63. See Humburg, Sheriff, Geissler & Roster, *Shotshell and Shooter Effectiveness: Lead vs. Steel Shot for Duck Hunting*, 10 WILDLIFE SOC'Y. BULL. 121, 125 (1982) [hereinafter Humburg]. Other field tests have concluded that steel shot is inferior to lead shot in downing birds. Anderson & Sanderson, *Effectiveness of Steel Shot in 3-inch, 12-Gauge Shells for Hunting Canada Geese*, 7 WILDLIFE SOC'Y. BULL. 213 (1979); Hebert, Wright, Zwank, Newsom & Kasul, *Hunter Performance Using Steel and Lead Loads for Hunting Ducks in Coastal Louisiana*, 48 J. WILDLIFE MGMT. 388, 397 (1974) [hereinafter Hebert]; Anderson & Roetker, *Effectiveness of Steel Shot for Hunting Interior Canada Geese*, ILL. DEP'T OF CONSERVATION, DIV. OF FISH AND WILDLIFE RESOURCES, PERIODIC REP. NO. 20, May 10, 1978.

64. Hebert, *supra* note 63, at 397.

centage of ducks would be crippled and left in the marsh with the use of steel shot.⁶⁵ However, fewer ducks would be hit with steel shot, and therefore the duck population would be subject to lower mortality.⁶⁶

In an Illinois study, number one and BB-sized steel shot were as effective as number two and BB-sized lead shot in knocking down Canada geese.⁶⁷ The study concluded that number one steel shot, BB-sized steel shot, and number two lead shot were more similar than different in crippling Canada geese.⁶⁸ In another test, the authors of the study concluded that number two steel shot almost equaled or exceeded the performance of number two lead shot in hitting, knocking down, and bagging without crippling large Canada geese.⁶⁹

Scrutinizing the results of the tests on the effectiveness (or lack of effectiveness) of steel shot leaves one unsure of exactly what to conclude. Each side of the controversy can point to a number of studies supporting its position.⁷⁰ However, it would seem that if more ducks are crippled using steel shot rather than lead shot, the causal factor is a lack of familiarity by hunters with the performance of steel shot. The argument that hunters will not learn to adjust to steel shot seems bogus. Even if more crippled waterfowl are a short-term result of switching to steel shot, it is a small price to pay for reducing the incidence of lead poisoning in millions of ducks and geese each year, preventing the accumulation of lead shot in the environment, and curtailing the secondary poisoning of many other birds and animals.

65. *Id.*

66. *Id.* Using steel shot, the number of cripples observed per blind day was deemed "nearly significant."

67. Anderson & Roetker, *supra* note 63, at 5.

68. *Id.*

69. Anderson & Sanderson, *supra* note 63, at 215.

70. Feierabend, *supra* note 16, summarizes several of these studies and their results. Recently, the Fish and Wildlife Service asked a committee of expert biometricians to review the data from these studies to see if there were any consistent trends. Locke, *supra* note 25, at 3. "The committee concluded that these 'crippling trials' were not comparable because of difference in the designs of the studies, differences in the methods of recording the data, etc." *Id.*

B. *Effects, Ballistics, and Economics of Nontoxic Shot*

Because steel shot is harder and lighter than lead shot, there is less "give" in the steel shot column as it moves through the shotgun barrel. In some older shotguns with thin-walled barrels, this can cause choke expansion.⁷¹ This choke expansion manifests itself as a small ring bulge about two inches from the muzzle. The ring apparently affects only the appearance of the gun, not its performance, safety, or shot pattern.⁷² Early tests with steel shot reported some ring expansion (choke deformation) and barrel bursts, with choke expansion less of a problem with shotguns having a less constricting modified or improved cylinder choke.⁷³

71. *Information Sheet*, *supra* note 57, at 4. "Choke" refers to the degree of barrel constriction at the muzzle of the shotgun. A full choke will produce a dense pattern of shot, improving the chances of hitting a bird at long range. Most waterfowl hunters use shotguns with full chokes. An improved choke (commonly known as an improved cylinder) has only a slight muzzle constriction. A shotgun will produce a broad, dispersed pattern with an improved cylinder choke boring. A modified choke results in a shot pattern between that of a full choke and an improved cylinder.

72. *Id.*

73. See EIS, *supra* note 8, at 50-52, 246-53. Both steel and lead shot shells provide an occasional disastrous result. *Id.* at 51. See generally *Steel Shot Regulations: Hearing Before the Subcomm. on Administrative Practice and Procedure of the Senate Comm. on the Judiciary*, 95th Cong., 2d Sess. 2 (1978) (79 C.I.S. 5521-22) [hereinafter *Steel Shot Hearing*]; *Fish and Wildlife Briefings: Hearings Before the Subcomm. on Fisheries and Wildlife Conservation and the Environment of the House Comm. on Merchant Marine and Fisheries*, 94th Cong., 1st Sess. 41, 102-06 (1975) (75 C.I.S. H561-19) [hereinafter *Fish and Wildlife Briefings*] (statements of Lynn A. Greenwalt, Director of U.S. Fish and Wildlife Service). See *National Rifle Ass'n of Am. v. Kleppe*, 425 F. Supp. 1101, 1106-08 (D.D.C. 1976) (discussion of barrel bursts and potential injury adequately covered in EIS); Bednarik, *Implementation of the Use of Steel Shot in Waterfowl Hunting in the Two Eastern Flyways in 1977*, at 12 (1977) (available from the Ohio Dep't of Natural Resources, Wildlife In-Service Note 349) ("the use of steel shot may cause barrel damage in some guns and should be used only in arms in good condition and designed for modern ammunition of the proper gauge. If doubt exists, check with the gun manufacturer or a competent gunsmith."); Sears, *The Quest for Non-Toxic Shot*, AM. RIFLEMAN, Dec. 1973, at 16; Sherwonit, *supra* note 61, at L1. See also DRAFT EIS, *supra* note 9 (there is one page dealing with barrel damage, compared to the earlier EIS, *supra* note 8, which devotes three pages to the subject); Feierabend, *supra* note 16, at 3 ("barrel scratching and erosion associated with earlier steel shot loads have been completely eliminated through the combined improvements of shotshell design and increased shotgun barrel hardness").

Conversations between the author and shotgun enthusiasts reveal that owners

However, improved shell design and thicker plastic wads surrounding the loads have eliminated concern over shotgun damage from steel shot use.

While protecting shotgun barrels, the thicker plastic wad surrounding steel shot loads causes a denser pattern and fewer stray pellets than in lead shotgun shells. This tight pattern may account for some missed shots by hunters who previously relied on lead shot's wider pattern to hit birds at the outer edge of their "true" aim. At forty yards, a shotgun with a full choke will place seventy-five percent of the lead pellets within a thirty-inch circle while eighty percent of the steel pellets will be placed in the same circle.⁷⁴ Again, practice with steel shot would allow for hunters to compensate for this factor, as would their use of more open choke borings.

Because of the special shot and wads used in steel shot shells, they are more expensive than lead shot shells. Generally, when shells with steel shot were first required, they cost thirty to fifty percent more than shells with lead shot.⁷⁵ This added cost may have deterred some hunters from switching to steel shot and is still often cited by hunters opposing steel shot. However, cost is a function of supply and demand. Increased demand leads to an increase in supply which eventually lowers the price as supply and demand meet.⁷⁶ Today, steel shot shells are not significantly more expensive than their lead equivalents.⁷⁷

of older shotguns, very expensive shotguns, shotguns used for trap and skeet shooting, and some owners of double-barreled shotguns (which typically have thinner barrels than single-barreled shotguns) would not use steel shot in these guns. In most cases, the gun owners are highly protective of the guns and do not take them into the normally wet, corrosive atmosphere of the marsh to hunt waterfowl. Requiring the use of steel shot when hunting would not significantly infringe on these individuals when pursuing their sport or hobby.

74. *Information Sheet*, *supra* note 57, at 4.

75. *EIS*, *supra* note 8, at 53.

76. Theoretically this is true, although there are a myriad of variables involved. See P. SAMUELSON, *ECONOMICS* 56-70 (8th ed. 1970).

77. The 1985 Draft EIS notes that steel shot is available in factory loads in shot sizes BB, 1, 2, 4, and 6. DRAFT EIS, *supra* note 9, at III-83 to III-84. While ammunition manufacturers are confident of meeting demand, they need adequate time to build inventory. *Id.* The price of lead shot shotgun shells in January 1985 ranged from an average of \$13.49 for 20 gauge, to \$17.48 for 12 gauge, to \$30.05 for 10 gauge. *Id.* at III-84. The average price of steel shotgun shells ranged from an average of \$14.50 for 20 gauge, to \$17.90 for 12 gauge, to \$26.30 for 10 gauge. *Id.* (This information in the Draft EIS is the suggested retail price effective January

V. OTHER LEAD SHOT MITIGATION MEASURES

Short of banning lead shot, other mitigations to its harmful effects exist. A 1976 Environmental Impact Statement (EIS) considered the proposal of replacing lead shot with steel shot when hunting waterfowl in certain areas of the United States.⁷⁸ Suggested alternatives in the EIS included not taking any action, banning waterfowl hunting, implementing steel shot requirements on a flyway-wide basis, simultaneous implementation of a steel shot requirement in all flyways, and delaying implementation of steel shot requirements.⁷⁹ A 1985 EIS on the same proposal listed the same alternatives.⁸⁰ Other mitigations to the lead shot problem, unlike the administrative mitigations proposed in the EISs, include deep-tilling the ground where there are large lead shot deposits, or altering the levels of bodies of water to limit waterfowl access to lead shot on the ground.⁸¹ This section describes these latter mitigation measures and concludes that they are inefficient, ineffective, and counterproductive.

