

Humans or bears: why not both?

The creation of an analytical framework to assess the transferability of non-lethal measures to mitigate the human-bear conflict and its application to the Trentino-Alto Adige (Italy) case

Master thesis (30 ECTS)



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Summary

Human interactions with wildlife escalating into conflictual and dangerous situations for both parties are called human-wildlife conflicts (HWCs), and occur worldwide with different species. This thesis focuses only on the human-bear conflict (HBC) in the Trentino-Alto Adige region (Italy).

There, after almost going extinct, brown bears have been reintroduced in 1999 and are currently increasing and counting almost 100 specimens. This has, consequently, raised the number of damages to livestock, crops and beehives and attacks to people. The conflict is mitigated with proactive and reactive measures and with damages compensation. Some measures, such as captivity and culling, are strongly rejected by animal rights groups but the level of tolerance of local populations towards bears is decreasing, as some episodes of illegal killings show. This case, hence, may benefit from the transfer of measures from areas experiencing the same conflict.

It is, in fact, very important that countries dealing with the same HWC exchange knowledge and, according to literature, it is urgent to enhance the transferability of measures. Currently, there is no framework taking into account the necessary success conditions to assess the transferability of measures to mitigate the HBC, so this thesis developed one and applied it to the Trentino-Alto Adige case, in order to gather some teachings on transferability for this case and in general. The transferability of some promising non-lethal measures in terms of conflict mitigation not yet applied in Trentino was assessed, namely the bear-spray, diversionary feeding, wildlife corridors and conditioned taste-aversion.

The results, obtained through literature review and interviews with experts working in the area, show that the bear-spray meets the most the transferability conditions in Trentino and would be successful in preventing bears attacks, while conditioned taste-aversion is promising in decreasing the predation of anthropogenic food sources but needs to be adequately tested. Diversionary feeding and wildlife corridors do not meet the transferability conditions in Trentino and would, therefore, hardly be transferred.

This is in line with literature, as every conflict has its own features and requires tailor-made solutions. Moreover, the interviewees also confirmed the importance of exchanging experience with colleagues from abroad and highlighted the need of a better communication with locals and a higher implementation of culling when needed.

In conclusion, the findings and the transferability framework developed have the potential of being helpful not only for this case-study but also to assess transferability of measures for HWC in general, and, to a greater extent, contribute to the enhancing of co-existence between people and wildlife.

Preface

It was only in the last year of my bachelor degree, that I started thinking more seriously about my professional future. I did some soul searching and wondered what I wanted to achieve in my life. What I understood was that I felt the need of doing something valuable, something for the next generations and for the weakest, those who do not have a voice and have to bear the consequences of someone else's choices. This made me realize I really wanted to undertake a study programme that could help me in at least trying to make things better. That is how I came across the Sustainable Development master of science, which in these two years gave me the opportunity to learn a lot on different topics related to sustainability and made me much more aware of what is happening in our world.

While writing a paper for an assignment I discovered the existence of an issue called "human-wildlife conflict" and learnt that there are many types of situations where people and wildlife fight for the same resources and areas and threaten each other's' lives. I immediately understood this is a very important issue in our current world, which is seeing the increase of human population which takes always more space. How are we going to co-exist with mammals, large carnivores and predators, then? I felt I needed to give my contribution to this, so I looked into some conflict occurring in my country, Italy, and found about the human-bear conflict in Trentino and realised I could try to suggest some new measures to alleviate a complex situation. This thesis is addressed to all the people working with conservation and human-wildlife conflict, as it strives to improve one local situation but may be useful even at a broader scale. If this thesis, with its results and recommendations, will help even one person, one bear or any other animal to have a better life, then my personal aim would be accomplished. I think it is not too ambitious to dream about a world where people and wildlife live together in harmony, respecting each other.

I really want to thank my supervisor, Prof. Dr. Hens Runhaar, for guiding me through the writing of this thesis. He has always encouraged me in these months and provided me with very valuable and useful pieces of advice and suggestions. I also want to thank the experts I had the opportunity and pleasure to interview, namely Claudio Groff, Andrea Mustoni and Filippo Zibordi for their fundamental contribution, without them this thesis would not have been complete.

This thesis is dedicated to my grandad, who has always supported me through my studies and transmitted to me the love and respect for nature.

1. Introduction

1.1. The Human-Wildlife Conflict

Human interactions with wildlife have been recorded since the very beginning of human life and, as early cave paintings can show, they included both fighting for the same resources and predation. Nowadays, the interactions are still happening frequently and can have either positive or negative connotations, which can escalate into conflictual situations (Nyhus, 2016). This thesis focuses on the latter.

Human-Wildlife Conflict (HWC) “occurs when the needs and behaviour of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife. These conflicts may result when wildlife damage crops, injure or kill domestic animals, threaten or kill people” (Madden, 2004, p. 248), but also when people try or manage to kill that wildlife. As of today, HWC is said to be a problem in many areas of the world (Mayengo, Bwagalilo & Kalumanga, 2017) and can involve several species, such as mammals, birds, reptiles, insects and fish (Manfredo & Dayer, 2004). All in all, interactions and conflicts between humans and wildlife pose serious threats to both sides’ existence. It is urgently needed, therefore, to carry on an integrated research that could improve the HWC management (Schell et al., 2021). It would be impossible, for the sake of time, to investigate and contribute to the mitigation of all the conflicts, hence, this thesis will focus only on one of them, namely the Human-Bear Conflict (HBC) and in one specific area, the Trentino-Alto Adige (hereafter only Trentino) region in the north-east of Italy. The HBC can, in fact, be mitigated by looking at what is currently used in other conflictual areas to improve the situation. Transferring knowledge from countries where different or more advanced mitigation measures are applied can, indeed, provide managers working with conflicts with additional expertise and measures to be adapted to the different context (Can, D’Cruze, Garshelis, Beecham & Macdonald, 2014). This research, therefore, strives to improve the transferability of measure to mitigate the HBC and to foster co-existence in conflictual situations; this is done by creating a framework to explore the transferability of successful measures, consequently applied to the Trentino case in order to obtain teachings on transferability for this case and in general.

1.2. The Human-Bear Conflict in Trentino-Alto Adige

The HBC is defined as “any situation where wild bears use (undesirably) or damage human property; where wild bears harm people; or where people perceive bears to be a direct threat to their property or safety” (Can, et al., 2014, p. 501) and “when a bear was intentionally harmed or killed (not including legal harvest) by a person” (Hopkins et al., 2010, p. 157). This phenomenon takes place in different parts of the world, such as North America, Canada and Europe, but, as already said, the focus of this thesis is on Trentino. This area has been selected because there, the HBC has basically arisen due to a reintroduction project carried out in 1999. Conflicts in areas where bears have been recently reintroduced can be more severe, as people are not used anymore to live with them, posing even bigger tolerance and conservation problems (Bombieri et al., 2019). In Trentino, in fact, people’s acceptance of bears has substantially declined, escalating into illegal bears killings as well (Tosi et al., 2015; Tattoni, Grilli & Ciolli, 2017). Moreover, despite being so far successful, the

reintroduction project's viability depends on future management and conflict mitigation, making clear the need of additional research on solutions to the conflict (Peters et al., 2015).

The coexistence between humans and the brown bear (*Ursus arctos arctos*), in fact, has never been simple in the Central-Eastern Alps and conflicts have been happening for a long time (Hardenberg, 2015). The bear population was abundant in the Alps until the 17th century but it started to decline in the 18th century due to the increasing deforestation for agricultural purposes and in the 19th century to the excessive persecution from farmers and killings from hunters, which lead to a near-extinction of the brown bear in the Italian Alps (Tosi et al., 2015). Therefore, the Adamello-Brenta Natural Park in the Trentino region decided to promote the “LIFE Ursus” project, with the support of the European Union, the province of Trento and the Italian Institute of Wildlife, with the aim to reintroduce the brown bears in the Central-Eastern Alps. For this purpose, between 1999 and 2002, 10 bears were translocated from Slovenia, whose bears are genetically very similar to the Trentino ones (Tosi et al., 2015). The project can be said to be very successful, as in 2019 the brown bear population in Trentino accounted between 82 and 93 specimens and probably reached up to 100 in 2020 (Groff et al., 2020; Groff et al., 2021). Consequently, also the number of conflicts between humans and bears has been rising since then as it can be seen in figure 1 (Tosi et al., 2015), resulting in over a million euros damages occurred and compensated by the province of Trento between 2009 and 2019 and 5 attacks to people (ISPRA-MUSE, 2021). Some of those problematic bears were subsequently enclosed in the Alps wildlife rescue centre called “Casteller”. Their conditions are reported by the CITES and Italian authorities to be very poor, as the space available for them is very little compared to what they would have if they were free. This has raised many protests by Italian animal rights groups who complain about bears' treatment in Trentino (Policante, 2021). Moreover, from 2003, 34 bears have been found dead, of these, 15 died because of anthropogenic causes; in particular, 4 due to illegal killings, 7 due to accidents and 4 due to authorized killings (Groff et al., 2020).

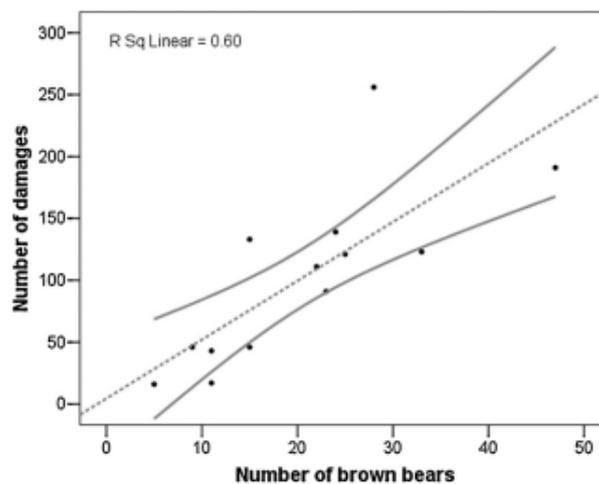


Figure 1: “Linear regression between the number of damages recorded in Trentino in the period 2000-2012 and bear consistency in the same area” (Tosi et al., 2015, p.14).

According to the report on problematic bears written by ISPRA, the Italian Higher Institute for Protection and Environmental Research, and MUSE, the museum of science of the province of Trento, the Trentino bears population is going to increase, which will, most likely, result in an intensification of the HBC as well, representing a problem for the future conservation of bears and the co-existence with people (ISPRA-MUSE, 2021). Therefore, the management of bears from the regional authorities will have to be improved and intensified. For these reasons, the investigation of further measures to reduce the conflict appears fundamental. Measures from other conflictual contexts can, in fact, provide an important starting point for future research and co-existence, since they could constitute useful proactive and reactive options needed there, as recommended by ISPRA-MUSE (2021), before resorting to culling, which should be applied only in extremis. Moreover, the PACOBACE, which is the Interregional Action Plan for the Conservation of the Brown Bear in the Central-Eastern Alps, underlines the importance of exchanging knowledge and mitigation plans with other contexts experiencing the same type of conflict (AA. VV., 2010).

1.3. Scientific background and knowledge gap

Currently, the HWC has been studied for many years and the number of papers written on it has been rising (Nyhus, 2016) as it can be seen in figure 2.

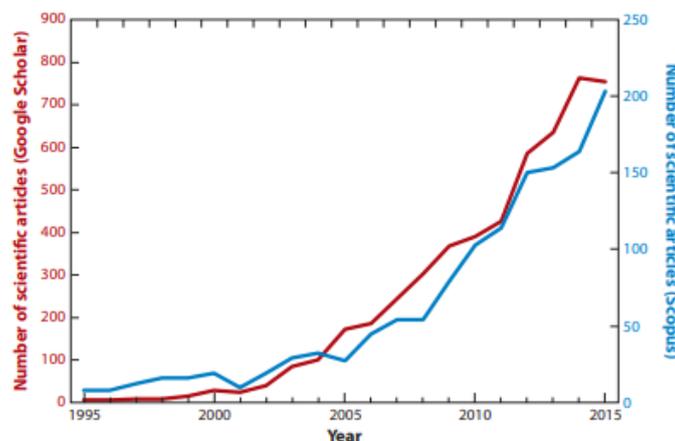


Figure 2: Growth in scientific papers dealing with human-wildlife conflict between 1995 and 2015 (Nyhus, 2016).

HBCs in different parts of the world, such as North America, Canada and East Europe have been investigated as well, which has helped in coming up with management techniques to mitigate the problem but also calls for further research to improve the situation, especially on non-lethal methods (Don Carlos, Bright, Teel & Vaske, 2009; Jerina et al., 2015; Bombieri et al., 2019). The issue of how managing conflictual situations persists and there is a continuous need of new measures, as the conflicts are not going to stop anytime soon (Schell et al., 2021). Moreover, papers expressing the effectiveness of some non-lethal measures in specific parts of the world, call for further investigation to assess their transferability elsewhere (Smith, Herrero, Debruyn & Wilder, 2008; Sage, 2019, Bombieri et al., 2019). This is because there is an urgent need to enhance and strengthen the transferability of knowledge regarding measures to mitigate the HBC from places where conflict management is in high force to others, adapting them to the different contexts (Can et al., 2014). Some countries, in fact, have been dealing with bears for longer and possess more knowledge and expertise in

managing them, which, if transferred, can be helpful for other areas to mitigate their conflictual situations. In North-America, human-bear management plans have been developed for a very long time and propose measures to the conflict. This knowledge has now been increasingly adopted by other continents as well. However, the transfer of such measures requires detailed attention to the peculiarities of each area, which, therefore, require tailor-made solutions (Can et al., 2014). As of now, the available scientific literature on the transferability of measures to mitigate not only the HBC but also the HWC in general, appears very scarce. This thesis will, hence, try to fill in the knowledge gap by creating a framework to assess the transferability of non-lethal HBC mitigating measures, which analyses the presence of success conditions that should be taken into account when considering of transferring measures from one place to another and by applying it to the Trentino case, which, as already explained, currently needs an improved management for the increasing conflict. The results on the transferability of measures may be helpful not only in Trentino but also for other HBC and HWC situations in need for innovative or alternative solutions, so this thesis will also derive some learnings on transferability for this case which could be useful for other cases as well.

1.4. Research aim, questions and framework

The main aim of this thesis is to fill in the void in scientific literature on the transferability of non-lethal measures implemented to mitigate the HBC by creating a framework that assesses transferability of measures taking into account the needed success conditions and by applying it to the Trentino case in order to provide learnings on transferability for this case but also in general. This framework is intended to check the transferability only of measures considered successful in other parts of the world, where with “successful” it is meant that the measures not only reduce the current extent of conflict but also decrease the possibility of future problems, such as damages, attacks, vehicle collisions and illegal killings (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). It will be applied to Trentino by looking at which elsewhere successful measures still have not been applied there and by assessing their transferability according to the presence of the needed success conditions.

In order to achieve the aforementioned goal, a research question needs to be answered:

What are the necessary success conditions for the transferability of non-lethal measures to mitigate the human-bear conflict and to what extent are they met in the Trentino case?

A set of sub-questions will also steer towards answering the main research question:

1. What are the necessary success conditions for the transferability of HBC measures according to the literature?
2. What are the successful measures applied abroad to mitigate the HBC? Which ones are already applied in Trentino and which are not?
3. What is the assessment of the transferability of the measures not applied in Trentino?
4. What are the learnings on transferability for this case that can be useful for other cases?

A research framework has also been developed to show the research steps needed to achieve the research aim:

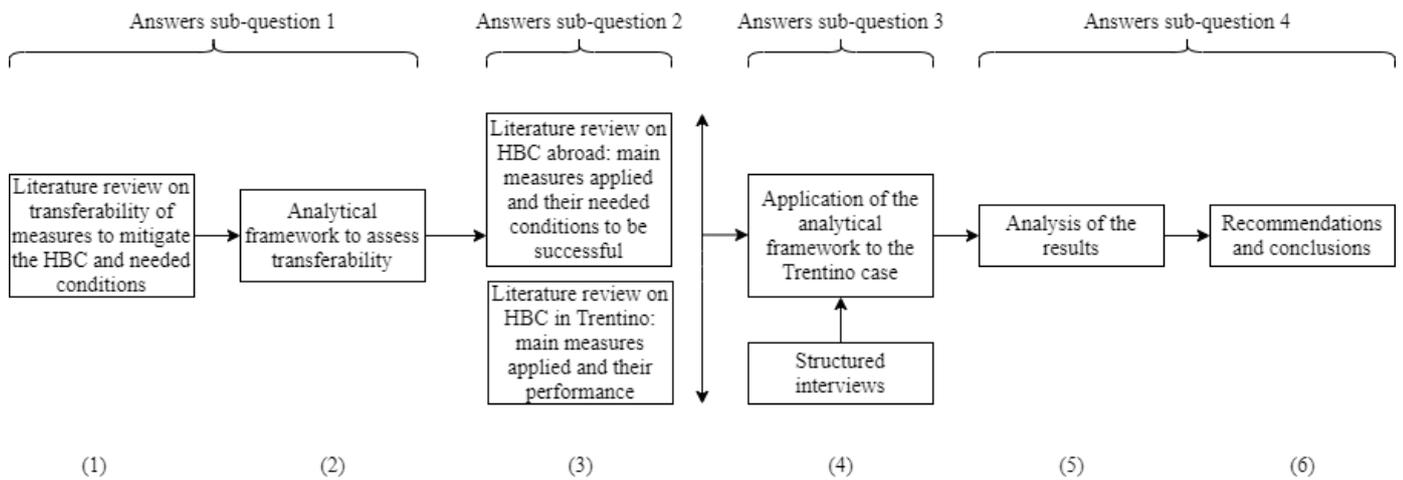


Figure 3: Research framework.

