



1922 - 2022
**100 ANNI
INSIEME PER LA NATURA**
PARCO NAZIONALE D'ABRUZZO LAZIO E MOLISE
PARCO NAZIONALE GRAN PARADISO



INTERNATIONAL WORKSHOP
CONFIDENT TO WHOM?
LET'S TALK IT OVER

Scanno (AQ) - 17th end 18th June 2022

CONFERENCE PROCEEDINGS



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FRIDAY 17TH

- 9.30** Registration of participants.
- 10.00** Opening and institutional greetings
Giovanni Mastrogiovanni, Mayor of Scanno
Giovanni Cannata, President of the Abruzzo, Lazio and Molise National Park
Eugenio Duprè, Ministry of Ecological Transition (MITE)
- 10.00-10.30** Piero Genovesi and Paola Aragno, Italian Institute for Environmental Protection and Research (ISPRA): **"The management of habituated bears in Italy: examples, management guidelines, legal basis, and public opinion perceptions"**
- 10.30-11.00** Giulia Bombieri, MUSE Science Museum of Trento, Conservation of Biology Field, **"Bold bear: a scientific approach"**
- 11.00-11.30** Roberta Latini, zoologist of the Abruzzo Lazio and Molise National Park **"Cases and contexts of confident bears in the Apennines. Conservation issues"**
- 11.30-12.00** Claudio Groff, Large Carnivore Team Coordinator, Autonomous Province of Trento, **"Cases and contexts of confident bears in Trento. Conservation issues"**
- 12.00-12.30** Stefano Grignolio, Department of Life Science and Biotechnology of the University of Ferrara, **"On the use of activity rhythms to study confident bears and their reactions to management practices"**
- 12.30 - 13.00** Time for question
LUNCH TIME
- 14.30-14.45** Luciano Sammarone
Director of the Abruzzo Lazio and Molise National Park, introduction
- 14.30-16.00** Jay Honeyman, Large Carnivore Conflict Biologist, Alberta Fish and Wildlife, **"Managing human bear conflict in western Canada"**
- 16.00-17.00** Open discussion.

SATURDAY 18TH

- 9.30 - 10.00** Daniela D'Amico, Communications manager of the Abruzzo Lazio and Molise National Park, **"The confident bears in our Park: a communication problem?"**
- 10.00 - 10.40** Andres Ordiz, Department of Biodiversity and Environmental Management at the University of León, **"Nature based tourism: implications for large carnivore conservation"**
- 10.45 - 12.15** Lana Ciarniello, PhD and RPBio, Independent Research Scientist, IUCN SSC BSG member NA Bear Expert Team, **"Building Bear Smart Communities: Supporting the Recovery of an Expanding Marsican Brown Bear Population"**
- 12.30-13.30** Questions and open discussion.
LUNCH TIME

Public session - INTERNATIONAL WORKSHOP Confident to whom? Let's talk it over

- 15.00-15.15** Luciano Sammarone
Director of the Abruzzo Lazio and Molise National Park, introduction
- 15.15-17.00** Lana Ciarniello and Jay Honeyman,
"Bears and Humans: coexistence is possible!"



Hotel Miramonti Via Domenico Di Rienzo, 32
Scanno (L'Aquila) - **17TH e 18TH JUNE 2022**



Ph. Francesco Lemma / Archivio PNALM







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The management of habituated bears in Italy: examples, management guidelines, legal basis, and public opinion perceptions

Piero Genovesi and Paola Aragno

Italian Institute for Environmental Protection and Research (ISPRA)

piero.genovesi@isprambiente.it - paola.aragno@isprambiente.it

In areas with brown bears population, it can become necessary to remove problem individuals, but this management option requires a complex decision, due to legal and scientific reasons, and, also, to the sensitivity of the public opinion. In the present paper we analyze the authorization process for managing problem bears in the Italian context and discuss possible ways to improve the current framework.



In Italy, the management of wildlife is a responsibility of the Regions and Autonomous Provinces (as stated by the national law 157/92 and the Presidential Decree 357/97 transposing the “Habitats Directive” 92/43 / EEC), or of the National Parks (Law 394/91). Pursuant to the legislation, for a series of activities involving wildlife, the technical opinion of the Institute for Environmental Protection and Research (ISPRA) is required, although this is not binding.

The brown bear is included in Annex D of Presidential Decree 357/97, listing species of community interest (Annex IV of the Habitats Directive 92/43 / EEC). Pursuant to Article 8 of Presidential Decree 357/97 (Article 12 of the Habitats Directive) it is therefore forbidden to capture, kill or disturb this species. The Ministry of Environment and Energy Security (MASE), based on a technical opinion of ISPRA, may however grant a derogation, pursuant to article 11 of Presidential Decree 357/97 (article 16 of the Habitats Directive), for example to prevent serious damage to production activities, in the interest of public health and safety or for research purposes.

The Autonomous Provinces of Bolzano and Trento, pursuant to provincial laws, respectively, n. 11/2018 and n. 9/2018, based on a technical opinion of ISPRA, can autonomously authorize the derogations, pursuant to art. 16 of the Habitats Directive, without the need of an authorization from the MASE.

An explanatory case of the authorization process was the one that concerned the management of M11 bear in 2013 in Trentino, which was completed in a rather short time.

M11, who ranged in the Monte Baldo area, was responsible for several predation events, even during the day, consuming its preys close to people, in highly frequented areas. On May 27, 2013, the Autonomous Province of Trento provided preliminary information to ISPRA, and the following day sent a formal request for removal of the individual, to ISPRA and to the Ministry of the Environment and Protection of the Territory and the Sea (MATTM, now MASE). On 29 May the Minister of Environment sent the request

for a technical opinion to ISPRA, which the following day issued a favorable opinion. On May 31st, the MATTM authorized the removal.

It must be said that, although the legislation provides in exceptional cases the possibility of acting by removing dangerous or harmful bears, and the example reported above shows that the national authorization framework can provide permit to act in a rather short time, national policies have tended to exclude this management option, also considering the opposition to similar management choices of a large part of public opinion.

Swenson et al, in the "Action Plan for the Conservation of the Brown Bear (*Ursus arctos*) in Europe" (2000), define as problematic those "bears that cause agricultural damages, visit garbage dumps, or bears involved in injuries/killing of humans", that is, individuals whose behaviors lead to conflicts with human beings.

In 2015, a technical document was produced in Europe entitled "Defining, preventing, and reacting to problem bear behaviour in Europe" in which a scheme for identifying the risk associated with problem bears is defined. It defines three levels of problematic and urgent action and each of these levels includes a series of behaviors assumed by bears for each of which management interventions and communication actions towards the public are suggested (Table 1).

In the bear management plan in Austria (Coordination board for Bear Management in Austria, 2005) the organization of the management (Figure 1) also includes the figures of the "Bear advocates", that are independent mediators between humans and bears. They are the first contact on site for people affected by the bears and inform about the bears and their current situation. Bear advocates are also responsible for the monitoring of the population and the collection and evaluation of signs of bear existence. In the document, the category "nuisance bear" includes harmful bears, which cause repeated damages, and bears that have undergone a process of habituating to humans (by becoming habituated to humans the bears can learn that humans are not dangerous) or positive conditioning through food (by overcoming its fear for humans, a bear is awarded with high quality food), and have become dangerous for humans. They are individuals who are no longer afraid of humans and actively seek food in the proximity of their settlements. Also, in this document, there is a table in which the human-bear interactions are ordered according to a gradient that goes from "bear behaving naturally - no measures necessary" to "nuisance bear – immediate measures required" (Table 2). Management actions are then suggested for each bear that cause damage (Table 3) or bear that cause imminent danger to humans (Table 4).

The PACOBACE is the Supra-regional Action plan for the Conservation of the Brown bear in the Central-eastern Alps, produced in consultation among the local administrations, ISPRA and the Ministry of Environment, published in 2010, it has been formally adopted by all relevant administrations (Provinces Autonomous of Trento and Bolzano, Autonomous Region of Friuli Venezia Giulia, Lombardy and Veneto; Piedmont has recently joined; ISPRA; Minister of Environment), so it represents the formal Italian policy on the brown bears in the Alpine region.

In this document is stated that "usually a significant part of the financial damage and genuinely dangerous situations associated with bears can be attributed to a few individuals, so-called problem bears, which adopt an over-confident attitude towards man". So, two sub-categories of problem bears are identified: damaging and dangerous bears.

In PACOBACE, as amended by the Directorial Decree of the MATTM Prot. 0015137 PNM of 30/07/2015,

“ a ‘damaging bear’ is a bear that repeatedly causes material damage to properties (preying on domestic livestock; destroying bee-hives; damaging crops, or causing general damage to infrastructures) or repeatedly uses sources of food linked to the presence of humans (foodstuffs for man and livestock; food for wild fauna; waste; fruit cultivated close to houses etc.). A bear that causes a single major incident of damage (or which only causes damages sporadically) should not be considered as a “damaging bear.”

Also, in the PACOBACE, it is stated that “a series of behavioural attitudes may suggest that a bear represents a source of danger for man” and “the dangerousness of an individual is generally directly proportional to its ‘habituation’ (dependence) on man. In other cases, the danger does not depend on habituation to man and is instead linked to specific situations, in the case that a bear is approached when it has cubs, for example, or when it is defending its prey or the carcass on which it is feeding.”

The document does not have a precise definition of a dangerous bear, but a series of behaviors ordered according to an increasing degree of problematic behaviours are reported in a table (Table 5, as amended by the Directorial Decree of the MATTM Prot. 0015137 PNM of 30/07/2015) and for each behavior, mild and energetic actions that are suggested to be implemented are described. The behaviors for which removal can be predicted are then identified (from 13 to 18). The removal option does not only concern dangerous bears.

The mild and energetic actions foreseen are the following:

- a) Intensification of monitoring (in the case of a radio-collared bears);
- b) Information:
 - for the owners and/or keepers of the domestic livestock
 - for the owners and/or frequent visitors of isolated mountain huts
 - for people possibly using the area (tourists, mushroom pickers, etc.);
- c) Overnight stabling of sheep, goats and cattle in stables and other protection measures;
- d) Rapid removal of dead animals in alpine pastures;
- e) Careful management of organic waste, with possible adaptation of containers and dumps;
- f) Setting up of structures suitable for preventing damage caused by bears (electric fences);
- g) Setting up of a defense surveillance, intended as a presence in the area of the bear emergency team;
- h) Aversive conditioning, with the scope of recovering a fear of man and his activities: this is intended as direct intervention to condition the behaviour of the animal;
- i) Capture with release, with the purpose of moving the bear and/or radio marking;
- j) Capture with the scope of taking it into permanent captivity;
- k) Killing of the animal.

In the PACOBACE it is then stated that to define a ‘problematic’ bear it is important to know the history of the subject and to get into account any previous anomalous behaviors; the degree of problematity increases when there is a repetition of potentially dangerous and/or harmful behaviors by the same individual.

In the Apennine area, in 2011, the PATOM, National Action Plan for the Protection of the Marsican brown bear, was drawn up. In this document, one of the actions envisaged concerns the management of confident bears and has the objective of “Preventing the onset of problematic behavior by bears and eliminating current and potential generation factors. Establish a fully efficient management system for any confident bears (protocols, staff, assigned roles and assumed responsibilities).”

As part of the LIFE Project 'Arctos', an "Operational Protocol for the prevention and management of the phenomenon of confident and/or problematic bears" was defined. This document contains the following definitions:

- Aggressive bear: shows aggressive behaviors, even in the absence of provocation or motivation;
- Damaging bear: causes harmful events. They are not necessarily conditioned, confident or problematic;
- Conditioned bear: actively searches for trophic resources of human origin;
- Confident bear: does not show obvious reactions in the presence of man;
- Dangerous bear: it can pose a risk to people's safety;
- Problem bear: causes frequent damage or human-bear interactions.

Also in this document, the behavior of the bear is ordered according to a growing gradient of problems and the actions to be taken are then suggested (Table 6).

In 2021, in the Alpine area, a technical report was produced by ISPRA in collaboration with the Science Museum of Trento MUSE (ISPRA-MUSE, 2021). The report, that was formally requested by the Minister of Environment and the President of the Province of Trento, provided an in-depth analysis of the classification of problematic behaviors displayed by bears, with respect to PACOBACE. The following categories are then proposed:

- 1) Damaging bears (PACOBACE category 14). These are bears that cause damage for which prevention has been found to be ineffective or impracticable.
- 2) Potentially dangerous bears i.e. confident bears (which are such with high probability as a consequence of food conditioning: category 13 of PACOBACE when enter inhabited centers; category 16 when follow people and 17, when try to penetrate homes, even seasonally frequented) and bears that attack and injure people for the first time in defense of their young, their prey or because they are provoked in any other way (category 15 of the PACOBACE).
- 3) High-risk bears, i.e. bears responsible for unprovoked attacks on a person (category 18 of the PACOBACE); bears belonging to category 15, but in association with other dangerous or second-time attacking behaviors, and confident bears subject to food conditioning who repeatedly and with increasing intensity show behaviors attributable to categories 13 and 16 and for which the deterrence has been found to be ineffective.

