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Proceedings of the International Conference 'Advancing the Conservation of the Great Bustard in Asia': Editors' preface

MIMI KESSLER & NIGEL J COLLAR

The Great Bustard *Otis tarda tarda* has one of the broadest ranges of any Palearctic bird species, from near the Atlantic seaboard of southern Portugal to the Pacific coastlands of China and to Khanka lake in Russia's Primor'e, a distance of almost exactly 10 000 kilometres. A little under half of this range—a massive 4500 km—falls across the OSME region, which extends from Turkey in the west to Kazakhstan in the east. In Europe to the west the situation of the species is kept under close and constant scrutiny. In Asia to the east the history and status of the species has at least been chronicled and charted in great detail in BirdLife International's *Threatened Birds of Asia* (Collar *et al* 2001). By contrast, however, information about the condition of the Great Bustard in the Middle East and Central Asia is troublingly inaccessible and fragmentary. Political, cultural, linguistic and logistic barriers have stood in the way of research and reporting, coordination and collaboration. In their isolation both inside and outside the region, conservationists have doubtlessly fallen back on the comforting hope that there is somewhere in this vast range, in those supposedly unending steppes of Central Asia, a place where the Great Bustard has been able to escape the ravages that modern development has elsewhere so comprehensively wrought on populations of the species.

To redress this imbalance in the community of knowledge, the Eurasian Bustard Alliance, in partnership with the Wildlife Science and Conservation Center of Mongolia, and Institute of Biology of the Mongolian Academy of Sciences, conceived and convened an international meeting, *Advancing the Conservation of the Great Bustard in Asia*, to which delegates from Iran eastwards were invited to provide historical reviews and contemporary

updates on the status of the species in their countries. The meeting was hosted by the Mongolian Ministry of Environment and Tourism at the Fresh Water Resources and Nature Conservation Center in Ulaanbaatar, Mongolia, on 25–29 May 2017 (see photo). The Trust for Mutual Understanding generously provided funding for conference expenses, article translation, and publication of the proceedings.

Those proceedings are published here, in this special issue of *Sandgrouse*, or more strictly the larger part of the proceedings which deal with the nominate (western) subspecies of the Great Bustard that occupies the OSME region (it is hoped that the papers relating to the eastern subspecies *dybowskii* will appear elsewhere). Speaker-authors were asked to present their evidence in a simple formulaic manner, involving a comprehensive overview of the species' historical presence and current state in their region, with a special outreach to capture unpublished records and easily overlooked sightings logged in dozens of brief journal reports and citizen science portals. Contributions also included a basic matrix for population estimations, in order to allow for a regional population summary to be compiled. Inevitably the resulting material varied massively depending on the size of the geographical unit under review, its historical and current importance to Great Bustards, and the size of the observer base on which to draw.

Following the decision to publish the Central Asian materials in *Sandgrouse*, supplementary papers were elicited from species experts in adjacent areas within the OSME region, resulting in contributions from the Russian Caucasus, Azerbaijan and Turkey. These, however, merely confirm what emerged so strikingly from the conference in 2017: there *are* no tracts of steppe where Great Bustard populations are robust and stable. The species is at risk—or already extirpated—from west-central Turkey right across to Nei Mongol, China. Nevertheless we have here an important set of conservation recommendations. An additional output of the Ulaanbaatar conference was a proposal to establish a *Concerted Action for the Great Bustard in Asia* under the umbrella of the Convention on Migratory Species (CMS). This Concerted Action was unanimously approved at the 12th Conference of Parties to CMS in Manila in October 2017. With this framework for cooperation firmly established, and recommendations for action clearly laid out, increased efforts and financing by governments and conservation donors are now imperative in order to undertake the key activities that will stabilise populations across the entire range of the species in the Middle East, Central Asia and East Asia.

The papers in this collection were written either in their authors' native language and then translated, or in English by non-native speakers of that language. We have edited the material intensively in order to ensure clarity of information and conformity of style, and we have encouraged updates to improve the quality and completeness of the record that each paper represents. We have sought to avoid geographical overlap, but the contribution by Prokopov forms a more focused study within the wider analysis by Shakula *et al* covering eastern Kazakhstan. When translating citations, the overriding concern was to facilitate future attempts in finding original sources; however, owing to changes in orthography over time, this results in some inconsistences in place names between the main body of the article and the literature cited. The ICAO romanisation system was used for translation of place and family names, with the addition of an apostrophe to mark the Cyrillic 'soft sign'. An effort was made to use contemporary official place names.

Many organisations and individuals have contributed towards this continental-scale initiative. The Trust for Mutual Understanding gave invaluable support for the conference, and the Mongolian Ministry of Environment and Tourism was a generous host. B Nyambayar at the Wildlife Science and Conservation Center of Mongolia and N Tseveenmyadag at the Institute of Biology of the Mongolian Academy of Sciences were welcoming partners in the conference organisation. D Ariuntuyaa at the Ministry and

B Heredia from the CMS Secretariat played central roles in the conference. They, and B Nyambayar, were vital to the development and advancement of the proposal to CMS. S Gareev provided several translations. M Koshkin helped with various aspects of the Kyrgyzstan paper.

OSME itself must be identified as a major benefactor in the production of these proceedings. We particularly thank Rob Sheldon for his enthusiastic championing of this publication and his role in commissioning and checking the additional material from the Russian Caucasus, Azerbaijan and Turkey. Furthermore, a bursary is planned by Eurasian Bustard Alliance to support Great Bustard conservation in the region, and OSME has very generously added significantly to the total available. We express our profound gratitude to the society and to its chairman for this outstanding support.

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Mimi Kessler & Nigel J Collar, Co-chairs, IUCN SSC Bustard Specialist Group

Status of the Western Great Bustard *Otis tarda tarda* in Asia and its significance to an updated estimate of the global population of Great Bustards

MIMI KESSLER

Summary: Although the Western Great Bustard *Otis tarda tarda* was historically abundant in the Eurasian steppes, its populations have suffered declines, extirpations and range fragmentation since the late 19th century. The papers presented in this collection provide geographically comprehensive coverage which enables us to estimate the current population of Western Great Bustards in wider Central Asia, inclusive of Iran and eastwards to Xinjiang, China. A total of 230–418 Western Great Bustards are reported on breeding grounds across this range. The small size of remaining leks and their geographic isolation raise concern about the vulnerability and viability of these populations. On wintering grounds, where Great Bustards gather in larger flocks, up to 500 individuals are counted in one region (Turkistan province, Kazakhstan). Estimated from sources within the last five years, the global population of the Great Bustard is approximately 29 000–32 500 individuals. This estimate is approximately 40% lower than the last global estimate, published in 2014. Although Central Asia occupies 30% of the species' former longitudinal geographic range from Portugal to Primor'e, Russia, the Central Asian population of Great Bustards now represents only 1% of the total global population. Poaching of birds in larger winter flocks, incompatible agricultural practices and predation by free-ranging dogs are serious and widespread threats described by Great Bustard experts across this range. Without rapid action the loss of the Western Great Bustard from additional regions of Asia is likely. These populations will be difficult to re-establish due to their distinct migratory behaviour.

HISTORICAL RANGE

Two centuries ago, the Great Bustard *Otis tarda* was a familiar inhabitant of the Eurasian steppes (Kessler & Smith 2014), with breeding populations established from Portugal to the Pacific coast of Russia. Within Asia, the range of the Western Great Bustard *O. t. tarda* extends from West Azerbaijan province, north-west Iran, eastward to Xinjiang, north-west China. In Asia, the Western Great Bustard breeds as far north as Omsk oblast' along the southern border of western Siberia, Russia, and earlier regularly wintered as far south as North Khorasan, north-eastern Iran. During the 20th century, this Central Asian population crashed catastrophically and its geographic distribution became highly fragmented (review in Kessler & Smith 2014). This paper summarises the data presented in a set of geographically comprehensive articles in this volume, to offer a current snapshot of the distribution and population size of the Western Great Bustard in Asia.

CONTEMPORARY POPULATION ESTIMATES

Breeding population estimate

The Great Bustard is a lekking species, in which groups of individuals gather each spring at discrete, traditional spots in the landscape ('leks'). Great Bustards generally remain on or near their leks during spring months to display, incubate eggs and raise young. This fidelity to breeding grounds allows us to estimate the total Central Asian breeding population by summing the number of individuals reported as present during the breeding season in each region. A total of 230–418 individual Western Great Bustards are recorded on breeding grounds in Asia, according to regional estimates produced from 2017 to 2021 (Table 1).

Most of the breeding populations reported in Asia are now at high risk of disappearance. A study of the dynamics of Western Great Bustard leks in Iberia indicated that the chance

of lek extirpation increases rapidly when the number of birds present is less than thirty (Pinto *et al* 2005). The data presented in Table 1 summarise the total number of Great Bustards breeding in each region, which may geographically encompass more than one lek. Even so, the number of Western Great Bustards reported breeding in any one region is less than thirty in all locations except southern Kazakhstan, eastern Kazakhstan, and Iran.

Migratory flock counts

The migratory habits of the Great Bustard differ longitudinally across its wide range (Kessler *et al* 2013). Within Asia, the remaining population of Great Bustards in Iran makes only short seasonal movements. Elsewhere in Asia, Western Great Bustards are largely migratory, with timing and distance of longer movements dependent on winter weather conditions (Kessler 2015). Even after spending a prolonged period at a winter site, Great Bustards in Central Asia may move further south in response to worsening winter weather, particularly snow cover precluding foraging. These flexible migratory movements make it impracticable to draw conclusions about regional population size by summing counts taken across the migratory range during the migratory and winter periods, unless these counts are tightly synchronised.

On the northernmost Asian breeding grounds (along the southern Russian and northern Kazakhstan border) a few individual Western Great Bustards sometimes remain to overwinter. Southern breeding grounds serve as migratory staging areas or, in mild years, overwintering sites. These sites, in southern and south-eastern Kazakhstan, currently report the largest accumulations of Great Bustards during the migratory period (Table 2).

A comparison of the maximum number of Great Bustards reported at any migratory stopover (Table 2) with the total number of individuals reported as breeding at sites northward on the same flyway (Table 1) finds more birds tallied on stopover in central Kazakhstan and Xinjiang than expected. This discrepancy is likely to be due to a combination of two factors: first, overestimates on wintering grounds, due to the high mobility of these large winter flocks, and, second, underestimates on the breeding grounds, as breeding females are less easily detected in growing vegetation, and some lek sites may not yet have been identified.

Wintering population estimate

In Central Asia, Great Bustards gather in larger flocks during the winter months. Although Turkmenistan was historically the most important region for overwintering Great Bustards in Central Asia, today the regions with the largest overwintering populations are Uzbekistan and southern and eastern Kazakhstan (Table 2). Again, it is inappropriate to sum winter counts that are not synchronised, because, for example, individuals tallied as overwintering in southern Kazakhstan may move suddenly to Uzbekistan if winter weather worsens.

The maximum number of individuals estimated to reach Uzbekistan during harsh winters (500) is roughly equivalent to the total number of breeding individuals estimated in Central Asia. The sum total of Great Bustards breeding in areas which might plausibly migrate to eastern Kazakhstan (a total of 127–173 in eastern, central and northern Kazakhstan, along the southern border of Russia from Omsk to Altai krai, and Xinjiang) is lower than the number reported to overwinter in eastern Kazakhstan (180–500). As described in the previous section, this discrepancy is likely to be due both to double-counting individuals over the course of their migratory movements and to underestimates of breeding populations.

Table 1. Summary of breeding season population estimates of Western Great Bustard *Otis tarda tarda* presented in this collection, which were prepared using identical templates and instructions in preparation for the conference 'Advancing the Conservation of the Great Bustard in Asia', held in Ulaanbaatar, Mongolia (with the exception of the estimate for Orenburg oblast', which is sourced from the regional Red Book). Estimates of population size are provided alongside a count of the number of sites currently used by the species and the author's level of confidence in the population assessment for that region. Quality of estimates: 1 = low, 5 = high.

Geographic area		Breeding season			Source
Country	**Region**	**Number of individuals**	**Number of sites**	**Quality of population estimate (low=1, high=5)**	
Iran	Boukan	33–35	4	4	Abdulkarimi 2022
Russia	Orenburg oblast'	'Fewer than 100'*	Not available	Not available	Kornev & Gavlyuk 2019
Russia	Tyumen' oblast'	2–6	1	2	Nefedov 2022
Russia	Kurgan oblast'	2–6	Unknown	1	Nefedov 2022
Russia	Omsk oblast'	10–20	25	3	Nefedov 2022
Russia	Novosibirsk oblast'	2–6	1	1	Nefedov 2022
Russia	Altai krai	10–20	3	2	Nefedov 2022
Kazakhstan	North Kazakhstan province	4–10	1	2	Nefedov 2022
Kazakhstan	Pavlodar province	4–10	Unknown	1	Nefedov 2022
Kazakhstan	Western Kazakhstan	5–26	2	2	Kessler & Bidashko 2022
Kazakhstan	Central Kazakhstan	20–30	6	2	Koshkin *et al* 2022
Kazakhstan	Southern Kazakhstan	50–70	13	4	Shakula *et al* 2022a
Kazakhstan	Eastern Kazakhstan (including Zaisan**)	60	11	1.5	Shakula *et al* 2022b
China	Xinjiang	17	Dispersed	4	Wang & Yang 2022
Kyrgyzstan	entire country	1–2	2	1	Kulagin 2022
Tajikistan	entire country	0	0 currently used (4 extirpated)	Not applicable	Muratov & Talbonov 2022
Uzbekistan	entire country	0	0	5	Kashkarov *et al* 2022
Turkmenistan	entire country	0	0	5	Rustamov 2022
Entirety of Asia		230–418***	>69	Average = 2.5	

*A range of 10–100 is used for the purpose of tallying. **Prokopov 2022 provides estimates for a subsection of this region, the Zaisan depression. ***The final row sums the number of Great Bustards observed in all regions. As estimates are provided for every region in Asia in which this subspecies is reported to persist, these sums represent the entire known extant breeding population of the Western Great Bustard in Asia.

Table 2. Summary of migratory season and winter population estimates of Western Great Bustard *Otis tarda tarda* presented in this collection, which were prepared using identical templates and instructions in preparation for the conference 'Advancing the Conservation of the Great Bustard in Asia', held in Ulaanbaatar, Mongolia (with the exception of the estimate for Orenburg oblast', which is sourced from the regional Red Book). Estimates of population size during the migratory (representing either flocks staging for migration, or on stopover, dependent on geographic area) and winter seasons are provided alongside a count of the number of sites currently used by the species and the author's level of confidence in the population assessment for that region. Citations are as in Table 1. Quality of estimates: 1 = low, 5 = high.

Geographic area		Migratory season			Winter		
Country	**Region**	**Number of individuals**	**Number of sites**	**Quality of population estimate**	**Number of individuals**	**Number of sites**	**Quality of population estimate**
Iran	Boukan	Not applicable	Not applicable	Not applicable	35–40	2	4
Russia	Orenburg oblast'	Not available	Not available	Not available	0	0	Not available
Russia	Tyumen' oblast'	3–15	1	2	0	0	Not applicable
Russia	Kurgan oblast'	3–15	Unknown	1	0	0	Not applicable
Russia	Omsk oblast'	9–25	3	2	0	0	1
Russia	Novosibirsk oblast'	3–15	Unknown	1	0	0	1
Russia	Altai krai	9–35	Unknown	2	0	0	1
Kazakhstan	North Kazakhstan province	9–35	Unknown	1	0	0	1
Kazakhstan	Pavlodar province	9–35	Unknown	1	0	0	1
Kazakhstan	Western Kazakhstan	20–40	3	2	0	0	2
Kazakhstan	Central Kazakhstan	80–100	21	3	Not applicable	Not applicable	Not applicable
Kazakhstan	Southern Kazakhstan	180–200	6	2	400–500	12	4
Kazakhstan	Eastern Kazakhstan (including Zaisan*)	80–90	14	4	180–500	15	5
China	Xinjiang	317–444	3	5	0	0	2
Kyrgyzstan	entire country	4–10	3	3	2–5	2	3
Tajikistan	entire country	1–5	4	3	1–2	1	2
Uzbekistan	entire country	10–30	3	1	50–70 to 200–500**	6	3
Turkmenistan	entire country	Up to 75, but some regions not surveyed	Sites across four ecoregions	2–4 (depending on region)	25–45	Sites across two ecoregions	2–5 (depending on region)
Entirety of Asia		Not applicable***	>61	Average=2.3	Approximately 500–1200***	>38	Average=2.4

*Prokopov 2022 provides estimates for a subsection of this region, the Zaisan depression. **First range of numbers represents the number of Great Bustards observed during a mild winter; the second range represents the number observed during a severe winter. ***The final row sums the number of Great Bustards observed in all regions. As estimates are provided for every region in Asia in which this subspecies is reported to persist, these sums represent the entire known extant population of the Western Great Bustard in Asia. Due to the likelihood of duplicate counts during migration, a sum cannot be produced for the migratory period. Similarly, the winter sum must be interpreted with caution. Refer to the text for interpretation of these totals.

Table 3. Updated global population estimate for the Great Bustard, calculated using the most recent data available, presented from west to east.

Region	Breeding population estimate	Subspecies	Percentage of global total	Reference
Portugal	320 ('160 pairs')	Western	1%	Instituto da Conservação da Natureza e das Florestas and Liga para a Protecção da Natureza 2018 (unpublished data)
Spain	22 000–24 000	Western	74–76%	Palacín & Alonso 2021
United Kingdom (reintroduced)	67	Western	< 1%	Great Bustard Group 2021
Central Europe	2444	Western	8%	LIFE Great Bustard 2022
Morocco	45–50	Western	< 1%	IUCN & HCEFLCD 2016
Ukrainian mainland	75–150*	Western	< 1%	Andryushchenko 2009, Beskaravainyi 2015
Crimea	150**	Western	< 1%	Beskaravainyi 2015
European Russia	'Not more than' 1870	Western	6%	Oparina & Oparin 2021
Turkey	559–780	Western	2%	Özgencil *et al* 2021
Central Asia (incl Iran, western Siberia, and Xinjiang)	230–418	Western	1%	Table 1 of this article
East Asia (including eastern Siberia)	1300–2200	Eastern	4–7%	Kessler *et al* 2021
Global Total	29 060–32 449	Both	100%	

*Population for Ukraine inclusive of Crimea was given as 150–200 nesting females in 2009 (Andryushchenko 2009). *Fide* Y Andryushchenko currently 3–5 females nest in the south of Kherson oblast'. Population size in Mykolaiv and Zaporizhzhia oblast's, where the species was noted as nesting in 2009, is currently unknown. Beskaravainyi (2015) gives the breeding population in Crimea alone as 100 breeding females. If the population in both Crimea and mainland Ukraine remained stable since 2009, this would imply 50–100 breeding females currently in mainland Ukraine. Using a ratio of 2 females per 1 male provides an estimate of 75–150 for mainland Ukraine.

**Calculated from 100 breeding females, using a ratio of 2 females per 1 male.

Overall population estimate

Which seasonal counts are more reliable for the purposes of estimating a total population size for the Great Bustard in Central Asia? Authors reported the quality of their estimates of breeding, migration, and wintering populations roughly equally, and of moderate quality, with averages of 2.3 (migration) to 2.5 (breeding season) on a scale of 1 to 5. Thus, the population of Western Great Bustards in Asia may be as low as 230 individuals (the lower range of the estimate of the breeding population) or as high as 500 (the highest estimate given for an overwintering Great Bustard population). However, even the highest estimate for this population is a cause for concern, given the observed extent of decline in this region. These remaining Great Bustards are splintered into small and discrete breeding populations scattered across a west–east distance of approximately 3000 km, raising concerns about genetic connectivity and lek persistence.

THREATS

Poaching is described as a critical threat to Great Bustards in all regions of Central Asia, with the exception of Iran and Xinjiang, China. Larger wintering flocks of this species are more noticeable, and their destruction by poachers can deal a fatal blow to the

small breeding populations from which these birds originate. Habitat conversion and incompatible agricultural practices are the second-most frequently mentioned threat in this collection of articles. Clutches and broods are destroyed by agricultural machinery, irrigation and livestock trampling, and food resources vital for rapid chick growth are limited by pesticide use. The role of predators in reducing Great Bustard populations, particularly free-ranging domestic dogs, is highlighted in approximately half of the papers presented in this volume. The cumulative impact of these threats is to increase adult mortality while further reducing the naturally low reproductive rate of this species.

CONSERVATION OUTLOOK AND PRIORITIES

A sum of the most recent data available provides a global estimate of roughly 29 000 to 32 500 Great Bustards (Table 3), which is approximately 40% lower than the last global estimate, made in 2014 (Alonso 2014). The range of the Great Bustard historically stretched from Portugal to Primor'e, Russia. Although Central Asia occupies 30% of this longitudinal distance, the number of Great Bustards observed in the region now represents only 1% of the global population of the species (Table 3). In comparative perspective, this wider Central Asia population is now calculated to be approximately five times smaller than that in Central Europe, despite the much larger extent of suitable habitat in Central Asia (Scholtz & Twidwell 2022).

The number of sites used by the Western Great Bustard in each subregion of Asia is generally low. Although this is an indicator of the severity of the species' decline, it provides an opportunity to focus conservation resources effectively at the regional level. Among regions, particular conservation attention should be placed on southern Kazakhstan, as it hosts populations of Great Bustards during all seasons, and most remaining migratory pathways for the Great Bustard in Central Asia pass through this region (Shakula *et al* 2022). Uzbekistan is also a region of high priority for action, as it hosts most of the Asian population of Western Great Bustards during colder winters (Kashkarov *et al* 2022).

While the entire Asian population of Western Great Bustards is at risk, certain populations emerge as particularly vulnerable to extinction. The disjunct population of Great Bustards in Iran makes only small seasonal movements and is spatially widely separated from other populations of Great Bustards, making recolonisation unlikely in the event of extirpation (Abdulkarimi 2022). Additionally, Great Bustards breeding in Orenburg, Russia, and western Kazakhstan are likely to represent the last populations utilizing the eastern Caspian flyway, which terminates in western Turkmenistan and north-eastern Iran (Kessler & Bidashko 2022). In previous centuries, this flyway was seemingly the most heavily travelled by Great Bustards in Asia (Kessler & Smith 2014), but few individuals are now observed. Should the breeding populations in Orenburg and western Kazakhstan be extirpated, re-establishing this migratory route may prove difficult, particularly as a genetic link is associated with the direction of migratory behaviour in bustards (Burnside *et al* 2020).

While specific conservation activities tailored to local circumstances are provided by the authors of each paper in this volume, it is clear that action must also be coordinated at the international level. For this reason, a *Concerted Action for Great Bustards in Asia* was proposed and unanimously approved by Parties to the Convention on Migratory Species (CMS) (Government of Mongolia *et al* 2017, Convention on Migratory Species 2020). In the context of CMS, a Concerted Action provides structure for international cooperation for the conservation of species, as well as a timeline for completion of agreed conservation actions. This has increased international communication about this species. However, financial resources for immediate conservation actions outlined in these proceedings

are urgently required to prevent further and perhaps irreparable declines in these populations, and the disappearance of a steppe icon from the historical heart of its range.

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The Great Bustard *Otis tarda tarda* is faced with extinction in Iran

RAHIM ABDULKARIMI

Summary: The Great Bustard *Otis tarda tarda* is a globally threatened species, classified as Critically Endangered in Iran. Its population size has experienced a sharp decline in the last few decades, mainly due to habitat loss associated with agricultural intensification and changes. Recent surveys from 2016–2017 showed that its breeding and wintering populations are strictly confined to some pastures and agricultural lands in Boukan, north-western Iran. Areas supporting the remnant population include Sootav, Se Kanian, Qazlian and Yengija-Albolaq plains, with a rough estimate of 33–35 individuals in spring and 29–33 in winter. Observations over multiple years suggest a total population of around 35–40 individuals in Iran. Urgent conservation measures are warranted by environmental authorities, especially protecting breeding sites, to help prevent the extinction of the Great Bustard in Iran in the coming decades.

INTRODUCTION

The Great Bustard *Otis tarda* is distributed in grassland habitat from the Iberian Peninsula through eastern Asia, but most populations are declining so that today the species is considered Vulnerable by IUCN (BirdLife International 2021). A decade ago the world population was estimated to be around 44 100–57 000 individuals (Alonso & Palacín 2010). Although the Great Bustard was declared a protected species by the Department of the Environment of Iran (DoE 1967), its current status in the country is Critically Endangered (Barati *et al* 2015) and both wintering and breeding populations have sharply declined in number as a result of habitat changes and hunting (Amini Tareh 2000, Barati & Amerifar 2008).

In the past, Iran hosted migratory populations of the subspecies *O. t. tarda* that arrived to overwinter in the north-east of the country, where Razdan & Mansoori (1989) reported 124 birds in 1976. However, Amini Tareh (2000) found no birds in these areas in 1990–1994, and in the last two decades the species was not observed there despite regular monitoring. The only recorded sighting is of a wandering male in Miankaleh wildlife refuge, Mazandaran province, north-central Iran, on 21 January 2008 (Rabiee & Moghaddas 2008).

Breeding populations were previously distributed in north-west and western Iran, in the provinces of West and East Azerbaijan, Kurdistan, Kermanshah and Hamedan (Figure 1). Scott (1971) estimated that 40–100 breeding females remained in the west of the country, and Cornwallis (1983) judged that 40 females remained in 1977. In the mid-1980s this population was estimated at 100–200 individuals (Collar 1985). Based on regular surveys in 1990–1994, Amini Tareh (2000) estimated 60 breeding females and 200–300 wintering individuals in north-western Iran. However, the most recent published data indicated a sharp decline from the 1990s, with only 43–48 individuals remaining in Iran in 2011 (Barati *et al* 2015).

CURRENT RANGE AND POPULATION SIZE

According to our current surveys, data recorded by DoE and also Barati *et al* (2015), Great Bustards have now disappeared from most areas of Iran (Table 1). For example, the most recent observation of Great Bustard in Telesm (Kermanshah province) dates to 1974. In the Qareh Gheshlagh non-hunting area, the major site for Great Bustards in East Azerbaijan province, numbers decreased from 60 birds in 1990 to zero in 2008. In Asad Abad non-hunting area (Hamedan province), the birds counted in 1995 had disappeared by 2004. In recent decades Kurdistan province has been considered one of the most important areas for breeding and wintering populations of Great Bustard, but no records have been confirmed since 2005. Over the same period the species has also disappeared from several traditional areas in West Azerbaijan province.

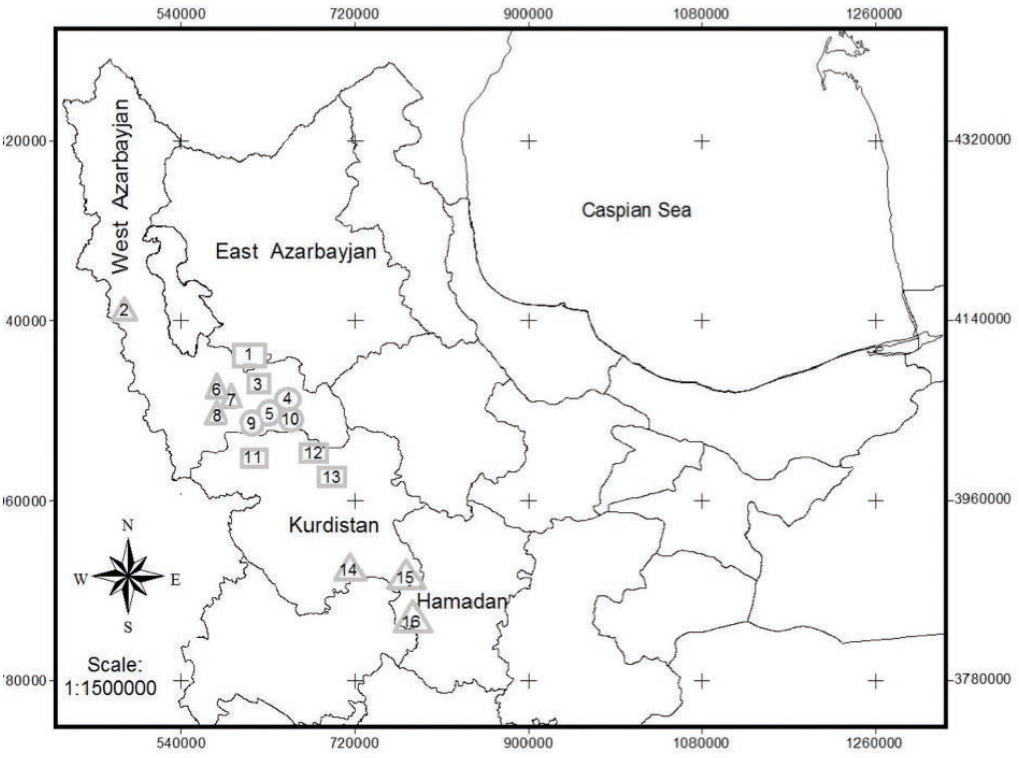

Figure 1. Map showing current and previous areas occupied by Great Bustards in north-west Iran. 1: Qareh Gheshlagh, 2: Nazloo, 3: Azad and Bajvand, 4: Se Kanian, 5: Sootav, 6: Hassan Abad, 7: Misalm, 8: Kani Sib, 9: Qazlian, 10: Yengija-Albolaq, 11: Yazibolaghi, 12: Zarrineh Obatou, 13: Gaveshleh, 14: Dashte-Ghaz, 15: Chhar-doli Qorveh, 16: Asad Abad. Map originally published in Barati *et al* (2015); presented here with one minor correction.

△ Areas where Great Bustards are assumed to be extinct (not observed for at least 10 years)

□ Areas with unknown status (not observed for more than 10 years)

○ Areas with extant populations (Boukan region)

According to the most recent data from 2016–2017, records in Iran are now restricted to the plains of Sootav, Yengija-Albolaq, Qazlian and Se Kanian, all located around Boukan city, in the Mokryan region in southern West Azerbaijan province, in the north-west of the country (Table 2). The climate is characterised by dry, hot summers and cold winters with moderate rainfall. According to the Meteorology Organisation of Iran, mean annual rainfall and temperature are 370.2 ml and 13.2 C respectively, with most rainfall occurring from November to May. The main crop in these areas is Wheat *Triticum aestivum*, but Chickpeas *Cicer arietinum*, Barley *Hordeum vulgare*, Lentils *Lens culinaris*, Alfalfa *Medicago sativa*, Corn *Zea mays* and Sunflower *Helianthus annuus* are grown as well.

The Sootav plain (Figure 1, site 5, 36° 33–37′ N, 46° 08–12′ E) is known as a wildlife refuge and is located 4 km north-west of Boukan city. The plain covers an area of about 44–50 km^2 and is 1410 m asl, adjacent to Shekhlar, Hammamiyan, Gerdi Ghabran, Dongoz and Akhtatar villages (Abdulkarimi *et al* 2010b). Breeding behaviour and nesting were confirmed here from March to June (Abdulkarimi *et al* 2010a). Traditional farming is widespread on the Sootav plain and the fact that it is a remote area with a low human population density makes it favourable as a breeding ground for Great Bustards. Human

Table 1. Last historical records and recent surveys of Great Bustards in western and north-west Iran

Area	Location	Last historical record[1]	2009-2011[2]	Current census (2016-2017)[3]
West Azerbaijan				
Azad & Bajvand	20 km NE of Mohabad	3 birds in June 2003, 2 birds in July 2007[7]	0	0
Hassan Abad	25 km NE of Mohabad	not confirmed since late 1990s[4]	0	0
Misalm	26 km W of Boukan	not confirmed since late 1990s[4]	0	0
Kani Sib	35 km S of Mohabad	2 birds in June 2003[7]	0	0
Nazloo	15 km NW of Urmia	7 birds in winter 1994[5]	0	0
East Azerbaijan				
Qareh Gheshlagh	15 km SW of Bonab	25 birds in Nov-Dec 2007[7]	0	0
Kurdistan				
Chehar doli-Qorveh	15 km SE of Qorveh	not confirmed since 1995[6]	0	0
Zarrineh Obatou	15 km N of Divandareh	4 birds in 2004 and 2005[6]	0	0
Gaveshleh	17 km NE of Divandareh	8 birds in 2002, 4 birds in 2005[6]	0	0
Yazibolaghi	30 km E of Saqqez	3 birds in June 2002, 2 birds in September 2005[6]	0	0
Dashte-Ghaz	SW of Dehgolan	not confirmed since late 1995[6]	0	0
Hamedan				
Asad Abad	S of Asad Abad	1 bird in 2003[7]	0	0
Kermanshah				
Telesm	70 km W & SW of Kermanshah	2 birds in August 1974[7]		

[1]Last records of Great Bustards in areas of Iran where the species is thought to be extinct, or nearly extinct at present; [2] Barati *et al* 2015; [3]Data from the authors' recent census, reports from DoE and local people; [4]reported by local people; [5]Amini Tareh (2000); [6]Barati & Amerifar (2008); [7]Department of Environment of Iran.

disturbance is very low in Sootav compared to other locations, and dry cereal farmlands are common.

Yengija-Albolaq plain (Figure 1, site 10, 36° 26–28′ N, 46° 13–17′ E) is located in E and SE Boukan region between Yengija, Albolaq and Kahriza villages. The area is about 22 km^2 and has a mean altitude of 1465 m asl (Abdulkarimi *et al* 2010b). Great Bustards are present on the plain in late summer and throughout the autumn, arriving from Sootav after breeding when juveniles are able to fly (Abdulkarimi & Ahmadi Sani 2012). Birds use the alfalfa and clover farms as a food source in autumn, but a decrease in human presence after the end of agricultural activities in autumn could also explain the higher bustard density during this time (Abdulkarimi *et al* 2010b). Unfortunately urban expansion, road construction and human population have increased in recent years, resulting in habitat loss.

Qazlian plain (Figure 1, site 9, 36° 28–30′ N, 46° 08–10′ E) is located 4 km south-west of Boukan city and covers an area of about 10 km^2, with a mean altitude of 1330 m asl. It is surrounded by Jambokha, Qazlian and Bogabasi villages, Bardeh Zard mountain and

Table 2. Breeding and wintering populations of Great Bustards on plains in Boukan, Mokryan region, West Azerbaijan province, Iran (2016-2017).

Season	Number of birds & Date of estimate	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding			
Sootav	27 (8 ♂♂, 19 ♀♀), April 2017		5
Se Kanian	4 (2 ♂♂, 2 ♀♀), April 2017		5
Qazlian (Bogabasi village)	4 (unknown), March 2017		3
Yengija-Albolaq	2 ♀♀, April 2017		3
Total breeding birds	33–35	4	4
Wintering			
Qazlian	29, February 2017		5
Yengija-Albolaq	18, November 2016		4
Total wintering population	29–33	2	4
Estimated total	35–40 birds		

Simina river. Qazlian plain seems to be less important for bustard breeding now, but according to previous censuses this area hosted flocks during the post-breeding season. Earlier, when farming was traditional, Great Bustards were present in the spring but since the mechanisation of agriculture, introduction of modern irrigation and consequently rising human presence, Qazlian plain has lost its potential as a breeding site. Bustards now use this area from mid-autumn to early March. They feed on the leaves and roots of cultivated plants such as Canola *Brassica* spp. and Alfalfa. Observations suggest that Qazlian holds a significant population of Great Bustards in winter, probably owing to the lower altitude of this plain and accessible food sources (Abdulkarimi *et al* 2010a).

Se Kanian plain (Figure 1, site 4, 36° 39–45′ N, 46° 1–17′ E) is a non-hunting area located 24 km north of Boukan, covering an area of about 45 km^2, with a mean altitude of 1430 m asl. The plain is surrounded by Se Kanian, Qolar and Qormish villages. Although the area has some favorable characteristics such as vast expanses of dry lands, traditional agriculture, and low human population density, it is used only by a small number of Great Bustards as a breeding site. Hunting, grazing sheep and weak law enforcement by the Department of Environment could be resulting in disturbance to Great Bustards and habitat degradation there (Abdulkarimi & Ahmadi Sani 2012).

