Update Report from the Lead Ammunition Group

Executive Summary

Lead Ammunition Group
April 2018

BACKGROUND

In June 2015, the Chair of the Lead Ammunition Group (LAG) submitted the report 'Lead Ammunition, Wildlife and Human Health' (LAG 2015) and an accompanying summary letter on the risks from lead ammunition to wildlife and people, and potential mitigation measures to the then Secretary of State for Environment, Food and Rural Affairs the Rt. Hon Elizabeth Truss. The 412 page LAG report included as appendices detailed risk assessments (LAG RAs) and a comprehensive register of risks and mitigation options. In her response to the report (12 July 2016), the Secretary of State mentioned a lack of studies providing evidence of population level effects in wild birds in the UK and decided that, in her view, the risks did not merit a change in current policy on the use of lead ammunition.

The LAG website provides details of all LAG activities.

NEW DEVELOPMENTS

Since submission of the LAG report, there have been developments in international policy towards reducing the risks to human and wildlife health from the use of lead ammunition, and some changes in practice towards the transition to non-toxic ammunition have occurred within the UK. Since the LAG RAs were first drafted (late 2013), considerable new research has been published, some of which may have been stimulated by the LAG process. New research particularly covers risks to human health, effects on population processes and trends in wild birds, and effects on scavenging and predatory birds across Europe. New ammunition types have also been developed and ammunition types have been tested for suitability, doubtless stimulated by new resolutions within multilateral environmental agreements and national legislation introduced elsewhere.

THE AIM OF THIS UPDATE REPORT FROM THE LEAD AMMUNITION GROUP AND THIS EXECUTIVE SUMMARY

The LAG Update Report aims to inform Defra, FSA and other interested parties of the new evidence plus risk reduction practice and policy developments since the original LAG report. New evidence identified since the submission of the LAG report is reviewed and evaluated with respect to the original report's conclusions and recommendations. This Executive Summary provides a synthesis of the LAG Update Report.

The Update Report is based on a comprehensive review of the literature and related developments between January 2013 and January 2018 (when the literature search was conducted). Web of Science was the primary source searched using combinations of relevant terms. The resulting reference list was checked against references that the LAG had been made aware of incidentally since 2015, as posted on the LAG website, and a small number of additional references were considered. While this search may have missed a few references, especially in the grey literature, we are confident that the vast majority will have been included. In addition, we have provided updates on national and international process, policy and advice relating to the use of lead ammunition and risks that it presents. The review does not include all new information on human health effects related to all sources of lead and as this literature is extensive.

The Update Report is destined for publication in the externally peer-reviewed scientific literature and so its circulation is currently restricted to key stakeholders. However, the Report's **Executive Summary** along with the **publications list** cited in the full report (including >160 publications from 2013 and later) are widely available. Significant new developments are highlighted in bold font.

1. RISKS TO WILDLIFE

The LAG report described several pathways of exposure of wildlife to lead from ammunition. Recent studies provide supporting evidence concerning these previously described pathways of exposure. **Recent papers expand the number of species and taxa affected and areas in which they occur[1,2,3,4,5,6,7,8,9,10], and include species present in the UK[7,11,12,13,14,15,16,17,18]. New evidence supports a previously little-studied pathway of exposure for wildlife: absorption of lead from embedded ammunition/fragments in injured but surviving birds[3,19,20,21].**

Much previous evidence about the effects of lead concerned wetland birds. Recent experimental studies on effects of exposure to lead from ammunition have focussed on non-wetland birds and have documented a range of sublethal effects. Studies suggest that some terrestrial species may be less susceptible to the effects of lead exposure than wildfowl while others may be more sensitive. While the many intrinsic and extrinsic factors that influence susceptibility to lead poisoning complicate interpretation, **the evidence suggests that there are likely interspecific differences in susceptibility[22,23,24,25,26,27]**.

