

Bird hunting in Europe: an analysis of bag figures and the potential impact on the conservation of threatened species

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Abstract Official hunting statistics from 24 EU member states as well as Switzerland and Norway were collated. Data on 82 permissible quarry species of bird (listed in Annex II of the EU Birds Directive), mostly from the hunting season 2014/15 but in some cases from earlier years, were evaluated and compared with a previous study. The results show a total annual hunting bag of at least 52 million birds. In addition, a significant number of birds are killed, legally or illegally, in areas just beyond the study area and in European countries for which no data were available (Greece, Ireland, the Netherlands and the UK). Despite a long-term decrease in the gross number of killings compared with older data, the bag figures for certain species, such as Common Pochard *Aythya ferina*, Northern Lapwing *Vanellus vanellus*, Turtle Dove *Streptopelia turtur* and Skylark *Alauda arvensis*, remain high in proportion to their declining populations in Europe. Against a backdrop of declining populations of many affected species, hunting pressures may be undermining conservation efforts undertaken for these species in other countries.

Introduction

The hunting of birds, including migratory species, is a widespread traditional pastime practised by several million people across Europe. The framework for hunting legislation in member states of the European Union (EU) is set by the provisions of the Birds

Directive 2009/147/EC, which specifies the conditions under which 82 species of bird may be hunted legally in one or more countries. Several migratory species listed in Annex II of the Directive, including Northern Lapwing *Vanellus vanellus*, Turtle Dove *Streptopelia turtur* and Skylark *Alauda*

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97. A Turtle Dove *Streptopelia turtur* shot in Malta, and picked up by a CABS team member in April 2012. The data collated by this study suggests that around one-fifth of the European breeding population (or 1.5 million birds) of this globally Vulnerable species is shot legally every year.

arvensis, have declined sharply in Europe in recent decades (EBCC *et al.* 2017). This raises the question as to whether hunting of these species may be contributing to their unfavourable conservation status.

National measures taken to implement the Birds Directive should be reported to the European Commission (EC) every three years by all EU member states. Reporting obligations are set out in Article 12 of the Directive and include the provision of data on hunting bags (European Commission 2016). A first overview of the hunting status of 13 endangered bird species listed in Annex II of the Directive and of the implementation of respective EU management plans was published by the EC in 2014 (N2K Group 2014). These reports contain data on annual hunting bags from several EU countries but do not assess the potential impact on the species' populations.

Hirschfeld & Heyd (2005) was the first published analysis of hunting-bag figures or corresponding estimates for all 82 huntable species. That study was repeated in 2016 (Hirschfeld & Attard 2017), to provide an overview of current hunting impacts and to compare later results with the earlier analysis. This paper presents a summary and discussion of the key findings of Hirschfeld & Attard (2017) in English, and with particular attention given to the most threatened (Red-listed) species of birds in the UK (Eaton *et al.* 2015) and Europe (BirdLife International 2015).

Material and methods

Study countries, species and period

In 2016, members of Committee Against Bird Slaughter (CABS) systematically compiled all available national hunting statistics from EU member states, Switzerland and Norway for the 82 species of birds listed in Annex II of the Birds Directive. For any given species, whether it is protected or can be

hunted in a particular country depends on factors such as its distribution, local traditions and laws, and the nature of its classification in Annex II. This annex is divided into two parts: part A lists 24 species that can be hunted in all countries of the EU (if local laws allow) while part B stipulates which EU countries can open a hunting season for the remaining 58 species – allowing national authorities in the relevant countries to decide whether to allow a hunting season or not. Parts A and B, as well as hunting regulations for Switzerland and Norway, result in a potential maximum of 1,120 bag figures to investigate across the study area. However, in some countries, certain species are fully protected (despite the fact that, theoretically, they may be hunted based on the provisions of the Birds Directive). After crosschecking with national lists of huntable species, we subtracted 357 possible bag figures, focusing the investigation on the remaining 763 individual bag figures.

In the first phase, undertaken in June–November 2016, all publicly available hunting statistics were compiled. Hunting-bag data that were not publicly accessible were requested from national hunting authorities, regulatory bodies and bird conservation organisations. By the end of this initial phase, datasets for 26 of the 30 study countries had been collected. To ensure consistency and comparability, the study aimed

to record national hunting bags from the same hunting period. Overall, the most frequently available data were from the hunting season 2014/15 or calendar year 2014. If hunting bags for this period were not available, those from the previous or the following year were utilised (see table 1).

