

# Threatened Birds of Asia:

## The BirdLife International Red Data Book

Editors

N. J. COLLAR (Editor-in-chief),  
A. V. ANDREEV, S. CHAN, M. J. CROSBY, S. SUBRAMANYA and J. A. TOBIAS

Maps by

RUDYANTO and M. J. CROSBY

Principal compilers and data contributors

■ **BANGLADESH** P. Thompson ■ **BHUTAN** R. Pradhan; C. Inskipp, T. Inskipp ■ **CAMBODIA** Sun Huan; C. M. Poole ■ **CHINA** ■ **MAINLAND CHINA** Zheng Guangmei; Ding Changqing, Gao Wei, Gao Yuren, Li Fulai, Liu Naifa, Ma Zhijun, the late Tan Yaokuang, Wang Qishan, Xu Weishu, Yang Lan, Yu Zhiwei, Zhang Zhengwang. ■ **HONG KONG** Hong Kong Bird Watching Society (BirdLife Affiliate); H. F. Cheung; F. N. Y. Lock, C. K. W. Ma, Y. T. Yu. ■ **TAIWAN** Wild Bird Federation of Taiwan (BirdLife Partner); L. Liu Severinghaus; Chang Chin-lung, Chiang Ming-liang, Fang Woei-horng, Ho Yi-hsian, Hwang Kwang-yin, Lin Wei-yuan, Lin Wen-horn, Lo Hung-ren, Sha Chian-chung, Yau Cheng-teh. ■ **INDIA** Bombay Natural History Society (BirdLife Partner Designate) and Sálím Ali Centre for Ornithology and Natural History; L. Vijayan and V. S. Vijayan; S. Balachandran, R. Bhargava, P. C. Bhattacharjee, S. Bhupathy, A. Chaudhury, P. Gole, S. A. Hussain, R. Kaul, U. Lachungpa, R. Naroji, S. Pandey, A. Pittie, V. Prakash, A. Rahmani, P. Saikia, R. Sankaran, P. Singh, R. Sugathan, Zafar-ul Islam ■ **INDONESIA** BirdLife International Indonesia Country Programme; Ria Saryanthi; D. Agista, S. van Balen, Y. Cahyadin, R. F. A. Grimmett, F. R. Lambert, M. Poulsen, Rudyanto, I. Setiawan, C. Trainor ■ **JAPAN** Wild Bird Society of Japan (BirdLife Partner); Y. Fujimaki; Y. Kanai, H. Morioka, K. Ono, H. Uchida, M. Ueta, N. Yanagisawa ■ **KOREA** ■ **NORTH KOREA** Pak U-il; Chong Jong-ryol, Rim Chuyon. ■ **SOUTH KOREA** Lee Woo-shin; Han Sang-hoon, Kim Jin-han, Lee Ki-sup, Park Jin-young ■ **LAOS** K. Khounbolin; W. J. Duckworth ■ **MALAYSIA** Malaysian Nature Society (BirdLife Partner); K. Kumar; G. Noramly, M. J. Kohler ■ **MONGOLIA** D. Batdelger; A. Bräunlich, N. Tseveenmyadag ■ **MYANMAR** Khin Ma Ma Thwin ■ **NEPAL** Bird Conservation Nepal (BirdLife Affiliate); H. S. Baral; C. Inskipp, T. P. Inskipp ■ **PAKISTAN** Ornithological Society of Pakistan (BirdLife Affiliate) ■ **PHILIPPINES** Haribon Foundation for Conservation of Natural Resources (BirdLife Partner); N. A. D. Mallari, B. R. Tabaranza, Jr. ■ **RUSSIA** Russian Bird Conservation Union (BirdLife Partner Designate); A. V. Andreev; A. G. Degtyarev, V. G. Degtyarev, V. A. Dugintsov, N. N. Gerasimov, Yu. N. Gerasimov, N. I. Germogenov, O. A. Goroshko, A. V. Kondrat'ev, Yu. V. Labutin, N. M. Litvinenko, Yu. N. Nazarov, V. A. Nechaev, V. I. Perfil'ev, R. V. Ryabtsev, Yu. V. Shibaev, S. G. Surmach, E. E. Tkachenko, O. P. Val'chuk, B. A. Voronov. ■ **SINGAPORE** The Nature Society (Singapore) (BirdLife Partner); Lim Kim Seng ■ **SRI LANKA** Field Ornithology Group of Sri Lanka (BirdLife Affiliate); S. Kotagama; S. Aryaprema, S. Corea, J. P. G. Jones, U. Fernando, R. Perera, M. Siriwardhane, K. Weerakoon ■ **THAILAND** Bird Conservation Society of Thailand (BirdLife Partner); U. Treesucon; R. Jugmongkol, V. Kongthong, P. Poonswad, P. D. Round, S. Supparatvirkorn ■ **VIETNAM** BirdLife International Vietnam Country Programme; Nguyen Cu; J. C. Eames, A. W. Tordoff, Le Trong Trai, Nguyen Duc Tu.

With contributions from: S. H. M. Butchart, D. S. Butler (maps), P. Davidson, J. C. Lowen, G. C. L. Dutson, N. B. Peet, T. Vetta (maps), J. M. Villasper (maps), M. G. Wilson

**Recommended citation**

BirdLife International (2001) *Threatened birds of Asia: the BirdLife International Red Data Book*. Cambridge, UK: BirdLife International.

© 2001 BirdLife International

Wellbrook Court, Girton Road, Cambridge, CB3 0NA, United Kingdom

Tel: +44 1223 277318 Fax: +44 1223 277200 Email: [birdlife@birdlife.org.uk](mailto:birdlife@birdlife.org.uk)

Internet: [www.birdlife.net](http://www.birdlife.net)

BirdLife International is a UK-registered charity

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, electrical, chemical, mechanical, optical, photocopying, recording or otherwise, without prior permission of the publisher.

ISBN 0 946888 42 6 (Part A)

ISBN 0 946888 43 4 (Part B)

ISBN 0 946888 44 2 (Set)

British Library-in-Publication Data

A catalogue record for this book is available from the British Library

First published 2001 by BirdLife International

Designed and produced by the **Nature**Bureau, 36 Kingfisher Court, Hambridge Road, Newbury, Berkshire RG14 5SJ, United Kingdom

Available from the Natural History Book Service Ltd, 2–3 Wills Road, Totnes, Devon TQ9 5XN, UK. Tel: +44 1803 865913 Fax: +44 1803 865280 Email [nhbs@nhbs.co.uk](mailto:nhbs@nhbs.co.uk)  
Internet: [www.nhbs.com/services/birdlife.html](http://www.nhbs.com/services/birdlife.html)

The presentation of material in this book and the geographical designations employed do not imply the expression of any opinion whatsoever on the part of BirdLife International concerning the legal status of any country, territory or area, or concerning the delimitation of its frontiers or boundaries.

## RED-CROWNED CRANE

### *Grus japonensis*

Critical  —

Endangered  C1

Vulnerable  A2c,d,e

*This crane qualifies as Endangered because it has a very small, declining population as a result of loss and degradation of wetlands through conversion to agriculture and industrial development.*



**DISTRIBUTION** The Red-crowned Crane is endemic to North-East Asia, where it has a migratory continental population and a resident population in Japan. The main breeding grounds of the continental population are in the wetlands in the Amur and Ussuri river watersheds near to the border between Russia and mainland China, as far west as the Zeya valley in Amur and north to Lake Bolon' in Khabarovsk. It also nests further west in north-east China almost to the border with Mongolia (but it is not currently known to breed in Mongolia), and there is an isolated southern breeding ground at Shuangtai Hekou Nature Reserve in Liaoning. The continental population migrates down the Korean Peninsula and the east Chinese coast to wintering grounds in North Korea, South Korea and eastern China, and there are a few records of migrant birds in Mongolia and a single record from Taiwan. The resident population breeds in eastern Hokkaido in Japan and on the southern Kuril islands, and remains in eastern Hokkaido during the winter.

■ **RUSSIA** In eastern Russia, the species has been recorded as a breeding summer visitor (and on migration) in Chita, Khabarovsk, Amur, Jewish Autonomous Region, Primorye, Sakhalin island and the Kuril islands. It is extinct on Sakhalin as a breeding species, but it still occurs there as a rare visitor on passage (Nechaev 1991). Its range was always naturally patchy because of its specialised habitat requirements, but many breeding sites have been lost as a result of man-made changes to the landscape, and it is now confined to a number of isolated areas which are separated by tens or even hundreds of kilometres (AVA). Records (by province) are as follows:

■ **Chita** Argun river, near **Kaylastuy** village, one breeding pair in the early 1990s (Golovushkin and Goroshko 1995); unspecified localities in "south-western Transbaykalia", 12 non-breeding birds, summer 1989, seven birds, summer 1990, one, summer 1991 (Golovushkin and Goroshko 1995);

■ **Khabarovsk** lower **Kharpi river**, 20 km from its mouth, Lake Bolon' basin, family party of two adults and juveniles, undated (Shibaev 1982); **Kharpi river mouth**, Lake Bolon' basin, groups of four and six (including two juveniles), September 1980, on the lakeshore and in sedge-grass meadows (Smirenskiy and Roslyakov 1982); lower Simmi river, shore of **Al'bite lake**, Lake Bolon' basin, three adults, September 1981, in sedge-grass meadows (B. A. Voronov *in litt.* 1997); **Simmi river**, Lake Bolon' basin, in and/or near to the Simmi Sanctuary, two pairs on the Kirpu stream, 30 km upstream from the mouth of the Simmi river, September 1980, in damp and marshy meadows with tall grassy vegetation (Shibaev 1982, Smirenskiy and Roslyakov 1982), two pairs on the left bank of the Simmi river, 1–3 km below its confluence with the Kirpu stream, September 1981, in marshy meadows (B. A. Voronov *in litt.* 1997), two pairs with two chicks each on the middle reaches of the Simmi river, 25 km upstream of the confluence of the Sel'gon river with the Simmi river, September–October 1980 (Smirenskiy and Roslyakov 1982), one pair on the left bank of the Simmi river, near the mouth of the Vakhtar stream, September 1980, in a grassy marsh (Shibaev 1982); right bank of the **Ukur**

**river**, 3 km from its confluence with the Simmi river, Lake Bolon' basin, two pairs, September 1980, in a grassy marsh (Shibaev 1982); near **Pervoye lake** (Pervoe lake), 2 km from the left bank of the Amur, opposite Naykhin settlement, Nanayskiy district, one pair, May 1981, in a sedge-grass meadow (B. A. Voronov *in litt.* 1997); Kur river valley, near **Novokurovka** village, one pair, April 1979, in a sedge-grass meadow (Smirenskiy and Roslyakov 1982); lower **Ul'ika river**, pair and two chicks, June 1979, in a grassy marsh (Smirenskiy and Roslyakov 1982); around the **Urmi river mouth**, near lake Urginoe, rare breeder, two birds, September 1981, in sedge-grass marshes (Shibaev 1982); near **Vyazemskiy** (Vyazemskaya) station, Vyazemskiy district, rare, two birds, September 1979, in damp grass-herbs meadows (Smirenskiy and Roslyakov 1982); middle reaches of the **Khor river**, Lazo district, one pair, May–June 1979 (Smirenskiy and Roslyakov 1982);

■ **Amur** Ogoron–Dep col, near **Ogoron lake**, northern upper Amur region, six pairs, June–July 1978, on bogs sparsely wooded with larch (V. A. Dugintsov *in litt.* 1997), single pair in 1979 (Ilyashenko 1982); **Tynda river mouth**, northern upper Amur region, one pair, July 1979, probably breeding (V. A. Dugintsov *in litt.* 1997), reported in 1980 at other sites by Ilyashenko (1982), but none seen there subsequently (V. A. Dugintsov *in litt.* 1997); **Norsky Nature Reserve**, between Nora and Selemdzha river, occasionally in summer (unspecified years) (Darman 1995); lower **Ushmyr river** and Orlovka river, northern upper Amur region, one pair, spring 1977, and one seen subsequently while the other member of the pair was probably on the nest, local people reporting that this species had bred regularly for a number of years in succession (Dymin *et al.* 1977); lower **Ul'ma river**, northern upper Amur region, total of four nests with incubating birds, and a further 10 birds (four pairs and two singletons) for which nesting was not confirmed, found during a survey of the valleys of the rivers Tom', Tashina, Aleun, Bol'shoy Maykur, Ul'ma, Girbichek and Birma, with the main concentration on the lower Ul'ma river, the actual number of the cranes breeding in this area presumably being considerably higher (Flint and Smirenskiy 1977); **Ulminski Wildlife Reserve**, four breeding pairs in 1986 (data *per* AVA); right bank of the Tom' river, at the mouth of the **Tashina river**, one pair nesting in 1975–1976 (Pan'kin 1981), 11 pairs in 1986, not all of them breeding (data *per* AVA); **Bol'shaya Kungul' river** (Bol'shoi Kungul'), two pairs, June 1975 (Efremov and Pan'kin 1977); near **Semiozerka** village, Ivanovskiy district, lower Zeya river, reported by shepherds to be present every year on marshy meadows near the village, with their numbers increasing to 5–7 by the autumn (Efremov and Pan'kin 1977); lake near **Lazarevka** village, four birds, August 1977 (Pan'kin 1981); **Gribskoye** village, Zeya river floodplain, Blagoveshchenskiy district, two breeding pairs in 1986 (Pan'kin and Dugintsov 1988); **Nizhiaya Tambovka** village, nesting pair in 1957 (Baranchev 1959); near **Innokent'evka** village, recorded nesting and on migration in 1968 (Pan'kin and Neufeldt 1976b); **Lebedinoe lake**, near Kuropatkino village, four birds, August 1978 (Pan'kin 1981); **Murav'evski Wildlife Refuge**, Amur valley, c.30 km from Blagoveshchensk, two breeding pairs in 1986 (data *per* AVA); Amurski Wildlife Refuge, around **Nizhenpoltavka** (Nizhniya Poltavka) village, c.50 km from Blagoveshchensk, nesting irregularly in 1974–1977 (Smirenskiy 1980), two single birds, May and July 1977, possibly breeding (Smirenskiy and Roslyakov 1982), 1–2 nesting pairs in 1985–1986 (data *per* AVA); near **Poyarkovo** village, in 1970, breeding on an island in the Amur river (V. A. Dugintsov *in litt.* 1997); lower reaches of the **Bureya river**, in the Bureya–Arkhar lowlands, eight pairs nesting in bogs with a total area of c.162 km<sup>2</sup> in 1975 and 8–12 non-breeding birds also present, with about the same number returning in 1976 (Vinter 1977), up to five nesting pairs annually, and an additional c.5 pairs on adjacent islands in the Amur river main channel (V. A. Dugintsov *in litt.* 1997); **Ukraina** village, Arkhara lowland, Amur floodplain, one brood in 1965, four pairs (two nesting successfully) in May 1969, four pairs (one nesting successfully) in 1970 (Pan'kin and Neufeldt 1976b); Bureya–Khingan wetlands, **Khinganskiy Nature Reserve**, 10–15 breeding pairs annually in 1960–1975, only 4–6 pairs in 1976–1978 (Pan'kin and Neufeldt 1976b, Pan'kin 1981), aerial censuses in 1984 locating 23 pairs with nests and 18 non-breeding birds in May,

24 cranes including three families in July, and 98 birds including 19 pairs in September (Andronov and Smirenskiy 1985), 30 nesting pairs in 1985 and 34 pairs in 1986 (data *per* AVA); **Kalinino** village, one breeding pair in 1976 (Smirenskiy and Roslyakov 1982); near **Krasnyy Luch** (Krasny Luch) village, recorded nesting and on migration in 1968 (Pan'kin and Neufeldt 1976b); near **Kasatkino** village, Arkhara lowlands, Amur floodplain, 2–3 pairs nesting in 1956–1957 (Pan'kin and Neufeldt 1976b), nesting irregularly in 1974–1977 (Smirenskiy 1980); **Ganukan Game Reserve**, c.100 birds breed here and in Khinganskiy Nature Reserve (V. Andronov *in litt.* 1997); near **Sagibovo** village, Arkhara lowlands, Amur floodplain, 2–3 pairs nesting in 1956–1957 (Pan'kin and Neufeldt 1976b), nesting irregularly in 1974–1977 (Smirenskiy 1980); between the Bureya river and the **Mutnaya river**, 13 adults, July 1972 (V. A. Dugintsov *in litt.* 1997); near the lower **Uril river**, Arkhara lowlands, Amur floodplain, 2–3 pairs nesting in 1956–1957 (Pan'kin and Neufeldt 1976b);

■ **Jewish Autonomous Region Bol'shaya Pad'**, Amur valley 90 km above Khabarovsk, Smidovichskiy district, rare breeding bird, one pair, September 1981, in a damp grass-reed meadow (Shibaev 1982); **Bidzhan river** basin, Bol'shoy Taymen' river valley, 15 km from its mouth, Bluchenskiy district, rare, one pair, September 1981, in a sedge-grass marsh (Shibaev 1982);

