

SIBERIAN CRANE

Grus leucogeranus

Critical ■ A2c,d,e

Endangered □ C1

Vulnerable □ —

This species qualifies as Critical because it is expected to undergo an extremely rapid decline in the near future, primarily as a result of the destruction and degradation of wetlands in its passage and wintering grounds. The wintering site, holding 95% of the population, is threatened by hydrological changes caused by the Three Gorges Dam.



DISTRIBUTION The Siberian Crane (see Remarks 1) has three separate populations, all of which nest in northern Russia. The relatively large eastern (“Yakutia/China”) population breeds in Yakutia and winters in eastern China, the tiny central (“Ob’/India”) population breeds in the Ob’ valley in Western Siberia and winters in north-west India, and the tiny western (“Tyumen’/Iran”) population also breeds in Western Siberia but winters in Iran (UNEP/CMS 1999).

Outside the Asian region The central population breeds in Western Siberia (for which details are given below), and is presumed to migrate across Russia, Kazakhstan, Uzbekistan, Turkmenistan, Afghanistan and Pakistan to spend the winter in India (Meine and Archibald 1996). It has occurred on migration in Kazakhstan, and may even have nested there in the nineteenth century (Dement’ev and Gladkov 1951–1954), and there are recent records of one at Ovrage Karasu, north of Zhuldyz, in the steppes of northern Kazakhstan, in September 2000, with six in the same area in October 1978 (A. Bräunlich and T. Heinicke *in litt.* 2000). In Afghanistan, Ab-i-Istada lake is an important stopover site on spring migration, and almost certainly in autumn in some years, as there is a record of three birds in December 1970; it is likely that birds from the central population migrate through the Hindu Kush mountains at Salang Kotal in Baghlan, flying over with Common Cranes *Grus grus*; and in the 1970s local people in the Pech and Waygal valleys in Kunar knew the species, and stated that 1–3 birds occurred on passage with Common Cranes in the Chaman valley in late March (Evans 1994).

The western population is believed to breed in a remote part of Tyumen’ district, and possibly also in Khanty Mansiysk district, in Western Siberia (UNEP/CMS 1999). It migrates through western Russia along the Tobol and Emba rivers towards the Caspian and Aral Seas (Cramp and Simmons 1980), along the northern and western coasts of the Caspian Sea through north-west Kazakhstan to the Volga delta in Russia (UNEP/CMS 1999). In the Volga delta, it is a regular spring migrant in March–April (exceptionally in May); up to 300 birds occurred there in the nineteenth century but the recent maximum was 21 birds in spring 1971, and smaller numbers occur on autumn migration (Cramp and Simmons 1980). From the Volga delta, birds migrate over Chechnya and Azerbaijan (where a bird fitted with a satellite transmitter stopped in 1995: UNEP/CMS 1997) to the wintering grounds at Fereidoonkenar and Esbaran in Iran (UNEP/CMS 1999). The wintering grounds of the western population were discovered in 1773 on the south-west shores of the Caspian Sea in Gila province, Iran, and there were reports at the turn of the twentieth century and in the 1920s from the western shores of the Caspian Sea in Gilan; it was rediscovered in the south-east Caspian lowlands, near the town of Fereidoonkenar (not mapped) in Mazandaran province in January 1978, the first sighting for c.60 years, although local villagers reported that the cranes had been wintering in the flooded fields near the town throughout the intervening years, and indeed, as far back as the oldest farmers could remember (UNEP/

CMS 1999). A small flock still winters there regularly (Evans 1994). The species was more numerous and widespread in the western part of its range in the past: there is a published medieval record (in 1315–1316 AD) from the Nile delta in Egypt (Provençal and Sørensen 1998) and two nineteenth-century reports from Turkey (Kasparak 1987), although the published details are insufficient to accept them as definite (Harrap 1987).

Asian region The relatively large eastern (“Yakutia/China”) population breeds in Yakutia in eastern Russia, and migrates through south-eastern Russia, eastern Mongolia and north-east mainland China to wintering grounds in eastern China, and has been recorded as a vagrant in Japan and South Korea (Chan 1999). The small central (“Ob’/India”) population breeds in the Kunovat river basin (and possibly elsewhere in the Ob’ valley), and is presumed to migrate across Central Asia (see above) and Pakistan to spend the winter at Keoladeo National Park, Bharatpur, Rajasthan, north-west India (Meine and Archibald 1996), and possibly elsewhere in India or even in western China (see below).

■ **RUSSIA** The Siberian Crane nests only in Russia; its range was considered to have been relatively extensive during the cool, wet period of the eighteenth and early nineteenth centuries, but it began to contract in the mid-nineteenth century when the climate became warmer and drier and suitable nesting habitats became less widespread (Krivenko 1991). It now has three disjunct breeding populations, two of which nest outside the Asian region in Western Siberia (see Meine and Archibald 1996). The small, declining central population breeds in the Ob’ valley, where the first nests with eggs were discovered in 1981 on the lower Kunovat river, a right-bank tributary of the Ob’ (Sorokin and Kotyukov 1982, Flint 1987). A bird from the small western population was recently found in summer in a remote part of Tyumen’ district, and it is possible that birds from this population nest there and elsewhere in this district (for example in the Dvuob’e area, where it has been seen in the breeding season: Braude 1982), or in Khanty Mansiysk district (UNEP/CMS 1999).

The eastern breeding population occupies an extensive system of lake depressions in north-east Yakutia between the Yana, Indigirka, Alazeya and Chukoch’ya rivers, estimated to cover 220,000–300,000 km², although most of the cranes are found in a relatively small area (c.30,000 km²) between the Khroma and Indigirka rivers and in the lower and upper Khroma river basin (Flint and Kishchinskiy 1975, Flint and Sorokin 1981, 1982a,b). More recently, three sub-areas with a higher-than-average density of nesting pairs have been located, on the Khroma river (10,300 km²), the Indigirka river (7,900–9,700 km²), and the Alazeya river (1,950–4,380 km²) (Degtyarev and Labutin 1991). A small number of (probably) non-breeding birds spend the summer outside the known breeding range in the Lena river basin (the Linde and Khoruonka river basin, west of Zhigansk settlement) (Degtyarev and Labutin 1991). There are also irregular reports from the right bank of the lower Kolyma river, to the east of the usual range in Yakutia (Portenko 1972).

On migration, the species is recorded almost throughout Yakutia, but the main migration route lies to the east of the Lena river (Maak 1886, Vorob’eva 1928, Sdobnikov 1959, Kapitonov 1962, Vorob’ev 1963, Egorov 1965, Perfil’ev 1965, 1976, 1986, Uspenskiy 1965, Andreev 1974, 1987, Flint and Kishchinskiy 1975, Larionov 1976, Yakhontov 1976b, Perfil’ev and Polyakov 1979, Flint and Sorokin 1982a,b, Degtyarev and Antonov 1989a, Labutin *et al.* 1985, 1988, Degtyarev and Labutin 1991, I. P. Gavril’eva and V. V. Okoneshnikova *in litt.* 1997). It occurs regularly in the Torey basin in Chita (and also extremely rarely in the Onon basin, and some immature birds sometimes summer in southern Chita) and on the Zeya-Bureya plain in Amur, but it is a rare visitor to the Lake Khanka area and elsewhere in Primorye, and there are a few records from Irkutsk, Buryatia, Khabarovsk and Sakhalin. Records (by province) are as follows:

■ **Western Siberia** lower **Kunovat river basin**, a tributary of the Ob’ river, c.60 km east of Gorki, a breeding population located in 1981 and shown by colour-banding to winter in

Keoladeo National Park (Bharatpur) in India (Meine and Archibald 1996); **Kunda river**, Tyumen' district, c.630 km south of the Kunovat river basin, where one satellite-tracked bird from the wintering population in Iran remained into June 1996 (Meine and Archibald 1996; also UNEP/CMS 1999);

■ **Krasnoyarsk** near **Yessey lake**, upper Kotuy river watershed, one seen in the 1960s, one adult in summer 1979, two birds in 1980, the species conceivably breeding in the north of Central Siberia along the middle reaches of the Kotuy river (Rogacheva 1992);

■ **Khakassia** swampy floodplain around **Fyrkal lake**, Minusinsk depression, two, July 1976 (Prokof'ev 1987 in Rogacheva 1992); **Koibal steppe**, near Izykh mountain, 50 km south-west of Minusinsk, one collected, 1877 (Sushkin 1914 in Rogacheva 1992);

■ **Altay** near **Novoyegor'yevskoye** (Egor'evka) village, Blagoveshchenskiy district, seen in boggy meadows, undated (G. S. Novikov-Daurskiy in Baranchev 1953);

■ **Irkutsk** lower **Kirenga river**, Tukolon' Wildlife Refuge, several birds in summer 1972–1978, with a flock of three birds in September 1978 (Naumov 1979);

■ **Buryatia** **Bol'shoye Yeravnoye lake** (Bolshe-Yeravinskoye lake, Eravinskies lakes), flock of six, June 1981 (Melnikov *et al.* 1988); **Selenga delta**, rare passage migrant (unspecified years) (Melnikov *et al.* 1988); Chikoy river, near **Durenskaya** (Dureny) village, rare passage migrant, seen in May 1969 (Melnikov *et al.* 1988);

■ **Chita Aginskiy lake district**, near Ekhe-Tsagan-Nor lake, Aginskiy Buryat National Territory, three records of non-breeding birds—eight in May 1988, three in July 1988 (M. I. Golovushkin *in litt.* 1988), and a single bird in July 1993 (O. A. Goroshko *in litt.* 1997); near **Nozhiy lake**, Aginskiy Buryat National Territory, four records of non-breeding birds—one in May 1988 (B. V. Shchekin *in litt.* 1996), five in June 1989 (B. V. Shchekin *in litt.* 1995), six in June 1989 (M. I. Golovushkin *in litt.* 1989), and one in May 1990 (M. I. Golovushkin *in litt.* 1990); **Borzya river** floodplain, Borzinskiy district, six non-breeding birds, August 1965 (Leont'ev 1976); small lake 3 km from **Urta-Khargana** village, Ononskiy district, one non-breeding bird, May 1994 (A. P. Borodin *in litt.* 1994); **Durulguay river** (Durulguyka river), Ononskiy district, Bayn-Tsaganskiy lake district, two non-breeding birds, July 1993 (O. A. Goroshko *in litt.* 1997); Barun-Torey lake shore, near **Kulusutay** village, Ononskiy district, two non-breeding birds, late summer 1992 (O. A. Goroshko *in litt.* 1997); 8–9 km east-north-east of **Buylesan** village, Ononskiy district, one non-breeding bird, July–August 1996 (S. Zh. Vaseev *in litt.* 1996); channel between the **Torey lakes**, Ononskiy district, recorded at the Torey lakes in spring in the late nineteenth century (Molleson in Bold *et al.* 1995), with three records of non-breeding birds—10 in August 1989, three in May 1990 (M. I. Golovushkin *in litt.* 1989), and two in August 1991 (O. A. Goroshko *in litt.* 1997), the Daursky Nature Reserve, part of the Torey lakes Ramsar site, being a migration stopover for up to 50 birds (Golovushkin and Goroshko 1995, V. Andronov *in litt.* 1997); small lake 7 km north-west of **Ust'-Imalka** village, Torey lakes basin, Ononskiy district, two non-breeding birds, spring 1993 (B. Ayushev *in litt.* 1994); **Khotogor**, Ononskiy district, three records of non-breeding birds—April 1994, one in May 1996, two in May 1996 (A. P. Borodin *in litt.* 1994, 1996); **Imalka river**, Ononskiy district, seven records of non-breeding birds—one in May 1988, three in August 1988, five in June 1989, one in August 1989 and 32 in early July 1991 (M. I. Golovushkin *in litt.* 1988, 1990, 1991), with six birds, June 1995 (O. A. Goroshko *in litt.* 1997); **Uldza river**, Borzinskiy district, six in August 1988, 14 in September 1989 (M. I. Golovushkin *in litt.* 1988), 32 in August 1990, up to three in July–August 1991 (O. A. Goroshko *in litt.* 1997); near **Solov'yevsk** village, Borzinskiy district, two records of non-breeding birds—one in April 1983 and two in September 1984 (Osipova and Golovushkin 1988); small lake near the “Belyi Stan”, a field station 6 km west of **Kyra** village, Kyrinskiy district, three juveniles in a flock of Demoiselle *Anthropoides virgo* and White-naped Cranes *Grus vipio*, May 1995 (E. E. Malkov *in litt.* 1996); **Srednie Kormachi**, Agutsa river floodplain, 12 km south-east of Altan village, Kyrinskiy district, single bird, May 1987 (E. E. Malkov *in litt.* 1996);

■ **Yakutia Khorgo cape**, Anabar gulf or bay (Anabarskaya Guba), flock of five flying south, July 1959 (Uspenskiy 1965); Arangastaakh river mouth, lower **Anabar river**, three flying south, July 1959 (Uspenskiy 1965); near **Ulakhan-Yuryakh river mouth**, Olenek channel, Lena delta area, one pair, undated (A. Romanov in Sdobnikov 1959); **Bustakh lake** area, in the lowland basin of the Sanga-Uryakh river, Omulyakh bay, and north to the coast at Oyagosskiy Yar beach, the northernmost site for this species, single bird in July 1978 (Vshivtsev *et al.* 1979), several in 1985 and in July 1987 and July 1989 (SCMPRS 1991); near **Stolb island**, Lena delta, reported on spring migration in 1980 (Labutin *et al.* 1985); **Namnugan-Kyuel lake**, one of the northernmost sites for Siberian Crane, undated (Degtyarev and Labutin 1991); middle reaches of the **Sanga-Uryakh river** basin, one bird in July 1989 (SCMPRS 1991); **upper Sanga-Uryakh river**, east of Mt Khar-Stan, the inhabitants of Yukagir village reporting that it regularly breeds east of the Khar-Stan mountains, and also occurs there regularly on passage (Degtyarev and Labutin 1991); southern shore of **Omullyakhskaya bay** (Omulyakh bay) and the peninsula between this bay and Khroma bay, one bird in July 1989 (SCMPRS 1991); **Mogotoyevo lake** area, between Khroma bay and Gusinaya bay, at least two single birds, early 1970s (Flint and Kishchinskiy 1975); **Muksunuokha river** basin, northern Sellyakh bay, pair in August 1980 (Labutin *et al.* 1982); **Buorkhaya cape**, between Buor-Khaya bay and Yanskiy bay, north-western Ust'-Yanskiy district, three pairs in August 1978 (Vshivtsev *et al.* 1979); **eastern shore of Khromskaya bay** (Khromakaya bay, Khroma bay), two single birds in July 1978 (Vshivtsev *et al.* 1979); southern tip of Zapadny bay, on **Khromskaya bay** near the Semdolgen river, pair in July 1991 (SCMPRS 1991); 25 km east of **Muksunuokha-Tas mountain** (Mt Muksunuokha-Tas), several birds in July 1989 (SCMPRS 1991); **upper Muksunuokha river**, 10 km east of Mt Muksunuokha-Tas, single bird in August 1978 (Vshivtsev *et al.* 1979), the inhabitants of Yukagir village reporting that it regularly breeds east of Muksunuokha mountain, and also occurs there regularly on passage (Degtyarev and Labutin 1991); near Tit-Ary island, Lena delta, probable record of a pair in spring 1974 (Perfil'ev and Polyakov 1979); Kyuel' river and its tributary, the Uryung-Ulakh, near **Soluntakh lake**, breeding, with four pairs and four single birds in July 1978 (Vshivtsev *et al.* 1979), and three well-separated single birds in July 1986 (SCMPRS 1991); lower half of the **Gusinaya river**, a left-bank tributary of the Indigirka river, breeding, with four well-separated single birds and one pair in July 1978 (Vshivtsev *et al.* 1979), single bird and five small groups in July 1989 (SCMPRS 1991); **Volch'ya river** basin, near the northern limit of the breeding range of this species, one pair and two well-separated single birds in July 1978 (Vshivtsev *et al.* 1979), two single birds in July 1989 (SCMPRS 1991); lower **Sogo river**, Lena delta, two birds on a plain with lakes in July 1945, six in 1954 and three in August 1954 (Kapitonov 1962); basin of an unnamed river flowing into Sellyakhskaya bay east of the **Sellyakh river**, three well-separated single birds in July (two birds) and August (one) 1978 (Vshivtsev *et al.* 1979); **unnamed locality** [GPS: 71°30'N 138°33'E], single bird in June–July 1994 (J. I. Hodges and W. D. Eldridge *per* N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997); upper reaches of an unnamed river 8 km west of **Uryung-Ulakh lake**, pair in July 1978 (Vshivtsev *et al.* 1979); lake 15 km east of the **Yarok strait**, one bird, July 1978 (Vshivtsev *et al.* 1979); basin of the upper **Uryung-Ulakh river**, a right-bank tributary of the Kyuel'-yuryakh river, breeding, with five pairs and three single birds in July 1978 (Vshivtsev *et al.* 1979), five pairs in June–July in the years 1977–1979 (Flint and Sorokin 1982a), three small groups and one single bird in July 1989 (SCMPRS 1991); **unnamed locality** [GPS: 71°20'N 139°29'E], nest found in June–July 1994 (J. I. Hodges and W. D. Eldridge *per* N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997); **Chondon river delta**, one bird, July 1978 (Vshivtsev *et al.* 1979), one pair, July 1978 (Vshivtsev *et al.* 1979); low-lying tundra between **Chondonskaya bay** (Chondon bay), Sellyakh bay and the basin of the lower Chondon river east of the Yana delta, Ust'-Yanskiy district, one pair, July 1972 (Flint and Kishchinskiy 1975); **Russko-Ust'inskaya channel** (Russkoe Ust'e channel) with adjoining