The breeding population of the Great Bustard in Boukan region has declined in recent decades (Abdulkarimi *et al* 2010a). In our most recent survey, conducted in April 2017, we observed only 4 adult bustards (2 males, 2 females) in Se Kanian and 27 adult breeding bustards (8 males, 19 females) in Sootav. Reports by farmers in April 2017 indicate that 2 adult bustards may exist at Yengija-Albolaq and 4 adult bustards at Bogabasi village (near Qazlian).

Previous studies indicated that breeding and wintering areas in Boukan overlap considerably (Abdulkarimi *et al* 2010b, Abdulkarimi & Ahmadi Sani 2012, Barati *et al* 2015). Current studies reveal that they are the same and that Great Bustards do not immigrate from other areas in winter (pers obs). The maximum number of birds observed during winter censuses was 18 at Yengija-Albolaq in November 2016, and 29 at Qazlian in February 2017.

During my regular monitoring surveys, when Great Bustards were observed in Sootav (for example in spring), the species was not recorded in other areas. Conversely, when

flocks (male and females) were observed in Qazlian in winter, Great Bustards were not found elsewhere. The flocks observed at Sootav may therefore have been the same birds present at Qazlian. The short distances between these sites (*c*12 km) make movements between them highly likely.

THREATS AND CONSERVATION RECOMMENDATIONS

Changes in the structure of farming practices have been shown to be the most important factor affecting the quality of breeding areas of the Great Bustard in Iran (Barati & Amerifar 2008, Abdulkarimi *et al* 2010b). It seems that advanced irrigated agroecosystems are the main cause of Great Bustard population loss, especially during the breeding season. Destruction of grasslands or pasture and their transformation to cultivated areas, industrial growth, and increasing human numbers are also among the main reasons for the rapid declines in Great Bustard populations in Iran. Other factors during the breeding season that may reduce habitat quality include human disturbance during agricultural activities, grazing sheep, hunting (targeting a variety of species), and the presence of domestic dogs, wolves, foxes and jackals.

Despite conservation measures implemented by the DoE (Boukan office), the population of Great Bustards at Sootav, Se Kanian and other sites has declined or, at best, not increased compared to the previous decade. This raises questions about the effectiveness of these conservation measures.

In conclusion Great Bustards currently only remain in the Boukan region. The maximum number of Great Bustards in 2017 is estimated to have been 35–40 individual birds. This represents a decline compared to 2011 numbers (Barati *et al* 2015). Based on these counts, the species is declining rapidly and is considered critically endangered. Urgent conservation measures are now needed by environmental authorities and breeding sites should be protected effectively, otherwise the species faces extinction in Iran in coming decades.

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The Great Bustard *Otis tarda tarda* is Critically Endangered in Turkmenistan

ELDAR ANVEROVICH RUSTAMOV

Summary: In Turkmenistan the Great Bustard *Otis tarda tarda* is a poorly studied passage migrant and wintering species, occurring widely but patchily in spring in March–April, autumn in October–November and winter in December–March, with records mainly in the north-west and south-west of the country. The species prefers (at any time of the year) open habitats—solid soil (clay, more rarely crushed stony or loessic) deserts with sagebrush–saltwort and small brush vegetation assemblages; sometimes it occurs at the edge of oases. The main threats are illegal hunting; desert development (gas exploration, animal grazing, expansion of transportation network), which causes disturbance to birds; and the irrigation and ploughing of wild lands. Hunting Great Bustards has been prohibited since 1958, and the species is included in the *Turkmenistan Red Data Book* (1985, 1999, 2011) as 'very rare, under threat of extinction', but illegal hunting continues. A conservation management plan is needed that will reduce illegal hunting, increase awareness of the species' needs, and strengthen the penalties for poaching; develop a research programme in strictly protected areas and Important Bird Areas but also outside them, studying winter distribution in and around cultivated landscapes; and draw on the experience of breeding birds at a laboratory in the Kopetdag foothills.

HISTORICAL AND CURRENT STATUS

The Great Bustard *Otis tarda tarda* is poorly studied in Turkmenistan, where it is a passage migrant and wintering species. Spring migration occurs in March–April, autumn migration in October–November, and overwintering from December to March. The species does not nest in Turkmenistan. There is only one case of possible nesting recorded in 1884 (Zarudnyi 1896). There have been no targeted studies of this species; all existing data (15 sources) were gathered incidentally. It was distributed widely and could have potentially been recorded in any part of the plain that covers about 80% of Turkmenistan, especially during the migratory period. However, historical winter observations were primarily in two main regions: (1) clay territories in the Kopetdag foothills (then free of human influence) and (2) in the plains of extreme south-western Turkmenistan. The species was occasionally recorded at other places in the country.

The Great Bustard was common, even numerous, during winter in the lower Atrek river in south-western Turkmenistan. Concentrations of birds were in the tens, and once up to 200 individuals, in December in the years 1935–1939 (Isakov & Vorobyev 1940), 1947 (Dement'ev & Turov 1951) and 1949 (Ataev *et al* 1978).

There are no numerical data available concerning Great Bustards wintering in the northern foothills of the central Kopetdag in the 1940s, but the number 'dramatically decreased in comparison with 1925–1926' (Dement'ev 1952), and especially in comparison with earlier periods, when flocks of hundreds of individuals were recorded on the outskirts of Ashgabat (Zarudnyi 1903).

From 1960–1980 the number of Great Bustards in the foothills of the Kopetdag declined dramatically (Saparmuradov 2003). Only small groups of birds (several individuals or even single birds) were observed (Ataev *et al* 1978, Mischenko & Scherbak 1980, Saparmuradov & Eminov 1993). However, as seen in Table 1, an increase in the number of records, particularly in very recent years, could be construed as evidence of an increase in the population, not only in the Kopetdag foothills, but in other areas of Turkmenistan as well, apparently owing to increased levels of cereal production. Even so, there are few recent sightings: 34 records in the past quarter of a century (Table 1 & Figure 1). The number of Great Bustards overwintering in the country is estimated at 25–45 (Table 2).

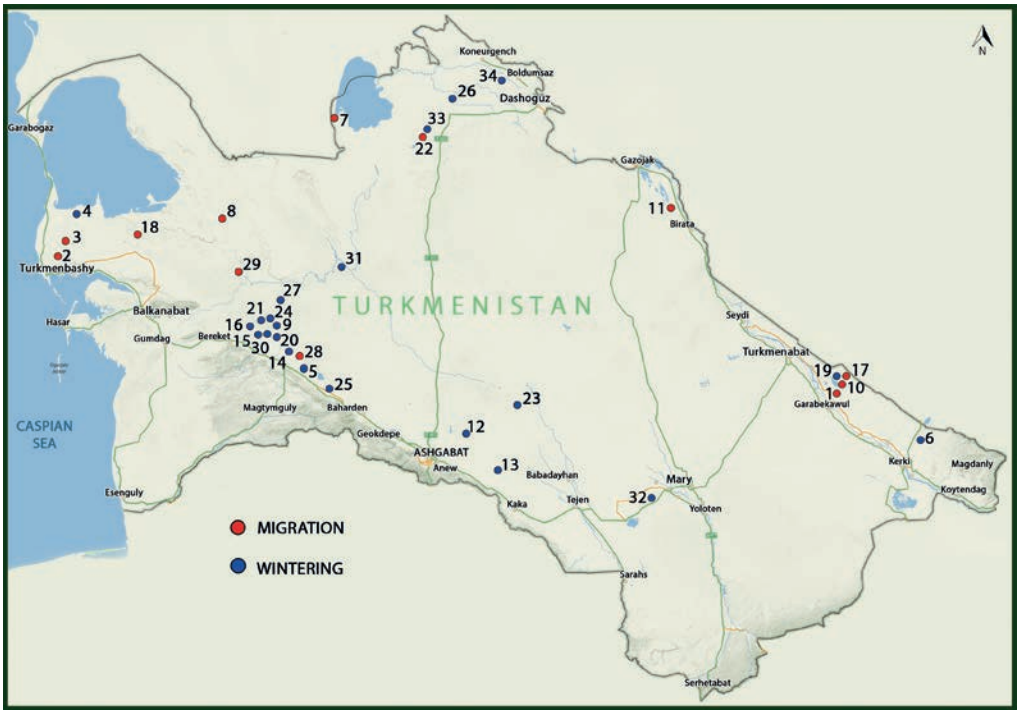

Figure 1. Map of observations of the Great Bustard in Turkmenistan over the past 22 years (see Table 1).

DISTRIBUTION, PROTECTED AREAS AND HABITAT

The Great Bustard is widely distributed across the country, but the major regions where the species is observed on migration are north-western and eastern Turkmenistan. Wintering areas are spread widely in the Kopetdag foothills (specifically in areas with cereal fields), with notably more in the northern foothills, which have well-developed agricultural lands, than in the south-western foothills, which consist of clay lowlands (Table 2).

Seven Important Bird Areas (IBAs) and three protected areas include habitat suitable for the Great Bustard in Turkmenistan. Particularly important is Chokrak-Tutly IBA (147 962 ha in area; Rustamov *et al* 2009), which encompasses a wide, 135-km long, west–east band along the Karakumdari river in the northern foothills of the western Kopetdag (Hojamuradov & Rustamov 2020). This is where most recent observations of Great Bustards have occurred (records 5, 9, 14, 15, 16, 20, 21, 24, 25, 27, 28, 30 in Table 1 and Figure 1).

Throughout the annual cycle the species prefers open habitats, specifically solid soil (clay, lesser crushed stony or loessic) deserts with sagebrush–saltwort and small brush vegetation associations; and it sometimes occurs at oases. It avoids blown sands, and sands with tree and bush vegetation, as well as large anthropogenic areas (with the exception of agriculture) and wetlands.

THREATS

Poaching

Hunting of Great Bustards has been prohibited by law since 1958 (Rustamov *et al* in press). In 1975, the species was included in the *Red Book of Turkmenistan* as a 'very rare endangered species' (Rustamov 1985), assessed as category I (CR – Critically Endangered) in the *Red Book of Turkmenistan* in 1999 (Saparmuradov 1999) and included in the third edition with the same category in 2011 (Saparmuradov 2011). It is also included in the fourth edition

Table 1. Observations of the Great Bustard in Turkmenistan over the past 22 years.

Record no. (see Figure 1)	Date	Coordinates	Number of birds	Location	Observer
1	5 April 1998	38°39'21"N 64°13'20"E	1 (male)	Compacted sand between channels of the Mehejan and Amudar'ya rivers, Lebap province	V Balakleets
2	13 May 2000	40°09'30.83"N 52°58'27.52"E	1	Schistose-loamy lowlands, 17 km north of Turkmenbashi, Balkan province	A Scherbina
3	13 May 2000	40°20'57"N 53°05'48"E	1	Schistose-loamy lowlands, 42 km north of Turkmenbashi, Balkan province	
4	12 December 2005	40°40'42"N 53°17'25"E	8	Dry plain north of Ilaman well, Balkan province	
5	November 2006	38°52'24"N 56°37'42"E	6	Loamy regions on piedmont lowlands north-east of Goch train station, Balkan province	A Potaeva
6	14 January 2007	38°07'04"N 65°24'51"E	1 (female)	Loamy lowlands on border between a sandy area and winter fields, 9 km west of Tallymerjen train station, Lebap province	E Rustamov
7	5-10 March 2007	41°43'25"N 57°83'50"E	1 (male)	Loamy lowlands, near Edykhovuz well, Dashoguz province	A Amanov
8	10 September 2013	40°35'37"N 55°25'05"E	1	Yaglydag ridge, loamy region at altitude of Itguirugy, 5 km south-west of Kyzylkaya settlement, Balkan province	A Scherbina
9	Early December 2014	39°20'86"N 56°06'31"E	49	Piedmont lowlands, loamy lowlands, 30 km north-west of Serdar, Balkan province	M Aiyriev
10	15 March 2015	38°45'23"N 64°18'10"E	1	Plateau at eastern shore of Soltandag lake, Lebap province	V Balakleets
11	17 March 2015	40°50'54"N 61°50'68"E	7	Plateau at north-eastern shore of Soltansanjar lake. Koshbulak district, Lebap province	K Davudov

12	January 2016	38°13'38"N 58°52'38"E	2	Abandoned and winter fields north of Chorly settlement, Akhal province	A Potaeva
13	January 2016	37°45'57"N 59°21'57"E	1	Abandoned and winter fields, 18 km north of Soltandesht settlement, Akhal province	
14	November 2016	39°05'20"N 56°17'51"E	8	Loamy piedmont lowlands, 11 km north of Serdar, Balkan province	
15	January 2017	39°16'41"N 55°55'05"E	30	Loamy piedmont lowlands, winter fields, 35 km east of Bereket, Balkan province	
16	January 2017	39°23'05"N 55°47'53"E	20 (in 3 flocks)	Loamy piedmont lowlands, winter fields, south of Gettin settlement, Balkan province	Kh Khojamuradov
17	17 March 2017	38°51'31"N 64°21'42"E	2	Plateau by a cliff of the Zennibaba depression, Lebap province	S Taganov
18	8 April 2017	40°26'01"N 54°12'21"E	Foot-prints	Schistose-loamy lowlands with dry plains, 13 km north of Koshoba village, Balkan province	E Rustamov
19	10 November 2017	38°50'23"N 64°13'99"E	2	Plateau to east of Soltandag lake, Lebap province	K Davudov
20	January 2018	39°14'39"N 56°09'37"E	7	Winter fields on shore of Karakmudarya, 15 km south of Ok village, Balkan province	Kh Khojamuradov
21	January 2018	39°24'18"N 55°55'08"E	40	Winter fields, 10 km north-east of Gettin settlement, in Chokrak district, Balkan province	A Potaeva
22	28 April 2018	41°29'39"N 58°19'44"E	Foot-prints	Clay area at base of southern part of Tarimkaya cliff, Dashoguz province	P Iankov & E Rustamov
23	Early November 2018	38°29'89"N 59°40'82"E	4	Sand-loamy lowlands, 40 km south of Mollakurban lakes, near Kyrkgui well, Akhal province	V Laptev
24	End November 2018	39°24'34"N 55°59'87"E	6-9	Loamy piedmont lowlands, winter wheat fields, 4 km east of Bereket, Balkan province	Kh Khojamuradov
25	End December 2018	38°43'51"N 56°56'09"E	2	Loamy piedmont lowlands, winter fields, 10 km east of Bamy settlement, Balkan province	

26	6 January 2019	41°57'37"N 58°42'51"E	3	Wheat fields, 20 km north of Rukhybelent settlement, Dashoguz province	A Amanov
27	5 February 2019	39°35'59"N 56°06'14"E	16	Piedmont lowlands, on border between a sandy area and winter fields, Khojaguima district, 10 km south-west of Ok settlement, Balkan province	Kh Khojamuradov
28	3 March 2019	39°04'27"N 56°22'57"E	9	Piedmont loamy lowlands, 3 km north-west of Serdar town, Balkan province	
29	10 March 2019	40°02'06"N 55°39'52"E	2	Solonchak-loamy desert, 20 km north of Dikche, Balkan province	
30	22 December 2019	39°17'56"N 56°01'00"E	6	Piedmont lowlands, wheat fields, 25 km north of Iskander train station, Balkan province	
31	15 January 2020	40°05'53"N 57°08'10"E	7 (4 males, 3 females)	Schistose-loamy lowlands around Ak-Yaila well, Balkan province	
32	25-26 January 2020	37°29'06"N 61°35'54"E	1	Field in level sands, 12 km south of Shatlyk settlement, Mary province	N Mallyev
33	25 November 2020	41°32'17"N 58°21'44."E	7	On clay area at base of northern part of Tarimkaya cliff, Dashoguz province	A Amanov
34	16 December 2020	42°07'35"N 59°28'56"E	2	Winter fields, 14 km west of Boldumsaz, Dashoguz province	

(Rustamov & Khojamuradov in press). Despite this, illegal hunting continues. Poachers usually kill bustards for their own use as food as well as for black market sale. They use motorcycles and cars to search for and pursue the birds, which have nowhere to hide in the open.

Development of desert lands

In Turkmenistan, especially in the last 25–30 years, large-scale development of deserts has been carried out: gas exploration and production, expansion of the transport and electricity network, construction of new settlements, expansion of pastures and increase in livestock (sheep, cows, camels). All this has placed increased anthropogenic pressure on desert ecosystems, degradation of wild bird habitats and impoverishment of their food supply, including for bustards; herders' dogs represent an addition to the predation pressure that (particularly breeding) birds experience.

Reclamation and cultivation of virgin lands

Large-scale irrigation of the Karakum and other deserts in Turkmenistan causes salinisation and degradation of the habitats of the Great Bustard. Although the cultivation

Table 2. Current population estimate for Great Bustards in Turkmenistan. These numbers are an expert evaluation of the number of individual birds appearing in the region in each season.

Season	Number of Great Bustards in country	Number of Great Bustards in sub-region	Description of region	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
On migration	Insufficient data	Up to 50 or more	Piedmont loess and sandy-loamy lowlands of the Kopetdag mountains, with agricultural lands	4
		Up to 10	Valley of the Amudar'ya river and agricultural lands of Tallymerjen (in Dovletli district)	3
		Up to 10	Schistose-clay plains of northern Turkmenistan	4
		Up to 5	Schistose-clay plains of north-west Turkmenistan	3
		unknown	Clay valleys of south-west Turkmenistan	2
Wintering	25-45	Up to 50	Piedmont loess and sandy-loamy lowlands of the Kopetdag mountains, with agricultural lands	5
		unknown	Clay plains of south-western Turkmenistan	2
		Occasional single birds	Right shore of Amudar'ya river in foothills of Gaurdak Mountains and agricultural lands of Tallymerjen (in Dovletli district)	5

of grain and fodder crops produces new areas for feeding bustards and other wintering birds (Black-bellied Sandgrouse *Pterocles orientalis*, Asian Houbara *Chlamydotis macqueenii*, Little Bustard *Tetrax tetrax*), it also attracts wintering bustards to the periphery of oases. This, in turn, makes the birds more accessible for illegal hunting.

PRIORITY CONSERVATION ACTIONS

A management plan is needed for the short- and long-term protection of bustards in Turkmenistan. This should not be a task only for scientists.

Most of all, it is important to provide for anti-poaching measures, which should include constant large-scale campaigning and publicity for the protection of the species, aimed at raising people's awareness of all issues related to the conservation of bustards. The law against poaching all bustard species needs to be strengthened with higher penalties, widely publicised and fully enforced, producing a sharp drop in illegal hunting and trade in harvested birds. A special role should be given to cooperation between the state bodies of the Biodiversity Control Inspectorate and the public, including the Society of Hunters and Fishermen and the Nature Protection Society of Turkmenistan.

A programme of research is needed on the Great Bustard's numbers, range and agricultural habitat use, both inside and outside protected areas, using GIS and other

technologies. Studies of crop rotation and production can help manage birds wintering on the fringes of cultivated land.

In the 1980s, on the southern edge of the Karakum desert (37°57′16″N 58°34′22″E) east of Ashgabat, a laboratory was briefly established at the Department of Nature Protection of the Turkmen Agricultural Institute to study the breeding of rare birds including the Chukar Partridge *Alectoris chukar* and Caspian Snowcock *Tetraogallus caspius*, and the experience gained there (Sopyev *et al* 1990) should be used in the development of measures to restore populations of bustards as well as various galliforms in Turkmenistan.

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The historical and current status of the Great Bustard *Otis tarda tarda* in Uzbekistan, a key winter refuge

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Summary: Before the middle of the 20th century, the Great Bustard *Otis tarda tarda* was largely a passage migrant in Uzbekistan, partially overwintering and rarely breeding. Currently, most birds found in Uzbekistan are winterers. The development of virgin lands in the mid-20th century led to a decline in the species' numbers, but due to the post-Soviet agricultural crisis in the 1990s its habitats and population recovered. We give an exhaustive list of recorded encounters and analyse the species' distribution in two historical periods – from 1878 to 1967 and from 1990 to 2017 (there were no records in between). Before the mid-20th century its key habitats were three extensive areas: the level part of the Chirchik–Angren interfluve; piedmonts and intermontane depressions in the Nuratau and nearby mountain ranges; and the Zaravshan river valley with the adjacent Agalyk and Karnabchul steppe areas. The piedmonts of the Nuratau range and the Karnabchul steppe remain key habitats for the species, but the total area of suitable habitat has decreased 15-fold. Approximately 10 000–20 000 Great Bustards visited Uzbekistan annually before the mid-20th century. The contemporary population wintering in Uzbekistan is no more than 500 individuals in severe winters. Illegal hunting is now the main threat. An action plan is being developed in Uzbekistan to protect Great Bustards overwintering in the country.

INTRODUCTION

Targeted research on the Great Bustard *Otis tarda tarda* has not been conducted in Uzbekistan. The most comprehensive review of the species' population since the end of the 19th century through the mid-20th century was made by Meklenburtsev (1990). Kreitsberg-Mukhina (2003) published a review of the contemporary status of the Great Bustard in Uzbekistan, presenting interesting observations during the period 1990–2003. Review and analysis of the Great Bustard population in Central Asia, including Uzbekistan, during the 20th century was carried out by Kessler & Smith (2013), and Kessler (2016).

Until the middle of that century the Great Bustard was mainly observed on migration in Uzbekistan, but it also partially wintered and occasionally nested in the country (Table 1). However, extensive anthropogenic transformation of nesting and wintering places in Kazakhstan and Siberia resulted in the almost-total disappearance of the species from Uzbekistan by 1970, after which no observations of the species were recorded until 1990, with no evidence that observer coverage of the relevant areas was weaker at this time (it is possible that individual birds did visit Uzbekistan during this period, but we have found no reliable data). In 1983, the species was added to the *Red Data Book of the Uzbek SSR* with the status 'extinct as a nesting species, very rare on migration and wintering' (Sadykov 1983); with this designation hunting of the species became illegal. In all subsequent editions of the *Red Data Book of Uzbekistan* (Azimov 2003, 2006, 2009, 2019), the Great Bustard was assessed on the national level as 'Critically Endangered – 1(CR) – migratory European subspecies on the verge of complete extinction.' Nevertheless, since 2000 there is some evidence of a recovery.

Here we present a comprehensive list of known observations and an analysis of the species' distribution in Uzbekistan during two periods, 1878–1967 and 1990–2017. Threats are described and conservation measures for the species suggested.

Table 1. Great Bustard records in Uzbekistan in chronological order. Season of observation is denoted: + = nesting; * = migration; W = wintering. See also Figures 1 and 2.

No.	Date	Season	Key details	Source
1878–1967				
1	03.1878	*	Near Chinaz village (Chinaz district, Tashkent province): KE Russov was observing migrating birds	Pleske 1888
2	04.1878	*	Near Djam village (Djam district, Samarkand province) KE Russov was observing migrating birds	
3	03.1896	*	Golodnaya steppe (Syrdar'ya province) pairs flying, but not nesting	Loudon 1910
4	03.1903	*	Near Kermine (Karmana district, Navoi province)	
5	08.11.1908	*	Sardaba (*ie* middle course of Syrdar'ya river, modern-day Sardoba village in Akaltyn district, Syrdar'ya province): ♀ taken (shot) by NA Zarudnyi	Zoological Collection of National University of Uzbekistan
6	15.01.1909	W	Golodnaya steppe (Syrdar'ya province) 3♂♂ taken by NA Zarudnyi	
7	02.02.1909	W	Outskirts of Tashkent (Tashkent province) 1♂ taken by NA Zarudnyi	
8	21.02.1909	W	Djaman-batkak (a marsh in the lower Chirchik river, Chinaz district, Tashkent province): ♂ taken by NA Zarudnyi	
9	30.12.1912	W	Suburbs of Tashkent: 1♂ taken by NA Zarudnyi	
10	Winter 1912	W	Tamdy and Sukuty oasis (Tamdy and Suketty villages, Tamdy district, Navoi province): feathers in the possession of local falconers	Zarudnyi 1915
11	12.02.1912	W	Sardaba (Akaltyn district, Syrdar'ya province) 2♂♂ and 2♀♀ taken by NA Zarudnyi	Zoological Collection of National University of Uzbekistan
12	08.11.1914	*	Sardaba (Akaltyn district, Syrdar'ya province) 1♂ and 1♀ taken by NA Zarudnyi	
13	23.03–10.04.1927	*	Outskirts of Karauzak village (Karauzak district, Karakalpakstan republic): flying individuals, pairs, sometimes small flocks	Spangenberg & Feigin 1936
14	20.03.1928	*	Near Tashkent	Sataeva 1937
15	21.10.1929	*	Near Tashkent	Sataeva 1937
16	20.10.1937	*	Near Samarkand (Samarkand province): 1 bird taken by hunters	Bogdanov 1956
17	12.08.1938	+	Kashkadar'ya river valley, between Chirakchi and Shakhrisabz (Chirakchi district, Kashkadar'ya province): 1 pair	Meklenburtsev 1958
18	09.03.1939	*	Near Samarkand (Samarkand province)	Bogdanov 1956
19	Summer 1940	+	Between Yangibazar and Parkent villages (Parkent district, Tashkent province) on dry-farmed vineyards: 1 nesting pair	Bogdanov 1992
20	10 & 11.1944	*	Southern Ustyurt plateau and Amudar'ya delta (Kungrad district, Karakalpakstan republic): a small number	Kolesnikov 1953
21	21.04.1947	*	Agalyk steppe near Samarkand (Agalyk district, Samarkand province): 1 pair	Bogdanov 1956
22	26.05.1947	+	Agalyk steppe near Samarkand (Agalyk district, Samarkand province): 1 bird	Bogdanov 1956

23	Winter 1948	W	Steppe between Nuratau and Karakchatau mountain ranges (Gallyaaral district, Jizzakh province)	Bogdanov 1956
24	27.03.1948	*	Near Samarkand (Samarkand province)	Bogdanov 1956
25	20.10.1948	*	Near Samarkand (Samarkand province): 2–15 individuals	Bogdanov 1956
26	10.06.1953	+	South-western foothills of Nuratau range (Khatyrchi district, Navoi province): abandoned nest	Salikhbaev 1983
27	21.05.1953	+	South-western foothills of Nuratau range (Khatyrchi district, Navoi province): destroyed nest with 2 eggs in lucerne field	Salikhbaev 1983
28	Summer 1953	+	Middle reach of Syrdar'ya river, Dalverzin hunting farm (Bekobod district, Tashkent province): huntsman VS Lustin discovered adult bustards with not-yet-fledged young	Meklenburtsev 1990
29	10.1953	+	South-western foothills of Nuratau range (Khatyrchi district, Navoi province): a group of 2 adults and 3 juvenile birds	Salikhbaev 1983
30	10.10.1961	*	Between Boldyr railway station and Muzrabad village (Termez district, Surkhandar'ya province): flock of 12 birds	Salikhbaev & Ostapenko 1964
31	01.1962	W	Hills on right shore of Surkhandar'ya river (Surkhandar'ya province): several small flocks	Salikhbaev & Ostapenko 1964
32	16–17.03. 1967	W	Foothills of Nuratau range near Sintabsay (Forish district, Jizzakh province): 2 groups of 4 and 6 birds	Salikhbaev *et al* 1970
1990–2017				
1	10–12.1990	*	Cliff of Ustyurt plateau (Kungrad district, Karakalpakstan republic): groups of 5–7 individuals on autumn migration, and sometimes in December (reported by IM Joldasova)	Kreitsberg-Mukhina 2003
2	03.03.1991	*	Karshynskaya steppe, near 'Djeiran' ecocentre (Karaulbazar district, Bukhara province) flock of 11 birds	Mukhina 2001
3	End of 1990s	W	Gulbakhor village (Termez district, Surkhandar'ya province) some observations of wintering birds	Kreitsberg-Mukhina 2003
4	12.1999	W	Eastern Kyzylkum desert near Aydar lake (Forish district, Jizzakh province): over several days *c*200 bustards appeared after cold snap in groups of 10–15. Practically all birds were killed by poachers (reported by AS Nuridjanov)	Kreitsberg-Mukhina 2003
5	12.2001	W	Surroundings of Pistalitau mountains (Forish district, Jizzakh province): individual bustards were hiding in small valleys (report from Aydar-arnasay Wildlife Inspectorate)	Kreitsberg-Mukhina 2003
6	Winter 2006	W	Middle reach of Chirchik river, Tashaul village (Urtachirchik district, Tashkent province): 1 adult	DA & AS Nuridjanov, verbal report
7	04.01.2007	W	Zaravshan nature reserve (Jambay district, Samarkand province): 2 individuals	Marmazinskaya 2011
8	01.2008	W	Zaravshan nature reserve buffer zone (Jambay district, Samarkand province): 15 birds in fields near Mugal village, moved into the nature reserve over two days	Marmazinskaya 2011
9	28.02.2008	W	Zaravshan nature reserve (Jambay district, Samarkand province): 7 individuals	Marmazinskaya 2011

10	01.2008	W	Keles river valley, near Keles village (Zangiota district, Tashkent province): individual birds were occasionally shot by hunters during pheasant hunting	AG Ten, questionnaire data
11	10.2010	W	Zaravshan river valley: regular mass wintering, exact location concealed by local hunters	AG Ten, questionnaire data
12	10-11.2009	*	Karnabchul steppe, Sakhoba village (Nurabad district, Samarkand province): flock of 6 birds in flight, single birds occasionally shot by local beekeepers when goose hunting	AG Ten, questionnaire data
13	03.2013	*	Karnabchul steppe, Sakhoba village (Nurabad district, Samarkand province): 1 pair	Martin *et al* 2014
14	07.02.2015	W	Sandy-loam desert to the south-west of Aidar lake (Forish district, Jizzakh province): a group of 9 individuals (Plate 1)	A Khan, verbal report + photo
15	21.02.2015	W	Sandy-loam desert to the south-west of Aidar lake (Forish district, Jizzakh province): local shepherd saw 35–40 birds after a snowfall; 6 of them were shot by local hunter	A Khan, verbal report
16	03.2017	W	Sandy-loam desert to the south-west of Aidar lake (Forish district, Jizzakh province): local shepherd documented a jackal attack on a Great Bustard (Plate 2)	A Khan, verbal report + photo

METHODS

Our goal was to collect all past and present records of Great Bustards in Uzbekistan, and compare their spatial and temporal distribution. We gathered data from all known reliable sources, including specimens in natural history collections (*eg* Kashkarov 2009), published observations, and oral reports from reliable observers, and compiled them into a table. We used these data to prepare maps. We also reviewed comments by different authors on the causes of the changes in range and numbers.

RESULTS

In all we assembled 48 records of Great Bustard in Uzbekistan (Table 1) and mapped their distributions (Figures 1 and 2).

Until the middle of the 20th century, more than half of all Great Bustard observations in Uzbekistan occurred on spring and autumn migration (Table 1). Observations of wintering birds were rarer, but also regular. A few geographically scattered pairs were observed nesting. Three large territories represented key habitat for the Great Bustard—the plains between the Chirchik and Angren rivers outside of Tashkent; the foothill plains and intermontane depressions of the Nuratau mountains and nearby ridges; and the Zaravshan river valley and adjacent Agalyk and Karnabchul steppes (Figure 1). The area of these open, sometimes steppe-like, partially cultivated territories occupies approximately 28 000 km^2.

No published estimates exist for the Great Bustard population in Uzbekistan in the 19th and 20th centuries, but certain authors provided indirect data. Zarudnyi (1915) listed it as a common game species. Photos of hunting trophies from that time confirm fairly large numbers of the species in autumn and winter. Meklenburtsev (1936) wrote that 'according to the indications of local peoples, Great Bustards fly in large numbers near the Nuratau foothills in autumn.' The same author (Meklenburtsev 1990) also mentioned that 'at the beginning of the 20th century, several tens of bustards, in small groups as well as single individuals, regularly flew over the outskirts of Tashkent and above the city

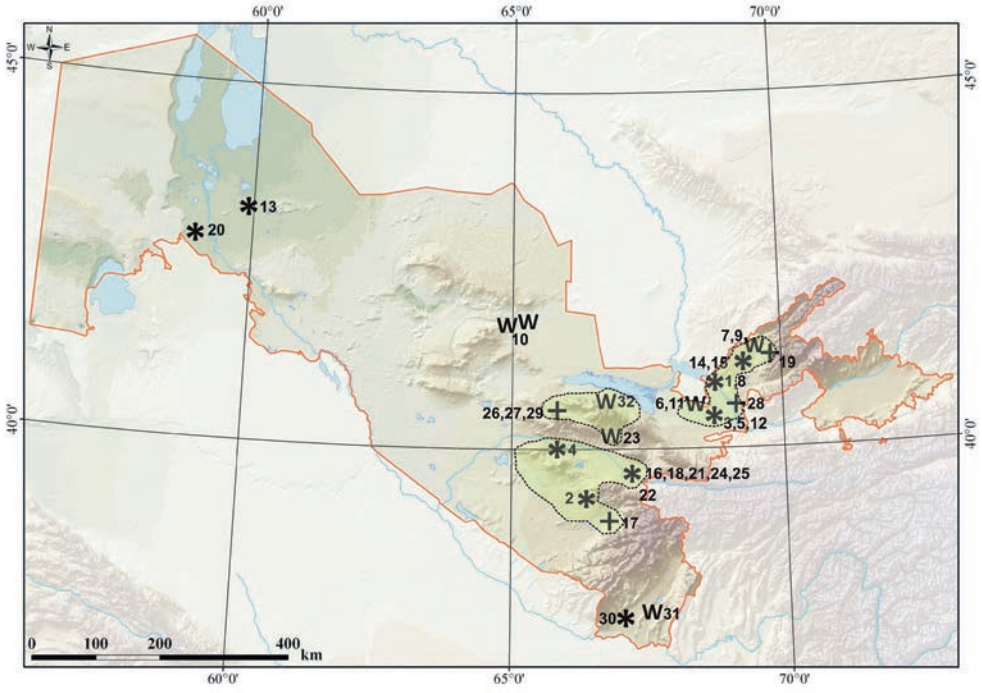

Figure 1. All records of Great Bustard in Uzbekistan from the period 1878–1967. Season of occurrence is indicated as: + = nesting; * = migration; W = wintering. Pale green areas delineated with dotted lines = approximate habitat boundaries of Great Bustard.

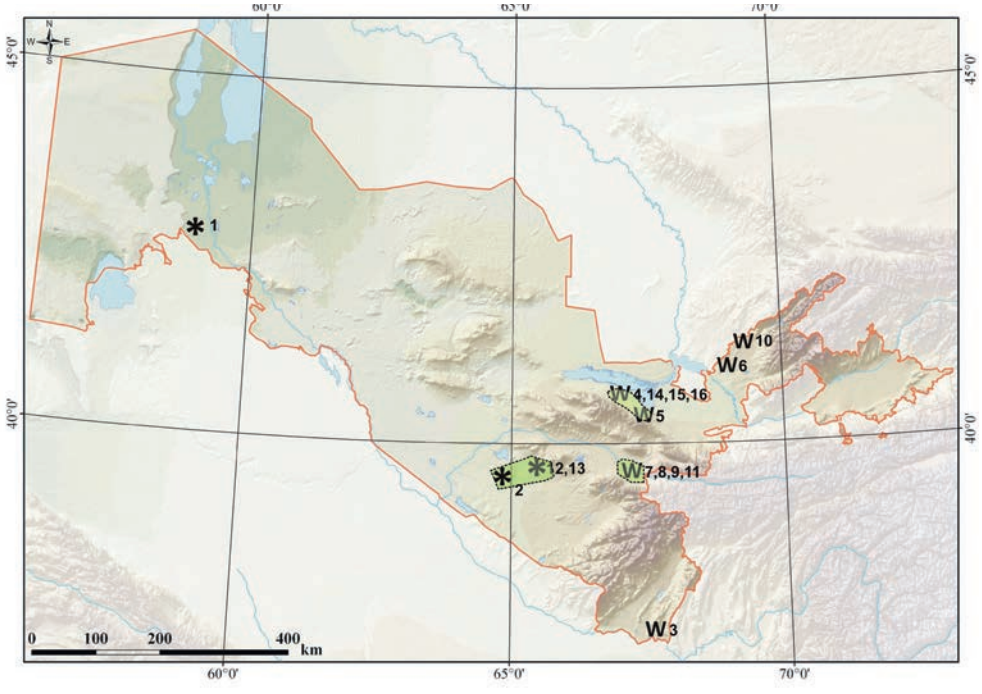

Figure 2. All records of Great Bustard in Uzbekistan from the period 1990–2017. Season of occurrence is indicated as: + = nesting; * = migration; W = wintering. Pale green areas delineated with dotted lines = approximate habitat boundaries of Great Bustard.

itself.' Taking all this into account, it is possible only to make a rough expert assessment of the number of Great Bustards: we estimate that around 10 000–20 000 individuals were visiting Uzbekistan each year until the middle of the last century.

