Distribution and migration of houbara bustard (Chlamydotis undulata) in China

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The study was financed by international cooperation between China and UZE: Project of Houbara Conservation and Ecological Monitoring in China (0866031) and The Key Projects of Chinese Academy of Sciences (KZ295-JI-114). We thank Dr. Frederic Launay, Mohammed Saleh, Mark Lawrence, Dr. Tourenq Christopher from NARC, UAE, Dr. Dai Kun from Xinjiang Institute of Ecology and Geography, CAS, and Su Hualong from China Bird Banding Center for their help with the fieldwork.
Distribution and migration of houbara bustard (Chlamydotis undulata) in China

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Abstract: The distribution and migration of houbara bustard in China was studied by range investigation and tracking through PTT satellite transmitter from 1997 to 2004. The houbara bustard occurs in the Junggar Basin, north part of Tacheng Basin and valley of Ulungur river in northern Xinjiang, southern part of Turpan Basin and Barkol in eastern Xinjiang. In Inner Mongolia, the houbara bustard occurs in Urathouqi, Alxahouqi and Ejinaqi. In Gansu province, the houbara bustard occurs in Wuwei, Minqin and Shandan. The whole range is not contiguous area. Houbara bastard started migration from Junggar Basin in northern Xinjiang, Turpan Basin and Barkol in eastern Xinjiang, Wuwei in western Gansu Province and Bayan Nur in western Inner Mongolia in the middle of September. Flying to the west and northwest, via Junggar Basin and area between Bole and Habae in northern Xinjiang, entered Kazakhstan, they turned toward southwest, passed Uzbekistan and Turkmenistan, arrived in Arabia Bay of southern Iran or fled over Afghanistan, arrived in southern Pakistan for wintering. The whole migration usually took 35 ± 13 days covering a distance of 4 800-7 000 km. In the next year, houbara went back to the breeding grounds in China through the same routes at the beginning of March. However, it took the birds 64 ± 17 days to finish the spring migration. They arrived in breeding site between middle of April and late May. The sub-adults arrived later and did not breed.

Keywords: houbara bustard, Chlamydotis undulata, distribution, migration, China

Houbara bustard (Chlamydotis undulata) is a rare bird around the world. It was classified as vulnerable species (VU) by IUCN (1994) and was collected into CITES Appendix I (1995). In China, houbara was classified as first category conservation bird. Houbara population has declined in the past half-century throughout the species’ range. This decline is thought to be due to habitat degradation, habitat loss, fragmentation and hunting. The houbara has been extinct in some places. For Example, there are only 49—120 individuals (Collar, 1983) and 700—750 (Goriup, 1997) of Canary subspecies (C. u. fiuerteventurcae). There are 2 000—3 000 individuals of North Africa subspecies (C. u. undulata) (Haddane, 1985). The population of Asia subspecies (C. u. macqueeni) in northwestern Uzbekistan had declined 75% in 1956—1979 (Alekseev, 1985). The Asia subspecies was divided into 6 sub-populations. They are Omman sub-population, Syria sub-population, Iran sub-population, Dulan sub-population, Middle Asia sub-population and Mongolia sub-population respectively. Nearly all of the sub-populations are migratory except Omman sub-population (Launay, 1989).