areas, part of the left-bank delta of the Indigirka river, breeding, with two well-separated single birds and one pair in July 1978 (Vshiltsev *et al.* 1979), and two small groups of birds in July 1989 (SCMPRS 1991); **Srednyaya channel** and Kolymskaya channel, central and left-bank delta of the Indigirka river, breeding, with a single bird and a pair in July 1978 (Vshiltsev *et al.* 1979), and two well-separated single birds in 1993 (N. I. Germogenov *in litt.* 1997); lakes along the middle reaches of the **Syuryuktyakh river**, a right-bank tributary of the Sellyakh, east of the Chondon river, pair with young in August 1980 (Labutin *et al.* 1982); basins of the **Bol'shaya Kuropatoh'ya river** and Malaya Kuropatoh'ya river and adjoining areas, east of the trading post of Logashkino, breeding, with one pair in July 1978 (Vshiltsev *et al.* 1979), and a single bird in July 1989 (SCMPRS 1991); upper **Lapcha river**, east of the Khroma delta, breeding, with one pair in August 1980 (Labutin *et al.* 1982), five single birds and three small groups in July 1989 (SCMPRS 1991), one single bird and four pairs in July 1993 (N. I. Germogenov *in litt.* 1997); right-bank tributary of the **Omoloy river**, flowing into Buor-Khaya bay, one pair, August 1978 (Vshiltsev *et al.* 1979); **upper Syuryuktyakh river** basin, regular breeding species, 12 records of parties and four of single birds in July–August 1978, 1980, 1982 and 1989, including 10 pairs (some with young) and a total of at least 28 birds (Vshiltsev *et al.* 1979, Labutin *et al.* 1982, Flint and Sorokin 1982a, SCMPRS 1991); basins of the **lower Berelekh river** and of right-bank tributaries of the Gusinaya river, lower Indigirka river basin, the area with the highest recorded breeding density of Siberian Cranes, consisting of eight single birds, 98 pairs and three groups each of three birds (a total of at least 213 birds) recorded during aerial and ground surveys and bird-ringing studies in 1990–1997 (Germogenov *et al.* 1996, Germogenov and Solomonov 1997, N. I. Germogenov *in litt.* 1997; for the results of earlier studies see Vshiltsev *et al.* 1979, Flint and Sorokin 1982a,b, Labutin *et al.* 1982, Degtyarev and Labutin 1991, SCMPRS 1991), this area and several of the other sites in the lower Indigirka river being protected inside the huge Kytalyk Resource Reserve (c.16,080 km²), where c.480 birds were recorded breeding in the late 1980s, although their population there is believed to be even larger and aerial surveys are required (N. I. Germogenov *in litt.* 1997); near **Chonobul lake**, the upper Lapcha river basin, breeding, with two nests found (presumably in the 1970s) (Flint and Sorokin 1982a), one pair with young in August 1980 (Labutin *et al.* 1982), three small groups of birds in July 1989 (SCMPRS 1991), one single bird and one pair in July 1993 and August 1994 (N. I. Germogenov *in litt.* 1997); **upper Sellyakh river**, above the mouth of the Tut-Balyktakh, party of three birds in August 1980 (Labutin *et al.* 1982), single bird in July 1989 (SCMPRS 1991); **Shandrin river** and **Keremesit river**, river basins of right-bank tributaries near the Indigirka delta, breeding, with three nests reported (presumably in the late 1970s) (Flint and Sorokin 1982a), single bird in August 1980 (Labutin *et al.* 1982), and one pair in June (presumably in the 1990s) (N. I. Germogenov *in litt.* 1997); between the **Malaya Kuropatoh'ya river** and the Bol'shaya Kon'kovaya river, breeding, with one breeding pair and several non-territorial birds in 1986–1991 (Potapov 1992); lakes in the middle reaches of the **Tut-Balyktakh river**, a right-bank tributary of the Sellyakh, one bird in August 1980 (Labutin *et al.* 1982); basins of the **Bol'shoy Khomus-Yuryakh river** (Bol'shoy Khomus-Uryakh river) and the **Malyy Khomus-Yuryakh river** (Malyi Khomus-Uryakh river, a right-bank tributary of the Sundrun river), breeding, with a pair and a single bird in July 1978 (Vshiltsev *et al.* 1979), and three well-separated single birds and a small group in July 1989 (SCMPRS 1991); **Orotko lake** and Tala-Kyuel' lake (untraced), left bank of the lower Chondon river, nest found in 1970 (Roshchevskiy 1973), with three pairs and a single bird in 1980 and 1989 (Labutin *et al.* 1982, Degtyarev and Labutin 1991); middle reaches of the **Khroma river** and adjoining areas, breeding, with two pairs and three single birds in July 1978 (Vshiltsev *et al.* 1979), six pairs in June–July in the years 1977–1979 (Flint and Sorokin 1982a), four pairs and three single birds in August 1980 (Labutin *et al.* 1982), at least 22 birds (10 “small groups” and two single birds) in July 1989 (SCMPRS 1991), 13 pairs and seven single birds in July–August 1993–1994 and 1996 (N. I.

Germogenov *in litt.* 1997); **Alazeya river** basin, one breeding pair in 1977 (Flint and Sorokin 1982a), single bird and three pairs in July 1978 (Vshiltsev *et al.* 1979), single bird, breeding pair and two small groups of birds in July 1989 (Degtyarev and Labutin 1991), and four territorial pairs in spring 1996 (SCMPRS 1991); **upper Khroma river** and adjoining areas, breeding, with one pair in June–July 1977–1979 (Flint and Sorokin 1982a), one pair and two single birds in August 1980 (Labutin *et al.* 1982), two small groups and six single birds in July 1989 (SCMPRS 1991), and three well-separated single birds in July 1993 (N. I. Germogenov *in litt.* 1997); near **Tarasovo lake** and Mugurdakh lake, basin of the middle Bol'shaya Kuropatoch'ya river, breeding, with at least two pairs present in the 1980s (SCMPRS 1991); near **Ukyulyakh lake**, single bird in August 1980 (Labutin *et al.* 1982); **lower and middle reaches of the Malaya Kuropatoch'ya river** basin, breeding, with a single bird and pair in July 1978 (Vshiltsev *et al.* 1979), and a single bird in July 1989 (SCMPRS 1991); middle **Khar-Yuryakh river** (Khar-Uryakh river) basin, which flows into the East Siberian Sea east of the Indigirka delta, breeding, with one small group in July 1989 (SCMPRS 1991); near **Iliergytygn lake** (Iliergytykn lake), south of Chaygurgino trading post, nest found in June 1981 (Krechmar *et al.* 1991); middle **Berelekh river** basin, breeding, near lake Et-Khatarbyt in June 1961 (Vorob'ev 1961), 10 breeding pairs in the same area in 1977–1979 (Flint and Sorokin 1982a), four single birds and three pairs in July 1978 (Vshiltsev *et al.* 1979), five pairs and a group of three birds in August 1980 (Labutin *et al.* 1982), four single birds and seven small groups in July 1989, three pairs and two well-separated single birds in July 1993, 1994 and 1996 (N. I. Germogenov *in litt.* 1997); left bank of the upper **Buor-Yuryakh river**, a left-bank tributary of the Chondon river, pair in August 1980 (Labutin *et al.* 1982); middle **Sundrun river** basin, breeding, with one pair with young in August 1980 (Labutin *et al.* 1982), and one small group in July 1989 (SCMPRS 1991); **upper Bol'shaya Kuropatoch'ya river** basin, breeding, with a pair and single bird in July 1989 (SCMPRS 1991); unnamed lake 10 km north-west of **Chukoch'ya** trading station, single bird behaving as if breeding in May 1978 (Z. Z. Borisov *per* N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997), at least three at “Chukoche, Kolyma”, June 1992 (P. Alström, U. Olsson and D. Zetterström *in litt.* 2000); near **Bol'shoye Morskoye lake**, breeding, with six pairs in 1972, some of which had young (B. N. Andreev in Flint and Kishchinskiy 1975), breeding pair on the eastern shore of the lake in September 1977 (Perfil'ev and Polyakov 1979), pair seen annually in wet sedge/cotton-grass hollows on the upper reaches of the Ankavaam river, which links Bol'shoye Morskoye lake and the Chukoch'ya river (Krechmar *et al.* 1991), recorded in 1984 (SCMPRS 1991); the eastern shore of near **Maloye Morskoye lake**, pair with a chick, July 1972, a downy chick being captured the following day 2 km from the presumed nest-site (Andreev 1974, 1987); **Siktyakh** settlement, one collected from a group of three birds flying north along the Lena in spring 1956 (Kapitonov 1962); upper **Oler river** basin, a left-bank tributary of the Bol'shaya Chukoch'ya river, breeding, with two widely separated single birds in August 1980, and also breeding on lakes on the middle reaches of the Bol'shaya Chukoch'ya river, above its confluence with the Oler river, where a pair was recorded in August 1980 (SCMPRS 1991); middle reaches of the **Allaikha river**, a left-bank tributary of the Indigirka river, one pair in August 1980 (SCMPRS 1991); **Rossokha river** basin, a left-bank tributary of the Alazeya, breeding, with total of one single bird and 10 pairs seen in the 1970s and 1980s (Flint and Sorokin 1982b, Degtyarev and Labutin 1991, SCMPRS 1991); left bank of the Malaya Kon'kovaya river, near **Chasha lake**, breeding pair seen in July and adults with chicks in August 1987 (Krechmar *et al.* 1991; also SCMPRS 1991); **Kolyma delta**, three (passage) birds reported on the Pokhodskaya ridge and a single bird at Nerpich'e lake in early June 1985 (Krechmar *et al.* 1991); **Bol'shoy Oler lake** and Malyi Oler lake, left bank of the middle Bol'shaya Chukoch'ya river, breeding, with nests found (presumably in the early 1960s) (B. N. Andreev in Vorob'ev 1963), and a total of at least three pairs in the region in all years (presumably in the 1980s) (SCMPRS 1991); near

Pokhval'nyy settlement, right bank of the Indigirka river, local enquiries indicating that 1–2 pairs were regular in summer in a large tundra-bog plain surrounded by sparse forest (Flint and Sorokin 1982b); Troskino lake, upper **Kon'kovaya river** (Bol'shaya Kon'kovaya river), probably breeding, with one agitated bird seen in July 1980 and a pair later in the month (Krechmar *et al.* 1991); middle reaches of the Alazeya river, near **Andryushkino** settlement, near the southern limit of regular breeding (Andreev 1974, 1987), total of at least six sightings of at least 11 birds in the 1980s, records of moulting birds including family parties being fairly frequent near this village (Degtyarev and Labutin 1991, SCMPRS 1991); upper **Suturuokha river**, a left-bank tributary of the Indigirka river, near Suturuokha lake, local enquiries indicating that 1–2 pairs were regular in summer in the area (Flint and Sorokin 1982b); upper **Khachimcher river**, a left-bank tributary of the Indigirka river, near Kyrshalakh lake, local enquiries indicating that it bred in 1987 (SCMPRS 1991); upper Alazeya river basin, recorded annually on passage upriver as far as **Argakhtakh** settlement, but not breeding there (Vorob'ev 1963), local inhabitants reporting that 2–3 pairs regularly occurred north-west of Argakhtakh in the 1970s (Perfil'ev and Polyakov 1979), but no birds were found during aerial surveys of the region in August 1980, 1983 or 1984 (SCMPRS 1991); lakes 80 km north-east of **Sylgy-Ytar** (Sylgyytar) settlement, upper Bol'shaya Chukoch'ya river basin, reported to breed regularly in the 1960s (V. G. Krivosheev in Perfil'ev 1965), and three pairs seen in July 1968 were probably at this locality (Flint and Kishchinskiy 1975); near **Keppekhtekh lake** and Chekhchengelekh lake, 120 km north of Srednekolymsk, nest with two eggs on a boggy isthmus between the lakes in June 1966, and a pair behaving as if with young in August 1967 (Perfil'ev 1976, Perfil'ev and Polyakov 1979), two pairs with young in August 1975 (Perfil'ev and Polyakov 1979), up to three pairs presumed to be present but no confirmation of this from aerial surveys in August 1980, 1983 and 1984 (SCMPRS 1991); lake near the **Muna river mouth**, left-bank tributary of the Lena river, taiga of western Yakutia, single bird at a large oxbow lake in September 1979 (Labutin *et al.* 1988); between the Indigirka river and its left-bank tributary the **Kebergene river**, nest found in June 1980 (Flint and Sorokin 1982b); middle reaches of the **Khoruonka river** (Khoruonka river), left-bank tributary of the Lena river, pairs seen in July 1984 (A. M. Boychenko *per* N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997), pair reported in June 1988 (SCMPRS 1991); **Ozhogina river mouth**, left-bank tributary of the Kolyma river, two pairs and a group of three birds reported by local people to have spent summer 1989 on nearby wooded swamps (SCMPRS 1991); Boyuo Kyuele lake, upper **Tyukyan river**, local people reporting that there were two old nests in an extensive wooded swamp near the lake in 1913 (see Andreev 1987); D'olo lake, 30 km from **Eyik** settlement, reported by local people to have been present regularly nearby up to the Second World War (Andreev 1987); near **Eyik lake**, June 1976 (N. P. Prokop'ev in SCMPRS 1991); near **Zyryanka** settlement, breeding reported, undated (Yakhontov 1976b; also Flint and Sorokin 1982b); **Linde river** basin, left-bank tributary of the Lena river, four dancing cranes on a bog at the Linde river mouth in early June 1980 (G. M. Stepanov in SCMPRS 1991), two immature birds near lake Kyra in August 1989 (Degtyarev and Labutin 1991); upper Kyygynay river, tributary of the **Ulakhan-Yukteli river** (Ulakhan Dzhuktele river) which joins the upper Markha river 230 km upstream of Malykay, nest with eggs on a dry raised bog in 1949 (Andreev 1974, 1987); lakes near the headwaters of the **Chilli river**, upper Tyukyan river, a left-bank tributary of the Vilyuy river, single male collected, undated, which was reported by Tungus nomads to have returned to this site during the previous three years after his mate was killed (Maak 1886); **Sileem-Badaraan lake system**, near lake Nidzhili, newspapers reporting that a young bird was caught by Kharchymakh lake during the Second World War, with regular sightings of four birds into the 1950s (Andreev 1987); **Kempendyayi river mouth**, right-bank tributary of the Vilyuy river, two seen in flight in July 1927 (Vorob'eva 1928);

