

Short Communication

Alarming decline of the Great Bustard *Otis tarda* world population over the last two decades

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Summary

Since 2005, the world population of Great Bustards *Otis tarda* has decreased at an annual rate of 3.23%. The current world total is estimated at 31,000–36,000 birds, 34% (range 30–38%) less than 16 years ago. The declines have been observed in nine of 17 countries with extant breeding populations, with highest values in China (-89%) and European Russia (-72%). Marked decreases have also occurred in the Iberian Peninsula, which is still the stronghold for the species with 70–75% of the world population. Within Iberia, declines are particularly alarming in Portugal (-50%), although perhaps even more concerning in Spain, where the -28% (range 25–30%) decrease implies a loss of more than 8,000 individuals. Increases have been only recorded in Germany, Austria, and at a smaller scale in Hungary (respectively, 202%, 91%, and 5%), thanks to continued and intensive conservation actions, and also in the small group breeding in Romania, likely due to dispersal from the increasing West Pannonian population. The isolated populations of Morocco and Iran are on the brink of extinction. More surveys are still needed in Russia, Ukraine, Kazakhstan, China, and Mongolia, to confirm numbers and trends. It is urgent to reinforce conservation actions worldwide to stop negative demographic trends and ensure the survival of the species. If current trends continue, IUCN should perhaps consider whether (a) conditions are met to upgrade the species' Red List category from globally 'Vulnerable' to 'Endangered', and (b) the two subspecies should be treated as separate conservation units and require different conservation strategies.

Keywords: Conservation, demography, endangered species, population estimate

Introduction

Steppe birds are one of the bird groups currently showing greatest population declines, which is a cause of conservation concern (BirdLife International 2018). Bustards (Otididae) are particularly vulnerable, since many of their species share farmland habitat with humans, and thus their status should be evaluated regularly in order to prevent severe declines and extinctions (Collar *et al.* 2017,

BirdLife International 2018). Great Bustard *Otis tarda* and Little Bustard *Tetrax tetrax* are two well-known species of this family living in the Palearctic, a region subjected to high human pressure, land-use changes and agricultural intensification. It is therefore most important to monitor their status and keep it up-to-date (e.g. Morales and Bretagnolle 2021 for the Little Bustard).

The last assessment of the Great Bustard *Otis tarda* status estimated the world population at 44,000–57,000 individuals (Alonso and Palacín 2010). With only minor amendments, this estimate was later used in subsequent revisions, which either cautiously expressed a lack of optimism about the future of the species worldwide due to the apparently recent decreases in Russia, uncertainty about numbers and trends in several countries like Mongolia, China, Turkey, or Ukraine, and signs of decline in some areas of the Iberian Peninsula, the species' main stronghold (Alonso 2014), or explicitly considered Great Bustards to be undergoing a moderate decline which could increase into the future (BirdLife International 2017). These reviews recommended keeping the species' status as 'Vulnerable' and carrying out further surveys to confirm numbers. Here we present a new update of the world status of the Great Bustard.

Methods

The latest available Great Bustard counts and estimates were collected from all countries with extant populations. We reviewed all census results published in scientific papers, presented at international conferences, communicated through websites of bird conservation organizations, or included in unpublished technical reports. In addition, we contacted most researchers working with the species in each country to ask them for the latest unpublished counts (Appendix S1 in the online supplementary material). The resulting figures were compared with those from Alonso and Palacín (2010) to establish demographic trends between these two comprehensive updates. In the case of Spain, the estimate consisted of counts from different years and/or regions, and a weighted average census year was calculated for the whole country. This was also the procedure used in Alonso and Palacín (2010). In all other countries, where detailed information on numbers and survey years in each region was lacking, the first and last survey years were taken from published or unpublished national surveys and the mean of these year intervals was used as year of estimate. The criteria used to evaluate the quality of counts were those described in Palacín and Alonso (2008).

The population trend between the last comprehensive assessment (Alonso and Palacín 2010) and the current estimate (this study) was assessed by means of (a) the percentage change in population size between the weighted average census years in both assessments; for population size we used the mean value between minimum and maximum figures of the estimate for each country; and (b) the population growth rate (Sibly and Hone 2002). We used the standard equation defining exponential growth $N_{t+\tau} = N_t e^{r\tau}$ where $N_{t+\tau}$ is the population size at time $t+\tau$, N_t is the population size at time t , r is the rate of natural increase (also known as instantaneous growth rate, intrinsic rate of increase, or exponential rate of increase), t is the time interval, and e is the base of natural logarithms. The growth rates are expressed as annual population increase or decrease values in Table 1.