Potentially dangerous bears are therefore bears that exhibit at least one of the behaviors that can be defined as risky for humans, with high probability because of food conditioning; or they are bears that attack and injure a person once in a defensive manner but who have always been shy towards humans.

While a case-by-case assessment is recommended for potentially dangerous bears, in case applying intensive monitoring and the prevention and deterrent actions provided for by PACOBACE, immediate removal is recommended for high-risk bears.

High-risk bears are:

- a) bears who are responsible for unprovoked attacks on people;
- b) bears who attack to defend their young, their prey or because they are provoked in any other way and that, at the same time, display other potentially dangerous behaviors or attack a second time;
- c) individuals subject to food conditioning who repeatedly and with increasing intensity show risky behaviors even without attacks, and for whom dissuasion is ineffective.

As part of the report, a demographic analysis was made considering the cases of bears that occurred in past years, a projection of the phenomenon was made for future years, both in the absence and in the

presence of management. It emerged that in the next 5 years 5 individuals (0-15) could exhibit dangerous behaviors. As it can be seen from the graph (Figure 2) the removal of individuals would be clearly below the population growth forecast.

The report also discusses the current management in Trentino, where several dangerous bears have been put in permanent captivity to avoid killing, causing on the one hand strong negative reactions by the public opinion, and on the other hand not ensuring adequate animal welfare conditions. From demographic data, it is evident that the number of dangerous bears in the future will arise, and it is therefore essential that a rigorous evaluation of the behavior of animals is ensured, and that the decision process also takes into consideration, when unavoidable, the killing of dangerous bears, instead of the removal for permanent captivity.

Finally, the report also stresses the need to improve communication with the local communities, to encourage more responsible behaviors and reduce oppositions to the required management actions.

In all bear populations, a small portion of the population is generally responsible for most conflicts with humans, and potentially dangerous and high-risk bears represent an even more limited portion of these. To ensure a coexistence between bears and man, it is essential to apply a proactive management, preventing the occurrence of potentially dangerous behaviors, ensuring a correct waste disposal, replacing waste bins with anti-bear bins, ensuring that people adopt correct behaviors and do not feed bears, and applying prevention methods to protect vulnerable sites such as beehives that can be effectively protected with electric fences.

However, it is also essential that the competent authorities adopt timely effective management actions on habituated or dangerous individuals, based on rigorous technical evaluations, in line with the legal frameworks, considering the social acceptance of the alternatives.

Several factors limit the capacity to apply this general principle, including slow and unclear decision processes, scarce coordination among authorities and the opposition of the public opinion to some of the management alternatives. The current increase of the Alpine bear population and the ongoing expansion of the Central Italy population to new areas out national parks make essential to improve the large-scale coordination among all relevant authorities, clearly defining responsibilities and roles among Regional and National Parks, Regions, Provinces and Municipalities, Prefectures, Carabinieri Forestry Corps, Minister of Environment and ISPRA.

Careful monitoring of the bear populations must be ensured, as well as rigorous evaluations of potentially dangerous cases, based on detailed information on both the temporal and spatial contexts in which any problematic behavior by bears occurs. Also, it is essential to improve communication with local communities and all stakeholders to mitigate the controversies on required management actions, ensuring a transparent, clear and effective information.

Table 1. Individual bear behaviour, recommended management and communication actions (from Swenson et al, 2000).

Degree of problem and urgency of action	Individual bear behaviour	Recommended management actions	Recommended public communication actions
	a bear unaware of human presence is continuing its natural behaviour	no action towards the bear	Provide information on bear biology. Provide information on human-bear encounters (how to behave) to the inhabitants and visitors of the bear areas.
	upon an accidental close encounter bear is retreating immediately	no action towards the bear (surveillance)	
	upon an accidental close encounter bear is rising on his hind legs	no action towards the bear (surveillance)	
	bear is causing damages in uninhabited areas	damage prevention and basic monitoring to assess the effectiveness of damage prevention	Provide targeted information on why damages happen and how to prevent them (including where to get help).
	bear is repeatedly causing damages in uninhabited areas in spite of prevention measures	intensive monitoring, re-evaluate and adjust damage prevention measures, (deterrence).	Provide targeted information on why damages occur and how to improve damage prevention.
	the bear is aware of your presence but is not running away and ignoring your presence in the natural bear habitat	intensive monitoring (deterrence)	Provide targeted information on human-bear encounters to the inhabitants and visitors

Degree of problem and urgency of action	Individual bear behaviour	Recommended management actions	Recommended public communication actions
	bear is repeatedly coming close to permanently inhabited houses	intensive monitoring, remove attractants and dense vegetation – cover for the bears, if appropriate (damage prevention), aversive conditioning	Provide targeted information to increase understanding of habituation and food conditioning processes and its consequences; information on avoidance of human-bear conflicts
	female with cubs makes a false attack	monitoring	Provide targeted information on avoidance of human-bear conflicts to the inhabitants and visitors and explain causes and possible consequences of the bear behaviour both for the bear and for people. Provide information on human-bear encounters (how to behave when you meet a bear).
	bear makes a false attack when surprised or provoked	investigation, monitoring	
	bear is defending its food by threatening and making false attack	investigation, monitoring	
	bear is searching for food or is causing damages close to inhabited houses	monitoring, damage prevention (remove attractants), aversive conditioning, removal of the dense vegetation (cover for the bear)	Provide targeted information on avoidance of human-bear conflicts (especially damage prevention) to the inhabitants and visitors and explain causes and possible consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
	bear is entering uninhabited buildings such as barns, stables and sheds close to inhabited houses several times	<p>-removal of attractants, intensive monitoring, aversive conditioning, removal of dense vegetation (cover for the bear)</p> <p>- In populations classified as endangered (IUCN) or better or depending on the social context removal may be considered as the first option.</p>	
bear attacks (physical contact) a human after being provoked (e.g. by dogs, disturbance of the den)	<p>- in populations classified as endangered (IUCN) or better or depending on the social context removal may be considered as the first option.</p> <p>-intensive monitoring</p>	Provide targeted information on avoidance of human-bear conflicts to the inhabitants and visitors and explain causes and possible consequences of the bear behaviour both for the bear and for people.	

Degree of problem and urgency of action	Individual bear behaviour	Recommended management actions	Recommended public communication actions
Yellow	bear is repeatedly intruding compact residential areas	<ul style="list-style-type: none"> - removal of attractants, - In populations classified as endangered (IUCN) or better or depending on the social context removal may be considered as the first option. - intensive monitoring and aversive conditioning is preferred in critically endangered (IUCN) populations, 	Provide targeted information and instructions on avoidance of human-bear conflicts to the inhabitants and visitors and explain causes and possible consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
	Red	bear is defending its food by attacking	intensive monitoring, (deterrence), possibly removal of the bear
bear is following humans in close distance		intensive monitoring, deterrence, removal of the bear if deterrence is not successful	Provide targeted information and instructions on avoidance of human-bear conflicts and rationalize management decision by explaining the causes and consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
injured bear attacks a human		removal of the bear	Rationalize management decision by explaining the causes and consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
bear cannot be deterred successfully by an expert team from compact residential areas or from repeatedly entering uninhabited buildings next to an inhabited house		removal of the bear	Rationalize management decision by explaining the causes and consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
bear enters inhabited buildings		removal of the bear	Provide targeted information and instructions on avoidance of human-bear conflicts and rationalize management decision by explaining the causes and

Degree of problem and urgency of action	Individual bear behaviour	Recommended management actions	Recommended public communication actions
			consequences of the bear behaviour both for the bear and for people. Provide channels for two-way communication with the public (bear management hotline, online Q&A section,...).
	bear attacks a human without being intentionally or unintentionally provoked	removal of the bear	Rationalize management decision by explaining the causes and consequences of the bear behaviour both for the bear and for people.

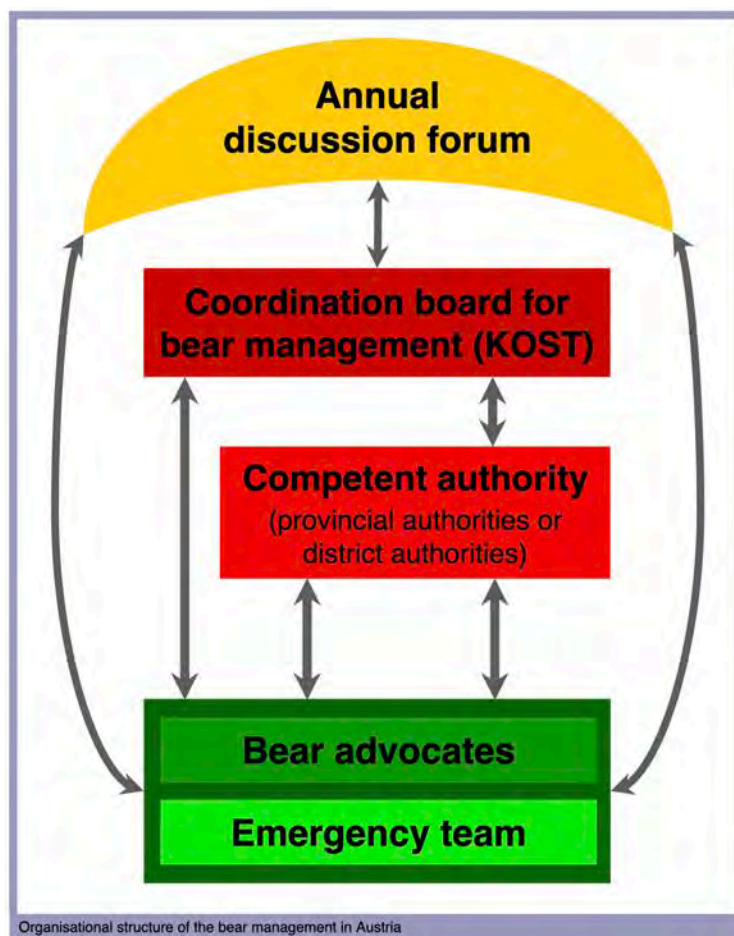


Figure 1. Organizational structure of the bear management in Austria (From Coordination board for Bear Management in Austria. 2005).

Table 2. Bear-human interactions and measures to mitigate a potential danger to humans (From Coordination board for Bear Management in Austria, 2005).

Examples for bear-human interactions and the necessity of measures to mitigate a potential danger to humans.	
Measures	Situation
Bear behaving naturally no measures necessary	Upon an accidental close encounter bear is retreating immediately
	Upon a close encounter bear is rising on its hind legs
	Bear is causing damages in uninhabited areas (e.g. destroying a beehive on a remote meadow)
	Bear is repeatedly coming close to remote buildings
	Surprised bear feels threatened and starts a feint attack
	Bear tolerates observation from a short distance without retreating
	Provoked bear starts a feint attack
	Female bear defends its young by attacking
	Bear is searching for food or is causing damages close to inhabited buildings
	Bear is defending its food by attacking
	Bear is repeatedly intruding residential areas
	Bear tries to enter inhabited buildings or stables
	Nuisance bear immediate measures required
Bear acts aggressively without being provoked	

Table 3. Measures for bear who cause damage (From Coordination board for Bear Management in Austria, 2005).

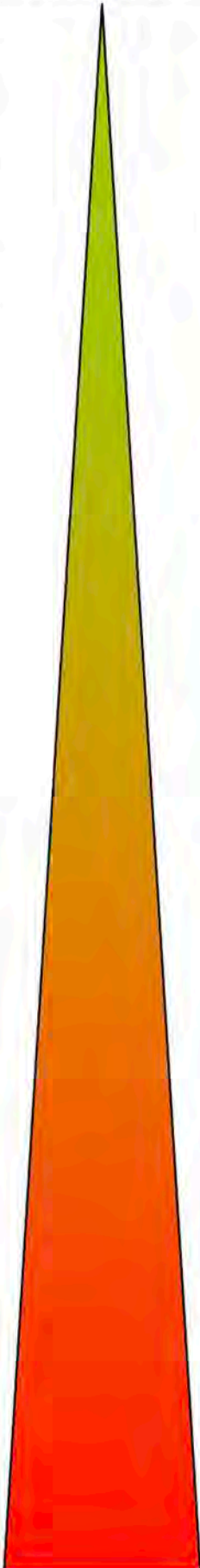
Recommendations for the handling of a bear that cause damage					
Behaviour of the bear	Measures				
	P	M	A	C	R
In the course of a summer a bear repeatedly visits bee hives, areas of forestry works or pastures.	X	X			
Bear sporadically causes damages	X	X			
Bear repeatedly causes damages	X	X	X	X	
Bear causes "unbearable" economic damages ⁸	X	X	X	X	(X)

P... intensify damage prevention measures, **M...** intensify monitoring activities, **A...** aversive conditioning, **C...** Capture / radio-telemetry, **R...** removal from the population

Table 4. Measures for bear who cause imminent danger to human (From Coordination board for Bear Management in Austria, 2005).

