

Tagung der Alpenkonferenz
Réunion de la Conférence alpine
Sessione della Conferenza delle Alpi
Zasedanje Alpske konference

XIII

TOP / POJ / ODG / TDR

A4

IT

OL: EN

ANLAGE/ANNEXE/ALLEGATO/PRILOGA

5

Report of the Platform's Presidency

1. Background and current mandate

The Platform “Large carnivores, wild ungulates and society” was set up by the X Alpine Conference in 2009. Liechtenstein was assigned the first presidency. Switzerland was allocated the second presidency by the XI Alpine Conference and Italy the third presidency by the XII Alpine Conference.

For the period 2013-2014 the Platform dealt with the following mandate:

- Development of practical goals and management options for the recovery and conservation of wolf, lynx and (according to availability of funds) bear populations in the Alps and presentation to the relevant bodies of the Alpine Convention;
- Working towards an Alpine-wide genetic monitoring programme for large carnivores;
- Development of a map with the distribution and abundance of the Alpine ibex population in cooperation with the Alpine Ibex Group.

The work of the Platform should apparently be based on and guided by WISO Guidelines that were adopted by the XI Alpine Conference according to which *inter alia* large carnivores and wild ungulates are to be preserved in balance with their habitat, other wildlife and human interests. Conflicts with human interests are to be dealt with and negative impacts to be counterbalanced.

2, Activities since the XII Alpine Conference

2.1. Meetings

The Platform held three meetings including an extended meeting/conference.

- **Cogne (22-23 April, 2013):** the first meeting focused on the following items: handing over the presidency of the Platform from Switzerland to Italy; presentation of the working methods and objectives of the Platform mandate for 2013-2014; update and discussion on the conservation status of the lynx, wolf and bear populations, including monitoring techniques and genetic monitoring; availability of a specific working group for bears similar to other working groups dedicated to wolves and lynxes; work and coordination of the RowAlps Project; encouragement of the governmental organisations' involvement in the Platform. The meeting also underlined the need to have a common overview as a basis for the elaboration of further technical outputs that require more time.
- **Cevo (28-29 October, 2013):** the second meeting of the Platform dealt with the following points: presentation and discussion of the revised action/management plan for the bear population of Italy; establishment of a technical bear Alpine Group, cooperation with the Large Carnivore Initiative for Europe (LCIE) in the framework of an EU-funded project to elaborate a common definition of problem bears and related actions aiming at defining, preventing, and reacting to problem bear behaviour; schedule and preliminary results of the RowAlps project

and preparation of a WISO Conference in 2014.

- **Venzone (Conference 02- 04 July, 2014):** the three-day third meeting of the Platform took place in the extended format of a conference with the participation of external experts in the Platform. The following topics were tackled: EU actions and activities, including the launch of new *EU Platform on coexistence between people and large carnivores* and possible cooperation with the WISO Platform and the preliminary results of the pilot action on problem bear management in the Alpine bear population (cooperation with LCIE); the role of the ECONET Platform of the Alpine Convention with a focus on large carnivores; coordinated management of bears, wolves and lynxes in the Alps, including new and ongoing initiatives and projects related to these populations; further steps of the Bear Alpine Group , update of the RowAlps project and further proceeding; update of the IBEX map of the Alps and preparation of the mandate of the Platform for 2015-2016.

2.2. Evaluation of activities and prospects

- **Practical goals and management options for the recovery and conservation of large carnivore populations in the Alps:**

Based on the exchange of national and regional experiences and initiatives, various management options and related tools have been presented and discussed during the meetings of the Platform. Although some aspects remain common to all large carnivores, the Platform agreed that practical goals and management options have to be tailored to and differentiated according to the population concerned and its status of conservation (IUCN list). Further work on this matter will require a more profound and detailed approach.

The Platform underlined that in general these tools and options have to be prepared in the framework of protection, compensation, conflict mitigation, management and land planning for the bear and wolf populations. For the lynx population the framework of protection, active conservation efforts (genetic remedy and connectivity) and conflict mitigation with hunters has to be taken into account.

Regarding its work on practical goals and management options, the Platform stressed that some urgent actions need to be taken, and a distinction between urgent and less urgent actions has to be made for the bear and wolf populations. For the lynx population there is need to start urgent conservation actions to mitigate the effect of inbreeding.

Management options and related tools for the wolf and lynx populations are being more specifically prepared in the framework of the RowAlps Project, whose preliminary results have been discussed and will be eventually endorsed by the Platform (see annex 1: Report on the implementation of the RowAlps project). In addition, experiences and lessons drawn from other projects and initiatives for the lynx population such as the UlyCA or the DinAlp Lynx projects will also be considered by the Platform for the preparation of these tools.

The expert Bear Alpine Group created in the context of the WISO Platform will also deal with management options and the related tools for the bear population. These tools will be based on the preliminary results of the EU-funded pilot action on problem bear management in the Alpine bear

population in the context of the established cooperation between LCIE and the WISO Platform. WISO experts contributed to and participated in two meetings of the pilot action “*defining, preventing, and reacting to problem bear behaviour* in the Alpine region” in Ljubljana on 9 May 2014 and in Venzone on 4 July 2014 in connection with the WISO Conference (see annex 2: Preliminary results of the EU pilot action on problem bear management in the Alpine bear population endorsed by the WISO Platform).

- **Development of an Alpine-wide genetic monitoring programme for large carnivores:**

In general, there has been some progress regarding the harmonisation of genetic monitoring methods for large carnivores, especially considering the new laboratory techniques which do not require the calibration of data any more and thus facilitate the exchange of genetic data analyses. In addition, considerable efforts have been made in sharing the monitoring of genetic results for brown bears. In this regard, the implementation of a web-based shared database on genetic data on brown bears is being envisaged.

- **Development of an Alpine IBEX population map:**

As the Alpine countries use different management strategies and counting methods and periods, there are no common data sharing policies in Europe in this field. Therefore, this initiative, in cooperation with the Alpine Ibex European Specialist Group, aims at collecting all available data on ibex distribution and abundance. It also aims at creating a new map of the actual distribution of the species and the current population size and status of the colonies as well as of potential distribution of the species in the Alps. The map will be finalised at the end of 2014 and should be accessible on the Alpine Convention website (see annex 3: preliminary version of the IBEX map in the Alps).

- **Cooperation with the ECONET Platform of the Alpine Convention:**

In line with the recommendations of the Permanent Committee, which encourages cooperation between relevant Platforms of the Alpine Convention, both platforms have established some cooperation by participating in each other's meetings and introducing their role and mandate in order to identify more specific forms of collaboration (a representative of the ECONET Platform participated in the WISO Conference in Venzone in July 2014 and the participation of a representative of the WISO Platform in the next meeting of the ECONET Platform at the end of September is planned). The preparation of a specific workshop on ecological connectivity and large carnivores is being envisaged for the end of year 2014. The Platforms aim at enhancing this cooperation in the future.

- **Cooperation with the EU:**

Some cooperation has been established in the context of the EU pilot action on problem bears management in the Alpine bear population and in the exchange of information that took place through other EU-funded projects such as LIFE Arctos projects. The Platform aims at enhancing this exchange of information and cooperation in order to optimise the synergies between the WISO Platform and the newly established *EU Platform on coexistence between people and large carnivores*.

3. Mandate proposal for 2015-2016

The following mandate proposal for the WISO Platform for 2015-2016 is based on the activities and achievements described above and the needs identified according to the large carnivore population:



- To finalise drafting of practical goals and management options for the recovery and conservation of wolf and lynx populations in the Alps; to continue the development of practical goals and detailed guidance on the application of management options for the recovery and conservation of bears in the Alpine region. To present all management options to the relevant bodies of the Alpine Convention in 2016.
- To develop procedures, among the Contracting Parties concerned, that ensure a transparent flow of information that supports decision-making and coordinates responding actions for wolves and bears; common interpretation of behaviour of problem bears; and more effective and coordinated conservation actions for the lynxes involving the key stakeholders.
- To continue the development of coordinated programmes of genetic monitoring of wolves and bears at the Alpine scale, and to ensure a detailed understanding of the genetic risks for the conservation of lynxes to guide conservation policies in the Alps.
- These goals are to be pursued taking into account the results of the RowAlps project and other relevant projects, including EU-funded projects, and exploring synergies with the *EU Platform on coexistence between people and large carnivores* and other relevant initiatives.

