Other threatened species

Table of Contents

Other threatened species

Other threatened species 2017

Chowdhury, S. U., Neumann-Denzau, G., & Muzaffar, S. Bin. 2017. **Nesting Ecology and Habitat Preference of the Masked Finfoot (Heliopais personatus) in Sundarbans, Bangladesh**. Waterbirds, 40(4), 410–416. https://doi.org/10.1675/063.040.0413

(Abstract)

The Masked Finfoot (*Heliopais personatus*) has a global population estimated at 1,000 individuals, but very little is known about its ecology. Therefore, the nesting ecology of the Masked Finfoot was studied in the Sundarbans of Bangladesh between 2011 and 2014, and compared to nesting observations from the same area made in 2004. A total of 25 nests were detected in 2011–2014: 56% (*n* = 14) on blinding mangrove (*Excoecaria agallocha*), 36 % (*n* = 9) on sundri (*Heritiera fomes*) and 8% (*n* = 2) on cannonball mangrove (*Xylocarpus granatum*). Factor analysis revealed that 2004 nest characteristics differed from subsequent years. The 2011–2014 nests were built on the periphery of vegetation along narrow creeks of 12.66 ± 3.54 m and located 1.78 ± 0.53 m above water level at high tide. Diameter of nesting tree (2004 = 16.68 ± 5.82, 2011–2014 = 34.19 ± 3.96), nest depth (2004 =16.88 ± 3.09, 2011–2014 = 13.28 ± 3.32) and creek width (2004 = 21.26 ± 9.09, 2011–2014 =12.66 ± 3.54) was significantly different between 2004 and 2011–2014. Reasons for changes in nesting locations are important to determine given the conservation status of the species and altering conditions in the Sundarbans.

PICKETT, EVAN J., MELANIE CHAN, WENDA CHENG, JOHN ALLCOCK, SIMBA CHAN, JUNHUA HU, KISUP LEE, *et al.* 2017. Cryptic and Cumulative Impacts on the Wintering Habitat of the Endangered Black-Faced Spoonbill (*Platalea Minor*) Risk Its Long-Term Viability. *Environmental Conservation*, 2017, 1–8. doi:10.1017/S0376892917000340.

(Abstract)

The East Asian–Australasian flyway contains some of the most threatened habitats in the world, with at least 155 waterbird species reliant on the tidal habitats it comprises. The black-faced spoonbill (Platalea minor) is an iconic endangered species distributed across the coast of East Asia. Its population suffered a severe decline into the 1990s, but extensive monitoring and conservation interventions have aided a substantial recovery of the species. We used a population viability analysis based on data collected over the past two decades in conjunction with species distribution models to project spatially explicit models of population change for the next 35 years. Over nearly all scenarios of habitat loss and climate change, the global spoonbill population was projected to increase in the short-term due to low population numbers likely well below current population carrying capacities. However, climate change and habitat loss together threaten the recovery of the spoonbill population such that, by 2050, population

declines are apparent as a consequence of these cumulative impacts. These threats are also cryptic and represent a challenge to the conservation of species recovering from anthropogenic impacts; observed population increases can hide large reductions in habitat suitability that threaten the long-term viability of species.

Other threatened species 2016

Ismail, A., and F. Rahman. 2016. Current Status of the Milky Stork Re-introduction Programme in Malaysia and Its Challenges. *Tropical Life Sciences Research* **27**:13-24.

(Abstract)

This review discussed the current status of the Milky Stork Re-introduction Programme in Malaysia and the challenges it faced. Although it has continued for almost seven years, more challenges appeared as time elapsed mainly due to the arising conflicts between the implementation of conservation policy versus the development projects in Kuala Gula. Hence, the released population is struggling to adapt mainly due to the reduction of suitable habitat for nesting and disturbed foraging areas by the continuous anthropogenic activities. Furthermore, the lack of appropriate training among captive storks prior to being released also slows the adaptation of the birds in their new habitat. The increasing pattern of pollution in the area is also highlighted. Several suggestions were given to help improve the current re-introduction programme. These include improvements to the captive training method, improvement of the existing enclosure's condition and environment, protection of remaining mangrove forest, creation of a buffer zone to mitigate the increasing pollution level in the area, close monitoring of the released population, and maintaining continuous support and awareness among the public. Considering the ongoing anthropogenic activities that may impair the status of Kuala Gula as an important bird sanctuary, emphasis should be given to achieve sustainable development throughout the area.

