

THE POLICY AND LEGISLATIVE DIMENSIONS OF NONTOXIC SHOT AND BULLET USE IN NORTH AMERICA

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ABSTRACT.—This paper addresses the policy and legislative considerations for moving North American society towards the use of nontoxic shot and bullets for all types of hunting and shooting. Progress in one or more areas of lead use reduction by society has not facilitated transitions in other areas of lead use, and the two solitudes of conservationists (anti-lead) and hunters (pro-lead) is real. Regulators must emphasize the gains in wildlife to both constituencies that will attend adoption of nontoxic products. Sixteen years of nontoxic shot use in waterfowl hunting is the most cost-effective conservation tool to date in conserving waterfowl populations. Similar savings could be expected from the use of lead-free shot such as for hunting migratory doves and upland birds. New ballistic materials are available for use on upland species, and in all gauges of modern and old guns. Industry has adapted materials for use in rifle cartridges of varying calibers. Although industry has responded well to the quest for nontoxic ballistic materials, industry requires enforceable regulations to create and assure the market demand for their products. Different policy and legislative options are presented. Regulatory progress would best be based on precedents under the Migratory Bird Treaty Act, entailing its application to species that fall under federal jurisdiction. The use of this Act would constitute the rationale for Canada to implement similar provisions for the same species under its Migratory Birds Convention Act. Individual states and provinces could then be petitioned to adopt complementary measures for hunting upland bird and mammalian species that fall under their jurisdiction. The development of nontoxic bullets for big game hunting could also be applied to the smaller caliber lead bullets used for small mammals, because they constitute a source of secondary lead poisoning of carrion feeders. Any legislation developed to phase out all lead use must be harmonized between the USA and Canada, and among the states and provinces to ensure consistency of regulation and its application. Progress in this task has to be based on the premise that use of nontoxic materials benefits all wildlife, the sport of proactive hunters, and society that experiences less lead in the environment. *Received 16 May 2008, accepted 6 August 2008.*

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THE EVOLUTION OF HUMAN CULTURE has been accompanied by an extensive use of lead products that have, inevitably, become released to the general environment. Awareness of the toxic properties of lead and lead compounds has existed for over

two millennia (Nriagu 1983, 1998). However, such awareness has resulted in only a slow rate of amelioration of the problem of toxicosis in the human environment, and especially the environment of aquatic and terrestrial wildlife. Instances where the

use of a toxic lead compound has been banned, based on extensive scientific evidence, should, in theory, facilitate the removal of lead products from other human uses, especially where equally compelling scientific evidence exists (Lanphear 1998).

Such facilitation has not been widespread in the human environment¹, and even less so for the environment of wildlife subject to lead poisoning from discharged lead shot bullets, and fishing weights (Thomas 1997, Thomas and Guitart 2005). Thus a complete ban on the use of lead shot for hunting has not been reciprocated by a ban on the use of lead fishing gear for angling (and vice versa), as shown in the USA, Canada, and a number of states in the European Union (Thomas 1997, Beintema 2001). This is despite scientific evidence of the need to adopt consistent policy on lead reduction across different user groups in these countries (Thomas and Guitart 2003, 2005). Thus each situation of primary or secondary lead poisoning (i.e., lead shot toxicosis in waterbirds and upland game birds, sinkers and piscivorous birds, and bullet fragments and carrion feeders) has been dealt with separately, each with its own peculiar user constituencies, jurisdictions, biases, and scientific researchers (USFWS 1986, Twiss and Thomas 1998, Scheuhammer et al. 2002, Sidor et al. 2003, Fisher et al. 2006, Hunt et al. 2006, Cade 2007).

The short history of transitions to nontoxic shot, bullets, and fishing weights has been exceedingly contentious, and resisted by all the principal user groups who viewed requirements for nontoxic materials to be unwarranted and infringements on their rights to practice their sport (Anderson 1992, Williams 1994, Center for Biological Diversity 2006, Schultz et al. 2007). Thus any proposal to extend the use of nontoxic materials to all forms of hunting and angling needs to address the sustainability of these sports, and the benefits of using these new materials to hunters and anglers, the wildlife, and the general environment.

