

AN UPDATED ESTIMATE OF THE WORLD STATUS AND POPULATION TRENDS OF THE GREAT BUSTARD *OTIS TARDA*

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SUMMARY.—*An updated estimate of the world status and population trends of the great bustard Otis tarda.*

Aims: To present an updated estimate of the status and trends of the great bustard *Otis tarda* worldwide, provide a baseline for future evaluations of the conservation status of the species and identify regions where more precise census work is needed.

Results and Conclusions: The world population is estimated to be between 43,500 and 51,200 individuals, of which *ca.* 60 % occur in Spain. The results suggest that total numbers have not decreased during the last decade, in contrast to the declining trend currently assumed. This is largely due to the overall positive tendency recently observed in the Iberian Peninsula. Some small central European populations that had been decreasing for several decades are also recovering now, apparently due to active conservation measures. However, a reduction in range is still occurring, with a tendency to concentrate at sites with high-quality habitat. This recommends keeping conservation efforts and the species' protection status worldwide. More accurate surveys are needed in Russia, northwest China, Turkey and Ukraine in order to confirm numbers and trends in these countries.

Key words: current estimate, great bustard, *Otis tarda*, population trend, world status.

RESUMEN.—*Estimación y tendencia de la población mundial de avutarda común Otis tarda.*

Objetivos: Presentar una estimación actualizada de la población mundial de avutardas y de su tendencia en la tres últimas décadas, proporcionar información reciente para futuras evaluaciones del estado de conservación e identificar las regiones donde es necesaria la realización de censos más precisos.

Resultados y conclusiones: La población mundial ha sido estimada entre 43.500 y 51.200 individuos, encontrándose en España el 60 %. El número total de individuos parece no haber disminuido en la última década, en contraste con el decrecimiento asumido hasta la fecha. Este cambio se debe, probablemente, a la tendencia positiva del conjunto de la población de la península Ibérica. Algunas poblaciones centroeuropeas, que habían disminuido durante varias décadas, parecen haber iniciado un lento proceso de recuperación debido a las medidas de conservación emprendidas en los últimos años. Sin embargo, a nivel global, parece existir una disminución del área de distribución y una tendencia a que la población se concentre en los lugares donde el hábitat presenta una alta calidad. Es recomendable la realización de censos más precisos en Rusia, noroeste de China, Turquía y Ucrania con objeto de confirmar la abundancia y la tendencia de sus poblaciones.

Palabras clave: estimación actual, avutarda común, *Otis tarda*, tendencia poblacional, población mundial.

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INTRODUCTION

The great bustard *Otis tarda* occurs in highly fragmented populations across the Palaearctic region, from the Iberian Peninsula and Morocco, eastwards, to China (Del Hoyo *et al.*, 1996). It is considered Globally Threatened and qualifies as Vulnerable in the Red List of Threatened Species (IUCN, 2006), due to the possible negative impact of land privatisation and land-use changes in eastern Europe, Russia and central Asia, which might cause a rapid population reduction equivalent to more than 30% in the next decade (BirdLife International, 2004a). The population trend is believed to be declining worldwide as a consequence of agricultural intensification and in some places hunting and infrastructure expansion. In Europe it is also classified as Vulnerable due to the estimated 30% decline over the last three generations (or 42 years, BirdLife International, 2004b). Over the last 50 years great bustards have become extinct in several European and Asian countries (Cramp and Simmons, 1980; Chan and Goroshko, 1998; BirdLife International 2001; Morales and Martín, 2002).

The first published assessments of the great bustard status estimated the world population to be under 30,000 birds (25,825–27,185 birds, Collar, 1979; *ca.* 20,000 birds, Collar, 1985; 22,480–23,860 birds, Hidalgo, 1990). However, these figures did not include the Asian populations of the eastern subspecies *O. t. dybowskii*, and were based on crude estimates for most countries. Some years later Collar (1991) published a new total of 28,000 birds and Hidalgo (1997) guessed between 25,640 and 30,480 birds. Based on an estimate of 17,000–19,000 birds for Spain (Alonso and Alonso, 1996) the world total was later increased to 31,000–37,000 (BirdLife International, 2000a), a figure maintained in the last status review, where the global trend of the species was qualified as decreasing (BirdLife International, 2007).