Other threatened species 2015 and earlier

2015

Lu Q, Li S, Tao X. 2015. Baer's Pochard *Aythya baeri*: breeding in central Yangtze region, China. *BirdingASIA* **24**:84–86.

(No abstract available)

Hearn RD. 2015. The troubled Baer's Pochard *Aythya baeri*: cause for a little optimism? *Birding ASIA* **24**:78–83.

(No abstract available)

Dai, Y., Q. Lin, W. Fang, X. Zhou, and X. Chen. 2015. Noninvasive and nondestructive sampling for avian microsatellite genotyping: a case study on the vulnerable Chinese Egret (*Egretta eulophotes*). *Avian Research* **6**:24.

(Abstract)

Background: Noninvasive and nondestructive DNA sampling techniques are becoming more important in genetic studies because they can provide genetic material from wild animals with less or even without disturbance, which is particularly useful for the study of endangered species, i.e., birds. However, nondestructively and noninvasively sampled DNA may, in some cases, be inadequate in the amount and quality of the material collected, which can lead to low amplification success rates and high genotyping errors.

Methods: In this study, noninvasive (eggshell swab, shed feather and feces), nondestructive (plucked feather and buccal swab) and invasive (blood) DNA samples were collected from the vulnerable Chinese Egret (*Egretta eulophotes*). DNA concentrations, PCR amplification success and microsatellite genotyping errors of different sample types were evaluated and compared to determine whether noninvasive and nondestructive samples performed as well as invasive samples in our experimental procedures.

Results: A total of 159 samples were collected in the field. Among the different sample types, the highest DNA concentrations (154.0–385.5 ng/μL) were obtained from blood. Those extracted from fecal samples were the lowest, ranging from 1.25 to 27.5 ng/μL. Almost all of the DNA samples, i.e., 95.59 %, were successfully amplified for mtDNA (n = 152) and 92.76 % of mtDNA samples were successfully genotyped for at least five of the nine microsatellite loci tested (n = 141). Blood samples and buccal swabs produced reliable genotypes with no genotyping errors, but in feces, allelic dropouts and false alleles occurred in all nine loci, with error rates ranging from 6.67 to 38.10 % for the dropouts and from 6.06 to 15.15 % for the false alleles.

Conclusions: These results indicate that both nondestructive and noninvasive samplings are suitable for avian microsatellite genotyping, save for fecal DNA. However, we should remain cautious of the appearance of genotyping errors, especially when using noninvasive material.

Chen, T.-S., H.-J. Lin, and S.-Y. Huang. 2015. A framework on habitat connectivity among Taiwan's wetlands for overwintering Black-faced Spoonbill. *Ocean & Coastal Management* **116**:78-88.

(Abstract)

More than half of all Black-faced Spoonbills, a threatened species, overwinter throughout the coastal areas of Taiwan. We used a geographic information system to develop a methodology of quantifying landscape connectivity to examine the quality and linkage of potential spoonbill habitat in Taiwan. We used number of overwintering years, maximum number of spoonbills, habitable area, and a landscape development intensity index to calculate the habitat value and connectivity of 23 selected wetlands during two different periods and to determine the least-cost path of the spoonbill for moving among habitats. During the first period (1984-2003), habitat and connectivity values were greatest in the Zengwun Estuary, confirming that it was the most suitable habitat. In the second period (2011-2014), the highest habitat value also occurred in the Zengwun Estuary, but the highest connectivity value shifted to the Sihcao wetland. The habitat and connectivity values in the second period were generally higher than those in the first period. However, in the Zengwun Estuary and Sihcao wetlands, the maximum number of spoonbills decreased as the population spread to surrounding wetlands, suggesting that habitat conditions declined in the two wetlands due to an increase in anthropogenic disturbance. The habitable wetlands with adequate connectivity were divided into three geographic groups: southwestern, northeastern, and northwestern. The habitat link of the southwestern group increased after spoonbills had been observed in several new wetlands. However, the links within the northeastern and northwestern groups decreased, as spoonbills were no longer observed in several wetlands in each group. Our results suggest that the conservation of wetlands in gap areas would improve their habitat condition and connectivity. This framework can be applied to other species and serves as a baseline for habitat linkage, corridor planning, and refuge design.

2014

Choi, C.-Y., H.-Y. Nam, and W.-S. Lee. 2014. Behavioural responses of wintering black-faced spoonbills (*Platalea minor*) to disturbance. *Wildlife Research* **41**:465–472.

