

Status of the East Asian population of the Dalmatian Pelican *Pelecanus crispus*: the need for urgent conservation action

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Summary

The Dalmatian Pelican *Pelecanus crispus* is a globally threatened species with three distinct populations, the smallest of which is the almost extinct eastern race with an estimated population size of 50 birds breeding in Mongolia and migrating to south-east China during the winter. We analysed recent survey information and published records to construct a picture of the annual life cycle of the Dalmatian Pelican and how it has changed over the years. We were able to obtain a total of 196 records from 82 sites in China and Mongolia dating back to 1862. Seasonal information was available for 168 records. The pelicans breed in western Mongolia and migrate in a south-easterly direction to the Bo Sea and then southwards along the coasts of Shandong and Jiangsu to the wintering area in south-east China. Return migration to the breeding grounds follows the same general path. There is some evidence that part of the population uses an inland migration route linking the wetlands along the Yellow and Huai Rivers and the middle reaches of the Yangtze River; this route was probably more important historically. The pelicans are encountering serious problems at all stages of their annual life cycle: destruction of nesting habitat and hunting in the breeding area, loss of important wetland habitats along the inland migration routes, and land claim, human disturbance and overexploitation of fisheries resources on the coast. It is highly desirable that a simultaneous count be conducted of the key wintering sites so that an accurate population estimate can be obtained. Use of satellite telemetry would provide very useful information on migration strategies and home ranges in the wintering grounds, and assist greatly in identifying key habitats for conservation action at different stages of the annual life cycle.

Introduction

The Dalmatian Pelican *Pelecanus crispus* has a range extending from south-east Europe through central Asia to eastern China and occurs in three separate populations. The species is globally threatened and is listed as 'Vulnerable' because of the rapid population declines that have occurred in the central and eastern races (BirdLife International 2006). The estimated population size of the eastern race, which breeds in Mongolia and migrates to south-east China for the winter, is only 50 birds (Wetlands International 2006) (see Figure 1 for most of the geographical locations mentioned in text; additional locations are given, as appropriate, in other Figures). The Dalmatian Pelican is listed in the Mongolian Red Book (Bold 1997) and is a nationally protected species (second class) in China (Anon 1992). The species is listed on Appendices I and II of the Convention on Migratory Species (CMS 2007).

Although the eastern race of the Dalmatian Pelican previously bred at a number of sites in central and western Mongolia, it currently only nests in the Great Lakes Basin in the far west of the country (BirdLife International 2001). Recent surveys of historically important nesting areas

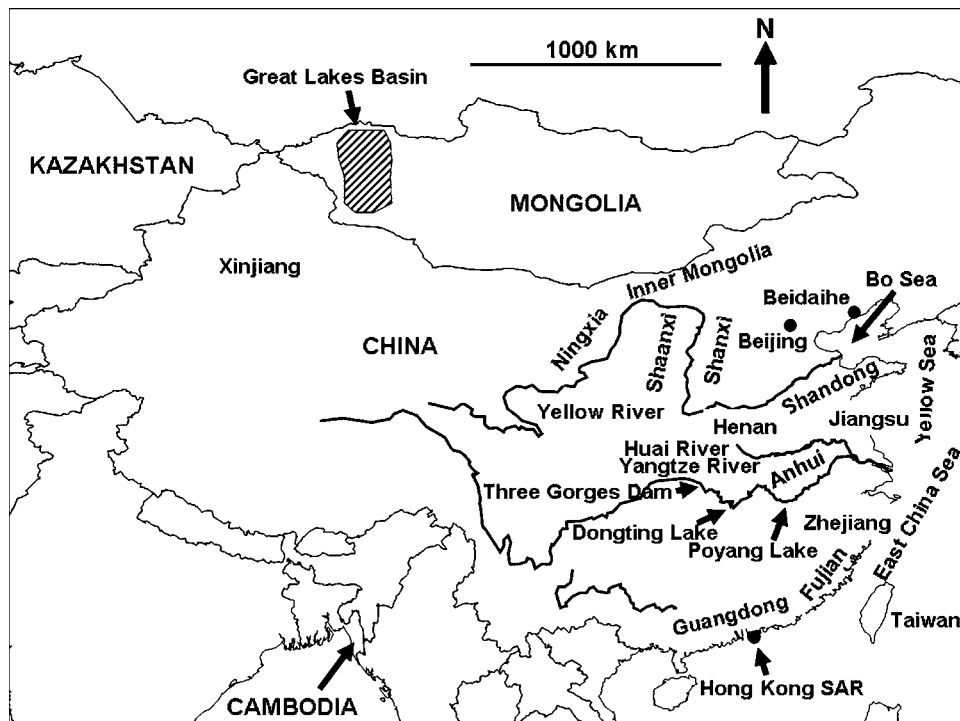


Figure 1. Major locations and geographical features mentioned in the paper. To maintain clarity additional locations are given in the other Figures.