Annex 1: Report on the implementation of the RowAlps project

Annex 2: Preliminary results of the EU pilot action on problem bear management in the Alpine bear population

Annex 3: Preliminary version of the IBEX map in the Alps

Report on the implementation of the RowAlps project in the framework of the WISO Platform of the Alpine Convention

The **overall goal of the RowAlps project** is to:

“Develop practical goals and management options for the recovery and conservation of wolf, lynx and (subject to availability of funding) bear populations in the Alps and to present them to the relevant bodies of the Alpine Convention.”

This is also a part of the **mandate of the WISO platform** for 2013-2014.

This overall goal is further closely linked to the main **goal of the guidelines of the WISO platform**, which was acknowledged by the Alpine Conference in March 2011 in Brdo: to “Achieve and conserve the favorable conservation status of the Wolf in the entire Alps by preservation of large carnivores and wild ungulates in balance with their habitat, other wildlife and human interest. Conflicts with human interests are addressed and negative impacts are counterbalanced. This shall be achieved by promoting dialogue concerning the relations between wildlife, habitat, and society and transboundary and cross-sectoral cooperation”.

To fulfil this overall goal the WISO platform members understood that additional capacity of experts is necessary to analyse adequately the background in the different countries and to develop appropriate solutions for the entire Alpine area. This additional work beyond the platform’s engagement is possible because of the especially designed RowAlps project financed by the MAVA foundation and Switzerland. Switzerland (BAFU) coordinates and leads this project. The RowAlps project started working in 2012 and is planned to be finalized by 2016.

The RowAlps project has an exchange and reporting with the WISO platform mainly at their meetings.

At the WISO meeting in Cogne, on April 22nd 2013 the WISO platform decided:

“To invite a sub-group of the WISO Platform to work on Objective 3 of the RowAlps project in between the WISO Platform meetings and coordinated by the Swiss Head of Delegation.” The aim was to establishing a more formal link between the WISO platform and the RowAlps project in order to strengthen and facilitate the cooperation of the two complementary initiatives.

The present report in hand is a contribution of the RowAlps project to the work of the WISO platform and the reporting of the WISO on the fulfilment of its mandate towards the bodies of the Alpine Convention.

The structure and sub-goals of the RowAlps project

Three sub – goals were defined in this project and for each of it a working group was established.

Goal of working group 1:

To review and assess, based on available scientific publications and reports, statistical materials and up-to-date experience, the present situation of wolf, lynx and prey populations in the Alps, the expected development of the populations and discuss challenges in wildlife management as a consequence of the return of the carnivores.

Goal of working group 2:

To describe mechanisms to achieve tolerance for lynx and wolf for different interest groups and to identify factors defining the tolerance and the potential measures to influence these factors.

Goal of working group 3:

To assess the output from Objective 1 and 2 and develop, considering these biological-ecological and socio-economic findings, management scenarios for the recovery and conservation of favorable wolf and lynx reference populations in the Alps, discuss them with interest groups (in the frame of the WISO Platform), and report to the relevant bodies of the Alpine Convention.

Preliminary results of the RowAlps project

Preliminary results of working group 1:

The work on the Objective 1 of the RowAlps project,

“to model the potential distribution and expected abundance at biological/ecological fringes (minimal viable population MVP versus carrying capacity (Ke)) of future Alpine wolf and lynx populations”

was originally focusing on scientific robust modeling of the distribution and the lower and upper abundances of the potential wolf and lynx populations in the Alps.

After many discussions the objective 1 of the project has finally been adapted according the goal mentioned above, mainly for two reasons:

- (1) the aims and approaches seem to have been too ambitious within the given time and financial frame. The two workshops hold revealed that the means for a solemn modeling approach (intended to stand scientific review) were too limited;
- (2) the information and input needed by Working Group 3 (management scenarios) seems to go substantially beyond wolf and lynx distribution, carrying capacity and minimum viable population

July 2014

assessment, but should include also information on prey populations and wildlife management practices, which vary considerably within the Alpine Arc.

Considering these aspects, Report 1 will aim less for new scientific modeling, but rather review and compile existing information and describe – without robust modeling – the expected higher and lower density values and the assumed expansion of the population, mainly based on empiric data from the past 20–40 years. On the other hand, it will give much more emphasis on the “ecological covariables” of carnivore conservation and management, e.g. prey species and their management. It is obvious that solutions for integrating large carnivores into the Alps strongly depend on the existing wildlife management systems and practices. These systems differ considerably between the Alpine countries, but such information is nowhere available to WG 3 in a compiled and condensed form.

Objective 1 is hence transformed into a comprehensive review of all biological and ecological parameters supporting, limiting or otherwise influencing the presence of wolf and lynx in the Alps and reviewing extant management approaches. This review bases on existing and available data and published scientific literature, but resign from developing further models. Wherever projection is needed, WG 1 would do this based on existing models, experience, and “best guess”.

With the help of several intensive discussions and workshops of WG 1 the way forward of the group has been identified as well as the tentative outline of content for Report 1:

The recovery of wolf *Canis lupus* and lynx *Lynx lynx* in the Alps: biological and ecological parameters and wildlife management challenges

1. Introduction
2. Methods (approach and map of the Alps and administrative subunits)
3. Return of lynx and wolf to the Alps (why, re-introduction, recolonisation)
4. Present situations and assessment of the Alpine wolf and lynx populations
5. Ecological factors: people, habit and prey (development and distribution of humans, development and fragmentation of suitable habitats, predation, availability of wild ungulates, wildlife management, livestock)
6. Assessment of the future development of the lynx and wolf populations in the Alps (potential distribution, abundance and expansion dynamics of the populations)
7. Discussion and conclusions (MVP, carrying capacity and FCS, interpretation, assessment)

The report of working group 1 will be drafted by end of October 2014.

Preliminary results of working group 2

The objectives of working group 2 were to describe tolerance mechanisms for lynx and wolf for different stakeholder groups and to identify factors influencing the tolerance as well as the potential measures to influence these factors. To reach these objectives,

- a meta-analysis of existing social science research on large carnivores (LC) was conducted by the Eidg. Forschungsanstalt für Wald, Schnee und Landschaft (WSL) (see Mondini and Hunziker 2013: „RowAlps Report Objective 2.1: Factors influencing attitudes towards large carnivores“) and
- interviews or workshops with experts in the fields of hunting, farming and social science research on LC were conducted by the Technische Universität München (TUM), Chair of Forest and Environmental Policy.
- A workshop with experts from hunting administrations and hunting associations in eastern Alps (Ossiach, 13.12.2013)
- A workshop with social scientists of Alpine countries to review and validate achieved results and to identify gaps of knowledge to propose further studies (Munich, 24.3.2014)

From a social science perspective three levels have to be differentiated to understand perception of and conflicts concerning LC (individual level, level of direct interaction, level of social and political conflicts). All these levels are interdependent. For each level, influencing factors were identified.

The **individual level** (describing attitudes towards LC for individual persons) is presented in the study of WSL (Mondini and Hunziker 2013).

The **level of direct interaction** between LC and actors directly affected by LC. Farming and hunting practices are influenced by the return or presence of LC. The central questions are right now whether prevention measures like flock protection work, resp. where it doesn't work and why not.

The **level of social and political conflicts**, with LC as a trigger for (existing) conflicts.

Each of the analyzed levels can be addressed by LC management actions. In the following the actions on the level of social and political conflicts are listed.

Participation

For implementing LC management, management plans have to be developed with a participatory approach not only on the national but also on regional level (see Identification of hotspots below). Concerning the participation process, it is helpful if the possibilities of sharing the power of decision among governmental decision makers and representatives of interest groups can be discussed. It has to be clear within which frame negotiations are possible: Actors will only constructively contribute to the process if they can gain something. If the demands of a certain group aren't considered and discussed, this actor will most likely boycott the process. A social monitoring (e.g. focus groups, media analysis, regular public surveys, stakeholder analysis) can evaluate management performance and the participatory process.