■ **Khabarovsk Ussuri river mouth**, Bol'shoy Ussuriysky island, one bird flying low, April 1973 (B. A. Voronov *in litt.* 1997);

■ *Amur* middle reaches of the **Tok river**, foothills of the Stanovoy mountain range, one bird in spring 1945 (V. A. Dugintsov *in litt.* 1997); **Ogoron lake**, in the lowlands between the Soktakhan and Dzhagdy mountain ranges, 10 birds, September 1980 (Ilyashenko 1982); upper **Arbi river**, tributary of the Urkan river, parties of 5–7 birds in flight, May 1980 (V. A. Dugintsov *in litt.* 1997); near **Urkan river mouth**, one pair, September 1965 (V. A. Dugintsov *in litt.* 1997); near **Volkovo** village, Blagoveshchenskiy district, two birds feeding on the floodplain of the Zeya river, April 1984 (Pan'kin and Dugintsov 1988); near **Koz'modem'yanovka** village, Tambovskiy district, in boggy meadows, undated (G. S. Novikov-Daurskiy in Barancheev 1953); lower **Bureya river**, early May 1965 (Dymin and Pan'kin 1975); plains above **Khingan** (Little Khingan, Chingan), April in the late nineteenth century, one collected near the town, undated (Stegmann 1930);

■ *Primorye* **Malaya Kema bay**, eastern slopes of the Sikhote-Alin' mountains, one bird in October 1960, feeding in oat fields (Rakhilin 1965); source of the **Sungacha river**, Lake Khanka lowlands, three flocks of 12, eight and five birds, April 1868, "far fewer" in 1869 (Przheval'skiy 1877, Shul'pin 1936); near **Lebedinoye** village, eastern shore of Lake Khanka, four birds feeding in paddyfields, October 1985 (Glushchenko 1987); **Tumen estuary** (Tumangan estuary), one adult in a flock of White-naped Cranes, March 1983 (Gafitskiy 1988);

■ *Sakhalin* unspecified localities, undated (Takahashi 1937), "vagrant", undated (Nechaev 1991).

■ **MONGOLIA** It is a rare migrant and summer resident (Bold *et al.* 1995) that has been reported to breed in and near to Mongolia in the past (see Kozlova 1932–1933), but there is no evidence to support such reports (Ostapenko *et al.* 1983). Records (by province) are as follows:

■ *Arkhangai* **Ogiy Nuur** lake, adult, September 1982 (Müller 1986), five, including one juvenile in 1994 (Bold 1997); ■ *Selenge* **Buryn-gol** river, Selenge basin, recorded in spring in the late nineteenth century (Taczanowski in Bold *et al.* 1995); ■ *Khentii* **Binder**, reported to be an important site for this species, undated (N. Tsevenmyadag *in litt.* 1997); ■ *Dornod* **Mongol Daguur Strictly Protected Area**, a migration stopover ground for 10 birds (unspecified years) (Tsevenmyadag 1998); **Haychin Tsagaan Nuur** (Chajtschin-Zagan-Nur, Khaikhen Tsaagan Nuur, Haichiyin Tsagaan) lake, Uldz river floodplain, one, July 1981, one, summer 1988 (Ostapenko *et al.* 1983, Bold *et al.* 1995; also Batdelger 1996, Bold 1997), the Uldz river valley being considered to be an important area for this species (N. Tsevenmyadag *in litt.* 1997), one adult, June 1998 (A. Bräunlich *in litt.* 2000); **Duchi river** (Duch river) valley, reported to be an important site for this species, undated (N. Tsevenmyadag *in litt.* 1997); **unnamed lake** (GPS: 49°28'N 113°50'E), 5–6 km north of the Uldz river, one, June 1987 (Bold *et al.* 1995; also N. Tsevenmyadag *in litt.* 1997); **Bulangiyn Shavar Nuur** (Bulan lake), reported to be an important site for this species, undated (N. Tsevenmyadag *in litt.* 1997); Baga lake (untraced), Ekhen lake (untraced), Kholboo lake (untraced), Kholbooshar (untraced), Khulst lake (untraced), Khurkh river valley (untraced), Turgen Tsagaan lake (untraced), reported to be important sites for this species, undated (N. Tsevenmyadag *in litt.* 1997); *province unknown* Bukheg river (untraced), tributary of the Tola river, one, May 1958 (Bold *et al.* 1995, Bold 1997); Bura river (untraced), northern Mongolia/Transbaykalia, one collected, undated (Kozlova 1932–1933); Buur river (untraced), spring (unspecified years) (Bold 1997); Tari lake (untraced), spring (unspecified years) (Bold 1997).

■ **JAPAN** This species was reported to be common on Hokkaido in the eighteenth century (Masatomi 1999), and a common winter visitor to Kyushu during the Edo Era (seventeenth to nineteenth century) (Takashima 1950; also Takashima 1953 in Brazil 1991), but it is now a rare and irregular winter visitor and spring migrant, mainly to western Japan. Records (by island and prefecture) are as follows:

Hokkaido **Notsuke-saki**, Notsuke-gun, one adult, May–August 1985 (WBSJ 1986, Brazil 1991); **Kushiro**, undated (Wildlife Information Center, Hokkaido 1985); **Kikonai-cho**,

October–December 1977 (Takano 1981, Brazil 1991); **Oshima**, undated (Wildlife Information Center, Hokkaido 1985);

Honshu ■ **Akita** unspecified locality, undated (OSJ 2000); ■ **Ishikawa** unspecified locality, April–May 1961 (Takano 1981, Brazil 1991); ■ **Shimane Matsue-shi**, one, April–May 1980 (Uchida 1982), one, April 1996 (Katoh 1997); **Izumo-shi**, one, May 1980 (Uchida 1982); **Ooda-shi**, one, May 1980 (Uchida 1982); ■ **Yamaguchi Shimonoseki-shi**, one, May 1980 (Uchida 1982);

Kyushu ■ **Nagasaki Nagasaki**, three collected, undated (Temminck and Schlegel 1849 in Austin and Kuroda 1953); ■ **Kagoshima Hirose**, Kokubu-shi, one, December 1995–March 1996 (Katoh 1997); **Izumi** (also known as Arasaki, or Izumi-Takaono), recorded in 1959/1960 and 1960/1961 (Takano 1981), single birds in winter 1982, 1994 and 1996 (Izumi Crane Museum database), one, November 1999–March 2000 (Y. Katoh *in litt.* 1999, SC);

Okinawa island, in Yonagusuku-son, November 1969 (Takano 1981, McWhirter *et al.* 1996).

■ **KOREA** ■ **SOUTH KOREA** It is a very rare non-breeding visitor, with records (by province) as follows: ■ **Kangwon Cheolweon** (Cholwon), adult, November 1999, juvenile, December 1999 (Pae Seong-hwan *per ICF in litt.* 1999); ■ **Kyonggi and Seoul Han estuary**, juvenile, November 1992 (Pae *et al.* 1996), one, March 1997 (Kim Jin-han *in litt.* 1998).

■ **CHINA** The species is mainly a localised passage migrant and winter visitor to eastern China, although a few non-breeding birds have been found in northern China in summer (Wang Qishan *in litt.* 1998). There are migratory stopovers at Zhalong Nature Reserve in Heilongjiang, Melmeg and Xianghai Nature Reserves in Jilin, Shuangtai Hekou Nature Reserve in Liaoning, the Luan He estuary (and Beidaihe, where large numbers fly through in autumn) in Hebei, Pangzhai in Henan and Shengjin Hu lake in Anhui, and the main wintering grounds are at Poyang Hu lake (which supports c.95% of the global population) in Jiangxi, with smaller wintering flocks at Dongting Hu lake in Hunan, and possibly at Shengjin Hu lake in Anhui and Heigangkou in Henan (Wang Qishan *in litt.* 1998). The unconfirmed reports of wintering birds in Xinjiang are of particular interest, as they suggest that some birds from the extremely rare central flyway population may winter in western China (SC). Little information is available on the status of this species in China in the past, but the lack of depictions of a white crane with red face and no black neck in the literature or art suggests that it was never very common and widespread in China, probably because of its specialised habitat requirements (SC). Records (by province) are as follows:

■ **Heilongjiang Honghe Nature Reserve**, Tongjiang county, two birds, September 1997 (Piao Renzhu 1999); **Zhalong National Nature Reserve**, Qiqihar city, and nearby areas including Lindian county and the lower Wuyur He river (Wuyu'er He), the area being a source of early records (e.g. Meise 1934, Piechocki 1956) and the eastern part of the reserve being a spring migratory stopover site for the species (Ma Yiqing *in litt.* 2000), local people at Lindian reed farm reporting that large flocks (more than 500 birds) were seen from 1978 to 1980 (Li Jinlu and Feng Kemin 1990), with 570 reported during an aerial census in May 1984 (Feng Kemin and Li Jinlu 1985), 121–806 on spring migration from 1981 to 1993 (Li Jinlu *et al.* 1987, Li Fangman 1998), but very few records in recent years (Wang Qishan *in litt.* 1998) and, despite reports in autumn (Xu Jie *et al.* 1995), none was observed on autumn migration from 1986 to 1993 (Li Fangman 1998); **Changlindao Nature Reserve, Baoqing county**, two birds, June 1999 (Piao Renzhu 1999); **Yingchun marshes**, reported to be a staging area (Lu Jianjian 1990), but this area was developed for agriculture in the 1950s and is unlikely to be important for the species (Ma Yiqing *in litt.* 2000); **Qixing He river, Sanjiang plain**, 21 birds reported to have been counted during an aerial survey, May 1984 (Feng Kemin and Li Jinlu 1985), although the species was not found there during other surveys at the same time and the record should therefore be treated as unconfirmed (Ma Yiqing *in litt.* 2000);

■ **Jilin Melmeg Nature Reserve** (Momoge), recorded on migration in spring and autumn, usually 100–200 birds, but with 422 in spring 1985 (Wu Zhigang *et al.* 1991a); near **Baicheng**, probably including Xianghai Nature Reserve, satellite-tracking studies revealing this to be an important autumn staging ground, with all five satellite-tracked cranes stopping over for 18–25 days in 1995 and 1996 (Kanai *et al.* 1997); **Xianghai National Nature Reserve**, reported to be a passage migrant (Wang Qishan *in litt.* 1998), with 27 birds found during an aerial census in May 1984 (Feng Kemin and Li Jinlu 1985) and in fact up to 200 birds in the reserve in 1984, although numbers and length of stay were highly variable (Bouffard *et al.* undated), single birds, May 1995 and May 1996 (*Oriental Bird Club Bull.* 25 [1997]: 61–69, P. Alström, U. Olsson and D. Zetterström *in litt.* 2000);

■ **Liaoning** Wolong lake, **Kangping county**, up to 28 birds, April 1998 (Xu Yangong 1998); **Shuangtai Hekou National Nature Reserve** and nearby areas (Panjin wetlands), fluctuating numbers occurring on passage in spring and autumn, with c.70–80 birds on passage in the reedbeds since 1985, their numbers increasing to c.120 in the late 1980s (Qiu Yingjie 1991), adult male collected at the Daling estuary in Jinxian county (in the west of the reserve) in March 1986 and an adult female collected in the reserve in April 1992 (Wang Qishan *in litt.* 1998), fewer than 25 birds annually in the early 1990s, mainly in spring, but c.425 birds on both during spring and autumn migration in 1995 and 1996, and fewer than 20 birds in 1996–1998, with no autumn records in 1996 and 1997 (Yang Fulin *et al.* 1998), although it has proved to be an important autumn staging ground and was used by four out of five satellite-tracked cranes for 1–11 days in 1995 and (despite the above) 1996 (Kanai *et al.* 1997); Leantung (Liaodong, eastern Manchuria), where reported to breed by Père David (Swinhoe 1873a), which could account for an old Chinese name for this species of “Liao He (Liaoning Crane)”, but with no definite evidence of breeding there (SC);

■ **Inner Mongolia Barga**, eastern Inner Mongolia, several collected, undated, suspected to breed there (Piechocki 1956); **Dalai Hu National Nature Reserve** (Hulun Nur Nature Reserve), 12 birds in 1986, six in May 1996 (Wuliji and Liu Songtao *in litt.* 1998); Tumuji Sum, **Jalaid Qi**, a rare passage migrant, three birds in April 1992 and two summering in June 1996 (Liu Bowen verbally 1999); **Horqin Nature Reserve**, a passage migrant, 10 birds in April 1988 (Arongqiqige *in litt.* 1998);

■ **Xinjiang** the central and western ranges of the Tien Shan and the Altay mountains, where the species is reportedly a passage migrant (Yuan Guoying 1991), although with only a single confirmed record, from **Kashi city** (Kaxgar), passage migrant, undated (Zheng Shengwu 1994); Korgas (Huo Cheng), five birds reported in both January 1991 and January 1992 (Waterbird Specialist Group 1994), but these records were probably erroneous because this area is very cold in winter (Ma Ming verbally 2000; see Remarks 2);

■ **Qinghai Qinghai Hu** lake (Koko-nor), flock of c.50 birds seen, October 1872 (Przheval'skiy 1877);

■ **Hebei Qinhuangdao** (Chinwangtao), “great numbers passing over”, October–November 1913, March 1915, April (unspecified years) (La Touche 1925–1934, Williams *et al.* 1992), at least some of La Touche's records having been erroneously listed under Red-crowned Crane *Grus japonensis* in his earlier publications, but he had evidently realised his error by 1925 (Williams *et al.* 1992); **Beidaihe**, flocks of 50–300 birds flying north-east in April 1916 and flying south in October 1923 (Wilder 1924a, Wilder and Hubbard 1924), totals of 15 in October 1942, 227 in October–November 1943, 80 in October 1944 and 628–728 in March and 34 in October–November 1945 (Hemmingsen and Guildal 1968), total of 652, March–April 1985 (Williams 1986), total of 398, March 1986 (P. Alström, U. Olsson and D. Zetterström *in litt.* 2000), totals of 192 in October–November 1986, 143 in October–November 1987, 344 in October–November 1988, 181 in October–November 1989 and 577 in November 1990 (Williams *et al.* 1992), 489, November 1995 (Xu Weishu 1998); “**Hsieh Chia Ying**”, c.20 km south of Beidaihe, spring 1915 (La Touche 1920–1921, male in MCZ);

