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GPS collar to test reliability of block count census on male Alpine ibex in Gran Paradiso National Park

Alice Brambilla[1,2], Michele Battoraro [1]

[1] DSTA - Department of Earth and Environmental Science, University of Pavia, Via A. Ferrata 9, 27100 Pavia (PV), Italy.

[2] Alpine Wildlife Research Centre, Gran Paradiso National Park, Degioz 11, 11010 Valsavarenche (AO), Italy.

Corresponding author: Alice Brambilla

E-mail address: alicebrambilla1@gmail.com

Introduction

The first step to conserve species and populations is to have an accurate knowledge of populations dimensions and dynamics. Censuses thus represent a fundamental tool for any authorities with conservations or management aims. Another fundamental step is then to test the goodness of census data.

There are different census methods used in different situations:

- Total Count

- Relative Counts

- Samples area Counts

In Alpine areas, above tree line where the visibility is high, usually ungulate censuses are conducted with the Block-Count method (Largo et al. 2008). Block-Count is a total count method. The fundamental assumptions for the suitability of the method are: animals don't have to move during census, detectability of individuals should be 100% (Lettink and Armstrong, 2003). Since these two assumptions are difficult to meet, this method may underestimate of 20% the real number of individuals. Anyway, the animals counted with this method, represent the MNA (minimum number of

alive animals in the area).

If in the area of the count there are marked individuals, it is possible to use the CMR - Capture-Mark-Recapture (or Capture-Mark-Resight) method. CMR has also the advantage to lead possible a comparison with the results of the Block Count method and to validate it.

Gran Paradiso Nationa Park conducted yearly Alpine ibex (*Capra ibex*) census since 1957. The long term census series represent thus a unique data set. Alpine ibex in Gran Paradiso National Park are counted with the Block Count method. In Gran Paradiso National Park (Levionaz basin), moreover, a long term study area is present since 1999. In Levionaz area, more than 80% of male individuals are marked with plastic ear tag. In 2013, 10 individuals has also been marked with GPS collars (Vectronic aerospace). In this study we performed census with CMR method to compare results obtained with Block Count method and to validate the official census method used in the park.

Aims

The first aim of this study is to test the basic assumptions of the block count census method that is used since more than 50 years to count the ibex population in Gran Paradiso National Park. The second aim is to obtain an estimate of the abundance of the male ibex population of Levionaz using the CMR method and to compare this estimate with the number of individuals counted during the traditional census. We performed this analysis on the male population of Alpine ibex in Levionaz basin.

Methods

Study area and population:

The study was conducted in summer 2013 in the Levionaz basin, Valsavaranche valley, Gran Paradiso National Park (GPNP; North-western Italian Alps; 45° 25' N, 07° 34' W). The study area is above the tree line, between 2300 and 3500 m a.s.l. and is characterised by high-altitude alpine meadows (mainly *Festuca varia*), moraines, rock cliffs and glaciers. Alpine chamois *Rupicapra rupicapra* are the only other mountain ungulate found in the area. In the study site most ibex are captured and individually marked with coloured plastic ear tags in the framework of a long term study on the life-history of the species (Bassano et al. 2003; Decristophoris et al. 2004; Grignolio et al. 2004; Bergeron et al. 2010). In 2013 in the Levionaz area there were 52 marked males ibex from 4 to 16 years of age. Moreover, 10 of these marked individuals with age ranging from 8 to 13 years were recaptured in spring 2013 and provided with GPS collar (GPS PLUS Collar, Vectronic Aerospace GmbH, Berlin). Permission for

captures has been accorded by the Executive Committee of Gran Paradiso National Park and approved by Italian Ministry of Environment.

Data collection:

Data were collected from May to July 2013. During this period, the position of the 10 GPS collar marked individuals was collected every 7 hours. Census data using the block-count method were provided by the Gran Paradiso National Park surveillance service that, the 1ˢᵗ of July 2013, performed the annual exhaustive count of the Park population. CMR data were collected walking through the study area and counting and identifying all the marked and unmarked individuals. Data for CMR method were collected in the early morning at same hours when the collars registered the position of the individuals. CMR data were collected repeatedly in 6 different days.

Data analysis:

To verify the assumption of CMR method (closed population) we calculated the percentage of GPS position that were registered inside the study area.

To verify the basic assumption of the block count method (all the individuals present on the study area are counted), we calculated an estimate of the detectability of the individuals. For each CMR session, the detectability has been calculated as the ration between the GPS collar marked individuals observed during the session and the total number of GPS collar marked individuals that were present in the study area (data obtained from the GPS positions). We then calculated an average of the detectability between the 6 CMR sessions. To obtain an estimate of the reliability of the census done with the block count method, we estimated the number of individuals of the population using CMR method. We first used the Lincoln-Petersen method and then two estimator more suitable for multiple sessions: Bowden implemented in the software NOREMARK (White 1996) and Logit-Normal implemented in the software MARK (White and Burnham 1999).