Sources and quality of data

Countries that provided national datasets

Several factors were considered when assessing the quality of the data collected; for

each country that provided national datasets, data quality (as discussed below) is indicated in table 1. Datasets were considered of good quality when they included precise bag figures for more than 90% of the species legally hunted during the hunting season; 16 of the 30 countries in the study area provided good-quality data.

Medium-quality data were provided by five countries and included bag figures for most of the species hunted during open seasons but in contrast to countries that

Table 1. The number of birds hunted annually in EU countries plus Norway and Switzerland.

country	data quality	period represented	total no. birds hunted annually *	no. species with bag figures	no. species legally hunted	no. registered hunters ***
Austria	medium	2014–15	154,114	24**	26	123,283
Belgium	poor	2014	1,019,701	13	13	23,000
Bulgaria	poor	2013–14	548,062	9	25	120,000
Croatia	good	2014–15	150,191	21	21	56,327
Cyprus	poor	2015	3,700,711	12	34	42,215
Czech Republic	medium	2014	783,265	14**	14	92,247
Denmark	good	2014–15	2,062,054	30	30	178,000
Estonia	good	2014–15	17,252	32	32	15,000
Finland	good	2014	1,265,700	29**	30	207,000
France	poor	2013–14	17,624,996	43	63	1,250,000
Germany	medium	2014–15	1,156,149	27**	30	374,084
Greece	no data	n/a	?	0	32	174,500
Hungary	good	2013–14	548,392	14	14	59,053
Ireland	no data	n/a	?	0	19	350,000
Italy	n/a	2014	6,959,635	34	34	689,000
Latvia	good	2014–15	21,507	27	28	25,000
Lithuania	good	2014	13,116	15	16	32,000
Luxembourg	good	2014–15	1,948	3	3	2,080
Malta	good	2014	121,496	31	32	11,076
Netherlands	no data	n/a	?	0	10	27,000
Norway	good	2014–15	449,920	26**	29	142,850
Poland	medium	2014–15	211,096	13**	13	118,362
Portugal	good	2013–14	1,562,224	29	30	120,000
Romania	good	2014–15	1,256,876	39	39	60,000
Slovakia	good	2014–15	113,748	20	20	38,719
Slovenia	good	2014	32,456	6	6	22,000
Spain	medium	2014–15	11,933,963	32**	32	906,437
Sweden	good	2014–15	549,585	33	33	300,000
Switzerland	good	2014	27,513	22	22	29,864
UK	no data	n/a	?	0	33	800,000
TOTAL	n/a	n/a	52,285,670	598	82	6,389,097

Notes: * Numbers recorded as shot, or estimates derived from original source, except for Italy (extrapolated from regional data).

** Figures include data calculated from combined bags for certain groups of species (see table 2).

*** Number of hunters according to FACE (2010), including estimates for some countries where registration is not mandatory.

provided good-quality data they included summarised bags for groups of species (e.g. wild ducks or pigeons; see table 2). To estimate the proportion of individual species in combined bags, Hirschfeld & Attard (2017) used various extrapolation methods (see below).

Four countries provided poor-quality data with bag figures for less than 90% of all huntable species and/or data that did not account for all regions within the country. For example, the Union of Hunters and Anglers in Bulgaria and the Game and Fauna Service of Cyprus provided data for less than half of all huntable species. The Office National de la Chasse et de la Faune Sauvage in France published results of a survey conducted among 15,034 hunters (less than 2% of licensed hunters in France), which contained estimated bag figures for 43 of the 63 quarry bird species in the country; since the basis for extrapolation was considered insufficient or inaccurate, bag figures for 20 species were not

mentioned in the report (Aubry *et al.* 2016). Data for Belgium were provided separately by the regions of Wallonia and Flanders. The Flemish region provided good-quality data; Wallonia provided data that did not include several provinces of the region and was thus incomplete.

Countries that provided regional datasets

For Italy, no national hunting bags were available except for the Turtle Dove (Sorrenti & Tramontana 2016). Hunting bags were collected for each of the 22 regions of the country, ten of which made data available (ISPRA 2016). The quality of data for the ten regions was good, and therefore an estimate for the 12 remaining regions could be derived from these figures, combined with ratios of regional hunters, calculated using the number of registered hunters per region in the year 2006 provided by ISTAT (2007), and the list of species hunted in each region during the investigation period.