Recommendations for the handling of a bear that cause imminent danger to humans					
Behaviour of the bear	Measures				
	P	M	A	C	R
Upon an accidental close encounter bear is retreating immediately					
Upon a close encounter bear is rising on its hind legs					
Bear is causing damages in uninhabited areas (e.g. destroying a bee hive on a remote meadow)	X				
Bear is repeatedly coming close to remote buildings		X			
Surprised bear feels threatened and starts a feint attack		X			
Provoked bear starts a feint attack		X	X	(X)	
Bear tolerates observation from a short distance without retreating		X	X	X	
Female bear defends its young by attacking		X		(X)	
Bear is searching for food or is causing damages close to inhabited buildings	X	X	X	X	
Bear is defending its food by attacking		X		X	(X)
Bear is repeatedly intruding residential areas		X	X	X	(X)
Bear tries to enter inhabited buildings or stables		X	X	X	X
Bear is following humans within the range of vision		X	(X)	(X)	X
Bear acts aggressively without being provoked		X			X

P... intensify damage prevention measures, **M...** intensify monitoring activities, **A...** aversive conditioning, **C...** Capture / radio-telemetry, **R...** removal from the population

	Behaviour	Degree of dangerousness	Mild actions	Energetic actions
1	Bear escapes immediately following a close encounter			
2	Bear stands up on its rear legs during an encounter			
3	Bear moves away from its usual area		a	
4	Bear is repeatedly sighted		a	
5	Bear stays around beehives, farms where animals are reared or unsupervised livestock		a-b-c-d-h-g	i
6	Bear is present close to houses in the mountains or isolated huts		a-b-e-g-h-g	i
7	Bear is repeatedly sighted at short distances		a-b-h-g	i
8	Bear stays around areas crossed by roads and busy paths		a-b-h-g	i
9	Bear causes continuous damage away from inhabited buildings		a-b-f-h-g	i
10	Bear causes damage close to inhabited buildings		a-b-e-f-g-h	i
11	Bear charges in a false attack because of caught by surprise or to defend its cub or its prey		a-b-h-g	i
12	Bear is repeatedly reported close to sources of food related to man		a-b-c-e-f-h-g	i
13	Bear is repeatedly reported in inhabited areas		h-g	l-j-k
14	Bear causes repeated damage to property for which the activation of prevention and/or deterrent measures are ineffective or impracticable		g	i-j-k
15	Bear attacks (with physical contact) to defend its cub or its prey or because of provocation		a	i-j-k
16	Bear follows people		a-b	i-j-k
17	Bear tries to get into inhabited buildings, even if used by man only seasonally			i-j-k
18	Bear attacks without being provoked			i-j-k

Facing page:

Table 5. Table 3.1. of PACOBACE revised in 2015, which defines dangerousness of possible bear behaviours and related actions. In the frame of PACOBACE, control measures are so defined: a) intensification of monitoring (in the case of a radio-collared bears); b) information for the owners and/or keepers of the domestic livestock, for the owners and/or frequent visitors of isolated mountain huts, for people possibly using the area (tourists, mushroom pickers, etc.); c) overnight stabling of sheep, goats and cattle in stables and other protection measures; d) rapid removal of dead animals in alpine pastures; e) careful management of organic waste, with possible adaptation of containers and dumps; f) setting up of structures suitable for preventing damage caused by bears (electric fences); g) setting up of a defense surveillance, intended as a presence in the area of the bear emergency team; h) aversive conditioning, with the scope of recovering a fear of man and his activities: this is intended as direct intervention to condition the behaviour of the animal; i) capture with release, with the purpose of moving the bear and/or radio marking; j) capture with the scope of taking it into permanent captivity; k) killing of the animal.

Below:

Table 6. Bear behaviors and actions suggested (From AA.VV., 2011).

	Behaviors	Actions
A	Bear escapes immediately following a close encounter	No action needed
B	Bear is repeatedly sighted	Surveillance and public information
C	Bear is repeatedly sighted on busy roads and paths or near inhabited center	Surveillance and public information
D	Bear attacks to defend its cub	Surveillance and public information
E	Bear launches itself in a false attack because it is caught by surprise	Surveillance and public information
F	Bear attacks to defend its prey	Surveillance and public information
G	Bear causes repeated damage on structure (beehives, pens and crops) far from inhabited center	Prevention, surveillance and public information
H	Bear sighted at short distances or near inhabited areas	Prevention, surveillance and public information and capture to radio marking
I	Bear usually hunts for food of anthropogenic origin, even far from inhabited center, or shows behavior little suspicious towards human	Prevention, surveillance and public information, capture to radio marking and, if necessary, aversive conditioning
L	Bear in search of food repeatedly reported in inhabited centers	Prevention, surveillance and public information, capture to radio marking and aversive conditioning
M	Bear feeds in inhabited centers penetrating uninhabited houses or structures	Prevention, surveillance and public information, capture to radio marking and aversive conditioning
N	Bear feeds in inhabited centers penetrating structures or houses with human presence	Prevention, surveillance and public information, capture to radio marking, negative conditioning and removal
O	Bear behaves like M and N, but it has aggressive behavior towards humans	Public information and removal
P	Bear attacks without provocation	Public information and removal

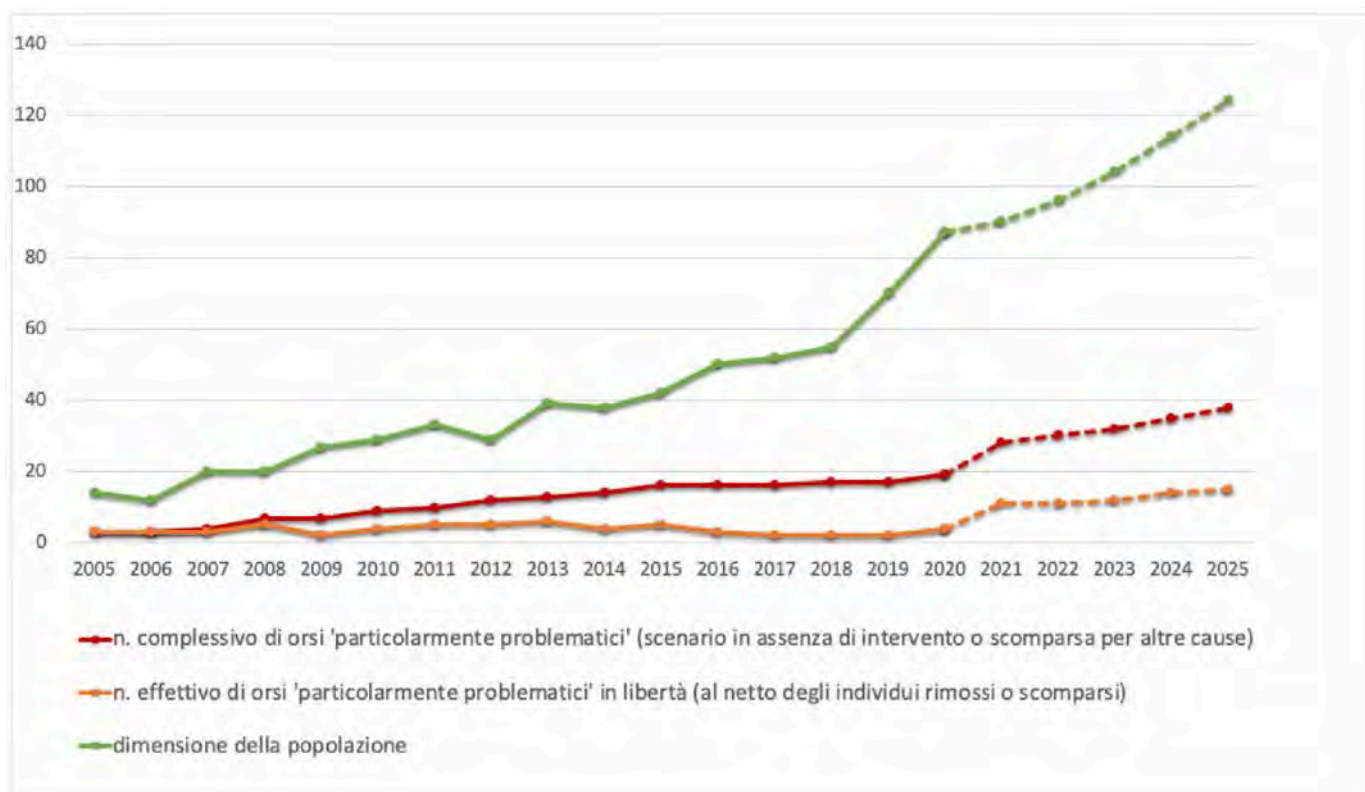


Figure 2. The graph shows the trend of the bear population (green line), compared with the number of bears that have exhibited at least once behaviors for which the PACOBACE provides for removal (indicated in the legend as ‘particularly problematic’ bears, red and orange lines). In particular, the red line shows the total number of particularly problematic animals in the absence of removal or disappearance interventions for other causes such as poaching (i.e. which also includes those animals that have been removed or have disappeared in any other way and therefore do not more present in the population), while the orange line shows the observed data, i.e. the number of particularly problematic animals actually present in the wild in each year, following removal operations or following disappearance for other causes. The dotted lines represent the projection over the next 5 years. (From ISPRA-MUSE, 2021).

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Bold bear: a scientific approach

Giulia Bombieri

*Cantabrian Brown Bear Research Group – IMIB (Biodiversity Research Institute, CSIC - Oviedo, Spain)
MUSE, Museo delle Scienze di Trento – Field of Conservation Biology (Trento, Italy)
giulia.bombieri@muse.it*

Like most wildlife, brown bears have adapted to live in highly humanized landscapes by adopting human avoidance behaviours, such as being active at twilight and night, and avoiding using areas in proximity to people and their activities. Yet, some individuals do not avoid human presence. Bears that do not fear the presence of people, or even approach human settlements, represent a management issue because, although they may not pose an immediate threat to human property and safety: (1) they might eventually turn into conflict individuals if no action is taken and, due to the disproportionate attention they often receive from the local media, (2) they represent a main cause of public fear and negative attitudes towards large carnivores, which have the potential to negatively influence management decisions concerning the entire local population to which the individual belongs. Although important and, sometimes, costly decisions are constantly taken by wildlife managers to deal with these individuals (ranging from intensive radio-tracking monitoring to applying aversive conditioning techniques to, in extreme cases, the permanent removal of the individual), little is known about this behaviour.



Specifically, understanding how and why this behaviour develops, identifying the factors that contribute to its development, investigating how bold bears behave and what are the most effective strategies to prevent or revert this behaviour is key to developing effective management strategies to deal with this problematic. Evidence-based knowledge that comes from a rigorous scientific approach to the issue is fundamental to this aim. The scientific approach should indeed have a major in supporting bold bear management since it can: 1) provide basic and in-depth knowledge that can be generalized; 2) identify patterns and factors of bold bear behaviour and its development; 3) test the effectiveness of different types of preventive and reactive strategies. Certainly, each question needs to be addressed via specific approaches and thus preliminary careful evaluations are necessary. Previous studies have already provided important insights into the topic. For instance, Elfstrom et al. (2014) reviewed proximal and ultimate causes of bears approaching settlements, identifying two main proximate causes: 1) food-conditioning and 2) habituation, and one main ultimate cause: despotic/hierarchic distribution of the population. Of course, many other internal as well as external factors contribute to the occurrence of this behaviour.

Performing rigorous research on this topic is however extremely challenging, since: 1) samples (number of bears that show certain problem behaviour) are often very small, 2) the effectiveness of management strategies is often difficult to test when a scientific approach in collecting data is not employed since the beginning. In general, good evidence come from rigorous and standardized data collection, which is not always easy to implement. Thus, caution must be taken when analyzing and interpreting such kind of data. When caution is not taken, the risk is to misinterpret results or driving conclusions from data that

have not been collected rigorously enough. An instance is represented by evidences on the effectiveness of diversionary feeding, which effectiveness is currently not sufficiently supported by evidenced-based data. Indeed, although it can have an effect in reducing conflicts when the cause is strictly related to scarcity of natural food in some contexts, rigorous studies are lacking, and negative effects of such practice have also been broadly demonstrated (Garshelis et al. 2017). In general, evidence-based approaches support some measures as the most effective in preventing conflicts, such as removal/securing of food sources, information/education campaigns targeting local communities and strict regulations on anthropogenic food management and, in general, people behavior.