■ **Primorye Bikin-Alchanskaya marr**, between the lower Bikin and Alchan rivers, right-bank tributaries of the Ussuri river, regularly nesting, with 2–3 pairs seen and one nest found, May 1981 (Shibnev 1982), three birds, July 1990, but none found in May–June 1997 (Mikhailov and Shibnev 1998); lower **Iman river** (Bol'shaya Ussurka), right-bank tributary of the Ussuri river, two breeding pairs with one chick, July 1986 (Shibaev and Glushchenko 1988), single pairs nesting irregularly (Yu. V. Shibaev *in litt.* 1997); right bank of the **Sungacha river** (Sungach river), north-east Lake Khanka lowlands, several pairs regularly nesting (Przheval'skiy 1877–1878, Shibaev 1982, Glushchenko and Shibaev 1996), six birds, spring 1978 (Shibaev and Glushchenko 1982), five breeding pairs with seven chicks and three non-breeding pairs, July 1986 (Shibaev and Glushchenko 1988); **Khanka Nature Reserve**, a breeding ground for c.55 birds, and a migration stopover (V. Andronov *in litt.* 1997); **Komissarovo river mouth** (Komissarovka river mouth), breeding in the nineteenth century, but no longer (Shibaev 1982); marshlands on the eastern shore of Lake Khanka, including the **Gnilye lakes**, the species's main nesting area in Primorye, 49–54 birds in spring and 45–57 in summer 1978 (Shibaev and Glushchenko 1982), with (in 1986) 13 territorial pairs and 47 non-breeding birds in May, 12 pairs with 15 chicks and 42 non-breeding birds in July, 56 migratory birds, including seven juveniles and seven subadults in two flocks in October (Shibaev and Glushchenko 1988); **Razdol'naya river mouth**, breeding in the nineteenth century, but no longer (Shibaev 1982); **Mel'gunovka river mouth**, breeding in the nineteenth century, but no longer (Shibaev 1982); near the **Lefu river mouth**, Lake Khanka lowlands, breeding regularly in small numbers, with 18 birds in spring and three in summer 1978 (Shibaev and Glushchenko 1982), one breeding pair and 4–6 non-breeding birds in May–July 1986 (Shibaev and Glushchenko 1988); **Kedrovaya Pad' Nature Reserve**, 24–54 birds seen annually in October–November in 1981–1986, also moving through the area in spring but then less conspicuous (Shibnev 1988); **Melkovodnaya bay**, next to Kedrovaya Pad' Nature Reserve, Peter the Great bay coastal wetlands, flocks occurring regularly on migration (Shibaev and Surmach 1994, Shibaev 1996); between the Tumen river mouth (Tumangan river) and **Vudunupty bay**, c.20 km east of Khasan settlement, 23–50 birds regularly on passage in March in 1980–1985 (Gafitski 1988); **Khasan plain**, near Melkovodnaya bay, important migration stopover for this species (Shibaev and Surmach 1994); **Tumen river** (Tumangan) wetlands, marshy plain at the junction of the Russian, Chinese and North Korean borders, Peter the Great bay coastal wetlands, where a non-migratory population formerly bred (Shul'pin 1936, G. Archibald *in litt.* 1999), currently a regular migrant, staying for up to a month in spring (Shul'pin 1936, Shibaev 1975, Litvinenko 1982), at the Tumen estuary, 112 birds in 1988, 87 in 1989 and 55 in 1990 (Wu Zhigang and Yang Xingjia 1995);

■ **Sakhalin Pionery islands** (Khabomai islands), single birds in 1970–1971 (Shibaev 1982), at least two pairs nesting from 1974 to 1985, sometimes remaining to winter (Shibaev 1982, Grigoriev 1988); **Gornozaodsk** (“Ranhaku”) village, near Gornozaodsk, south-western Sakhalin, 4–5 records on migration, undated (Takahashi 1937; see also Population: Russia);

■ **Kuril islands Kunashir island**, early 1970s (Shibaev 1982), probably two nesting pairs in 1974, with nests reported in 1982, 1984 and 1986 (Nechaev and Kurenkov 1987, Ilyashenko 1988); **Shibotsu island**, undated (OSJ 2000); **Yuri island**, undated (OSJ 2000).

■ **MONGOLIA** There was at least one nesting record (at an unspecified locality) in Mongolia in the 1920s (Meine and Archibald 1996), but it is now a very rare non-breeding visitor to the east of the country, with records (by province) as follows: ■ **Dornod Khalkhgol** (Khalhyn Gol, Khalka) river, one pair, September 1967 (Bold *et al.* 1995); small wetland 1 km west of the **Kerulen river** (Kherlen Gol), one adult, May 1999 (C. Ketzenberg *per* A. Bräunlich *in litt.* 2000); unspecified locality, one, summer 2000 (A. Bräunlich *in litt.* 2000).

■ **JAPAN** The Red-crowned Crane was apparently a not uncommon breeding bird throughout Japan in feudal times, but it was wiped out almost everywhere in the late nineteenth century (Austin and Kuroda 1953), and it is now only found regularly in eastern Hokkaido, with occasional records elsewhere on Hokkaido and on Honshu, Shikoku and Kyushu. On Hokkaido it inhabits six areas—Tokachi, Kushiro marshes, the Bekanbeushi river, Kiritappu marshes, Furen-ko lake and Notsuke peninsula—the western and southern limits of its range being the Toberi river in Tokachi district, and the northern limit near the Shibetsu river (Masatomi 1993). In winter, the cranes mainly concentrate at three major feeding grounds in Kushiro district—Akan, Nakasetsuri and Shimosetsuri (c.90% of the population)—but smaller numbers winter at scattered feeding stations elsewhere in eastern Hokkaido (Masatomi *et al.* 1995, 1997). Records (by island and prefecture) are as follows:

**Hokkaido Noshappu cape**, Wakkanai-shi, subadult, May 1998, the first record for Wakkanai (Harada 1999); **Onbetsu-gawa** river, Tokachi, a wintering ground, c.25 birds (including four young birds), winter 1986–1987, probably local breeding birds (Masatomi 1988), the wintering population increasing to 62 birds (including five juveniles) in 1996–1997, the fourth largest winter feeding ground in Hokkaido (Masatomi *et al.* 1997); **Kitami**, two birds, September 1926 and September 1937 (Austin and Kuroda 1953); **Notsuke peninsula**, Nemuro, eight breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), 10 breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Naka-shibetsu**, two birds, February 1993 (Masatomi *et al.* 1995), two in February 1996 and February 1997 (Masatomi *et al.* 1997); Mochida Sanctuary, **Nemuro**, one breeding pair which winters at Tsurui-Ito Sanctuary (Kamata and Tomioka 1994); **Nemuro peninsula**, Nemuro, five breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), seven breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Furen-ko** lake, Nemuro, 30 breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), 44 breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Shibeche** (Minamishibeche), three birds, February 1997 (Masatomi *et al.* 1997); **Akan-cho**, Kushiro, a major winter feeding ground, with c.110–120 birds (including c.15 young birds) wintering in the mid-1980s (Masatomi 1988), 120–163 birds in 1993–1997 (Masatomi *et al.* 1995, 1997); **Chobushi-ko** lake, Tokachi, one breeding record in 1984 (WBSJ Tokachi Chapter 1987); **Tsurui-mura**, Kushiro, a major winter feeding ground, with 394 birds in winter 1999, and the Hororo-gawa river, upstream of Setsuri bridge, a minor roosting site, not used in October–November 1998, but 2–6 birds seen from December 1998 to March 1999, their numbers increasing to a maximum of 33 birds later in March 1999 (probably because the river was frozen in midwinter) (Harada 1999); **Naka-setsuri**, Kushiro, a major winter feeding ground, with 136–247 birds in 1993–1997 (Masatomi *et al.* 1995, 1997); **Nakachambetsu**, three birds, February 1994 (Masatomi *et al.* 1995), three, February 1996, two, February 1997 (Masatomi *et al.* 1997); **Nakahororo**, two in February 1993 and February 1994 (Masatomi *et*

*al.* 1995), three at Nakahororo Junior Highschool, February 1997 (Masatomi *et al.* 1997); **Shimo-setsuri**, Kushiro, a major winter feeding ground, with 140–189 birds in 1993–1997 (Masatomi *et al.* 1995, 1997); **Shimo-teshibetsu**, two birds, February 1997 (Masatomi *et al.* 1997); **Ninishibetsu**, two birds, February 1994 (Masatomi *et al.* 1995), three, February 1997 (Masatomi *et al.* 1997); **Shitakara-gawa** river, six birds, February 1993 (Masatomi *et al.* 1995); **Kiritappu marsh**, Kushiro, 10 breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), 14 breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Akkeshi lake** and **Bekanbeushi marsh**, Kushiro, 15 breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), 24 breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Mochirippu-numa** lake, two birds in February 1993 and February 1994 (Masatomi *et al.* 1995); **Tokachi**, at Kimonto-numa lake, 1–2 breeding pairs regularly since 1973, maximum of three pairs in 1977 (Iijima and Yamada 1983), one breeding record at Horokayanto-numa lake in 1980 (WBSJ Tokachi Chapter 1987); **Kushiro marsh**, Kushiro, 28 breeding pairs estimated during an aerial survey in 1985 (Masatomi *et al.* 1986), 49 breeding pairs estimated in 1994 (Masatomi *et al.* 1994); **Sapporo**, collected, undated (Austin and Kuroda 1953); **Charo-gawa** river, two birds, February 1994 (Masatomi *et al.* 1995); **Chitose**, collected in 1876 (Austin and Kuroda 1953); **Otsu marsh**, Toyokoro-cho, Tokachi, one breeding pair regularly since 1972 (WBSJ Tokachi Chapter 1987); **Iburi**, collected, undated (Austin and Kuroda 1953; also Wildlife Information Center, Hokkaido 1985); **Yudo-numa** lake, Tokachi, one or two breeding pairs in some years (WBSJ Tokachi Chapter 1987); **Oikamanae-numa** lake, Tokachi, one pair occasionally breeding prior to 1987 (WBSJ Tokachi Chapter 1987); **Toberi marsh**, Tokachi, one pair breeding regularly in the marsh at the Toberi-gawa river mouth since 1971 (Iijima and Yamada 1983); **Taiki-cho**, Tokachi, a breeding area, first seen in 1953 and recorded annually from 1965, usually present from April–December when the area is not covered with snow (the birds probably winter in Kushiro), up to 15 found in 1969–1982 (Iijima and Yamada 1983); **Horobetsu-gawa** river, four birds, February 1994 (Masatomi *et al.* 1995); **Futaoki** (untraced), three birds, February 1997 (Masatomi *et al.* 1997); **Kayanuma** (untraced), five birds, February 1993, three, February 1994 (Masatomi *et al.* 1995), 10, February 1996, two, February 1997 (Masatomi *et al.* 1997); **Kayanuma station** (untraced), two birds, February 1994 (Masatomi *et al.* 1995); **Shimochanbetsu** (untraced), three birds, February 1993 (Masatomi *et al.* 1995), three in February 1996 and February 1997 (Masatomi *et al.* 1997); **Shimohororo** (untraced), two birds, February 1994 (Masatomi *et al.* 1995); **Shimokuchoro** (untraced), six birds, February 1997 (Masatomi *et al.* 1997);

**Honshu** ■ **Aomori** unspecified localities, undated (OSJ 2000); ■ **Iwate Hei-gawa** river, Miyako-shi, March 1994 (WBSJ Miyako Chapter database); unspecified localities, single bird from May 1974 to April 1975, probably the same individual as seen elsewhere in northern Honshu at this time (Masatomi 1984); ■ **Miyagi** unspecified localities, one collected from a flock of five, March 1922 (Kumagai 1928 in Austin and Kuroda 1953), single bird from May 1974 to April 1975, probably the same individual as seen elsewhere in northern Honshu at this time (Masatomi 1984); ■ **Akita Yuzawa-shi**, one bird, December 1993 to February 1994 (WBSJ 1994); ■ **Fukushima Kooriyama-shi**, one bird in 1929 or 1949 (Masatomi 1984); ■ **Ibaraki Sakuragawa-mura**, Inashiki-gun, one in April 1992 (WBSJ 1992); ■ **Hasaki-machi**, Kashima-gun, one in April 1992 (WBSJ 1992); ■ **Tochigi Nikko**, Oze, two birds in summer 1929 (Masatomi 1984); unspecified localities, single bird from May 1974 to April 1975, probably the same individual as seen elsewhere in northern Honshu at this time (Masatomi 1984); ■ **Gunma** unspecified localities, single bird from May 1974 to April 1975, probably the same individual as seen elsewhere in northern Honshu at this time (Masatomi 1984); ■ **Saitama** unspecified localities, undated (OSJ 2000); ■ **Chiba Tone-gawa** river, Inba-gun, one in April 1976 (Masatomi 1984); ■ **Tokyo Tama-gawa** river, one in March 1962, possibly an escape from captivity (Masatomi 1984); ■ **Niigata Sado island**, recorded in 1947 and from December 1974 to March 1975 (Masatomi 1984); **Yoita-machi** (not mapped), Santo-gun, unconfirmed

report in 1935 (Masatomi 1984); **Kubiki**, Joetsu area, one in rice paddies, December 1984 (Nakamura 1994); ■ **Ishikawa Kahoku-gata**, six birds, March 1929 (Masatomi 1984); ■ **Fukui Kugushi-ko** lake, Mihama-cho, one in November 1969 to December 1970 (Masatomi 1984); **Tsuruga-shi**, one in November 1973 (Masatomi 1984); ■ **Nagano** unspecified localities, undated (OSJ 2000); ■ **Shiga Echi-gun**, January 1943 (Masatomi 1984); ■ **Kyoto Takeno-gun**, single birds in December 1974 and February 1984 (Masatomi 1984); **Yagi-cho**, Funai-gun, one in December 1975 (Masatomi 1984); ■ **Hyogo** unspecified localities, undated (OSJ 2000); ■ **Tottori Hino-gawa river mouth**, one in March 1973 (Masatomi 1984); ■ **Shimane** Yatsukagun (not mapped), one unconfirmed report in July 1936 (Masatomi 1984); south-east of **Nakano-umi** lake, one in November 1973 (Masatomi 1984); unspecified locality, one in November 1973 (Uchida 1982); ■ **Okayama Okayama-shi**, subadult in November 1973 to March 1974 (Masatomi 1984); ■ **Yamaguchi** unspecified localities, undated (OSJ 2000);

**Shikoku** ■ **Tokushima Komatsushima-shi**, one in December 1949, and **Anan-shi**, one in December 1949, probably involving the same individual (Ishihara 1982, Masatomi 1984); ■ **Kagawa** Shirotori-cho watershed, **Ookawa-gun**, one in April–August 1930, possibly an escape from captivity (Masatomi 1984); ■ **Kochi** unspecified locality, one in winter 1994 (Y. Sawada *in litt.* 1998; also OSJ 2000);

**Kyushu** ■ **Nagasaki** unspecified locality, collected, undated (Austin and Kuroda 1953); ■ **Kagoshima Izumi** (Arasaki, Izumi-Takaono), single birds in 1936, 1937, 1939, 1942 and February 1943, one young bird in December 1967, with one bird at Akune (very close to Izumi) in January 1936 (Masatomi 1984); Kajiki-cho, **Aira-gun**, two birds in October 1928 (Masatomi 1984); **Satsuma**, collected, undated (Austin and Kuroda 1953).

