Lead Fishing Tackle: The Case for Regulation in Washington State

by

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ABSTRACT

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Approximately 69 tons of lead fishing sinkers and jigs are discarded in Washington's rivers, lakes, and marine waterways each year. Lost lead tackle is ingested by waterfowl and other wildlife, causing toxicity and death. Lead also infiltrates soil and water and is taken up by aquatic organisms. Additionally, the use and home manufacture of lead sinkers exposes users and their families to lead. Federal regulation proposed by the EPA in 1994 was not passed, leaving states to deal with the issue individually. Washington State has no regulations concerning the sale, use, or manufacture of lead fishing tackle, despite attempts by state agencies and the legislature. Economic, political, and social factors obstruct the passage of a ban on lead tackle in Washington, despite scientific studies demonstrating the toxic effects of lost lead tackle, and the availability of non-toxic sinkers and jigs at only slightly higher costs. Opposition from sportfishing associations stems from a predicted reduction in fishing participation. Resistance to a ban by tackle manufacturers and retailers is based on a predicted loss of revenue. Politicians and regulatory agencies may be reluctant to pursue lead tackle regulation because resistance associated with any ban proposal. Many anglers oppose banning of lead tackle because of concerns about government over-regulation. Anglers also claim that replacing lead sinkers and jigs with non-lead alternatives will be costly, although studies show that, on average, sinkers and jigs make up only about one percent of an angler's budget. Lack of understanding of the hazards of lead tackle also contributes to anglers' resistance. Although an essential part of efforts to reduce lead exposure and releases, educational programs alone do little to reduce the use and loss of lead tackle. Regulation of lead fishing tackle in Washington, in conjunction with an educational program, is therefore recommended.

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"If we were to judge of the interest excited by any medical subject by the number of writings to which it has given birth, we could not but regard the poisoning by lead as the most important to be known of all those that have been treated of, up to the present time."

--Mathieu Joseph Bonaventure Orfila, 1817, French toxicologist and chemist, founder of the science of toxicology.

Individual choices may seem harmless in themselves. But taken collectively, they produce unintended consequences that negatively affect all of us. Perceiving and avoiding such consequences requires that we develop a new kind of foresight, to be able to see over the horizon, to impacts that aren't immediately obvious.

--Mark Sommer, A World of Possibilities

Introduction

Imagine a small manufacturing business located near the Cowlitz River in Lewis County. The building has an outflow pipe through which wastewater discharges directly into the river. The wastewater contains, among other things, untreated sewage. Would this business be allowed to continue dumping raw sewage into the river once the practice were discovered by water quality officials? Of course not; we have regulations in Washington to protect the quality of our water and the health of those who depend on clean water, and those regulations preclude the dumping of raw sewage. Now imagine that the outflow pipe from this same business, instead of routing raw sewage to the river, deposited a few very small pieces of lead every day. Would this practice be allowed to continue? After all, the amount of lead deposited per day is quite small, perhaps only a few ounces. The answer is that businesses in Washington are strictly prohibited from dumping toxic materials into waterways under Washington's Water Pollution Control Act (RCW 90.48).

Now imagine that this business is one of several in a large chain in Washington, and all of the individual businesses in this chain dump a few ounces of lead into our state's waterways every day, adding up to several tons of lead deposited per year. It is unthinkable that such a practice could be legally allowed, and yet that is exactly what recreational anglers in our state are allowed to do with impunity. Every year in Washington, individual anglers collectively deposit approximately 69 tons of lead fishing tackle in the state's rivers, lakes, and marine waterways when lead sinkers and jigs become separated from fishing line or when an angler spills his or her tackle. Although non-toxic alternatives to lead tackle exist and are now widely available, there is no real incentive for anglers to discontinue using lead tackle. In this paper I will present the reasons why regulation, combined with an educational program, is the most effective tool for limiting the deposit of tens of tons of lead in our state's waterways by anglers year after year.

Approach of This Paper

This thesis will review and analyze the reasons why a ban on lead fishing tackle in Washington is recommended. The material is organized into five chapters. Chapter one looks at the history and significance of lead use. Chapter two focuses on lost lead fishing tackle and its effects on wildlife, people, and the environment; it includes a section on studies of lead-tackle-induced toxicosis of waterfowl. Chapter three covers historic and current efforts at legislating lead fishing tackle, as well as the effects that regulation of lead tackle has had on the extent of wildlife poisonings. Chapter four concentrates on several aspects of regulation: opposition to regulation, potential economic impacts, non-toxic alternatives that can be used in place of lead tackle, and existing Washington laws under which lead tackle could be regulated. Chapter five includes a comprehensive analysis and recommendations for Washington State.

1. Background and Significance of Lead Use

Lead: An Overview

Lead is a bluish-white naturally occurring metal of bright luster. Its chemical symbol is Pb, from the Latin *plumbum*, meaning “liquid silver.” Compared to most other metals, lead is extremely soft, dense, malleable, and ductile; it is also very resistant to corrosion (Lide and Frederikse 1995). These properties make lead extremely useful for many purposes. Small amounts of lead are released into the environment by natural processes, including weathering of rocks, volcanic activity, and radioactive decay. Lead exists in both inorganic and several organic forms. Anthropogenic lead emissions, especially over the last two hundred years, have resulted in soil and water lead concentrations up to several orders of magnitude higher than estimated natural background levels in many areas (Hoffman et al. 1995).

Lead Toxicity

Lead is nonessential to organisms, and its adverse health effects have been widely recognized for centuries; lead has been known to be poisonous since the Roman period. It is a highly toxic heavy metal, and all known effects of lead on biological systems are harmful (Hoffman et al. 1995). Lead poisoning can affect every system in the body. Inhalation and ingestion (of water, food, paint, soil, vapors, and/or dust that contain lead) are the primary routes of human exposure. Children and other juvenile animals have been determined through multiple studies across many decades to be more susceptible than adults to lead poisoning. This is due in part to their increased lead uptake, incomplete development of metabolic pathways, and incomplete development of the blood-brain barrier (Hoffman et al. 1995).

The majority of studies of lead's effects on human health show that even very low-level lead exposure can have serious harmful and irreversible effects on children's brain function, especially from exposures that occur in early life. These include lowered intelligence, diminished school performance, learning disabilities, and behavior problems. Hearing deficits and growth retardation have also been observed. Blood lead levels greater than 60 mg/dL are often associated with acute symptomatic disease, including abdominal colic, frank anemia, encephalopathy, seizures, coma, and death (Lanphear 1998). Because low-level lead poisoning often occurs with no obvious symptoms (or its symptoms can be erroneously attributed to other causes), it frequently goes undiagnosed and therefore untreated, which also means that preventive measures are not put in place.

Likely mechanisms for lead toxicity involve fundamental biochemical processes. For example, lead can inhibit or mimic the actions of calcium, which can affect calcium-dependent and related processes. The nervous system is the most sensitive target of lead exposure, and children suffer neurological effects at much lower exposure levels than do adults. Neurological effects of lead in children have been documented even at exposure levels below 10 µg/dL, levels once thought not to be harmful. Neurological and behavioral effects that have been documented in lead-exposed adults with blood levels ranging from 40 to 120 µg/dL include depression/mood changes, headache, diminished cognitive performance, diminished hand dexterity, diminished reaction time, diminished visual motor performance, dizziness, fatigue, forgetfulness, impaired concentration, impotence, infertility, reduced sex drive, increased nervousness, irritability, lethargy, malaise, constipation, anorexia, abdominal discomfort, tremors, wrist drop, paresthesia (abnormal skin sensations, such as burning, prickling, itching, or tingling), reduced IQ scores, weakness, damage to the kidneys and the nervous system, anemia, and high blood pressure (Agency for Toxic Substances and Disease Registry 2007, Washington State Department of Ecology and Washington State Department of Health 2009).

Uses of Lead: Historic and Current

Lead is an extremely easy metal to mine, and smelting can be accomplished at temperatures as low as 621^{o}F (327^{o}C) (for reference, a typical campfire is hotter than this). Consequently, lead has been used by humans for millennia. Humans' use of lead, especially over the last two centuries, has greatly altered the availability and distribution of lead, both locally and globally, more so than for any other toxic metal or element. Most anthropogenic lead emissions come from mining, smelting, and refining of lead and other metal ores (Washington State Department of Ecology and Washington State Department of Health 2009).

Over 7,000 years ago, the Egyptians used lead for weights and anchors, cooking utensils, pipes, solder, and pottery glaze. Lead was also used extensively by the Romans. Exhumed bones of Roman aristocrats have been shown to contain high levels of lead. This fact has lent credibility to the hypothesis that lead released from cooking pots used to prepare grape syrup for wine and preserved fruit for the aristocracy was a major culprit behind the ruin of Roman culture and genius (Hoffman et al. 1995). The use of lead to make ammunition dates back hundreds of years (Rattner et al. 2009), and modern lead shot is still typically close to 100 percent lead (Washington State Department of Ecology and Washington State Department of Health 2009).

The demand for lead rose significantly during the industrial revolution of the 18th and 19th centuries, and again after 1928, when tetraethyl lead began to be used as a gasoline additive to minimize engine knock and to improve the octane rating. Although lead is no longer used as a gasoline additive in the U.S. (lead was banned from gasoline used in transportation in December 1995), leaded gas is still used in many countries. Therefore, vehicle emissions continue to be a large source of lead emissions worldwide (Washington State Department of Ecology and Washington State Department of Health 2009).

Lead has also been used extensively in paint to enhance color and corrosion resistance; in addition, it shortens paint's drying time and changes the refractive quality in paint media and glazes. Although lead content is severely restricted in indoor paint today, prior to 1955, some paints contained up to 50 percent lead. Most leaded paint in use today is for exterior purposes only, such as road markings or as a corrosion inhibitor on iron or galvanized steel (Washington State Department of Ecology and Washington State Department of Health 2009, Organisation for Economic Co-Operation and Development 1993).

Lead is alloyed with other metals to produce solder and antifriction metals, and vast amounts of lead are used in storage (rechargeable) batteries. Lead is also used for radiation shields around x-ray equipment and nuclear reactors. Lead salts, such as lead arsenate, have been widely used in pesticides (Lide and Frederikse 1995).

Lead has been used for centuries in plumbing (in the form of lead pipes and solder). Lead is used in many consumer products as well, including toys (in both paint and plastic components), jewelry (especially imported children's jewelry, some of which has been found to be up to 99 percent lead), imported candy and snacks (due to packaging using lead-based inks or from contaminated ingredients), nutritional supplements, and traditional folk remedies (sometimes intentionally added because it is thought to be useful in treating some ailments, or because of contamination during the manufacturing process). Another source of lead has been from solder in food cans. Lead acetate is added to certain cosmetics and hair dyes in the U.S., and some “traditional” cosmetics may contain up to 50 percent lead. Lead is still used as a pigment in some artists’ paints, ceramic glazes, and inks (Washington State Department of Ecology and Washington State Department of Health 2009).

Lead is added to polyvinyl chloride (PVC) for stabilization and/or coloring. PVC is used in many products, with the largest uses in plumbing and vinyl siding. It is also used in toys, window blinds, flooring, shower curtains, packaging, cord and cable coverings (including holiday lights and computer cables) and many other plastic-containing consumer products. Leaded glass is used in television screens and computer monitors, and cathode ray tubes in televisions and computer monitors are one of the most common sources of leaded glass. Lead is also used to produce wheel weights, which are used on millions of vehicles (Washington State Department of Ecology and Washington State Department of Health 2009).

By the late 1980s, approximately 1.43 million tons of lead were used annually in the U.S.; about half of this use was for rechargeable batteries (Hoffman et al. 1995). World primary production of refined lead was just under 3.3 million tons in 1997. Adding in secondary sources (lead recycling and reuse) increased the total amount of lead used worldwide to approximately 6.3 million tons per year in 1997. A large proportion of future increases in demand for lead are likely to be met by recycling (the major source of recycled lead is spent lead-acid storage batteries) (Dzioubinski and Chipman 1999).

History of Lead Regulation

Lead has been known to be poisonous for hundreds, if not thousands, of years. There is a long and contentious history of attempts at regulation and resistance by the lead industry. For example, in the early 1900s, Dr. Alice Hamilton began systematically studying lead and its effects on industrial workers. Despite verifying multiple cases of lead poisoning, her (and many other doctors') letters to the Surgeon General concerning the addition of tetraethyl lead to gasoline, and hundreds of documented cases of lead poisonings and deaths of workers in plants that produced tetraethyl lead, it was determined that the economic benefits outweighed the human health risks, and lead was continued to be added to gasoline for several decades (Moore 2003). It wasn't until the 1970s that leaded gasoline began to be phased out in the U.S. The use of leaded gas for on-road vehicles was banned via the Clean Air Act on Jan 1, 1996, after a 25-year effort on the part of the EPA (U.S. Environmental Protection Agency 1996). Leaded fuel is still allowed to be used in some specialty applications, however. These include aviation fuel, farm equipment, and off-road vehicles (Washington State Department of Ecology and Washington State Department of Health 2009).

Although some European countries restricted the use of lead paint as early as 1909, and several others restricted its use and production throughout the 1920s and 1930s (Moore 2003, Markowitz and Rosner 2002), it took the U.S. until 1972 to significantly limit the lead content of most consumer paint. The Lead-Based Paint Poisoning Prevention Act of 1972 established a limit of 0.5 percent lead for house paints

(Washington State Department of Ecology and Washington State Department of Health 2009). In 1977, through the Consumer Product Safety Commission, stricter federal regulation was enacted, entitled the *Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint*. This rule states that "paint and similar surface-coating materials for consumer use that contain lead or lead compounds and in which the lead content (calculated as lead metal) is in excess of 0.06 percent are banned hazardous products" (Code of Federal Regulations 1977). The level was reduced from 0.06 percent to 0.009 percent effective August 14, 2009 (Federal Register 2008).

The 1986 Amendments to the Safe Drinking Water Act prohibited the use of pipes or plumbing fittings or fixtures, including solder or flux (a substance used to promote fusion of surfaces to be joined by soldering) after June 19, 1986, in the installation or repair of any public water system or any plumbing in a residential or nonresidential facility providing water for human consumption, that is not lead free. In this context, lead free means solders and flux containing no more than 0.2 percent lead and pipe fittings containing no more than 8.0 percent lead (National Drinking Water Regulations 1986).

The U.S. canned food industry phased out lead solder in favor of welded cans from 1979 through 1991. In 1995, the Food and Drug Administration issued a final rule prohibiting the use of lead solder in all food cans, including imported products (Washington State Department of Ecology and Washington State Department of Health 2009).

It has been understood for more than century that the ingestion of lead shotgun pellets by waterfowl causes lead toxicosis (Twiss and Thomas 1998). By the 1980s, Britain and some U.S. and Canadian jurisdictions began restricting the use of lead shot and fishing sinkers (Rattner et al. 2009). The use of lead shot for waterfowl hunting has been banned in the U.S. since 1991. The ban was phased in starting with the 1987-88 hunting season and became effective nationwide in 1991. The nontoxic shot regulations apply only to the family Anatidae (ducks, geese, and swans) and coots (U.S. Fish and Wildlife Service 2009). In 1997, Canada implemented a nation-wide ban on the use of lead shot for hunting waterfowl within 200 meters of a watercourse. As of September 1999, non-toxic shot is required nationally in Canada for hunting of all but three species of migratory game birds (Canadian Wildlife Service 1999). Various jurisdictions have regulated the use of lead fishing tackle to different extents (see chapter three for more-detailed information).

Although progress has been made in regulating and restricting lead use, much remains to be done. Lead is still used widely in industry and in many consumer products, and California is one of the few states that has strong labeling requirements for consumer products that contain lead. Lead exposure, especially for adults working in the lead industry and for children exposed to lead paint in older homes, continues to be a serious health problem.

2. Lost Lead Fishing Tackle and its Effects

About Lead Sinkers and Jigs

Sinkers are weights used to sink fishing line below the water's surface to a certain depth and are used to assist in casting. All sinkers are attached in some manner to the fishing line, and they provide weight so that the hook, bait, or lure is below the surface of the water (U.S. Environmental Protection Agency 1994). Types of sinkers include, but are not limited to, trolling sinkers, split-shot sinkers, bass-casting sinkers, and worm weights. Jigs are weighted hooks, often painted or decorated in such a way to attract fish (Scheuhammer and Norris 1996). Collectively, sinkers and jigs in this paper are referred to as fishing tackle, fishing weights, or simply tackle or weights.

Sinkers vary considerably in size and shape; there are no universal sizes or shapes of fishing sinkers, as differences in the type of fish being sought, the fishing equipment being used, and the environmental conditions require different types of sinkers. Those used in freshwater sport fishing typically range in weight from about 0.3 to 230 grams and in length or diameter from about two millimeters (mm) to eight centimeters (cm). The majority of lead sinkers are under two cm in any direction. The most common types used in freshwater fishing are worm weights, egg sinkers, bass casting sinkers, pyramid sinkers, and split shot (a round sinker with a slice through a small portion of it; fishing line is placed into this sliced area, and then the sinker is secured onto the line by pinching or, more often, biting it to crimp the slit shut). Split shot sinkers are estimated to account for almost half of all U.S. sinker production (U.S. Environmental Protection Agency 1994).

Amounts of Lost or Discarded Lead Fishing Tackle

Lead sinkers and jigs can be lost to waterways, riverbanks, or lakeshores when the line to which they are attached becomes caught or entangled and then breaks or is cut. Lead tackle can also be accidentally dropped or spilled during use (Twiss and Thomas 1998). Even as late as 2006, with the problem of lost lead tackle well known, few studies have been done to determine how much lead fishing tackle is lost to waterways (Radomski et al. 2006). Generally, amounts of lost tackle are determined indirectly. One method is to use the estimated number of anglers, multiply it by the estimated average amount of money anglers spend on sinkers, and multiply that by the average retail cost for sinkers. Scheuhammer et al. (2003) used this type of calculation for lead sinkers sold in Canada: an estimated 5.5 million anglers each spent an average of $3.25 per year on sinkers, totaling about $17.9 million spent on sinkers per year. At a cost of $0.032 per gram of lead, the calculation showed that approximately 616 tons of lead sinkers were purchased each year in Canada at the time of this study. Assuming most sinkers are purchased to replace those lost, Scheuhammer estimated that 616 tons of lead fishing sinkers are lost in Canadian waterways each year. This calculation does not take into account numbers of jigs sold/lost each year, which, if added in, would increase the estimate further.

Scheuhammer calculated the values for the United States as well; the estimates are for 1996. He used the USEPA's estimate of $2.50 per year per angler, on average, spent on sinkers. With 35 million anglers in the U.S., this calculates to $87.5 million spent on sinkers. The cost per gram of lead was derived from converting the Canadian cost per gram to U.S. dollars, resulting in $0.22 per gram of lead. This assumes a similar average retail cost of sinkers in the U.S. and Canada (taking into account the currency conversion factor). The calculation yields 4,384 tons of lead sinkers lost each year in U.S. waterways (Scheuhammer et. al. 2003).

The estimates stated in the EPA's 1994 proposed ban on lead fishing tackle stated that an estimated 480 million sinkers, representing 2,756 tons of lead, zinc, and brass (over 98 percent of the volume represented by lead), were manufactured each year in the United States at the time (U.S. Environmental Protection Agency 1994). Again, it is assumed that most of the sinkers purchased are to replace lost sinkers. Although these last two estimates, and the data on which they rely, are about 15 years old, the analyses nevertheless show that amounts of lead lost in waterways each year is measured in the thousands of tons.

A more recent study in Minnesota (Radomski et al. 2006) estimated lead tackle loss for five large lake fisheries targeting a particular species, the walleye (*Sander vitreus*), in the summer of 2004. The lakes used in the study are important for waterfowl populations. The authors used "creel surveys," also known as angler interviews, asking questions of anglers upon their return to the shore after a fishing excursion by boat. Interviewers asked 6,489 anglers whether they had lost any fishing tackle. If the answer was yes, interviewers followed up with questions to ascertain how much and what types of tackle the angler lost that day.

Estimated loss of the weight of lead items was calculated by multiplying the most common weight of the item by the estimated number of items lost. The estimated total loss of tackle (lead-based and non-lead-based) for the five lakes in the summer of 2004 was 214,811 items. Of these, over 100,000 lead-based items were estimated to have been lost, representing about 1.1 tons of lead. The authors then extrapolated cumulative numbers of lead tackle items lost from 1983 to 2004 for three of the five lakes, based on the 2004 lead tackle loss rates and existing data on angler effort for those years. Estimated lead tackle items lost to each of the three lakes (with standard error, SE, following in parentheses) were: Lake of the Woods: 285,000 (SE = 8,800), Mille Lacs: 1,033,000 (SE = 39,700), and Rainy Lakes: 211,000 (SE = 8,400). These authors also referenced an unpublished study that examined lead tackle loss rates for anglers fishing from the shore. The loss rates in that study were higher than in the Radomski et al. study, presumably because fishing from the shore (rather than from a boat) increases the chances of snagging a line on rocks, trees, and aquatic vegetation, thereby losing the tackle (Radomski et al. 2006).

The Washington State Departments of Ecology and Health published the *Lead Chemical Action Plan* in September of 2009. This document presents estimates of the quantity of lead fishing weights lost to Washington waterways each year. The first estimate is approximately 69 tons. This estimate is derived from (1) the number of fishing licenses sold each year; (2) an estimate that 30 percent of these are for fly fishermen using lead weights, and (3) an estimate that each angler loses four ounces (113 grams) of lead per year. Because this estimate of 69 tons was a very rough estimate and difficult to refine, the *Lead Chemical Action Plan* also used Scheuhammer and colleagues' 2003 estimates of lead fishing tackle lost annually to U.S. waterways to estimate how much lead tackle is lost in Washington each year. This calculation was done by multiplying Scheuhammer's U.S. estimate of 4,384 tons by two percent, as Washington has approximately two percent of the U.S. population. The estimate of lost lead fishing tackle derived from this calculation is approximately 88 tons annually, considerably more than the first estimate in the *Lead Chemical Action Plan* (Washington

State Department of Ecology and Washington State Department of Health 2009). It is likely, however, that the second estimate, based on Washington's population as a percentage of the national population, is low. Although Washington's population is approximately two percent of the U.S. population, Washington has far more fishing opportunities than many other states, especially those that are land locked. These fishing areas include Puget Sound, the Strait of Juan de Fuca, the Pacific coast, Gray's Harbor, and Willapa Bay, not to mention Washington's many rivers and lakes.

Effects of Lost or Discarded Lead Fishing Tackle

Lost fishing tackle has broad effects, due in part to the sheer volume of sinkers and jigs discarded. Most frequently and severely affected are waterfowl that ingest jigs and sinkers. Anglers who use or make their own lead tackle can also be exposed to lead dust and vapors, and their families and pets are prone to exposure. In addition, lost lead tackle accumulates in soil, water, and biota in ecosystems where angling occurs.

Effects of Lead Fishing Tackle on Wildlife

Wildlife Species Affected by Lead Fishing Tackle

The toxic effects of lead have been known for decades, and realization of the hazards of lead shot to waterfowl can be traced to the late 1870s (Rattner et al. 2009). The first published reports to document lead poisoning of waterfowl by ingestion of lead sinkers and jigs in North America were in 1973 (Scheuhammer et. al. 2003). The first documented cases of lead poisoning in mute swans in England were also in 1973 (Sears and Hunt 1991). Since that time, lead toxicosis of wildlife stemming from fishing tackle ingestion has been widely studied, and a network of wildlife biologists, wildlife rehabilitators, veterinarians, and volunteers has been established to assist in gathering data and reporting on cases of wildlife poisoned by ingestion of lead fishing tackle (Scheuhammer et. al. 2003). Therefore, extensive information is now available on lead poisoning of wildlife from lead fishing tackle. It is now well established by multiple studies in several countries that ingested lead fishing weights cause primary lead poisoning of waterfowl and other wildlife.

