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Original Article

Longevity Records for Bats in Mongolia

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Abstract

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Bats live disproportionally longer compared to other small mammals. This has made them good candidate for research questions related to aging and mechanisms that influence longevity. In this report, we compiled survival data from our own research as well as from published records of bat recaptures in Mongolia. Longevity records revealed that five out of the ten species that have been marked over time show evidence of long-term survival. This included max longevity records for: *Myotis petax* with an individual surviving for at least 28 years after initial banding. In addition, other records include *Myotis davidii* (>10 years), and *Cnephaeus nilssonii* (>7 years). All recapture data were from species roosting in caves and generally found during hibernation. These results contribute to our general understanding of longevity in hibernating bats and the potential importance of individual bats survival to the conservation of bats species in Mongolia.

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Introduction

Despite their small size and high metabolism during activity period, bats are repeatedly found to live longer than other similar-sized mammals. This has been linked to the evolution of diverse body sizes, specific types of DNA repair mechanism, and maintenance of the proteome (Austad, 2010), and hibernation (Brunet-Rossinni & Austad, 2004; Healy *et al*., 2014). Bats have received great interest among researchers who study aging and longevity (Podlutsky *et al*., 2005; Dammann, 2017). However, survival and maximum life expectancy are only known for small number of species, often from captivity, and there is a strong geographic basis regarding these studies (Ball *et al*., 2018; Huang *et al*., 2019; Jebb *et al*., 2018; Wilkinson *et al*., 2021). Aging in wildlife typically requires long-term mark-recapture studies (Wilkinson *et al*., 2021). Given that bats are so long-lived, studies focused on longevity can be challenging and need to proceed over decades to capture their full life expectancy.

Banding (ringing) is one of the oldest and most

common techniques for studying birds and bats in the wild. Bat banding originated in the United States (Greenhall & Paradiso, 1968) and is now widely used in many countries across the globe. It was introduced in Mongolia in 1977 by M. & A. Stubbe and N. Davaa during Mongolian-German biological expeditions. Banding studies allow a great deal of information to be collected, in order to better understand movement ecology of bats associated with migration strategy, hibernation ecology and longevity. Over the last 4 decades, various banding surveys have been conducted in Mongolia and over 1,200 individual bats have been banded at 17 locations. However, recapture events have not been systematically conducted, summarized, or analysed with regards to bat survival and longevity. Previously, only longevity records for the Eastern Water Bat (*Myotis petax*) have been reported, with an individual surviving for over 28 years, which was reported by the Mongolian-German Biological Expeditions (Stubbe *et al*., 2012). In this brief note we summarizes all available information of recaptures during bat marking studies in Mongolia. With this report, we aim to begin conducting a more systematic review of survival and longevity records of bats in Mongolia.

Materials and Methods

All available information was collected on bat banding surveys in Mongolia (Stubbe *et al*., 2012; Ariunbold, 2014; Dolch *et al*., 2017; Dalannast *et al*., 2024). Primary resources included journal articles, poster presentations, abstracts, book/book chapters, and our observations of recaptured animals banded in the field. The results of this survey are presented in Table 1. Banding information was compiled for each recaptured taxon present in the sites visited, providing data for a 47-year period of bat banding (August 6, 1977 to December 30, 2024). All bat survival records (Table 2) were obtained during a series of banding studies that was conducted by the authors. Age classification and species identification, follow published protocols and database information (Dietz & von Helversen, 2004; Simmons & Cirranello, 2024).

