

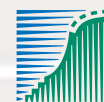
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Waterbirds around the world

A global overview of the conservation,
management and research of the
world's waterbird flyways

Edited by G.C. Boere, C.A. Galbraith and D.A. Stroud

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Sustainable hunting of migratory waterbirds: the Danish approach

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ABSTRACT

The harvesting of migratory waterbirds continues unmodified on a large scale in many European countries despite increasing calls in several countries and at the EU level to ensure that the take is “sustainable”. Despite widespread and common interest, there is neither consensus in Europe concerning an operational definition of “sustainable harvesting” nor consensus concerning the criteria that should be applied in determining sustainability. Around 700 000 wild waterbirds are killed annually in Denmark where the hunting of migratory waterbirds has a strong tradition. We applied simple assessments combining population trends and size of take to determine whether the current kill of quarry species in Denmark is sustainable or not. We present the national approach taken to determine sustainability and provide examples of how data on bag records and knowledge about specific population sizes have been used as case studies in Denmark.

INTRODUCTION

Shooting of waterbirds is a widespread and legitimate recreational activity in many parts of the world, including Europe. Over the past century, its role in regulating the size and distribution of waterbird populations has been the focus of much debate, and this has affected the management of hunting in both the USA and Europe. As a result of increasing political unification, enhanced international co-operation and a vast improvement in our knowledge, the legislative management of bird species and hunting activities in Europe has grown increasingly international over the last 30 years. Starting with the Ramsar Convention on Wetlands (1971), followed by the EEC Directive on the Conservation of Wild Birds (“Birds Directive”, 1979), the Convention on Migratory Species of Wild Animals (CMS, 1979) and the African-Eurasian Migratory Waterbird Agreement (AEWA, 1999), both international and national legislation have increasingly emphasised that the harvest of game animals must be “sustainable”. As yet, however, there is no general consensus nor any internationally accepted operational definition of “sustainable harvesting” that can serve as a basis for the scientific assessment of the impact of hunting (see, for example, Sutherland 2001).

Denmark is an important staging and wintering area for migratory waterbirds, and has a strong tradition of waterbird hunting. There are open seasons for 29 species of waterbirds, many of which occur in concentrations that are internationally important according to the 1% criterion of the Ramsar Convention. The present Danish Game Act came into effect in 1994, both confirming international obligations and emphasising the sustainable management of hunting and game species, not only in an ecological sense, but also in an ethical sense (although

we here limit the discussion to ecological rather than ethical considerations).

Responsibility for establishing hunting seasons lies with the Danish Ministry of the Environment and the process of their revision is administered by the Forest and Nature Agency. Under the 1994 Game Act, hunting seasons can be revised at three-year intervals by Government Orders, increasing flexibility considerably over the previous arrangements when, more often than not, Parliament had to pass a new Game Act to change hunting seasons. On a three-year cycle, the National Environmental Research Institute (NERI) undertakes a scientific review of changes in the bags and population sizes and a re-assessment of the effects of hunting on each species. The available estimates of population size for a given species may, for example, indicate that numbers continue to decline, in which case NERI may recommend that the length of the open season be reduced (see Bregnballe *et al.* 2003 for an example of a detailed review). This recommendation is passed on to the Council for Wildlife Management, which is composed of representatives of stakeholders (including the Danish Hunters’ Association and Danish Ornithological Society), and their main task is to discuss the options for adjusting current regulations, attempt to reach consensus and pass on their conclusions to the Forest and Nature Agency, i.e. the Minister of the Environment. Based on this and other advice, the Minister will thereafter announce the appropriate new local and national adjustments to the length of open seasons. For the species in decline, the change in the open season may or may not slow down the speed of decline.

It has been impractical to wait for international consensus on definitions of sustainability, and so NERI has had to establish operational pragmatic concepts on a “national” level. In this paper, we present this view of sustainability and use worked examples to exemplify how information on bag records and population trends is used to assess whether or not the take in Denmark is sustainable for three different species of waterbirds.

METHODS

What is sustainability?

Our basic concept of sustainability applied to exploitation is that a renewable resource must not be over-exploited, over-exploitation representing a state where the ability of a resource to renew itself and maintain current distribution and abundance is curtailed. In the long run, such over-exploitation will eventually exterminate the resource.

Much effort has been devoted to obtaining the population data necessary for assessing whether hunted populations are over-exploited (e.g. Sutherland 2001), often based upon information on trends in both reproduction and survival as well as abundance (e.g.

Williams & Nichols 2001). Sutherland (2001) argued that knowledge of growth rates should be provided as a basis for assessing sustainable takes. In the absence of such detailed data for most species, Madsen *et al.* (1996) defined sustainable exploitation by means of combining the size of the take and population trends, the basic idea being that as long as a population is stable or increasing, over short periods, current exploitation can be assessed as sustainable. While this obviously works for large and well-known populations, care has to be taken for small and vulnerable populations (Madsen *et al.* 1996). Since many of the waterbird populations hunted in Denmark are indeed stable or increasing, this definition reduces the task of assessing 29 different species considerably.