Identification of hotspots

Areas especially important for the return of the LC (near-border or cross-border regions, regions adjacent to core areas of LC etc.) or where coexistence of LC and given land use practices is highly challenging (e.g. alpine farming regions with less favorable natural conditions, high percentage of sheep or goat farming and no tradition of shepherding) have to be detected and LC specific management options discussed in participatory procedures at regional level. These specific regions (hotspots) and their characteristics should be considered in federal / national management plans.

Adapting the farming and hunting system

Social and political conflicts about LC are shaped by legal regulations / funding schemes of the hunting, agriculture and environmental sector. To minimize those conflicts contradictions in legal regulations and financial subsidies in these sectors need to be considered and solved. In this mainstreaming of farming, hunting and nature conservation policies LC need to be addressed as an issue. An example is the Swiss AlpFUTUR project which aims to develop solutions for expected changes in the alpine farming system. The task is to detect and implement synergy effects of LC management and other policy goals (e.g. biodiversity, nature protection or animal welfare) and to consider and reduce antagonisms of subsidies (e.g. subsidies for vulnerable livestock species) in the long term.

Current conclusions of WG 2 are in general to:

- Identify on which level(s) the conflict(s) occur(s);
- Consider all conflict levels in management plans;
- Develop and/or consider model projects for a functioning flock protection (best practice examples);
- Be open for negotiations with actors, e.g. in participatory processes or model projects;
- Be aware of participation level accepted by state administrations (process of decision-making).

Preliminary results of working group 3

2013 and 2014 the RowAlps Project entered a phase of close cooperation among the three working groups.

- In December 2012 a Workshop to prepare the work of the third working group, by defining the roles of the members of Working Group 3, took place in Vienna. During this meeting in Vienna it became clear that WG 3 needs to fulfill the third objective of the RowAlps Project and the conjunctive role among the representatives of the Parties of the Alpine Convention, the additional expert groups, and finally the different interest groups.
- At the WISO meeting in Cogne on April 22nd 2013, the platform invited a sub-group of the WISO Platform to work on Objective 3 of the RowAlps project in between the WISO Platform meetings which was coordinated by the Swiss Head of Delegation. The Delegations of the WISO Platform have recommended members to the WG 3 / sub-group of WISO, who are

July 2014

experienced in the development and implementation of management plans for large carnivores in their respective country.

- In April 2014 a meeting of WG 3 took place in Zäziwil with the goal to develop drafts of the management options on the base of the preliminary results of WG 1 and WG 2. Such preliminary management options have been drafted based on the discussions in Zäziwil and were included into the first outline of the reports on Lynx Management and Wolf Management.
- In July 2014 a next workshop of WG 3 took place in Venzone. The indexes of the draft reports and the preliminary management options have been discussed and adapted accordingly. Furthermore, the draft of a glossary has been presented.
- The draft indexes will be sent to WG 3 after the Venzone meeting again. Practical goals will be developed. The rough structure of the reports is:

Wolf and Lynx in the Alps: guidelines for an international coordinated management

- 1. Introduction** (assignment, goals, preambles, definitions)
- 2. Framework for large carnivore management** (superior law, common Alps-wide principles, reference situation)
- 3. Current situation of the wolf/lynx population** (present status, prey base, potential distribution, tolerance of interest groups)
- 4. Discussion, interpretation and assessment of the situation** (MVP, ECC FCS, hot-spot areas)
- 5. Practical goals** (FCS, distribution, damage-prevention, damage conservation, involvement of local people)
- 6. Basic issues** (Damage prevention and compensation, control of illegal action, monitoring, information and consultation)
- 7. Urgent issues**
- 8. Management: options and actions**

This report is a synthesis of the results of WG 1 and 2 as well as the results of workshops and discussions conducted in the frame of WG 3.

Outlook RowAlps 2014

Draft glossary until end of 2014

The glossary will be sent to the participants of WG 3 of RowAlps to:

1. Comment on the present definitions
2. Add missing terms
3. Add the translation of terms in the Alpine languages

Revise the glossary according to the feedback

Revised indexes for wolf and lynx for comments

The revised indexes will be sent to the members of WG 3 of RowAlps to:

1. Comment on the present index
2. Add missing issues

(all in track change)

Draft chapters 1-3 for wolf and lynx in the Alps

- draft chapters 1 – 3 (by end of the year)

- send chapters 1-3 for comments (beginning of 2015)

Report of the RowAlps project on behalf of WISO Platform

The report of RowAlps will be sent to the WISO Platform presidency not later than beginning of September as input to its report to the Alpine Convention bodies for the scheduled Alpine Conference in November 2014.

Workshop December 2014 on chapter 4

Interpretation and assessment of the situation for wolf and lynx in the Alps

Workshop spring 2015 on chapters 5, 6, 7

Discussion on practical goals, basic issues and urgent issues

PROGRESS REPORT FOR THE PILOT ACTION: DEFINING, PREVENTING, AND REACTING TO PROBLEM BEAR BEHAVIOUR IN THE ALPINE REGION

JULY 2014

Prepared by:

Aleksandra Majić Skrbušek and Miha Krofel from University of Ljubljana, Biotechnical Faculty, Jamnikarjeva 111, 1000 Ljubljana, Slovenia

Contributors (either via completing a questionnaire or by participating in a workshops): Agnieszka Sergiel, Bernhaard Gutleb, Claudio Groff, Diana Zlatanova, Djuro Huber, Elisabetta Rossi, Felix Knauer, Georg Rauer, Guiliana Nadalin, Ivan Kos, Jean-Jacques Camarra, Juan Carlos Blanco, Klemen Jerina, Marcus Elfström, Marko Jonozovič, Mateja Blažič, Michal Haring, Paolo Molinari, Peep Männil, Piero Genovesi, Reinhard Schnidrig, Robin Rigg, Slaven Reljić, Umberto Fattori, Urs Breitenmoser and Yorgos Mertzanis.

Contents:

- Defining, preventing, and reacting to problem bear behaviour in the Alpine region – Progress summary
- Literature review report
- Endnote database of the literature
- Lists of participants from the two bear expert workshops



1 DEFINING, PREVENTING, AND REACTING TO PROBLEM BEAR BEHAVIOUR IN THE ALPINE REGION – PROGRESS SUMMARY

1.1 SUMMARY OF CURRENT KNOWLEDGE

Throughout the history people have been coming into conflicts with bears. Good understanding of causes for human-bear conflicts is the first step for their effective resolution.

Human-bear conflicts are very diverse and are mainly connected with bear's opportunistic foraging and consumption of food. Several factors affect risk of human-bear conflict and probably most important is access to anthropogenic food (garbage, slaughter remains etc.). Key factor is also the number of problem bears. Although such bears represent only a small part of bear population, they usually cause majority of all human-bear conflicts, while most other bears come into conflict only rarely or never.

Common characteristic of problem bears is that during their lives they have changed their behaviour through the processes of habituation to human presence or conditioning to anthropogenic food. Habituation is a process involving a reduction in response over time as bears learn that there are neither adverse nor beneficial consequences of the occurrence of the stimulus, in this case presence of a human. Operant conditioning is a learning process, in which a behaviour is strengthened or weakened via consequences, such as reward or punishment. Food-conditioning is a type of operant conditioning, in which an animal learns to associate a given neutral stimulus (e.g. a presence of people) with reward in a form of high caloric food (e.g. various anthropogenic food sources, such as garbage). Operant conditioning can also be applied for management of human-bear conflict situations. Most common is aversive conditioning, which denotes procedure when a negative stimulus is used to prevent unwanted behaviour. Effectiveness of aversive conditioning depends on several factors, such as context in which learning process took place, immediacy of a consequence of given behavioural response, consistently and magnitude of these consequence and rewarding of alternative behaviour.

There are several factors that have been reported to affect the probability of occurrence of human-bears conflicts and other bear incidents: season, natural food availability, cover for bears, sex and age of a bear, habituation to human presence and food conditioning, availability of anthropogenic food sources, livestock husbandry, hunting and several factors that affect the probability of attack on humans (wounded bear, presence of cubs, presence of carcass used by a bear, proximity to a den, and the presence of dog).

