Duck hunting bag estimates for the 2013/14 season in France

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Abstract

A national survey of duck bags was carried out during the 2013/14 hunting season in France, for the first time in 15 years. An estimated total of over 2 million dabbling and diving ducks were shot in the country, half of which were Mallard *Anas platyrhynchos*. Proper statistical comparisons with earlier French surveys or with similar data from other countries were not possible because of the different (and sometimes unknown) sampling protocols, but the general trends suggest a relatively stable hunting bag compared to 15 years ago. France remains the European country reporting the greatest number of ducks harvested annually as a result of a long tradition of wildfowling, a dense human population and a central geographic position within the duck flyways. The only major change was a massive decline in the estimated harvest of Common Pochard *Aythya ferina*, reflecting a similar pattern in other countries and the poor conservation status of the species in Western Europe. Waterfowl hunting bag survey methods should be harmonised in the future, if coordinated adaptive management of populations is to be set in place at the flyway scale.

Key words: Anatidae, ducks, hunter survey, hunting bag estimate.

Precise simultaneous estimations of population size and bag size (including crippling loss) are necessary for proper management of hunting activity and of quarry species (Madsen *et al.* 2015). For this reason European duck (*Anatidae*) researchers have long called for coordinated collection of standardised hunting bag data at the continental scale (Lampio 1974; Nowak 1975; Elmberg *et al.* 2006). As far as

possible, such data should be collected on a regular basis; for instance, bag statistics are collected routinely on an annual basis in North America, where an adaptive harvest management scheme for waterfowl has been in place for the last 20 years (Nichols *et al.* 2007; Raftovich *et al.* 2015). The situation is improving in Europe, with most countries now collecting bag statistics and there are mechanisms in place to enable these to be publicly available (*e.g.* through the Artemis portal of FACE, the European Federation of Associations for Hunting and Conservation: www.artemis-face.eu, which provides direct links to published data or national contacts to obtain these from > 20 European countries). However, data are still neither collected in a standardised way nor necessarily at the same frequency in the different countries.

France is an important country for waterfowl in Europe because of its extensive coastline, relatively abundant wetlands and central geographic position within flyways providing winter quarters, migration stopovers and/or breeding grounds to numerous species (Issa & Muller 2015). The most recent published survey reports that there were *c.* 650,000 ducks and 148,000 geese (including 126,000 Brent Geese *Branta bernicla*) in France during mid-January 2015, reflecting a long-term increasing trend in the numbers wintering in the country (Deceuninck *et al.* 2016). France also has a long tradition of wildfowling and a dense human population which, combined with large numbers of wintering birds, often leads to waterfowl hunting bags being among the largest in Europe, especially for duck species (Hirschfield & Heyd 2005; Mooij 2005). Unfortunately, however, France has not been very good at producing regular general national duck hunting bag statistics. The results of some hunting bag surveys have been produced annually and over a long period, for instance those made at a local scale or involving particular hunting practices (*e.g.* for nocturnal hunting; Anstett *et al.* 2015), but only three national surveys have been published since the mid-1970s, for the hunting seasons of winters 1974/75 (ONC 1976), 1983/84 (Trolliet 1986) and 1998/99 (Mondain-Monval & Girard 2000; Schricke 2000). National hunting bag estimates for the 2013/14 hunting season have just been released (Aubry *et al.* 2016). These cover all species of birds and mammals hunted in France, but the aim of the present note is to provide estimates of the duck bags available to non-French readers, and to make a rough comparison of the estimated numbers taken with records from other European countries during the same season or from France during previous surveys.

Methods

A detailed description of the survey methods used to estimate French hunting bags during the 2013/14 season will be published elsewhere, but in brief, it consisted of sampling 60,000 hunters from the *c.* 1,200,000 individuals who validated their licence for the previous season (*i.e.* winter 2012/13). Hunters were not selected randomly at the national scale; instead, a stratified design was used to take into account the distribution of hunters among administrative units (départements, of which there are 96 in continental France, average

area = 5,700km²), and to put a greater emphasis on coastal areas where earlier surveys found that greater waterfowl hunting activity occurs (Mondain-Monval & Girard 2000). Hunters selected for the survey were informed by post at the beginning of the 2013/14 hunting season. Before the deadline for responding to the questionnaire, 30,000 hunters selected at random among those who had not yet responded received a postal reminder. After the deadline, 30,000 other randomly selected non-respondents received a second postal questionnaire. Among those who had still not responded to the second questionnaire, 8,000 hunters were randomly selected and surveyed by phone, of which 3,700 could be reached. This three-phase sampling design – a special case of three-phase sampling for stratification – was used to attenuate the non-response bias in the estimation of total hunting bags (Barker 1991; Pendleton 1992; Aubry *et al.* 2016).