Table 2. Combined hunting bags included in national datasets.

countries with combined hunting bags	groups of species	no. species included in combined bags	no. species legally hunted (per country)	total no. birds in combined bags (individuals)	species of conservation concern* included in combined bags (EU-27 regional assessment)
Austria	geese, ducks, pigeons & doves	16	25	74,427	Turtle Dove <i>Streptopelia turtur</i> (NT) Common Pochard <i>Aythya ferina</i> (VU)
Czech Republic	geese, ducks	5	15	2,103	Common Pochard (VU) White-fronted Goose <i>Anser albifrons</i> (LC)
Finland	ducks, gulls	5	30	134,300	
Germany	geese, ducks, pigeons & doves	16	30	1,030,241	Common Pochard (VU) White-fronted Goose (LC) Common Scoter <i>Melanitta nigra</i> (LC) Velvet Scoter <i>M. fusca</i> (VU)
Norway	gulls, thrushes	4	30	15,860	
Poland	geese, ducks	7	13	111,800	Common Pochard (VU) White-fronted Goose (LC)
Spain	partridges, pigeons & doves, waterfowl, corvids, thrushes	26	34	9,505,993	Common Pochard (VU)

Notes: * Conservation status in Europe (BirdLife International 2015) and/or UK Red List (Eaton *et al.* 2015).

Countries that provided no data

There are no current or reliable data on hunting bags during the investigation period for Greece, Ireland, the Netherlands and the UK (94 data points in total). Although hunting bags were collected for years in Greece as part of the 'Artemis' project, the relevant publication (Hellenic Hunters Federation 2016) does not provide any national bag statistics. Both the Hellenic Hunters Federation and the Ministry of the Environment were contacted directly but were unable to provide any statistics.

Ireland's National Association of Regional Game Council (NARGC) sends questionnaires to its members every year to collect hunting bags, but no recent data were available. The National Parks and Wildlife Services and the University of Galway, which published the statistics used in the previous study, were contacted, but could not provide any data. The most recent figure available for Ireland was the total bag for hunting season 2003/04, estimated at approximately three million birds (O'Hullachain & Henderson 2004).

In the Netherlands, no current bird-hunting statistics are publicly available and the Royal Hunting Association considered that the quality of the statistics they collected was not good and could not be shared. Despite several requests, no data were provided by the Central Bureau of Statistics, the Ministry of the Environment or the Forest Services.

In the UK, the Game & Wildlife Conservation Trust (GWCT) organises the National Gamebag Census (NGC), which records bag data annually from a sample of shooting estates in order to monitor local abundance and productivity, in line with the Birds Directive requirements (Aebischer & Harradine 2007). Following requests, the GWCT provided results of the NGC in the form of temporal trends in species-specific bag density rather than overall numbers killed (Aebischer & Baines 2008). These results show that, for example, hunting bags for Woodcock *Scolopax rusticola*, a species recently added to the Red List of birds in the UK, have been stable for the last 20 years. Hunting-bag trends have also been stable for the Common Snipe *Gallinago gallinago*, another species of conservation concern in the UK (GWCT 2015). A data request was

also made to the British Association for Shooting and Conservation, bird conservation organisations and governmental regulatory authorities (Defra, Animal & Plant Health Agency) but none of these organisations could provide any data. The total number of birds shot annually in the UK in the 1990s was estimated at around 22 million (Hirschfeld & Heyd 2005).

Extrapolation of combined data (hunting bags)

The statistics of seven countries contained hunting bags that were summarised in groups of species (see table 2). The total of all the summarised bags in the study represented around 10.9 million birds and 79 species-specific data points, for which we generated estimates (Hirschfeld & Attard 2017). Eleven of these data points included species of conservation concern, including, for example, the Turtle Dove in Austria and Common Pochard *Aythya ferina* in several countries.

