



AARHUS UNIVERSITY  
DEPARTMENT OF BIOSCIENCE

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# WOUNDING OF GAME BY SHOTGUN HUNTING

## Status of the Danish action plan to reduce wounding

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# INTRODUCTION

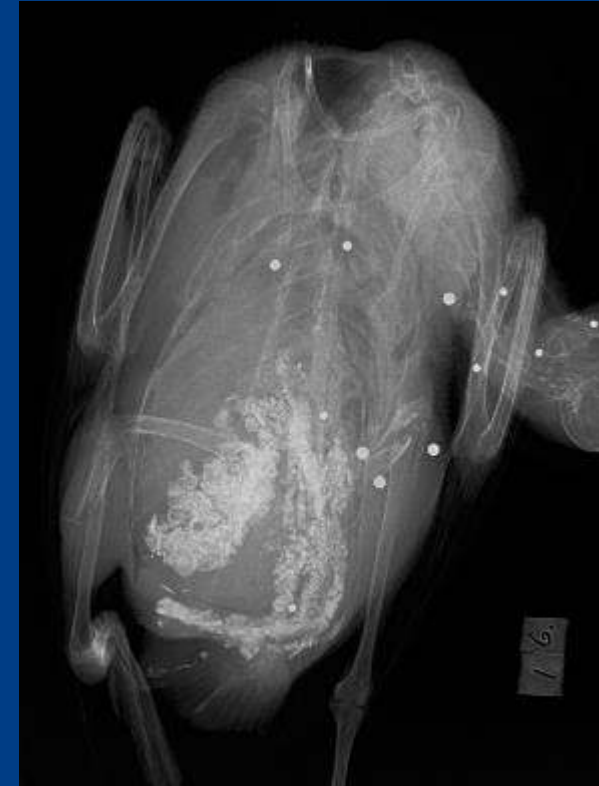
- › Hunting by shotgun unavoidably causes non-lethal wounding of game that are hit by pellets, but not retrieved by the hunter.
- › “Crippled, unretrieved loss”
- › Wounding affects individual survival rates, i.e. lightly crippled will survive, severely crippled will eventually die
- › Wounding is an ethical issue and used as argument against hunting
- › How big is the problem? – how many individuals are crippled?



# INTRODUCTION

Danish X-ray investigations in the 1990's detected  
shotgun pellets in Danish game species:

pink-footed goose (36%)  
eider (34%)  
red fox (25%)



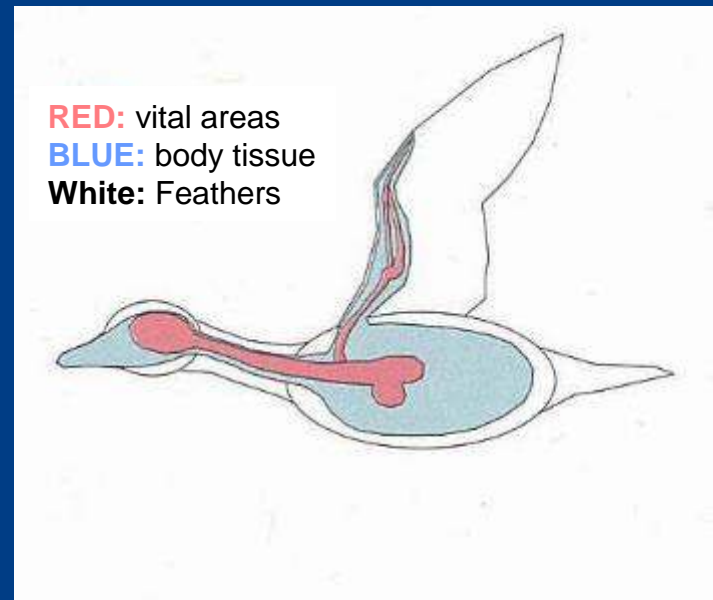
Nearly one bird is  
wounded for every one  
killed\*

\*Noer *et al.* 2007, Journal of Applied Ecology



# WHY DO WE CRIPPLE THE GAME?

- › *Ducks are well constructed to survive shooting* (Bellrose, 1953)
- › Vital tissue, body tissue and feathers
- › Risk of wounding is caused by:
  - › Weapon
  - › Ammunition
  - › shooting skills
  - › range
- › Improving the hunters shooting skills and their ability to judge the range are the most important factors to reduce wounding





# THE DANISH ACTION PLAN

- › A national action plan to reduce wounding was implemented in 1997 by the Danish Council for Wildlife Management, granting hunters an initial trial period to reduce the number of wounded animals on a voluntary basis.
  
- › If major reductions of numbers wounded did not result, limited hunting opportunities or protection were the alternative ways to achieve improvements



A real strength of the action plan was engaging hunters through information campaigns from both the government (Forest and Nature Agency) and the Hunting Association (1997-2005 & 2012-2016).