The initial definition, however, leaves open the interpretation of cases involving decreasing populations. Though not yet fully resolved, a decreasing population trend is not necessarily evidence of unsustainable hunting. For example, breeding numbers and output may be limited by available breeding habitat. If the extent of this breeding habitat is undergoing reduction, harvest is expected to contribute to the rate of population decrease, but also to reach a sustainable level eventually (though depending on the take), if the population in question stabilizes at a new level (Bregnballe *et al.* 2003). Basically, then, decreasing populations will have to be the focus of closer scrutiny before any assessment as to the sustainability of hunting can be made.

Classifying the hunting of a species as “not sustainable” does not necessarily result in recommending a ban on hunting, in particular if the population decline is moderate and the population continues to be large (see the example of Common Eider *Somateria mollissima* below). In the evaluations made at three-year intervals, we distinguish, as objectively as possible, between “sustainable”, “probably sustainable”, “probably not sustainable”, “not sustainable” and “not possible to judge”.

Compared to the Ramsar Convention and the EC Birds Directive, the Habitats Directive of 1992 (implemented 8-10 years later) introduced a new generation of Directives relating to nature conservation in Europe. Since the Habitats Directive does not concern birds, the legal status of the Birds Directive in Denmark was strengthened in 2001 by giving it the same status as the Habitats Directive by Government Order. This requires that an assessment of the conservation status of a given bird species be provided to the European Commission at regular (six-year) intervals. In order to ensure a unified treatment, Bregnballe *et al.* (2003) substituted the “simple” population trends used by Madsen *et al.* (1996) with an assessment of the conservation status of each individual species/population.

Information base

In the north-western Palearctic, most flyway populations breed, stage and winter across several member (and non-member) states of the European Union. Data on population trends – vital to our assessment by the definitions given above – are provided by Wetlands International, based on indices generated from the annual mid-winter International Waterbird Census (e.g. Delany *et al.* 1999). For some species, we also use results from other surveys, e.g. those aimed at estimating the size of sub-populations of geese, and results from the monitoring of Danish breeding populations.

Data on Danish hunting are provided through bag return statistics. After each season, all holders of Danish hunting licenses are required to inform the Forest and Nature Agency of the size

and composition of their annual hunting bag. However, the following groups are pooled in these returns: geese (five species), dabbling ducks except Mallard *Anas platyrhynchos* (six species), diving ducks except Common Eider (nine species), snipes (two species) and gulls (three species). Between the mid-1970s and the early 1980s, about 95% of all licence holders reported their annual bags, but after two major changes in the reporting system, the number of respondents dropped, first to 78%, then recently to 58%. Although estimates of the national bag are corrected for this, maintenance of a higher return rate would clearly be preferable. Since 1982/83, hunters have also voluntarily submitted the wings of bagged waterbirds to NERI, enabling assessment of changes in the age and sex ratios of the bagged sample (Clausager 2004 and references therein). Data from this wing survey are used to estimate the species composition amongst the amalgamated groups “geese”, “other dabbling ducks”, “other diving ducks”, “snipes” and “gulls”. The proportion of hunters submitting wings, however, is relatively low, ranging from 3% of those bagging “other dabbling ducks” to 1% of those bagging geese. Because so few wings are received compared with the total bag, uncertainties amongst species in which fewer than 2 000 individuals are bagged are considerable. The wing survey also provides us with an opportunity to estimate the temporal and geographical distribution of the bag, as well as the age and sex composition.

RESULTS

The bag of waterbirds in Denmark

The number of holders of hunting licences increased during the 1960s and 1970s, and has subsequently stabilized at 160 000 - 170 000 (Fig. 1), c. 3% of the total Danish population. The annual bag of waterbirds (excluding Mallard) declined from a maximum of 900 000 in the mid-1970s to 350 000 in the mid-1990s, and has changed little since then. The decline was partly caused by the protection in 1982 of divers, grebes, auks (alcids) and some species of waders, followed by the protection in 1994 of Eurasian Curlew *Numenius arquata*, Whimbrel *N. phaeopus*, Black-headed Gull *Larus ridibundus* and Common Gull *L. canus*. For species still subject to an open season, marked reductions in bag sizes have taken place for all species of diving ducks, Common Coot *Fulica atra*, snipes and gulls. The bags of Northern Pintail *Anas acuta* and Northern Shoveler *A. clypeata* have declined, but not those of Eurasian Wigeon *A. penelope* or

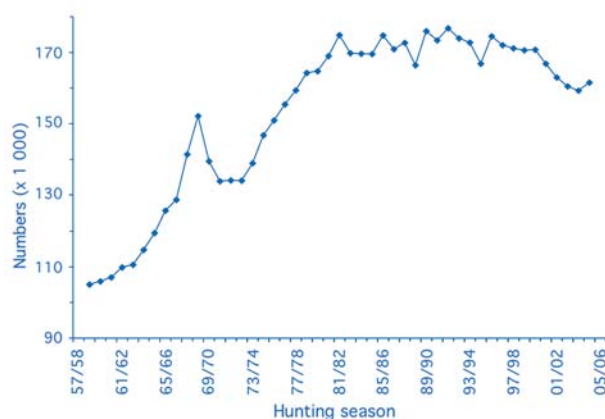


Fig. 1. Changes in the number of hunters holding a hunting licence in Denmark during the period 1969/70-2004/05.

