Status of the Bean Goose *Anser fabalis* wintering in central Asia

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Abstract

The discovery of Bean Geese *Anser fabalis* around Lake Issyk-Kul in east Kyrgyzstan in the late 1990s suggested that a little-known Bean Goose population or subspecies wintered in central Asia. A review of published data on Bean Goose numbers and distribution in central Asian countries was undertaken to clarify the historic and current status of Bean Geese wintering in the region. Recent counts suggest that there is a small wintering population of 2,000–5,000 birds in central Asia, which is concentrated in a few areas in southeast Kazakhstan, east Kyrgyzstan and northwest China. Assessment of museum specimens of birds collected in central Asia, and also field observations, found that the geese were of the Taiga Bean Goose *Anser f. fabalis* subspecies. Bean Geese from central Asia have previously been classed as *johanseni*, but there was no evidence found in the present study for a *johanseni* subspecies. The lack of regular counts meant that population trends could not be determined with any accuracy, but the small numbers suggest that the population has declined and is now threatened. Formal recognition of the population is important for its management and conservation. Further research into the numbers and distribution of Bean Geese in central Asia is strongly recommended.

Key words: China, Kazakhstan, Kyrgyzstan, Taiga Bean Goose, Uzbekistan.

The Bean Goose *Anser fabalis* breeds across large parts of the Palaearctic tundra and taiga belt, from Scandinavia in the west to the Chukotka Peninsula in the east. Four or five different subspecies are recognised: the smaller, thick-billed birds nest on tundra and larger, longer-billed birds breed in taiga habitat, with an increase in the size and length of the bill from west to east also contributing to their classification as different subspecies (Fox 2005; Mooij & Zöckler 1999). Wetlands International (Rose & Scott 1994, 1997) currently considers there to be four wintering populations: the two western subspecies *rossicus* and *fabalis* wintering in Europe and the two eastern subspecies *serrirostris* and *middendorffi* wintering in east Asia. The latest population estimates suggest that all Bean Goose populations except for *rossicus* are in decline (Wetlands International 2006). A comparison of counts made of geese in east Asia in 2000–2002 with those made in the

mid 1980s further indicate that most east Asian goose populations decreased in numbers during the late 20th century, including both of the Bean Goose subspecies wintering in east Asia (Syroechkovskiy 2006).

A fifth subspecies of Bean Goose breeding in the west Siberian lowlands and wintering in central Asia has been described as *A. f. johanseni*, intermediate between *fabalis* and *middendorffi* (Delacour 1954; Dolgushin 1960; Fox 2005), but this was not included in waterbird population estimates from the 1990s onwards (Rose & Scott 1994, 1997). Following the discovery of Bean Geese wintering at Lake Issyk-Kul, Kyrgyzstan (42°30'N, 77°30'E) in the late 1990s (Heinicke 2008), Wetlands International provisionally recognised a separate wintering population in central Asia (Delany & Scott 2002), but no population estimates or trends were provided.

This paper reviews recent published data on the numbers and distribution of Bean Geese in central Asian countries, with a view to clarifying the current status of Bean Geese in central Asia. The collated data are compared with historical records to determine any changes in winter distribution and numbers. Additionally, the taxonomic status of the geese is investigated, as the validity of the subspecies *johanseni* is thought to be questionable (Burgers *et al.* 1991; Mooij & Zöckler 1999; Fox 2005).

Methods

Records were collated of Bean Geese reported in the central-Asian former Soviet Republics of Kazakhstan (southern part only), Kyrgyzstan, Uzbekistan, Turkmenistan and Tajikistan, and also in the Xinjiang province of northwest China. The only regular records of Bean Geese wintering in the region in recent years were counts made at Lake Issyk-Kul, Kyrgyzstan, in 1999–2000 and 2002–2005 for the annual International Waterbird Census (IWC) coordinated by Wetlands International (Heinicke 2008; Gilissen *et al.* 2002; Solokha 2006). The IWC does not focus particularly on geese, so an unknown number may have been overlooked if the birds were feeding away from the monitored wetlands or if site coverage was incomplete. There have been no special surveys of geese in the region. A comprehensive literature search, mostly of regional Russian literature, therefore was undertaken to augment information on goose numbers and distribution in the region.

Data obtained from the literature search were digitised and analysed using ArcView® geographic information system (GIS) software. For each of the records, the location (including geographical coordinates), number of birds and exact dates or time periods were recorded. Additional unpublished recent data from Kyrgyzstan and from the Chinese Anatidae database (M. Barter, Wang Xin & Cao Lei, pers. comm.) were also collected and included in the GIS. All data were grouped into one of three time periods: group I = > 1995 records, group II = 1960–1995 records and group III = < 1960 records. The year 1960 was taken as the limit for group III for practical reasons; a main source of early data for Kazakhstan (Dolgushin 1960) gave sightings without exact dates. If precise dates were available, the birds were classified as being passage migrants (September–

November and March–May) or winter visitors (December–February). The reporting effort was random for each of the countries, because Bean Geese were not considered to be of special interest or concern.

The taxonomic position of the Bean Goose wintering in central Asia was investigated by comparing measurements recorded for several museum specimens of birds from the region with those for other Bean Goose populations. Single specimens were found in the Museum of the Issyk-Kul zapovednik, Ananevo, in the Natural History Museum, Berlin, and in the Koenig Museum, Bonn. Photographs from two type-specimens of *johanseni* were obtained from the American Museum of Natural History, New York, and another record from Afghanistan was found in the online catalogue of the same museum.

Additionally, ring recoveries of Bean Geese from central Asia and neighbouring areas were collected and analysed. The only available data were recoveries of birds originally ringed in the Netherlands. From 1957–1987, > 13,000 Bean Geese wintering in the Netherlands were ringed and most were identified to subspecies level (4,623 *fabalis* and 7,056 *rossicus*) (B. Ebbinge, *in litt.*). In contrast, there were no recoveries of birds ringed in Russia or the former USSR from central Asia (K. Litvin/Bird Ringing Centre Moscow, pers. comm.).