People developed various measures to prevent human-bear conflicts. Review of reported measures and their effectiveness is presented. Aversive conditioning of bears, as well as other wildlife, was in general met with mixed results. Measures were usually effective for a short-term, while long-term behavioural changes were often limited. However, certain patterns that emerged through the review indicate that in specific situations some of the aversive stimuli can

be effective when applied properly. Good understanding of the benefits and drawbacks, as well as factors affecting effectiveness of this approach is needed in order to successfully apply aversive conditioning techniques. Higher success was observed when very specific behaviour was targeted in comparison to the attempts that required the animal to generalize aversive conditioning to less specific unwanted behaviours. Effectiveness was lower when undesired behaviour was already strongly established or when benefits gained through this behaviour were higher. Well-established monitoring that quickly detects such behaviours is therefore crucial for successful application of aversive conditioning. Pain stimuli (e.g. rubber bullets) proved to be the most successful, although also taste aversion can be effective for specific foods. Prevention of access to anthropogenic food sources must be assured in order to achieve full effectiveness of aversive conditioning. It must be understood that application of aversive conditioning can be very costly and demand considerable effort. Based on current knowledge, aversive conditioning of bears is most warranted in the following cases:

- when potential conflict behaviour is detected early in the development of a problem bear
- when short-term solution is needed
- when adequate resources are available for continuous treatments for each problem bear
- when possibilities for lethal removal are limited

Lethal removal can be effective short-term solution for individuals strongly habituated to human presence or conditioned to anthropogenic food. However, these measures must be coupled with effective measures to prevent development of new problem bears. Limiting access to anthropogenic food is regarded as the most effective way to prevent conflicts with bears, with success rates up to >90% conflict reduction. Experiences suggest that this approach gives best results when local inhabitants are actively involved. Other potentially effective measures for preventing human-bear conflicts include use of bear spray to deter bear attacks on humans and adjustments in land-use practices (e.g. transition from sheep to cattle farming, maintaining open landscape around human settlements). Compensations can, when well-designed, address inequities of distribution of damages caused by bears across society and improve tolerance towards bears, but do not affect occurrence of bear incidents.

Table 2: Overview of main types of human-bear conflicts and most effective measures to mitigate them according to the experiences reported so far. Underlined are measures used to prevent conflicts before they occur. Normal writing is used for reactive measures that have been used to prevent reoccurrence of conflicts.

CONFLICT TYPE	MAIN MEASURES FOR CONFLICT PREVENTION
Livestock depredations	<ul style="list-style-type: none"> - <u>protection of livestock using electric fences and/or livestock guarding dogs</u> - <u>night enclosures for livestock</u> - removal of the problem bear - <u>transition to species less vulnerable to bear attacks</u>
Damage on beehives, crops, orchards and other human property	<ul style="list-style-type: none"> - <u>protection of property using electric fences</u> - removal of the problem bear - aversive conditioning - <u>removing dense vegetation (cover for bears)</u>
Damage in forestry	<ul style="list-style-type: none"> - <u>supplemental feeding</u>
Bear occurrence near human settlements	<ul style="list-style-type: none"> - <u>preventing bear access to anthropogenic food</u> - removal of the problem bear - <u>education of local inhabitants</u> - aversive conditioning - <u>removing dense vegetation (cover for bears)</u>
Attacks on humans	<ul style="list-style-type: none"> - removal of bear exhibiting aggressive behaviour towards people - <u>public education</u> - <u>decreasing bear habituation to humans and food conditioning (e.g. through preventing access to anthropogenic food and aversive conditioning)</u> - use of bear spray - <u>temporary limiting public access to most critical bear habitats and bear dens</u>
Vehicle collisions	<ul style="list-style-type: none"> - <u>appropriate planning when constructing transportation network</u> - construction of safe under- or over-passes for bears in combination with electric fences - <u>removing or preventing access to attractants (e.g. garbage bins) near roads and railways</u> - <u>measures used to prevent bear habituation to humans</u>

1.2 OVERVIEW OF EXISTING FRAMEWORKS

Bear experts and managers from 13 different European countries provided information on how their national management plans define **habituated and food conditioned** bears and what are the management approaches used in dealing with habituated and food conditioned bears.

Terms “habituated” and/or “human food conditioned” bears are very rarely used in the official management documents. Most often a term that would roughly translate to “**problem bear**” is used to describe a habituated or food conditioned bear, but in some countries this includes practically any conflict-causing bear behaviour (i.e. not related to repetitive behaviour). A range of **problematic bear behaviours** is usually described, and proposed management measures are linked to those behaviours.

How and when a bear is considered to be a problem bear varies considerably between the countries. The “diagnostic tools” range from **simple definitions** (e.g. a bear that is repeatedly approaching anthropogenic food sources) and individual **ad hoc expert assessments** to **complex classification systems** used for risk assessment. Overall, countries with smaller (more endangered) populations tend to have more complex and better defined risk assessment protocols which include management recommendations.

Although the overview of the theoretical background would suggest that preventive proactive measures should be a priority, management plans mostly deal with **reactive management**. Documents provide variable level of detail, but generally foresee following management measures: close monitoring, aversive conditioning, removal or fencing of the attractant, removal of individual animals (lethal or translocations to nature/captivity), compensations for the damages, information campaigns, emergency teams. **Proactive management** aimed at preventing occurrence of problem bears is often related to implementation of individual projects and is not systematically organized. Such measures include: prevention of damages to agriculture, prevention of access to organic waste, enhancing the trophic value of bear habitat (i.e. feeding of bears at feeding stations, planting of wild fruit trees), information campaigns to influence problematic human behaviour (intentional or unintentional feeding or disturbing of bears), dialogue with stakeholders, emergency teams, green bridges and specific road signs, abandoning the practice of rehabilitation of orphaned bears.

Considering the diversity of management approaches it is evident that **public perception** plays a considerable role both in identifying a “problem bear” and in selection of the appropriate reactive management measures.

1.3 RISK ASSESSMENT PROTOCOL AND MANAGEMENT RECOMMENDATIONS

European brown bear experts and managers were brought together in two workshops to discuss and develop a general approach to risk assessment regarding brown bear behaviours which can pose threat to human safety. Below is the most recent output, organized in a risk assessment protocol.

Degree of problem and urgency of action	Individual bear behaviour	Recommended management actions	Recommended public communication actions
	the bear unaware of your presence is continuing its natural behaviour.	no action towards the bear	Provide information on bear biology. Provide information on of human-bear encounters 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
	bear is repeatedly coming close to continuously inhabited houses	intensive monitoring, remove attractants and dense vegetation – cover for the bears, if appropriate (damage prevention), deterrence	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 starts 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.
	bear starts a false attack when surprised or provoked	investigation, monitoring	
	bear is defending its food by threatening and false attacking	investigation, monitoring	
	bear is searching for food or is causing damages close to inhabited houses	monitoring, damage prevention (remove attractants), chasing the bear away, removal of the dense vegetation (cover for the bear)	Provide targeted information on avoidance of human-bear conflicts (including 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 enters uninhabited buildings such as barns, stables and sheds close to inhabited houses several times	removal of attractants, intensive monitoring, deterrence, removal of dense vegetation (cover for the bear) - In populations classified as endangered (IUCN) or better or depending on the social context removal may be considered as the first option.	
	bear attacks (physical contact) a human after being provoked (e.g. by dogs, disturbance of the den)	intensive monitoring - In populations classified as endangered (IUCN) or better or depending on the social context removal may be considered as the first option.	
	bear is repeatedly intruding compact residential areas	- 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 deterrence 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,...).
	Injured bear attacks a human	removal of the bear	Rationalize management decision by explaining the causes and

	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	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 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,...).
	bear enters inhabited buildings	Removal of the bear	
	bear is defending its food by attacking	intensive monitoring, (deterrence), possibly removal of the bear	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.
	bear attacks a human without being 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.