Table 1. Conservation status, population trend, estimated annual bag (1999/2000-2003/04) and sustainability of hunting for 29 species of waterbirds for which there was an open season in Denmark in 2003/04. Conservation status, population trend (25 year trends up to and including 1996 or later) and sustainability of hunting were assessed by the National Environmental Research Institute in 2002 (Bregnballe *et al.* 2003). The estimated species composition of the bags of geese, ducks (except Mallard and Common Eider), snipes and gulls is somewhat uncertain and therefore given in brackets.

Group/species/sub-population	Conservation status	Population trend	Estimated bag 1999/00-2003/04	Sustainability of hunting
Geese			18 000 – 29 000	
Greylag Goose <i>Anser anser</i>	Favourable	Increasing	(> 12 000)	Sustainable
White-fronted Goose <i>Anser albifrons</i>	Favourable	Increasing	(< 300)	Sustainable
Bean Goose <i>Anser fabalis</i>			(< 400)	
Sub-population A (Finland)	Favourable	Increasing		Sustainable
Sub-population B (Åsele Lapmark, Sweden)	Unfavourable and decreasing	Decreasing		Local ban on hunting
Sub-population C (unknown origin)	Unknown	Stable-decreasing?		Uncertain
Pink-footed Goose <i>Anser brachyrhynchus</i>	Favourable	Increasing	(> 2 000)	Sustainable
Canada Goose <i>Branta canadensis</i>	Favourable	Increasing	(> 1 200)	Sustainable
Mallard <i>Anas platyrhynchos</i>	Favourable	Increasing	554 000 – 731 000 ¹	Probably sustainable
Other dabbling ducks			99 000 – 129 000	
Northern Pintail <i>Anas acuta</i>	Favourable	Stable?	(3 200 – 7 100)	Sustainable
Eurasian Wigeon <i>Anas penelope</i>	Favourable	Increasing	(29 000 – 53 000)	Sustainable
Common Teal <i>Anas crecca</i>	Favourable	Increasing	(59 000 – 82 000)	Sustainable
Garganey <i>Anas querquedula</i>	Uncertain	Decreasing?	(100 – 400)	Sustainable
Northern Shoveler <i>Anas clypeata</i>	Favourable	Stable	(1 300 – 2 700)	Sustainable
Gadwall <i>Anas strepera</i>	Favourable	Increasing	(300 – 1 100)	Sustainable
Common Eider <i>Somateria mollissima</i>	Unfavourable and decreasing	Decreasing	75 000 – 95 000	Uncertain
Other diving ducks			31 000 – 34 000	
Common Pochard <i>Aythya ferina</i>	Favourable	Stable	(700 – 1 700)	Sustainable
Tufted Duck <i>Aythya fuligula</i>	Favourable	Stable	(3 300 – 4 400)	Sustainable
Greater Scaup <i>Aythya marila</i>	Favourable	Stable	(300 – 500)	Sustainable
Common Goldeneye <i>Bucephala clangula</i>	Favourable	Increasing	(11 000 – 18 000)	Sustainable
Long-tailed Duck <i>Clangula hyemalis</i>	Favourable	Stable?	(1 500 – 4 700)	Sustainable
Common Scoter <i>Melanitta nigra</i>	Favourable	Stable	(2 800 – 5 200)	Sustainable
Velvet Scoter <i>Melanitta fusca</i>	Favourable?	Unknown	(1 600 – 2 800)	Sustainable
Goosander <i>Mergus merganser</i>			(800 – 1 900)	
Flyway	Favourable	Stable-increasing		Sustainable
Danish breeding population	Favourable but rare	Slowly increasing		Local ban on hunting
Red-breasted Merganser <i>Mergus serrator</i>	Favourable	Increasing	(2 000 – 3 700)	Sustainable
Common Coot <i>Fulica atra</i>	Favourable	Increasing	17 000 – 20 000	Sustainable
Snipes			15 000 – 24 000	
Common Snipe <i>Gallinago gallinago</i>	Unfavourable	Unknown	(14 000 – 23 000)	Probably sustainable
Jack Snipe <i>Lymnocyptes minimus</i> ²	Uncertain	Unknown	(1 100 – 3 500)	Uncertain
Eurasian Woodcock <i>Scolopax rusticola</i>	Favourable	Stable	24 000 – 39 000	Sustainable
Gulls			28 000 – 36 000	
Lesser Black-backed Gull <i>Larus fuscus</i>			(100 – 600)	
Baltic sub-population	Unfavourable and decreasing	Decreasing		Not sustainable
Other sub-populations	Favourable	Increasing		Sustainable
Herring Gull <i>Larus argentatus</i>	Favourable	Increasing	(19 000 – 25 000)	Sustainable
Great Black-backed Gull <i>Larus marinus</i>	Favourable	Increasing	(9 000 – 11 000)	Sustainable

¹ The vast majority were released for shooting.