Results

Observations and published records of Bean Geese in central Asia

Only eight records of Bean Geese reported in central Asia were found for the post-1995 period. All were located in a relatively small area, in the Ily River basin, southeast Kazakhstan, around Lake Issyk-Kul in eastern Kyrgyzstan and near Bole in northwest China (Fig. 1, Appendix 1). The geese were recorded at or near lakes or reservoirs, surrounded by agricultural fields which provided potential feeding areas. Observations from late autumn and during winter indicate that the birds remained in that region for at least part of the winter season. The numbers reported suggest that a wintering population of at least a few thousand birds was present in 1990s and early 2000s, with a maximum count of ~ 5,000 geese at Lake Kolzhazskoe in the 1990s (Erokhov 2002a, Appendix 1). A decline in the number of Bean Geese wintering at Lake Issyk-Kul, the only consistently monitored site, from 587 individuals in January 1998 to 48 birds in mid-winter 2005 (Heinicke 2008), may be indicative of a decline of the wintering population.

Although Gavrilov (2000) states that the Bean Goose occurs only as a migrant species in Kazakhstan, recent data show that the birds do winter in the southeast part of the country (Belyalov & Kovshar 2002). Dolgushin (1960) reported regular wintering of Bean Geese in south Kazakhstan in the first half of the 20th century, but these areas seem to be completely deserted in the 2000s. Bean Geese were not recorded in Uzbekistan during the winter counts made in 2003–2006 (Lanovenko 2008). The only recent observation is from October 2006, when a Bean Goose flock was reported migrating at Ayakagitma Lake near Buchara (Lanovenko 2008). The current status for

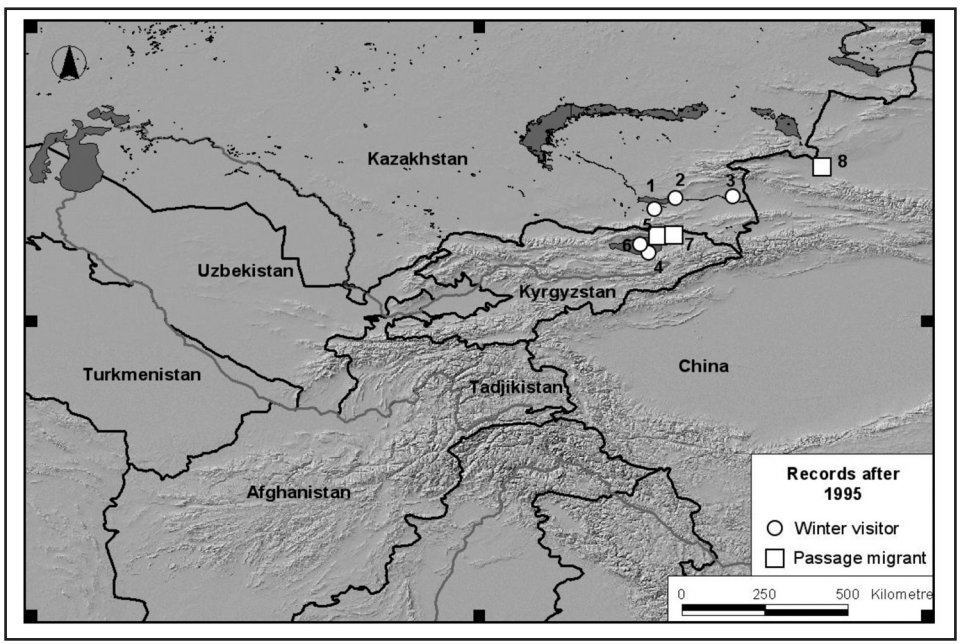

Figure 1. Geographical location of Bean Goose records in central Asia from 1995 onwards. Numbers are for the sites listed in Appendix 1.

Uzbekistan is unknown, but the Bean Goose is now most likely only an irregular visitor to the country.

The species is considered to be an occasional visitor to Turkmenistan, with no recent observations (E. Rustamov, pers. comm.). There were also no recent records found for Tajikistan, Afghanistan and Iran.

The current status of Bean Geese wintering in Xinjiang province, China, is unclear. The occurrence of larger flocks during spring and autumn migration in east Kyrgyzstan and the disappearance of Bean Geese from southeast Kazakhstan when the lakes and reservoirs freeze (Erokhov 2002a) suggest final wintering places somewhere in northwest China. The Chinese literature mentions wintering of *johanseni* Bean Geese in Qinghai province (Zheng Guangmei 2005) and the northern part of the Red Basin, Sichuan province (Lu Tai-Chun 1979). The extent to which these areas are still used by wintering Bean Geese is not known.

Bean Geese were recorded at > 20 different locations in central Asia between 1960–1995 (Fig. 2, Appendix 2). The data indicate a wider range of staging and wintering sites in central Asia during that period (Fig. 2). This includes wintering areas in the Amudarya lowlands (southeast Turkmenistan, southern Uzbekistan and southern Tajikistan; site numbers 13, 16, 18, 20 and 21 in Fig. 2), in the Syrdarya lowlands