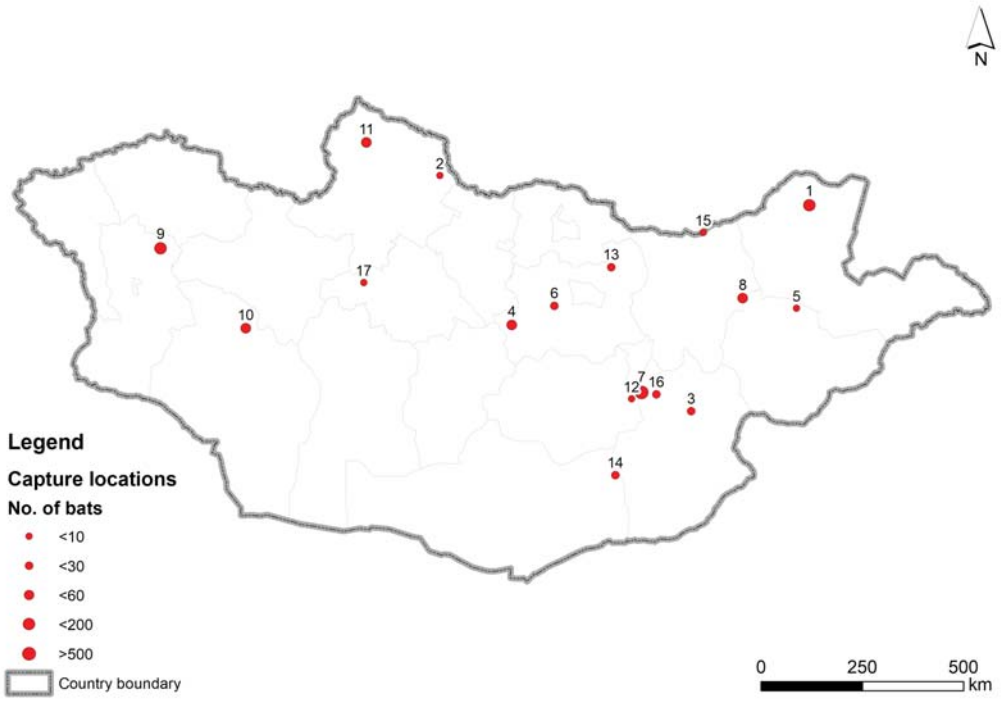

Figure 1. All sites for bat banding in Mongolia (1977-2024).
1 – Chukh Lake (n=186); 2 – Dayandeerkh Cave Nature Monument (n=7); 3 – Sainshand (n=16); 4 – Erdenesant Mountains (n=57); 5 – Ganga Lake National Park (n=2); 6 – Hustai National Park (n=29); 7 – Ikh Nart Nature Reserve (n=575); 8 – Khar-Yamaat Nature Reserve (n=44); 9 – Khavtsal Cave (n=126); 10 – Khasagt Khairkhan Strictly Protected Area (n=59), 11 – Khuit Cave (n=67); 12 – Shar Khanan Cave (n=9); 13 – Shatan River (n=30); 14 – Shuteenii Bayan River (n=30); 15 – Suugt Cave (n=11); 16 – Tsagaandel Cave Nature Monument (n=24), 17 – Zaluus Cave (n=2).

Results

A total of 1,272 bats were captured, banded and released in Mongolia at 17 locations, this included individuals of ten species across 5 genera. The numbers of banded bats ranged from 2-575 individuals at each site. The most banding events occurred within natural protected areas of Mongolia and the highest number of bats were banded in the Ikh Nart Nature Reserve, where 45.2 % of the total bats were marked (Fig. 1). More than 50 bats each were banded at the Chukh Lake, Khuit Cave, Khasagt Khairkhan, and Erdenesant Mountain areas.

The most frequently banded species was *Myotis davidii* (29.0 %), but also included *Vespertilio murinus* (16.6 %), *Vespertilio sinensis* (14.6 %), *Myotis petax* (11.9 %), and *Cnephaeus gobiensis*. The two least abundant species were *Cnephaeus nilssonii* (0.3 %) and *Myotis ikonnikovi* (0.07 %), (Table 1).

During the study period, seven recapture events took place at the following seven locations: Khavtsal Cave, Khuit Cave, Suugt Cave, Shar Khanan Cave, Shatan River (Student's Biological Station of Mongolian National University of Education), Ikh Nart Nature Reserve, and Chukh Lake (Fig. 2).

