BASC review of the HSE Annex 15 opinion on lead ammunition restrictions.

December 2023

1. The British Association for Shooting and Conservation.

The British Association for Shooting and Conservation (BASC) is the largest shooting organisation in the UK with approximately 150,000 members.

Our mission is to promote and protect sporting shooting and advocate its conservation role throughout the UK.

Our role is to provide an effective and unified voice for sustainable shooting sports; to benefit the community by providing education, promoting scientific research, and advocating best practice in firearms licensing, habitat conservation, and wildlife and game management; and to promote the benefits of game as food.

Shooting contributes more than £2 billion a year to the UK economy and supports the equivalent of 74,000 full-time jobs.

Shooting is involved in the management of two-thirds of the UK's rural land area and plays a key role in nature recovery, benefitting some of our most vulnerable habitats and species.

Shooting contributes £250 million annually on conservation projects, involving 3.9 million workdays which is equivalent to 16,000 full time conservation jobs.

2. BASC position on lead ammunition.

BASC is opposed to any further regulation on the use of lead ammunition in the UK.

Regulations are already in place to mitigate risks to wildfowl from the use of lead shot in wetlands.

There is clear evidence that lead shot poses a risk to a wide range of bird species in terrestrial habitats and a voluntary move away from lead shot for live quarry shooting with shotguns is reducing these risks.

The shooting sector must be allowed time to develop non-lead shotgun ammunition due to a world shortage of components and the need for manufacturers and assemblers to source new machinery to produce lead shot alternatives and biodegradable wads for all shotgun calibers.

Lead in game meat is potentially a risk to human health via secondary exposure and government guidance and market forces are managing risks via best practice.

Lead exposure pathways are not conclusive for livestock, soil, soil organisms, plants, and surface waters; and current legal and regulatory frameworks are in place to manage risks.

3. Background to the HSE lead ammunition review.

Following the UK's departure from the European Union the government needed to create new laws on the regulation of chemicals so that the trade in various substances between Great Britain and the EU could continue (Northern Ireland trade being covered under the NI Protocol).

The Health and Safety Executive (HSE) was tasked as the agency responsible for the implementation of the regulations (called UK REACH) and in March 2021 it was announced that the first two substances to be reviewed would be lead in ammunition and certain chemicals in tattoo inks: emulating similar reviews in the EU. Many more substances have since been reviewed and some banned.

The scope of the review is the outdoor recreational use of lead ammunition in England, Wales, and Scotland. The indoor use of lead ammunition is excluded, as is military and non-civilian use of lead ammunition.

The approach the HSE has taken, and is taking with its other reviews, is looking at the risks and investigating where it is feasible to reduce those risks to a 'nil or negligible' level.

On 22 October 2021 the HSE launched an eight-week call for evidence on the development of a UK REACH restriction dossier for lead ammunition.

BASC submitted detailed evidence to the HSE and successfully applied to be an accredited stakeholder for the lead ammunition review.

On 6 May 2022, the HSE launched a six-month public consultation on restriction proposals for the outdoor recreational use of lead ammunition in England, Wales and Scotland.

BASC provided a 280-page response to the consultation supported by the following four technical reports.

- BASC Technical report on lead airgun pellet weight retention
- BASC Technical report on lead airgun pellet accuracy and muzzle energy
- BASC Technical report on non-lead 22lr rimfire ammunition accuracy and penetration
- BASC Technical report on non-lead .243 rifle ammunition accuracy and penetration

Following the consultation period BASC attended a series of checkpoint challenge panel meetings with the HSE to have oversight of the restriction proposal process.

On 5 January 2023, the HSE announced that it was delaying the next stage of the review process by six months "due to the high response rate (2,759 responses)".

4. The HSE SEA consultation.

On 11 October 2023, the next stage of the review process was initiated with a 60-day public consultation launched on the HSE's socioeconomic assessment (SEA) of its lead ammunition restriction proposals.

There are three parts to the HSE SEA consultation.

Firstly, the HSE has published an updated 373-page **HSE background** document relating to the development of the restriction proposals, the evidence used, and some of the feedback received to date.

Secondly, the HSE has published a 104-page **HSE Annex 15 opinion** document containing its revised restriction proposals and its opinion on these proposals, including a socioeconomic assessment. The HSE obtained advice from the Environment Agency (EA) in the production of the proposals and assessment. The EA in turn collaborated with environmental regulators in Scotland and Wales for its advice to the HSE.

Thirdly, a consultation response form has been published which includes **HSE socioeconomic questions** seeking information on factors that the HSE states "need to be taken into account". The response form offers no opportunity, other than in the general comments sections, to provide opinion upon the proposed restrictions. The questions appear to be little more than evidence gathering for further restrictions, rather than to assess the socioeconomic impact of the existing restrictions.

5. BASC response to the HSE SEA consultation.

BASC's response to the HSE SEA consultation has two parts.

The first part contains **BASC's review of the HSE Annex 15 opinion** and this is contained in **Section 7** of this document.

The second part contains **BASC's response to the HSE socioeconomic questions** contained in the HSE consultation response form which has been submitted as a separate document.

Cutting across this and the other BASC document are the following BASC concerns and recommendations that we would like the HSE to take into account for the SEA consultation outcome.

BASC is concerned:

- that the HSE underestimated the costs of its restriction proposals.
- about the lack of UK evidence contained in the HSE background document.
- about the positions within the HSE Annex 15 opinion document
- about the narrow scope of the HSE socioeconomic questions in the consultation response form, which offers no opportunity, other than in the general comments sections, to provide opinion on the impact of the proposed restrictions.

BASC is calling on the HSE to:

- ensure that any proposals for live quarry shooting with lead shot have realistic time frames before any restrictions come into force.
- drop proposals to ban the sale of lead shot for target shooting as a means of enforcing restrictions on the use of lead shot for live quarry shooting because this is mission creep and outside the scope of the HSE review.
- ensure that an independent body is appointed to review the supply of lead shot cartridges before any restrictions come into force.
- drop the proposed restrictions on "approved clay grounds" where appropriate risks management measures are in place.
- not propose any restrictions for lead rifle ammunition for live quarry shooting.
- implement a buy-back scheme.

6. BASC position on the HSE proposed restrictions.

BASC is opposed to any further regulation on the use of lead ammunition in the UK for the reasons set out in BASC's position on lead ammunition in Section 2 of this document above.

It is in that context that BASC sets out its position below on the HSE's proposed restrictions.

See also Section 7 for further context on BASC's position on the HSE's proposed restrictions.

6.1 Lead shot for live quarry shooting.

BASC is opposed to the HSE's proposed restrictions for lead shot for live quarry shooting because the shooting sector voluntary transition away from lead shot for live quarry shooting addresses the evidenced exposure risks identified by the HSE for food and the environment.

Restrictions on the use and the sale of lead shot for target shooting as a means of enforcing restrictions on the use of lead shot for live quarry shooting are not appropriate because this is mission creep and outside the scope of the HSE review.

If there is a restriction recommended for lead shot for live quarry shooting it must be evidence based and proportionate to the evidenced risk. We encourage the regulator to work closely with the sector to secure realistic transition periods that account for global supply chain issues.

As such, there should also be a review by an independent body to ensure the availability of the c80 million cartridges needed across all gauges of shotgun before any legislation comes in to force. This review should be conducted by an external independent body such as Cranfield University and be funded by Defra/HSE.

BASC remains committed to the shooting sector's voluntary transition away from lead shot and single use plastics for live quarry shooting. The transition so far has been a success, given the challenges faced, such as the war in Ukraine and Covid.

6.2 Lead shot for target shooting.

BASC is opposed to the HSE's proposed restrictions on the use of lead shot for target shooting because the use of lead shot for target shooting can continue where risks are controlled.

Evidence for the exposure risks for lead shot for target shooting are theoretical and inconclusive, and any restrictions based on these would be deemed as over-precautionary.

Restrictions on the use and the sale of lead shot for target shooting as a means of enforcing restrictions on the use of lead shot for live quarry shooting are not appropriate because this is mission creep and outside the scope of the HSE review.

BASC believes that any proposed restrictions for lead shot should be aimed at controlling the risks, rather than risk elimination.

BASC believes that if HSE proposed restrictions for the use of lead shot for target shooting (with the correct risk management measures in place) were dropped, then increased CO2

emissions would be avoided given that the CO2 emissions for steel shot production are higher than for lead shot.

BASC's view is that lead shot can continue to be used for most forms of shotgun target shooting where risks are appropriately and proportionately controlled, including the application of existing legislation.

6.3 Lead rifle ammunition for live quarry shooting.

BASC is opposed to restrictions on the use of lead rifle ammunition for live quarry shooting.

The HSE has proposed no restriction "at this time" on the placing on the market or use of lead bullets for live quarry shooting. The HSE has been unable to sufficiently quantify the benefits of restricting this use and has not been able to explicitly demonstrate the proportionality of a restriction. Therefore, no restriction should be made or proposed.

6.4 Lead rifle ammunition for target shooting.

BASC is opposed to restrictions on the use of lead rifle ammunition for target shooting.

BASC believes that lead rifle ammunition can continue to be used for all forms of target shooting where risks are appropriately and proportionately controlled through the application of existing legislation.

6.5. Lead airgun pellets for live quarry and target shooting.

BASC is opposed to restrictions on the use of lead airgun pellets for live quarry and target shooting because risks can be appropriately and proportionately controlled through the application of existing directives, regulations, and best practice guidance.

7. BASC review of the HSE Annex 15 opinion document.

7.1 Overview.

Section 8 of this BASC submission provides an analysis of the key elements of the Annex 15 opinion document.

BASC provides an overview of the exposure pathways for lead ammunition and assesses whether the evidence provided by HSE offers a conclusive picture of lethal and sub-lethal effects of lead and their attribution to lead ammunition as a source.

A BASC view is offered on whether the restrictions proposed by HSE are justified and proportionate.

A number of technical factors are also reviewed to assess the feasibility of the proposed transition to lead-free ammunition for centrefire, rimfires, airguns and small caliber shotguns.

Where HSE proposals are considered unnecessary or disproportionate to the risk, an alternative proposal is given that would eliminate the evidenced risk without being unnecessarily bureaucratic or over-reaching. Each of these new proposals is tested against the HSE criteria of effectiveness, practicability, monitorability and enforceability.

Where specific sections of the HSE Annex 15 opinion document or HSE background document are being commented on, reference is given to the relevant sections in those documents.

7.2 Lead shot and its use.

The HSE has considered the use of lead shot for live quarry and target shooting and considers that a restriction on the placing on the market and use is the only realistic way to:

- limit the amount of lead entering the environment; or
- eliminate the risk to humans from ingestion of lead shot-derived lead in game meat.

The HSE believes that the most effective risk management option is prohibition of the placing on the market and use of lead shot. By restricting the placing on the market of lead shot for all uses (i.e., both live quarry shooting and target shooting), the HSE believes that the effectiveness and compliance of this restriction is increased, and subsequent enforcement simplified.

BASC disagrees with the restriction proposals as outlined Sections 7.3 and 7.4 below.

7.3 Live quarry shooting with lead shot.

BASC's assessment is that the HSE has misunderstood the complications associated with a transition away from lead shot for live quarry shooting and this has been further exacerbated by the war in Ukraine meaning that components are in short supply.

The HSE has stated within the consultation documents that it may consider a shorter period of transition for Live quarry shooting with shot. Within the opinion document the HSE has stated that steel shot for live quarry shooting is already available. This is a clear oversight and not a true reflection of the industry and there are a significant number of challenges that need to be addressed before we are able to go completely lead free for live quarry shooting with shot.

There are 142 types of steel shot cartridges currently available, however there is a shortage in the supply of components such as powder. This issue has been brought on by the war in Ukraine. Military ammunition uses the same double based powders as some steel shot cartridges and the military have a priority over supplies, leaving domestic ammunition to utilise what is left.

There are currently 74 variants of 12 and 20-gauge cartridges available with steel shot and biodegradables wads, and a further 68 options made up of alternative shot such as bismuth, tungsten and tin zinc and alloy mixes. This is a significant progress; however, demand is now outstripping supply and the production of steel shot cartridges is slower than that of lead, therefore many manufacturers are investing heavily, acquiring new machinery to meet the demand of cartridges. There is also an issue with acquiring such machines that are produced in Europe at a rate of roughly 1 per year, and due to demand the time has risen to 3 years. However, we are in a position where the UK needs several such machines in a very short space of time.

Currently the figure used for live quarry shooting in the UK is c80.2 million cartridges.

The HSE has made no separation for small gauge shotguns (20 gauge and below) in its restriction proposals, and these small gauges account for 22.9 % of cartridges used and 482.7 tonnes of lead. There are very few 20-gauge options on the market and as of

November 2023 there is one 16 gauge, no 28 gauge and no .410 / 9mm / .22 options available.

These are challenges we face almost four years after the voluntary transition announcement in February 2020 and the HSE consideration that these challenges can be overcome within 3 years is unrealistic.

BASC is calling on the HSE to ensure that any proposals for live quarry shooting with lead shot have realistic time frames before any restrictions come into force.

7.4 Target shooting with lead shot.

The HSE has proposed a restriction on the placing on the market and use of lead shot, with a derogation for individual athletes involved in target shooting, as identified by the appropriate sporting body.

The definition of an athlete is not within the Annex 15 opinion document and is yet to be clarified. This poses a significant issue as all potential TEAM GB athletes start their career by shooting at a clay ground. In this scenario they would have to shoot with non-lead cartridges until they were recruited as an athlete.

The HSE also states that when used for target shooting, lead shot will remain on the surface of the ground where there is a risk of primary poisoning to birds and livestock unless it is immediately collected.

BASC believes that the use of lead shot for target shooting can continue where risks are controlled.

See Section 7.12 for more detailed BASC comments on these aspects.

7.5 Mortality and sub-lethal effects from secondary exposure – birds.

As per BASC's 2022 consultation response to the HSE, there is no GB evidence which provides a causal link between lead shot and lead poisoning resulting in mortality or sub-lethal effects on predatory or scavenging species. BASC considers that the HSE has not appropriately addressed the uncertainties in the evidence base from which it has drawn conclusions to justify restrictions.

The study by Pain *et al*. (1995) found a range of liver lead concentrations in 16 species of raptors in the UK. The study **did not** attempt to demonstrate analytically that **lead shot was the cause of elevated liver lead concentrations**.

Pain *et al.* (2007) analysis of food pellets from Red Kite roosts provided **no confirmatory evidence of lead shot being present in samples**. "*Radiographs showed that 29 of 264 (11%) contained radio-dense material, **not verified but presumed** to be mainly shot or shot fragments. Sixteen pellets were dissected, six of which (37.2%) contained 1 to 3 objects **regarded** as lead shot".* The lack of confirmatory evidence renders the study speculatory.

Of the further studies referenced by the HSE covering 16 species of raptors, none offer a definitive causal link between mortality or acute poisoning from lead shot. Of the 22 studies of raptors cited by the HSE, only five studies offer any suggestion of the source of lead

where elevated levels were detected. The source is described by the HSE as "***suggested ingestion of ammunition***" The HSE does not go on to address this uncertainty.

Of the 16 raptor species studied, only three species - Common Buzzard, Peregrine Falcon and Red Kite - were found to exhibit lead levels above clinical thresholds. Six other species were recorded with liver concentrations of lead above sub-clinical thresholds, but in any sample <10% exhibited such concentrations.

The HSE suggests that a secondary exposure pathway exists to predatory and scavenging birds from lead shot and rifle ammunition used for 'live quarry shooting'.