Information campaign poster:

*“Shooting at too long ranges results in wounding of game”*

*“It’s cruelty to animals”*

*“It has to be stopped”*

*“Don’t shoot unless you are at the right range – its that easy!”*

Alarmerende rapport:  
Alt for mange gæs og  
edderfugle flyver rundt  
med høl i kroppen!

**Skydning på for lange hold  
giver for mange anskudninger!**

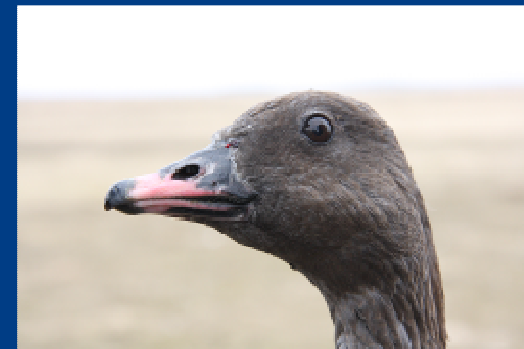
Det er dyrpilgeri. Det hører ingen steder hjemme. Det skal stoppes nu. Vis selvdisciplin og god jagttek. Skyd ikke, for du er helt sikker på, at vildtet er på forsvarligt hold. Er du i tvivl, så skyd ikke. Så nemt er det faktisk. Husk det. For vildtets skyld. Og for jagtens.

SKOV- OG NATURSTYRELSEN



# MONITORING WOUNDING OF GAME

- › Red fox and eiders were collected by using rifle or #BB shotgun pellets (4.6 mm)
- › #BB pellets are easily distinguished from ordinary shotgun pellets in X-ray images.
- › Pink-footed geese were caught alive using cannon-nets.





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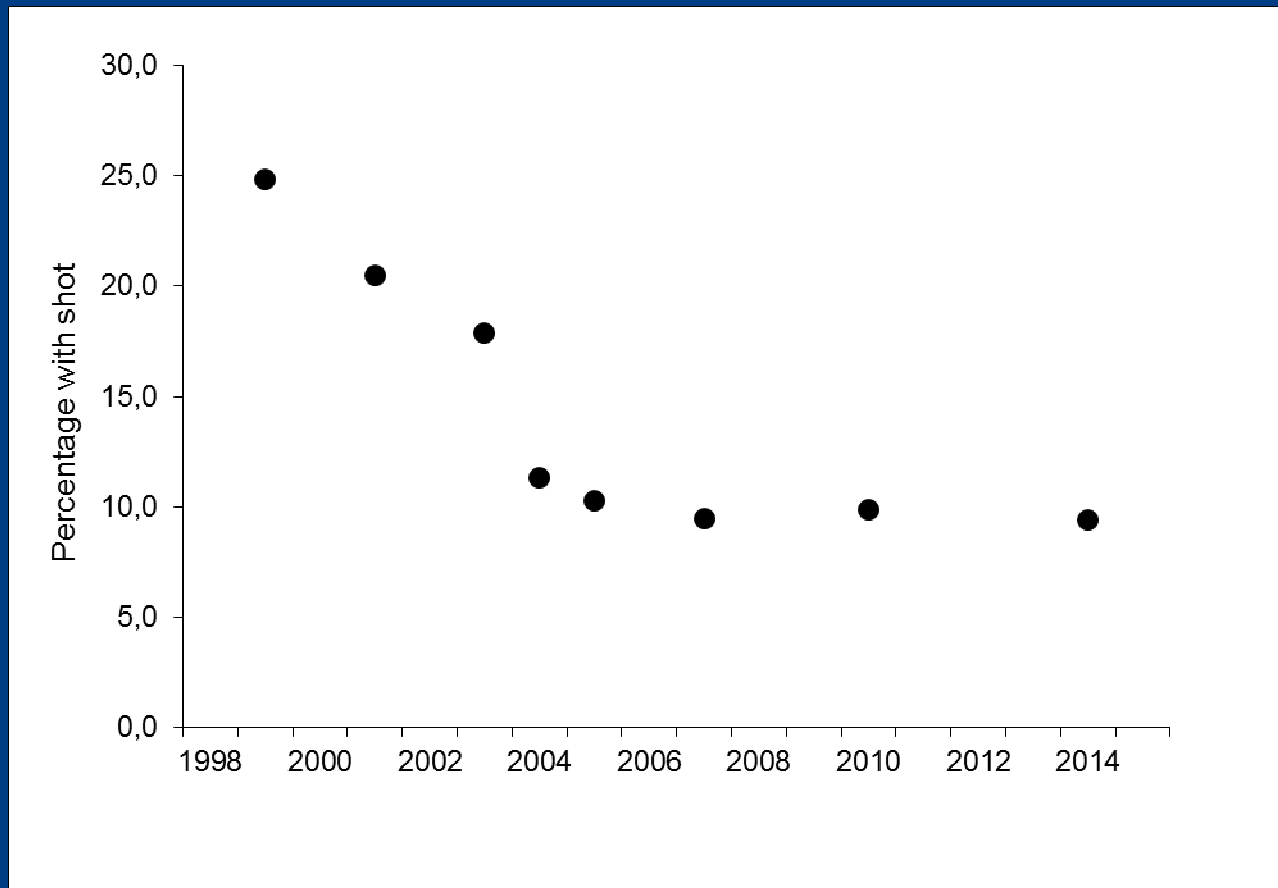