have found limited evidence of breeding: one immature bird in 2004, none in 2005, and two juveniles (with adults) and one dead juvenile in 2006 (Batbayar *et al.* 2005; Batbayar and Braunlich 2006; S. Chan *in litt.*; N. Batbayar *in litt.*). Passage and winter numbers in China have declined greatly during the last century and the species now only winters in small numbers at a handful of sites along the south-east coast (BirdLife International 2001).

The published information from the breeding area, migration staging regions and wintering sites confirms that the conservation status of the eastern population of the Dalmatian Pelican is extremely poor, and it is now considered to be virtually extinct (BirdLife International 2006). There is an urgent need to find out as much as possible about the key stages of the annual life cycle of this population, and the associated threats, so that effective conservation actions can be undertaken.

Since January 2003 we have been involved in extensive winter waterbird surveys in south-east China, during which information was obtained on the current wintering areas used by Dalmatian Pelicans and the contemporary status of the species in regions which were historically important during the non-breeding season. These surveys have comprehensively covered the coastlines of Fujian, Zhejiang, Jiangsu and Shandong, and the floodplains of the Yangtze (twice) and Huai Rivers (twice).

In this paper we analyse information from our sightings and from recent and historical published and unpublished records to construct a picture of the annual life cycle of the Dalmatian Pelican and how it has changed over the years. We also comment on the conservation status of the eastern population and make suggestions concerning the key data that are required for the development of effective management actions to ensure the survival of this highly endangered population.

Methods

Information sources

Records of Dalmatian Pelicans in China and Mongolia have been obtained during recent waterbird field surveys and from published and unpublished information. The records are mostly of sightings, but include some museum specimens.

The field surveys covered the middle and lower reaches of the Yangtze River floodplain (January 2003, January/February 2004 and February 2005) (Barter unpub. data; Barter *et al.* 2004, 2006), the Huai River floodplain (December 2005 and December 2006) (L. Cao unpub. data) and coastal wetlands in Fujian (February 2006) (Barter *et al.* 2007), Jiangsu (December 2006), Zhejiang (January 2007) and Shandong (February 2007) (L. Cao unpub. data). The surveys of the Yangtze River floodplain included all of the major wetlands between the Three Gorges Dam and the river mouth at Shanghai, a distance of 1,850 km, those of the Huai River covered about 350 km upstream from the confluence with the Yangtze, including major lakes in Jiangsu and Anhui, and the coastal surveys encompassed intertidal and near-coastal wetlands along the shores of Shandong (900 km straight line length), Jiangsu (500 km), Zhejiang (750 km) and Fujian (600 km).

Additional information on recent sightings in China was obtained from China Bird Reports (China Ornithological Society 2004, 2005, 2006, 2007), China Crane News (Xu and Wu 2004; Gao 2004; Shan 2006), China Bird Watch (2007), P. Ding (*in litt.*) and monthly waterbird counts in Hong Kong SAR (Deep Bay) (HKBWS 2007; Y.T. Yu *in litt.*), and in Mongolia from Batbayar *et al.* (2005), Batbayar and Braunlich (2006), N. Batbayar (*in litt.*) and S Chan (*in litt.*). Further information on contemporary sightings was obtained from updates to the BirdLife International Red Data Book of Threatened Birds of Asia (<http://www.rdb.or.id/viewupd.php?id=498>), China Bird Net (www.chinabirdnet.org) and by searching the internet for news stories. Data on long-term changes in numbers, and on the timing of arrivals and departures in Deep Bay, was acquired from Carey *et al.* (2001). We have used the comprehensive information available in *Threatened Birds of Asia* (BirdLife International 2001) to provide additional data from the breeding areas and useful historical context for the species in China.

Confusion between pelican species

In the past, the Dalmatian Pelican and Spot-billed Pelican *Pelecanus philippensis* have been treated as conspecific, i.e. *P. p. crispus* and *P. p. philippensis* (e.g. in Cheng 1987). Re-examination of Chinese museum specimens catalogued as *P. philippensis* has resulted in all but one being reassigned to *P. crispus* (BirdLife International 2001).

