



# MANAGEMENT OF PROBLEM BEARS IN THE ABRUZZO LAZIO AND MOLISE NATIONAL PARK (CENTRAL APENNINES, ITALY)

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## INTRODUCTION

Conserving small populations of large carnivores in a human-dominated landscape is extremely challenging, as conflicts arise frequently where human and wildlife coexist. The critically endangered Apennine brown bear population has been estimated in 2014 at 51 bears (95% CI: 47-66)<sup>1</sup>. It is mostly distributed within the Abruzzo Lazio and Molise National Park (PNALM) and its outer buffer area<sup>2</sup>. A very limited number of habituated and/or problem bears have been observed in this population. However, this phenomenon must be not understated due to its potential consequences. In such a relict and genetically depleted bear population, the reproductive contribution of each individual, especially adult females, is of paramount importance. By reviewing data compiled since 1994, we hereby report on the occurrence of habituated and problem bears in the PNALM and discuss some factors that currently limit the reach and effectiveness of management actions.

## STUDY AREA

**Location:** Apennines mountain chain (southern-central Italy)

**Elevation range:** 400 - 2285 m a.s.l.

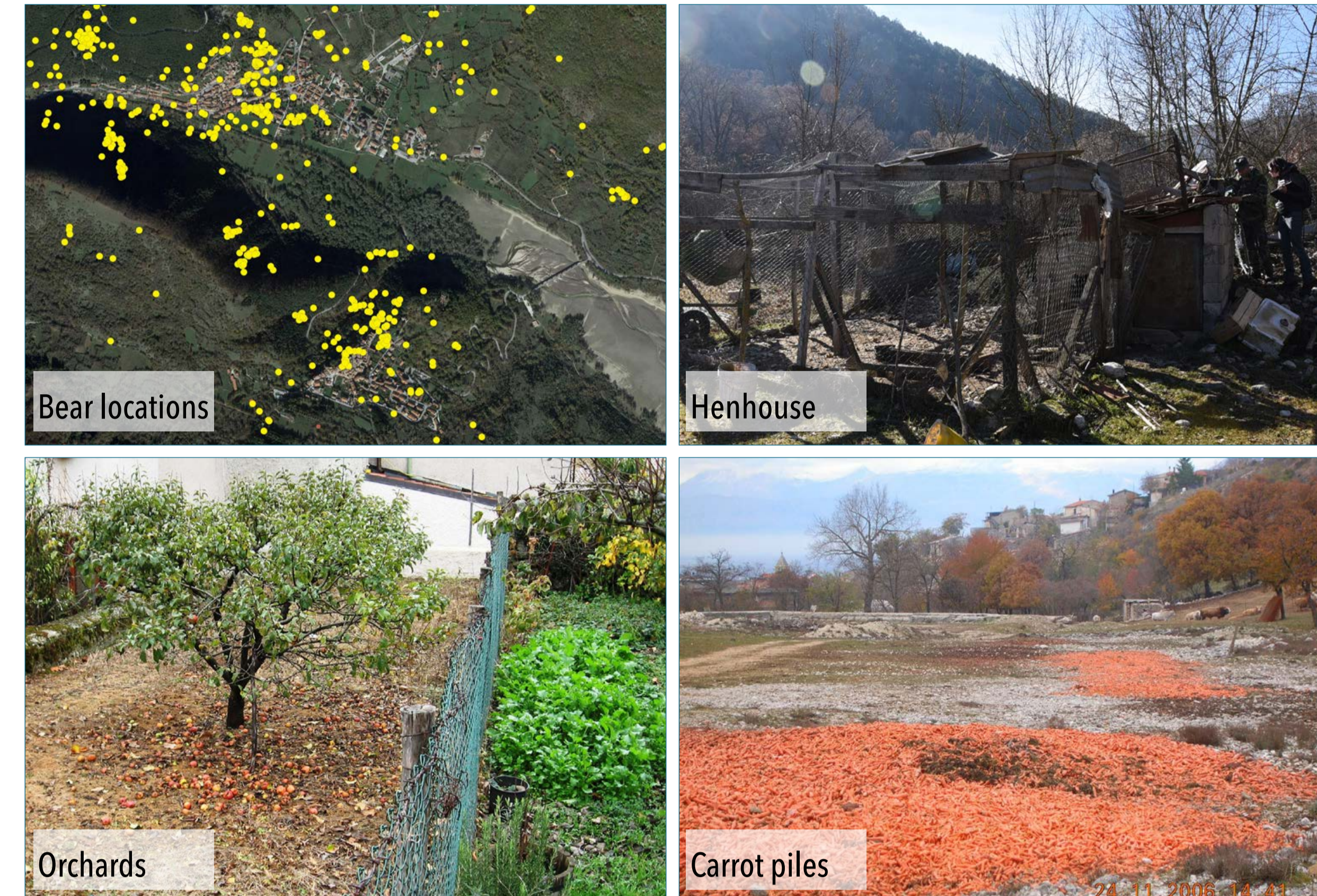
**Extension:** 1300 Km<sup>2</sup>, 507 km<sup>2</sup> of full protected area and 787 km<sup>2</sup> of outer buffer area in which regulated hunting is allowed.