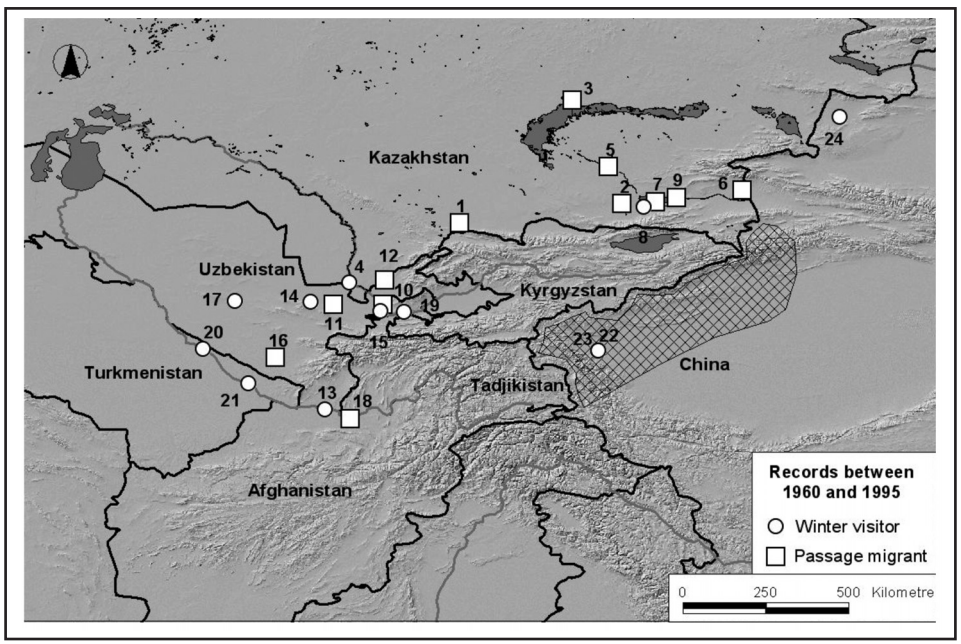

Figure 2. Geographical location of Bean Goose records in central Asia from 1960–1995 inclusive. Numbers are for the sites listed in Appendix 2. Black shading = Bean Goose wintering area reported in *Fauna Sinica* (Lu Tai-Chun 1979).

(southern Kazakhstan, Uzbekistan and northern Tajikistan; site numbers 4, 10–12, 14–15 and 19 in Fig. 2), in the Lake Balchash region (site 3 in Fig. 2) and in the Ily River floodplain (southeast Kazakhstan; site numbers 2, 5–7 and 9 in Fig. 2). The few data from Xinjiang province, China, indicate wintering places (site numbers 22 and 23) in the transition zone between the southern slopes of the Tianshan, the eastern slopes of the Kunlun Mountains and the Tarim Basin, including the Takla Makan Desert. Another wintering area (site number 24) seems to be situated within the range of the Dzhungar Gate (the border area between China and Kazakhstan), east and southeast of Lake Alakol.

The situation for the geese in Uzbekistan from 1960–1995 is described in greater detail by Kashkarov (1987), who described a substantial decline in numbers during the 1970s, with only very small numbers thereafter. He attributed this decline to changes in agriculture and land use in Uzbekistan, which are thought to have made the country less suitable for migrating and wintering Bean Geese.

Most records were from the period before 1960, with many observations made before 1920 (Appendix 3). Migrating and wintering Bean Geese were reported from a number of sites across central Asia (Fig. 3) Reports from the Lake Aral region (site numbers 23 and 34 in Fig. 3) and also from

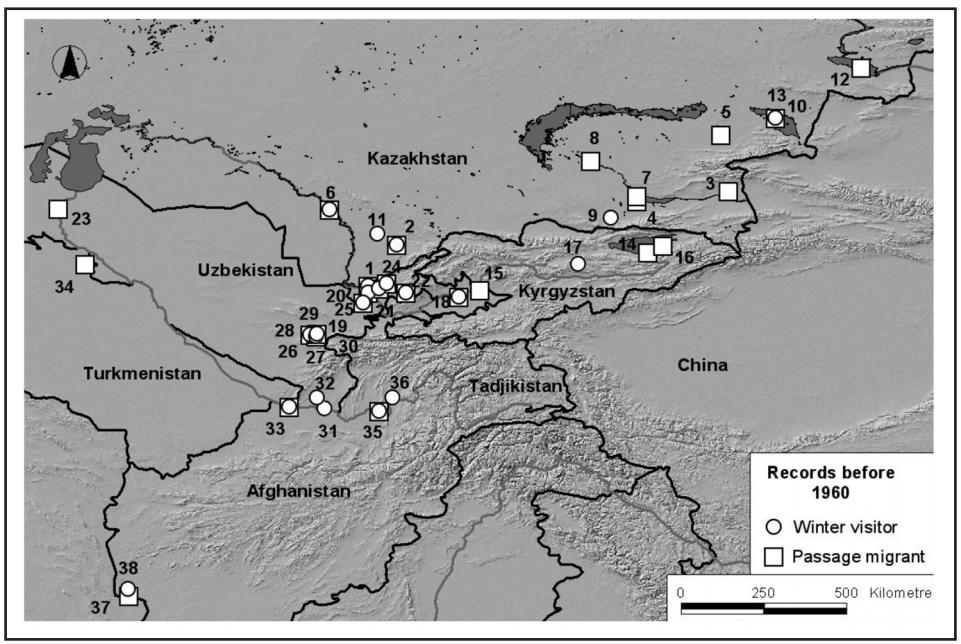

Figure 3. Geographical location of Bean Goose records in central Asia prior to 1960. Numbers are for the sites listed in Appendix 3.

the Seistan region (site numbers 37 and 38 in Fig. 3) are only for the period before 1960, but apart from these records the distribution is similar to that recorded for 1960–1995 (Figs. 2, 3), albeit that there were no data available from northwest China. The old records of Bean Geese in the Seistan region (nowadays southwest Afghanistan and east Iran) suggest that the extensive wetlands (Lake Puzak, Daryachen-ye-Sistan, Lake Zereh depression) and the floodplain of the Helmand River may once have been part of the winter range. This view is supported by descriptions of Sarudny (1911), who reported the Bean Goose as a common winter visitor in the south Caspian lowlands, the Seistan and the Parapamis region and as a rare winter visitor in the Zagros region and Khuzestan.

The early references provide little information on the numbers of Bean Geese in central Asia historically, but the number and distribution of the pre-1960 records suggest that the species was once a regular migrant and winter visitor, especially in south Kazakhstan and Uzbekistan. Although only two records (numbers 1 and 21 in Appendix 3) mentioned thousands of birds, the general lack of exact numbers in most historic ornithological records across Europe and Asia means that thousands or even tens of thousands of geese may once have used the whole region.

Ring recoveries of Bean Geese in central Asia

There have been very few ring recoveries of Bean Geese from central Asia; none for birds marked in Russia (K. Litvin, pers. comm.), but six birds with Dutch metal rings were found shot in central Asia (B. Ebbinge, pers. comm., Table 1). All of these birds were ringed whilst wintering in the Netherlands and were identified as Taiga Bean Geese *Anser fabalis fabalis*. Four of the six birds were recovered 2–3 years after ringing, one adult female (goose 8026598) changed winter quarters in the first winter after ringing and one bird (goose 8502769) was recovered 13 years later (Table 1).