Recaptures occurred in five species, and years since initial marking ranged from 1 to 28 years

Table 1. Captured, banded and released number of bat species (1977–2024). Recaptured species of bats are indicated with an asterisk (*).

Species and common names	Individuals (n)	Amount (%)
Myotis petax (Eastern Water Bat)*	152	11.9
Myotis sibiricus (Siberian Whiskered Bat)	45	3.5
Myotis davidii (David's Myotis)*	370	29.0
Myotis ikonnikovi (Ikonnikov's Bat)	1	0.07
Plecotus ognevi (Brown Long-Eared Bat)*	120	9.4
Vespertilio sinensis (Asian Particolored Bat)	186	14.6
Vespertilio murinus (Particolored Bat)*	212	16.6
Cnephaeus gobiensis (Gobi Big Brown Bat)	152	11.9
Cnephaeus nilssonii (Northern Bat)*	4	0.3
Hypsugo alaschanicus (Alashanian Pipistrelle)	30	2.3

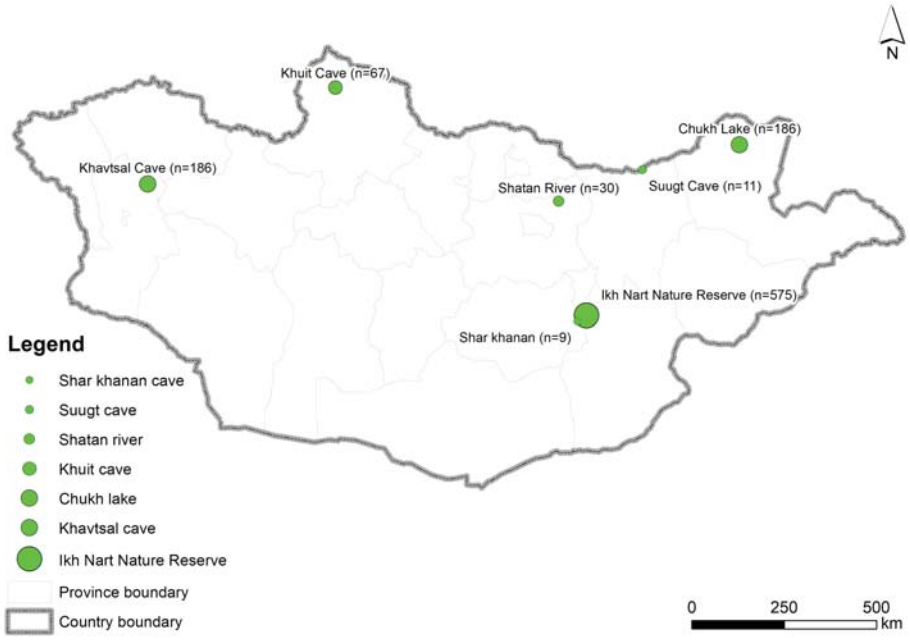

Figure 2. Recapture sites of banded bats in Mongolia (1977-2024).

Table 2. Survival records for bats in Mongolia (1977-2024).

Species	Date		Time between captures	Sex	Band ID	Sources
	Mark	Recapture				
Myotis davidii	2014	2024	10	F	IN023	Dalannast et al., 2024
	2014	2024	10	F	IN037	
	2015	2024	9	M	IN138	
	2015	2024	9	M	IN430	
	2015	2024	9	M	IN432	
	2016	2024	8	M	IN540	
	2017	2024	7	M	IN837	
	2016	2017	1	M	IN490	Dolch et al., 2017
Myotis petax	1977	2005	28	M	615	Stubbe et al., 2012
	1982	1998	16	M	1034	
Plecotus ognevi	2014	2015	1	M	UC0973	Ariunbold 2014
Vespertilio murinus	2015	2017	2	F	IN162	Dolch et al., 2017
Cnephaeus nilssonii	2017	2024	7	M	IN549	Unpublished data