A. Tillage

In areas heavily used by waterfowl and hunters, the concentration of spent shotgun pellets can be quite high. In an Illinois study, soil sample analyses performed in areas heavily used by

1985. The average price includes prices for all shot sizes and shell lengths, as well as premium, regular, and magnum loads.)

The difference in average cost for 12-gauge steel shotgun shells and lead shot shotgun shells is only about 50¢; hence, steel shot is not significantly more expensive for 12-gauge shotguns. Since the majority of waterfowl hunters use 12-gauge shotguns, the choice between steel and lead shot would not revolve around cost. Instead, consumer preference, or bias against steel shot, is probably a bigger factor in deciding which shot to purchase. And, with more than a decade of controversy surrounding the conversion to steel shot, many hunters are ingrained with the idea that steel shot is much more expensive than lead shot when in fact steel shot is not significantly more expensive for 12-gauge shotguns.

78. See EIS, *supra* note 8, at 1.

79. *Id.* at 59-61. The EIS proposed that a ban on the use of lead shot be put in effect first in the Atlantic Flyway, then the Mississippi Flyway, and then the Central and Pacific Flyways. *Id.* at 2. For a discussion of flyways, see *infra* notes 150-55 and accompanying text.

80. See DRAFT EIS, *supra* note 9, at II-1 to II-2.

81. Illinois law requires that these alternative methods of alleviating lead poisoning either be applied, or determined not effective in a given area. See *infra* note 92.

Canada geese for feeding found roughly 20,900 shotgun pellets per acre.⁸² The level at which lead pellets pose a hazard to waterfowl appears to be about 20,000 per acre.⁸³ In another study, spent lead pellets were most abundant in an area that was not tilled, disked, or otherwise cultivated, and least abundant on hard compacted soils, and at elevations not subject to flooding.⁸⁴

One suggested management technique to alleviate lead poisoning is annual plowing or tilling of public hunting areas to allow lead pellets to settle deeper into the soil, thereby making the shot less accessible to waterfowl.⁸⁵ Plowing is also recommended in those instances where pellets accumulate on compacted soils.⁸⁶ The availability of shotgun pellets is heavily dependent on soil composition and marsh bottom types.⁸⁷ In aquatic areas with silty or peat soils, the accumulation of lead shot pellets and their availability to waterfowl is low.⁸⁸ Firm or compacted soils, such as those consisting of clays, cinders, or gravel, exacerbate the long-term accumulation of shot pellets at or near the surface.⁸⁹

82. Anderson, *supra* note 9, at 3. Soil samples taken in woody areas had about 59,900 pellets per acre. *Id.*

83. *Id.* This is about one pellet per two square feet of soil. Waterfowl foraging for food would be expected to ingest many pellets with this density. Large waterfowl die-offs have been reported when spent lead shot densities have ranged from 17,424 to 118,048 pellets per acre. *Id.* at 3-4.

84. Anderson, *Potential for Lead Poisoning Die-Offs Among Waterfowl at Rend Lake*, ILL. DEP'T OF CONSERVATION, DIV. OF FISH AND WILDLIFE RESOURCES, PERIODIC REP. NO. 36, at 4-5 (1982). Shot accumulates near the surface of hard, compacted soils. Waterfowl prefer lowlands subject to seasonal flooding, and because they attract hunters, these lowlands generally have more shot pellets than higher elevations. The study concluded that the most feasible solution to the problem of lead poisoning was to discontinue the use of lead shot. *Id.* at 6.

85. *Id.*

86. *Id.* The study also concluded that if lead shot was not restricted, the waterfowl should be "discouraged" from using areas subject to heavy hunting pressure. Several other authors describe the relationship between soil type and shot availability. See White & Stendell, *Waterfowl Exposure to Lead and Steel Shot on Selected Hunting Areas*, 41 J. WILDLIFE MGMT. 469, 474; C. Esslinger & W. Klimstra, *Continued Availability of Lead Shot on a Public Goose Hunting Area in Southern Illinois* (n.d.) (unpublished manuscript); Frederickson, Baskett, Brakhage & Cravens, *Evaluating Cultivation Near Duck Blinds to Reduce Lead Poisoning Hazard*, 41 J. WILDLIFE MGMT. 624 (1977).

87. White & Stendell, *supra* note 6, at 474.

88. *Id.*

89. *Id.* See also Sporre, *Incidence of Lead and Steel Shot in Indiana Water-*

In a field study designed to evaluate its effectiveness, researchers concluded that cultivation can redistribute lead shot to lower soil strata, thereby appreciably lessening the availability to waterfowl.⁹⁰ However, merely plowing soils over does not remove the lead shot problem entirely. Lead shot does not disappear from the ecosystem. In fact, studies have shown that lead shot in soil for seven years shows few signs of oxidation.⁹¹ Even if tilling succeeds in burying lead shot deeper in the soil, neglecting sound soil conservation practices will allow wind and water erosion to expose the lead or wash it down to lowlands where waterfowl concentrate. Tilling ground is also an expensive proposition if done annually, and tilling in wildlife areas destroys cover, nesting areas, and the local ecology. Even if tilling effectively "removed" lead shot, waterfowl might avoid the area for lack of food and cover, thereby making the entire tilling exercise futile.

Further, if tillage is used as a mitigation measure to reduce the availability of lead shot to waterfowl, it must reach a point of diminishing returns. That is, there comes a point when a cultivator will turn up as much shot as it turns under, particularly in areas that are heavily hunted each year.

B. Water Management

Other measures that could possibly be used to mitigate the harmful effects of lead shot are water management techniques such as flooding and draining waterfowl areas. Illinois law specifically requires an analysis of draining and flooding alternatives

fowl Gizzards During Three Hunting Seasons 1977-78 Through 1979-80, in INDIANA DEP'T OF NAT. RESOURCES, PITTMAN-ROBERTSON BULL. No. 12 (1981). "The availability of spent lead shot to feeding waterfowl cannot be questioned, although its magnitude varies and depends on the feeding habits of the various species of waterfowl, water depth, siltation rates and bottom types, amount of shooting over an individual marsh, size of the pellets, and the duration of ice cover." *Id.* at 3.

90. Fredrickson, Baskett, Brakhage & Cravens, *supra* note 86, at 631. For example, in areas in front of duck blinds, the presence of lead shot in the uncultivated top portion of the soil was four times greater than the prevalence of lead shot in uncultivated soils in other areas. *Id.* at 626. This result would be expected because of the concentrated shooting that takes place at duck blinds.

91. C. Esslinger, *Continued Availability of Lead Shot on a Public Goose Hunting Area in Southern Illinois* 20 (Oct. 1979) (unpublished Master's Thesis) (available from Graduate School of Zoology, Southern Illinois University-Carbondale).

before the use of nontoxic shot becomes mandatory in an area.⁹²

When an area is drained, standing water is removed. Since waterfowl are naturally attracted to marshy, watery lowlands, they would theoretically not land and feed in the drained area and thus would not pick up lead shot. Similarly, if a lowland area were flooded, an area that may have a high concentration of lead pellets in the soil would become less accessible to those species of waterfowl that did not dive down to feed on the bottom.⁹³

Timing of either draining or flooding is critical. If an area were drained during hunting season, hunters would be disgruntled because their access to waterfowl would be reduced. Also, flooding or draining cannot be performed in every instance, for example in arid areas or protected wetlands, and therefore its efficacy is limited. Flooding may reduce access to lead shot, but flooding stresses vegetation. If an area is flooded too long or often, long-term changes in the local ecosystem may result. This may in turn disrupt waterfowl habitat and diminish local waterfowl populations.⁹⁴

Finally, the use of draining or flooding to mitigate lead shot's harmful effects on waterfowl would be very labor and capital intensive. The benefits of water management techniques may not outweigh either the economic or environmental costs. It is far more feasible from a wildlife management point of view, and probably more efficient from a regulatory stance, to require hunters to use nontoxic shot.⁹⁵ Also, hunters would be much less

92. ILL. ANN. STAT. ch. 61, para. 2.18-1 (Smith-Hurd 1983) provides in part: It shall be lawful for any person who holds the licenses, permits and stamps required . . . for the taking of migratory waterfowl to use . . . either lead or steel shotgun pellets in taking such waterfowl at any location in the State where the hunting of migratory waterfowl is authorized, except at specific sites where there are documented cases of lead poisoning of waterfowl and all alternative methods of alleviating lead poisoning (such as dewatering, flooding and/or tillage) have been determined to be unsuccessful in preventing lead poisoning losses of waterfowl. At such specific sites, shot shell ammunition containing non-toxic pellets, such as steel, shall be used. These specific sites may be designated by the Department after statewide public hearings have been conducted and the results of such hearings have been reviewed.

93. These species are the so-called puddle ducks and geese. See *supra* text accompanying note 31.

94. There is a dearth of research in this area.

95. In the alternative, lead shot could be taxed heavily, thereby discouraging

inconvenienced using steel shot than facing favorite hunting grounds that are either under water, dry, or devoid of huntable waterfowl populations.

VI. LEGISLATION AND REGULATIONS ON WATERFOWL AND LEAD SHOT

The United States Constitution grants to the federal government the power to regulate interstate commerce.⁹⁶ States may regulate wildlife within their borders as long as they are not preempted by the federal government, or as long as state regulation is not more lenient than federal regulation.⁹⁷ The federal government regulates the use of lead shot on lands under its jurisdiction, but otherwise leaves to the states the responsibility of implementing restrictions on lead shot.

A. *International Treaties*

On August 16, 1916, the United States concluded a Convention with Great Britain on behalf of Canada for the Protection of Migratory Birds in the United States and Canada.⁹⁸ This treaty established closed seasons for migratory game birds, migratory insectivorous birds, and other migratory nongame birds.⁹⁹ For migratory game birds, the treaty closed the hunting season between March 10 and September 1, and provided that the season not be open more than three and one-half months per year.¹⁰⁰ In February 1936, the United States signed a Convention with the United Mexican States for the Protection of Migratory Birds and Game Mammals.¹⁰¹ This treaty set the length of the hunting season for waterfowl to four months and required that the United States and Mexican governments issue permits for hunting. This treaty also required the establishment of "refuge zones in which the tak-

hunters from purchasing lead shot, or lead shot could be banned.