The evidence supports the likelihood of lead shot being dispersed in carcasses or discarded offal. Given that 97% of game meat goes into the food chain (PACEC, 2014) there is limited scope for predatory and scavenging species to be exposed via this potential exposure pathway.

Best practice guidance for pest mammal and pest bird species which are not placed into the human food chain (e.g., fox, carrion crow) is to dispose via a certified waste carrier, incinerate or leave in a discrete location away from view of the public. Again, this often means disposal in locations of dense cover that would be unavailable to raptor species or other scavenging birds further reducing any potential secondary pathway.

There is no conclusive evidence which links lead ammunition as a cause of lead poisoning via secondary exposure, despite a theoretical pathway existing.

Even where isotope analysis of detected lead is undertaken (Walker *et al.,* 2012 and Taggart *et al.,* 2020) it is inconclusive as to the source of the lead. This is due to overlaps with lead isotopes from coal in the Walker *et al.* (2012) study which reports: "*There was **no clear evidence** that birds with the higher residues (those with the top 25 percentile of total liver Pb concentrations) in either species had isotope signatures that particularly resembled that of shot or ammunition"* and "*There was also **some overlap with the isotope signature for coal and for Pb shot**, but the signatures in the birds were distinct from that of petrol"*

Whilst the Taggart *et al.* (2020) study is most comprehensive UK study of lead exposure to raptors, **it is not conclusive of the source of elevated lead levels in liver and bone**. Only a small percentage of studied birds had elevated levels of lead (2.7% in liver and 4% in bone). The abstract of the study states: "*Hence, most of the Pb acquired by Eurasian buzzards which have liver concentrations **likely** to be associated with lethal and sublethal effects is **probably** obtained when they prey upon or scavenge gamebirds and mammals shot using Pb shotgun pellets.*"

Therefore, the HSE has not provided any analytical or observational evidence to link reports of birds with levels of lead above background concentrations to lead in ammunition.

The submissions of the 'International Shooting Federation of Hunting Sport Weapons' (FITASC) to the European Chemicals Agency (ECHA) review of lead ammunition (Palinkas, 2020) discusses the behaviour of lead in soil and its relative stability, evidencing limited mobility of lead in soils where pH is >6.5. This report offers evidence that lead shot, even at sites with high use, can be adequately managed.

Some conclusions reached by the HSE are supported by evidence provided from modelling studies (Green *et al.,* 2022 and Meyer *et al.,* 2016). Such studies are modelled on a series of assumptions, and whilst they demonstrate a theoretical impact of lead poisoning, **they do not identify the source of lead as being from gunshot. BASC considers that such models are unsafe to support proposals for regulatory action.**

Finally, the HSE has not provided any empirical evidence in Great Britain to suggest negative impacts on individual terrestrial birds or at species population level.

BASC has concluded that highly restrictive regulation, based on the theoretical likelihood of secondary exposure to lead ammunition, is disproportionate to the risk. The HSE has identified significant uncertainty in its conclusion around secondary poisoning of birds but has not addressed this within its Annex 15 opinion document.

Currently, the proposed restrictions appear to be based on the existence of theoretical pathways of exposure rather than the actual impact because of the exposure. BASC contends that **any restriction on this basis is currently not justified** and is therefore **unnecessary and disproportionate**. If restrictions underpinned by secondary poisoning risk are to be implemented, this would be deemed an over-precautionary measure.

The table below, based on BSSC's submission to the HSE call for evidence provides an estimate of the total number of lead cartridges used annually and the resulting weight (tonnes) of lead emitted annually through "target shooting" and ''live quarry shooting'' respectively.

Table 1. Number of cartridges and tonnes of lead gunshot emitted annually.

	'Outdoor target shooting with shot Cartridges			**Live Quarry shooting Cartridges**			
Bore size	**Number of lead cartridges used / year (millions)**	**Average load of lead per cartridge in grams**	**Weight of lead in tonnes**	**Number of lead cartridges used / year (millions)**	**Average load of lead per cartridge in grams***	**Weight of lead in tonnes**	**Number of non-lead cartridges used per year (millions)**
10	n/a	n/a	n/a	<0.1	50	<1	<0.1
12	161	28	4508	61.8	30	1854	5.2
16	0.9	24	21.6	1.7	28	47.6	
20	10.1	21	212.1	11.7	28	327.6	1.3
28**				2.5	25	62.5	
36 (.410)	1	11	11	2.5	18	45	
TOTAL	**173**		**4752.7**	**80.2**		**2336.7**	**6.5**

BASC is calling on the HSE to drop the proposed restrictions on "approved clay grounds" where appropriate risks management measures are in place.

7.6 Lead bullets for target shooting.

The HSE has proposed a restriction on the use of lead bullets for outdoor target shooting with a derogation for use at ranges with appropriate risk management measures in place.

The HSE has stated in its Annex 15 opinion document that "*A risk for the environment that is not adequately controlled has been identified for outdoor target shooting with lead bullets. Given that industry-recognised risk management measures are available, the Agency*

considers that appropriate implementation of such measures would minimise the risk to acceptable levels. At present many, but not all, sites implement appropriate risk management measures. The Agency is, therefore, ***proposing a restriction on outdoor target shooting with lead bullets****, albeit with a derogation to allow the use of lead bullets at sites which can demonstrate appropriate risk management measures are in place".*

The HSE has proposed a restriction time frame of 2 years for rifle shooting on ranges that are not able demonstrate that they have the correct measures in place.

BASC believes that before any legislation is proposed the requirements for such measures should be in place. Until such measures are defined the impact of any legislation cannot be assessed.

There are regulations and specifications in place to control the proposed risks of lead bullets on ranges, therefore BASC believes that further regulation is not required.

7.7 Exposure pathway - soil, soil organisms and vegetation.

The HSE considers uses of lead ammunition that result in high inputs of lead ammunition to the same site (e.g. shooting ranges) to be a relevant exposure pathway. For soil, the data indicates that lead levels can be elevated, but, as outlined in the HSE Annex 15 opinion document, there are no quality thresholds for lead in soil in the UK. The HSE also fails to infer what impacts are occurring because of elevated lead levels in the soil.

Associated risks emanating from the accumulation of lead on shooting ranges i.e. to humans via environment (food) and livestock are already dealt with through the following existing EU directives and regulations that are retained in UK law:

- Regulation 1881/2006 that limits lead in food for human consumption,
- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed

BASC concludes that highly restrictive regulation, on account of the theoretical possibility of exposure of soil, soil organisms and vegetation from lead ammunition, is disproportionate to the risk.

Restrictions appear to be based on the existence of theoretical pathways of exposure rather than the actual impact because of the exposure. BASC contends that any restriction on this basis is currently not justified and therefore unnecessary and disproportionate. Furthermore, the presence of existing legislation would make the additional regulation for this theoretic exposure pathway unnecessary 'gold plating'.

7.8 Lead bullets for live quarry shooting.

The HSE has proposed no restriction "at this time" on the placing on the market or use of lead bullets for live quarry shooting.

The HSE has been unable to sufficiently quantify the benefits of restricting this use and has not been able to explicitly demonstrate the proportionality of a restriction. **Therefore, no restriction should be made or proposed.**

To clarify how risks are currently controlled, best practice guidance for disposal of viscera dictates that it should be buried at least 1m deep and away from water courses, deposited with a certified waste carrier or deposited on the ground in a discrete location away from view of the public. This often means disposal in locations of dense cover which would be unavailable to raptor species or other scavenging birds. This further reduces the likelihood of exposure of raptors to 'waste items' such as viscera from deer.

An extract from the HSE Annex 15 opinion document explains that: *"Shooters pursuing live quarry will need to both 'zero' their rifles, and practice, typically on shooting ranges, to ensure accuracy when shooting. Currently, non-lead bullets are not permitted to be used on some ranges; this is primarily due to concerns around safety and damage to infrastructure, the possible extent of which is currently unknown. This might make it difficult for shooters to practice or zero their rifles before engaging quarry, resulting in undesirable outcomes, e.g., missed shots, wounding live quarry without killing".*

The HSE has asked the question "where do live quarry shooters zero their rifles".

This is a leading question, and BASC believes that live quarry shooters should have the opportunity to zero on ranges, and by restricting the use of lead ammunition for live quarry shooting the opportunities for live quarry shooters would be reduced as they would no longer be able to practice or zero on ranges due to the lack of risk templates. The impacts of this would be animal welfare, economic and social.

The HSE has asked the question "when would you use nonexpanding ammunition for live quarry and in what caliber?

BASC would draw to the attention of the HSE that lead ammunition is expanding due to its malleability, and in many cases target rounds will be used for live quarry shooting. For example, when rabbit shooting with .22lr, target ammunition is commonly used as it is very accurate and would cause less meat damage.

Equally there are many calibers/gauges including .32, .38, along with 12g and .410 slugs that are all used for live quarry for humane dispatch or to be shot at range.

Historic and muzzleloading firearms ammunition is all "non-jacketed lead ammunition" and is used for live quarry and target shooting.

12-gauge slugs are commonly used for practical shotgun shooting and they are also used when shooting wild boar, whose population is on the increase in the UK.

7.9 Exposure pathway - surface or ground waters.

The HSE (2022) states: "*There is no evidence from GB that surface waters are contaminated with lead from the use of ammunition. This pathway is not considered further in the environmental risk assessment as it is not considered a key pathway".*

In any case, existing regulation through the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 and the Scotland River Basin District (Standards) Amendment Directions 2015 applies.

Further regulation in this regard would therefore be unnecessary. It is concerning that restriction proposals seek to regulate surface and ground waters despite the admission of HSE that it is not a key pathway, and that no evidence is presented to support this restriction measure.

BASC is calling on the HSE not to propose restrictions for lead rifle ammunition for live quarry shooting.

7.10 Lead in airgun ammunition for live quarry and target shooting.

The HSE has proposed **'no restriction'** at this time on the placing on the market or use of lead in airgun ammunition.

BASC believes that this is the correct decision based on the negligible risk posed by airgun ammunition as per the two technical reports submitted by BASC to the HSE in 2022.

7.11 Financial incentive (Ref: 2.1 HSE Annex 15 opinion document).

The HSE has not offered a buy back scheme, it has rather considered taxing lead cartridges to incentivise the transition away from lead ammunition. This is based on the belief that this would be successful due to steel cartridges being cheaper than lead equivalents and that shooters currently pay a premium to continue using lead.

The situation is more complex in reality and the use of steel shot loaded with biodegradable wads needs to be factored in. At the time the figures were provided, steel shot was being loaded with plastic wadding. However, since then there has been a sector move away from single use plastics and therefore the cartridge cost would be for sustainable ammunition – (non-lead shot and biodegradable wad). The current figures shows that sustainable ammunition is more expensive than the lead equivalent.

Below is a Table that sets out the average price of cartridges:

Gauge	Average cost (£'s) per 1000 cartridges (lead)	Average cost (£'s) per 1000 cartridges (non-lead)
12	£465	£548 Steel only
20	£426	£524 Steel only
16	£447	£1339 Bismuth and Steel
28	£416	£1443 Bismuth only
.410	£394	£1461 Bismuth only

The above Table shows that non-lead ammunition is more expensive than the lead equivalent (See Appendix 1 for a breakdown of the costs).

- 12-gauge 15.2% price increase of £83 per thousand
- 20-gauge 18.7% price increase of £98 per thousand.
- 16-gauge 66.7% price increase of £892 per thousand
- 28-gauge 71.2% price increase of £1027 per thousand
- .410-gauge 73.1% price increase of £1067 per thousand

Small gauge shotguns account for 22.9% of the cartridges used in the UK annually, and of the 253.2 million cartridges used, approximately 55.7 million are small gauge.

Currently there are very few non-lead cartridges available for small gauges. Below 20 gauge the predominant material used is bismuth. This causes a significant price increase to the small gauge shooting community, and it is expected that many would not make the transition due to the cost. This renders many guns in the UK obsolete until sustainable ammunition becomes readily available and will have an impact on the land management undertaken by these users.

Any restriction should allow for extended periods for small gauge shotguns. Currently in the UK there are not any providers of sustainable ammunition for small gauges other than 20 gauge, therefore an extended period will allow time for the development and manufacturing of such cartridges.

Aside from the need for a realistic time frame for small gauges, a buy back scheme that covers the costs to the user would be plausible. All time frames would need to be agreed with cartridge manufacturers.

BASC considers buy-back schemes to have three important functions that should be upheld:

- Fairly compensate material loss as a result of restrictions
- Incentivise the transition to lead-free alternatives.
- Ensure that the restrictions do not create a 'false' or 'early' cliff edge for sales of lead products that undermine manufacturers' ability to invest in development and production of lead-free alternatives.

Whilst financial compensation schemes will play a part in this, BASC would also direct HSE to 'swap' schemes which allow practitioners to trade-in lead ammunition for lead-free alternatives. Such incentivised offerings have achieved 80% compliance in voluntary transition programs (Sieg *et al*. 2009).

A trade-in scheme offers the practitioner the opportunity to exchange lead for lead-free products, which avoids material loss and incentivises compliance with new regulation. Further, a government-funded scheme would have the effect of providing a guaranteed income for manufacturers - allowing them to invest in research, development, and production of lead-free ammunition. This would further aid the sector to transition to any new regulatory requirements.

BASC is calling on the HSE to implement a buy-back scheme that:

- **Fairly compensates material loss resulting from restrictions.**
- **Incentivises the transition to lead free alternatives.**
- **Ensures that the restrictions do not create a 'false' or 'early' cliff edge for sales of lead products that undermine manufacturers' ability to invest in development and production of lead-free alternatives.**

7.12 HSE proposed text for restrictions (Ref: 2.0 HSE Annex 15 opinion document).

BASC has comments on the following HSE proposed text for restriction:

- *The **use of lead shot for live quarry shooting** would be prohibited.*

- *The **use of lead shot for target shooting** would be prohibited. **However,** a derogation will allow for a small number of athletes, as identified by the appropriate sporting body (for example British Shooting), that are required to continue shooting lead shot for the purposes of international competition and training.*

This wording is very vague and creates many questions. Further clarity will be needed.

For instance, for the statement “A small number of athletes”, what quantifies a “small number” and why is there a restriction on the number of athletes within shooting?

Anyone wanting to pursue a career through shooting Olympic disciplines could be considered in “training” so at what point do potential athletes meet the criteria to be able to train with lead shot?

BASC has comments on the following HSE proposed text for restriction:

- *The **sale or trade of lead shot** (for a price or otherwise) would be prohibited. **However,** a derogation will allow for those athletes referenced above to continue to source the lead shot required for international competition and training.*

Manufacturers do not sell to individuals, they generally sell to trade outlets.

Once athletes have been identified by British Shooting, how do athletes purchase cartridges for training and competition?

Would athletes be able to use lead shot cartridges at any nominated ground, or only grounds with risk management measures in place?

BASC believes that the proposed text for restriction will limit the opportunities for people to become athletes through shooting and reduce GB chances of medals and competing.

BASC believes that the use of lead shot for target shooting can continue where risks are controlled.