Historical data indicates that Spot-billed Pelicans spent the summer, and possibly bred, in south-east China up to the early 20th century (BirdLife International 2001). Given that Dalmatian Pelicans are only winter visitors to south-east China, it is assumed that historical summer records from this region are of Spot-billed Pelicans and that claimed winter records of this species are, in fact, of Dalmatian Pelicans. On this basis the last confirmed Spot-billed Pelican was in the 1960s and it is now considered to be an extremely rare non-breeding visitor to China from the closest breeding area in Cambodia (BirdLife International 2001).

Analysis

We compiled a database of records, organised to reflect the different parts of the annual life cycle. The records were plotted on maps, using Arcview GIS 3.3 (ESRI 2002), in order to examine historical and current information from the breeding area, migration routes and wintering areas.

We defined the wintering period as December-March, because long-term data (1960–1998) from Deep Bay shows that pelicans commence arriving in numbers in the second-half of

December and major departures start at the end of March (Carey *et al.* 2001). The distance between south-east China and the breeding grounds along the most likely route around the coast and across northern China (see below) is almost 4,500 km. Based on results from satellite tracking of Great White Pelicans *Pelecanus onocrotalus* migrating from their wintering area to the breeding grounds, which showed that birds travelled 99–164 km per day (Izhaki *et al.* 2002), we estimate that it will take Dalmatian Pelicans about six weeks to reach the breeding area. Therefore, we considered northward migration would take place during the April–May period. The breeding period from June to September is based on data in BirdLife International (2001) and breeding cycle information (N. Batbayar *in litt.*; Nelson 2005), and southward migration occurs during the remaining months of October to November.

In order to obtain as accurate an understanding as possible of the current status of Dalmatian Pelicans in east Asia we have focused particularly on data obtained during the last five years, i.e. 2003–2007.

Results

We obtained 196 records from China and Mongolia involving 82 sites; four records were from the 1800s, 10 from 1900–1949, 90 from 1950–1999, and 64 from 2000–2007; the years of the remaining 28 were unknown. Seasonal information existed for 168 records: 35 records for the breeding period (June–September), 29 during southward migration (October–November), 89 from the wintering period (December–March) and 15 during northward migration (April–May); 28 records could not be assigned to a season.

General distribution of records

The geographical distribution of Dalmatian Pelican site records is shown in Figure 2. There are 24 sites with more than one record (varying from 2–25 records).

Records are concentrated in an arc comprising the south and east coasts of China, the middle reaches of the Yangtze River, the lower and middle reaches of the Yellow River, around the Bo Sea, and the wetlands of Xinjiang and central and western Mongolia. It is possible that some of the records in Xinjiang could be of birds from the central Asian population breeding in south-east Kazakhstan, but this is considered unlikely as the Kazakhstan and western Mongolian populations are believed to be discrete (Zhatkanbaev and Gavrilov 1994), an opinion supported by a satellite telemetry study in which three Dalmatian Pelicans marked at Chardala Lake (Figure 2) migrated in a westerly direction and wintered in Turkmenistan (Morimoto 2005).

The reduced geographical spread of records since 2003 is most likely due to the decline in population numbers, as greatly increased ornithological activity during this period would be expected to have produced widespread sightings if pelicans were as numerous as in earlier years.

Breeding season

There are a total of 26 records at 11 sites in Mongolia during the breeding period, all but three from the Great Lakes Basin (Figure 1). Recent surveys of historical breeding areas have had limited success in finding evidence of breeding activity. In 2004, flocks of 15 and four birds, including one immature, were found, whilst in 2005, no young birds were present amongst 14 birds located (Batbayar *et al.* 2005; Batbayar and Braunlich 2006; S. Chan *in litt.*). In 2006 a dead unfledged juvenile was found in mid-September, whilst two juvenile birds were seen about 250 km south east of the closest known breeding location having probably commenced southward migration (N. Batbayar *in litt.*). Dalmatian Pelicans used to breed at Lop Nur in Xinjiang (Scott 1989), but this lake has been dry since 1973 (Yuan and Yuan 1998).