96. U.S. CONST. art. I, § 8, cl. 3. See M. BEAN, *THE EVOLUTION OF NATIONAL WILDLIFE LAW* 12-47 (1983); T. LUND, *AMERICAN WILDLIFE LAW* 35-56 (1980).

97. See M. BEAN, *supra* note 96, at 21.

98. 39 Stat. 1702, T.S. No. 628.

99. Waterfowl included the family *Anatidae*: ducks, geese, swans, cranes, rails, and shore birds. P. JOHNSGARD, *supra* note 21, at 1.

100. See M. BEAN, *supra* note 96, at 21.

101. 50 Stat. 1311, T.S. No. 912.

ing of [migratory] birds will be prohibited.”¹⁰² On March 4, 1972 the United States signed a Convention with Japan for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment.¹⁰³ This treaty required that hunting seasons not overlap with nesting seasons and urged the establishment of sanctuaries to protect migratory birds.¹⁰⁴ The United States-Japan Convention also urges the countries to “endeavor to take appropriate measures to preserve and enhance the environment of the birds protected.”¹⁰⁵

The fourth and latest United States treaty on migratory bird protection became effective on October 13, 1978 pursuant to the Convention between the United States and the Soviet Union concerning the Conservation of Migratory Birds and Their Environment.¹⁰⁶ The parties to this treaty agreed to “undertake measures necessary to protect and enhance the environment of migratory birds and to prevent and abate the pollution or detrimental alteration of that environment.”¹⁰⁷ Moreover, the treaty urges the establishment of preserves, refuges, and protected areas for migratory birds and ensures that either government may adopt stricter domestic measures “to conserve migratory birds and their environment.”¹⁰⁸

The four treaties differ in describing the birds under their protection.¹⁰⁹ The two chief goals of the treaties are to prevent

102. *Id.* at art. II.

103. Convention for the Protection of Migratory Birds and Birds in Danger of Extinction, and Their Environment, March 4, 1972, United States-Japan, 25 U.S.T. 3329, T.I.A.S. No. 7990.

104. *Id.* at art. III, paras. 2-3.

105. *Id.* at art. VI.

106. Conservation of Migratory Birds and Their Environment, November 19, 1976, United States-USSR, 29 U.S.T. 4647, T.I.A.S. No. 9073. See Comment, *Migratory Bird Treaty With Russia: Continued International Wildlife Protection*, 7 *Envtl. L. Rep. (Envtl. L. Inst.)* 10,026 (1977).

107. Conservation of Migratory Birds and Their Environment, *supra* note 106, at art. IV, para. 1.

108. *Id.* at art. VII.

109. For example, the Canadian Convention describes birds by their common names; the Mexican Convention describes them by their scientific family names, and the Japanese Convention gives the common name and the full scientific name for each bird, and includes only those birds that migrate between the United States and Japan. The Russian Convention gives the scientific family name, the scientific name, and the common name. Additionally, the Russian Convention applies to all species that migrate between the United States and the Soviet Union

the excessive harvest of migratory birds, and to protect bird habitat.¹¹⁰ Thus under the spirit, if not the words, of the treaties with foreign nations, the United States must make efforts to render its waterfowl habitat free from lead toxicity and work with foreign nations to do likewise.

B. Federal Legislation and Regulations

The Migratory Bird Treaty Act (MBTA) implements the treaties with Great Britain, Mexico, Japan, and the Soviet Union.¹¹¹ The MBTA makes it unlawful to "hunt, take, . . . kill . . . any migratory bird"¹¹² under the treaties except as permitted by regulations promulgated by the Secretary of Interior.¹¹³ The Act also provides that the Secretary is to determine when, the extent, and the means by which hunting, taking, and killing of migratory birds will be allowed.¹¹⁴ The Act does not prohibit any state from giving further protection to migratory birds.¹¹⁵

that share common wintering areas. See M. BEAN, *supra* note 96, at 71-72.

110. For example, the Russian Convention provides that necessary measures should be taken to "protect and enhance the environment and to prevent and abate the pollution or detrimental alteration of that environment." Conservation of Migratory Birds and Their Environment, *supra* note 106, at art. IV, para. 1.

111. 40 Stat. 755 (1918) (codified as amended at 16 U.S.C. §§ 703-711 (1982 & Supp. II 1984)). Congress originally passed the Act to implement the 1916 treaty with Great Britain and subsequently amended it to accommodate the other conventions.

112. 16 U.S.C. § 703 (1982).

113. *Id.* § 704.

114. *Id.*

115. *Id.* § 708. The United States Supreme Court upheld the constitutionality of the MBTA in *Missouri v. Holland*, 252 U.S. 416 (1920) (Holmes, J.). The Court decided that the Migratory Bird Treaty with Great Britain on behalf of Canada, and its implementing legislation (the MBTA) took precedence over conflicting state laws under the supremacy clause of the Constitution. U.S. CONST. art. VI. *Holland*, 252 U.S. at 432. The Court wrote:

The State . . . [claims] exclusive authority upon an assertion of title to migratory birds No doubt it is true that as between a State and its inhabitants the State may regulate the killing and sale of such birds, but it does not follow that its authority is exclusive of paramount powers. To put the claim of the State upon title is to lean upon a slender reed. Wild birds are not in the possession of anyone; and possession is the beginning of ownership.

. . . .

. . . But for the treaty and the statute there soon might be no birds for any powers to deal with. We see nothing in the Constitution that compels the

Since 1918, the federal government has regulated methods by which waterfowl could be taken.¹¹⁶ During the early part of the twentieth century, researchers discovered that lead shot was toxic to waterfowl and harmed the environment.¹¹⁷ Finally in 1976, after much discussion on the subject in the 1960s and early 1970s, the United States Fish and Wildlife Service (FWS) prepared an Environmental Impact Statement which considered the gradual transition from lead to steel shot for waterfowl hunting in certain areas of the United States to be designated by the FWS.¹¹⁸ Subsequent to its proposal, the FWS initially designated nine areas along the Atlantic seaboard as nontoxic shot zones in which lead shot would be banned,¹¹⁹ although other regions were soon added.

The FWS regulations provided for approval of nontoxic shot by the agency using various scientific and testing criterion.¹²⁰ Section 20.108 designated specific areas in the Atlantic, Mississippi, Central, and Pacific Flyways as nontoxic shot zones for waterfowl hunting.¹²¹

There was a great deal of opposition to the regulations by states which felt they were not properly consulted, and individual sportsmen who complained that steel shot was not available in sufficient quantities, even though the use of steel shot was re-

Government to sit by while a food supply is cut off and the protectors of our forests and our crops are destroyed. It is not sufficient to rely upon the States. The reliance is vain

Id. at 434-35.

116. EIS, *supra* note 8, at 9. See 50 C.F.R. § 20.21 (1985) for regulations on hunting methods.

117. See *supra* notes 16-33 and accompanying text.

118. EIS, *supra* note 8, at 1.

119. 41 Fed. Reg. 31,386-89 (1976). The subsequent regulations provided: Migratory birds on which open seasons are prescribed in this part may be taken by any method except those prohibited in this section. No person shall take migratory birds:

(j) While possessing shotshells loaded with shot other than steel shot or such shot approved as non-toxic by the Director pursuant to procedures set forth in § 20.134. *Provided*, [t]hat:

(1) This restriction applies only to the taking of ducks, geese, swans, and coots . . . in areas described in § 20.108 as non-toxic shot zones; and

(2) Prior to September 1, 1980, this restriction applies only to 12-gauge shotshells.

50 C.F.R. § 20.21(j) (1985).

120. 50 C.F.R. § 20.134 (1985).

121. *Id.* § 20.108.

stricted to only those areas where lead poisoning was most serious.¹²² After many hearings on the pros and cons of implementing steel shot regulations,¹²³ the Department of the Interior's 1978 annual appropriation bill contained an amendment providing:

No funds appropriated by this Act shall be available for the implementation or enforcement of any rule or regulation of the United States Fish and Wildlife Service, Department of the Interior, requiring the use of steel shot in connection with the hunting of waterfowl in any State of the United States unless the appropriate State regulatory authority approves such implementation and enforcement.¹²⁴

There is little legislative history regarding this amendment, which requires states to affirmatively approve a regulation, not simply acquiesce. Section 306 was offered as an amendment in the House-Senate conference committee by Senator Stevens of Alaska ("Stevens Amendment").¹²⁵

After passage of the Stevens Amendment, nine of thirty-two states that had areas designated as nontoxic shot zones did not approve implementation, and therefore the FWS regulations were not enforced in those states.¹²⁶ Each year since 1978, the Stevens Amendment has been added to Interior's appropriation bill, even though the FWS continues to call for the broad implementation of nontoxic zones because of the lethal effects of lead on waterfowl.¹²⁷

There may be a number of explanations for a state's refusing to enact nontoxic shot zones designated by the FWS, but the two

122. *Steel Shot Hearing*, *supra* note 73, at 12 (statement of Lynn Greenwalt, Director, U.S. Fish and Wildlife Serv.).

123. See *Fish and Wildlife Briefings*, *supra* note 73; *Steel Shot: Hearings Before the Subcomm. on Fisheries and Wildlife Conservation and the Env. of the Comm. on Merchant Marine and Fisheries*, 95th Cong., 1st Sess. (1978) (78 C.I.S. H561-17).