Associated risks emanating from the accumulation of lead on shooting ranges i.e., to humans via environment (food) and livestock are already dealt with through existing EU directives and regulations which are retained in UK law as follows:

- Regulation 1881/2006 that limits lead in food for human consumption,
- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed

BASC has comments on the following HSE proposed text for restriction:

- *The **sale or trade of lead bullets** (for a price or otherwise) would **not** be prohibited, since these would continue to be available for indoor shooting which is out of scope of this restriction.*

- *The **use of lead bullets for live quarry shooting** would **not** be prohibited.*

- *The **use of lead bullets for outdoor target shooting** would be prohibited. **However**, a derogation would allow for this use to continue at sites that have controls in place to reduce the identified risks to the environment, and documentation indicating why these controls are appropriate. **In practise**, these controls, which*

include de-leading of ranges, are broadly expected to be in place by the majority of existing outdoor shooting ranges. o This means that the majority of outdoor shooting ranges could continue to operate and allow the use of lead bullets.

The HSE needs to work closely with the relevant shooting organisations to ensure any such restriction process is transparent and workable ahead of any legislation being enforced, and this will need to include a realistic timeframe for ranges to make the necessary adjustments.

BASC notes the following HSE statement, and has commented on lead airgun pellets elsewhere in this document:

- *The **use of lead ammunition in air weapons** would **not** be prohibited.*
- *The **sale or trade of lead ammunition for air weapons** (for a price or otherwise) would **not** be prohibited.*

BASC also notes the following HSE statement:

- *To note that some of these **intended outcomes may change** as a consequence of the information received during the public consultation on the draft socioeconomic opinion.*

7.13 Alternatives to a REACH restriction (Ref: 2.1 Annex 15 opinion document).

Voluntary Measures.

BASC and eight other organisations agreed a voluntary transition away from lead shot and single use plastics for live quarry shooting.

The transition so far has been a success, given the challenges faced, such as the war in Ukraine and Covid.

The figures from the 2022 GunsOnPegs Game Shooting Census and Shoot Owner Census survey undertaken by GunsOPegs estimates that:

- 70% of shoots will insist on guns going lead free.
- 43% were going lead free and encouraging other to do so.
- 60% had plans to go lead free for the coming season.
- 77% of guns said they would be happy to change of a shoot requested them to do so.

The principle for the transition was to reduce the risk to humans through food and to wildlife through primary exposure. The statement did not include rifle shooting for live quarry or target shooting. The statement did not include lead shot for target shooting with shotguns.

Information in the supply chain.

BASC along with the other shooting organisations provide key messages continuously regarding the transition away from lead shotgun ammunition for live quarry shooting.

Existing regulations.

BASC notes that the following EU directives and regulations, which are retained in UK law, control the risks of lead:

- Regulation 1881/2006 that limits lead in food for human consumption,
- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed

The HSE states that the regulations prohibiting the use of lead shot for shooting over wetlands and certain bird species were introduced across England, Wales, and Scotland between 1999 and 2004 and considers that **compliance is low.**

The HSE has the ability through partner organisations to undertake enforcement action. Equally the HSE can issue stop notices to shoots that are not acting lawfully.

The control measures that are already in place are suitable and therefore further legislation is considered by BASC to be "gold plating" and over-precautionary.

Meat preparation measures.

Meat hygiene measures and stewardship programmes to minimise the amount of metal in meat for human consumption are already in place.

The HSE considers that further development of "labelling" of food that may contain "lead" could be considered, detailing the risks associated with lead consumption. The HSE believes this could reduce the risk of human exposure but not eliminate that risk. However, this would not have an impact on the environmental risk or on food that was not marketed and consumed by people and/or shared with their friends and families.

BASC believes that the voluntary transition away from lead shot for live quarry shooting addresses the risks identified by the HSE.

7.14 Procedure for adoption of the opinion (Ref: 3.0 Annex 15 opinion document).

There is an error within Table 3 in the HSE Annex 15 opinion document giving the end date for the current consultation as 9 December 2023. The end date of the consultation is 10 December 2023 as outlined on the HSE website and BASC would therefore expect the HSE to accept any submissions submitted on 10 December 2023.

7.15 Opinion of the agency – risk assessment (Ref: 4.1 HSE Annex 15 opinion document).

Hazard.

The HSE refers to theoretical scenarios, and whilst there is evidence that lead can be harmful in certain scenarios, the research presented by the HSE is from outside the GB where practices are considerably different.

The exposure risks from lead in food and the environment are being addressed by the voluntary transition away from lead shot for live quarry shooting and the secondary exposure risks remain theoretical and inconclusive.

A study by Pain *et al*. (1995) found a range of liver lead concentrations in 16 species of raptors in the UK. The study did not attempt to demonstrate analytically that **lead shot was the cause of elevated liver lead concentrations**.

The likelihood of lead shot being dispersed in carcasses or discarded offal is low, given that 97% of game meat goes into the food chain (PACEC, 2014) and that means there is limited scope for predatory and scavenging species to be exposed via this potential exposure pathway.

Best practice guidance for pest mammal and pest bird species which are not placed into the human food chain (e.g., fox, carrion crow) is to dispose via a certified waste carrier, incinerate or leave in a discrete location away from view of the public. Again, this often means disposal in locations of dense cover that would be unavailable to raptor species or other scavenging birds further reducing any potential secondary pathway.

There is no conclusive evidence that links lead ammunition as a cause of lead poisoning via secondary exposure, despite a theoretical pathway existing.

Lethal Effects.

The HSE indicates that the ingestion of a single pellet of lead shot is enough in some circumstances to kill an individual bird but there is limited evidence to support this.

However, there is evidence that the ingestion of several pellets of lead shot by birds can have lethal effects.

A GWCT paper published in 2005 found that 4.5% of discovered dead grey partridge contained lead shot in their gizzards and it was estimated that 1.2% of living wild grey partridges contained ingested lead shot at any one time.

Other UK studies report similar findings in pheasants and red-legged partridge but do not record impacts on bird health and welfare. A Canadian study found elevated levels of lead in American woodcock that were traced back to lead shot ingestion.

Evidence of the lethal effects from the ingestion of lead shot for some bird species in the UK was one of the reasons for the voluntary transition away from lead shot for live quarry shooting announced by the shooting organisations in February 2020, to address that risk.

Sub-lethal Effects.

It is considered that welfare effects will occur at exposure concentrations lower than those at which mortality occurs. A variety of sub-lethal effects have been reported, such as reduced body condition, altered immune responses, effects on blood parameters and the cardiovascular system, altered kidney histopathology, ocular lesions which may lead to blindness, and effects on reproduction, growth, and development (such as reduced egg hatchability and juvenile survival).

Advice and guidance published on the GWCT website outlines that many bird species other than wildfowl could be affected by sub-lethal effects from ingestion of lead shot.

There is little evidence to date for the sub-lethal effect of lead ammunition on non-avian species nor much knowledge about how lead shot interacts with the environment as it degrades. However, it is widely accepted that the effect of lead on humans and wildlife increases with the dose.

Exposure.

The HSE did not undertake a fully quantitative exposure assessment for the various uses of lead in ammunition in GB for the purposes of its Annex 15 opinion document.

Instead, the HSE has considered the evidence for the key exposure pathways for each use of lead ammunition in GB.

Information on the tonnages of lead ammunition used in GB annually for each use was provided by several stakeholders during the 2022 public consultation. The HSE has assessed consultation responses and derived the total estimated volumes of lead released from lead ammunition to be approximately 7,100 tonnes per year as detailed in the following Table published in its Annex 15 opinion document:

Table 4 Annual tonnage per use	**Annual use (tonnes per year)**
1. Live quarry shooting with shot	**1,601**
2. Live quarry shooting with bullets	**3**
3. Live quarry shooting with airgun ammunition	**1**
4. Outdoor target shooting with shot	**5,359**
5. Outdoor target shooting with bullets	**112**
6. Outdoor target shooting with airgun ammunition	**12**
Total	**7,089**

BASC is satisfied that the HSE has taken into account stakeholder responses to produce an estimated annual tonnage of lead dispersed into the environment in GB.

Primary exposure of birds.

It is clear from the evidence that lead shot can be ingested by birds, and in those species where feeding ecology includes use of grit to aide their digestive process, lead shot can be mistakenly consumed. This is likely to be an issue for larger species of birds with this anatomy and digestive process. Other forms of lead ammunition are not considered by HSE to be relevant for primary exposure given their size (i.e. bullets).

In relation to lead shot used for live quarry shooting, the potential for this primary exposure pathway is not as broad as indicated in the HSE background report, given that shot typically used for Live Quarry Shooting (LQS) has diameters between 2.6mm (#6 shot) and 4.01mm (#B shot). This is outside of the grit size used for species such as the house sparrow (0.1mm – 2.4mm (Gionfriddo and Best, 1995)) and at the top end of the range used by other songbird species (<0.2-3.4mm, (Vyas *et al.*, 2000)), as put forward as evidence in the HSE background document.

There remains overlap in the size of grit used by species and the size of lead shot used for LQS, although for smaller species of songbirds the opportunity for exposure is reduced given that lead shot used in LQS is in some cases larger than the grit particle sizes consumed by the birds.

There remains evidence that lead shot is available to larger birds using a gizzard as part of their digestive process such as pheasants, partridge, and ducks.

The exposure of waterfowl to lead shot remains a primary exposure pathway in wetland environments owing to the lack of compliance with the existing lead shot regulations (Cromie *et al.,* 2010, 2015), although exposure in terrestrial environments is not quantified.

Secondary exposure of birds.

As per BASC's 2022 consultation response to the HSE, there is no GB evidence which provides a causal link between lead shot and lead poisoning leading to mortality or sub-lethal effects on predatory or scavenging species. It is considered by BASC that the HSE has not appropriately addressed the uncertainties in the evidence base from which it has drawn conclusions to justify restrictions.

The study of Pain *et al*. (1995) found a range of liver lead concentrations in 16 species of raptors in the UK. The study did not attempt to demonstrate analytically that **lead shot was the cause of elevated liver lead concentrations**.

Pain *et al.* (2007) analysis of food pellets from Red Kite roosts provided **no confirmatory evidence of lead shot being present in samples**. The dossier reports that "*Radiographs showed that 29 of 264 (11%) contained radio-dense material, **not verified but presumed** to be mainly shot or shot fragments. Sixteen pellets were dissected, six of which (37.2%) contained 1 to 3 objects **regarded** as lead shot"*. The lack of confirmatory evidence renders the study speculatory.

Of the further studies covering 16 species of raptors, none offer a definitive causal link between mortality or acute poisoning from lead shot. Of the 22 referenced studies of raptors cited in the HSE background document, only five studies offer any suggestion of the source of lead where elevated levels were detected. The source is described in the HSE background document as "***suggested ingestion of ammunition***" The HSE does not go on to address this uncertainty.

Of the 16 raptor species studied, only three species - Common Buzzard, Peregrine Falcon and Red Kite - were found to exhibit lead levels above clinical thresholds. Six other species were recorded with liver concentrations of lead above sub-clinical thresholds, but in any sample <10% exhibited such concentrations.

The HSE suggests that a secondary exposure pathway exists to predatory and scavenging birds from lead gunshot and rifle ammunition used for 'live quarry shooting'.

The evidence supports the likelihood of lead shot being dispersed in carcasses or discarded offal. Given that 97% of game meat goes into the food chain (PACEC, 2014) there is limited scope for predatory and scavenging species to be exposed via this potential exposure pathway.

Best practice guidance for pest mammal and pest bird species which are not placed into the human food chain (e.g., fox, carrion crow) is to dispose via a certified waste carrier, incinerate or leave in a discrete location away from view of the public. Again, this often

means disposal in locations of dense cover that would be unavailable to raptor species or other scavenging birds further reducing any potential secondary pathway.

There is no conclusive evidence which links lead ammunition as a cause of lead poisoning via secondary exposure, despite a theoretical pathway existing.

Even where isotope analysis of detected lead is undertaken (Walker *et al.,* 2012 and Taggart *et al.,* 2020) it is inconclusive as to the source of the lead. This is due to overlaps with lead isotopes from coal in the Walker *et al. (2012)* study which reports: "*There was **no clear evidence** that birds with the higher residues (those with the top 25 percentile of total liver Pb concentrations) in either species had isotope signatures that particularly resembled that of shot or ammunition"* and "*There was also **some overlap with the isotope signature for coal and for Pb shot**, but the signatures in the birds were distinct from that of petrol"*

Whilst the Taggart *et al.* (2020) study is most comprehensive UK study of lead exposure to raptors, **it is not conclusive of the source of elevated lead levels in liver and bone**. Only a small percentage of studied birds had elevated levels of lead (2.7% in liver and 4% in bone). The abstract for the study states: "*Hence, most of the Pb acquired by Eurasian buzzards which have liver concentrations **likely** to be associated with lethal and sublethal effects is **probably** obtained when they prey upon or scavenge gamebirds and mammals shot using Pb shotgun pellets.*"

Further, the HSE reports that for birds with levels of lead above background concentrations "*there is no analytical or observational evidence to link these increased lead concentrations to lead in ammunition"*.

FITASC's submissions to the ECHA review of lead ammunition (Palinkas, 2020) discusses the behaviour of lead in soil and its relative stability, evidencing limited mobility of lead in soils where pH is >6.5. This report offers evidence that lead shot, even at sites with high use, can be adequately managed.

Some conclusions reached by the HSE are supported by evidence provided from modelling studies (Green *et al.,* 2022 and Meyer *et al.,* 2016). Such studies are modelled on a series of assumptions, and whilst they demonstrate a theoretical impact of lead poisoning, they **do not identify the source of lead as being from lead shot. It is considered by BASC that such models are unsafe to support proposals for regulatory action.**

In addition to the lack of evidence of impacts of secondary exposure on individual birds, the HSE Annex 15 opinion document concludes no empirical evidence of impacts at a population level, further bringing into question the proportionality and necessity of related risk management measures and regulation.

The HSE has identified significant uncertainty in its conclusion around secondary poisoning of birds but has failed to address this within its Annex 15 opinion dossier.

Currently, the proposed restrictions appear to be based on the existence of theoretical pathways of exposure rather than actual impacts as a result of such exposure.

BASC's contention is that any restriction **on this basis is currently not justified** and is therefore **unnecessary and disproportionate**. If restrictions underpinned by secondary poisoning risk are to be implemented, this would be deemed an over-precautionary measure.

<u>Primary and secondary exposure of grazing and companion animals.</u>

Whilst suggestions of a primary exposure pathway to other animals is made by the HSE, there is no evidence from GB to confirm a causal link between lead shot and lead poisoning in livestock or other wildlife. Three studies cited by the HSE indicate no impact between primary exposure of livestock (cattle) and lead shot.

The HSE background document states: *"there is also the **potential** for wild animals, such as deer, to consume shot whilst grazing"* and that *"reports of this pathway are lacking from GB"*.

Owing to a lack of evidence that this pathway exists BASC does not consider this pathway for wild animals (other than birds) to be relevant. The absence of data and uncertainty it creates must be addressed by HSE in rationalising the restriction proposals.

There is some evidence cited by the HSE of impacts from secondary exposure to livestock through vegetation and that this is a potential exposure pathway.

The HSE references cases outside of GB where secondary exposure of livestock to lead ammunition may have occurred. However, there is no causal link between the exposure and lead shot and the HSE states: "*This **suggests** that the process of producing the silage or the uptake of lead by plants growing in soils contaminated with metallic lead **may** be an exposure route"*.

Such an exposure pathway should already be regulated by the following EU directives and regulations that are retained in UK law:

- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed

The HSE has identified significant uncertainty in its conclusion around secondary exposure via lead ammunition for other wildlife and livestock but has failed to address this within its Annex 15 opinion document.

Restrictions appear to be based on the existence of theoretical pathways of exposure rather than the actual impact because of the exposure to lead ammunition. It is BASC's contention that any restriction on this basis is currently not justified and is therefore unnecessary and disproportionate. This is particularly the case given the existing legislation in place to address some of the potential areas of risk.