1.3.1 CONSIDERATIONS FOR SPECIFIC BEAR CATEGORIES

1.3.1.1 INJURED/HANDICAPPED BEARS

An injured bear will more likely demonstrate a problematic behaviour. In a case when an injured or otherwise handicapped bear occurs, an ad hoc assessment should be carried out by a bear manager (intervention group) and a veterinarian. Taking into account the conservation status of the population and likelihood of the recovery following decisions can be made:

1. Bear will recover by itself, no other actions but intensive monitoring recommended.
2. Provide the bear necessary treatment if feasible, return it to nature and closely monitor its recovery.
3. If complete recovery is unlikely or treatment is not feasible and the population is considered vital, remove the bear from the population.

1.3.1.2 ORPHANED CUBS

Orphaned bear cubs are not self-sufficient for survival without their mothers until they are at least six months old. Bear cubs which have been raised by humans have a high chance of developing problematic behaviour due to their habituation to humans. Because of that the practice of rehabilitation of human-raised bears is generally not recommended.

1.3.1.3 FEMALES WITH CUBS AND SUBADULT BEARS

Females with cubs and subadult bears are more likely to become exposed to situations which lead to habituation and food conditioning. For these two categories it is especially important to implement habituation and food conditioning prevention measures (i.e. instructing the public not to offer food to the female with cubs) and aversive conditioning as soon as possible.

1.4 CONCLUSIONS

Human-bear conflicts are complex and diverse. Consequently there is no single one-for-all solution to effectively prevent all of these problems. Because often few problem bears cause large part of all bear incidents, special attention needs to be given to preventing development of repetitive conflict behaviour. According to available knowledge, preventing access to anthropogenic food in combination with public education is in many cases the most effective approach. Experiences from several regions suggest that this approach gives best results when local inhabitants are actively involved. Successful preventive management is also considerably more acceptable to public than reactive responses once the conflicts have already occurred. Once problem behaviour is developed in a bear, changing it can be considerable challenge. Well-established monitoring that quickly detects such behaviours is crucial for successful application of aversive conditioning techniques that revise the process of habituation to human presence and/or conditioning to anthropogenic food. Once this process has proceeded to higher stages, considerably more effort will be needed to prevent further conflict behaviour and in some cases bear removal may be the only option.

1.5 LITERATURE

- Andelt WF, Phillips RL, Gruver KS, Guthrie JW (1999) Coyote predation on domestic sheep deterred with electronic dog-training collar. *Wildlife Society Bulletin* 27 (1):12-18. doi:10.2307/3783933
- Austrian Bear Emergency Team (2006) JJ1 „Bruno“ in Austria and Germany 2006: Protocol and Risk Assessment. Austrian Bear Emergency Team, Vienna
- Baruch-Mordo S, Wilson KR, Lewis DL, Broderick J, Mao JS, Breck SW (2014) Stochasticity in natural forage production affects use of urban areas by black bears: implications to management of human-bear conflicts. *PLoS One* 9 (1):e85122. doi:10.1371/journal.pone.0085122
- Bath AJ (2009) Working with people to achieve wolf conservation in Europe and North America. In: Musiani M, Boitani L, Paquet PC (eds) *A new era for wolves and people: wolf recovery, human attitudes, and policy*. University of Calgary Press, Calgary, Canada, pp 173–199
- Beckmann JP, Lackey CW, Berger J (2004) Evaluation of deterrent techniques and dogs to alter behavior of "nuisance" black bears. *Wildlife Society Bulletin* 32 (4):1141-1146
- Bejder L, Samuels A, Whitehead H, Finn H, Allen S (2009) Impact assessment research: use and misuse of habituation, sensitisation and tolerance in describing wildlife responses

- to anthropogenic stimuli. *Marine Ecology Progress Series* 395:177-185. doi:10.3354/meps07979
- Bereczky L, Pop M, Chirac S (2011) Trouble making brown bears *Ursus arctos* Linnaeus, 1758 (Mammalia: Carnivora) - Behavioral pattern analysis of the specialized individuals. *Travaux du Muséum National d'Histoire Naturelle «Grigore Antipa» LIV* (2):541-554
- Bischof R, Swenson JE, Yoccoz NG, Mysterud A, Gimenez O (2009) The magnitude and selectivity of natural and multiple anthropogenic mortality causes in hunted brown bears. *J Anim Ecol* 78 (3):656-665. doi:10.1111/j.1365-2656.2009.01524.x
- Boitani L, Ciucci P (2009) Wolf management across Europe: species conservation without boundaries. In: Musiani M, Boitani L, Paquet PC (eds) *A new era for wolves and people: wolf recovery, human attitudes, and policy*. University of Calgary Press, Calgary, pp 15-40
- Boitani L, Ciucci P, Raganella-Pelliccioni E (2010) Ex-post compensation payments for wolf predation on livestock in Italy: a tool for conservation? *Wildlife Research* 37 (8):722-730. doi:http://dx.doi.org/10.1071/WR10029
- Bouton ME (2007) *Learning and behavior: A contemporary synthesis*. Sinauer Associates, Sunderland, MA, US
- Breck S, Williams C, Beckmann J, Matthews S, Lackey C, Beecham J (2008) Using genetic relatedness to investigate the development of conflict behavior in black bears. *Journal of Mammalogy* 89 (2):428-434
- Breitenmoser U, Angst C, Landry JM, Breitenmoser-Wursten C, Linnell JDC, Weber JM (2005) Non-lethal techniques for reducing depredation. In: Woodroffe R, Thirgood S, Rabinowitz A (eds) *People and Wildlife. Conflict or Coexistence*. Cambridge University Press, Cambridge,
- Brosi G, Jenny H, Schnidrig R, Briner T, Molinari P, Theus M (2008) Protokoll und Beurteilung der Ereignisse rund um Bär JJ3 Sommer 2007 – Frühling 2008. Amt für Jagd und Fischerei Graubünden, Bundesamt für Umwelt,
- Brown R, Jeffries S, Wright B, Tennis M, Gearin P, Riemer S, Hatch D (2007) Field report: 2007 pinniped research and management activities at Bonneville Dam. U.S. Army Corps of Engineers, Portland District, Fisheries Field Unit Bonneville Lock and Dam Cascade Locks, Oregon
