

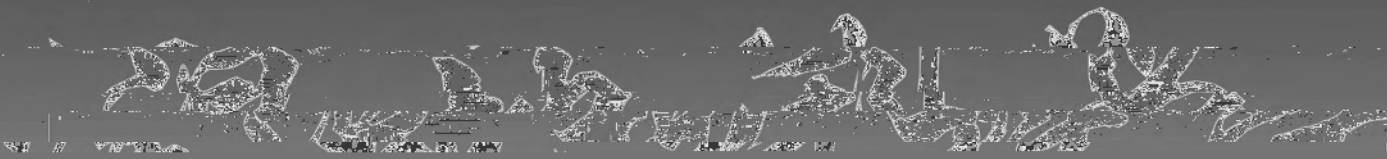
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# 湿地科学

湖沼生态学及水生植物学(以《中国植物志》为例)的编写(1)——非道、潘国柱等(289)

湖沼生态学及水生植物学(以《中国植物志》为例)的编写(2)——潘道、潘国柱等(295)

湖北东荆河高湖湿地植物形成机制研究——顾延生、曹高海、刘叶峰等(302)

湖南祁阳地区鸟类多样性及保护现状分析——曹高海、李福顺、刘叶峰等(311)

Ephemeroptera, Plecoptera, Trichoptera and Odonata (Insecta) Diversity and Distribution  
at Bukit Merah Reseyon River Feeders

Sumanda, Taufiq, M. Yonni, A. akhrifan, Saratssarahl, Miodo, A. rich, & mico, 2013. Sunana, A. H.  
Approach to Determine Herbivorous Diets of Wintering Geese (Anas platyrhynchos) Using Stable Isotope App  
Proximal Analysis of Duck (Anas platyrhynchos) and Goose (Anas platyrhynchos) Droppings

洞庭湖区域洪涝灾害与水土流失关系研究——曹高海、刘叶峰、刘士安等(354)

洞庭湖东洞庭湖湿地土壤重金属污染现状——曹高海、曹高海、曹高海、曹高海等(361)

1975—2014年鄂西地区湖泊水面面积的变化——曹高海、曹高海、曹高海等(368)

不同植物体碳氮含量与植物多样性关系的研究——曹高海、曹高海、曹高海等(376)

1990—2014年中国湿地公顷研究论文的文献计量学分析——曹高海、曹高海、曹高海等(382)

洞庭湖高滩余滩花米草地上生物量估计——曹高海、曹高海、曹高海等(391)

洞庭湖湿地植物多样性与生物量关系的研究——曹高海、曹高海、曹高海等(396)

洞庭湖湿地自然保护区景观格局变化及功能区划分——曹高海、曹高海、曹高海等(403)

洞庭湖不同植物体碳氮含量及其影响因素分析——曹高海、曹高海、曹高海等(408)

洞庭湖不同植物体碳氮含量及其影响因素分析——曹高海、曹高海、曹高海等(415)

Cd 和 Pb 对崇明东滩湿地土壤重金属污染物的污染评价——曹高海、曹高海、曹高海等(421)

## 研究报告

洞庭湖高滩余滩花米草地上生物量估计——曹高海、曹高海、曹高海等(391)

洞庭湖湿地植物多样性与生物量关系的研究——曹高海、曹高海、曹高海等(396)

1986—2012年吉林省西部湿地生态承载力评价——曹高海、曹高海、曹高海等(439)

洞庭湖高滩余滩花米草地上生物量估计——曹高海、曹高海、曹高海等(446)

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# WETLAND SCIENCE

Vol.14 No.3 June 2016

## CONTENTS

Discussion on Wetland Evaluation Competition Standard of Coastal Wetland in Wenzhou  
and its Importance ..... XIAO Jie, XIAO Yueshen et al. (1)

Soil Freeze-Thaw Characteristics of *Phragmites australis* Marshes in Pannu ..... WANG Yue, ZHOU Fei, JIA Qingyu et al. (25)

Formation Environment of the Subalpine Wetlands in Jingning She Autonomous County,  
Zhejiang Province ..... GU Yanshen, JIANG Qianjun, LIU Hongye et al. (30)

Wetland Diversity and Conservation Status in Fuyuan Lake Area ..... LIU Xiangyan, LI Yankuo, JIANG Weifeng et al. (41)

Insect Diversity of Diptera, Trichoptera and Odonata Insecta in Bukit Merah  
Reservoir River Feeders ..... Suhaila Ab Hamid, Nurhalida Hanapi, Mohd Fakhrullah, Saifussalam Mohd Atendi et al. (328)