# RESULTS: RED FOX

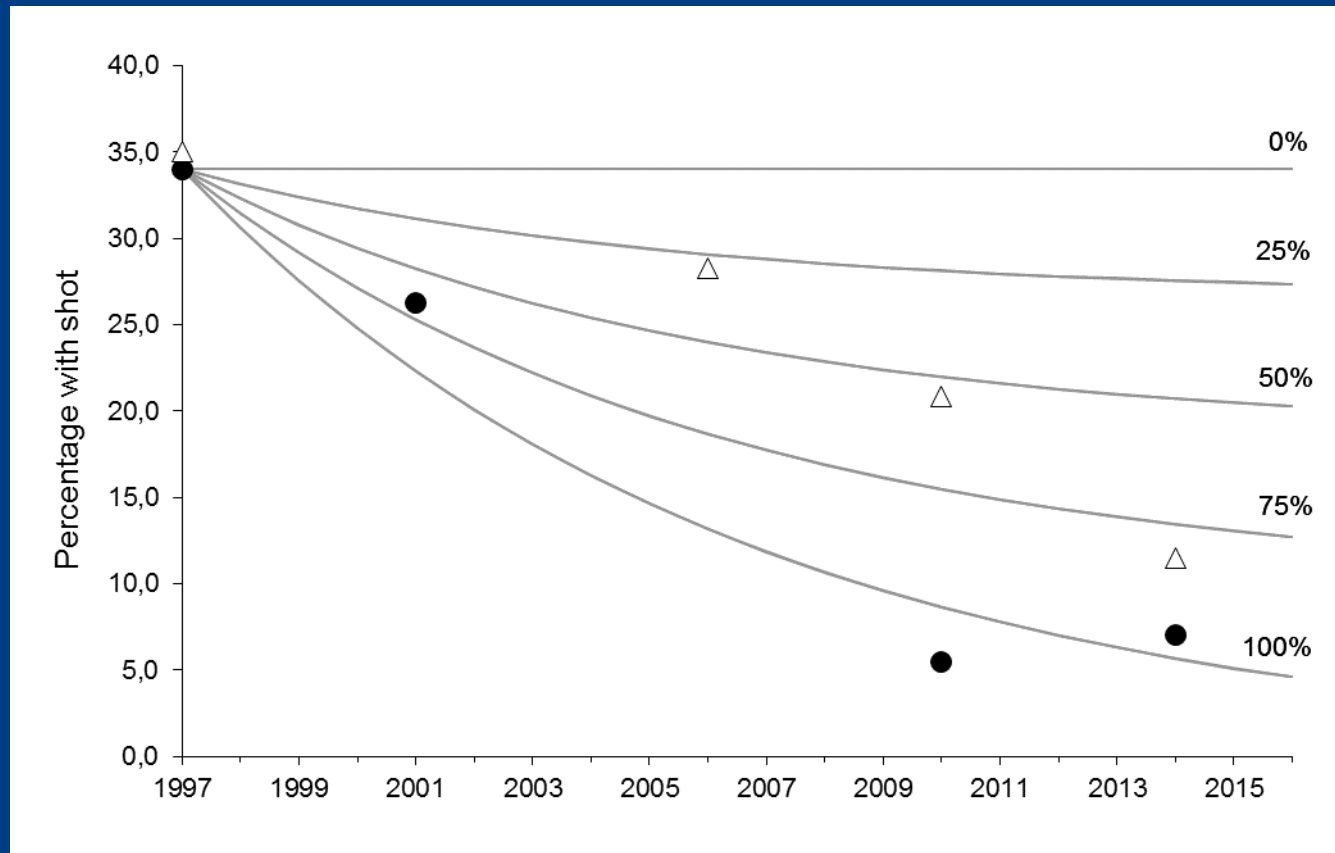
- › For red fox, there has been a significant decrease from 25% foxes carrying shotgun pellets in the 1990's, to a stable 10% from 2005 to 2014.