■ **Tianjin** Qilihai reservoir, reported by local people, March 1999 (Zhang Shuping *et al.* 1999);

■ **Shandong Nantuoji Shuidao** (Nantuozi Dao) island, Changshan islands, recorded annually in May as a passage migrant (Fan Qiangdong and Xu Jianmin 1996); **Yellow River delta**, satellite-tracking revealing that this is an important staging ground on southward migration, as four out of five cranes studied stayed for 2–6 days in 1995 and 1996 (Kanai *et al.* 1997), although there have never been any other reports of this species in the Yellow River Delta Nature Reserve (Lü Juanzhang verbally 1998); **Jiaozhou bay**, Qingdao city, an uncommon passage migrant on the tidal flats in April–May and October–November (unspecified years) (Liu Daiji *et al.* 1994), and two birds in January 1990 (Wang Qishan *in litt.* 1998);

■ **Henan Pangzhai** (Yu-bei Huanghe Gudao Nature Reserve or “Old Yellow River Channel Nature Reserve”), Weihui city, totals of c.21 birds in March–April and c.33 birds in October in the years 1985–1987 (Xu Xinjie *et al.* 1990), but no recent information (Wang Qishan *in litt.* 1998); **Heigangkou**, a large sedimentation pond 15 km north-west of Kaifeng city on the southern bank of the Yellow River, 43 birds in January 1991 (Waterbird Specialist Group 1994);

■ **Hubei Gantang** town, Huangpi county, one satellite-tracked bird found shot, November 1996 (Hu Hongxing 1998a); **Longgan Hu Nature Reserve**, Huangmei county, one bird with a flock of Hooded Cranes *Grus monacha* in January–February 1988, 11 birds in December 1990 (Hu Hongxing *et al.* 1996), four birds in December 1996 (Hu Hongxing 1997);

■ **Anhui Wabu Hu** lake, Shouxian, juvenile, some time before December 1989 (Wang Qishan *in litt.* 1998); **Dingji**, Liu’an, adult female, some time before March 1982 (Wang Qishan *in litt.* 1998); **Zhufo’an**, Huoshan, adult male, some time before December 1993 (Wang Qishan *in litt.* 1998); **Wuhu**, one bird from this locality was obtained at “Shanghai market” in January 1895 (specimen in BMNH); **Zhubao**, Yuexi, adult and juvenile, some time before December 1987 and December 1988 (Wang Qishan *in litt.* 1998); **Anqing** (possibly at Shengjin Hu), two collected, December 1953 (Wang Qishan *in litt.* 1998); **Shengjin Hu** lake, a wintering site for 4–5 birds (Liu Zhengyuan and Xu Wenbin 1998) but also a migration stopover for birds that winter at Poyang Hu lake, with 15 birds in December 1986 (Lu Jianjian 1990), 13 in February 1993, 81 in March 1994, nine in November 1994 and 14 in February 1998 (Wang Qishan *in litt.* 1998);

■ **Jiangsu Yancheng Nature Reserve**, a vagrant, two seen in January 1990 and one in November 1991 (Wang Qishan *in litt.* 1998); **Nantong county**, juvenile collected, November 1987 (Wang Qishan *in litt.* 1998); lower Yangtze valley, where Styan (1891) reported that “white cranes of small size, which I take to be of this species, were common on the Yangtze in winter”, including some seen in January 1889, but the identification—“small size” being entirely mistaken—could be incorrect (SC);

■ **Shanghai** Shanghai, December 1972 (specimen in WUCN), but it is possible that this bird was obtained from a zoo and not actually collected in Shanghai (SC);

■ **Zhejiang Hangzhou bay**, several captured in the tidal marshes at Yuyao and Xiaoshan, undated (Zhuge Yang 1990);

■ **Jiangxi Poyang Hu Nature Reserve** (Poyang lake), by far the most important wintering ground although birds are sometimes found outside the nature reserve boundaries (especially when the water level is unusually low or high), with 1,444 birds (including 191 juveniles) in December 1985, all on Dahu Chi other than 150 in flight over Bang Hu and apparently heading for Dahu Chi (Kennerley 1987), while inside the nature reserve (where the cranes also use many of the other ponds extensively: J. Barzen *in litt.* 1999) there were counts of 725 birds in 1993 (a very dry year when most cranes stayed outside the nature reserve), 2,896 in 1994, 2,369 in 1995, 2,112 in 1996 and 1,917 in 1997 (Liu Zhiyong and Zhao Jinsheng 1998); Nanjishan (55 birds) and Saicheng Hu lake (66 birds) in **Jiujiang county**, Tangyin (448 birds) in **Duchang county**, Nan Hu lake (847–987 birds) in **Yongxiu county**, Dalianzi Hu lake (180–506 birds) in **Boyang county** and **Junshan Hu** lake (64 birds) in Jinxian county, all counts in December 1998

following the death (by flooding) of food-plants inside Poyang Hu Nature Reserve in 1998 (Zeng Nanjing *et al.* 1999); relatively high sites at Sixia Hu lake, **Xingzi county**, Dashu township, Duchang county, Dalianzi Hu lake, Boyang county, and Nanhong, Gongqing county (untraced), to which c.1,400 birds from Poyang Hu moved in winter 1998/1999 because of the Yangtze flood in 1998, which killed most water plants in the reserve (Zhao Jinsheng and Wu Jiandong 1999); Jiangfang Hu lake (untraced), up to 103 birds in February 1993, and Palifu Hu lake (untraced), up to 46 birds in February 1993, both part of Poyang Hu but outside the nature reserve (Harris *et al.* 1995); Meitang town (untraced), Yongxiu county, juvenile female collected, November 1994 (Wang Qishan *in litt.* 1998);

■ **Hunan Dong Dongting Hu Nature Reserve** (East Dongting Lake Nature Reserve), a wintering ground, with 37 birds in 1992, 22 in 1993, 24 in 1994, 61 in 1995 and 76 in 1996 (Lei Gang *et al.* 1997).

■ **PAKISTAN** This species is known from Pakistan by a handful of records in the late nineteenth century (see Sauey *et al.* 1987, Ali and Ripley 1968–1998, Roberts 1991–1992), and several reports by hunters, most of which are considered to be unconfirmed (UNEP/CMS 1999). Despite the paucity of confirmed records, it is likely that the small central population must overfly the Zhob district of Baluchistan and Multan area in the Punjab (Landfried 1983, Scott 1989, Roberts 1991–1992; see Threats). Records (by province) are as follows: ■ **North West Frontier Province** Dowh Nalah, near **Bannu**, single bird, undated (Landfried 1983); **Kurram valley**, reported by a hunter to have been seen in the early 1960s, and that several were captured and eaten in c.1964 (Roberts 1991–1992; also Landfried 1983), with a hunter reporting a sighting of three birds in September 1997, but this record is considered to be unconfirmed (UNEP/CMS 1999); Lakki Refuge (not mapped), nine reported sightings in the late 1990s, but none confirmed (UNEP/CMS 1999); ■ **Sind Eastern Narra**, one, winter 1877/1878 (Butler 1878; also Ali and Ripley 1968–1998); **Ghaibi Dero** (Guibee Dera), Lang (Langh), Larkana district, small party, January 1872 (Hume 1872–1873; also Ali and Ripley 1968–1998, Sauey *et al.* 1987, Roberts 1991–1992); **Drigh Lake Wildlife Sanctuary** (Madho jheel), Mehur sub-division, small party, January 1872 (Hume 1872–1873; also Ali and Ripley 1968–1998, Sauey *et al.* 1987, Roberts 1991–1992).

■ **INDIA** The Siberian Crane was formerly a widespread winter visitor to northern India, straggling east to Bihar and south to Madhya Pradesh, but it was always mainly faithful to particular wintering sites, of which the most famous were Keoladeo National Park (Bharatpur) in Rajasthan and Payagpur jheel in Uttar Pradesh (Ali and Ripley 1968–1998). Only Keoladeo remains as a known site for the species, and even there it now only occurs intermittently; given that 9–10 birds were recorded on the presumed breeding ground of the central population in the mid-1990s, there must be an alternative wintering ground used by this population that has not yet been identified (Meine and Archibald 1996). Records (by state) are as follows:

■ **Jammu and Kashmir Leh**, Ladakh, one collected, around 1852 (Hume 1868a);

■ **Haryana Karnal** (Kurnal, Karnauli), 1864 and October 1879 (Hume and Marshall 1879–1881), two, March 1933, one being hunted by local people (Koelz 1940); **Hisar**, one collected, March 1933 (Walkinshaw 1973); **Hansi**, annual, undated (Blyth 1866–1867; also Hume and Marshall 1879–1881);

■ **Delhi Najafgarh lake** (Najafgarh jheel), undated (Hume and Marshall 1879–1881);

■ **Rajasthan Keoladeo National Park**, Bharatpur, the only known wintering site in India since at least 1937, but numbers declining from c.200 in 1965 to just three adults and one chick in 1996 (Meine and Archibald 1996), with one collected from 11 seen, 1937 (S. Ali in Sauey *et al.* 1987), 76, March 1970 (Breedon and Breedon 1982), 43, January 1973 (R. Lévêque *in litt.* 1999), 63 in 1974–1975, 61 in 1976, 57 in February 1977, 55 in February 1978, up to 43

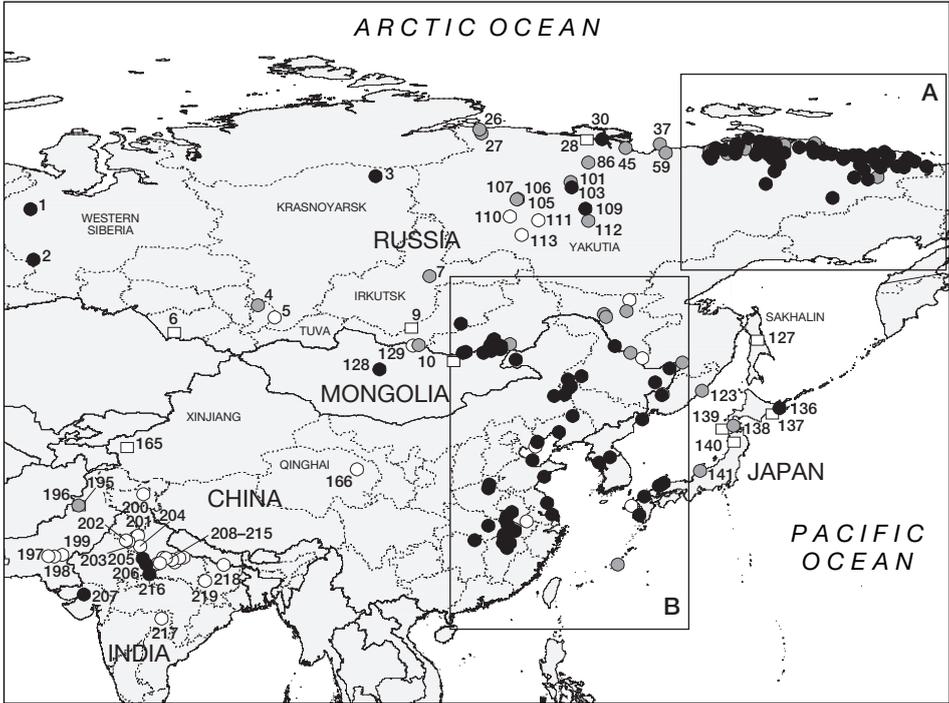
in 1978–1979, 33 in 1979–1980 (Breedon and Breedon 1982), at least 26, winter 1982/1983 (R. Lévêque *in litt.* 1999), at least 25, February 1986 (L. Marsh *in litt.* 1999), 18, November–December 1988, with up to 23 later in the winter (Bose *et al.* 1989), two adults and one chick in winter 1997/1998 and two adults in winter 1998/1999 (UNEP/CMS 1999); Thalab Shahi, near **Dholpur** (Dhaulpur), three birds, January 1990, two birds located in a nearby wetland during an aerial survey, February 1990 (Vijayan 1991);

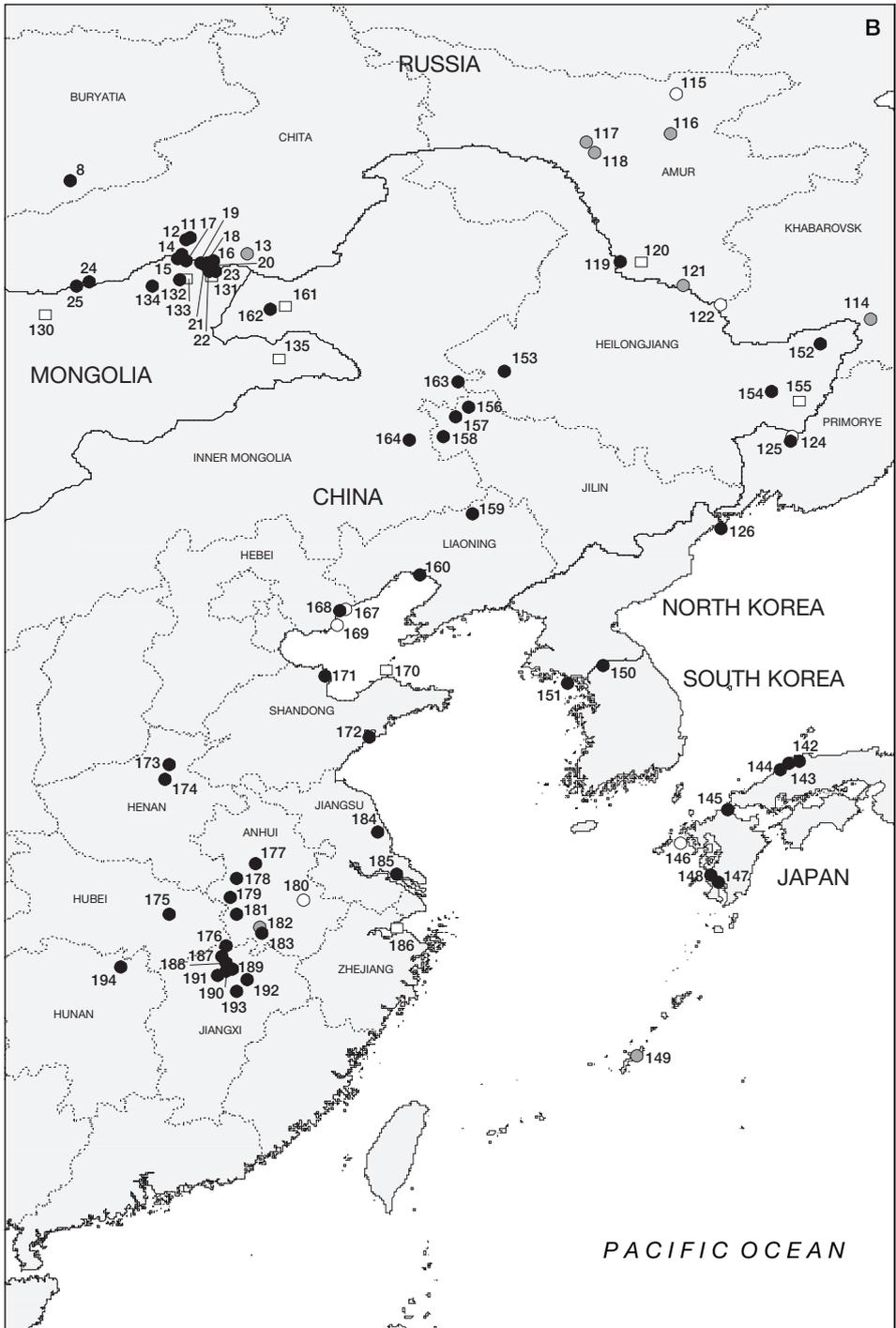
■ **Gujarat Little Rann of Kutch**, one seen, January 1991 (Malik 1991a,b; see Rahmani 1992d);