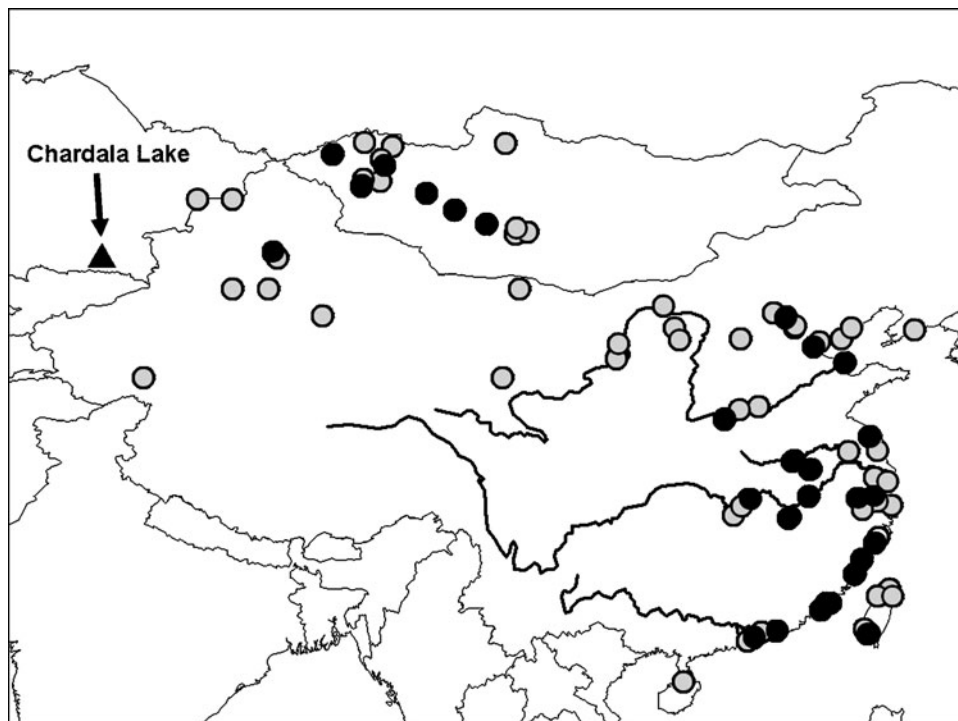


Figure 2. Location of all sites for which Dalmatian Pelican records are available (black-filled circles are records from the 2003–2007 period). Note that 24 sites have more than one record.

There are nine Chinese records during this season: in June (Beijing and Ningxia), August (Xinjiang) and September (Xinjiang, Inner Mongolia (2), Beijing (2) and Beidaihe). These could be late or early migrants to or from the breeding areas, or immature/non-breeding adults which are wandering nomadically during the breeding season (see Crivelli *et al.* 1991; Nelson 2005).

Southward and northward migration periods

Southward migration from the breeding area appears to take place in a south-easterly direction across southern Mongolia, Inner Mongolia and Shaanxi, and on to the Bo Sea coast (Figure 3), a distance of about 2,300 km. It has been reported that pelicans stop at Ulansuhai Nur (Inner Mongolia) for about a week in late September (Yang and Xing 1998) and at Hongjian Nur (Shaanxi) to moult (Lu 1990). Two birds were recorded migrating in a south-westerly direction into Xinjiang and these presumably then moved eastwards to join the main migration route.

Birds then move southward along the Yellow and East China Sea coasts towards the wintering areas in south-east China. Large numbers were present on the Jiangsu coast in November 1991 (largest flock 76). The recent records on the Zhejiang coast are of 10 birds seen in both November 2005 and November 2006. There are two recent records from inland lakes on the Yangtze River (one bird at Poyang Lake and two birds at Shengjin Lake) indicating that some birds may take an inland route between the Yellow and Yangtze Rivers.

Northward migration seems to be the reverse of southward, with birds moving up the coast and then migrating north-west from the Bo Sea to the breeding grounds (Figure 4). Birds are reported to stop for a few days at Ulansuhai Nur in early April (Yang and Xing 1998).