Several species of wildlife are susceptible to lead toxicosis from fishing sinkers and jigs. The most widely affected (and most extensively studied) are waterfowl that directly ingest lost or discarded tackle. Rattner et al. (2009) state that although fish can and do ingest sinkers, jigs, and hooks, unlike higher vertebrates, fish fatality generally appears to be caused by injury, blood loss, exposure to air, and exhaustion rather than lead toxicosis directly.

Lead poisoning by direct ingestion of lead from the environment is referred to as primary poisoning. Secondary poisoning can occur when raptors or other scavenging animals prey on waterfowl that have been weakened or killed by ingestion of lead (Scheuhammer and Norris 1996). Another example of secondary poisoning is when humans consume wildlife tainted with lead shot or tackle. These predators, scavengers, and other consumers may end up ingesting the lead object itself while eating the poisoned animal, or otherwise become poisoned by ingesting an animal that contains high levels of lead in its blood and tissues.

Four species of waterfowl are regularly reported to have lead poisoning from ingesting lead sinkers and jigs. They include mute swans (*Cygnus olor*) in the United Kingdom (Perrins et al. 2003, O'Halloran et al. 2002, Kelly and Kelly 2004, Kirby et al. 1994), common loons (*Gavia immer*) in New England, eastern Canada, and other parts of northern North America, including Washington (Pokras and Chafel 1992, Franson et al. 2003, Poleschook and Gumm 2009), trumpeter swans (*Cygnus buccinator*), and sandhill cranes (*Grus canadensisthe*) (Pokras et al. 2009). Other bird species that have been reported to ingest lead fishing tackle include (but are not limited to) brown pelicans (*Pelecanus occidentalis*), black-crowned night herons (*Nycticorax nycticorax*) (Franson et al. 2003), common mergansers (*Mergus merganser*), Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*) and various other duck species, greater scaups (*Aythya marila*), tundra swans (*Cygnus columbianus*), great blue herons (*Ardea herodias*), double-crested cormorants (*Phalacrocorax auritus*), green herons (*Butorides virescens*), and white-winged scoters (*Melanitta fusca*) (Scheuhammer and Norris 1995, Twiss and Thomas 1998).

Whether or not poisoning by ingesting sinkers is documented in any particular species, any bird that has feeding habits similar to those of species confirmed to have ingested sinkers or jigs are presumably also at risk for lead poisoning from this same route of exposure. These can include diving ducks, grebes, and ospreys (Scheuhammer and Norris 1995, 1996). In addition to bird species, lead sinker ingestion has also been reported in the snapping turtle (*Chelydra serpentina*) in Quebec and Massachusetts and the painted turtle (*Chrysemys picta*) in Massachusetts (Scheuhammer et al. 2003).

Scheuhammer and Norris reported in 1995 that accumulated evidence indicated that sinker/jig ingestion was the only significant source of elevated lead levels and toxicity for common loons, and that in Ontario, about 80 percent of lead poisoning deaths in loons are from ingestion of lead sinkers, and the other 20 percent occur from ingestion of lead-headed jigs. In the 1970s and 1980s, an estimated 4,000 mute swans in Great Britain died annually of lead poisoning due to ingestion of lead sinkers and jigs, and half of all deaths of mute swans was due to ingestion of lead tackle (Sears and Hunt 1991, Kelly and Kelly 2004). At the time Sears and Hunt conducted their 1991 study, lead poisoning was the largest single cause of death among mute swans in England (Sears and Hunt 1991).

Common loons are listed as an endangered or threatened species in several New England states (U.S. Environmental Protection Agency 1994, Pokras et al. 1992) and are listed as a State Sensitive Species in Washington. Sensitive species are any wildlife species native to the state that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their range within the state without cooperative management or removal of threats (WAC 232-12-011). Common loons are migratory aquatic birds with a circumpolar breeding distribution; in the summer, they breed on inland lakes throughout Canada and along the northern United States (Pokras and Chafel 1992). They are also top predators in aquatic food webs (Pokras et al. 1992).

Why and How Waterfowl Ingest Lead Sinkers and Jigs

Many waterbirds forage for grit to aid in digestion and for seeds for food. These birds may accidentally ingest fishing sinkers while foraging, as small sinkers often resemble seeds or pebbles used for grit. Not only can waterbirds ingest sinkers as they sift through sediments for grit, they may also ingest sinkers when eating fish with the fishing tackle still attached, as fish with attached line are easier for loons to capture (U.S. Environmental Protection Agency 1994, Poleschook and Gumm 2009). Common loons ingest lead fishing tackle primarily by taking hooked fish still on fishing line (whether still attached to the angler’s equipment or broken off), and secondarily by mistakenly selecting lost lead sinkers for grit to aid digestion (Poleschook and Gumm 2009).

Veterinary examinations of poisoned birds have shown this to be the case. In such instances, the birds may be pursuing live bait fish and inadvertently ingest the attached fishing gear. It is unknown whether loons may deliberately choose lead objects as grit based on taste or some other criteria (Pokras and Chafel 1992).

Figure 1. These similarly sized pebbles (brown) and sinkers (gray) were found in the gizzard of a lead-poisoned loon. Photo courtesy Minnesota Pollution Control Agency, "Let's Get the Lead Out."

Figure 2. These photos are identical except that the eight lead split shot sinkers are circled in the second photo. They are nearly indistinguishable from the surrounding gravel. Photo courtesy of New York State Department of Environmental Conservation.

Figure 3. Common loon ingesting fish with lead tackle on a broken line. Photo courtesy of Daniel Poleschook, Jr., and Virginia R. Gumm.

Figure 4. Lead fishing tackle found in poisoned loons. Photo courtesy of New York State Department of Environmental Conservation.

Levels of Lead Considered to Indicate Toxicosis in Birds

Lead levels are reported in a variety of ways, which can make comparing reports of lead poisoning confusing. Some of the ways lead levels are reported are: ppm (parts per million), µg/dL (micrograms per deciliter), µmols/dL (micromols per deciliter), µmol/L (micromols/liter), and µg/g (micrograms per gram). Twenty µg/dL is equal to 0.2 ppm and is approximately equal to 2 µmol/L. Although there is no agreed-upon upper limit for lead in birds, levels above 1.21 µmol/L, or 0.25 ppm, have been used and broadly accepted by researchers and veterinarians to indicate elevated blood levels. This is similar to that for adult cattle (Perrins et al. 2003, Kelly and Kelly 2004). A separate study indicated that blood lead levels of 0.35 to 0.60 ppm lead in the blood are considered to be diagnostic of lead poisoning in many species (Pokras and Chafel 1992). Lead toxicosis experiments using captive waterfowl have shown that ingestion of only 0.3 grams of lead in a single dose can result in 100 percent mortality. Because commonly used lead sinkers and jigs weigh between 0.5 and 15 grams, the ingestion of even one lead sinker or jig can be lethal (Twiss and Thomas 1998).

Lead Toxicosis in Birds: Symptoms

Although a blood sample is required to determine elevated lead levels and poisoning definitively (Kelly and Kelly 2004), symptoms of lead poisoning in birds include lethargy, loss of appetite, weight loss, emaciation, ataxia, lethargy, muscle weakness, drooped wings, impaction of the esophagus and proventriculus (the glandular portion of the stomach, in which food is partially digested before passing to the ventriculus, or gizzard), green diarrhea, kinked neck, impaired locomotion, an inability to fly, and impaired balance and depth perception (Pokras and Chafel 1992, U.S. Environmental

Protection Agency 1994). Green diarrhea and kinked neck are widely accepted as diagnostic of lead poisoning.

However, none of these symptoms, either alone or together, is definitive diagnostic criteria. For example, differences in how species react to lead poisoning and between acute and chronic disease states may have different manifestations (Pokras and Chafel 1992). An example of the differences between species in disease manifestation was evident in Pokras and Chafel's 1992 study. The authors found that common loons (*Gavia immer*) that had ingested lead did not exhibit signs of emaciation (as most bird species do when poisoned), and the birds' weights were within normal ranges. In light of this observation, they suggested that loons with lead poisoning suffer from acute to subacute toxicosis, not the chronic wasting syndrome that is common in most water birds with lead poisoning, wherein fat deposits in the body are eventually exhausted, and there is a marked atrophy of the bird's pectoral muscles (U.S. Environmental Protection Agency 1994).

Lead Toxicosis in Birds: Diagnosis

Definitive diagnosis of lead sinker ingestion by wild birds may be made (typically in the veterinary setting) through x-ray or fluoroscopic examination of the gizzard or entire digestive tract. Lead poisoning can also be determined by an analysis of tissue lead levels, most commonly in liver, kidney, and/or blood. Blood lead levels in common loons without lead sinker ingestion are generally below 0.1 µg/mL (Scheuhammer et al. 2003). Loons confirmed to have ingested lead sinkers typically demonstrate highly elevated blood, liver, bone, or gizzard lead concentrations, levels that would not be found from exposure to atmospheric lead dust or lead particles in the soil from leaded-gasoline vehicle exhaust. For example, one study showed that liver tissue concentrations in common loons with confirmed lead sinker or jig ingestion were as high as 142 µg/g dry weight in liver and 726 µg/g dry weight in kidney. This contrasts with liver lead levels typically below 5 µg/g in most wildlife that has not ingested lead (Scheuhammer et al. 2003).

Another study compared liver lead levels (in ppm) in common loons in New England with lead found in the gizzard to those with no lead in the gizzard. Those with lead in the gizzard had liver lead levels in the range of 5.03 to 18.0 ppm, whereas those with no lead in the gizzard had liver lead levels of 0.05 to 0.11 ppm. In juvenile loons without lead sinkers, blood lead levels were 0.01 to 0.05 ppm; two with internal lead sinkers had blood lead levels of 0.78 and 2.03 ppm (Pokras and Chafel 1992).

In the absence of standardized levels of lead in blood, liver, or gizzard that definitively indicate lead poisoning, it is important to note the wide contrast in each study between levels of non-poisoned birds versus those that have been determined to have ingested lead. The increase in lead levels in animals that have ingested sinkers or jigs is often orders of magnitude above background levels.

<u>Lead Toxicosis in Birds: Physiology and Behavior</u>

Lead is neither beneficial nor essential to animals, and studies commonly show its metabolic and other physiological effects on birds to be adverse. There is a definite progression of symptoms after sinkers are ingested, ending in most cases in death (U.S. Environmental Protection Agency 1994). Although organic lead compounds are generally higher in toxicity to animals than inorganic forms, most lead poisoning in animals results from exposure to inorganic lead because of its widespread use and distribution in the environment (Hoffman et al. 1995).

The extent of lead uptake in organisms depends on its chemical and physical form, route of exposure, and the biology of the organism in question. In terrestrial animals, ingestion and inhalation are the leading routes of lead exposure. Although ingestion of solid lead by animals is usually followed by excretion of the pellet through the feces, this is often not the case with waterfowl and other birds that ingest fishing weights. Because waterfowl actively ingest grit as an aid to the gizzard's grinding action to break down food, the lead objects themselves are often ground to some degree in the gizzard, releasing smaller lead particles and ionic lead. If an ingested lead sinker or jig becomes lodged in the gizzard, which often occurs, prolonged grinding, combined with the acidic environment of the gizzard, can cause extensive release of ionic lead (Hoffman et al. 1995, Scheuhammer et al. 2003). The combined effects of grinding and low pH on as little as one ingested lead sinker or jig is sufficient to expose a loon or other bird to a lethal dose of lead, and death may occur within a few days (Scheuhammer et. al. 2003, Beintema 2001).

Once lead is absorbed, it moves into the bloodstream and is transported throughout the body attached to the surfaces of red blood cells. From there, it is quickly deposited in soft tissues, mainly the liver and kidneys, and in bone (Hoffman et al. 1995). Lead acts at the molecular level by inhibiting the activity of many enzymes required for normal biological functioning. Lead affects both the structure and function of the nervous system, which can impair intellectual, sensory, neuromuscular, and psychological functions. Because lead has a strong effect on the developing nervous system, juveniles are more susceptible than adult animals to some of the neurological and behavioral effects of lead toxicosis (Hoffman et al. 1995).

Even small amounts of ingested lead, from very small sinkers or jig heads, can cause sublethal toxic effects on tissues, primarily the central and peripheral nervous systems, the function and structure of kidneys and bone, and circulatory system, including the production and development of blood cells. This results in biochemical, physiological, and behavioral impairments and adverse histopathological, neuropsychological, fetotoxic (adversely affecting the development of the fetus), and teratogenic (causing birth defects) effects. Ingested lead can also impair antibody production and reduce white blood cell counts and spleen plaque-forming cells in mallards. These effects contribute to an increased risk of starvation, vulnerability to predation, and incidence of disease in affected birds. In these instances, clinical symptoms of lead poisoning, such as green and watery feces, drooping wings, anemia, weight loss, and atypical behavior, appear more gradually than with acute poisoning, and affected birds usually die within two to three weeks after ingesting the lead, often in a very weakened state. Severe damage to the central nervous system from lead poisoning results in stupor, convulsions, coma, and death (Scheuhammer and Norris 1995, U.S. Environmental Protection Agency 1994).

Figure 5. Adult common loon on the shore of Lake Chelan, Washington, definitively determined to have died from lead toxicosis after four lead sinkers were found in its gizzard. Photo courtesy of Daniel Poleschook, Jr., and Virignia R. Gumm.

Figure 6. X-ray image of the common loon shown in Figure 5 above. The four lead fishing sinkers in its gizzard appear as the whitest spots in the image. Photo courtesy of Daniel Poleschook, Jr., and Virignia R. Gumm.

Effects of Lead Fishing Tackle on Humans

The physiological effects of lead exposure on humans was discussed previously (see section on lead toxicity, page 3). The risks specifically from lead fishing tackle arise from its use and handling in the home and while angling. In 1994, it was estimated 0.8–1.6 million individuals participated in the home manufacture of lead sinkers in the United States. These sinkers are used by the manufacturer, sold to or shared with other anglers, or sold to tackle distributors and retailers. This is what is referred to as the "cottage industry" (U.S. Environmental Protection Agency 1994). This cottage industry constitutes 30–35 percent of the all of lead sinkers produced in the United States (Scheuhammer and Norris 1995). To make sinkers, home manufacturers buy lead ingots, which are masses of solid lead metal. They then melt the lead and pour it into sinker-shaped molds. Home manufacturers, their family members, and even pets can be exposed to potentially harmful airborne lead particles or vapors while pouring molten lead into lead fishing sinker molds (U.S. Environmental Protection Agency 1994). Airborne lead particles from this process can end up on hands, clothes, floors, and carpets, posing a risk to families and pets beyond the actual time of sinker manufacture. As most fishing sinkers are quite small, they can be easily swallowed by young children or pets. People who cast their own fishing weights have a higher-than-typical risk of lead exposure, as do their families Washington State Department of Ecology and Washington State Department of Health 2009).

Effects of Lead Fishing Tackle on the Environment

Lead emissions into rivers and oceans derive from many sources, including emissions from lead-gasoline-fueled vehicles, sewage treatment plants (especially those that receive industrial discharges containing lead and highway runoff), leaching and seepage from waste dumps and mine tailings, and lost or discarded fishing tackle. Current lead concentrations in marine waters are likely up to an order of magnitude greater than concentrations prior to anthropogenic inputs of lead. Much of lead deposited in waterways ultimately reaches oceans (Hoffman et al. 1995).

Because so much of the focus of the effects of lost fishing weights has been on lead poisoning of waterfowl, it has commonly been assumed that lead from lost fishing sinkers is stable or inert and therefore not a meaningful source of lead contamination in waterways or riverbank sediments. Although particulate or ionic lead from lost fishing tackle is not readily released into aquatic and terrestrial systems under most environmental conditions (Rattner et al. 2009), scientific evidence shows that over time and under certain conditions, metallic lead in sinkers is converted into ionic, particulate, and molecular lead, much of which will be dispersed through the environment to some extent. This can result in lead levels in soils and water that greatly exceed normal concentrations (Beintema 2001).

Although lead pellets deposited in soils and aquatic sediments are neither chemically nor environmentally inert, tens or hundreds of years may pass before complete breakdown and dissolution of metallic lead pellets take place. Rates of erosion, dissolution, oxidation, and incorporation into lead-based organic molecules are dependent upon physical and chemical factors. Aerobic, acidic conditions enhance the rate of pellet breakdown. High water flow rates, soils and sediments containing a high proportion of coarse sand or gravel, and frequent disturbance of contaminated soils also accelerate the breakdown rate of metallic lead (Scheuhammer and Norris 1995).

If lead sinkers are buried, the dissolution of the lead weights will be slowed, as they will generally develop secondary coatings of cerrusite ($PbCO_3$), hydrocerrusite ($Pb_3(CO_3)_2\ (OH)_2$), or anglesite ($PbSO_4$). However, the sediments in fishing areas are generally coarse due to the rapid flow of the water. Because of this, lead weights are likely not to be buried but to remain exposed among the stones (Jacks et al. 2001).

Under environmental conditions that favor weathering and mobilization of lead from discarded sinkers (e.g., low pH of waters and soils, high erosive force), ionic lead, lead precipitates, and lead compounds are released (Rattner et al. 2009). Lead in fresh water often becomes adsorbed onto sediment particles because of the strong binding capacities of many soil components for metals (Hoffman et al. 1995). These particles can also be adsorbed onto or incorporated into the surface of plants and taken up by invertebrates (Rattner et al. 2009). Lead taken up by invertebrates that inhabit soil and sediment, and aquatic and wetland plants growing in contaminated riverbanks and lakeshores, can have an effect on entire food webs (Beintema 2001).

Both aquatic and terrestrial plants can take up lead from water and soils. For example, *Potamogeton* sp. (pondweed, an aquatic bed plant) downstream from a mine tailings pond in Missouri was shown to have a lead concentration of 11,300 ppm dry weight at the pond and 3,500 ppm dry weight one mile downstream from the pond. As a comparison, plants grown in environments that are not contaminated with lead generally contain 2 to 20 ppm dry weight (Hoffman et al. 1995).

A study of a shooting range at the shores of Lake Merced, in California, showed that tule (bulrush) seedheads and coontails (a submerged aquatic plant) growing in the lead-laden sediments contained lead levels averaging 10.3 µg/g for the tule and 69.2

µg/g for the coontail (dry weight). This compares with 2.3 µg/g and 11.9 µg/g, respectively, at control sites (Peterson et al. 1993).

Studies of Lead-Tackle-Induced Toxicosis in Waterfowl

The phenomenon of lead toxicosis in waterfowl due to ingestion of lead sinkers or jigs has been widely studied and documented. What follows is a sampling of the studies and their results.

Franson and colleagues (2003) collected data on 28 species of waterbirds (2,240 individuals) examined for ingestion of lead fishing weights from 1995 through 1999 in the United States. The records came from 25 states total, and 47 percent of the samples were from California and Florida. Searches for lead weights in the birds were conducted via both radiography and visual examination of stomachs. In addition, blood samples from live birds and liver samples from carcasses were collected for lead analysis.

Dead birds that were sampled included those found during disease mortality events, those that died at rehabilitation centers, and sandhill cranes and tundra swans shot by hunters. Live birds that appeared healthy were sampled in the field in conjunction with other studies being conducted, and evidently sick or injured birds were examined and sampled at bird rehabilitation centers.

Ingested lead weights were found most frequently in the common loon (*Gavia immer*) (11 of 313, or 3.5 percent) and brown pelican (*Pelecanus occidentalis*) (10 of 365, or 2.7 percent). Birds that had ingested lead fishing tackle, including split shot, jig heads, and sinkers, were found in California, Florida, Maine, New Hampshire, North Carolina, and Wisconsin. Lead concentrations of birds with lead fishing weights in their stomachs ranged up to 13.9 ppm in the blood and up to 26.0 ppm in the liver. A large number of birds that had not ingested lead were also examined in the study. Of 866 tested for liver lead concentrations, only 0.7 percent had concentrations greater than 2.0 ppm. Of 742 birds tested for blood lead concentrations, 2.2 percent had lead levels above 0.2 ppm. The authors note that because lead poisoning is a chronic disease, and affected birds likely seek cover and die where they may not be found, surveys of lead tackle ingestion may underestimate the true rate of lead exposure from ingested sinkers and jigs (Franson et al. 2003).

In a New England study of 124 common loons found dead or at the point of death during the study years of 1989 to 1992, 27 of 60 adult loons (45 percent) had ingested lead fishing sinkers. Two additional loons with no evidence of ingested sinkers had elevated liver lead levels of 9.41 and 22.6 ppm. The authors speculated that these two had likely ground down and excreted lead pellets prior to examination, leaving tissue levels high without the presence of a sinker. Lead sinker ingestion with elevated lead levels was the single most common pathologic finding in the adult birds in this study (48 percent). This cause of mortality was higher than any other single mortality factor, including tumors, trauma, fractures, gunshot wounds, and infections. All but one of these adults were from freshwater inland lakes. None of the juveniles or chicks examined had ingested sinkers. Despite efforts at rehabilitating any lead-poisoned loons that were still alive at the time of examination, most loons found alive with ingested lead died (Pokras et al. 1992).

In a 2.5-yr study during 1988-1990 of common loon mortality in New England, lead toxicosis from ingested fishing sinkers was the most common cause of death in adult breeding birds. Of 75 loons received, 31 adults were examined. Sixteen of these adult birds (52 percent) died from lead poisoning. The authors noted that it was primarily breeding adult loons, rather than juveniles, that were affected by lead toxicosis. This was of special concern because of the potential to limit or decrease loon populations, an effect that can be especially important in areas where loon populations may already be waning due to other human-induced factors (Pokras and Chafel 1992).

A 15-year study of the extent of lead toxicosis resulting from fishing-weight ingestion by waterbirds in Canada showed that birds of at least six species died after ingesting one or more lead fishing weights. Of these, most (215) were common loons. Of the adult loons, 27 percent died of lead poisoning. Not all of these birds were x-rayed to ascertain presence of a lead pellet, but 19 percent of the loons were shown by radiograph to have a lead sinker or jig in the gizzard. In the same study, common merganser, bald eagle, trumpeter swan, white-winged scoter, and herring gull were also reported to have died of lead poisoning following ingestion of lead fishing weights (Twiss and Thomas 1998).

In 1988, Sears published the results of a three-year study (from 1983 through 1985) of seven geographical areas, ranging from rural to urban, in England on geographic and temporal variation in lead poisoning levels of mute swans. The study looked at swan mortality, kidney lead levels (considering a level of greater than 100 μg/g abnormally elevated), blood lead levels (using levels greater than 4 μg/10 ml as indicative of excessive lead exposure). Of the 166 swans examined in the study, lead poisoning was the leading cause of death, accounting for 40 percent of the deaths. Of the 66 lead-poisoned birds, 50 (76 percent) had at least one lead fishing weight in their gizzard. There was regional variation in the proportion of lead-poisoned swans; in areas where the largest number of lead weights were found, lead poisoning accounted for up to 94 percent of local swan deaths.

There was also a direct relationship between the seasonal pattern of lead poisoning in mute swans and the fishing season. Most cases of swan lead poisoning occurred from August to November, during open fishing season. Relatively fewer cases occurred during the closed season, from March to June. This study also conducted a systematic investigation of numbers of lead weights in sediments and on river banks. There was a positive correlation ($r = 0.928$, $p < 0.05$) between the number of lead weights in the sediment (but not those on the banks) and the proportion of swan lead-poisoning deaths. Because lead weights were present in the sediments throughout the year (as most weights deposited from previous years remain and accumulate), but there was also a rapid increase in the incidence of lead poisoning within a few weeks of the opening of fishing season, the author suggested that swans mainly ingest the most recently deposited weights. Because of this, the author proposed that if the use of lead weights were to be discontinued, there should be a significant decrease in the incidence of waterfowl lead poisoning, despite the continued presence of accumulated weights from prior use (Sears 1988).