Results and Discussion

The Great Bustard world population has declined by c.17,500 individuals (range 13,361–21,603) since 2005, which means a 34.6% decrease (range 30.3–37.9%) in 13 years, at an annual average decrease rate of -3.23% (Table 1). This represents a radical change in the demographic trend observed in previous decades, when total numbers were estimated to be not decreasing, based on the stable to slightly increasing tendency observed in Spain, the species' main stronghold, after the hunting ban in 1980 (Alonso and Alonso 1996, Alonso *et al.* 2003, 2005, Palacín and Alonso 2008, Alonso and Palacín 2010). Interestingly, the decline reported in this study was foreseen as a possibility by the authors of the last IUCN assessment, and therefore the category of 'Vulnerable'

Table 1. Recent changes in Great Bustard numbers in countries with extant breeding populations, ordered by numbers of birds in 2005.

	Estimate in 2005 ¹	Year of estimate	Current estimate (2018) ²	Year of estimate	% change	r ³
	min – max		min – max			
Spain	29,400 – 34,300	2004-2010	22,000 – 24,000	2019	-27.8	-2.71
European Russia	8,000 – 12,000	1995-2005	2,500 – 3,000	2014	-72.5	-9.22
Asian Russia			200	2015		
NW China (Xinjiang)	400 – 2,400	1990-2002	100 – 200	2014-2016	-89.3	-11.76
Mongolia + SE Rusia + NE China (<i>O. t. dybowskii</i>)	1,500 – 2,200		1,450 – 2,030 ⁴	2010-2015	-5.9	-0.20
Portugal	1,893	2009	939	2021	-50.4	-5.84
Hungary	1,413 – 1,582	2009	1,559 – 1,600	2021	5.5	+0.44
Turkey	400 – 1,000	1990-2008	559 – 780	2019	-4.4	-0.22
Ukraine	520 – 680	2006	520 – 680	2012	₅	₅
Austria	199 – 216	2009	303 – 489	2019	90.8	+6.46
Germany	114 – 116	2009	347	2021	201.7	+9.20
Morocco	91 – 108	2005	60 – 65	2020	-37.2	-3.10
Iran	89 – 161	1990-1994	43 – 48	2009-2011	-63.6	-5.61
Kazakhstan	0 – 300	1990-1996	100 – 1,000	2014-2016	₆	₆
Serbia	35 – 36	2004	8 – 9	2019	-76.1	-9.53
Romania	0 – 8	2008	5 – 10	2021	87.5	+4.84

Table 1. (Continued)

	Estimate in 2005 ¹	Year of estimate	Current estimate (2018) ²	Year of estimate	% change	r ³
	min – max		min – max			
Slovakia	0 – 3	2008	0 – 3	2015	near extinct	
Czech Republic	0 – 2	2006-2007	0 – 2	2015	near extinct	
[United Kingdom] ⁷			[72-100]	[2021]	[reintroduced]	
Total	44,054 – 57,005	2005 ⁸	30,693 – 35,402	2018 ⁸	-34.6	-3.23

¹ Alonso and Palacín (2010).

² this review; 2018 is the weighted average census year of all counts in this column (see Methods).

³ annual rate of increase.

⁴ Russia: 380–430, Mongolia: ca. 1,000, China: 600.

⁵ unknown trend due to uncertain estimate in 2012.

⁶ unknown trend due to uncertain estimate in 1990-1996.

⁷ population reintroduced through artificial incubation of eggs or release of young birds imported from Russia and Spain 2004-2019; these birds are not included in the total, because this population is not yet considered self-sustaining (BOU 2017) and was therefore not assessed in the last review of birds of conservation concern in UK (Stanbury *et al.* 2021).

⁸ weighted average year of all counts in this column. References (for the current status only; for the status in 2005 see references in Alonso and Palacín 2010):

Spain: Palacín and Alonso (2021); European Russia: Mischenko *et al.* (2017); Asian Russia: Kessler and Smith (2014), Kessler (2015); NW China (Xinjiang): Wang *et al.* (2018); Mongolia, SE Russia, NE China: Mi *et al.* (2016), Collar *et al.* (2017), Liu *et al.* (2017); Portugal: ICNF & LPN (2021); Hungary: L. Miklós (*in litt.*, 2021); Turkey: Özgencil *et al.* (2021); Ukraine: Andryuschchenko (2013, *in litt.* 2021); Austria: R. Raab (pers. comm. 2021), LIFE Great Bustard (2021); Germany: Förderverein Grosstrappenschutz (*in litt.* 2021), T. Langgemach (*in litt.* 2021); LIFE Great Bustard (2021); Morocco: Alonso *et al.* (2019), Qninba *et al.* (2019); Iran: Barati *et al.* (2015); Kazakhstan: Mityaev and Yashchenko (2006), Kessler and Smith (2014), Collar *et al.* (2017), Martín *et al.* (2018); Serbia: L. Miklós (*in litt.* 2021); Slovakia: Hrabkovsky (2018); Romania: L. Miklós (*in litt.* 2021); UK: Waters (2018), Wiltshire Wildlife (2021), see also Stanbury *et al.* (2021).