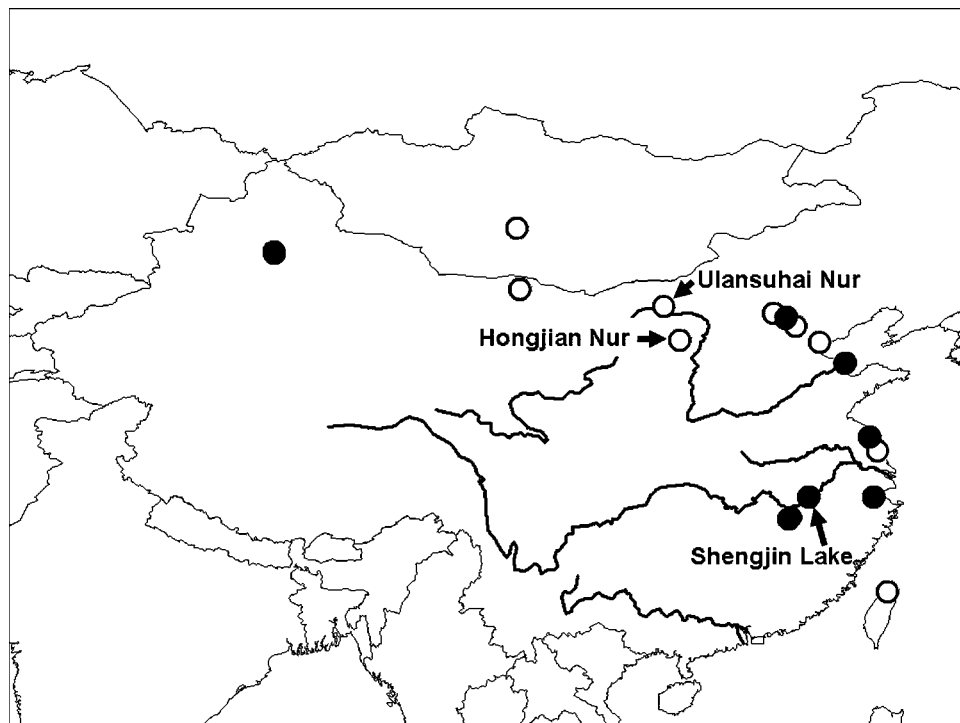


Figure 3. Location of sites at which Dalmatian Pelicans have been recorded during the southward migration period (October–November) (black-filled circles are records from the 2003–2007 period).

Additional evidence for a portion of the population using an inland migration route are the ‘winter’ records of four birds at Poyang Lake in January 2003 and one in February 2005, single birds at Chengxi Lake and Dongpu Reservoir in December 2005, and two birds at Chen Lake in March 2006 (see Figure 5). It appears these birds were on migration. Lakes in the middle reaches of the Yangtze River, especially the two biggest – Poyang Lake and Dongting Lake, are well watched sites and the absence of large numbers of pelicans at them during the migration and winter periods supports the conclusion that most pelicans use the coastal route during northward and southward migration.

Wintering period

Historically, Dalmatian Pelicans appear to have wintered further north, both along the coast, especially in the Yancheng National Nature Reserve (NNR), and at inland lakes in the Yangtze, Huai and Yellow River floodplains (Figure 5). The Yancheng records are from January 1990, 1991 and 1992 (highest count of 21 birds). Gaoyou Lake had 35 birds in January 1991 and there are a number of records from Poyang Lake, the highest being 18 in 1986. Dongting Lake was also previously important (BirdLife International 2001). The recent most northerly records are of single birds in March 2004 in the Bo Sea, both of which were probably migrating, and a single bird in January 2007 in Henan, which was probably wintering.

The current wintering area is now virtually limited to the coasts of Zhejiang, Fujian and Guangdong (Figure 6), in south-east China. The best long-term series of winter records is from Hong Kong SAR (Deep Bay), which is located at the western extremity of the wintering region (Carey *et al.* 2001; HKBWS 2007). Numbers in Deep Bay during the late-1960s to early-1980s,