■ **KOREA** ■ **NORTH KOREA** In the nineteenth century, the Red-crowned Crane was common in North Korea (Taczanowskii 1888 in Austin 1948), but it is now a relatively scarce passage and winter visitor to the maritime western and southern provinces in October–April (Tomek 1999), mainly at the Demilitarised Zone (DMZ). Records (by province) are as follows: ■ **North Hamgyong Sonbong county** and **Orang county**, a migration stopover, undated (Pak U-il *in litt.* 1998); ■ **South Hamgyong Haejung-ni** (Haejungri), March 1987 (Chung Jong-ryol 1988 in Tomek 1999); **Ryonghung estuary**, including the Kumya Wetland Reserve, an important migration stopover for c.100 birds (Pak U-il *in litt.* 1998), 54 birds, March 1993, usually roosting in the reedbeds at the Ryonghung estuary and feeding in the paddyfields of Haejungri in western Kumya, along the Tokchi river in south-western Kumya and around lake Hapo, Wonpyong district in northern Kumya (Chong *et al.* 1994); ■ **North Pyongan Jongju**, a migration stopover, undated (Pak U-il *in litt.* 1998); **Chongchon-gang estuary**, an important migration stopover, undated (Chong and Morishita 1996); ■ **South Pyongan Kaechon**, February 1955 (Won Hong-koo in Tomek 1999); **Tongrimri**, March 1987 (Chung Jong-ryol 1988 in Tomek 1999); **Mundok Wetland Reserve**, an important migration stopover for c.150 birds (Pak U-il *in litt.* 1998), 135 birds, March 1993 (Chong *et al.* 1994); **Chungsan** (Janganri), collected in April 1958 (Tomek 1999); **Onchon** plain, undated (Chong and Morishita 1996); ■ **Kangwon Wonsan**, October 1897 (“Yankovskii” 1898 in Tomek 1999); **Anbyon**, December 1989 and February 1990 (J. Fiebig in Tomek 1999), 150–200 birds winter on Anbyon (Anpyong) plain from December to March, this site being designated as a Natural Monument (Chong and Morishita 1996); **Tongchon county**, a wintering ground (unspecified years) (Pak U-il *in litt.* 1998); **Samilpho** (Samilpo) lagoon, a wintering ground for 50–70 birds (unspecified years), this site being designated as a Natural Monument (Chong and Morishita 1996); **Kosong**, seven, January 1999 (Chong Jong-ryol *in litt.* 1999); ■ **North Hwanghae Pyongsan**, February 1957 (Won Hong-koo in Tomek 1999); ■ **South Hwanghae Chaeryong**, November 1955 and April 1957 (Won Hong-koo in Tomek 1999); **Kwail**, December 1988 (J. Fiebig in Tomek 1999); **Changyon**, November 1955 (Won Hong-koo in Tomek 1999); **Ryongyon**, winter 1979–1982 (Pak U-il *et al.* 1983 in Tomek 1999), up to 39 birds, January–February 1999 (Chong Jong-

ryol *in litt.* 1999), Kokjong-ri being a wintering ground for 30–40 birds (Pak U-il *in litt.* 1998); **Suiya-ri**, c.100 km west of Kaesong, 600–700 cranes consisting of this species and White-naped Crane *Grus vipio* circling overhead, March 1929 (Kobayashi 1931); **Chongdan**, four, January–February 1999 (Chong Jong-ryol *in litt.* 1999); **Paechon**, February 1955 (Won Hong-koo in Tomek 1999); **Ongjin county**, winter 1979–1982 (Pak U-il *et al.* 1983 in Tomek 1999), three, January–February 1999 (Chong Jong-ryol *in litt.* 1999); **Kangryong**, winter 1979–1982 (Pak U-il *et al.* 1983 in Tomek 1999); **Sinpo city**, a migration stopover, undated (Pak U-il *in litt.* 1998); ■ **Kaesong Kaesong**, January and December 1956 and April 1957 (Won Hong-koo in Tomek 1999); **Panmunjom** (Panmun Plain), winter 1979–1982 (Pak U-il *et al.* 1983 in Tomek 1999), a wintering ground (unspecified years) (Chong and Morishita 1996), three, January–February 1999 (Chong Jong-ryol *in litt.* 1999).

■ **SOUTH KOREA** It is a passage and winter visitor, mainly to the Cholwon basin at the DMZ, and the south coast of Kanghwa island (Pae *et al.* 1996), with records (by province) as follows: ■ **Kangwon Cheolweon** basin, an important wintering ground, 203–269 birds, November 1995 to January 1996 (Pae *et al.* 1996), 177–285 birds, November 1997 to March 1998 (Kim Jin-han *in litt.* 1998), 372 birds, February 1999 (MOE Korea 1999); ■ **Kyonggi and Seoul Panmunjom**, eight, February 1998 (Lee Woo-shin *in litt.* 1998); **Kapyong** (Kampung), where a crane collected in February 1917 was originally identified as a Black-necked *Grus nigricollis* but was either a melanistic *G. japonensis* or a hybrid *G. japonensis* × *G. vipio* (Austin 1948); **Han estuary** and Imjin river, 40–50 birds, March (probably in 1919) (Kuroda and Miyakoda 1919), seven adults and two immatures at the Imjin river, 1995 (Lee Woo-shin *in litt.* 1998), four, February 1996 (Pae *et al.* 1995), not recorded in 1997–1998 (Kim Jin-han *in litt.* 1998), two, January 1999 (Kim Jin-han *in litt.* 1999); **Kanghwa island**, mainly in the south of the island at Kilsang-myon and Hwado-myon, up to five at Hwado-myon, January–February 1992, and up to 18 birds at Kilsang-myon, January–February 1992 (Forestry Research Institute, Korea 1992), 13 birds, January 1996 (Pae *et al.* 1996), two family parties totalling six birds, November 1997–March 1998 (Kim Jin-han *in litt.* 1998), and 10 birds at Kilsang-myon, February 1999 (MOE Korea 1999); **Inchon** (Incheon), April 1931 (male and female in YIO), one (banded at Khinganskiy in Russia), winter 1998–1999 (Yu. Darman verbally 1999); **Suwon**, seen and collected, January–March 1946, fairly common (Austin 1948); ■ **North Chungchong** unspecified localities, found in two or three localities in flocks of 2–3 birds, undated (Kuroda 1937 in Austin 1948); ■ **South Chungchong Daeho reservoir**, one subadult, March 1998 (Kim Jin-han *in litt.* 1998); unspecified localities, December 1916, December 1926 and December 1927 (Austin 1948); ■ **South Kyongsang Chunam reservoir** (Junam), one subadult, January–February 1998 (Kim Jin-han *in litt.* 1998); **Nakdong estuary**, winter visitor (unspecified years) (Woo *et al.* 1997); unspecified locality, undated (Austin 1948); ■ **South Cholla** unspecified locality, undated (Austin 1948).

■ **CHINA** ■ **MAINLAND CHINA** Historically the species's main wintering grounds were near Songjiang-fu (in present-day Shanghai) from the Three Kingdoms (220–280 AD) to the Song Dynasty (960–1279 AD), and it was widespread in China during the Ming and Qing dynasties (1368–1911 AD), when birds wintered in coastal Jiangsu as well as in the wetlands of the lower Yangtze River basin (He Yeheng 1994). Wintering birds were recorded at Dongting Hu lake and in western Hunan as recently as 1821, and in Hubei, while a prefecture report for Jingzhou (now Jiangling county in southern Hubei) in 1880 stated that “the [Red-crowned] cranes used to be abundant at Heze [literally ‘crane marsh’] in Jiangling, but now they are rare”; they also wintered in Wuning county in Jiangxi (c.100 km west of Poyang Hu lake), where the occurrence of the “Celestial Crane” (*Xian He*, an ancient Chinese name for Red-crowned Crane) was documented in the county reports in 1543, 1725 and 1782 (He Yeheng 1994). The species continued wintering in Jiangxi into the twentieth century (Gee *et al.* 1926–1927), but during the Ming and Qing dynasties the main wintering grounds of Red-crowned

Cranes shifted to Lüsi on the northern side of the Yangtze estuary, and in the early twentieth century they shifted further north to Yancheng (Liang Haitang 1987). Red-crowned Cranes have disappeared from the Yangtze basin within the last 100 years (Wang Qishan *in litt.* 1998).

Currently this species has a fragmented breeding range in Heilongjiang, Jilin, Liaoning and eastern Inner Mongolia, where an aerial census in 1984 showed that areas around the Wuyur He river (Song-nen plain) and the Qixing He and Dulu He rivers (Sanjiang plain) in Heilongjiang supported 90% of the known Chinese breeding population (Feng Kemin and Li Jinlu 1990; see Ma Yiqing and Li Xiaomin 1990). Outside the breeding season it is now mainly coastal in distribution, with large numbers recorded on passage at the Gulf of Bohai in Hebei, and the main wintering grounds on the tidal marshes of Jiangsu and Shandong, with smaller numbers reported on passage and in winter in Tianjin and Shanghai and inland in Yunnan, Shaanxi, Henan, Anhui and Jiangxi (Wang Qishan *in litt.* 1998). Records (by province) are as follows:

■ **Heilongjiang** Sanjiang Nature Reserve, **Fuyuan county**, rare summer visitor (unspecified years) (Liu Bowen *et al.* 1999), 13 birds, spring 1999 (Zhang Xixiang *et al.* 1999), nine birds at Haiqing township and two at Yanan township, May 1999 (Xing Hailin *et al.* 1999); Aobao Shan Nature Reserve, **Gannan county**, the reserve being reported as established for the conservation of this species, but with no further details (MacKinnon *et al.* 1996); Fuyu Nature Reserve (established for the conservation of this species), **Fuyu county**, reported to breed (MacKinnon *et al.* 1996, Wang Qishan *in litt.* 1998); **Honghe Nature Reserve**, Tongjiang county, Sanjiang plain, a breeding ground, where two ground surveys in July–September 1982 and April–July 1983 found c.40–50 cranes whereas an aerial survey in May 1984 only located 28 birds (Ma Yiqing and Jin Longrong 1985), with c.10 pairs breeding annually and 44 birds estimated during the breeding season in 1999 (Zhu Baoguang 1999); lower **Songhua Jiang** river, adult male collected, April 1925 (Wang Qishan *in litt.* 1998); Halahai wetland, **Longjiang county**, 15 birds, June 1999, presumed to be breeding, local fishermen reporting that c.150 birds occur on spring migration (Li Xiaomin 1999); **Xiangyangchuan**, Shuangyashan city, one, June 1998 (Piao Renzhu 1999); **Fujin county**, four breeding birds at Daxing farm, May 1999 (Piao Renzhu 1999), reported to breed at Liansanpao Nature Reserve, undated (Wang Qishan *in litt.* 1998); lower **Dulu He** river, 75 adults, 15 juveniles and 17 nests found during an aerial survey in May 1984 (Feng Kemin and Li Jinlu 1985), maximum of 23 birds during the breeding season in 1981–1986 (Lu Jianjian 1990), six birds and two nests in May 1995 (Piao Renzhu 1999); **Qixing He** and Naoli He river basins, including Changlindao, Yanwodao and Qixinghe Nature Reserves on the Sanjiang plain, 111 adults, 61 juveniles and 24 nests found during an aerial survey in May 1984, the cranes being concentrated in wetlands along these two rivers (Feng Kemin and Li Jinlu 1985), maximum of 176 birds during the breeding season in 1981–1986 (Lu Jianjian 1990), 15 birds and four nests Qixinghe Nature Reserve in 1995 (Piao Renzhu 1999), eight breeding birds and four nests at Changlindao in 1995 and 200 birds on migration in 1998 (Piao Renzhu 1999), c.60 breeding birds at Changlindao and Yanwodao Nature Reserves in 1999 (Li Xiaomin and Chang Yunhong 1999); **Zhalong National Nature Reserve** and adjacent areas, Qiqihar city, including the lower Wuyur He river and Lindian county, an important breeding ground, one near Qiqihar (Tsitsikar) in August 1956 (Piechocki 1956), c.200 birds recorded in the 1980s (Gao Zhongxin 1990), 346 birds and 66 nests 1996, representing c.70% of the population of this species in Heilongjiang province (Piao Renzhu 1999); **Xinglong Nature Reserve**, Fujin county, a breeding ground, with 176 birds found during an aerial survey in May 1984, then the largest breeding population in China (Ma Yiqing and Li Xiaomin 1990), but fewer than 10 birds present in the late 1990s and only two breeding birds found in 1997 (Piao Renzhu 1999); **Taikang**, adult collected, November 1979 (Wang Qishan *in litt.* 1997); Heiyupao Nature Reserve, **Daqing city**, the reserve being reported as established for the conservation of this species, but with no further details

(MacKinnon *et al.* 1996); **Yueya Hu Nature Reserve**, Hulin county, undated (Liu Donglai *et al.* 1996); near **Harbin** (Charbin), one adult in Harbin market in November 1922, male collected from a flock of six in April 1925 (Meise 1934); small section of western **Xiaoxingkai Hu** area, 13 adults and three nests found during an aerial survey in May 1984 (Feng Kemin and Li Jinlu 1985); **Xingkai Hu National Nature Reserve**, Xingkai lake (the Chinese side of Lake Khanka), a breeding ground, about 59–62 birds, including at least 28–30 breeding birds and 18–20 non-breeding birds) in 1984–1990 (Li Wenfa *et al.* 1994), but only 20–30 birds since 1994 (Luan Xiaofeng *et al.* 1999), 45 birds on migration, March–April 1997 (Piao Renzhu and Li Wenfa 1998);

■ **Jilin Melmeg Nature Reserve** (Momoge), including Yueliang Pao or “Moon lake”, a few birds breeding but more important as a migration stopover site, with 30–50 birds occurring in spring and autumn (Lu Jianjian 1990, Wu Zhigang and Han Xiaodong 1992); **Qagan Nur** lake (Chagan Pao), a former breeding ground before the lake dried up and became saline (Tong Yongchang and Wen Changchun 1986), and “pretty numerous” in swamps beyond Songyuan city (Petuna) (probably either at Qagan Nur or Xianghai: SC) every September (Ingram 1909, Sowerby 1923, Meise 1934); **Xianghai National Nature Reserve**, a breeding ground, 19 adults and two nests found during an aerial survey in May 1984 (Feng Kemin and Li Jinlu 1985), with an increase to 15–30 breeding pairs inside the core area of the nature reserve in recent years (Tong Yongchang and Wen Changchun 1986, Xianghai Nature Reserve Management Office 1996), c.25–30 pairs, including c.7–9 pairs breeding in the core area of the reserve, April 1999 (He Chunguang *et al.* 1999); **Jiutai county**, adult male collected, March 1993 (Wang Qishan *in litt.* 1998); lower **Tumen Jiang** river, 150 birds in spring 1988 and 87 birds in spring 1989, mainly at Yangguanping but occasionally at Liudaopao (Wu Zhigang *et al.* 1991d); **Changbai Shan** mountains, “Tonghua province”, January 1909 (specimen in YIO);

■ **Liaoning Shuangtai Hekou National Nature Reserve** and adjacent areas, including Panjin wetlands, the southernmost breeding ground of Red-crowned Cranes, first confirmed as such in March 1984 (Liu Mingyu *et al.* 1991) although local people reported that eggs were collected when the reed farm was established shortly after 1949 (Chen Tieshan and Sun Shide 1986), with c.50 breeding birds and another 300 migrants visiting the reserve annually (Chen Tieshan and Sun Shide 1986, Shuangtai Hekou Nature Reserve Management Office 1996; also Kanai *et al.* 1993); **Jinxi city**, small numbers occurring on migration (Liu Mingyu *et al.* 1991); **Yingkou city**, small numbers occurring on migration (Liu Mingyu *et al.* 1991); **Xingcheng city**, small numbers occurring on migration (Liu Mingyu *et al.* 1991); **Suizhong county**, adult male collected, March 1963 (Wang Qishan *in litt.* 1998); **Dongguo county**, small numbers occurring on migration (Liu Mingyu *et al.* 1991); **Dalian city**, small numbers occurring on migration (Liu Mingyu *et al.* 1991);

■ **Inner Mongolia Nanweng He** river, Songling, Da Hinggan Ling, 10 birds and one nest, June 1998 (Piao Renzhu 1999); **Duobukur**, Jagdaqi, Da Hinggan Ling, breeding pair and a nest, June 1998 (Piao Renzhu 1999); **Dalai Hu National Nature Reserve** (Hulun Hu Nature Reserve) Hulun Buir league, reported to be a breeding site by Tong Yongchang and Tong Junchang (1986) although reserve staff regard this species as a vagrant, with two in May 1986 (Wuliji and Liu Songtao *in litt.* 1998); **Medamuji**, four, July 1991 (P. Alström, U. Olsson and D. Zetterström *in litt.* 2000); **Huihe Nature Reserve**, Hulun Buir league, summer visitor suspected to breed, and probably an important autumn migratory staging ground, with 232 birds in September 1998 and 300–350 birds estimated in the Hui He river valley (4–6 km<sup>2</sup>) in the same season (Liu Songtao 1998); **Khalka** river (Chalchyn-gol), near the Mongolian border (probably Khalthyn-gol in Mongolia: SC), September (unspecified year), probably breeding (Tugarinov 1932 in Meise 1934); **Chaoer He** river basin, reported to be a breeding ground, but with no details (Lu Jianjian 1990); **Tumuji Sum**, **Jalaid Qi**, three birds, September 1991 (Liu Bowen *in litt.* 1998); **Ulgai** (Wulagai) marshes, a breeding ground, undated (Tong Yongchang and Tong Junchang 1986); **Horqin Nature Reserve** (Ke'erqin or Keerqin), 40 birds (including

16 breeding birds) in 1987 (Zhang Zixue *et al.* 1989); **Dalai Nur Nature Reserve** (Dalinar), Hexigten Qi, first breeding record in April 1984 (Duan Wenrui and Du Xiangdong 1987), seven birds, May 1986 (Ma Yiqing and Li Xiaomin 1990), breeding, with six birds in March–October 1987 (Arongqiqige *in litt.* February 1998); **Hexigten Qi**, Chifeng city, June 1972 (Fei Rongzhong *et al.* 1993);