# RESULTS: COMMON EIDER

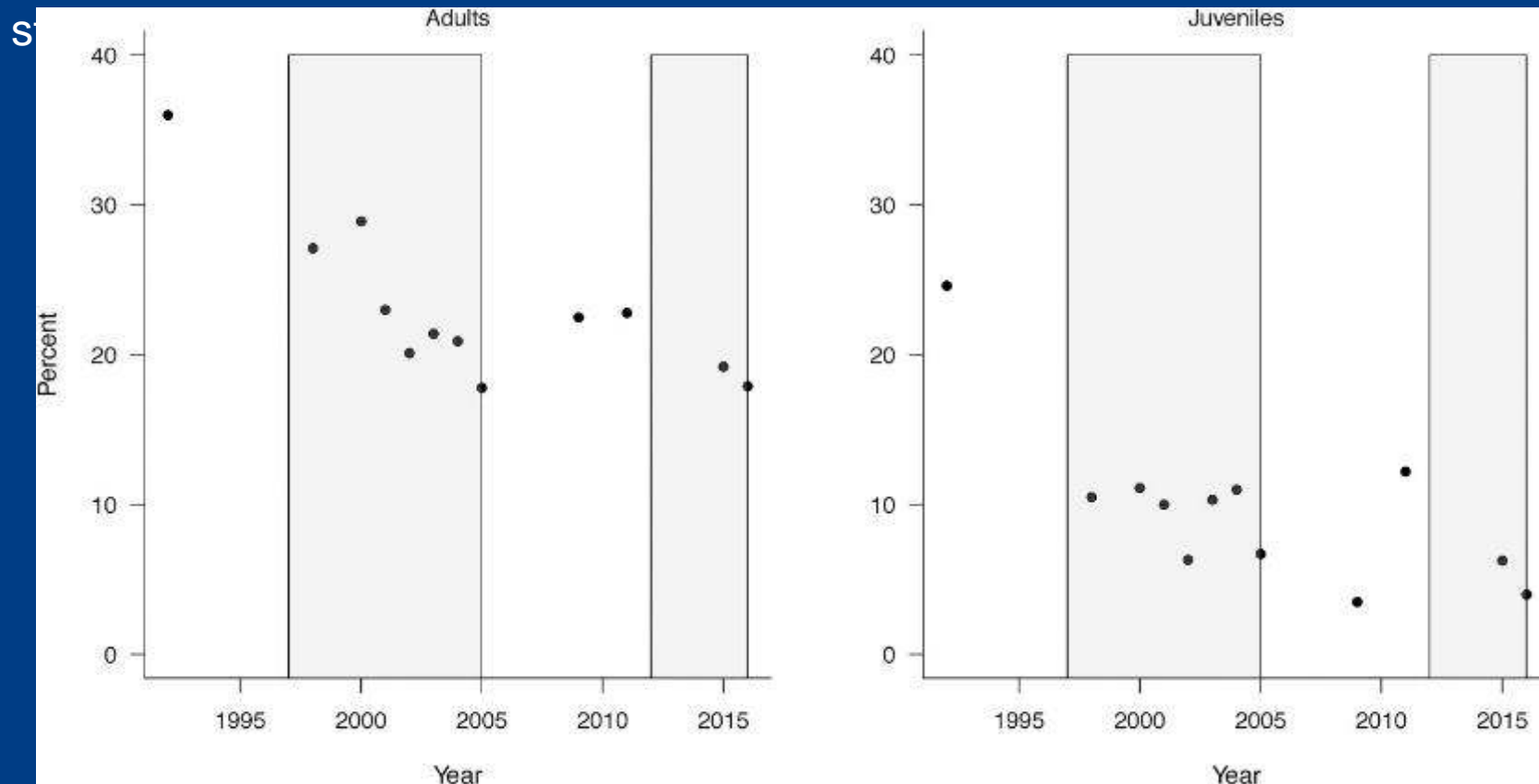
- › The percentages of eiders with pellets has dropped significantly from 34% in 1997 to 7% for females (black dots) and 11% for males (triangles) in 2014