The houbara bustard was studied including a piece of Eco-biology during past half century. The distribution and populations (Dementiev and Gladkov, 1951; Johnsgard, 1991; Osbarne, 1996; Osborne et al., 1997; Gao et al., 1996, 2007; Goriup, 1997, 1999), migration (Osborne, 1997; Combreau et al., 1999; Yang et al., 2001c), habitat selection (Cramp and Simmons, 1980; Mian, 1988; Osborne, 1996; Launay et al., 1997b; Goriup, 1997; Yang et al., 2000, 2001a, b, 2003a), food habits (Dementiev and Gladkov, 1951; Colla, 1983; Johnsgard, 1991; Tigar and Osborn, 2000; Yang et al., 2001c), behavior (Crampet et al., 1980;....
Surahio, 1985; Ponomareva, 1983; Mirza, 1985; Lavee, 1985; Mian, 1988; Hinz and Heiss, 1989; Lunnay et al., 1990, 1996, 1997a; Anegay, 1994; Yang et al., 2002; Qian et al., 2002), breeding (Cramp et al., 1980; Lavee, 1985, 1988; Gelinaud et al., 1997; Johnsgard, 1991; Combreau et al., 2000; Qiao et al., 2001; Yang et al., 2001c, 2003b;) and the causes leading to its endangered status, protection, and population resurrection have been studied and reported. However, the distribution and migration of houbara bustard population in China remains unknown. The purpose of this study was to get knowledge on the distribution and migration route of Chinese houbara Bastard. Such knowledge can help in developing management strategies for this vulnerable species.

1 Materials and methods

The study was conducted from 1997 to 2004 by cooperation between Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences and National Avian Research Center, United Arab Emirates.

1.1 Migration

From 1997 to 1998, houbara bastards were caught and weighed. When the birds had adequate weight and body condition, they were fitted with a PTT and released within one hr of capture. The birds were located the following day and occasionally afterwards, using a Gonio receiver (IESM Gonio 400P) to check for any post-release problems (Cramp et al., 1999).

The Microwave nano PTT (Microwave Telemetry Inc., Columbia, Maryland) used in this study weighed approximately 28 g without a harness. A transmitter was fitted to the houbara following the method described by Osborne et al. (1997). The package weighed around 34 g, constituting less 1.8%–2.3% of the body mass of adult houbara. The PTT duty circle was 10 h on/ 24 h off.

Data on the location of birds was collected through the Argos system that classified the locations according to accuracy, coded 7 classes from best to worst. In this paper, only 4 relatively better classes were used for mapping and analyzing the migration routes (Combreau et al., 1999).

1.2 Distribution

In the areas where the houbara may occur or houbara found by PTT, field survey was carried out to confirm its distribution range. The line transect combined point transect were used to count houbara. The transect line was selected randomly in the survey area. Equipped with the telescope, binoculars and GPS, car was driven at 30 km/h, starting the circular observation at each 4—5 km. Searching birds with naked eyes as well as binoculars and observe the houbara bird by the 20—60 times monocular telescope. All of the houbara birds found in the line transect and point transect were recorded, noting the number of the houbara, the distance from the bird to the observer, the visual angle and location (latitude and longitude).

2 Results

2.1 Distribution

The distribution range of Chinese houbara population was confirmed as detailed below: In Xinjiang province, houbara bustard occurs in Ganjiahu in the western fringe of Junggar Basin (breeding ground), Karamay district in western Junggar Basin (breeding ground), Fuhai in the northern fringe of Junggar Basin (46°53.905′N, 87°35.950′E; breeding ground), the valley of Ulungu river (46°50.817′N, 89°14.152′E) in the fringe of northern Junggar Basin (breeding ground), Dushanzi in the southwestern fringe of Junggar Basin (breeding ground), Kalamaili protected area in eastern Junggar Basin (breeding ground), Dushanzi in the southwestern fringe of Junggar Basin (breeding ground), Northern Fukang in the fringe of southern Junggar Basin (breeding ground), Kalamaili protected area in eastern Junggar Basin (45°50.817′N, 89°22.041′E; breeding ground), the area of Mt. Baytikshan to Jiangjun Gobi (breeding ground), Mori area in southeastern Junggar Basin (breeding ground), Northern Fukang in the fringe of southern Junggar Basin (breeding ground), the front area of Mt. Haputike in the fringe of northeastern Junggar Basin (44°52.130′N, 91°44.403′E; traveling ground), Northern Tacheng Basin in west Xinjiang (traveling ground), Southern Turpan Basin in eastern Xinjiang (breeding ground), Barkol in eastern Xinjiang (breeding ground).