Since year 2000 several new and more accurate great bustard surveys in various coun-

tries have been published, *e.g.* in Spain where the greatest part of the world population is found (Alonso *et al.*, 2003, 2005a, 2006; Palacín, 2007; Junta de Castilla y León, 2008), Africa (Alonso *et al.*, 2005b); central Europe (Bankovics, 2005, 2006; Langgemach and Litzbarski, 2005; Raab, 2004, 2006), Russia (Antonchikov, 2006; Watzke *et al.*, 2007) and Asia (Tsevenmyadag, 2002; Goroshko, 2004; Kong and Li, 2005; Gao *et al.*, 2007). Therefore it is advisable to make an updated review of its world status. In this paper such a review is presented, followed by a discussion on recent trends in countries where data are most reliable. The aims are to (a) provide a baseline for future evaluations of the conservation status of the species, (b) identify gaps in current knowledge of the status and trends of the different populations, and (c) identify regions where more precise census work is urgently needed, suggesting methodological improvements for future survey work. The ultimate objective is to assist in identifying priorities for conservation and research in order to maintain great bustard numbers worldwide.

MATERIAL AND METHODS

An exhaustive revision was made of the most recent published results of great bustard surveys throughout the whole distribution range of the species. The main data sources were papers published in scientific journals or presented at international meetings, as well as surveys accepted by national conservation authorities as reflecting the status of the species in their respective countries. The details of the census methodologies employed in each case may be found in the cited references.

In addition, most researchers working with great bustards were contacted to have access to their unpublished reports and know their latest counts. Finally, one of us participated in a spring survey of the second largest population in Saratov region, Russia, in April 2007 (A.

Khrustov, Alonso, J. C. and Waters, D., *unpubl. data*) to obtain a better impression of the conservation status and reliability of published estimates of this important population.

The following criteria were established to evaluate the quality of the population counts or estimates: (a) high, when (a1) the estimate was based on counts carried out by observers with previous experience counting great bustards, and applying a systematic and standardized methodology (for more details see Alonso *et al.*, 2003, Alonso *et al.*, 2005a), including long series of yearly counts of well monitored populations (*e.g.*, Germany, Hungary), and (a2) the interval between minimum and maximum estimates did not exceed 15 % of the maximum estimate, with the exception of very small populations (< 20 individuals), in which case we qualified estimates as high quality even if they not fulfilled a1; (b) medium, when (b1) the estimate was based on surveys with incomplete coverage of the habitat potentially suitable, and (b2) the interval between minimum and maximum estimates was between 15 % and 30 % of the maximum estimate; and (c) low, when (c1) the estimate was not based on systematic counts and (c2) the interval between minimum and maximum estimates was > 30 % of the maximum estimate.

RESULTS

The world population of great bustards is estimated to be between 43,514 and 51,227 individuals (Table 1), of which the largest part (56 - 65 %) occurs in Spain. European Russia holds 17 - 24 % of the world total, north-western China (Xinjiang) 4 - 7 %, Mongolia, south-eastern Russia and north-eastern China 3 - 4 % (subspecies *O. t. dybowskii*), Portugal and Hungary 3 % each, Turkey 2 - 3 %, and Ukraine 1 - 2%. Other countries hold less than 1% of the world total. Table 2 summarizes the results published on the species' status in each country through the last three decades. These data

suggest that great bustards went extinct in Bulgaria (last breeding recorded in 1997), Romania (although 4 birds have been sighted in spring 2007), Poland (2 individuals sighted until 1991, considered extinct since 1993), Czech Republic (2 - 5 birds seen up to 1994, later probably extinct, although in recent years 1 - 6 birds have been sighted), and Moldova. Numbers have almost certainly declined in Kazakhstan, Turkey, Iran, and Morocco, and in most of the distribution range of the eastern subspecies *O. t. dybowskii*. In contrast, the species has increased in Hungary, Austria, and Germany, and almost certainly in Spain and Portugal. Finally, recent trends are unknown in Russia and Ukraine (see numbers and references in Table 2, further details in the Discussion below).