As the framework suggests, the steps involved in this research start with literature review on transferability of measures to mitigate the HBC and on the general necessary conditions to transfer successful measures elsewhere. The second step concerns the creation of the analytical framework that will later on be applied. Then, some literature review on the HBC abroad will be conducted and the main measures applied and their performance, namely how successful they are in reducing the present and future conflict in terms of damages, attacks, vehicle collisions and illegal killings, will be investigated. Then, the main measures adopted in Trentino and their performance will be explored as well. It will be possible, after that, to identify which successful measures are still not applied in Trentino, and therefore, eligible for transferability. In the fourth step the analytical framework to assess the transferability will be applied to the selected measures still not adopted in Trentino and some structured interviews will be performed to help collect data. The results obtained will then be analysed and lead to some final recommendations and conclusions.

1.5. Scientific relevance

This thesis aims at contributing to scientific literature by providing an analytical framework that could be used when analysing the transferability of successful measures to mitigate the HBC, since transfer of knowledge is fundamental but many context-dependent factors need to be considered, as advised by Can et al. (2014). Moreover, it will also, hopefully, improve the situation in Trentino by supplying a transferability analysis of new measures that could mitigate the conflict. If the selected measures were found to be transferrable to Trentino, in fact, this thesis could represent a valuable starting point for further research on them by the team of experts working in that area. If not, this research could still be worthwhile as it would represent a preliminary study on the non-transferability of such measures and the underlying reasons, which could inform HBC management in other contexts as well, allowing further research in more meaningful directions. Theoretically speaking, this thesis adds to the field of human-wildlife management new insights and potential measures for a type of HBC that threatens both mankind and wildlife, and does so by analysing a local context, as suggested by Bombieri et al. (2019). This can, however, provide results and lessons that could be extended to transferability in other parts of the world and useful for other types of conflict as well. This is because the

study of the transferability of measures implied in the conflict mitigation can be helpful for different bear species and for other wildlife since it could shed a light on important aspects and conditions that should be taken into consideration before transferring a measure from one context to another (Can et al., 2014).

1.6. Societal relevance

Nowadays, there are many HWCs and interactions in the world which can even worsen due to the growing population trend and climate-change related effects and lead to catastrophic consequences such as SARS-COV-2 pandemic (Schell et al., 2021). Studying one of these conflicts, therefore, is a step further towards a human-wildlife reconciliation and peaceful co-existence, where biodiversity is protected while also ensuring people's health and welfare (Nyhus, 2016). Societally speaking this thesis has the potential to help mitigating the HBC in the Trentino region, which is affecting not only wildlife, but also people. Local farmers, breeders, beekeepers, tourists and excursionists have to deal with an unpleasant situation, which is, even if very remotely, potentially threatening both their lives and income. People's tolerance towards bears in Trentino is, in fact, decreasing and some episodes of illegal killings of bears have occurred (Tosi et al., 2015). Showing the transferability of some additional measures to the conflict could make the whole picture more liveable for everyone. Reconciling with nature, and bears, can also represent an additional value for Trentino, as their presence in a safe environment can promote eco-tourism and bear-watching, creating sources of income for people (Tattoni et al., 2017, Penteriani et al., 2018, Glikman et al., 2019). Bears, in fact, are said to be archetypal flagship species, namely species that are so charming that can affect an entire conservation program by becoming the symbol of it and therefore protecting whole ecosystems (Simberloff, 1999). Furthermore, the understanding of the context in which the conflicts take place is fundamental because it can lead to different attitudes and behaviours of people towards the animals, resulting in various types of management (Glikman et al., 2019). Studying the patterns of the conflictual areas can, therefore, trigger a better cooperation between managers and communities and foster a greater co-existence with wildlife, not only in Trentino but elsewhere (Glikman et al., 2019). Therefore, this thesis will, hopefully, be helpful for all the stakeholders dealing with bears in Trentino, by providing an assessment of the transferability of measures to mitigate the conflict there and recommendations for further research on the issue but also for human-wildlife managers in general thanks to the framework developed and the learnings on transferability.

After having presented the social and scientific background of the problem, the research aim, the societal and scientific relevance of this thesis, the next sections will discuss the main theories involved in it and the methods used.

2. Theoretical background

2.1. Causes of the HWC and mitigation measures

Before proceeding with the development of the framework for the HBC, it is, however, important to first understand what do HWCs entail, which are the root causes and the main measures applied to try to solve them.

The conflicts have severe consequences on both sides. On one hand, humans can be impacted directly or indirectly. Direct impacts involve human injury, or worse, death, as a result of an animal's attack such as bite or claw, a collision between animals and vehicles or from the transmission of parasites and diseases (Nyhus, 2016). The recent SARS-COV-2 pandemic, which is likely to have a zoonotic origin (Chakraborty & Maity, 2020; Ye et al., 2020), is a demonstration of how dangerous and complicated human-wildlife interactions can be (Schell et al., 2021). Indirect impacts comprehend the costs farmers and rangers incur into to protect the crops and livestock, but also the economic losses due to crop-raiding, lowered psychological well-being and food insecurity. On the other hand, wildlife is threatened as well, as the conflicts can lead to the extinction of many species, resulting, to a larger scale, in cascading effects and disruptions in ecological system services (Nyhus, 2016).

The causes underlying the conflicts are multiple and so are the management measures used to solve or at least mitigate them. The main drivers of the HWC are both ecological and social, combined with habitat conditions and global trends affecting the world (Nyhus, 2016). Starting with the ecological drivers, life-stage can affect the occurrence of the conflicts, since a sick, injured and old animal may be more prone to predate livestock because it is no longer able to compete for wild prey. Sex is another element influencing the conflicts, as it has been seen that, for example, male elephants, felids and bears are more implicated in crop-raiding and livestock predation. Females protecting their cubs are also usually involved (Nyhus, 2016). Moreover, food and water distribution and people and wildlife spatial distribution are all said to affect the type, duration, extent and time of the conflicts. The absence of wild preys can, indeed, increase the probabilities of livestock predation (Nyhus, 2016). Human and social behaviours can influence the conflicts as well. Culture and beliefs can differently frame the perception of the risk, leading to various responses from the people involved in the conflict, resulting in more tolerance or anger towards wildlife. The historical context where the conflicts occur plays a fundamental role as well, since people can be more used to them and develop co-existence techniques that can mitigate the HWCs (Nyhus, 2016). In addition to that, human population and economic development are rapidly growing, resulting in an alteration of the Earth as a whole. Mankind is expanding and becoming more urban than rural, hence reducing wildlife habitat. It is expected that by 2050, between 200 and 300 million of hectares will additionally be dedicated to agriculture, in order to satisfy the demand of the always increasing population (Nyhus, 2016). This will inevitably cause more encounters, and more likely, conflicts with wildlife. Moreover, climate-change related effects, such as droughts, floods, warming and acidification can exacerbate an already fragile situation (Nyhus, 2016).

Before deepening into the measures used to solve the HWC, it is important to know, in general, how is the HWC managed. The main measures adopted to mitigate to the conflict are both non-lethal and lethal. The former consists of the use of devices that can prevent the conflict to happen or at least, make the damages tolerable, such as physical barriers, noise and fire disturbance to, for example, keep wildlife away from the crops. However, wildlife often becomes used to such deterrents, making them successful only in the short-term (Shaffer, Khadka, Van Den Hoek & Naithani, 2019). Therefore, it is sometimes necessary to resort to

lethal methods, like the culling of the problematic specimen or targeted removal (Nyhus, 2016). Killings can also happen by exasperated people, who rely on resources that are raided by wildlife, leaving them with less food and income possibilities, despite of some kind of compensation provided by the governments (Mariki, Svarstad & Benjaminsen, 2015). The systems of conflict prevention and mitigation deriving from protecting crops and livestock and from offsetting the damages occurred amount to billions of dollars spent worldwide (Nyhus, 2016).

2.2. Necessary success conditions for HBC and HWC measures' transferability

In general, in order to be transferrable, a measure, a project or a policy is first required to be suitable to the context under study, feasible from the practical point of view and acceptable by the local communities (Johnson, Scholes & Whittington, 2009; Massei, Roy & Bunting, 2011). If the needed conditions are missing, it would therefore mean that the measures could hardly be transferred; if present, this could trigger further research from the competent team of expert in order to check for the effective transferability.

However, the scientific literature specifically regarding transferability of measures to mitigate the HBC and the necessary success conditions is extremely scarce, but some important ones could still be gathered. First, the HBC and HWC are highly dependent on human factors, which can favour or hinder the effectiveness of mitigation measures (Teel et al., 2010). The lack of public support on certain measures, in fact, can lead to conflicts among stakeholders which will hamper HWC mitigation as well. People's interests, therefore, play a crucial role in the acceptance of measures (Teel et al., 2010). Then, when choosing the measures to implement or transfer to mitigate the HWC, hence, it is also necessary to consider "their feasibility, sustainability, costs, humaneness and social acceptance" (Massei et al., 2011, p. 93). In fact, in case a strong public disapproval emerges or sufficient funds are not available, it may be necessary to revert to other measures, as these appears to be very important conditions for the measures to be successful, not only for the HBC but for other conflicts as well (Massei et al., 2011). However, as highlighted by Can et al. (2014), when dealing with transferability and HWC, it is important to remember that every context is different and there are many peculiarities that must be taken into account, such as the geographical characteristics of a place and the biological features of the species involved in the HWC. The Trentino case, for example, is also highly dependent on contextual factors and on the acceptance from local people, who are one of the main stakeholders (Tosi et al., 2015; Glikman et al., 2019).

2.3. Policy transfer and SFA model

Apart from the already explained conditions to transfer HBC and HWC measures, this thesis relies on the general concept of *transferability* which is defined as "the extent to which the measured effectiveness of an applicable intervention could be achieved in another setting" (Cambon, Minary, Ridde & Alla, 2012, p. 1). This is strictly linked to *policy transfer*, which refers to "a process in which knowledge about policies, administrative arrangements, institutions etc. in one time and/or place is used in the development of policies, administrative arrangements and institutions in another time and/or place" (Dolowitz & Marsh, 1996, p. 344).

As already mentioned in the knowledge gap, no framework has been found neither in the HWC nor in the HBC literature to assess the transferability of measures from one country to another experiencing the same type of conflict, which is why one will be developed within this thesis. However, it was thought that instead of creating a new framework from scratch, it could have been possible to base it on an already existing framework on policy or project transfer, in order to give it more scientific reliability. After having conducted some literature review, it was possible to gather enough information on policy transfer in general, especially from Dolowitz & Marsh (1996), who also identified the main factors affecting policy transfer failure. First of all, if the country in which the policy is transferred does not possess enough information on it, an uninformed transfer will occur. Then, in case some fundamental elements of the policy could not be transferred, an incomplete transfer can arise. Finally, if not sufficient attention is given to the economic, social, political and ideological differences between the country from where the policy is transferred and the country to which the policy is transferred, an inappropriate transfer may come about (Dolowitz & Marsh, 1996). The same authors also developed a policy transfer framework in 2000, visible in figure 4:

Why Transfer? Continuum Want To..... Have To			Who Is Involved in Transfer?	What Is Transferred?	From Where			Degrees of Transfer	Constraints on Transfer	How To Demonstrate Policy Transfer	Transfer leads to Policy Failure
Voluntary	Mixtures	Coercive			Past	Within-a Nation	Cross- National				
Lesson Drawing (Perfect Rationality)	Lesson Drawing (Bounded Rationality)	Direct Imposition	Elected Officials	Policies (Goals) (content) (instruments)	Internal	State Governments	International Organizations	Copying	Policy Complexity (Newspaper) (Magazine) (TV) (Radio)	Media	Uniformed Transfer
	International Pressures		Bureaucrats Civil Servants	Programs	Global	City Governments	Regional State Local Governments	Emulation	Past Policies	Reports	Incomplete Transfer
	(Image) (Consensus) (Perceptions) Externalities	Pressure Groups	Institutions			Local Authorities		Mixtures	Structural Institutional	Conferences	Inappropriate Transfer
	Conditionality (Loans) (Conditions Attached to Business Activity)	Political Parties	Ideologies					Inspiration	Feasibility (Ideology) (cultural proximity) (technology) (economic) (bureaucratic) Language	Meetings/ Visits	
	Obligations	Policy Entrepreneurs/ Experts	Attitudes/ Cultural Values Consultants Think Tanks Transnational Corporations Supranational Institutions	Negative Lessons			Past Relations			Statements (written) (verbal)	

Figure 4: Policy transfer framework (Dolowitz & Marsh, 2000).

Policy transfer literature in general and this framework provide very important notions regarding transferability, especially the above-mentioned factors affecting the success or failure of a transferred policy; however, the framework appears to be too vague with respect to the transferability conditions for HBC above identified and too much addressed to policy-makers. Therefore, it is used as a starting point for developing a narrower framework, specifically tailored for the transferability of measures in the HBC field.

More research was conducted to find other frameworks more focused on measures. This is how the Suitability, Feasibility and Acceptability (SFA) framework, developed by Johnson et al. in 2009, was gathered. This framework is usually used to assess the potential success or failure of a new project before implementing it,

according to the three criteria abovementioned. Despite belonging to the corporate business field, the SFA was chosen as the main base of the transferability framework as it is more centred on projects and measures and takes into great consideration social and geographical aspects when assessing the success or failure of a future project (Hassan & Mahdzir, 2016). Hence, it appears to be valuable in evaluating the transferability of HBC measures because, as explained above, those are very important conditions. Finally, it has also been successfully used to check the appropriateness of new measures in other fields as well, such as the adoption of the Ocean Thermal Energy Conversion in Malaysia (Hassan & Mahdzir, 2016) or of a project aimed at improving the vaccination rates in the UK (Lwembe et al., 2016). This framework will, hence, be used as a base for the new transferability framework that will be created later on, which will combine the elements of policy transfer and criteria of the SFA with the fundamental success conditions for transferability found in the HBC and HWC literature.

The SFA model, as already said, can evaluate the possible effectiveness or inappropriateness of a project or measure before implementing it (Lwembe et al., 2016). The main concepts behind the model are three: suitability, feasibility and acceptability. Suitability checks the circumstances in which the project (in the corporate business field but measure in the HWC) takes place, if it supports the organizational aims and in general the rationale behind it (Lwembe et al., 2016). More precisely, it is concerned with whether the projects are compatible with the socio-economic conditions in which they will operate and could facilitate answering the question “is the strategy congruent with the selected location and does it take into account the opportunities and threats in place?” (Lucidity, n.d.). Feasibility refers to whether the project can actually be executed in practice, according to the presence or not of the skills, financial resources and competencies needed for it (Hassan & Mahdzir, 2016). Finally, acceptability relates to potential barriers from stakeholders, also influenced by the expected performance and risks of the project. To be successfully transferrable, it needs to be accepted by local communities as well and to do so they must be informed about it and aware of the positive and negative consequences it may trigger (Hassan & Mahdzir, 2016). The final product of the SFA analysis is usually the filling of an SFA matrix, which requires the selection of the criteria or indicators to evaluate the different potential options to be implemented or transferred, according to what is important for the context under analysis, followed by the choice of the options to assess and finally, a score, that is given for each of them based their level of match with the indicators. After that, it is possible to see which is the one with the highest score, therefore the one that will be, more likely, successfully transferrable. Regarding the case this thesis focuses on, the three success conditions suitability, feasibility and acceptability will be operationalised with indicators to analyse the transferability of measures to mitigate the HBC and together will create a framework that will be applied to the Trentino case and will lead to the filling of the transferability matrix, based on the SFA one, which can be seen in a preliminary version in figure 5. This will, ultimately, be able to tell to what extent are the measures taken from other contexts transferrable to Trentino.

	Measure 1	Measure 2	Measure 3	Measure 4
Suitability				
Feasibility				
Acceptability				

Figure 5: Preliminary transferability matrix.

3. Methods

Visiting Trentino and collaborating with local experts to obtain data and knowledge in the field would have been of much greater value for this thesis, nevertheless, due to the current pandemic it was preferred to opt for a desk research as the main research method, together with some structured interviews to gather other primary data. The way each sub-question was answered, in order to answer the main one, will be hereafter better defined.

Sub-question 1: success conditions for the transferability of HBC measures

The first sub-question has already been answered above, by finding the main success conditions for the transferability of HBC and HWC measures. This was done through a literature review of the main peer-reviewed scientific articles found in Google Scholar and, in case they were not accessible, through Worldcat via the Utrecht University. The main key words used were “transferability HWC”, “transferability HBC”, “transferability of HBC measures”, and “knowledge transfer HBC”. Unfortunately, not much literature was found on transferability of measures, probably due to the fact that, as already mentioned in the knowledge gap section, this field has not been largely deepened yet. Moreover, in order to have a wider background on transferability in general and policy transfer, the words “policy transfer”, “transferability framework” and “transferability criteria” were searched. This is also how the SFA model was found, which was, consequently studied more in detail, by using the terms “SFA”, “SFA application”, “suitability”, “feasibility” and “acceptability” until a sufficient level of knowledge was reached for the whole model and for the single concepts.

