The influence of human disturbance on occupancy and activity patterns of the brown bear *Ursus arctos* in Trentino (Italian Alps) using systematic camera trapping

Valentina Oberosler[1,2], Claudio Groff[3], Paolo Pedrini[1], Francesco Rovero[1]

[1] MUSE - Museo delle Scienze, Corso del Lavoro e della Scienza 3, 38122 Trento, Italy, [2] Dipartimento di Scienze della Terra e dell'Ambiente, Università degli Studi di Pavia, via Ferrata 1, 27100 Pavia, Italy,
[3] Servizio Foreste e Fauna, Provincia Autonoma di Trento, Via Trener 3, 38121 Trento, Italy

Introduction

- **In human-dominated landscapes, habitat fragmentation, settlements, infrastructures and recreational activities represent increasing source of disturbance to wildlife.**
- Large carnivores are particularly sensitive to such changes, hence understanding how their spatio-temporal patterns of habitat use are affected by human disturbance is an increasingly important research question.
- Here, we studied the influence of human disturbance on a population of brown bears in central Alps.
- **The study is part of a long-term camera trapping monitoring programme of mammals**, which to our knowledge is the first of this sort in the Alps.

Objectives

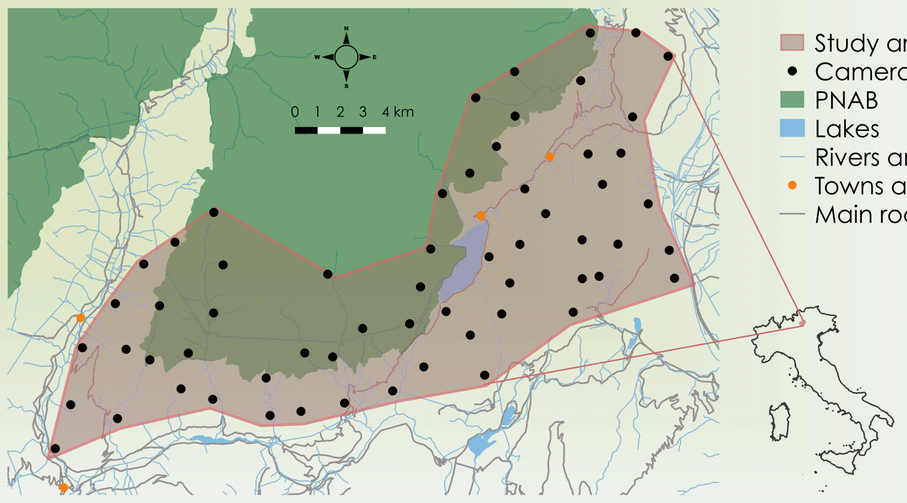
Our specific objectives were:

① to assess bear's probability of occurrence

② to determine anthropogenic and habitat drivers of variations in estimated occupancy and detection probability

③ to assess daily activity pattern of bears in the study area and investigate its overlap with humans'.

Study area



The study area, **western Trentino**, is of particular faunal importance for the historical presence of the last alpine population of brown bear that was recently reintroduced, as well as for the current recolonization of the wolf (*Canis lupus*).

Methods: data collection

WHAT Camera trapping

WHERE 60 sampling sites (220 km^2)

WHEN June-August 2015

HOW Standardized protocol for monitoring terrestrial vertebrates

WHY Cost-efficient, non-invasive, large amount of data

Sampling effort: 1,978 camera days (mean of 34.1 per camera).

Methods: data analysis

- We used detection/non-detection data to model brow bear's **occupancy (ψ) and detection probability (p)** in relation to a suite of environmental and disturbance covariates.
- We also compared daily **activity patterns** of bears and people for low and high levels of anthropogenic disturbance, by estimating the coefficient of overlap (Δ).

Figure 1. Images of brown bears taken by camera traps at different sites over the study area in 2015, western Trentino, central Alps.

Results

- Camera traps yielded 39 independent detections of bear at 20 sites (Fig. 1).
- Estimated occupancy did not significantly vary across sites in relation to anthropogenic/habitat factors (Fig. 2).
- **Bear's detectability was negatively correlated with capture rate of humans at sampling sites, and positively correlated with distance from settlements** (Fig. 3).
- The analysis of activity patterns of bears and people revealed **clear temporal segregation** (Fig. 4).
- The overlapping activity in crepuscular hours decreased significantly at sites with higher disturbance (Fig. 4).