A further 176 Dutch-ringed Taiga Bean Geese have been reported from other parts of Asia, ranging from the west Siberian lowlands eastwards to the Krasnoyarsk (River Yenisey), Novosibirsk and Tomsk regions (B. Ebbinge, pers. comm.). Most birds were shot during spring and autumn migration, but 33 birds were reported between June–August. The two easternmost records were from the Sayan Mountains near Krasnaya Zvezda (Krasnoyarsk Kray; 52°06'N 92°36'E) and near Turan (Tuva Republic, 52°06'N, 93°54'E), to the east of the central Asian area covered in this paper. Both birds were reported shot in mid–late September, one the following winter, the other in the second winter after ringing.

Taxonomy

The birds seen wintering in Kyrgyzstan during the IWCs in 1998–2005 were observed carefully to identify the subspecies present and digital photographs were taken to reinforce identification. All birds were considered in the field to be of the Taiga Bean Goose subspecies. Typical features were long necks, long and slender bills, and an elongated shape to the head and bill. Many birds showed more orange than black colouration on the bill, with bill colour being at least two-thirds orange for ~ 20% (n = 48) of the birds. In the field, all birds appeared to have the same structural features as the Taiga Bean Geese of *fabalis* subspecies, which winter in Europe.

In addition to the field identification, three different specimens from Kyrgyzstan were examined in the hand and several body and bill measurements were taken. All birds had a roundish nail and 25–27 teeth in the upper mandible, which are distinctive features of the Taiga-group subspecies (Alpheraky 1905). A comparison of measurements taken of Taiga Bean Geese from the *middendorffi* subspecies (samples from Mongolia and Japan) and the *fabalis* subspecies (samples from Germany and Poland) found that all of the specimens from Kyrgyzstan fitted into the range of measures recorded for *fabalis*, most obviously for culmen length (Table 2).

Inspection of photographs of two *johanseni* type specimens from the American Museum of Natural History in New York (adult male AMNH 730751 and adult female AMHH 730752, both collected in 1905 in the Tsinling Mountains, Shaanxi province, China) found that the birds had longish, slender bills with a roundish nail and with up to 50% orange colour on the bill. The original description (Delacour 1951) and the only drawing of *johanseni* (Delacour 1954)

Table 1. Ring recoveries for Bean Geese *Anser fabalis* ringed in the Netherlands and reported shot in central Asia (B. Ebbinge, pers. comm.).

Ring number	Ringing date	Age/sex on ringing	Recovery date	Recovery site	Record no. in Appendix 2
308036	22.01.1960	Juvenile male	22.11.1964	Tashkent (UZ)	12
8026598	19.01.1971	Adult female	28.12.1971	South of Lake Aidarkul, west of Uzynkuduk (UZ)	14
8026480	13.01.1971	Adult male	16.11.1973	South of Shak, mouth of River Kifirnigan (TD)	18
8502769	11.01.1968	Adult female	15.05.1981	North of Michailovka, near Dzhambul (KZ)	1
8034629	19.12.1983	Adult male	15.09.1985	North shore of Lake Balkhash, near Balkhash (KZ)	3
8035168	15.01.1985	Adult female	28.11.1986	River Kashkadarya near Karshi (UZ)	16

reported slightly larger measurements than recorded for *fabalis* and specified a black bill with a narrow orange band near the tip of the bill. On comparing the photographs with the drawing, the latter appears to be incorrect for *johanseni*. Interestingly, the form and colouration of the bills for the two specimens of the type series fit well with *fabalis* subspecies from European wintering grounds (*e.g.* Burgers *et al.* 1991). Measurements of the wing, tarsus and bill are also within the *fabalis* range (Table 2).

Literature data also indicate an occurrence of *fabalis* in central Asia. Although Severtzov (1873b) described Bean Geese from Kyrgyzstan as *middendorffi*, this opinion was corrected by Alpheraky (1905), who reviewed the taxonomic status of the Kyrgyzstan Bean Geese. He re-examined the specimen from the Severtzov collection, and corrected these as being *fabalis* ("Yellow-billed Bean Goose", a synonym of ssp. *fabalis*). The most recent systematic list of birds in Kyrgyzstan (Shukurov 1991) mentions the Bean Goose as being *fabalis*. Historic records of Bean Geese in west Turkestan and Seistan, described them as *Melanonyx arvensis*, which is also a synonym of *A. f. fabalis* (Sarudny 1911; Zarudny 1910, 1916; Zarudny & Bilkevitch 1918; Steinbacher 1926).

Table 2. Comparison of measurements for adult Bean Geese, for the *johanseni*, *middendorffi* and *fabalis* subspecies. The nail was recorded as being round in each case. Sample sizes (*n* values) are given in parentheses. [a] = wing length not taken because birds in moult; [b] = geese caught in central Mongolia; [c] = sex not determined; [d] = all recorded in Germany and west Poland.

Species	Wing (mm)		Tarsus (mm)		Culmen (mm)		Visible depth of lower mandible (mm)		Source
	♂	♀	♂	♀	♂	♀	♂	♀	
Anser f. johanseni	454–487 (7)	425–458 (10)	82 (1)		63–72 (7)	61–70 (10)	8 (1)	7–10 (10)	Delacour (1951)
Anser f. fabalis		431 (1)		85 (1)		60.8 (1)		9.4 (1)	Issyk-Kul/KS, Berlin Museum (ZMB 35.665)
Anser f. fabalis		456 (1)		83 (1)		55.8 (1)		8.3 (1)	Issyk-Kul zapovednik, museum specimen
Anser f. fabalis		455 (1)		73 (1)		60.7 (1)		8.4 (1)	Sonkul/KS, Koenig Museum, Bonn (ZFMK 5374)
Anser f. middendorfi [a, b]			90–101 (9)	81–91 (9)	75.2–89.1 (9)	69.3–75.8 (9)	9.3–12.3 (9)	8.0–10.0 (9)	M. Gilbert (pers. comm.)
Anser f. middendorfi [c]	440–530 (31)		75–115 (31)		70.3–91.0 (31)		8.3–12.6 (31)		Kurechi *et al.* (1983)
Anser f. fabalis [d]	415–509 (16)	425–485 (12)	70–84 (16)	64–88 (12)	54.2–74.9 (16)	57.2–64.0 (12)	7.1–9.5 (16)	6.6–9.0 (12)	T. Heinicke (unpubl. data)
Anser f. fabalis [c, d]	430–487 (12)		67–87 (12)		56.1–69.3 (12)		7.0–9.4 (12)		T. Heinicke (unpubl. data)