In the wild, sublethal effects have been documented in terrestrial birds, including scavenging/predatory birds and waterbirds including wildfowl. In Mallards[28], Whooper Swans[29] and Golden Eagles[11] **effects have been reported at lower blood lead (PbB) concentrations than previously reported. This development mirrors trends in human medicine, which have concluded that there is no clear threshold below which there is no effect of lead exposure on human health. Accepted upper 'thresholds' indicative of levels of effect in wild birds should therefore be reconsidered.**

Deaths from or associated with lead poisoning in wild birds have been reported in a range of scavenging and predatory species, especially raptors, including species that occur in the UK[11,12,13,16,30,31,32], supplementing previous evidence.

The number of birds estimated to suffer welfare effects may be higher than previously considered. Birds that absorb lead from ingested or embedded ammunition are likely to suffer some effect on their welfare. In Europe 3 million plus waterbirds are estimated to suffer sublethal lead poisoning annually from the ingestion of lead shot in addition to the 1 million estimated to die of lead poisoning[33]. As an estimated 6 million wildfowl are shot annually in the EU[34], additional birds (likely hundreds of thousands to millions) will be injured but not killed and carry embedded shot. The proportion of injured birds with embedded shot that have elevated PbB as a consequence is unknown, but may be considerable. In Europe, mild to severe welfare effects of lead poisoning probably affect more than a quarter of individuals in the 16 wildfowl species studied and may affect a third to a half of these populations. This does not include other wildfowl species, terrestrial birds and scavenging/predatory birds because no estimates exist for numbers affected across Europe. In the UK, c. 50-100,000 wildfowl are estimated to die from lead poisoning annually[35]. By applying a similar calculation, 150,000-300,000 birds may suffer sublethal poisoning following shot ingestion and additional birds will have embedded lead resulting in **200,000 to more than 400,000 wildfowl estimated to suffer welfare effects to some degree in the UK annually.**

Several new studies have examined population-level effects in birds. Population modelling and correlative studies suggest that lead poisoning may be affecting population growth rates and sizes in a number of species, including freshwater ducks in the UK and along their flyways[36], as well as Grey Partridge, Common Buzzard, and Red Kite in selected locations in Europe[37] including the UK. Particular concern has been expressed about the possible impact of lead poisoning on the population of the globally threatened Common Pochard[36]. Declining or recovering populations appear most sensitive to the effects of poisoning[37]. Beyond Europe, lead poisoning has been implicated in the negative population trends of local populations of

the Spectacled Eider[38], and lead poisoning from fishing tackle, which exerts similar effects, has been shown to have a population-level effect on the Common Loon in New Hampshire[39].

2. RISKS TO LIVESTOCK, DOMESTIC AND OTHER CAPTIVE ANIMALS

Due to its stipulated Terms of Reference the LAG was to assess risks to human health from livestock exposed to lead ammunition and did not specifically consider risk to livestock, domestic and other captive animals. However, we include a brief summary here for completeness.

Lead poisoning from feeding captive falcons on wild-shot prey has long been understood by falconers and others[40,41,42], although before the fragmentation of bullets was understood it was considered that feeding falcons game shot with bullets avoided the lead contamination presented by shot (as bullets could easily be removed). More recently, the deaths from lead poisoning of two captive Cheetahs[9] that had routinely been fed hunted antelope or game birds highlights that this **problem may be more widespread in captive animals and that some wild predatory and scavenging mammals could also be at risk**. Domestic pets may also be at risk, e.g. hunters feeding their dogs on trimmings from the wound channels of wild-shot large game could put them at risk of lead poisoning[43]. Small numbers of incidents of lead poisoning from lead shot have been previously reported in domestic poultry and cattle from the UK and a recent case has been reported in captive ducks[44]. These cases result in welfare effects and mortality in relatively small numbers of livestock.

3. RISKS TO HUMAN HEALTH

Reference thresholds used to define elevated PbB have decreased for adults and may further decrease for children as PbB levels in survey populations decrease and analytical precision further improves[45,46]. A large scale longitudinal study from the USA has found that many more adult deaths appear to be associated with low level lead exposure than previously considered. Results suggest that low-level environmental lead exposure is an important and largely overlooked risk factor for death, particularly from cardiovascular disease, in the USA[47].