As mentioned above, the scientific approach can, in the first place, provide basic and in-depth knowledge that can be generalized. In Bombieri et al. (2021), we used movement data previously collected on bold and non-bold bears in Slovenia and Trentino (Italy). GPS telemetry and other tracking techniques have allowed researchers to better understand individual behaviour and personalities in wild populations and have been extensively employed to study how large carnivores move and make use of their environment with respect to conspecifics, as well as humans and their activities. However, we are unaware of any work that has used GPS telemetry data obtained from specific monitoring of those individuals that managers identified as bold (i.e., individuals that were repeatedly seen in or near human settlements) to explicitly study their spatial behaviour and assess if and how it differs from that of their conspecifics. To this aim, we analyzed the behaviour of brown bears that had previously been identified by managers as bold and that, because their behaviour, might have turned or had already turned into conflictual attitudes, had specifically been GPS-collared for monitoring purposes and, in extreme cases, removal. Specifically, we investigated the spatial behaviour and rhythms of activity of bold brown bears and compared their behaviour with that of their control (i.e., non-bold) conspecifics. Because several variables are known to affect brown bear behaviour, we also considered in our analyses other potentially important factors (i.e., sex, age, season of the year and time of the day) as well as bear individual identity. Our results showed clear differences in diurnal index and use of open areas between bold and control bears. Specifically, according to our expectations, bold bears were considerably more diurnal and used open areas more often than control bears. As for the other movement parameters under study, although bold bears were found closer to settlements and roads and had larger daily home ranges and movement rate values than control bears, our models suggest that these differences were not as pronounced. On the other hand, other factors, both internal and external, were found to be important in explaining variation in bear movements. Importantly, a significant inter-individual variation in all behaviours was found. Our results are also a clear confirmation of that highlighted in numerous studies on personality and behavioural syndromes.

That is, rather than being a dichotomy where a bear can be either "bold" or "normal/shy", bold behaviour is more of a gradient, where a bear can show different degrees of boldness and tolerance towards humans. This supports the idea that wildlife management should try to take this gradient into account, as well as individual differences, and implement different management actions for different degrees of boldness and conflict, which makes the task extremely challenging. To conclude, although bold bears are a very small portion of a population, they represent a great challenge for managers, and the scientific approach can help in understanding more about their behavior and find the best strategies to deal with them. Surely, many other important aspects need to be further investigated. Existing literature highlights a great complexity of the issue and a general difficulty in combining research and management, which needs to be addressed in the first place.

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Cases and contexts of confident bears in the Apennines. Conservation issues

Roberta Latini

Zoologist of the Abruzzo Lazio and Molise National Park

roberta.latini@parcoabruzzo.it

The Marsican brown bear population is highly endangered. The last census, in 2014, counted fifty-one individuals (95% CI; 47-66). Its core area is mostly situated inside the PNALM and its surrounding buffer area, even if in the last years a gradual but steady range expansion has been detected in more external areas.

In 1993, the first case of a “problem” bear occurred, needing a supportive management strategy. The bear was a young female (FP07 – YOGA) who was used to visit picnic areas and some camping villages, attracted even intentionally by people. The applied management strategies included: dissuasive actions using shotgun and rubber pellets; supplemental feeding; temporary removal such as translocation and/or captivity. Since then, new “problem” bears have appeared, and new management strategies were developed too. Until 2021, 9 bears showed confident behaviour since young, even temporarily. Between these, 7 were females and showed habituation to humans; 2 were males and showed both habituation to humans than food conditioning.

The 9 bears had different endings: 1 captivity; 2 illegally killed; 1 victim of a car collision; 5 still roaming freely.

Even if the percentage of “problem” bears appears relatively high, especially in the last few years (2-14% of the population), it is still comparable to the others Ursidae families.

During the years, the management actions have been organized in a specific management protocol for “problem” bears and have been oriented in three different trends: communication; preventive measures (securing food resources) and reactive measures. The main critical issues responsible for the occurrence of problem bear behaviour are: abusive and dilapidated accessible poultry-houses; accessible fruit trees in an anthropogenic environment; open carrot fields and the social context. This last aspect is very crucial: in one hand because of the absence of a truly cooperation between the local population and the Park for securing the food resources (fruit removal; installation and maintenance of electric fences) and, on the other hand, because of the extensive media pressure around habituated bears which attracts numerous curious and enthusiasts, therefore increasing the bear’s habituation to humans and decrease the effect of management actions such as reactive measures which, sometimes, are also obstructed. Moreover, without a legislation which make compulsory the use of preventive measures, the management of the phenomenon becomes even more complex, especially outside the PNALM borders, where the Park’s staff has no competences.

During the last year, another problem was faced: garbage bins stood for an important food source for a young male bear (M20 – Juan Carrito). Also in this case, the calls for a correct management of anthro-



pogenic waste were not useful, both because of a little sensibility on the problem by the public authorities and because of real problems concerning the high costs of bear proof bins and the impossibility to modify the trash picking time with the responsible factories because of trade-union problems.

From 2000 to 2021, 767 preventing measures were dislocated and installed: electric fences; doors and windows bear proof grids and bear proof poultry-houses.

The main difficulty on prevention relies on the fact that, often, are involved small contexts, such as private small orchards and fruit trees, and the electric fences bought by the Park with ordinary funds are not well maintained by the owners. This implies a supplemental effort by the PNALM which is forced to control and maintain the structures every year. The absence of a true collaboration between the Park and the local authorities and people, again, makes impossible to have a uniform system of prevention and, therefore, undermines also the effect of reactive measures which have only a temporary function of the public order and the bears and people security.

From the habituated female F17 – Amarena, in 2020, born 4 cubs.

The family, since the beginning, regularly visited the human villages until the end of autumn, finding there many food sources easily accessible and complicated to secure in the short time. The exceptional family presence attracted thousands of visitors who, day after day, for months, saw the bears at a close distance.

The Park authority, at the beginning, decided not to intervene with reactive measures to avoid the early separation of the family group, but guaranteed a constant presence to maintain the public order and secure the bears and the people.

In May 2021, the family group dispersed, and a series of damages began to occur because of a bear's presence in the urban areas.

It was M20 – Juan Carrito, one of the 4 cubs.

M20 was captured and radio-collared and began a period of intense reactive actions, which brought to two important results: 1) increased reactivity of the bears faced with people; 2) increased nocturnal behavior.

The bear, however, didn't modify his spatial behaviour and continued to move and live in a buffer zone of 700 m from the human settlements, sometimes even sleeping in private gardens and garages.

In August 2021, due to some food baits located inside the garbage bins, M20 began to visit them and, at the same time, started a very complex management period. In fact, the bear settled in Roccaraso (a touristic village outside the border of the PNALM) and continued to feed at the garbage bins and fruit trees of the urban area.

Many meetings were organized involving the various authorities and reflecting on the garbage bins issue, however not finding any solution.

To relieve the situation, and facing the touristic ski season, a protocol of translocation was edited, considering three different scenarios with progressively increasing distance from the bear core living area: Gran Sasso and Laga Mountains National Park; Maiella National Park and PNALM.

On the December 7th, J. Carrito was translocated inside the PNALM and, after a week, came back to Roccaraso. On the December 30th goes into hibernation for about a month.

In February 2022, the bear came out of hibernation and its management moved on to the Maiella National Park (PNM).

M20 was captured and kept in captivity for 15 days. After that, it was translocated in another area of

the PNM. Around 15 days after, M20 came back again to Roccaraso and started a long period of movements between the town, PNALM and PNM, during which it showed an elusive behaviour, except for some episodes.

Human habituated bears highlight all the shortcomings of this territory, stress out and proofs the system, especially when the territories have different administrative competences and a different conservation level. Conservation biologists, in general, have as a goal the wellbeing of the population, and not of the individual. However, when the population counts only 50-60 bears, everyone becomes important, moreover for its genetic makeup already very compromised. Team working, legislation and increased awareness are the main points on which the long-term conservation actions must be based for this population.

Although in the European and North American context the "problem" bear's management often leads to a removal, this is not possible for the Marsican brown bear population. For this reason, the "problem" bear management is, in itself, a conservation problem.



Cases and contexts of confident bears in Trento. Conservation issues

Claudio Groff

*Large Carnivore Team Coordinator, Autonomous Province of Trento
claudio.groff@provincia.tn.it*

In the Central Alps of Trentino, brown bears (>100) are dealing with the highest human density all over the areas hosting bears in Europe and this means high social and legal conflicts. A great effort in terms of financial and human resources has been carried out in the past 40 years, in order to improve the coexistence between humans and large carnivores. The management is a responsibility of the local government (Trento Autonomous Province – Wildlife Department). The national Action plan “PACOBACE” is the main tool for the management of problem bears and include removal of the problem individual (lethal removal or captivity) as the ultimate solution, defining the cases when it should occur.



Regarding numbers, in Trentino, in total, are known: 6 damaging bears, with high damage rates on properties hard to secure, recorded in 2009-2019; 15 dangerous bears recorded in 2005-2020 (11 very bold; 4 aggressive and one with both the behaviours; 4 aggressive bears who caused 5 attacks and 6 people injured: 4 attacks to defend cubs and one deliberate attack without being provoked.

A study case about problem bears can be identified in the story of “M57”: a young male part of a four cubs’ litter of a quite confident mother, who was regularly entering villages. M57 was visiting urban areas mainly for garbage feeding (recorded at least 16 times); it followed people (7 times recorded) and it was observed standing close to them for 5 times. Aversive conditioning technics were used without success at all, and at the end, on 22 August 2020, M57 deliberately attacked a man. For that reason, it was captured and put in captivity the same day. A following long legal case confirmed the accuracy of the management decision to remove the bear.

In total, 19 problem bears were recorded between 2005 and 2020: 13 were defined as dangerous; 4 as damaging and 2 presented both the behaviours. These bears made up the 12,4% of the whole population (in that period). What was their fate? Four individuals (21%) were legally shot (one in Trentino and three abroad); four (21%) were put in captivity; three (16%) accidentally dead; two (10%) disappeared; three (16%) were poached and three (16%) are still alive. According to a National Wildlife Institute and Muse’s study, five new problem bears per year are expected in the future. However, the management decisions made by the Trento Autonomous Province brought to seven legal disputes, promoted by animal right associations, concerning the removal of problem bears: five of them ended in favour of the managers and two in favour of the associations.

The management of problem bears in Trentino involves 14 emergency teams (ET) available 24h on duty and 20 coordinators leading such teams; 1 capture team and 6 bear-dog units. ET has been called 733 times in 2002-2021 (not just on bears), on average 37 times per year. ET has been called 346 times for bears and in 107 times (31%) the ET got in touch with the bear: in 72 times they carried out aversive conditioning

(dogs, rubber bullets and/or both); most of the times (57 times) only one aversive conditioning per night has been carried out; 9 times two per night; 5 times three per night and in 1 case five on the same night. However, no data are available so far to show the effectiveness of such aversive conditioning. Communication tools used to address problem bear issues concerns the research of specific signs in the field; the creation of online map with positions of collared problem bears and online map with signs concerning the presence of females with cubs; meetings with locals on the spots and specific leaflets/video/brochures.

A study of the National Wildlife Institute supported by Muse showed that, in 2005-2020, the percentage of detected bears showed problematic behaviours (12,4%), would have been greater (29,9%) without the removal of problem bears carried out in the same period. To conclude, such data highlights the positive and significant effects of targeted removals on the level of conflicts.

On the use of activity rhythms to study confident bears and their reactions to management practices

Stefano Grignolio

Department of Life Science and Biotechnology of the University of Ferrara
stefano.grignolio@unife.it

The circadian clock is an evolutionary-conserved trait which play a fundamental role in the wellness of animals and plants: it allows organisms to anticipate time of the day and season, thus enabling them to prepare in advance their biochemical, physiological, and behavioral processes for environmental changes (Pittendrigh, 1993; Yerushalmi & Green, 2009). Likely, the most important characteristic of these endogenous circadian oscillators is their ability to attune the rhythms with such environmental cues. Indeed, the circadian oscillators are synchronised with the time of the year by periodical changes in environmental stimuli, the so-called zeitgebers (from German, zeit: "time"; geber: "to give"; Pittendrigh 1993). In temperate regions, the daily length (i.e., photoperiod), the variation in environmental temperature (thermoperiod), and food resource availability vary markedly among seasons. As a result, the variations in these environmental characteristics affect the physiology and behaviour of animals (Van Oort et al. 2007) and play a pivotal role as zeitgebers. Animals of species living along a broad range of latitude showed different patterns of activity in northern or southern populations in relation to the varying zeitgeber cycles. Generally, northern populations have a larger difference in circadian rhythms among the seasons, whereas southern populations show more homogeneous activity throughout the year (for instance, see the example of *Rangifer tarandus* - van Oort et al. 2007).



The changes in environment temperatures not only directly affect daily activity patterns (Signer et al. 2011), but also mask the effects of other environmental variables (Brivio et al. 2016). Elevated temperatures may lead animals to reduce activity during the day (Scheibe et al. 2009), to increase the crepuscular/nocturnal activity (Pita et al. 2011), and to switch from diurnal to nocturnal activity in summer (Berger et al. 1999). Conversely, when air temperatures are below the animals' thermoneutral zone, individuals concentrate their activity during the warmer parts of day, decreasing activity during the night and early morning as a strategy to prevent heat loss and, thus, to reduce the costs of thermoregulation (Maloney et al. 2005; Pipia et al. 2008).