Sub-question 2: HBC measures applied abroad and in Trentino

The second sub-question deals with understanding which successful HBC measures are applied in other contexts and which of those are not yet applied in Trentino in order to find new potential transferrable measures and to answer it, it was necessary to conduct a literature review as well. For what concerns the first part, namely the measures applied abroad, HBC in different parts of the world was investigated, in order to find the main measures adopted. In this case, Google Scholar and Worldcat were still the main platforms to look for peer-

reviewed papers. The main terms used were “HBC worldwide” and “HBC mitigation measures” to understand exactly how are the other countries dealing with the conflict.

After having identified the most commonly adopted successful measures in the world, it was necessary to gather some more information on the HBC management in Trentino, in order to understand which are the measures already applied and how successful they are in terms of conflict mitigation and prevention, namely if they reduce the damages, attacks, vehicles collisions and illegal killings in the present but also in the future. In this way, it was possible to identify some room for transferability, namely measures adopted abroad but not in Trentino. What was done is, once again, a literature review of the main papers containing the words “HBC in Trentino”, “bears in Trentino”, “HBC measures in Trentino”. With regard to this, two fundamental sources were used, namely the “Large carnivores reports” yearly elaborated by the province of Trento in Trentino, which can be found on the province of Trento webpage, and the report written by ISPRA and MUSE in 2021 on problematic bears in Trentino. The former provided detailed information on the bear population, damages provoked, attacks and interventions of the main authorities, while the latter describes the conflictual situation and the main measures used in Trentino, together with previsions for the future and pieces of advice. Once the principal measures applied were identified, a narrower research was conducted, namely every measure was further investigated by typing on Google Scholar the name of the measure identified together with the words “Trentino” and “success” in order to gather how successful they are in terms of conflict reduction. Since in some cases the papers found were too few to gain enough knowledge, the same words but in Italian were used to look for more, being the writer of this thesis Italian. The number of papers was considered sufficient once every measure had a definition, a description of usage a main indication on its performance.

Subsequently, it was possible to understand which are the successful measures applied abroad but not yet in Trentino. They are four, which were considered enough with respect to the amount of time available, so it was not necessary to make a selection according to the most efficient ones in terms of conflict prevention. For all the measures, it was gathered their definition, performance, drawbacks and conditions under which they are more successful. This was done by searching the name of every measure together with “bears” in Google Scholar and as many papers were read until all these elements were obtained.

Sub-question 3: assessment of transferability conditions in Trentino

The third sub-question requires the application of the transferability framework and the filling-in of the transferability matrix in order to understand to what extent do the measures under study meet the transferability conditions in Trentino and therefore, whether they would be transferrable or not there.

This was done by first using only the name of the selected measure in combination with “HBC” and then together with every indicator developed for the success conditions in the transferability framework. Thereafter, the extent to which those conditions were met in Trentino, was investigated by looking into peer-reviewed literature for such terms together with “Trentino” and “bear” and into grey literature and online newspapers. Structured interviews with some experts working in wildlife conservation in Trentino were also conducted in

order to gather primary data. The three people interviewed are the coordinator of the large carnivores' department of the province of Trento, a zoologist responsible for the scientific research unit and environmental education at the Adamello-Brenta National Park in Trentino and a zoologist and conservation and wildlife consultant, who also worked for the Life Ursus reintroduction project. Other people were contacted but never replied. The respondents were all identified during the literature review process, as co-authors of the read papers and selected according to their professional figures, in order to have more variety of answers. They were all explained the aim and methods of this thesis via e-mail and expressed their interest in this research, saying that it appears of great relevance in the Italian and European contexts, so they were willing to give their contribution and curious to know the final results. They were, subsequently, informed more in detail about the content of this thesis and provided all the information necessary in order to answer the questions, which can be found in Appendix I, with full knowledge and awareness, and asked to sign the informed consent form, visible in Appendix II. The interviews took place either on Microsoft Teams or by phone, according to the interviewee's preference, between the end of May and the beginning of June 2021 and lasted around one hour. They were structured, with open-ended questions and were held in Italian. The main questions were focused on filling in the gaps identified in the desk research regarding the presence of the necessary transferability conditions in Trentino and on whether the interviewees thought the potentially transferrable measures matched with the three main conditions of suitability, feasibility and acceptability in the area. The pieces of information gathered from desk research were then integrated with the ones obtained in the interviews, which were also helpful to confirm or deny the assumptions made during the desk research, in case it was not possible to derive information from literature. No major contradictory information was found between desk research and interviews, but the latter sometimes led to conflicting answers due to personal opinions of the respondents. This was taken into account during the analysis and the discussion of the results and included in the limitations of this research. This, finally led to a score according to the level of match between the transferability success conditions and the degree of presence in Trentino, which also answered the first part of the main research question.

Sub-question 4: learnings on transferability

The fourth sub-question and the second part of the main research question were answered by deriving some teachings on transferability from the application of the developed transferability framework to the Trentino case, which could be extended to other cases of HBC and HWC, and by providing some recommendations stemming from the results obtained.

3.1. Operationalisation

The success conditions suitability, feasibility and acceptability will now be operationalised with indicators, which will provide empirical results of the measures' transferability, which were derived from literature on HBC transferability and SFA. Starting from suitability, it is important to check whether the measures under study would comply with the geographical characteristics of the location and biological features of the bear (or other wildlife) where the measures are to be transferred, and hence, successful if actually applied and

whether there is any obstacle that could hinder the application of the measures. Therefore, the indicators selected are: *compatibility with the area*, *perceived potential success* and *obstacles*. In particular, the first indicator will look at the compliance of the measures' specific requirements with the geographical and territorial characteristics of the location where they are supposed to be transferred. This indicator is the one that mostly differs from the others as it looks at the specific and different requirements each measure needs in order to be applied. For example, one measure may need to be placed in a particular type of setting or may require a specific type of natural or anthropogenic conditions, so it will be investigated differently for every measure according to what has emerged to be necessary for them in the literature. The second indicator will look at the likelihood that the measure is successful in mitigating the HBC according to bears' behavioural and biological features and the third one at whether there is any impediment for the measures to be transferred, such as a law prohibiting them or any threat deriving from their application. Going on with feasibility, the indicators are *financial feasibility* and *practical feasibility*. The first one will check whether the cost each to-be-transferred measure requires is affordable in the new location, while the second one whether the needed skills and knowledge to apply each measure are possessed. Finally, acceptability investigates whether the local stakeholders would support the measures or whether any barrier from them would exist, thus, it will be analysed through the *attitude of local communities* and *attitude of local authorities*. These indicators form a transferability analytical framework, visible in figure 6, that will be applied to the to-be-transferred measures and will help in filling in the transferability matrix.

Being the transferability framework based on the SFA analysis', the last step consists of grading the options under study, which allows to rank them as well. Nevertheless, the SFA literature is scarce, and it does not strictly prescribe which scale to use, so a 1 to 5 numerical rating scale has been chosen because 5 different ratings are considered enough to evaluate the transferability of the measures. Although the SFA literature recommends to weigh the different criteria according to the importance they held, based on the success conditions needed for the transferability of HBC measures gathered from literature, it is not possible for now to establish which success condition holds more importance with regard to the success of transferability so no weighting will be applied in the scoring system. Scores will be given to every indicator of the success conditions and their average will be calculated in order to have a final score for each of the three main success conditions, up to a total of 15, assuming that each indicator has the same importance and is given the same weight. In particular, 1 means that the success condition is not present at all, so there are many deficiencies or there is a significant problem, therefore the measures will not be transferrable according to the framework. 2 will be given to measures for which the success condition is insufficiently met, 3 means that the success condition is essentially present, 4 means that the condition is met or it is assumed to be met but there is still some remaining uncertainty, finally 5 stands for a full meeting of the condition with a high degree of certainty (British Columbia Public Service, n.d.). Based on this, measures whose total score is between 3 and 9 are considered not transferrable at all, between 9 and 12 likely not transferrable, between 12 and 15 transferrable. It is, therefore, believed that only the measures that score between 11 and 15 will be taken into consideration

by the staff working in human-bear management in order to further study and test their actual transferability in real life.

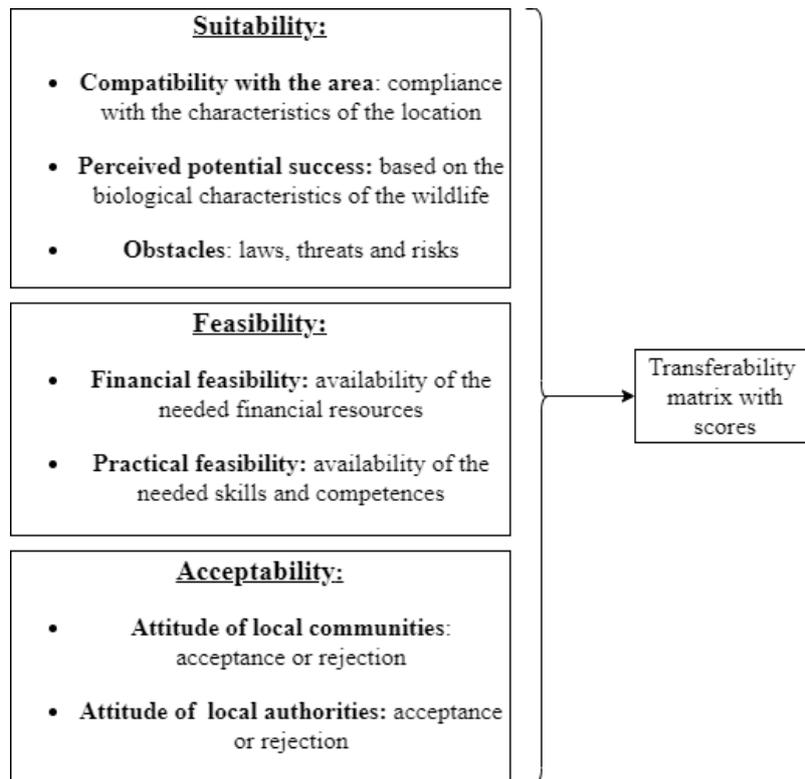


Figure 6: Transferability analytical framework.

4. Results

4.1. HBC abroad and measures applied

The HBC takes place in different areas and with different bear species. In North-America, for example, there are numerous conflicts with American black bears (*Ursus americanus*), in Asia with Asiatic black bears (*Ursus thibetanus*) and the sloth bears (*Melursus ursinus*), in South-America with the Andean bears (*Tremarctos ornatus*) and in the Arctic with polar bears (*Ursus maritimus*). The drivers of the conflicts vary according to the species and the location (Can et al., 2014). As far as black bears and grizzlies are concerned, food-conditioning combined with periodic natural food scarcity are said to be the main reasons for the conflict, while in Europe the main causes are availability of anthropogenic food and growing bears population. In Asia the main reason is the human spread into bears' areas, together with low tolerance concerning the sloth bear, due to the multiple attacks to people. Even with some differences, the conflict results almost everywhere with livestock predation, crops and beehives raids, damages to property and attacks to humans (Can et al., 2014).

In North-America HBC appears to be serious, with fatal events or injuries occurring, regarding both people and bears. Alaska, for instance, is home to 31.700 grizzly bears, 100.000 black bears and 3.800 polar bears, in a portion of land of 1.5630.699 km² and 682 conflicts happened between 1880 and 2015. In this time-span, 62 people were mortally attacked by the bears, especially by grizzlies (Smith & Herrero, 2018). Nevertheless,

North-America, where the HBC management plans were first developed, possesses the skills and resources to respond to the conflict with various measures and tools. This is also because the HBC literature is dominated by studies on North-America, providing useful insights for policy makers and wildlife managers. The same cannot be said for Asia, which appears to be far behind in the application of conflict resolving measures, apart from Japan and Bhutan, as displayed in figure 7 (Can et al., 2014). Different countries have experienced multiple conflicts with bears, often resulting in the killing of the problematic and dangerous ones. The situation is worsened by poaching, boosted by the illegal trade of bear bile and paws. Poaching and conflicts, therefore, are the main threats to the conservation of Asiatic black bear, which, as a consequence, has been listed as “vulnerable” by the IUCN red list (Liu et al., 2011). For what concerns Europe, 15.400 brown bears live in the area, spread particularly amongst Romania, Slovenia, Slovakia, Sweden and Finland, where they attacked people 291 times, killing 19 of them (Bombieri et al., 2019). Romania, in particular, has the largest bear population in Europe and the animals have been sharing the same land with humans for millennia. However, bear management has gone from sustainable hunting to active bear protection, which triggered an increase in population and density and a decrease in human tolerance (Stăncioiu, Dutcă, Bălăcescu & Ungurean, 2019). As far as Italy is concerned, bears can be found not only in Trentino, but also in central Italy, on the Apennines, where the Marsican bear (*Ursus arctos marsicanus*), a sub-species of the brown bear, has been living since the 17th century. This species is currently protected by the Italian law and inhabits a protected area, called the National Park of Abruzzo, Lazio and Molise (Ciucci & Boitani, 2008). The population accounts around 43-50 specimens and is considered to be critically endangered, also due to high poaching rates that occurred in the past. Conflict with local people mainly consists of livestock, beehives and crops depredation, but no attack to humans has ever occurred (Ciucci & Boitani, 2008). Many projects were undertaken in order to foster co-existence with local population during the decades and the area has been adapted to increase habitat connectivity and to create wildlife corridors, so that bears and people are more separated and conflicts can be significantly reduced (Silva et al., 2013).

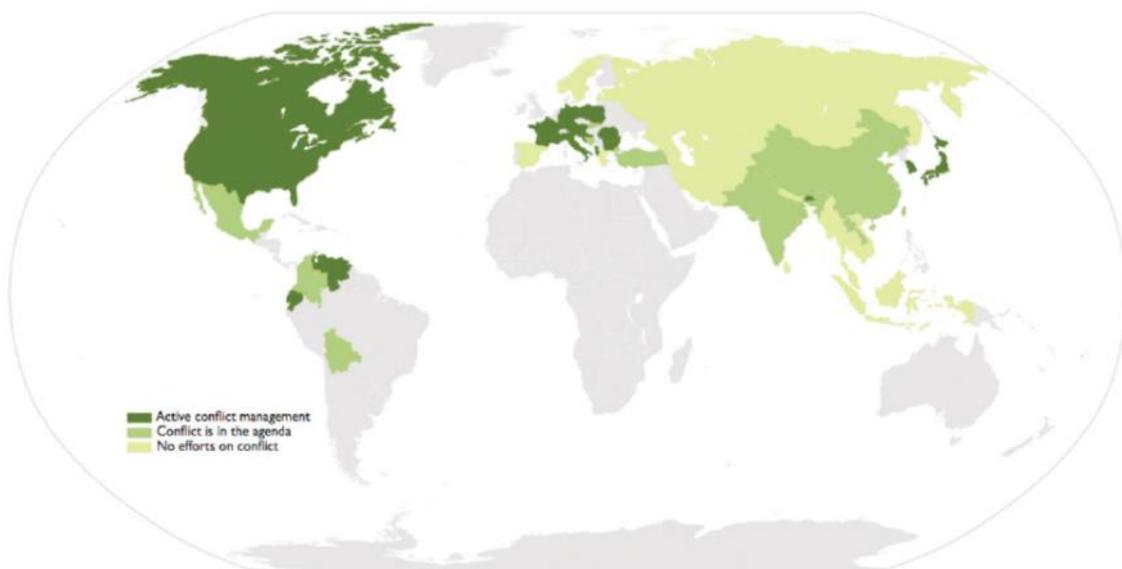


Figure 7: Status of HBC management worldwide (Can et al., 2014).

The type and severity of the conflict, however, changes according to the 8 species of bears, resulting in various conservation and management needs.

In general, human-bear management needs to take into account both the humans and the bears' needs and behaviours and must deal with the main causes of the conflict (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). The measures applied include both proactive and reactive measures. The former aim to prevent bears not already involved in problematic incidents from becoming involved. Proactive measures are usually addressed to human behaviour and the use of human areas where problems with bears may occur or have occurred. They include the management of anthropogenic food sources, the use of fences and livestock guardian dogs and public education (Hopkins et al., 2010). This is because HBC is often caused by wrong human behaviour, such as not protecting their livestock adequately, not removing the attractants, not securing the food wastes, or behaving in the wrong way when encountering a bear. The management of attractant appears to be particularly fundamental as it is considered the simplest way of reducing HBC. This can be done by either removing or protecting them when they cannot be removed, such as using electric fences to secure the livestock and using bear-proof bins (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). Moreover, people must know how to behave in case of encounters, such as keeping domestic animals on a leash, make noise to warn about their presence, and also use a bear-spray, a deterrent often used in North-America to prevent a bear to attack. Therefore, it is necessary to teach people which are the rules to follow in order to avoid incidents and requires the involvement of all stakeholders in order to find common action (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). Another human-focused measure is landscape planning, which consists of creating routes or corridors to drive the wildlife away from human settlements which can reduce not only predation but also vehicle collisions (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). Reactive measures strive to avoid that bears already implicated in incidents will do that again and require immediate action to be successful. While proactive measures are mainly addressed to people, reactive measures deal with bears. They include aversive conditioning treatments, closing areas to human access (and posting warning signs, or both) where there have been human–bear conflicts and, finally, management removal (lethal or non-lethal) if the former measures did not work as expected (Hopkins et al., 2010).