DISCUSSION

The world estimate of 43,514 - 51,227 great bustards presented here may be considered reasonably reliable, as the range between maximum and minimum figures was *ca.* 15 %. Moreover, most national figures, particularly those contributing more to this total, are based on trustworthy censuses carried out in recent years by experienced observers using standard methods (Spain, Portugal), or longer series of accurate counts throughout the last decades (Hungary, Austria, Germany). The sum of these counts represents *ca.* 70 % of the estimated world total. Another 20 % of the birds correspond to medium quality estimates, and the remaining 10 % to low-quality guesses (see Table 1).

As for the population trend of the species worldwide, data available for the last three decades suggest that, in spite of an apparent reduction in their distribution range, total numbers have not decreased during the last 20 years. This is largely due to the positive overall tendency observed in Spain, the main stronghold for the species, and contradicts the declining population trend currently assumed

TABLE 1

Current estimate of breeding populations of the great bustard, ordered by numbers of birds. See Methods for criteria used to evaluate the quality of estimate.

[*Estimación actual de las poblaciones reproductoras de avutarda común, ordenadas por abundancia. Véase Métodos para la definición de los criterios utilizados en la evaluación de la calidad de la estimación.*]

Country	Number of. birds (min-max)	Reference	Quality of estimate
Spain	27,500 - 30,000	Palacín, 2007 (updated); Junta de Castilla y León, 2008	high
European Russia	8,000 - 11,000	Malikov <i>et al.</i> , 2000; Khrustov <i>et al.</i> , 2003; Antonchikov, 2006; Watzke <i>et al.</i> 2007	medium
NW China (Xinjiang)	2,000 - 3,000	Gao <i>et al.</i> , 2007	low
Mongolia + SE Rusia +NE China	1,500 - 1,700	Goroshko <i>et al.</i> , 2004	high
Portugal	1,399	Pinto and Rocha, 2006	high
Hungary	1,353	Túzokvédelmi Program, 2006	high
Turkey	764 - 1,250	Kiliç and Eken, 2004	low
Ukraine	500 -850	Domashlinets and Andriushchenko, 2004; Yaremchenko and Bakhtiyarov, 2006	low
Austria	175	Raab, R. <i>pers. com.</i>	high
Iran	89 - 161*	Amini, 2000	low
Germany	110	Langgemach, T. <i>pers. com</i>	high
Morocco	91 - 108	Alonso <i>et al.</i> , 2005b	medium
Kazakhstan	0 - 50	Academy of Sciences, 1996	low
Serbia and Montenegro	35 - 40	Garovnikov, 2004	high
Slovakia	8 - 16	BirdLife International, 2004b	high
Czech Republic	1 - 6	Škorpíková and Horal, 2004	high
Romania	0 - 4	Istvan Leszai, <i>pers. com.</i>	high
Moldova	0	BirdLife International, 2004b	high
Bulgaria	0	Deleriev <i>et al.</i> , 2004	high
TOTAL	43,514 - 51,227		

* this maximum corresponds to an autumn count in 1991.

(BirdLife International 2004a, 2007). The reduction in range is evident from the local extinctions recorded during the last decades in several central European and Asian countries (see Table 2), as well as in some smaller and marginal breeding areas within the Iberian Peninsula (Alonso *et al.*, 2003; Pinto *et al.*, 2005; Palacín, 2007).

The current status and recent trends in each country where the species is still present are reviewed below. In Turkey, great bustards have probably declined, since partial counts at best known regions suggest that earlier estimates should be revised downwards, and that the distribution range of the species has decreased, with some populations becoming isolated (He-

unks *et al.*, 2001; Balmer and Kirwan, 2003; Özbagdatly and Tavares, 2006). In Morocco, a decreasing trend has been detected between 1999 and 2005 (Alonso *et al.*, 2005b), following the long-term moderate decline reported for earlier decades (see Alonso *et al.*, 2000a). In Iran, the estimates are from the period 1990 - 94, when the disappearance of a wintering population of 200 - 250 individuals in the northeast of the country was reported, and the north-western population was considered to be stable (Amini, 2000). More recently, however, several decreasing trends have been observed at some breeding sites of the Kurdistan (Barati and Amerifar, 2008). An autumn count carried out in 1991 is suggested as upper limit of the estimate for this country. Early winter surveys (*e.g.*, December - January) may sometimes give better estimates than spring counts: *e.g.* in Morocco, highest count 90 birds in December, versus 75 - 81 birds in spring (Hellmich and Idaghdour, 2002); in Extremadura, the highest counts were also obtained in winter, 5,500 - 6,000 as compared to only 3,500 - 4,000 in spring (Corbacho *et al.*, 2005). On the other hand, in migratory populations winter counts may give higher totals than spring surveys, or confirm the latter. For example, the winter estimate of 11,000 - 12,000 great bustards in Ukraine (Deleriev *et al.*, 2004) has been useful to support spring estimates carried out in Russia, since Russian bustards are known to spend the winter in Ukraine (Watzke *et al.*, 2001).