Since 1990, the majority of observations have occurred during the winter, and only one-third during migration. The two key areas for Great Bustard wintering are the northern foothill plain of the Nuratau range and the Zaravshan nature reserve and adjacent foothill plains of the Zaravshan range (Figure 2), but during the migratory period Great Bustards are also occasionally seen on the Karnabchul steppe. The area of these three locations covers no more than 3 000 km^2. Thus, the Great Bustard has completely disappeared as a nesting species from Uzbekistan, but is regularly recorded during severe winters, when deep accumulations of snow on the usual wintering grounds in southern Kazakhstan drive the species southwards. The Great Bustard occurs less regularly as a passage migrant. Our assessment of the current number of wintering Great Bustards in Uzbekistan is also very approximate—in certain cases, 100 or more birds are present, with up to 500 in severe winters (Table 2).

The most critical period for the Great Bustard in Uzbekistan occurred during the 1970–1980s, which saw the peak of agricultural activity in the former Soviet Union and during which not a single bird was recorded in the country. The area of habitat suitable for the species decreased by more than 15 times (compare Figure 1 with Figure 2). All authors agree that the conversion of virgin lands to farmland from the mid-20th century resulted in catastrophic decreases in the species' population. By the end of 1990s, however, the post-Soviet crisis in agriculture had contributed to a partial recovery of these habitats, positively affecting the population of the Great Bustard. The main improvement in Great Bustard habitat came from the expansion of rainfed crops: shallow sprouts of wheat and grain residues in field plots attract these birds during the winter.

Although the main reason for the Great Bustard's disappearance was the transformation of steppe habitats to intensive agricultural activity, migration routes, stop-over sites and wintering areas have always been well known to local hunters. Meklenburtsev (1953) wrote that 'migration of the Great Bustard takes place at the height of around 40 m, this bird is incapable of hasty manoeuvres and is extremely vulnerable on migration. Active amateur and semi-commercial hunting takes place, and several tens of Great Bustards are sold at bazaars in Tashkent.' Unsportsmanlike and hence 'illegitimate' hunting was indicated as a serious threat by Salikhbaev & Ostapenko (1964): 'The number of wintering birds in lower parts of the Surkhandar'ya river has considerably decreased because of carloads of hunters chasing the birds.'

On recent evidence it is apparent that poaching remains the main threat for the species in Uzbekistan. According to AS Nuridjanov's observations in winter 1999, around 200 Great Bustards appeared near Aidar lake after a cold snap. Over the course of several days, practically all of these birds were shot by poachers (Kreitsberg-Mukhina 2003). After

Table 2. Expert evaluation of the current Great Bustard population in Uzbekistan in each season.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	0	0	5
On migration	10–30	3	1
Wintering	50–70 (mild winters) 200–500 (severe winters)	5–6	3

intensive snowfall at the same places in February 2015 30–40 bustards appeared and six of them were then taken by local hunters (A Khan pers comm). Besides intentional poaching, losses of Great Bustards also result from a lack of knowledge among local hunters, some of whom admitted that they mistook birds for geese and pheasants in the Keles river valley in 2008 and on the Karnabchul steppe in 2009.

A natural threat to Great Bustards is presented by the currently quite high number of Golden Jackals *Canis aureus*. In March 2017 on the south-western shore of Aidar lake, a local shepherd documented a jackal attack on a Great Bustard (A Khan pers comm, Plate 2).

Plate 1. Great Bustards near Aidar lake, 7 February 2015. © *A Khan*

Plate 2. Great Bustard after attack by a Golden Jackal near Aidar lake in March 2017. Photo by local shepherd, provided by A Khan.

PROSPECTS AND RECOMMENDATIONS

Recently, the Uzbekistan Society for the Protection of Birds, supported by the Eurasian Bustard Alliance, for the first time in many years conducted special research into the overwintering of the Great Bustard (Ten *et al* 2020). Currently, the studies continue as part of the two-year project 'Conservation of wintering Great Bustard in Uzbekistan' implemented with the support of BirdLife International and Lush, in cooperation with the Laboratory for Vertebrate Animals at the Institute of Zoology, Academy of Sciences of Uzbekistan. The research aims to identify key areas and occurrence schedules of the species, as well as the main threats at these sites. Involvement of local people in the monitoring and conservation of this species is a key component of the study. This is expected to lead to the development of a comprehensive action plan to conserve the species. The results are due to be published when the project is completed in early 2022.

Meanwhile, based on the current situation in Uzbekistan, we see the highest priority for Great Bustard conservation to be protection from poaching as it migrates through and winters in Uzbekistan. Activity should be focused on three key areas, (1) the northern foothill plain of the Nuratau range, (2) the Zaravshan river valley, and (3) the Karnabchul steppe.

At these sites, we recommend work within local communities, including training of local people as 'caretakers', who observe Great Bustards in their vicinity and promote conservation of the species; and raising awareness of the Great Bustard among local people and hunters. In key areas, monitoring of Great Bustards should be included in the workplans of the Wildlife Inspectorate branches of the Governmental Committee on Ecology and Environmental Protection of the Republic of Uzbekistan, as well as the workplans of Wildlife Inspectorate organisations of the relevant provinces (Jizzakh, Samarkand and Kashkadar'ya).

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The historically abundant Great Bustard *Otis tarda tarda* is almost extirpated from western Kazakhstan

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Summary: Although historically abundant, Western Great Bustard *Otis tarda tarda* populations in western Kazakhstan (including West Kazakhstan, Atyrau, Mangystau and Aktobe provinces) declined catastrophically throughout the 20th century. Few observations have been reported in the 21st century, and our targeted surveys in 2006 and 2017 located only one small lek and two small flocks during the pre-migratory staging period. Considering our findings, as well as reports from other sources, we are unable to account for more than 40 Great Bustards across this large area of Kazakhstan. Threats to the species include poaching and agricultural intensification incompatible with successful breeding. Should the Great Bustard disappear from western Kazakhstan, recolonisation will be challenging unless population declines are also reversed in adjacent Saratov and Orenburg oblast's of Russia.

HISTORICAL STATUS AND DISTRIBUTION

In the first quarter of the 20th century, the Western Great Bustard *Otis tarda tarda* was described as an abundant breeding bird in the West Kazakhstan and Aktobe provinces of Kazakhstan, and also occurred in Atyrau province west of the Ural river and along portions of the Emba river, being found in natural steppe, abandoned fields, harvested wheat and winter wheat (Sushkin 1908, Bostanzhoglo 1911, Karamzin 1917). In the second quarter of the century, however, Great Bustard abundance declined, and by the 1960s the species was described as widely but only sparsely distributed across most of this area (Gavrin 1962). In 1971, the size of the 'Pricaspian-Ural population' (considered to encompass present-day West Kazakhstan and Aktobe provinces of Kazakhstan and the Orenburg oblast' of Russia) was estimated at only 350 adult individuals. By 1980, this had dropped to 260 individuals (Potapov & Flint 1987).

Since that time, almost all published reports of sightings in western Kazakhstan concern individual birds or small flocks (fewer than 10 individuals). In the 1980s, the species was observed breeding in very small numbers across West Kazakhstan province, particularly in the Utva river valley, the vicinity of Almaznoe town, and west of the Bitikskoe reservoir. The largest flock recorded consisted of 20 birds gathering for autumn migration north of Almaznoe (Debelo *et al* 1986). Groups of wintering Great Bustards have been reported only rarely in western Kazakhstan, and all have been located to the west of the Ural river in West Kazakhstan province (Debelo *et al* 1986).

Migration routes

There are several possible migration routes that may be used by Great Bustards in western Kazakhstan. Those breeding in West Kazakhstan province may migrate along the route documented for Great Bustards breeding on the left bank of the Volga river in the adjacent Saratov oblast' of Russia to overwinter in southern Ukraine and Crimea (Watzke 2007). The number of Great Bustards counted on these wintering grounds has decreased by a factor of seven since 1999 (Andryushchenko 2020). A migration corridor along the western shore of the Caspian sea was historically documented but is now rarely used by Great Bustards (Belik 1998). A third route traces the eastern Caspian shore, terminating in western Turkmenistan or north-eastern Iran (Bostanzhoglo 1911). The number of Great Bustards observed at the southern terminus of this route dropped dramatically during the 20th century (Kessler & Smith 2014).

PUBLISHED OBSERVATIONS IN THE 21ST CENTURY

There have been very few records of Great Bustards in western Kazakhstan in the 21st century. Most of these have occurred during the migratory period or pertain to individuals in flight, and are scattered across the region. In June 2001, four birds were observed on the Ustyurt plateau in Mangystau province (Grachev 2002). Four were observed in September of the same year in Oiyl district, western Aktobe province, and three in June 2002 in Irgiz district in eastern Aktobe province. In mid-May 2003, three Great Bustards were sighted flying over the open northern Caspian sea (Kovalenko 2003). In October 2003, a single bird was observed feeding along a riverbank north of Atyrau (Karpov 2003). In October 2007, five individuals were observed in the Utva river basin (Bidashko & Kolbintsev 2007). In late March and early April 2008 respectively one and two individuals were spotted flying over the Zhanakala district of West Kazakhstan province (Parfenov 2008). A single bird from Aktobe province was reported as sampled for a study of wildlife disease in 2018, but further details were not provided (Orynbayev *et al* 2018).

FIELD SURVEYS

We conducted surveys for Great Bustards in West Kazakhstan province in autumn 2006 and spring 2017. We selected this sector of western Kazakhstan because the majority of the recorded sightings of this species in recent decades have occurred there. We further targeted our surveys in West Kazakhstan by consulting field biologists and hunters with knowledge of the species in the region. The surveys in 2006 were undertaken from 9–16 October, and covered 997 km. Surveys in 2017 took place from 24 April–3 May, and covered 1503 km. Owing to the large escape distance for this species in this region, we conducted observations through spotting scopes from high points in the landscape. Despite these targeted explorations, we personally observed only two flocks (one of five birds, one of 13) during the pre-migratory staging period in 2006 and one small lek (two males and one female) in 2017. These birds were all observed in mosaics of agricultural cereals, although we also extensively surveyed areas with less anthropogenic impact.

At every opportunity we questioned local hunters, farmers and herders about their knowledge of Great Bustards. Local people associate the species with wheatfields, and ascribe its decline to overhunting. Older people reported large flocks during the Soviet era and a decline during more recent decades. By the time of our second survey, in 2017, we found that younger people were generally unfamiliar with the name of the Great Bustard.

In 2006, a local game warden estimated that a total of 20 Great Bustards remained during the breeding season in Burlinskii district. Local people also reported flocks of 2–30 birds gathering in October. It is likely that some of these individuals breed to the north, in Orenburg oblast' in Russia. In western Kazakhstan outside of West Kazakhstan province, a group of some six birds has been repeatedly observed in spring in Baiganinskii district of Aktobe province during aerial surveys of Saiga Antelope *Saiga tatarica* (Association for Conservation of Biodiversity of Kazakhstan, in litt), likely representing a lek.

POPULATION ESTIMATE

From our dedicated surveys, incidental observations in the course of other work in the region, and review of published reports, we find that the most important sites for the Great Bustard in western Kazakhstan are along the Utva river valley in Burlinskii (Borili) district and, to a lesser degree, Chingirlauskii (Shyngyrlau) district in West Kazakhstan province (Figure 1). Both breeding and migratory staging occur in these areas. Altogether, considering the information gathered above from published observations, our field observations, and oral interviews, we are not aware of more than 40 Great Bustards

occurring in western Kazakhstan, an area of over 700 000 km^2, during any season (Table 1). It is possible that further surveys might identify a few additional small leks.

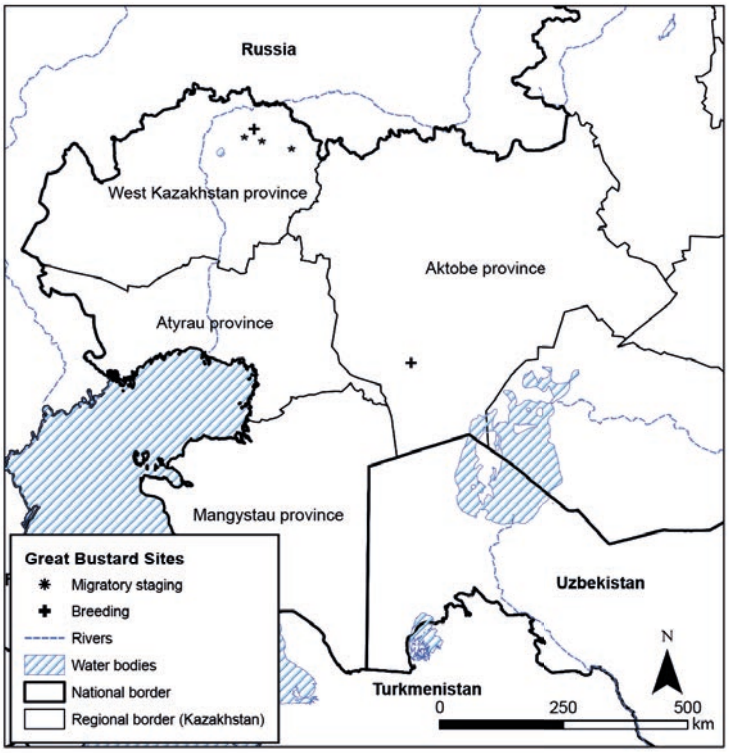

Figure 1. Contemporary sites confirmed to be used by Great Bustards in western Kazakhstan. Sightings of birds in flight and single, unrepeated stopovers are not included.

Table 1. Expert evaluation of the current Great Bustard population in western Kazakhstan in each season, based on our survey data and all known published and unpublished observations of the species in this region.

Season	Number of Great Bustards	Numbers of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	5–26	2	2
Gathering for migration	20–40	3	2
Wintering	0	0	2

THREATS AND CONSERVATION RECOMMENDATIONS

In the mid-twentieth century, Great Bustard populations across broader Central Asia declined as a result of agricultural reclamation, poisoning by pesticides and rodenticides, and large-scale hunting using automobiles before protection of the species in the USSR (full review of this period in Kessler & Smith 2014). Poaching is identified by local people as a major reason for declines in recent decades. Great Bustards are wary in this region and exhibit a large escape distance (> 1 km). Poaching is reported by both local people and sport hunters from cities, and poses a heightened risk in autumn when Great Bustards gather in larger, more conspicuous flocks. We recommend the development of motivated

and geographically flexible anti-poaching enforcement teams to protect groups of Great Bustards during this season. An outreach campaign emphasising the critical status of the species in this region and the importance of its protection could be helpful.

There is a likely conflict between successful Great Bustard breeding and agricultural practices in the wheatfields where these birds gather. We noted an intensification of agricultural practices in this region between our surveys in 2006 and 2017, particularly a decrease in the complexity of the agricultural mosaic. However, only two contemporary lek sites are known (Baiganinskii and Burlinskii) in the entire western Kazakhstan region. Owing to the difficulty in observing these wary birds, identification of additional leks may be most efficiently accomplished by intensive surveys of the human population, focusing on hunters and farmworkers, to be confirmed by field surveys. Protective measures should be undertaken at all remaining lek sites to ensure breeding Great Bustards are not disturbed and nests are spared from destruction by agricultural machinery. This will require the development of agreements with farm-owners concerning bustard-friendly farming practices.

The Great Bustard has been nearly extirpated from western Kazakhstan and there is currently little chance of natural re-colonisation owing to declines in adjacent populations and range fragmentation. The two documented leks in western Kazakhstan are approximately 500 km distant from each other. Fewer than 100 Great Bustards are reported to remain in the adjacent Orenburg oblast' of Russia (Kornev & Gavlyuk 2019). The number of Great Bustards breeding along the lower Volga, approximately 400–600 km from the lek in West Kazakhstan, has decreased to under 3000 birds (Oparin & Oparina 2020).

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IN MEMORIAM

This paper is dedicated to the memory of Fedor Grigorievich Bidashko (1950–2018), *with whom this research was conducted. His deep knowledge and enthusiasm for the natural history of this region, and his brilliant and singular character, will be long remembered.*

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The diminished status of the Great Bustard *Otis tarda tarda* in central Kazakhstan

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Summary: We collate available recent information on the status of the Great Bustard *Otis tarda tarda* in central Kazakhstan. The information available suggests the region holds 20–30 breeding birds and 80–100 autumn migrants. These numbers are very low given the habitat available, with the species apparently absent from large areas of pristine steppe and arable and abandoned arable lands. We found no evidence that poaching or land-use practices in the region could be responsible for the situation. However, illegal hunting of wintering birds in southern Kazakhstan and northern Uzbekistan could well explain the low numbers estimated. To save and restore the breeding populations in central Kazakhstan, urgent action is needed to minimise poaching pressure on the birds in winter and to conduct censuses of breeding birds to identify key areas for their conservation and any additional threats they might face.

INTRODUCTION

During the first half of the 20th century, the Great Bustard *Otis tarda tarda* used to be a common breeding species in central Kazakhstan, particularly in Kostanai (Gavrin 1962) and Akmola (Lavrov 1930) provinces. A rather rapid decline in numbers followed, which some authors attribute to the Soviet 'Virgin Lands' campaign which started in the 1950s (Gavrin 1962, Postavnoi 1984), when huge expanses of pristine and grazed steppe were converted to arable fields. Postavnoi (1984) encountered this bird only twice in Kostanai province in the 16-year period 1966–1982. Beketov *et al* (2004) reports that only 11 birds were encountered during a car survey along a 1304 km long route through the southern part of Akmola and northern part of Karagandy provinces. The same author refers to repeated observations of breeding Great Bustard in Nura district of Karagandy province, suggesting the species was still quite numerous in this scarcely populated area until the 1970s. After the mid-20th century the Great Bustard steadily declined across Central Asia as a whole, and went extinct in many parts of the region (Kessler & Smith 2014). However, like many other bird species, the Great Bustard probably benefited from the crisis in agriculture resulting from the collapse of the Soviet Union in 1989, which left many arable fields abandoned and reduced grazing pressure and disturbance in remoter areas of the steppe and semi-desert (Kamp *et al* 2011, Kessler & Smith 2014).

METHODS

We present a short overview of the status of the Great Bustard in the years 2000–2017, summarising recent records of the species collected across Kostanai, Karagandy and Akmola provinces, which here are referred to as 'central Kazakhstan'. We gathered a total of 32 records, most of which were provided by the Altyn Dala conservation initiative team of the Association for the Conservation of Biodiversity of Kazakhstan (ACBK). Both published (Bragin 2004, Kessler & Smith 2014, Koshkin 2017, Timoshenko 2017) and anecdotal reports collected from researchers and game wardens suggest that during this period the number of Great Bustards in the area remained low. As only one species-specific survey was conducted during the period under review (M Kessler 2006 unpublished), most of the observations presented here were opportunistic.

RESULTS

Distribution and population estimates

Great Bustards were observed relatively sparsely in Kostanai and Karagandy provinces in the years 2000–2017 (Figure 1). Several sites in Kostanai had regular observations (several

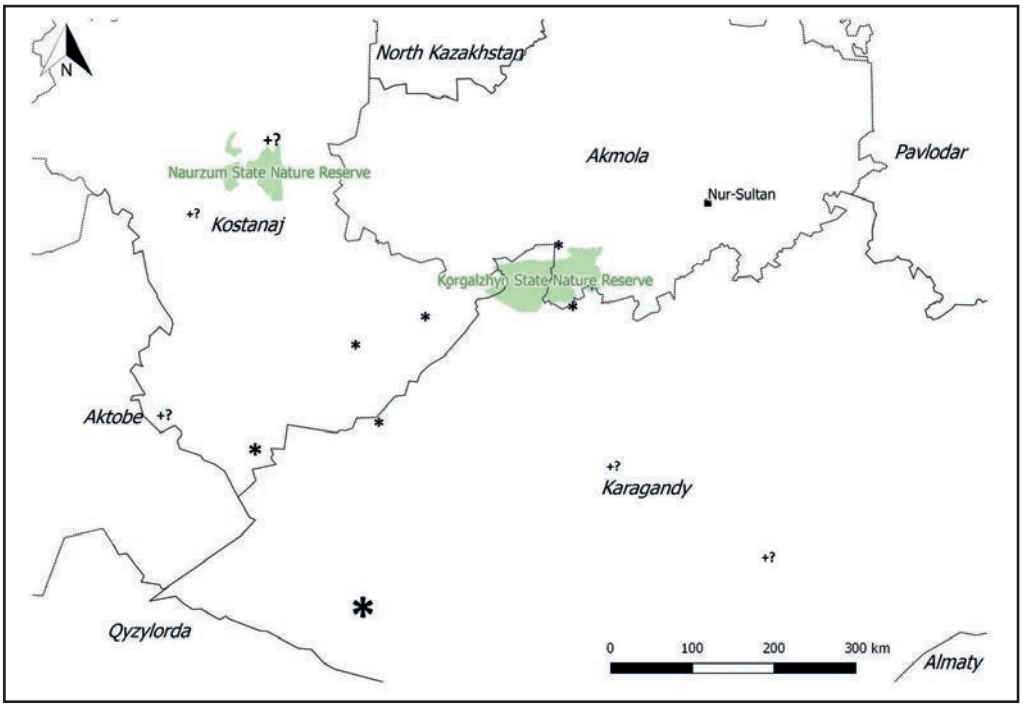

Figure 1. Locations of recent (2000–2017) observations of Great Bustards in central Kazakhstan (+? possibly breeding, * post-breeding and migration; larger symbols represent clusters of observations). Data sources: ACBK Altyn Dala conservation initiative database, M Kessler, AV Koshkin, A Timoshenko.

years in a row), including one site where adult birds were observed in May 2015 and 2016. On the other hand, only three observations of Great Bustard were reported in the Tengiz–Korgalzhyn region during the same period (Koshkin 2017), despite regular monitoring and anti-poaching patrols by Korgalzhyn State Nature Reserve's scientists and rangers through large expanses of natural steppe and semi-desert habitat potentially suitable for the species. No observations of Great Bustards were reported during 2004–2016 by fieldworkers monitoring Sociable Lapwing *Vanellus gregarius* breeding colonies across large areas of the Tengiz–Korgalzhyn region. Similarly, the only observation from central Kazakhstan published on www.birds.kz (a country-wide web portal of around 250 ornithologists and photographers) was of three birds photographed by Timoshenko (2017) at Alakol village, Kostanai province, on 28 July 2009. However, it is worth noting that central Kazakhstan is probably the least visited area of the country by birders.

Although most records of the Great Bustard are from late summer and autumn, some observations of adult birds in May/June suggest that Kostanai and Karagandy provinces could still support breeding populations (Figure 1). However, to the best of our knowledge there have been no recent (last 15–20 years) verified observations of displaying males, nests or females with chicks in the region, with the exception of several lekking birds observed in Kostanai in 2006 (M Kessler, unpublished) and some anecdotal information of breeding 'pairs' observed along the border between Kostanai and Karagandy provinces (Bragin 2004). Therefore our cautious estimate of breeding numbers, 20–30 individuals, is based on observations of adult and/or juvenile birds in May/June. All observations outside this period are treated as involving pre-migratory gatherings or migrants (Table 1). The largest group of migrating birds consisted of 80 individuals and was recorded on 3 October 2009 in the southern part of Karagandy province, with other observations consisting of 1–6

individuals; hence we cautiously estimate a total of 80–100 individuals being hosted in the region at migration times. There are no records from the winter season.

Table 1. Expert evaluation of the current Great Bustard population in central Kazakhstan, with the minimum estimate for gathering or migration derived from the total number of birds recorded in the area in autumn 2009.

Season	Number of Great Bustards	Numbers of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	20–30	6	2
On migration	80–100	21	3
Wintering	0	0	0

Habitat use and threats

Unfortunately there is very little information about habitat associated with recent records of Great Bustard, but evidence suggests that habitat loss is not currently an issue. Most observations in Kostanai province during the breeding and post-breeding period were relatively close to small or medium-sized settlements, suggesting that birds were using anthropogenic landscapes (pastures, hayfields, wheatfields, *etc*). One group of birds was flushed from a hayfield, another was spotted in a recently burnt area (AT pers obs). Most records of Great Bustards during migration, particularly in south-western Karagandy province, are likely associated with natural steppe and semi-desert, as these sites are further from populated areas and human disturbance.

Although hunting is reported as a major cause of declines in Great Bustard populations elsewhere in Central Asia, we found no evidence of this in central Kazakhstan in recent years. Poor law enforcement certainly suggests that the species would be targeted by poachers, despite its listing in the *Red Data Book of Kazakhstan*. However, owing to low densities when breeding and only partly predictable behaviour during migration, Great Bustards are most likely hunted opportunistically by city-based sport hunters (*eg* from Astana, Kostanai, Arkalyk) or poachers with high-quality weapons and vehicles pursuing other species (*eg* antelopes, boar, waterfowl, *etc*). We expect that there is much more damage to bustard populations in the south of the country, when birds congregate in large flocks during winter. Similarly, to the best of our knowledge there are no data from the region on natural and human-induced factors affecting adult and juvenile survival and breeding success.

DISCUSSION

As information on the distribution and numbers of Great Bustards in central Kazakhstan is very limited, there is an urgent need to conduct a thorough census to identify key breeding sites and important staging areas, if any. Once such areas and major threats are identified, relevant conservation actions can be proposed. On present evidence we consider the most urgent action to be the protection of wintering flocks in southern Kazakhstan and Uzbekistan to preserve breeding populations across Kazakhstan.

ACBK is the largest and most active nature conservation NGO in Kazakhstan, focusing on research and conservation of steppe and semi-desert ecosystems, using both site- and species-specific approaches. Playing an important role in running the Altyn Dala conservation initiative, ACBK successfully carries out monitoring and protection of key territories for steppe biodiversity on a large scale. Although the main focus of conservation and research work is currently the Saiga Antelope *Saiga tatarica*, the Great Bustard is now at the top of ACBK's list of priority species.

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Southern Kazakhstan is crucial to the survival of Central Asia's remaining Great Bustard *Otis tarda tarda* populations

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Summary: To characterise the presence of *Otis tarda tarda* in southern Kazakhstan, we present the most comprehensive collection of observations of the Great Bustard across this region, defined as encompassing Kyzylorda, Turkistan and Zhambyl provinces. We gathered observations of this species from 129 publications since 1864. Modern evidence is primarily derived from our own surveys from 2005 through 2021. We identified 264 records of the Great Bustard, including 67 of our own sightings. Based on these data, we estimate that a total of 50–70 Great Bustards currently occupy southern Kazakhstan during the breeding and migratory season, and 400–500 in winter. As the only region in Central Asia consistently hosting the species during all four seasons, southern Kazakhstan must play a central role in the species' conservation. Incentives for compatible and environmentally friendly agricultural practices will allow the species to breed more successfully in alfalfa and winter wheat fields. Particularly important is increased anti-poaching control during the migratory and winter seasons, when Great Bustards arrive from the north and unite into larger flocks, which are more conspicuous and attractive to hunters. International support for monitoring of the southern Kazakhstan Great Bustard population is needed, given the large territory to be covered, central role of this region in sustaining Central Asia's Great Bustard population, and ongoing issues of poaching.

HISTORICAL BACKGROUND

Records of the Great Bustard *Otis tarda tarda* in southern Kazakhstan, an area of just under half a million square kilometres covering the provinces of Kyzylorda, Turkistan (formerly South Kazakhstan) and Zhambyl, extend back to 1864 (Appendix). Chokpak pass, at the western end of the Tian Shan mountains in Turkistan province, became a famous hunting ground for Great Bustards in the early 20th century (Dolgushin 1960) owing to the large autumn congregations of the species at this site. Nesting and passage of Great Bustards was recorded in the adjacent Aksu-Zhabagly nature reserve in 1948 (Shevchenko 1948). Regular hunting of Great Bustards took place at the Maylikent pass, just west of Chokpak pass (Kovshar' 1966). Encounters with Great Bustards in the valleys of the Arys and Mashat rivers, north of Shymkent and west near Aksu-Zhabagly nature reserve, were noted by ornithologists in 1953, 1961 and 1964 (Kovshar' 1966).

Until the mid-20th century there were no lists of protected and rare species, and the Great Bustard was not legally protected. Regular hunting undoubtedly had a negative impact on its populations throughout much of Kazakhstan at this time (Gavrin *et al* 1962). However, hunting in southern Kazakhstan is primarily conducted in spring and autumn and thus may have impacted abundances on more northerly breeding grounds to a greater extent than in southern Kazakhstan itself.

MATERIALS, METHODS AND STUDY AREA

We analysed the abundance and seasonal distribution of Great Bustards in the south of Kazakhstan by reviewing observations from our own fieldwork in 2005–2021 and all known published data of other researchers, as well as pictures and data obtained from the Kazakhstan birdwatching citizen science website birds.kz (Appendix). Our field studies took place in spring 2005, 2009–2010 and 2014–2021, summer 2016–2021, autumn 2006, and winter 2009–2022, and were conducted in appropriate bustard habitats with a 64× spotting scope, 10× binoculars and an off-road vehicle, using both walking routes and circular observations from vantage points. We obtained additional information by questioning both professional

Table 1. Estimate of current Great Bustard population in southern Kazakhstan, encompassing Kyzylorda, Turkistan and Zhambyl provinces. These numbers are an expert evaluation of the number of individual birds appearing in the region in each season.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	50–70	13	4
Gathering for migration	180–200	6	2
Wintering	400–500	12	4

wildlife biologists and local people, including hunters, district environmental inspectors, shepherds, agricultural machinery operators, and rural residents.

The area we surveyed included steppe and agricultural lands in the foothills of the Syrdar'ya Karatau ridge and the north-western spurs of the Talas Alatau mountains within the Baidibek, Kazygurt, Ordabasy, Otyrar, Saryagash, Sairam, Shardara, Sozak, Tolebi and Tulkibas administrative districts of Turkistan (previously South Kazakhstan) province, as well as Baizak, Chu, Kordai, Merki, Moiynkum, Ryskulov, Sarysu, Talas, and Zhambyl districts in Zhambyl province and Aral, Karmakshi, Shieli and Syrdar'ya districts of Kyzylorda province.

We considered the breeding season to last from March to mid-July, covering the period when birds first arrive at breeding sites through to fledging. Pre-migratory staging lasts from late July through October, as Great Bustards gather in larger flocks, and birds pass through the province on migration. The wintering period was defined as November through February.

RESULTS

Seasonal dynamics

Seasonal distribution of Great Bustards in southern Kazakhstan is shown in Figures 1 and 2. Pairs and small groups of Great Bustards appear on the breeding grounds in late February and early March. Breeding displays were observed on 16 April 2017, 23 April 2015, and 30 April 2014. The breeding season must begin earlier than this, however, because females sitting on nests were found on 6 April 2015 and 8 April 2014. The hatching of chicks (in other nests) was observed on 10 May 2015 and 17 May 2014.

During high summer, July–August, young birds begin to fly and broods unite in flocks. Autumn migration begins in the second half of August and continues in September and October (individual birds may delay migration until mid-November), and given favourable feeding conditions (*ie* absence of heavy snow or ice cover) the birds may spend the winter in South Kazakhstan province, otherwise moving further south into adjacent areas of Uzbekistan. Birds from other regions also arrive in southern Kazakhstan in the late autumn and winter, forming large flocks of several tens and even up to 150 or more individuals (Shakula *et al* 2016, 2018). Unfavourable factors on wintering grounds include deep snow cover and low air temperature (Gubin & Vagner 2005). In February 2005, Great Bustards died due to unusually deep snow and temperatures as low as −20 C. Weakened birds were easily caught by local hunters on horseback (Gubin & Vagner 2005). On average, the depth of snow on wintering habitat is 0–10 cm, and the air temperature in winter varies from +2 C to −10 C. Quite often thaws occur, and in January–February the air temperature can rise to +10 or even +20 C during the day.

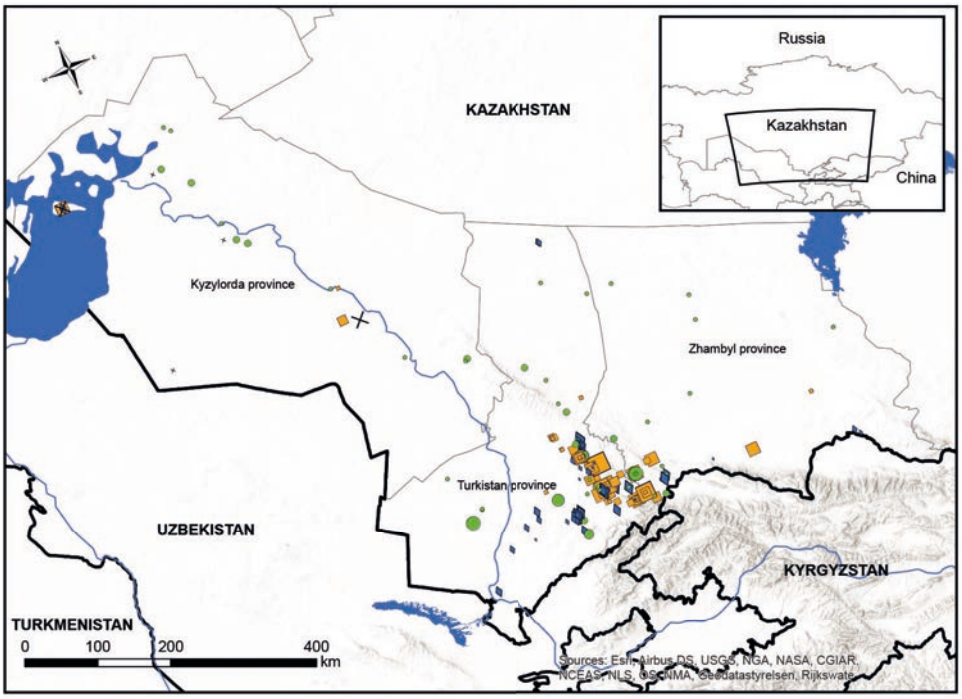

Figure 1. Seasonal distribution of Great Bustards in southern Kazakhstan, defined as Kyzylorda, Turkistan and Zhambyl provinces. Green circles indicate observations during the breeding season; orange squares indicate observations of pre-migratory flocks; blue diamonds indicate wintering; black x represent observations for which the season is unclear. The size of the symbol is proportional to the number of Great Bustards observed at a given point. Geographical relief is displayed with grey shading. Major rivers and water bodies are displayed in blue. The cluster of points in the south-east is shown at higher scale in Figure 2.

