

# 木格滩草场鼠、蝗数量分布调查兼论动物 在生物群落中的重要性\*

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## 摘 要

1974年秋研究了青海贵南木格滩的鼠类与蝗虫。发现鼠与蝗的数量均与草场植被有一定的关系,在草场区别不太大的情况下,鼠类数量多的地方蝗虫少,蝗虫多的地方鼠类少,同作为生态系统中的消费者,有相互代替补充的作用。因此,认为在生物群落中,应更多地重视动物的作用,动物可能在更高的层次上指示不同群落的差异。

**关键词:** 生物群落;鼠类;蝗虫;数量分布

木格滩位于青海省贵南县西北部,为放牧军马的草场,其上鼠害严重,土蝗危害亦不轻。为了掌握其危害情况,了解鼠、虫、草的关系,为防治提供科学依据,我们于1974年9月12—26日进行了调查。本应早日写出报告,但那时正处于十年动乱时期,写文章在很大程度上受到抑制,更兼人员调动,有些材料损失了,故未进行系统整理。最近第一作者行将退休,整理物品时,又发现了这份材料,细看之后,觉得还值得整理整理。如第二作者当时对鼠类的总结比较详实,第三作者对蝗虫也有一份小结,蝗虫标本虽被蠹蚀,经印象初同志协助,利用残屑,仍对大部蝗虫作出鉴定,参照部分原始记录,作如下的整理,整理中看到消费者鼠类与蝗虫的地域分异,消费功能的交替互补,又看到动物对反映生物群落的重要性,故报道如下。

## 一、自然概况

木格滩海拔3 025—3 400米之间,地势东南高西北低,北部多深沟,主要有木合沟等,南部为大片沙山,总体上是微有起伏的高平原。年均温0.1—1℃,最低在1月,月均温

\* 参加野外工作的还有肖运峰、梁杰、沙渠、林泽滨等同志。植物学方面由肖运峰同志负责,印象初同志协助鉴定蝗虫,王申裕同志协助绘图,特此致谢。

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-14℃(70年)。最热月为7月,月均温12.6℃(70年)。年降水量330毫米,6—9月占全年的75.9%(68年)。多西北风,风力多4—8级。1—3月为大风扬沙季节。土壤为沙质栗钙土或栗钙土,肥力低,耐牧性差。

植被属高山干草原类型,随土壤水分条件的变化,分别由旱生密丛禾草、旱中生根茎禾草、旱生耐沙禾草和根茎、轴根型杂类草各自形成草场,计有5种:

- 1) 赖草草场。分布在水分条件较好之处。
- 2) 针茅草场。分布最广,面积最大,为较稳定的类型。
- 3) 固沙草草场。是针茅草场土壤旱化、沙化之后形成的草场,在西部有较大的面积。
- 4) 杂类草草场。是上述各草场退化后的次生草场。
- 5) 羊草草场。分布于沙山边缘丘陵地区。

本地区的优势植物有:紫花针茅(*Stipa purpurea*)、大针茅(*S. grandis*)、克氏针茅(*S. krylovii*)、赖草(*Leymus secalinus*)、青海固沙草(*Orinus kokonorica*)、沙蒿(*Artemisia desertorum*)、苔草(*Carex* spp.)、披针叶黄花(*Thermopsis lanceolata*)、猪毛菜(*Salsola* sp.)、早熟禾(*Poa* spp.)、羊茅(*Festuca* sp.)、狼毒(*Stellera chamaejasme*)等。

## 二、工作方法

### (一) 鼠类调查

按不同植被选取样地,每块样地取4—5个样方,每一样方1/4公顷,以达呼尔鼠兔(*Ochotona daurica*)、喜马拉雅旱獭(*Marmota himalayana*)的洞口,高原鼯鼠(*Myospalax baileyi*)的土丘群为数量指标进行统计。共取样地16个,样方19.5公顷。

同时,乘汽车作了43公里的线路调查,折合258公顷。调查者在卡车上左右各站一人,各向外侧观察25米内的鼠兔草堆(秋季鼠兔堆在洞口附近的草堆,晒干后,储存过冬)数、旱獭洞口和鼯鼠土丘群数,两公里为一段落,由驾驶员负责鸣笛通知观察者,使之记录。此法虽较粗,但调查地区广,是取样方法之外的很好补充。

### (二) 蝗虫调查

也按不同植被选取样地,样地上进行两种方法的调查:一是在1/4米<sup>2</sup>的样方内,目视蝗虫的数量,每调查点取10个样方,以其平均值作为数量指标。二是在样方周围,以昆虫网扫网50次,收集标本,供室内进行准确的物种鉴定,并计数。

昆虫所调查的面积较小,南部沙山附近,基本上未做样方。

## 三、鼠类的数量分布

主要鼠类有3种,即达呼尔鼠兔、高原鼯鼠和喜马拉雅旱獭。小形鼠类对草场无甚危害,以少数鼠铗试捕的结果,数量极低,故未统计调查。

鼠类的数量分布与植被有密切的关系,以统计数据最充分的鼠兔为例,其洞口数在各

类草场上基本不同(表 1)。在针茅草场上,密度最高,达  $276.2 \pm 29.4$  个/公顷,赖草草场上密度最低,仅  $5.5 \pm 2.7$  个/公顷。以 5 类草场上鼠兔洞口数进行相互比较,经显著性测定(t-测验),绝大部分草场间鼠兔洞口数有显著差异。如针茅草场与其他草场上洞口数的差异均达到极显著水平 ( $P < 0.01$ ); 赖草草场上者与羊茅草场之间亦达极显著水平 ( $P < 0.01$ ),与杂类草草场和固沙草草场之间,洞口密度亦可达到显著水平 ( $P < 0.05$ ); 杂类草、固沙草、羊茅诸草场之间鼠兔洞口密度无显著差异 ( $P > 0.05$ ) 总之是不同草场上鼠兔的密度基本上是不同的。

表 1 各类草场上达呼尔鼠兔洞口统计(洞口/公顷)

Table 1 Statistics of openings of *Ochotona daurica* in various rangeland (openings/ha)