It should be noted that the 2013/14 survey relied on a (pure) probability sampling design, putting a great emphasis on the non-response problem, and thus used a different protocol than the earlier ones carried out in France, and also differed from surveys in other European countries (whose protocols are still insufficiently known). It was therefore impossible to conduct proper statistical comparisons between periods or between countries, and numbers are simply considered in relation to each other here to describe general patterns.

We first provide the hunting bag estimates for France during the 2013/14 season, together with their 95% confidence interval calculated using the normal distribution, for each duck species except Red-crested Pochard *Netta rufina*, Scaup *Aythya marila*, Goldeneye *Bucephala clangula* and seaducks (*i.e.* Common Eider *Somateria mollissima*, Long-tailed duck *Clangula hyemalis* and scoters *Melanitta* sp.), for which bag sizes were small and the confidence intervals around the estimates considered too wide and too unreliable for publication. We then considered these hunting bag estimates in relation to those of the three earlier surveys in France, with Mallard *Anas platyrhynchos* and "all other ducks" being treated separately, because this was the only distinction made between species during the 1974/75 survey (it was also the most obvious distinction given the preponderance of Mallard in the hunting bag estimates; see below). These figures were then compared with published estimates of the number of ducks (dabbling and diving ducks) wintering in the country each year over the same period (*e.g.* Deceuninck *et al.* 1997, noting that only mean values were provided for the periods 1967–1976, 1977–1986 and 1987–1996). These mean values per species should also be considered with caution, but they were the only data available and were hence summed to obtain a proxy for the total number of ducks other than Mallard present between 1967 and 1996. For Common Teal *Anas crecca* (hereafter Teal) and Common Pochard (hereafter Pochard) direct comparisons were made between the 1998/99 and the 2013/14 hunting bag and waterbird count surveys, because these species were already being distinguished from the other ducks in both surveys by 1998/99 (Mondain-Monval & Girard 2000; Schricke 2000). A correlation trend test

was used to assess the trends in numbers of counted birds over years. Statistical significance for the correlation trend tests was evaluated by using a randomization test (see Manly 1997; Edgington 2007). In order to obtain accurate results, we estimated the *P*-value of the test statistic by randomizing 10^6 times the values of the count data among the years, and the minimum attainable *P*-value is thus P = 0.000001. We therefore do not rely on an arbitrary α-level of statistical significance and strictly interpret the *P*-value as the strength of the evidence against H_0, conditionally to the data at hand (Edgington 2007, p .4).

Finally, we provide for comparison the 2013/14 (or nearest season) duck hunting bag data recorded in other European countries, but again because of the differences in survey methods between countries these cannot be compared statistically. Numbers were provided by the national body in charge of hunting in each country, with most compiled and accessible via the Artemis platform of FACE described above. The dataset was completed wherever possible through direct contact with the people in charge of these national organisations, or via colleagues contacted through the Wetlands International/IUCN-SSC Duck Specialist Group network.

Results

Among the three sampling phases, the average response rate was 14% for the first phase, 12% for the second phase, and 93% for the third phase. National hunting bag estimates for the nine duck species surveyed in France during the 2013/14 season indicated that Mallard was the most commonly harvested duck, followed by Common Teal then Eurasian Wigeon *Anas penelope* and Northern Shoveler *A. clypeata* (Table 1). Bag size estimates for diving ducks were smaller and associated with a wider confidence interval than for any of the dabbling duck species.

The current hunting bag estimate for Mallard in France (CI: 1,059,768–1,331,939 individuals) was relatively similar to those made during the former three surveys and did not appear to follow the long-term increase in mid-January Mallard numbers recorded in the country since the 1970s (Fig. 1).