124. Act of Oct. 17, 1978, Pub. L. No. 95-465, § 306, 92 Stat. 1279, 1302.

125. H.R. CONF. REP. No. 1672, 95th Cong., 2d Sess. 31 (1984). The only legislative history on the amendment is a statement of support by Maryland Representative Bauman, 124 CONG. REC. 34,489 (1978), and an acknowledging statement by Senator Byrd prior to passage in the Senate, 124 CONG. REC. 33,695 (1978).

126. National Wetlands Technical Council, *Steel Shot Zones Designated*, NAT'L WETLANDS NEWSLETTER, May-June, 1980 at 8, 9.

127. See 45 Fed. Reg. 37,847 (1980); 50 Fed. Reg. 2298 (1985); 50 Fed. Reg. 6017 (1985).

most likely are: (1) desire by the state to be independent from additional federal regulation, and (2) strong political pressures on state wildlife agencies and representatives by hunting organizations expressing opposition to steel shot. While state and congressional (through the Stevens Amendment) impediments to nontoxic zones continue, it is the growing policy of waterfowl managers to call for the elimination of all lead shot.¹²⁸ At present, the FWS is concentrating its efforts in three areas: (1) regulations aimed at implementing nontoxic shot zones to protect waterfowl; (2) regulations aimed at protecting the bald eagle from the secondary effects of lead poisoning; and (3) regulations which will gradually phase out the use of lead shot for waterfowl hunting.

1. *Nontoxic shot zone regulations*

On January 16, 1985, the Fish and Wildlife Service (FWS) proposed guidelines establishing minimum criteria for identification of nontoxic shot zones for waterfowl hunting.¹²⁹ The proposal contained specific criteria to determine whether an area poses a problem to waterfowl because of lead shot poisoning, and whether a nontoxic shot zone should be established. The FWS proposed to address nontoxic zones in four ways. First, where lead poisoning constitutes a threat to waterfowl, lead shot should be eliminated. Second, the states would provide the maximum opportunity to

128. See Atlantic Waterfowl Council, Atlantic Flyway Policy for Reducing Lead Poisoning in Waterfowl (July 27, 1984); National Military Fish and Wildlife Ass'n (Mar. 27, 1986); letter from J. Scott Feierabend, Legislative Representative, National Wildlife Federation, Washington, D.C. to author (May 7, 1986). The Central and Mississippi Flyway Councils urge their member states to give strong consideration to the use of nontoxic shot for waterfowl hunting (see Joint Resolution No. 19, authored by technical sections of both Flyway Councils and adopted in Wichita, Kansas, Mar. 8, 1984, contained in Feierabend letter, *supra*). See, e.g., Letter from Jack H. Berryman, Executive Vice-President, International Association of Fish and Wildlife Agencies to author (May 5, 1986). ("It is the position of the International Association of Fish and Wildlife Agencies that lead is an environmental pollutant and the continued use of lead shot for waterfowl hunting must be eliminated by 1991 through scheduled replacement with non-toxic shot through progressively more restrictive measures."). It is the "position of the National Military Fish and Wildlife Association that the use of lead shot for waterfowl hunting be eliminated nationwide." (policy statement given by Gene Stout President, National Military Fish & Wildlife Ass'n, contained in Feierabend letter, *supra*).

129. 50 Fed. Reg. 2298 (1985) (to be codified at 50 C.F.R. pt. 20) (proposed Jan. 16, 1985).

determine the most appropriate application of nontoxic shot zones within their boundaries. Third, the FWS would advise and assist the states in establishing nontoxic shot zones. Fourth, recommendations on the use of nontoxic shot on wildlife refuges and other FWS lands would be based on “a) clear evidence that a lead poisoning problem exists in or near the area where waterfowl hunting will take place; or b) the state wildlife agency requests that FWS lands be included in a nontoxic shot zone established and enforced by the state.”¹³⁰

The proposal includes as a threshold a “triggering criteria” to identify areas where lead poisoning is a problem, and a “decision criteria” to determine whether the area should be proposed as a nontoxic shot zone. Under the first criteria, monitoring of waterfowl populations is undertaken to determine if lead poisoning is a problem. A county or area within a state will be studied if (1) the three-year annual harvest is ten ducks and/or geese per square mile,¹³¹ or, (2) if three waterfowl have died from lead poisoning in the area.¹³² Areas meeting these criteria would be investigated for lead poisoning in their waterfowl.¹³³ If five percent or more of the waterfowl gizzards examined indicate ingested lead, and if the liver contains two parts per million (ppm) lead or the blood contains 0.5 ppm lead, the area will be proposed as a nontoxic shot zone.¹³⁴ If the state concurs that the area should be designated as a nontoxic shot zone, the FWS will propose that the area be added to its list in the regulations.¹³⁵

The FWS proposal represents a uniform approach to dealing with lead poisoning in waterfowl that does not excessively burden financial or human resources. However, the decision to establish the nontoxic shot zones remains with the states. Those states opposed to nontoxic zones are able to continue to deny protection to waterfowl.

130. *Id.* at 2299.

131. *Id.* at 2299-2300.

132. *Id.* at 2300.

133. *Id.* at 2299-2300. Monitoring studies require a 100-bird sample size. The Fish and Wildlife Service estimates that about 466 counties nationwide meet the 10 waterfowl harvest criteria. The length of the monitoring period is vague. *Id.*

134. *Id.* at 2300. The state must decide within 90 days that more monitoring studies of the area will begin in one year. *Id.*

135. *Id.* See 50 C.F.R. § 21.108 (1984).

2. Regulations to protect bald eagles from lead poisoning

On September 14, 1984, the Fish and Wildlife Service (FWS) proposed regulations to reduce the risk of bald eagle lead poisoning.¹³⁶ The FWS proposed to place areas where high concentrations of waterfowl and eagles overlap into three categories. Category I counties would be areas where eagles have already died of lead poisoning or would die from lead poisoning from eating lead-poisoned waterfowl.¹³⁷ Category I counties would be under active consideration for designation as nontoxic shot zones. Category II counties would be those counties where eagle poisoning from eating lead-poisoned waterfowl is suspected, but not acute enough to warrant designation as a nontoxic zone.¹³⁸ In Category II counties, data would be reviewed and the area scrutinized for possible further action on banning lead shot. In Category III counties, data on lead poisoning would be reviewed and public comments taken. Category III areas, like Category II areas, would remain under study for implementing lead free zones.

After announcing this proposal, the FWS proposed amending the regulations by adding nontoxic shot zones in eight states.¹³⁹ Reacting to this amendment proposal, the National Wildlife Federation threatened to sue the FWS unless the steel shot areas were expanded beyond the areas proposed in the Federal Register.¹⁴⁰ The FWS, on the other hand, threatened to close waterfowl seasons in the affected areas unless states approved nontoxic zones in those areas.¹⁴¹ However, litigation in the summer of 1985 changed the entire regulatory scheme and forestalled immediate action by the FWS.

C. State Legislation and Regulations

Most states have reacted to the lead poisoning of waterfowl

136. 49 Fed. Reg. 36,290 (1984).

137. *Id.* at 36,292. The Fish and Wildlife Service identifies five such counties: Siskiyou, Ca.; Modoc, Ca.; Klamath, Or.; Jackson, Or.; and Holt, Mo. Ostensibly the eagles would die because of a large number of lead-poisoned waterfowl.

138. *Id.* with "not acute" meaning no dead eagles.

139. 50 Fed. Reg. 6017 (1985) (to be codified at 50 C.F.R. § 20.108).

140. *Steel Shot Mandated in Portion of Klamath Basin*, *The Oregonian*, May 3, 1985, at E9, col. 2.

141. *Id.*

in various regulatory ways. Actions by states can be broken down into four categories: (1) states that have no laws or regulations on the issue, (2) states that have limited prohibitions on the use of lead shot, (3) states that ban the use of lead shot, and (4) one state that bars prohibitions of lead shot.

1. States without laws or regulations

Twenty states have no laws or regulations prohibiting the use of lead shot in the state.¹⁴² This does not mean that lands under federal jurisdiction do not have lead shot prohibitions. The Fish and Wildlife Service (FWS) has jurisdiction over National Wildlife Refuges in these states, and the FWS may impose hunting bans on the refuges unless the state in which the refuge is located

142. (All the following letters and telephone interviews were to the author.) These states include *Alabama*, letter from Keith McCutcheon, Waterfowl Biologist, Game and Fish Division, Alabama Dep't of Conservation and Natural Resources (June 26, 1985). *Alaska*, letter from Don. W. Collinsworth, Commissioner, Alaska Dep't of Fish and Game (June 11, 1985). *Georgia*, letter from Leon Kirkland, Director, Game and Fish Division, Georgia Dep't of Natural Resources (June 24, 1985). *Hawaii*, letter from Marie Morin, Biologist, Division of Forestry and Wildlife, Hawaii Dep't of Land and Natural Resources (June 6, 1985) (Hawaii prohibits all waterfowl hunting). *Idaho*, telephone interview with Garry Will, Idaho State Game Manager, Idaho Dep't of Fish and Game, Boise, Idaho (July 25, 1985). *Kentucky*, letter from William Graves, Director, Wildlife Division, Kentucky Dep't of Fish and Wildlife Resources (June 17, 1985). *Louisiana*, letter from J. Burton Angelle, Secretary, Louisiana Dep't of Wildlife and Fisheries (June 12, 1985). *Maine*, telephone interview with Fred Hurley, Maine Dep't of Fish and Wildlife (Aug. 20, 1985). *Mississippi*, letter from Lon Strong, Executive Director, Mississippi Dep't of Wildlife Conservation (June 10, 1985). *Montana*, letter from Don Childress, Waterfowl Coordinator, Montana Dep't of Fish, Wildlife and Parks (June 6, 1985). *Nevada*, telephone interview with Terry Retterer, Nevada Game and Fish (Aug. 16, 1985). *New Hampshire*, letter from Harold Lacaillade, Waterfowl Biologist, New Hampshire Fish and Game Dep't (June 10, 1985). *North Dakota*, telephone interview with Mike Johnson, North Dakota Dep't of Fish and Game (Aug. 16, 1985). *Oregon*, letter from John R. Donaldson, Ph.D., Director, Oregon Dep't of Fish and Wildlife (Aug. 12, 1985). *Oklahoma*, letter from Lem Due, Migratory Bird Supervisor, Oklahoma Dep't of Wildlife Conservation (June 24, 1985). *South Carolina*, letter from W. Brock Conrad, Jr., Chief, Game Management, South Carolina Wildlife and Marine Resources Dep't (June 14, 1985). *Utah*, letter from Tom Aldrich, Waterfowl Program Coordinator, Utah Natural Resources (June 21, 1985). *Vermont*, letter from Thomas R. Myers, Waterfowl Biologist, Vermont Dep't of Fish and Game (June 25, 1985). *Virginia*, letter from R. H. Cross, Jr., Executive Director, Virginia Commission of Game and Inland Fisheries (June 4, 1985). *West Virginia*, letter from Kermit T. Rinell, Game Biologist, West Virginia Dep't of Natural Resources (June 6, 1985).

imposes its own nontoxic shot zones. These states continue to monitor waterfowl for lead shot ingestion according to federal guidelines.