Aversive conditioning of bears can be defined as “a learning process in which deterrents are continually and consistently administered to a bear to reduce the frequency of an undesirable behaviour” (Hopkins et al., 2010, p. 160), such as predated on crop and livestock or feeding from human settlements. According to the type of deterrents used, the resulting aversion can be to a food, people or an area. Aversion usually uses two types of deterrents, primary and secondary; the former includes repellents that should frighten the bear when caught in an undesirable action or location, such as very powerful lights and noise. Secondary repellents are specifically used to provoke pain in the bears, so that they will associate it to the undesired behaviour, such as rubber bullets, hazing, pursuit with dogs and conditioned taste-aversion (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). Hazing consists of administering deterrents to a bear to change its behaviour immediately, in order to make the bear avoid that area in the future (Hopkins et al., 2010);

conditioned taste-aversion requires the drugging of a bait of the food the bears have to avoid (e.g., bovine, fruit, honey) with an emetic substance, that will provoke gastrointestinal pain to the bears and make them associate the pain to that food and avoid it in the future (Homstol, 2011).

Sometimes, it is, however, necessary to remove the problematic bear causing repeated damages or attacks. The four main types of management removal are translocation, re-location, captivity and culling. Translocation consists of removing the bear and releasing it in a location which is outside its home-range, while when it is re-located a bear is released in an area within its home-range. The latter is said to be more successful than the former, but both are considered to be almost ineffective, as they do not change the behaviour of the problematic bears, which, the majority of the time, return to the conflict area (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). In extreme cases, bears can also be enclosed in captivity facilities or, finally, killed. Other bear-focused measures include supplementary and diversionary feeding, which both provide food sources to the bears, the former to increase their nutrition, which could also help in avoiding they predate on anthropogenic food sources and the latter to lure them away from areas where they could create a damage (Garshelis, Baruch-Mordo, Bryant, Gunther & Jerina, 2017).

4.2. Features of the HBC in Trentino

Bears have been monitored by the province of Trento since 1970s with different techniques, which comprehend radiotelemetry, automatic video controls, camera traps and, only recently, genetic monitoring (Groff et al., 2020). This has made the collection of many data possible, such as population demographic, structure, distribution and dispersion. In 2019 the bear population in Trentino reached 82-93 specimens, with a constant increase of 12% in the past 5 years, as it can be seen in figure 8 (Groff et al., 2020). In 2020 the genetic monitoring was conducted only on the necessary samples, namely in emergencies or to identify the bear responsible of damages. From this year on, the monitoring will be performed only in alternate years, to limit the expenditures, but it has been assumed that the bear population now counts more than 100 specimens, which will be confirmed next year (Groff et al., 2021). The population is expected to reach 129 bears, excluding cubs, in 2025 (ISPRA-MUSE, 2021). Overall, out of the 82-93 bears present, 12 are considered to be potentially dangerous and 3 at high risk, according to the PACOBACE definitions, and indicate bears that show different problematic behaviours, such as being seen in human settlements, causing damages and attacking people, without being affected by the proactive and reactive measures. Moreover, between 0 and 15 are estimated to manifest dangerous behaviours between now and 2025 (ISPRA-MUSE, 2021).

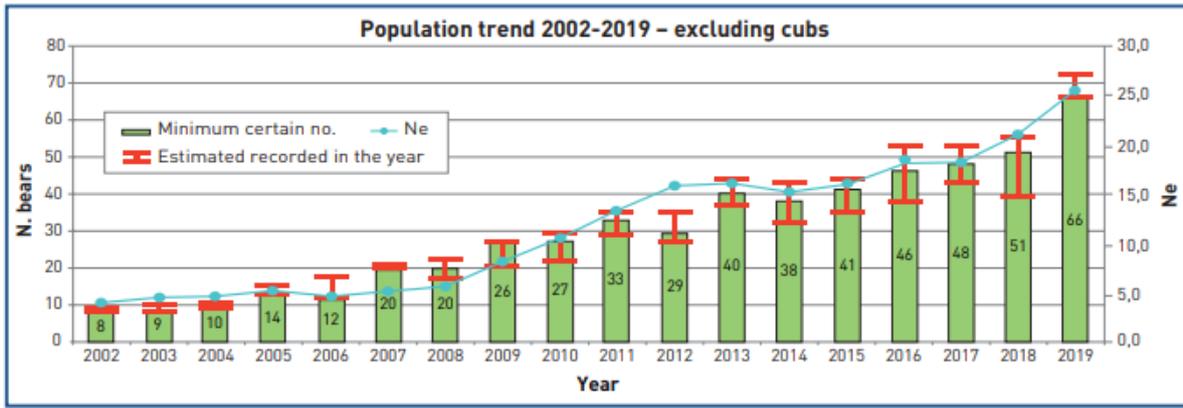


Figure 8: “Population trend for young and adult categories” (Groff et al., 2020, p. 18).

In 2019 the majority of the bear population was concentrated in the western part of the region, over an area of 45,327 km² and only 3 bears were detected outside the province of Trento, as shown in figure 9 (Groff et al., 2020). In general, it has been observed that bears try to avoid humans and encounters, but in Trentino recreational outdoor activities take place throughout the whole area, making it harder for bears to reach their safe spots if the disturbance will increase in the future. Due to the fact that they live in an highly densely populated zone, bears have been involved in 38 road accidents up to date (Groff et al., 2021).

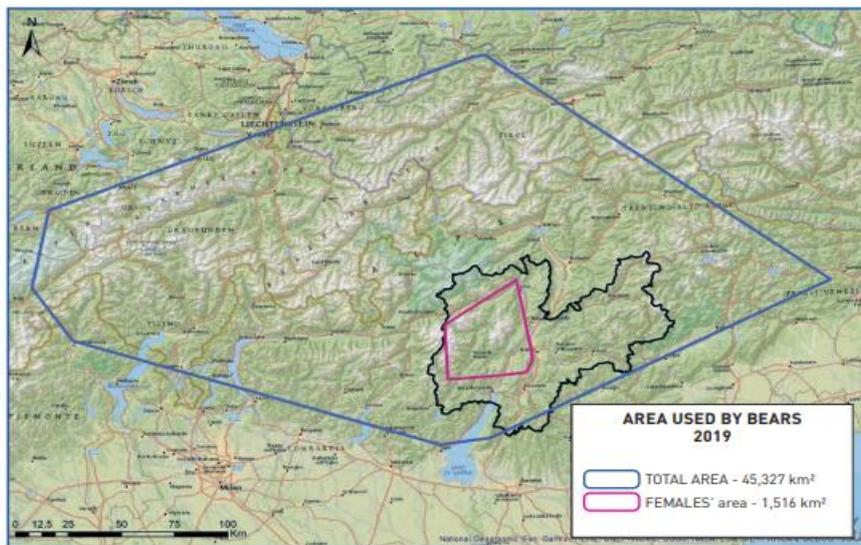


Figure 9: Bears distribution in 2019 (Groff et al., 2020).

As a result of bear population increase, also the number of damages created by them has been raising during the years, with a boost of +31% in 2019 with respect to 2018, and 29 different bears were observed at the damaged sites (Groff et al, 2020). Crops, beehives, livestock such as sheep, goats, equines, cattle and others were predated, with the addition of other assets damaged, for a total of around €152.000 compensated by the province of Trento in 2019 and in 2020 (Groff et al., 2021). In total, from 2009 to 2019, the region indemnified 1681 damages to the bee-keeping, livestock and agricultural sectors which amounted to over €1 million (ISPRA-MUSE, 2021). In the majority of the problematic cases, bears showed a confident behaviour, due to food-conditioning from wastes and restaurants, namely they now associate people to easily accessible food,

which pulls them closer to human settlements (ISPRA-MUSE, 2021). However, the 30% of the damages created in 2019 can be attributed to one bear only, called M49 and nicknamed “Papillon”, visible in figure 10, due to its ability to escape twice from the captivity centre he was put in, becoming famous on the media worldwide. The cost the province of Trento incurred in to fix the enclosure fence he broke out from was €162.000, €10.000 more than all the damages caused by all the bears in one year (Pianesi, 2020-a). For what concerns bear attacks to people, 5 have occurred so far, none of them was fatal and the majority involved females protecting their cubs (ISPRA-MUSE, 2021).



Figure 10: M49, or Papillon, while predating a bovine (Vinante - Archivio Servizio Foreste e fauna PAT, n.d.).



Figure 11: Beehives destroyed by a bear in the province of Trento (n.d.).

4.3. Measures applied in Trentino

In order to deal with the presence of bears and conflict with them in the region, a series of measures has been adopted to either prevent or tolerate the damages. As far as the management of the bears is concerned, it follows the directives of the PACOBACE, a document that has been approved by the main public bodies of the area, together with the Italian Minister of Environment, Land and Protection of the Sea and ISPRA, the Italian Higher Institute for Protection and Environmental Research, and which gives precise guidelines on how to deal with monitoring, damages, emergencies, communication with the public and staff training (AA. VV., 2010). However, being autonomous, the province of Trento can act without the permission of the State. This has created some tension on the bears management between the former Italian Environment Minister and the president of the region, which has made it a highly political matter as well and highlights the need of a greater cooperation between governmental bodies (Povoledo, 2020).

The PACOBACE, establishes that both proactive and reactive measures must be adopted in Trentino. The main proactive measures utilised are electric fences, livestock guardian dogs, bear-proof bins and meetings with local people to answer their questions on large carnivores and bears (Groff et al., 2020). Between 2009 and 2019 more than €700.000 were spent to prevent damages to occur, with the realization of 1.375 installations (ISPRA-MUSE, 2021). Electric fences are placed around beehives and livestock to protect them, as they release a little electric shock that should stop the bear to attack, not only immediately but also in the future, as they act as a sort of psychological barrier as well, since bears will associate the fence to a small pain (Berce, n.d.). The rate of adoption of electric fences has been increasing in the recent years; in 2020 only, more than 150 were installed. However, the success of this measure is limited by the inadequate functioning and installation of some fences. Between 2009 and 2014 an analysis of electric fences in Italy was undertaken, particularly in central Italy, where the Marsican bear lives, in Trentino and its neighbouring region Friuli-Venezia Giulia. In central Italy the rate of success of the electric fences was 97,3% and in Friuli-Venezia Giulia was 100% as the damages significantly decreased after the fences were installed. In Trentino, the 42% of the sample of fences installed, was not working properly to ensure the protection from bears' attacks (di Vittorio et al., 2016). In 2020, a sample of 219 electric fences out of 944 were examined, of these, the 60% were found to be correctly installed while the 40% was not, due to problems with the charge of the batteries, general maintenance, problems with some building elements and wrong placement of the fence. In 2013 another check was performed by the large carnivores' department of Trento, and the fences correctly installed were only 51% so there has been an improvement (Groff et al., 2021). However, according to Bautista et al. (2019), who conducted a research on prevention measures used to defend the livestock from large carnivores in Europe, including Trentino, this measure is only successful if fully correctly implemented and maintained, otherwise it can lead to up to 40% of the measure being ineffective. This aspect could, therefore, be improved, as of now not all the electric fences are working properly in defending livestock against bears' attacks.

The use of livestock guardian dogs, visible in figure 12, is said to be an efficient preventive measure, as they are really helpful in avoiding predators to attack the herd (Berce, Zahariaš, Sedmak & Bragalanti, 2018). At

the end of 2019 were 77 the guardian dogs used by farmers, purchased autonomously or together with the province of Trento. The number of livestock guardian dogs used in Trentino is increasing, which means they are considered a successful measure in decreasing the number of attacks from not only bears but other carnivores present in the territory as well. Many livestock breeders, are, in fact, satisfied with the use of livestock guarding dogs in particular of the breed “pastore maremmano abruzzese”, affirming that, together with the installation of electric fences, they really help in the protection of the herd, especially of sheep and goat farming (Grossi, 2021). However, dogs must be properly bred and trained, in order to ensure a higher rate of success in protecting the livestock.



Figure 12: Livestock guardian dog in Trentino (n.d.).

Furthermore, since bears are said to approach residential areas to look for food, such as from restaurants' wastes and organic waste bins, more than 250 bear-proof bins have been installed in the whole region, visible in figures 13 and 14 (Groff et al., 2021). These bins have a bear-proof closing system to impede bears to open them and to prevent them from becoming used to anthropogenic food sources and consequently discourage them to approach human settlements. Despite having so far given overall good results (Majić & Krofel, 2016), the adoption of bear-proof bins is not homogenous in the region, which limits the success of this measure in Trentino (ISPRA-MUSE, 2021). Moreover, 54 events of feeding from anthropogenic food sources were registered in 2020 (Groff et al., 2021), which means that the management of attractants needs to be improved and many more bear-proof bins should be provided. Where they had been installed, very few and sporadic cases of problems regarding wastes were registered in the years, indication that they work. Nevertheless, the bear M57 still managed to feed in one of those sites, so apparently, the measure adopted does not work with particularly able bears (Groff et al., 2021). Hence, the success of this measure is not fully reached, due to the fact that there are still normal bins to be substituted, which the bears can feed on.



Figures 13 and 14: Bear-proof bins (Theus, n.d.; Province of Trento, 2020).

Finally, almost 300 warning signs have been placed in the spots where the bear is known to be present, in order to warn people on how to behave correctly (Groff et al., 2020). As far as communication is concerned, the principal entities such the Wildlife Department or the Adamello-Brenta Natural Park organize meetings on bears and large carnivores to share information with the population and answer to the questions they may have on bears management and appropriate behaviours (Groff et al., 2020). Communication efforts appear to be fundamental in Trentino in order to reduce as much as possible the chances of encounters and the availability of food, which attracts bears into human settlements (ISPRA-MUSE, 2021). A communication plan regarding the bears and the wolves was developed in 2016 but still has not been applied (Di Tolla Deflorian, 2020).

Apart from proactive measures, there are also some reactive measures used, such as deterrents to push bears away from the attractive contexts. The main ones are very powerful lights addressed to the bear, emission of loud noises, shooting of rubber-bullets or explosive darts and the use of bear dogs. The latter in particular, is constituted by a bear dog unit, which uses the dogs, visible in figure 15, to scare the bear away from the attracting location and to reconstruct bears' movements thanks to their great olfactory sense (Groff et al., 2020). They were also used to detect poisoned baits, as 3 bears between 2015 and 2016 were found dead due to poisoning (Groff et al., 2018).



Figure 15: Bear dog unit (Stoffella - Archivio Servizio Foreste e fauna PAT, n.d.).

These actions are principally utilised for bears that are seen close to human settlements, beehives, livestock and anthropogenic food sources (ISPRA-MUSE, 2021). A team available in case of emergencies has also been

established, composed of a coordinator, two rangers and veterinary staff, in charge of using such deterrents. In 2019 the team received 44 call-outs concerning bears, 10 of those regarded the bear M49, considered responsible for 44 damages in the same year, which was subjected to some deterrent actions but none of them affected the bear's behaviour (Groff et al., 2020). The bear M57 was also considered very problematic since it had an over-confidence with man, which escalated into a deliberate attack to a person in 2020. The aversive conditioning actions with rubber bullets and dogs were not capable of changing its behaviour. This is why M49 and M57 are now being kept in permanent captivity in the Casteller centre (Groff et al., 2020; Groff et al., 2021). Rubber bullets were also repeatedly used in 2006 against the bear "Jurka" which was responsible of many incursions and damages to human properties, but the aversive conditioning efforts did not have any effect on the bear, which had, ultimately, to be removed and kept in the Casteller centre as well, now moved to a German facility (Bombieri et al., 2021). Despite other cases of successful dissuasion, it has been highlighted that the bolder a bear the harder it is to dissuade it with aversive conditioning (Bombieri et al., 2021). This is also due to the difficulty of acting immediately with these deterrents while the bear is preying, which is why some of the dissuasion actions were unsuccessful in Trentino (Groff et al., 2019). There are, in fact, no sufficient data to say that dissuasion is successful in changing the bears behaviour, especially on the most problematic ones (ISPRA-MUSE, 2021).

Extreme reactive measures are, finally, translocation, captivity and culling. One bear was translocated in 2007 and another was removed in 2011. Two bears, M49 and M57, are currently kept in captivity due to their problematic and repeated behaviours. Another bear called Daniza, which had attacked a man in 2014, died during the capture due to the anaesthetic shot; while, KJ2, was shot by the authorities after it mauled a man in 2017. These episodes led to many protests from animal rights groups and to a growing climate of intolerance towards bears from the local population and politicians, which escalated into some episodes of illegal bear killings (Tosi et al., 2015; von Hardenberg, 2017). However, the ISPRA underlines how important it is to prefer proactive rather than reactive actions to mitigate the conflict and highlights the unsustainability of the captivity in the "Casteller" centre due to the huge economic costs involved and low welfare of the animals. They suggest to reduce all the anthropogenic food sources and to create a better communication with residents and tourists on how to behave in case of encounters. The abatement of bears has, moreover, been described as an important measure to adopt in extremis, in case the proactive and reactive measures fail to mitigate the conflict. It is, indeed, believed that culling may be the only feasible solution in the future if the other measures do not work as expected (ISPRA-MUSE, 2021).