In Inner Mongolia, houbara occurs in Ejinaqi (41°36′N, 101°21′E) and Alashanyouqi (39°4.559′N, 101°42.515′E) in western Inner Mongolia (breeding ground). In Gansu province, houbara occurs in the southwestern Wuwei, Shandan (38°36′N, 101°39′E) and Minqin (38°55.478′N, 102°32.334′E) in west Gansu province (breeding ground).
Among them, Fuhai, the valley of Ulungur river, Dushanzi, the alluvial plain neighbor to the area of Mt. Haputike, the north part of Fukang, Tacheng Basin, the south part of Turpan Basin and Barkol in Xinjiang; Ejinqi and Alxayouqi in Inner Mongolia; Wuwei, Minqin and Shandan in Gansu province are the places where houbara bastards were firstly recorded.

In general, the distribution ranges of houbara bastard in China are the edge of Junggar Basin, the areas in the northern part of Tacheng Basin and the valley of Ulungu river in north Xinjiang, the south part of Turpan Basin and Barkol area in east Xinjiang; Urathouqi, Alashanyouqi and Ejinaqi in west Inner Mongolia; Wuwei, Minqin and Shandan in west Gansu province (Fig.1). The whole distribution ranges are not consecutive but fragmentized.

All houbara bastards in China occurs in desert and desert-steppe. The habitats of houbara can be divided into four types: (1) desert steppe; (2) gravel desert; (3) salt soil desert; and (4) sandy-desert. Such general habitat affinities are consistent with those described for the species elsewhere in its range (Cramp et al., 1980; Collions, 1984; Mian, 1988). Habitats chosen by houbara bastard were slightly undulating far from water source, where the mean annual precipitation is below 200 mm, soil is clayey, gravel, sandy and salty.

The survey result showed that average density of houbara is $17.6 \pm 8.5$ inds/100 km$^2$ in 1998 in Mori, which is located in the southeast fringe of Junggar Basin. 179 individuals of houbara were found on 46 survey routes. The survey covered an area of 3 168 km$^2$. So we estimated the population size of houbara in Mori reached 588±269 inds. Adding up the population ranging in Junggar Basin, Gansu province and Inner Mongolia, the total number of houbara in China was estimated around 2 000 individuals.

### 2.2 Migration

All of the Asian houbara populations are migrants except Oman sub-population (Launay, 1989). In 1997, 5 houbara bustards started their migration from wintering ground, UAE to breeding ground at the beginning of March. Moving to northeast, they passed the Arabia Bay, via Iran, 4 of them arrived in Turkmenistan, Uzbekistan and Kazakhstan. One houbara crossed the border between Turkmenistan and Uzbekistan. The bird entered into Kazakhstan, then turned toward northeast. It entered into China, via Tacheng Basin in northern Xinjiang, and then turned southeastward. The bird crossed Junggar Basin, and finally arrived in Wuwei, the west Gansu province.

In 1998, 4 houbara bustards started their migration from their wintering grounds in Cholistan desert between India and Pakistan at the beginning of March.
One of the birds crossed to Afghanistan, via north-eastern Iran, and reached the border area between Turkmenistan and Uzbekistan. The bird stayed and spent summer there. It was a relatively short migration. The other three houbara moved to western Afghanistan, then turned northeastward, across Turkmenistan, Uzbekistan and Kazakhstan. They then turned eastward to China. They crossed the open land of Habaehe, Tacheng Basin and mountain pass of Alashankou in north Xinjiang, China. One of three birds stayed at the edge of southern Junggar Basin as breeding ground. The two others crossed Mt. Altay, arrived the breeding grounds in the western part of Mongolia finally. In 1998, 7 houbara bastards started their migration from the breeding grounds in the eastern Junggar Basin at the middle of September. The birds moved westward, via Tacheng Basin and Bole, and entered into Kazakhstan. They then turned southward, via Uzbekistan and Turkmenistan, and reached the wintering grounds of Arabia Bay in northern Iran. Out of the group, three birds stayed there while the other four turned south-eastward, crossed Afghanistan, and arrived in southern Pakistan-wintering ground finally.