草场 Rangeland	样方数 Sample	极值 Range	平均值±标准误 $\bar{X} \pm SE$	标准差 SD
针茅草场 <i>Stipa</i> rangeland	36	0—692	$276.2 \pm 29.4$	176.6
赖草草场 <i>Leymus</i> rangeland	23	0—32	$5.5 \pm 2.7$	9.6
杂类草场 Forbs rangeland	7	0—104	$44.6 \pm 14.9$	19.4
固沙草草场 <i>Orinus</i> rangeland	17	0—84	$23.5 \pm 6.6$	27.2
羊茅草场 <i>Festuca</i> rangeland	4	4—44	$27.0 \pm 8.7$	17.4

同一草场类型下,草的群落结构不同时,鼠类数量也会不同。如马四队的针茅-沙蒿草场和藏民路的针茅-猪毛菜-沙蒿草场的鼠兔洞口多达  $304.27 \pm 23.39$  和  $605.00 \pm 47.75$  个/公顷,而马七队东南的针茅-赖草草场和木合沟西的针茅-赖草-固沙草草场,鼠兔洞口密度仅为  $80.80 \pm 35.06$  和  $25.33 \pm 7.42$  个/公顷,差异如此之大。

高原鼯鼠的分布中心在东部针茅草场中,北部木合沟沟沿的杂类草草场和农八队、农四队附近也有分布,它在退化草场上数量最多。喜马拉雅旱獭除东部针茅草场上有相当数量外,有向南部丘陵集中的趋势。在南部沙山边缘的羊茅草场上,旱獭数量最多。

鼠类群落和数量与植被有密切的关系,但二者都在发展变化着,我们的观察只限于一个片断。若从发展上看,还会复杂得多。如 70 年以前,在东部,特别是藏民路一带,鼯鼠占绝对优势,经过大规模灭鼠后,数量下降了,但 4 年后再观察,该地区主要为达呼尔鼠兔所占据。而且鼠兔与鼯鼠是,此多彼少,此少彼多,有互相补充代替的趋势(梁杰荣等, 1978)。尽管我们对这些复杂的关系,尚认识不多,毕竟鼠类分布与植被有较密切的关系,故以调查结果与植被情况对木格滩鼠类数量分布进行了区划(图 1),将鼠类数量分为 4 级:

I 级 密度很低,鼠兔洞口每公顷在 10 个以下,无鼯鼠和旱獭。草场为赖草-固沙草或固沙草-赖草类型。主要分布在木格滩西北部。

II 级 密度中等,每公顷之鼠兔洞口在 11—150 之间,间或分布有少数旱獭和鼯鼠,仅羊 11 队附近旱獭数量较多。草场类型包括有杂类草草场、羊茅草场,部分固沙草草场和针茅-赖草草场。主要分布于木格滩南半部和中段北部。占面积最大。