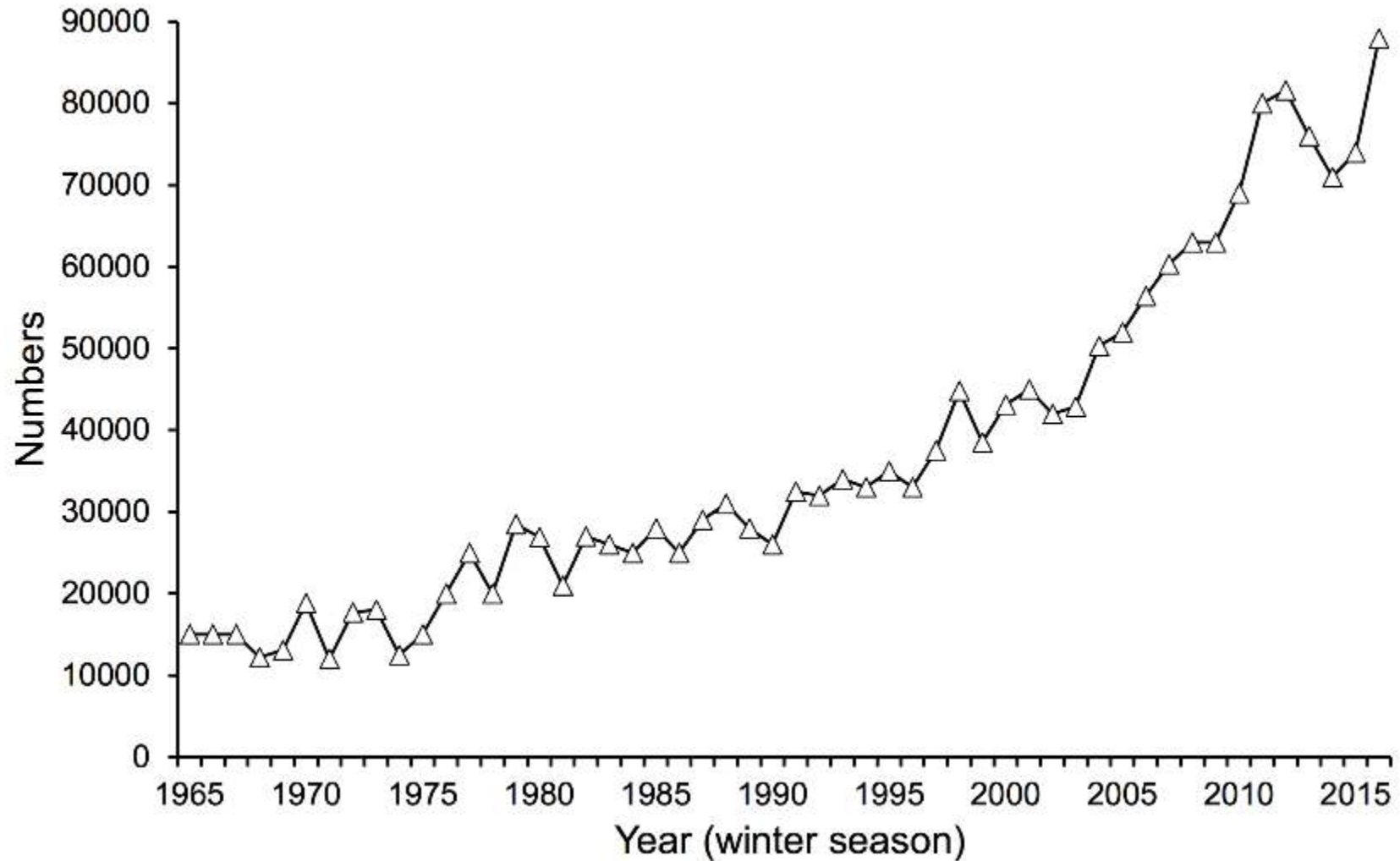


# RESULTS: PINK-FOOTED GOOSE

- › For pink-footed geese, there has been a significant decrease from 36% carrying shotgun pellets in 1997, to 20% in 2002. Since, numbers have been