■ **Uttar Pradesh Pyagpur or Payagpur jheel**, c.1937 (Sauey *et al.* 1987); **Fatehgarh** (Futtehghur), February 1873, December 1874/February 1875 and December 1876, one of the specimen labels indicating that one was collected at Palee, Fatehgarh, and another at

The distribution of Siberian Crane *Grus leucogeranus* (maps opposite): (1) Kunovat river basin; (2) Kunda river; (3) Yessey lake; (4) Fyrkal lake; (5) Koibal steppe; (6) Novoyegor'yevskoye; (7) Kirenga river; (8) Bol'shoye Yeravnoye lake; (9) Selenga delta; (10) Durenskaya; (11) Aginskiy lake district; (12) Nozhiy lake; (13) Borzaya river; (14) Urta-Khargana; (15) Durulguy river; (16) Kulusutay; (17) Buylesan; (18) Torey lakes; (19) Ust'-Imalka; (20) Khotogor; (21) Imalka river; (22) Uldza river; (23) Solov'yevsk; (24) Kyra; (25) Srednie Kormachi; (26) Khorgo cape; (27) Anabar river; (28) Ulakhan-Yuryakh river mouth; (29) Bustakh lake; (30) Stolb island; (31) Namnugan-Kyuel lake; (32) Sanga-Uryakh river; (33) upper Sanga-Uryakh river; (34) Omullyakhskaya bay; (35) Mogotoyevo lake; (36) Muksunuokha river; (37) Buorkhaya cape; (38) eastern shore of Khromskaya bay; (39) Khromskaya bay; (40) Muksunuokha-Tas mountain; (41) upper Muksunuokha river; (42) Soluntakh lake; (43) Gusinaya river; (44) Volch'ya river; (45) Sogo river; (46) Sellyakh river; (47) unnamed locality; (48) Uryung-Ulakh lake; (49) Yarok strait; (50) Uryung-Ulakh river; (51) unnamed locality; (52) Chondon river delta; (53) Chondonskaya bay; (54) Russko-Ust'inskaya channel; (55) Srednyaya channel; (56) Syuryuktyakh river; (57) Bol'shaya Kuropatoch'ya river; (58) Lapcha river; (59) Omoloy river; (60) upper Syuryuktyakh river; (61) lower Berelekh river; (62) Chonobul lake; (63) upper Sellyakh river; (64) Shandrin river; (65) Malaya Kuropatoch'ya river; (66) Tut-Balyktakh river; (67) Keremesit river; (68) Bol'shoy Khomus-Yuryakh river; (69) Orotko lake; (70) Khroma river; (71) Alazeya river; (72) upper Khroma river; (73) Tarasovo lake; (74) Ukyulyakh lake; (75) Malye Khomus-Yuryakh river; (76) Malaya Kuropatoch'ya river (lower and middle); (77) Khar-Yuryakh river; (78) Ilirgytgyn lake; (79) Berelekh river; (80) Buor-Yuryakh river; (81) Sundrun river; (82) upper Bol'shaya Kuropatoch'ya river; (83) Chukoch'ya; (84) Bol'shoye Morskoye lake; (85) Maloye Morskoye lake; (86) Siktyakh; (87) Oler river; (88) Allaikha river; (89) Rossokha river; (90) Chasha lake; (91) Kolyma delta; (92) Bol'shoy Oler lake; (93) Pokhval'nyy; (94) Kon'kovaya river; (95) Andryushkino; (96) Suturuokha river; (97) Khachimcher river; (98) Argakhtakh; (99) Sylgy-Ytar; (100) Keppekh'tekh lake; (101) Muna river mouth; (102) Kebergene river; (103) Khoruonka river; (104) Ozhogina river mouth; (105) Tyukyan river; (106) Eyik; (107) Eyik lake; (108) Zyryanka; (109) Linde river; (110) Ulakhan-Yukteli river; (111) Chilli river; (112) Sileem-Badaraan lake system; (113) Kependyayi river mouth; (114) Ussuri river mouth; (115) Tok river; (116) Ogoron lake; (117) Arbi river; (118) Urkan river mouth; (119) Volkovo; (120) Koz'modem'yanovka; (121) Bureya river; (122) Khingan; (123) Malaya Kema bay; (124) Sungacha river; (125) Lebedinoye; (126) Tumen estuary; (127) Sakhalin; (128) Ögiiy Nuur; (129) Buryngol; (130) Binder; (131) Mongol Daguur Strictly Protected Area; (132) Haychin Tsagaan Nuur; (133) Duchi river; (134) unnamed lake; (135) Bulangiyn Shavar Nuur; (136) Notsuke-saki; (137) Kushi; (138) Kikonai-cho; (139) Oshima; (140) Akita; (141) Ishikawa; (142) Matsue-shi; (143) Izumo-shi; (144) Ooda-shi; (145) Shimonoseki-shi; (146) Nagasaki; (147) Hirose; (148) Izumi; (149) Okinawa island; (150) Cheolweon; (151) Han estuary; (152) Honghe Nature Reserve; (153) Zhalong National Nature Reserve; (154) Baoqing county; (155) Yingchun marshes; (156) Melmeig Nature Reserve; (157) Baicheng; (158) Xianghai National Nature Reserve; (159) Kangping county; (160) Shuangtai Hekou National Nature Reserve; (161) Barga; (162) Dalai Hu National Nature Reserve; (163) Jalaid Qi; (164) Horqin Nature Reserve; (165) Kashi city; (166) Qinghai Hu; (167) Qinhuangdao; (168) Beidaihe; (169) Hsieh Chia Ying; (170) Nantuojii Shuidao; (171) Yellow River delta; (172) Jiaozhou bay; (173) Pangzhai; (174) Heigangkou; (175) Gantang; (176) Longgan Hu Nature Reserve; (177) Wabu Hu; (178) Dingji; (179) Zhufo'an; (180) Wuhu; (181) Zhubao; (182) Anqing; (183) Shengjin Hu; (184) Yancheng Nature Reserve; (185) Nantong county; (186) Hangzhou bay; (187) Jiujiang county; (188) Xingzi county; (189) Duchang county; (190) Poyang Hu Nature Reserve; (191) Yongxiu county; (192) Boyang county; (193) Junshan Hu; (194) Dong Dongting Hu Nature Reserve; (195) Bannu; (196) Kurram valley; (197) Eastern Nara; (198) Ghaibi Dero; (199) Drigh lake Wildlife Sanctuary; (200) Leh; (201) Karnal; (202) Hisar; (203) Hansi; (204) Najafgarh lake; (205) Keoladeo National Park; (206) Dholpur; (207) Little Rann of Kutch; (208) Payagpur jheel; (209) Fatehgarh; (210) Hilgee; (211) Sandi; (212) Sandila; (213) Indugurh jheel; (214) Tuman jheel; (215) Etawah; (216) Karera Bustard Sanctuary; (217) Kuhl; (218) Jaynagar; (219) Dehri.

○ Historical (pre-1950) ● Fairly recent (1950–1979) ● Recent (1980–present) □ Undated





Munjhlay Jheel (three specimens in BMNH; also Walkinshaw 1973); **Hilgee**, Chowka river, Avadh (Oudh), seen on four occasions, December 1859 (Irby 1861); **Sandi** (Sandee), three, seen on four occasions, February 1859 (Irby 1861); **Sandila**, five seen in a shallow jheel, undated (Reid 1881); **Indugurh jheel** (Indegarh), January 1871 (J. Anderson 1871); **Tuman jheel**, Etawah, February 1871 (Walkinshaw 1973, three specimens in BMNH); **Etawah**, one collected from a flock of 25, winter 1858/1859, many seen at different jheels, winters 1865/1866 and 1866/1867 (Hume 1868a), 1865 (three specimens in BMNH);

■ **Madhya Pradesh Karera Bustard Sanctuary** (Dihala jheel), one bird in winter 1987/1988 (Vijayan 1991);

■ **Maharashtra Kuhi** (Koohee), near Kampti and Nagpur, one collected, February of an unspecified year (Hume and Marshall 1879–1881; also D'Abreu 1935, Ali and Ripley 1968–1998);

■ **Bihar Beerpur factory, Jaynagar** (Jainagar), small flock seen, winter 1898, the species then being familiar to the local hunters (Inglis 1901–1904); **Dehri**, October 1879 (Hume and Marshall 1879–1881).

An unconfirmed record is from Dehra Dun in Uttar Pradesh, where a flock of 25 was reported over the New Forest, May 1955 (George 1957).

POPULATION The global population was recently estimated at 2,900–3,000 birds (Meine and Archibald 1996), including about 2,900–3,000 wintering in China (mainly at Poyang Hu lake), nine in Iran and four in India (Rose and Scott 1997). However, an aerial census in early 1999 located only 2,004 Siberian Cranes throughout the Poyang Hu lake area (Ji Weitao *in litt.* 1999), indicating that there may have been a real decline in the eastern population, and the total global population in the late 1990s was therefore estimated at just 2,500 birds (Chan 1999).

Russia Winter monitoring of the central and western populations has shown them to be in a critical state (Potapov and Flint 1987). The eastern population is considered to have remained stable over recent decades (Degtyarev and Labutin 1991), but it appears to have been stronger in the mid-nineteenth century than it is at present, on passage in both Primorye and southern Chita (Radde 1863, Przheval'skiy 1877–1878, Taczanowski 1891–1893; see Distribution). Various estimates were made of this breeding and summering population in north-east Yakutia between 1960 and 1989, including 250–300 birds (Flint and Kishchinskiy 1975, Flint and Sorokin 1982a,b), 325–790 birds (Perfil'ev 1965, Perfil'ev and Polyakov 1979, Vshivtsev *et al.* 1979, Labutin *et al.* 1982, Degtyarev and Labutin 1991), and 900–1,500 birds

The distribution of Siberian Crane *Grus leucogeranus* (map B opposite): (8) Bol'shoye Yeravnoye lake; (11) Aginskiy lake district; (12) Nozhiy lake; (13) Borzya river; (14) Urta-Khargana; (15) Durulguy river; (16) Kulusutay; (17) Buylesan; (18) Torey lakes; (19) Ust'-Imalka; (20) Khotogor; (21) Imalka river; (22) Uldza river; (23) Solov'yevsk; (24) Kyra; (25) Srednie Kormachi; (114) Ussuri river mouth; (115) Tok river; (116) Ogoron lake; (117) Arbi river; (118) Urkan river mouth; (119) Volkovo; (120) Koz'modem'yanovka; (121) Bureya river; (122) Khingan; (124) Sungacha river; (125) Lebedinoye; (126) Tumen estuary; (130) Binder; (131) Mongol Daguur Strictly Protected Area; (132) Haychin Tsagaan Nuur; (133) Duchi river; (134) unnamed lake; (135) Bulangiyn Shavar Nuur; (142) Matsue-shi; (143) Izumo-shi; (144) Ooda-shi; (145) Shimonoseki-shi; (146) Nagasaki; (148) Izumi; (149) Okinawa island; (150) Cheolweon; (151) Han estuary; (152) Honghe Nature Reserve; (153) Zhalong National Nature Reserve; (154) Baoqing county; (155) Yingchun marshes; (156) Melmeg Nature Reserve; (157) Baicheng; (158) Xianghai National Nature Reserve; (159) Kangping county; (160) Shuangtai Hekou National Nature Reserve; (161) Barga; (162) Dalai Hu National Nature Reserve; (163) Jalaid Qi; (164) Horqin Nature Reserve; (167) Qinhuangdao; (168) Beidaihe; (169) Hsieh Chia Ying; (170) Nantuojii Shuidao; (171) Yellow River delta; (172) Jiaozhou bay; (173) Pangzhai; (174) Heigangkou; (175) Gantang; (176) Longgan Hu Nature Reserve; (177) Wabu Hu; (178) Dingji; (179) Zhufu'an; (180) Wuhu; (181) Zhubao; (182) Anqing city; (183) Shengjin Hu; (184) Yancheng Nature Reserve; (185) Nantong county; (186) Hangzhou bay; (187) Jiujiang county; (188) Xingzi county; (189) Duchang county; (190) Poyang Hu Nature Reserve; (191) Yongxiu county; (192) Boyang county; (193) Junshan Hu; (194) Dong Dongting Hu Nature Reserve.

○ Historical (pre-1950) ● Fairly recent (1950–1979) ● Recent (1980–present) □ Undated

(Uspenskiy *et al.* 1962, Egorov 1965, 1971). However, these were all underestimates, because no allowance was made for the birds inevitably missed during aerial surveys, and a comparison of the actual population density found in a sample plot in the Indigirka delta (5.4 birds per 100 km²) with the previous estimates indicated that aerial surveys had on average underestimated crane numbers by a factor of 2.46; on the assumption that the 812 “recorded locations” (presumably this means individual birds) of Siberian Cranes represented only 40–50% of the birds actually present, it has been estimated that there are or were at least 1,620–2,030 birds in northern Yakutia (Degtyarev and Labutin 1991, Germogenov *et al.* 1996, Germogenov and Solomonov 1997, N. I. Germogenov *in litt.* 1997).

Mongolia It is a rare migrant and summer resident (Bold *et al.* 1995).

Japan It was reported to be common on Hokkaido in the eighteenth century (Masatomi 1999), and a common winter visitor to Kyushu during the Edo Era (seventeenth to nineteenth century) (Takashima 1950, Takashima 1953 in Brazil 1991), but it is now a rare and irregular winter visitor and spring migrant (see Distribution).