² Hunting of the species has been banned since 2004/05.

Common Teal *A. crecca*. The Mallard bag increased from 350 000 in the mid-1970s to 700 000 in the 1990s, concurrent with an increase in the release of Mallard for shooting, although the bag has recently decreased to 600 000. The bag of geese has more than doubled over the last 10 years, reaching 30 600 in 2004/05, mainly because of an increase in the take of Greylag

Goose *Anser anser*. The bag of Eurasian Woodcock *Scolopax rusticola* has increased since the early 1970s. Table 1 gives the range of the estimated bags during the period 1999/2000 to 2003/04, together with population trends, for most of the 29 species of waterbirds for which there was an open season in 2003/04.

Small and vulnerable populations: Bean Goose and other populations

The Bean Goose *Anser fabalis* occurs in Denmark during migration and winter. Information from phenology, recoveries and re-sightings of ringed birds suggests that the Taiga Bean Geese *A. f. fabalis* appearing in Denmark belong to at least three partly or entirely separated breeding populations (Madsen *et al.* 1996, Bregnballe *et al.* 2003). Sub-population “A” is large, and is composed of birds that breed in Finland and migrate to wintering areas in southern Sweden, south-eastern Denmark (Fig. 2) and The Netherlands. Sub-population “B” is small, breeds in central Sweden (Åsele Lapmark), and migrates to north-western Jutland (Thy; Fig. 2), with some birds continuing on to eastern England (Yare Valley) during the winter (Parslow-Otsu & Kjeldsen 1992). Sub-population “C” has unknown breeding origins and winters in north-eastern Jutland (Tjele near Viborg and Lille Vildmose; Fig. 2). These “C” birds have a different phenology from those occurring in north-western Jutland, and recovery and re-sighting data indicate that some of them winter in The Netherlands. A possible breeding area for the “C” birds is the border region between Norway, Finland and Russia. It is, however, puzzling that most birds ringed in northern Norway have been recovered in the same region as Finnish ringed birds, and that no Finnish and few Norwegian ringed birds have been recovered in the “C” bird region of Denmark (Fig. 2).

The Finnish breeding population (sub-population “A”) increased during the 1970s and 1980s and probably stabilized thereafter (Nilsson *et al.* 1999). The conservation status of this population is therefore judged as favourable (Table 1). The two other sub-populations do not, however, appear to have a favourable conservation status. Winter counts in northern Jutland show a decline over the last 30-40 years from 3 000-4 000 birds to fewer than 1 500 birds at present. During the 1990s, mid-winter counts for northern Jutland and the Yare Valley combined have never exceeded 2 000 birds. Based on such pieces of information, we judged the conservation status of sub-population “B” as unfavourable-declining and of sub-population “C” as uncertain.

The change in the size of the Bean Goose bag in Denmark is not known in detail because the hunters do not distinguish between species when reporting their kill of geese. Furthermore, the number of goose wings received from hunters in relation to the total bag of geese has declined from 4-5% in the second half of the 1980s to 1% in the second half of the 1990s. A study of the species composition of the bag of geese in the 1960s suggested that c. 1 100 Bean Geese were bagged annually in Denmark. Based on the wing survey, it was estimated that the annual bag amounted to c. 500 in the early 1990s. It is unknown what proportion of these birds belonged to the different sub-populations. Uncertainty about the effects of hunting on sub-population “B” in the early 1990s led to a regional ban on Bean Goose hunting in parts of northern Jutland in 1994/95. This regional hunting ban probably led to a further decline in the annual bag of Bean Geese.

In 2002, we assessed the effect of hunting as sustainable for sub-population “A” and uncertain for sub-population “C”. Based on the uncertainty of the effect on hunting on sub-population “C” and the unfavourable-declining conservation status of sub-population “B”, we recommended that the regional hunting ban