- Budic L (2010) Brown bears in northern and southern Europe: are they seeking food or avoiding dominant bears? Master thesis. Norwegian University of Life Sciences, Aas
- Bulte EH, Rondeau D (2005) Why compensating wildlife damages may be bad for conservation. *Journal of Wildlife Management* 69:14-19
- Chruszcz B, Clevenger AP, Gunson KE, Gibeau ML (2003) Relationships among grizzly bears, highways, and habitat in the Banff-Bow Valley, Alberta, Canada. *Canadian Journal of Zoology* 81 (8):1378-1390
- Ciucci P, Boitani L (2008) The Apennine brown bear: a critical review of its status and conservation problems. *Ursus* 19 (2):130-145. doi:10.2192/07per012.1
- Clark JE, Manen FTV, Pelton MR (2002) Correlates of success for on-site releases of nuisance black bears in Great Smoky Mountains National Park. *Wildlife Society Bulletin* 30 (1):104-111. doi:10.2307/3784643
- Coleman TH, Schwartz CC, Gunther KA, Creel S (2013) Grizzly bear and human interaction in Yellowstone National Park: An evaluation of bear management areas. *The Journal of Wildlife Management* 77 (7):1311-1320. doi:10.1002/jwmg.602
- Conklin JS, Delwiche MJ, Gorenzel WP, Coates RW (2009) Detering cliff-swallow nesting on highway structures using bioacoustics and surface modifications. *Human-Wildlife Conflicts* 3:93-102
- Cozza K, Fico R, Battistini ML, Rogers E (1996) The damage-conservation interface illustrated by predation on domestic livestock in central Italy. *Biol Conserv* 78 (3):329-336
- Creachbaum MS, Johnson C, Schmidt RH (1998) Living on the edge: a process for redesigning campgrounds in grizzly bear habitat. *Landscape Urban Plan* 42 (2-4):269-286
- Cromsigt JPGM, Kuijper DPJ, Adam M, Beshta RL, Churski M, Eycott A, Kerley GIH, Mysterud A, Schmidt K, West K (2013) Hunting for fear: innovating management of human-wildlife conflicts. *Journal of Applied Ecology* 50 (3):544-549. doi:10.1111/1365-2664.12076
- Darimont CT, Carlson SM, Kinnison MT, Paquet PC, Reimchen TE, Wilmsers CC (2009) Human predators outpace other agents of trait change in the wild. *Proceedings of the National Academy of Sciences* 106(3): 952-954. doi:10.1073/pnas.0809235106
- Derocher AE, Miller S (1985) Bear deterrent study-Cape Churchill, Manitoba. Rep. for the Gov. Northwest Territ., Canada.
- Dolson S (2010) Responding to human-black bear conflicts: A guide to non-lethal bear management techniques. Get Bear Smart Society.
- Elfström M, Zedrosser A, Støen O-G, Swenson JE (2013) Ultimate and proximate mechanisms underlying the occurrence of bears close to human settlements: review and management implications. *Mammal Review* 44(1):5-18. doi:10.1111/j.1365-2907.2012.00223.x
- Fontúrbel FE, Simonetti JA (2011) Translocations and human-carnivore conflicts: problem solving or problem creating? *Wildlife Biol* 17 (2):217-224. doi:10.2981/10-091
- Forrest KW, Cave JD, Michielsens CGJ, Haulena M, Smith DV (2009) Evaluation of an electric gradient to deter seal predation on salmon caught in gill-net test fisheries. *North American Journal of Fisheries Management* 29 (4):885-894. doi:10.1577/m08-083.1
- Fredriksson G (2005) Human-sun bear conflicts in East Kalimantan, Indonesian Borneo. *Ursus* 16 (1):130-137.
- Gearin PJ, Pfeifer R, Jeffries SJ, DeLong RL, Johnson MA (1988) Results of the 1986-1987 California sea lion-steelhead trout predation control program at the Hiram M. Chittenden Locks. NWAFC Processed Rep. 88-30. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, Seattle
- Gibeau M, Stevens S (2005) Grizzly bear response to human use. In: Herrero S (ed) *Biology, demography, ecology and management of grizzly bears in and around Banff National Park and Kananaskis Country: The final report of the Eastern Slopes Grizzly Bear Project*. University of Calgary, Calgary, p 12
- Gibeau ML, Clevenger AP, Herrero S, Wierzchowski J (2002) Grizzly bear response to human development and activities in the Bow River Watershed, Alberta, Canada. *Biol Conserv* 103 (2):227-236
- Gillin CM, Hammond FM, Peterson CM (1994) Evaluation of an aversive conditioning technique used on female grizzly bears in the yellowstone ecosystem. *International Conference on Bear Research and Management* 1:503-512
- Gillin CM, Hammond FM, Peterson CM (1995) Aversive Conditioning of Grizzly Bears. Can bears be taught to stay out of trouble? *Yellowstone Science Winter* 1995:1-7
- Gillin CM, Chestin IE, Semchenkov P, Claar J (1997) Management of bear-human conflicts using laika dogs. *International Conference on Bear Research and Management* 2:133-137
- Gniadek SJ, Kendall KC (1998) A summary of bear management in Glacier National Park, Montana, 1960-1994. *Ursus* 10:155-159
- Gray RM, Vaughn MR, McMullin SL (2004) Feeding wild American black bears in Virginia: a survey of Virginia bear hunters, 1998-99. *Ursus* 15 (2):188-196
- Greenleaf SS, Matthews SM, Wright RG, Beecham JJ, Leithead HM (2009) Food habits of American black bears as a metric for direct management of human-bear conflict in Yosemite Valley, Yosemite National Park, California. *Ursus* 20 (2):94-101. doi:10.2192/08gr027.1
- Groff C, Bragalanti N, Rizzoli R, Zanghellini P (2013) 2012 Bear Report of the Forestry and Wildlife Department of the Autonomous Province of Trento. Autonomous Province of Trento, Trento
- Gunther KA, Haroldson MA, Frey K, Cain SL, Copeland J, Schwartz CC (2004) Grizzly bear-human conflicts in the Greater Yellowstone ecosystem, 1992-2000. *Ursus* 15 (1):10-22.
- Gunther KA, Hoekstra HE (1998) Bear-inflicted human injuries in Yellowstone National Park, 1970-1994. *Ursus* 10:377-384
- Hawley JE, Gehring TM, Schultz RN, Rossler ST, Wydeven AP (2009) Assessment of shock collars as nonlethal management for wolves in Wisconsin. *Journal of Wildlife Management* 73 (4):518-525. doi:10.2193/2007-066
- Herrero S (1994) The Canadian national parks and grizzly bear ecosystems: the need for interagency management. *Int Conf Bear Res and Manage* 9:7-21
- Herrero S (2002) *Bear attacks: Their causes and avoidance*. 2 edn. Nick Lyons Books, New York