Most extrapolation methods were based on the premise that the likelihood of an encounter between hunters and birds is correlated with the abundance of the species concerned during the hunting season. Consequently, species-specific estimates for most groups were initially calculated using ratios of the wintering or breeding populations in each country (Hirschfeld & Attard 2017). For example, the shooting of pigeons in the three countries with summarised bags (Austria, Germany and Spain) is targeted primarily at local breeding species; estimates for species-specific hunting bags were therefore carried out on the basis of the ratios of the national breeding populations of those countries. Statistics on bird populations were taken from the European Topic Centre on Biological Diversity (2016), which published numbers provided by countries for the 2008–12 reports under Article 12 of the Birds Directive. If no quantitative information on wintering populations was included in the corresponding country report, the earlier data from Gilissen *et al.* (2002) were used.

For Germany and Spain, in addition to national collective data for several groups of species, species-specific data available from federal or autonomous regions were used to

estimate the share of species-specific bags. For Germany, the hunting statistics of six federal states permitted the application of this method. For Spain, the calculation of the estimated share of 26 species included in summarised bags was based on accurate data from the hunting season 2013/14 in Andalusia. With the exception of thrushes, which were also summarised in Andalusian statistics, the collective figures given in the national Spanish statistics were divided using the exact proportion of the species-specific bags in the Andalusian hunting statistics.

Analysis of temporal trends in hunting bags

Greece, Ireland, the Netherlands and the UK, for which bag figures or estimates were available during the first evaluation (Hirschfeld & Heyd 2005), have not published any statistics or estimates since. In addition, three new EU member states (Croatia, Bulgaria and Romania) provided bag statistics only for the most recent study period. A direct comparison of the current overall hunting bags with the values reported by Hirschfeld & Heyd (2005), to assess the change in the Europe-wide hunting pressure, is therefore not possible for most species. However, data from countries (hereafter termed ‘reference coun-

tries’) with comparable species-specific bag figures from both periods were used to generate trend data. Most of the older statistics in the sample countries are from the period 2001–04, but from 1998 in the case of France; the comparison was thus based on a period of 10–13 years, or 16 years in the case of France.

Results

For the current study period, a total of 598 individual bags were determined or estimated from the available sources, 78% of the possible 763 data points. Of these, 485 were reported as being accurate and 113 were estimated based on summarised bags or regional data. The sum total of all species-specific bags, summarised bags and extrapolated Italian bags for the study period involved at least 52 million birds belonging to the 82 quarry species (Hirschfeld & Attard 2017).

Among the species assessed, several are currently in serious decline (table 3). The hunting status of species considered to be at risk in Europe is of particular interest when assessing potential factors affecting populations. Below, results for the most endangered ‘hunnable’ species are summarised and, where possible, compared with data from



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98. Hunters at Colle San Zeno, Brescia, northern Italy, in autumn 2003 or 2004.

Table 3. Hunting status and trends of selected species on the UK Red List in EU countries.

species	IUCN conservation status	trends (%) in EU-27** populations over three generations	EU-27** breeding population size (pairs)	total species-specific bags*** (individuals)	trend (%) in hunting bags in reference countries
White-fronted Goose <i>Anser albifrons</i>	LC	increasing (wintering)	–	37,529	+579
Common Pochard <i>Aythya ferina</i>	VU	declining, -30 to -49 (breeding, wintering)	85,400–127,000	30,645	-40
Greater Scaup <i>Aythya marila</i>	VU	declining, -30 to -49 (breeding, wintering)	1,300–2,400	659	+59
Long-tailed Duck <i>Clangula hyemalis</i>	VU	declining, -30 to -49 (wintering)	2,400–3,800	15,212	+7
Velvet Scoter <i>Melanitta fusca</i>	VU	declining, -30 to -49 (breeding, wintering)	11,800–24,100	2,706	+37
Common Scoter <i>Melanitta nigra</i>	LC	stable (breeding)	48,600–68,600	9,242	+21
Black Grouse <i>Lyrurus tetrrix</i>	LC	increasing (breeding)	798,000–1,030,000	179,457	-58
Common Quail <i>Coturnix coturnix</i>	LC	declining, < -25 (breeding)	1,270,000–2,980,000	1,607,964	-41
Northern Lapwing <i>Vanellus vanellus</i>	VU	declining, -30 to -49 (breeding, wintering)	906,000–1,410,000	107,802	-78
Black-tailed Godwit <i>Limosa limosa</i>	VU	declining, -50 to -79 (breeding)	43,400–70,300	0	n/a
Woodcock <i>Scolopax rusticola</i>	LC	declining, < -25 (breeding)	728,000–1,470,000	973,414	-36
Turtle Dove <i>Streptopelia turtur</i>	VU	declining, -30 (breeding)	2,340,000–4,050,000	1,455,208	-36
Skylark <i>Alauda arvensis</i>	LC	declining, < -25 (breeding)	24,100,000–36,800,000	898,958	-72
Song Thrush <i>Turdus philomelos</i>	LC	increasing (breeding)	12,700,000–21,800,000	5,056,551	-52