**Ecological context:** a mosaic of largely continuous mountain forest and small human settlements mainly located in the valley bottoms. Natural food is largely available in the park ecosystem<sup>3</sup>. Ca. 60% of the study area is covered with deciduous forests, and 22% with subalpine meadows and grasslands. Anthropogenic food resources are widespread and easily accessible (*private vegetable gardens, orchards, small henhouses and beehives inside and in the neighborhood of villages*). Marginal areas (*outer buffer and external areas*) potentially represent an ecological trap. Improper use of carrot piles to feed livestock, unlawful disposal of rotten vegetable and fruit often occur.

## BEAR MANAGEMENT IN THE PNALM

History of bear management in the Abruzzo, Molise and Lazio National Park. The peak of habituated/problem bears generally occurred from August to October (i.e., before and during fall hyperphagia). Since 2012 a written and shared protocol that codify guidelines for the prevention and management of confident/problem bear phenomenon has been developed and adopted in the context of the Project LIFE09 NAT/IT/160<sup>4</sup>.

<sup>a</sup> Bears were classified as subadults (2-4 yr) or adults (≥4 yr) at capture  
<sup>b</sup> Nuisance behavior was not continuous during the years



Bear ID	Age at capture <sup>a</sup>	Definition	Period of occurrence	Reactive actions in human settlements	Proactive/preventive actions in human settlements	Fate
FP07	Subadult	Habituated problem bear	1994-1999 <sup>b</sup>	<ul style="list-style-type: none"> <li>Radio-collaring; translocation (1994)</li> <li>Aversive conditioning (1998-1999)</li> <li>Captivated (1999)</li> </ul>	<ul style="list-style-type: none"> <li>Waste management in campsites (1998-1999)</li> </ul>	Still alive in captivity
FP06	Adult	Habituated problem bear	2000-2001	<ul style="list-style-type: none"> <li>Radio-collaring; translocation (1999)</li> <li>Aversive conditioning (2000-2002)</li> </ul>	<ul style="list-style-type: none"> <li>Protection of beehives and hen-houses in 2 of 3 villages visited by FP06 (2000)</li> </ul>	Disappeared (cut collar found by rangers in 2002)
FP01	Adult	Habituated problem bear	2001-2018 <sup>b</sup>	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring; aversive conditioning (2004-2005)</li> <li>Recapture attempts following the loss of radiocollar (2006-2012)</li> <li>Radio-collaring; follow-up monitoring; aversive conditioning (2012-2017)</li> </ul>	<ul style="list-style-type: none"> <li>Protection of beehives, orchards and hen-houses in all 9 villages visited by the bear (2005-2014)</li> <li>Circumscribed protection of orchards and beehives (2015-2018)</li> <li>Participative process and communication campaign (2012-2014)</li> <li>Communication activities (2006-2018)</li> </ul>	Roaming (equipped with radiocollar)
F 1.99	Subadult	Habituated problem bear	2012	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring; aversive conditioning (2012)</li> </ul>	<ul style="list-style-type: none"> <li>Protection of beehives, orchards and hen-houses in all 9 villages visited by the bear (2012)</li> </ul>	Dispersal to an adjacent protected area (2012)
F17	Subadult	Habituated problem bear	2016-2018	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring (2016-2017)</li> <li>Aversive conditioning (2016)</li> </ul>	<ul style="list-style-type: none"> <li>Circumscribed protection of orchards and beehives (2016-2018)</li> <li>Communication activities (2016-2018)</li> </ul>	Roaming (lost radiocollar)
F18	Subadult	Habituated problem bear	2016-2018	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring (2016)</li> <li>Aversive conditioning (2016-2017)</li> </ul>	<ul style="list-style-type: none"> <li>Circumscribed protection of orchards and beehives in 5 villages visited by the bear (2016-2018)</li> <li>Removal of fruits from trees and ground in 1 of 4 villages visited by F18 and limited in the others (2016-2018)</li> <li>Communication activities (2016-2018)</li> </ul>	Roaming (expired radiocollar)
F19	Subadult	Habituated problem bear	2017-2018 <sup>b</sup>	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring (2017)</li> <li>Aversive conditioning (2017)</li> </ul>	<ul style="list-style-type: none"> <li>Protection of orchards in the only 1 village visited by F19 (2018)</li> <li>Removal of fruits from trees and ground in the only 1 village visited by F19 (2018)</li> <li>Communication activities (2018)</li> </ul>	Roaming (lost radiocollar)
M19	Subadult	Food conditioned problem bear	2016-2018	<ul style="list-style-type: none"> <li>Radio-collaring; follow-up monitoring (2017)</li> <li>Aversive conditioning (2017)</li> <li>Recapture attempts after radiocollar loss (2017-2018)</li> </ul>	<ul style="list-style-type: none"> <li>Protection of hen-houses and beehives in 2 of 4 villages visited by M19 inside the PNALM (2017-2018)</li> <li>Communication activities (2016-2018)</li> </ul>	Roaming (lost radiocollar)