¹As in the cases of prohibiting the use of leaded paints in interior use, banning the use of leaded gasoline, lead in glass and glazes, and rehabilitating urban soils contaminated with lead from smelters.

The abundant scientific literature documenting the extent and impact of lead poisoning on wildlife does not, by itself, make decisions about its use. Such decisions are rooted in social value systems, popular beliefs, economics, policy, court decisions and laws. As such, they may support, confound, or refute current scientific thought about the issues. This paper accepts the enormous legacy of published research that links primary and secondary lead toxicosis of birds and mammals to discharged lead shot and bullets and lost fishing weights (Church et al. 2006, Fisher et al. 2006, Cade 2007, Rattner et al. 2008, Papers in this Conference Proceedings). The paper focuses on spanning the gulf between science and policy, and how the emerging scientific “message” could be translated into policy options that may result in the creation of progressive law.

STARTING THE POLICY PROCESS AND THE TRANSITION TO NONTOXIC MATERIALS

The adversarial debate around the replacement of lead products has often polarized the positions of the hunting and angling communities from that of the largely non-hunting “conservationists”. Given that hunting and angling are socially and politically legitimized pursuits, and will continue, the real quest is to improve the apparent sustainability of both sports by finding and approving lead substitutes that leave no toxic legacy in the environment (Cade 2007). This should be in the interest of both hunting-angling communities and those with a non-consumptive approach to wildlife’s conservation.

Selecting the Appropriate Policy Options.—For those advocating further use of lead substitutes, knowing precisely what one wishes to achieve of the policy process is paramount. Thus the following graded options can be identified *a priori* for consideration:

- Requiring use of nontoxic shot for an additional particular species (e.g., Mourning Doves, *Zenaidura macroura*) nation-wide.
- Requiring use of nontoxic shot for hunting all species of migratory birds across all habitats in the USA.

- Requiring use of nontoxic shot for hunting all migratory and non-migratory game birds nationwide.
- Requiring nontoxic shot for all bird hunting and nontoxic rifle bullets for hunting both large and small mammals.
- Requiring nontoxic shot and bullets for all hunting and all types of target shooting.
- Requiring use of nontoxic shot and bullets for all hunting and shooting in addition to use of nontoxic sinkers, weights, and jigs for sport fishing nationwide.

These options cut across federal and state/provincial jurisdictions, and apply, progressively, to more recreational constituencies in society. While the above are presented as discrete policy options, it is recognized that further subdivision, or re-combinations, of some options is possible. For example, should requirements for using nontoxic shot apply across all public lands and privately-operated and owned shooting preserves dedicated to the hunting of game farm, non-migratory birds? Or, would nontoxic fishing gear be required in those states beyond the natural range of the piscivorous species most commonly afflicted?

The choice of option has to reflect the perceived scientific “message,” in that the array of scientific evidence has to be able to withstand considerable challenge. The option of a voluntary use of nontoxic products has not been considered in this paper. The disadvantages of this approach have been identified in Thomas and Owen (1996), and this author is of the view that only a regulated approach is capable of resolving the issue of lead poisoning of wildlife in North America. Moreover, given the present availability of lead-free products, concerned sportsmen could have already made the transition to lead-free products, were they so inclined. The option chosen may also reflect a desire of regulators and politicians to proceed successfully, in an incremental manner across time, rather than to attempt an unsuccessful simultaneous ban on all lead products. Whichever approach is taken it is vital to consider the legislative vehicle(s) that might be used to support transitions to nontoxic materials and important legal precedents that would support a given policy option. Where appropriate legislation does not exist, new legislation has to be created, or

existing legislation has to be amended. It is critical that any legislation selected has to be sufficiently robust to withstand repeated challenges by groups opposed to the removal of lead products (see Anderson 1992). For the purpose of this paper, the fourth policy option (requiring nontoxic shot use for the hunting of all migratory and non-migratory birds, and nontoxic rifle bullets for the hunting of big and small game mammals) will be used to address the legislative considerations that apply. The strength of the available research on lead toxicosis supports this policy option very well, as do the available legislative tools in the USA. Since lead discharged by hunting is the principal focus of the Conference Proceedings, this paper will not deal, overtly, with lead from fishing weights, especially since it involves a different public constituency.