2. States prohibiting lead shot in certain areas

Twenty-seven states have regulations prohibiting the use of lead shot when hunting waterfowl.¹⁴³ The state regulations

143. (The following letters were to the author.) *Arizona*, letter from Philip M. Smith, Migratory Game Bird Biologist, Arizona Game and Fish Dep't (June 7, 1985). *Arkansas*, letter from Steve N. Wilson, Director, Arkansas Game and Fish Commission (June 6, 1985). *California*, letter from Bruce E. Deuel, Waterfowl Specialist, California Dep't of Fish and Game (June 19, 1985). *Colorado*, letter from Richard M. Hopper, Wildlife Manager, Division of Wildlife, Colorado Dep't of Natural Resources (June 14, 1985). *Connecticut*, letter from Dennis P. DeCarli, Deputy Commissioner, Connecticut Dep't of Environmental Protection (July 17, 1985). *Delaware*, letter from William C. Wagner, II, Director, Division of Fish and Wildlife, Delaware Dep't of Natural Resources and Environmental Control (June 7, 1985). *Florida*, letter from Allan L. Egbert, Ph.D., Director, Division of Wildlife, Florida Game and Fresh Water Fish Commission (July 15, 1985). *Illinois*, letter from Michael B. Witte, Director, Illinois Dep't of Conservation (Aug. 19, 1985). See ILL. ANN. STAT. ch. 61, para. 2.18-1 (Smith-Hurd 1983), *supra* note 92. For a discussion of mitigating measures in this statute (dewatering, flooding, and tillage), see *supra* notes 84-94 and accompanying text. *Indiana*, letter from Edward L. Hansen, Director, Division of Fish and Wildlife, Indiana Dep't of Natural Resources (June 5, 1985). *Kansas*, letter from Marvin J. Kraft, Waterfowl Project Leader, Kansas Fish and Game (Jan. 9, 1985). *Massachusetts*, letter from H.W. Heusmann, Waterfowl Biologist, Massachusetts Division of Fisheries and Wildlife (June 10, 1985). *Michigan*, letter from Edward J. Mikula, Chief, Wildlife Division, Michigan Dep't of Natural Resources (June 18, 1985). *Minnesota*, MINN. WATERFOWL HUNTING REGS. 11 (1985) (available from Minnesota Dep't of Natural Resources, St. Paul, Minn.). *Missouri*, letter from Allen Bohn, Assistant Director, Missouri Dep't of Conservation (June 7, 1985). *New Jersey*, letter from Fred A. Carlson, Chief, Bureau of Wildlife Management, New Jersey Dep't of Env'tl. Protection (June 6, 1985). *New Mexico*, letter from Bruce Morrison, Assistant Chief, Game Management, New Mexico Dep't of Game and Fish (July 29, 1985). *New York*, letter from Kenneth F. Wich, Director, Division of Fish and Wildlife, New York Dep't of Env'tl. Conservation (June 10, 1985). *North Carolina*, North Carolina and Federal Migratory Bird Hunting Regulations Abstract 1985-86, at 3 (1985) (available from the North Carolina Wildlife Resources Commission, Raleigh, N.C.). *Ohio*, letter from Max E. Duckworth, Chief, Division of Wildlife, Ohio Dep't of Natural Resources (June 12, 1985) (see OHIO ADMIN. CODE § 1501:31-7-02(C) which makes it unlawful to use any shot other than nontoxic shot in certain areas). *Pennsylvania*, letter from G.D. Kirkpatrick, Director, Bureau of Law Enforcement, Pennsylvania Game Commission (June 6, 1985). *Rhode Island*, letter from John M. Cronan, Division of Fish and Wildlife, Rhode Island Dep't of Env'tl. Management (May 31, 1986). *South Dakota*, letter from Ron Fowler, Waterfowl

prohibiting lead shot are limited to certain areas where there is a high concentration of hunting and waterfowl, and where instances of lead-poisoned waterfowl have been documented.

3. *States with state-wide bans on lead shot*

Two states, Iowa and Nebraska, ban the use of lead shot when hunting waterfowl. Iowa bans the use of lead shot when hunting migratory birds on lands and waters under the jurisdiction of the United States, the state and county conservation commissions, on all waters adjacent to these areas, and on a zone 150 yards wide adjacent to these lands and waters.¹⁴⁴

The State of Nebraska requires that hunters use nontoxic (steel) shot throughout the state when hunting waterfowl.¹⁴⁵ Spe-

Specialist, Division of Wildlife, South Dakota Dep't of Game, Fish, and Parks (June 12, 1985). *Tennessee*, letter from Bobby L. Stratton, Attorney, Tennessee Wildlife Resources Agency (July 18, 1985). *Texas*, letter from William C. Brownlee, Program Director, Migratory Game Birds, Texas Parks and Wildlife Dep't (July 2, 1985). *Washington*, letter from Don Kraege, Waterfowl Program Manager, Washington Dep't of Game (July 31, 1985). *Wisconsin*, letter from Carroll O. Besadny, Secretary, Wisconsin Dep't of Natural Resources (July 25, 1985). *Wyoming*, letter from Pete Petera, Assistant Director, Wyoming Game and Fish Dep't (June 7, 1985).

144. Letter from Allen Farris, Chief, Fish and Wildlife Division, Iowa Conservation Commission to author (June 5, 1985). IOWA ADMIN. CODE §§ 290-105.3(109), 290-105.3(3) (1985) provides:

No person shall take migratory game birds

. . . .
On all lands and waters under the jurisdiction of the state conservation commission, the United States government, or any county conservation board while having in one's possession any shotshells loaded with other than steel shot. Also on all waters and a 150-yard zone of land adjacent to these waters, including reservoirs, lakes, ponds, marshes, bayous, swamps, rivers, streams, and seasonally flooded areas of all types, while having in one's possession any shotshell loaded with other than steel shot; except that temporary sheet water, farm ponds smaller than two surface acres in size, and streams with the water less than twenty-five feet in average width at the site where the hunting is occurring shall be excluded from the steel shot requirement, provided they are at least 150 yards from the water areas described above.

145. Letter from William J. Bailey, Jr., Assistant Director, Nebraska Game and Parks Commission to author (May 31, 1985). NEB. ADMIN. R. & REGS. 011-011.02 (1984) provides:

commencing with the 1985 hunting seasons

It shall be unlawful for anyone to use or possess shotgun shells or shotgun

cifically, Nebraska requires that steel shot must be used when hunting any game bird or game animal on lands managed primarily for waterfowl that are federally or state owned or controlled. These requirements prohibit the use of lead shot on government lands as well as private lands, and go beyond any other state's restrictions. Nebraska's general ban on the use of lead shot while hunting waterfowl is an important, thoughtful regulatory step in reducing the impact of lead shot on wildlife.¹⁴⁶

4. States banning regulations prohibiting the use of lead shot

The State of Maryland passed a law precluding any anti-lead shot regulations.¹⁴⁷ This law is contrary to the professional judg-

ammunition loaded with or containing shot other than steel while hunting, taking, or attempting to take waterfowl

It shall be unlawful for anyone to use or possess shotgun shells or shotgun ammunition loaded with or containing shot other than steel while hunting, taking, or attempting to take any game bird or game animal on any state or federally owned or controlled areas managed primarily for waterfowl and designated by the Commission and posted as non-toxic shot areas for all hunting.

146. Determining the level of compliance with bans on lead shot is a difficult task. It is virtually impossible to put enough enforcement personnel in the field to check every hunter's ammunition. At least one compliance study has been performed. P. Scarlett & B. Young, *A Survey of Waterfowl Hunters in the Steel Shot Area of New Jersey* (n.d.) (available from the New Jersey Division of Fish, Game, and Shellfisheries, Williamstown, New Jersey). The authors found that in non-toxic shot zones, hunter compliance with the ban on lead shot was 22% during the first week of the 1977 waterfowl season, progressing to 100% compliance by the end of the season. The study attributed this level of compliance to intensified law enforcement and news media advertising of the stepped-up enforcement. Non-compliance with the lead shot ban was 75% and 40% in two areas without enforcement. *Id.* The study concluded that about "two out of five hunters in the steel shot area are hunting with lead shot." *Id.* at 3. This study may be outdated, and compliance may in fact be higher. While this is the only printed study, anecdotal information indicates that in areas where lead shot is banned, compliance with the ban is good. However, future verification studies will be necessary.