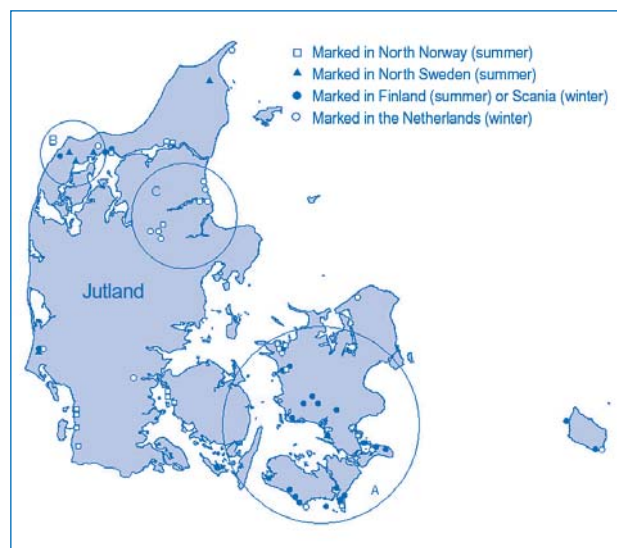


Fig. 2. Distribution of the three sub-populations of Taiga Bean Goose *Anser fabalis fabalis* in Denmark, based on ringing recoveries. Each sub-population has a different phenology, conservation status and breeding origin. Circle “A” indicates birds believed to belong to a population breeding in Finland and wintering mainly in southern Sweden (Scania). Circle “B” indicates birds from a small breeding population in northern Sweden. (In addition to the recoveries shown, neck-bands of 29 different individuals from the northern Swedish breeding range have been reported from this area). Circle “C” indicates a small population of unknown breeding origin which winters in north-east Jutland and apparently also in The Netherlands. Recoveries from outside these three areas indicate birds that were shot on migration or at staging areas that were used in the past. Map redrawn from Bregnballe *et al.* (2003) and updated with data from Bønløkke *et al.* (in press).

for Bean Goose (covering parts of northern Jutland) be expanded to include all areas in northern Jutland where the Bean Goose was known to occur. Following this recommendation, the Bean Goose was protected in Jutland by the 2004 Government Order.

Similar regional hunting bans have been used for a few other species of waterbirds in Denmark, e.g. hunting of gulls was banned south of latitude 55°40’N in order to increase the protection of the now threatened and declining nominate (Baltic) subspecies of the Lesser Black-backed Gull *Larus fuscus*. Also, as a result of representations to the Council for Wildlife Management, the Goosander *Mergus merganser* was protected south of 55°40’N in order to assist the establishment of a breeding population in Denmark (presently <30 pairs). Because of the problem of “look-alike species”, the Red-breasted Merganser *M. serrator* was also protected within this area.

Eurasian Wigeon

Eurasian Wigeon breeding in Scandinavia, Finland, Russia and Siberia occur in Denmark during August-November. Based on January counts, the estimated North-west European population of the Eurasian Wigeon increased three-fold between 1987 and 1996 (Delany *et al.* 1999), and subsequently declined to a lower level (Fig. 3). The decline in estimated population size was probably partly an effect of very poor breeding success in 1994 and in several of the subsequent years (Clausager 2004; Fig. 4).

The open season for Eurasian Wigeon is the same as that for all dabbling ducks in Denmark, i.e. 1 September – 31 December.

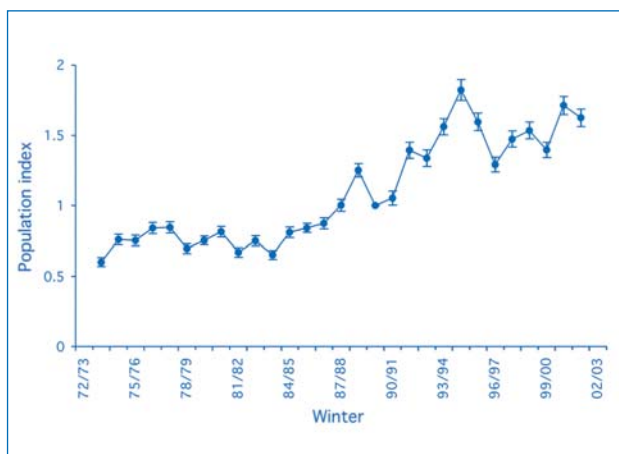


Fig. 3. Population trend of Eurasian Wigeon *Anas penelope* in North-west Europe during the period 1974-2002, estimated by Wetlands International from annual mid-winter counts (Wetlands International, unpubl. data). Points indicate index values \pm SE using TRIM methods to estimate values (Pannekoek & van Strien 1998).

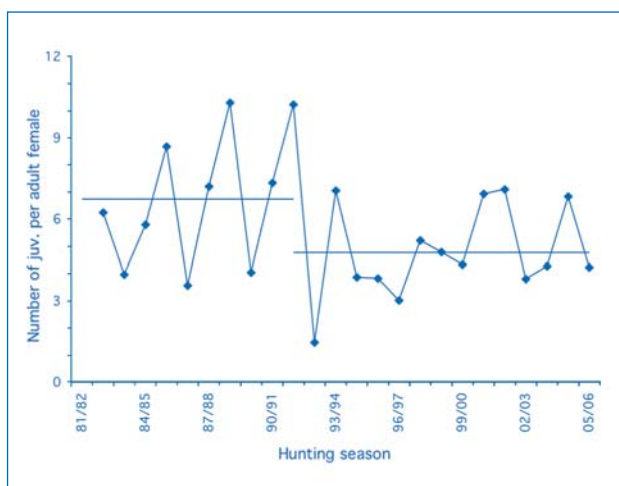


Fig. 4. Proportion of juveniles among Eurasian Wigeon *Anas penelope* bagged in Denmark during the hunting seasons 1982/83-2005/06. The proportion of juveniles is given as the number of juveniles of both sexes per adult female. The two solid horizontal lines give the means for the periods 1982/83-1991/92 and 1992/93-2005/06, respectively.