Estimates for the other duck species yielded a total of 847,105 ducks (CI: 712,593–981,617) shot in France during the 2013/14 season. This again was similar to those from the earlier surveys, and in any case did not follow the 85% increase in the estimated number of wintering ducks (Mallard excluded) between 1970–74 and 2010–2014 (Fig. 2).

Between the 1998/99 and 2013/14 hunting seasons, the number of wintering Teal recorded in France gradually increased (Pearson correlation: $r = 0.57$, $n = 16$ count years, $P = 0.021$), and the recent hunting bag estimates similarly exceeded the earlier one by 11.25% (Fig. 3a). The estimated number of Teal shot per season was 3.4–3.7 times greater than the estimated number of individuals counted in mid-January the same year.

The situation for Pochard was very different, with winter counts showing no significant trend in France over the same period (Pearson correlation: $r = -0.28$, $n = 16$ count years, $P = 0.30$, n.s.), yet the hunting bag estimate in 2013/14 was 42%

Table 1. Number of ducks (and other waterbirds) harvested in France (95% confidence interval in parentheses) and in the other European countries during the 2013/14 hunting season (except otherwise stated). Countries with no bag data or which did not answer our survey are not included. The exact list of species covered was not always known when only a total for all ducks was provided.

	Mallard *Anas platyrhynchos*	**Teal** *Anas crecca*	**Wigeon** *Anas penelope*	**Pintail** *Anas acuta*	**Gadwall** *Anas strepera*	**Shoveler** *Anas clypeata*	**Garganey** *Anas querquedula*	**Pochard** *Aythya ferina*	**Tufted duck** *Aythya fuligula*	**Pochard + T. duck**	**Waterbirds except Lapwing** *Vanellus vanellus*	**Total ducks**	**Ref.**
France	**1,195,853** (1,059,768–1,331,939)	**368,126** (310,910–425,342)	**159,265** (124,198–194,332)	**41,349** (27,355–55,344)	**57,047** (43,211–70,883)	**113,213** (86,437–139,989)	**38,977** (21,955–55,999)	**25,199** (14,222–36,176)	**14,285** (6,347–22,224)	**41,717** (23,782–59,651)	**2,377,087** (2,121,913–2,632,262)	**2,047,180** (1,823,709–2,270,650)	1
Austria												67,952	2
Bulgaria	54,048	2,031	224	742		177	16		20				3
Czech Republic	256,375									824			4
Denmark	445,000	96,200	40,700	5,000	2,700	2,800	683	653	5,200				5
Estonia	5,614	1,883	967	372	75	360	168	1	11				6
Finland	282,400	119,000	35,500	4,800		3,600	5,000	600	3,400				7
Germany												363,959	8
Hungary	46,724												9
Iceland	13,430	1,661	1,130						112				10
Italy	48,651	10,474	4,092	1,100	1,238	1,547	848	499	656				11
Latvia	20,085	949	431	69	207	201	79	87	25				12
Lithuania												13,269	13
Luxemburg	*c.* 850												14
Malta	11	86	16	9	19	14	11	3	1				15
Netherlands	160,000		4,783										16
Norway	13,600	2,150	1,900						370				17

Poland											100,627	18
Portugal	27,164	2,326	38	50	421	216		190	69			19
Slovakia											15,856	20
Slovenia	3,634											21
Spain										338,668		22
Switzerland	5,537	104	1	0	30	0	1	91	214			23
United Kingdom											1,000,000	24