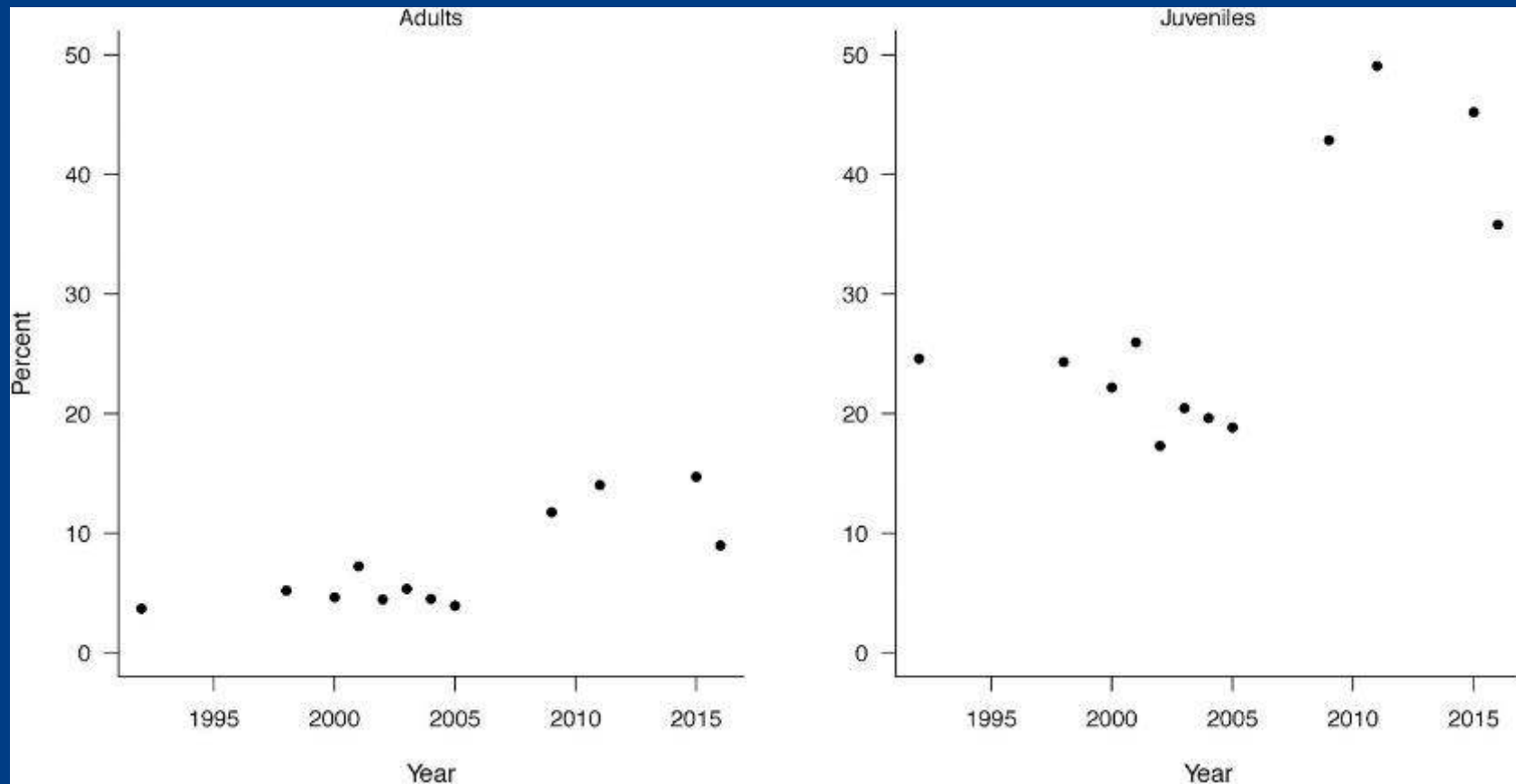


Development of the size of the Svalbard population of the Pink-footed



# HARVEST RATE

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# Introducing “CRIPPLING RATIO”

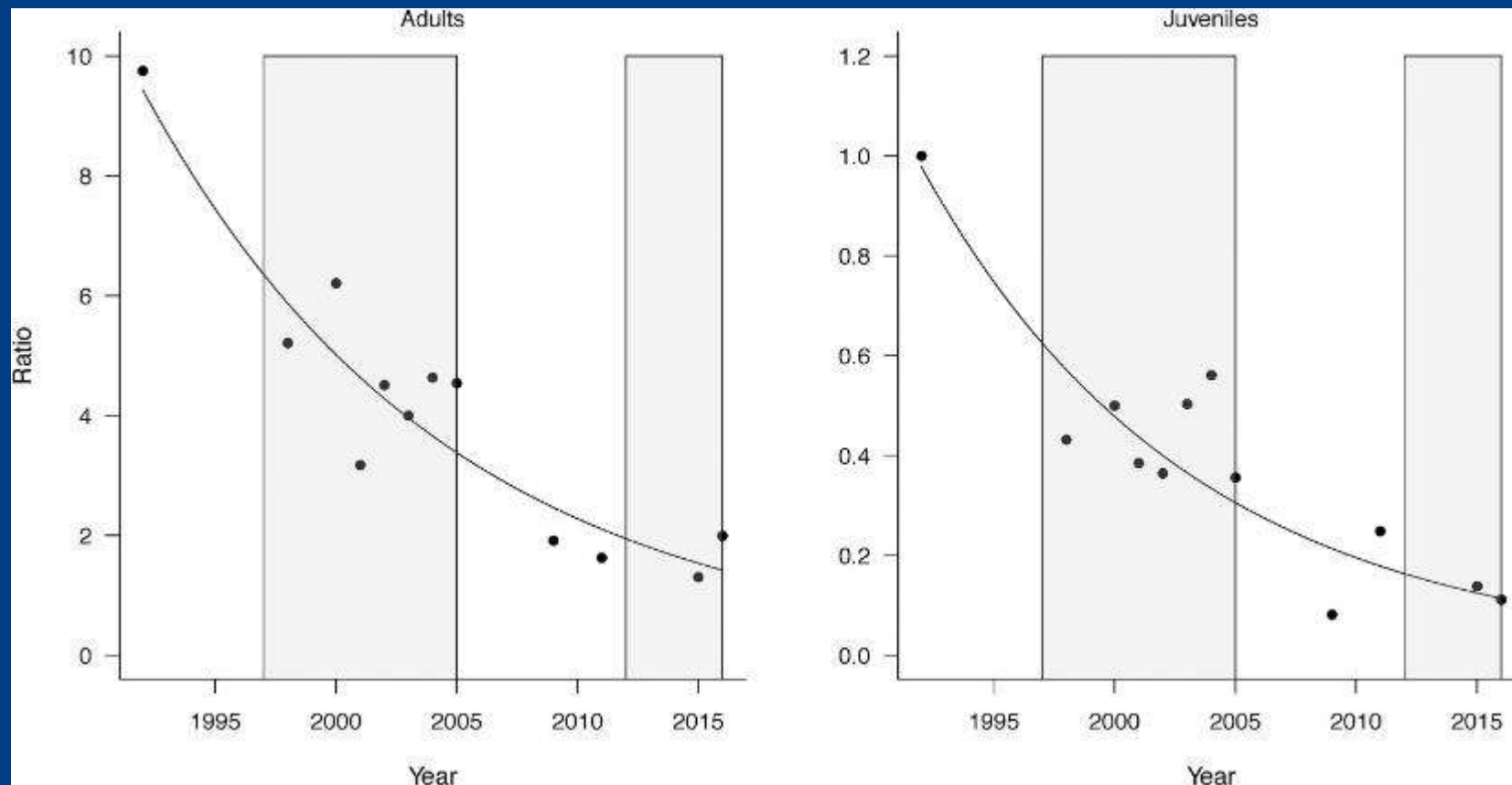
- a novel approach to evaluate hunter performance in a way that accounts for differences in population size and harvest pressure
- The unitless crippling ratio indicates the number of geese crippled per successfully bagged goose, and is therefore a suitable measure of hunter performance.
- Crippling ratio = Wounding rate / Harvest rate
- Wounding rate = No. of birds with embedded shotgun pellets / No. x-rayed birds
- Harvest rate = Hunting bag / Population size prior to hunting