Previous evidence linking PbB with game consumption has been augmented by recent studies[48,49,50], and **there is some evidence that the number of people that frequently eat game in some EU countries may be higher than previously supposed[51]. Evidence also suggests that in addition to the relationship between PbB and consumption of wild-shot game, elevated PbB is also, independently, associated with hunting activity itself though the pathways for this are still a matter of speculation[52].** PbB is also associated with the retention of embedded lead ammunition following firearms injuries in some cases[53].

Small numbers of incidents of lead poisoning from ingested lead shot occur in domestic poultry and cattle from the UK. Such incidents occur occasionally and continue to cause suffering and mortality in small numbers of domestic animals and create potential food safety incidents. A recent case of lead poisoning from shot ingestion in captive ducks destined for release for shooting resulted in a potential food safety incident where it was advised that no ducks from the estate should enter the human food chain[44]. Had the ducks already been released this preventative action would not have been possible. Large numbers of wild ducks also destined for the human food chain regularly absorb lead from ingested shot. **This highlights a legislative inconsistency in approach to food safety and human health.**

4. MITIGATING RISKS

New studies confirm that many types of non-lead gunshot and bullets are effective, widely available, and safer with respect to environmental and wildlife health risks than lead ammunition[54,55,56,57,58,59]. Some health concerns have been expressed in association with frequent exposure to fume from certain Pb-free ammunition types[60,61] under enclosed or experimental conditions and technical solutions have been suggested[62].

A number of recent studies have confirmed that partial bans on the use of lead ammunition, i.e. restrictions covering certain taxa or geographical/habitat areas, are ineffective or only partially effective in reducing risks to wildlife[12,32,63,64,65]. This is because of incomplete compliance and because partial bans over wetlands/for wildfowl shooting, even when complied with, do not prevent exposure of wildfowl to lead when they visit terrestrial habitats and do little to reduce risks to predators and scavengers or terrestrial birds.

One study has found that **careful butchering of game, including small game, can reduce human health risks from lead ammunition but not remove them[66]; with small game, especially, such butchering may not be practical;** and impracticality may also arise for large game if standards and supervision are uncertain.

In 2015, **Commission Regulation (EU) 2015/628[67]** amended Annex XVII to Regulation (EC) No 1907/2006 **restricting the placing on the market of articles containing ≥0.05% by weight Pb** if they could under normal or foreseeable circumstances **be placed in the mouths of children**. The presence of just one lead shot weighing c. 0.1g in 100g breast meat of a gamebird would represent double this lead concentration.

Several international agreements have adopted Resolutions calling for governments to phase out lead ammunition, or work towards this goal:

- **The UN Convention on Migratory Species (CMS)** Resolution 11.15 – Preventing Poisoning of Migratory Birds[68] was adopted at COP11 in 2014. Its guidelines[69] call for Parties to phase out the use of lead ammunition across all habitats by November 2017. Steps towards this have included establishment of the CMS Lead Task Group at CMS COP12 in 2017 (UNEP-CMS 11.15 (Rev COP12).
- **International Union for the Conservation of Nature (IUCN)** WCC Resolution 082[70]**, adopted in 2016** supports CMS Resolution 11.15 and additionally calls for action from the IUCN Director General and Commissions, governments and member organisations to work towards the phase out of lead ammunition with a specific focus on reducing risks to waterbirds and scavengers.
- **A Resolution on Environment and Health adopted in December 2017 by the United Nations Environment Programme Assembly (UNEA-3)** (UNEP/EA.3/L.8)[71] further encourages Member States and the Executive Director of UNEP to raise awareness of the negative impacts and risks of chemical pollutants including lead ammunition on wildlife and to encourage research and safety testing of alternatives.

To ensure adequate control of risks from lead ammunition to human health and the environment and to ensure a harmonised approach across the EU, in December 2015 the European Commission requested that in accordance with Article 69 (1) of the REACH Regulation, the **European Chemicals Agency (ECHA) prepare an Annex XV dossier in view of a possible restrictions on lead (metal) in shot in wetlands[72].** This is underway and may be followed by another dossier for restriction of any other uses of lead ammunition. The restriction report annexes[73] prepared support the LAG report's conclusions.

A ban on the use of all lead ammunition for all hunting will come into force in California from 2019 (AB 711 (Rendon)[74]).