Common Loons in Washington State

The common loon has been a Species of Concern in Washington since 1980. It was a "proposed threatened" species in 1983, but no listing action was taken. In 1990, when a formal listing process was adopted by the Fish and Wildlife Commission, the common loon was placed on the list of State Candidate Species (Richardson et al. 2000). Common loons in winter in several areas in Washington, including Puget Sound, the

Strait of Georgia, the Strait of Juan de Fuca, and along the Pacific coastline, and in fresh water on the 11 reservoirs of the Columbia River, in portions of the Okanogan River, Snake River, and Pend Oreille River, and on various open lakes. Although common loons breed on only a handful of lakes in Washington (there were 13 in 2008), they migrate throughout Washington. Over the last 30 years, common loon populations have experienced a northward contraction of the southern limit of the breeding range (from northern California in the to northern Washington presently) of 450 miles, or an average of 15 miles northward per year (Poleschook and Gumm 2009).

Common loons in Washington are also adversely affected by lead sinkers and jigs. Poleschook and Gumm have collected data on loon poisoning in Washington and present it in their *Recommendation to Ban the Use of Lead Fishing Tackle in Washington*. This paper was recently completed (November 2009) and is as yet unpublished in a peer-reviewed journal. However, it has been reviewed by 13 prominent common loon and other waterbird scientists across seven states. It is one of 52 individual documents compiled as a collective report entitled “Common Loon Reference Records” for the United States Forest Service, Colville, Washington.

Long-term records show that of 27 common loon carcasses collected in Washington from 1996 to 2009, nine died of lead toxicosis from various forms of lead fishing tackle. This is the leading cause of death (39 percent) for all known causes of death of common loon mortalities in Washington (Poleschook and Gumm 2009).

Problems with Estimating Mortality Rates

It is assumed that the number of animals affected by lead sinker poisoning is vastly underestimated because there are so many areas where there is little or no monitoring or research of this phenomenon (Scheuhammer and Norris 1996). Furthermore, the submission of bird carcasses for necropsy depends upon their being discovered and collected shortly after death (before decay or scavenging make retrieval and examination impossible), and appropriately stored until the time of examination. In addition, necropsies are not routinely done at wildlife rehabilitation centers, so even when dead or moribund birds are taken in, lead toxicosis can easily be missed (Twiss and Thomas 1998).

Waterfowl mortalities resulting from lead toxicosis may also be more difficult to detect than those caused by disease or some other environmental cause. The ingestion of lead sinkers causes only individuals to sicken and die; it does not cause large numbers of birds to die within a short time frame in a localized area. Die-offs of individuals are far less noticeable than those involving flocks. In addition, birds will typically conceal themselves in dense cover as they become weaker, which makes detection difficult even for those searching specifically for them. Other studies have shown that almost all waterfowl carcasses are scavenged within five days of death, with more than half of all carcasses disappearing completely, making discovery and opportunity for necropsy after this time period highly improbable (Twiss and Thomas 1998).

The EPA, in light of its review of multiple studies of bird mortality, also supported the view that bird mortalities are underreported or not fully reflected in the available data, and that actual mortality rates can be far higher than studies indicate. The EPA reported that even if a known number of carcasses are deliberately “planted” in known locations, it is difficult to locate all of them at a later time. Because they are susceptible to predation, ill or dead birds may quickly disappear as they become meals for predators such as mink, weasels, raccoons, fox, coyotes, eagles, hawks, and owls.

The EPA presented three such examples: (1) a Missouri study, where 62 percent of 90 planted carcasses had disappeared after only four days; (2) a study in Texas coastal marshes, where 89 percent of 47 carcasses had disappeared within eight days; and (3) a study in a Missouri refuge, where 25 percent of planted carcasses were not located when the areas were searched (no time range was given). These studies show that if the number of dead and lead- or zinc-poisoned birds is lower than the capacity of predators to consume them, few carcasses will be present for more than several days. This makes it difficult to determine the true extent of adverse effects to waterbirds due to sinker ingestion (U.S. Environmental Protection Agency 1994).

Summary

It is clear from multiple lines of evidence that lead is harmful to humans and wildlife. That lead is toxic is beyond dispute in the scientific community. For this reason, many safeguards have been put in place to reduce risks from and exposure to lead. However, regulations on the use and manufacture of lead fishing tackle remain limited in scope and geographic area. The following chapter will present current policy on lead sinkers and show that there is a strong need for a more comprehensive policy to protect wildlife and human health.

3. Legislation Efforts

There are several possible approaches to limiting or eliminating the disposal of lead fishing tackle into waterways and on riverbanks and lakeshores. These range from local education-only campaigns to nation-wide bans on the manufacture, use, and import of lead tackle. In between these two extremes lie various moderate approaches. One of these is a ban on lead tackle that is restricted to a particular geographic range where waterfowl known to be poisoned by ingesting lead live and breed. Another is a jurisdiction-by-jurisdiction limitation (e.g., by state, park, park system, or water body). Other options are to regulate only the use of lead tackle, or only certain sizes or types of lead tackle known to be ingested by waterbirds. The entire range of options has been attempted in various jurisdictions, and a few of the attempts have been successful at regulating and/or reducing the use of lead sinkers and jigs.

There is currently no nationwide ban on the use, sale, or manufacture of lead fishing tackle in the United States. Examples of attempted and enacted legislation in the United States, Canada, European countries, and smaller jurisdictions within the U.S. and Canada follow.

Nationwide Legislation of Lead Fishing Tackle: The Environmental Protection Agency's 1994 Proposed Ban

<u>Background</u>

On March 19, 1994, the U.S. Environmental Protection Agency (EPA) announced a proposed nationwide ban on lead fishing sinkers. The EPA had decided against a piecemeal approach of trying to regulate lead tackle in particular high-risk geographic zones because at-risk habitats, defined in this context as places where waterbirds live and anglers also fish, include essentially the entire United States. Not only that, but also the cost of conducting extensive research and monitoring to identify all local areas of concern would have made such an approach cost and time prohibitive (Scheuhammer and Norris 1996).

The authority under which the ban was proposed was the Toxic Substances Control Act, which is administered by the EPA (Thomas 1995). The proposal came about in response to a petition put forth in late 1992 by the Environmental Defense Fund (EDF), Federation of Fly Fishers, Trumpeter Swan Society, and North American Loon Fund. These groups petitioned the EPA not to ban lead fishing tackle, but rather to initiate rulemaking proceedings under Section 6 of the Toxic Substances Control Act (TSCA) to require that the sale of lead fishing sinkers be accompanied by a label or notice warning that such products are toxic to wildlife. The rationale behind the petition was that trumpeter swans and common loons were dying from ingestion of lead fishing sinkers, and the petition cited a number of studies which reported mortality in trumpeter swans, mute swans, and common loons due to ingestion of lead fishing sinkers (U.S. Environmental Protection Agency 1994).

Beyond Labeling

The EPA granted the environmental groups' original petition on January 14, 1993, but also decided to pursue further regulation in addition to labeling. The EPA did not think that labeling alone would adequately curtail the risk of injury to waterfowl and other birds from ingestion of lead fishing sinkers. Because fishing sinkers typically become deposited in the environment accidentally, the EPA was of the opinion that labels would have little effect on how sinkers are used in practice and would not significantly affect the environmental risks of using sinkers.

The actual number of sinkers located in the environment cannot be quantified because of limited available data, and they have been accumulating for hundreds of years. However, approximately 477 million lead, zinc, and brass sinkers are sold each year in the United States. It is assumed that most of these sinkers are purchased by anglers to replace those lost in use (U.S. Environmental Protection Agency 1994).

Because zinc had also been shown to be toxic to wildlife, and brass sinkers often contain some lead and zinc as well, the EPA proposed that the ban cover lead, zinc, and brass fishing sinkers. The ban would have prohibited the manufacturing, import, processing, and distribution in commerce of fishing sinkers under one inch or less in any dimension containing lead, zinc, and/or brass for use in the United States. While a comprehensive ban on all lead- and zinc-containing sinkers would have effected the highest level of risk abatement, the EPA did not select that option because the burden placed on society would have been, in their assessment, too great. Therefore, the EPA opted for a limited ban targeting those sinkers which would pose the greatest harm to waterfowl because of their size (U.S. Environmental Protection Agency 1994).

The ban on all manufacture, import, and processing was to take effect one year after the effective date of the final rule. The distribution in commerce of these fishing sinkers and jigs would be prohibited two years after the effective date of the final rule. The one- and two-year delays were chosen over an immediate ban because the agency believed an immediate ban would be too burdensome on industry. The built-in delays were designed to allow manufacturers of lead- and zinc-containing fishing sinkers enough time to modify their production procedures and equipment to produce other types of tackle. The EPA considered the option of delaying the regulatory requirements for even longer than the proposed one- and two-year delays, but they did not believe that this option would be justified in light of the continued and increasing risk to waterfowl. Ironically (in light of the fact that the ban never passed, and millions of lead fishing sinkers have been discarded in waterways in the intervening 16 years) the EPA decided against a longer delay to the ban because of the large number of lead- and zinc-containing fishing sinkers that would enter the environment during the delay time (U.S. Environmental Protection Agency 1994).

The ban would not have enabled the government to regulate the use of lead fishing tackle, only the manufacture or sale (Thomas 1995). However, the rule would have also prohibited the home manufacture of lead fishing sinkers (the "cottage industry") as well as commercial manufacture and sale. The EPA asserted that not only would the proposed rule serve to reduce risks posed to waterbirds, but it would also assist in reducing human health risk to home manufacturers of lead fishing sinkers, since individuals and their family members and pets can be exposed to harmful lead particles or vapors while melting lead and pouring it into lead fishing sinker molds (U.S. Environmental Protection Agency 1994). The ban would have done nothing to bring about cleanup of already-contaminated waterbodies, riverbanks, ponds, or wetlands; it would serve only to prevent the future entry of toxic sinkers into these areas.

The EPA appeared confident of its authority in regard to regulating lead fishing tackle because, according to the TSCA, if the EPA were to determine that there was a "reasonable basis to conclude" that the manufacture, processing, distribution, use, or disposal of lead or zinc fishing tackle would present an "unreasonable risk of injury to human health or the environment," Section 6(a) of the TSCA would authorize the EPA to apply one or more of the following requirements to the named substances to the extent necessary to protect against the risk:

> (1) Prohibit or limit the amount of a chemical substance or mixture manufactured, processed, or distributed in commerce; (2) prohibit or limit the amount of chemical substance or mixture manufactured, processed, or distributed in commerce for particular uses or at particular concentration levels; (3) require labeling or warning rules; (4) require manufacturers and processors to make and retain records of the process used to manufacture or process a chemical substance or mixture, and to conduct tests to monitor compliance with regulatory requirements; (5) prohibit or otherwise regulate any manner or method of commercial use; (6) prohibit or otherwise regulate any manner or method of disposal of such substance or mixture or articles containing such substance or mixture; (7) require that manufacturers notify the public of unreasonable risk associated with a chemical substance or mixture, and to replace or repurchase the product.

(Toxic Substances Control Act 1976).

However, in applying one or more of these requirements, Section 6 of the TSCA also requires the EPA to apply the least burdensome requirements to protect adequately against the risk (U.S. Environmental Protection Agency 1994).

<u>Non-Toxic Alternatives to Lead Tackle</u>

In preparing the proposal, the EPA studied the toxicity of several possible alternative substances. The hazards of these substitute materials to aquatic invertebrates, fish, algae, birds, and mammals were compared with those of lead to determine whether they were more or less toxic than lead. It was determined that steel, tin, bismuth, tungsten, copper, antimony, and terpene resin putty were likely to be far less toxic than lead to aquatic organisms, and they therefore should be examined as possible alternative materials from which to form fishing sinkers (U.S. Environmental Protection Agency 1994).

EPA's economic analysis indicated that there are several available or commercially viable substitutes for lead- or zinc-containing fishing sinkers. The analysis indicated that the average increase in annual costs to each individual angler from switching to non-toxic tackle would be substantially less than $4.00 per year. In analyzing the data, the EPA came to the conclusion that the scientific evidence demonstrating the severe adverse effects to waterbirds from the ingestion of lead- and zinc-containing fishing sinkers, in addition to the economic, social, and environmental value of these birds, and the low costs and availability of substitutes for toxic sinkers, would outweigh any costs that would result from imposition of the regulation (U.S. Environmental Protection Agency 1994).

Authority Under the Toxic Substances Control Act

Section 6 of the TSCA provides the EPA with broad authority to control the manufacture, processing, distribution in commerce, use, and disposal of chemical substances. As noted above, Section 6(a) gives the agency a wide range of options for controlling harmful chemicals. Section 6(a) of the TSCA actually requires that the EPA regulate a chemical substance when the agency finds there is a reasonable basis to conclude that it poses an unreasonable risk of injury to human health or the environment. This provision requires the agency to regulate such a substance to the extent necessary to protect adequately against such risk using the least burdensome requirements (Heinzerling 2004).

Section 6(c)(1) instructs the EPA, when issuing a rule under section 6(a), to "consider and publish a statement with respect to" the effects of a chemical on human health and the environment, the magnitude of exposures to such chemical, the benefits of the chemical for "various uses and the availability of substitutes for such uses," and "the reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, the environment, and public health" (Toxic Substances Control Act 1976). TSCA's Section 6 also allows the EPA to regulate harmful substances in various modes of exposure, such as industrial, commercial, and environmental, giving the agency the opportunity to control essentially all of the important risks from a harmful chemical at once (Heinzerling 2004).

Because of these authorities and requirements, the Toxic Substances Control Act, under which authority the EPA proposed its 1994 ban, would appear to be the perfect tool for controlling toxic substances. However, in reality, the TSCA as it is currently interpreted can deliver very little in the way of such control. The main reason the TCSA is not an adequate mechanism for regulating toxic substances is because one influential appeals court decision significantly narrowed the scope of the TSCA's most ambitious program for regulating toxic substances (Heinzerling 2004).

Legal Challenge to the EPA's Authority Under the TSCA

The first and only judicial interpretation of the EPA's authority to ban a substance under Section 6(a) of the TSCA came in the context of a legal challenge, heard in the U.S. Court of Appeals for the Fifth Circuit, to the EPA's ban on virtually all manufacturing, processing, distribution in commerce, and use of asbestos, the agency's first and only such ban under the TSCA. The ruling so severely limited the EPA's authority under this provision that Section 6 has actually never played a significant role in limiting the production or use of toxic chemicals in the United States (Heinzerling 2004).

The ruling came out of the EPA's efforts to ban asbestos. In 1989, after ten years of study, the EPA put forth a final rule under the TSCA banning virtually all uses of asbestos because of the unreasonable risk it posed to human health in all stages of its production and use. The subsequent legal challenge that came on the heels of the asbestos ban was brought by Corrosion Proof Fittings, representing asbestos manufacturers. In 1991, in *Corrosion Proof Fittings v. EPA*, the U.S. Court of Appeals struck down the EPA's ban on asbestos. This decision has been the only judicial ruling of the basic tenets of Section 6(a) of the TSCA (Heinzerling 2004). Heinzerling lays out four important components of the *Corrosion Proof Fittings* ruling and concludes that the ruling in effect paralyzed the EPA's ability to regulate persistent organic pollutants:

> 1. In order to regulate under section 6(a) of TSCA, EPA must begin by examining the least intrusive regulatory alternative (such as labeling), considering the costs and benefits of such alternative. EPA may consider a more intrusive regulatory option only if "unreasonable risks" are predicted to remain under the less onerous alternative. In order to justify a ban–like the asbestos ban–EPA would have to examine the costs and benefits of numerous less onerous regulatory alternatives, and conclude that each would allow unreasonable risks to remain unaddressed.
>
> 2. In examining costs and benefits under section 6(c) of TSCA, EPA was required to "discount" benefits as well as costs–which, in effect, means treating regulatory benefits such as lives saved as if they were a financial investment. Discounting benefits in the context of toxic chemical control places a large thumb on the scale–against regulation.
>
> 3. EPA may not use unquantified benefits to justify regulating a harmful chemical, except in close cases.
>
> 4. EPA may not exceed undefined limits on how much money it requires industry to spend to save a human life.

(Heinzerling 2004).

As the *Corrosion Proof Fittings* ruling was established before the 1994 proposed ban on lead fishing weights, its narrow interpretation of the parameters of the TSCA was applied to this proposed ban as well as any others that came after 1991. In Heinzerling's words, "TSCA's transformation from potentially powerful tool against toxic substances into an ineffective law is well illustrated by the next action EPA proposed under section 6(a): a ban on lead fishing sinkers used by fishermen. Even this rather small action–in comparison to the nationwide, staged ban on asbestos–never became final" (Heinzerling 2004).

Outcome

A two-day public hearing on the proposed ban took place on November 30 and December 1, 1994, in Washington, D. C. As part of the hearing process, reply comments could be submitted through December 15, 1994. During the hearing, the EPA received requests to extend the reply comment period deadline of December 15, 1994, for a period of time after the hearing transcript became available. In order to give all interested persons the opportunity to review the hearing transcript before submitting reply comments, the EPA decided to reopen the reply comment period until January 6, 1995. Comments submitted during this extension period had to be restricted to comments on: (1) Other comments; (2) material in the hearing record; and (3) material which was not and could not reasonably have been available to the commenting party a sufficient time before main comments were due (Federal Register 1994).

On April 30, 2007, the Federal Register (2007) published a statement that the EPA intended to publish a notice withdrawing the proposal. Evidently, the notice was never published, because again in 2009, the Federal Register published another statement that the EPA intended to publish a notice withdrawing the 1994 proposal (U.S. Environmental Protection Agency 2009a). Then in the fall of 2009, the EPA stated that it was reevaluating the 1994 proposal (U.S. Environmental Protection Agency 2009b).

Legislation in Other Countries

Canada

In 1997, under the authority of both the Canadian Wildlife Act and National Parks Act, Canada prohibited the possession of lead sinkers and jigs weighing less than 50 grams (1.76 oz.) in all of its national parks and wildlife areas (Wisconsin State Environmental Research Council 2003, Scheuhammer et al. 2003). The standard used to revise the Parks Act was simply that the use of lead sinkers, with its attendant inevitable loss of such tackle, was inconsistent with ecological integrity, a concept integral to the Parks Act (Thomas and Guitart 2010). The regulations affect less than three percent of Canada's land mass, however, and only about 50,000 of the approximately 5.5 million recreational anglers in Canada (Scheuhammer et. al. 2003).

On February 17, 2004, the Canadian Minister of the Environment announced his intention to propose regulations to prohibit the import, manufacture, and sale of lead sinkers and jigs used in fishing. The ban would apply to fishing tackle less than 2 cm in length in any direction, weighing under 50 grams, and containing more than one percent lead by weight. The proposed lead content limit of one percent would also apply to tackle such as spinners, lures, spoons, etc., that attach to fishing line. Because of their small size, all these types of tackle could be swallowed by waterbirds. The Canadian government was not proposing any prohibition on the use or possession of lead fishing gear. The proposed regulation would be supplemented by an education program geared toward anglers, manufacturers, and the general public (Environment Canada 2004). Environment Canada, along with stakeholders from the angling industry, is currently seeking a Canada-wide option to minimize the risk to waterbirds caused by the use of toxic sinkers and jigs (Canadian Wildlife Service 2007).

Denmark

Since December 2002, it has not been legal to use lead in fishing tackle in Denmark (Michael 2006, Pokras and Kneeland 2008, Thomas and Guitart 2010).

Great Britain

On January 1, 1987, Great Britain banned the sale and import of lead sinkers certain sizes and weights of lead tackle. Use of such tackle was banned at the same time (with the effective date of June 1, 2007) in both England and Wales, but not in Scotland (Owen 1992, Perrins et al. 2003, Sears and Hunt 1991). The ban was implemented after voluntary efforts were less than effective (Wisconsin State Environmental Research Council 2003, U.K. Environment Agency 2009). Prior voluntary efforts included the introduction in 1982 of a voluntary code of practice for anglers encouraging the careful use and disposal of lead weights. In 1984-85, several non-toxic alternatives to lead weights were marketed. Then in 1985 and 1986, there was a “voluntary ban” on the use of lead weights (Sears 1988). Since the 1987 ban, no fishing weights made of lead may be used except those of 0.06 grams or less and those of more than 28.35 grams. In angling terms, this means that only lead sinkers from size 14 to size 8 and lead weights of over one ounce can be used in fishing (Wisconsin State Environmental Research Council 2003, U.K. Environment Agency 2009). The ban does not extend to Ireland (O’Halloran et al. 2002).

Sweden

Sweden has only voluntary local prohibitions on the use of lead sinkers in some river systems (Hansen et al. 2004).

Legislation in the United States

Illinois

In February 2009, Senator Heather Steans (D-Chicago) introduced a bill in the Illinois legislature that would end the sale or distribution of lead sinkers and lead jigs. Steans' bill, called the Lead Sinker Act, would prohibit any person from selling, supplying, distributing, or offering to sell, supply, or distribute lead sinkers and lead jigs. It would prohibit the use of lead sinkers and lead jigs to take fish in freshwater lakes, ponds, rivers, streams, brooks, and similar bodies of water over which the Illinois Department of Natural Resources has jurisdiction under the Rivers, Lakes, and Streams Act. The bill also included an educational program aimed at discouraging the use of lead sinkers and jigs. However, only weeks later, on March 17, 2009, Senator Steans filed an amendment to the bill that dropped everything but the educational program component. The watered-down bill was passed in July 2009 and became effective January 1, 2010 (Illinois General Assembly 2009).

Maine

In May 1997, Maine introduced a bill that proposed prohibiting the use and possession of artificial lures and sinkers that contain any lead or zinc and that weigh less than two ounces or measure less than one inch along their longest axis. The enacted version of the bill, however, differed significantly from that proposed. The prohibition on the use of lead tackle was gone, and in its place was a provision promoting education on lead sinkers and lures. The text of the bill stated that the "commissioner may accept money, goods, or services donated to the department for the purpose of educating the public on ways to minimize the threat to loons and other bird species from discarded or lost lead sinkers and lures" (Maine Legislature 1997). In May 1999, Maine enacted LD 875, An Act to Minimize the Harmful Effects of Lead. The act prohibits the sale, but not the use, of lead sinkers (but not artificial lures, weighted line, weighted flies, or jig heads) weighing one-half ounce or less, effective January 1, 2002 (Maine Legislature 1999).

Massachusetts

Massachusetts has no ban on using lead tackle in saltwater; however, Massachusetts has banned the use of lead sinkers at the Quabbin and Wachusett reservoirs, as they support loon populations (Boardman, personal communication; Franson et al. 2003).

Minnesota

Lead sinkers are not regulated in Minnesota. In January 2003, the Minnesota House proposed a ban on both the sale and use of lead fishing sinkers weighing one ounce or less (Minnesota House of Representatives 2003). The proposed ban was defeated, but an educational program was launched wherein state agencies instead cooperate with tackle manufacturers, retailers, conservation groups, and community associations to promote awareness of the dangers of lead, and to organize sinker recycling days. This is where participants can exchange lead sinkers and jigs for new non-toxic varieties (Hakes 2004).

New Hampshire

The first state to issue a ban on lead sinkers and jigs, New Hampshire enacted House Bill 1196 in June 1998, which became effective on January 1, 2000. The act prohibits the use in freshwater lakes or ponds of lead sinkers weighing one ounce or less and lead jigs less than one inch long. Violators are subject to a maximum fine of $250. Additionally, the bill mandates the creation of an educational program to inform the public about the adverse effects of lead on wildlife and how individuals can reduce the introduction of lead into the environment. The legislation also encourages neighboring states to enact legislation to protect wildlife that use interstate lakes and ponds; it further encourages the director of the fish and game department to work with counterparts in these states towards those goals (Wisconsin State Environmental Research Council 2003, New Hampshire House of Representatives 1998).