■ **Yunnan Nagpag Co lake** (Napahai), Zhongdian county, reported by local officials to have been common before the 1960s, but the only recent records being of c.9 birds in winter of 1980 and c.5 in February 1981 (Yang Lan 1995); **Zhaotong county**, December 1963, and four birds in March 1976 (Wang Zijiang 1991a); **Mengzi** (Mengtsz) plain, white or very pale cranes reported (date unspecified) by La Touche being “undoubtedly this species”, undated (Rothschild 1926);

■ **Shaanxi Heyang county**, 150 birds at Weihuang Wetland Nature Reserve, undated (Fu Huanfu 1995–1996 in Wang Hui 1997), c.140 birds feeding in wetlands at Zhonglei village, March 1995, and flocks of about a dozen birds seen by the river at Xinxingba (Wu Jiayan *et al.* 1998); Zhaoduxiang township, **Dali county**, c.40 birds in wetlands by the Yellow River, February 1995 (Wu Jiayan *et al.* 1998); **Sanmenxia Nature Reserve**, 15–20 birds regularly seen in autumn (Cao Yonghan *in litt.* 1999);

■ **Hebei Shanhaiguan** (Shanhaikuan), one collected, November 1916 (La Touche 1920–1921); **Qinhuangdao** (Chinwangtao), two collected between 1910 and 1917 (La Touche 1920–1921); **Beidaihe**, totals of six in October 1942, 25 in March and 151 in October–November 1943, 18 in March and 92 in October–November 1944 and 47 in March and 98 in October–November 1945 (Hemmingsen and Guildal 1968), total of 244 birds, March 1985 (Williams 1986), totals of 501 birds in October–November 1986, 320 in October–November 1987, 281 in October–November 1988, 630 in October–November 1989 and 542 in October–November 1990 (Williams *et al.* 1992);

■ **Tianjin Beidagang reservoir** (not mapped), seven, November 1998 (Zhang Shuping *et al.* 1999);

■ **Shandong Nantuoji Shuidao** (Nantuozi Dao) island, Changshan islands, occurring annually in April (Fan Qiangdong and Xu Jianmin 1996); **Yellow River Delta Nature Reserve** (Huanghe Sanjiaozhou Nature Reserve), a wintering ground, seven birds in 1986, 11 in 1987, 23 in 1988, 27 in 1989, 36 in 1990, 31 in 1991, 43 in 1992, 37 in 1993 and 46 in 1994 (Ji Jiayi and Yu Xinjian 1990, Sai Daojian *et al.* 1996), 52 birds in winter (unspecified year) (Wang Keshan *et al.* 1992), the birds mainly being found on the southern bank of the canal, on farmland at Yiqian'er and Dawenliu and on tidal flats at Huanghekou (Yellow River mouth), with as many as c.800 birds now stopping over on autumn migration and 200 wintering in the reserve (Zhao Yanmao and Song Chaoshu 1995, Lü Juanzhang *et al.* 1998); **Rongcheng Nature Reserve**, “very rare”, several birds from November 1996 (Yang Zhen 1997); **Qingdao coastal wetlands**, uncommon passage migrant in March–April and October–November (Liu Daiji *et al.* 1994); **Rizhao coastal wetlands**, four birds on tidal flats, December 1984 to February 1985 (Ji Jiayi and Yu Xinjian 1988);

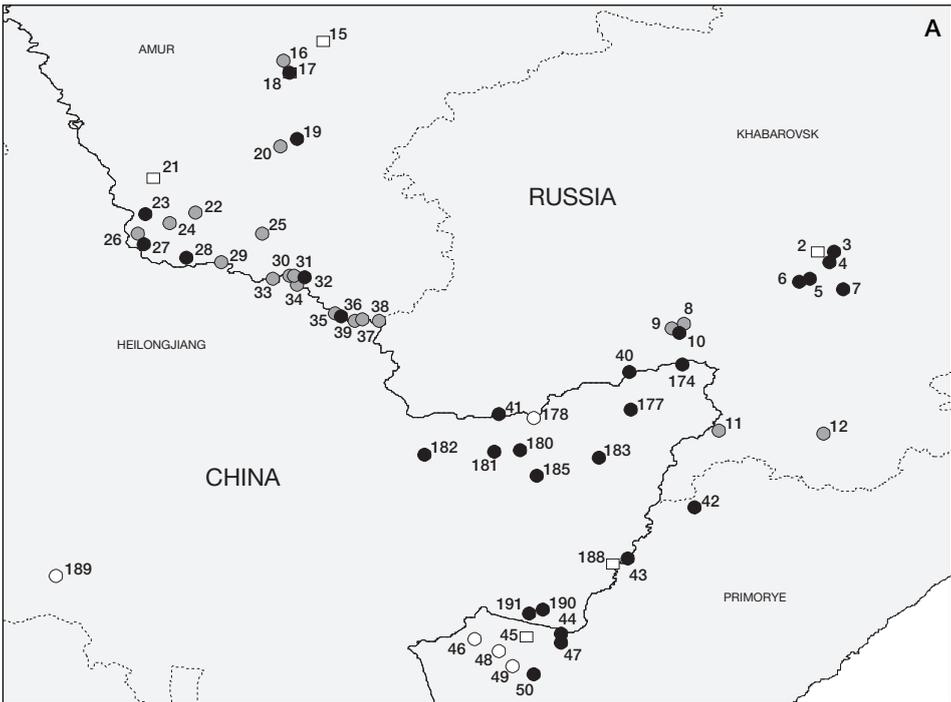
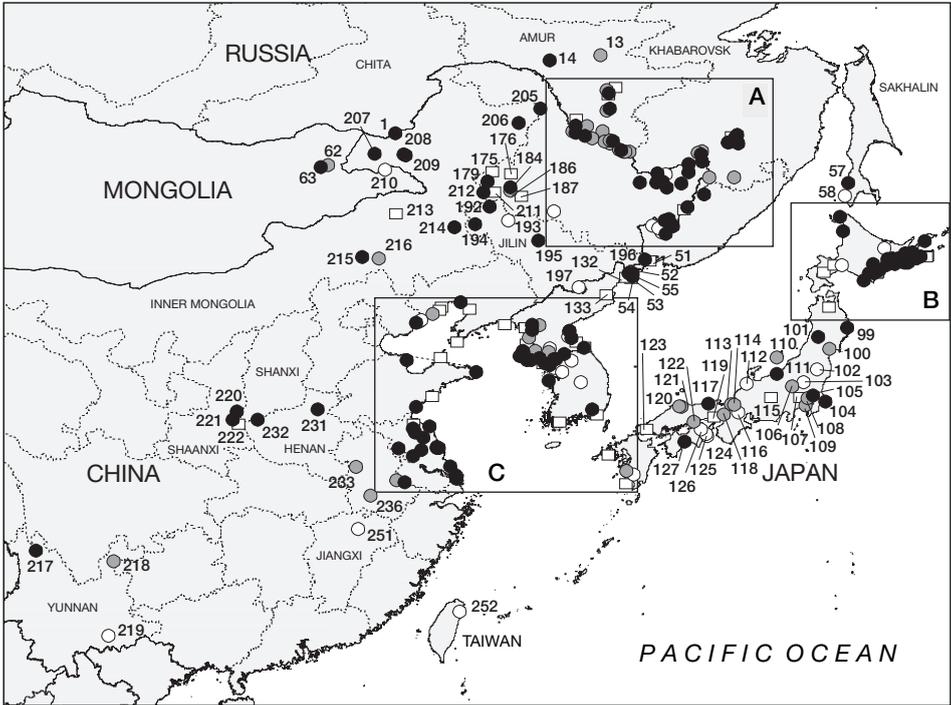
■ **Henan Pangzhai** (Yu-bei Huanghe Gudao Nature Reserve or “Old Yellow River Channel Nature Reserve”), a migratory staging site, 12 birds in autumn and six in spring in 1985–1987 (Xu Xinjie *et al.* 1990), two birds in January 1990, 13 in January 1991 and seven in January 1993 (Wang Qishan *in litt.* 1998); **Sanmenxia Nature Reserve**, rare passage migrant, recorded in March 1995 (Wang Wenlin *et al.* 1999);

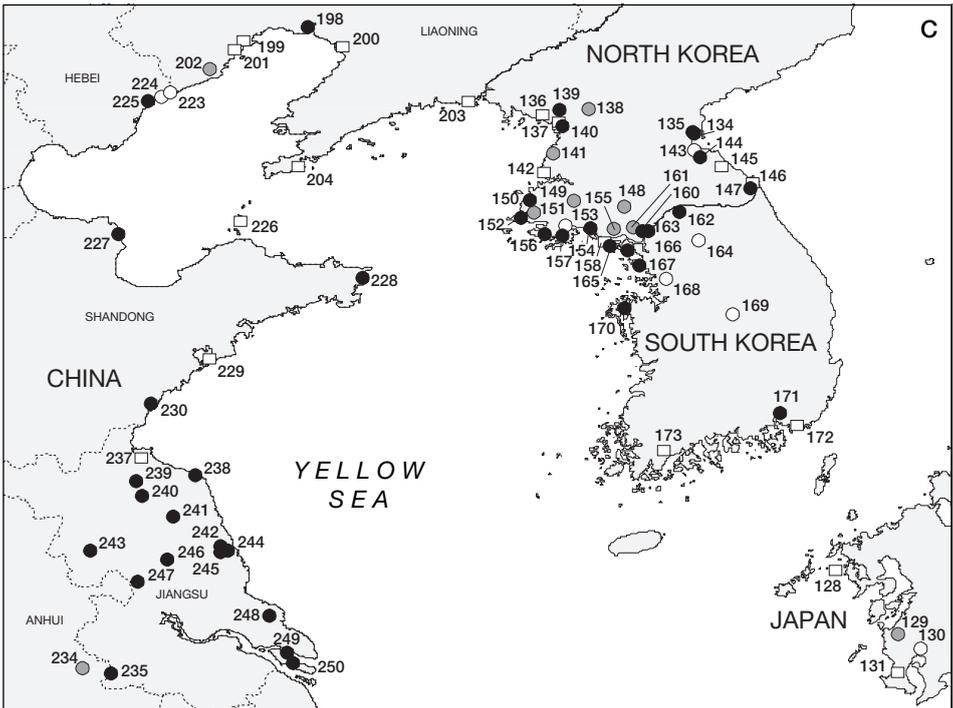
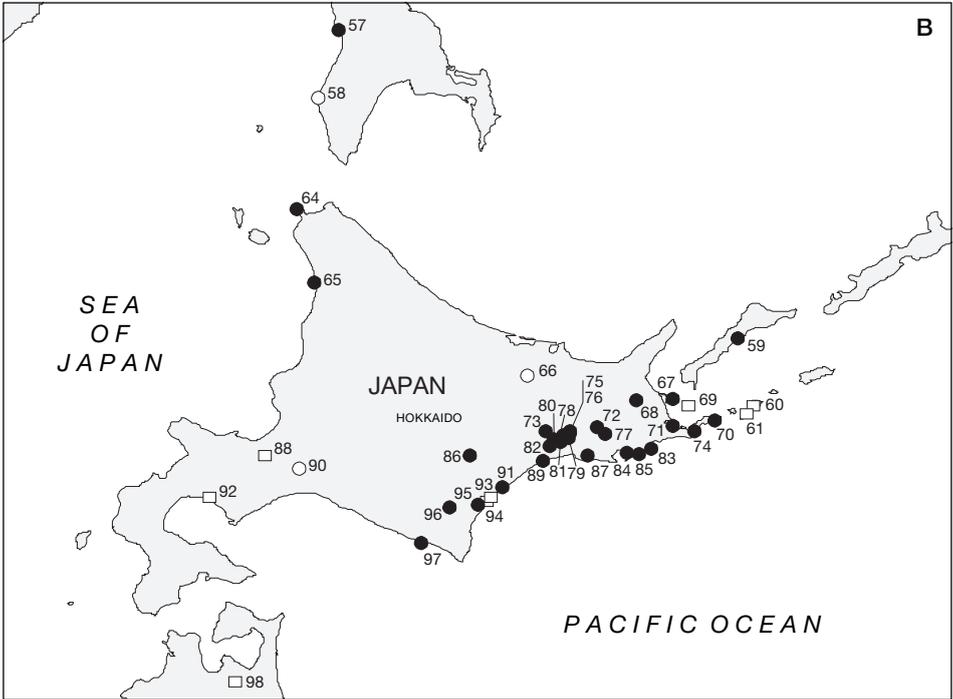
■ **Anhui Chengdong Hu lake**, Huoqiu county, reported to be a wintering ground in the late 1970s (Ding Wenning and Zhou Fuzhang 1986); **Dangtu county**, adult male collected, February 1964 (Wang Qishan *in litt.* 1998); **Shijiu Hu lake**, Dangtu county, an occasional wintering ground, with 12 birds in 1977, eight in 1982 and five in 1987 (Wang Qishan *in litt.* 1998), three birds, January 1990 (Waterbird Specialist Group 1994); **Caizi Hu lake**, Zongyang county, reported to be a wintering ground in the late 1970s (Ding Wenning and Zhou Fuzhang 1986);

■ **Jiangsu Yuntai Shan Nature Reserve**, Lianyungang city, undated (Liu Donglai *et al.* 1996); **Guandong salt works**, Yancheng Nature Reserve, 325 birds, January 1990 (Waterbird Specialist Group 1994); **Guanyun county**, Lianyungang city, 25 birds, January 1985 (Wang Qishan *in litt.* 1998); **Guannan county**, Huaiyin city, 67 birds, January 1985 (Wang Qishan *in litt.* 1998); Majia marshes, **Funing county**, 12 birds in 1996–1997 (Zhang Yibing in Wang Hui 1997); **Yancheng Nature Reserve**, the most important wintering ground of the Red-crowned Crane, 26 birds, December 1979 (Li Jinlu and Feng Kemin 1985), their numbers increasing subsequently, with 1,020 birds in winter 1996–1997 (Wang Hui *et al.* 1997) and 848 birds, December 1997 to January 1998 (Su Hualong *et al.* 1998), plus, inside the buffer zone of