# CRIPPLING RATIO

The number of juvenile geese crippled for each goose bagged dropped from 1 in 1992 – 0.1 in 2016 (juveniles). Among adult birds the ratio dropped from 10 to

2.





Original Articles

## Crippling ratio: A novel approach to assess hunting-induced wounding of wild animals



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### ARTICLE INFO

**Keywords:**  
Crippling  
Wounding  
Hunting  
Waterfowl  
Management  
Animal welfare  
Pink-footed Goose

### ABSTRACT

In order to use recreational hunting as a socially acceptable management tool, the practice of this activity should adhere strictly to the ethical standards of animal welfare and the conservation guidelines on sustainable harvest. A key measure in this regard is monitoring the negative side effects of hunting associated with crippling of wild animals. This study introduces “crippling ratio” (the number of individuals crippled for each successfully logged) as a novel approach to evaluate hunter performance in a way that accounts for differences in population size and harvest pressure, and which therefore can be used to evaluate initiatives launched to reduce wounding of wild game. We demonstrate that crippling ratios of Svalbard-brooding Pink-footed Geese *Anser brachyrynchos* has been declining steadily over the last 25 years despite an increasing harvest rate. Hence, for previous birds that have not previously experienced a hunting season, and therefore can be used as a direct measure of annual variation in the crippling ratio, the number of geese crippled for each goose tagged dropped from 1.00 in 1992–0.11 in 2016. This corresponds to an 89% reduction in crippling frequency. Among adult birds the ratio dropped from 9.75 in 1992–1.99 in 2016, corresponding to a reduction of 80%. This positive development might be ascribed to effective awareness campaigns, training of hunters and adjustment of hunting techniques in both Denmark and, recently, Norway. It exemplifies that monitoring the outcome of management programmes is an important element in ensuring that measures introduced to manage wildlife are socially defensible.

### 1. Introduction

Waterbird hunting is a widespread recreational activity and a key factor in the management of many waterbird populations. The direct and indirect effects of hunting on harvested as well as protected populations are subject to ongoing debate (Fox and Madsen, 1997; Haug et al., 2014; Nichols et al., 1995; Newth et al., 2011; Norton and Thomas, 1994; Sutherland, 2001). Whether hunting of wild animals serves as a management tool, a source of food, a mere recreational activity or any combination of these, it should be performed sustainably, ensuring the conservation status of populations as well as reducing negative side effects, such as displacement of birds from critical resources due to disturbance, lead poisoning or crippling (European Commission, 2008; Marben et al., 2015a).

Crippling due to shotgun shooting has for long gained focus in waterbird management (Elder, 1950; Jansson et al., 1988), not only because it constitutes an ethical and animal-welfare problem but also because it may potentially affect population dynamics through reduced survival of injured individuals. Mortality due to crippling may happen shortly after injury (within days or weeks), without the injured

individual being retrieved by the hunter, or from more subtle long-term effects (Madsen and Nøer, 1996). Main causes of crippling are shooting at birds at too long ranges, use of suboptimal shotgun ammunition and shotguns and, more generally, lack of experience in shooting at overflying waterbirds (Nøer et al., 2006). In Denmark, x-ray investigations carried out in the early 1990s showed high rates of crippling in geese and eider ducks. This led to a national action plan to reduce crippling, organized by the statutory authorities and the Danish Hunters' Association. The plan included annually recurrent awareness campaigns during 1997–2005 and relevant training of hunters. Subsequently, reductions in crippling rates were observed, which could be ascribed to the successful campaign (Nøer et al., 2007). A slight increase in crippling rate of Pink-footed Geese during 2009–2011 triggered the need for recommencing these initiatives, and a second round of recurrent campaigns was introduced in 2012 and is still running.

Recently, adaptive harvest management of Svalbard-brooding Pink-footed Geese *Anser brachyrynchos* has been introduced to regulate the size of this population, as part of the first International Species Management Plan (ISMP) under the auspices of the African–Eurasian

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SHORT REPORT  
15 SEP 2017 | 66 | 131 | 134

## Effects of a Danish action plan on reducing shotgun wounding of Common Eider *Somateria mollissima*

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**Capsule** The incidence of embedded shotgun pellets in Common Eider females declined from 34.1% to 9.5% from 1997 to 2009–2011 after the implementation of an action plan to reduce wounding. Males, which were exposed to hunting outside the area of the action plan, showed a lower rate of decline.