Spatial and temporal use of villages by 3 female and 1 male Apennine brown bears (*Ursus arctos marsicanus*) equipped with Global Positioning System (GPS) transmitters in the Abruzzo Lazio e Molise National Park, Italy, 2017. To describe the daily activity patterns, we categorized each location sampled into 1 of 4 daily periods: day, evening twilight, night, and morning twilight. Sunrise and sunset times were obtained from the tables of the Italian Ephemeris and Nautical Almanac.

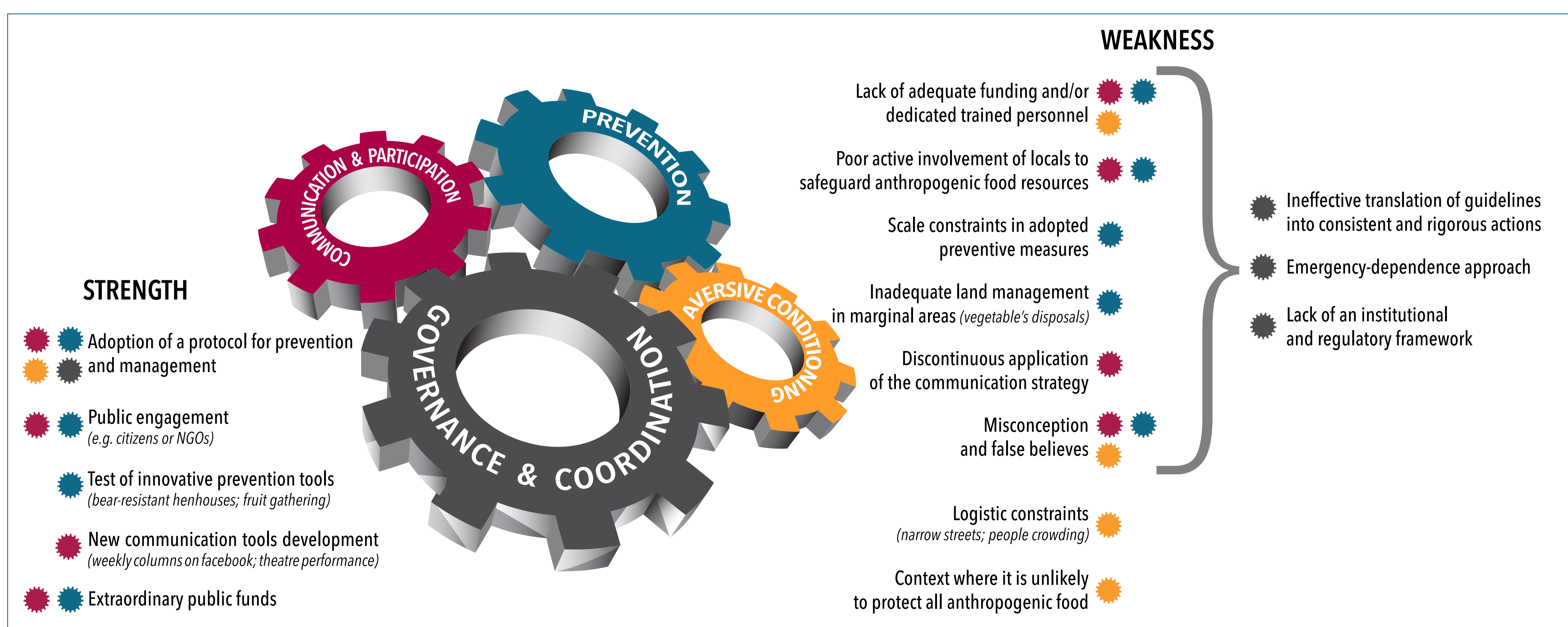
Bear behavior in villages	F18	FP01	F17	F19	M19
Monitoring period	19 Mar - 18 Nov	03 Apr - 26 Oct	24 Mar - 14 Nov	16 Sept - 12 Nov	29 Jun - 10 Oct
Days inside (%)	20%	22%	60%	38%	37%
Daily period (% Locations)	Night (82%)	Night (77%)	Night (77%)	Night (83%)	Night (89%)
Average daily Euclidean distance (± SD; km)	2.1 ± 1.5	1.3 ± 1.0	0.8 ± 0.9	1.4 ± 1.4	1.6 ± 1.3
Length of visit in hours (Mean; Min-Max)	2.2 (0.4-13.0)	3.6 (0.48-21.5)	2.45 (0.14-15.0)	4.4 (0.5-13.5)	1.9 (0.24-10.0)
N° of visited villages	4	8	8	1	10 (4 inside PNALM)