The population trend seems to be negative also in Kazakhstan, where great bustards have disappeared from certain areas in which they were a common breeding species in the 19th and first half of the 20th centuries. In the 1980s there are only some records in smaller areas southwest of the Altai mountains, in the Chilikinskaya valley and north of Prizaysanye and Tarbagatay. In 1992, the species was considered to be severely threatened in the eastern part of the country (Berezovikov, 1992), where rapid declines were reported (BirdLife Inter-

national, 2000a, 2000b). Since then it is considered threatened with extinction in this country (Academy of Sciences of Kazakhstan, 1996; Antonchikov, 2006).

In recent years, several local extinctions have been reported for some regions of the western part of the former Soviet Union. In the Podolie region (Ukraine), great bustards were a common breeding species during the early 20th century, but went extinct due to changes in land use and agricultural development (Matveyev and Tabachishin, 2003). In the Carpathians, great bustards were counted in hundreds before 1940, but today they have disappeared due to hunting and land use changes (Skilsky, 2000). In Azerbaijan, the species bred up to the 1940s, but now only several tens to a few hundred birds are reported wintering (Del Hoyo *et al.*, 1996). In Turkmenistan, great bustards are cited as a common breeder during the first half of the 20th century, after which a severe decline probably occurred (Saparmuradov, 2003). In the Altaiisky region, great bustards were in decline in the 80s-90s, with only isolated sightings at present (Irisova, 2000).

The latest data available for the populations in eastern Asia (*O. t. dybowskii*) also suggest a decline during the last two decades, with maximum estimates for its whole distribution range decreasing from 3,100 (Chan and Goroshko, 1998) to 1,700 birds (Goroshko, 2000, 2004; see Table 2). These figures are slightly higher (2,230 - 3,150 individuals) when summing up all local estimations: Mongolia, 1,500 - 1,700 individuals (Tsevenmyadag, 2002); Russia, the subspecies *dybowskii* occurs in the south-eastern region Chita, where numbers are estimated between 530 and 650 (Goroshko, 2000) after a decline during the last two decades (Puzanskii, 2000); and China, between 200 and 800 individuals estimated in the northeast of the country (Gao *et al.*, 2007). The estimate of 2,000 - 3,000 birds in north-western China (Gao *et al.*, 2007) is the same as that published for the previous decade (Gao, 1994), and much

TABLE 2

Estimates (min-max) and trends of populations with reliable data during the last three decades.
 [Estimación (min-max) y tendencia de las poblaciones con datos fiables en las tres últimas décadas.]

Country	Decade			Trend * and probable causes
	1980 - 1989	1990 - 1999	2000 - 2007	
Czech Republic	201 - 315 (Collar, 1985; Randik and Kirner, 1985)	7 - 13 (Goriup 1994)	1 - 6 (Škorpíková and Horal, 2004)	(-) agricultural intensification
Slovakia		25 - 40 (Goriup 1994)	8 - 16 (BirdLife Internacional, 2004b)	(-) agricultural intensification
Romania	300 - 350 (Collar, 1985)	10 - 15 (Goriup 1994)	0 - 4 (Istvan Leszai, pers. com.)	(-) unknown
Bulgaria	10 - 15 (Kollar, 1996)	3 - 5 (BirdLife Internacional, 2000b)	0 (last breeding 1997, Deleriev <i>et al.</i> , 2004)	(-) agricultural intensification, hunting
Poland	2 - 16 (Bereszynski, 1987)	0 (Goriup, 1994)		(-) agricultural intensification, hunting
Moldova	2 - 3 (Goriup, 1994)	0 (BirdLife Internacional, 2004b)		(-) unknown
Turkey	3,000 (Goriup and Parr, 1985)	3,000 - 6,000 (Eken and Magnin 2000)	764 - 1,250 (Kiliç and Eken, 2004)	(-) unknown, habitat degradation, hunting, collision with powerlines
Morocco	100 (Collar, 1985); 175 (Alonso <i>et al.</i> , 2000a)	90 - 133 (Hellmich and Idaghmour, 2002)	91 - 108 (Alonso <i>et al.</i> , 2005b)	(-) hunting, collision with powerlines
Iran	100 - 200 (Collar, 1985)	89 - 161 (Amini, 2000)		(-) hunting, nest destruction, agricultural intensification
Mongolia + SE Russia + N China		1,750 - 3,100 (Chan and Goroshko, 1998)	1,500 - 1,700 (Goroshko, 2004)	(-) hunting, habitat degradation, alteration of natural steppes
Spain	19,000 (Alonso and Alonso, 1996)	23,100 (Alonso <i>et al.</i> , 2003)	27,500 - 30,000 (present study)	(+) hunting ban
Portugal	1,017 (Pinto, in Bugalho, 1987)		1,399 (Pinto and Rocha, 2006)	(+) hunting ban