A Stable Isotope Approach to Determine Herbivorous Diets of Waterfowl Geese  
in Dongting Lake, China ..... GUAN Lina, MA ZI QI, DEBOCHEN, YANG Aifang et al. (37)

Migration Routes of Siberian Crane (*Grus leucurus*) in Spring and Autumn by Satellite Tracking ..... LI Xiuming, XU Jidun, QIAN Jiafen et al. (47)

Pollution Load and Environment Capacity in Longhu Lake Basin ..... WANG Yan, GAO Junfeng, LIU Zhengwen et al. (54)

Denitrification Rate of Soils in Marshes of Min River Estuary under the Nitrogen Addition ..... LIU Jie, LIU Jie, LIU Jie et al. (61)

Change of Water Area of Lake Balkhash during 1975-2014 ..... ZANG Jingjing, LI Guozhu, SONG Kaishan et al. (68)

Comparison of Insect Chlorophylls of Mangrove Species *Rhizophora apiculata* and *Sonneratia apetala* ..... WANG Jinyang, CHEN Qinxia, LI Xinyan et al. (76)

Environmental Analysis of Precipitation in the Qaidam Wetland Lakes in China during the Period 2000-2014 ..... WU Hongjun, DAN Xinqiu, HUANG Yan et al. (82)

Distribution of *Aburathia* and *Barrissia* Association in the Wetland of the Jialu River of Songliao Plain ..... ZHOU Xiuming, QIAN Xiuming, XIE Yuchang et al. (91)

Relationship between Plant Species Diversity of Riparian Zone in Hu River Wetlands and Soil Factors ..... LI Qian, SHI Hanqin, LI Shuyuan et al. (96)

Landscape Pattern Change and Division of Function Zones in Linhekou Wetland Nature Reserve ..... ZHOU Xiuming, XU Hongjun, ZHANG Junfei et al. (101)

Distribution of Total Nitrogen in Sediments and Its Pollution Risk Assessment in the Wetlands of  
Chelioshiang River Estuary ..... WANG Shun, LIU Yungen, HUANG Qibin et al. (108)

Distribution Characteristics of Phosphorus under Different Vegetation Communities in Salt Marshes of  
Qaidam Basin ..... QIU Runrong, XU Zhen, XU Wenxia et al. (115)

Environment Effect of *Phragmites australis* on the Increase of Soil Nitrogen in Wetlands  
in Chongming Island ..... FAN Diwa, TANG Yidan, CHEN Yuan et al. (121)

### Research Reports

Fuzzy Comprehensive Evaluation of Water Quality in Davao Lake ..... YIN Jipeng, YUAN Yanyan et al. (125)

Analysis of Mineral Element Contents in Organs of Mangrove Plants of *Lumnitzera littorea* and *Lumnitzera racemosa*  
in Dengzhang ..... LI Yanhui, YANG Yong, ZHANG Yang et al. (131)

Ecosystem Vulnerability Assessment of Wetlands in Western Inner Mongolia from 1986 to 2012 ..... YE Guoqiang, DU Baoguo, LIU Jiping et al. (139)

Physiological Adaptation of *Halobutyrus cordatus* to Substrate Moisture Change under Shading Condition ..... WANG Yanyan, LIU Yanyan, GUO Yanyan et al. (146)

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2014 10 2015 2 (Grus leucogranus) 6  
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F=1.47 p=0.27 F=0.86 p=0.39)

Q958.13 Q959.7\*26 A 1672-5948(2016)03-347-07

(Grus leucogranus) Sauey R T<sup>[8]</sup>  
<sup>[1]</sup> (International  
 Union for Conservation of Nature IUCN) ( )  
 (Critically Endangered) (http://www.iuc-  
 nredlist.org) I

1995 1996 Kanai Y <sup>[11]</sup>  
<sup>[2]</sup> 13  
 11 5  
 2008 (Fereydoon Kenar) <sup>[3,4]</sup> 9 10  
<sup>[5-7]</sup>

(Keoladeo National Park) 2002  
<sup>[4,8,9]</sup> 15

99%  
 2012 (5 312.8±260.6) km (4 903 5 586 km n=5)  
 3 800 4 000 <sup>[10]</sup>

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2016-05-13 2016-06-03  
 (2130211-15-004)  
 (1989-) E-mail: icelxming@163.com  
 E-mail: cranenw@caf.ac.cn

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monoch) [12,13]  
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( )  
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Table 1 Banding data of tracked Siberian Cranes during 2014-2015

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953	2014	10	22				Q02-1713	4AFFB5	7 000
954	2014	10	22	11	18		Q02-1714	4B0330	7 400
955	2014	10	22				Q02-1715	4B2FE9	7 800
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1)