**The distribution of Red-crowned Crane *Grus japonensis* (maps opposite):** (1) Kaylastuy; (2) Kharpi river; (3) Kharpi river mouth; (4) Al'bite lake; (5) Simmi river; (6) Ukur river; (7) Pervoye lake; (8) Novokurovka; (9) Ulika river; (10) Urmi river mouth; (11) Vyazemskiy; (12) Khor river; (13) Ogoron lake; (14) Tynda river mouth; (15) Norsky Nature Reserve; (16) Ushmyr river; (17) Ul'ma river; (18) Ulminski Wildlife Reserve; (19) Tashina river; (20) Bol'shaya Kungul' river; (21) Semiozerka; (22) Lazarevka; (23) Gribskoye; (24) Nizhiaya Tambovka; (25) Innokent'evka; (26) Lebedinoe lake; (27) Murav'evski Wildlife Refuge; (28) Nizhnepoltavka; (29) Poyarkovo; (30) Bureya river; (31) Ukraina; (32) Khinganskiy Nature Reserve; (33) Kalinino; (34) Krasnyy Luch; (35) Kasatkino; (36) Ganukan Game Reserve; (37) Sagibovo; (38) Mutnaya river; (39) Uril river; (40) Bol'shaya Pad'; (41) Bidzhan river; (42) Bikin-Alchanskaya marr; (43) Iman river; (44) Sungacha river; (45) Khanka Nature Reserve; (46) Komissarovo river mouth; (47) Gnilye lakes; (48) Razdol'naya river mouth; (49) Mel'gunovka river mouth; (50) Lefu river mouth; (51) Kedrovaya Pad' Nature Reserve; (52) Melkovodnaya bay; (53) Vudunupty bay; (54) Khasan plain; (55) Tumen river; (56) unallocated; (57) Pionery islands; (58) Gornozavodsk; (59) Kunashir island; (60) Shibotsu island; (61) Yuri island; (62) Khalkhgol; (63) Kerulen river; (64) Noshappu cape; (65) Onbetsugawa; (66) Kitami; (67) Notsuke peninsula; (68) Naka-shibetsu; (69) Nemuro; (70) Nemuro peninsula; (71) Furenko; (72) Shibecha; (73) Akan-cho; (74) Chobushi-ko; (75) Tsurui-mura; (76) Naka-setsuri; (77) Nakachambetsu; (78) Nakahororo; (79) Shimo-setsuri; (80) Shimo-teshibetsu; (81) Ninishibetsu; (82) Shitakara-gawa; (83) Kiritappu marsh; (84) Akkeshi lake; (85) Mochirippu-numa; (86) Tokachi; (87) Kushiro marsh; (88) Sapporo; (89) Charogawa; (90) Chitose; (91) Otsu marsh; (92) Ibur; (93) Yudo-numa; (94) Oikamanae-numa; (95) Toberi marsh; (96) Taiki-cho; (97) Horobetsu-gawa; (98) Aomori; (99) Hei-gawa; (100) Miyagi; (101) Yuzawa-shi; (102) Kooriyama-shi; (103) Sakuragawa-mura; (104) Hasaki-machi; (105) Nikko; (106) Gunma; (107) Saitama; (108) Tone-gawa; (109) Tama-gawa; (110) Sado island; (111) Kubiki; (112) Kahoku-gata; (113) Kugushi-ko; (114) Tsuruga-shi; (115) Nagano; (116) Echi-gun; (117) Takeno-gun; (118) Yagi-cho; (119) Hyogo; (120) Hino-gawa river mouth; (121) Nakano-umi; (122) Okayama-shi; (123) Yamaguchi; (124) Komatsushima-shi; (125) Anan-shi; (126) Ookawagun; (127) Kochi; (128) Nagasaki; (129) Izumi; (130) Aira-gun; (131) Satsuma; (132) Sonbong county; (133) Orang county; (134) Haejung-ni; (135) Ryonghung estuary; (136) Jongju; (137) Chongchon-gang estuary; (138) Kaechon; (139) Tongrimri; (140) Mundok Wetland Reserve; (141) Chungsan; (142) Onchon; (143) Wonsan; (144) Anbyon; (145) Tongchon county; (146) Samilpho; (147) Kosong; (148) Pyongsan; (149) Chaeryong; (150) Kwail; (151) Chanyon; (152) Ryongyon; (153) Suiya-ri; (154) Chongdan; (155) Paechon; (156) Ongjin county; (157) Kangryong; (158) Sinpo; (159) unallocated; (160) Kaesong; (161) Panmunjom; (162) Cheolweon; (163) Panmunjom; (164) Kapyong; (165) Han estuary; (166) Kanghwa island; (167) Inchon; (168) Suwon; (169) North Chungchong; (170) Daeho reservoir; (171) Chunam reservoir; (172) Naktong estuary; (173) South Cholla; (174) Fuyuan county; (175) Gannan county; (176) Fuyu county; (177) Honghe Nature Reserve; (178) Songhua Jiang; (179) Longjiang county; (180) Xiangyangchuan; (181) Fujin county; (182) Dulu He; (183) Qixing He; (184) Zhalong National Nature Reserve; (185) Xinglong Nature Reserve; (186) Taikang; (187) Daqing city; (188) Yueya Hu Nature Reserve; (189) Harbin; (190) Xiaoxingkai Hu; (191) Xingkai Hu National Nature Reserve; (192) Melmeg Nature Reserve; (193) Qagan Nur; (194) Xianghai National Nature Reserve; (195) Jiutai county; (196) Tumen Jiang; (197) Changbai Shan; (198) Shuangtai Hekou National Nature Reserve; (199) Jinxi city; (200) Yingkou city; (201) Xingcheng city; (202) Suizhong county; (203) Donggou county; (204) Dalian city; (205) Nanweng He; (206) Duobukur; (207) Dalai Hu National Nature Reserve; (208) Medamuji; (209) Huihe Nature Reserve; (210) Khalka; (211) Chaor He; (212) Jalaid Qi; (213) Ulgai; (214) Horqin Nature Reserve; (215) Dalai Nur Nature Reserve; (216) Hexignt Qi; (217) Nagpag Co; (218) Zhaotong county; (219) Mengzi county; (220) Heyang county; (221) Dali county; (222) Sanmenxia Nature Reserve; (223) Shanhaiguan; (224) Qinhuangdao; (225) Beidaihe; (226) Nantuoji Shuidao; (227) Yellow River Delta Nature Reserve; (228) Rongcheng Nature Reserve; (229) Qingdao; (230) Rizhao; (231) Pangzhai; (232) Sanmenxia Nature Reserve; (233) Chengdong Hu; (234) Dangtu county; (235) Shijiu Hu; (236) Caizi Hu; (237) Yuntai Shan Nature Reserve; (238) Guandong salt works; (239) Guanyun county; (240) Guannan county; (241) Funing county; (242) Yancheng Nature Reserve; (243) Hongze Hu; (244) Haifeng farm; (245) Dafeng Nature Reserve; (246) Shagou; (247) Gaoyou Hu; (248) Rudong county; (249) Xinglong Dongsha Island Nature Reserve; (250) Chongming Dao; (251) Poyang Hu; (252) Lotung.

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





Yancheng Nature Reserve, up to 87 birds in Dafeng county and up to 112 birds in Dongtai county in the late 1990s (Ma Zhijun *et al.* 1998); **Hongze Hu** lake, 78 birds, January 1990 (Waterbird Specialist Group 1994), 60 birds reported nearby at Xiangyang reservoir and Chengtou tree farm (Jiangsu Environmental Protection Bureau in Wang Hui 1997); **Haifeng farm** coast, Yancheng Nature Reserve, 93 birds, January 1990 (Waterbird Specialist Group 1994); **Dafeng Nature Reserve** (Dafeng Milu Reserve), up to 32 birds (in November 1986) in winter 1986–1987, leaving before April although an injured immature remained into June 1987 (Thouless 1989); **Shagou** town, Xinghua city, 36 birds reported in reed marshes in 1996–1997 (Wang Hui 1997); **Gaoyou Hu** and Shaobo Hu lakes, 22 birds, January 1990 (Waterbird Specialist Group 1994), with c.50 birds estimated to winter (Wang Hui 1997); **Rudong county**, six birds, November 1983 (Ma Yiqing and Li Xiaomin 1991); **Xinglong Dongsha Island Nature Reserve**, a recently formed sandflat, 50 birds in winter 1988, 50 in December 1989 (but only 17 in January 1990), 13 in 1990, seven in 1991, seven in 1993 and three in 1994 (Environmental Protection Bureau of Qidong City *per* Wang Qishan *in litt.* 1998); reported to occur in “some of the wildest marsh-lands of the [lower] Yangtze”, winter (listed as *Grus viridirostris*, which is a synonym for *G. japonensis* according to La Touche 1925–1934) (Styan 1891; also Moffett and Gee 1913);

■ **Shanghai Chongming Dao** island, 12 birds in 1984 (Ma Yiqing and Li Xiaomin 1991);

■ **Jiangxi Poyang Hu**, winter (unspecified years) (listed as *Grus viridirostris*—see above) (Styan 1891).

■ **TAIWAN** There is a single record: **Lotung** (Luotung), Ilan county, one immature collected, December 1932 (Lin Wen-horn 1997).

**POPULATION** Two recent estimates of the global population of Red-crowned Cranes have been of (1) c.1,700–2,000 birds, including 594 resident in Japan, 500–650 wintering in Korea and 600–800 wintering in eastern Jiangsu in China (Meine and Archibald 1996, Rose and Scott 1997), and (2) c.2,200 birds, including c.600 resident in Japan, c.400 wintering in Korea and c.1,200 wintering in China (Chan 1999). The species appears to have been considerably more widespread and numerous in the past in Japan, Korea and China, and it has also declined

**The distribution of Red-crowned Crane *Grus japonensis* (map B opposite):** (57) Pionery islands; (58) Gornozavodsk; (59) Kunashir island; (60) Shibotsu island; (61) Yuri island; (64) Noshappu Cape; (65) Onbetsu-gawa; (66) Kitami; (67) Notsuke peninsula; (68) Naka-shibetsu; (69) Nemuro; (70) Nemuro peninsula; (71) Furenko; (72) Shibechea; (73) Akan-cho; (74) Chobushi-ko; (75) Tsurui-mura; (76) Naka-setsuri; (77) Nakachambetsu; (78) Nakahororo; (79) Shimo-setsuri; (80) Shimo-teshibetsu; (81) Ninishibetsu; (82) Shitakara-gawa; (83) Kiritappu Marsh; (84) Akkeshi lake; (85) Mochirippu-numa; (86) Tokachi; (87) Kushiro Marsh; (88) Sapporo; (89) Charogawa; (90) Chitose; (91) Otsu Marsh; (92) Ibur; (93) Yudo-numa; (94) Oikamanae-numa; (95) Toberi Marsh; (96) Taiki-cho; (97) Horobetsu-gawa; (98) Aomori.

**(map B opposite):** (128) Nagasaki; (129) Izumi; (130) Aira-gun; (131) Satsuma; (134) Haejung-ni; (135) Ryonghung estuary; (136) Jongju; (137) Chongchon-gang estuary; (138) Kaechon; (139) Tonggrimri; (140) Mundok Wetland Reserve; (141) Chungsan; (142) Onchon; (143) Wonsan; (144) Anbyon; (145) Tongchon county; (146) Samilpho; (147) Kosong; (148) Pyongsan; (149) Chaeryong; (150) Kwail; (151) Changyong; (152) Ryongyon; (153) Suiya-ri; (154) Chongdan; (155) Paechon; (156) Ongjin county; (157) Kangryong; (158) Sinpo; (159) unallocated; (160) Kaesong; (161) Panmunjom; (162) Cheolweon; (163) Panmunjom; (164) Kapyong; (165) Han estuary; (166) Kanghwa island; (167) Inchon; (168) Suwon; (169) North Chungchong; (170) Daeho reservoir; (171) Chunam reservoir; (172) Nakdong estuary; (173) South Cholla; (198) Shuangtai Hekou National Nature Reserve; (199) Jinxi city; (200) Yingkou city; (201) Xingcheng city; (202) Suizhong county; (203) Donggou county; (204) Dalian city; (223) Shanhaiguan; (224) Qinhuangdao; (225) Beidaihe; (226) Nantuoji Shuidao; (227) Yellow River Delta Nature Reserve; (228) Rongcheng Nature Reserve; (229) Qingdao; (230) Rizhao; (234) Dangtu county; (235) Shijiu Hu; (237) Yuntai Shan Nature Reserve; (238) Guandong salt works; (239) Guanyun county; (240) Guannan county; (241) Funing county; (242) Yancheng Nature Reserve; (243) Hongze Hu; (244) Haifeng farm; (245) Dafeng Nature Reserve; (246) Shagou; (247) Gaoyou Hu; (248) Rudong county; (249) Xinglong Dongsha Island Nature Reserve; (250) Chongming Dao.

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

on the breeding grounds in Russia (see below). At present, it is slowly increasing in Japan while the trends in the Korean and Chinese population are unknown, but are likely to be downward because of ongoing habitat loss (Meine and Archibald 1996).

**Russia** The figures detailed below indicate that the total population in eastern Russia is between 75 and 97 breeding pairs, with a total late-summer population (breeders, non-breeders and subadults) of 400–422 individuals (AVA). An aerial survey in 1998–1999 indicated that there had been a decline in the breeding population of Red-crowned Cranes in Russia, especially in Khabarovsk and the Jewish Autonomous Region (V. Andronov *in litt.* 2000). In the Khabarovsk region, their numbers have declined in recent years, nesting has become irregular, and in some years they do not breed at all (Smirenskiy and Roslyakov 1982, B. A. Voronov *in litt.* 1997). Eighteen pairs were recorded on the valley plains between Khabarovsk and Lake Bolon' in 1975, 25 in 1976, 12 in 1977 (but none bred), 10 in 1978, four pairs bred successfully producing five young in 1979, and 4–5 pairs nested in the Lake Bolon' basin in 1980 (but 3–4 of these nests were destroyed by fire); the population in the entire region probably did not exceed 15 pairs by the early 1980s (Smirenskiy and Roslyakov 1982), and it is currently barely more than 10 pairs (B. A. Voronov *in litt.* 1997). In the Amur region, 10–15 pairs bred annually in the Arkhara lowlands between 1960 and 1975, with half of the population between the Bureya and Arkhara rivers, where eight nesting pairs and 8–12 lone birds were counted in 1975 (Smirenskiy and Roslyakov 1982). In 1976–1978, not more than 4–6 pairs bred in the Arkhara lowlands, and a single pair nested on the Tom' river below the mouth of the Tashina river (Pan'kin 1981). In 1985, aerial censuses and ground observations showed that there were 30 territorial pairs in the Arkhara lowlands, and in 1986 there were 34 pairs, 32 of which attempted to breed (of which 20 nests were protected in the Khinganskiy Nature Reserve and 12 in the Ganukan Game Reserve) (data *per* AVA). An additional 3–4 nesting pairs were found in the southern Zeya-Bureya plain and 15 pairs in the lower Zeya river basin, and, combined with reports from other regions, this gave at least 60 nesting pairs and at least 267 birds throughout the Amur region in autumn 1986 (data *per* AVA). In 1994, there were 18 breeding pairs in the Arkhara lowlands, 15 pairs in the southern Zeya-Bureya plains, and at least 10 pairs on the lower Zeya river, a total breeding population of 45 pairs, and a total autumn population of c.220 individuals (including unpaired birds and chicks born in 1994) (Andronov 1994). In Primorye, aerial censuses in the post-breeding period revealed that there were 116 birds and 18–19 successful pairs in 1980, and 123 birds and 20 successful pairs in 1986 (Shibaev 1982, Shibaev and Glushchenko 1982, Shibaev 1985, Shibaev and Glushchenko 1988, Glushchenko *et al.* 1995). In southern Sakhalin it was formerly a fairly common visitor on migration (Gizenko 1995 in Smirenskiy 1980), but it is now rare there (Nechaev 1991). On the Kuril islands, the breeding population on Kunashir and Khabomai islands is possibly c.2–3 pairs (see Distribution).

**Japan** According to ancient documents, Red-crowned Cranes were numerous on Hokkaido in the mid-eighteenth century, including on the Yufutsu plain in south-central Hokkaido, although the total population at that time might have been fewer than 1,000 birds (Masatomi 1993). Until the Edo Era (seventeenth to mid-nineteenth centuries), some birds migrated from Hokkaido to Honshu in winter, where they were seen in wetlands and rice paddies near the sea (Masatomi 1993). However, they declined massively after the mid-nineteenth century, ceased to breed in central Hokkaido, and were last reliably recorded there in about 1890; they were believed extinct in Japan until birds were discovered in almost inaccessible marshes just inland of Kushiro in the late 1910s, where their population was estimated at under 20 birds in 1926, 14–25 birds in 1932 and c.40 at the beginning of the Second World War (Masatomi 1993). When the first feeding station was established for them in November 1952, there were only 33 birds (Meine and Archibald 1996), although there might have been a few birds elsewhere in eastern Hokkaido and a total population of c.40 birds in the early 1950s (Masatomi 1993). Their numbers on Hokkaido steadily increased to 200 in December 1967,

reached 300 in the 1980s (320 in December 1982), and by the end of the 1980s there were almost 500 cranes (485 in December 1988) (Editorial Committee on Tancho Report, Kushiro City 1993). They continued to increase and colonise new breeding sites during the 1990s, and February censuses revealed 522 birds in 1993, 569 in 1994, 600 in 1996 and 619 in 1997, with the percentage of juvenile birds stable at 9.1–10.3% (Masatomi *et al.* 1994, 1995, 1997; also Chan 1999). In January and February 1999, censuses revealed 709 and 685 Red-crowned Cranes on Hokkaido respectively (Harada 1999, F. Matsumoto *in litt.* 1999).

**Korea** In the nineteenth century, the Red-crowned Crane was common in North Korea (Taczanowski 1888 in Austin 1948), but it is now a relatively scarce passage and winter visitor, mainly to the area around the Demilitarised Zone (DMZ). About 250–300 birds usually winter on the South Korean side of the DMZ (Pae *et al.* 1996, Kim Jin-han *in litt.* 1998) and c.180–250 birds on the North Korean side of DMZ (Pak U-il in Chan 1999), but there is presumably some interchange of birds between the two wintering flocks, and the total Korean wintering population was therefore conservatively estimated at c.400 birds in 1999 (Chan 1999). This estimate was consistent with simultaneous counts on both sides of the DMZ in spring 1999, which recorded 53 birds in late January and 40 birds in late February on the North Korean side (Chong Jong-ryol *in litt.* 1999) and 233 birds in mid-January and 372 birds in early February on the South Korean side (Kim Jin-han *in litt.* 1999). In recent years, the wintering population at Cholwon (on the South Korean side of the DMZ) has increased, from 54–79 birds in 1978–1986 (Won 1986a) to 250–300 in the late 1990s (Pae *et al.* 1996, Kim Jin-han *in litt.* 1998). However, the numbers on the North Korean side of the DMZ appear to have decreased, from an estimated 300–350 birds in the early 1990s (Meine and Archibald 1996) to no more than 100 in January–February 1999 (Chong Jong-ryol *in litt.* 1999), presumably indicating that some birds have shifted their wintering grounds from the north to the south.