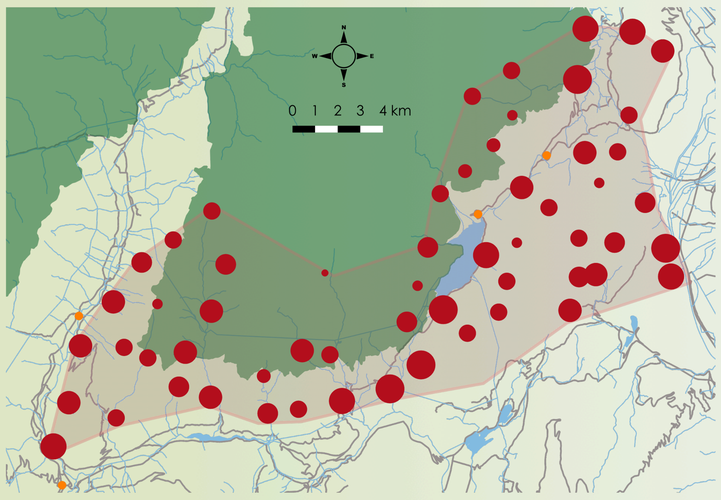


Figure 2. Map of the distribution of the brown bear in the study area, with locations of camera traps shown as dots of size proportional to its estimated occupancy.

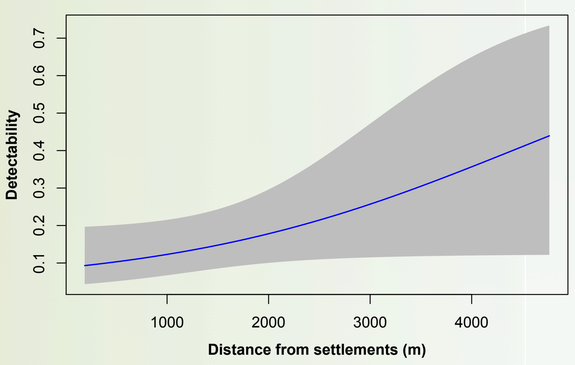
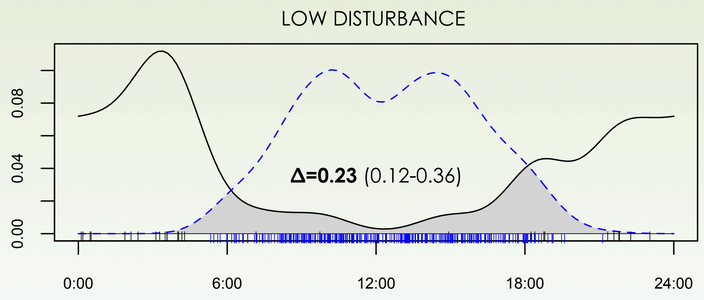


Figure 3. The influence of significant covariates on brown bear's detectability in the study area, western Trentino. Detectability was negatively related to the capture rate of people (left) and positively correlated with distance from settlements (right).



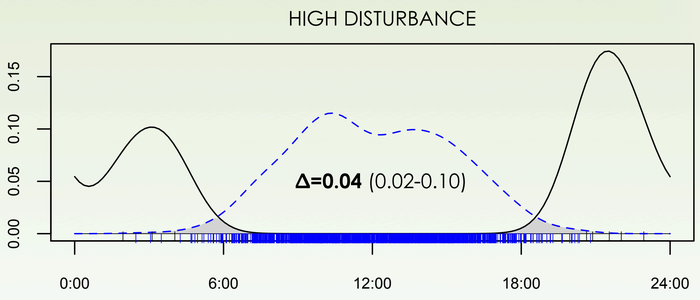
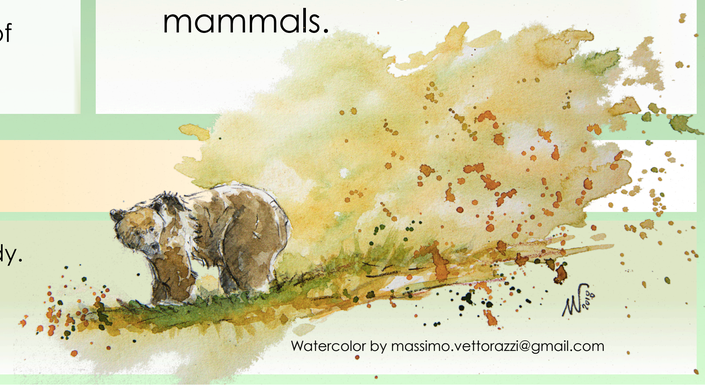


Figure 4. Diel activity patterns (kernel density curves) for the brown bear in the study area. The overlap with human activity is shown for low and high disturbance levels. The activity pattern of people is shown as dotted lines. The coefficients of overlap (Δ) are also reported.

Conclusions and Implications

- **Bears adjust their activity patterns in both time and space to decrease chances of encountering humans.**
- Such response to human presence is relevant toward the coexistence of brown bears and people in the study area and the Alps in general.
- These results come from the **first year of a systematic monitoring programme**, with sampling that is repeated annually.
- This will allow for assessments of population trends of bears, and of the whole community of medium-to-large mammals.



Acknowledgments

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