Everything considered, it appears clear that Trentino needs to strengthen and improve the measures in place, in terms of both quantity (e.g., more bear-proof bins, more electric fences and livestock guarding dogs) and quality (e.g., all the electric fences should be adequately installed and functioning), but that it could also benefit from the transfer of other promising proactive and reactive measures.

4.4. Potentially transferrable measures

After having identified the main measures applied worldwide and the ones applied in Trentino, it is possible to see that some of the formers have not been adopted in Trentino yet, and hence, are potentially transferrable. These measures are the bear-spray, diversionary feeding, wildlife corridors and conditioned taste-aversion, which will now be better defined.

Bear-spray

Its usage dates back to 1960s when it was utilized in North-America as a protection against aggressive dogs. The main ingredients, capsaicin and its related capsaicinoid compounds, trigger “a non-lethal yet debilitating response, including coughing, sneezing, bronchoconstriction, apnea, retrosternal discomfort, laryngeal paralysis, and temporary blindness” (Smith et al., 2008, p. 640). The spray was then tested on brown bears in captivity with good results: the bears, first charging, did not attack after being sprayed and holed up in a corner of the cage. This initial positive outcome, encouraged the creation of a red pepper spray specific for bears. The spray was then tested on wild black and brown bears as well, showing that the majority of them ran away after being sprayed (Smith et al., 2008). Nowadays, the spray is made of oleoresin capsicum, a thinning agent, needed to disperse the former into droplets when sprayed, and a propellant, mainly a refrigerant. What these substances provoke to the bears, is, hence, blepharospasms and restriction of the respiratory tract (Smith, Wilder, York, Obbard & Billings, 2021). This bear deterrent is thought to be used when incurring into aggressive encounters with bears during recreational or working activities, in order to prevent an attack and end such a behaviour (Smith et al., 2008, Bombieri et al, 2019). It can either make the bear flee or give the person attacked the time necessary to run away, avoiding a contact between the two (Smith et al., 2008). Figure 16 shows a canister of bear-spray.



Figure 16: A canister of bear-spray (Mace Brand, n.d.).

The bear-spray, in fact, is considered to be one of the most effective bear deterrents, even more than firearms (Brown & Conover, 2008). Its efficacy was studied in Alaska from 1985 to 2006, where it was used 83 times, against mainly brown and black bears. The former stopped showing aggressive behaviours in the 92% of the

cases and the latter in the 90%, considering also that out of 83, 11 cases were considered as spray misuses, i.e., the people sprayed on an object or in the air rather than on the bear or they were using the same canister repeatedly. In the majority of the cases the people involved were hikers and bear-managers carrying out outdoor activities, but also people at home or in their tents. In some cases, respectively the 17% and 11% of the total, bears came back to the sites after being sprayed. In some cases, people were attacked before they could spray (Smith et al., 2008). Bear-spray is also suggested to be carried by people in the Yellowstone National Park (Miller, 2019) and workshops on how to use it correctly are held in Alberta, Canada, to stimulate more people to carry it (Morehouse, Hughes, Manners, Bectell & Bruder, 2020). Its utilisation is now very common in North-America and Slovakia, but remains illegal in many other European countries, mainly due to the fact that it is considered as a sort of weapon that could be dangerous if used against humans. The positive results it obtained show the importance of further investigation on its effectiveness and potential usage in other contexts where bear attacks represent an issue (Bombieri et al., 2019). In those cases, it could foster a greater co-existence by not killing the bears and by making people feel safer (Smith et al., 2008).

There are, however, some episodes where the bear-spray failed to discourage bear attacks and this can be due to some factors, which can hinder its effectiveness such as temperature, wind, repeated use of the same canister and canister age. Nevertheless, it is still worth it to carry the bear-spray rather than not, but it is important to educate people on the good maintenance and utilisation, in order to make the best use of it, such as keeping it warm and not using it when expired (Smith et al., 2021).

Diversiory feeding

Another non-lethal measure used in different areas to mitigate the HBC is diversionary feeding. It consists of luring animals away from feedings places where they could cause damages by intentionally providing them with food (Garshelis, et al., 2017). The main goal of this measure, is, therefore, to alleviate the conflict by attracting bears to specifically selected areas where they create no damage. Practically speaking, food is given to bears in some easily accessible spots so that they do not predate crops and livestock and do not approach human settlements. Moreover, this practice may also indirectly satiate animals, which often feed on crops or livestock because no wild preys are available (Garshelis, et al., 2017). There are many other species subjected to diversionary feeding, but brown bears seem to be the most common ones. Moreover, they are often also provided baits for tourism and hunting purposes (Penteriani et al., 2021). This is because bears are said to be very opportunistic, in the sense that they feed on a variety of sources, both natural and anthropogenic. In particular, they usually feed on small wild foods, but may seasonally experience food supply boosts; they are highly mobile species and can use their great sense of smell to find food even from very far away. This peculiarity implies that humans could place food in strategic positions to manipulate bears (Garshelis et al., 2017).

As far as the type, location and modality of the food provided are concerned, they depend on the ecological requirements of the selected species, but, in general, the food has to be more attractive than the one usually predated, such as crops, orchards or livestock. For bears, usually some feeding stations filled with food are

used (Kubasiewicz, Bunnefeld, Tulloch, Quine & Park, 2016). This measure has usually met a wide public consensus because it does not kill the bears, while also taking care of their survival through food. However, this measure has also attracted some criticisms during the years, specifically regarding its effectiveness and the unintended consequences it may provoke on both target and non-target species (Garshelis et al., 2017). In fact, despite not having the purpose of increasing the target wildlife population, sometimes diversionary feeding does so by giving them an important source of food. Also, other non-target species can be affected since the provision of food may attract other carnivores or predators and increase their population as well, which will have a consequence on other species (Garshelis et al., 2017). This is also why this measure is sometimes said to be usable only for a short period of time, in order not to increase the wildlife populations. Moreover, the location of the feeding stations does not have to be too close to the problematic areas, because it risks to attract other types of animals and create more damages. Another problem related to it is the fact that wildlife may become dependent on the man-provided source of food, and once it is removed a boost in the damages may occur. This can partially be solved by choosing a food that is more attractive than the usually damaged one but less nutritious than the wild one (Kubasiewicz et al., 2016). Despite these drawbacks, given that the HBC is expected to continue in the future, it is still important to evaluate this measure (Garshelis et al., 2017). A study conducted in Minnesota, in fact, shows the effectiveness of this measure to not only decrease the number of nuisance episodes, but also to foster co-existence with people, who become used to see bears at the feeding sites and stop being as scared as before (Rogers, 2011). During the study some rainfalls caused severe food shortages, but diversionary feeding prevented bears from raiding crops and livestock. However, this measure did not make the bears used to the man-given food, as they still preferred the natural one, when again available. What is more, feeding stations were placed close to normal bins and dumpster, which highlights the potential of combining this measure with others, such as reducing the attractants. Since food is one of the main causes of the conflict, diversionary feeding demonstrates that food can also be a way-out (Rogers, 2011). In Washington, diversionary feeding is implemented to avoid black bears to destroy timber plantations and it has been accepted by animalist groups and timber managers, resulting in a continuous utilization of the measure (Kubasiewicz et al., 2016). This measure is also currently applied in many European countries, where it is considered to be effective (Garshelis et al., 2017). In Slovenia diversionary feeding is considered the main non-lethal measure to mitigate HBC and is believed to be so efficient that has already been used for more than 100 years. In particular, it was thought that feeding the bears with livestock carrions would have provided them with the proteins they needed and would, consequently, kept them away from livestock predation, which is very common there (Garshelis et al., 2017). This was, however, banned in 2004 due to the mad cow disease, which resulted in a slight increase in sheep depredation. However, evidence suggests that corn rather than carrions is more effective in HBC mitigation. Other European countries such as Croatia, Serbia, Bosnia and Romania are still using livestock carrion to feed the bears and the same measure is being proposed by some managers in other countries where feeding is currently illegal, like Sweden and Norway (Garshelis et al., 2017). Everything considered, the effectiveness of this measure depends on a lot of contextual factors, such as the kind of food provided, the location and the state of availability of natural food.

Despite having some potential drawbacks like population increase, bear habituation to humans and high costs, this measure could be very useful in contexts where sources of food like crops and livestock cannot be properly protected and bears are extremely hungry (Garshelis et al., 2017). In fact, diversionary feeding has proved to be very effective when natural food is scarce and is considered to be necessary to co-exist with bears especially in Europe, where fully wild natural areas where bears could live undisturbed are rare (Garshelis et al., 2017). Moreover, unlike North-America where bears were usually fed by people in parks, creating in the long-term some habituation issues, Europe mostly adopts automatic feeders to distribute the food, therefore the bears are less likely to become dependent to humans and to link them to food. In general, other countries which would like to implement this measure, are highly advised to rely on professionals who will identify all the characteristics of the bear population and will take into considerations all the variables that could affect the effectiveness of the measure (Garshelis et al., 2017).

Wildlife corridors

This measure is useful not only for HBC but for HWC in general, as the conflict can also take the form of animal-vehicle collisions, such as cars, trains, boats and planes accidents (Nyhus, 2016). Moreover, roads often create not only habitat fragmentation but also disturbance, physical barriers and cause fatalities in both wildlife and people (Clevenger & Waltho, 2000; Schell et al., 2021). All in all, fragmentation and habitat loss are considered to be the main cause of HWC, as it forces humans and wildlife to encounter. This is why habitat restoration is considered to be one of the main priorities for wildlife conservation. This is the case for HBC as well, as bears-cars collision are not rare. In Trentino, for example, it happened 38 times (Groff et al., 2021). One tool to increase the connectivity of habitats are wildlife corridors, consisting of different typologies, such as underpasses or overpasses to link protected areas crossed by barriers such as roads and railways (Pinter-Wollman, 2012). One example can be seen in figure 17.



Figure 17: Wildlife corridor overpassing the Expressway in Singapore (The Finder Singapore, n.d.).

Moreover, such corridors can also be helpful to direct animals in a determined area and to keep them away from human settlements, reducing encounters and conflicts (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019) and are currently highly popular among planners and land managers. The corridors are used by animals for daily, seasonal and migratory movements, but also represent an important habitat for both animals and plants in an environment predominantly human (Bennet, 1998, 2003). A species' connectivity is influenced by two main factors: a structural and a behavioural one. The former is affected by the spatial structure of the habitat, namely how long are the gaps and distances to be covered, whether there are alternative options and how continuous is the habitat. The latter factor is linked to the behavioural reaction of animals to the corridor and depends on different elements, such as whether the species tolerate human-disturbance, which are their requirements to live in the habitat, their life-stage and the degree of resistance to competitors. These factors change for every species, so their usage of the corridor will be different (Bennet, 1998, 2003). It is also fundamental to properly design the corridors, as a poor structure can even lead to animal population sink, huge economic loss and reduced stakeholders' support. Before implementing them, therefore, it is necessary to understand the behavioural and ecological patterns of movement and dispersal of any species (Benz et al., 2016). Despite being quite expensive, as of today, many types of corridors are used in different countries for many species (Bennet, 1998, 2003), in Africa, for example they are used to avoid conflicts with elephants (Pinter-Wollman, 2012). As far as bears are concerned, large carnivores are believed to be more likely to use corridors than other species, because they usually move across long-distances and corridors connecting areas will help them in having more land available (Dixon et al., 2006). In Slovenia, a wildlife passage and two viaducts were built in order to allow bears to avoid a very trafficked highway (Kaczensky et al., 2003). In the Italian Apennines, five corridors are currently being built by the "Rewilding Europe" project, with the aim of connecting the local economy with nature, so that people can benefit from nature-based solutions but also learn how to coexist with the Marsican bear and reduce future conflict (Rewilding Europe, n.d.). Another example of wildlife corridor is present in Florida, to reconnect two black bears populations and it is said to be functional and efficient for the populations' viability (Dixon et al., 2006).

Conditioned taste-aversion

This measure is used to reduce the attractiveness of a determined type of food, since taste-aversion arises when the intake of a food provokes gastrointestinal pain and illness, resulting in a future avoidance of that type of food. This occurs because the area postrema in the brain creates a subconscious reaction (Homstol, 2011). It has been tested on different species and it is considered a useful non-lethal measure to reduce bears predation on food that cannot be secured and the desirability of anthropogenic food sources (Ternent & Garshelis, 1999; Homstol, 2011). The illness is caused by the addition of substances to baits, made of the attractive food which is intended to be avoided by bears in the future. Often thiabendazole is chosen, which is a drug used to treat gastrointestinal worm infestations both in humans and animals and is preferred to others as it is quickly absorbed, favouring the immediate association of the illness with the food just ingested, and it is basically tasteless so it can hardly be detected by animals, finally it has a low toxicity, and just causes temporary nausea,

vomiting and dizziness (Signor, 2009). It is fundamental that the emetic is undetectable by the animal, otherwise they will not eat the treated bait. The baits can then be placed in strategic locations and animals' reactions will be monitored by professionals. Conditioned taste-aversion can occur even only after one single ingestion and can be long-lasting, but the administered dose of thiabendazole and the consequent illness can affect the strength of the aversion (Signor, 2009; Homstol, 2011). A study conducted on bears in Minnesota using thiabendazole proved that it decreased the tendency of bears to eat that type of food for more than one year (Ternent & Garshelis, 1999). Another study was performed in British Columbia and created conditioned taste-aversion of black bears to apples (Homstol, 2011). All in all, this measure is considered promising in decreasing the nuisance of food-conditioned bears; nevertheless, it should still be combined with other measures, such as bear-proof bins, as limiting anthropogenic food sources is fundamental (Signor, 2009).

4.5. Application of the analytical framework

Now that the general success conditions for transferability and details on each to-be-transferred measures have been gathered, the transferability framework can be applied to assess the transferability of those measures to the Trentino case. Hereafter, every measure's transferability will be analysed according to the three main success conditions and the relative indicators, in order to assess which is the most transferrable one.

Bear-spray

Suitability

For what concerns the *compatibility with the area*, what has to be established is whether this measure, which can also be considered as a weapon if used against man, is suitable and compatible with the types and number of attacks registered in Trentino, or whether it is considered a disproportionate measure with respect to the actual risk of being attacked. Up to date, 5 attacks to people took place, involving 4 different bears, of which 3 were females protecting their cubs, all outdoor and no fatality occurred (ISPRA-MUSE, 2021). This is compatible with the purpose of bear-spray which is mainly used during outdoor activities (Brown & Conover, 2008). Other encounters took place but the people were only chased and the bears ran away. Moreover, in 2019 a close encounter with the bear M49 has also happened in a stable in an Alpine hut, but the shepherd managed to escape without being attacked (Groff et al., 2020). The bear-spray could have, most likely, helped in those circumstances, but at the same time it could also be considered disproportionate in relation to the number of bears present and to the number of attacks occurred. On this regard, the interviewees had diverging opinions and highlighted that there is currently a debate on this matter in Trentino. On one side, one of the interviewees stated that this measure is absolutely necessary and totally suitable and compatible with the characteristics and numbers of the attacks registered so far. Moreover, the competent authorities are already working to make it legal at least for the personnel working with large carnivores, but it would be very useful if also all the people could have it, in order to feel more secure and to avoid conflictual situations as much as possible. Nevertheless, on the other side, the other interviewees consider the bear-spray disproportionate with respect to the small number of attacks that have occurred so far. In 20 years of co-existence with the bears, in fact, only 5 attacks

have been registered out of almost 100 specimens present nowadays (ISPRA-MUSE, 2021) and thousands of people living, working and carrying out recreational outdoor activities in Trentino. Encouraging the people to use the bear-spray, indeed, may convince them that the risk of being attacked is much higher than it actually is. In a climate of lowered tolerance, this could probably lead to even more fear and stress. Moreover, carrying the bear-spray could give people an excessive boost of confidence which could decrease their level of wariness and attention that they should have and result into dangerous situations. In addition to that, one interviewee reported that being the Trentino's bear temperamentally different from American black bears and grizzlies, it would be enough, when encountering a bear, to behave in a way that does not scare the bear. Therefore, it would be necessary to teach people how to manage an encounter rather than telling them to use the bear-spray. From the interviews, hence, it became clear that the debate in Trentino is still more than open, with people in favour of the bear-spray and others against. Everything considered, this measure could on one hand, be very helpful for the wildlife personnel and for the people who are really scared of the bears, but on the other hand, it could also incorrectly increase the perception of the risk, in an area where the tolerance versus bears is decreasing. For these reasons, the *compatibility with the area* is considered to be a 3, as it is essentially met but not fully.