**China** The Red-crowned Crane was described as “pretty numerous” in the “vast swamps” of western Jilin in the 1880s (Ingram 1909); it was regarded as “common” on migration in north-east China (Gee *et al.* 1926–1927), and as “not uncommon” on migration in Hebei in the early 1940s (Hemmingsen 1951), indicating that it was relatively numerous in China until the mid-twentieth century. However, it appeared to decline during the 1950s and 1960s because of hunting for its feathers, meat and eggs in north-east China (Cheng Tso-hsin 1963). Local people on the breeding grounds in Jilin reported that Red-crowned Cranes were still plentiful in the 1950s, but that they started to decline in the 1960s and declined very rapidly in the 1970s, at a time when suitable breeding habitats in Jilin were shrinking (Tong Yongchang and Wen Changchun 1986). In the early 1960s there were reported to be more than 1,500 Red-crowned Cranes wintering in coastal Jiangsu (Shi Zerong and Wu Lingxiang 1987b), but surveys at the wintering grounds in the late 1970s found that many wetlands had been destroyed because of water management activities (presumably drainage through the construction of dams, dykes, canals, etc.) and agriculture, and local people reported that wintering flocks up to 100 birds occurred in the past where only a few could be found in the late 1970s (Ding Wenning and Zhou Fuzhang 1986). Since the 1980s, further declines have been noted on the breeding grounds, apparently because of loss of habitat: in the Dulu He region (where development pressure was noted in 1984: Feng Kemin and Li Jinlu 1985) in Heilongjiang, the species declined from 90 birds and 17 nests in 1984 to almost none in 1994, and the main breeding area at Zhalong shifted to the north between 1981 and 1984 (Meine and Archibald 1996). At Xinglong Nature Reserve in Heilongjiang, 176 birds were present in May 1984, then the largest breeding population in China (Ma Yiqing and Li Xiaomin 1990), but fewer than 10 birds were found in the late 1990s (Piao Renzhu 1999). A decline also appears to have taken place in the core area of Xianghai National Nature Reserve, where 15–30 breeding pairs were present in the 1980s (Tong Yongchang and Wen Changchun 1986, Xianghai Nature Reserve Management Office 1996), but only c.7–9 pairs in 1999 (He Chunguang *et al.* 1999), although it is possible that this may simply reflect a shift in the location of nesting sites within the reserve.

**Table 1. Winter census counts of Red-crowned Cranes at Yancheng Nature Reserve in Jiangsu, from 1981 to 1998 (Wang Qishan *in litt.* 1998).**

Year	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Birds	361	301	472	611	618	314	582	637	531	595	775	673	877	707	789	1,020	848	892

**Table 2. Number of summering Red-crowned Cranes at Xingkai Hu lake in Heilongjiang, from 1987 to 1998 (Luan Xiaofeng *et al.* 1999). \*No age group analysis was made from 1996 to 1998.**

Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996*	1997*	1998*
Breeding birds	26	28	30	30	26	28	14	8-12	14-16	-	-	-
Non-breeding birds	18	20	18	16	10-12	8-10	9-12	13-14	5-6	-	-	-
First-year birds	14	12	14	14	13	9	14	4-5	4	-	-	-
Total	58	60	62	60	49-51	45-47	37-40	26-29	24-26	27-29	27	20-22

The number of Red-crowned Cranes wintering in China was recently estimated at 1,200 birds, on the assumption that a total of 1,000–1,100 birds winter at the two main sites (Yancheng and the Yellow River delta), and c.100 birds at the smaller wintering sites (Chan 1999). At Yancheng, wintering numbers during the 1990s have ranged from 595 birds in 1990–1991 to 1,020 in 1996–1997 (Wang Qishan *in litt.* 1997; see Table 1). Lü Juanzhang *et al.* (1998) estimated that c.200 birds have wintering at the Yellow River delta in recent years, although it is not easy to conduct ground censuses there because of the size of the reserve. However, the fact that 70 birds were counted there in three days (during the International Crane Census) in early January 1999 (Qian Fawen *in litt.* 1999), indicates that 200 is probably not an overestimate (SC). Wang Hui (1997) estimated a total 1,400 wintering Red-crowned Crane in China on the basis of recent counts, but this might have been an overestimate as it included counts from Shaanxi, where it is only a passage migrant (Cao Yonghan *in litt.* 1999), and from lakes on the border of Jiangsu and Anhui provinces where the habitats have deteriorated and cranes have not been reported in recent years (and have probably moved to Yancheng and the Yellow River delta) (SC). The numbers of wintering Red-crowned Cranes at Yancheng have tended to increase in recent years, possibly as a result of better protection and education at this site (Wang Qishan *in litt.* 1998). As a result of the construction of an artificial wetland to provide additional habitat for the cranes, and artificial feeding with maize and wheat, more than 500 Red-crowned Cranes are now found near the core area of Yancheng Nature Reserve (Wang Hui 1999). However, the increase at Yancheng could also be the result of deterioration and destruction of habitats in other wintering areas (Wang Qishan *in litt.* 1998). The tidal flats are currently being lost through development at Yancheng (see Ma Zhijun 1999), and it is uncertain whether this area can continue to support 800–1,000 wintering Red-crowned Cranes in the future (Wang Qishan *in litt.* 1998). The number of summering birds at Xingkai Hu (the Chinese section of Lake Khanka) in Heilongjiang has declined in recent years because of habitat destruction and disturbance (see Threats and Table 2).

**ECOLOGY Habitat** This species is “highly aquatic” (i.e. strongly linked to aquatic habitats), with a large home range, and it feeds in deeper water than other Asian cranes (Meine and Archibald 1996). On the breeding grounds in Russia, its habitats are characteristic of the “East Asian wet grasslands”, a biome mainly confined to the middle Amur drainage system (Andronov *et al.* 1988). In the Arkhara lowlands, it breeds in large grassland marshes composed of wet sedge/grass meadows mixed with open stands of oak and birch; swards of dry grass are especially important during the early nesting period, as well as shallow ponds, bow lakes and streams, and the crane therefore avoids nesting in burnt areas (Andronov *et al.* 1988). On the Lake Khanka plains, its breeding sites are in grassy marshes, vegetated with swards of

reed *Phragmites communis* and *Calamagrostis*, interspersed with numerous small lakes and meandering streams, and in the lower Bikin basin it nests in vast sphagnum bogs, also vegetated with reeds and grasses (Yu. V. Shibaev *in litt.* 1997). Breeding birds are very sensitive to human disturbance, they avoid settlements and roads, and they will not nest in areas that have been modified by man (but may visit these areas on migration) (Yu. V. Shibaev *in litt.* 1997). In China they mainly breed in reed marshes, where the typical plant community (e.g. in Zhalong, Xianghai and Shuangtai Hekou Nature Reserves) is *Phragmites communis* with *Deyeuxia angustifolia*, *Carex montana*, *Cyperus* and *Scirpus triqueter* (Ma Guo'en 1982).

On migration, they occur in wetlands or feed in rice-fields; in spring, they usually feed on swampy lakeshores, the banks of slow rivers and in rice- or grain-fields, but by early summer birds spend more time on the swamps and sedge mires, and sometimes move to drier meadows to forage for insects (Yu. V. Shibaev *in litt.* 1997). On the wintering grounds in the Yellow River delta, they occur mainly on tidal flats, river channels, marshy grasslands and farmlands (Zhao Yanmao and Song Chaoshu 1995). At Yancheng they also stay mainly on the coastal marshes and the wide tidal flats (up to 15 km or more in width) (Huan Baoqing 1986a, Liu Bai 1990). There are five main habitats types used by Red-crowned Cranes at Yancheng: (1) saltpans (mostly located in the northern part of the reserve), similar to the surrounding marine environment and suitable habitat for cranes, although their attraction declines somewhat during the evaporation process when there is much human activity; (2) aquacultural ponds, used to raise fish and shrimps, which are attractive in winter when the water is drained, exposing abundant food for waterbirds; (3) reedbeds, both natural and cultivated (on irrigated former tidal land); (4) saltmarshes (mostly in the central and southern parts of the reserve and outside the dykes), with wormwood *Artemisia halodendron*; (5) tidal grassland, one of the important natural habitat types in the reserve, although already somewhat modified by human activities (Ma Zhijun *et al.* 1998). Of these five the birds prefer the tidal grasslands, but their choice of habitat is related to the availability of food and, to some extent, to human activity: their numbers are stable in the reedbeds in the reserve, despite the high degree of human activity there, because the reeds provide good shelter and are usually located in freshwater; the birds stay there even after the reeds have been harvested, probably because it is then easier to hunt crabs (their main food in this habitat), although following improved protection in the reserve more Red-crowned Cranes have been using wheatfields (Ma Zhijun *et al.* 1997). Their habitat requirements in Yancheng have changed in recent decades: in 1982, c.61% of the wintering birds were found in natural wetlands but, following widespread wetland reclamation, in 1995 c.71% of the wintering birds were found on artificial and semi-artificial wetlands such as saltpans, aquacultural ponds and reed farms (Ma Zhijun 1999).

On passage and in winter, the Red-crowned Crane occurs in flocks, sometimes mixed with other crane species: for example, on the wintering grounds in China it is usually in flocks of 4–8 birds, but sometimes in larger flocks up to 20, and in mixed flocks with Common Cranes *Grus grus* (Zhao Yanmao and Song Chaoshu 1995). The wintering flocks in the Cholwon basin in South Korea feed on farmland and roost nearby, usually in family parties (Pae and Won 1994). In winter in Japan they use coastal saltmarshes, rivers, freshwater marshes, rice paddies and cultivated fields (Meine and Archibald 1996). They select roost sites which have unfrozen water, are secure with good visibility, and are close to feeding stations and areas with natural food available, and according to their temperature and the wind speed and direction (Kamata *et al.* 1994, Harada 1999).

**Food** Red-crowned Cranes are generalist feeders, eating a wide variety of insects, aquatic invertebrates, fishes, amphibians and rodents, as well as reeds, grasses, heath berries, corn, and other plants during the warm seasons (Meine and Archibald 1996). In Russia, they are mostly vegetarian in spring and early summer, eating leaves, buds and roots of marsh plants, as well as rice, grain and corn on the fields; soon after the eggs hatch, their diet switches to water insects (*Oxia chinensis*, *Hydrous dauricus*, *Diplonischus major*), molluscs (*Cipangopaludina*

*ussuriensis*), amphibians (*Rana*), fish (*Percottus glenni*, *Carrasius auratus*) and small rodents (*Microtus fortis*) (Shibaev and Glushchenko 1982). In the Amur region, a fish *Misgurnus anguillicaudatus* is of particular importance, and is frequently given to the chicks from June to September; from mid-July to August the adults feed on sprouts and roots of hydrophilic plants, sedges, iris and *Comarum*, and in late summer they frequently eat terrestrial insects; in autumn they form flocks and visit fields to feed on rice and corn (Andronov *et al.* 1988). On wetlands in north-east China they mostly feed on animals (fish, frogs, tadpoles and aquatic insects) and young shoots and seeds of plants such as *Triglochin palustre* and *Alisma* (Yin Ruixue 1992). In Japan, they are omnivorous, but feed mostly on plants from autumn to spring, and more on animals during the breeding season, including freshwater shrimps, loaches, small fish, mud snails, amphibians and larger insects such as dragonflies, with reports of feeding on mice and the chicks of other birds (Masatomi 1993).

Their winter diet varies with site: on Hokkaido, they feed on human-provided corn and on aquatic plants and animals in unfrozen watercourses, in Korea on waste grain and animal food items, and in the coastal saltmarshes of China on aquatic invertebrates, plants and some human-provided grain (Meine and Archibald 1996). At Onbetsu on Hokkaido, in November they usually feed in harvested fields, particularly of maize, in December they spend about the same amount of time on farmland, by rivers and at feeding stations, and in January–February (when farmland is covered by snow) they forage mostly by the rivers and at the feeding grounds (Kobayashi *et al.* 1997). At Mochida Sanctuary on Hokkaido, they spend most of their time foraging on the tidal flats; one bird was observed to take six 20-cm-long fish in c.10 minutes (Kamata and Tomioka 1994). On the tidal flats at Yancheng, animal food (mainly fish and molluscs) comprises over 90% of their total food intake, including snails, clams, razor clams *Solen*, crabs, lugworms and fish, and they also take some aquatic plants, the seeds of *Cyperus* and *Suaeda*, and the tubers of grasses and herbs (Huan Baoqing 1986a,b, Shi Zerong and Wu Lingxiang 1987a,b). In the Yellow River delta they feed mainly on aquatic plants, soya bean, wheat, molluscs, crustaceans and fish (Zhao Yanmao and Song Chaoshu 1995).

**Breeding** Birds arrive on the breeding grounds in the middle reaches of the Amur river by late March or early April, where they establish territories that vary in size from 4 to 12 km<sup>2</sup>, on average 6 km<sup>2</sup> (V. A. Dugintsov *in litt.* 1997). On Hokkaido in 1995–1998, the density of breeding pairs per square kilometre varied from 0.127 to 1.369 (i.e. territory size of 0.73–7.87 km<sup>2</sup>) and was always lowest on Kushiro marshes and highest on the Nemuro peninsula (Masatomi *et al.* 1996, 1998). In western Heilongjiang, pairing starts from early April, and the nests are built c.2–3 km or more apart in places normally not accessible to terrestrial predators (Feng Kemin and Li Jinlu 1990). On Hokkaido, pairs choose nest sites where reeds are available for nesting material and tall grasses for security, and in Kushiro the nests tend to be located near thickets, but in Nemuro and Tokachi they tend to be near open marshes, the sea or mudflats (Masatomi 1993). At Shuangtai Hekou in Liaoning, they also prefer to nest in open reedbeds (without large features within 500 m), and avoid nesting near the oilfields, probably because there is more traffic and human activity there; the nests are built on higher areas surrounded by deep water, and areas with dried, yellow reeds are preferred (Liu Mingyu *et al.* 1991, Kanai *et al.* 1993). Nesting Red-crowned Cranes show a significant preference for wetter wetland types, such as reed–sedge marsh, reed marsh, cattail marsh, and floating reed–sedge mat in China, and in Russia they use vast cottongrass–sedge bogs and similar habitats; the nests are built on wet ground or in shallow water up to 44 cm deep in Japan, and 20–55 cm deep in Russia, in areas with standing dead reeds 0.3–2.0 m tall, and preferentially in areas that were not cut the previous winter (Meine and Archibald 1996). The birds make simple nests of dry reed stalks, and new nests are built every year (they have not been observed to use old nests) (Feng Kemin and Li Jinlu 1990). In Russia, the nests are piles of sedge and grass straw 10–50 cm above water-level (V. A. Dugintsov *in litt.* 1997). In Japan, c.80% of the

nest is composed of decaying reeds, and the rest of sedges and true grasses and other materials, and is usually shallow and trapezoidal in shape (Masatomi 1993).

This species usually lays two eggs, the incubation period is 29–34 days, and the chicks fledge at about 95 days (Meine and Archibald 1996). At Shuangtai Hekou in Liaoning, the eggs are laid around 10–13 April (Liu Mingyu *et al.* 1991). In western Heilongjiang, broods of two eggs are laid in mid- to late April, and the chicks usually hatch in late May (Feng Kemin and Li Jinlu 1990). In the Amur region, the females start to lay by 16–22 April, and 14 completed clutches consisted of one (21.5%) or two (78.5%) eggs; both parents incubate (changing over c.4 times per day), incubation lasts 29–31 days, hatching occurs by late May–early June, the second chick hatches c.2–3 days after the first, and if undisturbed the families then stay near their nests for 1–2 weeks (V. A. Dugintsov *in litt.* 1997). On Hokkaido, one or two eggs are laid, and both male and female birds incubate the eggs (Masatomi 1993). The eggs are laid in mid-April, and chicks are observed in late May (Iijima and Yamada 1983). At the major breeding sites on Hokkaido in the late 1990s, the percentages of families with two chicks in the breeding season varied annually between 19.3 and 64.9%, and the percentage of pairs that failed to rear chicks varied between 26.3 and 51.8% (Masatomi *et al.* 1996, 1998). In Russia, only c.50% of chicks fledge successfully (Smirenskiy 1988). On the Zeya-Bureya plains in Amur, they gather in flocks of 4–8 individuals by late August–early September, with only c.25% of them being juveniles (Vinter 1977), and on the Lake Khanka plains this proportion varies from c.17 to 33% (Yu. V. Shibaev *in litt.* 1997). On Hokkaido, probably not more than one quarter of all chicks survive their first year, and many young birds are predated by mink and fox or killed by floods and disease (Masatomi 1993). On Hokkaido, the young birds become independent from about mid-February, when the parents either chase them away or leave them at the feeding areas (Kamata and Tomioka 1991).