Continuation of Applied Research Supporting Policy Process.—The continuation of applied research into the extent and distribution of primary and secondary lead toxicosis of birds and mammals is vital. It is important to have up-to-date, peer-reviewed, journal research that documents further the case for using lead substitutes, especially when proposing extension of nontoxic product use to other categories of hunting and shooting (e.g., Church et al. 2006, Cade 2007). Where gaps in the scientific coverage exist, it is advisable to address them. Similarly, where evidence of lead build-up applies to one part of a species range (as for American Woodcock, *Scolopax minor*, Scheuhammer et al. 1999), it is advisable to extend such studies throughout the species annual range. There will certainly be those from the angling and shooting communities whose role is to undermine or negate the science supporting change (Williams 1994, Center for Biological Diversity 2006), and their assertions must be countered in the policy process. Science, by its nature, cannot provide absolute certainty to society, but scientists can indicate that the state of understanding of the problem of lead poisoning of wildlife has become asymptotic, and that the issue does transcend political and geographic boundaries. A huge body of independently-replicated research reveals consistently that there is a single syndrome of ingested lead toxicosis, whose collective scientific credibility exceeds the burden of proof used in other forms of environmental chemi-

cal regulation (e.g., cigarette smoking and public health).

Awareness of Nontoxic Substitutes and their Applications.—The arms and the fishing tackle industries have done much in recent years to develop lead substitutes, and to provide an array of government-approved products for use. It is necessary for the proponents of change to be aware of what these new materials are and how they can be adapted to other shooting, hunting, and angling applications beyond their current use². Thus some materials (for example sintered tungsten-tin, sintered tungsten-bronze, and tungsten matrix shot) could be used in upland and wetland shooting situations and serve as excellent dense materials for fishing weights. Some of the federally-approved materials (for example, sintered tungsten-tin, and tungsten-matrix) have a physical softness that allows their safe use as shot in small gauge guns³ that are sometimes favored for use in upland game bird shooting. Such awareness reduces the impact of critics' remarks that no effective lead substitutes are available for shooting and angling. American manufacturers of rifle ammunition have already made effective substitutes for lead rifle bullets and shotgun slugs. Here, pure copper has been the metal of choice in a range of rifle calibers and bullet weights, including partition bullets in which an approved, nontoxic, tungsten formulation provides a dense lower core⁴.

It is also important to bring into the policy process constructive precedents and information gained in other jurisdictions that have already begun a

broader adoption of lead substitutes, whether in other nations (e.g., Denmark and the shooting of upland game birds) or states that have introduced requirements for nontoxic shot when hunting state regulated upland game. Such information can often assuage concerns of skeptics, and guide the policy process by setting legal precedents.

Emphasizing the Acknowledged Success of Existing Nontoxic Shot Regulations.—The evidence that nontoxic shot use has been an extremely successful management approach is vital in the policy process. The USA began the national adoption of nontoxic shot for waterfowl hunting in 1991, and the intervening 16 years have provided opportunities for agencies to assess the efficacy of nontoxic shot use. The evidence, to date, has favored the transition, is conducive to a broader use of lead substitutes, and should form the basis of any policy proposition. Samuel and Bowers (2000) analyzed the impact of a ban on the use of lead shot on elevated blood lead levels of American Black Ducks (*Anas rubripes*) and reported a decline of 44% in the prevalence of high blood lead levels. Stevenson et al. (2005) reported declines in wing bone lead levels in American Black Ducks and Mallards (*Anas platyrhynchos*) in Canada of 11.0 to 4.8 µg/g, and in Ring-necked Ducks (*Aythya collaris*) of 28.0 µg/g to 10 µg/g, over the period of 1989–90 to 2000. These results attest to the speed with which declines in body lead can become achieved.