As well as policy developments, there have been changes in practice. Beginning in 2016, being mindful of lead-contaminated game potentially going into the human food chain, **Forest Enterprise England (FE) required their staff to use non-lead ammunition for deer and boar culling[75].** The decision was made following successful trials of selected non-lead bullets and was based on the clear evidence that lead from lead ammunition can contaminate carcasses and that FE's marketing position could be seriously damaged if they continued to put lead-contaminated meat into the human food chain when there are proven alternatives available. In 2017, the **National Health Service (NHS) on their website added game shot with lead pellets[76] to the list of foods that should be avoided during pregnancy**. In 2016 Natural England acknowledged risks from lead shot to upland birds by listing its use as an operation that may damage the features of interest of the West Pennine Moors Site of Special Scientific Interest[77].

One study estimated replacement costs of lead poisoned waterbirds and opportunity losses from hunting at 142-185 million Euros per year in Europe[33]. A direct extrapolation of this figure to the estimated 50,000-100,000 wildfowl alone estimated to die annually of lead poisoning in the UK gives **an estimated annual replacement/opportunity cost of 7.1-18.5 million Euros a year.**

Several recent papers have examined barriers to change. There appears now to be international scientific consensus on the wildlife and human health risks associated with lead ammunition and solutions[78,79]; remaining barriers appear to be socio-political[80].

5. CONCLUSIONS

Since submission of the LAG report, evidence on the risks from lead ammunition to humans, wildlife and captive animals has increased. An additional pathway of exposure in wildlife (from embedded lead) has been identified, suggesting that many more wild birds than previously suspected may suffer welfare effects. Effects in birds have been found at lower PbB than previously reported, mirroring trends in human medicine and suggesting that 'thresholds' for certain effects need revision downwards. New studies have provided evidence that known levels of lead poisoning from ammunition may have population-level effects in a number of species including freshwater ducks in the UK and along their flyways, and possibly a range of other species. Particular concern has been expressed about impacts on the globally threatened Common Pochard.

In human medicine reference thresholds used to define elevated PbB have continued to decrease for adults and may do so further for children. It appears that in some places more people may frequently eat game than previously supposed. In addition to PbB being associated with the consumption of game shot with lead ammunition, PbB appears to be independently associated with hunting activity. A recent potential food safety incident in the UK associated with lead shot ingestion by captive ducks destined for eventual release and shooting has highlighted a legislative inconsistency in approach to food safety and human health. Similarly, new EU Regulation restricts placing on the market of articles that can be placed in children's mouths that contain amounts of lead similar to those often encountered in game shot with lead ammunition.

Mitigation options have been researched and variously incorporated into policy and practice. A range of non-lead gunshot and bullet types have been tested and found to be effective and widely available. A number of recent studies have confirmed that partial bans (i.e. covering only certain taxa or habitats) on the use of lead ammunition are ineffective or only partially effective at reducing risks to wildlife. Careful butchering of game, including small game, can somewhat reduce lead levels and thus health risks to humans, but does not remove them, and there are serious doubts about its practicality.

Over the last few years several international agreements have adopted Resolutions calling for governments to phase out lead ammunition, or work towards this goal. In addition the European Commission is considering options for phasing out lead gunshot, initially in wetlands, to better manage the risks. While previous work

had explored the costs of transition to non-lead ammunition, the costs of the status quo are beginning to be considered, and appear high.

There appears to be international scientific consensus on the wildlife and human health risks associated with the use of lead ammunition and the need for a transition to non-lead alternatives; the remaining barriers are largely socio-political. There has been considerable and increasing interest in the issue across all stakeholder groups including senior levels of policy making and the European Commission. The issue was covered at the CMS Leaders' Breakfast[81] at the CMS Conference of Parties, in Manilla in 2017, attended by Ministers and Deputy Ministers as well as leaders from the private sector and regional and global treaties, and highlighted within a resolution on Environment and Health originally submitted by the EU[71]. The public consultation on ECHA's dossier for restriction proposal had approaching 300 individual responses, the majority of which were supportive of restrictions.

We consider that the numerous peer-reviewed papers and other information published since production of the LAG report both support and strengthen its conclusions.

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