Discussion

Recent status of Bean Geese wintering in central Asia

Recent observations from Lake Issyk-Kul in Kyrgyzstan, southeast Kazakhstan and northwest China show that the Bean Goose still migrates and winters regularly in central Asia. The few larger flocks indicate a relatively small population which, tentatively, can be estimated at 2,000–5,000 birds. Due to the fragmented nature of the information and the lack of coordinated counts, it was not possible to give any recent trends in numbers. Nevertheless it seems likely that this small winter population has declined and is now threatened. Hunting and changes in agriculture and land use (notably desertification, large-scale cotton farming and abandonment of agricultural fields) are probably the most important threats. A lack of recent data from the former western part of its central Asian winter range suggests that the Bean Goose may have disappeared as a regular winter visitor from these areas.

Recognition of the Taiga Bean Geese wintering in central Asia as a separate population is important for its future management and conservation. This has been taken forward by Wetlands International, who put the central Asian population at 5,000 birds in its most recent waterbird population estimates (Wetlands International 2006). Since the winter population of Taiga Bean Geese in Europe (Denmark, Germany, Sweden, Poland and Great Britain) is also relatively small and decreasing (< 70,000 individuals in winter 2008/09; Wetlands International 2006 and T. Heinicke unpubl. data), more attention should be paid to the protection of *fabalis* Bean Geese at a global scale. Further research on the Bean Geese in central Asia would provide better information on its distribution, population trends and ecological requirements, including whether *fabalis* winters in central and eastern China.

Taxonomic status of Bean Geese wintering in central Asia

The field observations of Bean Geese wintering at Lake Issyk-Kul and investigation of three specimens from Kyrgyzstan suggested that these birds belong to the *fabalis* subspecies. This view was supported by recoveries of Dutch-ringed Taiga Bean Geese *A. f. fabalis* which were reported shot in central Asia. Delacour's (1951) suggestion that birds in Turkestan were a separate *johanseni* subspecies was not supported in the present study, with further investigation of photographs from type specimens and a comparison of body size measurements with those of known *fabalis* individuals also suggesting that the *johanseni* classification was not valid. This supports the views of Burgers *et al.* (1991), Mooij & Zöckler (1999) and Fox (2005), who also questioned the existence of *johanseni*. A genetics study of the Bean Goose complex (Rukonen *et al.* 2008) found no indication of a separate *johanseni* subspecies. It therefore seems likely that birds in Xinjiang province are also of the *fabalis* subspecies, but the taxonomic status of birds in central China still needs confirmation.

The presence of the Tundra Bean Goose (*rossicus* and *serrirostris* subspecies)

or Middendorff's Bean Goose (*Anser middendorffi*) in central Asia was not verified in this study, but it is possible that they do occur. There have been several reports of Middendorff's Bean Geese wintering in central Asia (Dolgushin 1960; Gavrilov 1999; Shnitnikov 1949; Salikhbaev & Bogdanov 1961), but these are likely to be misidentified Taiga Bean Geese *A. f. fabalis*. At least one of the observations mentioned by Shnitnikov (1949) (number 5 in Appendix 3) is a clear misidentification, as an orange bill is not a *middendorffi* trait. The occurrence of dark-billed *fabalis* individuals and occasional large *fabalis* males are the most likely reasons for misidentifying subspecies. A definite record of *middendorffi* (for instance a museum specimen and/or photographs) has not yet been obtained from central Asia.

Origin and possible migration routes of Bean Geese wintering in central Asia

The Taiga Bean Goose breeding range in the West Siberian lowlands is not known in detail, but it stretches from the Ural Mountains eastwards to the Yenisey River. Its southern limit is thought to be close to 60° latitude (Stepanyan 2003). Alpheraky (1905) mentioned that *fabalis* from the Taimyr Peninsula migrated through the Tomsk region and west Tian-Shan to winter in Russian Turkestan. He also examined several specimens from Tomsk (collected in May 1902 by Prof. Kashchenko) as 'Yellow-billed Bean Geese' (synonym of sp. *fabalis*). These findings are supported by recoveries of Dutch ringed Taiga Bean Geese near Omsk, Tomsk, Novosibirsk and along the Yenisey River. Also, a specimen shot in May 2002 north of Tomsk was a typical *fabalis* (K. Litvin, pers. comm.). These records all suggest that Taiga Bean Geese from the eastern part of their breeding range migrate south along the rivers Ob and Yenisey to winter in central Asia (Fig. 4). According to Dolgushin (1960), the geese may also follow the River Irtysh basin, as they were reported as regular migrants near Pavlodar, common near Semipalatinsk and very common at Lake Zaysan. The Lake Zaysan depression seems to be an important autumn staging area, from where the birds fly either to southeast Kazakhstan and east Kyrgyzstan or directly to northwest China.

The western part of the former wintering range in central Asia may have been reached by another more westerly migratory route, passing the Kustanai district of northwest Kazakhstan and the Turgai depression to staging areas around Lake Aral, then following the Amudarya and Syrdarya River basins to the wintering sites. Passage migrants have been reported in the Lake Aral region and the middle reaches of Syr-Darya historically (Zarudny 1910, 1916). By the early 2000s, the Bean Goose was an extremely rare passage migrants in northwest and central Kazakhstan (Heinicke 2008; Markkola *et al.* 1997; Tolvanen *et al.* 1999, 2000; Tolvanen & Pynnönen 1997), suggesting that the geese have now almost disappeared from former wintering areas in Uzbekistan, Turkmenistan, Tajikistan and south Kazakhstan.