The records we obtained on Great Bustards in southern Kazakhstan allow us to make an informed estimate of the current regional annual breeding population at 50–70 individuals (Table 1). Some 180–200 individuals are counted in total during the autumn migratory period (July–October), and 400–500 during winter (November through February; Table 1). Given the tendency of migratory Great Bustards to gather in larger flocks at southernmost breeding spots of a flyway in autumn before moving further south, it is likely that the breeding population is included in the estimates for the migratory period and possibly winter.

Habitat

In southern Kazakhstan the Great Bustard inhabits the foothill plains and spurs of mountain ranges at elevations of 250–1200 m above sea level (Rustamov & Kovshar' 2007). These habitats are widely used by people for growing grain, oilseeds and fodder crops, and for grazing livestock including sheep, cows and horses. A network of asphalt and dirt roads crosses the landscape. Cultivated fields and roads are surrounded by plantation shelterbelts. Typically, Great Bustards remain loyal to areas even after the habitat has been degraded and transformed for intensive agricultural production. In some regions where virgin steppe is available they prefer to nest in spring crops (Ponomareva 1983). Such is the case in southern Kazakhstan, where the species inhabits both cultivated farmland and unplowed valleys that humans have found unsuitable for cultivation or pasture. For nesting, Great Bustards select growing crops as well as fallows and depressions overgrown

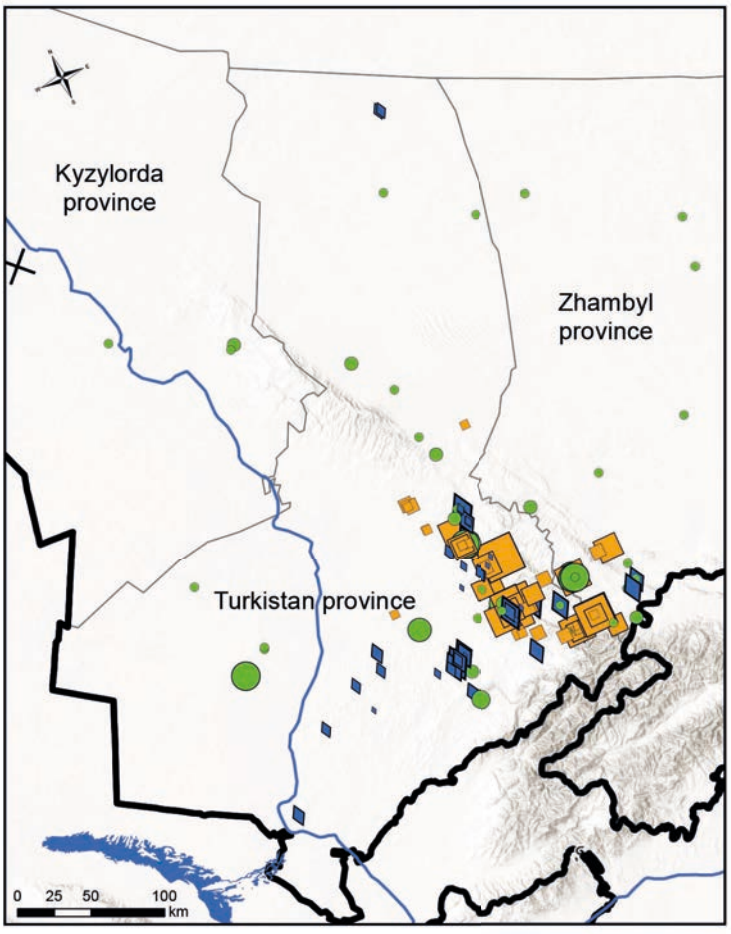

Figure 2. Close-up of the cluster of points in Turkistan and Zhambyl provinces shown in Figure 1.

with weeds and shrubs. In winter they prefer the southern slopes of depressions, covered with wild plants and often free of snow. An important factor in habitat choice in Kazakhstan is the availability of water sources for drinking (Isakov & Flint 1987). Great Bustard habitats in southern Kazakhstan are situated in a dry climate zone, but groundwater lies at a depth of 5–17 m and comes to the surface in foothills and mountains in the form of springs, forming a network of small rivers from which Great Bustards are observed to drink.

Threats

Poaching is one of the main factors reducing the number of Great Bustards in southern Kazakhstan. Although hunting is prohibited, persecution and shooting of Great Bustards occurs everywhere in the region and at any time of the year, involving ordinary citizens such as agricultural machinery operators and shepherds as well as rich hunters in jeeps with modern, long-range weapons (Gubin & Vagner 2005). Poaching is greatly facilitated by the widespread use of cellular communications (pers obs). Shepherds commonly herd their flocks in bustard habitat, and alert their hunting friends when they encounter Great Bustards.

Agricultural machinery is a significant danger for Great Bustards nesting in cultivated fields. For example, in 2015 one of four monitored nests was destroyed by a tractor during agricultural work (Shakula *et al* 2016). The use of pesticides in agricultural fields also presents threats to Great Bustards. Although diet analyses have not been undertaken in southern Kazakhstan, animal foods represent 35–85% of the Great Bustard diet in summer, according to work conducted in Kostanai province of northern Kazakhstan (Ryabov 1949). Studies in Europe have similarly found invertebrates to play a significant role outside of winter (Cabodevilla *et al* 2021), indicating that application of insecticides and rodenticides will negatively impact food availability for this species. It is possible that bioaccumulation of insecticides from invertebrate prey poses an additional threat. On 14 May 2017 we observed Rooks *Corvus frugilegus* eating locusts impaired by an aerial

application of pesticides, and we presume Great Bustards also eat insects poisoned in this way. Although pesticide use significantly declined with the disappearance of Soviet collective farms, its current extent in the private sector is unknown and the effects on Great Bustards have not been investigated.

The Sheikh Khalifa breeding centre for the Asian Houbara *Chlamydotis macqueenii* at Shayan, Baidibek district in Turkistan province, constitutes a further, unquantified threat by offering financial rewards to local people to collect Houbara eggs. Local farmers at Birlik recounted in 2017 to I Vagner and M Kessler that there have been cases of mistaken identity, involving collection of Great Bustard eggs rather than Houbara. We do not know how widespread this problem is.

The Great Bustard has few natural enemies, but it is highly vulnerable during the breeding season when steppe predators such as Red Fox *Vulpes vulpes*, Asian Badger *Meles leucurus* and Golden Jackal *Canis aureus* present a danger to eggs and young birds. Badgers and jackals inhabit small hollows between fields, and cavities overgrown with grasses and shrubs. Over the last 10 years, the number of foxes and jackals has increased as authorities have stopped making payments for their skins, and sport hunting of these species has become unpopular. On 29 May 2021, a jackal was observed predating a Great Bustard chick in the area of the Sheikh Khalifa breeding centre at Shayan (see above; A Martineau pers comm). The destruction of nests of other bustard species by these predators in southern Kazakhstan has been documented, including Little Bustard *Tetrax tetrax* nests in Arystandy Important Bird Area in May 2020, and an Asian Houbara nest in Moiynkum desert in June 2021 (authors' unpublished observations). Based on the range and abundance of these species, we infer that Carrion Crows *Corvus corone* and Rooks represent a threat to Great Bustard nests in the foothills of the Syrdar'ya Karatau. Domestic dogs also present a danger to nests and young birds; as a rule, dogs on farms and in rural settlements are not leashed and scavenge widely for food.

PROPOSED CONSERVATION MEASURES

Our surveys and experience convince us that sufficient ecological conditions for Great Bustard population growth exist in southern Kazakhstan; it is only necessary to minimise threats. As the only area in Central Asia regularly hosting Great Bustards during the breeding, migratory and wintering periods, and the region hosting the largest number of individuals during the breeding season (Kessler 2022), southern Kazakhstan plays a critical role in sustaining the region's populations. Successful actions to protect and nurture flocks here during the migratory and wintering periods may produce positive impacts for populations breeding to the north. Most urgently, anti-poaching efforts must be strengthened. The hunting inspectorate should devote increased attention to the protection of Great Bustard breeding grounds (see next paragraph), as well as migratory staging areas and overwintering sites and the flocks they host. Public engagement programs should promote the conservation of the species through social media, educational institutions, and hunting organisations, while taking care not to publicly identify sensitive sites (Kessler 2017a, b). Suitable habitat with preferred forage such as soy and alfalfa should be maintained for wintering flocks. If these fields are kept free of snow, they may retain Great Bustards for a greater portion of the non-breeding season, as observed at migratory staging points in eastern Kazakhstan (Berezovikov 2016). This could aid anti-poaching efforts and reduce risks encountered during nomadic and migratory movements, such as powerline collisions.

Conditions for the vulnerable southern Kazakhstan breeding population can be improved through strengthening the protection of lek sites. The status of locally protected sites significant to the species, in particular the Arystandy Important Bird Area should be

elevated to the national level to increase opportunities for funding and human resources. The network of protected sites should be expanded to include additional leks, specifically sites along south-western slopes of the Syrdar'ya Karatau range including Zhylandy, Mashat, Sastobe and Krasnaya Gorka. M Nukusbekov in Zhambyl province has admirably modelled the role of a community lek 'caretaker' (Nukusbekov 2016): he annually monitors a Great Bustard lek adjacent to his village and promotes the conservation of these birds by warning farmers of the location of nests in order to avert their destruction by machinery. A network of lek caretakers could be nurtured across southern Kazakhstan (and other parts of Central Asia!) through provision of a short training, a modest stipend and equipment (*eg* binoculars, cellular phone credits), and encouragement and recognition of their efforts. The observations of both caretakers and professional researchers can aid in the identification of site-specific activities to improve breeding success, such as control of locally abundant nest predators and changes to incompatible agricultural practices.

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Appendix 1. All records of Great Bustard in southern Kazakhstan, by province, district and locality. Provinces are ordered west to east. Districts and localities are ordered alphabetically. The most specific locality relating to the particular record is given in bold. IBA = Important Bird Area; NR = nature reserve.

Kyzylorda province

Aral district

- **Aral Sea**, north-eastern corner, on migration (noted as weak and brief), late April 1905 (Bostanzhoglo 1911)
- Aral Sea east coast between **Aral'sk** and Kamyshlybas lake, frequently seen on migration, much commoner near Kazalinsk, early 20th century (Zarudnyi 1916)
- **Barsakel'mes** island, flocks of <20 after snowfall, 15–27/11/1941; many flocks of 10–12, 06/11/1943; 16 birds reported, 14/01–25/02/1944; flocks of 10–20 after snowfall, mid-November 1944 (Ismagilov & Vasenko 1950)
- south-east of **Eza point**, flocks of 20–25, massive migration, extraordinarily abundant, 28/10/1935 (Grachev 2000)
- between **Kamyshlybas** and the Utebas well, 3 birds, 19–21/03/1873 (Bogdanov in Zarudnyi 1915)
- northern edge of **Kyzylkum** desert along the Karakum tract, flocks of 3–4, 15–17/07/1907 (Zarudnyi 1914); northern and eastern edges of Kyzylkum desert and Syrdar'ya basin, nesting, stopping over and wintering, 1914 (Zarudnyi 1915)
- unspecified locality, flock of 10 flying south, 01/11/1953, 2 flying north, 18/04/1954 (Grachev 2000)

Karmakshi district

- west of **Baykonur**, 2 and 2+1, May 1965 (Borisenko 1977)
- **Donsary**, 3 birds, May 1965, and female on nest with 2 eggs, 11/05/1965 (Borisenko 1977)

Shieli district

- south of **Baigakum** railway station (lower Syrdar'ya river), 1 in sand-dunes near a gravel road, 18/04/1964 (Malyshevskii 2004)
- eastern **Kyzylkum** desert towards Betpakdala, wintering, early 20th century (Zarudnyi 1915)

Zhalagash and Shieli districts

- lower reaches of the Syrdar'ya from **Zhusaly** to Shieli, spring and autumn (no years given; Spangenberg & Feigin 1936)

Zhanakorgan district

- **Domba river valley**, south-west foothills of Karatau range, 1, 09/06/2014 (Gubin & Belyalov 2017)
- **Kulanshi river valley**, south-west foothills of Karatau range, 4 including 2 juveniles, 08/06/2014 (Gubin & Belyalov 2017)

Turkistan province

Baidibek district

- **Arystandy** IBA, fresh bone and feathers of a bird at the southern edge, 27/10/2006 (MK and II Vagner, pers obs); 3, 29/12/2009, and 105, 04/01/2010 (Shakula *et al* 2016); 2 on fallow land near a ravine and cliffs, 15/04/2017; 1 with 12 on periphery, 10/02/2018 (Shakula *et al* 2018); 5, 16/02/2020 (Shakula *et al* 2021); Arystandy plateau, 3, 19/02/2019 (Shakula *et al* 2019)
- near **Boraldai** village, 2, 08/02/2018, 10, 09/02/2018, with 1 north of the village same day (Shakula *et al* 2018); 2, 16/02/2020 (Shakula *et al* 2021)
- western ridges of **Boraldai mountains** (Sastyube, Maybulak, Zhylandy and [for other records see below] Arystandy), 171, 14–15/02/2004 (Sklyarenko & Vagner 2004); birds were present in the same area of 'foothill steppe', but to a lesser degree, in December 2002 (Sklyarenko & Vagner 2004)
- between **Bugun' reservoir** and Boraldai range, 7, 20/01/2010 (Shakula *et al* 2016)
- south of **Karaoi**, eastern slope of Karatau range, 3, 29/05/2015 (Kornev 2016)
- north of **Mynbai**, 3 in wheatfield, 17/04/2017 (Shakula *et al* 2018)
- near **Mynbulak**, 2+3, 06/08/2021 (Shakula *et al* 2021)
- near **Shayan**, 35, 05/10/2001 (Gubin & Vagner 2005); near town on road north to Sozak, 5 in flight, 21/03/2021 (Isabekov 2021); by Shayan reservoir, 21+3, 10/02/2018 (Shakula *et al* 2018) and 5 there, 28/01/2019 (Shakula *et al* 2019)
- **Sheikh Khalifa houbara breeding centre**, near Birlik, at least 31 birds, with a minimum of 8 displaying males and annual records of nests and chicks, March–June 2015–2017 (Martin *et al* 2018); 3 females inside centre walls, 1 outside, and at least 1 chick eaten by jackal, 29/05/2021 (R Bigonneau, M Rohee & A Martineau, pers comm), with apparently different female flushed on same date, and on that and next day 2 females feeding 100–200 m apart, one with at least 1 pigeon-sized chick (Shakula *et al* 2021); 1 female flushed in the evening, 17/07/2021, 1 adult, 19/08/2021, and 2 adults, 21/09/2021 (Shakula *et al* 2021)
- between Boraldai and **Turakty**, 16 in field, 26/10/2006 (S Michel, pers comm)
- **Ulken Bugun' river**, foothill valley south of Karatau mountains, 33, 07/10/2004 (Gubin & Vagner 2005)
- between **Ulken-Tura mountain** and highway, 5, 08/02/2018, and 2, 09/02/2018 (Shakula *et al* 2018)
- near **Verkhnii Boraldai**, 6, 16/02/2021 (Shakula *et al* 2021)
- near **Zhuzemdyk**, 1, 22/07/2021, 1, 23/07/2021 (Shakula *et al* 2021)
- unspecified locality, between Boraldai and Arys' rivers, female on winter wheatfield, 1, 18/04/2017 (Shakula *et al* 2018)

Sairam and Tulkibas districts

- south of **Boraldai mountains**, 30 on agricultural land in steeply sloping foothills, 20–21/04/2005 (Gubin & Vagner 2005)

Kazygurt district

- near **Chanak**, 3, 09/02/2020 (Shakula *et al* 2021)
- between **Kazygurt** and Shymkent, group of 3 in steppe, 23/07/1938 (Dolgushin 2008); foothills near Kazygurt, 8, 29/06/2013 (Belyalov 2013)

- east of **Kyzyldala** and west of main road to Tashkent, 7+23 in hilly pasture, some of it recently burnt, 28/10/2006 (MK and II Vagner, pers obs)

Ordabasy district
- near **Arys'** town, 20 in bare desert steppe and 6 in steppe near dry riverbed cliffs, 07/02/2018 (Shakula *et al* 2018); 25 km south of the town, 6, 12/02/2020 (Shakula *et al* 2021)
- **Badam railway station**, 12 on agricultural land, 27/03/2016 (Shakula *et al* 2016)

Otyrar district
- **Baimakhan** well, Kyzylkum desert, 30, early April 1985 (Gubin & Sklyarenko 2014)
- unspecified locality: vast plain next to an artesian well in eastern Kyzylkum desert, 1 feeding male, 06/04/2016, and female near the well, 15/04/2016 (Gubin 2020)

Sairam district
- **Akzhar**, 15 km south of Shymkent, along the road to Tashkent, 4, 05/02/2018, and 152, 06/02/2018 (Shakula *et al* 2018); 23, 20/01/2019 (Shakula *et al* 2019); 6, 17/12/2019 (Shakula *et al* 2021); 'south of Shymkent', 70+9, 06/02/2018 (Shakula *et al* 2018); also 30 km south of Shymkent, 16 birds reportedly feeding in fields, 31/01/2004 (Erokhov *et al* 2004)
- between **Karabulak** and Mashat, 1 female, 27/05/2020 (Shakula *et al* 2021)
- **Kemeshbulak lakes**, outskirts of Shymkent, 1, 05/03/2014 (Belousov 2013-2014)
- **Mashat pass**, 2, 02/02/2021 (E Bies, pers comm)

Saryagash district
- near **Bel'tau mountains**, 1, 06/02/2018 (Shakula *et al* 2018)
- north bank of **Chardara reservoir**, two flocks of 7 and 8 seen by local hunters, 11/02/2006 (Kovalenko & Kravchenko 2006)
- unspecified locality near Syrdar'ya river, 9, 18/02/2021 (Shakula *et al* 2021)

Shymkent district
- near **Shymkent**, four groups (11+18+2+14; a male displaying in each of two groups) 3–5 km from each other on hilly plain with alfalfa crops, during aerial survey of Saiga Antelope *Saiga tatarica*, 07/02/1979; two groups totalling 40+, same habitat, 10/02/1979; several scattered groups (fewer than two days before but with many displaying males), same habitat, 12/02/1979 (Vygovskii 1986)

Sozak district
- **Chulak-Espe well**, 1, 07/04/1976 (Fadeev & Savinov 1986)
- 40 km south of **Karakoin lake**, 6, 26/11/1966, and 6, 10–15/12/1966 (Borisenko 1977)
- south-west of **Kyzemshek**, male feeding, 12/04/2021 (Shakula *et al* 2021)
- **Kyzylkol lake** southern shore, 1, 13/09/2008 (Valkenburg 2008)
- between **Sholakkurgan** and Kentau, 5 km from Karatau range, 1, 12/06/2012 (Berezovikov & Annenkov 2018); between Sholakkurgan and Shayan on upper reaches of Arystandy river, 2, 08/05/2014 (Gubin & Belyalov 2017)
- **Sozak**, during aerial census of Saiga Antelope, 3, 30/03/1972 (Fadeev & Savinov 1986); between Sozak and Chulakkurgan, 1, 11/04/1976 (Fadeev & Savinov 1986)

Tolebi district
- **Khanaryk**, Aksu river valley, 23 in agricultural fields and mountain foothills, 18/11/2018 (Shakula 2019)

Tulkibas district

- north of **Akkala**, Kyzyl Aryk Sovkhoz, 1 female, 2 males in harvested wheatfield with thin border of trees, 24/10/2006, with hunters reporting killing other birds the week before; north-east of Akkala, 2 flying over alfalfa and safflower, 26/10/2006 (MK and II Vagner, pers obs)
- near **Aksu-Zhabagly NR**, nesting (evidently annually) in low-elevation mountain steppes in piedmont of the Iirsu and Aksu river valleys (Shevchenko 1948); 1 bird, 04/05/1948 (Kovshar' 1966); in the reserve next to Kara-Alma ranger station, 6, 30/09/1977, 4, 01/10/1977, 4, 08/10/1977, unspecified numbers, 19/11/1977 and 26/11/1977; in the reserve, unspecified number between Aksai and Topshak ranger stations, 01/09/1979, with 8 in same area 21/09/1982 (Ivashchenko 1986); foothills of Topshak ravine, 2, 08/04/2007 (Chalikova 2007)
- towards **Alekseevka** via Abai, 3 (the largest flying off, the other two being killed by poachers, the two weighing > and <10 kg respectively, late October 2017 (A Satbaev, pers comm)
- upper reaches of **Arys'** and Mashat rivers in winter (Shevchenko 1948); Arys', Il'inka, Karabulak, Karaungur and Maktaly rivers, south of Karatau mountains, 56, 14–30/10/2004 (Gubin & Vagner 2005)
- **Balykty Sovkhoz**, between Sastobe and Il'inka, dead female with unlaid egg, three other birds seen, spring 2004 (II Vagner, pers comm); between Abai and Kalinino, 5 in fields, spring 2006 (II Vagner, pers comm); between Makhtaly and Sergeevka, 11 in group (mostly males) in fields, 25/10/2006 (MK and II Vagner, pers obs); south of Balykty town, 2 males, 2 females and 1 unsexed in group in fields, 25/10/2006, and on same date 4 likely males, 4 likely females in fields north-west of Abai (where nesting also reported) (MK and II Vagner, pers obs)
- north-west of **Boraldai**, 4 males feeding in winter wheat, 27/10/2006; south of Boraldai between Boraldai and Arys' rivers, 5+2+2, 29/10/2006 (MK and II Vagner, pers obs);
- **Chokpak pass**, well known as a site to hunt the species (Dolgushin 1960); 1, 19/05/1969; 2, 20/09/1970; 1, 08/04/1971; 2, 15/04/1971; 8, 19–25/09/1971; 1, 10/10/1971; 3, 27–28/04/1972; 1, 15/04/1973 (Gavrilov 1985); 1 by the northern boundary of Aksu-Zhabagly NR, 05/05/1983 and 06/05/1983 (Savin & Sema 1986); 2, 05–07/05/2002, 53, 28/09–06/10/2002, and 71, September–October 2002 (Kovalenko *et al* 2002); 1, autumn 2003 (Gavrilov *et al* 2003); 1, autumn 2004 (Gavrilov 2004); 1, 12/04/2005, 2, 08/05/2005 [1 also recorded on same date by Shakula *et al* (2016)], 1, 22/05/2005, and 4 flying east at a height of 100 m, 15/10/2005 (Gavrilov & Gavrilov 2005); 9, 11/09/2011 (Bis 2011); 2, 10/09/2016 (A Kovalenko, facebook)
- north of **Enbek**, 30 in winter wheat and unplowed fields, 19/10/2006 (MK and II Vagner, pers obs); male eaten by a Red Fox *Vulpes vulpes* in a field, 12/10/2006 (II Vagner, pers obs)
- north-west of **Enbekshi** west of road to Tashkent, 1+12 in hilly wheatfield, 28/10/2006 (MK and II Vagner, pers obs)
- **Iirsu valley**, 1500 m, moulting birds appearing in July–August (Shevchenko 1948)
- **Iirsu-Daubaba plateau** (next to Aksu-Zhabagly NR), 1, 03/10/1984, and 4, 10/10/1984 (Chalikova 2008)
- **Krasnaya Gorka**, 1, 30/04/2014 (Shakula *et al* 2016); 1 male, 23/04/2015 (A Aralbaev, pers comm); female, 19/04/2021 (R Karataev, facebook); 58, 20/02/2018 (Shakula *et al* 2018); 2, 01/02/2019 (Shakula *et al* 2019)
- **Makhtaly**, Kyzyl-Aryk, on Ulken Bugun' river in Karatau foothills, 140, 17–23/11/2004 (Gubin & Vagner 2005)
- south-east foothills of **Malyi Karatau**, 7 feeding in gently sloping meadows of short green grasses after a wildfire, 14/11/2004, locals reporting area being used by as many as 1500 birds on annual migration and in winter (Kovalenko 2004)
- east of **Mashat**, two broods (one involving 3 chicks) in hilly valley near stream, spring 2004, with 7 birds same place in autumn 2004 (II Vagner, pers comm)
- **Maylikent (Iirsu) pass**, regularly hunted (Kovshar' 1966); near the pass, unspecified number, 10/05/1975 and again 20/04/1976 (Ivashchenko 1986)
- **Pobeda Sovkhoz**, south-west of Karla Marksa, 5, 19/10/2006 (MK and II Vagner, pers obs)

- near **Sastobe**, 1, 03/12/2018 (Shakula 2019)
- **Sergeevka** (Yntymak), 5 at bottom of gully and on plowed field (1 male displaying), 16/04/2017 (Shakula *et al* 2018); around Sergeevka on both sides of railway, 59+20+8, 05/02/2018, 8+4, 15/02/2018, 102, 16/02/2018, 20, 17/02/2018 (Shakula *et al* 2018)
- **Sovkhoz Kirova** (Oktyabr'), north of Enbek, 38 in fields of wheat, safflower and alfalfa, 16/10/2006, with breeding there reported by locals (II Vagner, pers comm); hill nearby, between Il'inka and Kalinino, 3, 25/10/2006 (MK and II Vagner, pers obs)
- 3 km north of **Vannovka**, 1 in alfalfa field; later flew towards Boraldai mountains, 16/04/2008 (Ivashchenko 2008)
- **Zhabagly**, 12/10/1948 (when unspecified numbers feeding on sown safflower); 2 birds, 03/12/1948; 40 flying west after two-day snowstorm, 06/12/1948; 3, 20/01/1949; 3, 21/02/1949; nest with 2 eggs, summer 1949; 30 by haystack unable to fly after snow and rain, 10/12/1952; 28, 28/09/1953; 2 flying south-west, 15/09/1959; flock of 5 and flock of 4, 26/08/1960; flock of 5 and flock of 4, 23/10/1960; 2, 12/03/1961; flocks flying west, 26/08/1961 and 03/11/1961; 1, 17/04/1964; single birds noted multiple times, September–October 1964, with some remaining to winter in Arys and Mashat river valleys (Kovshar' 1966); between Zhabagly and Abail, 1, 13/10/1967 (Kovshar' in Gavrilov & Gistsov 1985)
- **Zhambyl Sovkhoz**, between Zhanakogam and Kyzylaryk, 12 in alfalfa field, June 2005 (II Vagner, pers comm); and between Sergeevka and Karabulak, 1 flying over alfalfa and a male in alfalfa, 26/10/2006 (MK and II Vagner, pers obs)

Zhambyl province

Assy district

- between **Balykchi** and Boraldai foothills, 1 male feeding in field, 23/04/1958 (Korelov 2012)
- hills near **Shavrovka**, 3 flying over, 23/04/1958 (Korelov 2012)

Chu district

- between **Chu** and Birlik, many (2 killed by geologists), early September 1981 (Brushko 1986)
- **Zhusandala steppe** west of Aksuek village and east from Khantau–Chiganak highway, 1, 15/07/1983 (Jatkanbaev 1986)

Kordai district

- **Kordai pass**, 2, 20/04/1906 (Shnitnikov 1949)

Moiynkum district

- **Betpakdala desert**, 1, 26/03/2015 (Akimkanova 2015)

Ryskulov district

- unspecified locality, 18 in sloping wheatfield, 31/10/2010 (Balykin 2010)

Talas district

- **Akkol' lake**, 2, 21/03/2017 (Balykin 2017)
- 45 km north and 45 km north-west from **Bol'shie Kamkaly lake**, 1 each, 30/03/1981 (Fadeev 1986)
- **Malye Kamkaly**, 1, 30/03/1981 (Fadeev 1986)
- 100 km north of **Zhambyl**, 1, 30/03/1981 (Fadeev 1986)

Zhambyl district

- **Nurly lake**, north-east foothills of the Karatau range, 06/08/2013 (Belousov 2013-2014)

Zhualy district

- **Akyrtas**, 2 males, 20/01/2020 (Nukusbekov 2020)

- entrance to the **Berkara gorge**, 3 moulting males, 01/07/2019 (A Isabekov, pers comm & Nukusbekov 2019)
- **Billikol' lake** (shared with Talas district), 16 birds, 26/09/1957 (remaining until heavy snowfall in November) (Gavrin 1962)
- **Ertai**, north-east foothills of the Boraldai range (all records from agricultural fields), 7, 19/04/2013, 4, 20/04/2013, 3, 23/05/2013 (Nukusbekov 2013); 1, 25/05/2013 (Dyakin 2013); 29, 09/04/2014, 4, 12/04/2014 (Nukusbekov 2014); 11, 26/04/2014, and 1, 03/05/2014 (Isabekov 2014); 17, 08/05/2014, and 9, 12/05/2014, with 5 nests found by 18/05/2014 and first-hatched chicks of year seen next day; 5, 27/08/2014, and 2, 04/11/2014 (Nukusbekov 2014); 3, 06/04/2015, 18, 08/04/2015, and 11, 12/04/2015, with chicks hatched from 4 nests; 24, 01-04/10/2015 (Nukusbekov 2015, M Nukusbekov, pers comm); 23 just arriving to breed, 05/03/2016, and 35 (4 displaying males), 11/03/2016, with 9 nests found by 11/05/2016 (Nukusbekov 2016, M Nukusbekov, pers comm); 3, 31/03/2017, and 8, 20–26/04/2017 (Nukusbekov 2017); 7, 03–15/03/2018, and 4, 19/04–06/05/2018 (Nukusbekov 2018); 4, 04/03/2019 (Nukusbekov 2019); 8 females and 5 displaying males, 21/03/2019 (Dyakin 2019); 1 female in flight, 27/04/2019 (Nukusbekov 2019); 9, 19/03/2020, and 35+, 13/04/2020 (Nukusbekov 2020); several males and females, 06/04/2021 (Nukusbekov 2021)
- Lower reaches of **Koksai canyon**, 3, 13/06/2005 (Kolbintsev 2006)
- **Kuyuk pass**, 40, 29/01/2003 (Kolbintsev 2014); 1 in hilly steppe, 20/06/2011 (Belyalov 2011)
- **Teris** river shoreline, in abundance, 08/07/1864 (Severtsov 1947); Ters-Ashybulak reservoir, 1, 18/04/2014 (Belyalov 2014), and 56, 06/12/2020 (Nukusbekov 2021)

A comprehensive review of records shows eastern Kazakhstan has multiple opportunities to conserve the Great Bustard *Otis tarda tarda* year-round

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Summary: We summarise observations of the Great Bustard *Otis tarda tarda* since 1856 and review information from over 127 publications and contemporary observations by amateur birdwatchers obtained from a citizen science website. The study area encompasses the Almaty and East Kazakhstan provinces of Kazakhstan, where 772 records in over 40 locations are identified. Based on the available data, we estimate that approximately 60 Great Bustards may breed in the study area, though our confidence in that estimation is low and further censuses should be conducted. From 150 to 500 Great Bustards overwinter in this area. The seasonal and long-term dynamics indicate that the eastern Kazakhstan population is small, unstable and vulnerable. Key conservation measures include eradication of illegal hunting and environmental education campaigns for local people, with the involvement of a wide group of stakeholders and subsequent international monitoring of the population.

HISTORICAL BACKGROUND

The Great Bustard *Otis tarda tarda* has been mentioned in eastern Kazakhstan in published literature since 1856 (Semenov-Tyan-Shanskii 1946). During the 20th century there was a small but fairly stable population in East Kazakhstan province, and a similarly sized population in the Xinjiang province of China, across the international border.

METHODS AND STUDY AREA

Our study area included present-day Almaty and East Kazakhstan provinces of Kazakhstan and is bounded by the international border with China to the east. We compiled data on the abundance and seasonal distribution of the Great Bustard derived from 127 published sources since 1856 (see list of references). We also collected material from a website used by the Kazakhstan birdwatching community (birds.kz) to obtain more recent data to understand the current status of the species. Observations were also collected by the authors at the Markakol' nature reserve in Kurchum district of East Kazakhstan province from 1988–1990, and in the eastern Balkhash area of Alakol' and Sarkand districts of Almaty province in autumn 2021. All in all, 772 Great Bustard observations were collated from over 40 sites, of which 610 were made during a period of regular monitoring in East Kazakhstan province from 1999 onward. Sightings were recorded in natural landscapes such as steppe, mountain foothills, lake and river shores, and large lake valleys, as well as human-modified landscapes, specifically agricultural plots.

RESULTS AND DISCUSSION

To examine seasonal dynamics of Great Bustard abundance in the region, records of the species were classed into three periods: breeding season, period of formation of pre-migration flocks and migration, and wintering. The breeding season was defined as March–mid-August, covering the period from the first appearance of birds at breeding sites through fledging and the gathering of young in flocks. The period of formation of flocks for migration, and migration itself, was defined as mid-August–early October. The wintering period was defined as mid-October–February. A map of the seasonal distribution of Great Bustards is provided in Figure 1. Our evaluation of the number of individual birds appearing in the region in each season based on observations from 1999

to 1 March 2022 is provided in Table 1. A complete list of observations is included in Appendix 1.

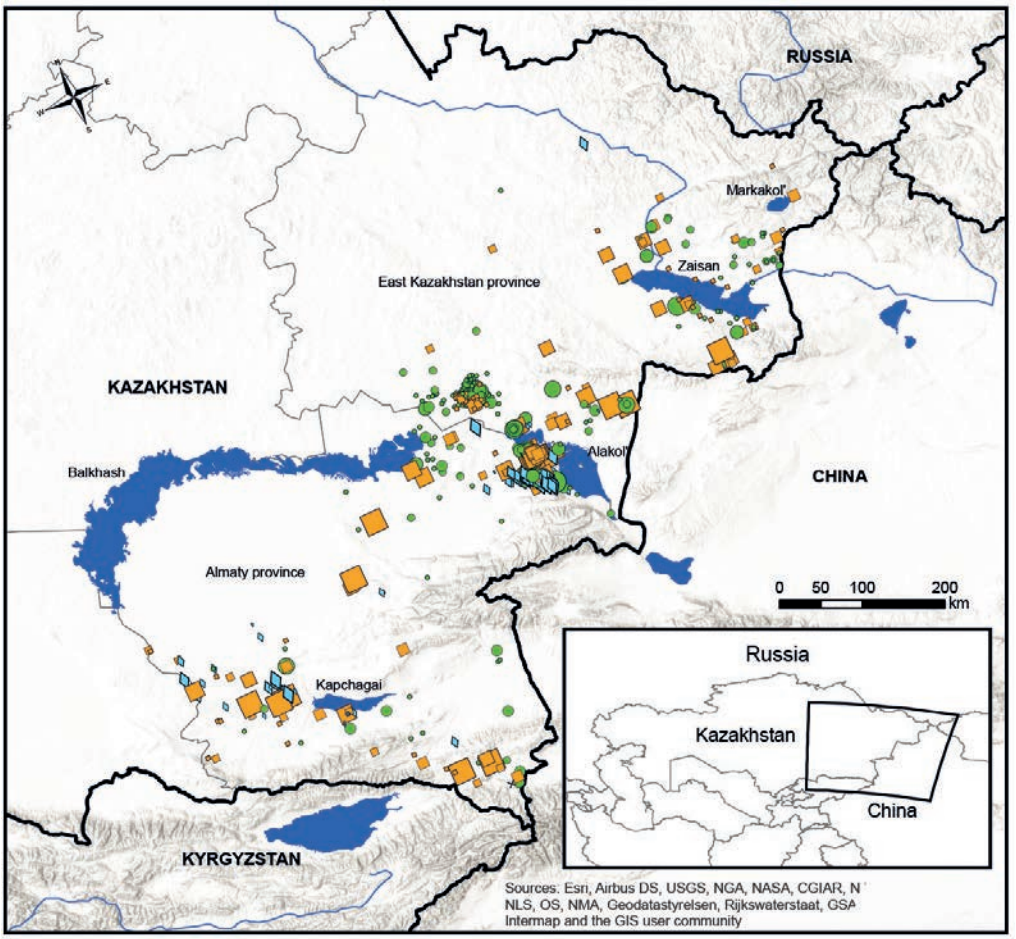

Figure 1. Seasonal distribution of Great Bustards in eastern Kazakhstan, defined as Almaty and East Kazakhstan provinces. Green circles indicate observations during the breeding season; orange squares indicate observations of pre-migratory flocks; blue diamonds indicate wintering; black x represents an observation for which the season is unclear. The magnitude of the symbol is proportional to the number of Great Bustards observed at a given point. Geographical relief is displayed with grey shading. Major rivers and water bodies are displayed in blue.