Notes: Data for columns 2–4 are from BirdLife International (2015).
 * LC = Least Concern, VU = Vulnerable.
 ** Croatia, which acceded to the EU in 2013, did not participate in the 2008–13 round of Article 12 reporting.
 *** Total of species-specific bags provided by national sources. It does not include estimates based on combined bags.

Hirschfeld & Heyd (2005) if available from at least one country in both study periods.

Overall, it was possible to compare data for 64 species. These indicate a decline in hunting bags in 49 species and an increase in 15 species. Hunting pressure in reference countries has increased for several species with an unfavourable conservation status (see table 3). For example, hunting bags for the Velvet Scoter *Melanitta fusca*, a species listed as Vulnerable (VU) on the IUCN Red List of Threatened Species, have increased by 37% in one country (Denmark).

White-fronted Goose

In the study period, 17 countries opened a hunting season for White-fronted Geese *Anser albifrons*, of which ten provided species-specific hunting bags, showing a total of 37,529 birds taken. [Note that here, and in the following sections, species-specific bag figures do not include extrapolations from combined bags, which are referred to separately. The total number of birds taken (given at the beginning of each section) includes actual bag returns or estimates provided by the countries.] In addition, the Czech



Bill Coster/FLPA

99. Common Pochards *Aythya ferina*, Welney, Norfolk, winter 2010/11. The European hunting bag for some species, including Pochard, remains high in proportion to declining populations across the Continent.

Republic, Germany and Poland provided summarised bags in which White-fronted Goose was included. This species has recently been moved from the Green List to the Red List of species of conservation concern in the UK yet no bag data are available for the UK. A significant increase in hunting bags in six reference countries (Denmark, Estonia, Latvia, Lithuania, Hungary and Sweden) was observed, from 2,209 to 15,003 individuals between the two study periods.

Common Pochard

Twenty-two countries authorised an open season for Common Pochards. Of these, 12 provided species-specific hunting bags, showing a total of 30,645 individuals. Of this total, 25,199 birds were hunted in France (according to estimates by Aubry *et al.* 2016), where the species is listed as Vulnerable (IUCN France *et al.* 2016). The French wintering population is estimated at around 75,500 individuals (Deceuninck *et al.* 2013).

Black Grouse

Red-listed in the UK, the Black Grouse *Lyrurus tetrix* was hunted in nine countries during the study period. Although Aebischer

& Baines (2008) indicated that hunting-bag trends were decreasing in the UK, partly because of voluntary restraint, no bag data were available. The UK population and range has declined in recent decades, and despite the population being less than 5,100 males (Robinson 2017), the hunting of Black Grouse is still permitted. For this study, a total of six national species-specific bags were collected, amounting to 179,457 birds taken. This equates to nearly 10% of the EU-27 average breeding population (the species is largely sedentary). The highest bag figure was from Finland with 136,700 birds, followed by Sweden and Norway with 20,566 and 20,120 birds respectively (these three figures are based on hunters' reports).

Common Quail

During the study period, an open season for Common Quails *Coturnix coturnix* was granted in ten EU countries, of which six provided species-specific hunting bags representing a total of 1,607,964 birds, equivalent to 40% of the EU-27 average breeding population. In addition, the total number of Quails taken in Italy was estimated by Hirschfeld & Attard (2017) at 76,064

individuals. The highest bag for Common Quails was reported by Spain, with an estimated 1,223,464 birds taken. The average Spanish breeding population has been estimated at around 925,000 mature individuals (Carrascal & Palomino 2008), suggesting that an important proportion of the Quails hunted originate from other countries or are captive-bred. The proportion of captive-reared Quails in hunting bags is generally unknown, although in some areas the number shot exceeds the known population of wild birds (Sanchez-Donoso *et al.* 2012). For Greece, Bulgaria and Portugal it was not possible to evaluate current bag figures but the EU management plan for the species (European Commission 2009a) suggests that the annual bag is c. 72,000 individuals in Greece and c. 275,000 in Bulgaria. The number of Quails reported as being shot in three sample countries (France, Cyprus, Malta) has declined from 363,000 to 215,230 individuals between the two study periods.