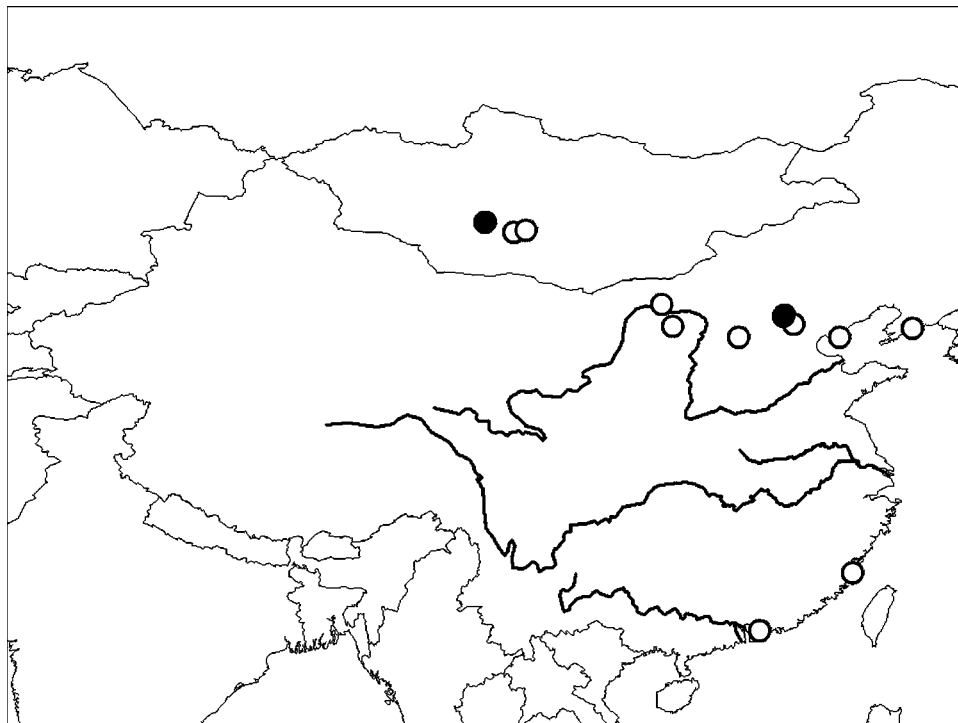


Figure 4. Location of sites at which Dalmatian Pelicans have been recorded during the northward migration period (April–May) (black-filled circles are records from the 2003–2007 period).

whilst variable, averaged around 60. In the 1980s the number halved to around 30 and then fell to a minimum of three birds before numbers increased again to about 20 in the late 1990s. However, counts have declined again in recent years to two birds in the 2005/2006 winter and none in 2006/2007.

Count data from Zhejiang, Fujian, Guangdong and Taiwan, and from Hong Kong SAR, during the 2003/2004 to 2006/2007 winter periods are summarised in Table 1, and the location of the sites is shown in Figure 6.

It is very difficult to make a satisfactory estimate of the numbers wintering in the region because of the likelihood of inter-site movements within and between years. The highest numbers reported annually at an individual site have varied from 17 to 29 during the last five winters. In January 2007 we counted a minimum of 24 birds in Wenzhou Bay, and on similar dates a single bird was present at the Minjiang estuary and seven at Haifeng implying that at least 32 birds were present along the coast. Thus, it seems that the current population estimate of 50 is probably realistic.

There was evidence of successful breeding during the 2006 season as four juvenile birds were seen in a flock of 12 birds in Wenzhou Bay on 23 January 2007, and a dead juvenile bird was found at Qingshan Lake in the same month.

Discussion

Given that the evidence clearly indicates that the great majority of Dalmatian Pelicans winter along the coasts of Zhejiang, Fujian and Guangdong, it is very important that a simultaneous

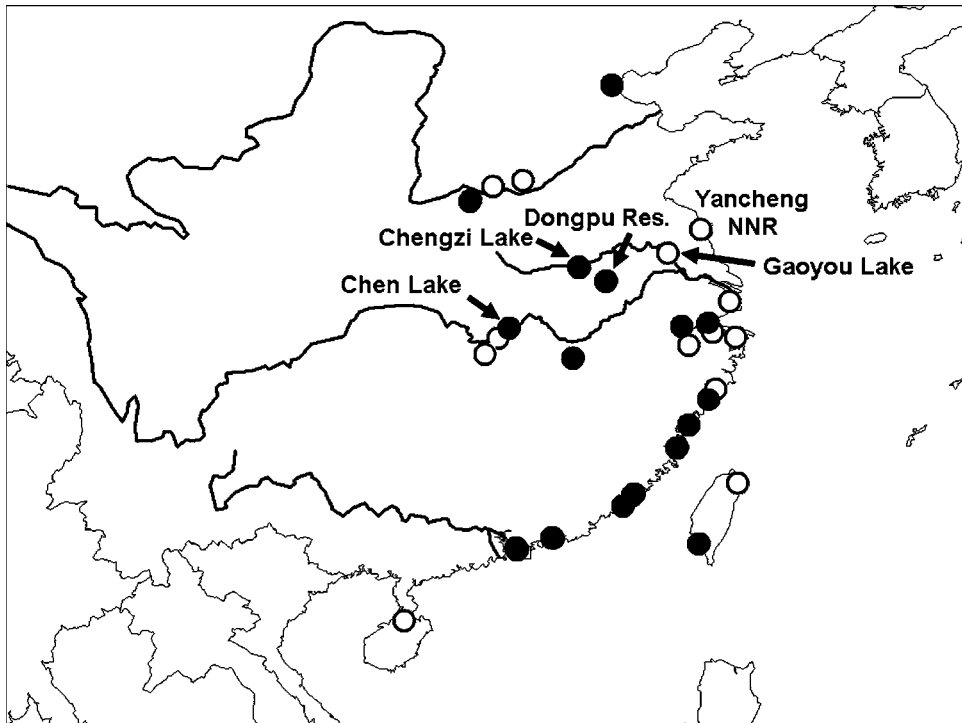


Figure 5. Location of sites at which Dalmatian Pelicans have been recorded during the wintering period (December–March) (black-filled circles are records from the 2003–2007 period).