Breeding

Given the data we have collated, we find that in the 21st century the Great Bustard breeds in the Zaisan depression, on the foothills of the southern Altai ridge and in the Shilikti valley (Saur-Tarbagatai mountain system) in limited numbers. It may breed in the southern foothills of the Tarbagatai range, where small groups have been observed in the summer almost every year (Rustamov & Kovshar' 2007). Breeding has been confirmed to the north-east of Balkhash lake (Gubin 2015). The slight decline observed in number of breeding individuals recorded in recent years may be a result of decreasing attention paid by researchers as the species became somewhat more re-established in the region over the past decade.

Most observations from May through July are of post-breeding, moulting birds, mostly males, which use well-protected sites with good feeding conditions within the Alakol' nature reserve. During this time they are typically observed singly, or in groups of 2–3, or occasionally up to 6 individuals (Borisenko 1977).

Migration

Comparatively large migratory groupings of Great Bustard are observed in the western part of the Alakol' basin, particularly in the Tentek river delta. Berezovikov & Levinskii (2003, 2004, 2005, 2006, 2007, 2008, 2011) found that pre-migratory flocks typically consist of 15–30 individuals. However, there is some variation in the number of birds from year to year, and multiple reports of what are likely the same individuals in some years, particularly around 2002 as the species had recently reappeared in the province.

It is possible that the incidental autumn appearance of a Great Bustard on the southern Altai ridge in Katon-Karagai national park on 15 November 2014 (Chelyshev & Berezovikov 2014) represented use of a previously hypothesised migratory path of the Great Bustard. This path, used by other bird species, could have connected extirpated populations of the Eastern Great Bustard *O. t. dybowskii* on the Ukok plateau in Gornii Altai with wintering grounds of the Western Great Bustard in Kazakhstan (Berezovikov 1986). This hypothesis is supported by the presence of several stable Great Bustard wintering grounds in the western part of the Alakol' depression, in the Ili river valley and in the Karatau and Boraldai foothills in the south of Kazakhstan (Shakula 2019), where we estimate that more individuals winter than breed (Table 1).

Wintering

Great Bustard wintering grounds in the Alakol' nature reserve and vicinity on the border between East Kazakhstan and Almaty provinces have been regularly reported on in a series of 54 articles by N Berezovikov and collaborators (see Appendix and Literature Cited). Since 2004, Great Bustards have stayed to overwinter in the Alakol' basin. The core habitat consists of soybean fields in the foothills of the Bolshoi Saikan range, and also between Tentek and the western shore of Alakol' lake (Berezovikov & Levinskii 2005, Berezovikov 2011, Berezovikov & Filimonov 2015). The number of birds observed wintering increased in 2006–2008, when many fields in the region were converted from wheat and sunflower to soy (Berezovikov & Levinskii 2009). In subsequent years, as these larger groups of Great Bustards were heavily persecuted by poachers, the escape distance of the birds increased dramatically (Berezovikov & Levinskii 2012). This may have made censusing more difficult, such that surviving birds were undercounted.

Large fluctuations in the number of Great Bustards censused from winter to winter can be attributed in part to snow conditions, which affect both feeding conditions for Great Bustards and ability of observers to reach the site. In years with greater snow cover, Great Bustards gather in large flocks on the soybean fields and are more easily censused (Berezovikov & Filimonov 2016b). In contrast, during winters with less snow cover, overwintering Great Bustards tend to be scattered in smaller groups across the landscape, and are harder to locate and census.

Habitat

In spring (April–May) Great Bustards were observed on green sedge *Carex* sward in the lower reaches of rivers, on wormwood semi-desert, adjacent to lakes, in dry steppe with shrubby vegetation, and on patches of saltmarsh and sedge-mixed grass meadows in depressions (Sushkin 1938). During the breeding season (May–June) a female with two downy chicks was observed in semi-desert habitat (Gubin 2015).

The earliest autumn gathering (32 birds) was recorded on hay meadows in the Kokpekti tract in the lower reaches of the Tentek river (Berezovikov & Levinskii 2009b). The same authors record that in October, Great Bustards were seen feeding on dry grassy steppe, and among reeds on Shiryaev island in the Tentek river inside Alakol' nature reserve. From November through February, wintering flocks were recorded feeding on harvested fields of soybeans, sunflower and wheat (Berezovikov *et al* 2010–2021).

THREATS

Poaching of large winter flocks is the major threat to the Great Bustard in eastern Kazakhstan, where over a period of years one-third of wintering flocks were poached annually (Isakov & Flint 1987, Berezovikov & Levinskii 2012). Proposed protection measures should, first of all, be aimed at eradicating poaching, by improving effectiveness of anti-poaching efforts and conducting public awareness campaigns (Chan & Goroshko 1998, Berezovikov & Gubin 2010). Steep declines in populations of Great Bustards in eastern Kazakhstan were observed during a time of agricultural intensification in the 1950s, and it is likely that incompatible agricultural methods still lower reproductive success (Berezovikov 1986). The establishment of a local network of interested scientists and amateurs could provide information about the likely location of nests, as well as migratory or wintering flocks, and advocate for their protection. Concomitantly, standardised long-term monitoring such as that conducted for many years around Alakol' should continue, under the supervision of state organisations and international scientific institutions.

Table 1. Estimation of current Great Bustard population in eastern Kazakhstan, based on observations from 1999 to time of publication in early 2022. These numbers are an expert evaluation of the number of individual birds appearing in the region in each season.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	60	11	1–2
Gathering for migration	80–90	14	4
Wintering	180–500	15	5

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Appendix 1. All records of Great Bustard in eastern Kazakhstan from first record to 1 March 2022, by province, district and locality. Provinces are ordered west to east. Districts and localities are ordered alphabetically; Almaty city is listed as if a district. Provinces and districts of each observation are identified using current boundaries and names. The most specific locality relating to the particular record is given in bold. When dates were not provided, the position of the sighting in the timeline was interpolated from context available in the article. Citations commonly refer to 'pairs' and this is repeated here, although the species does not form pair-bonds. Comments in square brackets are editorial.

Almaty province

Aksu district

- 20 km from the left bank of lower **Aksu river**, 2 in sands, 07/05/1983 (Gubin 1986)
- **Ityk**, in the Dzhungarian Alatau foothills between Ak-Ichke and Aksu rivers, and south of road between Ak-Ichke and Karabulak stations, large numbers after September, year unspecified (Shnitnikov 1949)
- **Kopal**, chicken-sized juvenile caught, 16/06/1908 (Shnitnikov 1949)
- western **Syugaty valley**, 2 birds, 21/06/1955 (Kuz'mina 2008)
- near **Zhetysu**, 3 recently hatched chicks caught on bank of Aksu river, 19/05/1909 (Shnitnikov 1949)

Alakol' district

- **Alakol' lake** including Alakol' nature reserve (see also under Sasykkol' lake), well over 150 separately dated published records on land adjacent to the lake's western shores since 1965 to present, usually involving small groups but cumulatively often over 100 (see figures below under Enbekshi) and including single flocks of (*eg*) 24, 30, in fields (including soybeans and wheat), hay meadows, reeds, steppe, gravel plains and wormwood–saltbush (*Artemisia–Atriplex cana*) semi-desert at sublocalities Ai river, Akkuduk, Akshi, Aktubek, At Bashik, Ateken, Baibala lake, Batpakzhol, Besagach, Beskol', Chimkozha lake, Chuba-Tubek, Karabulak, Karamoiyn lake, Kokpekti, Korzhunkol' lake, Shiryaev island, Talapker farm, Tastyube hill, Tentek delta, Togyztubek, Tuyuksu watercourse, Usharal town and vicinity (including railway junction 8), Yntaly (see below under Enbekshi) including to the north (400 birds on soy fields in December 2016) and to the south on rocky foothill plain where Tentek river debouches from mountains (40 on 29/09/2004, with 2 shot by hunters), Zayachaya Guba gulf, Zhagatal, Zhaipak (see below under Enbekshi), Zhalanashkol' lake, Zhanama village and Zholdyagach, and including breeding records (female[s] with juveniles in June 2005, May 2008, May–June 2010 and 2011; 2 and 3 chicken-sized juveniles on Shiryaev island, 19/07/2003), and intensive migration at the Almaty/East Kazakhstan provincial border, 05–25/11/1953 and 20/10–17/11/1954, also 20/10–25/11/1962 (Gavrin *et al* 1962, Auezov & Grachev 1977, Annenkov 1986, Berezovikov *et al* 2002, 2007, 2016, Berezovikov 2003, Berezovikov & Filimonov 2017a, 2018, Berezovikov & Levinskii 2003, 2004, 2005a, 2006, 2007, 2008, 2009a,b, 2010, 2011, 2012, Kovalenko 2006, 2016, Gubin 2015, Filimonov & Berezovikov 2016, 2019b, 2021, Filimonov *et al* 2018, 2021)

- between **Arganaty** and Lepsy fortresses, many birds seen, 22/08/1856 (Semenov-Tyan-Shanskii 1946)
- near **Arkharly** village, 5 seen thrice on sands in lower Shilikti river, December 1988 (Berezovikov *et al* 2015); on road between Arkharly and Bala-Saikan mountain, 1 in sands, 08/12/2002 (Berezovikov *et al* 2004, 2015)
- lower reaches of Ayagoz and **Bakanas river**s (to the north of the Kyskash, Arkharly and Arganata mountains), 7–8 birds moulting, late July 1982 and late July 1983 (Berezovikov *et al* 2015)
- **Bala-Saikan mountain**, repeatedly seen on plateau-like summit in strong winds, winter 1988/89 and 1989/90 (Berezovikov *et al* 2015); foot of mountain, 4 in soy field, 04/02/2007 (Berezovikov *et al* 2007)
- eastern end of **Balkhash lake**, 1 on yellow sand *takyr*, 28/10/1988 (Berezovikov *et al* 2015), 6 birds, 05–06/05/2017 (Shmygalev 2017), and a year-old male in Saryarka hunting estate, 06/06/2020 (Shmygalev 2020)
- near Il'ich village and at **Baybol**, valley of Shinzhily river (left tributary of Tentek), 8 birds, 27/12/2008, with birds present for at least 10 days (Berezovikov & Levinskii 2009b)
- northern foothills of **Bolshoi Saikan mountain**, 12 on soybean fields, 16/01/2005 (Berezovikov & Levinskii 2005a; flock of 35 in soy fields, October–November 2005 (Berezovikov & Levinskii 2005a); 20–30, winter 2007/08 (Berezovikov & Levinskii 2009a)
- between northern foot of Ulken Saikan mountain and **Enbekshi** village (roughly west of Usharal) on Shinzhily river**,** this area plus that between Yntaly and Zhaipak (see Alakol' lake above) being censused in January–February 2013, 2014 and 2015, yielding 276, 240 and 132 birds respectively (Berezovikov & Filimonov 2015); in equivalent censuses in 2016 numbers broke down as Zhaipak/Yntaly 180, Enbekshi 60 and Karabulak 23 (Berezovikov *et al* 2016), in 2017 Zhaipak/Yntaly 188, Enbekshi 80 and Karabulak 120 (Berezovikov & Filimonov 2017a), and in 2018 Zhaipak/Yntaly 32, Enbekshi 30 and Karabulak 24 (Filimonov *et al* 2018)
- **Gorkii Kluch**, near Alakol' lake, 1 bird, 11/07/1981 (Khrokov 1986)
- near **Kainar** village, 5 in soy fields, 30/10/2009 (Berezovikov & Levinskii 2010)
- **Karakum desert** between Sasykkol' and Balkhash lakes [presumably as traversed on road R-129], 4 on clay desert and sands, April 2010 (Berezovikov & Levinskii 2010)
- near **Koktuma**, south shore of Alakol' lake, 12/04/1981 (Annenkov 1986)
- **Kugurum**, Dzungarian Alatau foothills, 2 feeding in field, 06/12/2004 (Berezovikov & Levinskii 2004)
- between **Makanchi** village and Alakol' lake, next to Khatynsu river, 4 reported by hunter, May 1978 (Shcherbakov 1986)
- **Saikan Pass**, Kugurum mountain plateau, 3 birds, 01/03/2009 (Berezovikov & Levinskii 2009b); 14, 10/01/2010 (Berezovikov & Levinskii 2010); northern foot of pass at Akkuduk, 1 bird, 13/11/2010 (Berezovikov & Levinskii 2011)
- **Sarybel**, 12 birds, 03/02/2005, 16 birds, 15/02/2005 (Berezovikov & Levinskii 2005a)
- **Sasykkol' lake** (southern and western part in Alakol' district; see also under Urzhar district) near Zharsuat village, 3 birds, May 1981 (Annenkov 1986); 7, 17/05/1999, 2, 30/07/1999; between Zharsuat and the Zaisan–Semey (Semipalatinsk) highway, male, 06/06/2000 (Berezovikov *et al* 2002); 12 at an artesian well west of Zharsuat, 21/05/2001, with 2 there on 26th, and 1, 16/07/2002 (Berezovikov *et al* 2002); between Sasykkol' and Alakol' lakes, 45 birds in 6 encounters, 13–18/12/2006 (Berezovikov & Levinskii 2006); along 10 km of road bordering Sasykkol' lake, 15 birds in 4 groups, 08/07/2013 (Dyakin 2013)
- **Taskarakum**, lower Shilikti river, flock of 12 in sand-dunes, 09/12/2004 (Berezovikov & Levinskii 2004)
- near **Uch-Kul' lake**, nest, 28/04/1909 (Shnitnikov 1949)

- unspecified areas within more general landscape embracing northern foothills of Saikan, Tekeli, Kaikan and Zhabyk mountains, where groups of 12–18 wintered 2004/05 (Berezovikov & Levinskii 2005b)

Almaty city

- near Vernyi (modern-day **Almaty**), nest with fresh eggs, 07/05/1907 (Shnitnikov 1949)

Balkhash district

- **Akdala hunting estate**, lower Ile river, 1 bird, 01/02/2020 (Shmygalev 2020)
- **Bakanas**, Ile river, and on Ile at confluence of Kurty river [50 km south-east], small groups and singles on regular spring migration to north-east; passing through this area in the first half of October as single birds or pairs (Shnitnikov 1949)
- **Miyali** [southernmost part of district, on border], 1 bird, 24/03/2018 (Gubin 2018)

Enbekshikazakh district

- **Asy plateau**, flock seen in treeless alpine pastures at 2440 m, 18/09/1867 (Severtsov 1947)
- east of **Bezimyannoe lake** in lower Turgen river flowing into Kapshagai lake, 30 in October 2003 as reported by shepherd (Bevza 2003); 2, 03/12/2006 *fide* shepherd (Bevza 2006)
- **Karashengil'** on Karatal river, huge number feeding on harvested wheat fields, 20/10/1910 (Shnitnikov 1949); Karashengil' game reserve, poached male, late February 1974 (Belyalov 1986), 2 including large male, 08/12/2006 with 1 there, 14/12/2006 (Bevza 2006); west of this reserve, 2 km from Kapshagai lake, 3 birds, 21/08/2006 *fide* ranger (Bevza 2006)
- **Kush** village, 1 flying north-west, 24/12/2004 and 28/12/2004 (Bevza 2004)
- west of **Shebukty river** and east of Karashengil' game reserve, 6 birds, 11/02/2006, and 1 bird, early March 2006, *fide* local reports (Bevza 2006)
- 40 km north-east of **Shilik** village, 1 in sparse saxaul forest, 20/05/1979 (Grachev 1986)
- central part of **Sugaty valley**, 1 bird, 15/03/2015 (Berezovikov & Zhdanko 2015)

Eskeldi district

- near **Taldykurgan city**, 2 birds, 31/10/2015, and 6, 02/12/2017 (Belyaev 2015, 2017)

Ile district

- near **Druzhba** village on Shamalgan river, 1 bird, 12/11/2000, with shepherds reporting that a bird reared two young there that year (Belyalov 2002)
- **lower Ile river** across from Bakbakty (in Balkhash district), 7 birds 23/02/2016 (Shmygalev 2016)
- 50 km from **Iliiskii** village, 8 on virgin steppe, autumn 1976 (Kamyshnikov 1986)
- **Kanshengel'**, 6 birds, 26/11/2006, and 2, 22/03/2014 (Isabekov 2006, 2014)
- **Karaoi plateau** near Akshi village, 8 birds, 09/05/1982 (Mirkhashimov 1986); 1 bird, April 1983 (Stepanov 1986); along 70 km of Kurty–Kazakhstan–Kapshagai road, groups of 30, 60, 10, 10, 10 (total 120), 06/11/2000 (Zhuyko 2002); 20 km north-east of Akshi, 5 birds, 19/11/2000 (Belyalov 2002); 20 km north-west of Kapshagai town, 23 birds, and 1 bird at 30 km post on Kapshagai–Kazakhstan road, 07/12/2000 (Gubin & Belyalov 2002), and several hundred on plateau, winters 2000/01 and 2001/02, *fide* local hunters (Belyalov 2002); between Akshi and Kazakhstan villages, 1 flock of 16 in lower reaches of Kurty river, 10–11/01/2006, and 20 km south-east of Kazakhstan village, 2 groups of 11 and 16, 03/02/2006 (Grachev 2006); between Akshi and Kazakhstan, up to ten flocks of 40–60 birds each (*ie* 400–600) in lower reaches of Kurty river, mid-December 2006 (Berezovikov *et al* 2007); 80 km from Kapshagai on Kapshagai–Kurty highway, 4 groups (1, 3, 10, 10), 10/12/2007, and 4 birds, 17/12/2007 (Azarenko 2007); between Kapshagai and Akshi at Kostobe game reserve, 4 birds, December 2015, and 8–12, January 2016 (Berezovikov *et al* 2016)
- near **Kazakhstan** village, eastern outskirts of Taukum desert, 1 migrating male, 10/11/1996 (Berezovikov *et al* 1999)

- 20 km south-west of **Kurty**, 3 on wormwood plain, 25/11/2000 (Belyalov 2002); 20 km east of Kurty, flocks totalling 150–170 birds, 05/11/2001 (Zhuyko 2002); 30 km south-east of Kurty, 5 birds, 11/11/2001 (Karpov & Khrokov 2002); plain west of Kurty, flocks of 49, 19 and 14 birds several hundred metres apart (Karpov & Belyalov 2002); Kurty to Uzunagash village, 4, January–February 2016 (Berezovikov *et al* 2016); near Kurty, 4 flying on migration, 04/03/2018 (Isabekov 2018)
- lower **Kurty river**, 2 males and 1 female, 23/11/1996 (Berezovikov *et al* 1999)
- **Sarybulak**, large numbers, 06/04/1909 (Shnitnikov 1949)
- south-eastern spur of **Seriktes mountains**, species seen, 11/01/1995 and up to 10 reported by poachers in nearby Anrakhai foothills over winter 1994/95 (Levin & Belyalov 2002)
- **Sorbulak lake**, 2 birds, 26/10/2012 (Fedorenko 2012)

Karatal district
- between **Zhanatalap** and Engels stations, 10–12 on edge of Moiynkum sands, September 1998 (Berezovikov 2002b)

Kegen district
- lower **Temirlik valley**, Sharyn National Park, 15 birds, 05/02/2016 (Zhdanko & Berezovikov 2016)
- **Uch-Merke plateau** (near Zhalanash, between the northern and southern ridges of the Zailiiskii Alatau), birds at 1525 m in clay steppe with pebbles and sparse vegetation, 21–24/09/1867 (Severtsov 1947)

Kerbulak district
- upper reaches of **Bezhe river**, Dzhungarian Alatau, migrating birds (number unspecified), late September–early November 1962 (Gavrin *et al* 1962)

Panfilov district
- edge of **Taukum sands**, 20 km west of Aidarly village, 1 bird, 06/09/1982 (Lopatin 1986)
- foothill steppe near **Zharkent**, fairly frequent with small groups of males, and nest with 3 eggs, 09/05/1929, nest with 2 eggs, 13/05/1929, nest with 3 pipping eggs, 25/05/1929 (Shestoperov 1929)

Raiymbek district
- entire district with very large numbers, 20 October of unspecified year (Shnitnikov 1949)
- **Aybyrzhal mountains**, fresh feather, 09/04/1956 (Berezovikov *et al* 2005)
- **Bayankol' river** at 1800 m, species collected, 1902 (Lönnberg 1905)
- meadows on right bank of **Karkara river** between the Zhelkarkara and Malaya Karkara rivers, 'bustards roam undisturbed', after 27/07/1904 (Sapozhnikov 1904); Karkara valley, adult male collected, 28/10/1910 (Polyakov 2013)
- between **Kegen river** and Chul-Adyr mountains, 1900 m, unspecified observation, 10/07/1912 (Shnitnikov 1949); lower Shelkude (Kegen) river, between Burado-bosun (Tuzkul') lake and Sardzhaz-Tute station, fairly large numbers, 29/07/1912 (Shnitnikov 1949)
- near **Kumurchi** village in Shalkudusu valley, flock of 18 adults, 15/07/1953 (Korelov 1956); between Kumurchi and Aktasty, 2 reported in *Artemisia* steppe, July–August 1993 (Berezovikov *et al* 2005)
- near **Narynkol** in the Bayankol' valley, male killed from flying group, 05/05/1949 (Stogov 2008)
- **Shirganak river** (tributary of Kegen river), birds seen and collected, 05/10/1867 (Severtsov 1947)
- steppe valley of the middle reaches of the **Tekes river**, between the mouths of the Muzart and Koksu rivers, pairs and flocks, second half of July 1893 (Kozlov 1899); groups feeding

in fields in Tekes valley, autumn 1947–1950 (Stogov 2008); occasional spring flocks, Tekes valley, 1955–1957 (Berezovikov *et al* 2005)
- valley of Burado-Bosun (**Tuzkul'**) mountain lake, brood found at 2000 m, 28/07/1912 (Shnitnikov 1949)
- **Zhalanash valley**, birds hunted at 1700 m, 03/10/1867 (Severtsov 1947)

Sarkand district
- near **Cherkasskoe** village (Dzhungarian Alatau foothills), two nests close to each other, eggs of one pipping, early May 1909 (Shnitnikov 1949)
- **Lepsy**, by Arganaty railway siding, 15 birds in 5 groups, 01/04/2010 (Gubin 2015)
- south-west of **Kokterek**, 2 birds, 02/05/2017 (Katuntsev 2017)
- no specified locality, 2 flocks of 7 and 16 in winter wheat, 05/10/2002, in an area where by local report numbers had significantly increased in recent years (Annenkov 2003)

Uigur district
- **Alabuga river valley** in foothills of Kul'dzha-Bash pass, 1800 m, unspecified observation, 12/07/1913 (Shnitnikov 1949)
- between Shonzy (Chundzha) and **Sharyn** (Charyn) village, groups of 5–10 in winter 2015/16, with the species probably occurring along the entire deserted left bank of the Ile and adjacent northern apron of the Ketmen ridge between Shonzy and Kolzhat village near Chinese border, birds reportedly first wintering there in 2011/12 (Berezovikov *et al* 2016)

Zhambyl district
- between marker points 215 km and 260 km [hence close to **Aksuek**] on Almaty–Karagandy highway, 1 male, 3 females, 12/08/1983, and 1 bird, 24/08/1983 (Kovalenko 1986); Zhusandala steppe between Kanshengel' and Aksuek villages, 3 birds, 04/10/2001 (Lapshin 2002); between Kanshengel' and Sarybulak in lowland desert Zhusandala near the Chu-Ili mountains and Anarkhai foothills, as many as 565 birds, with another 150 on an *Artemisia* plain with needlegrass and 70 more further away, 20/01/2007 (Berezovikov *et al* 2007); northern Anarkhai foothills, 5 flocks of 3, 4, 7, 11 and 14, 21–26/10/2007 (Kovalenko 2007); between Aksuek and Kanshengel', 17, and between Kanshengel' and Anarkhai foothills, in Zhusandala valley, 7, in winter 2015/16 (Berezovikov *et al* 2016); Anarkhai pass in Chu-Ili mountains, 15, 17/02/2016 (Shmygalev 2016); Zhusandala, 22 birds, 13/12/2018 (Kessler 2019)
- near **Aydarly** on Almaty–Karagandy highway, species seen, 12/10/2002, and reported to number 2000 birds in winter *fide Okhotzooprom* inspectorate, with 2 pairs nesting in 2002 (Levin 2002)
- near **Bakhbakhty** village, 2 on ricefields, 01/11/1980 (Pole 1986)
- **Bozoi**, 15 seen, 27/10/2006, 20 reported a few days later (Sklyarenko 2006)
- **Jolbarstau** in Saz railway station area (100 km north-west of Almaty), 1 in steppe, 06/04/2002 (Karpov & Belyalov 2002)
- 20 km from **Kopa** station in the Anrakhai foothills, 2 birds, 23/10/1981, and 1, 30/10/1983 (Rodionov & Usatyi 1986)
- 109 km west of Almaty [seemingly therefore near **Otar Rgaytö**], 1 bird, October 1979, and 4 males, 28/11/1980 (Pfander 1986); also 120 km west of Almaty [*ie* border with Zhambyl province], bird flying towards mountains, 28/11/1979, and male (8 kg) killed, 12/11/1980 (Erokhov & Zhuiko 1986)

East Kazakhstan province
Ayagoz district
- near **Aktogai** station, 4 out of 5 birds shot by drill operators, 1982 (Khrokov 1986); nest with 3 eggs, 12/05/2010 (Gubin 2010)

- **Ayagoz**, first spring appearance 11/04/1884 (Shnitnikov 1949); 3 birds, 15/09/2013 (Barashkova 2013); Ayagoz river, along eastern Balkhash, 25/04/2016 (Shmygalev 2016)

Borodulikha district

- sandy areas 30 km north of **Rybach'e** village, 2 for several days, early August 1982 (Starikov 1986)

Katon-Karagai district

- **Katon-Karagai national park**, 1 feeding in hay meadow between highway and apiary on left bank of Bukhtarma, 1.5 km east of Zhanaul'ga (Zhana-Ulgo) village, *fide* E Zhumagulov, 15/11/2014 (Chelyshev & Berezovikov 2014)
- fields near **Sergeevka** on western spurs of Narymskii range, southern Altai, nesting, 1952–1955 (Berezovikov & Vorob'ev 2001); display and courtship seen west of Sergeevka at Zhenishke, where local people killed six birds 1975–1978 (Berezovikov 1986)

Kokpekti district

- near **Bukhtarma reservoir** (see also Kurchum district) in the steppe mountains between Novoslavyanka and Kuigan villages, several, summer 1982, and flock of 8 including juveniles, October 1982 (Vorob'ev 1986); opposite Palatsy village, 4 birds, 02–08/10/2006 (Shcherbakov 2007)
- in sands along **Bukon river**, 1 bird, 08/09/1985, 4 birds, 04/10/1985 (Berezovikov & Samusev 2003)
- **Kokpekti**, 7 in hayfields, 25/12/2006 (Berezovikov *et al* 2007)
- 2.5–3 km south-east of **Turanga lake**, adult and subadult, 05/08/1967 (Egorov & Berezovikov 2006)
- western end of **Zaisan lake**, 10–15 roosting (with one eaten by a fox), October 1949, fewer birds there (or south-west of the lake) at the onset of frost, 02/11/1049, and near outflow of Irtysh river two broods of 2 and 3 crow-sized downy chicks, 01/07/1950, and 2 full-grown young collected, 13/09/1950, stomachs full of grasshoppers and one lizard (Berezovikov & Samusev 2003)

Kurchum district

- south of **Ak-Mekteb** village, 20 birds, 25/08/1981 (Shcherbakov & Kochnev 1986)
- near **Akzhar** village, 1 pair, only birds found after 3000 km prospection of Zaisan lake, April–October 1975–1978 (Berezovikov 1986)
- middle reaches of **Ashaly river**, 6 in small hills, 25–26/08/1985 (Berezovikov 2002a)
- plateau-like steppe mountains adjoining **Bukhtarma reservoir** (see also Kokpekti district), between mouths of Kaiyndy and Kurchum rivers, nesting and with moulting groups of 6–8 males observed in summer, 1982–1983, and up to 10, 1996–1998 (Berezovikov & Vorob'ev 2001)
- steppe and on bare slopes along **Bukhtarma river**, quite common, 1912, 1914 (Sushkin 1938)
- near **Bukon estuary**, north of Zaisan, 1 reported by hunter, mid-May 1978 (Shcherbakov & Kochnev 1986)
- between **Chernyaevka** and Kalguty villages, 4 in semi-desert next to Kurchum range, 15/07/1977 (Prokopov 1986); at Baichuak between Chernyaevka and Takyr villages, reportedly regular till 1970, thereafter occasional including 1, 28/06/1983 (Berezovikov 2002a)
- **Irtysh river** left bank near bridge [P-164 road, east of south-east point of Zaisan lake], 1 bird, April 1997 (Berezovikov & Samusev 2003)
- fields near **Kara** village (Kurchum range), 2 birds by local report, May 1962 (Berezovikov 2002a)
- in grassland near **Karashilik**, 2, September 1998, 4, 30/08/1999, 1, 28/03/2000 (Berezovikov & Samusev 2003)

- near **Karoi** village in Batpakbulak, 1 in mountain steppe (Kurchum range), May 1966 (Berezovikov 1986); 2 birds, 14/05/1983 (Shcherbakov & Kochnev 1986)
- **Markakol' depression** on migration, 1900–1901 (Yablonskii 1914); granite foothills through desert steppe on way from Zaisan lake to Markakol' lake, quite common, 1912, 1914 (Sushkin 1938)
- along **Razdolnoe**–Karatogai (Kalguty) road, 4 in semi-desert, 10/05/1965 (Egorov & Berezovikov 2006)
- **Sarykuduk** (between Ardynka and Karashilik), female with 2 large downy chicks, early June 1978 (Berezovikov & Samusev 2003)
- **Shakpaktas**, Kurchum mountains, 2 on plowed field, May 1963, and family group of 3 there, late August 1963 (Berezovikov 2002a)
- near **Shingildy** village on northern shore of Zaisan lake, young bird, 12/08/1979 (Egorov & Berezovikov 2006); also in unspecified area of northern shore of Zaisan lake, only 2 seen in 60 km, 27/09/1963 (Berezovikov & Samusev 2003)
- **Shushkaly** near Burabai in Kurchum ravine, 5 birds, 05/04/1983 (Berezovikov & Vorob'ev 2001)
- **South Bakumbai** valley, bold female [suggesting nesting] in *Spirea*-dotted fescue–wormwood, 21/05/2000 (Berezovikov 2002a)
- steppe near **Terekti** (formerly Alexeevka) in Kurchum mountains *fide* IA Dolgushin, species regularly encountered by local residents, 31/08–4/09/1946 (Berezovikov 2002a); desert plain along Buran–Karashilik–Terekti road, often found singly and in groups of 2–5, 1952–1954, including female with egg in oviduct, April 1953 (Berezovikov & Samusev 2003); between Terekti and Karatogai, breeding stronghold, 1970s–1980s, when species in decline elsewhere in region (Berezovikov 2002a); semi-desert plain of Alkabek between Terekti and Buran, regular, 1998–2002 (Berezovikov & Samusev 2003)
- **Ust'-Bukon sands**, 2 birds, summer 1981, 12, autumn 1981, 2, summer 1982 (Shcherbakov & Kochnev 1986); 2, 29–30/08/1982 (Berezovikov & Samusev 2003)
- **Zelenyi ravine** in lower reaches of the Alkabek river, 4 birds, summer 1967 (Berezovikov & Samusev 2003)

Tarbagatai district

- near **Akshokka** station, flock of 12 (adult male killed by poachers), 18/07/1982 (Trutnikov 1986)
- near **Karabulak** village (currently Tugyl) on the Priozernoe–Zaisan road, 1 bird, 14/07/1966 (Egorov & Berezovikov 2006); also in northern Manrak foothills [south-west of Karabulak and south of south-east corner of Zaisan lake], 2 birds, August 1982 (Berezovikov & Samusev 2003)
- near **Priozernoe** and Baitugas villages, 1+1, April 1983, and south of Priozernoe, 2 seen all summer 1983 (Shcherbakov & Kochnev 1986)
- southern **Prizaisan'e** area [*ie* near Manrak ridge], 1 bird in snow-covered lowlands, 02/04/1950 (Berezovikov & Samusev 2003)
- **Shilikti valley** (see also under Zaisan district) in Manrak foothills, small numbers in 1970–1980s (Berezovikov 1986, 1992); near Komsomol' station, 4 birds, 30/08/1980 (Kovshar' & Sherbakov 1986); near Akhmetbulak village, 2 flocks of 8 and 4 birds, August 1981 (Shcherbakov & Kochnev 1986); between Shilikti and Akhmetbulak villages, 17 birds composed of females with young in groups of 2–4, early July 2001 (Berezovikov & Levin 2002)

Ulan district

- between **Preobrazhenka** and Kokpekti villages, bird flying towards Kalbinskii ridge, 30/07/1963, *fide* IA Dolgushin (Berezovikov & Samusev 2003)
- 20 km south of **Ust'-Kamenogorsk**, 40 birds, winter 1948/49 (Gavrin *et al* 1962)

Urzhar district

- south-east corner of **Alakol' lake**, 3 birds, 08/05/2016 (Shmygalev 2016)
- at **Zhenishke**, 70 km north-east of Sagat, 40 birds, 04/05/2008 (Shcherbakov 2008)
- **Balatuba mountain**, 30 on fields, September 1983 (Starikov 2002)
- 7–8 km south-west of **Karabuta** village, northern foothills of Karabas range, along the lower Laika river, 7 in harvested fields and hayfields, 28/08/2002, 27, 14/09/2002, two flocks of 16 and 20, 28/09/2002, 135–148 in somewhat wider area involving lower Laika river and Ashaly (Atagai, Karabuta, Bugubai, Bakhty, Karabas), 02/10/2002, with 145 counted in same area (with addition of Kokterek village), 15/10/2002 (Berezovikov & Shmygalev 2008); near Karabuta in Tarbagatai range, 1 bird, 13/05/2016 (Shmygalev 2016)
- 8 km east of **Makanchi** village, 8 birds, spring 1981, and 8 km north, fledged chick, late June 1982 (Trutnikov 1986); 10 km south, several seen regularly, summer 1982, 10 km east, 2 birds, mid-January 1983, 10 km north-west, 4 birds, late April 1985 (Starikov 2002); 30 km north, 4 feeding in harvested grain fields, mid-August 1982 (Trutnikov 1986)
- lower **Makanchi river**, 1 on green sedge sward, 12/04/2005 (Berezovikov & Annenkov 2005)
- north side of **Sasykkol' lake** (see also under Alakol' district) near Sagat, 2 birds, 19/05/2003, 3, 20/05/2003 (Belyalov & Gavrilov 2003); 58 birds, 14–30/03/2016 (Berezovikov *et al* 2016, Filimonov & Berezovikov 2016); 6, 27–28/03/2017 (Filimonov & Berezovikov 2017b); 7, 15/03/2018 (Berezovikov & Filimonov 2018); 24, 16–23/03/2019 (Filimonov & Berezovikov 2019b); between 3 and 8 on 4 different days, March 2020 (Filimonov & Berezovikov 2020b); 4, 25/03/2021 (Filimonov *et al* 2021); unspecified area of northern shore of lake, 31 feeding on locusts *Locusta migratoria*, 02–03/09/2013 (Berezovikov & Filimonov 2016a); 3, 10–12/01/2018 (Filimonov *et al* 2018); 5, 22–25/01/2019 (Filimonov & Berezovikov 2019a); 5 during 90 km drive, 18–21/01/2021 (Filimonov & Berezovikov 2021); 18 km north-east of Sagat, groups of 1, 2 and 8 in dry steppe with shrubby vegetation, patches of salty land and sedge/grass meadows in depressions, 17/05/2008 (Shcherbakov 2008); steppe north of lake at 46° 42′ N, 81° 30′ E, 3 birds, 14/07/2004 (Zinchenko & Bulgakova 2004); between Sagat and Saryzhol lake, 8 birds on 45 km transect, 12/01/2017 (Filimonov & Berezovikov 2017a)
- south of **Urzhar**, 1 bird, 11/09/2004 (Isabekov 2004)
- by **Ushkata river**, western foothills of Karabas, 25–30 drinking at artesian well in afternoon heat, fledged young in flock, 12/07/2004, and species seen there, 13/08/2004, when reportedly often in groups of 3–4 (Berezovikov & Shmygalev 2008)