(Abstract)

Context: Behavioural responses can be used to understand the impacts of disturbance on animals and to develop management strategies, and there is considerable conservation interest in quantifying the effects of disturbances on wild animals.

Aims: We seek to formulate a management plan for the endangered black-faced spoonbills (*Platalea minor*) in a nonbreeding ground, on the basis of their behavioural responses to different types of stimulus categorised by threat level (threatening vs non-threatening) and human involvement (anthropogenic vs natural).

Methods: We documented 16 stimuli from 379 disturbance events through continuous observation on 31 daily selected focal individuals, and estimated flight distances caused by human approach under different conditions at a non-breeding site in Korea.

Key results: The spoonbills showed the strongest behavioural response to the non-threatening anthropogenic stimuli, and human approach followed by motor vehicles caused longer responses per event than did any other type of disturbing stimulus. Flight distance caused by human approach varied depending on conditions; inactive spoonbills in mixed-species associations started to flee at the greatest distance (197.4 m, with a 50% probability), whereas the spoonbills in a single conspecific flock were the most tolerant of human approaches, regardless of their activeness (61.0–61.7 m, with a 50% probability).

Conclusions: Human approach had been identified as the most important disturbing stimulus that should be controlled as a priority. We also suggest that black-faced spoonbills benefit from the presence of other waterbirds and exploit them as an early warning system.

Implications: The tolerance of sympatric species as well as the behavioural response of target species should be considered when a buffer area for wildlife management, particularly against human disturbance, is planned. How the site has been used and what the species composition is are still important components for the design of safe refuges and roosts.

Chen K-N. 2014. Spatiotemporal Dynamics of Ecological Variation Affect an Endangered Migratory Bird Black-faced Spoonbill (*Platalea minor*) in Southwestern Coast of Taiwan. *Open Journal of Ecology* **4**, 87-97.

(Abstract)

Zengwun estuary in Taiwan is a key habitat for the endangered black-faced spoonbill (*Platalea minor*), a piscivorous migratory bird. In the winters 2011-2012 and 2012-2013, the percentages were nearly half of that in 2007-2008 (65.5% and 51.1%). To find the reasons of the decline of the habitats is important for the preservation of the endangered bird. So, we used an unsupervised classification method to analyze high spatiotemporal satellite images from FORMOSAT-2 from 2004 to 2013, and found that the quality of spoonbill habitats has deteriorated. The deterioration mainly caused by many of the fishponds there, changing the raised fish from milkfish to grouper fish for the purpose of business benefit in recent 3 years. The water depth in the fishponds, which raised milkfish, used to be kept below 30 cm for the convenience in harvesting in winter. Besides, they left the uneconomical small fish behind in the ponds, which provided the black-faced spoonbills good places to forage. However, after the fishponds were changed to raise grouper fish, it not only made the small fish no more exist in the ponds, but also the developing engineering to deepen the fishponds made the trees around these ponds been cleaned. These trees could have provided shields for the black-faced spoonbills against chilly wind. As a consequence, these changes have substantially reduced the agreeable region where the depth of water should be less than 30cm for black-faced spoonbill to forage and inhabit. New reserves for spoonbills have been established recently in Taiwan. Nevertheless, a detailed plan for maintaining food resources for spoonbills

as well as returning them habitats, must be implemented immediately.

2013

Kannan, V., and J. Pandiyan. 2013. A review on the spot-billed pelican *Pelecanus philippensis*literature. *Frontiers in Biology* **8**:333–352.

(Abstract)

Literature on spot-billed pelican has not been reviewed lately which could provide a critique of the emerging data. We have now chosen it as a key species through which we suggest a conservation action plan which will benefit several waterbird species. The information provided here is scholastic in nature and is meant to focus on aspects that require attention and help plan future work for applied conservation. All known information on this species is brought together in this review which will also provide an update of its biology. Notes on the breeding biology of the species first published in the Journal of the Bombay Natural History Society. So far, 380 works have appeared on the species; of these, 36 contain material reported in earlier works or appeared as papers subsequently. Most appeared as articles in journals, both national and regional, a few international journals, newsletters/bulletins (48.2%), 4 dissertations, 76 reports and 6 popular science articles in magazines. This review on the species will provide an insight into different factors that can be weighed and combined while making a decision in investing resources in species conservation, i.e. importance of the species, level of threat and the time frame over which results are to be achieved.