Perhaps, the most compelling evidence supporting the transition to nontoxic shot use comes from the research of Anderson et al. (2000), who observed that the use of nontoxic shot reduced the mortality of Mallard from lead toxicosis by 64%, and generated a national saving of approximately 1.4 million ducks a year from ingested lead shot mortality. These figures were generated from research undertaken only 5–6 years following the 1991 US national ban on lead use, and do not include estimates for Canada. The previous three studies illustrate that adoption of nontoxic shot for waterfowl hunting has been the most effective tool used by the individual hunter in the conservation of waterfowl in North America. Its contribution to the survivorship of birds exceeds the contributions to waterfowl numbers made by continental habitat manipulations and improvements (Anderson et al. 2000, Thomas

² In the USA, non-toxic materials are presently required for the hunting of waterfowl and coots, for sport fishing in several locations, and upland game hunting in some states. In Canada, in addition to the hunting of waterfowl, non-toxic fishing weights are required for use in all national parks and national wildlife areas.

³ As the gauge of shotguns increases, the pressure in the barrel chamber also increases. Thus shot that is harder than lead contributes to higher chamber pressures. Accordingly, some of the approved lead shot substitutes can not be used safely in cartridges smaller than 20 gauge because they might exceed safety standards.

⁴ As made by the companies Barnes, Lapua, Nosler, and Remington, and sold either as complete rifle or shotgun cartridges, or bulk bullets/slugs for hand loaders and muzzle loading guns.

and Guitart 2005). This is not to imply that habitat improvement and preservation is unimportant, but that hunters' purchase and use of nontoxic shot is an activity that directly complements and enhances the benefits of all types of habitat improvement and expansion. For maximum improvement to wildlife populations, do both: create new habitats and ensure that they remain uncontaminated by spent lead shot and bullet fragments. The resulting situation is then a "win-win" for hunters and wildlife, in that there are now more surviving birds, their populations are afflicted less by lead shot toxicosis, and there is less secondary lead toxicosis affecting predatory and scavenger bird populations (Kramer and Redig 1997, Wayland and Bollinger 1999).

Primary and secondary lead toxicosis are not confined to waterfowl and their predators/scavengers. Upland game species that have been hunted heavily during the past two centuries also display characteristic lead poisoning from ingested spent lead shot (Kendall et al. 1996, Butler et al. 2005, Fisher et al. 2006), as do their predators and scavengers (Kramer and Redig 1997, Wayland and Bollinger 1999, Mateo et al. 2001, 2007). Some of these hunted species are migratory and fall under federal jurisdiction in the USA and Canada (migratory doves and American Woodcock), while non-migratory species of pheasant, quail, grouse, and partridge are under state or provincial jurisdiction. The various forms of nontoxic shot that have been developed for shooting waterfowl could be used to great effect on upland species. Upland birds are usually shot at closer ranges than waterfowl. They are also less heavily feathered and have thinner skins than waterfowl, so promoting shot passage deeper into the body. The same advantages that accrue to waterfowl hunters using nontoxic shot (Anderson et al. 2000) should also extend to upland game bird species. Furthermore, the rapid reduction in secondary lead poisoning of scavengers would also justify an end to the use of lead shot for such hunting. Light steel shot shotgun loads (24–28g) for 12 and 20 gauge guns are already available to hunters⁵, and would, by virtue of their relatively greater pellet count, be effective for the hunting of migratory species of small-bodied doves, Common Snipe

(*Capella gallinago*), and American Woodcock. This is an important consideration in light of concerns about increased wounding losses of game birds by the use of nontoxic shot (Schultz et al. 2006a).

The use of lead-free rifle bullets can be expected to bring about a rapid decline in the prevalence of lead poisoning of scavengers, especially those that acquire the lead from bullet fragments in the discarded viscera of big game (Hunt et al. 2006, Cade 2007, Craighead and Bedrosian 2008). Where fragmenting, small-caliber, lead bullets are used to kill nuisance rodents in agricultural areas, discarded carcasses could also be a source of lead fragments to aerial and ground scavengers (Pauli and Buskirk 2007). The use of nontoxic fragmenting bullets, available in all of the common calibers⁶ would reduce this problem of secondary toxicosis.