count of these Provinces be organised during the winter period so that an accurate wintering population estimate can be obtained. It would also be desirable for searches to be made of the main historical wintering areas (e.g. Poyang Lake, Dongting Lake, Yancheng coast and inland lakes) at the same time.

The eastern population of Dalmatian Pelicans has a particularly difficult annual life cycle. They usually breed on islands amongst reeds or on floating vegetation (BirdLife International 2001), and these sites are under threat from overgrazing and trampling of nesting islands by cattle, camels and horses, and physical damage by introduced Muskrats *Ondatra zibethicus* which eat reeds and burrow in the nesting islands. Additionally, their food supply is being affected by unsustainable fishing and they are also killed for their bills, which are used for grooming horses (Batbayar and Braunlich 2006; BirdLife International 2001). It is very important that more surveys be conducted to identify the current breeding areas in western Mongolia and that breeding success be assessed both on the breeding grounds and by examining wintering flocks for juvenile/immature birds

We know very little about the migration strategies of Dalmatian Pelicans, but if they are similar to those of migrating Great White Pelicans (Izhaki *et al.* 2002) they would typically migrate diurnally, using most wetland stopover sites for only one or two days each, but staying at a few sites for longer periods. During both southward and northward migration, Dalmatian Pelicans have to traverse a distance of about 1,500 km over extensive arid areas in southern Mongolia and western Inner Mongolia. Despite the low rainfall, which varies from < 50 to 100 mm across the region (Liu 1997), there have existed, historically, a number of oases in the region, but many of these have disappeared or are greatly reduced in area due to diversion of water for irrigation (Ma 2004). In particular, two important wetlands (Gaxun Nur and Sogo

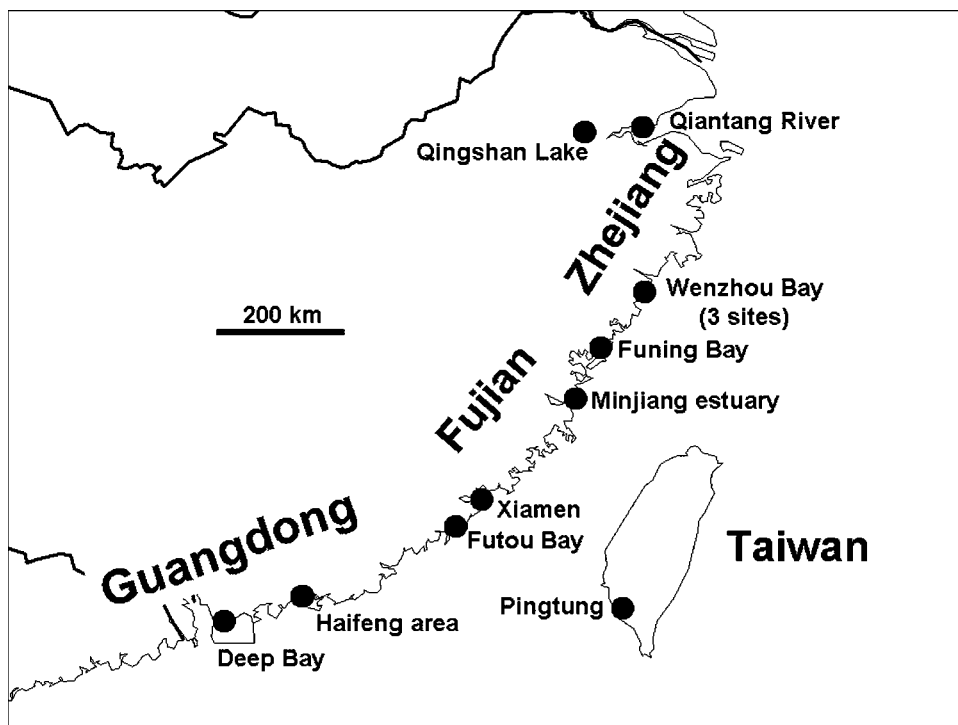


Figure 6. Location of sites at which Dalmatian Pelicans have been recorded in Guangdong (including Deep Bay (Hong Kong SAR), Fujian, Zhejiang and Taiwan during the five 2003/2004 – 2006/2007 winter periods.