<u>Exposure to soil and water.</u>

The HSE states that lead in soil has the potential to be ingested and accumulated by soil organisms or to be taken up and accumulated by plants, both of which may then be eaten resulting in lead moving along the food chain.

The word "may" and phrase "may be exposed" is used several times by the HSE in this section whilst also stating that emissions of lead shot from target shooting or from shooting of live quarry regularly over the same site "**would be expected"** to result in increased soil lead concentrations over a wider area.

There have been no GB studies investigating the concentration of lead in surface waters or groundwaters from sites where lead ammunition is used.

Therefore, there should be no restrictions based on theoretical pathways, and there is legislation in place to control such potential risks and any restrictions based on theoretical risk would be deemed over-precautionary.

Risk characterisation.

The HSE states that a fully quantitative risk assessment for the various uses of lead in ammunition **has not been attempted for the purposes of this report**. Instead, the HSE has considered the available data on hazard, exposure pathways and reported impacts on individuals and populations to produce a description of the risk.

The HSE has failed to undertake a quantitative risk assessment for the purposes of its restriction proposals, therefore any proposed risks are based on theoretical scenarios that are not evidenced based.

Risks via primary exposure to birds from lead shot and bullets.

Whilst it is widely accepted that some birds will be at risk of primary exposure through the ingestion of lead shot, the HSE states that the reported numbers of birds that have ingested and suffered from lethal and sub-lethal effects may both underestimate or overestimate mortality rates, depending on the species involved and sample type. Studies that have collected fully representative samples of birds **are not available, either from the UK or other countries.**

It is clear from the evidence that lead shot can be ingested by birds, and in those species where feeding ecology includes use of grit to aide their digestive process, lead shot can be mistakenly consumed. This is likely to be an issue for larger species of birds with this anatomy and digestive process. Other forms of lead ammunition are not considered by HSE to be a relevant for primary exposure given their size (i.e. bullets).

In relation to lead shot used for 'live quarry shooting', the potential for this primary exposure pathway is not as broad as indicated in the HSE report, given that shot typically used for 'live quarry shooting' has diameters between 2.6mm (#6 shot) and 4.01mm (#B shot). This is outside of the grit size used for species such as the house sparrow (0.1mm – 2.4mm (Gionfriddo and Best, 1995)) and at the top end of the range used by other songbird species (<0.2-3.4mm, (Vyas et al, 2000)

There remains overlap in the size of grit used by species and the size of lead shot used for 'live quarry shooting', although for smaller species of songbirds the opportunity for exposure is reduced given that lead shot used in 'live quarry shooting' **is in some cases larger than the grit particle sizes consumed by the birds.**

There remains evidence that lead shot is available to larger birds using a gizzard as part of their digestive process such as pheasants, partridge and ducks.

The exposure of waterfowl to lead shot remains a primary exposure pathway in wetland environments owing to the lack of compliance with the existing lead shot regulations (Cromie *et al.,* 2010, 2015), although exposure in terrestrial environments is not quantified.

Whilst BASC accepts that lead shot is a primary exposure pathway for some bird species, the exposure estimates detailed in Table 1.21 of the HSE background document are an overestimate of the total number of birds exposed to lead shot.

Given that shooting influences two-thirds of the UK landmass (PACEC, 2014) a reduction in exposure risk of one-third should be applied. **This remains a likely overestimate of exposure risk given that some shot is likely to be too large to be ingested by some species of birds within a given habitat** (Gionfriddo and Best, 1995 and Vyas et al, 2000).

The agency estimations for numbers of birds at risk from primary exposure should be adjusted in Table 1.21 of the HSE background document as follows:

HSE Table 1.21. UK population of terrestrial bird species identified as being at high risk of lead poisoning due to primary ingestion.

	HSE estimates	**BASC adjusted estimates for use of lead shot on two-thirds land mass**
Numbers at risk of death assuming 0.1% mortality rate.	**16,100**	**10,600**
Numbers at risk of death assuming 0.5% mortality rate.	**80,400**	**53,000**
Numbers at risk of death assuming 1% mortality rate.	**161,000**	**106,000**
Numbers at risk of death assuming 5% mortality rate.	**804,000**	**530,000**

Whilst the risk remains relevant, BASC's assessment is that the HSE has overestimated the exposure risk, in some cases to the order of several hundred thousand, as the figures do not account for the reality of use of shotgun ammunition or reflect the inability of large numbers of birds to ingest larger shot.

BASC believes that the HSE justification for the lack of adjustment due to overwintering and immature birds is unrealistic and based upon sceptical assumptions and the figures should be adjusted in line with the BASC estimation of potential risk, even then this risk is based on species and cross over of lead shot size, ingestion and land mass shot over.

BASC notes that there is no reference to bullets in this section of the HSE Annex 15 opinion document.

<u>Risks via primary exposure to birds - airgun ammunition.</u>

The HSE states that although this exposure pathway cannot be ruled out, and so a theoretical risk has been identified, the scale of the risk is considered to be low for GB. This aligns with the findings contained in two technical reports submitted by BASC to the HSE in 2022.

<u>Risks via secondary exposure to birds from lead shot.</u>

The HSE states within its Annex 15 opinion document that the risk via secondary poisoning is low and that the reasons for the status of the threatened species are varied, and that the assessment did not attempt to link the exposure to lead from ammunition as a specific cause for any of them.

The proposed restrictions appear to be based on the existence of theoretical pathways of exposure rather than the actual impact because of the exposure. It is BASC's contention that any restriction on this basis **is not justified** and is therefore **unnecessary and disproportionate**. If restrictions underpinned by secondary poisoning risk are to be implemented, this would be deemed an over-precautionary measure.

<u>Risks via secondary exposure to birds from lead bullets.</u>

Best practice guidance for disposal of viscera dictates that it should be buried at least 1m deep and away from water courses, deposited with a certified waste carrier or left on the ground in a discrete location away from view of the public. This often means disposal in locations of dense cover which would be unavailable to raptor species or other scavenging birds. This further reduces the likelihood of exposure of raptors to 'waste items' such as viscera from deer.

Best practice guidance for pest mammal and pest bird species which are not placed into the human food chain (e.g., fox, carrion crow) is to dispose via a certified waste carrier, incinerate or leave in a discrete location away from view of the public. Again, this often means disposal in locations of dense cover that would be unavailable to raptor species or other scavenging birds further reducing any potential secondary pathway.

Due to the lack of evidence and with control measures already in place, any restriction for live quarry shooting with lead bullets would be deemed **unnecessary and disproportionate.**

Risks via secondary exposure from airgun ammunition.

As stated in the HSE Annex 15 opinion document the secondary risks posed by lead airgun pellets are negligible, and the HSE are correct in proposing **no restrictions for lead airgun ammunition**.

Conclusion on risks to birds.

The risk to some bird species from lead shot is ingestion of lead shot which is a primary exposure pathway. All other exposure routes are sceptical, theoretical, and inconclusive.

In February 2020, BASC and eight other organisations agreed a voluntary transition away from lead shot for live quarry shooting, and this is addressing the primary exposure risk to birds.

Lead shot cartridges used for 'live quarry shooting' are typically #6 shots (2.6mm diameter pellets) and so have minimal cross over with lead 'clay pigeon / 'sports shooting'' cartridges. There is a potential cross over in #6.5, #7 and #7.5 shot size, although use of these shot sizes for live quarry shooting is highly limited.

Further, non-lead alternatives (namely #4, #5 or #6 steel shot) are likely to prove equally effective to lead loads in #6.5, #7 and #7.5 shot. This further reduces the likelihood of lead shot being used illegally for live quarry shooting.

Just Cartridges, one of the largest shotgun cartridge retailers in the UK (www.justcartridges.co.uk) stocks only 48 lead game shooting loads in shot sizes 6.5, 7, 7.5. By comparison, there are 287 lead game shooting loads in shot sizes #6 and #5.

In addition, restriction of cartridge shot weights to a maximum of 24 grams (12g) for lead loads would further limit the potential for illegal use in live quarry shooting.

Therefore, the risk of cartridges containing lead shot intended for clay pigeon shooting being used for live quarry shooting is minimal, with lead cartridges restricted to 24 gram loads of shot size <2.6mm. Such a restriction would make the use of non-lead alternatives more effective for the taking of live quarry.

In addition, the HSE proposals for labelling for cartridges containing lead shot with 'not for live quarry shooting' would be an additional preventative measure and would make monitoring and enforcement more effective.

Ranges would need to demonstrate measures to prevent birds consuming spent lead shot (should they have the target species of bird on the ground) and that should be recorded by way of management plans that could be audited by enforcement authorities.

Ranges should also be able to demonstrate compliance with EU directives and regulations that are retained in UK law, and other rules as follows:

- Regulation 1881/2006 that limits lead in food for human consumption,
- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- Scotland River Basin District (Standards) Amendment Directions 2015

BASC believes that the shooting of targets with lead shot on registered clay grounds could continue where registered grounds can evidence that they can comply with current legislation. The need for "de leading" would not be required.

Risks to mammals and companion animals.

The HSE references some cases within GB and several cases outside GB where secondary exposure of livestock to lead ammunition may have occurred. However, there is no causal link between the exposure and lead shot and the HSE background document states "*This **suggests** that the process of producing the silage or the uptake of lead by plants growing in soils contaminated with metallic lead **may** be an exposure route"*.

BASC believes that where rifle ranges and clay grounds can demonstrate compliance with current regulations then shooting with lead ammunition could continue, if there was a concern of secondary exposure through grazing then "no grazing on ranges" could be an agreement reached on this rather than the creation of over-precautionary legislation.

Risks to soil and water.

The HSE states that a small number of GB studies have measured the concentrations of lead in soil samples collected from shooting ranges that had been in use for between 10 and 40 years. All three studies from GB clay pigeon shooting grounds report soil concentrations that are significantly greater than the Predicted No-Effect Concentration (PNEC) for soil. The single study from a game shooting ground did not exceed the PNEC, **although how representative this study is of other sites is unknown.**

The HSE goes on to state that there have been **no GB studies investigating the concentration of lead in surface waters or groundwaters** from sites where lead ammunition is used. Therefore, there is no GB monitoring data for lead in the aquatic environment as a result of lead ammunition use that can be compared to the Environmental Quality Standard (EQS) **to determine if a risk would be identified.**

The HSE states: *"There have been no GB studies investigating the concentration of lead in surface waters or groundwaters from sites where lead ammunition is used".* In any case, existing regulation exists through the Water Framework Directive (Standards and

Classification) Directions (England and Wales) 2015 and the Scotland River Basin District (Standards) Amendment Directions 2015.

Further regulation in this regard would therefore be unnecessary.

Human health.

The HSE has considered exposure of humans to ammunition-derived lead in game meat. The highest consumers of game meat are hunters and their families. Employees of shoots are also likely to be high consumers of game meat.

The HSE background document states the following: *"The maximum lead level set by European Commission Regulation (EC) No. 1881/2006 [as retained in GB law] is intended to capture other routes of lead exposure to animals, such as dietary, that are likely to result in more uniform lead concentrations (i.e., biologically-incorporated lead). LAG (2015b) concluded that mean lead concentrations are likely to be generally higher in game meals made from small game (e.g. game birds and waterfowl) shot with lead gunshot than meals made from large game (e.g. deer) shot with lead bullets."*

One of the reasons for the voluntary transition away from lead shot for live quarry shooting announced by the shooting organisations in February 2020 was to address any uncertainty around the human consumption of game meat.

The hazards of lead to humans are well researched. However, there is still a lack of evidence that confirms the source of lead.

Whilst there is no evidence of lead shot ingestion having a negative impact on human health, there is a secondary exposure pathway from the consumption of game meat containing lead derived from ammunition. The Food Standards Agency advises that "anyone who eats lead-shot game should be aware of the risks posed by consuming large amounts of lead, especially children and pregnant women".

The HSE was not able to identify information on the quantities of non-bird game hunted with shot that is consumed in GB amongst either hunters and their families or the general population. Likewise, there was no information on the consumption of game species hunted with shot versus other ammunition, e.g., lead bullets.

As discussed in the HSE Annex 15 opinion document "large game" such as deer do not pose the same elevated levels of lead relative to small game and the risk of lead ingestion is negligible to humans where good game handling practices are followed.

BASC believes that restrictions are not required for shooting live quarry with bullets because the evidence supporting secondary exposure to humans and secondary exposure to wildlife supplied by the HSE is inconclusive. Any restrictions would be deemed unnecessary and disproportionate.

Exposure.

The HSE states the following in its Annex 15 opinion document: "Direct exposure to humans from the manufacture, handling and use of lead ammunition and additional indirect exposures from contamination of drinking water and other food types **were not in scope of the assessment**. Nevertheless, the proposed restriction would reduce both occupational exposures of those currently concerned in lead-ammunition manufacture and handling in the supply chain and secondary exposures via the environment".

BASC considers this HSE statement to be flawed given that manufacturers will still be making lead ammunition for the export market, along with several derogations in line with the HSE proposals themselves, such as a derogation for athletes, airguns, and target and live quarry shooting with rifles. Lead ammunition will still be sold and used. Whilst the numbers used may be reduced the suggested risks to those individuals would still be there. This demonstrates that the risk to individuals cannot be of true concern.

BASC would make the same point for the police or military whose use of lead ammunition is without the restriction proposals - why would the HSE consider the risk to be deemed less because of one's occupation?

There is a lack of evidence to support the proposed restrictions. Furthermore, the restrictions for lead shot for target shooting are not based upon the impacts but an attempt to stop lead ammunition that could be used for clay shooting being also used for live quarry shooting.

BASC believes that any proposed restrictions for lead shot should be aimed at controlling the risks, rather than risk elimination. The evidence for lead shot for target shooting is theoretical and inconclusive, and any restrictions based on this would be deemed as over-precautionary.

Lead in game meat.

The HSE states the following in its Annex 15 opinion document: "*Lead ammunition that hits an animal often fragments into small particles upon impact. The degree to which this occurs, and the consequent lead contamination of the meat, depends upon the type of ammunition and its velocity".*

This is true, and good game handling can mitigate against some of the risk however not all lead would be fully removed, therefore a potential exposure pathway remains.

Lead shot.

The HSE states the following in its Annex 15 opinion document: *"However, the FSA has stated that, in relation to small game, it is impracticable to remove all small lead pellets, since this would be overly time-consuming and would likely render the birds unsellable".*

BASC considers this to be a sweeping statement that is not factually correct. The issue remains when shot is missed by the person preparing the food or in the way that the food is prepared, for instance if dressing a whole pheasant or partridge and a piece of shot was in the cavity then it would potentially be missed. This however does not mean that it is ingested, as many will confirm that most shot left in birds is found with one's teeth.

The shooting organisations accept that lead shot for live quarry shooting is an exposure pathway in food for humans and that was one of the reasons for the voluntary transition away from lead shot for live quarry shooting announced in February 2020.

Lead bullets.

The HSE states the following in its Annex 15 opinion document: *"Average lead concentrations above the EUML have been reported in UK wild deer shot with lead ammunition, **presumably bullets**".*

Not all lead bullets expand with the same ferocity, and generally when shooting live quarry for the table "soft point" bullets are used. This is to ensure they expand enough to create

enough energy to cause a sufficient wound channel, resulting in the efficient and humane death of the intended quarry.

This is not the same as a ballistic tip that would generally be used for varmint shooting (i.e. pest and predator control) and expands very fast.