Chevallier D, Baillon F, Le Maho Y, Blanc S, Brossault P, Massemin S. 2013. Importance of the connectivity of Spanish stopovers for Black Storks. *Bird Study* **60**, 550-554.

(Abstract)

Sixteen Black Storks (*Ciconia nigra*) were tracked by satellite during their autumnal and spring migrations in order to identify their major stopover sites and connections between stopovers in Europe and Africa. Among journeys with stopovers, the longest distance that a stork travelled without stopover was 2433 km (defined here as ‘accessible distance’) meaning that those storks which have stopovers use only a single stopover on average, and this is usually in Spain. We identified nine crucial stopovers (seven in Spain and two in Africa) with high connectivity highlighting the importance of Spanish stopover locations on the flyway of Black Storks.

Wood C, Tomida H, Jin-Han K, Lee K-S, Cho H-J, Nishida S, Ibrahim J, Hur W-H, Kim H-J, Kim S-H, Koike H, Fujita G, Higuchi H, Yahara T. 2013. New perspectives on habitat selection by the Black-faced Spoonbill *Platalea minor* based upon satellite telemetry. *Bird Conservation International* **23**, 495-501.

(Abstract)

In 2011 the Black-faced Spoonbill Platalea minor census recorded a 22% drop in numbers from 2010, particularly at the known large coastal wintering sites. During this period, we discovered two new inland wintering sites for the species using satellite telemetry data, one located in China, where the individual followed the Yangtze river as far as Wuhan (500 km inland), and the other across the Vietnam-Cambodia border (70–200 km inland). Long periods of concentrated use of various freshwater habitats were in evidence for these two tagged individuals (China: 79 days, Vietnam/Cambodia: 91 Days) and in the latter case visual confirmation indicated a larger group of at least five individuals. The importance and potential of inland freshwater environments is highlighted towards the further conservation of the recovering population.

Yang C, Hou X, Zhou L. 2013. Behaviors of the Oriental White Stork (*Ciconia boyciana*) in a semi-natural enclosure. *Chinese Birds* **4,** 161-169.

(Abstract)

Environmental factors affect animal behavior in a variety of ways. Compared to animals in the wild, captive animals are kept in narrow enclosures, suffer higher densities and are more intensely affected by human activities. Therefore, behavioral elasticity is likely modified to some extent in captive animals, which may negatively affect the possibility of successful release of endangered species in the wild. In our study we investigated the behaviors of the Oriental White Stork (*Ciconia boyciana*) in a semi-natural enclosure from 15 October 2005 to 8 September 2006 in Hefei Wildlife Park, China. The behavioral data were collected by instantaneous and scan sampling methods, and we analyzed the relationships between environmental factors and their behaviors. The amounts of time spent on maintenance behavior (foraging and moving) were at similar levels for birds reproducing multibroods (Group 1), birds reproducing one brood (Group 2) and birds without reproduction (Group 3). On the other hand, the amount of time spent on elastic behavior (defensive, breeding and preening) for Group 3 was lower than that for Groups 1 and 2. The behavioral pattern of the storks exhibited marked seasonal changes, which may be a function of ambient temperature, human disturbanc, and the length of daylight, but not of wind intensity. Our results provide basic data for future conservation measures of this endangered species.

Zhou L, Xue W, Zhu S, Shan K, Chen J. 2013. Foraging Habitat Use of Oriental White Stork (*Ciconia boyciana*) Recently Breeding in China. *Zoological Science* **30,** 559-564.

(Abstract)

The Yellow River Delta, a stopover site, has become one of the breeding sites of oriental white storks (*Ciconia boyciana*) in China, with 28 breeding pairs. To gain insight into the characteristics of foraging habitat use during the breeding season, we surveyed the foraging habitats in 2009 and 2010. In 2009, using a quadrat sampling technique, we surveyed 74 quadrats in two breeding phases. Fourteen variables were analyzed with DCA. Oriental white storks mainly foraged in the reed swamp of recovered wetlands during the early breeding phase (70.29%), and in the reed swamp of unrecovered area during the late phase (32.74%), and in the open water of recovered wetlands (29.95%). The variation in proportional habitat use was not significant in the two breeding phases. Differences of the foraging sites in the two phases were extremely significant in terms of plant density, distance from nest, and distance from highway. In 2010, the storks also mainly used the reed wetlands for foraging (87.00%). The top three parameters on the first axis with the highest scores were distance from nest, plant height, plant coverage; on the second axis, the top three variables with the highest scores were plant density, number of other waterbird species, and water depth. These results showed that there are differences in the foraging habitat use of oriental white storks in the early and the late breeding phases. It is favorable for the breeding of oriental white storks to recover the reed wetland and to preserve a certain area of open water habitats.