III 级 数量高,每公顷鼠兔洞口 151—350 之间,分布有大量的鼯鼠与少量的旱獭。草场为针茅-杂类草类型。主要分布在东部偏南地区。

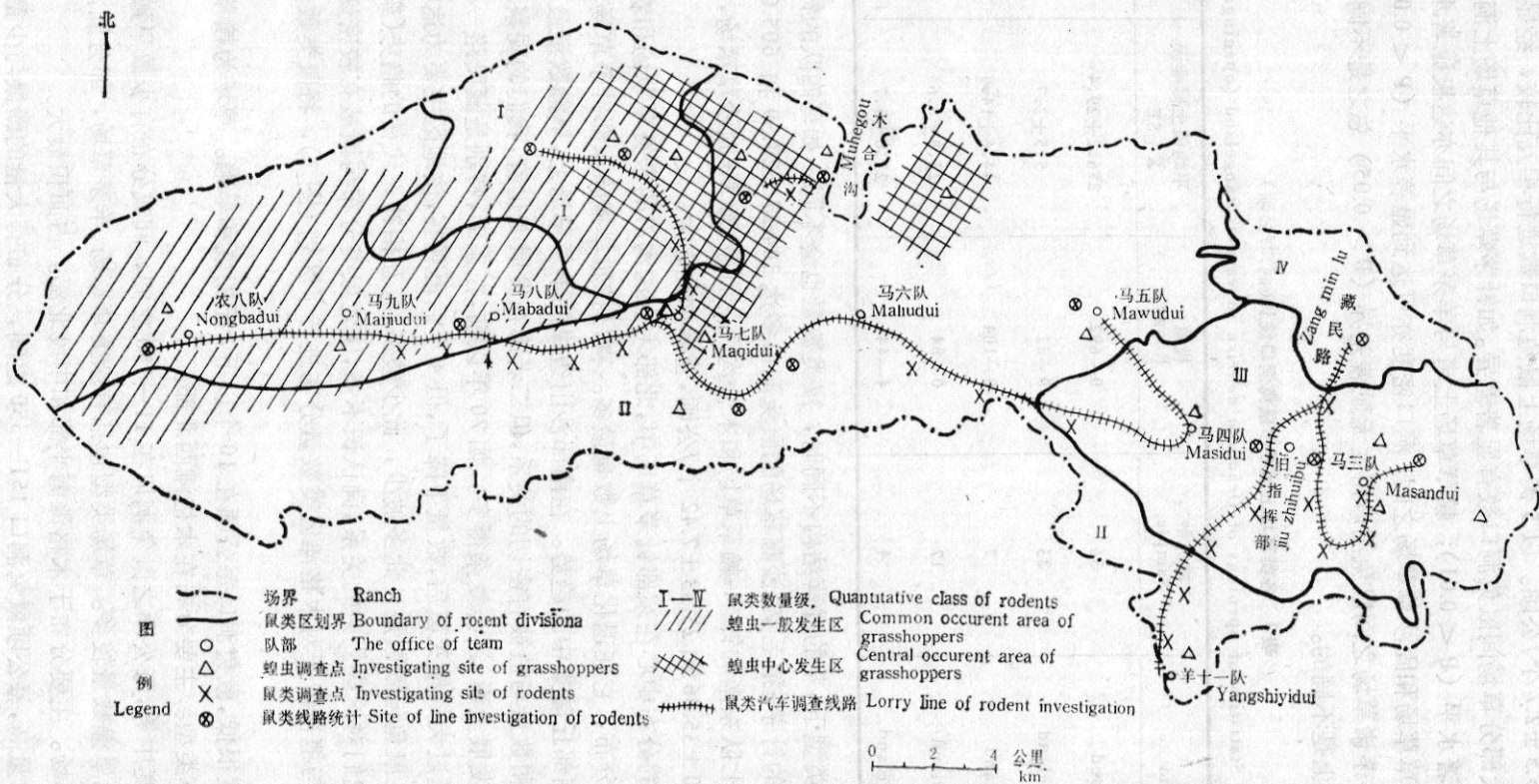


图1 木格滩鼠、蝗数量分布图

Fig. 1 Quantitative distribution map of rodents and grasshoppers at Mugetan

IV 级 数量最高,每公顷有鼠兔洞口 351 个以上,有大量的鼢鼠。草场为针茅-杂类草类型。仅存在于藏民路附近地区。

路线统计的标准与样方统计不同,也不好折算,但它反映的结果与样方统计者一致:1)从马七队北行,统计了 3 段路程,未见鼠迹,样方统计该地区数量最低;2)由马四队向南转北,绕道马三队途中,统计了 4 段路程,其上鼠兔草堆数量均高,与样方统计反映一致,这一带鼠兔数量较高;3)由马四队西行去马六队,3 段统计路程中,鼠兔草堆由东向西递减,接近沙山处则有旱獭分布,与样方表现一致;4)旧指挥部南行至羊 11 队高数量区(III 级),向低数量区(II 级)过渡。同样看到鼠兔数量渐减的情况。

以样方分级为标准,结合路线调查的结果,绘制出鼠类数量分布图(图 1)。该图虽较粗糙,但基本上可以反映木格滩鼠情的分布,可供鼠害防治工作参考。

#### 四、蝗虫的数量分布

该地蝗虫种类比较简单,主要为狭翅雏蝗 (*Chorthippus dubius*) 数量占绝对优势。就被蠹蚀后的残体 21 分样品中,鉴定出狭翅雏蝗 1855 头,占 99.0%,其余不过 18 头,计:

蚁蝗 (*Myrmeleotatix palpalis*) 3 头

红翅皱膝蝗 (*Angaracris rhadopa*) 9 头

亚洲小车蝗 (*Oedaleus asiaticus*) 1 头

白边迦蝗 (*Bryodema luctuosum*) 4 头

短星翅蝗 (*Caliptamus abbreviatus*) 1 头

因此,蝗虫的群落结构非常简单,狭翅雏蝗占绝对优势。下文所谈均为此种。当然,蝗虫的种类及数量会有季节变化,现今的研究仅指秋季,可能有些种类在此季之前,已经消失,就蝗虫群落全年来看,不那么简单。

表 2 不同草场内蝗虫的密度(头/米<sup>2</sup>)

Table 2 Density of grasshopper in different rangeland (indiv/m<sup>2</sup>)

草场 Rangeland	样方数 Sample	极值 Range	平均值±标准误 X±SE	标准差 SD
针茅草场 <i>Stipa</i> rangeland	5	0.6—2.0	1.12±0.60	1.34
赖草-固沙草草场 <i>Leymus-Orinus</i> rangeland	10	10.4—36.0	17.24±2.63	8.33
杂类草场 Forbs rangeland	3	0.5—3.8	2.10±0.95	1.65
严重退化草场 Seriously degenerated rangeland	5	0.01—0.20	0.08±0.03	0.07

蝗虫的数量分布与植被也有密切的关系。就现有记录中,明确记载有草场类型者的蝗虫数量记录,从表 2 可以看出,不同草场内蝗虫的密度变化甚大,以赖草-固沙草草场上者数量最高,达 17.24±2.63 头/米<sup>2</sup>,而严重退化草场上者,数量最低,仅 0.08±0.03 头/米<sup>2</sup>。经显著性测定(t-测验),赖草-固沙草草场的蝗虫密度较任何其他草场上者均高,达到极显著水平(P < 0.01),而其他各草场之间,蝗虫密度均无显著差异(P > 0.05)。与

达呼尔鼠兔数量相比,虽均因草场不同而密度不同,但趋势相反,鼠兔在针茅草场(多有不同程度的退化)上数量最高,在赖草草场上的数量最低,而蝗虫正好与此相反。

蝗虫的数量分级:根据蝗虫在不同地区的密度,为制图的需要,大体上可分为3级:

I、基本无蝗区。蝗虫数量极低,密度在1头/米<sup>2</sup>以下。主要分布在严重退化草场上,藏民路以东的调查,5个样方的平均密度为 $0.08 \pm 0.03$ 头/米<sup>2</sup>,扫网6次,仅得雏蝗8头,平均为 $1.33 \pm 0.49$ 头/50网,旧指挥部附近扫网6次,未获得蝗虫。该地区的鼠兔与鼢鼠极多。

II、蝗虫一般发生区。数量中等,密度平均为5头/米<sup>2</sup>左右。主要分布在马八队与农八队之间的广大地区。6个样方调查平均为 $33.34 \pm 0.77$ 头/米<sup>2</sup>;扫网10次,50网平均得雏蝗 $14.60 \pm 2.83$ 头。鼠密度低。

III、蝗虫中心发生区。蝗虫数量极高,一般在10头/米<sup>2</sup>以上。分布的主要一片在马七队以北,西起马七队与马八队之间,东至木合沟以北,另一片在马六队与马五队之间,木合沟以东。5个样方平均蝗虫密度为 $12.27 \pm 1.24$ 头/米<sup>2</sup>,扫网结果,两个点9次,每50网得雏蝗 $61.22 \pm 10.78$ 头,另有其他蝗虫4头。此外,在马七队之南得到一个数据,高达22.04头/米<sup>2</sup>;3次扫网平均50网得雏蝗 $105.00 \pm 15.18$ 头,其他蝗虫4头。把上述II、III区域同时标在图1上,基本无蝗区与未调查地区,不加标志。则由图可见,凡蝗虫多的地方,鼠则少;反之,鼠类多的地方,蝗虫则少。这是一个很有趣的现象。