In many cases soft nose bullets remain intact and when weighed once extracted from the animal, such as deer, weigh the same as before being fired from the rifle.

Fragmentation of bullets is a "cause and effect" of velocity and material used, and with good selection of ammunition and following best practice in line with good game handling the risks are mitigated.

Low-velocity ammunition.

The HSE states the following in its Annex 15 opinion document: *"Ammunition types for use at lower velocities than shot and bullets (e.g., airgun ammunition)* ***are unlikely to represent a risk to human health****, since they generally do not fragment upon impact".*

This is the same for all ammunition types, dependant on the ballistics and makeup of the ammunition used, and in that context, and the HSE statement, restrictions for live quarry shooting with rifles should not be proposed as the potential risk can be controlled via ammunition choice and good game handling.

Game meat consumption in the UK.

Whilst information on the effect of lead shot in game meat on human health is limited, it is accepted as a potential risk and an exposure pathway by the shooting organisations. The joint statement announced by the shooting organisations in February 2020 proposed a voluntary transition away from live quarry shooting with lead shot. The transition will mitigate against any suggested risks highlighted by the HSE.

Relative partitioning between lead exposure from shot and bullets.

The HSE states the following in its Annex 15 opinion document:

"Although the quantity of lead shot used for LQS is far greater than that of lead bullets used for LQS, the different shot-to-kill ratio of each ammunition type could mean that humans are exposed to more lead via secondary exposure per tonne of lead bullets than per tonne of lead shot".

"… it is possible that game-bird consumers might be consistently exposed to elevated lead levels, whereas consumers of large game killed with lead bullets might be exposed to both low levels of lead. The differences in health risk between these two potentially different patterns of exposure is not known."

BASC considers the above statements to be completely theoretical.

The HSE also states the following:

"Butchery practices and the cuts of meat consumed will have a major impact on human lead exposure via large game hunted with lead bullets. Overall, ***the Agency concludes that, although the total quantity of lead in large game from bullets is potentially greater than the quantity of lead in small game from shot, this does not necessarily translate into greater human exposure from the former****. It cannot be excluded that consumers of*

large game might sometimes be exposed to high lead concentrations, but the frequency of this occurrence and numbers of people impacted is unknown."

As BASC has explained in its comments on the 'Lead Bullets' section of the HSE Annex 15 opinion document – with good selection of ammunition and following best practice in line with good game handling the risks are mitigated.

Blood lead levels.

The HSE states the following in its Annex 15 opinion document: *"The most common and accurate method of assessing lead exposure is by analysis of lead in whole blood, which reflects recent lead exposures. Amongst hunters, exposure to lead can result from both hunting/shooting activities (the handling and use of lead ammunition) and the consumption of meat that contains ammunition derived lead. The data on BLL increments from game meat consumption only (excluding hunting and shooting activities) are very limited. Whilst some data have indicated a small increase in BLL amongst high-level (non-UK) consumers and subsistence hunters, other studies have not identified an association of increased BLL with consumption of game meat. No UK-specific measured data on the impact of game meat consumption on BLL have been identified. RAC, in its opinion on the EU proposal to restrict lead and its compounds (ECHA, 2022b), noted that, for adults (excluding pregnant women), exposure modelling showed only minor increases in BLL even in high-consumption scenarios; this was in agreement with the limited biomonitoring data, which did not show a clear association between game meat consumption and BLL".*

Dietary exposure to lead in game meat would constitute a source of exposure. Most concerning is the evidenced neurotoxicity impacts of dietary lead exposure including reduction in IQ of children, and 'in-utero' impacts on the developing foetus.

Existing advice from the Food Standards Agency (FSA) alongside best practice in the preparation of game meat, whilst not able to eliminate risk of exposure offers a significant reduction in the potential exposure pathway to humans.

Given that lead is a 'zero-threshold neurotoxin' it may be appropriate to place further control on human exposure pathways where shot is concerned and that is one of the reasons for the voluntary transition away from lead shot for live quarry shooting, to address that risk.

Bioavailability of ammunition-derived lead.

The HSE states the following in its Annex 15 opinion document:

"Information on the bioavailability of ammunition-derived lead is also limited, with considerable variation in those values that have been proposed but is expected to be lower than that of lead in the general diet".

"As discussed in the Background Document (Section 1.5.2), the modelling relied on Greenland data that were not necessarily representative of the UK and comprised some small group sizes, which increases the uncertainty associated with the model and the ensuing calculations. Furthermore, the relative contributions of lead exposure from hunting activities (non-dietary) and from exposure via game bird meat to the measured Greenland BLL were not considered".

Whilst the shooting organisations accept that there is a potential exposure pathway for lead to humans via game meat the evidence relating to this is limited. It is clear from the evidence produced that the bioavailability of lead in game meat can be elevated when cooking.

Potential health impacts of exposure to lead in game meat.

The HSE states the following in its Annex 15 opinion document:

"LAG (2015b) and FSAS (2012) estimated the increase in dietary lead exposure that could result from the consumption of typical weekly quantities of wild game birds amongst UK high-consuming adults and children in different age groups. Both organisations considered that children aged 1.5 - 4.5 years who consumed two 30 g portions of game-bird meals per week could increase their dietary exposure to lead by up to 5 times."

"The calculations for risks to adults indicated that a high level of game meat consumption would be needed to elicit the effects characterised by EFSA's BMDL values: 6.5 game bird meals of 200 g per week for a 10% increase in risk of chronic kidney disease (CKD) (129 to 338 people estimated to be at risk, depending on the assumptions made of the numbers of high-level game meat consumers in the UK) and 5.2 game bird meals per week for a 1% increase in systolic blood pressure (403 – 1060 people estimated to be at risk, again depending on the assumptions made of 47 high-level game meat consumers) (Green and Pain, 2015a, 2012)."

The exposure pathway to humans from consuming game shot with lead shot is clear, although the relationship between lead shot and clinical effects in humans is not conclusive. However, owing to lead's zero-threshold neurotoxicity, BASC believes that the risks are being addressed by the voluntary transition away from lead shot for live quarry shooting.

Risk characterisation.

The HSE states the following in its Annex 15 opinion document:

"The primary human-health risk addressed in the Background Document is that to ***high-level consumers of game meat that has been shot with lead ammunition*** *(i.e., wild game). The highest consumers of game meat are hunters and their families. Employees of shoots are also likely to be high consumers".*

"In 2017, the FSA advised that consumption of lead-shot game meat, particularly that of small game, should be minimised because frequent consumption of this can expose consumers to potentially harmful levels of lead. The FSA highlighted that lead consumption is especially harmful, thus should be minimised, in vulnerable populations such as toddlers, children, pregnant women and women trying to conceive. The FSA also advised that there is no safe level of lead consumption".

BASC notes that lead shot in food is a source of secondary exposure to humans through game meat, that this exposure risk is widely accepted by the shooting organisations, and that the voluntary transition away from lead shot for live quarry shooting is addressing the secondary exposure risks, including any environmental concerns.

Conclusion on risk.

The HSE states the following in its Annex 15 opinion document:

"The Agency concludes that for all identified uses there is a risk to the environment that is not adequately controlled".

*"In addition, the consumption of game meat that has been hunted with **lead shot or lead bullets presents a risk** to vulnerable populations (young children and women of child-bearing age, given the potential for placental transfer of lead) that is not adequately controlled".*

"…the Agency considers that for an equal tonnage of lead used as lead shot compared with lead bullets, a higher proportion of the bullet tonnage is relevant for secondary poisoning than the proportion of shot. In addition, because of feeding patterns and life history traits, the impact on population sizes of the larger raptor species that are exposed to bullet or bullet fragments has the potential to be greater than the impacts on population sizes of smaller raptor species that are exposed to lead shot".

BASC notes that the secondary exposure pathway to humans and wildlife (and in particular for raptors), from huntable species that has been shot with lead bullets is **inconclusive**, that the HSE accepts this, and have not proposed any restrictions at this time. If the evidence was conclusive a restriction would have already been proposed.

BASC believes that any proposed restrictions should be proportionate and evidenced based.

7.16 Opinion of the agency – rationale for the scope of the proposed options (Ref: 4.2 HSE Annex 15 opinion document).

The HSE states the following in its Annex 15 opinion document:

"To propose a restriction under Article 69(1) of UK REACH, the Agency must demonstrate that there is risk that is not adequately controlled and that the proposed restriction is the most appropriate measure to manage that risk. The appropriateness of the proposed restriction is assessed on these criteria".

"Effectiveness: the restriction must be targeted to the effects or exposures that cause the risks identified, capable of reducing these risks to an acceptable level within a reasonable period of time, and proportional to the risk."

"Practicality: the restriction must be implementable and manageable".

Monitorability: it must be possible to monitor the result of the implementation of the proposed restriction".

"Enforceable: there must be a clear and efficient mechanism by which the enforcing authority can ensure compliance with the proposed restriction".

There is currently regulation and legislation to control risks to water, soil, soil organisms. There are also regulations to control the use of lead shot in and around wetlands.

BASC believes that the only area where the risk cannot be controlled is secondary exposure to humans through lead shot for live quarry shooting and primary exposure to birds through the ingestion of lead shot.

7.17 Overview of the options that have been considered (Ref: 4.2.1 HSE Annex 15 opinion document).

<u>Live quarry shooting with lead shot (Use 1).</u>

The HSE states the following in its Annex 15 opinion document:

"The only option the Agency identified to reduce risks to both wildlife and human health that would be fully effective, practical, monitorable, and enforceable was a prohibition on the placing on the market and use of lead shot for live quarry shooting. The same conclusion was drawn by LAG (2015a) and (ECHA, 2021)".

"A full prohibition on the placing on the market and use of lead shot for live quarry shooting would result in a 100% reduction in the release of lead shot compared with the baseline and would therefore be effective in reducing future risks to the environment. Human exposure via game meat consumption would also be prevented as soon as the prohibition came into force".

"Shotgun cartridges are labelled for sale for either target or live quarry shooting, as the shot pattern and load required are different for each activity, although the Agency understands that there is some crossover between the uses. Restricting both uses ensures that no crossover can take place. ***Restricting both uses ensures that no crossover can take place".***

BASC notes that the HSE is in effect proposing restrictions on lead shot for clay target shooting to ensure no crossover can take place for live quarry shooting.

Restrictions on the use and the sale of lead shot for target shooting as a means of enforcing restrictions on the use of lead shot for live quarry shooting are not appropriate because this is mission creep and outside the scope of the HSE review.

BASC believes that any proposed restrictions for lead shot should be aimed at controlling the risks, rather than risk elimination.

The HSE has failed to consider issues with the supply chain. There is a shortage in the supply of components such as powder. This issue has been brought on by the war in Ukraine.

There are very few cartridge options available for small gauge shotguns at this time, we understand that small gauge makes up for 22% of the ammunition used in live quarry shooting.

If there is a restriction recommended for lead shot for live quarry shooting, there should be a review by an independent body to ensure the availability of the c80 million cartridges needed across all gauges of shotgun before any legislation comes in to force.

This review should be conducted by an external independent body such as Cranfield University and be funded by Defra/HSE.

BASC believes that clay shooting can and should continue with lead shot where risk management measures are in place.

<u>Live quarry shooting with lead bullets (Use 2).</u>

The HSE states the following in its Annex 15 opinion document:

"The only option the Agency has identified to reduce the risks to both the environment and human health that would be fully effective is a prohibition ***on the placing on the market and use of lead bullets for shooting live quarry.*** *Secondary poisoning of wildlife and human exposure via game-meat consumption would be prevented as soon as the prohibition came into force".*

Lead ammunition by design is expanding when projected fast enough. It is legal to shoot live quarry (except deer) with ammunition marketed for target shooting, and in many cases people regularly do so, for example in 22lr for shooting rabbits due to the reduced risk of meat damage. The same could be said for foxes due to accuracy.

Theoretical exposure pathways, including secondary pathways for wildlife and humans, should not be used to propose restrictions on the use of expanding lead ammunition for live quarry shooting.

There is a significant overlap where people use their rifles on ranges and on private land. Any restrictions would result in a lack of venue to zero one's rifle, as per best practice one should re-zero with new ammunition, or if one feels the need to do so. Restrictions would have economic and social impacts and for animal welfare.

BASC believes that restrictions are not required for shooting live quarry with rifle ammunition because the evidence provided by the HSE on secondary exposure pathways for wildlife and humans is inconclusive. Any restrictions would be deemed unnecessary and disproportionate.

Live quarry shooting with lead airgun ammunition (Use 3).

The HSE has not proposed a restriction on the use of lead airgun pellets.

BASC believes this is the correct decision given that the risk posed by lead airgun pellets is negligible, having undertaken testing of available options on pellet accuracy and weight retention.

Target shooting with lead shot (Use 4).

The HSE states the following in its Annex 15 opinion document:

"The only option the Agency identified to reduce risks to the environment that would be fully effective, practical, monitorable and enforceable was a prohibition on the placing on the market and use of lead shot for target shooting".

"The Agency considers the only derogation that would be practical is to allow a select number of athletes to continue to source and use lead shot. This is considered to be practical as these athletes are already identified annually by the relevant sporting bodies for the purposes of funding and training".

"This derogation could be indefinite or time-limited. If time-limited, it could be paired with action to influence the governing bodies to change their rules to allow for a full restriction of lead shot in target shooting without undesired impacts on British athletes".

"The derogated athletes could be supplied directly by lead shot manufacturers, without general supply to the public".

"Two risk management options were taken forward into the socio-economic analysis for this use: a prohibition on the placing on the market and use of lead shot for target shooting; and a prohibition on the placing on the market and use of lead shot for target shooting with a derogation for suppliers and athletes identified by the appropriate sporting body".

BASC believes that if target shooting sites using lead shot undertake the correct risk management measures, then the use of lead shot on those sites should continue.

If there is no agricultural use or livestock grazing on the ground and if risks to species of birds are being mitigated via a management plan, then the risks are negligible.

Target shooting sites using lead shot would need to demonstrate that they have considered relevant risks to the environment and are documenting the actions they are taking to minimise those risks.

There are already EU directives and regulations that are retained in UK law, and other rules, to control the potential risks, as follows:

- Regulation 1881/2006 that limits lead in food for human consumption,
- Regulation 1275/2013 that limits lead in animal feed, and
- DIRECTIVE 2002/32/EC on undesirable substances in animal feed
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- Scotland River Basin District (Standards) Amendment Directions 2015

BASC believes the shooting of targets with lead shot on registered clay grounds could continue where registered grounds can evidence that they can comply with current legislation. The need for "de leading" would not be required.

Target shooting with lead bullets.

The HSE states the following in its Annex 15 opinion document:

"The only risk management option that the Agency considers effective, monitorable, practical and enforceable in principle is a prohibition on the use of lead bullets for target shooting with a derogation for sites with appropriate risk management measures".

"Risks to soil, water and livestock are expected to occur if lead bullets are left uncollected over longer periods of time. It is considered possible to mitigate against 55 the identified risks by the implementation of appropriate risk management measures at shooting ranges. Therefore, a derogation is proposed allowing the use of lead containing bullets at ranges where action is taken to reduce the risks to the environment from this activity. Ranges would be required to notify the enforcing authority that action has been taken to reduce the environmental risks, and a ***list of notified ranges would be made publicly available****".*

"Further, as there are already requirements for bullet capture on ranges for safety reasons it is expected that nearly all ranges will have bullet capture and de-leading. This management of lead which could pose a risk to the environment around ranges is expected to be the main contributing factor in risk reduction. Responses to the GB call for evidence indicated that risk management measures achieving 90 % lead recovery are already in place at some shooting ranges in GB. Therefore, this appears to be a practical option".