CHOICE OF LEGISLATIVE VEHICLES AND CONSIDERATION

Federally-regulated Migratory Birds.—The Migratory Bird Treaty was signed initially between the USA and Great Britain for Canada (Lyster 1985) and is administered in the USA and Canada by The Migratory Birds Treaty Act (MBTA), and The Migratory Birds Convention Act (MBCA), respectively, the two articles of law that regulate all management of the two nations' migratory birds. The regulations of the MBTA were used in 1991 to regulate the use of nontoxic shot for the hunting of waterfowl and American Coots (*Fulica americana*) throughout the USA, as well as the composition of lead shot substitutes. The MBCA was used in Canada in 1999 to effect the same transition throughout Canada. At the time of passage, the regulations were applied only to the hunting of waterbirds because this was the area of greatest primary and secondary lead poisoning that federal authorities wished to address (USFWS 1986). Hunted migratory species, such as Mourning Doves and American Woodcocks were excluded from the regulations requiring nontoxic shot use in both Canada and the USA, a situation that exists to the present. The hunting of migratory doves (*Columba fasciata*, *Zenaidura macroura*, *Zenaida asiatica*) occurs

⁵ As made by Kent Cartridge Co., and Remington Arms, in the USA.

⁶ As made by the Barnes Bullet Co., in the USA.

across most states (40 states) of the USA, where present, but only in the Province of British Columbia in Canada. Thus federal legislation is preferable for reasons of jurisdiction as well as geographical coverage to provide consistent regulation.

The case that Mourning Doves ingest lead shot and succumb readily to lead poisoning has been made (Lewis and Legler 1968, Schultz et al. 2002, 2006b), including the suggestion that the impacts from recreational hunters may be greater than once believed (Schultz et al. 2002). In a later paper Schultz et al. (2006b) advocated that a national nontoxic shot regulation be implemented for Mourning Doves, based on the numbers of doves suspected to be afflicted by lead poisoning and their susceptibility to ingested lead shot.

Because the MBTA already has the authority to manage all migratory birds in the USA, it is the appropriate legislative vehicle to use in extending requirements for nontoxic shot when hunting these species. This Act applies throughout the entire USA. The Act has withstood successfully numerous legal challenges when used to enforce nontoxic shot requirements for hunting waterfowl (Anderson 1992), and it should act as the legal precedent for the greater protection of all hunted migratory birds. It is the opinion of this author that the use of federal legislation to manage the hunting of federally-regulated species is preferable, because of regulative efficiency, to situations in which individual states or provinces pass laws requiring use of nontoxic shot for hunting the same migratory species. Then a consistent approach to management is achieved throughout the species range.

An important consideration is that the regulations of the MBTA and the MBCA which determine the forms of lead shot substitutes that are acceptable for hunting waterfowl in the USA and Canada would also apply to the shot types used for hunting "upland" species of migratory birds. Given that migratory doves are hunted legally in only one Canadian province, there is greater need for the USA to extend nontoxic shot requirements to these species than Canada. There are no studies of the levels of lead in the bodies of migratory doves in British Columbia, but there is no reason to suppose that the prevalence of lead shot ingestion by doves and its

impacts on birds in the province differs from that in the USA. If Canada were to advocate the use of nontoxic shot for the hunting of doves, it could do so on the basis of protecting a species throughout its entire migratory range (Thomas and Owen 1996). In Canada, the MBCA could be used to regulate the hunting of doves, snipe and American Woodcock with nontoxic shot as it has done for regulating the shot required for hunting waterfowl. Then, Canada would be acting in concert with the USA, both nations using the legislation under the Migratory Bird Treaty as the basis for a common, consistent approach to management at the continental level. The USA and Canada are bound to manage their common migratory birds in a complementary manner, and the harmonization of legislative approaches on extending a ban on use of lead shot would be highly desirable (Thomas 2003).