Human disturbance is another pivotal driver affecting animal activity rhythms: for example, animals can be more vigilant during the hunting season or when human harassment is more important; thus, altering their normal rhythms. If the activity patterns of wildlife can be changed by human presence, their energy intake rate might result reduced, with ensuing long-term costs on fitness. Hence, the daily behavioural rhythms are often affected by several different cues at the same time, including thermal conditions, reproductive and social status, competition, illness, stress, human presence and harvest. The impact of these cumulative factors can modify, shift, and even completely change the behavioural circadian rhythm of a spe-

cies. In turns, these changes, when an endangered species is involved, are likely to increase the levels of extinction risk. On the other hand, the study of activity patterns can help us to correctly understand the reasons driving a species to use some anthropogenic resources and, so, to cause damage or conflicts. Therefore, the availability of information on activity patterns can improve the success of management strategies for pest species (see for instance Brivio et al. 2017 about wild boar).

In this framework, we focused our interest on Apennine brown bear (*Ursus arctos marsicanus*) activity records collected in an area including and surrounding the Abruzzo, Lazio and Molise National Park, a strict nature reserve where about 50 bears live and are critically endangered.

The improvements in micro-electromechanical systems allowed the construction of accelerometers: i.e., spring-like piezoelectric sensors generating a wave-like voltage signal which is proportional to the acceleration (change in velocity) they experience (Brown et al. 2013). To study activity on terrestrial wild mammals, accelerometers are mainly integrated into activity sensors in Global Positioning System (GPS) collars, which provide summary statistics of activity, calculated by subtracting the static acceleration (gravity) component from the total acceleration values. By taking advantage of this highly detailed information provided by GPS-collars equipped with accelerometers, we studied bear circadian and seasonal activity rhythms with a chronobiological approach, investigating the effect of environmental conditions and human disturbance on their total activity levels.

The staff of the Park captured 8 bears (6 females and 2 males) with chemical immobilisations and equipped them with GPS Collars (Vectronic Aerospace GmbH, Berlin, Deutschland). The collars recorded the actual acceleration experienced by the collar along two orthogonal axes (x-values recording forward/backward motions, y-values recording left/right motions) four times per second. The accelerometer recorded the accelerations on a dynamic range from $-2G$ to $+2G$ (G =gravitational constant) and measured activity as the change of static acceleration (gravity) and dynamic acceleration (collar). Activity values were given within a relative range between 0 and 255. Value 255 was equal to $-2G / +2G$ and showed maximum acceleration, while 0 showed no acceleration at all. The collars provided mean values averaged over sampling intervals of 5 minutes. We transformed each record, provided by the collars, accordingly to the method developed by Gervasi et al. (2006) and revised by Brivio et al. (2021), which enables us to distinguish between active and inactive records at the individual levels. Activity data were then associated with weather information provided by a weather station (Alvito) located in the surrounding area.

The effect of the selected intrinsic and extrinsic factors on activity patterns was assessed by modelling the binary activity variable (0 = inactive; 1 = active) by Generalised Additive Models (GAMs). GAMs allow for non-linear effects, using non-parametric smoothing functions; we estimated such effects for each predictor variable to obtain the best possible prediction for each variable. GAMs were implemented within the `mgcv` package in R (version 3.3.3; R Core Team, 2016).

The visual inspection of the actograms showed a clear nocturnal pattern of activity. The changes in photoperiod across the seasons affect the moment when the bears began to be active or to rest (Figure 3). However, some little and short bouts of diurnal activity were also present. Based on the currently available information, it is not clear which are the drivers forcing bears to be mainly nocturnal throughout the year.

In the first step of our statistical analysis, we considered the modifications in activity caused by the capture. The general additive model describing the total activity of bears after the capture shows that bears had low activity immediately after the capture, after which the activity appeared to stabilize to a baseline situation. It seems clear that chemical immobilisation and manipulation affected total activity in the follow-

ing 10 days after the capture (Figure 4). This is an expected result because the capture event is probably one of the most stressful episodes which can occur in the life of large mammals (Koch et al. 2017) as it often overturns their behavioural patterns (Northrup et al. 2014) and can even increase their mortality rate (Arnemo et al. 2006). Nevertheless, the modifications in activity recorded in our study area are similar or smaller than those recorded in other projects involving brown bears (Cattet et al. 2008).

To investigate the difference in activity rhythms of human-habituated bears, we fitted a model including a variable classifying the bears in human-habituated/no human-habituated individuals. In the model we also included the variables that are known to affect the activity patterns of large mammals. We found a significant effect of Julian date and hour (figure 5), and temperature. The activity pattern of the monitored bears was clearly bimodal, with a peak of activity in the early morning (about 5:00) and another in the evening (about 19:00). The finding about temperature showed that bears were able to keep their activity constant irrespectively to the ambient temperature. However, there was a threshold value (about 30° C) beyond which bears were forced to decrease their activity, likely to avoid overheating. Instead, we did not detect any difference in total activity between human-habituated and no-human-habituated bears (figure 6): the use of anthropogenic areas did not force or favour a clear modification in the activity levels of bears.

Finally, we estimated the change in the total activity of human-habituated bears during dissuasion events. To do it, we compared the activity of bears in the period before (from 24 to 1 hours before the event), during (from 1 hour before to 1 hour after the event) and after (from 1 to 24 hours after the event) a dissuasion event implemented by the Park Staff. The aim of this analysis was to understand if these actions induced human-habituated bears to reduce or increase their activity rates. We detected differences among the three periods. Bears were more active during the dissuasion event, likely as a direct response (flight) to human harassment. Conversely, in the hours after the dissuasion event, they were less active compared to the activity before the event. This finding pointed out that these management actions caused a slight behavioural modification (i.e., a change in total activity) immediately after the event, even if this effect was limited in the brief period.

As behavioural adaptations to the changing environmental and social conditions have been shown to respond more rapidly than physiological or morphological ones (Van Buskirk 2012), our results may help to understand the immediate adaptations and response of an endangered taxon, as the Apennine brown bear, in an area where conflicts with humans can be frequent.

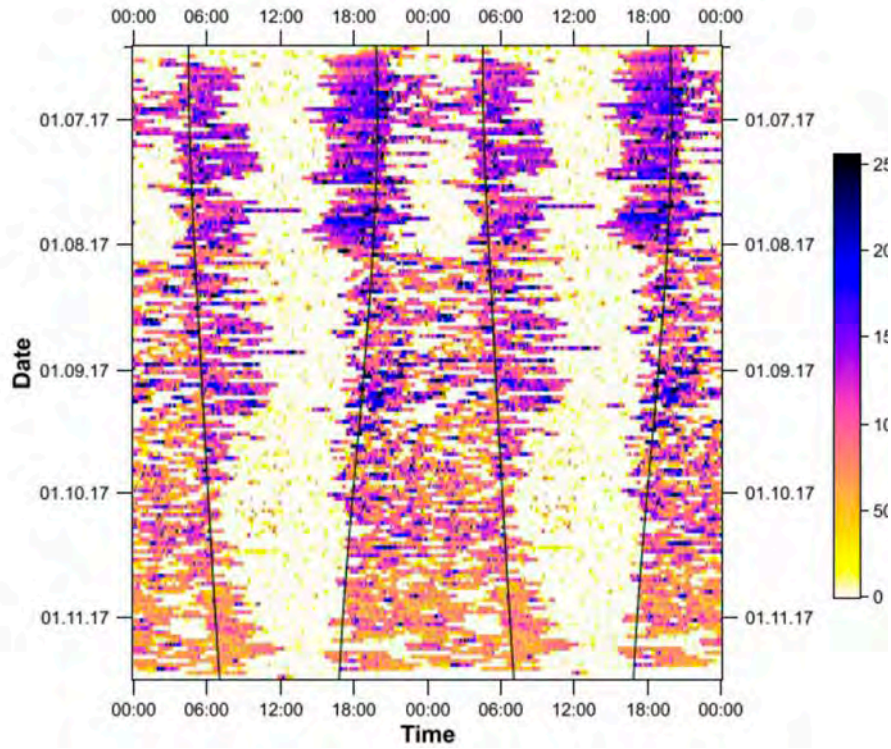


Figure 3. Representative actogram of daily activity of one radio-collared female bear. Vertical bars stand for their activity levels (over intervals of 5 min), the colour of the bar being a function of activity level: from white (=0) to black for maximum values (i.e., 255). Black vertical lines show dawn and dusk according to civil twilight. Records are double plotted on a 48-h time scale to help the interpretation.

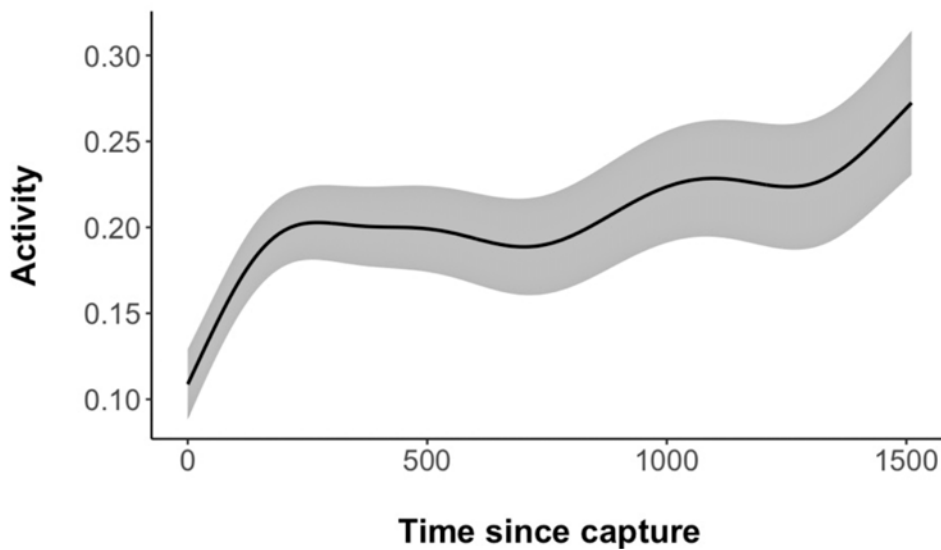


Figure 4. Predicted effect of capture on bear activity. The values of activity reported were predicted by the best Generalised Additive Mixed Model. The figure shows the effect of time since the capture on bear activity (continuous line), while the grey shaded areas are the estimated standard errors.

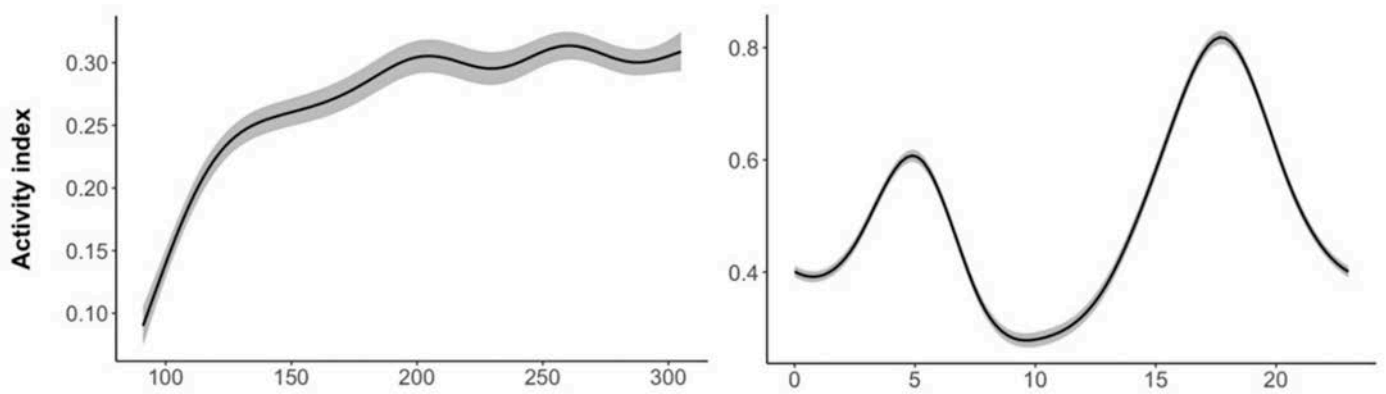


Figure 5. Predicted effect of Julian date and time of the day on bear activity. The values of activity reported were predicted by the best Generalised Additive Mixed Model. The figures show the effects on bear activity (continuous line), while the grey shaded areas are the estimated standard errors.

