

## Grouping Patterns of Argali in Ikh Nart Nature Reserve, Mongolia

Navinder J. Singh<sup>1</sup>, Sukh Amgalanbaatar<sup>2</sup> and Richard P. Reading<sup>3</sup>

<sup>1</sup>Department of Life Sciences, Imperial College London, Silwood Park Campus, Buckhurst Road, Ascot, Berkshire SL57PY U.K., e-mail: n.singh@imperial.ac.uk

<sup>2</sup>Institute of Biology, Mongolian Academy of Sciences, Ulaanbaatar 51, Mongolia.

<sup>3</sup>Department of Conservation Biology, Denver Zoological Foundation, 2300 Steele Street, Denver, CO 80205, USA., e-mail: rreading@denverzoo.org

### Abstract

Gregariousness is a common behavioural trait observed in many large mammalian herbivores. Habitat characteristics, life history, spatio-temporal resource dynamics, population density, predation risk, competition with kin and social learning often determine gregariousness in a species. These factors may influence grouping patterns between species as well as between sexes within a species and several of these factors may be interrelated. In this study we examined the temporal dynamics of grouping behaviour and sexual segregation in argali (*Ovis ammon*) using eight years of observations in Ikh-Nart reserve, Mongolia. We measured monthly and yearly variations in typical group sizes and used a sexual segregation and aggregation statistic to assess sexual segregation. The typical group size observed was  $14.97 \pm 2.74$ . The largest groups within the year occurred during lambing (May-June) and mating periods (November-December). On an average, females formed larger groups than males. The sexes were segregated all year round except for the mating period and this pattern was consistent for all years. Argali grouping behaviour in Ikh Nart resembles the patterns observed in other sexually dimorphic mountain ungulates and argali subspecies across Asia.

**Key words:** aggregation, segregation, typical group size, argali, open habitats, Mongolia

### Introduction

Argali (*Ovis ammon*) is a sexually dimorphic, polygynous and gregarious mountain ungulate inhabiting highly seasonal, semi-arid rangelands of Central Asia. Argali generally inhabit open, rolling mountainous terrain, plateaus, and areas with rocky outcrops (Fedosenko & Blank, 2005; Reading *et al.*, 2006, 2009). Rut occurs in late autumn and lambing occurs in spring (Schaller, 1998, Fedosenko & Blank, 2005). As is typical for Caprinae (Schaller, 1977), ewes separate from other animals as parturition approaches and deliver lambs in isolation. Females hide lambs for the first few days of life. Sex-ratio is skewed towards females (Schaller, 1977; Reading *et al.*, 1997; Fedosenko & Blank, 2005). Wolves (*Canis lupus*) and snow leopards (*Uncia uncia*) are the main predators of argali, but lynx (*Lynx lynx*) and domestic dogs (*Canis familiaris*) also kill some animals occasionally (Reading *et al.*, 2005, 2007).

We monitored the grouping behaviour and

sexual segregation patterns in argali in Ikh Nart Nature Reserve, Mongolia at monthly and yearly temporal scales. To identify the factors determining grouping behaviour in argali, we tested the following predictions. Since the predation risk to lambs during and immediately after lambing may be greater than that to only males or females in open habitats (Bleich *et al.*, 1997; Festa-Bianchet & Côté, 2008), females with lambs will form larger groups compared to males in argali. As predation risk varies over time, reaching a maximum during and immediately following the lambing period the largest groups will occur during and immediately after lambing. Based on the life history and polygynous mating system, argali will form larger groups during the mating season compared to the rest of the year. Considering the high sexual size dimorphism we predict that sexes will display strong year-round segregation, except during the mating period, as commonly occurs in other sexually dimorphic ungulates (Ruckstuhl & Neuhaus, 2005).