"Practically, existing range management guidance, which is in place for safety, may go a significant way towards documenting risks to the environment and identifying how to address those risks – especially regarding de-leading".

"This was the only risk management option taken forward into the socio-economic analysis for this use".

BASC agrees that where control measures are in place then target shooting could continue with lead ammunition. Each range would need to be considered when any restrictions or mitigation measures are put in place.

There is no evidence to justify restricting the use of lead rifle ammunition or large caliber rifles for long distance target shooting because they are shot over large sites at "gongs" with a suitable backstop. In many cases the lead will not be in one place, the bullets are too large for ingestion and the ground would not be grazed by livestock. Equally there is insufficient supply of non-lead ammunition.

Target shooting with lead airgun ammunition.

The HSE states the following in its Annex 15 opinion document:

"The only option that could reduce risks to the environment would be a prohibition on the use of lead airgun ammunition for target shooting. However, there are no viable alternatives for many airguns and ammunition would still be available for sale for indoor use. Therefore, a prohibition on use would not be practical, monitorable, or enforceable".

BASC believes this is the correct decision given that the risk posed by lead airgun pellets is negligible, having undertaken testing of available options on pellet accuracy and weight retention.

7.18 Costs outlined in HSE Annex 15 opinion document (4.2.2) on restriction proposals for live quarry shooting with lead shot.

Costs of restriction on live quarry shooting with lead shot.

Based on (Blake International, 2022 Organisation #132) (Hurley, 2022), the HSE estimates the following baseline number of cartridges to be used in GB per year for LQS:

Lead: 54,160,820.
Steel: 1,716,895.
Other metals (primarily bismuth): 258,071.

BASC will assume that cartridge consumption will not go up or down over the next 20 years, but will remain stable for these calculations, and therefore these are conservative estimates.

The price of steel shot cartridges are currently more expensive than non-lead alternatives, contrary to what we reported in 2022.

BASC (2023) provides estimates below on average prices per set of 250 cartridges, which are based on the Guns on Pegs Price per 1000. These are very conservative estimates, as one would not get this price at the gun shops. We will assume that smaller bored shotguns, where steel is not currently available fall into the bismuth category with the agencies 89:11 split between steel and other shot (bismuth). Again, this is an under-estimation. Also, some alternatives to lead, such as tungsten, are more expensive than bismuth, although some other alternative metals are currently cheaper than bismuth

Guns of Pegs 2023 prices (conservative price estimates for 250 cartridges based on the price of 1000 cartridges):

Lead: £112.
Steel: £135.
Bismuth: £422.

Using these figures for 2024:

Lead cost = £24.3 million.
Steel cost = £927,000.
Other/bismuth cost = £436,000.
TOTAL = £25.9 million.

Using these figures with the HSE's 10% reduction in the use of lead for 2025 and assuming the HSE's 89:11 split between Steel and other/bismuth shot:

Lead cost = £21.9 million.
Steel cost = £3.5 million.
Other/bismuth cost = £1.4 million.
TOTAL = £26.8 million.

When we transition to non-lead, the costs based on today's prices will be (assuming no inflation):

Lead cost = £0 million.
Steel cost = £26.8 million.
Other/bismuth cost = £10.9 million.
TOTAL = £37.7 million.

BASC's £37.7 million estimate is substantially more than the HSE 32.9 million estimate after the transition, and across a 20 year-period will additionally add £100 million to the cost of ammunition, doubling the HSE's estimate of £48 million.

BASC recommends that the HSE updates its cost estimates based on BASC's calculations.

<u>Shooter substitution costs.</u>

The HSE states the following in its Annex 15 opinion document:

"The Agency anticipates that, under a restriction on LQS with lead shot, a variety of costs would occur directly to shooters in moving away from lead shot to alternative shot. These costs can be classified as either one-off or on-going costs".

"…the Agency anticipates the restriction to induce the following one-off costs for shooters:

- *The cost of purchasing a new shotgun in order to shoot alternatives to lead shot. The Agency estimates this cost to total £76.7m in present value (PV) terms.*
- *The cost of modifying their existing shotguns(s) in order to shoot alternatives to lead shot. The Agency estimates this cost to total £3.6m in PV terms.*
- *Any re-proof that may be required after such modifications. The Agency estimates this cost to total £0.5m in PV terms".*

BASC agrees that the replacement cost estimated by the HSE of £82 million over five years is the best estimate with the data available.

BASC agrees that the HSE estimated modification costs to shotguns used for live quarry shooting of £3.8 million over five years is the best estimate with the data available.

BASC opinion of the proof costs of £0.5 million over five years is that this is a conservative estimate made by the HSE as there will also be handling fees and storage fees added by gun shops.

Climate impacts.

The HSE states the following in its Annex 15 opinion document:

"Under this worst-case scenario, the Agency estimates that a restriction will result in 2,239t CO2/annum compared to 286t CO2/annum under the baseline (from 2025 onwards). This equals an annual addition of 1,954t CO2, roughly equal to the average annual carbon footprint of 210 UK citizens (WWF, 2023). Using the BEIS (2021) carbon values for the corresponding year, the climate impacts from restriction can be estimated at £9.4m across the 20-year appraisal period in undiscounted terms, and £6.2m in PV terms. Details of how the Agency has arrived at this estimate are in section 2.6.1.1.3 of the Background Document".

BASC notes that the majority of the increased CO2 emissions will be to do with the proposed change from lead shot to steel shot for clay shooting, given that the C02 emissions for steel shot production are higher than for lead. There is no proposed restriction for lead airgun pellets, or target/live quarry shooting with lead rifle ammunition.

BASC believes that if the HSE proposed restrictions for the use of lead shot for target shooting (with the correct risk management measures in place) were dropped, then the resulting increased carbon emissions would be avoided.

Enforcement costs and compliance-check cost.

The HSE states the following in its Annex 15 opinion document:

"Based on discussions with Environment Agency enforcement experts, the Agency expects that the necessary compliance checks under a restriction would be less than ***£50,000*** *(PV) across the 20-year appraisal period. This cost is based on the FTE requirements anticipated by the Agency to undertake the relevant compliance checks across GB. In the event of non-compliance, further action will likely be required which would see this cost rise. In any case, it is certainly not considered to be a significant cost relative to the others identified".*

Given that there are regulations already in place for the use of lead ammunition on ranges, and restrictions on the use of lead shot for wildfowl and/or wetlands BASC is concerned that an estimated compliance checks cost of £50,000 (PV) across a 20-year appraisal period is extremely low. **That amounts to c£2,500 per annum for enforcement of the HSE restriction proposals, which seems unrealistic.**

Totals and summary statistics.

The HSE states the following in its Annex 15 opinion document in relation to the use of lead shot for live quarry shooting (LQS):

"…the Agency estimates the societal costs of restriction on lead shot for LQS to be £148.7m across the 20-year appraisal period. This is £123.7m in PV terms, resulting in an average annual discounted cost of £6.2m. The Agency estimates that this restriction, with a 5- year transition period, would avoid the release of roughly 21,600t of lead across the same 20-year appraisal period. This results in a cost-effectiveness ratio of £5,700/t Pb avoided".

In this context risks are listed by the HSE and BASC's comment is in bold adjacent to each listed risk as follows:

- Birds (primary poisoning) – **the voluntary transition away from lead shot for live quarry shooting is addressing this risk.**

- Birds (secondary poisoning) – **there is limited evidence for this risk and that is based on data outside GB.**

- Ruminants/Grazing - **the evidence for this risk is theoretical.**

- Mammalian scavengers/companion animals- **the evidence for this risk is theoretical.**

- Soil contamination – **there are regulations in place to manage this risk.**

- Water contamination – **there are regulations in place to manage this risk.**

- Neurodevelopmental impacts in children – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**

- Chronic Kidney Disease impacts – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**

- Cardiovascular impacts. – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**

For the majority of the theoretical and potential risks raised by the HSE the evidence is lacking and there are currently regulations, advice and best practice in place that enable actual and potential risks to be managed.

Therefore, BASC considers the HSE estimates and recommendations for savings and CO2 emissions to be unrealistic.

7.19 Costs outlined in HSE Background document (2.6.1.3) on restriction proposals for target shooting with lead shot (with derogation).

Below are BASC comments on some of the estimated costs of proposed restrictions in the HSE background document for target shooting with lead shot (with an athlete derogation). There are some overlaps in this section to that contained in 6.18 above.

Replacement cost of unsuited shotguns.

BASC has no reason to question the HSE estimate of £258 million to replace unsuitable shotguns for target shooting over five years.

Modification costs.

The HSE estimates that £12.8 million will have to be spent over the next five years to modify guns to use non-lead alternatives. BASC has no reason to dispute this calculation and considers it the best estimate available.

Proof costs.

The HSE estimates that £1.8 million will have to be spent over five years to get guns re-proofed for the use on non-lead shot. BASC believes this is an underestimate due to costs incurred through gun shops acting as the 'middle-man' between customer and the proofing house.

Ammunition costs.

As already mentioned with regards to LQS the cost of non-lead cartridges is much higher than originally thought and the cost of using them could be significantly more than the HSE's calculated value of £178.7 million over 20 years.

Costs to manufacturers.

The HSE estimates the cost to manufacturers to be £15.2 million over a five-year transition period before any restrictions took effect. BASC believes that this figure is the best estimate but is reliant on there being a five-year transition period. If the transition period was shorter this figure would need to be reviewed by the HSE.

Climate impacts.

Using the same methodology as in 4.4.2.1.3 of the HSE Annex 15 opinion document, the HSE estimates the worst-case annual increase in carbon emissions attributable to a derogated TS restriction to equal 7,905t CO2. This is roughly equal to the average annual carbon footprint of 850 UK citizens.

BASC believes that target shooting with shot should continue where risk management measure can be demonstrated, this would reduce any risks along with any increased carbon footprint.

Enforcement and compliance-check costs.

The HSE estimates the compliance costs to be £3,290 per year over a 20-year period. BASC considers this an unrealistic estimate if there is to be any investment in enforcement of any restrictions imposed.

Totals and summary statistics.

The HSE states the following in its Background document in relation to the use of lead shot for target shooting:

"The Agency estimates that this restriction, with a 5-year transition period, would avoid the release of roughly 80,400t of lead across the same 20-year appraisal period. This results in a cost-effectiveness ratio of ***£5,300/t*** *Pb avoided".*

In this context risks are listed by the HSE and BASC's comment is in bold adjacent to each listed risk as follows:

- Birds (primary poisoning) – **the use of lead shot for target shooting can continue where risks are controlled.**
- Birds (secondary poisoning) – **the evidence for this risk is theoretical.**
- Ruminants/Grazing - **the evidence for this risk is theoretical.**
- Mammalian scavengers/companion animals- **the evidence for this risk is theoretical.**
- Soil contamination – **there are regulations in place to manage this risk.**
- Water contamination – **there are regulations in place to manage this risk.**

For the majority of the theoretical and potential risks raised by the HSE the evidence is lacking and there are currently regulations, in place that enable actual and potential risks to be managed now and in the future.

Therefore, BASC considers the HSE estimates and recommendations for savings and CO2 emissions to be unrealistic.

7.20 Costs outlined in HSE Background document (2.6.3.1) on restriction proposals for live quarry shooting with large caliber lead bullets (≥6.5mm).

Restriction on live quarry shooting with large calibre lead bullets (≥6.5mm).

The HSE states the following in its Background document in relation to the use of large caliber (LC) lead bullets (≥6.5mm) for live quarry shooting:

"Based on engagement with the GTA, the Agency considers LC alternatives to be suitable for existing rifles in use without modification. This in turn means that new rifles should not need to be purchased to enable use of alternatives to lead. Similarly, according to the GTA, civilian centrefire is typically produced outside of the UK, meaning any manufacture costs of a LQS restriction with LC bullets should fall beyond the geographic scope of this restriction. Climate impacts have not been considered; alternative bullets are made from a variety of different metals such as tin, zinc and copper, each with their own respective emissions factors. In any case, the reduction in use of lead from intervention in bullets will comprise a very small share of that of shot, meaning that any climate impacts are considered to be insignificant when compared to those of shot intervention".

BASC agrees with the HSE's opinion and assumptions.

Ammunition substitution costs.

Totalled across the 20-year appraisal period, the HSE estimates that a restriction on LQS with LC lead bullets would result in an ammunition substitution cost of £3.5m in undiscounted terms, and **£2.4m** in PV terms.

BASC agrees with the HSE-calculated substitution costs at the time they were made.

Enforcement costs.

Based on discussions with Environment Agency enforcement experts, the HSE estimates that the necessary compliance checks under a blanket restriction would cost £5,400 across the 20-year appraisal period in undiscounted terms, and **£3,600** in PV terms.

BASC considers this an unrealistic estimate, given that it would amount to £270 per year spent on enforcement in GB.

Totals and summary statistics.

The HSE states the following in its Background document in relation to the use of large caliber lead bullets (≥6.5mm) for live quarry shooting:

"Combining these two costs, the Agency estimates that a restriction on LQS with LC lead bullets would result in costs of £3.5m totalled across the 20-year appraisal period. Once discounted, this is £2.4m. The Agency estimates that such a restriction would avoid the release of 21t of lead across the 20-year appraisal period, resulting in a cost-effectiveness ratio of £89,700/t lead avoided".

In this context risks are listed by the HSE and BASC's comment is in bold adjacent to each listed risk as follows:

- Birds (secondary poisoning) - **limited evidence and based on data outside the GB and risk could be controlled through best practice such as burying of gralloch.**
- Mammalian scavengers/companion animals - **the evidence is theoretical and easily avoided by following best practice.**
- Neurodevelopmental impacts in children – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**
- Chronic Kidney Disease impacts – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**
- Cardiovascular impacts. – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**

For the majority of the theoretical and potential risks raised by the HSE the evidence is lacking and there are currently regulations and best practice, in place that enable actual and potential risks to be managed.

7.21 Costs outlined in HSE Background document (2.6.3.2) on restriction proposals for live quarry shooting with small caliber lead bullets (<6.5mm).

Ammunition substitution costs.

BASC has no comment, as the Gun Trade Association (GTA) is the best placed representative body to provide this information.

Rifle re-barrelling cost.

BASC has no comment, as the GTA is the best placed representative body to provide this information.

Manufacturer costs.

BASC has no comment, as the GTA is the best placed representative body to provide this information.

Enforcement costs.

Based on discussions with Environment Agency enforcement experts, the HSE estimates that the necessary compliance checks under a blanket restriction would cost £5,400 across the 20-year appraisal period in undiscounted terms and **£3,600** in PV terms.

BASC considers this an unrealistic estimate, given that it would amount to £270 per year spent on enforcement in GB.

Impacts from worse performing alternatives.

The HSE states the following:

"As outlined in Section 2.2, current alternatives available for this use are considered by the Agency to perform less well than lead. Concerns are particularly centred around accuracy at longer ranges and additional noise when compared to current sub-sonic SC lead bullets. SC bullets are used in pest control, which is highly dependent on the ability to stealthily and accurately shoot the target animal. With less accurate and supersonic ammunition, the ability to control pests may be affected, having several potential undesirable impacts including to the environment. Other pest control measures exist, but it can be assumed that these are less effective, accessible, cost-effective, etc., for the given use, otherwise they would already be used instead of ammunition. The Agency is unable to quantify this impact".

BASC agrees with the HSE's opinion above. The technical reports that BASC submitted to the HSE on non-lead 22lr rimfire ammunition, and on .243 centrefire ammunition accuracy and penetration, back up HSE's opinion.