New York

Effective May 7, 2004, New York Consolidated Law Section 11-0308 makes it unlawful for persons to sell lead sinkers (but not artificial lures, weighted line, weighted flies, or jig heads) weighing one-half ounce or less. This law does not prohibit any use of lead tackle for fishing. The law was enacted to limit human health risks, and mortality of the common loon and several other species of waterfowl. The legislature also found that lead tackle can easily be replaced by cost-competitive non-lead sinkers that are less hazardous to both people and birds (Wisconsin State Environmental Research Council 2003, Hakes 2004).

Vermont

In May 2004, the Vermont Legislature passed H.516, which prohibits the use (effective January 1, 2007) or sale (effective January 1, 2006) of lead sinkers for taking of fish in any state waters. The rule pertains only to sinkers weighing one-half ounce or less, and it does not include other lead fishing-related items such as weighted fly line, lead-core fishing line, downrigger cannon balls, weighted flies, lures, spoons, or jig heads. In addition, the rule instituted an education program to alert the public to the threat that lead fishing tackle can pose to wildlife. The bill also established exchanges wherein Vermont anglers can obtain lead-free fishing sinkers in trade for their lead sinkers (Vermont State Legislature 2004).

Washington

In late 2009, the Washington Fish and Wildlife Commission proposed a ban on lead tackle on lakes where loons breed. The proposal would make it unlawful to use lead weights weighing less than one half ounce or lead jigs measuring less than one and a half inches in 13 freshwater lakes: Ferry Lake, Swan Lake, and Long Lake in Ferry County; Pierre Lake in Stevens County; Big Meadow Lake, Yocum Lake, and South Skookum Lake in Pend Oreille County; Lost Lake, Blue Lake, and Bonaparte Lake in Okanogan County; Calligan Lake and Hancock Lake in King County; and Lake Hozomeen in Whatcom County (Washington Department of Fish and Wildlife 2009). The public comment period closed in December 2009, and the Fish and Wildlife Commission considered this proposal at its February 4-6, 2010, meeting. The proposal was not adopted. The commission agreed to schedule additional public input during the next several months on the proposal before acting on any proposed changes to sportfishing rules (Washington Department of Fish and Wildlife 2010a).

On May 25, 2010, the Washington Department of Fish and Wildlife announced that it will be forming an advisory group to review the impacts of lead fishing tackle on common loons. The advisory group will be responsible for providing guidance on the development of management alternatives for recreational fisheries on 13 lakes in Washington where common loons breed. The advisory group will review studies on the effects of small lead fishing tackle on common loons. The management alternatives could include lead tackle restrictions. In July, the department is expected to seek public comment on the proposed recommendations developed in conjunction with the advisory group. WDFW staff is scheduled to brief the Washington Fish and Wildlife Commission on the proposed alternatives in October 2010 (Washington Department of Fish and Wildlife 2010b).

On January 29, 2010, Representative Al O'Brien (D), introduced House Bill 3158, which would prohibit the sale and use of lead sinkers containing more than one half of one percent lead by weight, the lead portion of which has a mass of one ounce or less or that measures less than one inch along its shortest axis, and lead jigs, the lead portion of which has a mass of one ounce or less or measures less than one inch along its shortest axis. If passed, the rule would become effective January 1, 2011.

The fine for a selling or offering to sell such a sinker or jig would be no less than $1,000 and no more than $5,000. The fine for use of such sinkers or jigs would be a minimum fine of $125 for the first offense. For the second offense, the proposed penalty is a minimum fine of $500, and forfeiture of all fishing tackle, rod and reel, and the loss of any fishing license for a period of at least one year. For a third or subsequent offense, the proposed penalty is a minimum fine of $2,000, forfeiture of all fishing tackle, rod, and reel, and a lifetime loss of any fishing license. The bill also includes a provision for to provide public education and outreach to disseminate information regarding the regulation (Washington State Legislature 2010).

As of the end of the first regular legislative session of 2010, this bill had not been sent for a vote. It was reintroduced in the first special session on March 15, 2010. However, in my communications with Representative O'Brien, he indicated that the bill would not be pursued during the 2009-2010 legislative session. The two major concerns that caused this bill to lose momentum were: (1) Washington's economic woes—Representative O'Brien felt that focusing on fixing the economy first was a bigger priority, and (2) The pro-gun lobby's fear that any mention of banning lead related to fishing would inevitably lead to bans on lead ammunition. It is unclear at this time whether Representative O'Brien will pursue this bill in a future session (O'Brien, personal communication).

National Park Service

Leaded fishing tackle such as leaded split-shot sinkers, weighted jigs, and soft lead-weighted ribbon for nymph fishing are prohibited in Yellowstone National Park (U. S. Department Of The Interior 1998).

On March 4, 2009, the National Park Service's acting director issued a memorandum stating that it would require the use of non-lead-based ammunition and fishing tackle in National Park Service units by December 31, 2010, if not sooner. The statement also included an educational component to be combined with the ban in order increase public awareness of the dangers of lead shot and fishing tackle (National

Park Service 2009a). However, only one week after the memorandum's release to the public, the National Park Service issued a clarification statement that included the following components:

> 1. Nothing has changed for the public. We are simply announcing the NPS goal of eliminating lead from NPS activities to protect human and wildlife health.
>
> 2. We will work to clean our own house by altering NPS resource management activities. In 2009, we will transition to non-lead ammunition in culling operations and dispatching sick or wounded animals.
>
> 3. In the future, we will look at the potential for transitioning to non-lead ammunition and non-lead fishing tackle for recreational use by working with our policy office and appropriate stakeholders/groups. This will require public involvement, comment, and review.

(National Park Service 2009b). Meanwhile, no new system-wide rule has passed or is pending with regard to the 2009 proposal. The one exception is in Yellowstone National Park, where leaded fishing tackle such as leaded split-shot sinkers, weighted jigs, and soft lead-weighted ribbon for nymph fishing is not allowed. Lead core line and heavy (greater than four pounds) downrigger weights used to fish for deep-dwelling lake trout are permissible because they are too large to be ingested by wildlife (National Park Service 2006, Franson et al. 2003).

<u>National Wildlife Refuges</u>

In an effort to reduce the number deaths of common loons from lead poisoning, the U.S. Fish and Wildlife Service in 1999 proposed establishing lead-free fishing areas on selected national wildlife refuges, specifically those areas that are both frequently used by recreational anglers and contain habitat used by common loons. After the two-year phase-in period, anyone fishing in lead-free areas would have been required to use non-toxic sinkers and jigs (U.S. Fish and Wildlife Service 1999). The proposed lead-free fishing areas included portions of national wildlife refuges in Alaska, Maine, Michigan, Minnesota, Montana, Wisconsin, and Wyoming only (Fowler, personal communication). The proposed rule was published in the Federal Register in 1999, and in May 2000, in the Final Rule for the 1999-2000 refuge-specific hunting and sport fishing regulations, it was stated that: "We will not be making a decision on the establishment of lead-free fishing areas in this final rule. We will address this issue in a separate final rule at a later date" (Federal Register 2000).

Subsequent rules have so far not been issued. Because the final rule has not been issued, lead sinkers are not banned by a system-wide ruling on any unit of the National Wildlife Refuge System (Fowler 2007). However, the use of lead sinkers (no size limit) is prohibited in Red Rock Lakes National Wildlife Refuge in Montana in order to prevent waterfowl poisoning (U.S. Fish and Wildlife Service 2010, Franson et al. 2003). This ban has been in place since 1986. Fishing on national wildlife refuges is managed by the staff at the individual refuges. It is not necessary for there to be a system-wide ban on lead sinkers throughout the National Wildlife Refuge System in order for any given refuge manager to ban their use (West, personal communication).

Effects of Regulation of Lead Tackle on Wildlife Mortality

Most of the studies that examine the effects of a reduction in the use of lead fishing tackle have taken place in Great Britain, where the ban has been in effect since 1987.

Mute swan populations in Britain have long been known to be affected by deaths due to the ingestion of lead fishing sinkers. In order to determine whether mortality numbers were affected by the 1987 ban on lead fishing sinkers in Great

Britain, Kirby and colleagues analyzed population trends in mute swans in Britain. In their 1994 paper, Kirby, et al., found that mute swan numbers increased dramatically after 1986-87 and reached their highest level for 27 years in 1987-88. They used bird count data encompassing 30 years, from 1960-61 to 1989-90 (September to March). The count in January 1990 reached 12,900, over 3,000 more than the average for the preceding five winters, which was 9,550. They noted that the timing of these population increases correlated closely with the ban on the use of lead fishing weights.

Although trends differed somewhat between regions and habitat types (for example, populations in northwest and southwest England had not increased in response to the ban), overall in most regions record levels were recorded in 1987-88. At the time this study was done, the 1990 census numbers were not yet available. Although lead sinkers from prior years had not been removed from mute swan habitat, the authors noted that many weights sink into the sediment over time, and with fewer sinkers added each year, the numbers available to waterfowl decrease over time. They further projected that illegal use of lead sinkers would decrease as anglers' stocks were used up. From detailed statistical analyses of population data, Kirby and his co-authors concluded that Britain's ban on lead fishing sinkers had contributed to overall increases in mute swan numbers in Great Britain (Kirby et al. 1994).

Sears and Hunt (1991) pursued another method of assessing change in lead poisoning of mute swans in Britain after the ban in their 1991 study. The three methods of analysis they used were (1) post-mortem examination of swans found dead, (2) veterinary diagnosis of rescued swans, and (3) blood lead analysis of live swans. They found that the proportion of deaths of mute swans throughout England due to lead poisoning dropped from 50 percent in the 1980-81 census year to 40 percent in the mid

1980s. Although the ban was not introduced until 1987 and therefore could not be attributed to any decrease in mortality in the mid 1980s, two changes occurred in the mid 1980s, prior to the ban's passage: (1) non-toxic alternatives to lead tackle became available, and (2) an educational program aimed at raising awareness of the harmful effects of lead tackle was instituted. These may have decreased the number of lead sinkers and jigs available to waterfowl for ingestion.

Subsequent to the ban, data showed that in 1987, mute swan deaths due to lead poisoning dropped to 30 percent.   (The researchers chose to use proportion of deaths due to lead poisoning rather than absolute numbers from year to year because variation in survey/collection efforts would have skewed absolute numbers.) In addition, the number of cases of lead poisoning in swans rescued from the Thames and adjacent waterways dropped to 25 in 1988, from a peak of 107 in 1984. Blood lead levels of swans on the Thames dropped from a median of 127 µg/dL in 1984 to 22 µg/dL in 1987, nearly a six-fold decrease. Previous studies had ruled out lead shot and overall exposure from environmental lead (e.g., car exhaust) as a significant contributor to mute swan mortality (Sears and Hunt 1991).

A strong indicator that the decrease in mortality rates of mute swans just after the 1987 ban on the sale and use of lead fishing tackle was due to the ban and not other causes came from another study. Sears (1988) reported that regional and seasonal variation in the incidence of lead poisoning among swans from the Thames valley area correlates strongly with fishing patterns. Regionally, the highest rates of swan poisoning occurred in heavily fished urban waterways, where large numbers of lead weights were found on the river banks and in the sediment. A clear seasonal pattern showed a peak in lead poisoning in mid summer and a low during spring. This correlates with the fishing season in that from mid March to mid June, when fishing is prohibited, the incidence of lead poisoning dropped markedly. This was despite the continued availability of large numbers of lead weights that had accumulated over the years on the banks and in the sediment. Once the fishing season opened, there occurred a rapid increase in swan lead poisoning, which suggested that the swans were, for the most part, ingesting recently lost lead sinkers (Sears 1988). The correlation with the ban was that if fewer recently lost sinkers were available for ingestion due to the ban, this would handily account for the decreases in loon mortality due to lead poisoning after the ban.

A 1990 census of mute swans in England estimated the population at 20,000 birds, the highest level yet recorded. By contrast, the 1983 census, prior to the ban, was 14,800. The authors concluded that, at least in parts of England (the survey results were broken out by region), the decrease in exposure of mute swans to lead after the ban on the sale of most sizes of fishing weights in 1987 has been a major contributor to the recovery of their populations (Delaney et al. 1992).

Summary

Although few data of the effects of regulation of lead tackle on waterfowl in U.S. states are available, the British studies indicate that regulation of lead fishing tackle results in a rapid decrease in waterfowl poisoning. Common loons have been poisoned by ingesting lead fishing tackle in Washington (Poleschook and Gumm 2009), but because there is no regulation of lead tackle in Washington, it is unclear what the effect of a ban would be on waterfowl. Extrapolation of existing studies of the effects of lead tackle regulation on waterfowl, however, would point toward a reduction in waterfowl mortality if only non-toxic sinkers and jigs were to be used.

4. Regulation: Opposition, Economic Impacts, Non-Toxic Alternatives to Lead Tackle, and Regulatory Authority

Resistance and Obstacles to Regulation

Opposition to regulation of lead fishing tackle is widespread and comes from many sectors. Fishing associations fear that it will reduce participation in fishing, the lead manufacturing and tackle industries fear economic repercussions, and anglers want the government out of their tackle boxes. The next section will illustrate the types of opposition presented against proposals to regulate lead fishing sinkers and jigs, along with analysis of and commentary on the opposition. In the interest of brevity, I will present examples of a few comments on the EPA's 1994 proposed ban, opposition to a few other proposed bans, and opposition by the American Sportfishing Association to regulation of lead tackle in general.

The EPA's 1994 Proposed Ban

In conjunction with the limitations imposed on the EPA's regulatory authority by the *Corrosion Proof Fittings* ruling, there was a great deal of opposition to the proposed ban on lead fishing sinkers and jigs. Much of the resistance to the proposal became evident during the public comment period. The opposition came mainly from the fishing tackle industry, angling organizations, state agencies, and the fishing public (Thomas 1995).

One of the problems with the ban from the point of view of the fishing tackle industry was their contention that any new tackle substitutes allowed after the ban might in the future be banned also if they hadn't been thoroughly vetted as to their safety for wildlife and the environment before being approved for use. The fishing tackle industry claimed that, in the absence of government-approved non-toxic substitutes, if they were to invest time and money into technology to produce sinkers from alternative materials, this would not preclude their being forced to reconfigure production yet again if alternatives were later declared toxic as well (Thomas 1995). The Migratory Birds Treaty Act (MBTA) requires that any shot material be tested extensively before it can be declared nontoxic and used legally for waterfowl hunting. However, because the MBTA doesn't control fishing, there is no similar requirement for testing of fishing sinkers by the MBTA (Thomas 1995).

According to the American Sportsfishing Association (ASA), the EPA's proposed ban "caused immediate public opposition and was in fact responsible for eliciting the largest number of comments on an EPA draft rule to date." The ASA claims that the EPA eventually withdrew the proposal because of insufficient data to support the idea that lead sinkers were adversely affecting water bird populations (American Sportfishing Association 2002), although by 2009, the proposal had not yet formally been withdrawn. The ASA, representing the U.S. angling equipment industry, objected to the proposed ban on many levels. They alleged that there was a lack of scientific evidence of a problem, that the ban would result in interference in the recreational lives of Americans by government, and that many small cottage industries would lack the capital and developmental capacity to produce new non-toxic products (Thomas 1997).

Shortly after the ban was proposed, Senator Tom Harkin (D-Iowa), in an effort to ensure a vote on the use and manufacture of lead fishing sinkers rather than a rule imposed by the EPA, changed a bill he had recently introduced into an amendment that he planned to attach to the Senate's main regulatory reform bill. The bill, The Common Sense in Fishing Regulations Act, as originally proposed, would have blocked the EPA's proposed ban. Senator Harkin saw the EPA's proposal as government regulation run amok. He stated that the EPA went far beyond the scope of the original petition for labeling, and that it was basing its proposal on speculation and anecdotes rather than scientific data (Mississippi Cooperative Extension Service 1995).

Comments to the EPA on the Proposed Ban

Among the comments received by the EPA were several from manufacturers and retailers, although not all of them produced or sold lead tackle. The main concern of Northland Fishing Tackle, a tackle shop with 25-50 employees, was that a transition to alternative alloys would be expensive and burdensome, both to their own tackle shop and to those manufacturers who supply them with merchandise. They also claimed that the ban proposal was an over-reaction to a problem that did not have sufficient supporting evidence. Evidently, this was in their area of expertise, since they had, "lived a life-time around the loons, swans, and other waterfowl of Minnesota, without ever seeing a death that could be attributed to their eating fishing sinkers" (Northland Fishing Tackle 1994). Apparently, ignoring the scientific studies and not having first-hand experience in dealing with lead toxicosis of waterfowl made the whole issue rather inconceivable to this business. The company went on to point out that many other things kill birds (e.g., soda-pop six-pack plastic rings, power boating props, predators, poachers, acid rain, etc.), ostensibly with the intent to distract from the lead sinker issue. They then relegated the issue of lost lead tackle to the "insignificant" bin with respect to the "big picture" and purported that it was "extreme environmental activists" who were pushing for the legislation "without justifiable reason" (Northland Fishing Tackle 1994).

The National Marine Manufacturers' Association's (NMMA) opposition to the proposed ban was based on their assertion that the EPA had not presented sufficient evidence to show that bird mortalities due to ingestion of lead sinkers was a significant threat to bird populations. While acknowledging that bird toxicosis had been documented, the NMMA didn't agree that there was enough documentation of sufficient harm on which to base such a widespread ban. They also claimed that unless the EPA were also to ban the use of lead sinkers (recall that the ban proposed to regulate only the sale and manufacture of lead tackle, not use), home manufacture of these lead products would likely increase dramatically. Furthermore, without the ban on use, anglers would likely stock up on lead products prior to the ban's effective date, and lead tackle would continue to be used widely. A further complaint by the NNMA was that the EPA had not coordinated with the U.S. Fish and Wildlife Service or National Park Service on regulation or implementation, which could lead to confusion and conflict in industry and for the angling public (National Marine Manufacturers' Association 1994).

The NMMA argument that home manufacture of lead tackle would likely increase under the EPA's ban on manufacture and sale alone is certainly valid. Without a restriction on the use of lead weights, it is unlikely that the large numbers of lead sinkers and jigs being lost to waterways would decrease. NMMA's highlighting of this loophole actually lends support to regulation of lead by states or state departments of fisheries, which could include a ban on the use of lead tackle, not just its use or manufacture.

Rather than asserting directly that its business would be adversely impacted by the ban, the Lead Industries Association, Inc., in its comments to the EPA regarding the proposed ban, asserted that the EPA had not demonstrated that the level of harm to waterfowl from lead sinkers was significant, and that the costs to industry of banning lead sinkers to prevent such harm would far outweigh the benefits to wildlife. They also purported that the EPA had not provided evidence that home manufacturers of lead sinkers experience elevated blood lead levels as a result of such lead smelting, and that therefore there was no evidence of harm to people who make lead sinkers at home (Lead Industries Association, Inc. 1994).

The National Party Boat Owners Alliance contended that the proposed ban, which was "the latest engagement in our industry's battle to survive the onslaught of bureaucratic juggernauts that are bent on squeezing the life out of our small businesses," would cripple their industry. They claimed that without the use of lead sinkers or lures, their "time-tested methods of fishing would no longer exist." Because other metals do not have the same density as lead, tackle made from other materials would be overly large and therefore impractical (National Party Boat Owners Alliance Inc. 2004).

The Association of Northwest Steelheaders was also opposed to the EPA's proposed ban on the grounds that the EPA presented insufficient scientific evidence to support their proposal, and that the ban would "add to the already disastrous economic impact brought on the sportfishing industry by the devastation of our anadromous fish runs." They further were fearful that they would have to divert resources being directed at restoration of fisheries to the issue of lead in fishing weights (Association of Northwest Steeleheaders 1994).

The president of the Association of Louisiana Bass Clubs, Mr. Wayne Allemand, representing approximately 4,500 anglers, was of the opinion that more birds die from plastic than lead (e.g., plastic ring holders on six-packs of drinks, sandwich bags, etc.). Furthermore, Mr. Allemand stated that "the cost of replacing lead sinkers will be greatly unappreciated by my members" (Association of Louisiana Bass Clubs 1994).

One tackle company wrote in support of the ban. Environalloys, a producer of purportedly non-toxic alternative sinkers and jigs that they expected would soon be available, was eager for the ban. They even requested that the maximum size of sinkers to be banned be increased to two inches, "to insure that not even one sinker could be inadvertently swallowed by waterfowl." Whether the company was sincere in its claimed desire to protect waterfowl or whether they saw in the proposed ban a potentially lucrative business opportunity is not known. However, they commented that they were confident that other manufacturers would investigate new non-toxic materials for producing tackle if the ban were to be passed (Environalloys 1994).

Aside from Environallys' embracing of the proposed ban, there are some common arguments in these commenters' objections: (1) lack of scientific evidence that lead tackle harms wildlife, (2) economic hardship, and (3) other things kill birds too, so relatively speaking, lead isn't really a big problem. These and more are shown to be recurring themes in the comments below pertaining to other ban proposals on smaller geographic scales.

Illinois

I asked Jen Walling, of the office of Illinois State Senator Heather Steans, why the proposed ban was reduced to an education-only program. Her response was that there was too much opposition from the general public and from other legislators (who were hearing opposition from their constituents) on the ban. Ms. Walling stated that the responses to the proposed ban were the most negative they had encountered on any other proposed bill. The public comments included claims that there was not enough good science to back up the claims of the hazards of lead poisoning to waterfowl (Walling, personal communication).