954 2014 11 18

1 (a 951 b 952 c 953 d 954 e 955 f 956 )

Fig.1 Migration routes of the tracked Siberian Cranes

(a: Number 951; b: Number 952; c: Number 953; d: Number 954; e: Number 955; f: Number 956 Siberian Crane)

(n=5)

2015 951 953 955 1

956 2015

(5 594.83±371.70) km (5 264.63 5 933.66 3

km) (57.51±8.61) d (50.17 66.83 d)

(50.14±8.43) d (42.00 59.71 d) 2015 3.1

(5 366.66± Kanai Y <sup>[11]</sup>

61.19) km (5 300.20 5 428.89 km)

(51.52 ± 9.68) d (40.38 64.00 d)

(42.05±6.08) d (33.04 45.88 d)( 2) 2015 Kanai Y

( F=1.47 p=0.27

F=0.86 p=0.39 F=2.42 p=0.17)

2.2 (5 366.66±

2) 2 ( 61.19) km Kanai Y

(5 312.8±260.6) km<sup>[11]</sup> (F=0.16 p=0.70)

80 km nai Y <sup>[11]</sup> Sauey R T<sup>[8]</sup> Ka-

350 km 2014 2015

6 /

3 /

3

(n= <sup>[19]</sup>

1) (n=1) <sup>[20,21]</sup>

(n=2)

2

( 3)

(n=3)

Table 2 Migration distance, migration time and roosting time of the tracked Siberian Cranes

	951	953	955	956	±
(d)	66.83	62.83	50.17	50.21	57.51 ±8.61
(d)	59.71	54.63	44.21	42.00	50.14±8.43
(km)	5 899.23	5 933.66	5 264.63	5 281.81	5 594.83±371.70
(d)	40.38	64.00	50.42	51.29	51.52±9.68
(d)	33.04	45.54	43.75	45.88	42.05±6.08
(km)	5 330.46	5 300.20	5 407.08	5 428.89	5 366.66±61.19

( ) ( )

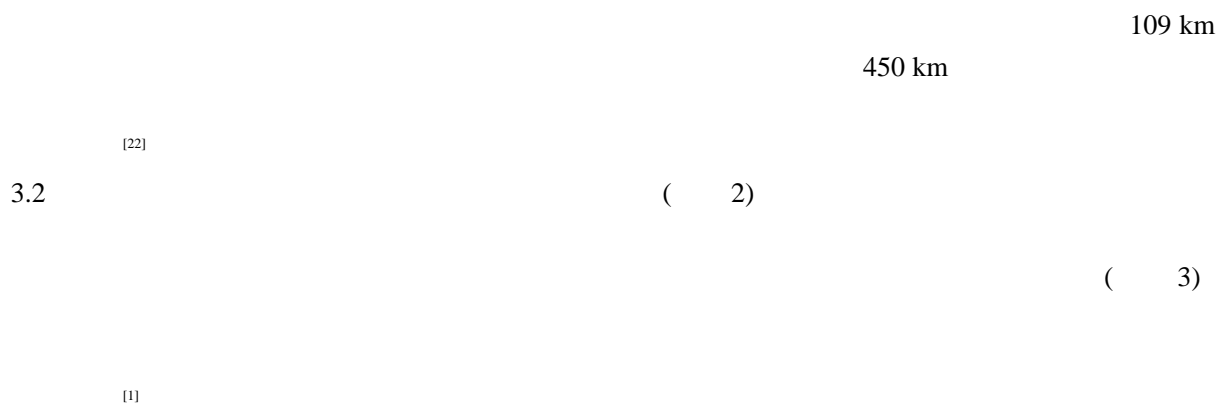


2

Fig.2 Migration routes over the Bohai Sea of the tracked Siberian Cranes

3

Fig.3 Migration routes over the Dabie Mountain area of the tracked Siberian Cranes



50 km  
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 1 500 m  
 ( 500 1 000 m  
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4