[1]Aubry *et al.* (2016).
[2]www.statistik.at/web_en/statistics/Economy/agriculture_and_forestry/livestock_animal_production/hunting/index.html
[3]Union of hunters and anglers in Bulgaria, pers. comm. Note these data are for the full 2013 calendar year.
[4]Ministry of Agriculture of the Czech Republic, unpub. data.
[5]Asferg (2015).
[6]www.keskkonnaagentuur.ee/et/kuttimine
[7]Finnish Game and Fisheries Research Institute (2014).
[8]www.jagdverband.de/node/3304
[9]Csányi (2014).
[10]Beck (2016).
[11]www.federcaccia.org. Note these data are for the 2012–13 hunting season and only cover Lombardia + Friuli Venezia Giulia regions.
[12]Latvian State Forests, unpub. data.
[13]http://lmzd.lt
[14]Schley *et al.* (2014).
[15]Parliamentary Secretariat for agriculture, fisheries and animal rights (2013, 2014).
[16]Royal Hunting Association of the Netherlands, pers. comm.
[17]http://www.ssb.no/statistikkbanken
[18]Domaszewicz *et al.* (2012) Note these data are for the 2011–12 hunting season.
[19]www.icnf.pt Note these data are for the 2010–11 hunting season and only cover 1,680 hunting states.
[20]www.mpsr.sk/en/index.php?start&lang=en&navID=30 Note these data are for the 2003 hunting season.
[21]www.stat.si/StatWeb/doc/letopis/2013/17_13/17-12-13.html Note these data are for the 2012 hunting season.
[22]www.magrama.gob.es/es/desarrollo-rural/estadisticas/Est_Anual_Caza.aspx Note these data are for year 2013.
[23]www.wild.uzh.ch/jagdst/index.php
[24]www.shootingfacts.co.uk/pdf/consultancyreport.PDF Note these data are for the 2012–13 hunting season.

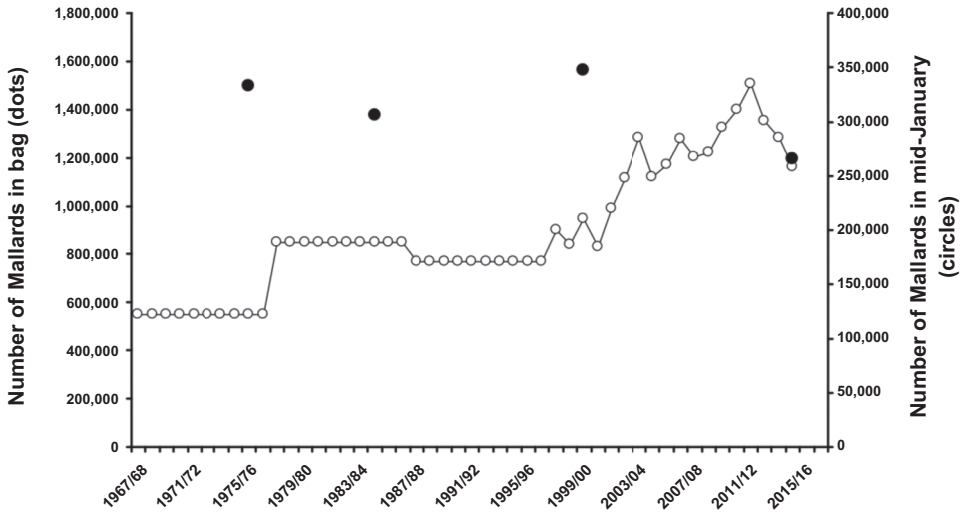

Figure 1. Estimated annual hunting bag for Mallard in France (filled circles) and estimation of winter population size based on mid-winter surveys (empty circles). See text for sources of the data.