Zaisan district

- **Aidapkel'** near Uiden reservoir, 3 birds including a juvenile, summer 1999 (Berezovikov & Levin 2021)
- between **Aktoubas** and Baitagas, pair, August 1982 (Berezovikov & Samusev 2003)
- between **Daual** and Karabulak villages, adult in wormwood steppe in eastern foothills of Manrak, 16–17/06/2004 (Berezovikov & Levinskii 2004)
- near **Kamyshzavod**, 1 bird, 20/09/1981 (Berezovikov & Samusev 2003)
- 3 km west of **Kara-Biruk mountain**, 2 wary birds (flight distance 500 m) in clay semi-desert with shrubby vegetation, 26/07/2008 (Shcherbakov 2008)
- near **Karatal**, 2 in fields after first snow, 05–10/11/1984 (Berezovikov & Samusev 2003)
- **Kusty river** valley, 2 birds, 11–15/09/1984 (Berezovikov & Samusev 2003)
- **Mukashi**, just south of Zaisan lake, 2 birds, early April 1997, and 1 bird between Polovinka and Mukashi, May 2000 (Berezovikov & Samusev 2003)
- near **Sarchii** village at eastern edge of Manrak ridge, flocks in vast steppe-like mid-mountain plateau at 1300–1400 m, 1960 (Shcherbakov & Berezovikov 2004)
- **Shilikti valley** (see also under Tarbagatai district), pre-migration flocks so large that 'at any hour of day riding through the valley you can find thousands of them', autumn 1855 (Plotnikov 1893); concentrations in valley and adjacent Manrak when moulting, and even on high plateaus, summer of year(s) unspecified (Berezovikov & Samusev 2003); moulting in

valley, May, in flocks of 10–20(–100), with fledged broods after 20 June moving from desert plain to alpine meadows in watersheds at 1700 m, 1910–1920 (Khakhlov 1928)

- meadows west of **Zaisan lake**, several small groups (2, 3, 3, 4, 4, 7 and 8), with one young (3.8 kg) caught, 04/10/1950 (Berezovikov & Samusev 2003); young female killed at Baklanyi cape on the lake, stomach full of tenebrionid beetles, 28/08/1976 (Egorov & Berezovikov 2006); pair at Volchii cape, mid-May 1981 (Berezovikov & Samusev 2003)
- steppe adjacent to **Zaisan**, flocks of 3–7 birds on 52 km journey, *c*1950 (Samusev 1977); arable land near the city, 3 birds, 10–15/10/1985 (Berezovikov & Samusev 2003); 7 km from Zaisan at Zhanaturmys, female with chick, summer 1997, female with chick, summer 1998, 4–5, August–September 1999 (Berezovikov & Levin 2021)
- near **Zelenoe** village, south of Kurchum, 18 feeding in hay meadow, 22/09/1981 (Shcherbakov & Kochnev 1986)

Zharma district

- 20 km from **Charsk** station, 2 birds reported by hunter, late June 1981 (Shcherbakov 1986)
- north of **Karakultas mountain** [on Google Maps as Kara-ut-kul'], between Arshaly and Zharma, female with two juveniles in steppe, late August 2000 (Zinchenko 2002)

Breeding and migratory Great Bustards *Otis tarda tarda* persist in the Zaisan lake basin, eastern Kazakhstan

KONSTANTIN PAVLOVICH PROKOPOV

Summary: In eastern Kazakhstan the Great Bustard *Otis tarda tarda* occurs in the Zaisan lake basin, Shilikti valley, foothills of the Saur, Tarbagatai and Manrak mountains and in the Alakol' depression. According to interviews, small flocks of Great Bustards are recorded annually in the Zaisan depression, most often in harvested wheat fields in autumn, during post-breeding movements. In the Shilikti valley, on the northern apron of the Saur, Tarbagatai and Manrak mountains, Great Bustards are recorded annually in wheat and barley fields between the Kenderlyk and Aksair rivers. Almost all records have been made in autumn, when birds leave the region. The landscape is an undulating feathergrass steppe, where groups of shrubs can be found in long gullies with gentle sides. The territory is used as pasture. Up to 30 Great Bustards inhabit the Alakol' depression, where the species nests every year. Active development of the area led to a sharp decrease in Great Bustard numbers, to the verge of extinction. Indeed, the species is now absent from most of its historical range in eastern Kazakhstan. In eastern Kazakhstan, losses of the species peaked when a wide network of roads was built. Unrestricted and uncontrolled hunting using cars and rifles had an especially strong negative impact on the Great Bustard. Anthropogenic disturbance negatively affects this species. There are also records of individuals dying on powerlines. The critical situation of the Great Bustard population in eastern Kazakhstan requires urgent conservation steps from the hunting inspectorate and general public.

FORMER ABUNDANCE AND DECLINE IN EASTERN KAZAKHSTAN

In the 19th and first half of the 20th centuries, the Great Bustard *Otis tarda tarda* was a typical bird of the semi-desert and steppe landscapes of eastern Kazakhstan. It was found commonly in the basin of Zaisan lake (hereafter 'Zaisan basin'), northern foothills of the Saur mountains, Shilikti valley, Tarbagatai foothills, low spurs of the Kurchumskii range, Bukhtarminskaya and Kurchumskaya valleys, foothills of the western Altai and Kalbinskoe plateau, and steppes of Semipalatinsk Priirtysh'e (the region west of the Irtysh river; Berezovikov 1986). Writing about the Great Bustard in the Shilikti valley at the beginning of the 20th century, Plotnikov (1905) gave a striking account of its abundance:

> 'There is no bird that occurs in such enormous numbers in the Shilikti valley as the Great Bustard. Suffice it to say that, before migration, the valley is completely covered with them; at this time of year—at any time of day when you pass through the valley—you can observe them in the thousands. The Great Bustard is not particularly timid and, in order to kill one, there is absolutely no need to use any kind of stratagem; their trustfulness is such that they sometimes tolerate 5–7 shots and only take off when a bullet strikes very close and sprays them with tiny stones. Generally, Great Bustard hunting here is not at all difficult; a good hunter specifically targeting this species can (as I have seen several times) kill 12–15 in a day.'

Even so, it is the Zaisan basin, 300 km long by 150 km wide, that represents the primary region for the Great Bustard in eastern Kazakhstan, as well as being the most north-easterly outpost of the species in Central Asia. It is located in the semi-desert zone at 400–1000 m above sea level. Its northern edge is defined by the southern Altai mountains, the western edge by a spur of the Kalbinskoe plateau, and the south by the Saur, Tarbagatai and Manrak mountains (Gvozdetskii & Nikolaev 1971). In the 19th century, the Great Bustard was encountered here in 'enormous flocks.' According to Khakhlov (1928), until 1905 Great Bustards 'were still encountered in large numbers some 7–8 versts

[7.5–8.5 km] from Zaisan city. The further from the city, the larger the number that could be encountered. The road connecting Zaisan city with Topolevyi Mys was oftentimes alive with these birds.'

The creation of settlements at the beginning of the 19th century, the plowing of land, haymaking, pasturing of livestock, and hunting disrupted the breeding of these birds in many districts, and served to reduce their populations. In this manner, as a result of progressive reductions in the numbers of Great Bustards in a large portion of the species' historical range in eastern Kazakhstan, the species largely disappeared, remaining only in a handful of areas in the south-western foothills of the southern Altai, Shilikti valley, north Prizaisan'e (the region west of lake Zaisan) and Tarbagatai. The sharpest declines in Great Bustard numbers in eastern Kazakhstan coincided with the appearance of automobiles and the development of a large-scale network of roads, penetrating areas that had previously been poorly accessible. Excessive and uncontrolled shooting of Great Bustards from automobiles with rifles had a particularly negative effect on Great Bustard populations, leading to the widespread destruction of the remaining Great Bustards in the Zaisan depression (Scherbakov 1976).

Table 1. Current population estimate for Great Bustards in the Zaisan basin, eastern Kazakhstan. These numbers are an expert evaluation of the number of individual birds appearing in the region in each season based on field investigations and conversations with local people and researchers.

Location	Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Karagiya area	Breeding	0	–	
	Gathering for migration	5–7	2	3
	Wintering	0	–	
Akzhon sands, near the Black Irtysh river	Breeding	4–6	1	3
	Gathering for migration	6–8	1	
	Wintering	0	–	
Near Ulken-Karatal village	Breeding	0	–	
	Gathering for migration	10–15	1	3
	Wintering	0	–	
Near Priozernoe village	Breeding	0	–	
	Gathering for migration	4–6	1	3
	Wintering	0	–	
Shilikti valley	Breeding	10–15	3	3
	Gathering for migration	20–30	3	4
	Wintering	0	–	
Total	Breeding	14–21	4	3
	Gathering for migration	45–66	8	3
	Wintering	0	0	

RECENT SURVEYS AND STATUS IN AND AROUND THE ZAISAN BASIN

The international project 'Eurasian Bustard Alliance,' is working to evaluate the contemporary population size of Great Bustards in Asia, including those in eastern Kazakhstan, with our contribution. We carried out field research on the present status of the Great Bustard in eastern Kazakhstan from 9 to 20 May 2017, and 3 to 7 August 2017, travelling thousands of kilometres through the eastern, northern and southern portions of the Zaisan basin and the Shilikti valley. We also gathered information from local people, interviewing dozens of farmers, herders and hunters, and each time received a similar answer: 'We see Great Bustards, but only very rarely… most often in autumn on harvested wheat fields… In earlier days we used to see birds during haymaking and each year we killed 5–7 of them. Where have they gone?' Our estimates of the current population size in each region are presented in Table 1. The critical status of the eastern Kazakhstan population of Great Bustards demands immediate action for its protection by both the hunting inspectorate and the wider community.

Zaisan basin

We began our data collection in the eastern portion of the Zaisan basin, in the area known as Karagiya, 25 km north of Buran village in Kurchumskii district. The existence of Great Bustards in Karagiya was brought to our attention by MK Agiekov, who has a farm in the area. For the past several years he has encountered from 4–6 Great Bustards each spring and autumn. At the time of our observations, the area was being sown with wheat, soy, sunflower and melons; no fertiliser was used. Anthropogenic pressure has undoubtedly damaged the Great Bustard population here. One bird died in a collision with a powerline in the spring. A shepherd and hunter from the neighbouring village of Karachilik, AA Aimbaev, counted 15 Great Bustards in Karagiya in autumn 2015, noting differences in their sizes, but in spring 2017, he saw only two. However, he mentioned that when the feathergrass blooms the birds become difficult to observe.

On the left bank of the Black Irtysh, in the east of the Zaisan basin, there is a flat, wide, sandy feathergrass–*Artemisia* steppe known as Akzhon. This area, within the international border zone, is subject to little human disturbance. Here, border guards and herders say, individual Great Bustards are sighted in spring, summer and autumn.

According to local people, only the Asian Houbara *Chlamydotis undulata* is found in the northern portion of the Zaisan basin, which is composed of a clay-schistose and sandy-schistose semi-desert and *Artemisia*–grass steppe. KK Kysaubaev and AT Sarsenbaev, hunters from the villages of Egilik and Chengel'dy respectively, showed us sites where they had observed houbara.

East of the village of Ulken-Karatal in Zaisan district, in the eastern portion of the southern half of the Zaisan basin, in grass-brush steppe, 5–6 Great Bustards are observed each year in wheatfields after harvest. The maximum number observed at a single time was 23.

FK Karamullin, director of the Zaisan Game Enterprise, and hunters with whom we spoke, indicated that the Great Bustard only occurs in the Zaisan valley during more irregular movements in autumn. Near the village of Priozernoe, in the southern half of the Zaisan basin, both Great Bustard and Little Bustard *Tetrax tetrax* are occasionally observed.

Shilikti valley

FK Karamullin and other interviewees unanimously confirmed that the Great Bustard nests in the Shilikti valley. According to observations of hunters, herders and other local people over many years, Great Bustards are observed every year in the valley in the northern alluvial plain of the Saur mountains, on the section between the emergence of

the Kenderlyk and Aksyir rivers on sown wheat and barley. Sightings largely coincide with the autumn migration, more rarely in spring. It is possible that the birds nest along the northern foothills of the Saur mountains, but because of their wariness when breeding they are not noticed by local people.

SV Starikov, a senior ornithologist who has studied the avifauna of eastern Kazakhstan for many years, has observed a small number of Great, Little and Asian Houbara Bustards in the Shilikti valley and the foothills of the Saur, Tarbagatai and Manrak mountains. According to Starikov, there are three sites in the Shilikti valley where Great Bustards are more frequently encountered. The first is the alluvial plains along the southern foothills of the Manrak range, which are covered with dry feathergrass steppe and used intensively as sheep pasture. The second is the more elevated and damp eastern portion of the valley, an immense area covered by feathergrass steppe, sometimes with brushy *Spirea* and *Caragana* scrub, and used for haymaking and pasture. The third is pasture in the south-west corner of the valley, flanking and partially encompassing the foothills of the Tarbagatai range, where the steeply sloping terrain is covered by feathergrass steppe with bushy thickets in long river valleys with gently sloping banks. At all three sites, the Great Bustard is encountered both in the breeding season and on migration, but more frequently in fall than in spring or summer. Numbers of the species are, however, so low that during a targeted search it was virtually impossible to find them.

ACKNOWLEDGEMENTS

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The near-extirpation of the Great Bustard *Otis tarda tarda* as a wintering and breeding species in Tajikistan

RUSTAM SHARIFOVICH MURATOV & KHURSAND MIRZOSHOEVICH TALBONOV

Summary: In Tajikistan the Great Bustard *Otis tarda tarda* is a very rare migratory and irregularly wintering species. Before the 1940s it used to nest in southern Tajikistan, and at that time, before the development of fallow lands in valleys began, wintering Great Bustards were recorded in flocks of up to 20 individuals, in pairs or singly, on flatlands almost all across the country. The species still occurs on migration and in winter almost every year but in tiny numbers. Threats are hunting, development of virgin lands and degradation of habitats including through overgrazing. Conservation steps needed include organising temporary protected areas in the potential breeding grounds and controlling illegal hunting.

INTRODUCTION

The status of the Great Bustard *Otis tarda tarda* in Tajikistan has deteriorated greatly in the past hundred years. Tajikistan is located in the southern extremity of its Central Asian range, and therefore was mainly a wintering ground for the species in considerable numbers, although it also bred. Steppe, desert and semi-desert landscapes were and remain its primary habitats; it was also found in steppe in the piedmont zone (*adyrs*). However, habitat conversion and degradation (plowing of grassland, agricultural intensification causing loss of fallows, overgrazing) combined with hunting had such a profound negative impact on the Great Bustard that the first (1988) and second (Kurbanov 2015) editions of the *Red Book of the Republic of Tajikistan* treated it as a rare and disappearing species. Here we summarise what little is known about the Great Bustard in Tajikistan.

PAST AND PRESENT DISTRIBUTION AND POPULATION

Breeding

Until the 1940s, the Great Bustard nested in southern Tajikistan, in districts near the border along the Zaravshan river (near Penjikent) and along the Syrdar'ya river valley, in the Pyanj Karatau and in the region between the Pyanj and Kyzyl-Su rivers (Meklenburtsev 1937, Ivanov 1940, 1969, Abdusalyamov 1971; Figure 1). Hunters verbally reported adult Great Bustards with chicks on the right bank of the Syrdar'ya river in Sol'proma district (Abdusalyamov 1971). In former springs dating back 30 years or more, Ivanov (1969) observed the species in the Hissar valley, in Penjikent district, in 'Tigrovaya Balka' nature reserve, and in the Pyanj and Kyzil-Su river valleys. As most of these areas have been plowed, almost no natural areas remain for the species to nest in. The only places where it could possibly now do so are in the south-west of the country, in parts of the Kashkakum and Shakh (Kurdzhalakum) deserts, in the Karadum valley, and in 'Tigrovaya Balka' nature reserve.

Migration

In autumn, Great Bustards have been observed outside of Dushanbe, in the Hissar and Yavan valleys, in the Parkhar district and in southern Tajikistan (Abdusalyamov 1971; see Figure 1). AI Ivanov also observed birds flying through the Hissar mountains. The discovery by Popov (1959) of Great Bustards near Iskanderkul lake on 17 September indicates that on migration these birds can occur high in the mountains (2100 m above sea level). Two to three migrating Great Bustards were seen in the Sughd region in the outlying areas of Khujand in October–November 2017.

Table 1. Expert evaluation of current population of Great Bustards in Tajikistan.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) – 5 (high-quality)
Breeding	No longer observed	4 (previously)	2
On migration	1–5	4	3
Wintering	1–2	1	2

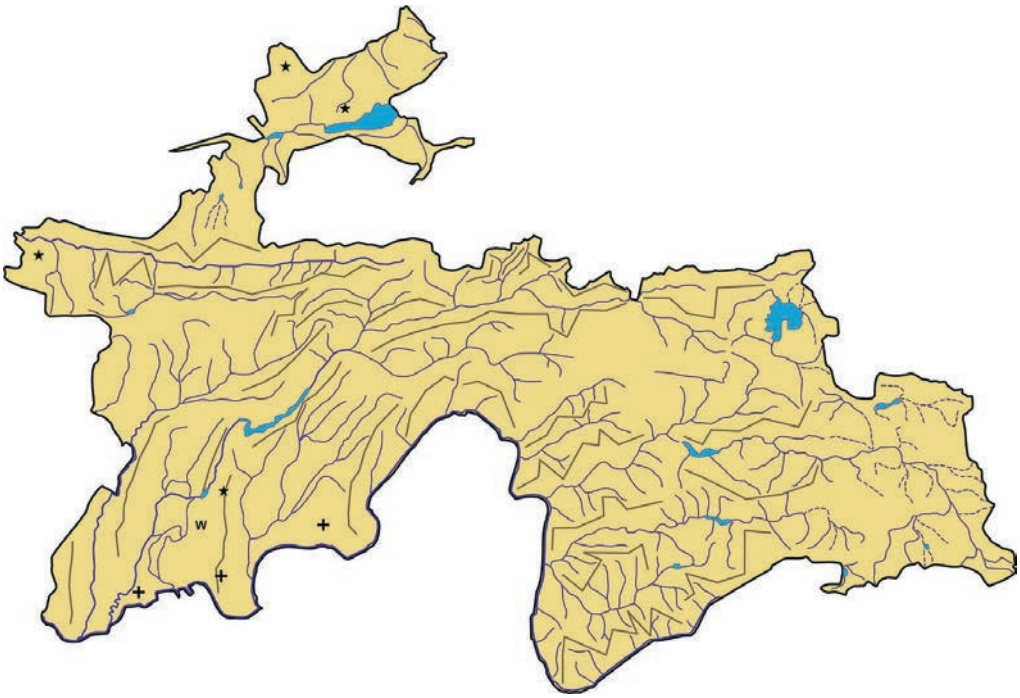

Figure 1. Contemporary distribution of the Great Bustard in Tajikistan. * = current migratory stopover, w = current wintering site, + = former breeding locality (no breeding record in Tajikistan in the past 40 years).

Wintering

Until the 1940s, before the intensive conversion of valleys and uncultivated land, there were large numbers of Great Bustards wintering in Tajikistan. The birds were encountered in flocks of up to 20 individuals, in pairs and singly, across virtually all lowland regions of the republic. Specifically, wintering birds were observed in the Hissar and Yavan valleys, in the Rengentau mountains, and on the Kumsangirskoe plateau, in 'Tigrovaya Balka' nature reserve and Shaartuz, as well as in the Vakhsh, Syrdar'ya, Zaravshan and Kafirnigan river valleys. Wintering occurred from the end of August to 10 April, with some individuals departing as early as February (Abdusalyamov 1971). There were well-known hunting parties in the Yavan valley during the 1950s, when groups of hunters on motorcycles pursued wintering Great Bustards. A typical take was from 40–50 birds per season (hunter verbal reports).

Over the past 30 years, the species has been observed only very rarely. Currently, the Great Bustard occasionally winters near Olimtai, Saartuz and Kubodiyon in tiny numbers; see Figure 1 and Table 1. We observed a pair of Great Bustards on winter wheat in Dangarinskii district in February 2006.

THREATS

The main threats to the Great Bustard in Tajikistan are habitat destruction and degradation, poaching and overgrazing in nesting areas. There is not enough habitat for the Great Bustard to nest, as all its territories were plowed. The situation has become even worse because of poaching. Free-ranging dogs also predate these birds, alongside natural predators such as foxes and jackals.

CONSERVATION MEASURES

We think that it is necessary to make seasonal protected areas for the species in winter and during migration. It is also important to consider the idea of establishing one big Central Asian nursery. Another important measure is poaching reduction, with corresponding public awareness campaigns to support Great Bustard conservation.

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Status of the Great Bustard *Otis tarda tarda* in Kyrgyzstan

SERGEI V KULAGIN

Summary: Kyrgyzstan has very little suitable habitat for Great Bustards, but the species is known to have nested in four widely separated areas. Currently, it is recorded mainly on migration, rarely in winter, in steppe and semi-desert areas and intermontane valleys, often at 2500 m above sea level. Threats are habitat loss and poaching. Steps to restore populations must include greater local community awareness, incentives for farmers who could have the species nesting on their land, protected areas on flyways and wintering grounds, and control of poaching.

INTRODUCTION

Kyrgyzstan is a mountainous country with very little habitat suitable for the Great Bustard *Otis tarda tarda*. Nevertheless, the species has been recorded breeding in four widely separated areas, with observations of migratory birds in several other places. Hunting and habitat loss have led to the species being listed as Critically Endangered (CR: R, A1) in the country (Shukurov & Kasybekov 2007). A brief overview of records follows.

PAST AND PRESENT DISTRIBUTION AND POPULATION

During 1900–1910, the Great Bustard regularly nested in steppe areas and cereal fields in the Chui valley (Shnitnikov 1949; Figure 1, Chui province). During the 1940–1950s, it was also found nesting in the mountain valleys of the Naryn river, near Kulanak (Figure 1, site 1) and Toguz-Toro (Figure 1, site 2) villages at altitudes up to 2500 m above sea level (Yanushevich *et al* 1959). In the middle of last century, the species nested and wintered in Osh province in the south of Kyrgyzstan (Figure 1, Osh province), although there is no recent information about its presence in that area. Breeding of this species in the republic is known only from the period 1900–1950 and is not currently observed (Shnitnikov 1949, Yanushevich *et al* 1959).

Great Bustards arrive at their wintering sites at the end of October through early November in small flocks of 5–7 individuals. Historically, they were recorded regularly

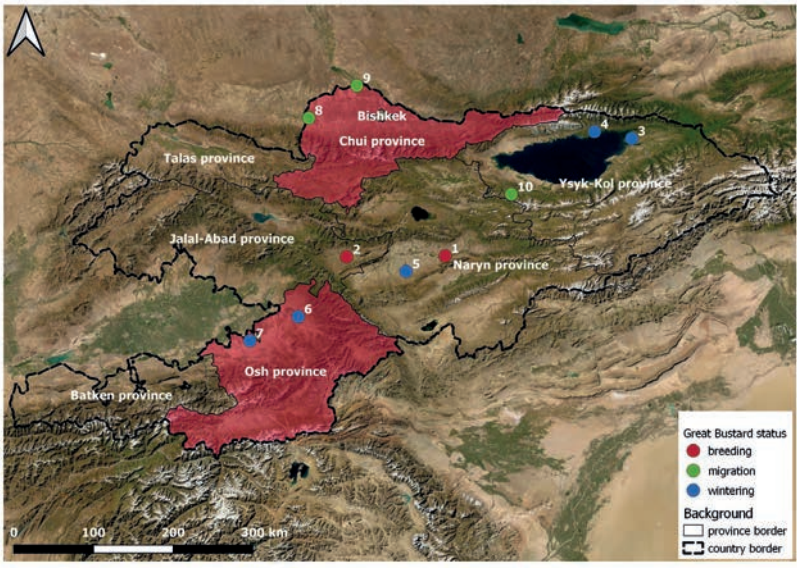

Figure 1. Distribution of Great Bustard breeding sites, stopover and wintering sites in Kyrgyzstan. Numbers refer to the respective references to the locations in the text. The two provinces mentioned in the text as breeding areas of Great Bustard are highlighted in red.

in the eastern part of the Ysyk-Kol valley in winter (Figure 1, site 3) and on migration (Shnitnikov 1949, Yanushevich *et al* 1959). In winter 2001–2002, three Great Bustards occupied a field near the village of Ananevo (north-eastern shore of Ysyk-Kol lake; pers obs) (Figure 1, site 4). In the western Ysyk-Kol lake basin, Naryn, Osh and Jalal-Abad provinces, they remained in the foothills and adjacent agricultural fields from fall through winter, where they fed on orthopterans, grains and safflower seeds (Figure 1, sites 5,6,7; Yanushevich *et al* 1959). After snowfall, the birds gather along the southern slopes of foothills (Shnitnikov 1949, Yanushevich *et al* 1959). However, snow cover is not frequent or long-lasting at these sites and typically melts within 1–2 days. Great Bustards also use piedmont regions near Chaldovar village in the Chui valley (Figure 1, site 8), adjacent to Kazakhstan, as migratory stopovers (Shnitnikov 1949, Yanushevich *et al* 1959). A large migratory gathering of some 300 Great Bustards was observed on 14 April 1958 in the Chui valley, feeding in a cereal field in groups of 10–15 birds close to the border with Kazakhstan (Figure 1, site 9; Yanushevich *et al* 1959). In October 2019 local shepherds caught one injured Great Bustard in an area near Toguz-Bulak village, Tong district, Ysyk-Kol province (Figure 1, site 10; pers obs).

The Great Bustard's main habitat in Kyrgyzstan is steppe and semi-desert areas, as well as cereal cropfields. Its latitudinal and especially altitudinal distribution depends on the presence of suitable habitat. This species has been found in mountain foothills and intermontane valleys at altitudes of up to 2000–2500 m above sea level (Yanushevich *et al* 1959).

At present, the Great Bustard is extremely rare everywhere in Kyrgyzstan, where it is still found in small numbers mostly during migration and more rarely in winter (Table 1). There has been some increase in the number of birds observed in the northern border regions in recent years, perhaps influenced by an increase in neighbouring Kazakhstan (Rustamov & Kovshar' 2007).

Table 1. Expert evaluation of the current Great Bustard population in Kyrgyzstan in each season.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	1–2	2	1
Gathering for migration	4–10	3	3
Wintering	2–5	2	3

THREATS AND CONSERVATION MEASURES

Some researchers believe that the main factors influencing the recent increase in number of Great Bustards have been associated with the decline in agriculture and other economic activities in breeding areas after the collapse of the Soviet Union (Rustamov & Kovshar' 2007). Despite this, high anthropogenic pressure, including habitat transformation, high grazing pressure and direct persecution by poachers remain major limiting factors impacting the presence and abundance of this species.

Special measures are needed for the restoration of Great Bustard populations in Kyrgyzstan, including awareness-raising among local inhabitants, and incentives for farmers in places where the species might breed (cropfields and pastures). Special seasonal protected areas should be established in migratory and wintering territories. Enforcement of existing regulations and prevention of poaching are also necessary.

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The urgent need for a transboundary steppe sanctuary to secure the last Great Bustard *Otis tarda tarda* populations in western Siberia and northern Kazakhstan

ALEKSANDR ALEKSEEVICH NEFEDOV

Summary: Historically and into the first half of the twentieth century the Great Bustard was widespread and patchily abundant in steppe and forest-steppe in parts of western Siberia and northern Kazakhstan, with a focus on Omsk oblast' and adjacent areas in Kazakhstan, used by a nomadic population which did not undertake a long-distance southern migration. However, a decline began in the early 20th century and by the 1960s the species was either extinct, an uncommon vagrant or very rare everywhere in this large region. Agricultural expansion, pesticides, overgrazing, poaching, human disturbance, herders' and other free-ranging dogs, powerlines and nest predation by corvids have all played a part in this catastrophic decline. The situation was briefly reversed in Omsk oblast' in the decade 2000–2010, when a very small population attempted to re-establish itself in several districts following reductions in grazing, cultivation, pesticide use and human disturbance, but the news reached hunters and numbers stabilised at around several dozen. Key to the preservation of the species in the region is much greater public awareness along with the creation of federal protected areas. In particular, a unique opportunity exists to create a 300 000-ha transboundary steppe sanctuary, the Kurumbel'skii nature reserve, in the south-east of Omsk oblast' (Cherlakskii and Okoneshnikovskii districts), adjacent Novosibirsk oblast' (Chistoozornyi district) and Pavlodar province in Kazakhstan (Zhelezinskii district).

HISTORICAL STATUS IN WESTERN SIBERIA AND NORTHERN KAZAKHSTAN

The area under study here, comprising the south of western Siberia and adjacent parts of northern Kazakhstan, is an enormous tract of largely open landscapes around 1650 km from west to east and 1250 km from north to south, comprising seven political administrative divisions, five in Russia (Kurgan, Tyumen', Omsk and Novosibirsk oblast's and Altai krai) and two in Kazakhstan (North Kazakhstan and Pavlodar provinces; Figure 1). Until the mid-19th century, the Great Bustard *Otis tarda tarda* and Little Bustard *Tetrax tetrax* were abundant species in the region, the former inhabiting vast forest-steppe and steppe areas. Even the Asian Houbara C*hlamydotis macqueenii* was recorded in the northern and southern districts of modern-day Omsk oblast' by authors writing in the 19th and early 20th centuries (Pallas 1786, Levshin 1832, Atkinson *et al* 1865, Krasovskii 1868, Slovtsov 1881, 1897, Finsh & Brem [*sic*] 1882, Stepanov 1886, Sotnikov 1892, Ruzskii 1897, Morozov 1898, Plotnikov 1898, Dmitriev-Mamonov & Zdzyarskii 1900, Yelpat'evskii 1901, Sedel'nikov & Borodin 1903, Sedel'nikov 1907, Ioganzen 1907). Great Bustards were even reported as being kept in captivity by local people (Krasovskii 1868).

Tyumen' oblast'.—There is no information available on the species' occupancy of the south of Tyumen' oblast', although what were probably vagrant birds have occurred in the area. In September 1960, game manager G Sedel'nikov hunted an adult individual flying across a road near lake Marukha in Abatskii district (Azarov 1996).

Omsk oblast'.—In western Siberia in the 19th century the Great Bustard nested as far north as Omsk (54° 58′ N, 73° 22′ E; Stepanov 1886, Morozov 1898, Slovtsov 1897). Later, however, the species was 'observed rarely and not closer than 60–70 versts [65–75 km] from Omsk' (Lavrov 1925). Ruzskii (1897) referred to the Great Bustard as a common species around Krestiki village and the nearby lake Chebakly and Golodnaya steppe. According

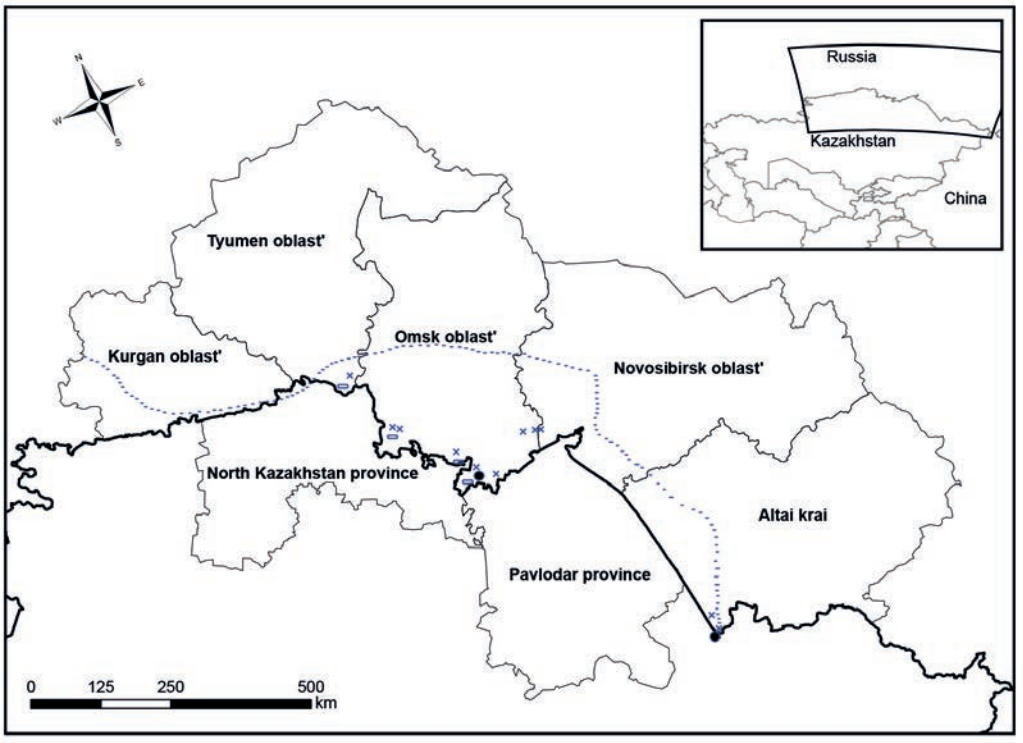

Figure 1. Distribution of Great Bustard in western Siberia and northern Kazakhstan. Dotted line represents the northern boundary of Great Bustard distribution by the middle of the 20th century. The following marks represent recent observations: black filled circles represent observations during the winter period; rectangles represent observations in autumn; X represents observations during the breeding period.

to old-time local hunters and naturalists, in the 1930s–1940s large populations of the Great Bustard lived in the south of Omsk oblast', in particular, in Russko-Polyanskii district between the villages of Novo-Sanzharovka, Bessarabka and Khlebodarovka and the areas known as Sumurza and Beliki. These populations used to make short-distance migrations southwards, to the Kazakh steppes, as the food in their breeding habitats became inaccessible due to weather conditions. However, when plenty of forage was available during low-snow winters, Great Bustards remained in this region. They could be observed on the slopes of snow-topped ravines, where, under thickets of bushes and weeds, niches remained clear of snow, which were used by these birds for shelter in windy and frosty weather (Nefedov 2004, 2005, 2007b). In the late 1950s (1954–1959) local hunters repeatedly observed Great Bustards on the Irtysh floodplain near Kitaily village north of Omsk (55° 15′ N) after the autumn hunting season was opened in mid-August, and shot one from a group of 5–7 in late August or early September 1957 (Nefedov 2002, 2007b). Salin (1960) was the last author to mention the Great Bustard as a species inhabiting Omsk oblast'.

Novosibirsk oblast'.—The species occupied the south of the Barabinsk depression (Kashchenko 1898) and Tobol-Ishim plain (Ruzskii 1897, Slovtsov 1897) and the north of the Kulundinskaya plain (Ioganzen 1907). It nested in Novosibirsk oblast' to 54° N, near lake Chany in Barabe (Buturlin 1935).

