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BERECZKY LEONARDO

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Individual distinctiveness in juvenile brown bears - have personality constructs predictive power across time and situations?

Leonardo Bereczky

Témavezető: Prof. Dr. Náhlik András

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Értekezés doktori (PhD) fokozat elnyerése érdekében

Írta:

Bereczky Leonardo

Készült a Nyugat-magyarországi Egyetem Roth Gyula Erdészeti és Vadgazdálkodási Tudományok Doktori Iskola Keretében

Témavezető: Dr. Náhlik András

Elfogadásra javaslom (igen/nem)

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a Szigorlati Bizottság elnöke

Az értekezést bírálóként elfogadásra javaslom (igen /nem)

Első bíráló (Dr. …...................... …................) igen /nem

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Második bíráló (Dr. …...................... …................) igen /nem

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A doktori (PhD) oklevél minősítése…...............................

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Az EDHT elnöke

Contents

Abstracts

The thesis is structured in 5 thematic chapters gathered around a main topic: “personality” in juvenile brown bears.

1st section: “Individual distinctiveness at sub adult brown bears. Are they “somebody”?”

Abstract:

Individual personality distinctiveness has been measured at 71 juvenile brown bears in the frame work of a rehabilitation center in the Romanian Carpathians. The personality profiles were defined based on clusters of behavior traits using a Principal Component Analysis. Ten profiles have been distinguished: “irritable-aggressive”, “focused”, “opportunistic-bold”, “self-confident”, “curious-confident”, playful-sociable”, “greedy-assertive”, “shy”, “lazy” and “absent minded”. Although most of bears were “opportunistic – bold”, “self confident”, “curious-confident” and “playful – sociable”, only half of them fell under the ‘focused’ dimension. Approximately a quart of the bears showed a high level of aggressiveness and irritability and also a quart showed a high degree of shyness. Only few were lazy or absent minded and even fewer were greedy-assertive. The study revealed that brown bears have a distinct personality profile that is measurable already at juvenile ages.

2nd section: “The relation between the life history of bear cubs and their personality profile development”

Abstract

Life history of 71 juvenile brown bears has been recorded during their rehabilitation process in an orphan bear rehabilitation center in the Romanian Carpathians. The following variables were taken in consideration: (1) Did the bear interact with other bears during the rearing process?; (2) Was or not the cub of a problematic (habituated to human food source) mother?; (3) Was the bear kept more than 5 months in captivity by humans before its arrival in the rehab center? The study tries to investigate whether exists a relation between the recorded personality profiles of the observed bears and their life history in early development stage. To test whether the up mentioned variables have a certain degree of influence on the personality development, Pearson chi square cross tabulations were performed for every personality construct. The study showed that in the first year of their life, the interaction with other bears (mother or other cubs) is important in the

development of the “aggressiveness”, “focused”, “opportunistic-bold”, “playful-sociable”, “self confident” and “curious-confident” profiles at sub-adult bears. “Absent mind”, “lazy”, “greedy” and “shyness” seems to be in no relation with whether the bears interacted with other bears or not during cub stage. According with the results, the personality development of a bear cub depends strongly on the captivity period.

The study showed that “aggressiveness”, “absent minded”, “lazy”, “greedy-assertive” and “shy” profiles have no relation with the behavior of the mother. Oppositely, there was a relation between the “focused”, “opportunistic-bold”, “playful”, “self confident” and “curious confident” profiles and the behavior of the mother.

The study revealed relations between life history of bear cubs and their personality construct development.

3rd section: “Can personality profiles influence the later fate of juvenile bears?”

Abstract

The fate of 61 radio and GPS tracked juvenile brown bears has been assessed after their release from an orphan bear rehabilitation center in the Romanian Carpathians. 43 bears of the 61 survived more than 6 months, the others died due to different reasons. In this study we tried to investigate whether different personality profiles identified at the tracked individuals influenced the later fate of the animals. Cross-tabulations of the fate frequencies with each personality profile revealed that the “absent-minded” and “lazy” profiles have a decreased chance of survival, especially vulnerability to predation, while all other profiles have less chance to be caught by predators and less vulnerability to other risks. According with the results, personality constructs have an influencing power on the survival capacity of young brown bears.

4th section: “Is there any relation between personality profiles and later individual dispersal patterns?”

Abstract

The dispersal of 14 juvenile brown bears (8 males and 6 females) has been assessed, after their release from an orphan bear rehabilitation center in the Romanian Carpathians. The dispersal distance was measured from the release area to the middle of the most remote 95% Kernel home range. The study tried to investigate whether personality profiles of brown bears have effect on the juvenile dispersal. The Pearson correlation coefficients indicated that at males the playfulness and curiosity had a medium effect while at females all the profiles

had a substantial effect on the dispersal distance. The study showed that the personality profiles have an influencing power on the dispersal dynamic of juvenile brown bears.

