Evidence for a Restriction on Lead shot in Wetlands

BirdLife Europe and Central Asia and RSPB/BirdLife UK

1. Can you please provide information on the suitability of alternatives to lead shot, in terms of hunting efficiency and safety of hunting?

- **Efficiency** has two elements: lethality (the ability to successfully kill the hunted species, also hunting efficiency) and minimizing crippling. The efficiency of alternatives to lead shot are well studied and have been summarized in Thomas (2015)¹.

  - **Steel, tungsten, bismuth-tin alloys and Hevi shot** are the main alternatives to lead shot. Steel shot has a lower density than lead shot, but this can be compensated by increasing the size of the shot. The other alternatives have a comparable density as lead shot.
  
  - **Lethality and crippling rates** of steel shot have been studied recently in detail by Pierce et al. (2014)² using a blind-field trial on pigeons. No significant differences were found between lead shot and steel shot.
  
  - **Non-toxic alternatives to lead shot are being used efficiently and with low crippling rates in Denmark** where lead shot was banned 20 years ago ³ ⁴. In Denmark crippling rate decreased during the period of lead shot phase-out, while hunting bags remained stable⁵. Concerns which have been raised in Denmark about the safety of tungsten shot are limited to alloys for military use which also contain nickel and cobalt⁶.
  
  - **Non-toxic alternatives to lead shot are being used efficiently and are effective, as demonstrated by low crippling rates in the USA** where use of lead shot in wetlands was banned 30 years ago. USFWS Waterfowl Harvest Survey data show that crippling rates for both ducks and geese were slightly higher in the phase-in period of five years (1987 - 1991) immediately after the ban on lead shot was introduced. However, after the phase-in period (1992 – 2001) crippling rates of both ducks and geese were much lower than when lead shot was the predominant ammunition used (1952 – 1986) and showed a long-term continuing decline during the period reported. Average post-phase-in crippling rates with non-toxic shot (predominantly steel) were 18% lower than pre-ban crippling rates (predominantly lead) for ducks and 15% lower for geese. The small short-lived increase in crippling during the phase-in period probably occurred while hunters switched from lead to steel and got used to the differences in ballistics between ammunition types. Once they had done so, the period with non-toxic ammunition was associated with less crippling⁷.

  - **Lethality decreases and crippling increases with distance regardless of the ammunition type being used**⁸ ⁹. To increase efficiency, it is important that hunters are well-trained in estimating distances, as attempting to shoot an animal outside the range is unlikely to be efficient.

- **Safety** is understood here as safety for humans using the alternative-ammunition caused by gun-malfunction. The risk of gun-malfunction is largely dependent on the choke. Testing and replacing the choke or if need be widening the choke by gunsmiths is a satisfactory solution¹⁰. There has been no increase in gun-malfunction or ricochet related incidents in Denmark as evidenced by insurance statistics¹¹.
Avoidance of human health impacts which result from the toxic effects of lead consumed via shot game is also a key factor in safety considerations for non-toxic alternatives to lead shot and rifle bullets. See section 5. Below.

2. Would a restriction on lead shot have an impact (positive or negative) on your industry (as manufacturer, distributor, importer, SME)? What would be the impact on consumers (e.g. hunters)? Please be as specific as possible and provide where possible quantitative information.

The costs to hunters switching to alternative cartridges have been estimated in Thomas (2015) at zero change for switching to steel shot, which is already widely used for wildfowling. It was also estimated that use of other alternatives, such as bismuth-tin shot in some older guns for example, will result in minor increases in the overall costs of game shooting with this type of gun, representing small increases in the average cost of shooting a pheasant (approximately 4%), or red grouse (approximately 2%) with bismuth-tin shot.

3. What has been the experience with existing (national or regional) regulations on lead-shots: are there difficulties in compliance with existing restrictions?

Compliance is likely to be the highest when the possession and sale of lead shot has been completely prohibited. In the Netherlands, non-compliance is estimated to be close to 0%13. The ban on possession of lead shot creates an incentive for hunters, shops and suppliers to switch to alternatives. An added benefit is that this creates a clear framework for enforcement – the only thing the enforcement authorities needs to establish is whether the cartridges in fact contain lead shot. In Greece, enforcement of a recent partial ban in wetlands is being hampered by the burden of proof, as hunters can claim they are hunting hares when found in the possession of lead shot in a wetland14.