Altai krai.—Formerly, to the north-east, the Great Bustard ranged approximately to a point between Barnaul and Kemerovo, in the south-west outskirts of Leninsk-Kuznetskii (54° 28′ N, 86° 06′ E; Cherkasov 1884). There are 19th-century reports of birds overwintering in the Altai: '…great bustards, partridges and quails winter on sunlit and snowless

mountain slopes in the northern extremities of Altai (just below 53° N)' (Middendorf 1877). An old record, presumably of the Great Bustard's western subspecies, occurred just east of our area between the present-day towns of Gurevsk and Leninsk-Kuznetskii, Kemerovo oblast' (54° 23′ N, 86° 03′ E; Cherkasov 1884). Near Zmeinogorsk, by 1928 the species was already 'very rarely encountered in the gently rolling steppes of the Aleisko-Loktevskaya rise, displaced everywhere by humankind' (Selevin 2003).

Altai republic.—The species was noted in the north-east Altai near the Andaba mine, near 52° 20′ 00″ N, 88° 07′ 36″ E (Kashchenko 1899).

Kazakhstan.—The Great Bustard was regarded as a typical bird of the north of Akmolinsk oblast', which at that time partially incorporated some territories of the northern oblast's of Kazakhstan and southern Siberia, including the southern and central territories of modern-day Omsk oblast' (Anon. 1908, 1911). For the same oblast' Sedel'nikov (1916) listed it as an 'important bird'. At the end of the 19th century, the Great Bustard bred 10 versts [10 km] from Petropavl (Petropavlovsk), but after construction of the railway, not closer than 30–40 versts (Grachev & Berezovikov 2005). With the reclamation of virgin steppe, the Great Bustard completely disappeared from the region between the Ubagan and Ishim rivers, and in recent years even vagrant individuals were not reported from the area surrounding the villages of Presnovka, Blagoveshchenka, Tselinnyi and Timuryazevo (south of the border with Chelyabinsk). The last reliable observation was of two Great Bustards south of Petropavl in the summer of 1969, at Gorodetskoe village in Sergeevskii district (Grachev & Berezovikov 2005). Borisenko (2003) encountered the species twice in Kostanai oblast' in 1963 but in the two summers (May–August) of 1971 and 1972 he drove 4500 km through Kostanai, North Kazakhstan, Kokshetau and Tselinograd oblast's without seeing any Great Bustards or Little Bustards; he concluded that by 1977 'the Little Bustard and Great Bustard had practically disappeared from farmed lands in steppe regions' and only then survived in the semi-desert and desert areas, the Little well in a few places, the Great extremely rare everywhere' (Borisenko 2003). In North Kazakhstan oblast', the Great Bustard survived into the late 1960s, with vagrants recorded in the south in the 1990s, thus overall 'an extremely rare vagrant species' (Vilkov & Drobovtsev 1999, Vilkov 2010). Observations of birds in the Irtysh river area in Pavlodar province (150 km south of Pavlodar and 40–50 km west of the Irtysh) made in August, September and early October 1958 are mentioned in a 1960 report (*fide* Ivliev *et al* 2012).

RECENT STATUS IN WESTERN SIBERIA AND NORTHERN KAZAKHSTAN

As we have seen, numbers of Great Bustards in our region began decreasing in the late 19th–early 20th century, sharply dropped in the 1950s, and after the early 1960s almost entirely disappeared. Nowadays, except in Omsk oblast' the Great Bustard is not regularly recorded in western Siberia (Kurgan, Tyumen' and Novosibirsk oblast's and Altai krai) and northern Kazakhstan (North Kazakhstan and Pavlodar provinces). In the 21st century the only records outside Omsk oblast' in the Russian part of our region are from Tyumen' oblast': 4–5 birds (a family?) near the village of Blagodatnoe in Kazanskii district in early October 2005 (Tarasov *et al* 2007), and a bird later identified by the observer, V Gultyaev, from a field guide, in mid-May 2001, performing a distraction (injury) display in a portion of a field which was reverting to steppe vegetation near lake Gorkoe, 18 km south of Ishim town (Tarasov & Primak 2013). However, birdwatchers from the popular citizen data websites Birds of Kazakhstan (http://birds.kz) and Birds of Siberia (http://sibirds.ru), which began to operate in 2012, have not recorded Great Bustards in these localities.

According to Ryabitsev (2001, 2008, 2014), the Great Bustard's range does not overlap Omsk oblast'. Nevertheless, in annual publications he edited there are are two published reports of Great Bustards in the oblast', including a pair of Great Bustards and a vagrant

Asian Houbara (Nefedov 2001b, 2012). These were reported again in other publications (Nefedov 2001a, 2002, 2003, 2005, 2007b, 2013a,b, Nefedov & Sidorov 2005, Sidorov & Rusakov 2005). More concretely, on 16 May 2000, together with VS Kryuchkov (senior researcher at the Western Siberian Department of the All-Russia Hunting Research Institute), I observed 2 Great Bustards in the Stepnoi federal hunting reserve (54° 15′ N, 75° 30′ E), 1.5 km north-east of lake Porshnevo, Cherlakskii district, Omsk oblast', near the border with Novosibirsk oblast'. This was the first record of the species since the 1960s (Nefedov 2001b). After that, the Great Bustard was given the status of a very rare species in Omsk oblast', with single records of vagrant individuals requiring confirmation (Ryabitsev *et al* 2001). In August 2001, VA Novikov, leading specialist at the oblast's State Committee for Nature Conservation (*Goskompriroda*), recorded a female with two fledglings the size of adult chickens in Pavlogradskii district. I estimated that 1–2 pairs nested in the oblast' in 2000 and 4–5 pairs in 2002, when the entire population was, probably, not larger than 15 individuals (Nefedov 2002). The species' range was expanding, and by 2003 the bird was recorded in Okoneshnikovskii, Cherlakskii, Pavlogradskii, Novovarshavskii and Russko-Polyanskii districts. In 2004 5–7 pairs nested in the oblast', while the total number in the beginning of the breeding season was, probably, 20–25 individuals (Nefedov 2005, 2007b). In Russko-Polyanskii district local farmers repeatedly encountered 1–3 individuals and recorded 10 in total. All records were incidental (Nefedov 2007b). Probably, the species was also increasing in adjacent areas in Kazakhstan and Novosibirsk oblast', where the grazing of livestock and cultivation of former steppe had almost entirely ceased.

According to AN Skripkarev (verbally), a pair of Great Bustards was observed in the Stepnoi hunting reserve near Leninsk (54° 34′ N, 75° 32′ E) in Okoneshnikovskii district in May 2006. Leninsk is only 15 km north-west of my record of the species in May 2000. This area requires more study. Up until the early 20th century, the Great Bustard was common there, but disappeared by about the middle of the century. PM Artamonov (verbally), a ranger at the Stepnoi hunting reserve, did not record the species in his journal between 1961 and 1987. VV Mitin (verbally) saw a small individual—a female or youngster—on 15–17 September 2009, 1 km south of Lezhanka, Gorkovskii district. GG Andreev, head of the Omsk Department of the Russian Federal Service for Veterinary and Phytosanitary Supervision (*Rosselkhoznadzor*), made several records of single birds in the fields of the former Tselinnyi state farm in Russko-Polyanskii district in May–June 2008 (Nefedov 2012, 2013a). Unfortunately, the Stepnoi hunting reserve was liquidated in 2015 by a resolution issued by the Russian government following a proposal from the executive bodies of Omsk oblast'. That was the only protected area with steppe landscapes in western Siberia where the Great Bustard had been repeatedly recorded since the early 2000s.

Sidorov & Plikina (2015) contains two questionable records of the Great Bustard. First, game manager VV Klevno reportedly witnessed a bird being shot above Valerinskoe (Kaban'e) lake (55° 03′ N, 74° 51′ E) in Kalachinskii district in 1991, but upon reassessing the information, Klevno (verbally) denied this. Alongside this, a local hunter, now deceased, told him in a personal conversation that he saw one in Kalachinskii district near Osokino village (central forest-steppe) in the 2000s. The second error in Sidorov & Plikina (2015) concerns VA Lebedev, who was reported to have observed a female with a brood at an unnamed marsh in July 2003 in Isil'kul'skii district. But district game manager AF Kalashnikov, a close friend of the now-deceased hunter Lebedev, absolutely refutes this record, saying that if it had occurred, he would have known.

However, the information given by game manager VI Ivko of the Hunters' Association of Omsk oblast' (*Oblokhotobschestvo*) deserves special attention. Ivko reports 'numerous' records of the Great Bustard in Isil'kul'skii district, south of the town of Isil'kul', mainly near the border with Poltavskii district, in spring and autumn between 2007 and 2013. He

made four records himself and received 'regular' reports of 1–3 adult individuals from agricultural machine operators, farmers and other residents. In summer 2012 he came across a brood of four (!) young the size of Woodpigeons *Columba palumbus*. He estimated that by 2012 Isil'kul'skii district held 50–60 Great Bustards. The numbers dropped sharply after 2013, and no records of the species were made in the district between 2014 and 2017. There were, probably, up to 100 Great Bustards in Omsk oblast' in 2012, but only some 20 in 2017. The reasons for the sudden growth of the population in 2007–2012 and the equally sudden decrease after 2013, at the northern extremity of the species' range, are unclear.

After 2005, as the news about the Great Bustard's reappearance in Omsk oblast' leaked out, poaching led to a halt in the growth of the species' population there (excluding Ivko's report above about Isil'kul'skii district). By 2010, numbers had decreased everywhere, stabilising at several dozen individuals.

MAIN LIMITING FACTORS

Currently, the Great Bustard is very rare not only in Omsk oblast', but also throughout western Siberia and northern Kazakhstan. The main reasons for this circumstance are largely the same everywhere in the region. In the 19th through 20th centuries they included the following: conversion of land for agricultural purposes; use of pesticides; livestock herding and stray dogs; overgrazing; depredation of nests by corvids (whose populations expanded greatly in the 1950s and 1960s with the plowing of steppe and planting of trees); high levels of disturbance by humans; illegal hunting; electric powerlines; haymaking; and fires set for agricultural purposes. In the 21st century the main limiting factors remained the same, and only their relative impacts have changed. In descending order of impact they are: active illegal hunting of wintering birds; high levels of human disturbance; livestock herding and stray dogs; depredation of nests by corvids; burning for agricultural purposes; powerlines; and haymaking.

The growing numbers of the Great Bustard in the early 2000s were associated with the expansion of areas suitable for nesting. In the late 1990s, the sharp shrinkage of cultivated agricultural areas and decrease in livestock populations, expansion of fallow lands, almost complete cessation of pesticide use and reduction of human disturbance combined to have a positive impact on the Great Bustard population.

CONSERVATION MEASURES TAKEN

The Great Bustard is listed in the *Red Data Book of Russia* (Danilov-Danil'yan 2001) as a category 3 species and in the *Red Data Book of Omsk Oblast'* (Sidorov & Plikina 2015) as category 4 (with insufficient data available on the current status in the wild). The species' status in some neighbouring administrative units of the Russian Federation is: Altai krai – category 1 (Bondarenko 2017); Novosibirsk oblast' – category 0 (probably extinct; Glupov & Shaulo 2018); and Tyumen' oblast' – category 0 (probably extinct; Bol'shakov 2004). The Great Bustard is not included in the *Red Data Book of Kurgan Oblast'* (Bol'shakov 2012).

RECOMMENDATIONS

The Great Bustard's micropopulations in western Siberia and northern Kazakhstan are migratory and therefore more sensitive to various negative impacts in different countries and regions. International cooperation all along the migration routes and across wintering grounds is essential to protect the species. In addition, for Asian countries it is necessary to maintain close cooperation with the European regions of Russia inhabited by neighbouring populations. It is clear that without governmental support it will be impossible to take successful conservation steps. It is also evident that priority interventions may vary across the regions. But wildlife conservation is beneficial to all, and the greater the number

Figure 2. Map of the area in Omsk and Novosibirsk oblast's of Russia and Pavlodar province of Kazakhstan for possible inclusion in the Kurumbel'skii state steppe nature reserve. Scale – 1:200 000. Green line – outer boundary of possible nature reserve; dark red line – state border between Kazakhstan and Russia; orange crosses – sites which hosted large numbers of bustards at the end of the 19th and early 20th centuries, and where the species has also been observed in the 21st century.

of stakeholders involved the sooner the problems associated with the Great Bustard's conservation and breeding will be solved. Of cardinal importance are measures to raise the awareness of local people and to involve them in the conservation of the Great Bustard, with broad coverage by the press.

The basic and most efficient step to protect the Great Bustard is the conservation of their natural habitats, for which purpose protected areas, primarily nature reserves, should be created at a federal level. Therefore, the priority and pressing task is to establish an international steppe reserve in the south-east of Omsk oblast' (Cherlakskii and Okoneshnikovskii districts), with the partial inclusion of adjacent districts in Novosibirsk oblast' (Chistoozyornyi district) and Pavlodar province in Kazakhstan (Zhelezinskii district; Nefedov 2002, 2004, 2005, 2007a,b, 2008, 2010, 2011a, 2013a,b). In general, the areas proposed for inclusion in the nature reserve are the least impacted by agricultural activity; most (80%) of the territory has never been tilled. In the adjacent territories in Novosibirsk oblast' and Pavlodar province of Kazakhstan, the proportion of cultivated lands is even lower. The ecosystems of former pastures and hayfields, which occupy two-thirds of the proposed nature reserve, are re-establishing themselves (Nefedov 2007c). The organisation of the Kurumbel'skii nature reserve (Figure 2) on an area of 300 000 ha is itself expected to start natural processes of restoring steppe ecosystems and their components, including the Great Bustard and Little Bustard. There is also potential for the Asian Houbara to use the area for regular breeding. For that purpose, field research has been carried out and necessary legal documents obtained. Strict protection of the unique virgin steppe ecosystems would also be commercially beneficial to local communities. The inclusion in the Kurumbel'skii nature reserve of the buffer zones along the state border between Russia and Kazakhstan, which are controlled by border troops, would facilitate the creation and

protection of the transboundary nature reserve. This would also allow for a larger core zone and facilitate international cooperation to create natural populations of bustards and large steppe ungulates and protect them along their migration routes.

Table 1. Current population estimate for number of Great Bustards in each region in this study: Omsk, Tyumen', Kurgan, and Novosibirsk oblast's and Altai krai of Russian Federation, and adjacent North Kazakhstan and Pavlodar provinces of Kazakhstan. These numbers are an expert evaluation of the number of individual birds appearing in the region in each season, with data available in May 2017. Estimate of the number of sites is based on the total number of locations in which the birds were observed from 2010–2017.

Geographic region	Season	Number of Great Bustards	Number of sites	Quality of estimate (from 1–5)[4]
Tyumen' oblast', Russia[1]	Breeding	2–6	1	2
	Gathering for migration	3–15	1	2
	Wintering	–	–	–
Kurgan oblast', Russia[1]	Breeding	2–6	–	1
	Gathering for migration	3–15	–	1
	Wintering	–	–	–
Omsk oblast', Russia[2]	Breeding	10–20	25	3
	Gathering for migration	9–25	3	2
	Wintering	–	–[3]	1
Novosibirsk oblast', Russia[1]	Breeding	2–6	1	1
	Gathering for migration	3–15	–	1
	Wintering	–	–	1
Altai krai, Russia[1]	Breeding	10–20	3	2
	Gathering for migration	9–35	–	2
	Wintering	–	–[3]	1
North Kazakhstan province, Kazakhstan[1]	Breeding	4-10	1	2
	Gathering for migration	9–35	–	1
	Wintering	–	–[3]	1
Pavlodar province, Kazakhstan[1]	Breeding	4–10	–	1
	Gathering for migration	9–35	1	1
	Wintering	–	–[3]	1
Total for these regions of western Siberia	Breeding	34–78	31	2
	Gathering for migration	Sum not applicable	4	1
	Wintering	–	–	1

[1] In these regions nesting and migratory gatherings of Great Bustard have not been well researched.
[2] In Omsk oblast' I have registered the maximum number of places that may represent potential breeding sites (25) and migratory gathering sites (3). These include two sites where broods were encountered. The data available indicate that nesting sites are not constant between years. An exception is presented by two large territories that are known to host this bird regularly in the nesting season: the regional (until 2015, federal) Stepnoi nature reserve and the southern half of Isil'kul'skii district.
[3] Regions with *potential* for overwintering Great Bustards in western Siberia (Omsk oblast', Novosibirsk oblast', Altai krai, North Kazakhstan and Pavlodar provinces). In the past, Great Bustards were observed overwintering in the south of Omsk oblast' (Nefedov 2005). Conditions for overwintering in the other four marked regions are superior to those in Omsk, as they are located further to the south.
[4] Quality of estimate, from 1 (low-quality) to 5 (high-quality)

One of the most important objectives of the Kurumbel'skii nature reserve will be to establish a station to study the ecology of the Great Bustard (alongside other steppe animal species) and develop methods to hatch and release them into the wild in the south of Omsk oblast' and adjacent territories. The most notable nursery for the protection of the Great Bustard in Russia is that managed by the Institute of Ecology and Evolution, Russian Academy of Sciences, in Saratov oblast'. The Karasuk research station under the Institute of Systematics and Ecology of Animals, Siberian Branch of the Russian Academy of Sciences, located in neighbouring Novosibirsk oblast', has also acquired some experience in caring for bustards. Such a nursery in Omsk can be organised only on the basis of a protected area with a federal status, for which both suitable environment and regulatory framework are still available.

Apart from the Kurumbel'skii nature reserve, a network of federal protected areas is needed along migration routes and on wintering grounds in Kazakhstan and other countries. Such a network should also be created in the south of western Siberia and northern Kazakhstan to breed the Great Bustard. Steppe areas of special value can be protected only within cluster-type reserves with a federal status. A cluster reserve must cover, for instance, all the districts in Omsk oblast' (Isil'kul'skii, Novovarshavskii, Odesskii, Okoneshnikovskii, Pavlogradskii, Poltavskii, Russko-Polyanskii, Cherlakskii and Sherbakulskii) where the Great Bustard is recorded. Reserves like this are also necessary in other parts of the region, where the Great Bustard occurs in spring and summer.

Adopting a federal program by the Ministry of Natural Resources and Environment would be of great importance for the restoration of bustards. The program should cover all related issues, from controlling corvid populations to international cooperation. Alas, however, for over 20 years Omsk officials have avoided meeting laws prescribing the establishment of the Kurumbel'skii nature reserve. Yet for over 20 years hundreds of thousands of hectares in the Kurumbel'skii steppe have not been used even as pastures or hayfields. In the meanwhile, these lands offer the most suitable environment within Russia to establish and maintain a viable population of the Great Bustard. The area is also large enough to support natural populations of wild ungulates. To lose another chance to establish a reserve in Russia's largest and most unique surviving steppe area would be, to say the least, irresponsible.

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The diminishing status of the Great Bustard *Otis tarda tarda* in Xinjiang province, north-west China

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Summary: The Western Great Bustard *Otis tarda tarda* is restricted in China to Xinjiang province, where its status is little known. Using transect methods, we surveyed three previously reported potential distribution areas, Tacheng, Qapqal and Altay, from 2014 to 2016, and again in 2018. During these surveys, we saw no Great Bustards in Qapqal, the only recorded overwintering area in Xinjiang. We found only four males in Altay during the breeding season, but the survey was limited and needs to be repeated. In Tacheng, we found 17 individuals during the breeding season, and 317–444 individuals from different years before autumn migration. The major threats to the Great Bustard in Xinjiang are habitat loss and nest destruction as a result of human activities. We recommend the establishment of a reserve for Great Bustards in Xinjiang, development of compatible agricultural activities, public awareness campaigns, and continued monitoring.

INTRODUCTION

Both subspecies of Great Bustard, *Otis tarda tarda* and *O. t. dybowskii*, occur in China. The former is found only in the north-west of China, in Xinjiang province, while the latter inhabits north-east China, migrating south to overwinter in the Yangtze and Yellow river basins (Tian & Zhang 2006, Mi *et al* 2016). In comparison to *O. t. dybowskii*, *O. t. tarda* has been little studied in China and its migratory routes are unknown (Gao *et al* 1994, Hu *et al* 1996, Gao 2007).

Historically in Xinjiang, China, the subspecies *O. t. tarda* was thought to use steppe, grassland, desert steppe and farmland habitat, especially near river margins and lakesides, meadows, meadow-grasslands and wheat fields in the Tacheng and Qapqal valleys (Jiang 2004, Gao *et al* 2007). Together, Qapqal and Tacheng have held the highest densities of Great Bustard in the country (Gao *et al* 1994, Hu *et al* 1996). Recently, it was estimated that around 70% of China's *O. t. tarda* population inhabits the Tacheng basin, which was considered to be the largest breeding area of this subspecies in China (Jiang 2004). Qapqal county contained the only recorded wintering area for *O. t. tarda* in Xinjiang, while Tacheng birds are thought to overwinter at unknown sites outside Tacheng (Gao *et al* 1994, 2007). Currently, these two areas, encompassing *c*12 500 km^2, are sparsely occupied by Great Bustards (Wang *et al* 2018; Figure 1).

Traditional agriculture is practised in the areas inhabited by Great Bustards. Two-year rotations are used on small fields of cereal crops, alfalfa and rapeseed. The fields are interspersed with pasture (Wang *et al* 2015a). During the breeding season, Great Bustards are observed primarily in winter wheat and alfalfa, with very few birds in natural steppe habitat. In summer, most Great Bustards are observed in oilseed rape and fewer in alfalfa. During the pre-migratory period, the species mainly uses winter wheat and stubbles from harvested wheat (Wang *et al* 2015a).

Annual average precipitation in Xinjiang is less than 200 mm (Wang *et al* 2015b). Over recent decades, irrigation systems have been widely installed to intensify agricultural production. This presents dangers to breeding Great Bustards such as nest loss to irrigation or to disturbance.

The breeding range of *O. t. tarda* in China is thought to have shrunk to several isolated areas (Jiang 2004, Tian & Zhang 2006), probably hindering gene exchange between populations. Over the past few decades, numbers have declined, seemingly linked to the large-scale conversion of steppe to agricultural land, increasing human disturbance on the

breeding grounds, habitat loss and population isolation on both wintering and breeding grounds (Chan & Goroshko 1998, Gao *et al* 2008).

SURVEYS AND POPULATION ESTIMATE

Late in the last century, researchers conducted surveys and estimated the population of *O. t. tarda* in Xinjiang province to be 2000–3000 birds (Gao *et al* 1994). However, this estimate was criticised as low-quality (Palacín & Alonso 2008). Since those surveys, when 120 birds were counted in Qapqal in 1988 and 119 birds were counted in Tacheng in 1992 (Wang *et al* 2018), the population of *O. t. tarda* in China has rarely been monitored, and citizen science data have also been unavailable. However, our study, which found no birds in Qapqal in 2013–2014 and a maximum of 19 in Tacheng in 2014–2016, suggested that the breeding population had strongly declined from 239 in 1988 and 1992 to 19 (*ie* by 92%; Wang *et al* 2018). We did not identify an obvious lek centre in Tacheng over the course of our work, perhaps because of the very low population size in this area; in 2018 we counted only 17 birds.

Before migration in autumn, the Great Bustards in Tacheng gathered at three sites (near Abudula town, Qiaxia town and 168 Regiment; Table 1, Figure 1). At this time, larger numbers (317–444) were observed than during the breeding season. This difference may reflect difficulties observing these birds on their breeding grounds. Alternatively, the birds seen may have involved migrants moving temporarily into China from adjacent eastern Kazakhstan.

Great Bustards have only been recorded as wintering in one area in Xinjiang, at Qapqal, Ili Kazakh autonomous prefecture. However we failed to find any Great Bustards there during two years of surveys, which suggests either a very low or even extinct population in this former wintering area (Table 2).

Four Great Bustards were observed during survey work in April 2018 in Altay prefecture, Xinjiang (Figure 1). However, surveys were only conducted in this region once, and it is unclear if these individuals were migrating or remained to breed.

Figure 1. Map of the areas used by Great Bustards in Xinjiang, China. * represents breeding and pre-migratory gathering areas. W represents a known wintering site, although the species was not observed there in recent surveys. Δ represents a single spring observation.

Table 1. Expert evaluation of the number of Great Bustards in Tacheng, Xinjiang, based on observations from 2014–2018.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	17	dispersed	4
Summer	2–16	1	3
Gathering for migration	317–444	3	5
Wintering	0	–	2

Table 2. Expert evaluation of the number of Great Bustards in Qapqal, Xinjiang, based on observations from 2013–2014.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	0	–	4
Gathering for migration	0	–	4
Wintering	0	–	4

THREATS TO GREAT BUSTARDS

Both Great Bustard subspecies are currently listed as first-category protected animals in China (Zheng 1994), where habitat loss is definitely the most serious threat to the species. For *O. t. tarda*, over recent decades most of the grasslands within its Chinese range were reclaimed. Most of the habitat for the species within this range is severely fragmented and isolated owing to agricultural intensification and habitat fragmentation caused by human activity.

In these human-modified habitats in Xinjiang a major threat is nest loss: agricultural irrigation is the major cause of breeding failure. Sometimes farmers locate a nest before flooding a field. In some cases, they simply remove the eggs, but in others they attempt to rescue the nest by building a higher embankment for it; however, these nests are almost always abandoned by the female.

As noted above, the small and fragmented nature of the remaining populations of Great Bustard in China represents a threat to the species' genetic diversity. Moreover, as a result of small group sizes, birds spend more time in vigilance behaviours than feeding (Wang *et al* 2016).

We observed several adult Great Bustards with injured legs during our surveys, although the cause of the injury was not clear.

RECOMMENDATIONS FOR CONSERVATION

A stronger understanding of the Great Bustard's ecology in Xinjiang would aid in the species' conservation. A provincial-level survey would further clarify the total number of this species and their exact distribution. Telemetry research could clarify the breeding and wintering grounds of the larger flocks observed in autumn in Tacheng, which could launch flyway-scale collaboration for the conservation of these birds. Research into habitat selection can guide the development of compatible agricultural mosaics, which is particularly important for breeding success.

A nature reserve focused on the Great Bustard should be established in Tacheng, which could regulate human disturbance and establish suitable conditions. Public awareness campaigns about the species and its habitat should be conducted, particularly promoting conservation of nests during the breeding season.

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The loss of wintering Great Bustards *Otis tarda tarda* from the steppes of Azerbaijan

ZULFU FARAJLI

Summary: The Great Bustard *Otis tarda tarda* was abundant in winter in steppe and semi-desert in Azerbaijan in the mid-20th century and bred in small numbers in the south, but rapidly declined so that by the 1990s breeding had stopped and non-breeding visitors only numbered around 100. Now only up to 10 birds are thought to visit per year, scattered between up to four sites. There are two migration routes, one through the west and one round the eastern littoral. Hunting and agricultural development are considered responsible for the plight of the species.

INTRODUCTION

The current global population of Great Bustard *Otis tarda tarda* is estimated to be lower than 60 000 individuals (Alonso 2014) and the species is listed as Vulnerable by IUCN. Historically it had a much larger distribution and was formerly abundant in Azerbaijan. The largest of three bustard species in Azerbaijan (Little Bustard *Tetrax tetrax* and Asian Houbara *Chlamydotis macqueenii* also occur), it is included in the Red Book of the country (MENR 2013). In the middle of the last century, it was considered abundant in winter in Azerbaijan, with a small breeding population (Patrikeev 2004). However, in the 1990s there were no confirmed breeding records and fewer than 100 individuals were thought to occur on migration and in winter (Patrikeev 2004). Here I present historical records of Great Bustards in Azerbaijan and update the current population estimate.

HISTORICAL RECORDS

Breeding & summer records

It is likely that Great Bustards have always been a relatively scarce breeding species in Azerbaijan. Radde (1884) observed many adults while travelling between Shamakhi and Mugan in mid-April, mostly pairs. He also saw birds south of Salyan, where they both breed and winter (Radde 1884). One nest was found in Alpaut (Alpout), Mugan steppe, in May 1912 by Satunin (Point 1 on Figure 1), who also recorded six individuals in Aslan Duz (bordering Iran) on 11 July (Point 2 on Figure 1) (Vereshchagin 1940). Vereshchagin (1940) himself also observed Great Bustards during the summer months, for example noting a flock of four adults feeding on locusts on 14 June 1939, near Sigirli village, Shirvan steppe (Point 3 on Figure 1). It is thought that the species probably continued to breed in small numbers in Azerbaijan until the 1950s, after which its decline became more apparent (Patrikeev 2004). A similar considerable decline in the Great Bustard populations breeding in the Russian Caucasus was also observed in the second half of the last century (Dzhamirzoev & Bukreev 2008).

Migration

Great Bustards migrated through Azerbaijan in both spring and autumn, mostly singly or in small groups and mainly by day, and were presumed to be from the breeding population in the Volga region of Russia (Vereshchagin 1940). There were thought to be two migration routes, one coastal and one inland (Figure 1). The coastal route followed the Caspian shore in the autumn, when birds flew at an altitude of 50–100 m, rarely up to 300 m (Vereshchagin 1940). In the spring, birds returned by the same route, although some were observed migrating a few kilometres away from the shoreline. The last record of regular migrating Great Bustards utilising this coastal route was in March 1969 in the

Figure 1. Black arrows: inland and coastal migration routes of Great Bustards through Azerbaijan. Blue triangle: Alibeyli meteorological station where high numbers of migrating Great Bustards observed by MS worker. Red dots: breeding or summer records of Great Bustards: 1 - A nest in Alpaut, Mugan (1912); 2 - Aslan Duz (1912); 3 - Sighirli, Shirvan (1939); 4- Julfa, NAR (2005).

Samur river delta near the Azerbaijan–Russia border (But'ev *et al* 1989), and only a handful of single birds have been observed in the southern Dagestan region in recent decades (Dzhamirzoev & Bukreev 2008).

The inland migration route passed through the west of Azerbaijan over the Caucasus mountain ridges towards the Nakhchivan Autonomous Republic. Workers at the Alibeyli meteorological station close to Zagatala, in the north of the country, recorded both Great and Little Bustards during autumn migration using this route annually between 1931 and 1937, with the capture of two Great Bustards being reported in October 1934 (Vereshchagin 1940). Migrating birds were historically recorded at Gokcha (Sevan) lake, Armenia, just across Azerbaijan's western border, in April and September (Radde 1884). There are also some historical sightings of late migrants or wintering birds in easternmost Georgia near the Azerbaijani border, including three individuals in Iormuganlo village on 23 November 1972 and one in northern Vashlovani nature reserve on 18 December 1976 (Abuladze 1992). The inland route was also used in the spring, with, for example, 18 Great Bustards observed heading north in March 1937 from the Alibeyli meteorological station (Fig. 1) (Vereshchagin 1940). Birds using this route were clearly capable of migrating at higher altitudes as they passed over the Caucasus; 34 were seen at 1900–2000 m on 14 February 1938 (Vereshchagin 1940). Old records indicate that by the end of March most wintering Great Bustards had left Azerbaijan.

Wintering

Radde (1884) noted that Great Bustards did not appear before the start of the calendar year in Mugan and left by April. He also mentioned that during periods of snow birds were forced to relocate to river valleys where they could find suitable feeding habitat and shelter (Radde 1884). According to Vereshchagin (1940), Great Bustards were commoner in Acinohur, Shirvan and Mugan steppes, and islands or coastal areas of Qizilagach,

in winter (no months specified). As already noted, there have been very few records of wintering Great Bustard in recent decades. However, there are some recent claims of wintering Great Bustards from locals in eastern Georgia, close to Azerbaijan (A Abuladze pers comm).

HABITAT CHOICE

The main historical wintering areas are the steppe and semi-desert areas of Acinohur, southern Shirvan and Mil-Mugan, as well as the coastal areas of Qizilagach bay (Vereshchagin 1940). The birds fed on ploughed fields with emerging weeds and were seen taking locusts in Shirvan (Vereshchagin 1940). In neighbouring Armenia, Great Bustards prefer wide flat areas, alfalfa fields, and low-vegetation steppes (Adamian & Klem 1997). Similarly, in Spain and other parts of the species' range, agricultural habitats are important (Lane *et al* 2001), and there is no obvious reason why this would not be the case in Azerbaijan.

CURRENT STATUS

Nowadays the Great Bustard is rare in Azerbaijan with only a few recent reliable records. There are several claims of observations around the country, but mostly of individual birds or small flocks.

Ten birds were observed in Shirvan national park in 2001 (MENR 2013), which presumably used the coastal migration route along the Caspian. More recently, systematic autumn migration counts at the Besh Barmag bottleneck (in Siyezen) have recorded no Great Bustards, although Little Bustards occur in significant numbers (Trektellen 2018, Heiss *et al* 2020). A single Great Bustard was recorded on the south shore of the Caspian Sea, close to Rasht in Iran, on 28 December 2018 and again on 3 January 2019 (Zirakjou 2018, Seifi 2019). Whether this individual passed through Azerbaijan or over the Caspian from Central Asia is not known. Given the paucity of recent records, especially during intensive monitoring at Besh Barmag, it is reasonable to assume that the coastal migration route of Great Bustard is now very rarely used by the species. There are more recent observations of Great Bustard using the inland migration route (probably continuing to Armenia and Iran). Six birds were observed in Julfa (Point 4 on Figure 1), Nakhchivan autonomous republic, on 9 May 2005 (MENR 2013). Rangers at the Qakh state nature sanctuary observed 8 birds in 2009 and 5 in 2011 during spring migration (specific timing not reported) (MENR 2013). In 2021, an individual was in Qakh in early March and three birds were observed in the Acinohur steppes between 10–14 March (A Muradov pers comm). Most records of Great Bustards from the last two decades have been during the autumn and spring migration periods with very few records from the typical wintering months of November to February. I conclude that the Great Bustard now only occurs as a migratory and occasional wintering species within Azerbaijan, and only in small numbers (Table 1).

It is worth noting that social media (mostly Facebook) postings by hunters' groups show that Great Bustards have been illegally killed in Azerbaijan in recent years. The specific timing and locations of the illegally killed birds could not be determined, but the images were circulated at times consistent with them being of migratory birds (Plate 1).

MAIN THREATS

Based on historical records and recent reports, poaching seems to be one of the biggest threats to the Great Bustard in Azerbaijan and indeed the wider Caucasus. Long ago Radde (1884) mentioned that in December tired birds were even hunted using sticks in Tbilisi. Similarly, large numbers of Great Bustards were caught along the Caspian coast

Table 1. The current estimated population of Great Bustards in Azerbaijan.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	0	0	4
Migration	5–10	3–4	3
Wintering	1–5	3–4	3

annually, mostly during autumn migration, especially at Besh Barmag and adjacent Gilazi (Vereshchagin 1940). The more recent confirmation of illegal hunting of Great Bustards within Azerbaijan (Plate 1) is of serious concern given the rarity of the species. The killing of a single Great Bustard could represent more than 10% of the Azerbaijani population (Table 1). It is illegal to kill Great Bustards in Azerbaijan (Azərbaycan Respublikasının İnzibati Xətalar Məcəlləsi 2015) and a combination of stricter law enforcement and education of hunters is urgently required. Other protected bustard species (Little and Asian Houbara) are also illegally hunted in the country, often by foreign hunters (Collar & Kessler 2021).

However, another major threat and perhaps the main reason for the sharp decline of the population in the middle of the last century is habitat destruction and the conversion to agriculture of historical stopover and wintering grounds. Interestingly, Vereshchagin (1940) did not consider that the protection of wintering Great Bustards in the eastern Caucasus was an urgent matter as the species is well adapted to agricultural lands. However, this was before various major developments in crop management. During the last century, population declines in the Russian steppes were linked to the widespread use of pesticides on cereal crops to kill rodents (Belik 1998). Many granivorous bird species were killed, resulting in the extinction of the Great Bustard population in Kalmykia which migrated to the Caucasus for the winter (Belik 1998). Additionally, the widespread use of pesticides may also reduce food availability in agricultural areas, making them less suitable for Great Bustards. Recent research from nearby Turkey identified agricultural intensification and livestock herding (disturbance and overgrazing) as key threats to Great Bustards (Özgencil *et al* 2021). Predation by shepherd/feral dogs could also pose a significant threat to nests and young birds.