- Herrero S, Higgins A (2003) Human injuries inflicted by bears in Alberta: 1960-98. *Ursus* 14 (1):44-54
- Herrero S, Smith T, DeBruyn TD, Gunther K, Matt CA (2005) Brown bear habituation to people-safety, risks, and benefits. *Wildlife Society Bulletin* 33 (1):362-373
- Hopkins JB (2013) Use of genetics to investigate socially learned foraging behavior in free-ranging black bears. *Journal of Mammalogy* 94 (6):1214-1222
- Hopkins JB, Herrero S, Shideler RT, Gunther KA, Schwartz CC, Kalinowski ST (2010) A proposed lexicon of terms and concepts for human-bear management in North America. *Ursus* 21 (2):154-168. doi:10.2192/ursus-d-10-00005.1
- Hopkins JB, Kalinowski ST (2013) The fate of transported American black bears in Yosemite National Park. *Ursus* 24 (2):120-126
- Hopkins JB, Koch PL, Ferguson JM, Kalinowski ST (2014) The changing anthropogenic diets of American black bears over the past century in Yosemite National Park. *Frontiers in Ecology and the Environment* 12 (2):107-114. doi:10.1890/130276
- Hopkins JB, Koch PL, Schwartz CC, Ferguson JM, Greenleaf SS, Kalinowski ST (2012) Stable isotopes to detect food-conditioned bears and to evaluate human-bear management. *The Journal of Wildlife Management* 76 (4):703-713. doi:10.1002/jwmg.318
- Horstman LP, Gunson JR (1982) Black bear predation on livestock in Alberta. *Wildlife Society Bulletin* 10 (1):34-39
- Howe EJ, Obbard ME, Black R, Wall LL (2010) Do public complaints reflect trends in human-bear conflict? *Ursus* 21 (2):131-142
- Huber D (2010) Rehabilitation and reintroduction of captive-reared bears: feasibility and methodology for European brown bears *Ursus arctos*. *International Zoo Yearbook* 44 (1):47-54. doi:10.1111/j.1748-1090.2009.00089.x
- Huber D, Kusak J, Majic-Skrbinsek A, Majnaric D, Sindicic M (2008) A multidimensional approach to managing the European brown bear in Croatia. *Ursus* 19 (1):22-32
- Huffman J, al. e (2010) New Jersey Bear Aversive Conditioning Report. Northeast Wildlife DNA Laboratory, East Stroudsburg University
- Huygens OC, Hayashi H (1999) Using electric fences to reduce Asiatic black bear depredation in Nagano prefecture, central Japan. *Wildlife Society Bulletin* 27:959-964
- Jenkinson EM Aversive conditioning and monk seal – human interactions in the main Hawaiian Islands: Aversive Conditioning Workshop. In: Aversive Conditioning Workshop, Honolulu, Hawaii, November 10-11, 2009 2010. U.S. Dep. Commer., NOAA Technical Memorandum
- Jerina K, Jonozovič M, Krofel M, Skrbinek T (2013) Range and local population densities of brown bear *Ursus arctos* in Slovenia. *Eur J Wildl Res*:1-9. doi:10.1007/s10344-013-0690-2
- Jerina K, Krofel M, Stergar M, Videmšek U (2011) Factors affecting brown bear habituation to humans: a GPS telemetry study. Final report. University of Ljubljana, Biotechnical Faculty, Department of Forestry and Renewable Forest Resources, Ljubljana
- Joep KL (1985) Implications of grizzly bear habituation to hikers. *Wildlife Society Bulletin* 13 (1):32-37
- Kaczensky P (1999) Large Carnivore Depredation on Livestock in Europe. *Ursus* 11:59-72
- Kaczensky P, Jerina K, Jonozovič M, Krofel M, Skrbinek T, Rauer G, Kos I, Gutleb B (2011) Illegal killings may hamper brown bear recovery in the Eastern Alps. *Ursus* 22 (1):37-46
- Kaczensky P, Chapron G, von Arx M, Huber D, Andrén H, Linnell JDC (2012) Status, management and distribution of large carnivores – bear, lynx, wolf & wolverine – in Europe. Istituto di Ecologia Applicata & IUCN/SSC Large Carnivore Initiative for Europe,
- Kavčič I, Adamič M, Krofel M, Jerina K, Kaczensky P (2011) Brown bear food habits in human dominated landscapes of Slovenia: importance of intensive long-term supplemental feeding. In: 20th International conference on bear research and management, July 17-23, 2011, Ottawa, Ontario, Canada. Program and abstracts, pp 162-163
- Kavčič I, Adamič M, Kaczensky P, Krofel M, Jerina K (2013) Supplemental feeding with carrion is not reducing brown bear depredations on sheep in Slovenia. *Ursus* 24:111-119. doi:10.2192/ursus-d-12-00031r1.1
- Kloppers EL, St. Clair CC, Hurd TE (2005) Predator-resembling aversive conditioning for managing habituated wildlife. *Ecology and Society* 10 (1):31-48
- Knight RR, Blanchard BM, Eberhardt LL (1988) Mortality patterns and population sinks for Yellowstone grizzly bears, 1973-1985. *Wildlife Society Bulletin* 16:121-125
- Krofel M, Jerina K (2012a) Review of human-bear conflicts: causes and possible solutions. *Professional Journal of Forestry* 70 (5-6):235-253 [in Slovenian with English summary]
- Krofel M, Jonozovič M, Jerina K (2012b) Demography and mortality patterns of removed brown bears in a heavily exploited population. *Ursus* 23 (1):91-103. doi:10.2192/ursus-d-10-00013.1
- Leigh J, Chamberlain MJ (2008) Effects of aversive conditioning on behavior of nuisance Louisiana black bears. *Human-Wildlife Conflicts* 2 (2):175-182
- Linnell JDC, Aanes R, Swenson JE, Odden J, Smith ME (1997) Translocation of carnivores as a method for managing problem animals: a review. *Biodivers Conserv* 6 (9):1245-1257. doi:10.1023/B:Bioc.0000034011.05412.Cd
- Linnell JDC, Lescureux N, Majic A, von Arx M, Salvatori V (2013) From conflict to coexistence: Results from a stakeholder workshop on large carnivores in Brussels, January 2013. Istituto di Ecologia Applicata, Norwegian Institute for Nature Research and IUCN/SSC Large Carnivore Initiative for Europe,
- Linnell JDC, Odden J, Smith ME, Aanes R, Swenson JE (1999) Large carnivores that kill livestock: do "problem individuals" really exist? *Wildlife Society Bulletin* 27 (3):698-705
- Madison JS (2008) Yosemite National Park: the continuous evolution of human-black bear conflict management. *Human-Wildlife Conflicts* 2 (2):160-167
- Maren S (2001) Neurobiology of Pavlovian fear conditioning. *Annual Review of Neuroscience* 24 (1):897-931. doi:10.1146/annurev.neuro.24.1.897
- Martin J, Basille M, van Moorter B, Kindberg J, Allainé D, Swenson JE (2010) Coping with human disturbance: spatial and temporal tactics of brown bear. *Canadian Journal of Zoology* 88:875-883
- Mason JR, Shivik JA, Fall MW (2001) Chemical repellents and other aversive strategies in predation management. *Endangered Species Update* 18:175-181
- Mattson DJ 1990 Human impacts on bear habitat use. *Int Conf Bear Res and Manage* 8:33-56
- Mattson DJ (1998) Changes in mortality of Yellowstone's grizzly bears. *Ursus* 10:129-138
- Mattson DJ, Blanchard BM, Knight RR (1992) Yellowstone grizzly bear mortality, human habituation, and whitebark-pine seed crops. *Journal of Wildlife Management* 56 (3):432-442
- Mazur R, Seher V (2008) Socially learned foraging behaviour in wild black bears, *Ursus americanus*. *Animal Behaviour* 75 (4):1503-1508.
- Mazur RL (2010) Does Aversive Conditioning Reduce Human—Black Bear Conflict? *The Journal of Wildlife Management* 74 (1):48-54
- McArthur Joep KL (1983) Habituation of Grizzly Bears to People: A Hypothesis. *Int Conf Bear Res and Manage* 5:322-327
- McCarthy TM, Seavoy RJ (1994) Reducing nonspout losses attributable to food conditioning: human and bear behavior modification in an urban environment. *International Conference on Bear Research and Management* 9:75-84
- McCullough DR (1982) Behavior, Bears, and Humans. *Wildlife Society Bulletin* 10 (1):27-33. doi:10.2307/3781798
- McLellan BN, Hovey FW, Mace RD, Woods JG, Carney DW, Gibeau ML, Wakkenin WL, Kasworm WF (1999) Rates and causes of grizzly bear mortality in the interior mountains of British Columbia, Alberta, Montana, Washington, and Idaho. *Journal of Wildlife Management* 63 (3):911-920
- Meagher M, Phillips JR (1983) Restoration of natural populations of grizzly and black bears in Yellowstone National Park. *Int Conf Bear Res and Manage* 5:152-158
- Miller GD (1983) Responses of captive grizzly and polar bears to potential repellents. *Int Conf Bear Res and Manage* 5:275-279
- Miltenberger R (2007) Behavior modification: principles and procedures. Cengage Learning
- Moen GK, Støen O-G, Sahlén V, Swenson JE (2012) Behaviour of Solitary Adult Scandinavian brown bears (*Ursus arctos*) when approached by humans on foot. *PLoS One* 7 (2):e31699. doi:10.1371/journal.pone.0031699
- Naughton-Treves L, Grossberg R, Treves A (2003) Paying for tolerance: Rural citizens' attitudes toward wolf depredation and compensation. *Conserv Biol* 17 (6):1500-1511