Northern Lapwing

During the study period, Northern Lapwings were hunted in five EU countries, of which three released species-specific bags, amounting to 107,802 birds. Nearly 90% of these were killed in France (estimated by Aubry *et al.* 2016), where the species' conservation status is Near Threatened owing to its declining breeding population (75% decline over the last three decades in several French regions; IUCN France *et al.* 2016). In addition, the total hunting bag in Italy was estimated by Hirschfeld & Attard (2017) at 7,489 individuals. Current data from Greece are unavailable, although the EU management plan (European Commission 2009b) estimated that 100,000 birds were taken annually. A trend could be estimated based on two countries (France and Malta) and indicated a decrease in hunting bags of 78% between the two study periods. Although the total bag represents a small proportion of the wintering population in western Europe, sustainable harvesting cannot be established in regions where the breeding population is in serious decline, since it is impossible to distinguish between breeding and wintering birds.

Woodcock

This species is legally hunted in 26 countries; 21 countries provided species-specific hunting bags, totalling 973,414 birds. In addition, Hirschfeld & Attard (2017) estimated that the number of Woodcocks taken in Italy is 144,099 birds. No bag data were available for the UK, Ireland, Bulgaria and Greece. Hirschfeld & Heyd (2005) reported that around 125,000–150,000 Woodcocks were hunted annually in the UK and trends show that bags have been stable for the last 20 years (GWCT 2016). A comparison based on 16 countries from which data are available for both reference periods indicate a reduction in the number of birds taken, from 1,277,606 to 819,210.

Turtle Dove

In the study period, eight of the ten countries which opened a hunting season for the Turtle Dove provided species-specific hunting bags totalling 1,455,208 birds, despite the species having a global Vulnerable conservation status. The breeding population in the EU-27 is estimated at 2.3–4.1 million pairs (BirdLife International 2015), indicating that approximately one-fifth of the EU-27 breeding population was killed by hunting in the study area.

Spain, which has the largest breeding population in the study area, accounted for the highest (estimated) bag, 701,600 birds. In neighbouring countries, Portugal and France, (estimated) hunting bags were 109,815 and 91,704 birds respectively; while Sorrenti & Tramontana (2016) estimated that 305,590 Turtle Doves were taken in Italy during the hunting season 2014/15. No recent data were available for Greece; while the EU management plan for the species (European Commission 2007b) indicated that between 300,000 and 600,000 Turtle Doves were taken every year in Greece, in view of the species' progressive decline across the entire region, the number of Turtle Doves currently shot in Greece is probably lower. Until 2016, Malta was the only country which opened a season for Turtle Doves in April, and so the recent hunting ban in spring does not account for the overall decrease in hunting of these birds in three sample countries (France, Malta and Portugal), in which hunting bags have fallen from 323,933 to 208,133 between the two study periods.

Skylark

Of the six countries in which Skylarks could be hunted during the study period, four provided species-specific bag figures, totalling 898,958 birds. In addition, the total hunting bag in Italy was estimated at 451,671 birds by Hirschfeld & Attard (2017). No figures were available for Greece, where the species is a popular quarry; the EU management plan estimated a hunting bag of 180,000–400,000 birds annually (European Commission 2007a) but again, in view of the trends in hunting bags in other countries, the real total is now probably lower. In recent years, shooting in the sample countries France and Malta has fallen by 72%, from 684,135 to 194,229 birds. In fact, the significant decline of Skylarks in the last decade in France has led to a recent re-evaluation of the species' conservation status in the country from Least Concern to Near Threatened (IUCN France et al. 2016).

Song Thrush

Song Thrush *Turdus philomelos* is listed with an open hunting season in eight countries, five of which provided species-specific

hunting bags totalling 5,056,551 birds, one-eighth of the EU-27 average breeding population (12.7–21.8 million pairs; BirdLife International 2015). In addition, Hirschfeld & Attard (2017) estimated the number of birds killed in Italy at around 2,954,311 and in Spain at 2,872,691. Cyprus and France reported (estimated) bags of 2,749,144 and 1,426,165 birds respectively. The French bag equates to nearly 35% of the estimated national breeding population (EIONET 2014). The current number of Song Thrushes harvested annually in Greece is not known; Hirschfeld & Heyd (2005) reported 3,751,514. In one reference country (Malta), the number of Song Thrushes killed annually (hunters' reports) has decreased by 58% between the two study periods.