## DISCUSSION AND CONCLUSION

In an endangered bear population such as the Apennine brown bear one it is mandatory to avoid captivity. Although the management program has been improved in the last 10 years, some factors still limit the reach and effectiveness of management actions: 1) *public misinformation that does not facilitate public awareness and support to management initiatives* and 2) *lack of administrative integration among different institutions*.

Within the Park, bears and people always coexisted, so generally Apennine brown bears are tolerated by local inhabitants.

However, the presence of habituated bears inside villages generate contrasting reactions among the locals. Some people enhance bear presence inside villages to attract tourists (e.g. by deliberately feeding bears, leaving potential attractants in place, spreading the news about the presence of bears in the village - e.g. using social networks - and sabotaging aversive conditioning) and this reinforces habituation. Other people consider bears as a nuisance (economic loss or potential danger posed by bears to humans). In addition, strong opponents of the Park take advantage of the situation and habituated bears are used as scapegoat. Anyway, both positive and negative attitudes do not translate into the adoption of adequate practices. Aversive conditioning works only over short time frames since securing human-associated food resources inside the villages is often unviable.



In this context, the best management scenario rests on the following proactive measures:

- Establish a constant dialogue with the local population and visitors to improve the area's social carrying capacity
- Raise awareness on the appropriate behavior people should adopt for the prevention of human-bear conflicts with a clear message about the importance of preventing bear access to anthropogenic food sources.

In any case, a governance that is effective, scientifically supported and that includes self-assessment is mandatory. Hard data, rather than politics or social emergency, should guide the process through a proactive strategy.



Bibliography  
<sup>1</sup> Gervasi, V., Bollani, L., Pwetkau, D., Pasillo, M., Randi, E., & Ciucci, P. (2017). Estimating survival in the Apennine brown bear accounting for uncertainty in age classification. *Population Ecology*, 59(2), 119-130.  
<sup>2</sup> Ciucci, P., et al. (2017). Distribution of the brown bear (*Ursus arctos marsicanus*) in the Central Apennines, Italy, 2005-2014. *Hystrix, the Italian Journal of Mammalogy*, 28(1), 86-91.  
<sup>3</sup> Ciucci, P., Tosoni, E., Di Domenico, G., Quattrocchi, F., & Bollani, L. (2014). Seasonal and annual variation in the food habits of Apennine brown bears, central Italy. *Journal of Mammalogy*, 95(3), 572-586.  
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