2014 10 2015 2  
 951 953 955 2014  
 2015

[1] . [M]. : , 2012.  
 [2] , , [M]. : , 1998.  
 [3]Kanai Y, Nagendran M, Ueta M, et al. Discovery of breeding grounds of a Siberian Crane *Grus leucogeranus* flock that winters in Iran, via satellite telemetry[J]. Bird Conservation International, 2002, **12**(4): 327-333.  
 [4]Meine C, Archibald G. The cranes: status survey and conservation action plan[M]. IUCN, 1996.  
 [5]Bragin E. Siberian Crane sightings in north Kazakhstan in spring 2013 and 2014[J]. Siberian Crane Flyway News, 2014, **6**(13): 5-6.  
 [6]Rusanov G. A sighting of the Siberian Crane in Volga Delta, Russia, in autumn 2013[J]. Siberian Crane Flyway News, 2014, **6**(13): 6-7.  
 [7] . (*Grus nigricollis*) (*Grus leucogeranus*) [D]. : , 2009: 10-12.  
 [8]Sauey R T. The range, status, and winter ecology of the Siberian Crane (*Grus leucogeranus*) [D]. Ithaca: Cornell University, 1985: 191-197.  
 [9]Vardhan H. Autumn migration and wintering 2002/2003 in central flyway[J]. Siberian Crane Flyway News, 2002, **12**(3): 7-8.  
 [10]Li F S, Wu J D, James H, et al. Number and distribution of cranes wintering at Poyang Lake, China during 2011-2012[J]. Chinese Birds, 2012, **3**(3): 180-190.

- [11] Kanai Y, Ueta M, Germogenov N, et al. Migration routes and important resting areas of Siberian Cranes (*Grus leucogeranus*) between northeastern Siberia and China as revealed by satellite tracking[J]. *Biological Conservation*, 2002, **106**(3): 339-346.
- [12] Ma Y, Li X. The population and habitat of cranes in China's nature reserves[C]//The future of cranes and wetlands. Proceedings of the international symposium held in Tokyo and Sapporo, Japan, 1993: 141-145.
- [13] Zhang F. Conservation of wetlands and cranes in China[M]//The Future of Cranes and Wetlands. Proceedings of the international symposium held in Tokyo and Sapporo, Japan, 1993: 130-135.
- [14] , , . [J]. , 2007, **41**(6): 82-91.
- [15] , , . [J]. , 1991, **12**(5): 21-24.
- [16] , , James Burnham. [J]. , 2013, **11**(3): 305-312.
- [17] , , . 2012 [J]. , 2014, **42**(1): 39-43, 51.
- [18] , , . [J]. , 2012, **33**(4): 355-361.
- [19] , , . [J]. , 2007, **39**(2): 106-111.
- [20] . [D]. : , 2012: 21-24.
- [21] , , . [J]. , 2007, **42**(3): 68-72.
- [22] Rappole J H, King D I, Diez J. Winter-vs. breeding-habitat limitation for an endangered avian migrant[J]. *Ecological Applications*, 2003, **13**(3): 735-742.
- [23] Newberry R C. Environmental enrichment: increasing the biological relevance of captive environments[J]. *Applied Animal Behaviour Science*, 1995, **44**(2): 229-243.

## Migration Routes of Siberian Crane (*Grus leucogeranus*) in Spring and Autumn by Satellite Tracking

LI Xiuming, XU Jiahui, QIAN Fawen

(Research Institute of Ecology, Environment and Protection, Chinese Academy of Forestry, Beijing 100091, P.R.China)

**Abstract:** From October 2014 to February 2015, six Siberian Cranes (*Grus leucogeranus*) had been installed satellite trackers at stopover and wintering sites. Five of them provided fall migration information in 2014, and 4 birds completed spring and autumn migration in 2015. The results showed that 3 birds tracked flew to Poyang Lake as their wintering ground in China; their breeding ground located in the Arctic tundra between lower Yana River and lower Indigirka River in Republic of Sakha of Russia; all important stopover sites were in the marshes of southwest Songnen Plain in northeast China, which included the marshes in Momoge National Nature Reserve and Xianghai National Nature Reserve in Jilin province, Tumuji National Nature Reserve in Inner Mongolia Autonomous Region, and surrounding wetlands; the wetlands in Qiqihar became less important as stopover sites for Siberian Crane in this study; the migration routes in spring and autumn were roughly similar, but neither strictly migrating along the same route, nor roosting at the same stopover sites except the marshes in southwest Songnen Plain; the migration distance was  $(5\ 594.83 \pm 371.70)$  km ( $n=4$ ) and migration time was  $(57.51 \pm 8.61)$  days ( $n=4$ ) in spring 2015, and migration distance was  $(5\ 366.66 \pm 61.19)$  km ( $n=4$ ) and migration time was  $(51.52 \pm 9.68)$  days ( $n=4$ ) in fall 2015, there is not significant difference on migratory distance and time between spring and autumn migration (migration distance:  $F=1.47$ ,  $p=0.27$ ; migration time:  $F=0.86$ ,  $p=0.39$ ); different migration strategies were adopted by the tracked birds in spring and autumn migration when they flew over the Bohai Sea and Dabie Mountain. In addition, the research showed that it is feasible to release the rescued cranes into the wild in order that they return back to the wild population.

**Keywords:** *Grus leucogeranus*; satellite tracking; migration route; migration strategy