Practical and social barriers to switching from lead to non-toxic gunshot – a perspective from the EU

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ABSTRACT

Denmark has a long hunting tradition and a very high density of hunters. The total annual bag is approximately 2.3 million specimens. More than 90% is harvested by shooting, be that driven shoots of pheasant and mallard, walk-up shooting of upland game, decoyed waterbirds or open sea motor boating targeted at sea ducks.

In Denmark, the use of lead shot was first regulated in 1985 by setting up a ban on *inter alia* the use of lead shot for hunting in 26 wetlands designated as Ramsar-sites and for clay pigeon shooting in certain areas. Denmark enforced a total ban on the use of lead shot in 1993 in all areas outside forests and with a subsequent enforcement of a lead shot ban in forests in 1996. Since then all use, trade and possession of lead shot has been banned throughout the country (Kanstrup 2006).

The phase-out of lead shot raised a number of practical and social barriers. The first barrier was connected to the availability of alternative shot types. Also the quality and efficacy of alternative shot types, safety to hunters, and the risk of damage to guns and machinery in the forestry industry, were raised as potential obstructions to the implementation of the regulation. However, all issues were discussed and managed. The hunters' community made their own investigations of the lethality *i.e.* effectiveness of non-lead shot. New guidelines were drawn up to ensure safe hunting practice, and gunsmiths developed good practice to guide hunters to the appropriate combination of gun, cartridge and shot. Since the mid-1990s non-lead shot has been available and can be obtained for any hunting purpose in any habitat and with any type of shotgun. A good deal of focus has been put on the quality of shotgun cartridges, and efficacy of non-lead types is proven to be comparable or even higher than lead shot.

During the phase-out period many Danish hunters feared that the process would cause a decline in numbers of hunters and weaken the socio-political power of the hunters' community. However, today, 30 years after the first regulation of lead shot and almost 20 years after the total ban, the number of hunters in Denmark is the highest (177,000) since the registration of hunters was introduced in the 1930s. The annual bag of quarry species has shown a high degree of fluctuation but a general trend of decline. However, there seems to be no connection between this decline and the regulation of lead shot since the 1980s. The decline is caused by other regulations of hunting, *e.g.* full protection of several species, combined with a general population decline in central quarry species *e.g.* upland game.

The Danish example of a total ban on lead shot for hunting has demonstrated that this can be achieved without jeopardising the hunters' interests and weakening the hunters' community. On the contrary, it is believed, though never investigated, that the public image value of hunting not being connected to a pollutant such as lead is of paramount importance for the perception and long-term political sustainability of hunting.

Key words: *social barrier, practical barrier, Denmark, hunting tradition, transition, sustainability of hunting*

NARRATIVE

The land surface area of Denmark is 44,000 km and the surrounding shallow sea area is approximately the same again. The coastline is approximately 7,000 km and the human population is just below six million. With a population of registered hunters of 177,000, Denmark has one of the highest densities of hunters according to surface area and as a proportion of the population (~3%). According to Danish legislation, 45 game species can be hunted. In addition, several species are regulated according to a special scheme for prevention of damage to agriculture and other society interests. The annual harvest is monitored according to a mandatory bag statistic programme that has been in operation since 1941. The total annual bag is approximately 2.3 million (2013) with pheasant *Phasianus colchicus* (700,000) and mallard *Anas platyrhynchos* (480,000) representing about half of the total (Naturstyrelsen 2014). The most common hunting practice is driven shoots of pheasant and other bird species based extensively on the release of reared birds. Mixed shooting of upland game with the use of flushing and pointing dogs and decoying of wood pigeon *Columba palumbus* and ducks is also very widespread. A special tradition is shore and sea shooting from punts and small motorboats with diving ducks as the primary quarry. Rifle hunting/stalking is a growing interest. Roe deer *Capreolus capreolus* are the most common deer species and are hunted by shooting with rifles as well as shotguns. Red deer *Cervus elepahus* and fallow deer *Dama dama* populations are increasing and spreading to most parts of the country. Consequently, the hunting interest and need to manage their populations is increasing. The larger deer species (red and fallow) can only be hunted with rifles.