- Nisbet ICT (2000) Disturbance, habituation, and management of waterbird colonies. *Waterbirds: The International Journal of Waterbird Biology* 23 (2):312-332. doi:10.2307/4641163
- Ohta U, Jusup M, Mano T, Tsuruga H, Matsuda H (2012) Adaptive management of the brown bear population in Hokkaido, Japan. *Ecological Modelling* 242:20-27. doi:10.1016/j.ecolmodel.2012.05.011
- Ordiz A, Bischof R, Swenson JE (2013) Saving large carnivores, but losing the apex predator? *Biol Conserv* 168 (0):128-133.
- Ordiz A, Støen O-G, Sæbø S, Kindberg J, Delibes M, Swenson JE (2012) Do bears know they are being hunted? *Biol Conserv* 152:21-28. doi:10.1016/j.biocon.2012.04.006
- Ordiz A, Støen OG, Delibes M, Swenson JE (2011) Predators or prey? Spatio-temporal discrimination of human-derived risk by brown bears. *Oecologia* 166 (1):59-67. doi:10.1007/s00442-011-1920-5
- Osborn FV (2002) Capsicum oleoresin as an elephant repellent: field trials in the communal lands of Zimbabwe. *J Wildlife Management* 66 (3):674-677
- Penteriani V, Delgado MDM, Melletti M (2010) Don't feed the bears! *Oryx* 44:169-170
- Primm S, Wilson SM (2004) Re-connecting grizzly bear populations: Prospects for participatory projects. *Ursus* 15 (1):104-114
- Ralf R (1995) History of bear-human conflict management in Jasper National Park: 1907-1995. Jasper National Park
- Rankin CH, Abrams T, Barry RJ, Bhatnagar S, Clayton DF, Colombo J, Coppola G, Geyer MA, Glanzman DL, Marsland S, Others (2009) Habituation revisited: an updated and revised description of the behavioral characteristics of habituation. *Neurobiology of learning and memory* 92 (2):135-138
- Rauer G, Kaczensky P, Knauer F (2003) Experiences with Aversive Conditioning of Habituated Brown Bears in Austria and other European Countries. *Ursus* 14 (2):215-224
- Rogers LL (2011) Does diversionary feeding create nuisance bears and jeopardize public safety? *Human-Wildlife Interactions* 5 (2):287-295
- Rogers LL, Kuehn DW, Erickson AW, Harger EM, Verme LJ, Ozoga JJ (1976) Characteristics and management of black bears that feed in garbage dumps, campgrounds or residential areas. *International Conference on Bear Research and Management* 3:169-175
- Sagor JT, Swenson JE, Roskaft E (1997) Compatibility of brown bear *Ursus arctos* and free-ranging sheep in Norway. *Biol Conserv* 81 (1-2):91-95
- Sahlén V (2013) Encounters between brown bears and humans in Scandinavia – contributing factors, bear behavior and management perspectives. Doctorate thesis. Norwegian University of Life Sciences, Department of Natural Resource Management, Ås
- Sato Y, Mano T, Takatsuki S (2005) Stomach contents of brown bears *Ursus arctos* in Hokkaido, Japan. *Wildlife Biol* 11 (2):133-144
- Schirokauer DW, Boyd HM (1998) Bear-human conflict management in Denali National Park and Preserve, 1982-94. *Ursus* 10:395-403
- Schultz RN, Jonas KW, Skuldt LH, Wydeven AP (2005) Experimental use of dog-training shock collars to deter depredation by gray wolves. *Wildlife Society Bulletin* 33 (1):142-148. doi:10.2307/3784849
- Schwartz CC, Swenson JE, Miller SD (2005) Large carnivores, moose, and humans: a changing paradigm of predator management in the 21st century. *Alces* 39:41-63
- Selva N, Berezowska-Cnota T, Elguero-Claramunt I (2014) Unforeseen effects of supplementary feeding: ungulate baiting sites as hotspots for ground-nest predation. *Plos One* 9 (3):e90740. doi:10.1371/journal.pone.0090740
- Serban-Parau N (1999) Brown bear-man conflicts at the garbage deposits in Prahova valley and Brasov, Romania. Paper presented at the 12th International Conference on Bear Research and Management, Poiana Brasov, Romania,
- Shettleworth SJ (2009) Cognition, Evolution, and Behavior. Oxford University Press, USA,
- Shivik JA, Martin DJ (2000) Aversive and disruptive stimulus applications for managing predation. *Wildlife Damage Management Conferences - Proceedings Paper* 20
- Shivik JA, Treves A, Callahan P (2003) Nonlethal techniques for managing predation: primary and secondary repellents. *Conserv Biol* 17 (6):1531-1537
- Sindicic M, Zec D, Huber D (2011) Analysis of brown bear damages in Croatia in the period from 2004 until 2009. *Sumar List* 135 (1-2):63-68
- Smith TS, Herrero S, DeBruyn TD (2005) Alaskan brown bears, humans, and habituation. *Ursus* 16 (1):1-10
- Smith TS, Herrero S, DeBruyn TD, Wilder JM (2008) Efficacy of bear deterrent spray in Alaska. *Journal of Wildlife Management* 72 (3):640-645. doi:10.2193/2006-452
- Sowka P (2009) Techniques and refuse management options for residential areas, campgrounds, and group-use area. *Living with Predators Resource Guide Series. Living with Wildlife Foundation, Montana Fish, Wildlife and Parks. Living with Black Bears, Grizzly Bears and Lions Project. 3. edition. Swan Valley, Montana*
- Spencer RD, Beausoleil RA, Martorello DA (2007) How agencies respond to human-black bear conflicts: a survey of wildlife agencies in North America. *Ursus* 18 (2):217-229
- Swenson J (1999) Does hunting affect the behavior of brown bears in Eurasia? *Ursus* 11:157-162
- Swenson JE, Andren H (2005) A tale of two countries: large carnivore depredation and compensation schemes in Sweden and Norway. In: Woodroffe R, Thirgood S, Rabinowitz A (eds) *People and Wildlife, Conflict or Coexistence?* Cambridge University Press, Cambridge, U.K., pp 323-339
- Swenson JE, Gerstl N, Dahle B, Zedrosser A (2000) Action Plan for the conservation of the Brown Bear (*Ursus arctos*) in Europe. Council of Europe Publishing,
- Swenson JE, Sandegren F, Söderberg A, Heim M, Sørensen OJ, Bjärvall A, Franzén R, Wikan S, Wabakken P (1999) Interactions between brown bears and humans in Scandinavia. *Biosphere Conservation* 2:1-9
- Tavss EA (2005) Correlation of reduction in nuisance black bear complaints with implementation of a nonviolent program and a hunt. New Jersey public hearing on the comprehensive black bear management policy. State University of New Jersey, Rutgers, New Jersey, USA.
- Ternent MA, Garshelis DL (1999) Taste-aversion conditioning to reduce nuisance activity by black bears in a Minnesota Military Reservation. *Wildlife Society Bulletin* 27 (3):720-728
- The Wildlife Team DNPap (2003) Bear-Human Conflict Management Plan. The Wildlife Team, Denali National Park and Preserve; Center for Resources, Science, and Learning, Alaska, Denali Park
- Treves A, Jurewicz RL, Naughton-Treves L, Wilcove DS (2009) The price of tolerance: wolf damage payments after recovery. *Biodivers Conserv* 18 (14):4003-4021. doi:10.1007/s10531-009-9695-2
- Treves A, Karanth KU (2003) Human-carnivore conflict and perspectives on carnivore management worldwide. *Conserv Biol* 17 (6):1491-1499
- Treves A, Wallace RB, Naughton-Treves L, Morales A (2006) Co-managing human-wildlife conflicts: a review. *Human Dimensions of Wildlife* 11:383-396
- Vaughan MR, Scanlon PF, Mersmann SE, Martin DD (1989) Black bear damage in Virginia. *Proceedings of the Eastern Wildlife Damage Control Conference* 4:147-154
- Whittaker D, Knight RL (1998) Understanding wildlife responses to humans. *Wildlife Society Bulletin* 26 (2):312-317.
- Wilder JM, DeBruyn TD, Smith TS, Southwold A (2007) Systematic collection of bear-human interaction information for Alaska's national parks. *Ursus* 18 (2):209-216
- Wilson SM (2007) Community-supported conservation of grizzly bears on private agricultural lands. Final close-out report for conservation innovation grant. U.S. Department of Agriculture – Natural Resources Conservation Service, Portland, OR
- Wilson SM, Madel MJ, Mattson DJ, Graham JM, Merrill T (2006) Landscape conditions predisposing grizzly bears to conflicts on private agricultural lands in the western USA. *Biol Conserv* 130 (1):47-59. doi:10.1016/j.biocon.2005.12.001
- Witmer GW, Whittaker DG (2001) Dealing with nuisance and depredating black bears. *Western Black Bear Workshop* 7:73-81
- Woods CP, Heinrich WR, Farry SC, Parish CN, Osborn SAH, Cade TJ (2007) Survival and reproduction of California Condors released in Arizona. In: Mee A, Hall LS, Grantham J (eds) *California Condors in the 21st Century. American Ornithologists' Union and Nuttall Ornithological Club,*

- WSPA (2009) Principles of Human-Bear Conflict Reduction. Human-Bear Conflict Working Group, Istanbul
- Zabel A, Holm-Muller K (2008) Conservation performance payments for carnivore conservation in Sweden. *Conserv Biol* 22 (2):247-251. doi:10.1111/j.1523-1739.2008.00898.x
- Zedrosser A, Dahle B, Swenson JE, Gerstl N (2001) Status and management of the brown bear in Europe. *Ursus* 12:9–20
- Zedrosser A, Gerstl N, Rauer G (1999) Brown bears in Austria: 10 years of conservation and actions for the future. Umweltbundesamt GmbH, Vienna
- Ziegltrum GJ (2004) Efficacy of black bear supplemental feeding to reduce conifer damage in western Washington. *Journal of Wildlife Management* 68 (3):470-474
- Zimmermann B, Wabakken P, Dötterer M (2003) Brown bear–livestock conflicts in a bear conservation zone in Norway: are cattle a good alternative to sheep? *Ursus* 14:72-83