State-regulated, Non-migratory, Game Species.—

The requiring of nontoxic shot for the hunting of non-migratory small game has already received much attention within the USA, but a large range of policy decisions exists. There are states that have already regulated the use of nontoxic shot for all such hunting, states that still favor the use of lead, and positions between these two extremes. This situation across the entire USA and Canada has been investigated by the Nontoxic Shot Advisory Committee (NSAC 2006) for the State of Minnesota. The analysis reveals that, as of 2006, 26 jurisdictions had nontoxic shot regulations that extended beyond those set federally for waterfowl and American Coots. However, there was considerable variation in the use of the regulations, depending on the target species, and whether hunting occurred on public or private lands (NSAC 2006, Tables 2–7). As an example, South Dakota requires nontoxic shot be used when hunting grouse, quail, and pheasants, except when hunting on private lands, walk-in areas, state school lands, and on US Forest Service National grasslands. There was no consistency in the application of nontoxic shot requirements across the states, and the exceptions to legislated use varied greatly among states (NSAC 2006). These findings argue in support of a consistent approach to regulation, because that facilitates enforcement, supports habitat improvement across a species range, and makes compliance easier for the public. The response to banning lead shot use by

individual states is encouraging. More than 1.3 million acres of habitat across 23 states have been secured from further lead deposition, including more than 400,000 acres in Nebraska and South Dakota, combined⁷.

Acting as a precedent in this matter is the existing federal requirement that nontoxic shot be used for hunting state-regulated species when hunting occurs on federally-regulated lands. Thus, the public has been introduced to this requirement and the need to comply. What emerges from this analysis of nontoxic shot requirements for upland game hunting is a patchwork of regulatory application, which may cross jurisdictional lines. As an example of this, 15 of the 40 states that allow dove hunting require use of nontoxic shot over some specified lands (NSAC 2006, Table 4). Thus, in these instances the approved type of shot for hunting this migratory species has been governed by the states, and not the federal government. The fact that 26 states are already engaged in regulating the use of nontoxic shot bodes well for extending this regulation further, both within compliant states and to states that still have to embark on this initiative. Individual states and provinces value their particular autonomy and right to manage wildlife within their jurisdiction. So the most successful approach would be to encourage more states to regulate nontoxic shot use. Then, the successes and experiences of other states become valuable tools in the transition, especially if there is an existing federal requirement for nontoxic shot use for all migratory birds in that state.

The passage of California Assembly Bill 821, the Ridley-Tree Condor Preservation Act in 2007 has been a major landmark in requiring use of lead-free bullets for big game hunting in the range of the California Condor (*Gymnogyps californianus*). This state Act is complemented by a state-assisted voluntary use of nontoxic bullets/slugs in the adjacent state of Arizona (Cade 2007). The deposition of lead bullet fragments in the gut piles and unretrieved carcasses of large and small game annually

across the USA presents an enormous toxic risk to all species of scavengers, especially mobile Bald Eagles (*Haliaeetus leucocephalus*) and Golden Eagles (*Aquila chrysaetos*). Although the California and Arizona initiatives were predicated on the preservation of the California Condor, adoption of available nontoxic rifle bullets by other states and provinces would be highly appropriate to reduce further risk of lead ingestion.

DISCUSSION

Resolving lead toxicosis of wildlife requires the application of regulation across all forms of hunting and angling, and across all federal and state/provincial jurisdictions. Regulatory efficiency would suppose that suitable federal legislation existed in both the USA and Canada that would enable the phase-out of lead in sporting uses, as for other forms of environmental pollution. This assumption is problematic. The segregation of lead pollution into human environmental pollution and wildlife pollution compounds the issue because different agencies and different laws have been applied.

In 2005, the Canadian Wildlife Service of Environment Canada was considering application of the Canadian Environmental Protection Act (CEPA) to regulate a national ban on the importation, manufacture and sale of lead fishing weights. Application of the Act's provisions would have over-ridden any objection of a province to the proposed ban on lead weights⁸. The same Act's provisions could also have extended to a ban on all forms and uses of lead shot in Canada (Caccia 1995). There is no direct US equivalent of the Canadian CEPA, and historically, two separate US federal agencies have been involved in the regulation of lead sporting products. The US Fish and Wildlife Service still regulates the hunting of migratory birds under the MBTA. However, the US Environmental Protection Agency, a different agency in the Department of the Interior, had intended⁹ using the Toxic Substances Control Act to regulate the use of lead fishing weights and their consequent poisoning of piscivo-

⁷ Minnesota, Department of Natural Resources. The case for nontoxic shot.
http://www.dnr.state.mn.us/outdoor_activities/hunting/nts/index.html

⁸ This intent was not translated into a Parliamentary Bill, however.