## 五、讨论:关于动物在生物群落研究中的意义

不论所研究的是鼠类还是蝗类,都是草地生态系统的一部分,都处于消费者的地位。而且两类动物的食物主要是草,鼠兔尝食绿色食物,鼢鼠主食草类的地下根茎,旱獭食物稍杂,但也以绿色食物为主。蝗虫以草叶为食,也是绿色食物。所以两类动物,就食性来说,其功能生态龕是基本相同的,因此,在空间生态龕上发生了分异。木格滩东部地区鼠类多,西部地区蝗虫多鼠类少,正体现这一规律。

一个生态系统的初级生产(或称第一性生产),总要被消费者消费,从而形成次级生产,至于由那一部分动物行施这一职能,则由具体条件来决定,但是,很可能一类动物占优势时,将要排斥与其食性相同的另一类动物。故鼠类占优势时,蝗虫必居次要地位,反之亦然。当然,鼠、蝗在各自的群落中,仍有生态龕的分异,蝗虫方面,因狭翅雏蝗占绝对优势,群落结构单一;鼠类群落中,两个优势种,鼠兔营地上生活,鼢鼠营地下生活,生态龕差别非常明显,可是它们之间仍有一定的竞争,数量互为增减(梁杰荣等,1978)。人类在草地上放牧牲畜。就是要以家畜居于消费者的主要地位,自然要与原有的消费者和放牧后因退化等增加的新消费者产生矛盾。调整它们的关系,为灭虫、杀鼠和改良牧草等等,以求增牧牲畜。当然,应以生态系统的观点,综合治理,使草、畜皆优,长期取得最好的经济效益。

生物群落的研究,一般认为应以植物为主,我们过去曾以草原啮齿动物为例,提出过一些意见(夏武平,1964),认为植物为动物提供食物和隐避所,故应在不同植被上研究各类动物群落。钟文勤等(1981)、周庆强等(1982)在内蒙古即以草地类型为基础,研究了当地啮齿动物群落,刘季科等(1982)也以相似的方法研究了青海海北门源马场的鼠类群落,

张晓爱(1982)也以植被为基础研究了门源马场风厘口地区的小形鸟类群落,均取得良好的结果。一般情况下,植被随小地形变化快,级别划分得较细,而动物活动范围大,其群落常跨多个植被类群;二级消费者,为猛禽和食肉小兽的活动范围更大,又跨多个小型鸟、兽群落;大型草食或肉食的动物跨过的地区更大。所以,动物群落的作用,常体现在生物群落的高级层次上。目前的研究指出,以针茅、赖草、固沙草等建群的植物群落,固有明显的区别,总不如蝗虫和鼠类两大群落区别那么大,正体现了这种情况。

不妨设想,以狭翅雏蝗为代表的生物群落其下又可主要分为赖草、固沙草、针茅等为建群种的植物群落;以达呼尔鼠兔和高原鼯鼠为代表的生物群落,其下又有针茅和杂类草草场等;以喜马拉雅旱獭为代表的生物群落为羊茅草场等。看来,动物在生物群落中,可以提供更重要的信息。

60年代,第一作者在内蒙中部一些地区工作时,曾看到在土壤较干旱,牧草较稀疏的草原上,鼠类与蝗虫并存,都有一定的数量。在那里与木格滩不同,两者不是互相排斥的。当地的优势鼠种——黄鼠(*Citellus dauricus*)的食物中还包含相当数量的蝗虫,形成草、鼠、蝗的复杂关系。

以植物为食的动物,其食性即可影响植被的结构。如高寒草甸上,有家畜放牧时,家畜吃去禾草,而嵩草(*Kobresia* spp.)耐牧,就形成了以嵩草建群的单层结构,如加封育,则恢复为上层禾草,下层嵩草的双层结构。高原鼠兔(*Ochotona curzoniae*)亦喜食禾草,在数量多时,也起一定的上述作用。

草地动物的挖掘活动形成的土丘、土坑,也可以在其上形成植被镶嵌体,改变植被的一致性。故研究生物群落应动、植物结合进行,研究其相互关系。至少在陆地生态系统中,除研究高等植物外,还应研究脊椎动物和一些昆虫的重要类群。

举个极端的例子,东北虎(*Panthera tigris amurensis*)存在于由长白山到小兴安岭的广大林区,但大兴安岭无虎,其大型食肉兽的代表为貂熊(*Gulo gulo*)。以大型草食动物来说,驯鹿(*Rangifer tarandus*)仅存在于大兴安岭,驼鹿(*Alces alces*)则存在于大、小兴安岭,不存在于长白山、完达山等地,梅花鹿(*Cervus nippon*)则仅存在于长白山。故大型动物群落在一定程度上也能反映森林的不同。大、小动物在生物群落高层次上都会有指示作用,不应忽视。

## 参 考 文 献

- 刘季科、梁杰荣、周兴民、李建华,1982,高寒草甸生态系统定位站地区的啮齿动物群落与数量。夏武平主编,高寒草甸生态系统,甘肃人民出版社,34—43。  
张晓爱,1982,高寒草甸繁殖鸟类的群落结构,同上,117—128。  
钟文勤、周庆强、孙崇澍,1981,内蒙古白音锡勒典型草原区鼠类群落的空间配置及其结构的研究,生态学报,1(1): 12—21。  
周庆强、钟文勤、孙崇澍,1982,内蒙古白音锡勒典型草原区鼠类群落多样性的研究,兽类学报,2(1): 89—94。  
夏武平,1964,谈谈草原啮齿动物的一些生态学问题,动物学杂志,6(6): 299—302。  
梁杰荣、肖运峰,1978,鼯鼠与鼠兔数量的相互关系及其对草场植被的影响,灭鼠和鼠类生物学研究报告,第三集,118—124。

# A SURVEY ON THE RODENTS AND GRASSHOPPERS AT MUGETAN RANGELAND, WITH A DISCUSSION ON THE IMPORTANCE OF ANIMALS IN BIOTIC COMMUNITIES

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A study on the rodents and grasshoppers was carried out at Mugetan rangeland in Guinan, Qinghai Province, in the autumn, 1974. It was discovered that the densities of both rodents and grasshoppers vary on the vegetations of the rangeland and that the area with plenty of rodents will be rare in grasshoppers and vice versa. Being the consumers of the ecosystem, the two kinds of animals have a function of mutual replacement or mutual compensation, so that more attention should be paid in the study of biotic communities. Animals may give more informations in the higher levels of some biotic communities.