Mainland China The historical status of this species in China is poorly understood (see Distribution). It was described as a “not uncommon migrant” at Beidaihe in Hebei in the 1940s by Hemmingsen (1951), when similar numbers were recorded on migration (Hemmingsen and Guildal 1968) to those found by Williams (1986) and Williams *et al.* (1992) in the 1980s. Large numbers have also been recorded on migration at Lindian Reed Farm (in Zhalong Nature Reserve) in Heilongjiang, where workers reported flocks of more than 500 birds in 1978–1980 (Li Jinlu and Feng Kemin 1990), and 121–525 birds were seen annually on spring migration and 5–25 in autumn in 1981–1986 (Li Jinlu *et al.* 1987). Spring counts there were of 525 birds in 1986, 746 in 1987, 806 in 1988, 761 in 1990 and 790 in 1993 (Li Fangman 1998), but the species has very seldom been reported from Zhalong subsequently (Wang Qishan *in litt.* 1998). The eastern population was relatively poorly known until the main wintering grounds were discovered at Poyang Hu lake in January 1981 (Zhou Fuzhang *et al.* 1981, Meine and Archibald 1996). The number known to winter in Poyang Hu Nature Reserve remained in the general order of 2,500 birds in the years 1988–1997 (other than in 1993, when many cranes wintered outside the reserve) (Table 1). However, there appears to have been a decline there since the mid-1990s (Wang Qishan *in litt.* 1998): in winter 1998/1999, only 741 birds were recorded inside the reserve, although c.1,400 were found in other parts of the Poyang Hu system (Zhao Jinsheng and Wu Jiandong 1999), and an aerial census in early 1999 located only 2,004 throughout the Poyang Hu area (Ji Weitao *in litt.* 1999). The other wintering grounds in China are Dong Dongting Hu Nature Reserve in Hunan, which supports under 100 birds, and Shengjin Hu in Anhui, which has never held more than 20 birds (Wang Qishan *in litt.* 1998).

Table 1. Counts of wintering Siberian Cranes in Poyang Hu Nature Reserve (1980–1997) (Song Xiangjin *et al.* 1995, Song Xiangjin *per* Wang Qishan *in litt.* 1998, Liu Zhiyong and Zhao Jinsheng 1998) and Dong Dongting Hu Nature Reserve (1985–1996) (Lei Gang *et al.* 1997).

Year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Poyang	91	148	189	730	840	1,482	1,784	1,882	2,653	2,540	2,486	2,671	2,709	725	2,896	2,369	2,112	1,917
Dongting	-	-	-	-	-	15	23	27	16	57	23	62	37	22	24	61	76	-

Iran The small western population that winters near Fereidoonkenar in the south-eastern Caspian lowlands has remained stable at 9–11 birds since the mid-1980s (or 7–14 birds from 1977–1999: UNEP/CMS 1999), but it is highly vulnerable (Meine and Archibald 1996).

Pakistan There has been no record this century from Pakistan, reflecting the increasing rarity of this species over many decades (Roberts 1991–1992). Nevertheless, the entire central population of the species probably passes through the country each autumn (see Threats).

India In the nineteenth century, the Siberian Crane was regularly reported in the Gangetic Basin of northern India (Sauey *et al.* 1987), and in the early twentieth century Baker (1922–

1930) described it as “not uncommon in north-west India but always in small flocks”. Since 1937 most records in India have been from Keoladeo National Park (Meine and Archibald 1996), but the numbers there declined from c.200 birds in 1965 to 33 in winter 1980/1981, increased to 41 in 1984/1985, and then decreased again to only five in 1992/1993 and none in the following two winters (Vijayan and Vijayan 1996; see Distribution). However, four birds (including one chick) returned in February 1996 (Vijayan and Vijayan 1996; see Distribution), indicating that the population had not yet become extinct but was wintering elsewhere (UNEP/CMS 1999). Reports of 9–10 birds in the Kunovat basin in Russia in summer 1994, on the breeding grounds of the central population (Meine and Archibald 1996), also support the theory that there must be other wintering grounds for this population, perhaps elsewhere in India (see Sauey *et al.* 1987, Singh *et al.* 1987) or in western China (see Distribution).

ECOLOGY Habitat This species is the most specialised crane in terms of its habitat requirements, and the most aquatic, exclusively using wetlands for nesting, feeding, and roosting, preferring wide expanses of shallow fresh water with good visibility (Meine and Archibald 1996). In Yakutia, the breeding grounds are mainly in typical subarctic tundra and scrub tundra, to a lesser extent in wooded tundra and the northern taiga, and single nests have also been found in tundra-like landscapes south of the main tundra zone (in the Indigirka basin near the Momskie mountains at c.68°N) (Flint and Kishchinskiy 1975, Flint and Sorokin 1981, 1982a). On the breeding areas it inhabits wet sedge/cotton-grass marshes, moss swamps and damp shores of lakes in vast lacustrine depressions (called locally “laida”), which are usually interspersed with a patchwork of drier sites on ridges vegetated with dwarf birch and heaths (called locally “yedoma”); its nests are typically sited amidst lake-side polygonal swamps (called locally “alas”) or in the wetter parts of land between two lakes (AVA). The breeding grounds of the central population are in the northern taiga in sphagnum bogs and marshes, usually in large, open wetlands surrounded by forests and divided by low ridges, the cranes nesting in the shallow waters between them (Sorokin and Kotyukov 1987 in Meine and Archibald 1996). Studies of the eastern population in the Kolyma lowlands indicated that narrow (10–20 m wide) strips of floating turf bordering permafrost-formed ponds and lakes may be essential for birds feeding a chick, which would therefore be a major limiting factor on the distribution and abundance of this species within its breeding range (Potapov 1992).

On migration, the Siberian Crane roosts and feeds in large, isolated wetlands away from human settlements, and although it will occasionally use dry mounds within or on the border of wetlands, and even upland wet meadows, it virtually never uses drier upland areas, even in drought years (Meine and Archibald 1996). On the wintering grounds in China it occurs in the marshes near freshwater lakes of the lower Yangtze basin, principally at Poyang Hu lake, where birds move from the smaller lakes into the main body of Poyang Hu as the water level gradually falls from November to March (Wang Qishan *in litt.* 1998). Certain lakes at Poyang are particularly favoured, including Da Huchi and Bang Hu, possibly because of the abundance in them of the clam *Anodonta woodiana*; moreover, Da Huchi, where the cranes congregate whenever there are snowstorms and strong north-west winds, is surrounded by earth mounds on three sides and provides the best shelter (Wang Qishan *in litt.* 1998). In India and Iran the wintering birds use artificially maintained wetlands (Meine and Archibald 1996).

Food The diet of this species on its breeding grounds mainly consists of plants, but it also includes insects, fish, frogs, small animals (e.g. voles and lemmings) and even occasionally waterfowl; animal foods are especially important at the beginning of the breeding season, when plant foods are unavailable, and during the chick-rearing period (Meine and Archibald 1996). In tundra habitats the main foods are the roots and sprouts of sedges, cotton-grasses, horsetails and other plants, but lemmings and voles are also taken as well as the clutches of smaller birds (Vorob'ev 1963, Perfil'ev 1965, Potapov and Flint 1987).

In China, this species eats mainly tubers of pondweed *Potamogeton malainus*, stems and tubers of wild celery *Vallisneria spiralis* and small freshwater clams (Meine and Archibald 1996). The stomachs of three Siberian Cranes dissected at Poyang contained only the roots and shoots of sedges *Carex* and gravel (Ding Wenning and Zhou Fuzhang 1991), and observations showed that plant materials comprise more than 90% of their food intake, mainly the roots and underground stems of *P. malainus*, *V. gigantea* and *Polygonum hydropiper*, but they may also take some clams, small fish, snails and gravel (Liu Zhiyong *et al.* 1987). However, some other observations suggest that Siberian Cranes feed mainly on clams, snails and the young roots of aquatic plants (Yan Li and Ding Tieming 1988). On the wintering grounds at Poyang Hu lake, the species feeds primarily on the roots or tubers of aquatic plants in shallow water or wet mud, its feeding areas changing according to water levels, human disturbance and presumably also the densities of the aquatic food-plants (Harris *et al.* 1995). Observations at Poyang suggested that families with chicks may use different feeding locations from the large flocks (Harris *et al.* 1995). The Siberian Cranes only feed in shallow water, and when the water level dropped at Poyang they moved farther from the shore, even when tubers of *Vallisneria* were still plentiful in the mud, presumably because it is easier to dig and wash the tubers in water (Ding Wenning and Zhou Fuzhang 1991). On the wintering grounds in India, the species feeds mainly on vegetable matter such as the tubers of *Scirpus tuberosus*, *S. littoralis*, *Cyperus rotundus*, *Eleocharis dulcis*, *Hydrilla verticillata* and *Nymphaea*, and the basal parts of the leaves of *Lymnophyton* and the tips of the culms of *Eleocharis dulcis*; they also eat some animal matter, including aquatic insects (water bugs, beetles), molluscs, worms and probably fish (Vijayan 1991). At an autumn migration stopover in the Da Hinggan Ling mountains in China, two cranes were observed feeding in c.25–35 cm deep water in a *Carex* marsh on the young roots of *Triglochin palustre*, *Alisma* and *Sparganium stoloniferum*, frogs and small fish (Yin Ruixue 1992). At Zhalong, they feed mainly on the roots and shoots of aquatic plants (Wang Qishan *in litt.* 1998). A migrant in north-eastern Mongolia foraged mainly in vegetation-free mud by a slightly saline lake, apparently taking crustaceans (Ostapenko *et al.* 1983).

Breeding Siberian Cranes reach full maturity when they are seven years old (Potapov and Flint 1987), but they may form pairs and breed when only three years old (N. I. Germogenov *in litt.* 1997). On the breeding grounds along the Indigirka river in north-east Yakutia, the population has been found to be composed of 92% paired individuals, 3.8% single birds, and 4.2% small flocks (N. I. Germogenov *in litt.* 1997). The population in Yakutia in general comprises 7.3% one-year-old birds, 17% two-year-old birds, 34.1% three-year-old birds and 41.6% birds of four or more years old (Flint and Kishchinskiy 1975). Mating has been observed at the migratory stopover (Zhalong) in Lindian county, Heilongjiang, in spring (Zhao Zhengjie 1988). Pairs are strictly territorial, and birds may occupy the same territories throughout their lives; following their arrival on the breeding grounds (by the second week of May) they stay within their nesting territories until their departure in September (Potapov and Flint 1987, N. I. Germogenov *in litt.* 1997). On the Indigirka river breeding grounds the distance between neighbouring nests varies from 2.5 to 7.0 km (average 3.0 km, n=25) (Potapov and Flint 1987, N. I. Germogenov *in litt.* 1997). The nest consists of a flat mound of grass and sedge elevated 12–15 cm above the surrounding water (Meine and Archibald 1996). The laying period lasts for a few days in late May and early June, varies little from year to year, and is highly synchronised within the population; periods of cold weather have therefore caused massive nesting failure in some years (Flint and Sorokin 1982a, Potapov and Flint 1987). For example, the proportion of parents with chicks in the Indigirka population in 1993–1996 varied from 4.5% to 64.3% (n=121) (N. I. Germogenov *in litt.* 1997). However, other studies on the breeding grounds in Yakutia have indicated that alternative breeding areas are essential, and that during springs with cold weather and late snowmelt the primary breeding area for Siberian Cranes may shift 100–150 km east of the “normal” area; this alternative breeding area is characterised

by an uneven, slightly hilly surface to the tundra, where the cranes are able to place their nests on slightly higher ground (c.1 m higher than the surrounding land) that is clear of snow (Harris *et al.* 1995). Complete clutches may include one or two eggs (1.85 on average, $n=20$), but an increased proportion of one-egg clutches (up to 50%) occurs in years with cold weather (Potapov and Flint 1987). Incubation is by both parents, but mainly by the females, the incubation period lasts 28 days (or 29 days: Meine and Archibald 1996), and up to 94% of eggs hatch successfully in early July, but usually only one chick survives to fledging from the two-egg clutches (Potapov and Flint 1987). The chicks fledge at 70–75 days (Meine and Archibald 1996). Soon after hatching, the broods move to lakeside marshes, where they appear to depend (at least in the easternmost part of their range) on narrow strips of floating turf bordering permafrost-formed ponds (called locally “splavina”), which provide high-quality feeding habitat where the roots of hydrophilic plants, invertebrates, small fish, etc., can be gathered rapidly enough to provide sufficient food for the juveniles (Potapov 1992). The productivity of the three populations is normal for a healthy crane population, as juveniles comprise 18.56% (11 years of data), 15.12% (16 years of data) and 17.18% (seven years of data) of the western, central and eastern wintering populations respectively, suggesting that conditions are excellent in the breeding habitat (Archibald and Mirande 1999).

Migration The Siberian Crane has three populations, all of which nest in northern Russia and undertake long-distance migrations to their wintering grounds (see Distribution).

Eastern population During the migration period, Siberian Cranes have been recorded from virtually throughout Yakutia, but the main migration front lies to the east of the Lena, where their flyways follow all the large rivers of north-east Yakutia: the Yana, Indigirka, Alazeya and Kolyma; there are regular staging sites in the Verkhoyansk mountain system, used especially in bad weather (the Moma, Dulgalakh, Bytantay, Adacha, Tumara and upper Indigirka valleys), and the northern half of the region between the Lena and Aldan rivers (especially the basins of the Amaga and Aldan rivers) is a crucially important resting and feeding area where they concentrate for prolonged periods, particularly in autumn (Maak 1886, Vorob'eva 1928, Sdobnikov 1959, Kapitonov 1962, Vorob'ev 1963, Egorov 1965, Perfil'ev 1965, 1976, 1986, Uspenskiy 1965, Andreev 1974, 1987, Flint and Kishchinskiy 1975, Larionov 1976, Yakhontov 1976b, Perfil'ev and Polyakov 1979, Flint and Sorokin 1982a,b, Degtyarev and Antonov 1989a, Labutin *et al.* 1985, 1988, Degtyarev and Labutin 1991, I. P. Gavril'eva and V. V. Okoneshnikova *in litt.* 1997). An analysis of records of migrating cranes outside Yakutia (see Distribution) suggests that there are two migration routes: a western route, used mainly in autumn and including the upper reaches of the Lena and Vitim rivers, the Lake Baikal area and Transbaykalia; and an eastern route, used mainly in spring, along the upper reaches of the Aldan and Zeya rivers, Primorye and, apparently, the north-western coast of the Yellow Sea (Degtyarev and Labutin 1991). In Yakutia, the crane migration occurs from early May until the first ten days of June, and in autumn migration has been observed from 24 August to 7 October, with the heaviest passage during September; the average size of spring flocks is 3–4 individuals, while in autumn it is 10–11 individuals (N. I. Germogenov *in litt.* 1997). In Primorye (Lake Khanka) and Amur (the Zeya-Bureya plains), the earliest records were on 25 March, and the mass arrival occurs in the period 4–24 April (Vorob'ev 1954, Panchenko 1976, Gafitskiy 1988, Ilyashenko 1982, Pan'kin and Dugintsov 1988). In Transbaykalia, immature, non-breeding Siberian Cranes appear later, from 20 April until June and even July (Flint and Kishchinskiy 1975, Naumov 1979, Vasil'chenko 1982, Melnikov *et al.* 1988, Ostapenko and Tsevenmyadag 1988, Prokof'ev and Kustov 1988, O. A. Goroshko *in litt.* 1997), and typically leave early in the season, in the period 12–28 August (Dement'ev and Gladkov 1951–1954, Leont'ev 1976), with the latest date being 13 September (O. A. Goroshko *in litt.* 1997).