Many reactions from anglers to Senator Steans' proposed ban were posted on an anglers' discussion forum on the Internet. Not all of the comments were negative; a few anglers were supportive of switching from lead to non-toxic alternatives. People whose comments demonstrated and encouraged a rational understanding of the toxicity issues, however, were roundly criticized by those opposed to the ban. The following are verbatim examples of eight comments posted by anglers opposed to the Illinois proposed ban:

> I bet it will cost hundreds to replace just whats in my box.I can't dispute the lead killing waterfoul, but it's darn hard to prove that lead is from sinkers, again I dont doubt that it has happened, but seriously how much of it comes from fishing? It's also kinda funny how the govenment is pushing the lead thing when at the same time thier pushing mercury laced light bulbs on us, how safe is that, I can't wait to see the fallout over someone throwing thier energy saving poison lightbulbs in the land fill. Theres a lot worse geting pumped into our water than lead from my sinker. I do believe we can't win tis battle but it's still BS in my opnion. do you seriously think that the legislation is going to stop at our "small" sinkers and baits? Again I don't think we can win this fight, we will loose lead as sinkers AND bullets probably sooner then later, and I'm not denying that lead is toxic but this appears to be "a foot in the door" type of thing, I mean why now? Has there been a die off of water foul or lead related poisonings form sinkers here in Illinois? (smitty)

> Seeing how the people are uneducated about this topic, of course theyre going to assume it's evil and bad. So if everyone continues to not fight the battles with facts and just go along with the BS so we dont look bad….we lose. Look at how many years lead has been used….why is it only now that it's bad and evil? How many people actually died from lead sinkers or lead pellets? Look it up, do your homework on the subject. It is a looney left BS propaganda scheme.
> Look at who is running the EPA…a complete nutcase hellbent against hunters. Look at who is running the BATF…the biggest anti-gun lawyer there is in this nation. So go ahead and choose not to fight the battle

with facts and stop the BS in it's tracks now and it will hit it's mark later on down the road. Remember…the SCOTUS ruled in our favor to let us keep our guns….AMMO WASNT AND ISNT PART OF THE DEAL…..WAKE UP. (and yes the caps were left on intetionally…lol) It is all BS. How many years has lead been used in fishing?...How many people died from eating fish?...The sky is falling folks…join the looney left and lets get back to the cave-man ways of life because everything is bad for ya….It's not about your health or the health of the wild life they claim that are being hurt….it's about chipping away at your god given right to hunt and fish. So keep choosing not to fight the battles and let them chip away some more….soon there will be nothing left and everything will be deemed as "bad for you". PC / looney left BS at it's finest…..........
p.s. do some homework on the subject of lead…the looney left hopes you dont. (Ronbo)

Wow. I see this as a very dangerous precedent. This could definitely lead to gun bans. I mean it makes perfect sense. If we let them get away with this, the next headline will be "America's gunowners shoot poison lead bullets, and for the sake of a few dollars, they don't care" Does anybody see this besides me?????? (stage01)

I can't believe the level of support for this ridiculous bill on this website! The language in this bill is enough to show me that it reeks with big government trying again to protect us from ourselves B.S.! And while I understand that a privileged few on here think its no big deal replacing their tackle with a nontoxic alternative, I know many who fish not just for the sport but also to help put a meal on their plate would find this as another economic burden along with the small bait and tackle shops. The way things are heading, hunting and fishing will only be enjoyed by a privileged few who can afford it. If you haven't noticed lately I don't think the state has funds to help alleviate these burdens either. I guess if this law passes we'll have to find a hazardous waste hauler to properly dispose of all our lead tackle and who's going to foot that bill? (RiverHunter)

yes if it becomes illegal I will empty my takle box of lead which will suck because I have a lot of $$ in my takle box but do people think about the small shops or even the big stores that will have to empty their shelves with this new bill? STIMULAS MY A$$!!!!!! I've been fishing and hunting for 38 years and I've yet to hear of anyone getting sick of lead in fish!!!! (FultonCoBuck)

According to the USGS, lead fishing gear(sinkers, jigs, etc.)may have been used as far back as the bronze age. If the enviroment has supported the lead up to this point, what will inhibit it from not taking care of itself? This bill specifically states fishing gear, not lead shot.In my hometown, we have lost one small bait shop and the other is up for sale with everything marked 30%-50% off just to get rid of inventory. Most

> of the inventory is lead bases products. This bill is taking this store down hard and every small bait shop will follow in time. The complete ridiculousness of this bill is based on the fact that since lead can be bad, then lead products must be bad. Informing the public will help get more people on board to fight this problem.(Why are all the senate members on the enviromental comittee from Chicago? It has some of the worst pollution in the US and they can't take care of themselves How are they going to clean up the state's enviroment? Let's get some new eviromenta comittee members from around the state, so our voices can be heard sooner) Basically, I don't want to fix what is not broken and this lead fishing gear does not even come close to the same impact as mercury levels have on the enviroment. Lets focus on that instead of lead for a while Springfield!!! (kirk)
>
> I don't think it's good for us to accept them taking anything away. This will eventually lead to MORE bans. Lead sinkers verses oil spills, how many birds does that kill? Wanna ban oil? Pesticides are killing our pheasants and quail, anybody care? Wanna ban pesticides? How many of these Chicago politicians are just Blago-nation sheep looking for a new shepherd to fill their pockets with dirty money? Remember what Blago did for us? I wonder what actual percentage of waterfowl are effected by lead sinkers and jig heads. If we're lucky maybe the JTF aka "Task Force" will get envolved and give the deer herd a break. (Andy)
>
> I think that just is and attempt to get a law on the books to ban lead for all purposes.The real thrust behind this legislation is to circumvent the second ammendment.Once lead is banned ammunition already in your possession will be illegal and its replacement will be very costly or unavailable.They have tried to take away our weapons through costly legal battles but now they have shifted gears to something not protected by the Constitution.Why do you think after all of these years we suddenly have numerous bills before state legislators calling for bans on lead.I think that if these people who desire these bans can prove beyond a reasonable doubt by studies conducted by independent sources at their expense then and only then should a ban be considered.I am really getting tired of the sponsers of these bills being allowed to introduce them on vague statistics and partial findings of previous test.Too often they use the statements about protecting our children and endangered species without supporting their positions. (JBlk)

(Prairie State Outdoors 2009).

The above comments from anglers demonstrate what appears to be a common mindset among many (but certainly not all) anglers. One aspect is fear: that the government is going to control their choices in recreation, and that the slippery slope effect will mean that more and more regulation will follow on the heels of a ban on lead fishing tackle. Another aspect is lack of understanding of the science: although the toxicity of lead is undisputed, and poisoning of waterfowl by lost sinkers has been widely documented, many anglers seem to be unaware of these realities and therefore dismiss such claims without investigating their veracity. A third facet of the anti-ban mindset is that other environmental problems (e.g., oil spills, mercury-containing light bulbs, habitat destruction, etc.) are of a greater magnitude than that of lost lead sinkers, and therefore use of lead tackle isn't an action-worthy problem in light of the larger issues. Another tenet of this common attitude is the idea that lead has been used for centuries or millennia, and therefore what's always been done can't really be harmful. And, of course, the fear that switching to non-toxic alternatives will hit anglers in the pocketbook figures prominently on the list of complaints as well.

Washington

The American Sportfishing Association (ASA) was vehemently opposed to the Washington Fish and Wildlife Commission's 2009 proposal to ban lead fishing tackle on select lakes. On their website, the ASA posted the following form letter urging the commission to reject the proposal, and encouraged anglers opposed to the proposal to fill it out and send it to the Washington Fish and Wildlife Commission:

> As an avid angler, I am deeply concerned about the ban's potential impact on an activity that my friends, family and I enjoy very much. Not to mention the income it generates for the state.
>
> The Washington Department of Fish and Wildlife found no evidence of a declining loon population. In fact, loon populations throughout their range are stable and increasing in most cases despite substantial threats such as habitat loss, predation, disease and environmental toxins which have much more significant impacts on loon populations than ingestion of lead fishing tackle.

> The data presented in the proposal says that 39 percent of loon deaths result from lead toxicosis. However, this estimate was determined by examining only 27 loon carcasses collected from 1996-2008 of which only nine loons were found to have died as a result of ingesting lead fishing tackle. As any scientist would agree, a sample size of 27 over 13 years is not nearly large enough to accurately represent an entire wild bird population.
>
> The proposal also says that alternatives to lead sinkers and jigs are widely available and no more expensive than lead. This just isn't true. Products made from alternative materials can cost 20 times more than lead products, are not as available and do not perform as well.
>
> According to the U.S. Fish and Wildlife Service, Washington is the fifteenth largest state in terms of annual sportfishing expenditures. Annually, fishing license sales and funds from the federal manufacturers excise tax on fishing tackle provide approximately $25 million for fisheries conservation and restoration. Washington's 736,000 anglers spent $1.04 billion in 2006, generating $210 million in state and local tax revenue. Washington's anglers support 15,000 jobs with $513 million in salaries and wages. If Washington's anglers stopped fishing and did not spend their money elsewhere in state, the state's economy would shrink by $1.66 billion. In addition, non-residents comprise 13 percent of Washington's anglers who have a significant impact on the state's economy.
>
> Please reject this proposed ban on lead fishing tackle. Ultimately, an unjustified lead ban will reduce fishing participation, which will have a significant impact on our state's economy and fisheries conservation efforts. In the end, everyone will lose.

(American Sportfishing Association 2009).

Opposition from the ASA, as shown by the above form letter, shows concerns similar to those voiced by other sectors, but puts special emphasis on the economic aspects of regulation. They claim that participation in fishing will greatly decrease (if not disappear altogether) if lead alternatives are imposed. The alarmist statement from the ASA's form letter that "If Washington's anglers stopped fishing and did not spend their money elsewhere in state, the state's economy would shrink by $1.66 billion" seems to imply that a ban on lead fishing tackle would cause all anglers to abandon fishing entirely and immediately. Although such an implication is quite absurd, statements such as this are often used to argue against regulation. Further, their assertion that non-lead tackle can cost 20 times more than lead does not take into account the fact that lead sinkers and jigs are quite inexpensive and account for only a small proportion of an angler's budget; therefore, the increased prices of non-toxic tackle actually remain a small proportion of the budget. Also, while some non-lead alternatives may cost significantly more than lead, many of the alternative products are only slightly more expensive.

A public comment letter written by an articulate angler to the Washington Fish and Wildlife Commission in 2009 is more rational. The author takes issue with the validity of the idea that banning lead sinkers in Washington is vital to protect loon populations, but he is also quite focused on economic concerns. Portions of the letter are reproduced below:

> I have studied and written papers on lead toxicosis as far back as 1975, and I clearly recognize the potential danger ingestion of lead poses to certain species of waterfowl. My concern with the proposed lead ban is that WDFW has not yet established or quantified that a problem actually exists that warrants this proposal, and until doing so should not take actions that will have unintended consequences. Such a decision may invite legal action from the businesses that depend on lead tackle manufacturing and sales, and if escalated to a total ban of lead tackle will significantly reduce the very revenue that pays the salaries of biologists through Federal Excise Tax and fishing license sales, as well as reducing sales tax revenue to the State.
>
> The paper submitted by Poleschook and Gumm suggests that 9 loons over a 13 year period may have died from lead toxicosis (no liver or blood tests confirmed this). This number is not statistically significant, nor is it a significant limiting factor to Common Loon populations in Washington. Shoreline development and the loss of breeding habitat are more significant. As you are probably aware, Washington is not considered within the normal breeding region of the Common Loon to begin with, and the population of the Common Loon is believed to be increasing in Washington. Again, where is the problem that justifies such an important decision?

> I get it about lead toxicosis. It does occur, and it does occur in Common Loons and many other waterfowl. Lead is toxic under certain conditions, but so are many other substances in our environment including tungsten, brass, copper, zinc, iron, mercury, herbicides, pesticides, insecticides, fertilizers, and even items that are normally inert. We should be especially concerned about the effect of endocrine disrupters from medications and hormone supplements entering our groundwater and surface water in septic and sewer systems. We can all agree that there are many dangers to consider, from loss of habitat, predation, and toxins. This issue before the Commission is a matter of perspective, and context. (Marc)

(Washington Fishing: Washington's Online Fishing Community 2009). The writer appears to be using fear tactics in his entreaty to the Commission to reject the proposed ban. He warns of legal action and reduced revenues for biologists' salaries without providing support for such claims. Although this is simply an opinion letter, not a scholarly article, and as such does not require references, the result is little more than unsupported fear mongering. His claim that a total ban of lead tackle will significantly reduce revenues is countered by a British study showing that tackle sales after the 1987 ban were actually higher for three years, and then settled to pre-ban levels after that, in spite of the increase in tackle prices (Hansen et al. 2004).

Much like the anglers' comments in response to Illinois' proposed ban above, this letter writer attempts to diminish the significance of lead toxicosis to waterfowl by citing other detrimental environmental issues that affect waterfowl habitat. This bit of sophistry is intended to distract the reader from the very real problem of waterfowl lead poisoning from sinkers and jigs. Shoreline development is undisputed as a large contributor to habitat destruction; but focusing on that doesn't make the problem of lead toxicosis disappear. And curtailing the use of lead sinkers, which has been directly and definitively shown to cause waterfowl mortality, is far more easily solved than many other environmental problems, like preventing endocrine disrupters from medications and hormone supplements from entering the water supply.

The author of this comment letter states that the number of common loons poisoned by lead fishing tackle in Washington is not statistically significant. It is true that the toxic effects of lead sinkers on waterfowl are more pronounced in some areas than others. For example, in some northeastern states, the population-scale effects of lead toxicosis on waterfowl have already prompted legislation. In Washington, the numbers of loons poisoned by lost lead tackle may be less than in other geographic areas, and opponents of legislation use this to claim that regulation of lead tackle is unwarranted. What the letter writer fails to take into account, however, is that, especially when considering small populations, if only a few loons die from poisoning due to ingestion of a lead sinker, there will be fewer birds to reproduce, and less future offspring. This is of particular concern where local populations are already low, making the loss of an individual bird more significant. Therefore, deaths of individual birds may in turn have a large impact on the total population of a species over time. Lost lead fishing sinkers in unregulated areas continue to be an unnecessary source of adverse pressure on already-stressed populations.

The writer goes on to suggest that without access to lead tackle, not only will young anglers not be able to catch fish, they won't ever learn to love fishing and therefore are unlikely to become environmental stewards:

> Environmental stewards are not born, but rather become stewards by learning to love the outdoors experience. Lead fishing tackle enables beginning and advanced anglers to be successful, which is the critical element in enjoying the outdoor recreational experience and learning to become stewards. A ban would be counterproductive to this process. (Marc)

(Washington Fishing: Washington's Online Fishing Community 2009). The irony in this statement is glaring. What better opportunity to teaching young anglers respect for the environment and wildlife than by educating them about the benefits of using non-toxic tackle and the devastating effects to waterfowl that lead sinkers and jigs can pose?

National Parks

The U.S Sportsmen's Alliance has urged its followers to protest the proposed ban on lead fishing tackle in National Parks. The Alliance posted the following admonition in March 2009, recommending that anglers express to Congress their adamant opposition to the proposal:

> Sportsmen nationwide must immediately contact their U.S. representatives and senators. Ask your congressman and two U.S. senators to urge the Obama Administration to stop the National Park Service from its plan to stop the use lead ammunition and fishing tackle on its lands.
>
> The park service, which administers many lands that permit hunting and fishing, including National Preserves, National Recreation Areas and National Rivers, announced March 10 that it would ban lead ammunition and sinkers from its lands.
>
> Acting NPS Director Dan Wenk stated that the NPS goal is to eliminate all lead in ammunition and tackle by the end of 2010. Over 20 million acres of NPS land is open to hunting and would be adversely impacted by this decision.
>
> This decision is seen as a blatant anti-hunting move. It is clearly designed to limit hunting by imposing high priced alternative products like tungsten, copper, and steel. It will reduce available conservation dollars as sportsmen reduce purchases of hunting and angling gear.
>
> Take Action! Sportsmen are urged to contact their congressperson and their senators and tell them to ask the Obama Administration to oppose this measure. Tell them banning lead will destroy both part of America's heritage and reduce conservation dollars.

(U.S. Sportsmen's Alliance 2010). This letter is framed to evoke a defensive stance from hunters and anglers, especially the phrase "blatant anti-hunting move." The letter also uses appeals to emotions rather than reason, e.g., banning lead will "destroy part of America's heritage." Such logical fallacies obscure the true issue of lead's toxicity to wildlife and the environment. Claiming that the proposal is "designed to limit hunting" clearly obfuscates the true goal of reducing the toxic effects of lead shot and sinkers on wildlife and natural areas.

American Sportfishing Association's Opposition

The American Sportfishing Association (ASA) concedes that lead toxicosis of waterfowl by lead fishing tackle occurs but contends that it is not a significant factor in the health of common loon populations. The ASA attempts to diminish the conclusions of multiple studies that demonstrate varying levels of mortality in waterbirds due to ingestion of lead sinkers and jigs. For example, without citing any source, they purport that "lead poisoning, when occurring in larger birds, causes the bird to be more noticeable, more vulnerable to capture, and more likely to be brought forward for examination, thus causing examination in a disproportionate frequency in relation to the actual mortality of the population" (American Sportfishing Association 2002). This is in direct contradiction to statements by Twiss and Thomas (1998) that "waterfowl mortalities resulting from lead toxicosis may also be more difficult to detect than those caused by disease or some other environmental cause." One of the main reasons that these mortalities may be difficult to detect is that poisoned birds "will typically conceal themselves in dense cover as they become weaker, which makes detection difficult even for those searching specifically for them" (Twiss and Thomas 1998). The EPA concurs, asserting that, due to the reasons presented previously in chapter three, “the potential magnitude of the risk to waterbirds is greater than the number of known deaths indicates” (U.S. Environmental Protection Agency 1994).

The ASA claims that it has found that loon populations in the lower 48 states are stable and increasing in most cases. It is unclear how they arrived at this conclusion. However, in its attempts to deflect blame for what it identifies as substantial threats to loon populations by pointing to habitat loss through shoreline development, the ASA tacitly acknowledges that substantial threats to loons do indeed exist. But preventing the deposit of lead sinkers in loon habitat is something the ASA claims is unnecessary, even though the ASA “acknowledges that lead toxicosis can kill water birds and lead fishing sinkers may contribute to this mortality” (American Sportfishing Association 2002).

Summary

Arguments against imposing bans on lead tackle range from the rational to the ridiculous. On the more rational end, anglers and sportfishing associations maintain that the risks to wildlife haven’t been shown to outweigh the burden of having to switch to non-toxic tackle. Additionally, the potential economic impacts of a ban on lead fishing tackle is something that concerns recreational anglers and industry alike. Arguments on the nonsensical end include concerns that the inability to use a neurotoxin as fishing tackle will dissuade young potential anglers from the activity. Protests that a ban on lead sinkers will cause a jurisdiction’s economy to break down or that only other, less-manageable environmental issues should be addressed to stem threats to wildlife populations are unfounded as well.

It is highly unlikely that any young angler will grow to shun environmental stewardship unless s/he has unfettered access to toxic fishing tackle. Non-toxic alternatives have been shown to be only marginally more expensive than their lead counterparts; this increase in cost is proportionally small in the context of anglers' expenses on the whole. Anglers' and sportsfishing associations' resistance to legislation largely stem from a (perhaps willful) lack of understanding of the science and data behind proposed bans, and from an exaggerated idea of what the economic impacts would be.

Of course, some of the resistance comes from anglers' not understanding or not being willing to accept their part in the cumulative effects of lost lead tackle. According to Thomas (1997), "the attitudes of individuals towards their roles in environmental lead contamination and remediation reflect marked self-deception about the need for changes and benefits to be derived from substitution." Much of this opposition to proposed lead bans also results from a lack of public understanding of the science. And as shown in the comments above, many sportsmen's groups and individual anglers criticize attempts to prohibit lead as an infringement on their rights, rather than a way to minimize risks to the health of people and wildlife. There is a broad misconception that laws regulating lead are set in motion by groups that oppose shooting and fishing sports in general. These types of uninformed assumptions hinder the transition to nontoxic fishing tackle (Pokras and Kneeland 2008).

Economic Impacts of Regulation and the Switch to Non-Toxic Alternatives

Economic Impacts to Anglers

One of the objections commonly made by anglers when faced with a possible ban on lead tackle is the increased expense of having to switch from lead to non-toxic sinkers and jigs. Several analyses of the costs to anglers of using non-toxic tackle show that although non-lead alternatives generally do cost more than their lead counterparts, the increase in cost is negligible when compared to the typical angler's fishing expenditures. Each study presents somewhat different cost analyses, yet none of the assessments puts the increased cost at anything more than a diminishingly small proportion of the overall angling budget.

Fishing can be an expensive pastime. However, relatively little of a typical angler's budget goes towards sinkers. Lead fishing sinkers generally account for less than one percent of the total angling budget (Scheuhammer and Norris 1995). Far more of an angler's expenses are for items such as boats and boat trailers; motors and associated fuel and maintenance costs; equipment such as depth finders and auto pilots; rods and reels; transportation to and from the fishing area; guided fishing trips; and attire such as vests, jackets, waterproof clothing, and boots. The United States Fish and Wildlife Service reported that in 2006, the average fisher spent $1,407 per year for costs related to fishing (U.S. Fish and Wildlife Service 2006). One percent of this, using Scheuhammer and Norris's estimates, would amount to only $14 for sinkers yearly.

A 1995 study estimated that the average angler would spend up to an additional $10.00 per year for the use of non-toxic sinkers, and that switching to lead-free alternatives would, in most cases, cause an increase of less than one percent in the average recreational angler's annual expenses (Scheuhammer and Norris 1995). The

EPA, in 1994, estimated that anglers spent about $1.50–$3.50 per year on sinkers and that the average increase in annual costs to individual anglers in switching to alternative sinkers and jigs would be less than $4.00 (U.S. Environmental Protection Agency 1994). In a Canadian study, Scheuhammer (2009) also acknowledged that many of the non-lead tackle products are more expensive than lead, but that switching to non-lead products was estimated to increase the average Canadian angler's total yearly expenses by only about $2.00. The Washington Departments of Ecology and Health expect that replacing lead fishing weights with non-toxic alternatives will increase the cost of fishing weights by a factor of up to 4.5, depending on the type of alternative tackle used (Washington State Department of Ecology and Washington State Department of Health 2009).

Unfortunately, anglers tend to view the slightly higher costs of non-toxic tackle as a government imposition upon an unquestionable right rather than a reasonable users' fee to help maintain the sustainability (or prevent the deterioration) of a recreational practice and reduce the toxic risk of that practice to wildlife. The small increase in costs needs to be viewed in terms of a balance between rights and responsibilities (Thomas 1997).

Economic Impacts to Industry

A fair amount of the resistance to regulation of lead fishing tackle has come from the lead manufacturing and fishing tackle industries, including small-scale and home manufacturers (often referred to as the cottage industry). Although home manufacture is substantial (t is estimated that between 0.8 and 1.6 million anglers may produce their own lead sinkers), fewer than ten major manufacturing companies account for most of the domestic industrial production of lead fishing sinkers (U.S. Environmental Protection Agency 1994).

Direct costs to industry due to switching to non-lead alternatives include investments for conversion of existing production lines into production lines based on substitute materials, as well as operational and administrative costs. The conversion costs consist of two separate components: costs for development of new products (research and development) and cost for adaptation of existing machinery (Hansen et al. 2004). For example, a recent European analysis of the advantages and drawbacks of restricting the marketing and use of lead in fishing sinkers states that the production of tin sinkers would likely require major changes in manufacturing design because, due to the hardness of the tin, the sinker has to be fastened to the line in a different way (Hansen et al. 2004). However, this is somewhat in dispute, as the EPA maintains that that tin sinkers are actually easier to affix to the line than are lead sinkers (U.S. Environmental Protection Agency 1994).

The manufacturing of cast iron or steel sinkers is more complicated and would typically have to take place in iron and steel foundries. In Britain, where the ban went into effect in 1987, the change from lead to alternatives like tin required some development of technology and investment in new tools (e.g., new molds). By the time the law went into effect, the number of manufacturers of split-shot and small sinkers in Britain decreased from about ten to four (Hansen et al. 2004).

It is unclear what the actual costs to industry might be to switch from manufacturing lead tackle to non-toxic alternatives. The EPA ran an economic analysis when it was first proposing its ban in 1994, but the economy and the manufacturing industry have changed significantly since that time. Because so many non-lead sinkers and jigs are already available, a state-by-state or nationwide conversion to the use of non-lead tackle by anglers would have less of an impact now than it might have had 16 years ago.

Industry has been concerned that, due to the higher price tags associated with non-lead tackle, sales would decrease as anglers purchased less tackle. However, this has not proven to be the case in Great Britain, where the sale of alternative sinkers boomed within the first three years following the 1987 ban, because anglers had to replace their lead sinkers with the non-toxic substitutes. After three years, the volume of sinker sales returned to the same level as before the ban, indicating that overall demand was unaffected by increases prices (Hansen et al. 2004).

Studies of the cost impact on consumers have clearly shown that the impact of switching to non-lead tackle is relatively minor; therefore, the production and sale of sinkers would not likely be affected negatively by a switch to alternative materials. Any decreased commerce in lead would likely be offset by an increased sale of other, substitute metals (Scheuhammer and Norris 1996). Furthermore, as stated in Principle 16 of the Rio Declaration on Environment and Development, the polluter should, in principle, bear the cost of pollution (UNCED 1992). This principle is already broadly applied to industry; applying it to anglers is equally sensible.

In examining economic consequences of regulating lead fishing tackle, one must also consider the detrimental economic effect of lead tackle use in terms of waterfowl deaths. Birds have value to society in terms of human recreation: bird watchers, photographers, hikers, and campers, have a stake in the existence of robust bird populations. Many are willing to pay for this type of recreation, for example, going on guided birding tours or contributing to support of wildlife refuges.