**Migration** The Japanese population is virtually resident on Hokkaido, but the continental population migrates from the breeding ground in Russia and north-east China to winter on the Korean Peninsula and the coast of eastern China. In eastern Hokkaido, the birds are more widespread in summer, but in winter they concentrate in the feeding areas at Akan-cho and Tsurui-mura in Kushiro (Momose and Nakamura 1983). In 1993, the breeding birds from Mochida Sanctuary departed on 1 October and arrived at the wintering ground of Tsuru-Ito Sanctuary on 3 October (c.90 km from Mochida) (Kamata and Tomioka 1994). Colour-banding has shown that birds sometimes move between different feeding grounds during the winter (Masatomi *et al.* 1995, 1997).

In continental Asia, satellite-tracking has identified two migration routes: a 2,200-km western route from Khinganskiy Nature Reserve in Russia to coastal Jiangsu in China, and a 900-km eastern route from Lake Khanka in Russia to the Demilitarised Zone (DMZ) on the Korean Peninsula (Higuchi *et al.* 1998). The western route has also been confirmed by colour banding, as colour-banded cranes that breed at Zhalong (Heilongjiang) were seen at Xianghai and Melmeg in Jilin in December 1985, and at Yancheng in Jiangsu in December 1988, while a juvenile bird banded in the Amur valley in Russia was seen at Zhalong on migration (Xu Jie *et al.* 1995). However, one bird banded at Khinganskiy in Russia did not travel to China, but turned up at Inchon in Korea in winter 1998–1999 (Yu. Darman verbally 1999). There is some evidence indicating that the breeding population at Shuangtai Hekou in Liaoning may be non-migratory, and there was formerly a non-migratory population in the Tumen river area in southern Primorye (G. Archibald *in litt.* 1999).

In Russia, birds leave the Arkhara lowlands in flocks by early November, and there are two major migration stopovers in Primorye, at Lake Khanka (where they may stay for two months) and the Khasan plain (Shibaev and Surmach 1994). Migrants are present in southern Primorye in September–October, and sometimes stay until early November (latest observation on 8 November) (Shibaev and Glushchenko 1988). In spring, the earliest record at the Tumen (Tumangan) delta in extreme south-east Primorye was on 29 February, but most passage

occurred on 14–28 March (Gafitski 1988). Another study found that birds arrived in the Tumen delta area on about 12 March, with peak numbers around 18 March, and that most arrived in flocks of 10–25 (Wu Zhigang and Yang Xingjia 1995), while on the Chinese side of the border they are seen mainly from mid-March to early April (Wu Zhigang *et al.* 1991d). The species occurs nearby at Lake Khanka in the first 10 days of April (Shibaev 1976), and on migration in the Arkhara lowlands in Amur from late March to early April (Pan'kin and Neufeldt 1976b). It migrates along both the western and eastern coasts of the Korean Peninsula, and winters around the Demilitarised Zone (DMZ) (Chong 1987). At Cholwon (near the DMZ) in winter 1992–1993 the first 35 birds arrived on 10 November and 228 were present by 2 December, their numbers remaining fairly stable until 275 birds were counted on 8 March, declining to 52 on 14 March, and only 5–6 birds remaining in late March (Pae *et al.* 1996). On the breeding grounds in China, the species arrives at Shuangtai Hekou in mid-March and departs in late November (Liu Mingyu *et al.* 1991; also Zhao Zhengjie 1988), and it occurs there on passage for c.20 days in March and from the end of October until mid- to late November (Yang Fulin *et al.* 1998). In western Heilongjiang, it arrives in mid- to late March and departs in late October to early November (Feng Kemin and Li Jinlu 1990). It occurs on passage at Xingkai lake from mid-October to mid-November, and the peak of autumn migration is in early November (Zhang Aizhong *et al.* 1995). The arrival time at Yancheng is directly related to air temperature: the first flocks appear in the last 10 days of October and the first 10 days of November, when the daily average air temperature is 13–14°C, and they begin to migrate north in the last 10 days of February and the first 10 days of March, when the air temperature is 2–6°C (Wang Hui 1991).

**THREATS** *Habitat loss* *Russia* This species has declined in most parts of its Russian breeding range (see Population), mainly because of habitat loss and degradation. In the upper Amur region, many of its breeding grounds have been drained, and the floodplains are used for increasingly intensive cattle-grazing (Dymin and Pan'kin 1975, Pan'kin 1981, Smirenskiy and Roslyakov 1982). As a result of this land reclamation and ploughing, its breeding habitats have become much more fragmented than before (Vinter 1977). In Primorye, there were intensive drainage schemes at Lake Khanka in the 1960s–1980s, mainly to develop rice cultivation, but most of the marshlands used by this species survived; however, when the nature reserve was established there in 1990, the bird's habitats were mainly excluded from the reserve and remain practically unprotected (Glushchenko and Shibaev 1996). The staging sites used on migration are also inadequately protected (Yu. V. Shibaev *in litt.* 1997). The development of the Tumen river estuary as an international seaport could destroy an important staging area for the Red-crowned Crane and many other waterbirds (Yu. V. Shibaev verbally 1992). Breeding success in many parts of its Russian range is seriously affected by the practice of burning off grass and other plant debris in meadows, which is widely used by local farmers to improve their pastures from early April to mid-June (Dymin and Pan'kin 1975, Dymin *et al.* 1977, Dugintsov and Pan'kin 1990, V. Andronov *in litt.* 2000). In early spring, this deprives nesting pairs of the long grass that they require in their nesting territories, and if fire occurs during incubation it destroys the clutch (Vinter 1977, Dugintsov and Pan'kin 1990). On the Lake Khanka plains, 50–90% of potential crane habitat is burnt annually (Yu. V. Shibaev *in litt.* 1997). Fires are also set by farmers in autumn, and although they do not have a direct effect on the cranes, they can reduce the quality of the nesting habitat for the following season (Dugintsov and Pan'kin 1990).

*Japan* In the nineteenth century, as Japan was industrialised, many of the wetlands on Honshu where this species formerly wintered were drained, and agriculture expanded rapidly on Hokkaido, including at Oshima, where the area of rice paddies increased from 4.20 km<sup>2</sup> in 1872 to 55.23 km<sup>2</sup> in 1911, and in Ishikiri, where only 0.04 km<sup>2</sup> of rice paddies in 1881 increased to 323.55 km<sup>2</sup> by 1911 (Masatomi 1993). No rice paddies were developed in Kushiro

and Nemuro at that time because of their colder climates, but since the 1970s one-third of the 291 km<sup>2</sup> of marshland in Kushiro has been converted to agricultural, industrial or residential use, and wetlands in Tokachi and Nemuro are being similarly developed (Masatomi 1993). Economic development, especially agricultural expansion, river channelisation, deforestation and road-building, continue to destroy breeding wetlands on Hokkaido (Meine and Archibald 1996).

*South Korea* The most important wintering ground of Red-crowned Cranes on the Korean Peninsula is in the Cholwon basin in the Demilitarised Zone (DMZ), where access for civilians and development are limited, but local people foresee that economic development may become possible if Korea were to be reunited, and they are therefore not supportive of the designation of the site as a protected area for cranes (SC). The construction of Incheon International Airport in the mid-1990s reclaimed wetlands on Sammok and Yongjong islands, the latter of which used to be a wintering ground for about four cranes, and there have been no records there since 1995 (Park *et al.* 1997). There appear to be plans to reclaim the tidal flats on Kanghwa island, at least in the south-west of the island, where there have been proposals for resort development and industrial estates (Moore 1999).

*Mainland China* The main threat to this species on its breeding grounds is the decrease in the area of wetland because of development projects, and the remaining wetlands are tending to become drier as the area of wetlands shrinks (Wang Qishan *in litt.* 1998). Large areas of wetland are being lost on the Sanjiang plains in Heilongjiang. For example, during an aerial survey in mid-May 1984, it was observed that wetlands in the north-east and the south of the lower Dulu He river had been converted into farmland, that most of the wetlands at Xiao Xingkai Hu lake had been reclaimed for farmland, and that the basin of the Qixing He and Naoli He rivers had become drier and that the cranes were concentrated in wetlands along the two rivers (Feng Kemin and Li Jinlu 1985). A dramatic decline in the number of nesting birds at Xinglong Nature Reserve, which supported the largest known breeding population in China in the 1980s (Ma Yiqing and Li Xiaomin 1990), was presumably also caused by habitat loss—only 45% of the original wetlands on the Sanjiang plains remained in 1983, and at that time farmland covered 34.1% of the total land area (Li Xiaomin 1996). Farmland had increased to 74% of the plains by 1991 (J. Minton verbally 1998; details in Threats under Swan Goose *Anser cygnoides*). Road-building is a problem at Zhalong Nature Reserve in Heilongjiang, where National Highway 301 cuts through the wetlands, and reclamation for rice paddies and the development of tourist facilities are taking place even inside the core area of the reserve (Wu Changshen 1997). At Zhalong, the water inflow to the marsh and the area of the wetlands have been reduced in recent years, as large areas of reedbeds are gradually being converted into wet or even dry grassland (Wang Qishan *in litt.* 1997). Xingkai Hu Nature Reserve in Heilongjiang includes two state farms and one fish farm, and the reserve management office does not have the right to control land use in these areas; the Forestry Department of Heilongjiang signed an agreement regarding the boundary of the nature reserve in 1995 under which 530 km<sup>2</sup> of the reserve core area (which lies inside a state farm) was ceded to the farm, including 220 km<sup>2</sup> that was leased to individual developers for fisheries; another 260 km<sup>2</sup> of marshland in the southern part of the reserve core area is being reclaimed by the farm, and the “experimental zone” (a type of buffer zone) on the eastern side of the nature reserve was leased to the Mining Bureau of Jixi and Qitaihe in 1996; another 200 km<sup>2</sup> of the lakes in the northern part of the reserve will be developed by the fish farm, and the core area of the nature reserve is rapidly becoming surrounded by development, a trend which may not stop as a 13 km highway connecting the Qidui (Seventh League) of the farm and Longwangmiao will start construction very soon (Luan Xiaofeng *et al.* 1999). In Jilin, nesting sites were abandoned at the Tao'er He river and the Qagan Nur following the drying up of the wetlands, and the crane habitats in the Yueliang Pao area were flooded by a dam (Tong Yongchang and Wen Changchun 1986). At the recently discovered migration stopover

in Heyang county in Shaanxi, the wetlands are being converted into fishponds, and the area of reedbeds is declined rapidly because the reeds are harvested for paper manufacture (Ding Changqing *et al.* 1999b). At the main wintering grounds in Yancheng Nature Reserve, the reclamation of tidal flats and the construction of a large power plant at the Sheyang estuary have forced the cranes to concentrate in the southern part of the reserve and at the estuaries and larger fishponds (Wang Qishan *in litt.* 1998, Wang Hui 1999). By altering the sedimentation processes, the Three Gorges Dam on the Yangtze valley may result in the loss of wintering habitat in the coastal marshes of Jiangsu (Meine and Archibald 1996).

Spring fires set by farmers also damage the nesting grounds of this species in China (Wang Qishan *in litt.* 1998). At Xingkai Hu Nature Reserve, fire affected over 80% of the reserve in April 1993, and fewer than seven pairs were able to nest that year (down from the usual 13–15 breeding pairs) (Li Wenfa 1997). In April 1996, the core area of Xingkai Hu Nature Reserve was almost totally burnt again (Luan Xiaofeng *et al.* 1999). No Red-crowned Cranes were found nesting there (or stopped over on migration) in 1998, following a very dry spring, when almost all of the lakes dried up, and fires in late March burnt about two-thirds of the reedbeds in the core area of the reserve; in summer 1998 there was more rain, the wetlands recovered, and 7–9 pairs bred (He Chunguang *et al.* 1999). On the breeding grounds, farmers harvest reeds in early winter, and when the cranes arrive back at the breeding grounds the reeds are often still not tall enough to provide favourable nesting habitat (Wang Qishan *in litt.* 1998).

**Hunting/persecution** *Russia* There is some poaching of this species on the breeding grounds in eastern Russia (Vinter 1977, Yu. V. Shibaev *in litt.* 1997), and birds are sometimes found shot dead or injured (V. Andronov *in litt.* 2000). The level of hunting of cranes in Russia has been reported to have increased recently because of immigration of people with different cultural traditions (Smirenskiy 1992 in Meine and Archibald 1996). *Japan* One of the reasons for the decline of this species in the late nineteenth century was weak law enforcement during the chaotic Meiji Restoration period, allowing it to be over-hunted (Masatomi 1993). Although hunting is no longer a serious threat, there are still reports of birds being shot (Momose and Nakamura 1983). *Mainland China* Hunting is a serious threat. On the breeding grounds, wildlife is poached in Xingkai Hu Nature Reserve in Heilongjiang (Luan Xiaofeng *et al.* 1999). Two hunters were reported to have killed about a hundred cranes (including at least eight Red-crowned Cranes) within a 10-year period at Xianghai Nature Reserve in Jilin (Tong Yongchang and Wen Changchun 1986). Farmers and fishermen also sometimes collect crane eggs (Wang Qishan *in litt.* 1998). Farmers use beans soaked in pesticides to kill “pest” birds on their farmland, and poachers use similar poisoned baits to kill ducks; in March 1995, 19 migrant Red-crowned Cranes were killed at the Luan He estuary in Hebei after ingesting poisoned grains (Chan 1998). Illegal hunting and poisoning of waterfowl was also observed at the recently discovered migration stopover at Heyang county in Shaanxi (Ding Changqing *et al.* 1999b). At the Yellow River delta, farmers use poison baits to stop sheep grazing in their wheatfields, and cranes have sometimes been killed by taking such poison, including three birds in 1996, although in June 1997 the Dongying city government banned the use of poisons on farmland (Lü Juanzhang *et al.* 1998). In winter 1990–1991, four Red-crowned Cranes were poisoned on the tidal flat at Haifeng farm in November 1991 and 12 birds were killed near Wanggang (Wang Qishan *in litt.* 1998), while seven were poisoned in winter 1995 (Ma Zhijun *et al.* 1997). At Yancheng, a survey team learnt that three birds had been shot and 14 captured shortly before their survey in December 1979 (Ding Wenning and Zhou Fuzhang 1986) and, despite the establishment of the nature reserve there, cranes are sometimes found killed by illegal poison baits set for ducks (Wang Hui 1999). When scientists from Khinganskiy Nature Reserve in Russia visited Yancheng in January 2000, they heard of 11 cases of Red-crowned Cranes being poisoned at the reserve, including one bird which was carrying a satellite transmitter from Khinganskiy and which had been poisoned and eaten (Yu. Darman verbally 2000).

**Disturbance** *Russia* Human disturbance is one of the main threats to this species on the breeding grounds (V. Andronov *in litt.* 2000). On the Amur and Bureya river floodplains, intensive cattle-grazing causes constant disturbance (even within protected areas), mechanised haymaking takes place, and teams of land-surveyors travel about in rough-terrain vehicles (Smirenskiy 1980). Some of the cranes' nests and eggs are trampled by the grazing animals and crane chicks still unable to fly frequently fall prey to herdsmen's dogs (Dymin and Pan'kin 1975). *Mainland China* Fishing activities cause great disturbance in wetlands (Wang Qishan *in litt.* 1998). At the recently discovered migration stopover in Heyang county in Shaanxi, tourism and resort development cause disruption (Ding Changqing *et al.* 1999b). The illegal digging of lugworms in winter at Yancheng Nature Reserve causes much disturbance and destroys benthic animals and plants, and this is especially serious on the tidal flats in Dafeng county (Wang Qishan *in litt.* 1998).

**Reduction in food supply** *Mainland China* Overfishing has reduced the crane's food supply (and presumably its numbers) at many wetlands, and fishermen now catch smaller fish because of the decline in stocks (Wang Qishan *in litt.* 1998). For example, in Heilongjiang there has been overfishing in Zhalong Nature Reserve in recent years (Wu Changshen 1997) and the areas leased to fishermen in Xingkai Hu Nature Reserve are also overfished (Luan Xiaofeng *et al.* 1999).

**Pollution** *Russia* On the breeding grounds, lakes and marshes are being affected by run-off containing fertiliser or toxic chemical residues, which is reducing the cranes' food supply (Vinter 1977). *Mainland China* In Heilongjiang, pollution and eutrophication have affected the wetlands in Zhalong Nature Reserve in recent years (Wu Changshen 1997), and at Xingkai Hu agrochemicals have polluted the water in the lakes (Luan Xiaofeng *et al.* 1999). Shuangtai Hekou Nature Reserve is under threat of pollution from oil extraction operations in the Liaohe oilfield (Chen Tieshan and Sun Shide 1986). The breeding grounds along the Nen Jiang river and the wintering ground at the Yellow River delta are also located in oilfields, and pollution from oil spills is also likely there (SC). At Yancheng Nature Reserve, the largest wintering population of Red-crowned Cranes is threatened by the use of agrochemicals and pesticides (Ma Zhijun *et al.* 1998).