Ye Y, Davison GWH, Zhu P, Duan L, Wang N, Xing S, Ding C. 2013. Habitat Utilization, Time Budget and Daily Rhythm of Ibisbill (*Ibidorhyncha struthersi*) in Daocheng County, Southwest China. *Waterbirds* **36,** 135-143.

(Abstract)

The Ibisbill (*Ibidorhyncha struthersii*) is a rare shorebird uniquely adapted to high-altitude river rapids. Ibisbill has received little study as a result of its isolation and the inaccessibility of its habitat. The habitat utilization, time budgets and daily rhythm of Ibisbill were studied in the southwestern part of Sichuan Province, China, in July to August 2008 and January to February 2010. A total of 55 Ibisbills were recorded in summer and 87 in winter. Encounter rates and group size were similar in summer and winter, but habitat selection differed. In summer, most Ibisbills chose central islands in rivers that had many large stones offering opportunities for both camouflage and physical concealment, and riverside pasture covered by weedy growth with abundant insects making them suitable for foraging. In winter, when water levels are low and many stony beaches are exposed, Ibisbills were more often encountered on riverbanks. Foraging (48.9%) and resting (32.3%) were the most commonly observed behaviors, and the time that Ibisbills spent on foraging ($t_{19} = -4.0$, $P = 0.001$) in winter was significantly higher than in summer. In winter, Ibisbills spent less time engaged in locomotion ($t_{19} = 5.1$, $P = 0.001$) and resting ($t_{19} = -2.8$, $P = 0.012$). Alertness increased toward sunset in summer but not in

winter.

Ma Z, Cheng Y, Wang J, Fu X. 2013. The rapid development of birdwatching in mainland China: a new force for bird study and conservation. *Bird Conservation International* **23,** 259–269.

(Abstract)

Birdwatching is a popular activity in western countries where it has helped to integrate research into birds, bird conservation, and socio-economic development. We analysed the development of birdwatching in mainland China and its roles in bird study and conservation using a standard questionnaire and interviews. Birdwatching in mainland China began only recently (in the 1990s). The increased numbers of foreign birdwatchers visiting China promoted birdwatching there. As of 2010, a total of 36 local birdwatching societies had been established, and the number of birdwatchers exceeds 20,000. The development of birdwatching has been positively correlated with local economic conditions–that is, the number of birdwatchers is much greater in economically developed areas than in relatively undeveloped areas. Birdwatchers have not only contributed to a greater understanding of the population status of birds in China but also promoted bird conservation at the local level. Although China's conservation policies are currently formulated and implemented in a top-down manner via government regulation, with little contribution from local individuals, the rapid development of birdwatching reflects an improved understanding of conservation by local communities and growing participation in conservation initiatives by local people and organisations. We predict that with the continued development of China's economy, birdwatching will further develop and play an increasing role in China's conservation policies and practices. This is important as China is a country with a high rate of endemism and many globally-threatened species.

2011

Park, S.-R., J. Yoon, and S.-K. Kim. 2011. Captive propagation, habitat restoration, and reintroduction of Oriental White Storks (*Ciconia boyciana*) extirpated in South Korea. *Reintroduction* **1**:31-36.

(Abstract)

Reintroduction of wildlife that is extinct or extirpated in its ecological range becomes a new conservation tool to restore the status of historic biodiversity in ecosystems. However, reintroduction projects often meet the uncertainty of successful results due to a lack of scientific knowledge on how the system previously worked. To minimize the reintroduction failure, successful captive propagation should be followed by a series of assessing habitat quality for the target species in reintroduction sites before and after releases. The purpose of

the present paper is to describe the past, present, and future efforts of Oriental White Stork (*Ciconia boyciana*) reintroduction in South Korea. The species is listed as a globally endangered bird species currently breeding only in Russia and partially in China, and it has been extirpated in Japan and South Korea more than a decade ago. Reintroduction of a stork population was recommended in Japan and the Korea peninsula. The last stork individual was translocated and died in a zoo in 1994 so that Korea Institute of Oriental White Stork Reintroduction Research Center (KIOWSRRC) was launched in 1996. Our captive breeding effort tightly linked with veterinary management yielded near one hundred captive storks in the facility up to dates. Prior to reintroduction, a wide range of GIS-related analyses using past breeding habitat information determined reintroduction sites, which habitat quality for future releases began to be managed and restored. The pre-release training program is also scheduled prior to the first reintroduction of 2013. The significance of the reintroduction projects in South Korea is to not only restore the extinct population in their historic breeding ranges but also augment the total size of the endangered metapopulation of storks in one of its historic regions.