⁹ This intent has not been pursued into law.

rous birds (Thomas 2003). Here is a clear case of two federal agencies needing to agree on how best to regulate a lead product to obviate secondary lead poisoning of species that are, for the most part, protected under the MBTA.

Regulatory efficiency has to be tempered with practicality. Use of a strong article of federal law might not be politically expedient if it were perceived to usurp the roles and rights of states and provinces. Because, historically, the MBTA and the MBCA have been used successfully in the USA and Canada to regulate hunting of waterfowl and American Coots, it might be more expedient to retain these same legal tools for regulating other migratory bird hunting. Then the quest is to have states and provinces complement the federal initiative with respect to game animals under their jurisdiction.

The final policy option presented earlier (a regulated national ban on all uses of lead shot, bullets and sinkers) is certainly supported by a wealth of scientific evidence and precedents from other nations, and is favored by many (e.g., Cade 2007). The US Environmental Protection Agency (USEPA 1979) has already identified the need to control the use of lead in the environment, and the Toxic Substances Control Act would likely be the legislation used to implement a total ban on use of lead sporting products. The legislation would have to specify what was being banned, whether use, sale, manufacture or importation of certain lead products. Use would be difficult to enforce, but controlling the commercial availability would have a greater impact on public compliance. The legislation would also have to consider whether a national ban would apply to hunters and target shooters. The Toxic Substances Control Act would require amendment to include provisions for regulating the approval of all lead substitutes (shot, bullets, and fishing weights), as in the present regulations of the MBTA for shot (Thomas 2003). This policy option would pit federal powers against state powers, and would affect a broad range of sporting constituencies for whom hunting, shooting and angling form the basis of their heritage. Most important, the legislation proposed from this policy option would have to withstand the inevitable massive opposition from such constituencies, and would require broad sup-

port among both Houses and the Presidency to avoid rejection.

The US Toxic Substances Control Act is an appropriate legislative tool to regulate the deposition of a known toxin in the nation's environment. However, given the reluctance of the USEPA to pursue a ban on lead sinkers (Thomas 2003), it is questionable as to whether the same agency is suited for pursuing a national ban on all uses of shot, bullets, and sinkers. The US Fish and Wildlife Service is already effective in regulating nontoxic shot use for hunting over wetlands, and could extend this requirement further. Over two dozen individual states are already proceeding with nontoxic shot use for upland game hunting (NSAC 2006). Only the political process will determine whether an incremental, cooperative, approach versus a blanket, federal ban will be attempted.

Complementing any federal initiatives assumes that requirements for nontoxic shot and bullets are supported by the state agencies administering wildlife and the public, so a period of analysis, consultation and education is required (NSAC 2006, Schultz et al. 2007). The public, if compliant, demands a period of phase-in of lead substitutes. The duration of such a period is difficult to determine. For the ammunition producers, a 2-3 year period is probably adequate, given that new nontoxic loads have to be developed, made, and distributed widely. Most of the large ammunition producers have already been making suitable nontoxic shot and bullets, so the technology is already in place. The length of a phase-in for hunters is more problematic. If a period of five years (for example) were allowed, very little transition would be expected until the last year. Moreover, because nontoxic shot and bullets would not be required, legally, until the fifth year, there would be no incentive for manufacturers to distribute before that time because the market demand might be low. It is fallacious to assume that knowledge about lead poisoning of waterfowl and use of nontoxic shot will translate into a realization of the same problem and its resolution in upland game hunting and angling (Thomas 1997). The sporting public behaves as very different communities (i.e., upland bird hunters, big game hunters and anglers) and each may have valid concerns that must be addressed (Schultz et al. 2007). Even

where a state agency has diligently prepared its case for adopting nontoxic shot for hunting upland game, met with the user groups, engaged in education, and appeared to act progressively and environmentally responsibly (NCAS 2006), there is no assurance of political support for the case.¹⁰ Thus it is important to consider the procedures used by states such as Nebraska and South Dakota, which have successfully implemented nontoxic shot requirements, and use them to good effect.