The experience with partial bans is negative in Europe. In the United Kingdom, legislation to prevent lead shot entering wetlands and poisoning waterfowl was introduced in 1999 in England, 2001 in Wales, 2004 in Scotland and 2009 in Northern Ireland, but current laws in England, at least, are known to be widely ignored. A study carried out under contract to Defra found 70% non-compliance with the law long after it came into force15 and again similarly so after a subsequent campaign by hunters’ organisations to encourage adherence16.

Similarly, in France, a study found that in the Camargue significant mortality from lead shot on a number of species was occurring while a ban was in place17.

A clear limit to a partial ban has been shown in the United Kingdom where significant mortality of water birds continues despite bans in place, with reported low compliance levels and which do not extend to terrestrial wildfowl feeding habitats, in addition notable exposure occurs for other species outside wetlands18. Similarly, in Spain significant mortality of water birds has occurred around wetlands, where birds in dry years forage outside the wetlands19. A ban on lead shot in wetlands alone is insufficient to address the harmful effects of lead shot on water birds and other species. See also section on impacts of lead shot and rifle ammunition over terrestrial environments.

4. What will be the effects on wildlife and water ecosystems if a ban on using lead shot will not be introduced?
A review by Pain et al. (2015) shows that waterfowl are exposed to lead through ingestion of spent shot. The birds actively select it mistaking it for food or the grit they need to aid digestion. Embedded gunshot is an additional exposure route. Raptors and people are exposed by consuming fragments of lead ammunition in shot waterfowl, terrestrial gamebirds, deer and other game. Both acute and chronic lead poisoning result from these exposure pathways. This is a significant and avoidable cause of mortality and sub-lethal effects to wild birds which impact on the annual survival rates of many bird species.

Predatory birds kill wounded animals carrying shot-in embedded lead ammunition and others with ingested shot and scavenged carrion from such animals. In Europe, the species exposed include owls, falcons and a wider range of accipitrid raptors. Many species of raptors and owls could potentially kill and feed upon a game animal with fragments of lead ammunition shot into its tissues and ingested lead is recorded as the cause of mortality of numerous predatory and scavenging birds in Europe, effects of which may be greatest where hunting with lead ammunition is prevalent. Because they frequently prey upon waterfowl which may be contaminated with embedded lead gunshot, western marsh harriers, white-tailed eagles and peregrine falcons are the raptor species which might be expected to be most exposed to ammunition-derived lead via this route. X-radiography or dissection of regurgitated food pellets shows that predatory and scavenging birds ingest lead gunshot frequently. Species affected in Europe include red kite, western marsh harriers, Spanish imperial eagle, peregrine falcon and white-tailed eagle. Some of the ingested lead is absorbed, resulting in harmful levels in some cases. Blood levels of lead in free-flying western marsh harriers have been found to be much higher during the duck hunting season when the occurrence of lead gunshot in regurgitated pellets was also higher.

In the UK, long term wildfowl disease surveillance between 2000 and 2010 found lead poisoning to be responsible for 8% of all deaths. A total of 73,750 wildfowl are estimated to die annually in the UK because they are poisoned by ingested lead shot. This represents about 3.1% of the wintering wildfowl population in the UK dying annually because of lead poisoning from ingested shot. Waterfowl species vary considerably in their exposure to ingested shot because of differences in diet, foraging behaviour and habitat. The equivalent calculations to those used to calculate UK additional mortality for all wildfowl give considerably higher annual mortality rates caused by lead shot ingestion for the two wintering duck species with the highest prevalence of ingested shot. For common pochard the estimated annual mortality rate from ingested lead is 7.6% and for northern pintail the annual rate is 11.7%. Populations of both of these species have declined markedly in the UK in recent decades, and to a greater extent than other duck species with lower exposure to ingested lead.