**Key words:** Biotic community; Rodent; Grasshopper; Quantitative distribution

## 摘 文 著 者

摘要: 1974年秋在青海省贵南县穆格滩牧场进行了鼠类和蝗虫的调查。发现鼠类和蝗虫的密度随牧场的植被而变化,鼠类多的地方蝗虫少,反之亦然。鼠类和蝗虫作为生态系统中的消费者,它们具有相互替代或相互补偿的功能,因此在生物群落的研究中应给予更多的重视。动物在生物群落的高层次上可以提供更多的信息。

关键词: 生物群落; 鼠类; 蝗虫; 数量分布

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## DISTRIBUTION AND ABUNDANCE OF BLACK-NECKED CRANES (*GRUS NIGRICOLLIS* PRZEWALSKI) IN CHINA

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### Abstract

The Black-necked Crane, a typical swamp bird, is the only type that lives on a plateau. It finds its breeding places on the Qinghai-Xizang Plateau and overwintering places along the middle reaches of the Yarlung Zangbo (Brahmaputra) River and on the Yunnan-Guizhou Plateau, a range roughly extending northward to the south slope of the Aerjin Mountains in Xinjiang and the Qilian Mountains in Qinghai, southward to the north slope of the Himalayas, westward to the Kalakunlun Mountains and eastward to the Wumeng Mountains in Guizhou, between N 26°—38° and E 78°—106° at an altitude of 2,200—5,000m above sea level. The authors made statistical investigations thrice, 1984 to 1987 (during winter-spring period) at the overwintering sites of the bird in Xizang (Tibet), Yunnan and Guizhou and spotted about 900—1,100 of the cranes.

**Key words:** Block-necked Crane; Distribution; Abundance; Breeding; Overwintering

The Black-necked Crane is few in number and on the verge of extinction. Reports on the distribution and abundance have been made from time to time. It was Przewalski who found the variety for the first time by the Qinghai Lake in 1876. In the first half of the century, however, not only were cranes of this kind seen, but also made into specimens one after another by Watton (1904), Baker (1929), Stone (1933), Ali, S. (1946), Ludlow (1937, 1944, 1950), and so on, in Sichuan, Qinghai, Xizang and Yunnan Provinces. In recent years, Wu *et al.* (1985), Lu (1983), Yao *et al.* (1982), Li (1986), Li *et al.* (1979), made investigations and studies on the distribution and abundance in just a few areas. On the other hand, the authors of this paper made a comparatively thoroughgoing survey during 1984—1987 in Xizang (Tibet), Qinghai, Gansu, Sichuan, Yunnan and Guizhou Provinces arriving at results as follows:

### 1. Physical environment of ranges

These ranges are taken as those of the breeding or overwintering of Black-necked Cranes. The breeding ranges are on the Qinghai-Xizang Plateau, a vast land making up one fourth of China's territory. It is 2,600—5,000m above sea level with many mountains being 6,000—7,000 metres high, hence named "Roof of the World". There are crisscrossed rivers,

scattered lakes and rich underground water and surface water, from which are formed lots of marshes and swamps concentratedly in such areas as Haibei and Yushu Prefatures of Qinghai Province, the southwest and north of Xizang Plateau, Songpan Grassland on the boundaries of Sichuan, and the South of Gansu Provinces. Thus better living conditions are offered to the Black-necked Crane.

Although the weather on the Qinghai-Xizang Plateau is cold, the day is often filled with a strong sunshine and thin air. The average annual temperature is about 0°C and the rainfall merely 100—400mm on the Songpan Grassland, though on the east slope of the Plateau. It is wet and cold. For instance, the average annual temperature is 1°C in Ruergai County, Sichuan Province.

As to the overwintering areas, along the valley of the Yarlungzangbo River, below 4,000 m above sea level, the average annual temperature is about 6°C, therefore it is warmer and a bit more humid. The topography varies in the Hengduan Mountains, in the east of the Plateau, the basins and large valleys are generally over 3,000 m above sea level. In Zhongdian, northwest of Yunnan, the average annual temperature is 5.5°C; and eastward, the transition from the Qinghai-Xizang Plateau to the Yunnan-Guizhou Plateau, which is mainly located in the east of Yunnan and west of Guizhou, lower than Qinghai-Xizang Plateau in altitude. The climate here is more humid and less cold. For instance, in Huize of Yunnan and Weining of Guizhou, the average annual temperature is 12.7°C and 10.3°C, the relative humidity 65% and 78%, and the altitude 2,100 m and 2,200 m above sea level respectively.

## II. Habitats surrounding

The habitats are marshes, lakes, riversides, and occasionally some vast farmlands, mostly unforested. The Black-necked Cranes feed mainly on the underground parts of the plants of the marshes' vegetation.

Some climate factors in the habitat of the Black-necked Crane are shown in Table 1 and 2. We take Ruergai and Weining as examples of the easternmost part of breeding and overwintering areas during the last decade.

It is evident that the important climate factors are similar between the two halves of the year—one from April to October, including summer and the other from October to April, including winter. The key factors are sunshine, temperature and humidity. A suitable habitat for Black-necked Cranes, consists of the average monthly sunshine totaling 61.2—282.9 hours, the temperature 0.7—13.2°C, and the humidity 54—91%.

## III. Distribution

### 1. Breeding areas

1) Qinghai: Mainly in Rongbotan of Yushu County, Kuochihe of Zhiduo County, Maduo of Qumalai County, and other Counties such as Chengduo, Maduo, Juizhi, Zeku, Gonghe, Tianjun, Qilian, Wulan, Dulan, etc., of which Rongbaotan, Nomohong, south of Ngoring Lake are important.

2) Xizang: Mainly in the marshes and rivers on north Xizang Plateau, the Loubu River in Shenza County, Gaer, Ritu, Bange, Shenza, Anduo and other counties.

3) Sichuan: Reerdabab, Heihe, Machi, Nenwa, Xiaman and Tangke of Ruergai County, Sichuan, and Waqie in Hongyuan County as well as Aba County in the northwest.

4) Gansu: Mainly Gahai in Liuqu County close to Sichuan Province, Meichi, Manerma and Rierma in Maqu County, etc.

5) Xinjiang: Mainly, Ayakekumu Lake in Ruoqiang County.

