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## Review article

# Bat study in the Kharaa region, Mongolia

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## ABSTRACT

Our study objectives were to determine bat species composition and to study the genetic variations and sound characteristics in bats of the Kharaa, Shatan, and Ulgii areas of Mongolia. This study is the first bat survey in this area. Nineteen species were from Mongolia. Six bat species belonged to three genera. We performed mitochondrial DNA sequencing of *Myotis bombinus*, *Myotis gracilis*, and *Myotis petax* to confirm the morphological identification of these species. We also determined the sound frequencies of the six bat species, based on their echolocation calls. The conservation status was determined using World Conservation Union red list categories and criteria. Sixteen bats from three species were ringed during this study and three artificial boxes were placed on trees in the Kharaa River Valley. Other than the northern bat, all species were eastern Palearctic. The northern bat (*Eptesicus nilssonii*) species is widespread in the northern Palearctic region.

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## Introduction

Most species of mammals distributed in the Kharaa region are usually animals of the Siberian taiga and temperate zone. The Khentii biogeographic zone is included in the Siberian taiga region (Bannikov 1954). The unique mammalian diversity of the region is composed central Asian steppe species and temperate zone taiga mountain species. Our study area was in the Khentii Mountain biogeographic region. There are seven orders of mammals distributed in this area such as hedgehogs, insectivoras, bats, rabbits, rodents, carnivores, and ungulates (Punsalpaamuu et al 2012). Diverse habitat heterogeneity of the region supports diverse biodiversity, which includes rare species. Bats have not been studied in the study area. Therefore, our study objectives were to determine bat species composition in the Kharaa, Shatan, and Ulgii areas of Mongolia and to study their genetic variations (to confirm morphological identification) and their sound characteristics.

## Materials and methods

### Geographical characteristics of the study area

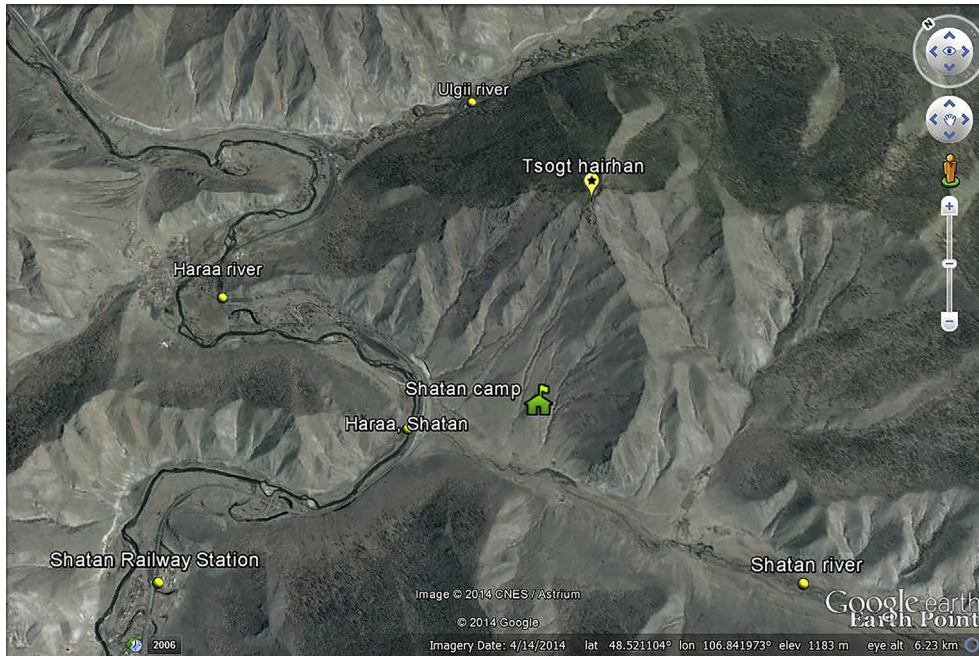
The study area was in Batsumber Soum, the Tov province (N48.52117, E107.83190), and 120 km away from the north of Ulaanbaatar. The Kharaa region is a subwatershed of the Tuul River and the Orkhon-Selenge watershed (Figure 1). The maximum altitude is 1,300–1,700 m and the mean altitude is 500–800 m. The surface soil of the Kharaa region is composed of Imperial granite and mafic rock minerals of the Paleozoic era (Punsalpaamuu et al 2012). The highest mountain, Tsogt Hairhan, is 1,628 m and on the west side of our camp site; the lowest altitude was at the confluence of the Shatan and Kharaa rivers.

### Study period and method

This study was conducted during June 2–15, 2005 and 2010–2015. We used mist nets with two 3-m poles for capturing the bats. Every day during this study, our capture work began 30 minutes before sunset and ended at midnight (approximately 1 AM). We placed mist nets at five different sites in Kharaa, Ulgii, Shatan Railway station, and the confluence of the rivers of Kharaa and Shatan (Figures 1 and 2). During the day, tree and rock holes were searched for bats by boreoscope. We collected 41 individual bats.

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**Figure 1.** Study sites in the Kharaa, Ulgii, and Shatan areas.

We measured the body size, weight, and sex. Ectoparasites were preserved in 70% ethanol. Genetic samples were preserved in 96% ethanol. Before releasing the bats, we recorded their call using the Anabat detector (Titely Scientific Co., Columbia, Missouri, USA), and analyzed the data on Analook (Titely Scientific Co.) and Microsoft Excel (Microsoft, Redmond, WA, USA). We computed the

descriptive statistical parameters: maximum, minimum, average, and standard deviation of the body measurements. All photos presented in this paper were taken during the field research. We used the mitochondrial cytochrome c oxidase subunit I (COI) DNA sequencing of *Myotis bombinus*, *Myotis gracilis* and *Myotis petax* to confirm the morphological identification.



**Figure 2.** Main study sites. A, Kharaa River (N48°31'57.4" E106°49'29.5"; altitude, 1048 m); B, Ulgii River (N48°32'02.8" E106°51'14.0"; altitude, 1052 m); C, The confluence of the Kharaa and Shatan rivers (N48°31'11.3" E106°49'51.4"; altitude, 1096 m); D, Shatan valley (N48°30'02.4" E106°50'53.7"; altitude, 1099 m).

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