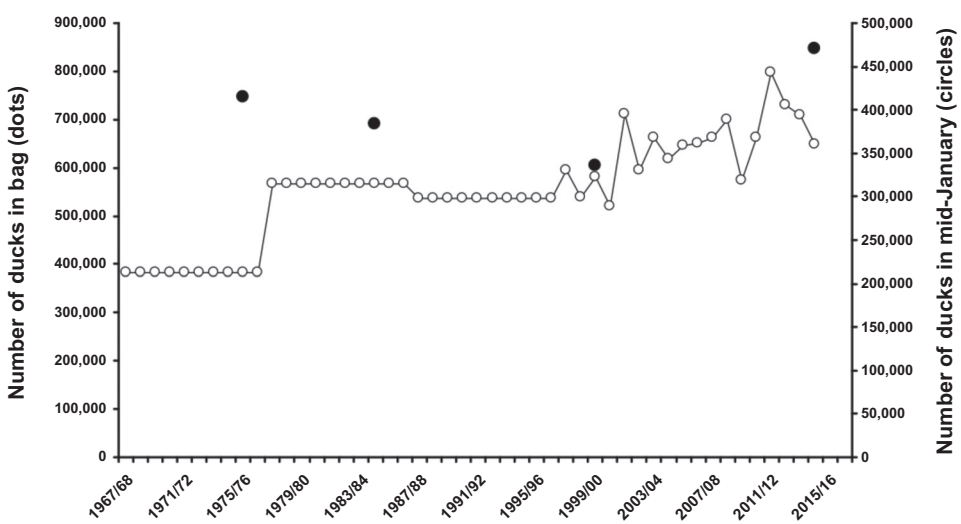

Figure 2. Estimated annual hunting bag for ducks except Mallard in France (filled circles) and estimation of winter population size based on mid-winter surveys (empty circles). See text for sources of the data.

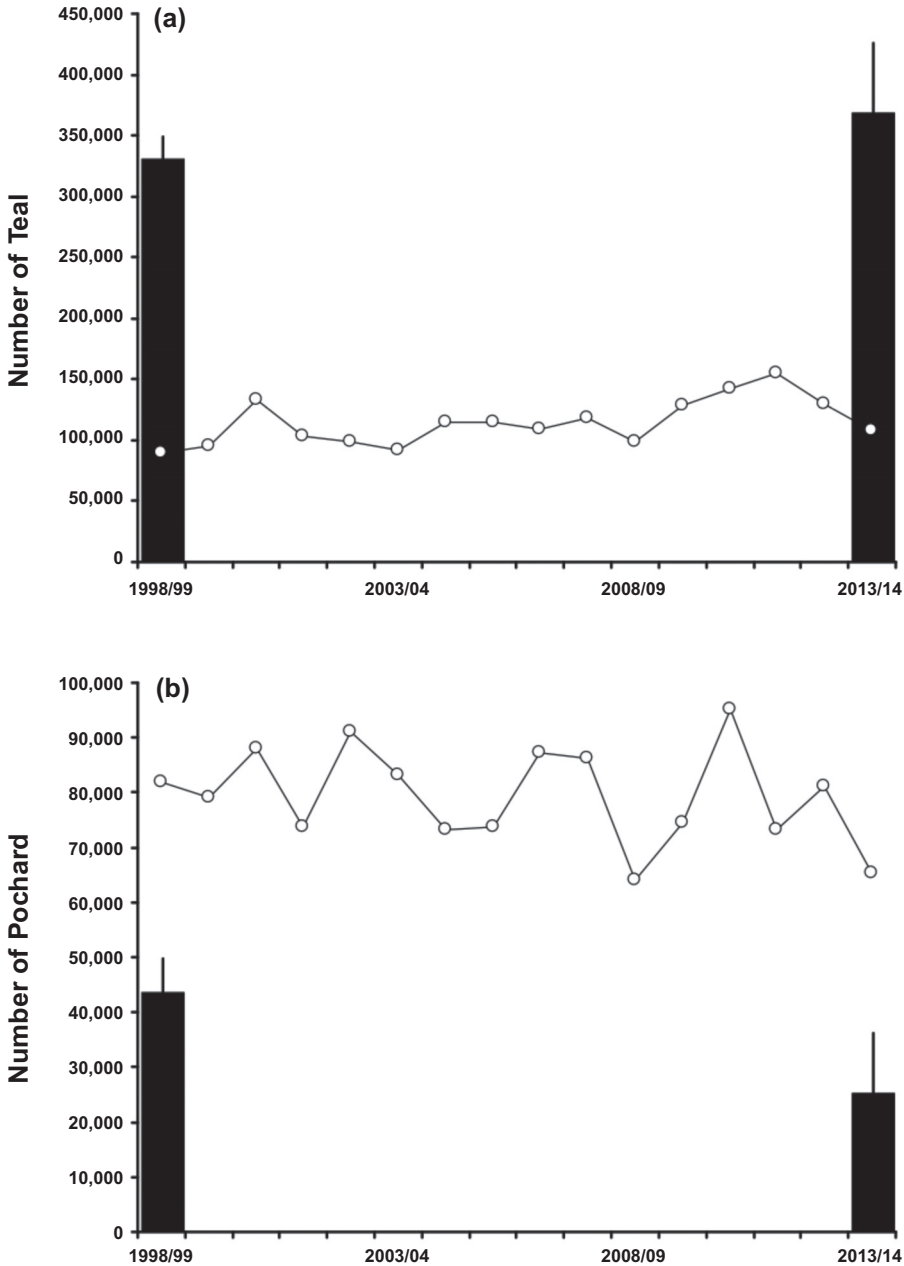

Figure 3. Number of individuals shot (black columns) and counted in mid-January (circles) between winter 1998/99 and winter 2013/14 in France for: (a) Common Teal, and (b) Common Pochard. Vertical bars show upper limit of 95% CI (national hunting bag).