In autumn 1999, one dead houbara was found by the local people in southern Tacheng Basin at the end of March. It proved again that Tacheng Basin was on the migration route of houbara in China. In October 17, 1998, the authors found 2 houbaras in the south alluvial plains of Mt. Haputike (44°52.130′N, 91°44.403′E); In September 25 of 2000, the authors found 3 birds in the north alluvial plain area of Mt. Tianshan (43°54.837′N, 90°49.780′E). It is believed that all these birds were migrants because they were found during the migration season. It is believed that the two areas are being used as stopovers on the migration route.

In general, the migration routes and wintering grounds of Chinese houbara population are as follows:

Houbara starts migration from Junggar Basin in northern Xinjiang, Wuwei, Mingqin and Shandan in western Gansu province, and Bayan Nur in western Inner Mongolia in the middle of September. They fly westwards, via Junggar Basin’s Bole and Habaehe in northern Xinjiang, entered into Kazakhstan. The birds then turn southward, crossing Uzbekistan and Turkmenistan, arrive in south bank of Arabia Bay and southern Iran, or fly over Afghanistan reaching southern Pakistan for wintering. Houbara finished its migration between middle of October and the beginning of November. The whole migration took the birds 35 ± 13 days covering a distance of 4 800—7 000 km. The next year, the birds moved back to the breeding grounds in China along the similar routes. They start...
their migration at the beginning of March. However, it took the birds $64 \pm 17$ days to finish spring migration. The houbara arrived in breeding ground between middle April and late May. The sub-adult birds arrived relatively later.

3 Discussion

The studies showed that the satellite tracking combined with distribution range survey is an efficient method for studying the distribution and migration of houbara bustard. By this method, one can study clearly and accurately the distribution range, migration route, winter range, the migration distance and duration of migration. Based on these important data, one can provide a scientific basis for the protection of this endangered bird species.

In China, houbara bustard was recorded occurring in western Tianshan Mt. and northern Xinjiang (travelling bird and breeding bird) (Zhen, 1976). Boye in Hebei province (Cao, 1989) and western Inner Mongolia (breeding bird) (Fen, 1991). Gao et al. (1994, 1996, 2007) reported that houbara bustard ranges in Qinghe, the south alluvial plain area of Baytik Mt., Mori, Kalamaili protected area in Junggar Basin, northern Xinjiang (breeding bird). However, there was no proof of the houbara distributed in western Tianshan Mt. Boye in Hebei province is neither a wintering ground nor breeding ground. In the mean time, it is not a place on the migration route of houbara. We assumed that this bird lost the way. The Ulungur river valley, Tacheng basin, Dushanzi in the southwestern fringe of Junggar Basin, northern Fukang in the southern fringe of Junggar Basin and the south alluvial plain area of Mt. Haputike, the south part of Turpan basin and Bakol were found as the distribution areas of houbara in Xinjiang, which were not recorded before. Ejina Qi and Alashan Youqi in western Inner Mongolia, Wuwei, Minqin county and Shandan county in Gansu Province were found as the distribution areas of houbara, which were not recorded before. Using satellite tracking combined with range investigation, we got the whole distribution range of houbara in China. The ranges are not consecutive but fragmented.

There was no report about the migration routes and wintering grounds about the Chinese houbara sub-population before this study. All such aspects like the migration routes, wintering sites, the distance covered during migration and duration of migration of the Chinese sub-population were covered the first time and rather accurately. Satellite tracking showed that some juvenile houbara bastards did not fly back to their breeding sites in the second year; they did join other sub-populations that were breeding in other areas. It was therefore confirmed that there are some gene flows, going on, between the sub-populations from different breeding grounds.

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