5th section: "The relations between personality profiles and habitat selection at juvenile brown bears"

Abstract

The habitat selection of 9 GPS tracked juvenile brown bears has been analyzed. Among others we tried to investigate whether exists any relation between habitat selection strategies and the personality traits of the individuals. The bears were released from an orphan bear rehabilitation center in the Romanian Carpathians. Seven environmental variables were selected to describe the habitats with respect to food availability, shelter availability and human activity: five landscape scale variables: elevation, ruggedness, slope, land cover type, forest succession stage, and two local scale variables: buffers of 500 m and 1500m around human settlements and artificial surfaces. The habitat selection was analyzed using the sample protocol of Manley *et al.* (2002), adopting the design II.

Though the habitat preference of the bears showed quiet a strong heterogeneity, the study showed that the most important factors influencing habitat selection at bears are the food availability and human disturbance, the animals facing a clear trade-off between them. According the Manley selection ratios, animals with certain personality profiles showed different proneness to take risks. This is underlying the presumption that some personality constructions can induce the apparition of different surviving strategies in the same environmental conditions, and there is a degree of predictability in whether certain "risky" profiles, might lead the animals towards conflict situations with higher chance than those that have not these "ingredients" in their profile configuration.

Kivonatok

A dolgozat 5 kutatási fejezetre van osztva, amely, egy központi téma köré összpontosít: fiatal barnamedvéknél mért egyéniségi különbözőség.

1. Kutatási fejezet: „Személyiségi különbségek fiatal barnamedvéknél: beszélhetünk „valakiről”? „

Kivonat

Egyéniségi különbözőséget mértünk 71 fiatal barnamedvénél egy árva medvebocs rehabilitáló központban a Román Kárpátokban. A személyiségi profilok főkomponens-analízis által csoportosított viselkedés-magatartás csoportokból kerültek meghatározásra. E módszer segítségével tíz egyéniségi profilt sikerült megnevezni: “ingerlékeny-aggresszív”, “figyelmes”, “opportunista-bátor”, “önbízalmas”, “kíváncsi-bízalmas”, “játékos-barátságos”, “kapzsi”, “félénk”, “lusta” és “szórakozott”. Annak ellenére, hogy az egyedek többsége “opportunista-bátor”, “önbízalmas”, “kíváncsi” és “játékos” volt, az egyedek csak felére volt jellemző a “figyelmes” jelző, körülbelül az egyedek negyede mutatott az átlagnál magasabb aggresszivitást, ingerlékenységet illetve “félénkséget”, az egyedek kis hányada volt “szórakozott” és csak nagyon kevés volt “kapzsi”. A megfigyelések kiértékelése kimutatta, hogy a medvéknél egyedenkénti elkülöníthető jellembeni egyéniségről beszélhetünk, ami már ivarérettségi kor előtt mérhető.

2. Kutatási fejezet: „Fiatal barnamedvék életmúltja és személyiségi fejlődésük közti összefüggések”

Kivonat

71 árva medvebocs életmúltja került rögzítésre egy árva medvebocs rehabilitáló központban a Román Kárpátokban. A következő mutatók voltak figyelembe véve: (1) szocializált-e a medvebocs más medvékkel a nevelkedése alatt?. (2) Problémamedve anyától származott-e vagy sem?. (3) Öt hónapnál többet vagy kevesebbet volt emberi gondviselés alatt a rehabilitáló központban való kerülésig? A megfigyelések során a személyiségi mutatók Pearson kereszttabulációjának segítségével mérni próbáltuk a fent említett életmúlti változók és az egyed személyiségi jellegzetesség kifejlődése közti összefüggéseket. A kutatás kimutatta, hogy életük első évében való fajtársakkal való szocializálás fontossággal bír az

„aggresszivitás”, „figyelmesség”, „opportunizmus-bátorság”, „játékosság”, „önbízalom”, „kíváncsisság” kifejlődéséhez, míg a „szórakozott”, „lusta”, „kapzsi” és „félénk” profilok kialakulásában nem. Az emberi fogság szignifikáns hatással van a személyiség kialakulásban. Az „aggresszív”, „szórakozott”, „félénk”, „erőszakos” és „lusta” személyiségi profilok kialakulásához az anya viselkedésének nem volt mérvadó hatása, de a „figyelmes”, „opportunista-bátor”, „játékos”, „önbízalmas” és „kíváncsi” profilok kifejlődésében már igen.