Table 1 Some climate factors in Ruergai, a breeding area of Black-necked Cranes

表1 黑颈鹤在若尔盖繁殖区的几项主要气候指标

Month 月份	4	5	6	7	8	9	10	Range 范围
The average monthly sunshine (hours) 各月日照时数(时)	196.1—273.1	178.2—270.1	149.7—244.1	185.5—282.9	171.6—252.9	89.1—207.9	111.7—220.4	89.1—282.9
The average monthly temperature 各月平均温度(°C)	0.7—2.9	3.7—6.6	6.6—9.3	9.1—11.9	9.2—11.4	5.6—8.4	0.1—3.5	0.7—11.3
The average monthly highest temperature 各月平均最高气温(°C)	8.6—11.5	11.4—13.8	13.0—15.8	16.0—19.4	15.2—20.2	12.2—15.3	7.4—10.3	7.4—20.2
The average monthly lowest temperature 各月平均最低气温(°C)	-5.2—-3.1	-1.6—1.2	1.1—4.4	3.2—7.0	2.9—6.2	0.7—3.8	-6.5—0.8	-5.2—7.0
The average monthly in 10 cm. depth of soil temperature 各月10厘米平均地温(°C)	2.3	6.6—9.2	10.6—12.5	13.0—15.5	12.7—15.6	9.6—11.9	5.1—7.1	2.3—15.6

Table 2 Some climate factors in Weining, an overwintering area of Black-necked Cranes

表2 黑颈鹤在威宁越冬区的几项主要气候指标

Month 月份	10	11	12	1	2	3	4	Range 范围
The average monthly sunshine (hours) 各月日照时数(时)	87.5—160.3	61.2—200.7	60.2—217.2	87.1—211.7	84.7—234.5	164.7—240.9	147.7—241.4	61.2—241.4
The average monthly temperature 各月平均温度(°C)	9.5—11.7	2.9—9.2	0.1—5.2	0.9—3.3	0.5—9.1	5.8—10.1	9.3—13.2	0.9—13.2
The average monthly highest temperature 各月平均最高气温(°C)	14.8—17.4	6.8—15.3	5.7—12.6	5.3—11.8	4.8—17.3	13.1—19.4	16.2—20.9	4.8—20.9
The average monthly lowest temperature 各月平均最低气温(°C)	6.1—9.1	0.6—5.8	-3.9—1.2	-4.4—-0.6	-3.6—3.2	0.7—5.1	5.1—7.7	-4.4—9.1
The average monthly in 10 cm. depth of soil temperature 各月10厘米深平均地温(°C)	12.6—15.1	7.1—13.2	4.2—7.5	3.6—6.7	2.9—10.2	8.2—13.4	12.7—17.6	2.9—17.6