Going on with the *perceived potential success*, namely whether the bear-spray would have the same efficacy on brown bears as it does on grizzlies and black bears in North-America to scare them away by provoking a debilitating response. The bear-spray is currently being used in Slovakia on brown bears as well and it is considered as an efficient measure (Bombieri et al., 2019), therefore there is no reason to think it would not have the same effect on Trentino's brown bears, if properly used, and the perceived potential effectiveness seems to be high. Also, the experts confirmed that the bear-spray would likely be successful on Trentino's brown bears as well in order to give the attacked person the necessary time to flee. For this reason, the *perceived potential success* is given a 5.

So far, this measure seems to be quite suitable to the context under study, but before confirming it, *obstacles* must be checked, namely whether it complies with national and regional regulations and whether there is any perceived risk or threat that could hinder its transferability. Right now, the use of the bear-spray is illegal in Italy, and this is because it is considered as a weapon which could be misused, against people as well (Frasconi, 2020). This measure, in fact, has also been used in the wrong way in the years, such as during riots, protests, personal fights and car jackings in North-America. If misused against people, it can cause permanent eye-damages or can provoke wheezing, which, combined with asthma, can be dangerous, and it is therefore considered partly a hazard to humans according to the U.S. Environmental Protection Agency (EPA) (Briley, 2021). This can, hence, be regarded as a risk when thinking of introducing it in Trentino. In addition to that, the bear-spray is made of three components, one of these is a propellant, which in many cases is the refrigerant R134a, which has been suggested by the EPA to be phased out due to its high global warming potential (Smith et al., 2021). Nevertheless, the bear-spray is said to have no lasting effect on the environment (SABRE, 2020). One last obstacle is the possibility to increase the perceived risks from the people which would exasperate an

already fragile situation and also the risk of decreasing people attention when being outdoor, as they feel safer carrying the bear-spray. Seen these risks and the fact that it is still illegal, although one interviewee reported that authorities are currently working to make it legal, the *obstacles* indicator receives a 1, as there is a major impediment to its transferability. Given the scores of 3, 5 and 1, the overall suitability is a 3, making the bear-spray an essentially suitable measure to the Trentino context.

Feasibility

Starting from the *financial feasibility*, this measure must be affordable in Trentino to be applied. A canister of bear-spray costs around \$40, for about 8 seconds of spray-time (Miller, 2019), an inert bear-spray, used for practicing, costs \$25, which can be considered a bit costly in comparison with other defensive measures such as shotguns (Davis & Bio, 2017). In general, however, the cost of this measure is very low, so it could be left to Trentino's citizens to decide whether or not to buy it for their personal safety, but it could also be implemented by the province as a tool to protect wildlife managers during their outdoor working activities. The interviewees confirmed that due to the little cost of the bear-spray, this measure could easily and fully be implemented from the financial point of view, so the *financial feasibility* receives a 5.

Proceeding with the *practical feasibility*, this measure does not require any particular capabilities, but it is important to know how to use and conserve the bear-spray properly, in order to ensure a higher efficiency (Smith et al., 2021), so the personnel working with bears in Trentino must be aware of this. Workshops and training courses for both people and staff could, therefore, be really helpful to ensure a correct use of it. This will have a cost in terms of time to organize and teach people how to use it. Usually, several meetings organised by the Forestry and Wildlife department are held every year to answer people's questions and explain the current situation regarding large carnivores, together with press releases teaching how to behave in case of encounters. The instructions on how to use the bear-spray could be included as well during these occasions. Furthermore, personnel are frequently updated and trained on new techniques, also in collaboration with other European countries living the same conflict, such as Slovenia, France and Spain, to exchange experience and knowledge (Groff et al., 2020). It can, therefore, be assumed that bear-spray expertise can easily be gained by the staff and transmitted to people during the yearly meetings and therefore it would easily become feasible in terms of capabilities required. The interviewees confirmed that there are plenty of data on its application and results and they believe it could easily be applied in Trentino, therefore, also the *practical feasibility* receives a 5, making the total feasibility a 5 as well and the bear-spray a fully feasible measure in Trentino.

Acceptability

For what concerns the *attitude of local communities*, it must be ensured that they would accept its usage in Trentino. A fake bear-spray was already being sold in some hunting and fishing shops in Trentino in 2017, but it was actually a normal self-defence pepper spray and passed off as bear-spray. Nevertheless, there was a boom of sales from the residents (Del Frate, 2017). Furthermore, from 2015 people living in Trentino have already tried to make their voice heard on the matter by launching and signing petitions on the liberalization

of the bear-spray (“Legalizziamo lo spray anti-orso”, 2015). Therefore, it is deductible that this measure is highly accepted by the majority of local people, who will, probably buy and use the spray if legalized and sold on the market. The interviewees, indeed, reported that this measure is very likely to be accepted by the population, since it would make them feel safer in certain circumstances and the cost is really low. Hence, this measure scores a 5 for the *attitude of local communities*.

Going on with the *attitude of local authorities*, it must be checked whether Trentino’s local authorities would support the implementation of this measure or not. Despite currently being illegal according to the Italian law, the province of Trento has already tried to request its legalization in 2017 without success, but after the attack of a female bear to two people during the summer 2020, they are currently trying again, which was also confirmed by the interviewees. This is because the bear-spray is considered as a valid measure to protect people carrying out outdoor activities, such as tourists, residents and also forest rangers. In particular, the Councillor for Agriculture, Forestry, Hunting and Fishing of the Trento province has expressed herself favourable to the use of the bear-spray and hopes it can be made legal at least for the forest rangers in charge of the wildlife management, in order to ensure a higher safety (Pianesi, 2020-b). It can, therefore, be said that the local authorities would not only accept the implementation of this measure, but that are currently working to make it legal, which makes its adoption even more probable. For this reason, the bear-spray receives a 5 for the *attitude of local authorities*, which gives the bear-spray a total acceptability of 5 and makes this measure fully acceptable in Trentino.

Table 1 shows the total transferability score of the bear-spray measures, which is 13 out of 15 possible points and is therefore, considered as transferrable.

	Bear-spray
Suitability	3
Feasibility	5
Acceptability	5
Total:	13

Table 1: Bear-spray transferability score.

Diversionsary feeding

Suitability

Continuing with diversionsary feeding, since it is said to be more effective during food shortages, in order to check its *compatibility with the area*, it must be verified whether the Trentino’s bear population is preying on livestock, crops, beehives and waste-bins because the natural food is scarce or because of other reasons.

Damages to livestock and crops, in fact, can be related to the absence of natural preys and it could be the case for Trentino as well (Tosi et al., 2015). If natural food is not scarce, hence, a very attractive type of food has to be chosen in order to lure the bears away from the problematic contexts. However, despite an accurate research, it was not possible to gather from literature whether there is an absence of natural food in Trentino, or not. So, this question was posed to the interviewees who filled in the gap and all agreed that there is a great variety and quantity of natural food available. The reason why bears feed on anthropogenic trophic sources is that these are sometimes easy to access and bears are very opportunistic, so there is no certainty that they would stop feeding on them because of the diversionary feeding stations. Another important aspect to be considered when analysing the compatibility with the area is whether there are suitable locations to place the feeding stations, so that the bears would be lured away from crops and other appealing contexts. It was not possible to gather from literature whether there would be accurate and strategic locations where to place the feeding stations, so this was also asked to the interviewees who agreed on saying that according to them, diversionary feeding would work mainly to keep bears in selected and desired locations, e.g., for hunting or tourism purposes but it is believed that this cannot be done in Trentino, as there are not enough large areas to keep them. Therefore, the *compatibility with the area* is given a 1, as it is not compatible with the natural availability of food and it would be very hard to find proper locations.

For what concerns the *perceived potential success*, it must be inspected if diversionary feeding would work with Trentino's bears, according to their feeding habits and biological requirements. The type of food, is, again, essential in this case. Some bears have been seen foraging at ungulates feeding stations, placed by hunters ("L'orso che mangia il cibo dei cinghiali", 2021) so if the food chosen is appealing to them, they may be attracted to it as well but it is still hard to foresee if the level of damages will decrease. This aspect was also criticized by the interviewees, due to the fact that bears have different personalities and it is likely that if a specimen likes preying on livestock, it will go on doing it, despite of the diversionary feeding stations. Furthermore, bears can move up to 20-30 kilometres per day, and it could be hard to solve the issue with some feeding stations only. This measure is likely to be more effective to solve extremely critical situations and for a limited amount of time, such as a bear which is repeatedly preying on the same source. For these reasons, the *perceived potential success* is given a 2, as diversionary feeding does not sufficiently meet this condition's indicator.

Regarding the *obstacles* it is important to investigate what do regional and national regulations say on bear-feeding and to check if there is any risk linked to it. Despite not having found any real barrier to this measure, there are indeed some potential risks linked to it, such as the possibility of increasing the bears and other wildlife populations and also the damages, that bears link food to humans and that they could become addicted to this trophic source. These risks were encountered in literature and confirmed by the interviewees; therefore, the *obstacle* indicator is given a 2, because there is not a big impediment but there are many risks and no certainty of being successful. The total suitability of this measure is, hence, 1,6, meaning that it is not suitable at all.

Feasibility

Continuing with the *financial feasibility*, this measure requires much more financial availability than the previous one, as it is said to be an expensive practice, due to the high costs regarding the food administered and the personnel involved in the monitoring (Kubasiewicz et al., 2016). Moreover, extra food costs could incur due to the use of feeding stations by non-target animals, but this would be very hard to predict before implementation (Kubasiewicz et al., 2016). What must be checked, hence, is whether Trentino would afford to implement this measure or not. It is, therefore, difficult to a priori establish the cost of diversionary feeding in Trentino, however, an estimate could be made based on what other countries spend. In particular, the city of Alberta, in Canada, has been using ungulates killed in road accidents to feed the bears in strategic sites for 16 years. They used helicopters to move the carcasses to the desired locations in order to provide bears with important sources of protein that could discourage them to predate on livestock (Morehouse & Boyce, 2017). The expenses, estimated for the functioning and maintenance of 13 feeding sites, have been annually allocated as figure 18 shows:

Item	Estimated cost (\$CAD)
Personnel time	\$20,000
Helicopter costs	\$19,000
Vehicle costs	\$3,100
Equipment and repair costs	\$1,750
Total annual costs	\$43,850
Equipment costs—non-annual	\$19,000

Figure 18: Estimate of Canadian dollars spent every year for 13 bear feeding sites (Morehouse & Boyce, 2017).

The annual expense of \$46.850 is much different from what spent in Slovenia for bears feeding with livestock carrions, which was around €500.000 only for veterinary and transportation costs. This is because the EU regulation imposes that the carrions are checked by veterinaries before being administered to the bears (Kavčič, Adamič, Kaczensky, Krofel & Jerina, 2013). The type of food given, thus, can highly change the final cost, as well as the equipment used. The province of Trento has already spent a significant sum for bears management, namely more than €1 million for damages compensation and €700.000 for prevention in 10 years (Groff et al., 2020; ISPRA-MUSE, 2021), and thousands of euros for maintaining the bears in captivity in the Casteller centre every year (ANSA, 2021). Part of what is yearly spent for damages compensation and prevention could, therefore, be used for diversionary feeding as well, considering that this measure should reduce the number of damages and therefore, of money spent to compensate them. Based on the annual expenses, it can be assumed that the province could afford this measure, as it is aimed at reducing damages and the cost of compensating them. However, there are many variables affecting the costs of implementation and monitoring, such as natural food shortages and the behaviour of non-target animals (Kubasiewicz et al., 2016). Moreover, despite having the potential of reducing conflict, there is no certainty that it will happen, and the situation could actually get worse due to the bears population increase thanks to the additional food given to them, resulting in more damages overall, as underlined by the interviewees. Nevertheless, they also said this measure could actually

be implemented in Trentino with a relatively low cost, as for example some carnages could be created and filled in with dead carrions or other low-cost but appealing foods. Even if literature considers diversionary feeding an expensive measure, the *financial feasibility* is given a 5 because the people working with wildlife conservation, believe it would be easily financially feasible.

For what concerns the *practical feasibility*, this measure requires knowledge on the behavioural and biological characteristics of the bears, which type of food to administer, where, for how long and the monitoring method (Kubasiewicz et al., 2016), so this must be known by the personnel working with bears in Trentino. It can be assumed that these pieces of information could easily be obtained by the highly-skilled professionals working in the Forestry and Wildlife department, also thanks to the periodic updating sessions they attend. Moreover, meetings with experts from other countries could be organized, as it is already done with other measures, in order to exchange knowledge. However, according to the interviewees, the *practical feasibility* remains a bit more limited, due to the uncertainty related to bears' trophic choices, since they are considered opportunistic omnivores, with different personalities, tastes and preferences that could make it difficult to choose a food that appeals to all of them and diverts them from the other anthropogenic food sources. Hence, the score for the *practical feasibility* is a 4, as it would be feasible but some uncertainty remains. The total feasibility of this measure is 4,5, meaning that it is almost fully feasible.

Acceptability

Proceeding with the *attitude of local communities*, the people in Trentino must support and agree with the application of this measure. First, its cost is certainly higher than the bear-spray's. Placing diversionary feeding stations and monitoring the outcomes on the bears will require a sum of public money to be spent by the province of Trento, therefore it is important that the citizens agree with this (Kubasiewicz et al., 2016). However, right now the most problematic bears causing economic damages or attacking people are either enclosed in the Casteller centre or killed. Keeping bears in the centre, by the way, is very expensive as it has already been highlighted before. This means that the same money could be spent to prevent the bears to become problematic, instead of "punishing" them after they became conditioned to anthropogenic food sources, preventing much money to be spent in the long-term for their captivity.

Second, with the purpose of applying the measure, diversionary feeding stations will have to be placed in specific areas, which has to be decided by the team of experts, based on where they would be more effective and used by the bears. This could imply that people will see the bears while feeding, as it happened in other contexts, which could potentially help them in better knowing this animal which is sometimes considered as scaring and dangerous (Rogers, 2011). This will probably be accepted by people, since if the measure would work in practice, it will also reduce the money spent in the damages' compensation. In addition to that, being non-lethal, this measure would most likely be preferred by all the animal rights groups who have been protesting with sit-ins and hunger strikes to ask for a better treatment of the bears in the region. Even though being ranked high in terms of social acceptability in some areas (Boertje, Grangaard, Valkenburg & DuBois, 1992), it is important to ask for citizens' opinion about the implementation of diversionary feeding in Trentino.

It is, in fact, fundamental that they are heard as well and have a say in the decisions regarding wildlife management, due to the amount of public money spent and to the fact that public support is fundamental for the success of HBC measures (Kubasiewicz et al., 2016; Teel et al., 2010). So, even if it is difficult to a priori foresee to which degree people would agree with it, the interviewees, who have had the opportunity of meeting citizens in public meetings regarding bears conservation, affirmed that people would easily accept this measure, if properly presented and justified to them as a mean of reducing the HBC and solving an unpleasant situation, so the *attitude of local communities* is given a 5.

Likewise, it is not easy to predict the *attitude of local authorities* in Trentino regarding the implementation of this measure, but some assumptions can be made. If diversionary feeding resulted to be an effective measure to prevent the HBC, even for a short period of time, it would avoid authorities to spend money and time for damages compensation and would surely reduce the number of complaints received by animal rights groups and NGOs fighting against captivity and culling, being diversionary feeding a good alternative to such drastic measures (Kubasiewicz et al., 2016). Its effectiveness should, nevertheless, surely be tested in some sample areas and the behaviour of other non-target animals be checked, before fully applying it and spending money and in order to avoid other populations to grow more than the environment can carry. Regarding this indicator, contrasting opinion from the interviewees were heard. On one side it was said that the large carnivores' issue has been largely politicized in the recent years, and that the funds for the prevention have been decreasing, so it is likely that authorities will not accept this measure. However, this latter aspect has been denied by another interviewee, who reported that funds have been stable in the years and authorities are very likely to support measures that would prevent damages to occur. Another interviewee believes that, even if funds have not been decreasing, this does not mean they are enough for bear conservation. Everything considered, due to the discrepancy of information received, the *attitude of local authorities* receives a 4, because it is only possible to assume they would accept it but it cannot be ascertained. The total acceptability is 4,5 so it is almost fully acceptable, and the total transferability score for diversionary feeding is 10,6, visible in table 2, meaning that this measure is likely not transferrable.

	Diversionsary feeding
Suitability	1,6
Feasibility	4,5
Acceptability	4,5
Total:	10,6

Table 2: diversionary feeding transferability score.

Wildlife corridors

Suitability

For what concerns the *compatibility with the area*, corridors must be compatible with the geographical characteristics of Trentino, so there must be areas to connect and barriers to under or overpass. The Adige valley contains the main towns, roads and railways, in particular, the motorway A22 is one of the main north-south transportation roads in central Europe (Peters et al., 2015). Therefore, the valley is considered one of the biggest impediments to the bear population's connectivity. Peters et al. (2015) identified some potential crossing of the A22 but also of other highways and secondary roads, as it can be seen in figure 19.