147. MD. NAT. RES. CODE ANN. § 10-604(e) (1983) provides:

Any law to the contrary notwithstanding, neither the Secretary of Natural Resources nor any other official of the Department of Natural Resources may promulgate any rule or regulation banning or limiting the use or possession of lead shot ammunition while hunting wild waterfowl. Any rule or regulation which bans or limits the use or possession of lead shot ammunition while hunting wild waterfowl is declared null, void, and of no effect. Neither the State nor any agency or Department may request that the federal government enforce any federal rule or regulation regarding a ban or

ment of the Maryland Forest, Park and Wildlife Service, and the Governor, whose veto of the bill was overridden by the Legislature.¹⁴⁸ Although history on the Maryland law is sparse, Maryland's sentiment against a ban on lead shot is a matter of record on the part of its delegation to Congress.¹⁴⁹

D. Actions By Flyway Councils

When waterfowl move south in the fall and north in the spring, they travel along routes called flyways.¹⁵⁰ As waterfowl managers became increasingly familiar with the movement of waterfowl in the flyway corridors, management of the flyways became inevitable. The Flyway Councils are comprised of representatives from each flyway state. While not official bodies, they combine research and administrative efforts on a variety of waterfowl management issues. There are four Flyway Councils: the Pacific, Central, Mississippi, and Atlantic.¹⁵¹ Establishment of the

limit on the use or possession of lead shot ammunition.

148. Letter from Donald E. MacLauchlan, Director, Forest, Park and Wildlife Service, Maryland Dep't of Natural Resources, to author (June 7, 1985).

149. See *Steel Shot: Hearings Before the Subcomm. on Fisheries and Wildlife Conservation and the Environment of the House Comm. on Merchant Marine and Fisheries*, 95th Cong., 1st Sess. (1977) (77 C.I.S. H561-9). State Senators Boyer and Malkus and United States Representative Bauman, all of Maryland, registered strong opposition to a lead shot ban. *Id.* at 137-38. These statements were followed by those of a number of Maryland residents expressing similar sentiments. *Id.* at 148. While this Congressional testimony may only remotely indicate the legislative history of a state law, it may be reasonable to assume that these opinions against steel shot were also heard in the state legislative hearings. This assumption was confirmed in a telephone conversation between the author and Bernard Halla, special assistant to the Secretary, Maryland Dep't of Natural Resources, Annapolis, Md. (Mar. 17, 1986).

150. FLYWAYS, *supra* note 30, at 2. See also E. TEALE, AUTUMN ACROSS AMERICA 94-97, 191-201 (1956). An excellent map of the North American flyways is in Madsen, *supra* note 33, at 570.

151. FLYWAYS, *supra* note 30, at 373-77. The Pacific Flyway Council is comprised of representatives from the States of Alaska, Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. The states represented in the Central Flyway Council include Wyoming, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, and Texas. (The split between Central and Pacific flyways occurs along the Rocky Mountains. Such Rocky Mountain states as New Mexico, Colorado, Montana, and Wyoming are represented on both the Central and Pacific Flyway Councils.) The states represented on the Mississippi Flyway Council include Alabama, Arkansas, Illinois, Indiana, Iowa, Kentucky, Louisiana, Michigan, Minnesota, Mis-

Councils arose from a need to gain a greater understanding of the biology and migration of waterfowl.¹⁵² Flyway Councils assist states in promulgating regulations, maintaining waterfowl habitat, and improving basic understanding and information on waterfowl. They also facilitate the exchange of information between waterfowl biologists in different regions of the country.¹⁵³ Flyway Councils generally favor phasing out lead shot and substituting the use of nontoxic shot for waterfowl hunting.¹⁵⁴ The Central and Mississippi Flyway Councils urge the exclusive use of nontoxic shot for waterfowl hunting.¹⁵⁵

VII. CASES ON MIGRATORY BIRD PROTECTION

A. Seminal Court Tests

The Migratory Bird Treaty Act of 1918 (MBTA) implemented the Migratory Bird Treaty with Great Britain.¹⁵⁶ An amendment to the MBTA implemented the provisions of three more conventions with foreign nations for the protection of migratory birds. The constitutionality of the MBTA was tested in *Missouri v. Holland*.¹⁵⁷ There, the State of Missouri sought to prevent a federal game warden, Holland, from enforcing the MBTA and its regulatory provisions. The United States Supreme Court rejected Missouri's argument that it owned wild birds

Mississippi, Missouri, Ohio, Tennessee, and Wisconsin. The states represented on the Atlantic Flyway Council include Connecticut, Delaware, Florida, Georgia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, North Carolina, Pennsylvania, Rhode Island, South Carolina, Vermont, Virginia, and West Virginia.

152. FLYWAYS, *supra* note 30, at 381-82.

153. The Atlantic Flyway Council adopted the following policy for reducing lead poisoning in waterfowl on July 27, 1984: "Non-toxic steel shot shall be used for waterfowl hunting in the Atlantic Flyway no later than the 1987-88 waterfowl season." Letter from Larry J. Hindman, Waterfowl Population Project Leader, Maryland Dep't of Natural Resources, to author (June, 1985).

154. Letter from Max E. Duckworth, Chief, Division of Wildlife, Ohio Dep't of Natural Resources, to Robert A. Jantzen, Director, United States Fish and Wildlife Service (Oct. 5, 1984) (discussing lead/steel shot in Central Flyway controversy). *See supra* note 128.

155. Letter from Max E. Duckworth, *supra* note 143. The Association of Mid-west Fishland Wildlife Agencies' position is similar. *Id.*

156. Pub. L. No. 95-616, 92 Stat. 3112 (codified at 16 U.S.C. § 712 (1982 & Supp. II 1984)).

157. 252 U.S. 416 (1920).

within its borders,¹⁵⁸ and upheld both the Treaty with Great Britain and the MBTA's supremacy over the states regarding federal wildlife regulation.¹⁵⁹

The federal government's ability to regulate both the extent and the means by which migratory birds may be taken came under attack in 1937 in *Cochrane v. United States*.¹⁶⁰ The Seventh Circuit Court of Appeals wrote that "the authority to deprive hunters of any open season carries with it the power to provide for a limited open season for *limited purposes only*."¹⁶¹ In *Cochrane*, the defendant was charged with violating provisions of the MBTA that prohibited hunting with the "aid of corn and rye."¹⁶² *Cochrane* challenged the constitutionality of the MBTA and the regulations promulgated under its authority.¹⁶³ The court held that hunting seasons, bag limits, and the methods hunters can use to kill birds are legitimate exercises of federal authority.¹⁶⁴ Further, the court held that under the commerce clause,¹⁶⁵ Congress can regulate the taking of waterfowl which migrate between states with the changing seasons.¹⁶⁶

In *Cerritos Gun Club v. Hall*,¹⁶⁷ gun club members sought an injunction to prevent prosecution of members who used grain to lure waterfowl to their hunting area. In denying the injunction, the Ninth Circuit affirmed that the treaties and the MBTA prohibited such baiting and that wild ducks, as articles of commerce, could be regulated by Congress under the commerce clause.¹⁶⁸

158. *Id.* at 434.

159. See M. BEAN, *supra* note 96, at 25.

160. 92 F.2d 623 (7th Cir. 1937), *cert. denied*, 303 U.S. 636 (1938).

161. *Id.* at 626 (emphasis in original).

162. *Id.* at 624. See 16 U.S.C. § 704 (1982) which allows the Secretary of Interior to adopt regulations on how migratory birds may be taken; 50 C.F.R. § 20.21(i) (1984) prohibits the taking of migratory birds by the use of baiting an area.

163. Specifically, it was argued that the MBTA violated the tenth amendment and that the regulations were arbitrary and an unconstitutional delegation by Congress. 92 F.2d at 624. ("The powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the states respectively, or to the people." U.S. CONST. amend. X.)

164. 92 F.2d at 627.

165. U.S. CONST. art. I, § 8, cl. 3.

166. 92 F.2d at 627.

167. 96 F.2d 620 (9th Cir. 1938).

168. *Id.* at 624.

Moreover, other cases have shown that takings under the MBTA are not restricted to intentional or direct killings of migratory birds. In an unreported case, an oil company was fined when fourteen ducks drowned in an oil pit which they apparently mistook for a pond.¹⁶⁹ And in *United States v. Corbin Farm Service*, an individual who sprayed pesticides on a field, subsequently causing the deaths of more than a thousand migratory ducks, violated the MBTA even though the act was unintentional.¹⁷⁰ By analogy, then, the use of lead shot would violate the MBTA, because the lead shot, when ingested by waterfowl, results in an indirect, unintentional killing of waterfowl.¹⁷¹

B. Lead Shot Regulation Litigation¹⁷²

In 1976, in *National Rifle Association of America, Inc. v. Kleppe*,¹⁷³ the National Rifle Association (NRA) sought a declaration that nontoxic shot zone regulations promulgated by the Fish and Wildlife Service (FWS) were arbitrary and capricious, an abuse of discretion by the agency, and in violation of the National Environmental Policy Act (NEPA).¹⁷⁴ The NRA argued that the Fish and Wildlife Service's 1976 Environmental Impact Statement (EIS) inadequately discussed lead and steel shot comparisons, that steel shot would create a health risk, and that the EIS failed to describe adequate alternatives to the action. The NRA also alleged that the EIS did not consider the environmental impact of the proposed action and any irreversible and irre-

169. M. BEAN, *THE EVOLUTION OF NAT'L WILDLIFE LAW* 85 (1977), citing *Conservation News*, Jan. 15, 1976 at 7. See also *United States v. FMC Corp.*, 572 F.2d 902 (2d Cir. 1978) (toxic wastes discharged into pond indirectly and unintentionally killed migratory birds but strict liability imposed). See generally M. BEAN, *supra* at 78-89.

170. 444 F. Supp. 510 (E.D. Cal. 1978), *aff'd on other grounds*, 578 F.2d 259 (9th Cir. 1978).