Hungary	2,691 (Farágó, 1993)	1,100 - 1,300 (Farágó, 1996); min 875 in 1991 (Práger, 2005; Bankovics, 2006)	1,353 (Túzokvédelmi Program, 2006)	(+) conservation measures
Austria	151 (Collar, 1985)	61 (Kollar and Wurm, 1996)	175 (Raab, R. pers. com.)	(+) conservation measures
Germany	350 (Litzbarski and Litzbarski, 1996)	90 - 100 (Litzbarski and Litzbarski, 1996); min 57 in 1997 (Langgemach and Bellebaum, 2005)	110 (Langgemach, T. pers. com.)	(+) captive breeding, conserva- tion measures
Saratov (Russia)	6,000 - 7,000 (Flint and Mishchenko, 1991)	4,500 - 6,000 (Oparina <i>et al.</i> , 1998)	6,000 - 8,000 (Malikov <i>et al.</i> , 2000; Oparin <i>et al.</i> , 2003; Antonchikov, 2006; Watzke <i>et al.</i> 2007)	(-) (+) agricultural changes**

* trend: (-) decreasing; (+) increasing; ** possible decrease in the 80s, followed by increase in the 90s, see text for further details.

higher than the 250 - 300 birds guessed by Chan and Goroshko (1998), and judged as dubious by BirdLife International (2001).

In contrast to the above mentioned declining populations, current data indicate increases during the last 1 - 2 decades in the following central European countries (see Table 2). In Hungary, a minimum of 875 individuals was recorded in spring 1991 (Práger, 2005; Bankovics, 2006), after a prolonged decline since the 8,557 birds estimated in 1941 (Sterbetz, 1975). Numbers remained more or less stable during the 90s and slightly increased afterwards, reaching 1,353 in 2006 (Túzokvédelmi Program, 2006). This increase is attributed to the implementation of conservation measures, as well as to changes in land-use associated to the new political situation since 1989 (Bankovics *et al.*, 2005; Bankovics, 2006). In Austria, a steady decline was also recorded since the first half of the 20th century, to a minimum of *ca.* 61 in 1995 (Kollar and Wurm, 1996), with a subsequent increase up to 175 in spring 2006, also attributed to the agri-environmental measures taken in recent years (Raab, 2004, 2006, *pers. com.*). In Germany, a steep decline has also occurred since 1940, from an estimated 4,100 birds, to a minimum of 57 birds in 1997, after which numbers increased up to the 101 individuals counted in spring 2005 and 2006 (Langgemach and Bellenbaum, 2005; Langgemach and Litzbarski, 2005; Langgemach, T. *pers. com.*) and 110 in spring 2007 (Langgemach, T. *pers. com.*, see www.grosstrappen.de). This change in trend is attributed to the more efficient measures (improvement of insemination and hatchings rates, predator control and others) taken in the last years within the captive breeding program running there since 1973, which includes systematic egg collection and artificial incubation. Today over 40 % of all German bustards are artificially reared birds (Langgemach and Litzbarski, 2005).