2010

Xue W, Zhou L, Zhu S, Shan K, Wang L, Xu R. 2010. Breeding Ecology of Oriental White Stork (*Ciconia boyciana*) in the Migratory Stopover Site. *Chinese Journal of Applied Environmental Biology* **16,** 828-832.

(Abstract)

The Yellow River Delta is an important stopover site of the oriental white storks (*Ciconia boyciana*) in China. In order to collect the breeding data of *C. boyciana* for its effective conservation of the population, we observed the breeding habits of the birds in the Yellow River Delta. A total of 21 pairs of C. boyciana were found breeding there in 2009. The birds chose the nest sites in early February, and began to build nests in mid-late February. Nests were built on wire poles, artificial nests and pylons. In Dawenliu, the average height of nests was 13.25 m ± 2.07 m (N = 18), and the distance between nests was 647.22 m ± 1 086.49 m (N = 18). In Huanghekou, the height was 25.50 m ± 7.97 m (N = 3), and the distance between nests was 42 640.00 m ± 62 838.80 m (N = 3). The earliest hatching began on February 25, but the disturbed breeding pairs postponed their hatching to mid-May. The hatching period lasted for 33.23 d ± 1.36 d, and parental care for 63.33 d ± 6.83 d (N = 12). Parents fed their nestlings for 6.23 ± 2.23 times (N = 68) every day. The nestlings left their nests early on May 28 and late up to August 19. Only 17 pairs of the 21 breeding pairs made their hatching successful with 47 baby birds coming out from eggs and 37 nestlings surviving to fledging. Strong wind was the major factor affecting their breeding. In addition, the disturbance by visitors and lack of suitable nest sites also influenced the breeding. In order to increase the breeding rate of the stopover population, it is necessary to provide more artificial nests and solidate the nests.

2008

Zhan S, Zhou L, Jiang H, Zhang B, Wu Z, Hou Y. 2008. Genetic structure of the oriental white stork (*Ciconia boyciana*): implications for a breeding colony in a non-breeding area. *Integrative Zoology* **3,** 235–244.

(Abstract)

The oriental white stork (*Ciconia boyciana*) is a threatened species, and their numbers are still in decline due to habitat loss and poaching. China is a breeding and main wintering area for this animal and in recent years some individuals have been found breeding in wintering areas and at some stopover sites. These new breeding colonies are an exciting sign, however, little is understood of the genetic structure of this species. Based on the analysis of a 463-bp mitochondrial DNA (mtDNA) control region, we investigated the genetic structure and genetic diversity of 66 wild oriental white storks from a Chinese population. We analyzed the sequences of 66 storks obtained in this study and the data of 17 storks from a Japanese population. Thirty-seven different haplotypes were detected among the 83 samples. An analysis of molecular variance showed a significant population subdivision between the two populations (FST = 0.316, P < 0.05). However, the phylogenetic analysis revealed that the samples from the different populations did not form separate clusters and that there were genetic exchanges between the two populations. Compared with the Japanese population, the Chinese population had a relatively higher genetic diversity with a haplotype diversity (h ± SD) of 0.953 ± 0.013 and a nucleotide diversity (π ± SD) of 0.013 ± 0.007. The high haplotype diversity and low nucleotide diversity indicate that this population might be in a rapidly increasing period from a small effective population. A neighbor-joining tree analysis indicated that genetic exchange had occurred between the newly arisen southern breeding colony and the northern breeding colony wintering in the middle and lower Yangtze River floodplain. These results have important implications for the conservation of the oriental white stork population in China.

2007

Yang C, Zhou L, Zhu W, Hou Y. 2007. A preliminary study on the breeding biology of the oriental white stork *Ciconia boyciana* in its wintering area. *Acta Zoologica Sinica* **53,** 215-226.