among recaptured animals. The longest survival records observed in this research were for *Myotis petax*, *Myotis davidii,* and *Cnephaeus nilssonii* (Table 2). All recaptures were recorded at the original banding sites after periods of a few days up to 28 years. *Myotis davidii* were recaptured at Shar Khanan Cave near the initial capture and marking site (Ikh Nart Nature Reserve), located ~ 40 km away. Recorded survival (in years) by species of bats is summarized in Table 2. Longevity records for *Myotis davidii* included two female bats recaptured after 10 years and one male *Myotis petax* after 28 years. Only six bat species have been recorded living over 30 years of age (Wilkinson & South, 2002). *Myotis petax* will likely be the seventh species documented to have individual longevity records over 30 years.

Discussion

Over the past 50 years, several bat bandings surveys have been conducted in Mongolia by Russian researchers, Mongolian-German biological expeditions, and Mongolian-American bat researcher teams. In this report, bat banding and recent fieldwork conducted by the authors provide preliminary, data toward the long-term goal of determining average life span and longevity by species, of bats in Mongolia. Recapture of individuals away from their initial capture location were recorded for 4 species, which did not include *Myotis davidii*. All recaptures showed only short distance movements and regional or long-distance migrations were not observed. The results show that recaptures tended to be related to recapture effort.

Past research has suggested that males spend longer in hibernation females (Podlutsky *et al*., 2005), which may be linked with the increased survival. This may explain why the majority of the long-lived individuals was documented in male versus female bats (individual captured >5 years after initial marking, eight males and 2 females). Stubbe *et al* (2012) previously reported a maximum longevity record of 28 years for *Myotis petax* at the Khavtsal Cave in western Mongolia. However, this cave was destroyed due to establishment of the Durgun Hydro Power Station in 2005.

In March, 2017, *Cnephaeus nilssonii* and the eight individuals of *Plecotus ognevi* were banded at Suugt Cave. These species consistently use these sites and are likely roosting in tree hollows, buildings, and foliage when not in hibernation nearby the site (Kunz & Fenton, 2005). In December, 1988 and April 1992, Avirmed (2020) confirmed that bat hibernation occurred in this cave. During the second visit, researchers sampled a few individual bats from the cave, and provided them to the Institute of Biology, Mongolian Academy of Sciences in same year. In 2000, in working at the institute, Ariunbold Jargalsaikhan identified, and confirmed that this was *Plecotus ognevi*. This evidence suggests that *Plecotus ognevi* had been used the cave at least 29 years. *Cnephaeus nilssonii* is noted for its

long hibernation period, and low mortality rate (Kizhina *et al*., 2018).

Bat longevity is influenced by reproductive rate, a propensity to hibernate, body mass and use of cave roosts (Wilkinson & South, 2002) and some of these phenomena were observed for cave roosting species such as *Myotis petax*, *Myotis davidii*, and *Plecotus ognevi* in Mongolia. These species' hibernacula (Ariunbold, 2016a, b; Hoyt *et al*., 2020) and hibernation may contribute to longevity through reduction body temperature (Wilkinson & South, 2002), evaporative water loss (EVL), and predation risk (Furey & Racey, 2016). Previous studies of bat longevity show that the life span of *Myotis* species tends to be longer than other species of bats (Wilkinson & South, 2002; Podlutsky *et al*., 2005; Stubbe *et al*., 2012), and this is consistent with our data in *Myotis petax* and *Myotis davidii*. Additional survival records will likely contribute to additional longevity estimates, as more animals are recaptured (Wilkinson & South, 2002). Should focus on more routine marking and recapture events to help understand the role of long-term survival in the broader population ecology of hibernating bats in Mongolia.

Declaration of competing interest

The authors declare that they have no conflict of interest.

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