Across Europe, the impacts of ammunition-derived lead are likely to be affecting bird population trends. For example, one European study showed that differences among wildfowl species in their recent population trends was correlated to the degree to which they are exposed to ingested lead shot. Common Pochard is the species with the highest or second highest prevalence of ingested gunshot, depending on the measure used, and has recently been categorised as globally threatened (Vulnerable) in the IUCN Red List because of rapid declines across its large global range.
Reduction in exposure to ingested lead by enhanced regulation of another source has already been shown to benefit wildfowl populations. The banning of anglers’ lead weights affected mute swan populations in the UK. Lead poisoning incidence decreased and populations increased following the 1987 restrictions on the use of the lead weights for angling in the UK48. It is therefore expected that a ban on using lead shot will result in facilitating wildfowl population recovery, through removing a significant cause of mortality. No comprehensive figures are available in Europe on the likely scale of population recovery. In the United States, it was estimated that six years after introducing a nation-wide ban on lead shot in wetlands per year 1.4 million ducks were saved49.

5. Do you have any other information that would be relevant for the preparation of this Annex XV report? (including case studies and lead pollution in wetlands, remediation costs and hunting activities leading to high concentrations of lead)

Socio-economic costs which result from use of lead shot-over wetlands include a wide range of costs to the environment and society, which in many cases are likely to be significant, despite a lack of research to determine the true economic value. Use of lead shot imposes additional costs on society, via costs to the conservation community of research, monitoring and surveillance; in addition to the cost to governments of negative effects on human health, enforcement, monitoring and research; costs of contamination, pollution and remediation at points of extraction, manufacture and use; and organisations which undertake veterinary care and rehabilitation of lead-poisoned birds. Other costs result from the impacts of lead on wildfowl and raptor populations, including corresponding loss of benefits in the form of hunting, bird watching, and other uses.

The network of Natura 2000 sites in the EU involves considerable opportunity and maintenance costs. Natura 2000 sites are of particular importance in protecting breeding, feeding and roosting habitats for wildfowl and raptors. Although this network is effective, its cost-effectiveness is reduced by contamination of sediments by spent shot in and around the sites and the presence of wounded wildfowl and birds with ingested gunshot that contaminate raptors when they prey upon or scavenge them. Many Natura 2000 sites have been or are still being contaminated by lead shot50,51,52. Hence, the costs of conservation measures required to maintain bird populations at Favourable Conservation Status is increased by the absence or ineffectiveness of restrictions on the use of lead ammunition in and near wetlands.

The negative effects of dietary lead on human health are well-documented. According to EFSA53 there are impacts of importance to society through effects of ingested lead on the cognitive development of children, kidney disease and cardiovascular disease. In addition to the obvious effects on human well-being, there are substantial costs in terms of medical treatment and loss of capability and function in the workplace. Part of these costs is attributable to ammunition-derived dietary lead, including that from wild-shot wildfowl. For individuals who eat gamebirds and wildfowl shot with lead ammunition regularly, there are increased risks of adverse health outcomes and the associated costs because ammunition-derived lead is absorbed and adds substantially to the exposure to lead involved in a
normal diet. In the UK, it is estimated that between 4,000 and 48,000 children may be at risk of incurring 1 point reduction in IQ as a result of current levels of consumption of wild-shot gamebirds and wildfowl. Economic impacts resulting from a reduction of 1 IQ point have been estimated to range from £788-997. For the UK only and considering only this aspect of the impacts of lead shot use, resulting economic impacts may be in the region of £23m (range £3.2m-£48m). Given that 3.9% of the combined gamebirds, pigeons and wildfowl shot in the UK are wildfowl, most of which remain contaminated with shot-in lead shot, despite a long-standing ban, the hunting of wildfowl with lead ammunition makes a non-trivial contribution to this risk.

In 2003, it was estimated that EU15 Member States consumed approximately 53,000 tonnes of lead for manufacturing of ammunition, 38,600 tonnes of which was used within the EU. The processing of lead ore releases large amounts of lead and other toxic elements, such as cadmium into the environment, with the highest levels of production existing in countries which operate fewer safeguards than the EU. These processes can impact on wildlife in some cases. Commensurate reductions in the environmental impacts which can result from lead mining and processing would be an additional benefit for a switch to use of steel shot.