As for the Iberian Peninsula, after the steep decrease that presumably occurred in Spain until 1980, due mostly to hunting, the population currently shows a slight tendency

to increase at some areas and to decrease in marginal sites (Hidalgo, 1997; Alonso *et al.*, 2003; Palacín *et al.*, 2004). In some regions the observed increase is partly a consequence of conspecific aggregation, a process by which the population is concentrating at high quality sites and disappearing from poor quality ones (Alonso *et al.*, 2004). An overall nationwide increasing trend may be inferred from changes in numbers at certain better monitored areas, although longer and more precise series of censuses are necessary at some other sites in order to be able to quantify the suggested increase. In Portugal, very similar demographic trends have been identified in the last two decades, also with a suggested slight nationwide increase, and a tendency to concentrate in a single high quality area, and to disappear from smaller marginal sites (Pinto *et al.*, 2005; Pinto and Rocha, 2006).

Finally, changing trends have been described for the Russian population, with contradictory interpretations by different authors. A marked decrease occurred in the former USSR due to strong agricultural transformations in the 19th and 20th centuries. Since 1991, it seems that the crisis of the agricultural infrastructure favoured a recovery of the great bustard population (Chernobai, 2003), but in the last 3 - 4 years agribusiness has started a recovery and is threatening again the future of the species (Antonchikov, 2006). Based on recent estimates (see Table 2) it is not possible to establish reliable trends for the last two decades, with some authors suggesting slight increases (Khrustov *et al.*, 2000, 2003; Chernobai, 2003; Shlyakhtin *et al.*, 2004), whereas others cast doubt on such increases (Antonchikov, 2006). A similar conclusion holds for Ukraine, where the only estimates available (640 - 850 birds, Domashlinets, 2004; 500 - 720 birds, Yaremchenko and Bakhtiyarov, 2006) do not enable any judgment about its demographic trend. Winter counts of great bustards in Ukraine amounted between 3,000 - 8,000 birds (Yaremchenko and Bakhtiyarov, 2006), 7,000 - 8,000 only in southern

Ukraine (Andryushchenko, 2007) and 11,000 - 12,000 birds (Deleriev *et al.*, 2004), supporting the Russian estimate of 8,000 - 11,000 birds (see Table 1). However, we should remark that estimates of the Russian population are based on counts of a relatively small number of birds (*ca.* 2000 - 2700 birds) which are later extrapolated to all potential habitat in a vast territory. These extrapolations may be uncertain and therefore further census work should be carried out in these countries to confirm both numbers and trends.

A reintroduction project has recently started in Great Britain, where young birds hatched from artificially incubated eggs are imported from Russia and released near Salisbury in England (Osborne, 2005; Waters and Waters, 2005; Waters, 2006). In total, 74 birds have been released between 2004 and 2007, of which some 20 still survive (see www.greatbustard.com).

Conclusions and recommendations

Summing up, the quality of great bustard population estimates worldwide has increased notably in the last decade, and many new national or local accounts have been published within the last few years. The new world total presented here (43,500 - 51,200 individuals) is based on 70 % high-quality counts, with another 30 % medium to low-quality guesses for north-west China, Russia, Turkey, Kazakhstan, Iran, Morocco, and Ukraine. Detailed surveys of all these populations are urgently needed to improve our knowledge of their status and possible trends, in order to adequately plan their conservation and keep the species' IUCN category updated. The overall population trend is not a decreasing one, as currently thought (BirdLife International, 2007), although the recently identified tendency to concentration at a smaller number of sites with appropriate habitat conditions, with still continuing declines and local extinctions at many marginal areas, even in Iberia where the species' strong-

hold lives, recommends keeping the species as Vulnerable in the IUCN list, and enhance the conservation measures at all sites.

A detailed knowledge of the migration and breeding phenology of the species would be desirable to adequately plan optimal survey dates. In addition to spring counts, or as a means to confirm the latter, it is recommended to carry out winter counts, particularly in regions where the density of breeding birds is too low. The tendency of great bustard to aggregate in winter at some feeding areas facilitates obtaining a maximum count at this time of the year. Specifically for Spain, a count is recommended in December-January (Alonso *et al.*, 2000b, 2005a; Palacín, 2007).

The experience from some central European countries (Hungary, Austria, Germany) shows that the species may react positively to conservation measures. Thus it is important that such measures are urgently implemented, though with the appropriate scientific control, at all other areas where the species is declining or threatened with extinction.

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