was retained for this species (BirdLife International 2017). However, no census data were available on that date to confirm any new trend, and the present study confirms for the first time that an important decline has taken place over the last decade and a half.

During the last one or two decades, demographic declines have occurred at least in nine of 17 countries with extant breeding populations, with highest values in China (-89%) and European Russia (-72%) (Table 1). However, perhaps more worrying declines due, to the numbers involved, are those that have occurred in the Iberian Peninsula, which holds 70–75% of the world population. The decline is particularly pronounced in Portugal (-50%), although more troubling in Spain, where the drop of -28% (range 25–30%) implies more than 8,000 birds (range 7,400–10,300) lost since 2004–2010 (Table 1).

Current data do not allow reliable trends to be established in Ukraine, where no surveys have been carried out in the last 15 years, and in Kazakhstan, where numbers were probably underestimated in the 1990–1996 assessment, and are still quite imprecise today (Mityaev and Yashchenko 2006, Kessler 2014). More surveys are needed in these two countries, as well as in Russia, China, and Mongolia, to confirm numbers and trends (Collar *et al.* 2017).

Significant demographic increases have only been recorded in Germany and Austria (respectively, 202% and 91% in little more than a decade), and at a smaller scale also in Hungary (5%), thanks to continued and intensive conservation actions (www.grosstrappe.de, www.grosstrappe.at, Raab *et al.* 2012, Faragó *et al.* 2014), as well as in the small group breeding in Romania, likely due to dispersal from the increasing West Pannonian population (Table 1).

The isolated populations of Morocco and Iran are on the brink of extinction, and deserve special attention due to their contribution to the overall genetic diversity of the species, and their strategic location, respectively in the south-western end of the distribution range, and between the European and Asian continents. The Moroccan population is the only one of this species on the African continent (Palacín *et al.* 2016). Great Bustards there seem to be genetically isolated from Iberian birds, and thus may be regarded as a separate management unit (Alonso *et al.* 2009, Hórreo *et al.* 2014). Iranian Great Bustards are also relatively isolated from the closest populations (i.e. Turkey), and might as well represent a genetically independent unit (Barati *et al.* 2015).

As for the causes of the reported declines, agricultural intensification has been mentioned in first place by most authors (Palacín and Alonso 2018), followed by collision with power lines (Barrientos *et al.* 2012, Vadász and Lóránt 2015, Palacín *et al.* 2017) and poaching (e.g. in China, Mongolia and parts of Russia; Collar *et al.* 2017). The lack of invertebrate food for chicks, caused by an increasing use of pesticides and other agro-chemicals, is surely the main factor determining the low juvenile productivity values observed in recent years in many areas, including some Iberian regions (authors' unpubl. data). Maintenance of High Nature Value (HNV) farming systems, like Mediterranean dry farmland, with high diversity of land-use types, is essential for the conservation of the species (Palacín *et al.* 2012).

In conclusion, it is urgent to reinforce conservation actions worldwide to stop the alarming negative demographic trends and ensure the survival of the species. Such actions should include burying the most dangerous powerlines, implementing agri-environmental programs to improve habitat quality, and enforcing surveillance to prevent poaching in some Asian regions. The two latter measures should be carried out involving farmers and local people in general, who should be educated to understand the benefits of conservation, and compensated through social improvements in their rural communities (e.g. in education, transportation, infrastructures, etc.). The success in Austria and Germany after adopting strict conservation measures to protect Great Bustard habitat shows that the recovery of even the most endangered populations is possible. In the meantime, if current trends continue or get worse, the IUCN should check whether Red List criteria are met to consider upgrading the species' conservation category from globally 'Vulnerable' to 'Endangered'. Moreover, since the two subspecies, *O. t. tarda* and *O. t. dybowskii*, are geographically separated, subject to similar threats but with different intensities, and show quite different population sizes, they should perhaps be treated as separate conservation units.

Supplementary Materials

To view supplementary material for this article, please visit <http://doi.org/10.1017/S095927092200003X>.

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