Totals and summary statistics.

The HSE states the following in its Background document in relation to live quarry shooting with small caliber (SC) lead bullets (<6.5mm):

*"The Agency estimates that such a restriction would avoid the release of **27t** of lead across the 20-year appraisal period, resulting in a cost-effectiveness ratio of **£41,400/t** lead avoided".*

In this context risks are listed by the HSE and BASC's comment is in bold adjacent to each listed risk as follows:

- Birds (secondary poisoning) - **limited evidence and based on data outside the GB and risk could be controlled through best practice such as burying of gralloch.**
- Mammalian scavengers/companion animals - **the evidence is theoretical and easily avoided by following best practice.**
- Neurodevelopmental impacts in children – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**
- Chronic Kidney Disease impacts – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**
- Cardiovascular impacts. – **the relationship between lead ammunition and clinical effects in humans is not conclusive, however, FSA consumer advice and best practice in the shooting sector offers a significant reduction in this risk.**

7.22 Costs outlined in HSE Background document (2.6.3.3) on restriction proposals with a derogation for outdoor target shooting with large and small caliber bullets.

Administrative and enforcement costs.

BASC has no comment and will rely upon the National Rifle Association (NRA) to provide data so that the HSE can verify its assumptions and calculations.

Range compliance costs.

BASC has no comment and will rely upon the NRA to provide data so that the Agency can verify its assumptions and calculations.

Totals and summary statistics.

The HSE states the following in its Background document in relation to restriction proposals with a derogation for outdoor target shooting with large and small caliber bullets**:**

"In total, the PV costs of this option are estimated at £0.6m. It would entail the recovery of the estimated 5% of the quantity of bullets from this use that are currently not recovered, estimated to be 93t. As such, the cost-effectiveness ratio of this option is estimated at £5,900/t lead avoided".

In this context risks are listed by the HSE and BASC's comment is in bold adjacent to each listed risk as follows:

- Ruminants/Grazing - **the evidence for this risk is theoretical.**
- Soil contamination – **there are regulations in place to manage this risk.**
- Water contamination – **there are regulations in place to manage this risk.**

7.23 Airgun intervention – both uses (Ref: 4.4.2.4 HSE Annex 15 opinion document).

The HSE has stated the following:

"As outlined during the options analysis, the Agency has not identified any option for managing the risk from this use that would be monitorable and enforceable. As such, the Agency does not recommend restriction of this use, and will not provide further socioeconomic analysis on it within this dossier".

BASC agrees that this is the correct action.

7.24 Benefits (Ref: 4.4.5 HSE Annex 15 opinion document).

The HSE has stated the following:

*"The benefits of restriction are the reductions in risk associated with the emissions of lead from each use**. Such benefits are difficult to quantify and monetise**; because of this, the Agency primarily adopts a cost-effectiveness framework with tonnage of lead released used as a proxy for avoided risk. The Agency has nonetheless attempted to monetise the benefits of restriction. For the shot uses, the Agency has been able to partially monetise benefits. This is not the case for the bullet uses, where a fully qualitative assessment has been undertaken. This is because a quantitative risk assessment was not undertaken for this use. No assessment of benefits has been undertaken for the airgun uses as no monitorable or enforceable option was identified in the Background Document".*

BASC notes that a true costing of the proposed restrictions could not be made by the HSE. It is also clear to BASC that the benefits could not be justified due to the lack of data.

BASC believe that any restrictions should be evidenced based and proportionate.

7.25 Proportionality (Ref: 4.4.6 HSE Annex 15 opinion document).

<u>Restriction on live quarry shooting with lead shot.</u>

It is accepted by the shooting organisations that lead shot when live quarry shooting provides a secondary exposure to humans and a primary exposure to birds through the ingestion of lead shot. Managing proven risks is beneficial to the environment and the long-term future of shooting. It is why the sector has already committed to a voluntary transition away from lead gunshot for live quarry shooting and has ambitions to source shot game from lead free supply chains.

The HSE has proposed a 5-year transition period before any restrictions are implemented for the use of lead shot for live quarry shooting.

If there is a restriction recommended for lead shot for live quarry shooting, there should be a review by an independent body to ensure the availability of the c80 million cartridges needed across all gauges of shotgun before any legislation comes in to force.

This review should be conducted by an external independent body such as Cranfield University and be funded by Defra/HSE.

that an independent body is appointed to review the supply of lead shot cartridges before any restrictions come into force.

BASC is calling on the HSE to ensure that an independent body is appointed to review the supply of lead shot cartridges before any restrictions come into force.

Restriction on target shooting with lead shot.

The HSE recommends a derogation on the use of lead shot for a select number of identified athletes on the basis that the HSE believes that this would likely be a more cost-effective intervention than a restriction for target shooting without a derogation.

BASC notes that this HSE proposed restriction excludes the military, police, security companies and most athletes and therefore the reduction of lead shot on the ground would be limited.

BASC believes that target shooting with lead shot should continue where risk management measures are in place. This would be the correct outcome as it would comply with the caveats of the restrictions, reduce the risk to wildlife and not have such a high carbon impact.

Live quarry shooting with large caliber lead bullets (≥6.5mm).

The HSE states the following:

"The Agency has been unable to quantify the benefits of a restriction on the use of lead bullets. A quantitative risk assessment has not been conducted for this use, meaning the Agency is unable to compare quantitative, monetised or non-monetised impacts".

"…no benefits in terms of avoided primary poisoning, avoided soil contamination, and avoided water contamination are anticipated as a result of restricting this use".

"…*The Agency is unable to conclude whether restriction on this use is proportionate, but it is currently considered less proportionate than restriction (+ derogation) on the lead shot uses. Net benefits may be positive or negative; although given the overall costs associated with this option are expected to be low, the level of benefit required to achieve proportionality would also be low.*

"Furthermore, the Agency still has concerns around the enforceability and practicality of this option – especially given that lead bullets will remain available for indoor and outdoor target shooting".

BASC believes that evidence of secondary exposure is inconclusive, and as concluded by the HSE, a restriction may not offer any net benefits, with the added difficulty of enforcing such legislation. Live quarry shooting with lead bullets should not be restricted and BASC notes that the HSE has decided that *"a restriction has not been proposed, at this time".*

Live quarry shooting with small caliber lead bullets (<6.5mm).

As with large caliber lead bullets (≥6.5mm) the HSE cannot determine the benefits or enforceability of a restriction. Therefore, the HSE cannot conclude that restriction would be a proportionate intervention.

The HSE does state that further assessments on proportionality will be undertaken during the consultation period. However, the socio-economic assessment fails to ask any specific questions relating to small caliber rifles and the ammunition used.

There is currently no proposed restriction at this time.

BASC notes that many small caliber target rounds will be used in pursuit of live quarry, because they can be extremely accurate, with reduced risk of meat damage, making them ideal for live quarry shooting.

BASC believes that due to the lack of evidence, the inability to evidence any gain and the lack of enforceability that there should be no proposed restrictions.

Any proposed restriction for live quarry shooting with bullets should be evidenced based and not over-precautionary.

Target shooting with large and small caliber lead bullets.

The HSE states the following:

"The Agency considers restriction with derogated use for all ranges with suitable risk management measures to be a proportionate intervention to address risk".

"Additionally, a derogated restriction would also protect against future additional risk that would arise if the ***governing body's public safety requirements were to change****.*

BASC agree that where a range can control the risk though current and proposed regulations then it should be able to continue with lead bullets.

Airguns (both uses).

The HSE states the following:

"The Agency has been unable to identify any monitorable or enforceable option to manage the risk from this use. As such, irrespective of how proportionate a restriction may be the Agency does not consider such intervention to currently be feasible".

BASC notes that the risk posed by lead airgun pellets is negligible.

Summary statistics.

BASC believes that the summary statistics fail to identify the increased environmental impacts of CO2. Currently CO2 is rated at a value of £60 per ton, with the increase of 1,954 tons pa estimating a total of £117.240k - The cost of increased carbon for the restrictions on lead shot over the 20-year period is £2,344,800 at the current rate of £60 per ton.

7.25 Practicality and monitorability (Ref: 4.5 HSE Annex 15 opinion document).

Lead shot.

The HSE considers that a full restriction on lead shot covering both placing on the market and use for both live quarry shooting, and target shooting would facilitate enforcement, as this can be done at the point of sale.

A derogation for a small number of individual athletes as identified by the appropriate sporting body to continue to be supplied is considered by the HSE to be practical as these athletes are already identified by the relevant sporting bodies for the purposes of funding and training. The HSE suggests that suppliers and athletes could be required to maintain records of the volumes of lead shot supplied/received and to provide this to the appropriate enforcement authority on request.

Under such proposals individual athletes granted permission to continue to use lead shot **would not be able to share the lead shot with any other users.**

The HSE restriction proposal excludes the military, police, security companies and derogated athletes. Clearly the restrictions for lead shot for target shooting are not based upon the impacts but an attempt to stop lead ammunition that could be used for clay shooting being also used for live quarry shooting. That discriminates against live quarry shooters.

BASC believes that target shooting with lead shot should continue where risk management measures are in place.

BASC is calling on the HSE to drop proposals to ban the sale of lead shot for target shooting as a means of enforcing restrictions on the use of lead shot for live quarry shooting because this is mission creep and outside the scope of the HSE review.

Lead Bullets.

Whilst the HSE has stated that they propose no restrictions at this time, within its Annex 15 opinion document the HSE also states the following:

"Unlike with the use of lead shot where a restriction on the placing on the market is proposed for both target shooting and live quarry shooting, lead bullets will still be 85 available for lawful purchase for target shooting on sites that meet the criteria for derogation. This may create challenges regarding the enforceability of a restriction on lead bullets only for live quarry shooting. At this stage, the Agency is unable to determine whether lead bullets that remain available for target shooting would continue to be purchased for target shooting but used for live quarry shooting (unlawfully, in the event a restriction is proposed)".

"…there is a practical concern for such a restriction on live quarry shooting with lead bullets. It is expected that shooters pursuing live quarry will need to both 'zero' their rifles and practice, typically on shooting ranges, in order to ensure accuracy when shooting. Currently, non-lead bullets are not permitted to be used on a number of ranges primarily due to concerns around safety and unknown damage to infrastructure".

It is clear to BASC that the HSE would like to restrict the use of lead bullets for live quarry shooting, even though the evidence of secondary exposure to humans and wildlife is inconclusive, because the HSE has a concern that the shooting community would openly break the rules and use ammunition marketed for target shooting to shoot live quarry.

It is legal to shoot live quarry with non-expanding ammunition, and many will do so as it can be very accurate and cause less meat damage.

It is encouraged to zero one's rifle as often as one feels the need to and especially with a new batch of ammunition. It is equally as important to practice with one's rifle where one would shoot significantly more ammunition rather than in a live quarry situation, and this would normally be undertaken on a range.

BASC believes that live quarry shooting with lead bullets should continue.

7.26 Potential unintended consequences (Ref: 4.6 HSE Annex 15 opinion document).

The HSE states: *"Derogations have been proposed to allow identified athletes to train and compete without obstruction. However, others who aspire to reach that level could be hampered by the inability to train with lead shot which is required for use in international competitions".*

BASC notes that there are currently no small gauge sustainable cartridges available such as .410 .28g, 9mm, .22, and these gauges are used in more than 22% of LQS whether it be game or pest control. The agency should ensure that suitable alternatives are available before any legislation come into effect. There should also be a review by an independent body to ensure the availability of the c80 million cartridges needed across all gauges of shotgun before any legislation comes in to force. This review should be conducted by an external independent body such as Cranfield University and be funded by Defra/HSE.

The HSE states: ***"****The increased potential risk from ricochet of harder non-lead shot may mean it may be unsuitable for pest control in and around farm buildings or stony or rocky ground and alternative methods of pest control may need to be considered such as traps or poisons".*

BASC notes that pest control would normally be undertaken with small gauges in and around buildings, and currently the suitable alternatives are bismuth, and this is very expensive by comparison. BASC believes that rather than creating the extra cost of acquiring traps and restricting the use of lead ammunition, there could be a derogation for pest controllers to use lead ammunition. The risk to the environment and birds would be significantly reduced and pest control would continue in its current form. As per athletes and clay pigeon shooting pest controllers would not be allowed to give away lead cartridges.

The HSE states: "In the case of Practical Shotgun disciplines where steel targets are fired at from ranges as little as 5 m, redesign of the targets / discipline to something that does not cause rebound."

BASC notes that where grounds can evidence the correct control measures then they should be able to continue with lead in line with clay pigeon shooting and ranges.

The HSE states: *"Use of steel shot will typically require protective biodegradable plastic wads, as opposed to fibre wads; these will be present on the ground after firing for an unspecified period of time until they degrade and potentially will look unsightly, particularly if in large quantities associated with organised shoots. However, much will depend on the technical development and properties of the wads".*

BASC believes that it is too early to understand the full breakdown times of wads but the longest information relating to such is 18 months, and manufacturers are making them in browns and greens to make them look less unsightly.

The HSE states: *"It could be a transition period does not give time to gain access to replacement shot before the use of lead shot is restricted. Those using shot will have to stop shooting instead of running the risk of buying lead ammunition which they will be unable to use within a certain time period, or else be out of pocket for this ammunition. It is expected that the transition will be widely publicised by trade associations and manufacturers so there will be awareness that this is coming. An additional "use-up" period after prohibition on the placing of the market may also help mitigate this latter issue".*

BASC believes there should also be a review by an independent body to ensure that any supply chain issues are addressed and cartridges for all gauges are available before any legislation comes into force. This review should be conducted by an external independent body such as Cranfield University and be funded by Defra/HSE.

7.27 Assumptions, uncertainties, and sensitivities (Ref: 4.7 HSE Annex 15 opinion document).

The HSE states the following:

"A number of estimates were provided for the tonnages of each ammunition type for each use, each with uncertainties depending on the estimation method used".

"Although a risk has been identified for primary and secondary poisoning of birds, estimates of the numbers of birds at risk are uncertain".

"No GB data on primary ingestion by grazing mammals have been identified".

"No GB data on secondary poisoning of predatory or scavenging non-avian species have been identified".

"GB data on lead concentrations in surface or groundwater associated with the use of lead ammunition are not available".

"A single study reports ingestion of airgun pellets by birds. It is unclear whether this exposure pathway is significant in GB".

"Throughout the dossier the risks posed have been considered for all uses of lead ammunition combined. Where the same risk is identified for different uses we have considered whether the relative risks can be determined qualitatively, but this assessment is uncertain".

BASC does not concur with the magnitude of risk presented by HSE in its Annex 15 opinion document, in relation to the volume of lead shot emitted from 'live quarry shooting' and in relation to the number of birds which are at risk through the primary exposure pathway.

The risk to some bird species from lead shot is the ingestion of lead shot, which is a primary exposure pathway. In February 2020, BASC and eight other organisations agreed a voluntary transition away from lead shot for live quarry shooting and this is addressing the primary exposure risk to birds.

Whilst a theoretical secondary exposure pathway for birds exists, the available evidence considered and presented by the HSE do not demonstrate mortality or sub-lethal effects that are directly attributable to lead shot or other forms of lead ammunition. The HSE has failed to address this uncertainty, and as such the restriction proposals related to this evidence cannot be justified.

In addition to the lack of evidence of impacts of secondary exposure on individual birds, the HSE Annex 15 opinion document concludes no empirical evidence of impacts at a population level, further bringing into question the proportionality and necessity of related risk management measures and regulation.