Historic records suggest that a third more easterly migration route may have existed in the past. Two ring recoveries of Taiga Bean Geese from the Sayan

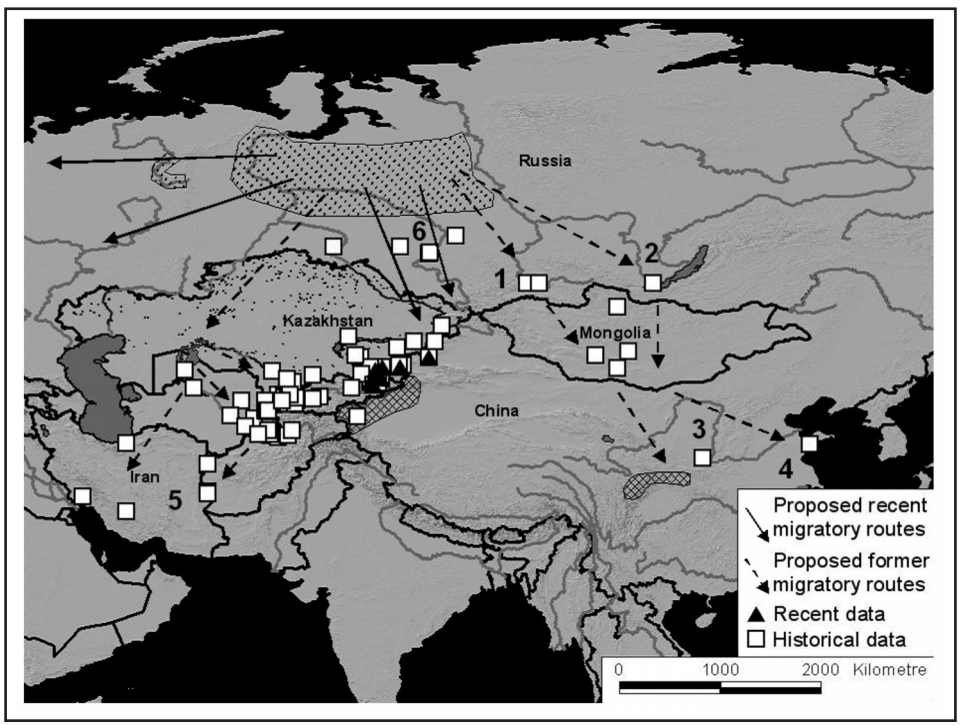

Figure 4. Overview of possible migration routes between the breeding and wintering areas for Taiga Bean Geese wintering in Asia. Dotted black = breeding area in West Siberia; hatched black = wintering areas, after *Fauna Sinica*. 1 = ring recoveries in Sayan Mountains; 2 = specimen from Irkutsk; 3 = *johanseni*-type specimen; 4 = specimen from Tsingtau; 5 = records in Iran (Sarudny 1911); 6 = ring recoveries near Omsk, Tomsk and Novosibirsk. Records in Mongolia from Kozlova (1930).

Mountains (in September 1968 and 1972) and an old *fabalis* specimen from Irkutsk (collected < 1930, Natural History Museum Berlin, ZMB 33.629) indicate that at least a small number of birds followed the upper Yenisey River to staging areas in Tuva region, or flew along the northern slopes of the Sayan Mountains to staging areas near Lake Baikal, although it is not known whether this was an established route. Observations of Taiga Bean Geese *A. f. fabalis* in northern and central Mongolia during spring and autumn migration (Kozlova 1930) suggest that these birds may have crossed Mongolia to wintering areas in central and eastern China. *Johanseni* specimens collected in 1905 at the Tai-pai-Shan and Tsinling Mountains (Shaanxi province, 33°57'N, 107°45'E) provide tentative evidence for a historical wintering area in China beyond Xinjiang province. Another *fabalis* specimen was collected around 1900 at Tsingtau (now Qingdao, 36°04'N, 120°18'E) in east China (Natural

History Museum Berlin: ZMB B.163c; T. Heinicke unpubl. data).

Changes in winter distribution and numbers

Historical data suggests that the Taiga Bean Goose *A. f. fabalis* once commonly occurred across central Asia in winter. According to Sarudny (1911), it even wintered in Persia (now Iran). Although little information was available for China, there was some indication that its pre-1960 wintering area not only reached northwest China but extended to sites in central and eastern China. Winter distribution has since contracted, particularly in the second half of the 20th century, with western and probably also eastern parts of the birds' earlier range almost abandoned by the early 2000s. The small winter population of a few thousand birds may be a remnant of a formerly much bigger population. Although exact numbers are very scarce in the historic records, the range contraction seems likely to be connected with a decline in numbers.

Recoveries of Taiga Bean Geese ringed in the Netherlands and shot in central Asia show that there is some but probably limited exchange between the populations wintering in Europe and in central Asia. Nevertheless, a major shift in wintering areas from central Asia to western Europe during the last 30–40 years may have occurred for birds breeding in western Siberia, which could at least partly explain the low numbers and reduced distribution for birds wintering in central Asia. The Greater White-fronted Goose *Anser albifrons* and the Western Tundra Bean Goose *A. f. rossicus* are thought to have shifted wintering grounds from central Europe to western Europe in a similar way (Mooij *et al.* 1999; van den Bergh 1999).

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Appendix 1. Records of Bean Geese reported in central Asia from 1995 onwards. KZ = Kazakhstan, KS = Kyrgyzstan, CN = China.

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
1	KZ	Mid December 1998	5	Turgen River valley, near Kayrat (43°32'N, 77°36'E)	On fields	Belyalov & Kovshar (2002)
2	KZ	Late December 2002	Some 100s	Kapchagay Reservoir (43°52'N, 78°15'E)	Roosting on the River Ili delta	Belyalov & Kovshar (2002)
3	KZ	1990s	1,000–5,000	Lake Kolzhazskoe, River Ili valley, near Chinese border (43°55'N, 80°02'E)	Feeding on surrounding maize stubble fields. When the lake froze in mid December the geese left this area	Erokhov (2002a)
4	KS	January 1997	3	Lake Issyk-Kul (42°09'N, 77°25'E)	On south shore of the lake	van der Veen (unpubl. data)
5	KS	March 1998	5	Ananevo/Issyk-Kul district (42°43'N, 77°42'E)	One bird collected; specimen now in the Issyk-Kul zapovednik museum, Ananevo	S. Sagymbaev (pers. comm.)
6	KS	Early to mid February 1998–2005	48–587	Lake Issyk-Kul (42°25'N, 77°09'E)	Counted for the International Waterbird Census (IWC). Geese mainly feeding in fields on cereal stubbles	Heinicke (2008)
7	KS	Spring and autumn 2005/2006	Several 1,000s	Tyup saliv, eastern part of Lake Issyk-Kul (42°44'N, 78°12'E)	In mixed flocks of up to 12,500 birds with Greylag Geese *Anser anser*	A. Yakovlev (pers. comm.)
8	CN	31 October 2005	2,300	Bole Reservoir/ Zhongguo (44°52'N, 82°48'E)	Seen by a "Sunbird Tour" expedition	Robson (2007)

Appendix 2. Records of Bean Geese reported in central Asia, 1960–1995. KZ = Kazakhstan, UZ = Uzbekistan, TD = Tajikistan, TM = Turkmenistan, CN = China.