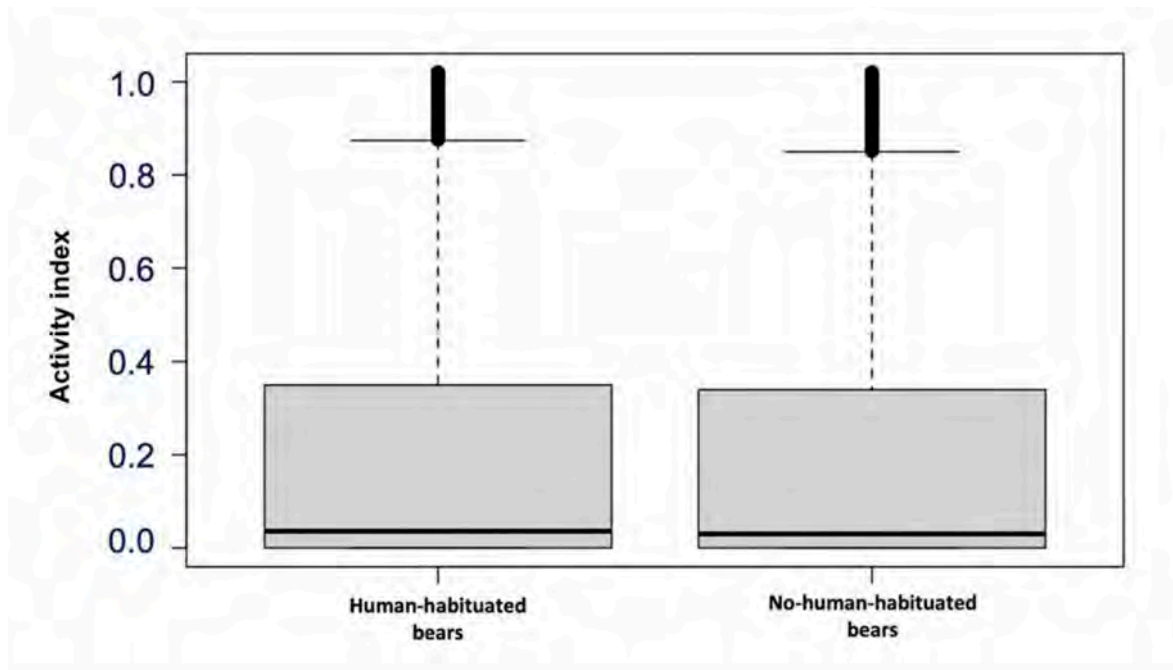


Figure 6. Difference in total activity in human-habituated and no human-habituated bears.

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Managing human bear conflict in western Canada

Jay Honeyman

Large carnivore Conflict Biologist (Retired), Alberta Fish and Wildlife
jayh@telusplanet.net

Southern Alberta is made up by various landscape features including the Rocky Mountains, foothills and prairie landscapes. There are a variety of human activity including industry (oil and gas; forestry and mining); agriculture (hobby farms; croplands and large-scale cattle operations); recreational activities (hiking; mountain biking; climbing and camping) and many large and small towns throughout the region. It is home to multiple wildlife species including deer, elk and moose and large carnivores including wolves, cougars and bears (black and grizzly bears).



In 2010, the grizzly bear was listed as a threatened species in Alberta. Along with this status came a [Grizzly Bear Recovery Plan](#) intended to increase grizzly bear numbers to a more sustainable population level. In 2016, an updated draft Recovery Plan was completed which identifies a Bear Management Area (BMA) specific approach to managing grizzly bears intended to address the unique management challenges within each BMA. This includes a Zoning criterion with management zones: Recovery Zone; Support Zone; Habitat Linkage and Outside BMA.

The **Recovery Zone**, essentially public lands along the foothills and west into the mountains, would inform the management of industrial development and human use. Managing attractants as well as other sources of human-grizzly bear conflict that often results in public safety concerns, bear mortality or translocations would be a priority within this zone.

The **Support Zone**, those lands east of the Recovery Zone, is intended to maintain grizzly bears that have home ranges only partially in the Recovery Zone. The management intention here is to maintain grizzly bear occupancy, likely at lower density than in Recovery Zones, with an emphasis given to sows with cubs. The grizzly bear population in the Support zone will likely not be self-sustaining without dispersal from the adjacent Recovery Zone. The Support Zone will contribute to grizzly bear recovery by increasing the regional population size and ensuring that bears that move in and out of the Recovery Zone can survive. Given that the Support Zone is comprised of largely private lands, it is expected to be a focal area for proactive attractant management strategies to reduce human bear occurrences.

The **Habitat Linkage Zone** identifies key wildlife movement corridors that also have significant development including urban areas, major highways and railways. Occupancy of grizzly bears outside of the Grizzly Bear Recovery and Support Zones, i.e., **Outside BMA**, is not required to recover the Alberta Grizzly Bear population. Management tolerance for grizzly bears that come into conflict with humans outside of the Recovery and Support Zones would be lower, resulting in increased management removals.

In the interest of public safety and conservation, wildlife managers have introduced various programs intended to reduce the number of negative interactions between bears and people.

These include the [Wildlife Predator Compensation](#) and [Alberta Bear Smart Programs](#). These Programs are important tools to help support communities and other stakeholder groups living, working and recreating in bear country.

The Wildlife Predator Compensation program is intended to compensate ranchers who have livestock killed or injured by wildlife predators. Compensation currently covers cattle, bison, sheep, swine and goats that have been attacked by wolves, grizzly bears, black bears, cougars or eagles.

The Alberta Bear Smart Program seeks to reduce human-bear conflicts and increase public stewardship in Alberta by providing strategic information and education materials to the public, stakeholders and government agency staff dealing with bears. Stakeholders include local communities, conservation groups and industry, including oil and gas, forestry and agricultural producers. The Program is intended to:

- Reduce the number of undesirable human-bear interactions, which may result in injury or death to either humans or bears;
- Reduce the number of bear mortalities and relocations that occur because of negative interactions with people;
- Reduce annual costs associated with property damage and management actions to address conflict situations.

There are several non-profit groups assisting AEP in delivering programs to promote best practices and reduce conflict between grizzly bears and people through education. These include:

- [WBR Carnivores and Communities program](#)
- [Bow Valley WildSmart](#)
- [Crownsnest Pass BearSmart Association](#)
- [Redwood Meadows WildSmart](#)
- [Mountainview BearSmart](#)

A formal Aversive Conditioning Program has been in place since 2001 in parts of southern Alberta. The program finds and works on Low Conflict level grizzly bears: these are the easiest to change their behavior. When we were considering which bears to do conditioning on, we wanted to have the best chance for success for the Aversive Conditioning Program and the individual bear. In fact, the best chance for success is with those bears that are just beginning to show signs of low-level conflict, i.e., habituated but not food conditioned or aggressive. Conversely, the most difficult bears to change behavior through conditioning are those that are food conditioned, extremely habituated or showing signs of aggression. Using radio collars and following the Wind River Bear Institutes Bear Shepherding protocols (WRBI, 1999), the staff from AEP attempt to discourage bears from using developed areas such as campgrounds and residential areas, and to increase the wariness of those bears when interacting with the public, through the delivery of noise and pain stimuli when bears try to enter developed areas.

Some communities have specific community wildlife attractant bylaws that prohibit the feeding of wildlife and/or bylaws that prohibit feeding birds from April 1st to November 30th.

AEP, along with community partners, have had Loan or Cost Sharing Programs for landowners experiencing grizzly bear conflict for several years now. The Programs promote the use of electric fences; bear proof garbage bins and grain bin doors; sea canisters and metal hopper bottoms. Most of these projects occur outside the Recovery Zone in the Habitat Linkage, Support Zones and Outside the BMA.

AEP had created a number of Fact Sheets that are available on the [BearSmart](#) web page, including:

- [Electric Fence and Bears](#)
- [Chickens and Bears](#)
- [Bees and Bears](#)
- [Deadstock Composting and Bears](#)
- [Fruit Trees and Bears](#)

A number of videos have been created to promote co-existing with large carnivores. They include:

- [Living with Wildlife](#) – describes what one mountain town has done to try and live with wildlife;
- [Sharing the range](#) – focuses on local ranches implementing programs to live with large carnivores;
- [Zapped](#) – highlights the versatility and effectiveness of electric fence for various stakeholder groups.

The adoption and continued promotion of best practices related to mitigation, delivered by both AEP and local community groups, will help to reduce human bear occurrences. This reduction in negative interactions with bears, particularly on private lands within the Support Zone, will help to maintain tolerance levels for grizzly bears, an essential component of grizzly bear recovery in Alberta.



Figura 7. Dimostrazione dell'uso dello spray anti-orso.



Figura 8. Recinti elettrificati messi a protezione di un apiario.



Figura 9. Cassonetti di compostaggio a prova d'orso.

The confident bears in our Park: a communication problem?

Daniela D'Amico

Communications manager of the Abruzzo Lazio and Molise National Park

daniela.damico@parcoabruzzo.it

The communication role on the management of habituated bears is very much essential. A habituated bear, for definition, is a wild animal that interacts with humans, generating conflicts of a different level and nature with the human communities who live in the shared area. Nowadays, the communication of a similar topic and its management is a challenge because the phenomenon is extraordinarily complex, both from an ethological point of view than a cultural one. Like often happens in the front of a complex context, humans feel uncertain and unstable and respond, from a cognitive point of view, searching the easiest solution: it's here that the communication develops a much more important role.



Communicating about "habituated bears" means communicating to different stakeholders who, for several reasons, are all involved in managing the phenomenon. The communication of the Park administration, or any other public administration too, must speak clearly and effectively to tourists, naturalistic photographers, mountain lovers, and to residents, landowners, farmers at the same time, which are all involved in the conflicts due to the presence of a habituated bear in the area. Moreover, two other opposite stakeholders are present: the public opinion and the staff workers (such as biologists; wildlife technicians; vets; park rangers). Interacting with the first category is critical to ensure that false beliefs and news do not spread widely and become political pressures for policy makers. To dialogue and, overall, to make interacting the different staff workers is also particularly important to build shared and coherent point of views, strategies, messages, and values in the same local area, which can become a bridge between the communities and the administration officers.

The communication about "habituated bears" must consider the rapid and important social changes happened in the recent years: changes that involved both the feeling of the people towards wildlife, and the relationship between nature and existing natural areas where bears are present. To believe that the communication about "habituated bears" concerns only local communities and public opinion, in the years when tourism is the most rapidly increasing industry contributing to the 10% world PIL, means to intentionally miss an overall view and an organic strategy. An efficient communication strategy, on the contrary, must be very conscious of how rapidly increasing is the nature-based tourism: nowadays, it reaches new unknown areas and it's practiced by 20-40% of international tourists. Considering the recent years, also the park visitors are increasingly, especially because of people's desire to fully experience nature and/or see wildlife. We must pay attention: this phenomenon can cause a higher risk of negative interactions between wildlife and humans, because of a higher frequency of disturbance events coming from these outdoor recreational activities.

This growing interest in nature means that more people are approaching it, even without basic ecolog-

ical and naturalistic knowledge and respect, essential for outdoor activities without disrupting species and habitats. What really affects this issue is how people deal with wildlife today. The perception of wildlife is plagued by a raging and influential animal rights movement. In Italy, there are almost 60 million pets so distributed: 14 million between dogs and cat; 13 million birds; 30 million fishes; and almost 3 million between rodents, reptiles, and other small animals. (*ASSALCO Report, "Pet Food and Care Enterprises National Association", 2018. Eurispes data from 2019 confirm this trend*). The "dangers" of this phenomenon are truly relevant for wildlife conservationists. More often, focusing exclusively on the animal's interests, pet or not, we lose the ecological dimension at all: this form of ignorance is extremely dangerous for the environment and wildlife, and for whom is concerned in their conservation.

Unleashed ecotourism also resulted in an increase in the number and variability of outdoor recreational activities. If years ago, the visitation rate of protected areas and national parks was linked only to hiking, today there are thousands of activities which bring people to these areas: naturalistic photography; mountain bike; trail running; climbing; rafting; ski touring and so on. A change in the practiced activities also determines a change on the disturbance's type for wildlife and ecosystems, caused by who does not respect the Park's rules. The relation between ecotourism and nature conservation is, indeed, very fragile and in a continuous evolution. Protected area's managers must always remember how much these outdoor recreational activities are an important education and awareness-raising tool, which promotes the reconnection with nature for thousands of people every year. However, at the same time, if not seriously planned and controlled, these activities can be damaging for habitats and species, especially the threatened ones. Surveillance and communication are the most important actions to be conducted by the Protected Area employees to avoid the "Park-Zoo" association made by many tourists who confuse protected areas with amusement parks, where to search continuously the encounter with wildlife or other adrenaline-filled experiences. By doing so, we lose the true value of a protected area: an open-air lab for a better coexistence with all life forms.