lower than the estimate during the 1998/99 hunting season (Fig. 3b). As opposed to the situation regarding Teal, the estimated hunting bag represented only 39–53% of the number of Pochard counted in January of the same year.

The total estimated number of ducks harvested in France during the 2013/14 hunting season was 2,047,180 individuals (CI: 1,823,709–2,270,650), which was far greater than the estimates in any other European country for which data were available (Fig. 4).

Discussion

The new national hunting bag survey for France during the 2013/14 season yielded results generally in accordance with earlier similar surveys in the country: an estimated *c.* 2 million ducks are harvested per year, approximately half of which are Mallard, and with dabbling ducks being harvested in much greater numbers than diving ducks (equivalent to a 50-fold difference in estimated bag size).

Before continuing the discussion, it should be highlighted again that the probability sampling design used to obtain the present estimates relied on multiphase sampling of the hunter population and put a great emphasis on attenuating the non-respondent bias in the estimation of the total hunting bag (if non-respondents are hunters with limited or no effective hunting activity, or with a bag judged too low by them to deserve reporting, then such a bias would strongly overestimate total hunting bag). It therefore differed from the methods

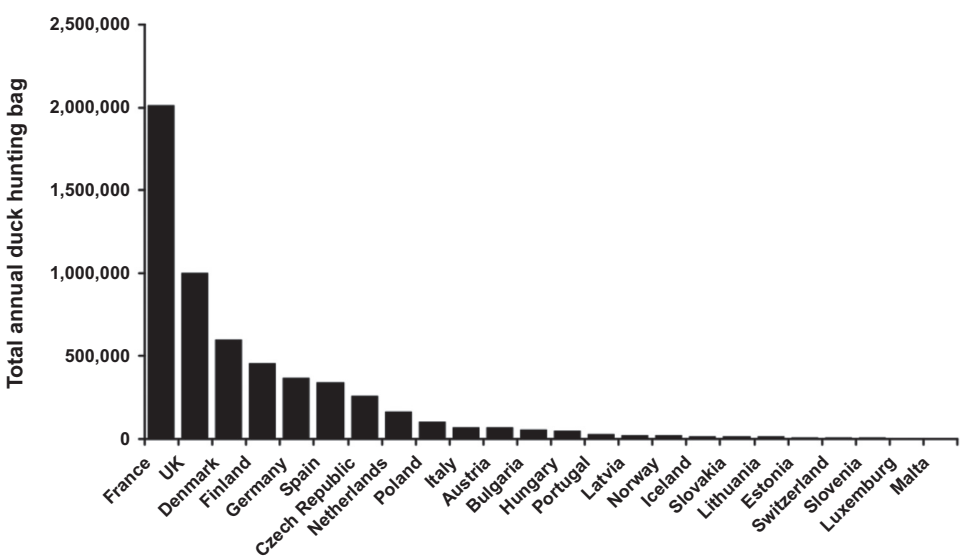

Figure 4. Annual duck hunting bag in the 24 European countries for which data were available. Data generally refer to the 2013/14 hunting season and entire countries except where specified in the footnotes of Table 1.

used in France during earlier surveys, and such methods were not harmonised between European countries either. This is of course a major limitation, and all comparisons between surveys should hence be considered with caution.