Table 1: **The annual bag for 2013 of quarry species or groups of species, including the distribution of shotgun and rifle hunting.**

Species	**Individuals killed by:**		
	Shot	**Bullet**	**Other***
Roe deer	40,000	87,400	
Other hoofed mammals	18,200		
Hare	55,300		
Rabbit	10,400		
Red fox**	20,000	17,500	
Other mammals	90,00		8,000
Partridge	28,800		
Pheasant	710,800		
Wood pigeon	278,500		
Mallard	486,000		
Other dabbling ducks	158,500		
Diving ducks	71,200		
Geese	77,100		
Gulls	21,700		
Coot	10,900		
Woodcock	34,000		
Snipe	10,700		
Crows and magpie	90,000		25,000
Rook		90,700	
Other birds	9,800		
Total	**2,122,700**	**213,800**	**33,000**

Source: Naturstyrelsen (2014). *"Other" includes trapping and bow hunting. **Distribution of red fox *Vulpes vulpes* bag killed by shot or bullet is judged by the author.

Table 1 shows the annual bag for 2013 with the distribution of quarry species or groups of species. The data are additionally divided into those killed with shot or bullets, indicating that about 90% of the annual harvest is shot using shotguns.

In summary, Denmark is a country with a long hunting tradition, and a large population of hunters whose main interest is in hunting with shotguns. This is comparable to other North European countries, including the UK. In the context of evaluation of the impact of legislation changes on the use of shot materials Denmark is therefore regarded as representative of most countries of relevance.

Lead shot phase-out

AVAILABILITY OF NON-LEAD ALTERNATIVES

In Denmark, the use of lead shot was first regulated in 1985 by setting up a ban on *inter alia* the use of lead shot for hunting in 26 wetlands designated as Ramsar-sites and for clay pigeon shooting in certain areas. Only American brands of steel shot were available, and at that time many hunters regarded these as being unsuitable for hunting in Denmark.

Hence, the availability of non-lead shot became a practical barrier from the beginning. However, a Danish programme of producing steel shot was initiated (DanArms), and a variety of different shot types designed for different purposes was introduced. In addition, new American and other products were introduced to the Danish market. Denmark decided to ban all use of lead shot in 1993. However, the use of steel shot was considered unacceptable to foresters because of its hardness and the consequent risk of damage to machinery used in the timber industry from steel shot embedded in trees. This delayed the introduction of the lead shot ban in forests until 1996 and led to pressure to develop softer shot alternatives ("forest shot") such as bismuth, tin and wolfram products. These alternatives, particularly bismuth, have proved to be popular. Since the mid-1990s, non-lead shot can be obtained for any hunting purpose and any type of shotgun. Steel shot is the cheapest alternative, the price being comparable to that of lead shot, though steel shot for clay pigeon shooting tends to be slightly cheaper. The price of non-steel alternatives is significantly higher. Concern over the use of hard shot in forests is today less pronounced, and many forest properties now allow any type of shot to be used.

SAFETY

A central concern, and therefore also a barrier to the phase-out of lead shot, was that non-lead shot could cause an increased risk to humans either by guns exploding or shot ricocheting. Furthermore, some hunters and members of the firearms industry claimed that non-lead shot would cause increased wear and risk of damage to certain types of guns. However, the successful introduction of steel shot for clay pigeon shooting allayed the concerns of many hunters by showing that steel shot cartridges were not dangerous to fire. New constructions of cartridges, development of new powder types, and not least a focus on the functionality of the plastic wad to avoid direct contact between load and barrel, resulted in new a generation of non-lead shot cartridges that have been shown to be very useful and have become very popular amongst Danish hunters. The marked demand driven by the legislation forced the manufacturers to create and develop the necessary products. Thirty years of experience in the use of non-lead shot types has provided no evidence that the change from lead shot has jeopardised personal safety or caused damage to guns. Analysis of insurance statistics gives no indication of an increased number of cases of injuries following the phase-in of non-lead shot, and concern over an increase in accidents caused by ricochets from hard steel shot has proved groundless.

LETHALITY

The most pronounced barrier connected to the phase-out of lead shot was a general perception in the hunting community that the efficacy and lethality of non-lead shot was not sufficient for hunting under typical Danish circumstances. Many hunters claimed that by solving the problem of lead toxicosis in waterbirds by banning lead we would only cause another problem by increasing the level of wounding loss. Research in shot lethality was at that time limited to American studies. Despite these studies supporting steel shot as an acceptable, non-toxic alternative to lead (Humburg *et al.* 1982), it became obvious that there was a need to undertake studies in Denmark. Consequently, reviews and field research was initiated by the state administration and research institutions (Hartmann 1982). Also the Danish Hunters' Association introduced a research programme mainly on eider duck *Somateria mollissima* shooting in the 1980s (Kanstrup 1987). In the following years, new lethality studies were performed in other European countries and there were further American publications. The particular focus on the quality of non-lead shot has resulted in