Five cranes satellite-tracked from their breeding grounds in the lower reaches of the Indigirka river in Russia to Poyang Hu lake in China (in 1995 and 1996) moved across eastern Siberia to the Songnen river basin in China, then along the coast of the Gulf of Bohai

to the Yellow River delta, and then took an inland route over the provinces of Shandong, Henan and Anhui to Poyang Hu lake; their migration started in October in 1995 and on 16 September in 1996, and they arrived at Poyang in the period 4–19 November (Kanai *et al.* 1997). Ground observations show that birds occur regularly on the Songnen plain (including at Zhalong, Melmeg, Xianghai and Horqin), and that when they meet the coast at the Gulf of Bohai they migrate along the coast of Hebei to Henan and then to the lakes in the Yangtze valley, where they move through Shengjin Hu or the lakes in Hubei before they arrive at Poyang Hu and the Dongting Hu lakes (see Distribution). Reports that this species is seen annually in April on one of the Changshan islands in Shandong (Fan Qiangdong and Xu Jianmin 1996), and migrates through Jiaozhou bay (also in Shandong) (Liu Daiji *et al.* 1994, Wang Qishan *in litt.* 1998), perhaps refer to vagrants because this species is thought to be very rare on the eastern coast of China (Chan 1999), but they may possibly indicate that some birds regularly follow a coastal migratory route. At Zhalong in Heilongjiang, this species has been recorded in spring between 22 March and 10 May and typically stays for 47–59 days, and in autumn between 29 September and 30 October (Li Jinlu *et al.* 1987, Xu Jie *et al.* 1995, Li Fangman 1998). At Melmeg Nature Reserve in Jilin, it was recorded in spring from 25 March to 10 May, and in autumn it arrived in the period 14–29 September, increased in numbers in early October, and started to migrate southwards from 7 November (Wu Zhigang *et al.* 1991a). In the Shuangtai Hekou Nature Reserve area it arrived in early to mid-April, and began its northward migration from late April to early May, and in autumn birds arrived in mid-October and departed in early to mid-November (Yang Fulin *et al.* 1998). It normally arrives at Poyang Hu Nature Reserve in the period 21–30 October (but was recorded in early October in 1988 and 1989) and departs in the period 5 March–5 April (Song Xiangjin *et al.* 1995).

Central population This population was presumed to migrate from the breeding grounds at the Kunovat river through Kazakhstan, Uzbekistan, Turkmenistan, Afghanistan and Pakistan to India; Lake Tengiz and the Naurzum wetlands in Kazakhstan and Ab-i-Istada lake in Afghanistan are possible stopovers (Meine and Archibald 1996). A wild Siberian Crane chick colour-banded at Kunovat in 1995 arrived at Keoladeo National Park in February 1996, proving that the Kunovat cranes are the ones which migrate to India in winter, and confirming their migratory route, although the details of their movements over Pakistan are still unknown (UNEP/CMS 1999). The reported sightings in Xinjiang in north-western China (see Distribution) suggested that some birds from the extremely rare central flyway population may winter in western China, but these records were probably erroneous (Ma Ming verbally 2000).

Western population Satellite-tracking has shown that a male bird wintering in Iran migrated along the western and northern coasts of the Caspian Sea, across western Kazakhstan, and east of the Ural Mountains to a site on the Kunda river, c.630 km south of the central population's breeding grounds at Kunovat; there is some evidence to indicate that scattered pairs may breed in Russia to the west of the Ural Mountains, possibly between the Mezen and Pechora rivers (Meine and Archibald 1996).

THREATS The Siberian Crane suffers from a host of threats at many sites throughout its wide range. However, in Yakutia, conservation measures designed to protect it on the breeding grounds and during migration have been in operation for quite a long period and would appear to have eliminated the majority of factors causing unnatural mortality, although a number of new problems have emerged recently (Pshennikov *et al.* 1996).

Habitat loss and degradation *Russia* The breeding grounds of this species are remote and relatively undisturbed, but oil exploration and development pose a significant threat; oil has been discovered in and near the areas where the eastern population nests in Yakutia, and drilling rights have been granted on the Yamal peninsula near the Kunovat Nature Reserve, where the central population breeds (Meine and Archibald 1996). Until recently, intensive economic development in Chita, and the consequent steady loss of suitable habitat together

with increased disturbance, was considered to be a threat to the non-breeding birds that occur on migration and sometimes summer there; however, it now occurs in such small numbers that these factors no longer have the effect of limiting the population size (O. A. Goroshko *in litt.* 1997). *Mainland China* The greatest threat to the Siberian Crane on its migration staging grounds and wintering grounds in China are the loss and degradation of its habitats, or their inadequate management (Wang Qishan *in litt.* 1998, Archibald and Mirande 1999). The increasing human population, agricultural intensification and development of oilfields are reducing the availability of water, fish, reedbeds and other resources along the migratory route, and reclamation and overfishing in the lower Yangtze basin threaten the survival of many waterbird species (Wang Qishan *in litt.* 1998). Oil exploration and development pose a threat to crane habitat at several important wetlands in China, including Melmeg Nature Reserve in Jilin, Shuangtai Hekou Nature Reserve in Liaoning, at the mouth of the Yellow River and at Poyang Hu lake (Meine and Archibald 1996). Wetlands have been lost rapidly in the latter half of the twentieth century in the Yangtze basin (in Hunan, Hubei, Jiangxi, Anhui and Jiangsu provinces), where more than 12,000 km² of lakes and open water are reported to have been reclaimed since the late 1950s, and in the lower Yangtze basin the total area of lakes has been reported to have declined by 61.5% in c.30 years, from 17,198 km² in the 1950s to only 6,605 km² in the 1980s (Huang Baolin 1999). More than 1,100 lakes have been totally reclaimed, for example in Hubei province there were 1,066 lakes with a total surface area of 8,300 km² in the 1950s, but only 83 lakes with a total surface of 2,484 km² remained in the 1980s (Huang Baolin 1999). Drainage, reclamation and agricultural development have claimed major portions of the wintering grounds at Poyang Hu and Dongting Hu lakes (Meine and Archibald 1996). Reclamation for agriculture reduced the surface area of Poyang Hu lake by about one-fifth between 1954 and 1976, and in the 1970s 331 dykes were built there to convert 900 km² of marshland into farmland (Wu Jiangtian 1994). The surface area of Poyang Hu has been reduced from 5,000 km² to 3,600 km², and of Dongting lake from 4,350 km² to 2,740 km² (Huang Baolin 1999). The area of farmland in Jiangnan plain and Dongting lake area was c.8,660 km² in 1949, and the agricultural population about seven million, but the farmland area has now increased to c.15,300 km² and the population of farmers to 15 million (Huang Baolin 1999). Since aquatic plants depend on water quality, quantity and periodicity, river development projects pose additional serious concerns (J. Barzen *in litt.* 1999), and in December 1998 the water quality of Nan Hu (part of Poyang Hu lake), where over 800 Siberian Cranes were found, was found to be bad (Zeng Nanjing *et al.* 1999). The construction of the Three Gorges Dam on the Yangtze River will have a profound impact on the eastern population of Siberian Cranes, disrupting the hydrology of the floodplain wetlands along the middle Yangtze (including those at Poyang Hu lake) by artificially maintaining low water levels during the summer flood season and raising them in the winter (when the cranes are present) (Meine and Archibald 1996, Archibald and Mirande 1999). It has been predicted that the Three Gorges Dam will affect the wintering cranes at Poyang Hu Nature Reserve by reducing the availability of the roots and tubers of aquatic plants, leading to starvation in late winter and early spring, while high water levels resulting from the release of water from the dam in March may force the cranes to move closer to human settlements and make them more susceptible to mortality from poison baits (Liu Yunzhen *et al.* 1996). *India* At Keoladeo National Park maintenance of adequate water levels has been an acute problem, but measures undertaken since the early 1980s have reduced pressures to drain and utilise the wetlands, and management strategies have been adopted that maintain water supplies in a portion of the reserve for the benefit of the resident Sarus Cranes *Grus antigone* (Meine and Archibald 1996). The grass *Paspalum distichum* is encroaching upon some of the park's wetlands (Meine and Archibald 1996). The feeding efficiency of the cranes was adversely affected by changes in the habitat, such as water depth and vegetation (Vijayan 1991). For example, the normal duration of their digging bouts

varied from 4–8 seconds, but it increased to 25 seconds in 1985 when grass had overgrown the feeding habitats (Sauey 1985, Vijayan 1989; also Spitzer 1981).

Disturbance Russia During the spring migration of wild reindeer *Rangifer tarandus* and, especially, when domesticated reindeer are being driven, cranes are disturbed and forced to leave their nests, and the eggs can be destroyed by skuas or large gulls (Potapov and Flint 1987). In the Kunovat basin, crows pose a significant threat, destroying eggs when the cranes are disturbed by the approach of elks *Alces alces*, reindeer and other large animals (Meine and Archibald 1996). Logging practices also have a negative impact in the Kunovat region, as trees that are cut during the winter are hauled out by water after the spring thaw, and cranes that nest close to the rivers may abandon their nests (Meine and Archibald 1996). **Mainland China** Disturbance affects the eastern population at migration stopovers (e.g. Zhalong, Melmeg and Xianghai Nature Reserves) and on the wintering grounds, where the cranes at Poyang Hu lake are regularly disturbed by fishing, burning, grazing and other activities that take place within the reserve (Meine and Archibald 1996). The conservation authorities at Poyang Hu lake do not have the power to control land use and human activities inside the nature reserve, and fishermen can drain lakes in autumn (Wu Jingtian 1994). Dalianzi Hu lake, where over 500 birds have been found wintering, is drained for fishing every winter (Zeng Nanjing *et al.* 1999). **India** The wintering grounds of the central population at Keoladeo National Park are situated in one of India's most populated regions, and pressure from fishing, burning, firewood-cutting and other activities has risen in recent decades, although significant progress has been made in controlling and even eliminating these types of disturbance (Meine and Archibald 1996). Nevertheless, the few surviving individuals at Keoladeo National Park, Bharatpur, each winter are often disturbed by grass-cutters (over 300 of which are apparently present in the park on a daily basis) and possibly dogs (*Oriental Bird Club Bull.* 27 [1998]: 16–20).

Hunting and persecution Russia Illegal hunting is considered to be a threat to this species (V. A. Dugintsov *in litt.* 1997). In Yakutia, cranes were shot by poachers until relatively recently, but there are few if any cases nowadays (Pshennikov *et al.* 1996). In Chita, cranes of various species gather in cereal fields and damage the crops in the summer and especially in the autumn, and farmers have begun to shoot them; Siberian Cranes visit the fields less frequently than the other species, but they are still in real danger of being shot (O. A. Goroshko *in litt.* 1997). **Mainland China** A study of hunting pressure in the middle and lower basins of the Yangtze River in 1987–1992 estimated that c.50% of the total wintering waterfowl in this region were killed each year by local hunters, using netting, shooting and poisoning; the Siberian Crane was one of the quarry species found in hunters' bags during the study, but not one of the main targets of hunting (Lu Jianjian 1993a). A total of four birds were found killed at Poyang Hu lake (probably in the early 1990s), including at least one shot by hunters (Song Xiangjin *et al.* 1995). Mist-nets and poisons are used to catch birds there, and although no dead cranes were found in 1993, at least 10 out of the 500 Siberian and White-naped Cranes observed had injured legs, perhaps from entanglements with nets (Harris *et al.* 1995). **Pakistan** The traditional Wazir and Mahsud Pathan hunters of the Kurram valley have long been hunting and live-catching Demoiselle and Common Cranes (Roberts 1977), and such hunting in the Zhob district in North West Frontier Province (NWFP) may have unwittingly contributed to the decline in the central population (Landfried 1983). During interviews, the crane catchers in the Kurram Valley reported that Siberian Cranes were infrequently seen and, rarely, eaten (Landfried 1983). A hunter at Dowh Nalah, close to Bannu, also reported that he had seen the species in the area (Landfried 1983). The cranes are caught by teams of 5–15 men on dark stormy nights by throwing lead-weighted cords called "soiia" 25–30 m into the air at migrating cranes decoyed to the area by loudly calling caged cranes (Landfried 1983). By 1984, nearly 6,700 wild cranes were estimated to be in captivity in the NWFP (Landfried 1984). Given that the entire central population of Siberian Cranes is believed to migrate through Pakistan, this persecution is probably the most serious threat it faces (Landfried 1983), and crane hunting has been held

largely responsible for the central flock's 60% decline in the decade up to 1983 (Stewart 1987, Archibald and Landfried 1993). The increase in the human population in the Kurram valley in the last few decades has vastly expanded the number of potential hunters in the area (Landfried 1984). Crane hunting has become increasingly popular among tribals, and it has spread from Bannu to new areas in Zohab district of Baluchistan, and to remote areas near Dera Ismail Khan and to western Punjab along the Indus wetlands (Landfried 1983). These areas include the Zhob district, which lies on a direct line from Keoladeo National Park (Bharatpur) to Ab-i-Istada lake in Afghanistan, where the species rests for 2–3 weeks on migration (Archibald and Landfried 1993). *India* A juvenile was reported to have been shot at Keoladeo National Park (Bharatpur) in January 1973 (R. Lévêque *in litt.* 1999).

Poisoning and pesticides *Russia* In Yakutia, two migrating Siberian Cranes were found in a weakened state in October 1995, and soon died in captivity; their stomachs contained lead shot, which they had presumably ingested as grit, and the birds apparently died of lead poisoning (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997). In the tundra districts of Yakutia, 0.1–2.8% of the waterfowl examined contained lead shot, and in areas where hunting is most intensive the figure is much higher, at 3.0–28.8%; the concentration of lead shot in deposits on the bottom of water bodies is at its highest level in the Kolyma lowlands, reaching 196 pellets per 1 m² (Degtyarev 1991). *India* At Keoladeo National Park, air- and water-borne pollutants and pesticide use in adjacent areas are a problem (Meine and Archibald 1996).

Genetic and demographic factors The problems of the central and western populations are compounded by their low numbers, and they may be susceptible to problems associated with inbreeding, skewed sex or age structure, and increased risk through losses caused by catastrophic events (Meine and Archibald 1996).

MEASURES TAKEN **International cooperation** International conservation efforts for the Siberian Crane have expanded greatly since the 1970s, and attempts to establish a Siberian Crane Recovery Team (modelled on the team established for the Whooping Crane *Grus americana*) have been underway since 1992 (Meine and Archibald 1996). The satellite-tracking project has helped to initiate a network for the conservation of cranes in North-East Asia (Ichida 1994). This network was launched in 1997, with financial support from the Environment Agency of Japan: several of the important sites for Siberian Cranes (including Kytalyk Resource Reserve in Yakutia, Daursky Nature Reserve in Chita, Mongol Daguur Strictly Protected Area in Mongolia and Poyang Hu Nature Reserve in China) are listed as key sites in the North East Asian Crane Site Network; there are regular meetings and communications involving scientists and conservationists working for the protection of cranes throughout North-East Asia (SC). A GEF programme is being developed by the International Crane Foundation, in consultation with the Secretariat of the Convention on Migratory Species (CMS, Bonn Convention), for the conservation of the wetlands and migration corridors required by this species (J. Harris verbally 2000).

Legislation The Siberian Crane is listed on Appendix I of CITES, and on Appendix I of CMS (for which see Boere 1991). *Russia* It is included in the Russian Red Data Book (Kolosov 1983), and the Red Data Book of Yakutia (1987 and 1997 editions: N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997). *Mongolia* It is listed as a "Very Rare Animal" in the Mongolian Law on Hunting (1995), which means that it may be hunted or trapped only for research and with permission from the government, and it is prohibited to hunt, trap, or sell any parts for any other purposes. In the Mongolian Red Data Books, it is listed as Endangered (Bold 1987) and "Very Rare" (Bold 1997). *Mainland China* It is a Nationally Protected Species (First Class) in China (Zheng Guangmei and Wang Qishan 1998). *India* It is legally protected under India's Wildlife Protection Act of 1972 (Meine and Archibald 1996).