Discussion

Evaluation of the various extrapolation methods for summarised bags

The publication of combined bag figures is problematic because these groups sometimes contain endangered species, such as the Turtle Dove and Common Pochard, for which losses through hunting cannot be



100. Skylarks *Alauda arvensis* from a hunter's bag in Pavia, northern Italy, January 2004. This species is a popular quarry in southern European countries such as Italy and Greece.

assessed accurately. The EC has committed all member states to provide hunting bags after the introduction of the new reporting format under Article 12 of the Birds Directive and, until these figures are available, the proportion of individual species in such combined datasets can only be estimated. This projection can be based on factors such as likelihood of encounter (see above), or on accurate statistics from sample countries or regions. As shown in Hirschfeld & Attard (2017), different methods of extrapolation lead to very different results.

To test the suitability of the various methods, we created 'artificial' combined bags for ducks in Denmark (ten species), and for pigeons (two species) and geese (three species) in Hungary (both countries provided accurate species-specific data). We subsequently calculated the proportion of each species using the various extrapolation methods. These estimates were then compared with the original data, allowing us to assess the suitability of each method for each group of species.

When comparing the derived Danish duck data with the original dataset, we found that extrapolations based on the proportion of duck species within the entire sample set of all other countries (for which species-specific data were available) were much more reliable than estimates based solely on the (neighbouring) Swedish data (see Hirschfeld & Attard 2017). The same was true for artificially combined hunting-bag data for pigeons in Hungary. Extrapolation of the species-specific Danish duck bags based on the proportions of the local wintering populations proved to be the most unreliable method for all species, other than Pintail *Anas acuta*. Conversely, the figures extrapolated for hunting bags of goose species in Hungary proved to be most accurate when derived from data on local wintering populations.

Extrapolation from regional to national statistics in federalised countries was complicated by the fact that the number of legal quarry species varies among federal states or regions. Similarly, some populations are not equally distributed across a country, which may lead to errors in estimates based on wintering populations. A further source of error

in estimates based on wintering populations is that some species are more likely to be hunted during passage periods. Furthermore, population levels do not reflect the fact that certain members of a species group are more popular among hunters than others because of factors such as tradition or culinary appeal; that some bird species are more difficult to kill because of their habitat preferences and behaviour, or that species are subject to varying levels of hunting restrictions.

Validity of the data

For some species, such as Common Pheasant *Phasianus colchicus*, Common Quail, Mallard *Anas platyrhynchos*, Grey Partridge *Perdix perdix* and some partridges of the genus *Alectoris*, hunting bags may also include captive-reared birds. However, their exact proportion in the total species-specific bags is generally not known; making it more difficult to assess the consequences for wild populations.

On the other hand, it must be the case that for most species the total estimated bags are only a proportion of the total losses caused by hunting. Approximately 20% of all hunters registered in the study area live in the UK, Ireland, the Netherlands and Greece (see table 1), for which no bag data were available. In addition, numerous species-specific hunting bags were not included in the datasets of the countries under review.

Also unknown is the number of birds that were injured by pellets and died later or had their reproductive performance limited by hunting-related injuries, and the losses due to illegal killing which for some species constitute a significant cause of mortality. In the study area, examples include the illegal spring hunting of Turtle Doves and Common Quails in southern Italy, Greece and several Balkan countries; and the large-scale illegal trapping of thrushes in Cyprus and Italy (BirdLife International 2011; Brochet *et al.* 2016; Debersek & Rutigliano 2016). Brochet *et al.* (2016) indicated that the Common Quail and Song Thrush are respectively the fourth and fifth most targeted species, with an estimated 2.9 million individuals (mean value) of both species illegally killed every year in the Mediterranean region.