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
1	KZ	15 May 1981	1	Michailovka, near Dzhambul (43°04'N, 71°31'E)	Shot, Dutch metal ring NLA 8502769	B. Ebbinge (*in litt.*)
2	KZ	3–12 March 1985	7	Sorbulak Reservoir (43°40'N, 76°34'E)	Sometimes small flocks together with *Anser anser* in November/ December	Erokhov (2002b)
3	KZ	15 September 1985	1	Lake Balchash, north shore (46°54'N, 75°01'E)	Shot, Dutch metal ring NLA 8034629	B. Ebbinge (*in litt.*)
4	KZ	December 1985	1	Chardarinskiy reservoir (41°11'N, 68°06'E)	Shot; reported as *A.f.fabalis*	Kashkarov (2007)
5	KZ	15 October 1991	2	near Bakanas (44°49'N, 76°09'E)	Ily river floodplain	Belyalov & Kovshar (2002)
6	KZ	12 October 1992	400	Lake Altynkol near Zharkent (44°06'N, 80°18'E)	Roost	Belyalov & Kovshar (2002)
7	KZ	3 October–8 November 1992	1–5	Kapchagay Reservoir near Karachenggel (43°44'N, 77°37'E)		Belyalov & Kovshar (2002)
8	KZ	16–24 December 1993	2	Turarskye dachi, 40 km NE of Almaty (43°33'N, 77°14'E)	On fields	Belyalov & Kovshar (2002)
9	KZ	26 November 1995	200	Lower reaches of River Chilik, Kysylzhida hunting farm (43°52'N, 78°15'E)	Roosting at delta of river Ili/Kapchagay reservoir	Belyalov & Kovshar (2002)
10	UZ	11 March 1962	1	Dalverzinsky lakes (40°32'N, 69°09'E)		Kashkarov (2007)
11	UZ	12 March 1962	1	River Kly, mouth into Lake Tuzkan (40°32'N, 67°35'E)	One male shot	Kashkarov (2007)
12	UZ	22 November 1964	1	Tashkent (41°18'N, 69°12'E)	Shot, Dutch metal ring NLA 308036	B. Ebbinge (*in litt.*)
13	UZ	January 1965	2	Surkhandarya lowlands near Termez (37°15'N, 67°20'E)	Identified as *A.f.fabalis*	Kashkarov (1987)

Appendix 2 (*continued*).

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
14	UZ	28 December 1971	1	South of Lake Aidarkul, west of Uzynkuduk (40°36'N, 66°53'E)	Shot, Dutch metal ring NLA 8026598	B. Ebbinge (*in litt.*)
15	UZ	Mid February 1983	14	Lake Sultankul (40°19'N, 69°03'E)	Aerial survey	Zinchenko *et al.* (1984)
16	UZ	28 November 1986	1	River Kashkadarya near Karshi (38°53'N, 65°48'E)	Shot, Dutch metal ring NLA 8035168	B. Ebbinge (*in litt.*)
17	UZ	January 1991	23	Lake Ayakkagitma, north of Buchara (40°37'N, 64°32'E)	Reported as *A.f. middendorfii*	Kashkarov (2007)
18	TD	16 November 1973	1	Shak, mouth of River Kifirnigan (37°00'N, 68°07'E)	Shot, Dutch metal ring NLA 8026480	B. Ebbinge (*in litt.*)
19	TD	1973/1974	60–76	Kayrakkum Reservoir (40°17'N, 69°48'E)		Seleznev & Bidos (1984)
20	TM	December 1984	23	Amudarya near Chardzhoy (39°08'N, 63°32'E)	Reported as *A.f. middendorfii*	Kashkarov *et al.* (1986)
21	TM	December 1990	270	Amudarya lowlands, SE Turkmenistan (38°04'N, 64°58'E)	Aerial survey	Kashkarov (2007)
22	CN	20 January 1988 and 25 December 1990	50	Aketao (39°05'N, 75°50'E)	Counted for the International Waterbird Census (IWC).	Chinese Anatidae database (M. Barter, Wang Xin & Cao Lei, pers. comm.)
23	CN	29 January 1991	16	Aketao (39°05'N, 75°50'E)	Counted for the International Waterbird Census (IWC).	
24	CN	12 January 1991	60	Nanhu Caochang (46°20'N, 83°20'E)	Counted for the International Waterbird Census (IWC).	

Appendix 3. Records of Bean Geese reported in central Asia before 1960. KZ = Kazakhstan, KS = Kyrgyzstan, UZ = Uzbekistan, TD = Tajikistan, TM = Turkmenistan, AFG = Afghanistan.