Protected areas *Russia* There are 13 federal and regional protected areas on the breeding grounds of the eastern population in north-east Yakutia, several of which are particularly

important for the conservation of this species, notably the Kytalyk Resource Reserve (formerly the Elon' and Khroma local sanctuaries), the Chaygurgino State Reserve and the Khroma State Reserve; these are estimated to support 767 Siberian Cranes (44.1–51.8% of the entire Yakutian population) (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997). Away from the main breeding area, Siberian Cranes are occasionally recorded on migration in and near the Ust'-Lenskiy State Reserve and the Ust' Vilyuyskiy and Ungra State Sanctuaries (Perfil'ev 1986). The migratory stopover at the Torey lakes is protected in the Daurisky Nature Reserve (O. A. Goroshko *in litt.* 1997). The breeding grounds of the central population are protected in the Kunovat Nature Reserve (Meine and Archibald 1996). The protection of the cranes in the Kunovat basin has also been improved by removing logging camps from the nesting grounds (UNEP/CMS 1999). *Mongolia* A migration stopover site of this species is protected in the Mongol Daguur Strictly Protected Area, part of the Dauria International Nature Reserve (Tseevenmyadag 1998). *Mainland China* Most of the important migration stopover sites in eastern China are inside protected areas, including Zhalong Nature Reserve in Heilongjiang, Melmeg and Xianghai Nature Reserves in Jilin, Shuangtai Hekou Nature Reserve in Liaoning and Yellow River Delta Nature Reserve in Shandong (Meine and Archibald 1996; see Distribution). The main wintering grounds of the eastern population have been protected in the Poyang Hu Nature Reserve in Jiangxi since 1983 (and as a National Nature Reserve since 1988), and the other wintering sites are also protected, in Shengjin Lake Nature Reserve in Anhui and Dong Dongting Hu Nature Reserve in Hunan (Wang Qishan *in litt.* 1998). *India* The traditional wintering grounds of the central population have been protected in Keoladeo National Park, Bharatpur, since 1981, which is now also a Ramsar site and World Heritage Site; there have been problems in the park caused by encroachment of the grass *Paspalum distichum* into the wetlands and pollution (see Threats), but efforts are being made to control the wetland vegetation and improve the habitat for the cranes (Vijayan 1991, Vijayan *et al.* 1993, Meine and Archibald 1996).

Research The migratory movements of this species have been studied using satellite-tracking (Kanai *et al.* 1997; see Meine and Archibald 1996). All three populations are counted on a regular basis on their wintering grounds (Meine and Archibald 1996; see Distribution and Population). *Russia* Numerous ground and aerial surveys have been conducted of the eastern breeding population in Yakutia (e.g. SCMPRS 1991; see Distribution). Extensive ecological and behavioural studies have been completed on the breeding grounds (Meine and Archibald 1996; see Ecology). In 1997 and 1998, sites between Kunovat to Tyumen' that had been identified during satellite-tracking studies were investigated (UNEP/CMS 1999). *Mainland China* Several ecological and behavioural studies have been completed on the wintering grounds (Meine and Archibald 1996; see Ecology). *India* Long-term ecological studies have been conducted at the traditional wintering grounds of the central population in Keoladeo National Park, focusing on habitat utilisation and feeding behaviour under changing ecological conditions during 1975–1977 (Sauey 1979, 1985) and 1984–1991 (Ali and Vijayan 1986, Vijayan and Vijayan 1987, 1989, *in press*, Vijayan 1991). A study of the ecology of the park from 1981–1990 greatly improved knowledge of this ecosystem, its major management problems and their possible solutions (Vijayan *et al.* 1993, Vijayan and Vijayan 1996).

Conservation education *Russia* A Siberian Crane Project (“Project Sterkh”) and Centre in Yamalo-Nenetsky have been established to raise public awareness near the breeding grounds of the central population, and crane information packets have been distributed to 50 schools, seminars have been organised for schools, a project booklet has been produced and a special school for ecology has been established (UNEP/CMS 1999). *Pakistan* In the areas where cranes are hunted in Pakistan, conservation efforts have entailed broad public awareness programmes, programmes targeted specifically at hunters, and training sessions for conservation officials (Meine and Archibald 1996). School programmes, teaching materials, four crane conservation clubs, lectures and slide shows have been organised to increase public

awareness, and three crane hunter associations have been formed to educate the hunters to protect the Siberian Cranes; communities at Lakki and Ghoriwala have offered voluntary protection to the Siberian Cranes, and the local community has helped enforce a two-year ban on hunting in Zhob (UNEP/CMS 1999). *India* Education and public awareness programmes have been organised, including the production and organisation of a calendar, school programme, crane booklet, monsoon bird video and “wetland week” (UNEP/CMS 1999). Postage stamps of Siberian Cranes in Pakistan and India, and mass media releases about the birds, have increased public awareness (Archibald and Mirande 1999).

Captive breeding and re-introduction Given that two of the three populations of this species are on the brink of extinction, the propagation and re-introduction of captive birds is considered to be critical for its survival (Meine and Archibald 1996). A captive breeding programme was therefore established in 1977, using eggs collected in Yakutia (Archibald and Mirande 1999). The first successful breeding of the species in captivity was at the International Crane Foundation (ICF) in 1981, and breeding efforts at ICF, at Vogelpark Walsrode in Germany and at the Oka State Nature Reserve in Russia had produced 111 chicks by the 1994 breeding season (Meine and Archibald 1996). There are now 91 birds in captivity in 11 zoos and breeding centres worldwide, and an international studbook is being maintained (Archibald and Mirande 1999). Captive-raised birds are now being released in an effort to maintain the central (Ob'/India) population and releases are also planned for the western (Tyumen'/Iran) population (Meine and Archibald 1996). Several release experiments were conducted from 1991 to 1998, including (a) the release of captive-reared chicks and (b) foster-rearing by wild Common Cranes *Grus grus* on the breeding grounds of the central population in the Kunovat basin, plus (c) the release of captive-reared chicks on the wintering grounds at Keoladeo National Park, but so far none of the released birds is known to have joined the wild Siberian Crane population (Meine and Archibald 1996, Archibald and Mirande 1999, UNEP/CMS 1999).

MEASURES PROPOSED ***International cooperation*** Efforts should be continued to establish an international Siberian Crane Recovery Team (Meine and Archibald 1996), and to improve exchange of information and technical expertise between the species's range states (UNEP/CMS 1999). The eastern population of Siberian Crane shares many conservation problems and priorities with the other migratory cranes of East Asia (Meine and Archibald 1996), including the threatened White-naped, Red-crowned and Hooded Cranes, and several of the measures proposed in this account and those for these other species (which see) will be of common benefit for them.

Protected areas and habitat management *Russia* The known breeding habitats of the central and eastern populations should be better protected by creating and/or upgrading protected areas in the Kunovat river basin and near Chokurdakh in Yakutia (Meine and Archibald 1996). Two of the existing protected areas on the breeding grounds in Yakutia should be enlarged: the Kytalyk Resource Reserve should be extended in the south to Kubalah and Alysardah lakes, and in the north-east to Russkoye Ustie settlement and the Indigirka river; the Chaygurgino State Reserve should be extended to include the right bank of the Alazeya river (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997, N. I. Germogenov *in litt.* 2000). Three new (lower status) reserves should be established in important breeding and passage areas, at Nizhneyansky (the eastern part of the Yana delta in Ust-Yana region and adjacent areas of the Yana-Indigirka lowlands to the borders of Allaikha region, an area of 24,750 km²), at Kuoluma (the northern part of the Aldan-Amga, within the boundaries of Ust-Maya, Tatta and Churapcha regions, an area of 9,900 km²) and at Chabda (in the Ust-Maya region, an area of 6,638 km²) (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997, N. I. Germogenov *in litt.* 2000). At the migratory stopovers in Chita, a new protected area should be created in the northern part of the Torey depression, on the Khila and Suduntuy rivers and around Nozhiy and Ekhe-Tsagan-Nor lakes, and the Daursky Nature Reserve should

be enlarged to include Khotogor bay at lake Barun-Torey (O. A. Goroshko *in litt.* 1997). Some fields of wheat could be sown especially for migratory cranes in protected areas in Chita, to help prevent damage to farmers' crops (O. A. Goroshko *in litt.* 1997).

Mainland China There is a need to protect additional migration stopovers in Heilongjiang and Jilin provinces, and between the Bohai bay and Poyang Hu lake (Meine and Archibald 1996; see Distribution). However, the key to the survival of the eastern population is the protection and appropriate management of the wintering grounds at Poyang Hu lake and other potentially suitable wetlands in the Yangtze basin. The conservation authorities at Poyang Hu lake currently do not have the power to control land use and human activities inside the nature reserve (Wu Jiangtian 1994), a fundamental anomaly that must be addressed. Ownership of the core area of the reserve should be transferred to the nature reserve management office and a development plan drafted for the reserve (Wu Jiangtian 1994, Liu Yunzhen *et al.* 1996); the core area should be enlarged (Liu Yunzhen *et al.* 1996) and the area of the nature reserve expanded (Liu Zhiyong and Zhao Jinsheng 1998). There is a need to improve enforcement of wildlife conservation laws and regulations in the reserve (Wu Jiangtian 1994, Liu Zhiyong and Zhao Jinsheng 1998), and for education of the general public to help prevent poaching (Liu Yunzhen *et al.* 1996). The water level of the lake should be artificially controlled (Liu Zhiyong and Zhao Jinsheng 1998): two different levels should be used (if necessary by legal enforcement) to maintain the wetland ecosystem at Poyang, a flooding cycle to submerge the grasslands under 17–18 m of water for 50–100 days, and then the maintenance of optimal water levels for feeding of Siberian Cranes and other waterbirds in the winter (Liu Yunzhen *et al.* 1996). The regulation of fishery practices should be improved in the reserve (Wu Jiangtian 1994), including the compensation of fishermen to prevent them from draining the lakes, regulation of the size of fish that can be taken, and the development of fish-farming (Liu Zhiyong and Zhao Jinsheng 1998). Artificial feeding of the cranes should be considered (Liu Zhiyong and Zhao Jinsheng 1998). Even if water levels are regulated as recommended above, it is likely that water levels on the wintering grounds will vary between years, so the long-term survival of the species will depend on the availability of alternative feeding areas; protection strategies must therefore ensure the continued availability of extensive wetland habitats with different hydrological characteristics, particularly through the protection of additional wetlands in the Poyang Hu lake complex (Harris *et al.* 1995). Following aerial surveys in 1998, Zeng Nanjing *et al.* (1999) proposed that the following sites at Poyang Hu should also be protected: Nan Hu lake in Yongxiu and Xingzi counties, Dalianzi Hu lake in Boyang county, Saicheng Hu lake in Jiujiang county and Tangyin in Duchang county.

The construction of the Three Gorges Dam will change the seasonal flow of water in the Yangtze River and inevitably affect, almost certainly negatively, the wetlands downstream (Iwabuchi *et al.* 1998). A coordinated programme is needed to monitor (a) the water levels and condition of the key wetlands in the Yangtze basin and (b) the numbers of waterbirds and the effects of habitat changes on their distribution and behaviour. The authorities responsible for the operation of the dam should be kept fully informed of the water flow required to maintain the conditions required by Siberian Cranes and other threatened species at Poyang Hu lake (see above) and elsewhere in the Yangtze basin, and alerted if there is a decline in the quality of these critically important wetlands that is related to the water flow in the river.

India It is necessary to maintain strong protection at the wintering grounds at Keoladeo National Park, through: continued efforts to minimise the effects of disturbance and drought; maintenance of consistent supplies of water from the rivers feeding the park; continued efforts to protect park resources against negative impacts from human use; continued controls on grazing by feral animals; and intensified efforts to reduce the spread of the grass *Paspalum distichum* and to provide areas of open water (Vijayan 1991, Meine and Archibald 1996).

Research Russia Efforts should continue to locate the breeding grounds of the western population through satellite-tracking studies and aerial surveys, and these techniques should

also be used to identify more precisely the migration corridors, important staging and stopover areas and wintering grounds of all three populations (Meine and Archibald 1996). Further international scientific studies should be conducted on the breeding grounds and at stopover sites, to improve the scientific basis for the conservation of the species (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997). The research that is required includes a monitoring programme of its population demography, habitat mapping, local aerial counts and investigation of the spring migration of first-year birds by satellite-tracking (N. I. Germogenov *in litt.* 2000). The status of habitat in crucial breeding, staging and wintering areas should be monitored through aerial surveys and remote sensing (Meine and Archibald 1996). There should be widespread investigations in north-east and central Yakutia, to identify which wetlands are polluted with lead shot, and hence evaluate the level of threat posed by lead poisoning and the measures required to counter this problem (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997). *Mainland China* Recommendations on monitoring the wetlands and bird populations below the Three Gorges Dam are made above. Surveys should be conducted to investigate the reports of this species from Xinjiang in winter, which if true are likely to involve birds from the central population (but see Remarks 2). *India* The ecosystem at Keoladeo National Park should continue to be monitored, to keep track of any habitat changes and their effects on this (and other threatened) species (Vijayan 1995a,b). Comprehensive land surveys should be conducted in India to identify alternative existing and potential wintering sites of the central population outside Keoladeo National Park (Meine and Archibald 1996). The Siberian Crane was historically recorded from many localities in the northern Indian subcontinent (Sauey *et al.* 1987, Singh *et al.* 1987; see Distribution); the fact that birds returned to Keoladeo National Park after an absence of two years indicates that they must have been using one or more of these historical sites, or perhaps sites where their presence has never been documented. There is a small but real possibility that significant numbers winter away from Keoladeo National Park, and that the decline in the central population has not been as severe as is feared.

Conservation education *Russia* Campaigns are required to improve public awareness of this species and its requirements, for example in Chita, where a programme of ecological education is recommended for the people who live in areas where the cranes occur regularly (O. A. Goroshko *in litt.* 1997). Measures should be taken to reduce mortality from lead poisoning in and near to the breeding grounds (N. I. Germogenov, A. G. Degtyarev and Yu. V. Labutin *in litt.* 1997), presumably including the promotion of the use of alternatives to lead shot and enforcement of legislation to reduce levels of hunting at critical sites.

Captive breeding and re-introduction It has been proposed that the western and central populations should be bolstered with the release of 10–20 captive-reared Siberian Cranes annually, until mortality is reduced and each population reaches 100 birds (Archibald and Mirande 1999).

REMARKS (1) The Siberian Crane is a relatively distinctive species which was formerly considered congeneric with an African species, the Wattled Crane *Bugeranus carunculatus*, although an alternative proposal is that it should be placed in a separate monospecific genus, *Sarcogeranus* (del Hoyo *et al.* 1996). (2) The records from Korgas require confirmation (and checking to ensure that they are not a transcription error of records of another crane species), as they suggest that birds from the extremely small central flyway population may winter in Xinjiang (SC). However, the area is extremely cold and inhospitable in winter (Ma Ming verbally 2000).