171. Should ducks have standing? See *Sierra Club v. Morton*, 405 U.S. 727 (1972); C. STONE, *SHOULD TREES HAVE STANDING?* 9 (1974); Huffman, *Book Review*, 5 ENVTL. L. 199 (1974) (reviewing C. STONE, *SHOULD TREES HAVE STANDING?* (1974)).

172. Three unreported trial cases in New York, Florida, and Texas upheld federal and state regulations imposing nontoxic shot areas. Feierabend, *supra* note 16, at 46.

173. 425 F. Supp. 1101 (D.D.C. 1976), *aff'd sub nom.* *National Rifle Ass'n v. Andrus*, 571 F.2d 674 (D.C. Cir. 1978).

174. 425 F. Supp. at 1103. See 50 C.F.R. pt. 20 (1985).

trievable commitments of resources.¹⁷⁵

After reviewing the EIS and the trial record, the District of Columbia District Court held that the EIS adequately assessed the effects of steel shot on hunters, waterfowl, and the environment, and analyzed all "reasonable, viable and meaningful alternatives" to banning lead shot.¹⁷⁶ The court also found that the EIS adequately discussed irreversible and irretrievable commitments of resources.¹⁷⁷ Finally, the court held that since lead shot poisoned waterfowl, the FWS's decision to promulgate nontoxic shot regulations had a rational basis and was not arbitrary, capricious, or an abuse of discretion.¹⁷⁸

In 1981, the South Dakota Migratory Bird Association sued the South Dakota Game, Fish, and Parks Commission for issuing a rule banning the use of lead shot in certain areas of the state.¹⁷⁹ The court addressed only the narrow issue of whether the state properly delegated authority to the Commission to issue the steel shot rule. In a brief opinion, the court upheld the Commission's authority.¹⁸⁰

The most recent case on lead shot regulation is *National Wildlife Federation v. Hodel*.¹⁸¹ In *Hodel*, the United States District Court for the Eastern District of California enjoined the United States Fish and Wildlife Service (FWS) from allowing hunting during the 1985-1986 season in areas of five states where bald eagles had been poisoned by lead shot.¹⁸² The National

175. 425 F. Supp. at 1104. The Fish and Wildlife Service regulations also prohibited the taking of ducks, geese, swans, and coots while using shotgun shells other than those loaded with nontoxic shot, in nontoxic shot zones. See *id.* at 1103 n.1. The regulations were proposed in 41 Fed. Reg. 31,386-31,389 (1976) and 41 Fed. Reg. 38,772-38,774 (1976) (originally codified at 50 C.F.R. §§ 20.21(j)(1), (2) (1976)) (current version at 50 C.F.R. § 20.134 (1985)). The regulations required that prior to Sept. 1, 1980, the restriction on use of nontoxic shot applied only to 12-gauge shotgun shells. See 50 C.F.R. pt. 20 (1985).

176. 425 F. Supp. at 1110.

177. *Id.* at 1111.

178. *Id.*

179. *South Dakota Migratory Bird Ass'n. v. South Dakota Game Fish and Parks Comm'n.*, 312 N.W.2d 374 (S.D. 1981).

180. *Id.* at 376. S.D. CODIFIED LAWS ANN. § 41-2-18 (1985) provides the commission with power to regulate the protection of all game birds.

181. *National Wildlife Fed'n v. Hodel*, 23 Env't Rep. Cas. (BNA) 1089 (1985).

182. *Id.* at 1090. The five states were California, Oregon, Oklahoma, Illinois, and Missouri. The disputed areas in California included the Lower Klamath Basin

Wildlife Federation (NWF) alleged that because the FWS allowed waterfowl hunting with lead shot in these areas, bald eagles were being poisoned. These eagle deaths, the Federation asserted, put the FWS in violation of several federal laws, including the National Environmental Policy Act (NEPA)¹⁸³ and the Endangered Species Act (ESA).¹⁸⁴

The NWF submitted a great deal of evidence documenting the link between the eagles' consumption of lead shot contaminated waterfowl and their subsequent poisoning. The court sided with the NWF and noted that lead poisoning caused the death of ninety-six bald eagles in 1976 and twenty-three in 1984.¹⁸⁵ Even though the FWS took a series of regulatory steps to establish steel shot zones, the NWF sued because the measures proposed by the FWS did not go far enough to protect the eagle.¹⁸⁶

First, the NWF argued that NEPA was violated because the

(including all of Lower Klamath National Wildlife Refuge) beginning at the junction of Highway 161 (state line road) and the Dorris-Brownell Road at the northwest corner of Indian Tom Lake; then south and east of the Dorris-Brownell Road as it makes a semicircle and unites again with Highway 161; then west along Highway 161 to the point of origin at the northwest side of Indian Tom Lake. Also included is the Tule Lake National Wildlife Refuge (excluding Refuge lands on Sheepy Ridge) in the Tule Lake portion of the Klamath Basin. *Id.* at 1094. In Illinois, the disputed areas included Henderson, Peoria, Fulton, Mason, Calhoun, Pike, Alexander, Jackson, Union, and Williamson Counties. *Id.* In Missouri, the disputed areas included Holt, St. Charles, Pike, and Lincoln Counties, and those portions of Chariton, Livingston, Carroll, and Linn Counties contained within the Swan Lake Goose Management Area. *Id.* In Oklahoma, the disputed area was Sequoyah County. *Id.* In Oregon, the disputed area included the portion of Klamath County lying west and south of a line commencing at the Oregon-California state line and proceeding along State Highways 39 and 39-140, U.S. Highway 97, and State Highway 62 to the Klamath County-Jackson County line. *Id.*

183. 42 U.S.C. §§ 4321-4361 (1982 & Supp. II 1984).

184. 16 U.S.C. §§ 1531-1543 (1982 & Supp. II 1984). The NWF also alleged violations of the Bald and Golden Eagle Protection Act, 16 U.S.C. §§ 668-668d (1982), and the Migratory Bird Treaty Act, 16 U.S.C. §§ 703-712 (1982). However, the court did not reach the merits of these claims.

185. *Hodel*, 23 Env't Rep. Cas. (BNA) at 1090.

186. For example, the FWS proposed steel shot zones in 30 counties in eight states. 50 Fed. Reg. 6017-22 (Feb. 13, 1985). In the FWS's final agency action, it established the steel shot zones in only three of these states. 50 Fed. Reg. 19,178-82 (May 7, 1985). On the same day, the FWS proposed to close the disputed areas in the five states (*see supra* note 182) for waterfowl hunting during the 1986-1987 season. 50 Fed. Reg. 19,248-49 (May 7, 1985). The suit by the NWF to close the disputed areas to hunting for the 1985-1986 season followed.

FWS allowed waterfowl hunting with lead shot in the five states without preparing an environmental impact statement (EIS).¹⁸⁷ Because an EIS must be prepared on all "federal actions significantly affecting the quality of the human environment,"¹⁸⁸ and because the MBTA forbids the hunting of migratory birds until regulations establish "when, to what extent . . . and by what means,"¹⁸⁹ the court required that an EIS be prepared before the FWS allowed hunting in the disputed areas.¹⁹⁰ The court made this determination even though an EIS was prepared in 1976 because the agency had a "continuing duty to gather and evaluate new information relevant to the environmental impacts" of lead shot on waterfowl and eagles.¹⁹¹

Next, the NWF charged that when the FWS allowed migratory bird hunting in the five state areas, it violated the Endangered Species Act (ESA) because the bald eagle is endangered in Missouri, California, Oklahoma, and Illinois, and threatened in Oregon.¹⁹² The ESA mandates that the FWS use "all methods . . . which are necessary to bring any endangered . . . or threatened species to the point at which" protections of the Act "are no longer necessary."¹⁹³ The FWS argued that it should be allowed to choose the alternatives to achieve this end.¹⁹⁴ But the court rebuked this argument for two reasons. First, the FWS had not identified the factors which it considered "relevant to their [sic] choosing to authorize the use of lead shot in the disputed areas,"¹⁹⁵ and therefore the court could not find a basis for upholding the FWS's decision. Second, the court held that even if the FWS identified the factors relevant to its decision to allow hunting with lead shot, there was no "rational connection between the factors found and the choice that [FWS] made."¹⁹⁶

187. *Hodel*, 23 Env't Rep. Cas. (BNA) at 1090-91.

188. NEPA, 42 U.S.C. § 4332(2)(c).

189. 16 U.S.C. § 704.

190. *Hodel*, 23 Env't Rep. Cas. (BNA) at 1091.

191. *Id.* at 1091, citing *Southern Or. Citizens Against Toxic Sprays v. Clark*, 720 F.2d 1475, 1480 (9th Cir. 1983), cert. denied, 469 U.S. 1028 (1984).

192. *Id.* at 1092 n.5.

193. 16 U.S.C. § 1532(3).

194. *Hodel*, 23 Env't Rep. Cas. (BNA) at 1092.