very sophisticated high performance products. Recently, Pierce *et al.* (2014) reviewed historical studies and showed comparable lethality performance by lead and non-lead shot based on field test hunting of mourning doves *Zenaida macroura*. In summary, development has shown that steel and other non-lead metals can be manufactured into pellets and loaded into high quality cartridges in a way that ensures a well performing and lethal shot. Several studies show that the practical efficiency and lethality of a shot is connected primarily to the ability of the shooter to hit his/her target. The change from lead to non-lead shot in Denmark has put a positive focus on the need to educate and train hunters. Noer *et al.* (2001) showed that during the period when lead shot was phased out the frequency of wounding of different game species (*e.g.* pink-footed goose *Anser brachyrhynchus* and red fox *Vulpes vulpes*) in Denmark declined. Danish hunters have become acquainted with non-lead shot. A generation of new hunters has never fired a lead shot cartridge.

SOCIAL BARRIERS

Many Danish hunters were worried that the phasing out of lead shot would cause a decline in numbers of hunters and weaken the socio-political power of the hunting community in Denmark. The same concern is raised today in other countries as an argument against the phase-out of lead shot. The validity of this argument can be tested by using the Danish example of a 20 year total ban on lead shot. The hypothesis is that if hunters began giving up hunting due to the phase-out of lead shot this would cause a decline in the harvest of game and/or numbers of hunters. In the following section two parameters are analysed: firstly, the number of hunters in Denmark over time, and secondly, the hunting bag of three groups of quarry species harvested with shotguns over time. Data for both are available from the 1970s and 1980s respectively and data for the period of the phase-out of lead shot can easily be extracted.

Since the 1930s Danish hunters have been registered as it is a legal requirement that they possess a hunting license. The system is administered by the Government, and since 1989 by the Ministry of Environment. Data are published and are openly available. Figure 1 shows the number of hunting license holders in Denmark in the period from 1980 to 2013.

In general, the number of hunters remains stable over the whole period. It has fluctuated between 160,000 and 175,000, and thus has changed by less than 10% over the period of 33 years. There seems to be a slight decline from the year 2000 and thereafter, but this is unlikely to be a reaction to the regulation of lead shot that came into force earlier. Neither is it likely that the new hunting act of 1993 had a significant impact. The most likely reason for the small fluctuations is that the number of hunters is affected by the popularity of hunting and therefore on societal trends more than legal regulations. Today, 30 years after the first regulation of lead shot and almost 20 year after the total ban, the number of hunters in Denmark is the highest (177,000) since registration was introduced in the 1930s. There seems to be no indication, that the regulation and total phase-out of lead shot for hunting has had any negative impact either on the number of hunters or on the long term popularity of hunting.

The annual harvest is monitored by the Danish Centre for Environment and Energy/Aarhus University and basic data are publicly available.

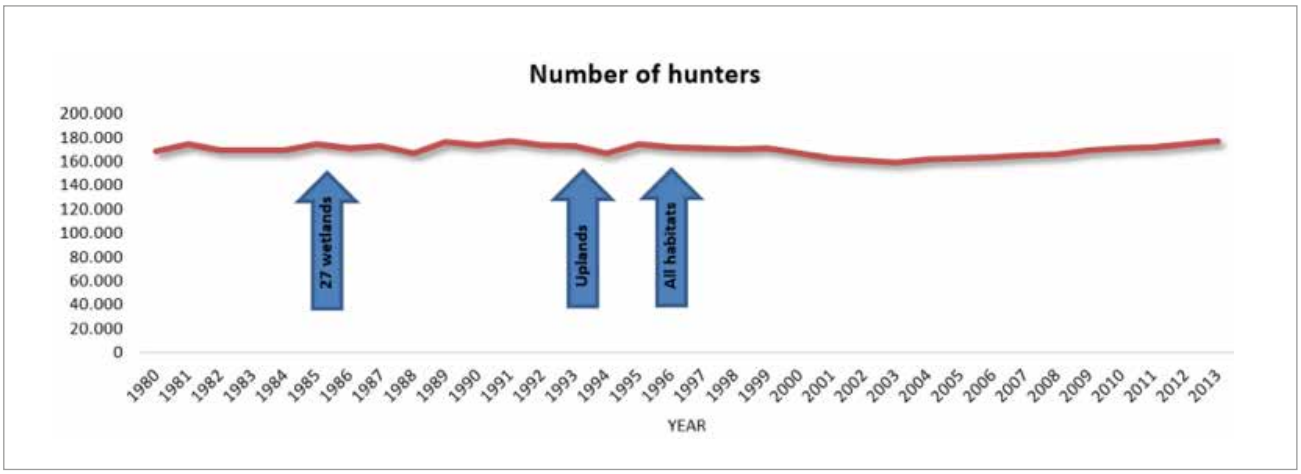

Figure 1: **Number of hunting license holders in Denmark from 1980 to 2013.** *Arrows indicate the time of regulation of lead shot in three hunting habitats. Source: Annual publications from the Danish Nature Agency protocols.*