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
1	KZ	Before 1900	1,000s	River Keles (41°07'N, 68°43'E)	Migrant and winter visitor; Severtzov reported thousands of birds	Menzbir (1914); Dolgushin (1960)
2	KZ	Before 1900	?	Chimkent (42°24'N, 69°37'E)	Regular migrant and winter visitor; several birds collected by Severtzov	Alpheraky (1905)
3	KZ	26 March 1900	1	Ak-Aral southwest of Dzharkent (44°04'N, 79°56'E)	Shot; said to be *middendorffi*	Shnitnikov (1949)
4	KZ	23 March 1903	2	Near mouth of Kaskelen River (43°45'N, 77°05'E)	Shot; said to be *middendorffi*	Shnitnikov (1949)
5	KZ	September 1908	1	Near Baskan, Kopal region (45°49'N, 79°41'E)	Shot; orange feet and bill	Shnitnikov (1949)
6	KZ	Before 1910	?	Middle reaches of Syrdarya River (43°29'N, 67°31'E)	Migrant and winter visitor	Zarudny (1910)
7	KZ	Before 1929	7–8	Ily River basin near Kapchagay (formerly Iliysk) (43°55'N, 77°05'E)	Small flocks during autumn migration	Shestoperov (1929)
8	KZ	Before 1929	6	Lower reaches of River Ily near Akkul (45°00'N, 75°38'E)	Small flock on 26 November	Shestoperov (1929)
9	KZ	Winter 1946/47	?	Near Uzun-Agach, west of Almaty (43°14'N, 76°16'E)	Small numbers wintering at open springs	Dolgushin (1960)
10	KZ	Winter 1953	?	Lake Alakol (46°21'N, 81°24'E)	Small flocks wintering	Dolgushin (1960)
11	KZ	Before 1960	?	River Bugun (42°44'N, 69°00'E)	Regular wintering of small numbers	Dolgushin (1960)
12	KZ	Before 1960	?	Lake Zaysan (47°55'N, 84°03'E)	Common passage migrant in autumn (September–early November)	Samusev, cited in Dolgushin (1960)

Appendix 3 (*continued*).

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
13	KZ	Before 1960	?	Lake Alakol (46°21'N, 81°24'E)	Common passage migrant in autumn (early October–mid December), occasionally wintering in small numbers	Dolgushin (1960)
14	KS	11–13 October 1867	?	South shore of Lake Issyk-Kul (42°09'N, 77°25'E)		Severtzov (1873a,b)
15	KS	15 November 1878	1	Fergana valley, between Andishan and Utch-Kurgan (41°00'N, 72°11'E)	Severtzov collection	Yanushevitch *et al.* (1959)
16	KS	9 November 1904	1	Southeast shore of Lake Issyk-Kul (42°22'N, 77°54'E)	Shot; in Museum of Natural History, Berlin (no. ZMB 35.665)	Heinicke (2008)
17	KS	8 December 1904	1	Lake Sonkul (41°48'N, 75°15'E)	Shot; in A. Koenig Museum, Bonn (no. ZFMK 5374)	T. Heinicke (unpubl. data)
18	UZ	Before 1900	2	Fergana basin (40°46'N, 71°33'E)	Severtzov collection	Alpheraky (1905)
19	UZ	Before 1900	?	Near Samarkand (39°36'N, 66°55'E)	Winter visitor	Severtzov, cited in Salikhbaev & Bogdanov (1961)
20	UZ	Before 1900	?	Syrdarya River valley near Chinaz (40°55'N, 68°43'E)	Migrant and winter visitor	Severtzov, cited in Salikhbaev & Bogdanov (1961), Pleske (1888)
21	UZ	Before 1900	1,000s	River Chirchik (41°03'N, 69°04'E)	Migrant and winter visitor, Severtzov reported thousands of birds	Menzbir (1914), Dolgushin (1960)
22	UZ	Before 1914	?	Angren River valley between Ablyk and Kondzhigaly (40°55'N, 69°53'E)	Migrant and winter visitor	Menzbir (1914)
23	UZ	Before 1916	?	Lake Aral region (43°32'N, 59°05'E)	Migrant	Zarudny (1916)

Appendix 3 (*continued*).

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
24	UZ	Before 1918	100s	Near Tashkent (41°12'N, 69°17'E)	*Melanonyx neglectus* very rarely shot, about 1 among 100 *M. arvensis*	Steinbacher (1926)
25	UZ	Before 1920	?	Lake Sardoba (40°35'N, 68°33'E)	Several observations between October and February	Zarudny, cited in Salikhbaev & Bogdanov (1961)
26	UZ	27 February 1939	?	Near Samarkand (39°36'N, 66°55'E)	Migrant	Salikhbaev & Bogdanov (1961)
27	UZ	Before 1950	?	Rivers Dargom, Siab and Karasu near Samarkand (39°33'N, 67°06'E)	Migrant and winter visitor in small numbers	Akhmedov (1950)
28	UZ	Before 1905	?	River Zerafshan (39°37'N, 67°08'E)	Big flocks in early May	Ugryumov, cited in Kashkarov (1987)
29	UZ	Before 1956	?	River Zerafshan (39°37'N, 67°08'E)	Migrant and winter visitor in small numbers	Bogdanov (1956)
30	UZ	21 February 1958	12	Lake Sardoba (40°35'N, 68°33'E)	1 individual shot	Salikhbaev & Bogdanov (1961)
31	UZ	Before 1960	?	Lower reaches of the Surkhandari River (37°18'N, 67°22'E)	Winter visitor in small numbers	Kashkarov (1987)
32	UZ	Before 1960	?	Near Sherabad (37°39'N, 67°08'E)	Winter visitor in small numbers	Kashkarov (1987)
33	TM	~1900	?	Amudarya River near Kelif (37°21'N, 66°15'E)	Migrant and winter visitor	Zarudny & Bilkevitch (1918)
34	TM	1936	?	Lower reaches of the Amudarya River near Tashauz (41°48'N, 59°55'E)	During migration time	Shestoperov, cited in Salikhbaev & Bogdanov (1961)
35	TD	~1900	?	Amudarya River near Pjandsh (formerly Kirovabad) (37°14'N, 69°04'E)	Migrant and winter visitor	Zarudny & Bilkevitch (1918)

Appendix 3 (*continued*).

Record No.	Country	Date	No. of birds recorded	Location	Comments	Source
36	TD	~1900	?	Floodplain of Kyzyl-Su River (37°39'N, 69°28'E)	Winter visitor, rarer than *Anser anser*	Abdusalyamov (1971)
37	AFG	9 December 1900	1	Seistan (31°41'N, 61°15'E)	One female shot by Zarudny. Originally reported as *Anser neglectus*; in AMN collection (no. 730791)	American Museum of Natural History, online catalogue
38	AFG	4 March 1949	?	Hamun-i-Sabari (31°29'N, 61°16'E)	Large flock among *Anser anser*	Paludan (1959)