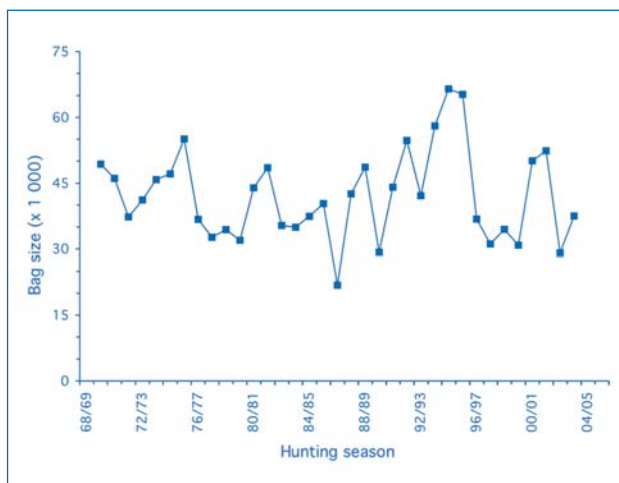


Fig. 5. Danish bag of Eurasian Wigeon *Anas penelope* during the period 1969/70-2003/04.

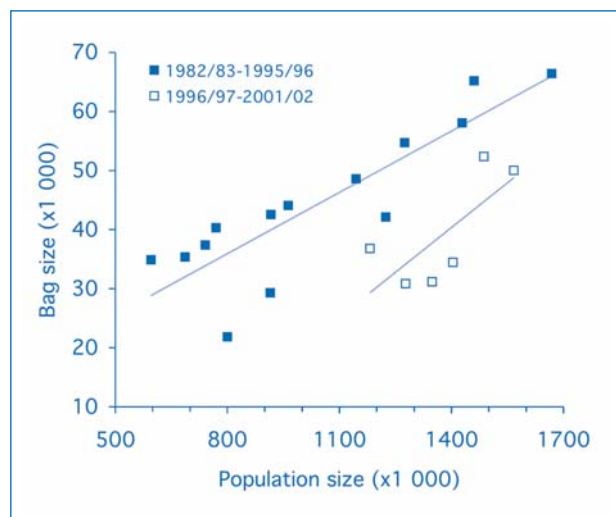


Fig. 6. Relationship between the annual bag of Eurasian Wigeon *Anas penelope* in Denmark and the estimated population size for North-west Europe during the periods 1982/83-1995/96 and 1996/97-2001/02.

The Danish bag of Eurasian Wigeon increased until 1995/96 (Fig. 5) simultaneously with an increase in the size of the population (Fig. 6). After 1995/96, the bag decreased markedly to a lower level than expected from the relationship between bag size and population size in the preceding years (Fig. 6). The seasons 2000/01 and 2001/02 had a higher bag than in former and subsequent years, probably because of a relatively high breeding success (Fig. 4).

Our interpretation in 2002 was that there had been no further decline in the size of the flyway population and that the species had a favourable conservation status. Furthermore, the take in Denmark in proportion to the size of the flyway was low in most seasons after 1995/96. Consequently, we judged the take in Denmark as sustainable.

Common Eider: first steps towards adaptive management?

Common Eiders breeding in Denmark, southern Norway, the west coast of Sweden and the Baltic moult, stage and winter in Danish waters. These populations all increased substantially throughout the twentieth century, but from the mid-1990s, the population trend was reversed, with overall peak numbers of at least 2 000 000 apparently decreasing by 30-50% in less than a decade (Desholm *et al.* 2002). This decline has been further aggravated by a change in the sex ratio over the same period from 60:40 (males to females) to 70:30 at present. The decline in the Baltic Sea/Wadden Sea flyway of Common Eiders is probably, to some extent, a result of the combined effects of avian cholera (causing mass mortality of incubating females), parasites and viral infections (causing low duckling survival), and poor feeding conditions in parts of the wintering area causing mass mortality, e.g. 25 000 Common Eiders were found dead in the Dutch-German part of the Wadden Sea in 1999/2000 (Desholm *et al.* 2002).