As the species is large and low-flying, collision with powerlines is a serious threat especially during migration. In some parts of the world, the mortality rate from powerline collisions can be as high as 13% of the population (Alonso 2014).

CONSERVATION

There is an urgent need to confirm the status of the Great Bustard in Azerbaijan. Historical areas known to be used by the species such as the Acinohur, Shirvan and Mugan steppes should be surveyed and, if found to be still used by the birds, either designated as nature reserves or subject to appropriate conservation measures (especially annual monitoring and protection). Protection of such sites would be crucial for the survival of the species in Azerbaijan, and habitat management is certainly regarded as the best way to invest in Great Bustard conservation (Alonso 2014).

Tackling illegal hunting of Great Bustards and other rare and threatened species in Azerbaijan, involving local people in conservation, is also imperative. Additionally, training of farmers and hunters about the species and its ecology will result in higher

Plate 1. Illegally killed Great Bustard photos acquired from social media (Facebook). A: Shared on 13.09.2016, location is unknown. B: Shared in the same year, but exact date and location are unknown. *Anon.*

protection measures. After habitually used sites are identified, collaboration with landowners should be sought. For example, financial incentives for farmers to use a mix of crops, moderate irrigation and rotational fallows, all of which the species is known to prefer, can be suggested (Özgencil *et al* 2021). Historically, grazing livestock was a threat to Great Bustard nests as well. Even though the species seems not to breed now in Azerbaijan, certain locations of potential importance to Great Bustards should have grazing pressure controlled.

Collaboration with other range states, including potentially satellite-tagging birds on their breeding grounds, could lead to a much greater understanding of any populations that still migrate through Azerbaijan and the wider Caucasus. Ensuring energy infrastructure, such as transmission lines, use bird-friendly designs and are located away from key migration corridors would benefit not just Great Bustards but a wide range of other bird species.

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The steady decline of the Great Bustard *Otis tarda tarda* in the Russian Caucasus

VIKTOR FEDOSOV & GADZHIBEK DZHAMIRZOYEV

Summary: In the lowland semi-desert and steppe areas (Ciscaucasia) of the northern Caucasus of Russia the Great Bustard *Otis tarda tarda* was a common breeder and, in places, an abundant passage migrant and winter visitor. Starting in the late 19th century the spread and later intensification of agriculture steadily converted the steppe areas, such that breeding populations are now confined to only three areas (Taman' peninsula, east coast of Sea of Azov, and westernmost Kalmykia) involving tiny numbers (total probably 10–15 pairs). Meanwhile wintering visitors from areas of Russia to the north have also greatly declined from thousands to tens of birds.

INTRODUCTION

The Great Bustard *Otis tarda tarda* was formerly a common, widely distributed steppe bird in the northern Caucasus, Russia. Until the late 19th century, most of the bird's original habitats in this region changed little. Initially, it appeared unaffected by anthropogenic encroachment and was recorded all year round (Bogdanov 1879). It continued to breed in virgin steppe, whereas in the middle part of Russian and Western Europe it adapted to living in agricultural fields (Menzbir 1900). Females made their nests in ample untilled steppe areas (Il'in 1905), less often near cereal fields. Birds foraged in hayfields, stubble fields, newly plowed fields and areas with short and sparse vegetation. Females raised their chicks in areas far from human disturbance, where they could easily anticipate threats and search for food (Dinnik 1886).

There were major wintering grounds in the northern Caucasus. Some of the birds migrating from the middle and southern portions of Russia stopped over in the Caucasus, the rest in Crimea (Menzbir 1900). In autumn, flocks of 100–150 Great Bustards appeared in fields all across the steppe, and with the first snowfall the migration intensified: enormous flocks arrived one after another, and when snow covered most of the territory the birds moved to higher ground with gullies and ravines where the wind kept the ground free of snow (Dinnik 1886). Wintering flocks comprised 200–300 birds (Rossikov 1884, Il'in 1905). Lorenz (1887) recorded considerable numbers on the Borgustan mountain plateau and ridge south-west of the city of Kislovodsk, and reported the species as very common in the steppe valley of the Kuban' river in the west of Ciscaucasia, where birds stayed throughout mild winters.

In the second half of the 19th century, peasants from central Russia moved to the Caucasus, sparking population growth and agricultural development. Cultivation of the Ciscaucasian steppes expanded in the 20th century, particularly in its second half. More virgin steppes were tilled, chemicals became widely used to fight pests and plant diseases, and manual labour was largely replaced by machines, resulting in a sharp growth in the numbers of cars, trucks and tractors in the steppe. But what is the effect of these economic and infrastructural changes on the Great Bustard population in this region?

METHODS

No comprehensive studies have been made of the Great Bustard population in the Russian Caucasus. Most information about this bird has accumulated incidentally during various ornithological excursions and surveys. We used data from the annual winter surveys of birds and mammals conducted by the regional hunters' associations. We also interviewed local people, hunters and other ornithologists, and checked the literature. This generated considerable material that has allowed us to establish the bird's status and abundance in regions we did not visit and track its long-term population dynamics.

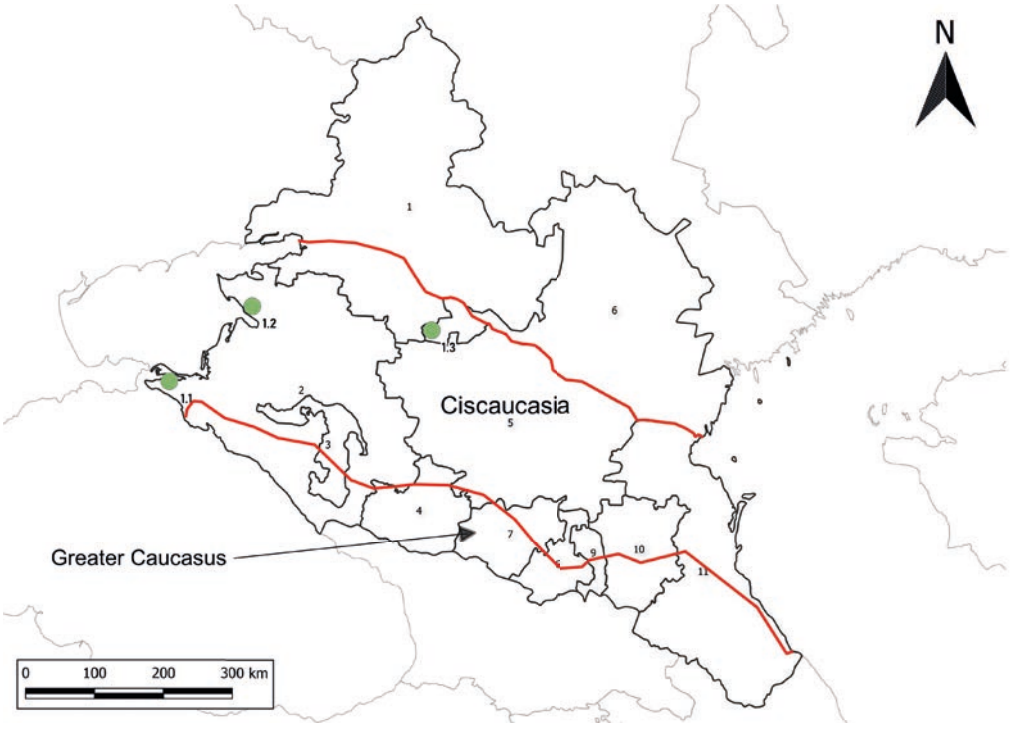

Figure 1. Map of the Russian Caucasus, showing current breeding areas of the Great Bustard (green circles with codes: 1.1 Taman' peninsula; 1.2 eastern coast of the Sea of Azov; 1.3 Zamanych'e, agricultural landscapes in the south of Rostov oblast' and western part of Kalmykia). Smaller single numbers indicate administrative divisions: 1 Rostov oblast', 2 Krasnodar krai, 3 Republic of Adygea, 4 Republic of Karachay-Cherkessia, 5 Stavropol' krai, 6 Republic of Kalmykia, 7 Republic of Kabardino-Balkaria, 8 Republic of Northern Ossetia-Alania, 9 Republic of Ingushetia, 10 Republic of Chechnya, 11 Republic of Dagestan. The northern red line indicates the border of the northern Caucasus (runs along the Kumo-Manych depression). The lower red line divides lowland Ciscaucasia from the Greater Caucasus mountain system.

The Russian Federation encompasses the northern Caucasus as far south as the Greater Caucasus watershed and, in the west, part of the southern Caucasian macroslope (Figure 1). The Great Bustard mostly inhabits Ciscaucasia—the lands to the north of the Greater Caucasus. In the north Ciscaucasia is bordered by the Kuma-Manych depression, in the west by the Sea of Azov and the Black Sea, and in the east by the Caspian Sea. The region stretches for about 900 km east to west and about 300 km north to south.

The climate of Ciscaucasia is moderately continental, formed by humid Atlantic and Mediterranean air masses and dry continental air currents arriving from Central Asia. Summers are very warm, winters moderately cold, with a thin unstable snow cover. The landscape grades southwards from level semi-desert in the north-east through steppe to forest steppe in the foothills of the central southern parts. Around half the semi-desert and almost all the steppe is cultivated. Natural steppe vegetation survives in a few places, largely concentrated on the slopes of gullies and hills.

Ciscaucasia lies entirely within the Russian Federation and includes the following regions: Stavropol' krai, north-western Krasnodar krai and the Adygea republic, south-eastern Rostov oblast', south-western Kalmykia republic and lowlands in the republics of Karachai-Cherkessia, Kabardino-Balkaria, North Ossetia, Ingushetia, Chechnya and Dagestan (Figure 1).

RESULTS

In the first half of the 20th century, the Great Bustard was still common in the northern Caucasus and was even abundant in certain periods (Spangenberg 1951a). In 1927, Russian zoologists studying the vertebrate fauna of Kalmykia recorded large flocks of Great Bustards in the west of the region (Orlov 1928). Until 1945–1946 in the steppe near Manych lake there was a large Great Bustard breeding population, which in autumn gathered into large flocks in the same area (Spangenberg 1951b). At around that time, in Krasnodar krai the species bred on the coastal areas of the Sea of Azov, with occasional pairs recorded more or less regularly in the low-lying areas of the Kuban' valley (Ochapovskii 2017). However, the birds were less numerous in the semi-desert in the north of Dagestan in the breeding season, with only a few pairs recorded (Beme 1925, Turov 1952). After World War II agriculture began to develop rapidly, with the cultivation of large areas of virgin steppe, negatively impacting the Great Bustard population. In May 1950, an expedition crossing Stavropol' krai from south to north recorded only one individual (Spangenberg 1951b). Similar changes were observed in other regions: by the mid-20th century the Great Bustard no longer bred in Kabardino-Balkaria (Molamusov 2017).

Nevertheless, wintering and migrating populations of the Great Bustard maintained their numbers in the northern Caucasus. Ciscaucasia was crossed by major flyways, one following the Caspian littoral through Dagestan, one along the Black Sea coast in Krasnodar krai, and a smaller central one passing across the mountains (Spangenberg 1951a, Gambarov 1954, Dzhamirzoyev 2002). Along the Caspian coast lowlands and in the lower stretches of the Sulak and Terek rivers flocks of up to a thousand Great Bustards used to settle in winter and spring (Beme 1925, Isakov & Sazonov 1947, Bannikov 1948, Pishvanov 1986), but when snow fell they moved south over lowland areas or even into the mountains along river valleys (Krasovskii 1932, Dzhamirzoyev 2002). On the Black Sea coast many wintered in the lowlands and foothills of Krasnodar krai, with flocks of 12–50 often observed in the region in the 1960s (Ochapovskii 2017). In the mid-20th century, in Kabardino-Balkaria (on the central flyway), although not recorded every year, Great Bustards sometimes visited in large numbers for the winter, forming flocks of 5–20, more rarely 40 individuals (Molamusov 2017).

Overall, in the early second half of the 20th century, the Great Bustard in the northern Caucasus had the status of a rare breeding but common passage and wintering bird. In the cold season its numbers remained high owing to the immigration of better-preserved populations from Saratov and Volgograd oblast's of Russia and from Kazakhstan. Nevertheless, wintering flocks became smaller: having consisted a hundred years earlier of 100–300 individuals (Rossikov 1884, Dinnik 1886, Il'in 1905), in the second half of the 20th century they dropped to 5–50 individuals in size (Molamusov 2017, Ochapovskii 2017). In Dagestan, despite the favourable wintering conditions, the population of the species decreased rapidly in the 1960s and after that decade there were just occasional records in the region (Dzhamirzoyev 2002).

In the Caucasian foothills the decline of the Great Bustard became apparent in the 1980s. In the late 20th century birds stopped breeding in Stavropol' krai. The last reliable record was in 1988: a pair of Great Bustards was seen in fields near the city of Stavropol' in May and June, and in late July a machine operator caught their fledgling (Bicherev & Skiba 1990). Great Bustards have not been seen in the breeding period since; nor are there any data on their breeding in Adygea, Karachai-Cherkessia, Kabardino-Balkaria, North Ossetia, Chechnya and Dagestan—all regions where the species formerly bred. Currently, the Great Bustard nests only in three areas of the Russian Caucasus: on the Taman' peninsula; on the east coast of the Sea of Azov in Krasnodar krai; and in the farmed

Plate 1. A male Great Bustard wintering near the village of Divnoe, Stavropol' krai, December 2019. Winter wheat fields alternate with *Artemisia* pastures. © *Viktor Fedosov*

landscapes to the south of Manych lake in adjacent areas of Rostov oblast' and westernmost Kalmykia (Figure 1) (Lokhman & Gozhko 2020). Seven years ago, near the town of Gorodovikovsk, Kalmykia, local people observed up to 6 males displaying courtship behaviour, and once encountered a female with a chick.

Since the late 20th century, wintering populations have also decreased strongly in the northern Caucasus. In the steppes of the Manych depression over the last 20 years we recorded a total of just 14 birds (once 7 together, otherwise 1–2) on five occasions. In December 2004 up to 100 individuals visited westernmost Kalmykia, but in 2019/2020 only nine wintering birds were recorded there (BI Ubushaev, verbally). According to hunters, numbers dropped sharply in all seasons in Krasnodar krai 40–50 years ago, so that the species became rare in the region, even in winter. This century wintering birds have almost completely disappeared from Stavropol' krai, where once they occurred in large numbers, with as many as 1000 birds wintering in the semi-desert areas in the east of the region as late as the 1980s (Khokhlov & Vitovich 1990). In southern Stavropol' krai in 1995–2006 just five encounters were logged, each time of only 3–8 birds (Parfenov 2007), while across Stavropol' krai in 2006–2012 hunters recorded between 1 and 25 individuals, 13 on average, during regional winter bird surveys (Drup & Drup 2012). In Dagestan, since 1995, there have been only 10 records of the Great Bustard, a total of 100 individuals, although in the south of the republic 50 birds were seen foraging on a dry piedmont steppe in November 2015. Currently, only single vagrant individuals are recorded in the largely mountainous republics of Adygea, Karachai-Cherkessia, Kabardino-Balkaria, North Ossetia, Ingushetia and Chechnya. Single wintering individuals and, more rarely, pairs are recorded in river valleys at the Black Sea coast (Til'ba 2007). Almost all our records were made in autumn and winter, and only one flock of 18 Great Bustards was observed in March, with birds foraging in cereal fields, semi-desert rangelands or dry steppe (Plate 1).

DISCUSSION

In the Russian Caucasus the Great Bustard is now a very rare breeding and rare passage and wintering bird. The breeding population has shrunk to three small areas and probably does not exceed 10–15 pairs (Ubushaev 2013, Lokhman 2017); we regard it as critically endangered and fear that it may soon disappear completely.

The crisis and decline in the Russian agricultural sector in the late 20th century did not have a positive impact on the Ciscaucasian Great Bustard population, other than that the spread of the Crimean population produced a slight growth in the number of pairs on the Taman' peninsula (Lokhman & Gozhko 2020). The rest of the region showed only population declines. Illegal hunting and powerline collisions have held numbers back, and now Russian agriculture has resumed development. Modern crop-growing technologies appear to have led to a strong reduction in the abundance of invertebrates in agricultural fields, which Great Bustards commonly use to nest in, depriving the growing chicks of a key food resource.

Winter conditions in the northern Caucasus remain suitable for Great Bustards. The warming of the climate has resulted in a shorter snow cover period, which makes large areas with winter wheat available for the species. Nevertheless, wintering birds are rare in all parts of the region. This is probably due to the low numbers of birds migrating from Kazakhstan.

Table 1. Expert evaluation of the current Great Bustard population in the northern Caucasus.

Season	Number of Great Bustards	Number of sites	Quality of estimate, from 1 (low-quality) to 5 (high-quality)
Breeding	20–30	3	Low
Migration	100	15	Low
Wintering	50	15	Low

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Unconventional habitat choices by some Great Bustard *Otis tarda tarda* populations in Turkey

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Summary: Great Bustard *Otis tarda tarda* is a globally threatened bird inhabiting the steppe regions of the Palearctic. Although its populations are shrinking fast, Turkey still holds regionally important numbers of the species. However, these remaining populations face a wide array of threats, and understanding their habitat use can help with their conservation. Here, we highlight the marginal and unusual habitat choices that some Great Bustard populations in Turkey are apparently forced to make due to human pressure. Records from islands on a hypersaline lake, an island on a river, a semi-desert plain, and a pine forest are described. We also present more expected findings from some previous work to contribute to the literature on habitat selection by Great Bustards in Turkey. Further studies are required to understand the extent and fitness costs of the use of unconventional habitats by Great Bustards.

INTRODUCTION

Great Bustard *Otis tarda tarda* is one of the 26 internationally red-listed bird species found in Turkey (IUCN 2020). The species is a natural steppe and grassland bird which, with the coming of agriculture, has partially adapted to living in anthropogenic habitat mosaics (Nagy 2018, Collar & García 2020). Steppes are one of the most degraded and disturbed habitats in Turkey and indeed the world, mainly owing to their ease of conversion (mostly to agricultural fields and settlements) and to their relatively lower attractiveness (Laiolo & Tella 2006, Smelansky & Tishkov 2012, Ambarlı *et al* 2016). This has had detrimental consequences for specialised grassland birds (Suárez-Seoane *et al* 2002, Brennan 2005, Donald *et al* 2006). Currently, although they are protected by law throughout their range, Great Bustards are still very widely hunted (Kessler & Smith 2014, Nagy 2018). Disturbance by agricultural work and other human activities also poses a threat to Great Bustards, by increasing their energy expenditure, collision risk with human-made structures, and reproductive failure rates (Sastre *et al* 2009, Rocha *et al* 2013, Ponce *et al* 2018). Moreover, both hunting pressure and disturbance can also force bird populations to live in suboptimal habitat conditions, which may come with a fitness cost (Thiollay & Probst 1999).

In Turkey, hunting remains the most serious and widespread threat to Great Bustards, and disturbance is among the most widespread of other threats to the species (Özgencil *et al* 2021). The sighting of a female Great Bustard with three chicks at the edge of the Scots Pine *Pinus sylvestris* forest in Sarıkamış, Kars, in the summer of 2011 (Per *et al* 2012) was an extremely intriguing record. Eight years later, video footage of a Great Bustard flying within Sarıkamış forest in September 2019 suggested that the situation needed investigation. In this review, we assemble examples of unusual and marginal habitat choices that some Great Bustard populations in Turkey are possibly being forced to make in response to hunting pressure and disturbance. We also present a short review of other records from Turkey, reporting more usual habitat preferences as a contribution to the literature.

METHODS

Driven by the intriguing sightings mentioned and documented in Per *et al* (2012) and Özgencil *et al* (2021), in June 2021 one of the authors (FA) surveyed the Scots Pine forests and the openings in these forests in Ardahan and Kars provinces in eastern Turkey (Figure 1). He surveyed the forests and forest edges using walked and driven line transects (Bibby *et al* 2000,

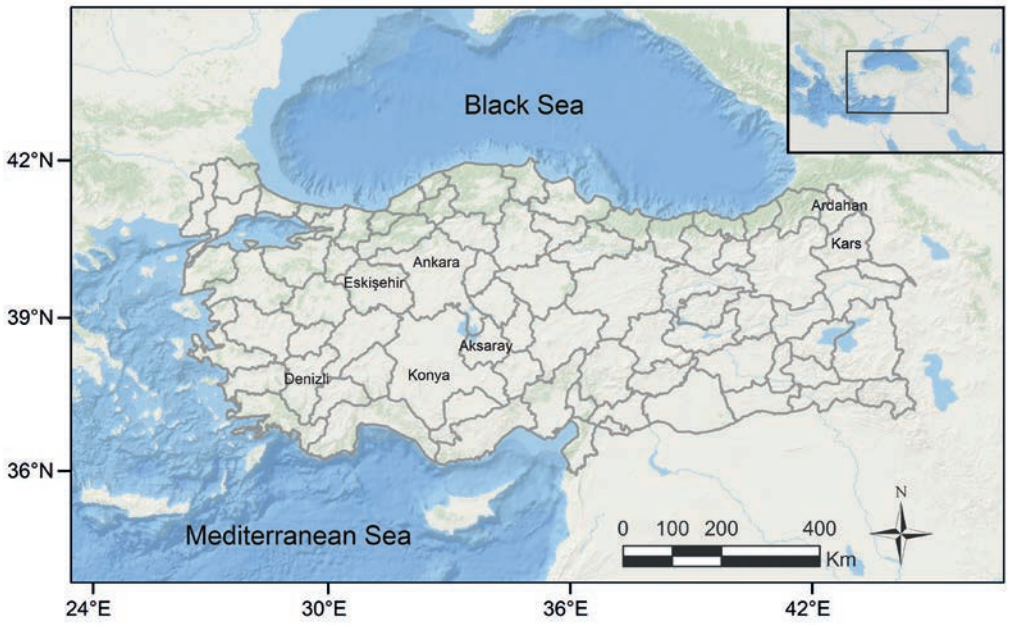

Figure 1. Turkey and its provincial borders (grey lines). Provinces where we conducted our fieldwork are labelled. Base map sources: ESRI, GEBCO, DeLorme, NaturalVue.

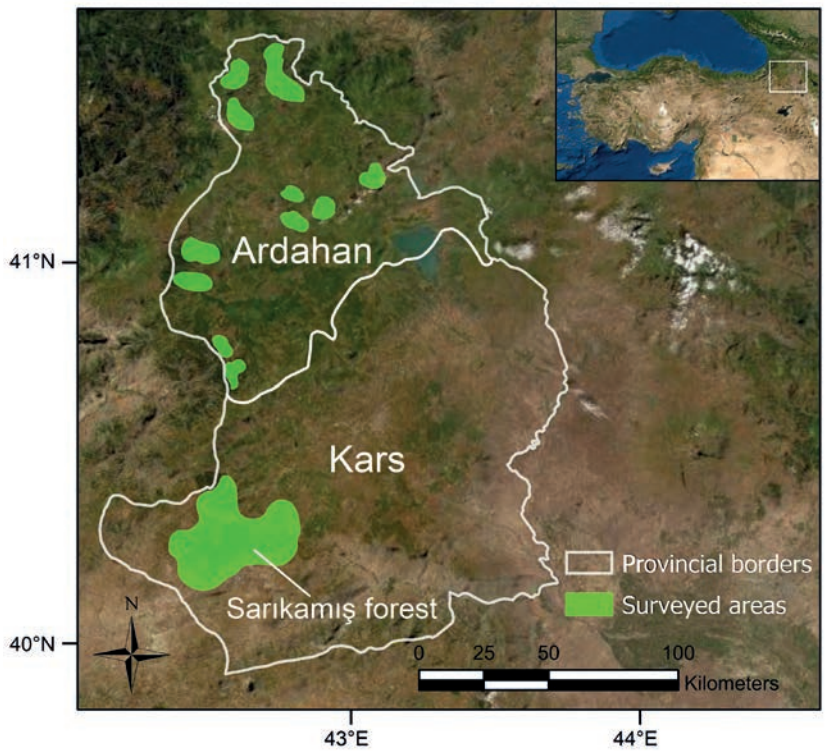

Figure 2. Map showing the surveyed Scots Pine forests in Ardahan and Kars provinces in June 2021. Base map source: ESRI, Earthstar Geographics.

Sutherland *et al* 2004), which can be a useful method for detecting Great Bustards, at least in their usual open-field habitats (Alonso & Alonso 1996). The transects were positioned 900–1,000 m apart, leaving 450–500 m detection range on both sides, which is substantially below the 700–800 m

Table 1. Summary of records of unconventional habitat choices by Great Bustards in Turkey. IBA = Important Bird Area.

Source	Location	Date	Use	Details
Kasparek (1989)	Çamlıyayla, Mersin, in the Tauruses, southern Turkey	February 1876	Migration?	Exact location not known. 1000-1500 m elevation. Highly mountainous area.
	Pozantı, Adana, in the Tauruses, southern Turkey	March 1876	Migration?	Exact location not known. 1000-1500 m elevation. Highly mountainous area.
Dicle Tuba Kılıç pers comm	Islands on Murat river in Upper Murat River IBA, eastern Turkey	Early 2000s	Lek site	Exact location not known. Alluvial islands in the river.
Per *et al* (2012)	Sarıkamış forest in Kars, eastern Turkey	July 2011	Nesting site	Scots Pine forest edge. More in Per *et al* (2012)
DKMP in Kars pers comm	Sarıkamış forest in Kars, eastern Turkey	September 2019	Not known	Within Scots Pine forest. Landcover: 80% forest, 20% forest openings
Özgencil & Özcan (2018)	North and north-west of Aksaray, central Turkey	April 2018	Lek site, resting site	Small islands in a hypersaline lake. Island landcover: 60% halophilic, short-growing herbs, 40% barren salty soil
		April 2018	Lek site	Dry and flat semi-desert steppe area. Landcover: 100% salty steppes / semi-desert steppes
		May 2018	Nesting site	Reedbeds growing around freshwater springs. Landcover: 100% brackish & freshwater marshes

distance given in Alonso & Alonso (1996), to account for the limited visibility in the forest. To our knowledge, nobody has ever surveyed Great Bustards in forests and forest openings in Turkey (although they have been found and surveyed in some woodland areas in other countries: see Discussion). We expected to find the species in the forest openings and margins, so more effort was allocated to these habitats by making sure that these areas were covered by transects in our systematic transect replacement. The surveyed areas are shown in Figure 2. We also used the results of the monitoring surveys conducted by teams from the General Directorate of Nature Conservation and National Parks (DKMP) in Kars and Ardahan provinces. We contacted DKMP in Kars to obtain the footage of Great Bustards they recorded within Sarıkamış forest.

We reviewed the literature from Turkey to collate all records of breeding and wintering Great Bustards in less conventional habitat as gauged from the existing literature, *eg* Cramp & Simmons (1980), Kasparek (1989), Kollar (1996), Kirwan *et al* (2008), Rocha *et al* (2013), and Collar & García (2020). We also collated the unpublished findings of some of our fieldwork in Eskişehir, Ankara, Konya, Aksaray and Denizli provinces in Inner Turkey (Figure 1) to contribute to the literature about the species' breeding habitat choice (both nesting and lek sites: Morales *et al* 2001) in Turkey.

Plate 1. Still from a video of a Great Bustard flying in a Scots Pine forest in Kars in September 2019. © *DKMP in Kars*

Plate 2. Aerial photograph of islands in the hypersaline Tuz lake in Konya and Aksaray provinces, Turkey. © *Umut Tank*

RESULTS

We found several historical records involving cases of unconventional habitat choice by Great Bustards in Turkey (Table 1). An expedition encountered flocks of the species in Mersin, Çamlıyayla, in the Taurus range in February 1876 and near Adana, Pozantı, in March 1876 (Danford 1877, Kasparek 1989). These records are from highly mountainous areas, which Great Bustards do not usually inhabit. In the early 2000s, a group of Great Bustards used to display on an alluvial island in the river in the Upper Murat Valley Important Bird Area in eastern Turkey (D Kılıç pers comm), which, to the best of our knowledge, is the only record of the species using a river island as a lek site. Per *et al* (2012) reported and photographed a female Great Bustard with three chicks at the edge of a Scots Pine forest in Sarıkamış, Kars, in July 2011. In September 2019, DKMP rangers filmed a Great Bustard flying through the same forest (80% Scots Pine, 20% openings) in Sarıkamış (Plate 1).

In an expedition around Tuz lake in the spring and summer of 2018, İKÖ and FA obtained a few records of unconventional habitat choices by Great Bustards. The birds in this region use islands in the hypersaline Tuz lake as lek sites during the day and roosting sites during the night (Özgencil & Özcan 2018). These islands are mostly inaccessible to humans and have sparse beds of a few short-stature, salt-tolerant herbaceous plants such as *Salicornia* (Plate 2).

Plate 3. Aerial photograph of the semi-desert Great Bustard lek site north-west of Aksaray, Aksaray province, Turkey. © *Umut Tank*

Another extraordinary lek site was discovered by İKÖ and FA on an apparently semi-desert salty steppe area north-west of Aksaray, close to Tuz lake, in April 2018 (Plate 3). There was a tiny (*c*1 m in diameter) freshwater spring within a few hundred metres of the area where several Great Bustards were spotted.

The following month (May 2018), a shepherd told İKÖ and FA that Great Bustards occasionally make their nests in the reedbeds of *Phragmites australis* growing around the freshwater springs north-west of Aksaray, and that he had himself found such a nest with two eggs in early May, when the reeds would have been around 1 m tall. When İKÖ visited the area in June, he found two Great Bustard feathers within these reeds, which were by then 1.5–2 m tall. Given this circumstantial evidence and the fact that the shepherd knows the species very well, we fully trust his story.

FA found no Great Bustards during his surveys in and around the Scots Pine forests in Ardahan and Kars. However, local people confirmed that the species is seen around the edges of the forests and that an injured chick was found by a farmer in a cereal field in Ardahan province in June 2021 and sent to DKMP in Kars for treatment. This is the first record of the species breeding in Ardahan.

Over the last several years, we have also recorded Great Bustards in habitat that was more in line with the species' ordinary preferences. In 2016, FA found a lek site north of Tuz lake in an agricultural mosaic of dry farming (mostly wheat) and ploughed fields. The same site was surveyed by FA and İKÖ in 2018 again, and its land cover, quantified from aerial photographs, involved 75–80% cultivated fields (wheat and barley), 10% ploughed fields, 5–10% semi-natural steppe and 1–5% dirt roads. All four nests found by our crew and local farmers were located in wheat or barley fields. In 2020 MMK surveyed a few lek sites in Eskişehir and Denizli provinces. All were in agricultural mosaics made up of cultivated fields, stubbles, ploughed fields and fallows. One of the three nests found

by MMK was in a wheat field, one in a barley field, and one in a semi-natural steppe dominated by Wild Arugula *Eruca vesicaria* and Tumbleweed *Gundelia tournefortii*.

DISCUSSION

According to the latest estimates, with 559–780 breeding and 593–775 wintering Great Bustards, Turkey still holds regionally important numbers of the species (Özgencil *et al* 2021). However, Turkish populations have been declining very fast, and they face a wide range of threats (Kirwan *et al* 2008, Karakaş & Akarsu 2009, Özgencil *et al* 2021). From the evidence we have gathered here, we suggest that, in addition to their more direct impacts, widespread hunting pressure and disturbance may be responsible for forcing some of these remaining populations to live under suboptimal conditions.

Normally, Great Bustards avoid both mountainous and wooded areas (Cramp & Simmons 1980, Alonso *et al* 2004, Kirwan *et al* 2008). The winter/early spring records from the Taurus mountains probably referred to migrants, as mentioned in Özgencil *et al* (2021), but given that the species used to breed in areas up to 2500 m in Kyrgyzstan (Yanushevich & Tyurin 1959), the remote possibility remains that a high-elevation breeding population once inhabited the Tauruses. The species' use of wooded areas is, however, better documented. Some Great Bustard populations in Iberia may occupy open-canopied oak *Quercus* spp stands and Olive *Olea europaea* orchards in the breeding season (Cramp & Simmons 1980, Alonso *et al* 2004, Moreira *et al* 2004, Delibes *et al* 2012, Martín *et al* 2012, NJ Collar in litt). Moreover, the eastern subspecies *O. t. dybowskii* is known to utilise openings and edges in the forest-steppe zone in Siberia and northern Mongolia (Mel'nikov & Popov 2000, Goroshko 2002, 2008, Kessler 2015). Birds from some of these populations have been found to regularly lek and nest inside forest openings, and at forest edge (Ponomareva 1986, Goroshko 2002, 2008, Kessler 2015).

Whether these unusual choices of habitat are driven by natural or anthropogenic factors is unclear. There are documented cases of other typically grassland species taking refuge in forest to avoid human pressure, one being the European Bison *Bison bonasus* (Kerley *et al* 2012) and another involving various carnivores in the Sarıkamış forest in Turkey (Chynweth *et al* 2016) where the record of the female Great Bustard was the first of its kind in the country. Our own surveys in Scots Pine forests in Ardahan and Kars failed to locate any Great Bustards, but a more intensive and better-timed survey (in April and May) might prove more productive. The plains surrounding these forests should also be properly surveyed because the whereabouts of the Kars population's lek site(s) are currently unknown, while the injured chick found in Ardahan also points to a local breeding population waiting to be discovered. Certainly, it appears that the Great Bustards in this region must occasionally be utilising the forest habitat, and any conservation management plan should not discount these records.

Reports of Great Bustards breeding on islands on a river in eastern Turkey and a hypersaline lake in central Turkey are further examples of unusual habitat choice by the species in Turkey. Although the island on the Murat river no longer exists (it was lost after dam construction upstream), the islands in the hypersaline lake in central Turkey still seem to support a breeding population. These islands are particularly hard to reach and have never been completely surveyed; the use of drones, which have proved to be important tools in ecology (Schiffman 2014, Chabot & Bird 2015, Blight *et al* 2019), might help in this regard. Great Bustards are largely birds of dry but temperate grasslands and quasi-grasslands, not desert and semi-desert (Cramp & Simmons 1980, Alonso *et al* 2004, Moreira *et al* 2004), so the use of a desert area as a lek site by Great Bustards in Kazakhstan between 2009 and 2011 (Gubin 2015) may represent the impact of human pressure. Consequently, the semi-desert lek site north-west of Aksaray merits study to evaluate the

possible anthropogenic factors that might have led to its use. It should, however, be noted that the unusual habitat choices mentioned in this paper might occur due to a combination of anthropogenic factors and natural predation pressure, rather than the former alone, because these habitats, especially the islands, may offer better protection from natural predators. The fitness costs and benefits to the birds of these choices are also worthy of investigation.

The discovery of a nest within reedbeds near a freshwater spring north-west of Aksaray suggests that overgrazing might be causing additional hardship for the Great Bustards in the region. Overgrazing is quite widespread in the steppes of central Turkey (Ambarlı *et al* 2016, Özgencil *et al* 2021). We saw during our previous surveys in this area that overgrazing leaves no vegetation in which females can nest other than sparse and highly spinose plants (too little cover against predators), reedbeds (risk of flooding) and crops (risk from harvest; Kılıç & Karakaş 2005, Nagy 2018). The biggest lek discovered in this region in 2000 was found in a small plot fenced off against grazing (Heunks *et al* 2001), suggesting that Great Bustards may prefer ungrazed and disturbance-free areas with an abundant herbaceous plant layer.

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