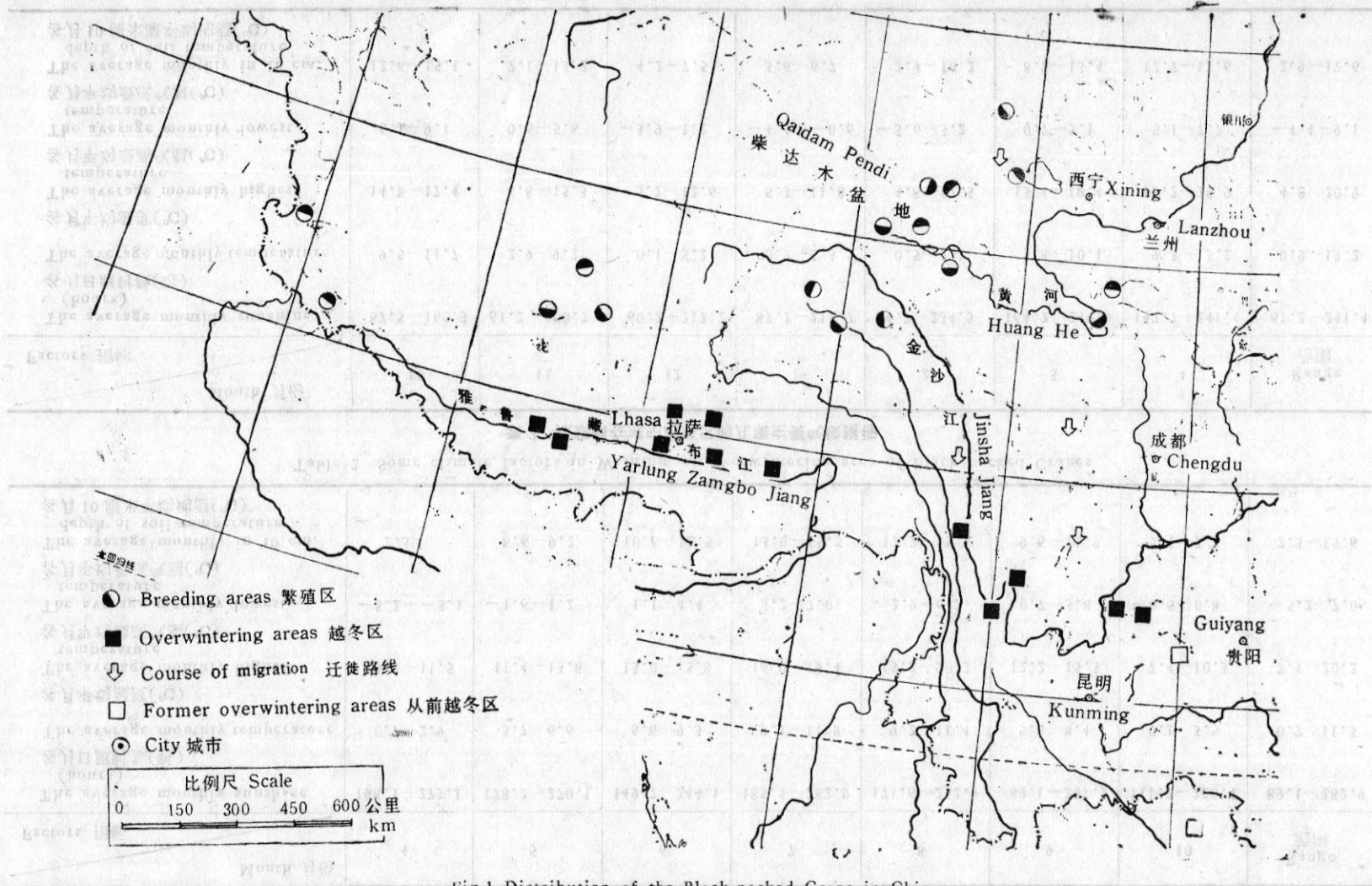


Fig.1 Distribution of the Black-necked Crane in China

图1 黑颈鹤在中国的分布

## 2. Overwintering areas

1) Xizang: Mainly along the middle reaches of the Yarlung Zangbo, Nianchu and Lhasa Rivers, Southern Xizang, and also in the counties of Qushui, Gongga, Rikaze, Xietongmen, Sajia, A Laze, etc., of which Laotongmen of Xietongmen County, Yalucangbo river sides in Rikaze, Xiaojitun of Sajia County and the riverside along Qushui to Cetang are most densely populated.

2) Yunnan: Napahai in Zhongdian County, Lukuo Lake in Ninglang County, Xiangyun and Lijiang counties, Northwestern Yunnan and the Bigbridge Reservoir in Huize County, Northeastern Yunnan.

3) Guizhou: Concentratedly in Caohai, Weining County, Western Guizhou.

In addition, on historical records, overwintering is in the middle reaches of the Jialing River, Sichuan Province and Puan County, Guizhou Province; and migration has been seen in Huanghetan of Guide County, Qinghai Province; Shiqu, Ganze, Litang, Ya'an, Sichuan Province (Fig. 1).

## 3. Elevational distribution

The breeding localities on Qinghai-Xizang Plateau are at 2,600—5,000 m above sea level; Nomohong of Dulan County, 2,600 m, is the lowest and Bengu of Xizang, 4,900 m, the highest. The overwintering areas are at 2,200—3,900 m above sea level. Weining of Guizhou, 2,200 m, is the lowest and Saga of Xizang 3,900 m, the highest (Fig. 2).

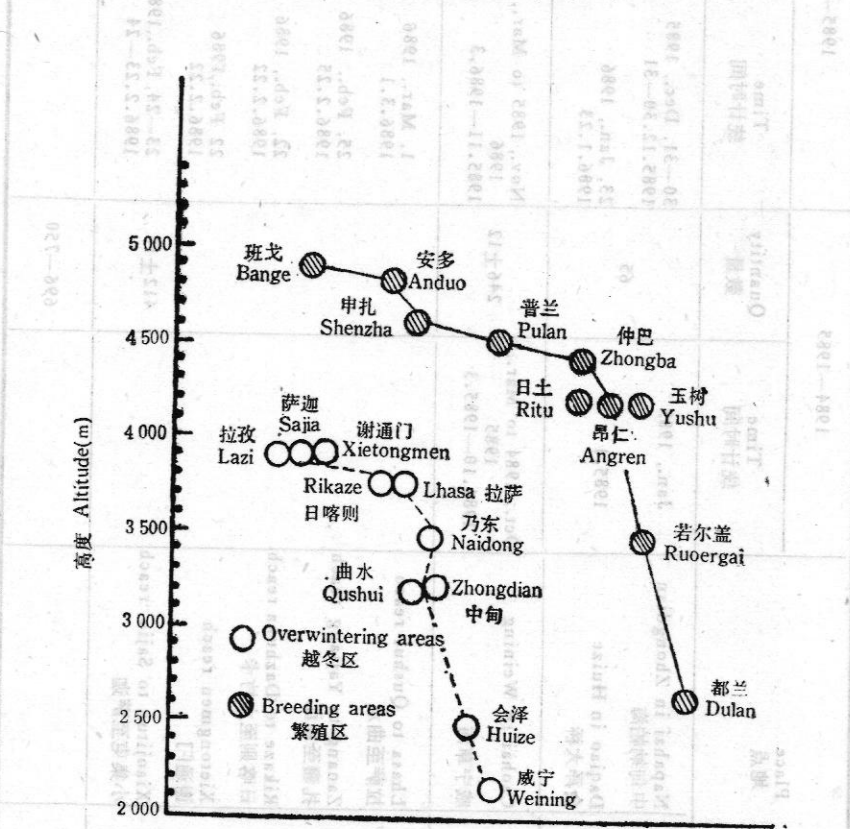


Fig. 2 The elevational distribution of the Black-necked Cranes in China

图2 黑颈鹤在中国的垂直分布

Table 3 Statistics of Black-necked Cranes during overwintering

表3 黑颈鹤越冬区数量统计

	Place 地点	1984—1985		1985—1986		1986—1987		Habitat surroundings 栖息环境
		Time 统计时间	Quantity 数量	Time 统计时间	Quantity 数量	Time 统计时间	Quantity 数量	
Yunnan 云南	Napahai in Zhongdian 中甸纳帕海	Jan., 1985	65	30—31, Dec., 1985 1985.12.30—31	50			Lakes and Marshes 湖泊和沼泽
	Daqiao in Huize 会泽大桥	1985.1		23, Jan., 1986 1986.1.23	35			
Guizhou 贵州	Caohai in Weining 威宁草海	Oct., 1984 to Mar., 1985 1984.10—1985.3	246±12	Nov., 1985 to Mar., 1986 1985.11—1986.3	252±5	3, Feb., 1987 1987.2.3	243	Lakes and Marshes 湖泊和沼泽
Xizang 西藏	Lhasa to Qushui reach 拉萨至曲水			1, Mar., 1986 1986.3.1	10			Riversides (beach) 河滩
	Zanang to Yajiang reach 扎囊至雅江			25, Feb., 1986 1986.2.25	6			
	Rikaze to Dazhuka reach 日喀则至大竹卡			22, Feb., 1986 1986.2.22	8	3, Feb., 1987 1987.2.3		Riversides and Farmlands 河滩和耕地
	Xietongmen reach 谢通门			22 Feb., 1986 1986.2.22	76			Riversides and Grasslands 河滩和草地
	Xiaojitun to Sajia reach 小集屯至萨迦		412±15	23—24, Feb., 1986 1986.2.23—24	218		661	Riversides and Farmlands 河滩和耕地
Total 合计			696—750		642—688		904	

It can be seen that elevational distribution of the Black-necked Crane is at 2,200—5,000 m, thus the bird belongs to plateau species and the name matches the reality.