The annual bag in Denmark has partly reflected population trends, increasing to c. 140 000 in 1970, after which it fluctuated until the 1990s and then declined to 69 000 in 2004/05 (Fig. 7). It is likely, however, that the decline in annual bags reflects the declining interest of hunters in seaducks, as the number of hunters

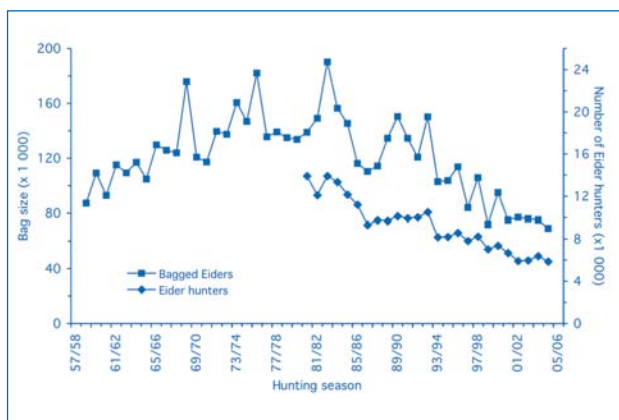


Fig. 7. Danish bag of Common Eider *Somateria mollissima* during the period 1958/59-2004/05, and the number of hunters that bagged Common Eiders during the period 1980/81- 2004/05.

bagging Common Eiders decreased from c. 14 000 in 1980 to 6 000 in 2001/02 (Fig. 7, Christensen 2005). For many years, the open season for eiders in Denmark was 1 October – 29 February, but since 1994, hunting in February has not been permitted in EU Special Protection Areas.

In 2002, we assessed the conservation status of the Baltic Sea/Wadden Sea population of the Common Eider as



Shooting seaducks from punts in the shallow waters around Denmark is highly traditional. Photo: Niels Søndergaard

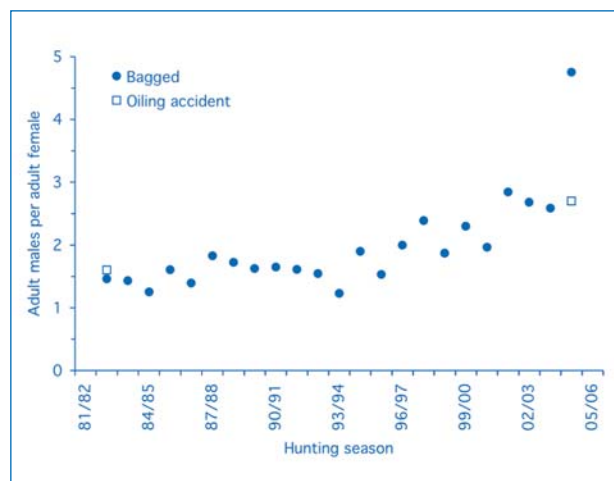


Fig. 8. Number of adult male Common Eiders *Somateria mollissima* per female based on the wing survey in 1982/83-2004/05 and on birds found dead during oiling accidents in 1982/83 and 2004/05.

unfavourable-declining and the effect of hunting as uncertain. Our interpretation of the available information was that the overall impact of hunting on the population had probably changed from reducing the rate of annual increase to potentially adding directly to the decline in breeding numbers. By 2002, the declines led NERI to consider means to limit the take, particularly of females. Consequently, we recommended differentiating between the two sexes, with the open season for females closing on 15 January and that for males on 15 February. At the same time, the open season for Common Scoter *Melanitta nigra*, Velvet Scoter *M. fusca* and Long-tailed Duck *Clangula hyemalis* was extended from 31 January to 15 February. This proposal was accepted, and although the data are still limited, they suggest a shifting sex ratio in the bag of eiders (see 2004/05 in Fig. 8), with the harvest of females being reduced by approximately 8 800 per year, of which 7 500 would belong to the Baltic population breeding to the east of Denmark.

DISCUSSION

Sustainability of hunting

Strategies for achieving and developing sustainable hunting differ widely. In general, researchers have sought to develop highly sophisticated systems of adaptive management based on collection of data, not only on population trends but also on reproduction and survival rates and habitat conditions, which coupled with advanced modelling lead to adaptive management through the introduction of bag limits and variations in annual open seasons. In our case, we have been forced by temporal and financial constraints to develop much more pragmatic systems based on the best information available.

Although most scientists would probably agree that improved data sets are always needed to inform changes in hunting regulation, we note that given an inventory of 29 huntable waterbird species, a considerable subset will always be scarcer, and that abundant species may be split into sub-populations, some of which may be small. By definition, these species and populations will be more vulnerable. The obvious solution – to protect them because they are of limited hunting interest – is often difficult because of “look-alike” issues; for example, it is hardly practicable to protect the Garganey *Anas querquedula*

efficiently while maintaining an open season for the Common Teal. While over-exploitation of common and abundant species leaves time to carry out needed adjustments in case of population declines, the quest for sustainability may indeed be more challenging for scarce populations or sub-populations.

In our case, the continuing development of simple systems is based on the political desire for simplicity of management. So far, the specific objective for providing guidelines for Danish hunting management has been the desire for simple rules.

While the tools for assessing sustainability of hunting are undoubtedly in need of further refinement, we note that the need for assessing the impact of hunting on other aspects of waterbird populations based on factors other than population size are increasing. The recent demands for improved information relating to the timing of breeding seasons and the onset of spring migration under the Sustainable Hunting Initiative launched by the European Commission emphasise that hunting should not take place after birds commence their pre-nuptial migration. Combined with the demands for ethical sustainability, such new initiatives are likely to prolong the period necessary to harmonize general definitions of sustainability at international level.