**Impacts of lead shot and rifle ammunition over terrestrial environments**

**Alternatives hunting efficiency and safety**

Ricochet exists as a risk for shooting with all types of ammunition and hunters have a responsibility for safe shooting practice. Non-toxic alternatives to lead shot have been used over terrestrial environments in Denmark since 1996. Non-toxic rifle bullets have been used in a number of situations, including within condor protection ranges in the USA, a number of German Federal States and for deer control in the UK by the RSPB.

Most alternatives to lead ammunition are copper, which is available internationally in a range of calibres at comparable prices and with comparable effectiveness to lead bullets.

**Quantitative Industry impacts**

The use of lead shot and rifle bullets over terrestrial environments accounts for a majority of shooting in Europe and consequently, the majority of costs to the environment and society which result from the toxic effects of lead.

Whilst in many cases the wider costs resulting from use of lead ammunition have not yet been quantified, many of these are likely to be substantial on a European scale. For example, chelation therapy used to reduce the effects of lead poisoning on reintroduced California condors is an additional potential cost for protection of vulnerable scavenger populations and reintroduced species, which can be avoided via the use of non-toxic alternatives. Monitoring for lead poisoning and chelation treatment of 11 condors with high blood levels of lead was carried out in California in 2002, at a cost of $20k (approx. $2,400 per bird when adjusted for inflation).
Compliance

Whilst there are few studies of compliance with restrictions of lead ammunition use over terrestrial environments in Europe, in areas of California where use of lead rifle ammunition has been banned, 99% compliance has been reported within condor protection areas73. In the neighbouring state of Arizona, fewer than half of hunters surveyed in one study were complying with advisory restrictions without the provision of an incentive, although incentivising compliance via provision of free non-toxic ammunition significantly increased compliance74. This study also recorded no significant difference in harvest success between ammunition types.

Susceptibility of scavenging birds to mass-poisoning events and the capacity for individual carcasses to attract birds from a wide area may be factors in the failure of partial restrictions to prevent lead poisoning impacts in the USA75, which may contribute to the limited capacity of voluntary or localised restrictions to fully address the impacts of lead poisoning on the condor population76. Similar issues could be encountered in Europe, where a partial ban of lead shot use over wetlands in Sweden did not reduce the proportion of lead poisoned white-tailed sea eagles, which remained a significant mortality factor for the population77.

Consequences of no ban

Raptors and people are exposed by consuming fragments of lead ammunition in shot terrestrial gamebirds, deer and other game78, 79. Exposure of granivorous birds can also occur via uptake of lead as grit in terrestrial environments80. There is currently a lack of studies of population effects of use of lead ammunition over terrestrial environments, however, modelling by Meyer et al. (2016)81 indicates that these routes could lead to levels of exposure which represent a limiting factor for some bird populations, predicting that exposure to lead ammunition could result in a 10% reduction in population size for grey partridge and could slow recovery of red kite populations.

There is growing evidence that a number of other species of scavenging bird are exposed to lead from ammunition. Madry et al. (2015) found evidence of lead poisoning from ammunition in the Swiss golden eagle population, indicating a sub-lethal lead burden within the population, the effects of which are currently unknown82. Use of lead ammunition has also been identified as a potential threat to scavenging bird populations in the Pyrenees, including the reintroduced bearded vulture population, although further study will be required in this case to determine the significance of lead ammunition use as a threat to recovery83. Lead bullet fragments have also been determined to be a substantial cause of mortality for white tailed eagles in Sweden and Estonia84, 85. There is greater availability of research in the USA, where recovery of the California condor is threatened by lead poisoning86 and restrictions on use of lead ammunition are capable of significantly reducing exposure87. An existing ban on use of lead ammunition in the condor protection range will be extended State-wide for all hunting from July 201988.


14 HOS/BirdLife Greece, personal communications.


54 Green, R.E. & Pain, D.J. (2012) Potential health risks to adults and children in the UK from exposure to dietary lead in gamebirds shot with lead ammunition. Food & Chemical Toxicology 50, 4180-4190.