Nur) previously used by pelicans in Inner Mongolia (BirdLife International 2001) have dried up. Wetland conditions may be better on southward migration, as more than 90% of the annual rainfall occurs during the summer and autumn periods (Liu 1997). Other inland wetlands used by pelicans during migration are suffering from water shortage, especially those in central and western Xinjiang and along the Yellow River in Ningxia, Inner Mongolia, Shanxi, Shaanxi and Henan Provinces (Ma 2004; Lu and He 2007). It seems that pelicans are probably encountering increasing difficulties in successfully completing their annual migrations across the arid areas in southern Mongolia and northern China due to the significant loss of wetland habitat in these regions.

Conditions along the Chinese coastline will also almost certainly be causing serious problems for migrating and wintering pelicans. The coastal provinces are amongst the most densely populated within China and have fast economic growth rates (China National Bureau of Statistics 2007) and, consequently, the coastal wetlands have suffered greatly from land claim, pollution and human disturbance (Barter 2002; UNEP 2005a, 2005b, 2005c). Changes in river flows, as a result of water extraction and damming, are greatly affecting sediment and nutrient inputs to coastal areas with a consequent effect on biological productivity (ADB 2000; Wang 2006). A recent study into the effect of the Three Gorges Dam on the Yangtze River showed that sediment flow had declined by 65% and that the coastline at the river mouth was now eroding (Yang *et al.* 2006).

Overexploitation of fisheries resources has been found to be one of the most serious environmental issues in the coastal areas of east and south China (UNEP 2005a, 2005b, 2005c) and the reduction in fish biomass could be impacting seriously on the species' feeding ecology.

Table 1. Dalmatian Pelican counts from the coasts of Zhejiang, Fujian, Guangdong and Taiwan, and from Hong Kong SAR (Deep Bay), during the five 2003/2004 – 2006/2007 winter periods. Counts in Wenzhou Bay in January 2007 were at different sites.

REGION	DATE	COUNT	SITE
Zhejiang	04-Dec-05	3	Qiantang River
	04-Jan-07	1	Qingshan Lake
	22-Jan-07	13	Wenzhou Bay
	23-Jan-07	12	Wenzhou Bay
	24-Jan-07	24	Wenzhou Bay
	03-Feb-07	10	Wenzhou Bay
Fujian	09-Mar-03	5	Minjiang estuary
	29-Mar-03	9	Minjiang estuary
	21-Dec-03	29	Minjiang estuary
	20-Mar-04	26	Minjiang estuary
	20-Mar-05	14	Xiamen
	09-Feb-06	6	Funing Bay
	13-Feb-06	13	Minjiang estuary
	17-Feb-06	17	Minjiang estuary
	24-Feb-06	2	Futou Bay
	21-Jan-07	1	Minjiang estuary
Guangdong	02-Mar-04	24	Haifeng area
	23-Jan-05	13	Haifeng area
	25-Feb-06	9	Haifeng area
	20-Jan-07	7	Haifeng area
Hong Kong SAR	19-Jan-03	14	Deep Bay
	25-Jan-04	13	Deep Bay
	16-Jan-05	14	Deep Bay
	22-Jan-06	2	Deep Bay
Taiwan	Dec-03	1	Pingtung

Reduced food supply in the intertidal areas could cause pelicans to feed in the extensive coastal fishponds along the coastline, thus leading to conflict with fishermen as has happened with the Great White Pelican (Izhaki *et al.* 2002).

Some of the wintering sites where pelicans have been found recently are, at least partly, in Protected Areas, i.e. Deep Bay, Funing Bay, Minjiang estuary, Xiamen and Futou Bay, but the key sites in Wenzhou Bay, and the adjacent Yueqing Bay, are not currently in reserves. In addition to providing protection for feeding areas, it is also very important to ensure that secure roosting sites are available where pelicans are free from predation and disturbance (Crivelli 1996).

It is highly desirable that the suggestion by Batbayar and Braunlich (2006) to use satellite telemetry to study migration strategies be implemented as soon as possible. Satellite telemetry would also provide useful information on home ranges in the wintering grounds and assist in obtaining accurate estimates of the numbers of pelicans in coastal south-east China. The knowledge gained would help greatly in identifying key habitats/sites and in determining the appropriate management actions needed to ensure the survival and, hopefully, the recovery of this highly endangered population.

Acknowledgements

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