Improvement of the information base

Compared to many other countries, Denmark has a unique and fairly reliable system for monitoring its bag of migratory waterbirds. Nevertheless, challenges remain to improve the system: two major current problems are that the proportion of hunters reporting their bag has dropped to 58%, and that the estimated bag for most species is based on the wing survey, which is subject to bias. Steps have now been taken to ensure that reporting rates will increase again, but as long as wings are received from only 1-3% of the migratory waterbirds harvested, we face problems of scaling up from such samples. For example, the Eurasian Wigeon bag may be underestimated if the proportion of hunters contributing to the wing survey is low in that part of the country where most wigeon are bagged. This scaling-up problem could largely be avoided if hunters were required to report their entire bag at species level.

At present, it is possible for a few species to give a rough estimate of the proportion of the total bag in the flyway that is taken in Denmark. However, for most species we lack precise information on bag sizes along the remainder of the flyway. It would be useful if, for example, all Member States of the EU were obliged to publish their annual bag statistics, preferably within a year to permit effective feedback to flyway management.

With the present definition of sustainable hunting applied in Denmark, we rely heavily on the best available information from a variety of sources, such as estimates of population trends. It is therefore most unfortunate that trends have been updated only after a delay of several years because of insufficient resources for the International Waterbird Census, co-ordinated by Wetlands International. For a number of species, the available information on population size and geographical extent of populations and sub-populations is insufficient or unreliable. As a consequence, information on the conservation status of the populations we are harvesting may be outdated or inaccurate. We must continually strive to improve this situation, especially at the international level.

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REFERENCES

- Bregnballe, T., Asferg, T., Clausager, I., Noer, H., Clausen, P. & Christensen, T.K. 2003. Vildtbestande, jagt og jagttider i Danmark 2002. En biologisk vurdering af jagtens bæredygtighed som grundlag for jagttidsrevisionen 2003. NERI Technical Report No. 428, National Environmental Research Institute, Denmark. (Available electronically at: http://www2.dmu.dk/1_viden/2_Publikationer/3_fagrapporter/rapporter/FR428_2.pdf).
- Bønløkke, J., Madsen, J.J., Thorup, K., Pedersen, K.T., Bjerrum, M. & Rahbek, C. In press. Dansk Trækfugleatlas. Forlaget Rhodos, Holtegaard, Humlebæk, Denmark.
- Christensen, T.K. 2005. Factors affecting the bag size of the common eider *Somateria mollissima* in Denmark, 1980-2000. *Wildlife Biology* 11: 89-100.
- Clausager, I. 2004. Vingeindsamling fra jagtsæsonen 2003/04. NERI Technical Report No. 504, National Environmental Research Institute, Denmark.
- Delany, S., Reyes, C., Hubert E., Pihl, S., Rees, E., Haanstra L. & van Strien, A. 1999. Results from the International Waterbird Census in the Western Palearctic and Southwest Asia 1995 and 1996. Wetlands International Publication No. 54, Wetlands International, Wageningen, The Netherlands.
- Desholm, M., Christensen, T.K., Scheiffarth, G., Hario, M., Andersson, Å., Ens, B., Camphuysen, C.J., Nilsson, L., Waltho, C.M., Lorentsen, S.-H., Kuresoo, A., Kats, R.H.K., Fleet, D.M. & Fox, A.D. 2002. Status of the Baltic/Wadden Sea population of the Common Eider *Somateria m. mollissima*. *Wildfowl* 53: 167-203.
- Madsen, J., Asferg, T., Clausager, I. & Noer, H. 1996. Status og jagttider for danske vildtarter. Thematic Report No. 6, National Environmental Research Institute, Denmark.
- Nilsson, L., van den Bergh, L. & Madsen, J. 1999. Taiga Bean Goose *Anser fabalis fabalis*. In: J. Madsen, G. Cracknell & T. Fox (eds) *Goose Populations of the Western Palearctic. A Review of Status and Distribution*. National Environmental Research Institute, Denmark, and Wetlands International, Wageningen, The Netherlands. Wetlands International Publication 48: 20-36.
- Pannekoek, J. & van Strien, A. 1998. Trim 2.0 for Windows (Trends and Indices for Monitoring Data). Research Paper No. 9807. Statistics Netherlands, Voorburg.
- Parslow-Otsu, M. & Kjeldsen, J.P. 1992. Laplandske sædgæs i Nordvestjylland. *Dansk Ornitologisk Forenings Tidsskrift* 86: 104-106.
- Sutherland, W.J. 2001. Sustainable exploitation: A review of principles and methods. *Wildlife Biology* 7: 131-140.
- Williams, B.K. & Nichols, J.D. 2001. Systems identification and the adaptive management of waterfowl in the United States. *Wildlife Biology* 7: 223-236.