The numbers of Mallards and total numbers of other ducks reported wintering in France have clearly increased from the early 1970s to the mid-2010s (Deceuninck & Fouque 2010; Deceuninck *et al.* 2016), yet their respective estimated national hunting bags have not showed the same pattern, and indeed remained rather stable. It is true that in both cases the estimated annual bag is several times greater than the number of birds counted in mid-January. This is likely to be due to both the fact that: (i) duck counts are carried out at the end of the hunting season, and (ii) throughout the hunting season, hunters harvest from a much larger number of ducks on the move, including a pool of mobile birds continuously crossing the country during migration, as well as those that winter *per se* (Trolliet 1986; see also Caizergues *et al.* 2011). The apparent stability in the estimated numbers shot (assuming the methods were still comparable to some extent) may therefore indicate that fewer birds were present or crossed the country, and could therefore be harvested, before the January counts. It is also possible that hunting pressure decreased in France. Some recent analyses do suggest a decline of the North-western European populations of some ducks (*i.e.* Pintail *Anas acuta* or Wigeon), but this is over the short term (2003–2012). The trends in population size have conversely been generally positive for all species if one considers the last 40 years, apart maybe for Mallard, whose trend from 1974–2002 was considered declining or stable, and Pochard which have been considered to be in decline but contributed only a minor part to the estimated bags (Scott & Rose 1996; Wetlands International 2016). It is possible that the hunting pressure per hunter has decreased since the 1974/75 survey in France, but we have no study to ascertain the precise changes involved. Seasons have been reduced (République Française 2015) and the total number of French hunters fell from around 2,200,000 hunters during the 1974–75 hunting season (ONC 1976, pp. 3,5) to fewer than 1,200,000 hunters during the 2013/14 season (see also Lecocq & Meine 1998). Although no specific licence is necessary for waterfowl hunting in France, which prevents any estimation of the number of wildfowlers, there is no reason to believe that their number has not also decreased. Moreover, according to the FNC (Fédération Nationale des Chasseurs – the French National Hunters' Federation) the average age of French hunters is gradually increasing (with the median age of French hunters currently around 55 years; http://www.chasseurdefrance.com/decouvrir-la-chasse-en-france/qui-sont-les-chasseurs/les-chasseurs-qui-sont-ils/). These two facts are consistent with the hypothesis that hunting pressure has gradually reduced in France over the last 40 years. This could explain why the estimated duck hunting bag in France has remained fairly stable despite globally increasing duck populations (which could also be due to saturation effects on hunters; *e.g.* Kahlert *et al.* 2015). A closer

look at Figure 2, however, shows that changes in duck hunting bags (Mallard excluded) between 1998/99 and 2013/14 were very consistent with the trend in wintering bird numbers. It is therfore also possible that the earlier surveys in 1974/75 and 1983/84 simply over-estimated the hunting bags, perhaps by underestimating the number of hunters coming home having shot no birds, who are unlikely to respond to hunting bag surveys to a similar extent as successful hunters (Barker 1991; Pendleton 1992).

Concerning Mallard, it should also be kept in mind that, independent of trends in the wild population, released farmed birds form the bulk of the harvest in this species, with releases in Europe and in France being counted in millions of individuals (Mondain-Monval & Girard 2000; Champagnon 2011). It is therefore most likely that the Mallard harvest in France is driven more closely by fluctuations in the number of birds released annually than by any trend in the natural population.

Changes in estimated Teal hunting bags since the 1998–99 survey were consistent with the recorded increase in their wintering numbers in France, as well as in Europe (Wetlands International 2016). As discussed above, the fact that the French hunting bag amounted to *c.* 3.5 times the wintering population size indicates that most of the harvest is of birds crossing the country during autumn and winter or at least that these birds, once harvested, are replaced by new immigrants (Trolliet 1986; Caizergues *et al.* 2011; see also Guillemain *et al.* 2010). The situation was somewhat different for Pochard: here the estimated numbers wintering in France have been fairly stable, but have declined markedly in Europe, to the point that the population is now considered "Vulnerable" by IUCN (Birdlife international 2015). Such broad-scale decline is mirrored in the massive decrease of the estimated French hunting bag which has become *c.* 40% lower in 15 years, a pattern also reported *e.g.* in Denmark (Christensen *et al.* 2013) and in Switzerland (www.wild.uzh.ch/jagdst). Such a decline in European Pochard numbers (and thus the estimated hunting bag) could partly be due to the re-distribution of birds to areas outside their previous geographic range where they are counted in western Europe, but is also likely linked to falling reproductive success attributed to a large extent to degradation in breeding conditions (Fox *et al.* 2016). The sustainability of the harvest of this species is currently subject to study and requires further review.