195. *Id.*

196. *Id.* The court reached its holding based on the Administrative Procedure Act (APA). 5 U.S.C. § 706(2)(A) (1982). An administrative action is upheld if the agency "has considered the relevant factors and articulated a rational connection

Finally, the court addressed the issue of whether the FWS's decision violated the provision of the ESA which "prohibits the 'taking' of endangered species by degrading its habitat in a way that kills individuals of a species."¹⁹⁷ The court found that the FWS's authorization to allow lead shot to be used during the 1985-1986 hunting season in the disputed state areas amounted to a taking under the ESA. When there is a taking incidental to an agency action, the ESA requires the Secretary of Interior to specify "reasonable and prudent measures . . . necessary or appropriate to minimize" the incidental taking.¹⁹⁸ The *Hodel* court found that the FWS did not provide measures to minimize eagle deaths resulting from lead shot; its measures were directed only to the 1986-1987 hunting season, not the 1985-1986 season,¹⁹⁹ and therefore the court found that the FWS violated the ESA.²⁰⁰

The court's injunctive order prohibited the FWS from allowing any migratory bird hunting in the disputed areas for the 1985-1986 hunting season.²⁰¹ The harshness of this order was mitigated by requiring the FWS to inform the affected states that if they established steel shot zones concurrent with the disputed areas, then those areas would be opened for waterfowl hunting.²⁰² But, the court indicated, if a state containing a disputed area refused to establish these steel shot zones, then all hunting in the area would be prohibited.²⁰³

The court's decision is particularly important for parties considering litigation under the Endangered Species Act. The plaintiff in *Hodel* had gathered enough factual data, through its own initiative and through Fish and Wildlife records, to reasonably substantiate that lead shot poisoned eagles, and that this poisoning constituted an impermissible and illegal taking of an endangered species. *Hodel* sends a signal that the causal connection be-

between the facts found and the choice made." *Baltimore Gas & Electric Co. v. NRDC, Inc.*, 462 U.S. 87, 105 (1983) (citation omitted).

197. *Hodel*, 23 *Env't Rep. Cas. (BNA)* at 1092. See 16 U.S.C. § 1539(a)(1)(B); 50 C.F.R. § 173 (1984).

198. 16 U.S.C. § 1536(b)(4)(B)(ii).

199. *Hodel*, 23 *Env't Rep. Cas. (BNA)* at 1093.

200. *Id.*

201. *Id.* at 1094.

202. *Id.*

203. *Id.* This prohibition would last, according to the court, only until the provisions of NEPA and ESA were complied with.

tween lead shot and injury to an endangered species may be remote as long as it can be proven. There are literally hundreds of endangered species, including mammals and birds, which may consume lead-poisoned waterfowl or ingest lead shot.²⁰⁴ Plaintiffs willing to gather the data on lead shot's impact on these species should be able to successfully challenge its use.

C. Resulting Regulatory Proposals

Subsequent to *Hodel*, the Fish and Wildlife Service (FWS) completed a draft supplemental EIS on the use of lead shot for hunting migratory birds.²⁰⁵ In addition, it promulgated proposals to require nontoxic shot in areas not litigated in *Hodel*.²⁰⁶ These proposals included additional nontoxic shot zones on National Wildlife Refuges for the 1986-1987 hunting season and expansion of "eagle protection zones" which prohibit lead shot.²⁰⁷

In January 1986, however, the National Wildlife Federation (NWF) proposed to the FWS that lead shot be banned for all waterfowl hunting in the continental United States beginning with the 1987-1988 season.²⁰⁸ The NWF's proposal goes considerably further than the FWS.²⁰⁹ Considered by the proposal are: (1) potential violations of the Endangered Species Act, the Bald and Golden Eagle Protection Act,²¹⁰ and the Migratory Bird Treaty Act due to the use of lead shot; (2) provision for adequate preparation time for ammunition manufacturers, suppliers, and retailers; (3) elimination of lead poisoning in waterfowl and eagles; (4) perceived widespread support; and (5) inadequate earlier FWS steel shot zone proposals,²¹¹ which fail to protect eagles from lead poisoning.²¹² The FWS requested comments on the proposal, but as of this writing, no action had been taken.

204. See the list of threatened and endangered wildlife at 50 C.F.R. § 17.11(h) (1985).

205. See DRAFT EIS, *supra* note 9.

206. 51 Fed. Reg. 409 (1986) (proposed rule on nontoxic shot zones).

207. 50 Fed. Reg. 410 (1986).

208. Notice of Proposal, 51 Fed. Reg. 6012 (1986).

209. *Id.*

210. 16 U.S.C. §§ 668-668d (1982).

211. See *supra* notes 129-39 and accompanying text.

212. 51 Fed. Reg. 6012 (1986) (to be codified at 50 C.F.R. pt. 20).

VIII. SYNTHESIS

A. *Legislative Reforms*1. *Federal reforms*

The Fish and Wildlife Service (FWS) is responsible for managing migratory waterfowl resources in the United States. Yet the very federal agency charged with protecting waterfowl, eagles, and other wildlife from the harmful effects of lead shot is precluded by Congress from enacting strong, coordinated policies on the reduction and elimination of lead shot. Each year in the Department of Interior's appropriation bill, the Stevens Amendment prevents the FWS from requiring the use of nontoxic steel shot without prior state approval.²¹³ Congress should repeal the Stevens Amendment. While the FWS can close the waterfowl season in states which reject regulations enforcing nontoxic shot zones, this does not argue against repeal of the Stevens Amendment because lead shot can still be used outside the zones, where it continues to threaten waterfowl. Further, the FWS sanction does not prevent an obstinate state from interfering with and delaying the implementation of comprehensive regulations.

The Stevens Amendment is inefficient, inappropriate, irresponsible, and harmful to the wildlife which the federal government is charged with protecting. The amendment is inefficient because proposed regulations must not only go through the agency required review, analysis, and comment period, but must also be submitted to the state in which the regulations will be implemented. Thus, waterfowl continue to die while some states veto the FWS regulations imposing nontoxic shot zones in their states. The Stevens Amendment is particularly inappropriate because there are decades worth of compiled data documenting the severity of the lead poisoning problem. Continuing to pass the Stevens Amendment in Congress does not respond to this problem; instead, the amendment results in piecemeal solutions causing more waterfowl and bald eagle deaths. The federal government is legally required to protect migratory birds under the Migratory Bird Treaty Act. The Stevens Amendment ties the hands of migratory bird managers and therefore encourages irresponsible husbandry of wildlife resources.

213. See *supra* text accompanying note 124.

2. State reforms

States that continue to do nothing about lead shot poisoning contribute to the mortality of waterfowl. States should convince their representatives in Congress to repeal the Stevens Amendment. Further, states should act aggressively to ban lead shot, as the State of Nebraska did, for all waterfowl hunting and in all areas where waterfowl may potentially be affected.²¹⁴ States should work with the Fish and Wildlife Service (FWS) in establishing zones where lead shot is prohibited (nontoxic shot zones), and towards a policy of eventually banning the use of lead shot for all bird hunting.

A small but important detail is that states, as well as the FWS, should require the use of nontoxic, or lead-free shot, rather than requiring the use of steel shot. This approach would allow research and development of materials as effective ballistically as lead, but without lead's toxicity.

States can no longer afford to ignore the reality that lead shot poisons wildlife. Even states that claim to have no problem with lead poisoning should enact provisions banning the use of lead shot. This is because migrating waterfowl may pick up lead shot deposited by hunters in these states and manifest symptoms elsewhere. This delayed toxicity affects interstate commerce as waterfowl move state to state during their seasonal migrations. While it may be difficult to prove where waterfowl pick up the lead shot that poisons or kills them, justification still exists for the federal government to step in and take strong measures to protect waterfowl as an article of interstate commerce.²¹⁵ It would then be compelling for those states that are politically adverse to federal regulation, or not subject to its constraint, to militate against its imposition by implementing their own regulations con-

214. See *supra* notes 145-46 and accompanying text.

215. See *Hughes v. Oklahoma*, 441 U.S. 322, 329 (1979) ("[S]tate regulations of wild game have been held subject to the strictures of the Commerce Clause . . ."). See also *Baldwin v. Fish and Game Comm'n of Montana*, 436 U.S. 371 (1978); *Toomer v. Witsell*, 334 U.S. 385 (1948). Reliance upon the commerce clause to protect waterfowl would "insure uniformity in regulation." *Pennsylvania v. West Virginia*, 262 U.S. 553, 596 (1923). See generally Comment, *South-Central Timber Development, Inc. v. Wunnicke: The Commerce Clause and the Market Participant Doctrine*, 15 ENVTL. L. 593, 601-05 (1985) (discussing the commerce clause).

cerning lead shot. The day seems to be fast approaching when the use of lead shot will be banned for waterfowl hunting. The decision states need to make is either to take the initiative or by their inaction allow federal agencies to implement bans on lead shot for them.

B. *Future Litigation*

Due to the outcome of *National Wildlife Federation v. Hodel*,²¹⁶ future litigation may require the Fish and Wildlife Service to either ban the use of lead shot for waterfowl hunting, or ban hunting altogether when lead shot potentially or actually harms an endangered species. Litigants able to collect sufficient data to show the harm lead shot causes an endangered species should be able to prevail, especially in areas where the endangered species shares habitat with huntable populations of waterfowl.

C. *Private Organization Actions*

The National Wildlife Federation has already taken a leadership role in collecting data on the harmful effects of lead shot on waterfowl and eagles, and in litigating federal actions concerning lead shot. Other private hunting and conservation organizations can assist in the national transition from lead to nontoxic shot by educating their members and the public about the benefits of nontoxic shot, lobbying Congress to enact laws contributing to the welfare of waterfowl, and urging support for a nationwide ban on the use of lead shot by hunters. Such organizations as the Nature Conservancy, Audubon Society, National Rifle Association, the Conservation Foundation, and Ducks Unlimited have large memberships and hold considerable sway over policies and programs affecting wildlife management; they should put this influence to work.

IX. CONCLUSION

If private hunting and conservation organizations educate their members and the public about the harm of lead shot, opposition to steel shot should eventually wane. Joint regulatory and political efforts by Congress, the states, and agencies responsible

216. 23 *Env't Rep. Cas.* (BNA) 1089 (1985).

for managing wildlife resources should dovetail with private efforts to ban lead shot. The lead shot problem has existed too long and its magnitude is too great to permit continuing piecemeal regulation. Recent efforts by the National Wildlife Federation to ban lead shot nationwide are on the right track. Responsible legislators and game managers should endorse this effort and carry it to its logical culmination: the complete ban of lead shot in every area of wildlife habitat in all fifty states.

It is past time to consider the duck.