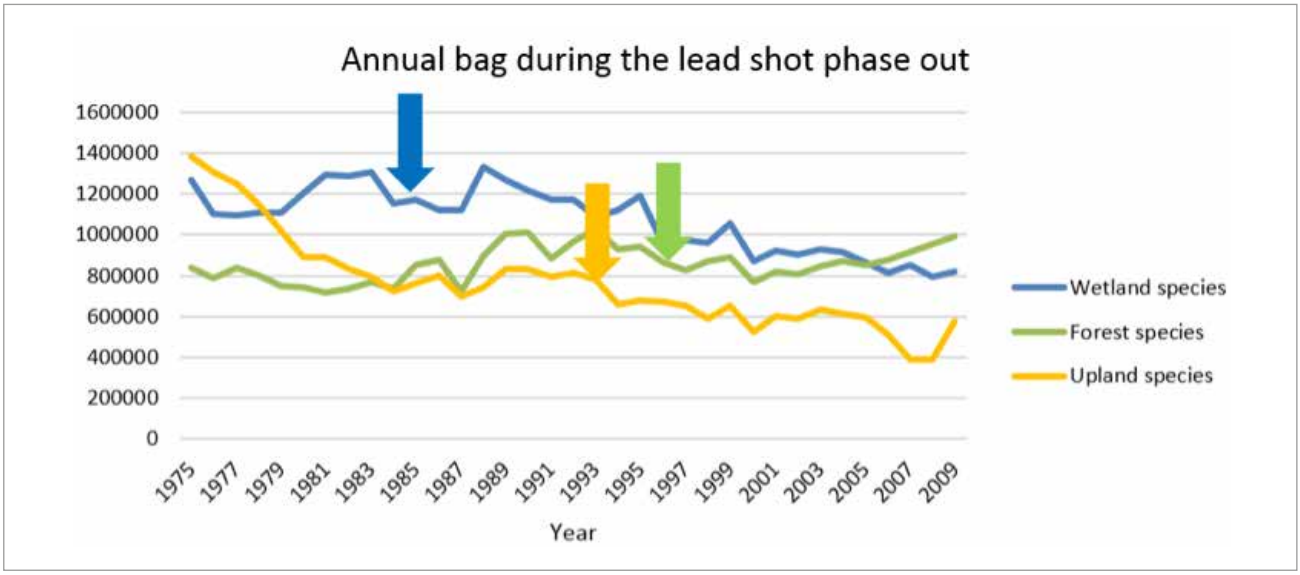

Figure 2: **Annual bag of three groups of quarry species during the period of phase out of lead shot for hunting in the three habitats: wetlands, uplands and forests.** *Arrows indicate the time of regulation of lead shot in the particular habitat. Source: The Danish Bag Statistics.*

Data for species hunted with shotguns in the period 1975 to 2009 are shown in Figure 2.

The annual bag of quarry species in all habitats in Figure 2 shows a high degree of fluctuation during the whole period. In the years after the regulation of lead shot in certain wetlands (26 Ramsar sites) there seems to be a slight increase in the harvest of both wetland and other species. From the mid-1990s the bag of all groups of species shows a slight decline. There is no reason to believe that this is due to hunters giving up hunting because of the lead shot ban. The legal basis for the lead shot regulation was a new hunting law that came into force in 1993. However, this act changed other principles of hunting, *inter alia*, shorter open seasons for certain species, *e.g.* woodpigeon and seaducks, and a new network of hunting free sanctuaries in Danish Special Protection Areas causing a general decline in the hunting potential mainly in coastal wetlands. Together with a general decline in populations of upland game species such as grey partridge *Perdix perdix* and European hare *Lepus europaeus*, this has caused a general reduction in the annual harvest (Asferg *et al.* 2009). During the last approximately 20 years the total annual bag has been relatively stable at about 2-2.5 million specimens annually. The bag of forest species tends to have increased slightly.

In conclusion, the Danish example of a total ban on lead shot for hunting has demonstrated that this can be achieved without jeopardising the hunters' interests and weakening the hunting community. On the contrary, it is believed likely that the public image value of hunting not being connected to a pollutant such as lead is of paramount importance for the long-term political sustainability of hunting.

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Pheasant shooting is popular in the UK and remains popular in Denmark 20 years after the transition to non-toxic shot.

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