A major barrier to communication is the problem of cognitive gaps: harmful behaviours to wildlife are not always clear and recognized. Why? The problem lies in the period that separates the cause from the effect. Indeed, the longer the period, the more difficult it is to see the connection between our daily behaviour and its consequences, both positive and negative. Many people then, even affirming their love for animals, often, don't really know how much they disturb them with their outdoor recreational activities. For this reason, balanced, ethical, authoritarian and objective communication by Parks and Protected Areas employees must be encouraged in order to educate sport and nature lovers. At the same time, similar communication must be encouraged towards local communities that, even living near bears, fall into common false beliefs and misconceptions. The bears, in fact, in their problematic behaviour and in their interactions with urban areas, make waver the common belief that exist precise and well-defined borders between wildlife and humans, which, firstly, must be respected by wildlife and then, by humans. The Parks, Administrations and ONGs role is to inspire and spread awareness of the need for a change and an adaptation of the human behaviour to reduce the conflicts and better coexist with external factors, even natural ones, which are not under our control. This requires routine's changes and behavioural adaptations that are perceived as out of our comfort zone: from a first resistance, thanks to a punctual and precise communication and process management, people can see and appreciate the benefits of a new routine and adopt the complete motivations behind. A fundamental aspect must support communication, especially in protected areas: an exact surveillance system over the entire territory. Human-bear coexistence is based on knowledge, respect and awareness, but only continues with norms that effectively mitigate conflict.

Another fundamental aspect in the communication of habituated bears is the ability to read the continuous changes of our society, even beyond the ones regarding protected area users. Reflecting on the social dynamics triggered by the social networks, we can easily understand how the time, the topics and the tools of communication have been distorted during the last years. Now more than ever, it is important to realize that communication is a major responsibility to the public and to the representative institution. Nowadays, the communication on habituated bears, to be effective, must be ethical, responsible, impartial, scientific and immediate. It must be multiform and multi-channel: it must reach both the crowd and the niche of the public interested in the environment. A public that, in the absence of a safe and respected reference point, may search for information in a world full of difficulties and shadows. In particular, the mass media involved in topics so much subjected to the sensationalism, don't always look for the good and authoritarian sources. Most often, approximation prevails, with the absence of just sources, strong sensationalism despite reality, the absence of good scientific knowledge and a strong anthropocentrism.

As previously affirmed, moreover, it's essential to have a clear and effective communication between the employees: "making a system" is the slogan used by different institutions working together for the same goal. However, "making a system" requires a common and shared communication, vision, and vocabulary, together with a unique sense of belongingness that tightens the staff workers around the same values and messages. There are several interpersonal factors which play a role in a social group, and they may have an influence in the achievement of the goals. To communicate the complex phenomenon of habituated bears to the people is not simple at all and that's why staff workers must speak the same "language". Communicating in an efficient and shared way leads to "speak" with a unique voice generating an increased reliability and trust from the public, both in the science aspects and in the institution itself. To continue the improvement of the communication on Apennine brown bears, especially habituated individuals, is needed: ongoing planning for new and consistent storytelling that takes into account what has already been done and looks for changes in the new cultural context; a shared communication between the various staff members to express the objectives to be achieved and those already achieved; attentive communication with renewed tools, data science, professional workers and socioeconomic conditions that avoid individualism and highlight the bear conservation work system.

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To conclude, the habituated bears must be thanked because they are the ones who highlight the issue of coexistence to the maximum; they are the ones which have thrown our egoism and individualism in our face, both in our approach to nature and in our inability to manage institutional processes. Mother Nature does not consider a unique species' exigences (the Homo sapiens): every species' life builds on complex ecosystems, where every part, living or not, has an influence on the good of all. Our survival as a species, indeed, depends on how much we will be able to coexist with all the other species.

Nature based tourism: implications for large carnivore conservation

Andrés Ordiz

Department of Biodiversity and Environmental Management, Zoology Unit - Universidad de León, Spain
andres.ordiz@unileon.es

Recent years are seeing an increase of recreational activities that target the observation of endangered wildlife in their natural habitats. Brown bears (*Ursus arctos*) are one of the iconic species that attract more interest from “ecotourism” in different continents, and the potential effects of such activities require close attention by responsible management agencies (Penteriani et al. 2017). This chapter a) emphasizes the need to assess and quantify the potential impacts of recreational activities that typically take place in protected areas and, b) demands a proper regulation of those activities.

Apex predators placed at the upper top of food chains, i.e., species such as bears and wolves (*Canis lupus*), generally avoid people, becoming more nocturnal in areas with higher human activity and relying in dense vegetation patches to avoid encounters (Ordiz et al. 2017). However, individuals exposed to contact with humans, may lose fear and eventually get habituated to humans, which is a threat for both the animals and people. Avoiding such a scenario is a crucial task for the responsible management agencies, particularly in the human-dominated landscapes where some carnivore populations are partially recovering former ranges (Chapron et al. 2014).

Over the last centuries, human persecution has caused the disappearance of populations of bears, wolves, and other large carnivores at a global scale (Ripple et al. 2014). However, a tendency of human populations to migrate from the countryside to cities; the partial recovery of the natural vegetation cover and of the wild ungulate populations, and some conservation efforts, have recently contributed, to a greater or lesser extent, to reverse the demographic trend of several populations of large carnivores in Europe (Chapron et al. 2014). This is a general pattern, which would require nuances and local analyzes to describe the evolution of specific populations. In this historical context, reducing the risk of extinction and securing the demographic viability of threatened species has been and continues to be main conservation goals. Nevertheless, it is also particularly important to secure that large carnivore behavior is not altered by humans and their activities, especially in the human-dominated landscapes where some species are partially recovering. Favoring long-term large carnivore recovery requires proper management of human activities, including tourism (Penteriani et al. 2017), and a maintained effort to protect wilderness zones. The latter are likely crucial to ease connectivity among different areas and, consequently, large carnivore recovery in the long term (Gilroy et al. 2015).

From a behavioral perspective, large carnivores change and adapt their patterns of feeding, resting, and moving when they meet people. If they feel threatened, animals spend more time vigilant or fleeing than feeding and resting, for instance, and become even more elusive of humans (Ordiz et al. 2013a and 2017). However, contact with humans may also generate loss of fear or even habituation of some animals to people (Ordiz et al. 2019), which in turn increases carnivores’ mortality risk. For instance, brown bear mortality



ty rate is higher closer to roads and settlements than in remoter areas (Steyaert et al. 2016).

Studies with radio-tagged bears in various parts of Europe show us that bears try their best to avoid humans spatially (avoiding human settlements) and temporally (being more nocturnal in areas with higher human activity). Most of the locations of adult Scandinavian bears, for example, are found several kilometers from towns and ski resorts, while the less secure areas, closer to people and human settlements, are those that are available and thus more used by younger individuals (Nellemann et al. 2007). In the Cantabrian Mountains of northern Spain, the monitoring of a female bear with cubs showed that during weekends, when more people visited the natural park they inhabited, the family group traveled longer distances, used more rugged terrain, farther from roads, and spent more time vigilant (Naves et al. 2001). In the Cantabrian Mountains, as in other South-European areas where bears persist, such in the Italian Apennines, wildlife coexist with people in highly humanized environments, and it is important to avoid contact between people and wild animals, bears included. The proximity of a person to a bear, often without the person even being aware of bear presence, can change bear daily rhythms of activity for many days, which can have different implications (Ordiz et al. 2013a). On the other hand, if a bear loses fear to humans, it faces higher risk of mortality, as said above, and it could also pose a risk for people. This, in turn, can fuel negative attitudes to the species. Altogether, it is essential to prevent bear-human encounters by responsibly managing human activities that can cause alterations in bear's innate behavior.

At the global scale, protected areas typically aim at fulfilling two functions, namely conserving spaces and species and boosting local economies, which in turn can dilute the first of these goals (Wittemyer et al. 2008). As an example, to illustrate this point, in the year 2015, 904 (88%) of the 1,017 mountain races registered in Spain took place within protected areas (Europarc 2016). Nearly 238,000 people took part in races inside protected areas that year, with an average of 358 people per event. These data illustrate the high volume of participation and the fact that practically all the tests are carried out in spaces with protection figures, that is, in spaces that should limit human activities, especially recreational ones, and give priority to their conservation.

While nature-based tourism in protected areas can increase the value of these spaces for the public, it must be regulated to minimize negative environmental impacts. In the case of tourism activities targeting bear observations, a fundamental requirement is that the minimum distance between observers and animals eliminates any possibility of direct contact, that is, that no bear must be aware of the human presence, so that there is no chance to their behavior and, ultimately, no possibility to get used to human presence (Ordiz 2014, Penteriani et al. 2017).

Experience from the past illustrates the importance of not altering bear behavior. Bear viewing was already going on in Yellowstone National Park during last century. Many decades ago, Yellowstone bears were artificially fed to ease observations at close distance, which led bears to become food-conditioned individuals. This fueled loss of fear to humans, direct bear-human encounters, and ultimately bear attacks to people, which ended up causing a dramatic decline of the bear population in response to management actions that were put in place to deter conflict (Herrero 2002; Yellowstone National Park 2020).

Losing fear to humans by bears and other large carnivores may also be seen as an ecological trap, where animals that happen to meet non-aggressive humans (i.e., tourists) may get used to use areas closer to human infrastructure and eventually face an increased mortality risk (Penteriani et al. 2018). In some areas, tourists target the observation of bear females with cubs of the year, which are typically more diurnal and seasonally use areas closer to people than other bears, precisely to avoid other bears during the spring mat-

ing season (Ordiz et al. 2007). Family groups may thus be easier to find and observe, but they should be protected from human disturbance, which can cause displacements and thus increased vulnerability for the cubs, and/or the loss of fear to humans for the female and/or the cubs. The same recommendation, i.e., avoid touristic activities near breeding areas, has been posed for wolves, for instance (Frame et al. 2007).

Recreational activities in protected areas and that use endangered species as tourism resources must comply with regional, national and international legislation, which includes the management plans of protected areas; recovery plans for endangered species; national strategies for conservation; as well as, for Europe at least, EU legislation that EU countries must transpose into their own legal frame. Indeed, bear recovery plans often point out specifically that it is necessary to regulate tourist activities considering seasonal differences in the bear use of habitats, to avoid interference with the biological cycle of the species. This implies setting minimum requirements for recreational activities to be implemented, imposing specific periods, places, and times of day when activities can be conducted. Many species, not only large carnivores, become nocturnal when they face increased levels of disturbance. In one hand, this can be seen positively, because this behavioral adaptation (nocturnality) can allow species to persist in human dominated landscapes by temporally avoiding periods of the day when humans are more active (Gaynor et al. 2018). However, altering ideal circadian rhythms of activity imply energetic costs that can affect wildlife negatively in terms of fitness costs, population persistence, community interactions, and evolution (Gaynor et al. 2018). For bears in particular, flexibility in daily movement patterns (i.e., becoming more nocturnal to avoid people) may also help them survive in human-dominated landscapes, but behavioral changes alter bear foraging and resting routines, potentially with fitness costs (Ordiz et al. 2013a; Hertel et al. 2016).

In conclusion, there is an urgent need of regulation of bear (and other large carnivores) based tourism to make it compatible with bear conservation. Nature based tourism can favor conservation if people engage in activities that value and appreciate natural resources, but avoiding negative impacts implies setting up a proper regulation of planned activities, considering environmental laws, scientific knowledge, and keeping in mind that altering large carnivore behavior can have negative effects for both wildlife and people. Logically, the requirements for touristic activities to be respectful will vary depending on the proposed activities and local conditions. Ultimately, it cannot be assumed without a proper assessment that the conservation of protected areas and species and recreational activities are just compatible. True protection of areas, as opposed to just "paper parks" (Wittemyer et al. 2008) seems crucial to prevent disturbance and to favor carnivore recovery, as said above (Gilroy et al. 2015). Furthermore, large carnivores should be conserved not only as mere numbers, but as a highly interactive species with an ecological function that is more likely to be fully performed if humans and carnivores interact as least as possible (Ordiz et al. 2013b and 2021, Newsome and Ripple 2015).

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Building Bear Smart Communities: Supporting the Recovery of an Expanding Marsican Brown Bear Population

Lana M. Ciarniello

*PhD and RPBio, Independent Research Scientist, IUCN SSC BSG member NA Bear Expert Team
aklak@telus.net*

Lana M. Ciarniello presented on the British Columbia (BC), Canada, Bear Smart Communities Program with a presentation titled, *Building Bear Smart Communities: Supporting the Healthy Recovery of an Expanding Marsican Brown Bear Population*. BC's Bear Smart program began in 2002, under the guidance of the BC Ministry of Environment, and supplies community-based solutions to human-bear conflicts (Davis et al. 2002). It is a voluntary bear awareness program that is based on a series of criteria that communities must fulfil to be accredited as "Bear Smart". The program has both an educational and enforcement part. It promotes voluntary proactive attractant reduction and management but recognizes that implementing and enforcing attractant bylaws may be important to achieve the level of compliance needed to reduce "problem" bear behaviour. Fulfilment of the Bear Smart Program requires participation from the provincial government, municipal government and local citizens.