The widespread availability of nontoxic shot and bullets rests on the reality of an assured market demand for those products that is provided only by regulation and enforcement. Failing that, people will continue to use lead products. This “Catch-22” can be resolved only by regulations being created first. For nontoxic shot and bullet regulations to work at the Continental level, especially to reduce the secondary lead poisoning of highly mobile species, there has to be a “buy-in” from a majority, or more, of the states and provinces. The 2006 figure of 26 states is a promising start (NSAC 2006). A greater participation by states and provinces would reduce the price of ammunition by an economy of scale effect, and would encourage competition among manufacturers eager to increase their sales in an expanding nontoxic product market.

The extension of nontoxic requirements to shot and bullets on a wider scale would complement other conservation initiatives in the USA. The Sonoran Desert population of the Bald Eagle was re-listed as “Threatened” under the US Endangered Species Act in May, 2008 (USFWS 2008). If lead poisoning were to afflict this population, as it had afflicted other populations (Anderson 1992; USFWS 1986), then relief from local lead poisoning would assist recovery. In California, passage of Assembly Bill 821, The Ridley-Tree Condor Preservation Act in 2007, requires the use of nontoxic bullets and shot when hunting large game and small game in central and southern California, the range of the endangered California Condor. The action of the state of California is to be applauded for action that deliberately complements the intent of the Endangered Species Act, and protects California Condors and

other scavengers from secondary lead poisoning. In this regard, it is advisable to expand the requirement of nontoxic shot for the hunting of all migratory birds so that the MBTA is seen to complement and potentiate the provisions of the Endangered Species Act.

Convincing the different hunting and angling organizations that use of lead-free products is in their interest is the key to effecting policy and legislative change. These same groups have done much, historically, to enhance conservation of all wildlife and their habitats across North America. Perhaps it has been easier for these organizations to promote conservation when threats to wildlife and their habitats have originated from agricultural, urban, and industrial development. However, using lead-free products requires that hunters and anglers change their *own individual behavior* to contribute to species conservation, and then often not their preferred target species. Industry in North America has provided an array of effective substitutes for all lead products. Thus, the policy process has to focus on communicating the message that using these products promotes the sustainability of hunting and angling, bolsters all wildlife populations, and leaves no long-term toxic legacy in the environment. This is the “win-win-win” situation. Part of that message should be the research of Anderson et al. (2000), which shows that investment in nontoxic shot yields an enormous dividend in wildlife that compounds the gains arising from private investments in habitat. The successful articulation of this message in the policy process of the federal and state/provincial agencies will be the precursor to passage of appropriate legislation.

Preventing further lead toxicosis in birds requires regulating the use of nontoxic shot, bullets and fishing weights for all types of hunting and angling. Nontoxic substitutes exist, and their use in waterfowl hunting has constituted an enormous saving of birds each year in North America. Reduction in the mortality of birds from primary and secondary lead toxicosis would be expected following use of nontoxic products for all hunting and angling.

Resolution of the problem at the policy and legislative level demands careful choice of which policy option(s) to pursue in the short and long terms.

¹⁰ Minnesota was required to abandon its proposal to use nontoxic shot for small game hunting in 2008.

Continuing research on the prevalence of lead toxicosis and how it is reduced by use of lead substitutes is vital to support the policy process and inform the sporting community. It is argued that the greatest regulative efficiency is achieved by using the Migratory Bird Treaty Act to regulate, nationally, nontoxic shot use for hunting all species of migratory birds. That also provides incentives for individual states (many already embarking on this initiative) to regulate nontoxic shot and bullet use for all hunting of species under their jurisdiction.

The arms industries are already able to make effective nontoxic shot and bullets widely available, but need the assured market demand provided by law to make it happen. Central to any policy at both levels of government is communication with public user groups, who should perceive nontoxic shot, bullets and fishing sinkers as an investment in the sustainability of their sport, the complementing of habitat conservation, a direct generator of wildlife, and a less polluted environment.

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