**Collision with power-lines** *Japan* About 70% of the Red-crowned Cranes found dead in the wild on Hokkaido in recent years (23 in 1971 and 1972) were killed by collision with power-lines (Momose and Nakamura 1983).

**Over-concentration** *Japan* There has been some concern that the concentration of wintering Red-crowned Cranes at feeding sites on Hokkaido might put them at risk from the outbreak of disease or some other catastrophe (Momose and Nakamura 1983).

**MEASURES TAKEN** *International cooperation* Since the 1980s, there has been international collaboration on projects for the conservation of this species within the Asia region, and the North-East Asian Crane Site Network was established in 1997, to encourage international cooperation on conservation of cranes and wetlands and to ensure the long-term survival of all crane species and their habitats in the North-East Asian flyway system; reserves important for conservation of Red-crowned Cranes—including Lake Khanka, Khinganskiy, Kiritappu Marsh, Akkeshi Lake/Bekanbeushi marsh, Kushiro, Kumya, Mundok, Cholwon, Han river estuary, Xingkai Hu, Yellow River delta and Yancheng—are listed as key sites in the North-East Asian Crane Site Network (SC; see the account for Hooded Crane *Grus monacha*).

**Legislation** This species is included in the Russian national Red Data Book (Kolosoov 1983). It was designated as natural monument no.202 in South Korea on 30 May 1968 (Lee Woo-shin *in litt.* 1998). The Hokkaido (Japan) government banned hunting of Red-crowned Cranes in 1889, but too late to save the remaining known population; it was designated as a Special Natural Monument in March 1952, and all Red-crowned Cranes were designated as special national natural monuments in 1967 (Momose and Nakamura 1983, Masatomi 1993).

It was later designated as a "Special Bird" in 1972 (Environment Agency of Japan 1976), and has been protected as a National Endangered Species since 1993, and is also on the Red List of Japan, which means that its conservation importance is recognised and it can be used as a reference species in environmental impact assessment for development projects (Environment Agency of Japan *in litt.* 1999). It is a Nationally Protected Species (Second Class) in China (Zheng Guangmei and Wang Qishan 1998). The use of poison baits was a problem at the Yellow River delta, but in June 1997 the Dongying city government banned the use of poisons on farmland (Lü Juanzhang *et al.* 1998). It is listed on Appendix I of CITES, and on Appendix I of the CMS (Bonn Convention, for which see Boere 1991).

**Protected areas** *Russia* This species is protected in Lake Bolon' State Reserve and Simmi Sanctuary in Khabarovsk, the Ul'minski, Murav'evski, Amurski, Khinganskiy and Ganukan reserves in Amur, the Lake Khanka (also a Ramsar site) and Tumangan reserves in Primorye and the Kuril'ski reserve in the Kuril islands (see Distribution). Although some breeding sites are protected in the Khanka Strict Reserve (established in 1990), 80% of the breeding population of this species unfortunately occur outside the reserve boundaries (Yu. V. Shibaev *in litt.* 1997). The "Khasanskiy" Nature Park was established at the migratory stopover at the Tumen (Tumangan) estuary in 1997, but this did not prevent hunting in this area (Litvinenko and Shibaev 1996). In the early 1990s, the Wild Bird Society of Japan helped to raise funding in Japan to purchase land near Blagoveshchensk to establish the Muraviovka Nature Park, which was first discovered to be important for breeding and migratory cranes during satellite-tracking and a ground study of cranes, and was the first protected area in Russia to be managed by a non-governmental organisation since 1917; this park is playing an important role in demonstrating how human activities can co-exist with crane conservation in Russia, and has been the focus of many educational activities to promote public awareness of crane conservation (SC). *Japan* In 1925, after this species was rediscovered in Kushiro, the Ministry of Agriculture and Forestry designed the wetlands between the Kuchoro and Chiruwatsunai rivers as a non-hunting area; in 1935, the Ministry of Culture designated 27 km<sup>2</sup> of breeding grounds in the Kushiro marshes as a national natural monument; in 1952 the crane breeding grounds (27.5 km<sup>2</sup>) in Kushiro were elevated to the status of special national natural monument, and in 1967 the area of marshes protected was expanded to 50 km<sup>2</sup> (Masatomi 1993). Kushiro wetland (c.50 km<sup>2</sup>) was designated as a Ramsar site in 1980 (Momose and Nakamura 1983). National wildlife protection areas mainly established for the conservation of Red-crowned Cranes include Kushiro-shitsugen (115 km<sup>2</sup>, including 70 km<sup>2</sup> of Special Protection Area), Furen-ko (78 km<sup>2</sup>, including 9 km<sup>2</sup> of Special Protection Area) and Akkeshi-Bekanbeushi-Kiritappu (109 km<sup>2</sup>, including 74 km<sup>2</sup> of Special Protection Area), with the Notsuke peninsula being designated as a National Wildlife Protection Area in 1999; Kushiro, Akkeshi-Bekanbeushi and Kiritappu have been designated as Ramsar sites (Environment Agency of Japan *in litt.* 1999). Mochida Sanctuary was established for the Red-crowned Crane by WBSJ in 1987 (Kamata and Tomioka 1994). At Tsurui Ito Tancho Sanctuary, measures taken have included artificial feeding in winter, the erection of fences and noticeboards to keep out trespassers and photographers, ranger patrols in the sanctuary from September to March to protect the cranes from disturbance, special markers placed on power and telephone cables to prevent cranes colliding with them, and the restoration of reedbeds and natural feeding grounds (Harada 1999). Similar measures have been taken at Akan, and the special markers placed on electricity cables seemed to be effective, because by the late 1970s far fewer cranes were flying into them, and collectively these measures appeared to be helping the crane population to increase (Masatomi 1993). *Korea* The main wintering and staging areas of this species in North Korea are designated as reserves and monuments (Pak U-il *in litt.* 1998). The Cholwon Bird Reserve protects a small portion of the wintering grounds in South Korea, and the Demilitarised Zone (DMZ) functions as a protected area because of the relative lack of intensive economic development (Meine and Archibald 1996). *Mainland*

**China** Protected areas have been established at many of the sites used by Red-crowned Cranes in China, including: at breeding sites, Honghe, Xinglong, Sanjiang, Zhalong, Xingkai Hu, Aobao Shan, Changlindao, Yanwodao, Liansanpao, Fuyu, Heiyupao, Qixinghe and Yueha Hu Nature Reserves in Heilongjiang, Xianghai, Melmeg and Qagan Nur Nature Reserves in Jilin, Shunagtai Hekou Nature Reserve in Liaoning, and Dalinor and Horqin Nature Reserves in Inner Mongolia; at wintering sites, Yellow River Delta Nature Reserve in Shandong, and Yancheng, Yuntai Shan, Dafeng Milu and Xinglong Dongsha Nature Reserves in Jiangsu (see Distribution; also Liu Donglai *et al.* 1996, MacKinnon *et al.* 1996, Qian Fawen *in litt.* 1998). At Yancheng Nature Reserve, habitat management since 1994 to maintain suitable wetlands for Red-crowned Cranes proved to be successful, and c.580 wintered there in 1995 (Wang Qishan and Du Jianjian 1998). However, problems inside protected areas are significant (see Threats).

**Supplementary feeding Japan** On Hokkaido, a local conservation organisation was formed in 1935, and artificial feeding in winter started in 1936, although it was not successful until 1952; since then about 20 feeding sites have been established, and have prevented cranes from dying of starvation in winter, although there have been concerns that the cranes have become too concentrated in winter and too dependent on artificial feeding (Momose and Nakamura 1983). At Tsurui Ito Tancho Sanctuary, 9,300 kg of maize were fed to the wintering cranes from October 1998 to March 1999 (Harada 1999).

**Research** Periodic aerial surveys of this species have been conducted in Russia and China, and extensive research on its conservation status and ecology has been conducted since 1970 (Meine and Archibald 1996). A winter census of the Red-crowned Crane population on Hokkaido was started in 1952 (Momose and Nakamura 1983).

**Conservation education Russia** Since 1995, an art contest for children, called “Crane, the bird of peace”, has been conducted by the Amur Chapter of the Socio-ecological Union, and has promoted public awareness of crane conservation through the participation of children from Primorye, Khabarovsk, Jewish Autonomous Region, Amur and Chita; more than 1,200 people took part in the contest in 1999, which was arranged in cooperation with other North-East Asian countries (and with funding from the Japan Fund for Global Environment), and an exhibition of c.170 paintings was held in South Korea in February 2000; a children’s festival called “Crane Day” was held at Khinganskiy Nature Reserve in 1999 (V. Andronov and Yu. Darman *in litt.* 2000). The Muraviovka Nature Park has organised many education activities to promote public awareness of crane conservation (SC).

**Captive breeding** Red-crowned Cranes have been kept in captivity for centuries; there are captive birds in many countries, an international studbook has been established, and limited re-introduction has taken place at Khinganskiy, Zhalong and Kushiro (Meine and Archibald 1996). Zhalong Nature Reserve in China started a captive-breeding programme in 1984, and a re-introduction programme of captive-bred cranes has begun; Shenyang Zoo in Liaoning also started re-introduction of captive-bred Red-crowned Cranes at Panjin wetland (Shuangtai Hekou environs) in 1993 (Wu Changshen and Ma Jianhua 1999). The purpose and value of these exercises, in relation to the wider problems of Red-crowned Crane conservation in China, need to be explained and explored.

**MEASURES PROPOSED Legislation** Poison baits are used widely in China, being either deliberately placed by poachers to kill ducks and geese, or deployed by farmers to control rodents, but they also cause high mortality amongst cranes (and can harm the people who consume poisoned birds); the laws to prevent the use of these poisons should be more strictly enforced, and an education campaign launched to warn users of their adverse effects on wildlife and people. The use of agrochemicals and pesticides should be restricted on the wintering grounds at Yancheng Nature Reserve (and surrounding areas), and at the stopover sites on its migration routes (Ma Zhijun *in litt.* 1999), and farmers should be encouraged to use alternative methods of pest control.

**Protected areas and habitat management** In the protected areas on the breeding grounds in Russia and China, the adoption of sustainable methods of reed harvesting, grazing and other resource use should be encouraged, and activities that disrupt nesting in these protected areas (including over-harvesting of reeds, agricultural fires, use of vehicles near nests and water diversion) should be regulated (Meine and Archibald 1996). *Russia* In Amur province, if the breeding sites are to be preserved, their exact location needs to be determined, and protection at the local government level established as quickly as possible, to prevent habitat degradation by stock-grazing and burning (Dugintsov and Pan'kin 1990; also Dymin and Pan'kin 1975). In Primorye region, a nature reserve is needed in the Khasan region, or the adjacent Kedrovaya Pad' reserve should be expanded to include the Khasan coastal plains (Shibaev and Surmach 1994). The Lake Khanka Nature Reserve (392 km<sup>2</sup>, in five separate blocks) protects only c.20% of the breeding pairs of this species, and must be expanded to c.600 km<sup>2</sup> and the separate blocks joined into a single area; this would give a greater stability to the whole system and significantly increase the survival chances of the Khanka crane population (along with many other birds) (Glushchenko and Shibaev 1996). As part of this process, the buffer zone of the Lake Khanka reserve needs to receive full protected-area status, because most of the breeding cranes (both this species and White-naped Crane) nest in this zone (Shibaev and Surmach 1994). The Tumangan Nature Park has been established on the coastal plains around the Tumen river estuary, which is an important staging area for migrating cranes, but designated hunting areas (for wildfowling and pheasant shooting) close to this park cause disturbance, and the zonation of the areas around the park needs to be corrected (Shibaev and Surmach 1994, Litvinenko and Shibaev 1996, Yu. V. Shibaev *in litt.* 1997). Ideally, an international protected area should be established at the Tumen river estuary, including areas in Russia, China and North Korea; the boundaries of this reserve should include all important habitats for Red-crowned Cranes and other waterbirds. If the proposed seaport and railway construction go ahead, an environmental impact assessment should be conducted to minimise the destruction of natural habitats, and a management plan drafted for the area to ensure that all human activities are compatible with the conservation of the area. Efforts are being made to create an international protected area in the southern Kuril islands, and should be supported (Meine and Archibald 1996). *Korea* The wintering grounds at Cholwon and the Han river estuary in South Korea should be officially established as a protected area, which would be large enough to sustain a viable wintering population without a need for artificial feeding. *Mainland China* This species has declined in numbers in several nature reserves, notably at Xinglong Nature Reserve in Heilongjiang, which supported the largest known breeding population in China in the 1980s but now only holds small numbers (see Distribution); the causes of these declines need to be investigated, with the aim of developing habitat management regimes in these reserves which would benefit the species and allow its numbers to recover (at least partially). A general measure that would greatly benefit conservation would be to give the management offices of nature reserves more authority to control land use inside the reserves (Wang Qishan *in litt.* 1998). At Xingkai Hu Nature Reserve, a conservation committee should be established to coordinate the management of the area, reclamation and development inside the reserve strictly forbidden, a research centre established to monitor the populations of rare birds and develop conservation measures, and ecotourism and the sustainable use of natural resources promoted (Luan Xiaofeng *et al.* 1999). Moreover, the Xingkai Hu reserve in China should improve communication and cooperation with the Lake Khanka reserve in Russia, to benefit the conservation of cranes throughout the entire area. At Zhalong Nature Reserve the construction of roads in the wetlands and the damming of streams and rivers that provide water to the wetlands should be curtailed (Wang Qishan *in litt.* 1997, G. Archibald *in litt.* 1999), the construction of recreation facilities stopped and the established facilities removed (Wang Qishan *in litt.* 1997). The important wetlands for breeding Red-crowned Cranes on the Sanjiang plains and Song-

nen plains require protection: the breeding grounds there may be too extensive to be covered by a few nature reserves, so local government offices should be encouraged to help establish a system for the protection of the nesting areas and neighbouring feeding areas during the breeding season, to ensure that they are not destroyed or disturbed. At Shuangtai Hekou, development of the oilfield should be restricted, because the infrastructure and human activity would disturb breeding birds, the roads built to transport the oil would fragment the wetlands, and spilled oil would cause serious pollution problems (Kanai *et al.* 1993). The reedbeds there need to be managed to maintain the diversity of habitats, and the nature reserve should establish a monitoring system (Kanai *et al.* 1993). Care must also be taken to prevent oil spills and pollution at the Yellow River delta and the Song-nen plain. At Yancheng Nature Reserve, the reclamation of tidal flats should be controlled, in order to maintain sufficient areas of suitable wetland habitats for wintering Red-crowned Cranes (Ma Zhijun *in litt.* 1999). Large flocks of these cranes have been found in the transitional buffer zones of the reserve, so the core zone of the reserve should be redesigned to include more of their wintering habitats and the management of these areas should be strengthened (Ma Zhijun *et al.* 1998).

**Research** Annual surveys of the Hokkaido population should be continued and annual surveys of the Chinese and Korean wintering sites initiated, with simultaneous counts in North and South Korea to avoid duplication, and periodic (e.g. every five years) aerial surveys conducted of the main nesting areas in Russia and Heilongjiang (Meine and Archibald 1996). Several ecological studies are required: to investigate the effects of different reed harvesting, grazing and other resource-use practices on nesting Red-crowned Cranes, in particular to determine the impact of variations in the timing of the different practices; to study the impact of various rice planting and harvesting methods and paddy management regimes on the wintering population in Korea; to study the incidence of crane mortality due to human factors (especially poisoning and power-line collisions) at Yancheng in China; to model the impact of the Three Gorges Dam on the Yancheng wintering grounds; and to survey the Heilongjiang–Beidaihe migration route and the Chinese coast for important migration stopover areas (Meine and Archibald 1996).

**Conservation education** On the breeding grounds, educational programmes need to be developed to promote the sustainable use of wetland resources by farmers and other local residents, and to advise people about the adverse effects of certain human activities on the cranes during the nesting season (Meine and Archibald 1996). Campaigns need to be developed to educate local people in Russia about the conservation of cranes, particularly to address the problem of agricultural fires (Andronov 1988b, Andronov 1994). At the key nature reserves for this species in China education programmes should be designed to involve the local communities more closely in crane conservation, for example by helping schools establish bird conservation interest groups, encouraging public participation in the counts of wintering birds, and involving local people in some simple management work (Meine and Archibald 1996, Wang Qishan *in litt.* 1998).

**Captive breeding** A comprehensive recovery plan should be developed for this species, coordinating habitat protection measures and the captive propagation programme (Meine and Archibald 1996). It is certainly the case that the need for and role of captive breeding should be clearly established within the framework of overall management of the species. It has been proposed that a breeding population should be re-established at the Tuman river estuary (V. Andronov, R. Andronov and Yu. V. Shibaev *per* G. Archibald *in litt.* 1999; see also Smirenskiy and Roslyakov 1982).