The BC Bear Smart program was developed in response to how bears that got into conflicts with humans were being managed. The management of conflict bears was very reactive; bears were labelled as a "problem" and most often killed. For example, in BC from 1992-96, a minimum of 245 grizzly bears and 4,246 black bears were destroyed due to their "problem" label: that's approximately 850 black bears and 50 grizzly bears a year being removed due to perceived and actual threats to human safety in BC alone (Ciarniello 1997). Most of those Human-Bear Conflicts (HBC) were the result of the availability of human-provided non-natural attractants to bears and therefore were considered preventable (Ciarniello 1997).

The premise behind achieving "Bear Smart" status is to move from reactive management of "problem" bear behaviour to applying a proactive approach.

Proactive management is achieved largely through managing human-provided attractants, particularly restricting bear access to garbage (i.e., landfills, residential garbage bins, commercial bins, etc.), discouraging the planting of fruit trees, and encouraging bear-resistant management of gardens, bird feeders, pet food, composts, chicken coops, livestock calving areas, and livestock carcass removal. The goal is to secure attractants before bears access them because feeding on anthropogenic attractants encourages bears to develop "problem" behaviours; once a bear has been rewarded confident behaviour becomes more difficult to deter. However, education alone will not reduce human-bear conflicts (Dietsch et al. 2017) and as such the Bear Smart program combines education with enforcement. In BC it is an It is an

offence under the BC Wildlife Act to feed dangerous wildlife and enforcement is conducted by the Conservation Officer Service.

The goals to building a Bear Smart Community are to:

- Prevent the development of “problem” bear behaviour;
- Prevent conflicts between bears and humans;
- Keep bears out of communities.

To achieve those goals, the BC Bear Smart Program focuses on applying a behavioral based approach to managing HBC. The concept is based on developing a site-specific understanding of the development of “problem” bear behaviour to effectively manage humans and human-provided attractants by community. Although the development of

“problem” bear behaviour is similar the types of non-natural attractants available and the habitat configuration within and next to the communities differ. To identify the primary conflict causes by community, each community must fulfil six steps that are mandatory requirements to achieve BC’s Bear Smart Status:

1. Prepare a bear hazard assessment;
2. Prepare a bear-human management designed to address the bear hazards;
3. Revise planning and decision-making documents to be consistent with the management plan;
4. Implement a continuing education program;
5. Develop and support a bear-proof municipal solid waste management system; and,
6. Implement “Bear Smart” bylaws.

The first phase of Bear Smart is to conduct a Bear Hazard Assessment (BHA). A BHA is a *community-specific* bear profile developed to prevent human-bear conflicts. The Assessment presents a problem analysis and rates the probability of selected areas for creating “problem” bears and/or human-bear conflicts. The hazards stand for the likelihood of a bear becoming food conditioned and/or habituated to humans – *they do not* stand for the probability of simply meeting a bear or the hazard to the public. Rather, BHAs are conducted to find the site-specific sources that may be responsible for bears developing learned “problem” behaviours; by proxy reducing those sources will reduce HBC.

The Province of BC’s guidelines for conducting a BHA are to “qualitatively and/or quantitatively identify existing and potential hazards in and around communities” (Davis et al. 2002:21).

Although BHAs must be community specific because the causes, frequency, type and spatial distributions of HBC differ, there are five main criteria that each community must complete when conducting a Hazard Assessment:

1. Identify high-use bear habitat by species (grizzly or black) in the community and surrounding area (travel corridors, natural food sources such as berry patches and salmon streams, breeding areas, denning areas, etc.);
2. Map non-natural attractants within the community and surrounding area that attract and/or are accessible to bears such as landfills, transfer stations, park, highway pull- out litter barrels, orchards, residential garbage collection routes, downtown dumpsters, etc.;
3. Review and map patterns of historic bear-human conflicts based on complaint records to help with the identification of bear hazards;
4. Map human-use areas that may conflict with bear habitat such as school yards and residential areas

found next to heavy bush, walking trails that pass-through berry patches, etc.; and,

5. Using the above information, find and map existing and potential bear hazards. The hazards should be mapped with a ranking scheme of high/moderate/low.

The results of two different Bear Hazard Assessments were presented: one conducted in Prince George, BC (Ciarniello 2008) and one in Pemberton Meadows, BC (Ciarniello 2020). The two communities were chosen because they significantly differed in the types of bear hazards present. Pemberton Meadows is an agricultural community and was found to have no issues with garbage management. Instead, the lowland agricultural oriented meadow valley was acting as a facture between two Threatened grizzly bear populations. Some bears that tried to move through the meadow area encountered unsecured attractants, such as carrots. The goal of the Pemberton Meadow BHA was to allow bears to safely move through the agricultural Meadows and not become 'trapped.' Conversely, Prince George is a growing city and was found to have extreme commercial and residential waste management issues as well as concerns with the green-space landscape planning next to and within the City.

The second phase of the Bear Smart program is to develop an HBC management plan that is based on the site-specific results of the Bear Hazard Assessment. The management plan supplies detailed recommendations aimed at reducing HBC by dissuading the development of "problem" bear behaviour using proactive management strategies. For example, the management recommendations for Pemberton Meadows focused on the use of electric fencing to protect livestock and vegetable crops and the creation of movement/habitat corridors for bears to safely move between the two Threatened populations. In contrast, the recommendations for Prince George focused on implementing bear resistant residential and commercial garbage systems and the reconfiguration of green spaces to dissuade bears from being drawn into the town. Regardless of issues identified in a BHA achieving provincial Bear Smart status requires a commitment on the part of the City or municipality as well as the residents.

To fulfil the requirement for a continuing education program, Bear Smart communities have a Bear Awareness coordinator who leads an information and education program.

Educational material is developed to inform the public on bear behaviour and how to prevent and respond to bear encounters. The education program is aimed at fostering stewardship in residents. Anyone interested in learning more about bears and how to manage attractants in bear country may request a presentation, such as elementary and high schools, summer camps and community groups. The Bear Smart program may also provide bear safety workshops, such as how to effectively use bear spray. The use of bear spray as a personal protection device is encouraged in BC. The workshops increase the feeling of safety for participants, foster co- existence measures, and provide non-lethal solutions to coexist with bears.

An example Bear Smart community program was presented. In 1997 in Prince George, concerned residents formed the Northern Bear Awareness Society (NBAS). The mission of NBAS is "to reduce conflict in neighborhoods between people and bears, through education, innovation and cooperation." The NBAS is volunteer run and provides public information signs, media releases, and a bear sightings map. The Bear Awareness coordinator is also responsible for programs such as fruit tree gleaning and removal. For the past seven years, the NBAS has partnered with a local winery in Prince George (Northern Lights Estate winery) to produce an apple wine made using surplus apples from local properties. The aim is to remove unwanted fruit from within the city, so it is not available to bears. From 2015-2021, approximately 43,772 kilos (96,300 lbs.) of unwanted fruit have been donated to the winery program and thereby removed from

within the community. In turn, the winery supplies funding to the NBAS's outreach and education campaigns. Both Prince George and Pemberton Meadows have developed site-specific Bear Smart educational pamphlets based on their BHA results.

The last step necessary to achieve Provincial Bear Smart Status requires the implementation of "Bear Smart" bylaws that prohibit the provision of food to bears because of intent, neglect, or irresponsible management of attractants (Davis et al. 2002). Cities trying to obtain Bear Smart status must implement bylaws about garbage storage (residential, industrial, commercial, City & District). Bylaws about fruit bearing trees are often also considered.

The premise behind achieving Bear Smart status is to move from the reactive management of "problem" bear behaviour to applying a proactive approach. Proactive management techniques are used to deter the creation of "problem" bears which requires forethought to dissuade and predict bear problems before they occur as opposed to reacting to an event(s) as it unfolds. Examples of reactive management include destroying, translocating, moving or aversively conditioning bears that are in conflicts with humans or having to reconfigure green-spaces, fence designs or garbage storage and collection methods because they were not carefully planned at the onset. If proactive management techniques are properly and consistently implemented, they should reduce the need for reactive management and ultimately reduce the amount of funds spent on property damage inflicted by bears, Conservation Officer Service time in managing bear conflicts, and conflicts between bears and humans. Increasing or persistent bear conflicts can result in negative attitudes towards bears and hinder conservation efforts. The BC Bear Smart program aims to reduce the number of bears killed as "problems" each year, increase people's sense of safety, and improve tolerance for bear encounters.

Allegati

The Bear Smart steps and aims presented have been modified from the Provincial Bear Smart document (Davis, Wellwood and Ciarniello 2002).

The background report for BC's Bear Smart Program may be downloaded from:

<https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/human-wildlife-conflict/staying-safe-around-wildlife/bears/bear-smart>

The Ciarniello, L.M. 1997 report that formed the basis of the Bear Smart Communities background report may be downloaded from:

(PDF) Reducing-Human-Bear-Conflicts: Solutions through better management of non-natural foods (researchgate.net)

The Bear Hazard Assessment and Management plan for Price George may be downloaded from:

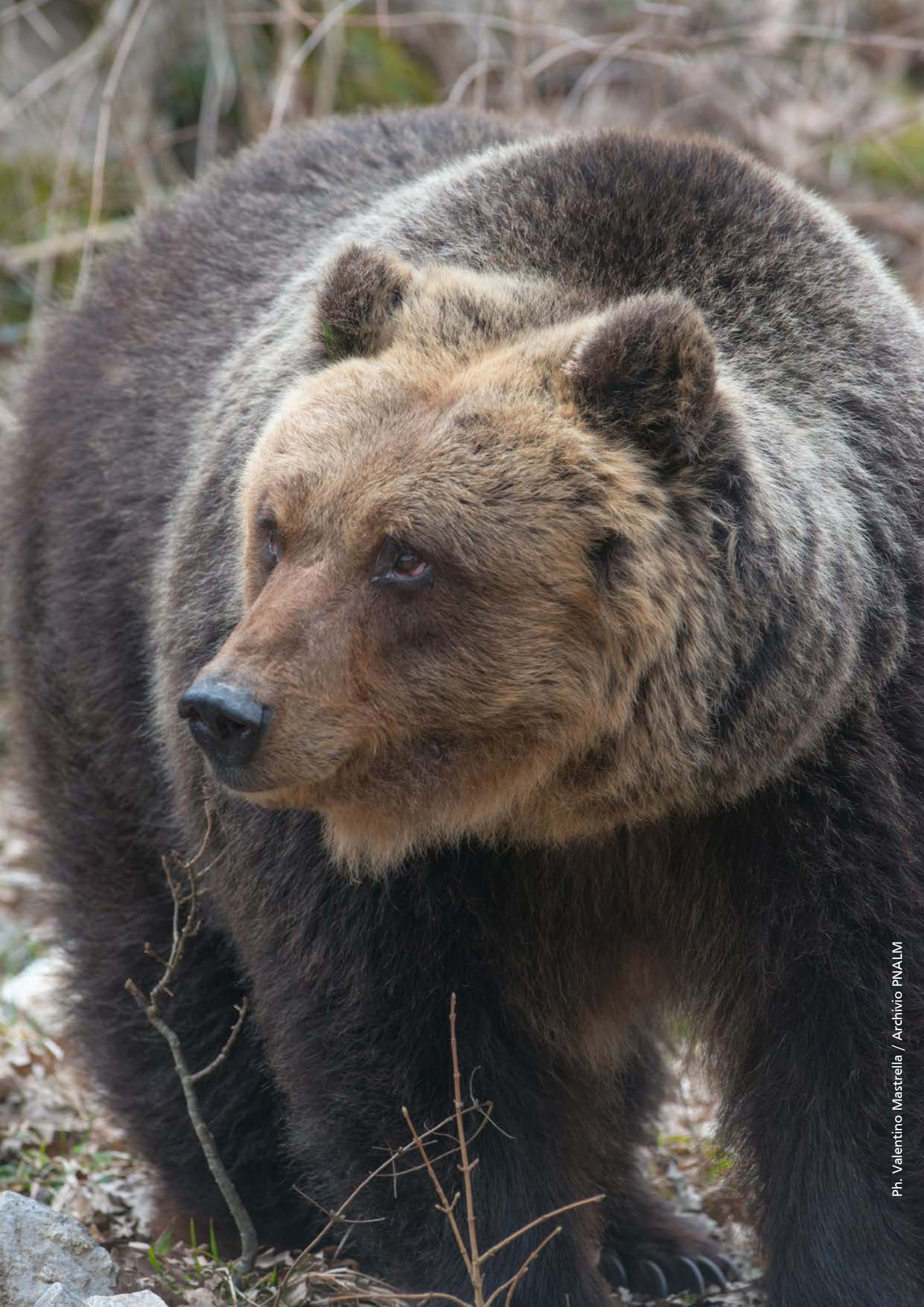
<https://www.northernbearawareness.com/reports-documents>

The Bear Hazard Assessment and Management Plan for Pemberton Meadows may be downloaded from:

https://static1.squarespace.com/static/52703aeb4b079ec23e10fa2/t/61baa52aca673c522a-8d977c/1639622075235/BHA_Pemberton_Meadows_2020%28Final%29.pdf

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