On a European scale, France had the largest estimated duck hunting bag of all the countries for which data were available during the 2013/14 season, with estimates twice that from the United Kingdom with the second highest take. It should not be forgotten that half of the French bag was composed of Mallard, of which the vast majority is likely of reared and released origins (see above). However, this leaves *c.* one million wild dabbling and diving ducks which are harvested annually in France, highlighting again the importance of this activity, the density of human population (and hence, hunters) and the unusual hunting opportunities provided by the extent of French wetlands and the central geographic position of France in the flyways. France already had the largest estimated duck bag in

earlier pan-European analyses, which like here also included the UK, Denmark, Finland and Germany within the top five countries with the largest bags in Europe (Mooij 2005; Hirschfeld & Heyd 2005).

Fifteen years after the last hunting bag survey in France, the present analysis provides results which are very consistent with earlier ones, apart from the substantial decrease in the estimated Pochard harvest. The observation that over 2 million ducks are shot annually in France may constitute a very large number of birds, and cause concern to an outside observer. It should however be emphasised that a very large proportion of these are Mallard of captive reared origin (in Camargue, southern France, genetic analyses confirmed a wild origin for only 9% of sampled hunted Mallard; Champagnon *et al.* 2013), and that most of the other species have been increasing over the long-term, despite such an apparently large harvest (Wetlands International 2016). Given their specific life-history traits of relatively limited lifespan but especially high fecundity (*e.g.* Gaillard *et al.* 1989), ducks are naturally well equipped to compensate for the mortality due to hunting, and hence sustain relatively high harvest rates compared to other species (*e.g.* Cooch *et al.* 2014). This could be one of the reasons why Pöysä *et al.* (2013) could actually not demonstrate any correlation between breeding duck population trends in Finland and hunting pressure at the European scale.

This is not to say that the hunting activity plays no part in the population dynamics of duck species, nor that it should not be adequately monitored. It was important for the general understanding of duck population dynamics that a bag survey was conducted for a country where duck hunting is so extensive as in France. However, fifteen years have passed since the previous survey in France, while other countries could readily provide (although not necessary always with a precise survey protocol) annual hunting bag data on demand for a specific year (see Table 1 and footnotes). Such infrequent assessments in France may prevent us from detecting short-term changes in harvest trends, and hence compromise our ability to implement conservation actions effectively for the harvested species. Furthermore, with a survey every 15 years it is not possible to assess inter-annual fluctuations in the harvest, which may be great in species such as ducks that are differentially prone to distribute themselves across Europe in response to adverse (Ridgill & Fox 1990) or mild weather (Lehikoinen *et al.* 2013; Pavon-Jordan *et al.* 2015). Bag surveys at a smaller scale (*i.e.* only nocturnal hunting, for which annual bag reporting is mandatory) suggest the 2013/14 hunting season in France was comparable to the former surveys, with 333,588 individuals shot at night during that season, compared to between 280,908 and 393,317 individuals during the three earlier assessments (Anstett *et al.* 2012; 2013; 2014; 2015). It is, however, difficult to provide any robust analysis of the causes of potential differences between national bag sizes when these are estimated as infrequently as at 15-year intervals.

Conclusion

The main limitation of the present analysis was the heterogeneity in the methods

employed to survey hunters and estimate hunting bags through time in France, and between the different European countries. There are regular calls for harmonised collection of waterfowl hunting statistics in Europe (Lampio 1974; Nowak 1975; Elmberg *et al.* 2006), and a general move towards coordinated adaptive management schemes for these species at the European scale or under the auspices of AEWA (Madsen *et al.* 2015). Such schemes will require both reliable and coordinated assessments of hunting kill as well as greater frequency of hunting bag assessment in the near future, but the fact that hunting statistics were so easily accessible to us from so many European countries during the present analysis shows that the community is now considering seriously the issue of hunting statistics. This gives some basis for optimism that such statistics will become increasingly available from more countries in the future. The next step should be that someone, or some European organisation, takes the initiative and leads on developing a harmonised, systematic and integrated system of hunting bag assessment at the flyway scale.

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