The HSE has identified significant uncertainty in its conclusion around secondary poisoning of birds but has failed to address this within its Annex 15 opinion dossier.

Currently, the proposed restrictions appear to be based on the existence of theoretical pathways of exposure rather than actual impacts as a result of such exposure.

BASC's contention is that any restriction on this basis is currently not justified and is therefore unnecessary and disproportionate. If restrictions underpinned by secondary poisoning risk are to be implemented, this would be deemed an over-precautionary measure.

Exposure pathways to animals other than birds (including livestock and other wildlife) are theoretically possible, but the evidence of lethal and sub-lethal impacts apportioned to lead ammunition is lacking. There is significant uncertainty in the data which has not been addressed by HSE. Furthermore, this exposure pathway for livestock is already controlled through existing regulation and directives retained in UK law.

Exposure pathways related to soil, soil organisms and plants are already regulated through existing legislation and therefore further restriction on lead ammunition is unnecessary. There is again considerable uncertainty in the data.

Exposure pathways related to surface water are already regulated through existing legislation and therefore further restriction on lead ammunition is unnecessary.

The exposure pathway to humans from consuming game shot with lead shot is clear, although the relationship between lead shot and clinical effects in humans is not conclusive. However, owing to lead's zero-threshold neurotoxicity, BASC believes that the risks are being addressed by the voluntary transition away from lead shot for live quarry shooting.

<u>Uncertainties related to the risk assessment.</u>

The following uncertainties are identified within the HSE Annex 15 opinion document, with BASC's response provided **in bold** below each HSE statement.

The HSE states that: *"A number of estimates were provided for the tonnages of each ammunition type for each use, each with uncertainties depending on the estimation method used. In particular, estimates of airgun ammunition are very uncertain. Tonnage values selected for use in this assessment should not be seen as definitive but are sufficient for the purposes of this assessment for the reasons described in the background document".*

BASC provided reviewed figures used based on ammunition, birds and trade information as per the tables within this document and the response to the Annexe 15 dossier.

The HSE states: *"A single study reports ingestion of airgun pellets by birds. It is unclear whether this exposure pathway is significant in GB".*

BASC notes that when airguns are used for live quarry shooting head and heart shots are taken resulting in few injured species that would be preyed upon by carrion, and given the size of airgun pellets this means that they will not be mistaken by birds for grit.

The HSE states: *"No GB data on primary ingestion by grazing mammals have been identified, although it is assumed to be a possibility based on evidence from other countries".*

BASC notes that the data is inconclusive and that there is legislation in place to control the risks of lead as contained in our consultation responses to the HSE.

The HSE states: "*No GB data on secondary poisoning of predatory or scavenging non-avian species have been identified".*

BASC recommends that theoretical pathways of lead exposure should not be considered, and that any proposed restrictions should be evidenced based.

The HSE states: "*GB data on lead concentrations in surface or groundwater associated with the use of lead ammunition are not available".*

BASC notes that there is legislation in place to control the risks of lead as detailed in our consultation responses to the HSE. Theoretical pathways of lead exposure should not be considered, and any proposed restrictions should be evidenced based.

The HSE states: *"Although a risk has been identified for primary and secondary poisoning of birds, estimates of the numbers of birds at risk are uncertain (N.B., the number of organisms at risk has not been a factor in any environment-focussed restriction of other substances under REACH)".*

BASC recommends that sceptical assumptions should not be relied on to propose restrictions, and any proposed restriction should be evidenced based and proportionate.

The HSE states: **"***Throughout the dossier the risks posed have been considered for all uses of lead ammunition combined. Where the same risk is identified for different uses, we have considered whether the relative risks can be determined qualitatively, but this assessment is uncertain. Tonnage used annually is used as a general indicator of relative risk. However, for secondary poisoning of birds in particular, the use of annual tonnage is not considered a suitable proxy to determine the relative partitioning of risks from lead derived from shot and lead derived from bullets".*

BASC notes that the evidence of secondary poisoning is based on assumptions and theoretical pathways, that the evidence is inconclusive, and that any restrictions based on this would be deemed as over-precautionary.

<u>Uncertainties in the human-health assessment.</u>

BASC accepts that in some settings lead ammunition poses an evidenced exposure risk that must be controlled. Managing proven risks is beneficial to the environment and the long-term future of shooting. It is why the sector has already committed to a voluntary transition away from lead shot for live quarry shooting and has ambitions to source shot game from lead free supply chains.

<u>Sensitivities related to the socio-economic analysis.</u>

Below is a non-exhaustive list of some key assumptions made by the HSE:

- 22% of shotguns are assumed to be unsuited to steel shot.
- 50% of shooters who cannot use steel are assumed to switch to bismuth, 50% replace their shotgun with one suited to steel.
- Several different assumptions taken within the monetisation of benefits.
- The cost-effectiveness framework uses tonnage as a proxy for risk across different uses.
- Relative ammunition prices are assumed to remain constant over time.
- No shooters assumed to cease activity due to restriction.

7.28 Buy-back schemes.

BASC notes that the HSE has not provided any buy-back scheme options but has remarked that such schemes would unlikely be offered on a 'market value' basis.

BASC considers buy-back schemes to have three important functions that should be upheld:

- Fairly compensate material loss as a result of restrictions
- Incentivise the transition to lead-free alternatives.
- Ensure that the restrictions do not create a 'false' or 'early' cliff edge for sales of lead products that undermines manufacturers' ability to invest in development and production of lead-free alternatives.

Whilst financial compensation schemes will play a part in this, BASC also directs HSE to 'swap' schemes which allow practitioners to trade-in lead ammunition for lead-free alternatives. Such incentivised offerings have achieved 80% compliance in voluntary transition programs (Sieg *et al.*, 2009).

A trade-in scheme offers the practitioner the opportunity to exchange lead for lead-free products which avoids material loss and incentivises compliance with any new regulation.

Furthermore, a government-funded scheme would have the effect of providing a guaranteed income for manufacturers - allowing them to invest in research, development and production of lead-free ammunition. This would further aid the sector to transition to any new regulatory requirements.

BASC is calling on HSE and EA to implement a buy-back scheme that:

- **Fairly compensates material loss resulting from restrictions.**
- **Incentivises the transition to lead free alternatives.**
- **Ensures that the restrictions do not create a 'false' or 'early' cliff edge for sales of lead products that undermines manufacturers' ability to invest in development and production of lead-free alternatives.**

8. Papers referenced by BASC or contained in HSE quotes in this document

Aebischer 2019. Fifty-year trends in UK 'live quarry shooting' bags of birds and mammals, and calibrated estimation of national bag size, using GWCT's National Gamebag Census

Aebischer NJ, Wheatley CJ, Rose HR (2014) Factors Associated with Shooting Accuracy and Wounding Rate of Four Managed Wild Deer Species in the UK, Based on Anonymous f7tField Records from Deer Stalkers. PLoS ONE 9(10): e109698. https://doi.org/10.1371/journal.pone.0109698

BASC 2019. Availability and price of non-lead ammunition.

BASC 2022a. Fox snaring and control in England – code of practice. https://basc.org.uk/codes-of-practice/snares-for-fox-control-in-england/

BASC, 2022b – BASC Technical Report. Accuracy and penetration testing of lead-free ammunition in .243 calibre.

BASC, 2022c – BASC Technical Report. Accuracy and penetration testing of lead-free ammunition in .22lr rimfire calibre.

BASC, 2022d – BASC Technical Report. Accuracy and muzzle energy testing of lead-free airgun ammunition in .177 and .22

BASC 2022e – BASC Technical Report. Weight retention of lead airgun pellets.

Bischoff, K., Higgins, W., Thompson, B., Ebel, J.G., 2014. Lead excretion in milk of accidentally exposed dairy cattle. Food Additives & Contaminants: Part A 31, 839–844. https://doi.org/10.1080/19440049.2014.888787

Cromie, R.L., Loram, A., Hurst, L., O'Brien, M., Newth, J., Brown, M.J., Harradine, J.P., 2010. Compliance with the environmental protection (restrictions on use of lead shot) (England) Regulations 1999. CR0411. Report to Defra. Bristol.

Cromie, R.L., Newth, J., Reeves, J., O'Brien, M., Beckmann, K., Brown, M., 2015. The sociological and political aspects of reducing lead poisoning from ammunition in the UK: why the transition to non-toxic ammunition is so difficult. Pages 104-124 in: R.J. Delahay & C.J. Spray (eds.) Proceedings of the Oxford Lead Symposium. Lead Ammunition: understanding and minimising the risks to human and environmental health. Edward Grey Institute, University of Oxford, Oxford, UK.

European Chemicals Agency, 2007. Guidance for the preparation of an Annex XV dossier for restrictions. https://echa.europa.eu/documents/10162/2324906/restriction_en.pdf/d48a00bf-cd8d-4575-8acc-c1bbe9f9c3f6

Gionfriddo, J.P., Best, L.B., 1995. Grit Use by House Sparrows: Effects of Diet and Grit Size. The Condor 97, 57–67. https://doi.org/10.2307/1368983

Green, R.E., Pain, D.J., Krone, O., 2022a. The impact of lead poisoning from ammunition sources on raptor populations in Europe. Science of The Total Environment 154017. https://doi.org/10.1016/j.scitotenv.2022.154017

Hampton, J. O., A. J. DeNicola, and D. M. Forsyth. 2020. Assessment of lead-free .22 LR bullets for shooting European rabbits. Wildlife Society Bulletin 44: 760– 765. https://doi.org/10.1002/wsb.1127

Howard, D.R., Braum, R.A., 1980. Lead poisoning in a dairy herd, in: Proceedings of the Annual Meeting of the American Association of Veterinary Laboratory Diagnosticians.

Home Office. National statistics. Statistics on firearm and shotgun certificates, England and Wales: April 2021 to March 2022. Published 7 July 2022. https://www.gov.uk/government/statistics/statistics-on-firearm-and-shotgun-certificates-england-and-wales-april-2021-to-march-2022/statistics-on-firearm-and-shotgun-certificates-england-and-wales-april-2021-to-march-2022

HSE, 2023a. Agency opinion on the Annex 15 dossier proposing restrictions on Lead in Ammunition. Published 11 October 2023. https://consultations.hse.gov.uk/crd-reach/lead-in-ammunition/user_uploads/lead-in-ammunition-restriction-opinion-document---draft-sea-opinion.pdf

HSE, 2023b. Background Document to the Agency Opinion on the Proposal for a Restriction Substance name(s): Lead, IUPAC names(s): Lead, EC NUMBER(S): 231-100-4 CAS NUMBER(S): 7439-92-1. Published 11 October 2023. https://consultations.hse.gov.uk/crd-reach/lead-in-ammunition/user_uploads/lead-in-ammunition-background-document---draft-sea.pdf

LAG, 2015. Lead ammunition, wildlife and human health: a report prepared for the Department for Environment, Food and Rural Affairs and the Food Standards Agency in the United Kingdom. Lead Ammunition Group.

Meyer, C.B., Meyer, J.S., Francisco, A.B., Holder, J., Verdonck, F., 2016. Can Ingestion of Lead Shot and Poisons Change Population Trends of Three European Birds: Grey Partridge, Common Buzzard, and Red Kite? PLoS ONE 11, e0147189. https://doi.org/10.1371/journal.pone.0147189

Mustin, K., Newey, S., Irvine, J., Arroyo, B., Redpath, S., 2012. Biodiversity Impacts of Game Bird 'live quarry shooting' and Associated Management Practices in Europe and North America. https://www.hutton.ac.uk/sites/default/files/files/RSPB_ReportFINAL_Covers.pdf

PACEC, 2014. The Value of Shooting The economic, environmental, and social benefits of shooting sports in the UK. PACEC. http://www.shootingfacts.co.uk/pdf/consultancyreport.PDF

Pain, D.J., Sears, J., Newton, I., 1995. Lead concentrations in birds of prey in Britain. Environmental Pollution 87, 173–180. https://doi.org/10.1016/0269-7491(94)P2604-8

Pain, D.J., Carter, I., Sainsbury, A.W., Shore, R.F., Eden, P., Taggart, M.A., Konstantinos, S., Walker, L.A., Meharg, A.A., Raab, A., 2007. Lead contamination and associated disease in captive and reintroduced red kites Milvus milvus in England. Science of The Total Environment 376, 116–127. https://doi.org/10.1016/j.scitotenv.2007.01.062

Palinkas, J. Chevalier, P. Sauvain, F., 2020. Contribution of FITASC prior to ECHA's decision regarding a possible call for restrictions on the use of lead shot at clay target shooting ranges. https://www.fitasc.com/upload/images/echa_mai_2021/20200720_eng_fitasc_doc_contribution_echa.pdf

Pierce, B. L. et al. 2014. A comparison of lead and steel shot loads for harvesting mourning doves. – Wildl. Soc. Bull. 39: 103– 115. https://wildlife.onlinelibrary.wiley.com/doi/full/10.1002/wsb.504

Reynolds, J.C. 2016. Assessing the nature and use of corvid cage traps in Scotland: Part 1 of 4 – Questionnaire survey of corvid trap users in Scotland. Scottish Natural Heritage Commissioned Report No. 931.

Rice, D.A., McLoughlin, M.F., Blanchflower, W.J., Thompson, T.R., 1987. Chronic lead poisoning in steers eating silage contaminated with lead shot–Diagnostic criteria. Bull. Environ. Contam. Toxicol. 39, 622–629. https://doi.org/10.1007/BF01698454

Stroud, D., Pain D.J., & Green, R.E., 2021 Evidence of widespread illegal 'live quarry shooting' of waterfowl in England despite partial regulation of the use of lead shotgun ammunition Conservation Evidence Journal 18, 18-24 ISSN 1758-2067 https://doi.org/10.52201/cej18grkf2551

Sieg, R., Sullivan, K.A., & Parish, C.N., 2009. Voluntary lead reduction efforts within the northern Arizona range of the California Condor. 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.2009.0309

Taggart, M.A., Shore, R.F., Pain, D.J., Peniche, G., Martinez-Haro, M., Mateo, R., Homann, J., Raab, A., Feldmann, J., Lawlor, A.J., Potter, E.D., Walker, L.A., Braidwood, D.W., French, A.S., Parry-Jones, J., Swift, J.A., Green, R.E., 2020. Concentration and origin of lead (Pb) in liver and bone of Eurasian buzzards (Buteo buteo) in the United Kingdom. Environmental Pollution 267, 115629. https://doi.org/10.1016/j.envpol.2020.115629

Thomas, V.G., Kanstrup, N., Gremse, C., 2014. Key questions and responses regarding the transition to use of lead-free ammunition. Proceedings of the Oxford Lead Symposium Lead Ammunition: understanding and minimising the risks to human and environmental health.

Vyas, N.B., Spann, J.W., Heinz, G.H., Beyer, W.N., Jaquette, J.A., Mengelkoch, J.M., 2000. Lead poisoning of passerines at a trap and skeet range. Environmental Pollution 107, 159–166. https://doi.org/10.1016/S0269-7491(99)00112-8

Walker, L.A., Lawlor, A.J., Potter, E.D., Pereira, M.G., Sainsbury, A.W., Shore, R.F., 2012. Lead (Pb) concentrations in predatory bird livers 2010: a Predatory Bird Monitoring Scheme (PBMS) report (pp. 13): Centre for Ecology and Hydrology (CEH), Lancaster, UK.

WWF, 2023. The Footprint Calculator Report 2023. https://www.wwf.org.uk/our-reports/footprint-calculator-report-2023