Non-Toxic Alternatives to Lead Sinkers and Jigs

Most of the likely metal candidates to substitute for lead have been proposed and evaluated (Thomas and Guitart 2003). The EPA lists substitutes for lead sinkers that they have determined to be less toxic to waterbirds than lead. These include tin, copper, antimony, bismuth, steel, tungsten, and terpene resin putty. The EPA asserts that these substitutes for lead fishing sinkers should perform as well as lead (U.S. Environmental Protection Agency 1994). Additional options are sinkers made of rubber, ceramic, granite, or clay (Scheuhammer 2009, Michael 2006).

Although it is bird species that are most likely to be directly exposed to fishing sinkers (by ingestion), in order to determine the effect of lead fishing sinker substitutes on the environment, the EPA evaluated their toxicity to terrestrial animals (rats, mice, and ducks) and aquatic organisms (fish, oysters, crustaceans, clams, worms, insects, and algae) using available studies (U.S. Environmental Protection Agency 1994). Zinc, although less toxic than lead, can also cause fatal poisoning when ingested, and therefore is not recommended as an alternative. Unfortunately, when Great Britain banned the use of lead weights in 1987 but did not conduct a scientific process to evaluate alternatives, it did not simultaneously ban the use of zinc weights. Zinc is therefore commonly used in the U.K. as a "non-toxic" substitute for lead sinkers (Thomas and Guitart 2003). Brass contains a significant amount of both lead and zinc (up to 8 and 20 percent by weight, respectively), and it is therefore not a suitable alternative to lead (U.S. Environmental Protection Agency 1994).

Other than cost, density of weights is the major concern to anglers, as lower-density weights will necessarily be larger than equally weighted lead counterparts. Also, substitutes for lead split shot need to be malleable and have a soft edge so that fishing lines are not damaged when substitute weights are crimped or squeezed onto the line. Although it is less dense than lead, tin is suitable for use as split shot due in part to its softness. The main disadvantage of tin sinkers is that because tin is less dense than lead, tin sinkers have in roughly a 50-percent increase in volume over lead at the same weight as lead split shot (U.S. Environmental Protection Agency 1994). However, as lead sinkers are typically quite small, a 50-percent increase in volume still yields a fairly small sinker. The density of tungsten, on the other hand, is significantly higher than lead (19.3 g/cc for tungsten versus 11.34 g/cc for lead) and therefore, for any given mass, tungsten sinkers are 41 percent smaller in volume than lead sinkers (Massachusetts Toxics Use Reduction Institute 2006).

Bismuth is an appealing material for use as alternative to lead sinkers. Because of bismuth's low melting point (slightly lower than lead's, and lower than those of copper and steel), bismuth sinkers can even be manufactured at home, using a lead sinker mold. Further, bismuth's density is only slightly lower than that of lead (9.78 g/cc vs. 11.34 g/cc), meaning a bismuth sinker would be only slightly larger than a comparably weighted lead sinker. Bismuth cannot effectively replace lead for split shot because of its brittleness, which results in breakage when it is crimped onto the line.

As laws in some states requiring anglers to use lead-free tackle have been put into effect, manufacturers have stepped up production of many more options for weights and jigs (Michael 2006). And as production has increased, many retailers now sell alternatives to lead tackle. The ban on the use of lead shot for hunting waterfowl in 1991 in the U.S. brought about significant innovation in the industry, and nontoxic alternatives are now widely accepted by sportsmen (Pokras and Kneeland 2008). Further innovation in non-toxic fishing tackle is just as likely to increase beyond what has already been developed in response to restrictions on lead gear. A quick online search shows that lead-free sinkers and jigs are readily available. For example, Cabela's carries an assortment of non-toxic sinkers and jigs. Most are made of tungsten or steel. In addition to Cabela's, other online and brick-and-mortar retailers of non-toxic tackle include Orvis, Green Tackle, Hometown Hardware, South Bend Sporting Goods, Friendly Hardware, Fish Freak Online, and Boss Tin to name just a few. (See Appendix 1 for a list of several manufacturers and suppliers of non-toxic fishing tackle.) And as far back as 1994, during the comment period for the EPA's proposed ban, Sportsman's Supply, a distributor of fishing tackle products servicing several tackle retailers in the U.S., stated that bismuth jig heads were selling and were accepted by both dealers and consumers (Sportsman's Supply 1994).

Regulatory Authority

Lead is regulated in the United States and in Washington under various regulatory acts and by various agencies. For example, the U.S. Fish and Wildlife Service presides over non-toxic regulations under the Migratory Bird Treaty Act, while the EPA proposed the ruling on non-toxic fishing weights under the Toxic Substances Control Act (Thomas 1997). Within Washington, the Washington Department of Fish and Wildlife establishes fishing regulations, but sections of the Revised Code of Washington (RCW) and the Washington Administrative Code (WAC) also govern the use and release of toxic substances. Legislation suitable for regulating the use of lead fishing weights in Washington already exists. A brief summary of some of the regulatory acts and agencies under which lead fishing sinkers could theoretically be regulated follows.

Regulatory Authority in the U.S.

U.S. Clean Water Act

The U.S. Clean Water Act (CWA), initially passed in 1972, establishes programs to prevent or control water pollution. The CWA lists lead and lead compounds as priority pollutants. The Act and its amendments prohibit people from discharging pollutants from a point source without a National Pollutant Discharge Elimination System (NPDES) permit (Washington State Department of Ecology and Washington State Department of Health 2009).

Federal Hazardous Substances Act

The Federal Hazardous Substances Act (FHSA), initially passed in 1960 and amended several times, grants the Consumer Product Safety Commission (CPSC) the authority to regulate protection of consumers from products containing hazardous substances. The FHSA requires that products containing any hazardous substance bear cautionary labels stating such. Under the FHSA, the CPSC has the authority to ban certain products containing hazardous substances (Washington State Department of Ecology and Washington State Department of Health 2009).

Pollution Prevention Act

The Pollution Prevention Act (PPA) of 1990 promotes the prevention and reduction of pollution at its source whenever feasible; its approach to pollution is to prevent problems before they occur. The PPA encompasses the pollution of air, water, and land. Pollution prevention as defined in the PPA means reducing or eliminating waste at the source by modifying production, the use of less-toxic substances, better conservation techniques, and re-use of materials. The PPA seeks to address the historical lack of attention to source reduction. Text from the PPA states that "Congress declared it to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible" (U.S. Environmental Protection Agency 2008).

Regulatory Authority in Washington State

Water Pollution Control Act, RCW 90.48

Washington's Water Pollution Control Act was established in 1945. The text of section 09.49.010 reads as follows:

> It is declared to be the public policy of the state of Washington to maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods by industries *and others* to prevent and control the pollution of the waters of the state of Washington. It shall be unlawful for *any person* to throw, drain, run, or otherwise discharge into any of the waters of this state, or to cause, permit or suffer to be thrown, run, drained, allowed to seep or otherwise discharged into such waters any organic or inorganic matter that shall cause or tend to cause pollution of such waters according to the determination of the department, as provided for in this chapter.

(Washington State Legislature 1945, emphasis added).

Water Quality Standards for Surface Waters, 173-201A WAC

This chapter of the Washington Administrative Code took effect in 1992. It implements Chapters 90.48 and 90.54 of the Revised Code of Washington in order to protect the water quality of surface waters of the state. The Washington Department of Ecology establishes criteria for surface water quality, institutes an anti-degradation policy, and implements use-based protection measures (Washington State Department of Ecology and Washington State Department of Health 2009).

Sediment Management Standards, Chapter 173-204 WAC

Enacted in 1991, this chapter establishes marine, low-salinity, and freshwater surface sediment management standards. Its purpose is to reduce health threats to humans and other biological resources that result from surface sediment contamination (Washington State Department of Ecology and Washington State Department of Health 2009).

Washington Department of Fish and Wildlife, Fish and Wildlife Commission

The Fish and Wildlife Commission’s primary role is

> to establish policy and direction for fish and wildlife species and their habitats in Washington and to monitor the Department's implementation of the goals, policies and objectives established by the Commission. The Commission also classifies wildlife and establishes the basic rules and regulations governing the time, place, manner, and methods used to harvest or enjoy fish and wildlife.

(Washington Department of Fish and Wildlife n.d.). The Fish and Wildlife Commission has the authority to adopt, amend, and repeal rules concerning the equipment and methods that may be used in the state for taking wildlife and fish. Using this authority, the Commission has prohibited the use of toxic shot in some of the state's wildlife areas and when hunting for waterfowl, coot, or snipe (Washington State Legislature 2009).

The Path Forward

Because of the high level of opposition to the 1994 proposed ban, along with the Appeals Court's stripping of the Toxic Substances Control Act in the *Corrosion Proof Fittings* case, the EPA has so far not been able to regulate lead fishing tackle. Even if the 1994 proposed ban had become law, it would not have had any legal effect on anglers' ability to use lead sinkers or jigs; the ban would have regulated only the manufacture and sale of lead tackle. In the absence of federal legislation, it may be up to states to regulate the use of lead tackle. There is certainly opposition to regulation in states as well, but Washington has the regulatory authority to control the use of lead fishing tackle. Other states have passed bans, and their economies have not bottomed out due to such regulation, nor have anglers abandoned their pastime *en masse*. States that have passed bans have been able to do so partially by using evidence of waterfowl toxicosis to highlight the harm done by discarded lead tackle. It is important that Washington enact regulation of lead fishing tackle. Two recent attempts have been made: one (concerning 13 lakes that support common loons) has not been adopted; the other (statewide) has not been put to a vote.

5. Analysis and Recommendations

Analysis

In 2005, the U.S. Consumer Product Safety Commission announced a nationwide recall of 1.5 million children's fishing rods after it was determined that the paint on the rod exceeded the limit of 0.06 percent lead. The recall advised discontinuing use of the fishing rod immediately (Pokras and Kneeland 2008). And in March 2009, the U.S. Consumer Product Safety Commission announced a recall of about 2,600 of the "Shakespeare Casting Game and Fishing Kit" because the label on the fishing rod contained high levels of lead, in violation of the ban on lead in paint. The recall advised immediately taking the recalled game away from children and advised consumers to stop using the recalled products immediately (Consumer Products Safety Commission 2009).

Yet at the same time as the 2005 recall, "The Ultimate Fishing Kit for Kids" was available for sale by an online retailer specializing in children's fishing gear. The kit included a plastic tackle box packed with 78 lead fishing sinkers (Pokras and Kneeland 2008). Currently, the online retailer "The Kids Fishing Shop" sells a variety of tackle and other fishing gear specifically for children. The disclaimer on their web pages states that "The fishing products we sell are real. They may include lead weights and sharp hooks. Close adult supervision is strongly recommended!!" (The Kids Fishing Shop 2010). These and countless other similarly lead-stocked fishing kits designed for and marketed to children continue to be widely available and have never been subject to a recall (Pokras and Kneeland 2008).

These examples underscore the disparities among levels of protections and regulations regarding lead and highlight the inconsistency of how lead is addressed in terms of consumer products. Because the risks of the use of lead to humans and wildlife are widely known, and so many precedents have been set controlling and reducing the prevalence of lead use in products such as paint and gasoline, one might expect expansive support for a swift phase-out of lead fishing tackle. However, resistance to the regulation of lead sinkers and jigs has been broad and persistent, and it has been allowed to stand in the way of a general draw-down of the manufacture and use of lead tackle, against scientific evidence and reason.

Thomas (1997) points out that the perception of hunters and anglers of themselves as the major conservationists and protectors of wildlife in society has been and continues to be an attitude that interferes with reconciling the reality of the severe health effects lead poisoning has on wildlife and people with their ongoing use of lead in their sport. Thomas asserts that this attitude is an outgrowth of their usual financial support of their sport through such things as license fees and financial contributions for habitat acquisition to organizations such as Ducks Unlimited or Trout Unlimited. In this light, to hunters, anglers, and their representative organizations, the detriments of lead poisoning pale by comparison with the multiple goods that many such outdoor recreational hobbyists believe they provide to both wildlife and society (Thomas 1997).

Some of the reasons given for opposition to a ban on lead fishing gear were detailed in chapter four. These include, but are not limited to, a purported lack of scientific evidence for harm to humans or wildlife from the use and loss of lead tackle, increased costs of non-toxic tackle, a projected financial burden on both the cottage industry and the larger tackle manufacturing and retail industries, and a fear of government's encroaching on anglers' rights and even attempting to curtail fishing itself.

The claim that there is insufficient scientific evidence of substantial harm to waterfowl populations from ingestion of lost lead tackle is best met with both the existing scientific evidence and the Precautionary Principle. As a preface, Thomas (1997) explains that, extensive documentation of waterfowl poisoning by ingestion of lead tackle aside, "except for British mute swans, in no instance have the reported mortality levels from lead poisoning been of such a magnitude that they could be blamed, with a high degree of probability, for any population's decline or endangerment." Groups and individuals opposed to a ban on lead fishing weights expect that before limitations on lead can be imposed, scientific evidence must identify the critical threshold level of lead poisoning at which population decline begins.

Thomas (1997) goes on to explain that "This experiment cannot be performed under realistic field conditions on wild waterfowl and fish-eating birds because of limitations posed by the large number of birds which need to be monitored and the other complicating factors which defy control." Rather than assuming that regulation of lead tackle should be based upon rigorous scientific study alone, the Precautionary Principle states that: "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation" (UNCED 1992). Viewed through the lens of the Precautionary Principle, the need to curtail the use of lead fishing gear does not arise from some threshold level of lead-induced mortality only above which remedial action is initiated. Rather, limits on lead tackle become necessary in light of the existence and extent of lead toxicosis or water pollution already present (Thomas 1997).

Markowitz and Rosner (2002) agree that the demand for ever-more scientific evidence of harm is usually nothing more than a stalling tactic, and that advocates for change must move beyond this ploy. They cite only one of many examples of how, when the burden of incontrovertible proof of large-scale harm is put on science alone, unnecessary suffering and irreparable damage can occur. Their example is that of the inability of science in the 1920s to prove that lead in gasoline was dangerous, which resulted in severe damage to children for more than a half century beyond that time. The authors advise that “in the absence of final proof, the government must step in to protect a fragile environment from a host of man-made insults” (Markowitz and Rosner 2002).

In response to those who would continue to demand that population-level effects be demonstrated as a necessary reason to control lead tackle, the EPA in its 1994 proposal described how the loss of relatively small numbers of loons can impact populations, especially if those populations are already small:

> If only a few of these loons die from poisoning due to ingestion of a lead- or zinc-containing fishing sinker, there will be fewer birds to reproduce, and less future offspring. This is of particular concern regarding endangered species where both the total and local populations are low, and the loss of an individual is very significant. Therefore, deaths of individual birds may in turn impact the total population of avian species. However, direct effects may only be seen concerning individuals, or local breeding populations.

(U.S. Environmental Protection Agency 1994).

The EPA’s 1994 proposal continues in describing the broader effects of waterfowl die-off from lead poisoning. Because populations of waterbirds do not occur in isolation, but rather in conjunction with other populations of animals and plants in the ecosystem, the health of one population is often interconnected with other populations in a natural system. Lead fishing sinkers may therefore cause indirect adverse effects on organisms and populations beyond waterfowl that ingest sinkers, causing disruptions within food webs in ecosystems, such as predatory/prey and competition relationships (U.S. Environmental Protection Agency 1994).

Regardless of the difficulty described above in fully determining the impacts on waterfowl populations, it is difficult to dispute the fact that lead fishing sinkers and jigs remain a source of unnecessary toxic threat to wildlife. This is only exacerbated when the populations are already stressed due to other factors such as loss of habitat. EPA further stated that it “does not believe it is necessary to demonstrate population effects before taking regulatory action” and that

> The scientific evidence demonstrating the severe adverse effects to waterbirds from the ingestion of lead- and zinc-containing fishing sinkers, the economic, social, and environmental value of these birds, and the low costs and availability of substitutes for these sinkers, outweigh any costs that would result from imposition of the proposed regulation.

(U.S. Environmental Protection Agency 1994).

Thomas (2005) also points out that, regardless of whether scientific studies can or cannot determine threshold levels at which populations begin to fall off due to lead toxicosis, the toxicological process of lead poisoning of waterbirds, from ingestion through fatality, is extremely well understood and documented. The remedy for this widespread problem is extremely simple and straightforward, and it is the switch to widely available, effective, non-toxic substitutes.

Type I and Type II Errors

The issue or whether or not to regulate lead tackle in the absence of overwhelming scientific evidence and in the presence of high levels of resistance can also be viewed in terms of Type I and Type II errors. The Type I error, also known as a false positive, is the error of rejecting the null hypothesis when it is actually true. The null hypothesis in this case would be that the use and loss of lead fishing sinkers and jigs poses no appreciable harm to humans, wildlife, or the environment. In making a Type I error, we would assume that the use and loss of lead tackle does indeed pose risks even if this assumption were false (i.e., the null hypothesis is true). The risk involved with making this Type I error, regulating lead tackle even if no hazard to humans, wildlife, or the environment is posed by its use, would be that anglers and industry would incur unnecessary costs and inconvenience. Conversely, a Type II error, also known as a false negative, would involve assuming that the use and loss of lead tackle poses no harm to humans, wildlife, or the environment when it actually does pose this harm (i.e., that the null hypothesis is false). The risk of making a Type II error in this case would be that in spite of the hazards posed by the use and loss of lead sinkers and jigs to the environment, lead tackle use is allowed to continue unregulated and unabated.

Many of those opposed to regulation of lead tackle have emphasized that multiple factors threaten waterfowl, including boat propellers, habitat loss, and, other forms of pollution (e.g., soft drink six-pack rings and other plastics, oil spills, etc.). Drawing attention to other sources of wildlife mortality appears to serve as a simple diversion from the lead tackle issue. The upshot of this sophistry is that because wildlife can be threatened on many levels, one straightforward and clear-cut way to reduce that threat (banning the use of small lead sinkers and jigs) should be ignored. Contrary to this argument, as common loons are listed as sensitive species in Washington, it is advisable that **all** reasonable steps be taken to limit all human-created disturbance factors, including fishing-sinker-induced lead toxicosis.

The American Sportfishing Association contends that the costs that would be incurred by American anglers in switching to nontoxic tackle are too high relative to the number of birds saved to make regulation reasonable or worthwhile. However, Thomas (2005) states that such “environmental costing” is rejected by many in society. Thomas also points out that recent U.S. court decisions, in cases concerning forestry practices and spotted owls in the Pacific Northwest, and dolphin-friendly tuna fishing practices, uphold the view that American wildlife will not receive a marketplace value. This means that fishers should be required to bear the cost of not causing harm to wildlife and their habitat.

Principle 16 of the Rio Declaration On Environment And Development states that:

> National authorities should endeavor to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment (UNCED 1992).

This is often called the “polluter pays principle.” This principle has been applied already to many areas of industry. There really is no logical reason that it should not also be applied to anglers in the form of the intrinsically higher costs of non-toxic sinkers and jigs. The reality that the costs of non-lead fishing tackle are only marginally higher than of lead weights, especially in the context of the entire cost of fishing, as described in chapter four, serves to further weaken the economic burden argument.

Many wildlife poisonings and other health maladies are a result of non-point-source industrial, agricultural, or municipal releases of pollution. Lead poisoning of waterfowl by ingestion of lead fishing tackle, however, can be attributed directly to the activities of individuals. More and more, society has placed restrictions on many industrial sectors with regard to levels of toxic emissions and releases. It appears that anglers and angling organizations are reluctant to apply such stringent criteria to their own activities, even if they agree that toxic emissions in industry and agriculture should be controlled. This inconsistency is likely explained by the difference in scale. The relatively low levels of lead lost by individual anglers (usually measured in grams or ounces per year) appears small, versus the tonnage collectively emitted by industries and municipalities (Thomas 2005). When taken collectively, however, releases of lead into the environment by anglers is measured in the thousands of tons annually in both the U.S. and Canada (Scheuhammer et al. 2003). The restrictions placed on industry must also rightly be placed on individuals who, in the aggregate, unnecessarily release astoundingly large quantities of lead into our nation's and state's waterways each year.

Recommendations

<u>Education</u>

Pokras and Kneeland (2008) assert that "Strict legislation banning the use of lead hunting and fishing gear that does not provide for the interests of sportsmen would result in ardent protest, low compliance, and ultimately would fail to resolve the lead-poisoning issue." These authors advocate having scientists and health professionals collaborate with hunting and fishing groups and approaching the issue in a way that encourages people to take a proactive role in eliminating the use of lead tackle. The importance of educating the angling public of the risks to wildlife and themselves of handling and depositing lead tackle in waterways cannot be understated. Educating anglers about the scientific and ecological reasons for transitioning away from lead and to non-toxic alternatives is essential, and without a concerted educational program, compliance will almost certainly be low. Because many sportsmen are unaware of the ecological harm caused by the use of lead tackle, Pokras and Kneeland (2008) recommend employing an educational campaign that appeals to the conservationist roots of hunters and anglers.

Washington State, through the Departments of Health and Ecology, also supports educational measures to reduce exposure to and releases of lead. In their *Lead Chemical Action Plan* (2009), the Departments of Health and Ecology point out that it is not uncommon for people in Washington to have inadequate knowledge of lead hazards and how to reduce exposure. The *Lead Chemical Action Plan* specifies approaches that have shown to contribute to success in reducing lead exposure and releases. These approaches include "ensuring that people understand the dangers of lead by increasing public awareness about lead hazards and how harmful exposures can be prevented." In conjunction with its support of educational efforts, one of the several recommendations made in the *Lead Chemical Action Plan* (under the category of Reducing Exposures from New Products), is to "work with stakeholders to reduce the lead in products that have non-lead alternatives" (Washington State Department of Ecology and Washington State Department of Health 2009). Lead fishing tackle certainly falls within this category, and an educational program combined with working with stakeholders to reduce lead in tackle products is clearly supported in principle (if not financially) by Washington State.

Recall also from Sears and Hunt's 1991 study (discussed in chapter three) that the deaths of mute swans throughout England due to lead poisoning dropped in the mid 1980s, prior to the 1987 ban on lead tackle. The authors surmised that the educational program aimed at raising awareness of the harmful effects of lead tackle instituted around this time may have decreased the number of lead sinkers and jigs used by anglers, thus decreasing the waterfowl mortality rate due to lead sinker ingestion (Sears and Hunt 1991).

Education alone, however, can be used as a delay tactic and can also foster the illusion that the problem is being addressed, if not solved, and will be ameliorated by education alone, when this is rarely the case. Twiss and Thomas (1998) contend that

> By initiating public education campaigns requesting that anglers voluntarily switch to lead-free fishing weights, government agencies can claim to be taking action on the issue, while incurring minimal expense, particularly if non-government organizations are such partners. This avoids conflicts with the groups and individuals opposed to legislative change.

Scheuhammer and Norris concur, stating in their 1995 Canadian Wildlife Service paper that addressed both lead shot and lead fishing tackle, that "encouraging a voluntary switch to non-toxic shot use in Canada has been generally ineffective." As essential as education is, it alone is unlikely to bring about the badly needed course correction away from lead and towards non-toxic tackle. For example, when interviewing anglers to whom they had given on-site education about the toxicity of lead fishing tackle, Poleschook and Gumm (2009) found that although many anglers did not dispute that lead fishing tackle is harmful to wildlife and the environment, they would not switch to lead-free alternatives unless a ban required them to do so.