(Abstract)

In recent years, some breeding individuals of the oriental white stork *Ciconia boyciana*were observed in their wintering areas in the middle and lower Yangtze River. In order to assess the status of oriental white stork populations and their breeding strategy, breeding biology was studied from 2004 to 2006 in Wangjiang Country, Anqing City, Anhui Province (116o51.15′ – 116o49.47’E, 30o19.53′-30o19.79’N). The nest building period began at different times, the

earliest being on Feb 5. All the nests were on electricity pylons, at height of 34.5+/-0.8 m (n=11). The distance between the neighbouring nests was 908.8 +/-1039.4 m (n=6). Egg-laying occurred between Feb 11 and Jun 21. The clutch size varied from 4 to 5, and averaged 4.2 +/- 0.4 (n=6). The nestling stage was reached by 71.0+/-16.1 days (n=3). Parent birds provided food for the nestlings at a rate of 5.1+/-2.6 trips per day (n=38). Nestlings left their nests from Jun 14 to Sep 20. During our observations, this population of oriental white storks had 8 broods and laid 25 eggs, of which 9 eggs were hatched, and 7 nestlings survived to fledge. Activitiy budgets for foraging, resting, vigilance, fetching material, egg turning-over, feeding, mating, on-nest, out of eyeshot show significant difference, however, flying, walking, preening, bill clattering, fixing nest and others show no significant difference among breeding stages. Activity budgets of nestling for feeding, flying, fixing nest, on-nest, walking, out of eyeshot show significant differences. However, preening, alerting, bill cluttering and others show no significant differences between nesting stages.

2004

Shimazaki, H., M. Tamura, Y. Darman, V. Andronov, M. P. Parilov, M. Nagendran, and H. Higuchi. 2004. Network analysis of potential migration routes for Oriental White Storks (*Ciconia boyciana*). *Ecological Research* **19**:683–698.

(Abstract)

From 1998 through to 2000, we satellite-tracked the movements of 13 Oriental White Storks (*Ciconia boyciana*) on their autumnal migration in order to identify their important stopover sites for preserving links from the Russian Far East breeding sites to the wintering sites in south-eastern China. New analytical methods of satellite tracking data were employed to derive robust information on the locations of stay sites, the number of stopovers made during migration, and the distance traveled without making stopovers. Based on the derived information, we modeled a stay site network as an abstraction of the storks' potential migration routes from their breeding sites to wintering sites. Using network analysis techniques, we explored how the loss of stopover sites could affect the connectivity of potential migration routes. The results suggested that if the seashore stopover sites facing Bohai Bay in eastern China were lost, the storks' wintering sites along the Yangtze River in south-eastern China would be isolated. Among the seashore stopover sites, Jiantuozhi Gley Mire (39.185oN, 118.627oE), located on the northern seashore of Bohai Bay, was considered particularly important for migrating storks, because it was used every year by the storks we tracked. If conservation needs of this critically located site fail to be addressed, the stay site network of storks can create weak links in the chain of migration and, if 'broken', storks will have great difficulties in completing their autumnal migration.

Shimazaki, H., M. Tamura, and H. Higuchi. 2004. Migration routes and important stopover sites of endangered oriental white storks (*Ciconia boyciana*) as revealed by satellite tracking. *Memoirs of the National Institute of Polar Research Special Issue* **58**:162-178.

(Abstract)

From 1998 through 2000, we tracked the autumnal migrations of 13 oriental white storks (*Ciconia boyciana*) by satellite in order to identify their important stopover sites. The storks were successfully tracked and provided data on partial (n = 4) or complete (n = 9) autumnal migration between the Russian Far East breeding sites and the wintering sites in southeastern China. Twenty-seven stopover sites were identified, the most important of which were in Tonghe Peat Moor (46.095°N, 128.942°E), Momoge Nature Reserve (45.945°N, 123.939°E), and Jiantuozhi Gley Mire (39.221°N, 118.672°E). The connectedness between each stopover site and its surrounding stay sites was also evaluated; the results suggested that the stopover sites situated on the seashores of Liaodong Bay, Bohai Bay, and Laizhou Bay in eastern China are less connected than the others. We concluded that, among the sites studied, Jiantuozhi Gley Mire on the northern shore of Bohai Bay should have a higher priority for protection for two reasons: it is used by many storks, in common, for relatively long periods; and it is at higher risk of being isolated from the migration route network.