Hunting using shotguns inevitably causes mortality of birds that are hit by pellets but not instantly killed. A proportion of these birds eventually die as a direct consequence of their injuries (1998), but lightly crippled individuals may survive embedded pellets, dependent on the extent of injury. It has been shown that birds in poor body condition of Common Eider *Somateria mollissima* (Birkel et al. 2006) such that birds have difficulties maintaining adequate body condition. This may have potential consequences, such as lower reproductive success (Fournier & Hines 1994; O'Hij 2002), and ultimately affect where population growth rates of birds are generally more sensitive to changes in adult survival than to changes in adult mortality (Sæther & Bakke 2000).

To assess the extent of wounding by shotgun pellets in 34% of sub-

explicitly states that management of hunting shall be based on a 'wise use' concept, based upon ethical and ecological principles, and that hunters must not hunt upon game species, which are considered to be scarce or in danger of extinction.

Environ Biol Fish (2017) 98:131–134  
DOI 10.1007/s10641-017-0649-4

ORIGINAL PAPER

## Incidence of embedded shotgun pellets and inferred hunting kill amongst Russian/Baltic barnacle geese *Branta leucopsis*

Thomas Eska Holm · Jesper Madsen

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**Abstract** X-rays of wild caught barnacle geese from the Russian/Baltic population were taken in Denmark in the winters of 2009 and 2011 to determine the incidence of embedded shotgun pellets and to estimate the annual hunting kill. On average, 13% of adult geese ( $n=212$ ) and 6% of first year geese ( $n=35$ ) examined contained pellets in their tissue. Assuming that these birds represented a random sample, extrapolation to the entire population of c. 770,000 individuals indicates that 96,000 barnacle geese carry embedded pellets. Based on the assumption that the ratio between the number of birds with embedded shot and the total number of birds harvested per season is similar to that found in pink-footed geese *Anser brachyotos* (recorded as 3.6:1 during 1990–1996 and 1.7:1 during 2009–2011), the annual kill of barnacle geese was estimated at 26,300–58,300 birds. The Russian/Baltic barnacle geese are protected from hunting on their winter quarters (The Netherlands, Germany and Denmark), but are quarry in Russia and are shot under license to protect agricultural crops in Estonia, Germany, Sweden and Denmark. Barnacle geese are known to be harvested in large numbers and deliberately.

**Keywords** Crippling · Pink-footed geese · Hunting bag · Infliction rate · Harvest rate · X-ray

### Introduction

Mortality rates are important in the management of goose populations. Small fluctuations in adult survival of these relatively long-lived species have a more profound effect on overall population size, than relatively large-scale changes in breeding output (Fox and Madsen 1999; Sæther and Bakke 2000). There are relatively few goose populations in the Western Palearctic for which precise mortality rates exist, and since a very high proportion of mortality is caused by shooting, it is becoming ever more vital that assessment of the size of the hunting bag is made for all species (Fox and Madsen 1999).

The use of X-ray imaging

Environ Biol Fish (2017) 98:131–134  
DOI 10.1007/s10641-017-0651-7

ORIGINAL PAPER

## Prevalence of embedded shotgun pellets in protected and in legally hunted medium-sized carnivores in Denmark

Morten Elmervik · Thomas Esku Holm · Lars Haugaard · Aksel De Madsen

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**Abstract** Illegal killings of protected species may significantly affect their population status or lower recovery rates after persecution. Poaching is difficult to monitor directly, hence indirect methods are required to document poaching incidences and levels. The use of shotgun poaching results in wounding some animals that are not killed. Insufficient hunting methods may result in high removal rates in game species. To reduce wounding of game species, an action plan was implemented in Denmark. Using X-ray analysis, we monitor incidence of embedded shotgun pellets in

**Keywords** Embedded shotgun pellets · Hunting · Poaching · Wounding · X-ray analysis

### Introduction

Population status of long-lived species with low annual reproductive output and low population densities is sensitive to variations in adult mortality (Sæther and Bakke 2000; Schaal et al. 2009). These factors characterize population dynamics for large and many medium-sized carnivore mammals (Gittleman et al. 2001). Over harvest and illegal killing of carnivores may cause population declines or slower recovery rates after they have been persecuted (Woodroffe and Ginsberg 1998; Liberg et al. 2011). Illegal killings of protected carnivores are often reported but indirect methods are required to assess the levels at poaching incidents are difficult to assess directly (e.g. Thiel et al. 2007; Owen et al. 2010).

X-ray analysis of prevalence of embedded shotgun pellets is a feasible method to study poaching. The use of X-rays inevitably causes non-lethal wounding of some animals that are inflicted but not killed by pellets. X-ray analysis has been used to assess crippling of game birds (e.g. Møller 1976; Jussani et al. 1985; Noer et al. 1998, 2001; et al. 2006), and to document and assess poaching level in



# CONCLUSIONS

- › The Danish Action Plan has been a success
- › Knowledge of population size (counts) and harvest rates (bag statistics) can be essential to analyse and evaluate wounding rates