Owing to their popularity and their status among many bird hunters, the Turtle Dove and Common Quail are particularly affected by shooting or trapping outside the study area. Both species are killed (legally or illegally) in almost all countries of southern Europe, the Balkans, the Arabian Peninsula and the Maghreb countries (European Commission 2007b, 2009a; Fisher *et al.* 2016), some of which allow additional hunting of birds returning to their breeding grounds in spring. For instance, Omer (2015) reported that Common Quails are an important source of food for many residents of the Gaza Strip during the migratory season. In Lebanon and Egypt, every spring and autumn, hundreds of thousands of European migratory birds are killed for human consumption, including waterfowl, Common Quails, Turtle Doves and thrushes (CABS 2013; Eason *et al.* 2016). A particularly high additional hunting pressure is to be expected outside the study area.

Finally, one issue that potentially compromises the validity of the data is that hunters may be under-reporting bags (see, for example, Sultana 2014).

Hunting-bag trends and bird populations

The observed trends in hunting-bag statistics in the sample countries have various causes, which often vary among species and interact in complex ways. What is striking, however, is the sharp fall in the hunting bags of species that have suffered sharp declines in their European population, such as Common Pochard, Common Quail, Northern Lapwing, Turtle Dove and Skylark (see table 3). It can be assumed that the decline in hunting bags largely reflects the overall decline of the populations and the consequent 'hunting opportunities'. Furthermore, since the first study that was published, in 2005, hunting seasons have been reduced for certain species and this could partially account for the decrease in hunting bags. Another factor that probably affects almost all species-specific hunting bags is the slow but steady decrease in the number of hunters in many countries under investigation (Heberlein 2008; FACE 2010).

With approximately 2.3 million Turtle Doves killed annually between 1980 and 2002 (Hirschfeld & Heyd 2005) and approximately 1.5 million annually between 2003 and 2013, the total number of Turtle Doves killed in the



Richard Chandler

101. Northern Lapwings *Vanellus vanellus*, Northamptonshire, November 2008. The hunting bag represents a small proportion of the wintering population of Lapwings in western Europe, but since it is impossible to distinguish breeding and wintering birds, the impact of hunting may be significant in areas where the breeding population is in serious decline.

study area between 1980 and 2013 was at least 65 million individuals. In the same period, the Turtle Dove population in Europe decreased by 78% (European Bird Census Council 2015). In the study period, available bag data equalled one-fifth of the estimated breeding population in the EU-27. These estimates do not include bag data for Greece, where the species is a popular quarry, so the number of Turtle Doves killed by hunters in the study area (and the proportion of the estimated breeding population) is probably significantly higher.

Conclusions

Against the backdrop of continuing urbanisation and agricultural intensification, there are grounds for concern that hunting may be an unnecessary pressure and potentially a contributing factor to the population declines observed in several huntable species, notably Common Pochard, Common Quail, Northern Lapwing, Turtle Dove and Skylark.

In our opinion, current levels of hunting of these species are no longer ethically and politically justifiable, especially given that it is effectively a minority hobby and generally not about the regulation of common species for public interest (such as protection of crops, livestock, human health or for aviation safety reasons). While hunting is not the main cause of their decline in European countries, it seems incomprehensible to consider further killing to be acceptable for reasons such as 'harvesting a surplus' or tradition.

Turtle Dove numbers have declined rapidly across much of the species' range, resulting in it being listed as globally threatened. Declines are thought to be driven by a number of factors, including loss of foraging and nesting sites, disease and hunting along its migration routes. The fact we can conservatively estimate that approximately 1.5 million birds (one-fifth of the EU-27 breeding population) are shot legally each year is evidently not helping the sustainability of the species. The same can be said for several other vulnerable species listed in table 3. We suggest that Annex II of the Birds Directive should be reviewed, taking into account the latest information available on population trends and hunting pressure. Since the inception of the Birds Directive in

1979, no single species has been removed from Annex II Part A, which outlines the 82 huntable species within member states.

Article 7, section 1 of the Birds Directive states: 'Member States shall ensure that the hunting of these [Annex II] species does not jeopardise conservation efforts in their distribution area.' If European countries continue to authorise the hunting of vulnerable species, there is a risk that conservation efforts for these species will be compromised and they may continue to decline. This would be contrary to the aims and objectives of the Birds Directive and requires urgent consideration by individual member states and the EU Commission. In our view, wildlife conservation organisations should be more pro-active on the hunting issue, and campaign rigorously for hunting bans on vulnerable species in the individual countries.

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