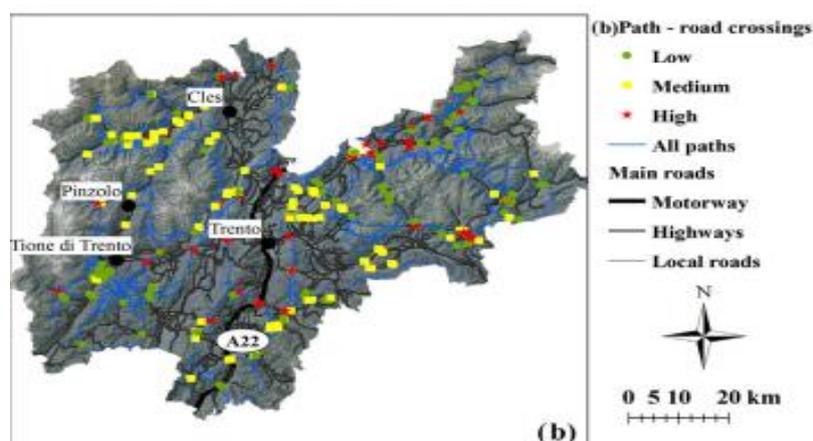


Figure 19: Possible crossing sites (Peters et al., 2015).

Nevertheless, the interviewees reported that bears-vehicles collisions happen in dozens of different sites and it would be very hard to create corridors on all of them. Moreover, the Adige valley is 2 kilometres wide and it is impossible to create a corridor that could cross it. For these reasons, they believe corridors are not suitable to the characteristics of Trentino. Another important aspect within the *compatibility with the area* is that wildlife corridors could, if built, connect the Trentino bears population with the Slovenian Dinaric-Pindos one. One of the reasons why the reintroduction project was carried out in the Italian Alps was, in fact, to favour the creation of a large Alpine bear population, composed of the Austrian, Swiss and Italian-Slovenian populations. Even low rates of immigration can, indeed, favour the viability of the bear population, as it could prevent the loss of polymorphism and heterozygosity (Peters et al., 2015). Therefore, despite not being suitable to the types of barriers in Trentino, corridors are considered by the interviewees to be a potential measure to increase the connectivity of the Trentino's bears population, which, being isolated from other populations, has a risk of inbreeding. Everything considered, even though some hotspots have been defined, so far, no plan on building corridors is in place. Therefore, the *compatibility with the area* is given a 2, because they are still suitable in some specific points and for the population's viability, but would probably not be helpful in limiting incidents and anthropogenic food sources depredation because there are too many sites of crossing.

Moreover, regarding the *perceived potential success*, it is important to check whether, according to their behavioural and ecological characteristics, bears of Trentino would use those corridors, to both avoid human

settlements but also road and railway collisions. Some bears have already been expanding to unoccupied areas not only in Trentino, but also Austria, Germany, Switzerland and Slovenia, since they move through great distances (Peters et al., 2015). Nevertheless, the majority of the population is still stable in the province of Trento, even if there are not important barriers in the west or north of the region the bears are not moving there, apart from the above-mentioned singular specimens. It is not clear why this happens but is likely that the environmental conditions in the Trento area are so optimal to make the bears stay there, reported one interviewee, so the *perceived potential success* is also questioned, due to the fact that it is not possible to ensure that bears will use the corridors. According to these biological characteristics, the indicator is given a 2 because it is not sufficiently met, as there is no impediment for bears to use them but is highly possible that they will not as it happened in other countries, according to the interviewees.

Lastly, *obstacles* must be verified, namely whether corridors would be suitable according to the Italian and regional law of Trentino but most importantly if there would be any physical barrier or threat involved in the construction of corridors, such as environmental risks. Wildlife corridors are also already used in Central Italy to improve the coexistence with the Marsican bear, hence, they would presumably comply with the national regulation as well. Moreover, an ungulates underpass has already been built in Trentino (Pedrotti & Bragalanti, 2008), therefore it can be assumed that there are no major barriers to the constructions of others, from the legal and risks points of view. The interviewees agreed on that and confirmed this is in fact a currently highly debated measure in the region. Nevertheless, the huge price and the uncertainty linked to the usage from wildlife are considered the main *obstacles*, so this indicator is given a 3, as it is essentially met but some risks and uncertainty remain. The total suitability is therefore 2,3, meaning it is not suitable.

Feasibility

For what concerns the *financial feasibility*, wildlife corridors require careful planning and design, as they are big construction works (ARC Solutions, 2017). Corridors in fact, can cost up to millions, but the price is very context-dependent, according to the to the type, such as overpass, underpass, or tunnel, to the materials used, length and width (Guccione, Gori & Bajo, 2008), so they must be affordable in Trentino. Nevertheless, being the number of incidents occurring in the region every year due to the investments of ungulates and carnivores very high, causing the deaths of people, animals and thousands of euros of damages which are partly compensated by the region (Andreazza, 2019), the construction of wildlife corridors could be seen as a long-term investment (Chung, 2014). The corridors, in fact, will not be used only by bears, involved in 38 car-accidents up to date (Groff et al., 2021), but also by other animals (Mark, 2016; Groff et al, 2021). An underpass to avoid collisions with ungulates has already been realized in the region, and cost €150.000 (Pedrotti & Bragalanti, 2008). They will, moreover, increase the habitat connectivity, allowing for further animal dispersal and possible distancing from human settlements, livestock and crops conflicts (Human-Bear Conflicts Expert Team of the IUCN SSC Bear Specialist Group, 2019). To precisely establish whether this measure would be financially feasible and worth it, however, it would be necessary to conduct a cost-benefit analysis, by taking into consideration the cost of damages occurring every year. Due to the fact that it would be hard, however, to

give a monetary value to the people and wildlife lives saved from diminishing the number of incidents, a cost-effectiveness analysis could be more accurate (Seiler, Olsson, Rosell & Van Der Grift, 2016), but this is beyond the scope of this thesis. The city of Alberta, for example, hired a consultant to conduct such an analysis, to forecast the costs of the measure and to check whether they would be higher or lower than the benefits (Ellis, 2019). A Swedish report has also conducted a cost-benefit analysis for the implementation of measures to reduce wildlife-vehicle collisions including wildlife corridors, compared to the benefits that would arise from them and obtained that there would be a very high benefit from the implementation of such measures (Seiler et al., 2016). Talking to the interviewees, however, it became clear that this measure would not be financially feasible in Trentino, due to the huge cost they require and to the fact that there are too many barriers that would need to be overpassed, so the *financial feasibility* receives a 1.

For what concerns the *practical feasibility*, wildlife corridors require some degree of knowledge of bears' behaviour to understand whether the measure would actually and really be helpful to mitigate the conflict so this must be present in Trentino as well, together with the necessary engineering and architecture. Wildlife corridors have already been suggested by different experts as a possible solution to the HBC, mitigating both damages and collisions and some research has already been conducted showing the high mobility of bears in Trentino, which could, without certainty, use the corridors if built (Peters et al., 2015). It is believed that those findings can be used as a starting point for future research on the real implementations of the crossing sites identified. What else would be needed is the contribution of engineers, architects, planners and ecologists (Mayer-Pinto et al., 2017). However, according to the interviewees, there are many biological and ecological factors to consider that would determine the usage of corridors by the wildlife, and there is hardly any certainty that this would work. Nevertheless, some degree of knowledge on this measure can be said to be possessed anyway, since an ungulates underpass has been built and some research has been conducted on some hotspots where they could be built, so the *practical feasibility* indicator receives a 2 because it is not sufficiently met. The total feasibility is, hence, 1,5, meaning that wildlife corridors are not feasible at all.

Acceptability

Regarding the *attitude of local communities* in Trentino, despite requiring a great amount of money as described in the feasibility section, they could be helpful not only to reduce the damages caused by conflict and increase the viability of the bear population, but also, and mainly, to lower the number of incidents with carnivores and ungulates, as they will cross the road using the corridor. This would allow to save many lives, both of people and of wildlife as car incidents can be mortal for both parties, and also the money needed to repair the vehicles which incurred in the collisions. Interviewees believe this measure would be accepted, but maybe the high price could make this measure less acceptable than others, so it is given a 4 for the *attitude of local communities*.

Regarding the *attitude of local authorities*, it is known that an ungulate underpass has already been built in the region, hence, it can be assumed that this is a measure accepted by them. Some potential corridors for bears have already been identified by Peters et al. (2015) and they were already suggested by the Forestry and

Wildlife Department of the province of Trento in 2010 to favour the creation of the Alpine bear population (Servizio Foreste e Fauna, 2010). Furthermore, in 2019 one political party already asked the province of Trento the construction of a wildlife corridor in order to avoid vehicles-ungulates collisions (Redazione TrentoToday, 2019). Nevertheless, since this practice has been already suggested in 2010 by the Forestry and Wildlife Department but not realized yet, this could imply that governing authorities do not fully agree with it. The interviewees did not report anything on this, but they confirmed it is still a highly debated topic, especially because of the uncertainty of success and the high price, also considered how politicized the HBC is. Corridors are therefore given a 4 for the *attitude of local authorities*, because they are believed to be accepted but there is no full certainty of this. The total acceptability of the measure is 4 so it is acceptable, but the total transferability score, visible in table 3, is 7,8, which makes it is not transferrable at all.

	Wildlife corridors
Suitability	2,3
Feasibility	1,5
Acceptability	4
Total:	7,8

Table 3: Wildlife corridors transferability score.

Conditioned taste-aversion

Suitability

Examining the *compatibility with the area*, this measure does not require specific geographical patterns, but there need to be suitable locations where the process of conditioning will be carried out by the wildlife managers and where bears' behaviours can be monitored. Monitoring of bears in Trentino has been going on for years, so this would not be a problem, but interviewees highlighted that it would be difficult to intercept so many bears in such a vast area with baits, also because they feed on so many different trophic sources, so the *compatibility with the area* is given a 3, because it is considered essentially compatible but there are some uncertainties.

For what concerns the *perceived potential success* of this measure, to be successful, it entails that bears in Trentino would eat the baits and associate them with pain in order to avoid that food in the future, so it is necessary to investigate whether it is likely that they would do so, according to their behavioural and biological features. The potential success is also affected by the type of bait used and by the response of the animals, so it must be studied whether it is likely to work or not. Bears, as already mentioned before, are considered opportunistic omnivores, therefore it is likely that they will eat the baits in Trentino as well, especially

because it is conducive to food they have already predated. However, this cannot be ascertained, moreover, it is possible that the bears will not associate the gastrointestinal pain to the food but rather the specific place or situation, underlined the interviewees. Nevertheless, since it has never been applied in Trentino it is not possible to certainly know how bears will react, but only assumptions can be done, therefore, it has been said that this measure could at least be tested in the area, before being completely rejected. The *perceived potential success*, therefore, receives a 2, it is not sufficiently met, as conditioned taste-aversion could be successful but there are hardly any certainties of this.

Concluding with the *obstacles*, threats to non-target species together with any potential existing regulation in Trentino regarding this measure must be considered. Despite incurring in the risk of attracting bears to human settlements and associate people with food, this type of feeding would be limited in time, as even one meal with the drugged bait could be sufficient to create taste aversion, and people will not be directly seen by bears. Therefore, it is unlikely that bears will associate the baits to humans. No other major risks, threats or impediments have for been found neither in literature nor during the interviews, so the *obstacles* indicator receives a 5, as also the interviewees said it could be worth it to test this measure in the future. The total suitability is therefore 3,3, meaning that it is essentially suitable.

Feasibility

For what concerns the *financial feasibility*, this measure is said to be very cheap with regard to its application, but requires a lot of monitoring to check whether the bears eat the baits or not, so this must be available in Trentino, in terms of both money and skills. It was impossible to find in the literature a cost-benefit analysis or an estimation of costs to cause conditioned taste-aversion in bears. Thus, in order to have a rough idea of the financial requirement of this measure, the average quantity of mg of thiabendazole administered to bears was examined which is around 120 mg per kg of food altered, but 200 mg were seen to be the most effective dosage (Homstol, 2011). The price on the online market for 500 g of TBZ is around €650 and considering that CTA can arise even after one single bite of a treated bait, it can be said to be not too expensive. What would cost more is probably the monitoring carried out by the personnel, who have to check the baiting sites, the immediate reaction of the bears and the future behaviour, to see whether they were successfully aversively conditioned (Snijders, Greggor, Hildernik & Doran, 2019). According to the interviewees, conditioned taste-aversion is considered very affordable, as it could have a low cost of implementation. The monitoring would be a bit more costly and time-consuming but it is still deemed as doable according to the availability of funds that the province of Trento establishes for large carnivores' management, hence the measure receives a 5 for the *financial feasibility*.

Concluding with the *practical feasibility*, despite never applied in Trentino, it is believed that the team of experts could gather enough knowledge to administer the right type of food and the right amount of drug. This would, of course, take some time as some tests may be needed before finding the right combination. Nevertheless, according to one interviewee, this practice is not enough worldwide applied to have very consistent data on it; he reported that he had discussed this measure with his colleagues in Spain, where it has

recently been applied, but it is too early to have defined and precise results about it. However, they all think it would not be difficult to adopt it in Trentino. Consequently, it is believed that the personnel working in the area would still be able to apply conditioned taste-aversion, but some degree of uncertainty remains so the *practical feasibility* scores a 4. The total feasibility is 4,5, which means it is would be almost fully feasible in Trentino.

Acceptability

Like diversionary feeding, this measure aims at reducing the number of damages created by the bears, holding even long-term potential effectiveness. This would almost certainly be a positive thing for the *attitude of local communities* in Trentino, so this measure would likely be accepted by the categories mostly impacted by the bears’ damages, namely beekeepers, farmers and livestock breeders. Moreover, being the negative effect of the drug administered only temporary, the bears would learn the lesson and still be alive and free, which will probably be accepted by the animal rights groups as well. There does not seem to be any concern regarding the social acceptability of this measure, but rather it would make all categories better off. The interviewees confirmed that it is very likely that people would accept it, so the *attitude of local communities* scores a 5.

Concluding with the *attitude of local authorities*, at the moment, some other kinds of aversive conditioning are being carried out by the Forestry and Wildlife Department of the province of Trento, such as shooting the bears with rubber bullets or chasing them with dogs when found creating damages or feeding from anthropogenic sources, in order to try to modify their behaviour by “punishing” them (Groff et al., 2020). This means the practice of aversive conditioning is already accepted in Trentino by the local authorities. It is surely fundamental that the drugged baits are place in suitable locations where neither non-target animals nor people could interfere with the conditioning process. However, due to the discrepancy of information received during the interviews regarding the *attitude of local authorities* on the bears conservation matter, this indicator scores a 4, as it is believed to be met but there is degree of uncertainty on authorities’ position on this measure. The total acceptability score of this measure is 4,5, which makes it almost fully acceptable and the total transferability score, visible also in table 4, is 12,3, which makes it transferrable.

	Conditioned taste-aversion
Suitability	3,3
Feasibility	4,5
Acceptability	4,5
Total:	12,3

Table 4: Conditioned taste-aversion transferability score.

4.6. Analysis of the results

After having given scores for every indicator, it is now possible to see in table 5 all the transferability scores and to analyse them.

	Bear-spray	Conditioned taste-aversion	Diversionsary feeding	Wildlife corridors
Suitability	3	3,3	1,6	2,3
Feasibility	5	4,5	4,5	1,5
Acceptability	5	4,5	4,5	4
Total:	13	12,3	10,6	7,8

Table 5: Transferability scores of all the measures.

The results obtained show that none of the measures under study is fully suitable, feasible and acceptable, as none scored 15/15, but some are more than others.

With a score of 13 out of 15, the bear-spray has resulted to be the most suitable, feasible and acceptable measure of the 4, nevertheless there are still some doubts regarding its implementation and its legality, especially because it can be considered almost as a weapon, as it can be harmful for people as well, if wrongly used. One way to overcome this problem could be to make it compulsory to have the proper licence to have the bear-spray. In this way, is it likely that not everyone will have it, but only the ones who really feel the need of it, after being properly trained and informed about its risks, so that they can be held accountable in case of misuse. This measure, however, is supposed to be used to prevent attacks and not damages, therefore the latter issue would remain. With regard to this, conditioned taste-aversion scores 12,3, and very well in the feasibility and acceptability, and it is also essentially suitable to the territory, even if some uncertainty linked to it and bears' behaviours remains. Nevertheless, it could be taken into consideration to try to decrease the damages to crops, livestock and beehives. More research on this aspect is probably needed in order to have more knowledge and expertise on it, indeed the interviewees agreed that it could be tested in the future. Diversionsary feeding scores 10,6 which makes it unlikely to be transferred, since, despite being probably feasible and acceptable, the very low suitability due to the many drawbacks linked to it hinder its transferability, application and effectiveness but it could be useful in specific situations of repeated predation. Wildlife corridors score 7,8 and are therefore considered not transferrable, especially due to the too high costs of implementation, probably unaffordable by the Trentino region and to the fact that it is not suitable to the barriers present there. For what concerns collisions with vehicles, one interviewee reported that some cheaper solutions than wildlife corridors are currently being tested, such as the RoadKill project, which is installing devices that would inform the drivers on the presence of an animal crossing the street so they can slow down, but in case this does not happen, other

devices would emit sounds (e.g., shots, screams, howls) to discourage the animals to cross the street. Everything considered, the bear-spray seems to be on its way to be transferred and applied; conditioned taste-aversion could be further explored by the personnel in Trentino, as it scored the second highest score and it is deemed transferrable; while diversionary feeding and wildlife corridors have very low chances of being transferred.