Often the only way to effect a wholesale change in behavior is through regulation first, and a shift in public attitudes will follow through education and the institution of new norms. If, through regulation, the use of non-lead tackle were to become the standard, those who currently know no other way to fish than with lead will be faced with a necessary push to switch to alternatives. Over time, and with the complement of educational programs, such anglers will become fewer, outmoded, and less influential. A shift to non-toxic alternatives may be somewhat difficult at first, but once non-toxic alternatives become the mainstay of the market and the sport, current concerns about the difficulty of the transition will be a thing of the past. An uncomfortable shift is often necessary in order to move past a detrimental practice toward one that is less damaging to the environment, wildlife, and users themselves. With a combination of regulation and education, a new generation of young anglers will grow up never having used lead sinkers, and never having considered the casual use of something so highly toxic to be acceptable.

Voluntary efforts and education did not get lead out of paint, gasoline, or children's toys. History has shown that regulation has been the only truly effective mechanism for minimizing or eliminating lead from consumer products and that released to the environment. Resistance from users, manufacturers, and suppliers was strong in each of these cases as well, and regulation was the tool that turned the tide on the addition of lead to such products. As important as education is, it alone is unlikely to bring about a significant reduction in the amount of lead tackle being put into the environment.

Regulation

Not only is a ban in Washington reasonable, it is also necessary in order to curtail common loon and other wildlife deaths from lead poisoning. Recent precedent already exists for such a ban and transition to non-toxic alternatives. In 1991, the U.S. prohibited the use of lead shot in waterfowl hunting because too many waterfowl were being poisoned by lead shot. The result of this regulation was that, although accustomed to and comfortable with using lead shot, hunters adapted, and manufacturers adjusted their production. The ban prompted innovation and improvements in non-lead shot, and the end result was lower prices for non-lead shot than the original costs. Because some states already regulate lead tackle, and awareness of the toxicity issue is increasing, the same changes in terms of attitudes, behavior, and production have already begun to occur with respect to lead sinkers and jigs. When manufacturers have an incentive to change their operations, they will expend the capital necessary to convert to the production of non-lead weights. And when lead sinkers and jigs are banned, an increase in the availability, affordability, and performance of non-lead alternatives will soon follow (Wisconsin State Environmental Research Council 2003).

Opposition to a statewide or nationwide ban on lead weights of certain sizes has led to other, more narrow, regulatory options being proposed, including requiring the use of non-toxic substitutes in only those areas where a known high risk of waterfowl toxicosis occurs. This option has been suggested largely to minimize the impact of a statewide or national ban on anglers, rather than to reduce the harm to waterbirds (Thomas 2007). This may be the rationale behind the Washington Department of Fish and Wildlife’s recent proposal to regulate small lead fishing tackle on 13 Washington lakes known to be used by common loons. Because common loons migrate within North America, unified regulation throughout the species’ range, especially by Canada and the U.S., would offer the highest level of protection to loon populations (Twiss and Thomas 1998). Nevertheless, viewing the problem of lead fishing tackle as one limited to waterfowl poisoning confines the discussion and the proposed policies to only one aspect of the issue. All the effects of this matter must be considered in order to work toward an effective solution.

A nationwide ban would be the most effective, comprehensive, and consistent way to regulate lead fishing tackle, as there are inconsistencies among the few states that already regulate lead tackle. Recall from chapter three that New Hampshire banned the use of lead weights, but not their sale or production. Maine and New York both prohibit the sale of certain sizes of lead sinkers, but not their use. Vermont prohibits both the sale and use of lead tackle. Furthermore, the EPA (1994) determined that zinc and brass weights are also toxic to waterfowl; a nationwide ban would preclude other toxic materials and also specify approved substitutes (something that does not appear to be addressed by individual states' regulations). In addition, ongoing and increasing reduction of waterfowl habitat due to human population increases and encroachment may cause the places that common loons and other susceptible waterfowl occupy while migrating, resting, and breeding, to become more widely separated. Requiring that nontoxic tackle be used only where mortality currently occurs is not rational, as migratory birds are vulnerable to lead poisoning at most points along their annual routes. For these reasons, a nationwide ban would do the most to reduce the incidence of lead poisoning throughout ranges of migratory birds (Thomas 2005).

Although nationwide regulation of use, manufacture, and sale of lead tackle would effect the highest level of consistency and protection, it does not appear that the EPA's proposal will become law anytime soon. Not only that, but the EPA's 1994 proposal contained a fatal flaw in that it would not have banned use of lead tackle (only the sale and manufacture). The next best option for control of lead tackle is a state-by-state approach to regulation. As the Puget Sound Partnership works toward its mission to restore and protect Puget Sound by 2020, Washington needs to take a comprehensive and consistent leadership position on regulating lead fishing tackle and continue the precedents set by the handful of northeastern states that have already put regulations in place. As individual states come to ban the use, sale, and manufacture of lead fishing tackle, the ensuing momentum will begin to counteract the present resistance and foster a shift in both attitudes and behavior.

Conclusion

In December 2009, 13 states, including Washington, signed the *States' Principles on Reform of the Toxic Substances Control Act*. The rationale behind the forming of this set of eight principles is that the 33-year-old Toxic Substances Control Act does not contain powerful enough tools to safely monitor and control chemicals used every day in the United States. This was certainly corroborated by Ms. Heinzerling's testimony, as shown in chapter three. One of the principles in the *States' Principles* document is entitled "Demonstrate Chemicals and Products are Safe." It asserts that "Manufacturers should provide the necessary information to regulators to conclude that new and existing chemicals and products in commerce are safe and do not endanger the public or the environment. The public has a right to expect that the products they use are safe" (States' Principles on Reform of the Toxic Substances Control Act 2009). The lead products that most anglers use to weight their lines and lure fish have been shown unequivocally to be unsafe for humans and wildlife. And yet many in the segment of the public that uses these products either do not understand the toxic effects of lead or do not think that their individual use of lead is a problem that should be modified at all, let alone controlled through regulation.

Commenting on the *States' Principles* document and the rationale behind its development, Washington State Department of Ecology director Ted Sturdevant voiced his support for regulation of toxics, if not at the federal level, then by individual states:

> Without adequate protection at the federal level, it has fallen to the states to protect people and the environment from the toxic chemicals that are causing harm. But dealing with toxic contamination after the fact is ultimately futile–the human, environmental and economic damage is already done. We need a federal law that prevents contamination from happening in the first place, and phases out the harmful chemicals that are already in widespread use. That's common sense, but it's not the system we have today.

(Washington State Department of Ecology 2009). This statement clearly summarizes all that is wrong with the legal use of lead fishing products. In addition to the mountains of evidence establishing the toxicity of even the lowest levels of lead exposure, common sense dictates that lead should not be allowed to be deposited in our state's rivers, lakes, and marine waterways. In the absence of Mr. Sturdevant's aim of a federal law that prevents contamination, it falls to the states to prevent ongoing contamination of our state's waterways by lead fishing tackle.

It is of little import that lead has been mined, smelted, and used for thousands of years. Traditional ways of making products, when known to be harmful, must be phased out. Over the last several decades, many once-common uses of lead have been reduced or eliminated, including lead in paints, water pipes, solder, pottery glazes, gasoline, and children's toys. Less-toxic materials and production processes have been developed to take their place. There exists a long history of externalizing the costs of lead use in such products, and that externalizing continues today with lead products that are still in use. This is true as well for lead tackle, as it is very inexpensive, despite the fact that as soon as it is lost on a riverbank, it becomes the concern of all of society, who must then bear the costs of environmental degradation. Lead fishing tackle remains a significant source of ongoing pollution, despite its known consequences to the environment and to the health of humans and wildlife. Lead has always been cheap, and for this reason alone, the serious health and environmental risks associated with lead have for too long been eclipsed by its economic value. Policy decisions about lead poisoning cannot continue to favor the lead industry or economic concerns over the health of humans, wildlife, and the environment.

Lead toxicosis of waterfowl can be moderated by discontinuing the use of lead tackle, without eliminating or even reducing fishing participation. Because functional and affordable non-toxic alternatives to lead are already available, a mandated switch to non-lead fishing tackle will be less disruptive to anglers and industry than many suppose. The adjustment of the attitudes of anglers, suppliers, and manufacturers on such a wide scale will certainly be slower than the practical switch to non-toxic tackle, but a ban will provide a much-needed opportunity to foster the modification of attitudes and practices that are unnecessarily detrimental. In order to promote a change of attitude, it is important that a ban on lead tackle in Washington include a comprehensive educational component that includes all significant stakeholders.

Loon distribution data for Washington presented by Poleschook and Gumm (2009) indicate that although common loons are known to breed in only a few lakes in Washington, migration routes, migration staging water bodies, and the adult winter and juvenile-maturation range encompass far more water bodies, including both salt and fresh water. A ban on the use of lead fishing tackle limited to water bodies where common loons breed would reduce lead exposure for a only very few common loons (approximately 13 breeding pairs), and only for the breeding season. A geographically limited ban would provide little benefit to the larger population of common loons (including juveniles and non-breeding adults) and other waterbirds throughout the year and throughout all of Washington. If common loon mortalities due to fishing tackle-induced lead toxicosis mortalities are reduced by a statewide ban on the use of lead fishing tackle of the sizes waterfowl can ingest, the northward contraction of the common loon breeding range in Washington would be slowed and could possibly even be reversed (Poleschook and Gumm 2009).

Washington's recently introduced House Bill 3158 proposes to ban the sale and use of certain small-sized lead sinkers and jigs throughout the state, which would benefit common loons and other waterfowl in all areas of Washington. Further, it includes an educational component. Section 6 of HB 3158 states that "The department shall provide public education and outreach to disseminate information regarding this chapter." The purpose of the educational program should be to inform the public about adverse effects of lead on wildlife, ways individuals can reduce the amount of lead introduced into the environment, the potential risk to human health from handling and working with lead (especially from making one's own sinkers), and the availability of non-toxic alternatives to lead jigs and sinkers.

Although no details on the proposed educational program are given in the text of House Bill 3158, a comprehensive educational program should consist of distribution of press releases to news media, informational brochures for distribution at licensing outlets and retail stores, televised public service announcements, informational posters for boat access areas and other appropriate bulletin boards, informational booths at public angling-related events, lead tackle exchange events, and information on the Department of Fish and Wildlife's website.

I will conclude with a passage from Pokras and Kneeland's recent paper that focuses on using transdisciplinary approaches to solve the problem of lead poisoning:

> The effects of lead poisoning are not confined to human health nor to any one species of animal. Thus, we will never successfully gain control of the problem unless we take an approach that is all-inclusive. We cannot continue to view the different aspects of plumbism in isolation from one other. Paint, gasoline, occupational exposure, toys, bullets, fishing gear, and all the other sources of lead are not separate issues but rather are components of the same fundamental problem. Bringing together a wide range of stakeholders to participate in the lead-poisoning dialogue will allow us to find solutions that are scientifically accurate, environmentally sound, economically viable, and socially acceptable.

(Pokras and Kneeland 2008).

House Bill 3158 is not currently being pursued because of the shifting priorities related to Washington's present economic crisis. Although the budgets of many state programs have been cut because of the financial crisis, the regulation of lead tackle can be seen as an opportunity for manufacturers and tackle retailers to innovate and benefit from an expanding product niche.

I strongly urge, for the sake of not only Washington's wildlife, but for the environmental integrity that we value, that the bill be considered and passed by the state legislature without delay.

Literature Cited

Agency for Toxic Substances and Disease Registry (subsidiary of the Centers for Disease Control and Prevention). 2007. Available from: http://www.atsdr.cdc.gov/csem/lead/pbphysiologic_effects2.html.

American Sportfishing Association. 2002. The Practical Biological Impacts of Banning Lead Sinkers for Fishing: Position of the American Sportfishing Association.

American Sportfishing Association. 2009. Action Alert—Washington State Anglers Face a Ban on Lead Fishing Tackle—Update. Available from: http://www.capwiz.com/asafish/issues/alert/?alertid=14446771.

Association of Northwest Steelheaders. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1864.

Association of Louisiana Bass Clubs. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-2008.

Beintema, N. 2001. International Update Report on Lead Poisoning in Waterbirds. Wetlands International. Available from: http://www.wetlands.org/WatchRead/tabid/56/ArticleType/ArticleView/ArticleID/1845/Default.aspx.

Boardman, John. Massachusetts Division of Marine Fisheries. Personal communication 2-2-2010.

Canadian Wildlife Service. 1999. Progress Notes No. 213, October 1999.

Canadian Wildlife Service. 2007. Fish lead free. Available from: http://www.cws-scf.ec.gc.ca/flf-psp/index_e.cfm.

Code of Federal Regulations. 1977. Title 16, part 1303.

Delaney, S., J. Greenwood, J. Kirby. 1992. National mute swan survey 1990: Report to the Joint Nature Conservation Committee.

Dzioubinski, O. and R. Chipman. 1999. United Nations Department of Economic and Social Affairs Discussion Paper No. 5. Trends in Consumption and Production: Selected Minerals.

Environalloys. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1826.

Environment Canada. 2004. Fishing lead free: a regulatory proposal.

Federal Register. 1994. Lead Fishing Sinkers; Response to Citizens' Request; Reopening of Public Hearing Reply Comment Period, 49:31463.

Federal Register. 1999. Establishment of lead-free fishing areas, 64:43835.

Federal Register. 2000. 1999–2000 Refuge-Specific Hunting and Sport Fishing Regulations, 65:30772.

Federal Register. 2007. Lead fishing sinkers; response to citizens' petition and proposed ban, 72(82):23254 (Unified Agenda). Available at: http://www.epa.gov/lawsregs/documents/regagendabook-spring07-pt2.pdf).

Federal Register. 2008. Ban of Lead-Containing Paint and Certain Consumer Products Bearing Lead-Containing Paint, 73(24):77492.

Fowler, Ronald. U.S. Fish and Wildlife Service. Personal communication 12-3-2007.

Franson, J., S. Hansen, T. Creekmore, C. Brand, D. Evers, A. Duerr, S. Destefano. 2003. Lead fishing weights and other fishing tackle in selected water birds. Waterbirds 26(3):345-352.

Hakes, D. 2004. Where is lead tackle banned? EJ Magazine, Michigan State University, fall 2004.

Hansen, E., C. Lassen, A. Elbæk-Jørgensen, COWI. 2004. Advantages and drawbacks of restricting the marketing and use of lead in ammunition, fishing sinkers and candle wicks. 216 p.

Heinzerling, L. 2004. Testimony of Lisa Heinzerling, Professor of Law, Georgetown University Law Center, Member Scholar, Center for Progressive Regulation, Before the Subcommittee on Environment and Hazardous Materials of the Committee on Energy and Commerce U.S. House of Representatives Hearing on POPs, PIC, and LRTAP: The Role of the U.S. in Draft Legislation to Implement These International Conventions.

Hoffman, D., B. Rattner, G. Burton, Jr., J. Cairns, Jr., eds. 1995. Handbook of Ecotoxicology. Boca Raton: CRC Press, Inc. 755 p.

Illinois General Assembly. 2009. Available from: http://www.ilga.gov/legislation/BillStatus.asp?GAID=10&GA=96&DocNum=1269&DocTypeID=SB&SessionID=76&LegID=42210&SpecSess=&Session=.

Jacks, G., M. Byström, and L. Johansson. 2001. Lead emissions from lost fishing sinkers. Boreal Environment Research 6:231-236.

Kelly, A. and S. Kelly. 2004. Fishing tackle injury and blood lead levels in mute swans. Waterbirds, the international journal of waterbird biology 27(1):60.

The Kids Fishing Shop. 2010. Accessed at http://www.thekidsfishingshop.com.

Kirby, J., S. Delany, J. Quinn. 1994. Mute Swans in Great Britain: a review, current status and long-term trends. Hydrobiologia 279-280(1):467-482.

Lanphear, B. 1998. The paradox of lead poisoning prevention. Science 281(5383):1617.

Lead Industries Association Inc. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1829.

Lide, D., ed. in chief, H. Frederikse, assoc. ed. 1995. CRC Handbook of Chemistry and Physics, 76th ed. Boca Raton: CRC Press.

Maine Legislature. 1997. 118th legislature, first special session, SP 333, LD 1111, enacted May 19, 1997.

Maine Legislature. 1999. 119th legislature, first regular session, HP 625, LD 875, enacted May 24, 1999.

Markowitz, G. and D. Rosner. 2002. Deceit and Denial: the Deadly Politics of Industrial Pollution. Berkeley: University of California Press. 408 p.

Massachusetts Toxics Use Reduction Institute. 2006. Five Chemicals Alternatives Assessment Study. Lowell, MA: Massachusetts Toxics Use Reduction Institute.

Michael, P. 2006. Fish and Wildlife Issues Related to the Use of Lead Fishing Gear. Washington Department of Fish And Wildlife, Fish Program.

Minnesota House of Representatives. 2003. H. F. No. 192, 83rd Legislative Session.

Minnesota Pollution Control Agency. Accessed March 2010. Lead-free alternatives: Manufacturers and retailers. Available at: http://www.pca.state.mn.us/oea/reduce/sinkers.cfm#manufacturers.

Mississippi Cooperative Extension Service. 1995. Gulf Coast Fisherman, Sea Grant Advisory Service, Mississippi State University, MASGP 95-006(10).

Moore, C. 2003. Silent Scourge: Children, Pollution, and why Scientists Disagree. Oxford: Oxford University Press. 318 p.

Munsen, D. 2004. Common loons in the crosshairs: lead poisoning take its toll on a threatened species. EJ Magazine, Michigan State University, fall 2004.

National Drinking Water Regulations. 1986. U.S. Code title 42, chapter 6a, subchapter xii, part b, § 300g–6.

National Marine Manufacturers' Association. 1994. Comments on EPA's proposed ban on lead fishing tackle. Docket #OPPT 62134-C1-1811.

National Park Service. 2006. Yellowstone National Park Fishing Regulations.

National Park Service. 2009a. March 4, 2009, memo from NPS acting director Daniel N. Wenk re: Get the lead out! An initiative to address lead reduction in National Park Service natural resource activities. Available at: http://www.peer.org/docs/nps/09_26_03_nps_lead_ban.pdf.

National Park Service. 2009b. March 10, 2009, news release, clarification statement. Available at: http://home.nps.gov/applications/release/Detail.cfm?ID=857.

National Party Boat Owners Alliance Inc. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1857.

New Hampshire House of Representatives. 1998. House Bill 1196, final version, 1998 session.

Northland Fishing Tackle. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1759.

O'Brien, Al. Personal communication 4-2-2010.

O'Halloran, J., P. Smiddy, X. Quishi, R. O'Leary, C. Hayes. 2002. Trends in Mute Swan Blood Lead Levels: Evidence of Grit Reducing Lead Poisoning. Waterbirds: The International Journal of Waterbird Biology, v 25, special publication 1: proceedings of the fourth international swan symposium 2001 (2002), p 363-367.

Organisation for Economic Co-Operation and Development. 1993. Risk reduction monograph no. 1: lead: background and national experience with reducing risk. Paris.

Owen, M. 1992. Progress on lead-free shot in the UK, 1991. Wildfowl 43:223-333.

Perrins C., G. Cousquer, and J. Waine. 2003. A survey of blood lead levels in mute swans *Cygnus olor*. Avian Pathology 32(2):205-212.

Peterson, S., R. Kim, and C. Moy. 1993. Ecological risks of lead contamination at a gun club: waterfowl exposure via multiple dietary pathways. Prepared for Society of Environmental Toxicology and Chemistry. Ecology and Environment, Inc., San Francisco, California. 12 p.

Pokras, M. and R. Chafel. 1992. Lead toxicosis from ingested fishing sinkers in adult common loons (*Gavia immer*) in New England. Journal of Zoo and Wildlife Medicine 23(1):92-97.

Pokras, M. and M. Kneeland. 2008. Lead Poisoning: using transdisciplinary approaches to solve an ancient problem. EcoHealth 5:379–385.

Pokras, M., M. Kneeland, A. Ludi, E. Golden, A. Major, R. Miconi, R. H. Poppenga. 2009. Lead Objects Ingested by Common Loons in New England. Northeastern Naturalist 16(2):177-182.

Pokras, M., S. Rohrbach, C. Press, R. Chafel, C. Perry, J. Burger. 1992. Environmental pathology of 124 common loons from the northeastern United States. In L. Morse, S. Stockwell and M. Pokras (eds.), The loon and its ecosystem. Status, management and environmental concerns, p 20–53. American Loon Conference Proceedings, Bar Harbor, Maine.

Poleschook, D. Jr. and V. Gumm. 2009. Recommendation to Ban the Use of Lead Fishing Tackle in Washington.

Prairie State Outdoors. 2009. Comments posted by readers following an online article entitled *Lead sinker, jig ban proposed*, by Jeff Lampe, on February 12, 2009. Available at: http://www.prairiestateoutdoors.com/index.php?/pso/article/lead_sinker_jig_ban_proposed/P50/.

Radomski, P., T. Heinrich, T. Jones, P. Rivers, P. Talmage. 2006. Estimates of Tackle Loss for Five Minnesota Walleye Fisheries. North American Journal of Fisheries Management 26:206-212.

Rattner, B., et. al. 2009. Technical review of the sources and implications of lead ammunition and fishing tackle on natural resources. Extended abstract in R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt (Eds.). Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA. DOI 10.4080/ilsa.2009.

Richardson, S., D. Hays, R. Spencer, J. Stofel. 2000. Washington State Status Report for the Common Loon. Washington Department of Fish And Wildlife, Wildlife Management Program.

Scheuhammer, A. 2009. Historical perspective on the hazards of environmental lead from ammunition and fishing weights in Canada. In R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt (Eds.). Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho, USA. DOI 10.4080/ilsa.2009.0105.

Scheuhammer, A., S. Money, D. Kirk, G. Donaldson. 2003. Lead fishing sinkers and jigs in Canada: review of their use patterns and toxic impacts on wildlife. Occasional paper no. 108, Canadian Wildlife Service.

Scheuhammer, A. and S. Norris. 1995. A review of the environmental impacts of lead shotshell ammunition and lead fishing weights in Canada, Occasional Paper Number 88, Canadian Wildlife Service.

Scheuhammer, A. and S. Norris. 1996. The ecotoxicology of lead shot and lead fishing weights. Ecotoxicology 5:279-295.

Sears, J. 1988. Regional and seasonal variations in lead poisoning in the mute swan *Cygnus olor* in relation to the distribution of lead and lead weights, in the Thames area, England. Biological conservation 46(2):115.

Sears, J. and A. Hunt. 1991. Lead poisoning in mute swans, *Cygnus olor*, in England. Proceedings of the 3rd IWRB International Swan Symposium, Oxford, Sears J, Bacon PJ (eds). Wildfowl Supplement 1.

Sportsman's Supply. 1994. Comments on EPA's proposed ban on lead fishing tackle, Docket #OPPT 62134-C1-1858.

States' principles on reform of the toxic substances control act. 2009. Available at: http://www.ecy.wa.gov/news/2009news/docs/TSCAstatesSIGTFINAL.pdf.

Thomas, V. 1995. Why the U.S. and Canada aren't adopting nontoxic shot and fishing sinkers. International Environmental Affairs 74(4):364-378.

Thomas, V. 1997. Attitudes and issues preventing bans on toxic lead shot and sinkers in North America and Europe. Environmental Values 6:185-99.

Thomas, V. 2003. Harmonizing approval of nontoxic shot and sinkers in North America. Wildlife Society Bulletin 31(1):292-295.

Thomas, V. 2009. The policy and legislative dimensions of nontoxic shot and bullet use in North America. In R. T. Watson, M. Fuller, M. Pokras, and W. G. Hunt (Eds.).

Ingestion of Lead from Spent Ammunition: Implications for Wildlife and Humans. The Peregrine Fund, Boise, Idaho.

Thomas, V. G, and R. Guitart. 2003. Evaluating Non-toxic Substitutes for Lead Shot and Fishing Weights. Environmental policy and law 33(3-4):150.

Thomas, V. G. and R. Guitart. 2010. Limitations of European union policy and law for regulating use of lead shot and sinkers: comparisons with North American regulation. Environmental Policy and Governance 20:57-72.