#### IV. Abundance

Since Black-necked Crane is a species both few in number and on the verge of extinction, researchers are concerned about its number and trying to make predictions according to the reports available, for instance, in breeding localities they number 113 (Guo, 1981), or 271 in Qinghai (Yao, 1982); in overwintering areas, Zhongdian and Lijiang of Yunnan Province, they number 67 and 5 respectively (Lu, 1983), in Caohai, Weining County of Guizhou, 305 (Wu, 1985). These are no more than fragmentary statistics in some areas. And the Songpan, in the northwest of Sichuan, a breeding locality has been omitted, where the authors made observations and found 105 of Black-necked Cranes, and a rough estimate would mean not less than 150—200. Meanwhile, in the overwintering areas, they number 400—600 in the middle reaches of the Yarlung Zangbo River, Xizang.

The Black-necked Cranes scatter loosely in the vast expanse of breeding ranges. However, in overwintering areas though concentratedly and gregariously, they are amassed to a limited extent, for the lands are even and smooth, with vast visual field, and withered plants, and their big bodies are easily to be discovered. The authors made counting of the Black-necked Cranes with telescopes in their overwintering areas during 1984—1987. Table 3 shows the data taken in different places during three overwintering periods.

From Table 3, the quantity during the third overwintering periods is 904; and this is a minimum reckoning. During the spring of 1987, in overwintering areas they numbered 661 (source Liu Shaochu) in Xizang; 243 in Guizhou; if plus 65 in Zhongdian, 5 in Li Jiang, 53 in Ningland (source; Lu Zongbao), 2 in Xiangyun and 35 in Huize of Yunnan Province, the Black-necked Cranes would number 1064 birds in China.

#### References

- Ali, S., 1946, An ornithological Pilgrimage to Lake Manasarovar and Mount Kailis, *Jour. Bombay Nat. Hist. Soc.* Vol. 46.
- Baker, E. C. Sturtevant, 1929, The fauna of British India, including Ceylon and Burma. *Birds* Vol. 6. Taylor & Francis, London.
- Guo Juting, 1981 on the Black-necked Cranes Ecology. *Wildlife* (4): 35—38.
- Li Dehao, 1986, Distribution of Black-necked Crane on the Qinghai-Xizang Plateau. Crane Research and Conservation in China. Heilongjiang Education Press. Harbin, China. (in Chinese).
- Li Dehao *et al.*, 1979, The birds of Ali region, Xizang Report on the botanical and zoological investigation in Ali region, Xizang. Science Press, Beijing. (in Chinese).
- Ludlow, F., 1937, The Birds of Bhutan and adjacent territories of Sikkim and Tibet with notes by N. B. Kinneas. *Ibis* (14) 1. 1944 The birds of Southeastern Tibet. *Ibis* 86. 1950 The birds of Lhasa. *Ibis* 92.
- Lu Zongbao, 1983, The overwintering habits of Black-necked Crane. *Wildlife* (2): 35—36. (in Chinese).
- Stone, W., 1933, Zoological results of Dolan West China expedition of 1931. Pt. I Birds. *Proc. Acad. Nat. Sci. Phila.*
- Wu Zhikang and Li Ruoxian, 1985, A preliminary study on the overwintering Ecology of Black-necked Crane. *Acta Ecologica Sinica* 5(1): 71—76. (in Chinese).
- Yao Jianchu, 1982, The Amount on Distribution of the Black-necked Cranes in Qinghai. *Wildlife* (1): 20—23. (in Chinese).

# 黑颈鹤 (*Grus nigricollis*) 在中国的分布和数量

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黑颈鹤是典型的湿地鸟类,鹤类中唯一的高原种类,迁徙鸟,有越冬区和繁殖区之分。繁殖区主要分布在青藏高原的青海、西藏及毗邻的甘肃、四川部分地区,海拔在2600—5000米之间;越冬区主要分布在西藏雅鲁藏布江及其支流河谷与云、贵高原的部分地方,海拔在2200—3900米之间。无论繁殖区或越冬区都紧紧与高原相联系,两者涉及范围(不包括国外的分布)大致北起新疆与青海交界的阿尔金山至祁连山南坡,南到喜马拉雅山的帕里,西至喀喇昆仑山,东至贵州乌蒙山。栖息环境主要为河、湖沼泽地区。

黑颈鹤属珍稀濒危物种,数量问题一直为中外研究者所注目、笔者经多次在我国越冬区反复调查统计,得到黑颈鹤数量的初步结果是900—1100只之间。

**关键词:** 黑颈鹤;分布;数量;繁殖;越冬

## References

1. 23. 1946. An ornithological pilgrimage to Lake Mtschenow and Moon Kalia. Jour. Bombay Nat. Hist. Soc. Vol. 46.
2. Baker, E. C. 1938. The birds of British India, including Ceylon and Burma. Part 6. Taylor & Francis, London.
3. Guo Junyi. 1981. On the black-necked crane. Zoology, 26(1): 32-36.
4. Li Dahan. 1986. Distribution of black-necked crane on the Qinghai-Xizang Plateau. Crane Research and Conservation in China. (In Chinese).
5. Li Dahan. 1979. The birds of Altai region. Report on the historical and zoological collection in Altai region. Xizang Science Press, Beijing (in Chinese).
6. Ludlow, F. 1937. The birds of Burma and adjacent territories of Sikkim and Tibet with notes by K. H. Kincaid. Part 11. The birds of Sikkim and Tibet. The birds of India, 11: 93.
7. Lu Xingjun. 1973. The overwintering habits of black-necked crane. Wildlife (2): 27-30. (in Chinese).
8. Stone, W. 1932. Zoological results of Johns-Wain China expedition, 1931. Part I. Birds. Proc. Acad. Nat. Sci. Philadelphia.
9. Wu Zhiqiang and Li Kuozhan. 1982. A preliminary study on the overwintering ecology of black-necked crane. Zoology Review (1): 21-26. (in Chinese).
10. Yao Jianshan. 1981. The present on distribution of the black-necked crane in Qinghai. Wildlife (1): 20-23. (in Chinese).

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