Talking to the experts, however, other important measures were highlighted. In particular, despite being the focus of this thesis on non-lethal measures, it became clear how fundamental culling is to preserve the whole bear population and to increase the level of tolerance. It is a measure already applied in other countries, and fully legal in Italy and agreed with the Environment Ministry in the PACOBACE, in case a bear is too problematic and considered as a threat for human safety (AA. VV., 2010). Nonetheless, this measure is highly contrasted by the animal rights groups and by the former Environment minister as well. Despite being very sad to eliminate one living being, it is considered to be necessary in addition to non-lethal measures and can probably represent the only way-out to the conflict in Trentino, as also underlined in the report by ISPRA-MUSE (2021). Captivity is considered incompatible with the bears' characteristics and not suitable for their welfare, moreover it is also very expensive. All the interviewees explained that the problematic bears in Trentino are a very small percentage of the total population, this would mean that sacrificing those problematic bears would probably safeguard the whole population, as tolerance from the local population would probably increase and a more peaceful co-existence could be reached. Another very important aspect highlighted in the interviews is the importance of enforcing the communication plan on living with bears which was created in 2016 but still has not been applied. It is believed, in fact, that it is fundamental to teach people how to behave and which is the real entity of the risk they incur into while being outdoor, as it may result to be much lower than thought. Moreover, improvement of prevention actions such as the use of electric fences and the substitution of normal bins with bear-proof ones, are considered the priority at the moment, as also suggested in their report by ISPRA and MUSE (2021).

5. Discussion

Now that the measures' transferability has been investigated, it is possible to summarise the main contribution of this thesis and to gather the main teachings learned on transferability for the Trentino case which can be extended to others as well. Finally, the limitations and recommendations deriving from this research will be presented.

5.1. Contributions and teachings on transferability

Everything considered, the developed transferability framework appears to be the main contribution of this thesis, as it fills in the gap in literature regarding a tool to assess the transferability of measures within the HBC and HWC more in general. Despite being partially taken from another field, namely the corporate business one, it considers all the main success conditions that should be taken into account, as also underlined by the interviewees, when asked if they considered the framework complete, at least for the Trentino case. The

framework is regarded as useful and adequate in assessing the transferability of the four non-lethal measures under study in Trentino, as it provided a detailed analysis of the indicators and led to the fulfilment of the transferability matrix, which easily displays which are the most transferrable measures. It can therefore, be helpful for other measures and for other contexts experiencing conflict as well. However, the main focus of this framework was on non-lethal measures, so when applied to lethal ones, other indicators, such as animal welfare, might be included, together with the specific features of the context under study.

Furthermore, as promised in the research aim, the application of the framework to the Trentino area, makes it possible to gather some teachings on transferability that can be useful not only for this case but also for other contexts, especially directed to all the stakeholders working with human-wildlife management,

What became even clearer after obtaining the results is that each case is very specific, due to its unique geographical, biological, ecological, social and political characteristics. What works well in one country, therefore, could be totally inappropriate and useless somewhere else. Measures that perfectly works in other parts of the world to mitigate the HBC, are here considered not to be equally successful if transferred to Trentino, due to many reasons, such as geographical patterns, bears' behavioural characteristics, local features and population traits. Moreover, each measure has different requirements in order to be successful in terms of placement, costs, skills, and acceptance, so this must also be considered. It is not only the place where measures are transferred that has to be studied but also the necessary conditions that every measure requires. This is in line with what asserted in Can et al. (2014) and Tosi et al. (2015), namely that every situation is different and requires specific and personalized solutions that take those differences into account. It is, hence, very important that all these factors are taken into consideration and deeply investigated when thinking of new measures for a situation of conflict.

In general, the collaboration among countries experiencing the same type of conflict also seems fundamental, to exchange information, experience, help and data and to foster a greater co-existence with wildlife not only in Europe but in the whole world. Talking to the people working in wildlife conservation in Trentino, in fact, it was clear that there is a high degree of collaboration with the other European countries dealing with HBC, which made it possible to advance their expertise on measures and to know about the ones still not implemented in Trentino. It is therefore advisable that all the countries living a situation of conflict with wildlife, establish contacts and cooperation with others who have a more advanced management of the conflict, which could help to transfer measures according to their capabilities and characteristics.

Another lesson that can be learnt is that not all the success conditions for transferability possess the same weight when thinking of transferring a measure. Talking to the interviewees, in fact, it became clear that a non-suitable measure, despite feasible and acceptable, will never be transferred, because it would be useless. On the other side, a measure that is considered to be compatible to the location where it has to be transferred and deemed successful to mitigate the conflict present there, is much more likely to be adopted, despite maybe not feasible and acceptable at the beginning. These latter aspects could, in fact, be influenced by the way a measure is framed. It is believed, for example, that in Trentino the bears matter has been highly instrumentalized and

discussed by the mass-media and politicians, which over-exposed the issue and over-awakened public opinion on it, as underlined by the interviewees and in Tosi et al. (2015). If the HBC and HWC were framed in the right way, namely reporting facts correctly without creating an unjustified climate of fear, people would be more eager to accept them. Moreover, if the matter is dealt with by the authorities in a way that does not politicise it, it would maybe be easier to find the needed funds to support the new measures. Therefore, despite some HWC papers assessing that when thinking of adopting new measures, it is necessary to first consider “their feasibility, sustainability, costs, humaneness and social acceptance” (Massei, Roy & Bunting, 2011, p. 93), from this case study it became clear that suitability is the most important factor to be checked. Especially talking to the experts, it emerged how significant it is that a measure is successful in decreasing the conflict, so that it can also be presented to the public and to the authorities, which will, likely, accept it as it would mitigate a problem they are living. For these reasons, it is advised that suitability is weighted more than feasibility and suitability when giving the scores.

5.2. Limitations

Despite providing great contribution to scientific literature, this thesis also presents some limitations that could reduce the validity and reliability of the results obtained.

First, the full reliability and validity of the methods used cannot be assured. As aforesaid, this thesis mainly used desk research as a research method, which could, to some degree, have limited the validity of the results, as some data needed were missing in the scientific literature and only gatherable in the field. Validity of results is also limited by the low availability of scientific data online for what concerns Trentino, especially for the feasibility and acceptability conditions. Some more data were gathered by reading Italian sources and online magazines reporting the latest news on the situation. However, sometimes some assumptions had to be made, when no data at all could be found. This is why structured interviews were chosen as a supplementary method to obtain data and to verify the reliability of the results, which really helped in filling in those gaps and in confirming or denying the assumptions.

Furthermore, the transferability framework developed is based on both transferability conditions for HBC and HWC measures and on the SFA, which is a model principally used in corporate business. This could also partially limit the validity of the results, being the HBC a different field from the one SFA is usually used in. Nevertheless, it is believed that the SFA still provided a very useful basis on which building the transferability framework, as it already took into consideration not only the concept of suitability, but also feasibility and acceptability, considered to be very important when investigating the measures to apply in conflictual cases (Teel et al., 2010). However, some factors, such as humaneness, animal welfare and long-term effects, have been neglected so this may have affected the results as well, since the measures could have been analysed with other indicators too. Nonetheless, the experts interviewed defined the transferability framework as complete, at least for what concerns non-lethal measures and the Trentino case, and believe all the most important aspects have been considered.

Another limitation of this thesis is the very low response rate of the interviewees, in fact it was not possible to interview more than 3 people but a higher number of respondents could have provided more data and insights. There were, indeed, some discrepancies in the answers, such as on the bear-spray, and on the availability of funds and on the attitude of local authorities, but apart from these, there was consensus between the respondents on all the other questions. It can also be argued that this is a pro-bear biased sample of respondents, being all the three interviewees working in wildlife conservation. Anyhow, all of them underlined the importance of taking into consideration what people say as well and they are all in favour of using culling as a conflict mitigation measure, in order to ensure not only the viability of the bear-population, but also to increase the tolerance of people so that a more peaceful co-existence could be reached.

Finally, mainly due to COVID-19 and to time constraints, it was not possible to interview any representatives of the local population and authorities, so their opinion on acceptability could not be gathered, which could limit the reliability of the results on the acceptability success condition. Those questions, however, were posed to the experts who live and work in the area with both categories, so they are believed to be well-informed on the perception of things. For these reasons, the data obtained through interviews are considered to be of high value and to be enough to answer the research question.

5.3. Recommendations

Despite not finding any measure which is fully suitable, feasible and acceptable to mitigate the HBC in Trentino, this thesis can be considered as a starting point for further research.

First, the bear-spray and conditioned taste-aversion, which seem to be the most likely transferrable measures, have the potential of being helpful in mitigating the conflict. However, the former measure still needs to be approved and legalized in Trentino and the latter requires some additional research since the available data and results on it are promising but still scarce. A further investigation on the transferability of conditioned taste-aversion in the European context, and more specifically in the Trentino one, may shed a light on the possible implementation of this measure to reduce the damages. The experts, in fact, considered it suitable, but only after it has been tested. Second, the other two measures discarded for Trentino, namely diversionary feeding and wildlife corridors may still be of value for other contexts, but all the success conditions and indicators considered in this thesis' analysis must be at least considered, in order to have a view of the measures' requirements as comprehensive as possible. Third, by talking to the experts, it emerged that more communication, higher implementation of the preventive measures already in place and culling could be the only viable solution in the future for the Trentino case. Culling, in particular, is largely rejected by the animal rights groups and has been discarded also by the former minister of the Environment. What is needed, therefore, is a way to make this measure accepted by all the parts, so future research may steer towards this direction as well, in order to reach a compromise and find solutions that could ensure the viability of the bears population and of the co-existence with people. Fourth, it has resulted that collaboration with other countries is fundamental, so it would be important to also deepen this aspect in the future, as for example, it could be helpful to create a common database to share experience, data and results regarding the conflict. Fifth, by establishing that some measures may not be transferrable, this thesis suggests to focus research into more

worthful directions in the future, by discarding the measures that scored the lowest and by focusing on the ones which already proved to be more transferrable.

6. Conclusions

The research question “*what are the necessary success conditions for the transferability of non-lethal measures to mitigate the human-bear conflict and to what extent are they met in the Trentino case?*” can now be answered and some conclusions be drawn. Thanks to the literature review performed, the transferability framework developed and the interviews conducted, it is possible to say that the main necessary success conditions for the transferability of non-lethal measures to mitigate the HBC are suitability, feasibility, acceptability and their indicators. These have been assessed by applying the framework to a real case and gathered to what extent are the measures transferrable there. Within this thesis, it was applied to the Trentino case, which showed that there is no measure that fully meets all the success conditions to be transferred, but some score better than others and are therefore more likely to be successfully transferred and applied. In particular, the bear-spray scores the best in total, and is considered to fully meet the feasibility and acceptability conditions. The suitability score can surely be increased when it will be made legal in the country and when there will be no more debate on the compatibility with the attacks registered in Trentino. Conditioned taste-aversion has the potential to be transferrable, but some doubts still exist regarding its potential success, so it could be taken into consideration in the upcoming years, when maybe more certain results will become available from the other countries testing it, such as Spain. Diversionary feeding and wildlife corridors are not likely to be transferred because the success conditions are insufficiently met: the former due to its very low suitability, while the latter for the very low feasibility due to the high costs involved in it, together with the uncertainty of being effective.

This thesis was also able to draw some learnings on transferability that can be useful not only for the HBC but for HWC in general and worldwide. It has, in fact, showed that the characteristics of a conflict and of the area where it takes place greatly influence the potential of a measure to be successful in mitigation and must therefore be all taken into account when considering the transfer of new measures. Moreover, collaboration with other countries experiencing the same conflict is also regarded as fundamental, as they could provide important data, pieces of advice and expertise. It also became clear that suitability should hold a greater weight than feasibility and acceptability when applying the developed transferability framework in the future, as it resulted to be the primary aspect examined by the experts when thinking about measures to mitigate the HBC, so the framework can be refined in future applications with regard to this.

Everything considered, the research question has been fully answered and the research aim of contributing to scientific literature by creating a transferability framework that takes into account the main success conditions needed to successfully transfer measures that mitigate the HBC and by applying it to the Trentino case in order to gather more insights on transferability from this case and in general has been reached, thanks to the development of the transferability framework and its application. Hopefully, apart from filling in the void in literature on transferability, this thesis can also be helpful by providing useful insights on a conflict that is

threatening the co-existence of people and wildlife in an astonishing landscape and area, such as Trentino, and practically be used as a starting point to finding new solution to mitigate the conflict not only there but worldwide.

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Appendix I

Primary questions to the experts:

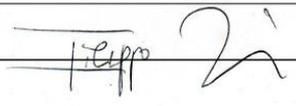
1. According to your knowledge, do bears in Trentino predate livestock, crops and beehives because there is natural food scarcity or because of other reasons? E.g. because they are opportunistic omnivores?
2. Do you think that conditioned taste-aversion could work in the Trentino context according to the characteristics of the bears population? Could there be any barriers or risks linked to it?
3. Is there any obstacle to the creation of wildlife corridors? If yes, which ones?
4. In general, do you think these four measures are suitable to Trentino?
5. Do you think the four measures are feasible from the financial and practical point of view? Do you believe the Forestry and Wildlife Department possess or could easily possess the knowledge needed to apply the measures?
6. Do you think the local people and authorities would accept and support these measures?

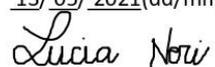
Secondary question:

- Do you think the indicators I used are adequate and enough to fully analyse the transferability of measures?

Appendix II

	Utrecht University	INFORMED CONSENT FORM for participation in:
<i>Humans or bears: why not both?</i> An analysis of the human-bear conflict in Trentino-Alto Adige (Italy) and of the transferability of measures applied abroad		
To be completed by the participant:		
I confirm that:		
<ul style="list-style-type: none">• I am satisfied with the received information about the research;• I have been given opportunity to ask questions about the research and that any questions that have been risen have been answered satisfactorily;• I had the opportunity to think carefully about participating in the study;• I will give an honest answer to the questions asked.		
I agree that:		
<ul style="list-style-type: none">• the data to be collected will be obtained and stored for scientific purposes;• the collected, completely anonymous, research data can be shared and re-used by scientists to answer other research questions;• video and/or audio recordings may also be used for scientific purposes.		
I understand that:		
<ul style="list-style-type: none">• I have the right to withdraw my consent to use the data;• I have the right to see the research report afterwards.		
Name of participant: <u>FILIPPO ZIBORDI</u>		

Signature:  Date, place: 14 / 05 / 2021, TRE VILLE (TN) - ITALY

To be completed by the investigator:	Name: <u>Lucia Neri</u>
I declare that I have explained the above mentioned participant what participation means and the reasons for data collection.	Date: <u>13/05/2021</u> (dd/mm/yyyy)
I guarantee the privacy of the data.	Signature: 



Utrecht University

INFORMED CONSENT FORM for participation in:

Humans or bears: why not both?

An analysis of the human-bear conflict in Trentino-Alto Adige (Italy) and of the transferability of measures applied abroad

To be completed by the participant:

I confirm that:

- I am satisfied with the received information about the research;
- I have been given opportunity to ask questions about the research and that any questions that have been risen have been answered satisfactorily;
- I had the opportunity to think carefully about participating in the study;
- I will give an honest answer to the questions asked.

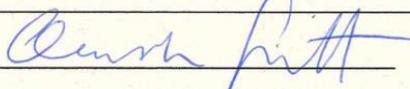
I agree that:

- the data to be collected will be obtained and stored for scientific purposes;
- the collected, completely anonymous, research data can be shared and re-used by scientists to answer other research questions;
- video and/or audio recordings may also be used for scientific purposes.

I understand that:

- I have the right to withdraw my consent to use the data;
- I have the right to see the research report afterwards.

Name of participant: CLAUDIO GROFF

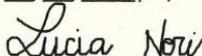
Signature:  Date, place: 26/5/21 TRENTO (I)

To be completed by the investigator:

I declare that I have explained the above mentioned participant what participation means and the reasons for data collection.
I guarantee the privacy of the data.

Name: Lucia Neri

Date: 13/05/2021(dd/mm/yyyy)

Signature: 



INFORMED CONSENT FORM for participation in:

Humans or bears: why not both?

An analysis of the human-bear conflict in Trentino-Alto Adige (Italy) and of the transferability of measures applied abroad

To be completed by the participant:

I confirm that:

- I am satisfied with the received information about the research;
- I have been given opportunity to ask questions about the research and that any questions that have been risen have been answered satisfactorily;
- I had the opportunity to think carefully about participating in the study;
- I will give an honest answer to the questions asked.

I agree that:

- the data to be collected will be obtained and stored for scientific purposes;
- the collected, completely anonymous, research data can be shared and re-used by scientists to answer other research questions;
- video and/or audio recordings may also be used for scientific purposes.

I understand that:

- I have the right to withdraw my consent to use the data;
- I have the right to see the research report afterwards.

Name of participant:  dott. Andrea Mustonj

Signature: 

Date, place: 7/6/01, Sirmione (TN)
Italy

To be completed by the investigator:

I declare that I have explained the above mentioned participant what participation means and the reasons for data collection.
I guarantee the privacy of the data.

Name: Lucia Neri

Date: 13/05/2021(dd/mm/yyyy)

Signature: Lucia Neri