Results

During the block count census of the 1ˢᵗ July 2013 the surveillance service of Gran Paradiso National Park counted 68 male individuals. During the same census all the 10 GPS collar marked individuals were present in the study area and were counted. The assumption of the closed population was verified with 99,95% of the GPS positions that were recorded inside the study area (Figure 1).
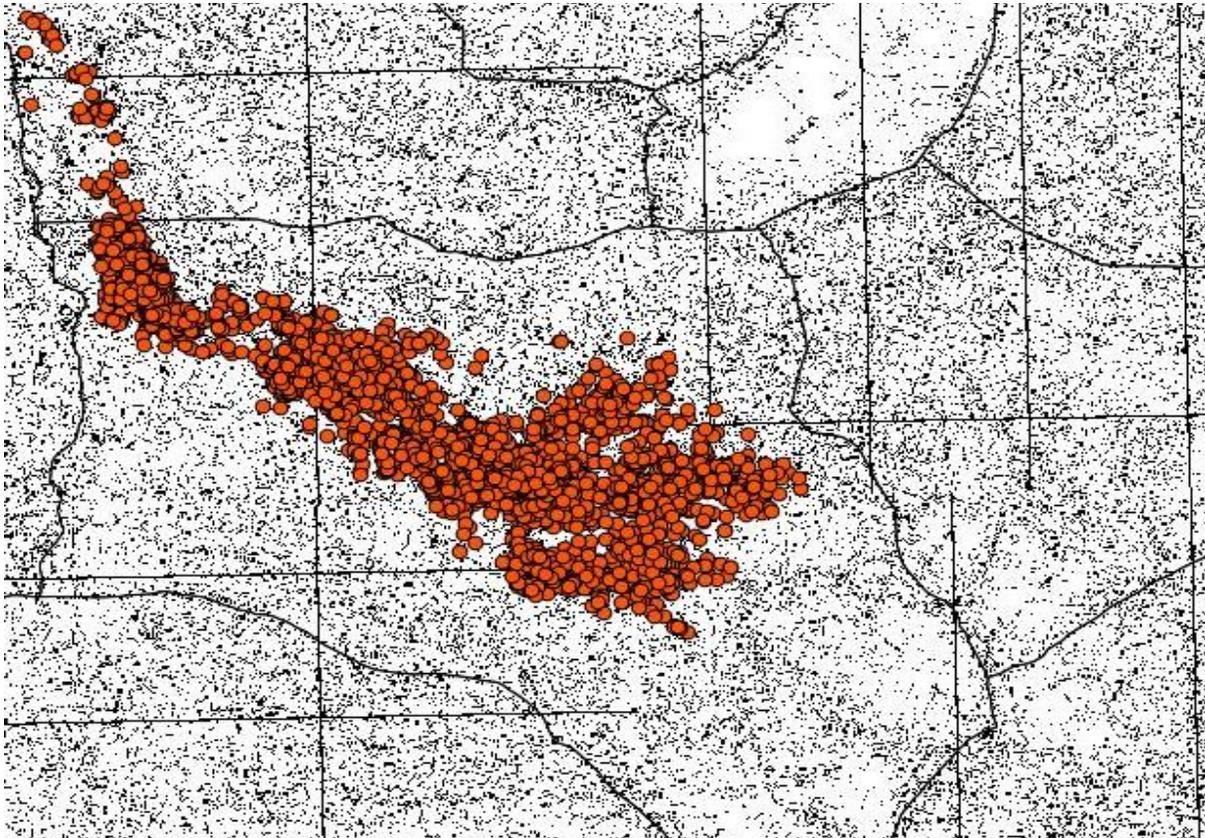
Figure1: Localization of the positions of GPS collar marked males in the study area of Levionaz during summer 2013.

In Table 1 are reported the number of GPS collar marked individuals present in the study area and counted during the 6 sessions of CMR and the detectability of each session. The average detectability was (mean ± st. dev. d= 0.85 ± 0.14).

Date	H start survey	H end survey	N tot ind counted	N marked counted	N marked present	d
21/06/2013	07:06	07:36	49	6	8	0,75
29/06/2013	06:53	07:03	52	9	10	0,9
29/06/2013	17:27	18:35	52	6	10	0,6
30/06/2013	08:19	10:06	57	10	10	1
12/07/2013	06:30	09:00	47	9	10	0,9
19/07/2013	06:30	09:00	54	8	9	0,89

Table 1: detectability of marked individuals during 6 sessions of CMR.

The estimate of the population dimensions obtained with Lincoln-Petersen method was: N=63.

The estimate of the population dimensions obtained with Logit-Normal estimator was: N=63.9, 95% C.I.= 57.0-78.1.

The estimate of the population dimensions obtained with Bowden estimator was: N=64, 95% C.I.= 56-74 with a variation coefficient of 6%. In figure 2 are represented the counted or estimated number of individuals obtained with different methods.

Discussion

The results of this study indicate that the number of male ibex of population of Levionaz area is between 58 and 68 individuals. The estimates obtained with three different methods (Lincoln-Petersen, Bowden and Logit-Normal estimator) are very similar with little variations. These results are in line with our expectations since the assumptions of the methods used are met. The Levionaz populationscan be described as a closed populations with almost all the positions of the marked individuals registered inside the study area. The number of individuals counted during the block count was instead slightly bigger than the number of estimated individuals. This can be explained with the fact that during the block count the Park rangers also counted individuals in areas that are very peripheral to the study site and that are poorly in contact with the main population.

The detectability of the marked individuals was lower when calculated for the CMR sessions. Was instead of 1 when calculated during the block count census done by the Park rangers. This results gave even more power to the statement that the block count census perfromed by the Surveillance Service of Gran Paradiso NationalPark are reliable.

The results of this study demonstrate the reliability of the census data provided since 1956 by the Surveillance Service of Gran Paradiso National Park and demonstrate the importance of marking individuals in the study areas to be able to test the reliability of the counts and also to follow the animals during the whole life in order to better understand the ecology of the species.

References

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