Toxic Substances Control Act. 1976. U. S. Code title 15, chapter 53.

Twiss, M. and V. Thomas. 1998. Preventing fishing-sinker-induced lead poisoning of common loons through Canadian policy and regulative reform. Journal of Environmental Management 53:49-59.

U.K. Environment Agency. 2009. Lead weights for fishing. Available at: http://www.environment-agency.gov.uk/homeandleisure/recreation/fishing/37941.aspx.

UNCED. 1992. Report Of The United Nations Conference On Environment And Development, Rio Declaration On Environment And Development.

U.S. Consumer Product Safety Commission. 2009. Office of Information and Public Affairs. Pure Fishing Recalls Children's Fishing Games Due to Violation of Ban on Lead in Paint. Accessed at http://www.cpsc.gov/cpscpub/prerel/prhtml09/09150.html.

U. S. Department Of The Interior. 1998. National Park Service, Yellowstone National Park: designations, closures, permit requirements and other restrictions. Available at: http://www.yellowstonenationalpark.com/regulations.htm.

U.S. Environmental Protection Agency. 1994. Lead Fishing Sinkers; Response to Citizens' Petition and Proposed Ban. Federal Register 40 CFR Part 745.

U.S. Environmental Protection Agency. 1996. EPA Takes Final Step in Phaseout of Leaded Gasoline. Available at: http://www.epa.gov/history/topics/lead/02.htm.

U.S. Environmental Protection Agency. 2009a. Semiannual Regulatory Agenda, spring 2009, document number EPA-230-Z-09-001.

U.S. Environmental Protection Agency. 2009b. Regulatory Plan and Semiannual Regulatory Agenda, fall 2009, document number EPA-230-Z-09-002.

U.S. Fish and Wildlife Service. 1999. Service seeks comments on refuge "lead-free fishing areas" plan; phased-in regulations would protect loons from lead poisoning. Available at: http://www.fws.gov/r9extaff/pr9908.html.

U.S. Fish and Wildlife Service. 2006. 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. U. S. Department of Commerce and U.S. Census Bureau.

U.S. Fish and Wildlife Service. 2009. Nontoxic shot regulations for hunting waterfowl and coots in the U.S.

U.S. Fish and Wildlife Service. 2010. Red Rock Lakes National Wildlife Refuge fishing regulations.

U.S. Sportsmen's Alliance. 2010. Contact Your Federal Legislators to Stop Ban on Lead in National Parks. Available at: http://www.ussportsmen.org/Page.aspx?pid=1933.

Vermont State Legislature. 2004. 2003-2004 Legislative Session. Bill H.0516: a prohibition against the use and sale of lead sinkers.

Walling, J. 2010. Office of State Senator Heather Steans, personal communication, 2-26-2010.

Washington Department of Fish and Wildlife. No date. About WDFW: Fish and Wildlife Commission. Available at: http://wdfw.wa.gov/commission/. Accessed April 2010.

Washington Department of Fish and Wildlife. 2009. 2010-2012 Sportfishing Rule Change Proposals. September 2009, p 19. Available at: http://wdfw.wa.gov/fish/regs/rule_proposals/sportfishing_rule_proposals_2010-12.pdf.

Washington Department of Fish and Wildlife. 2010a. Commission tightens conservation guidelines for sturgeon, adopts sportfishing rules. Available at: http://wdfw.wa.gov/do/newreal/release.php?id=feb0910b.

Washington Department of Fish and Wildlife. 2010b. WDFW seeks nominees for advisory group on fishing with lead tackle at lakes with loons. Available at: http://wdfw.wa.gov/do/newreal/release.php?id=may2510a.

Washington Fishing: Washington's Online Fishing Community. 2009. Responses to online article, *Lead Ban - CALL FOR ACTION*, by Jon Sessler, 11-13-2009.

Available at: http://www.wafish.com/group/bassfishing/forum/topics/lead-ban-call-for-action?commentId=2523793 percent3AComment percent3A42046&groupId=2523793 percent3AGroup percent3A87.

Washington State Department of Ecology. 2009. States Urge Federal Action on Toxic Chemicals, News Release December 2, 2009. Avaliable at: http://www.ecy.wa.gov/news/2009news/Maine_TSCA_120209.html.

Washington State Department of Ecology and Washington State Department of Health. 2009. Washington State Lead Chemical Action Plan, publication #09-07-008.

Washington State Legislature. 1945. Chapter 90.48 RCW Water pollution control.

Washington State Legislature. 2009. Senate Bill Report SB 5095, 1-27-09.

Washington State Legislature. 2010. State of Washington 61st Legislature, 2010 regular session, house bill 3158.

West, Bill. Manager, Red Rocks Lakes National Wildlife Refuge, personal communication 2-12-2010.

Wisconsin State Environmental Research Council. 2003. www.serconline.org.

Appendix 1: Manufacturers and Retailers of Non-Lead Fishing Tackle

These lists of companies that sell or manufacture non-lead fishing tackle are not exhaustive. There is some overlap between the two lists. The first list is courtesy of the Minnesota Pollution Control Agency, http://www.pca.state.mn.us/index.php/living-green/living-green-citizen/household-hazardous-waste/get-the-lead-out/get-the-lead-out-manufacturers-and-retailers.html). The second list is courtesy of the Great Lakes Pollution Prevention Roundtable, www.glrppr.org/docs/non-lead-tackle-suppliers.pdf.

1. Minnesota Pollution Control Agency's List

Bass Pro Shops | www.basspro-shops.com
Search their web site for "XPS" and "Excalibur" weights (tungsten), "Ultra Steel 2000," and "Sticky Weight" tungsten putty, "Lake Fork" tungsten jigs, Gremlin Green "bismuth worm sinkers," and "Safe-Sink" densified plastic worm weights.

Big Ten Tackle | www.bigtentackle.com
An online source for ceramic and steel sinkers.

BossTin | www.bosstin.com
Fishing weights made of tin, including split shot, stylers, swivel sinkers, and a variety of egg and bullet sinkers.

Bullet Weights | www.bulletweights.com
Alternative terminal tackle products. "Ultra Steel" sinkers and interchangeable jigs; tin split shot; tungsten bullet and screw-in weights.

Cabela's | www.cabelas.com
This retailer carries many brands of "non-toxic fishing weights" in their online catalog.

Conquistador Tackle Company | www.conquistadortackle.com
The Conquest tungsten bullet slip weight is available in seven different sizes.

Double Necker Rigs | www.doublenecker.com
Fishing rig made from recycled beverage bottles. Use as a bobber or a weight.

Dr. Drop tungsten composite sinkers | http://drdropsinkers.com
Tungsten composite sinkers use exclusive "friction grip" allowing for fast attachment and retrieval. New for 2006, a "click and slide" weight, as well as traditional bullet and bell sinkers in several weights.

Eagle Claw Fishing Tackle | www.eagleclawclassic.com
Colorado retailer's online catalog includes non-toxic removable split-shot made of tin, and a variety of steel sinkers (bass-casting, egg, and rubber core).

First Mate Lures, Inc. | www.firstmatelures.com
Online retailer of non-toxic tackle made from a bismuth/tin alloy. Jigs, drop shots, bottom bouncers, and slip sinkers, available in a variety of styles and sizes.

Fiskas Wolfram Jigs | www.yourbobbersdown.com
Tungsten jig heads in a variety of sizes, shapes, and colors. Available at many retailers throughout the U.S. and Canada; made in Sweden.

Flambeau Outdoors | www.flambeauoutdoors.com/fishing.asp
"Safe-Sink" worm weights and jig heads are made from a proprietary nontoxic plastic material with tungsten that promises the same specific gravity as lead, so the weights are the same size.

Gitzit, Inc. | www.gitzitinc.com
Lead-free "Little Tough Guy" and "Micro Little Tough Guy" jig heads.

Green Tackle | www.greentackle.com
Manufactures unpainted round jig heads and pyramid sinkers made from a bismuth-tin alloy; many sizes offered. Green Tackle is also an online retailer of "environmentally friendly" tackle, including lead-free and biodegradable options.

Hookem Lures | www.hookemlures.com
Each Hookem lure uses glass as its weight. These lures are basically jig heads: durable, nontoxic, and offered in a range of colors and sizes.

Jackfish Lures | www.jackfishlures.com
Jigs and sinkers made of bismuth.

JC Manufacturing | www.planer-board.com
Cast-iron downrigger weights in 4, 6, 8, and 10-pound sizes. The torpedo-style weights are covered with a soft plastic which makes them easy on your boat.

Keitech | http://keitech.co.jp/english/
Tungsten-composite bass jigs and round head jigs.

Lead Free Jig Heads | www.leadfreejigheads.com
Online retailer of tin/bismuth alloy sinkers and jigs in a variety of styles.

Lindy Fishing Tackle | www.lindyfishingtackle.com
The Techni-Glo Rattl'n Flyer Spoon is made from a tin/pewter alloy with a brass rattle. Eco-Safe E-Z Tube Weights are made of a tin/pewter alloy, and available in four weight sizes, with and without rattles.

Loon Outdoors | www.loonoutdoors.com/sinkets.html
The "Deep Soft Weight" (1 oz.) is made from tungsten.

Lucky Strike Bait Works Ltd. | www.luckystrikebaitworks.com
Jigs, jig heads, sinkers, and split-shot made from nontoxic bisumth and tin.

Northland Fishing Tackle | www.northlandtackle.com
The "Nature Jig" is 100 percent lead free, cast from a nontoxic bismuth/tin alloy.

Pallatrax USA | http://pallatraxusa.com
Weights in the Stonze System are made from naturally occurring stones. Available in a range of sizes and colors, in swivel and in-line versions.

Panther Martin | www.panthermartin.com
"Big Belly" spinners are made from stainless steel and come in a number of sizes.

Penetrater Weights | www.penetraterweights.com
Tungsten steel bullet-style worm weights available in a variety of colors.

PJ's Finesse Baits | www.ejigs.com
Non-toxic tackle made from bismuth: Maribou jigs, Barbless Woolly Buggers, Eggboos, and Wormaboos.

Recycled Fish | www.recycledfish.org/safe-angling/safe-angling-kits.htm
All new for 2009! The SAFE Angling Kit has everything you need to catch fish, and do so as a steward of lakes and streams. Packed with name-brand gear--non-lead weights, biodegradable molded lures, circle and cam-action hooks--these kits are ready to go. Great for the novice or a seasoned angler making the switch to non-toxic weights and baits. Visit the web site for participating retail locations.

River2Sea | www.river2seausa.com
California-based manufacturer of non-toxic tungsten sinkers and bismuth/tin alloy buzzbaits and spinnerbaits.

Rocky Ledge Bass Tackle | www.rockyledge.com
Spinnerbaits, buzzbaits, and jigs made from pewter.

RockyBrook Sinkers | www.rockybrooksinkers.com
Fishing weights made from limestone. Weights from 1/10 oz. to 1/2 oz. Same weight as lead, but not as dense.

Salamander Sinkers | www.salamandersinkers.com
Steel sinkers with a new, patent-pending design for terminal tackle. Nontoxic, snag-resistant, and weight-adjustable.

South Bend | www.south-bend.com
Eco Weights are made from highly pressurized iron oxide, and come in many weights and styles: worm weights, egg sinkers, and bank sinkers. Also makes steel removable split-shot sinkers.

Tacklesmith | www.tacklesmith.com
Wisconsin-based online retailer of lead-free sinkers and jigs made from a variety of non-toxic metals.

The Gapen Company | www.gapen.com
Minnesota manufacturer sells some tin jigs, including the Crappie Vixen and The Jerk.

XCalibur Baits | www.xcaliburtackle.com
XCalibur Tungsten fishing weights in bullet, barrel, and drop-shot versions.

Yakima Bait Co. | www.yakimabait.com
The Hildebrant® product line includes many spinnerbaits made from molded bismuth or tin.

Suppliers to tackle manufacturers

Du-Co Ceramics | www.du-co.com
Jigs and sinkers made from ceramic. Call Nick Norante for product information or becoming a distributor.

Ecomass Technologies | www.ecomass.com
Ecomass is a non-toxic polymer-metal composite with the same density as lead which can be molded into fishing weights and lures. Used in lead-free fishing tackle lines from Flambeau Outdoors and Bass Pro Shops.

RTP Company | www.rtpcompany.com
Manufactures lead-free "high gravity compounds" for terminal tackle and ammunition manufacturers.

2. Great Lakes Pollution Prevention Roundtable's List

CANADA

Alchemy Castings, 563 Kenilworth Avenue N, Unit A, Hamilton, Ontario, Canada L8 4T8, 866-312-9084, 905-312-9085 (fax), www.alchemycastings.com

Bismuth Baits, #606-8575 Riverside Drive E, Windsor, Ontario, Canada N8S 1G2, 519-948-6561, www.bismuthbaits.com/

D&D Lures, 1576 Howard Avenue, Windsor, Ontario, Canada N8X 3T5, 519-256-8073, www.ddlures.com

Jackfish Lures, Alberta, Edmonton, Canada, 780-424-2876, www.jackfishlures.com

Jims Jigs and Tackle Ltd., Box 357, Fallis, Alberta, Canada, 780-797-2484, 780-797-4212 (fax)

Lucky Strike Bait Works Ltd., 2287 Whittington Drive, RR3, Peterborough, Ontario, Canada K9J 6X4, 705-743-3849, 705-743-4043 (fax), www.luckystrikebaitworks.com

Sourdough Bay Fishing Supplies, 25 Collins Crescent SE, Medicine Hat, Alberta, Canada T1B 1T7, 403-528-4801, www3.memlane.com/sourdbay/index.html

UNITED STATES

A Better Angle Inc., 1027 18th Street, Myrtle Point, OR 97458, 541-572-2109, www.tackledeals.com

Ambush Lures, PO Box 542, Maryville, MO 64468, 800-678-5274, 660-582-4377 (fax), www.ambushlures.com

Atlantic Metals & Alloys, Inc., 335 Benton Street, Stratford, CT 06615, 203-378-9025, 203-378-9570 (fax), www.atlanticmetals.com/metlallo.htm

Bass Pro Shops, www.basspro-shops.com

Belvoirdale/Dinsmoress, PO Box 176, Wyncote, PA 19095, 215-886-7211, 215-886-1804 (fax), www.belvoirdale.com/

Big Ten Tackle, 412 Thompson Street, Latrobe, PA 15650, 800-480-4216, www.bigtentackle.com/bt/ceram.htm

BIO-CAST, 510 Sabil Drive, Fruita, CO 81521, 970-858-4019

Bullet Weights, 120 Apollo Drive, Alda, NE 68810, 308-382-7436, 308- 382-2906 (fax), www.bulletweights.com

Du-Co Ceramics, 155 S Rebecca Street, PO Box 568, Saxonburg, PA 16056, 724-352-1511, 724-352-1266 (fax), www.ceramics.com/duco/

Flambeau, 15981 Valplast Rd, Middlefield, OH 44062, 800-232-2474, 440-632-1581 (fax), www.flambeau.com

General Fishing & Tackle, 3201 N. El Paso, Colorado Springs, CO 80907, 719-634-6831, 719-634-7651 (fax), www.generalfishingtackle.com

GlowOptics, 34072 Helium St NW, Cambridge, MN 55008, www.glowoptics.com

Havoc Fishing Products, PO Box 801, Natick, MA 01760, 508-654-2884, www.fishhavoc.com

Hildebrandt Corporation, PO Box 50, Logansport, IN 46947-0050, 219-722-4455, 219-722-3712 (fax), www.hildebrandt.net/

Jack's Lures, Rt. 1, Box 38, Jet, OK 73749, 580-626-4444, www.jackslures.com/

Jadico, 580 W Highway 54, Camdenton, MO 65020, 573-346-4305

Lake Fork Tackle, 8052 Jills Creek, Memphis, TN 38133, 901-213-9211, 901-213-9212 (fax), www.lakeforktackle.com/weights.htm

Lead Free Jigs, PO Box 1625, Keaau, HI 96749-1625

Lead Masters, 17229 Lemon Street, Unit E11, Hesperia, CA 92345, 888-800-8735, www.theoriginalstickyweight.com

Loon Outdoors, 7737 W. Mossy Cup, Boise, ID 83709, 800-580-3811, 800-574-0422 (fax), www.loonoutdoors.com/sinkets.html

Luhr Jensen and Sons Inc., PO Box 297, 400 Portway Avenue, Hood River, OR 97301, 800-535-1711, www.luhrjensen.com/peacock_bass/default.htm

Orvis Company, Market Square, 19 Campbell Avenue SE, Roanoke, VA 24011, 800-541-3541, www.orvis.com

PRADCO Outdoor Brands, 3601 Jenny Lind Road, Fort Smith, AR 72901, 479-782-8971, www.lurenet.com

Rocky Ledge Bass Tackle, 1025 Catamount Road, Pittsfield, NH 03263-3816, 603-435-6387, 603-435-7329 (fax), www.rockyledge.com

SafeCasters, 251 Lisa Lane, Pasco, WA 99301, 509-545-5095

Tri-Cast, 510 Sabil Drive, Fruita, CO 81521, 970-858-4019

Warrior Sporting Goods, PO Box 1511, Sherwood, OR 97140, 503-296-2149, www.warriorsg.com

Water Gremlin, 1610 Whitaker Avenue, White Bear Lake, MN 55110, www.watergremlin.com

INTERNATIONAL

Dinsmores Ltd, Westgate, Aldridge, Great Britain WS9 8EX, 01992 456421

Eco Weight, Stockholm, Sweden, +46(0)8 775 0081

Jinju Powder Metallurgy Co., Ltd., 798 Jiancheng Rd, Hangzhou, China, +86-571-87825090

Appendix 2: Summary of Alternatives for Lead Fishing Sinkers

The following table shows comparisons among lead and several alternative materials from which fishing tackle is made. Comparison criteria include technical and performance criteria, environmental criteria, human health criteria, and cost. Table is from the Toxics Use Reduction Institute, University of Massachusetts, Lowell. http://www.turi.org/content/view/full/5670.

Assessment Criteria		Lead (Reference)	Comparison Relative to Lead				
			Bismuth	Ceramic	Steel	Tin	Tungsten
Technical and Performance Criteria	Density	11.34 g/cm^3	-	-	-	-	+
	Hardness (desirable for "feel" and noise)	Soft Mohrs: 1.5	+	+	+	= (pure) + (alloy)	+
	Malleability (split-shot application)	Yes	-	-	-	=	-
	Low Melting Point (for home production)	622 °F	+	-	-	+	-
	Corrosion Resistant	Yes	=	=	-	=	=
Environmental Criteria	Highly toxic to waterfowl	Yes	+	?	+	+	+
	Toxic to Aquatic Species	Yes	+	?	+	+	+
	Primary Drinking Water Standards (MCL Action Level)	15 μg/L	?	?	+ (iron)	+ (FL & MN)	?
Human Health Criteria	Carcinogenicity	EPA B2 IARC 2B	+	+	+	+	+
	Developmental Toxicity	Yes (Prop 65)	+	+	+	+	+
	Occupational Exposure: REL (8-hour TWA)	0.050 mg/m^3	?	+	+	+	+
Cost	Retail Price	Low	-	-	- / = / +	-	-
	Availability of End-product	Excellent	-	-	-	-	-

COMPARISON KEY

\+ Better = Similar - Worse ? Unknown

Appendix 3. Text of Washington House Bill 3158, prohibiting the sale and use of lead sinkers and jigs

State of Washington 61st Legislature 2010 Regular Session By Representative O'Brien
Read first time 02/01/10. Referred to Committee on Agriculture & Natural Resources.

AN ACT Relating to prohibiting the sale and use of lead sinkers and 2 jigs; adding a new chapter to Title 77 RCW; prescribing penalties; and 3 providing an effective date.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

Sec. 1. The legislature finds and declares the following:
(1) The fish and wildlife of the state of Washington are a valuable natural resource and an integral part of the economic and social fabric of our state;
(2) A review of available literature and research indicates that lead sinkers and jigs pose a significant hazard to water birds that mistakenly ingest lead sinkers and jigs and experience lead poisoning;
(3) Lead is a toxic metal known to cause many health problems in water birds and leads to an increasing susceptibility to disease, predation, and infection. A single sinker can cause death within two weeks;
(4) Lead has been linked to human health problems, including brain damage, mental retardation, behavior problems, anemia, liver and kidney damage, hearing loss, hyperactivity, developmental delays, other physical and mental problems and, in extreme cases, death. Lower IQ scores, slower development, and more attention problems have been observed in children exposed to lead;
(5) Lead sinkers are small and easily swallowed, posing a toxic hazard to children. Furthermore, many anglers make their own sinkers or make sinkers in their home for sale to others. If proper precautions are not used, lead vapors and dust can impact anyone within the household; and
(6) Effective and comparably priced alternatives to lead sinkers and jigs exist. It is irresponsible to continue to allow the use of toxic products and their deposition in the waters of the state.

Sec. 2. The definitions in this section apply throughout this chapter unless the context clearly requires otherwise.
(1) "Lead jig" means a lead weighted fishing hook, the lead portion of which has a mass of one ounce or less or measures less than one inch along its shortest axis.
(2) "Lead sinker" means a fishing sinker containing more than one- half of one percent lead by weight, the lead portion of which has a mass of one ounce or less or that measures less than one inch along its shortest axis.

Sec. 3.
(1) A person may not sell or offer for sale within the state a lead sinker or lead jig.
(2) A violation of this section is a civil infraction for which a fine of not less than one thousand dollars nor more than five thousand dollars may be adjudged.

Sec. 4.
(1) A person may not use a lead sinker for fishing in the waters of the state.
(2) A violation of this section is a civil infraction for which the following penalties apply:
(a) For the first offense, a minimum fine of one hundred twenty- five dollars.
(b) For the second offense, a minimum fine of five hundred dollars, and forfeiture of all fishing tackle, rod and reel, and the loss of any fishing license for a period of at least one year.
(c) For a third or subsequent offense, a minimum fine of one thousand dollars, forfeiture of all fishing tackle, rod and reel, and a lifetime loss of any fishing license.

Sec. 5. The procedures for enforcement of sections 3 and 4 of this act are the same as the procedures for natural resource infractions under chapter 7.84 RCW.

Sec. 6. The department shall provide public education and outreach to disseminate information regarding this chapter.

Sec. 7. Sections 3 and 4 of this act take effect January 1, 2011.

Sec. 8. Sections 1 through 7 of this act constitute a new chapter in Title 77 RCW.

Appendix 4. Text of Department of Fish and Wildlife's Proposal to Regulate Lead Tackle on Lakes Where Loons Breed, per *2010-2012 Sportfishing Rule Change Proposal*

#32. Lead-Tackle on Lakes Where Loons Breed

Proposal: This proposal would make it unlawful to use lead weights weighing less than one half ounce or lead jigs measuring less than 1 ½" in the following freshwater lakes: Ferry Lake, Swan Lake, and Long Lake (Ferry County), Pierre Lake (Stevens County), Big Meadow Lake, Yocum Lake and South Skookum Lake (Pend Oreille County), Lost Lake, Blue Lake and Bonaparte Lake (Okanogan County), Calligan Lake, Hancock Lake (King County), and Lake Hozomeen (Whatcom County).

Explanation: Common loons are currently state listed as a sensitive species with significant questions as to the species' population status. Washington has both breeding populations and wintering populations of common loons. Ingestion of small lead fishing gear has been identified as one of the major causes of loon mortality in WA. Lead toxicosis from fishing tackle was responsible for mortalities in 39% of common loon carcasses recovered in Washington from 1996-2008 (Poleschook & Gumm 2008). Over the past few years, an increasing number of manufacturers have begun offering for sale lead-free sinkers and jigs. This is an incremental step in reducing the availability of lead to loons and the proposal is restricted to lakes in Washington where we have documented common loon breeding.