3. Kutatatási fejezet: „ Az egyedi személyiségek és a túlélőképesség közti kapcsolat fiatal barnamedvéknél”

Kivonat

61 rádió és GPS távérzékelési rendszerrel követett fiatal barnamedve túlélési rátáját és elhalálozási okait vizsgáltuk egy árva medve rehabilitáló központból való szabadon engedésük után a Román Kárpátokban. A 61 egyedből 43 maradt életben több mint 6 hónapig. Különböző személyiségi vonások hatását próbáltuk vizsgálni az állatok túlélési képességére. A túlélési/elhalálozási gyakoriságok személyiségi profilokkal való kereszttabulálása kimutatta, hogy a „szórakozott” és „lusta” vonásokat hordozó egyedek túlélési esélye szignifikánsan kissebb a többi személyiségi mutatatóval jellemezhető egyeddel szemben. Az eredmények kimutatták, hogy az egyedek személyiségi jellemzője és túlélési képességük közt összefüggés van.

4. Kutatási fejezet: „Medvebocsok személyisége és későbbi otthonterületválasztásuk közti összefüggések?”

Kivonat

Egy árva medve rehabilitáló központból természetes élőhelyükre visszaengedett 14 fiatal medve (8 hím és 6 nőstény) otthonterületválasztási dinamikáját mértük a Román Kárpátokban. Az elvándorlási távolság a szabadon helyezés pontjától, a legtávolabb eső 95%-os Kernel otthonterület középpontjáig volt mérve. A kísérlet során próbáltuk felderíteni az állatok személyiségének a fiatalkori otthonterületválasztási dinamikára gyakorolt hatását. A Pearson korreláció alapján a hímeknék a „játékosság” és „kíváncsiság” közepes, míg a nőstényeknél minden személyiségi profil fokozott hatást gyakorolt az elvándorlási távolságokra. A megfigyelések szerint az egyedi személyiségi vonások mérhető hatást gyakorolnak az ivarérettség előtti diszperzióra.

5. Kutatási fejezet: "Egyéni személyiségi jelzők és élőhelyválasztás közti összefüggések fiatal barnamedvéknél"

Kivonat

9 GPS rendszerrel felszerelt fiatal barnamedve személyiségi vonásai és élőhelyválasztási sajátosságai közti összefüggéseket próbáltuk mérni a Román Kárpátokban. 7 változót vettünk figyelemben az élőhelyi sajátosságok jellemzésére a táplálékkínálat illetve búvóhelyet illetőleg: öt táji változót, (tengerszint feletti magasság, lejtőmeredekség, terepi szabdaltság, corine élőhelytipus, erdőrétegződés) és két helyi változót (emberi települések körüli 500 illetve 1500 méter sugarú kört). Az állatok élőhelyválasztása a Manley et al. (2002), II. desing szerint előírt protokoll követésével volt elvégezve. Annak ellenére, hogy az állatok élőhelypreferenciájában erős heterogenitás volt, a kutatás kimutatta, hogy a fő élőhelyválasztást befolyásoló tényezők a táplálékkínálat és az emberi zavarás. E két véglet közti kompromisszumot különböző személyiségi vonások aktívan befolyásolják. Ez alátámasztja a feltételezéseinket, hogy ugyanazon élőhelyi sajátosságok közepette, különböző jellembeni vonások egyedenként más-más túlélési stratégiát indukálnak. Megállapításaink szerint egyes "érzékeny" egyéni vonások, bizonyos mértékű előreláthatósággal, bizonyos egyedeket nagyobb eséllyel sodorhatnak konfliktus helyzetekbe szemben olyanokkal, amelyek személyisége nem tartalmazza ezen "összetevőket".

Foreword and acknowledgement

"The bear is a great philosopher. While the days of his life are carried by sunshine, he enjoys them but if the situation gets bad, he doesn't look for another home as the storks do, neither goes to rob as the wolves, or become a servant of the man as the dog, but hides himself in a good time prepared quiet hole, heaps himself up, and waits with great patience who will get board earlier of the passive resistance: he or the winter. Usually the patience of the winter is shorter, because regularly it comes to an end by itself, while frozen bear on the snow has nobody found yet."

Jókai Mór

This work is about philosophy of bears. A predator which has been eradicated from a big part of the Old Continent - one of the great sins of man committed against nature, since life for any other creature can't be of the same quality where bears cannot live anymore. To discover the causes of this phenomenon is important in order to avoid it in the future, but impossible without the right knowledge of this species behavior characteristics and life activity.

This thesis is the result of more than 10 years of work, observations and passion towards large carnivores. It is a multi-level approach to investigate ways in which bears respond to their environments at various scales in the Carpathian habitat heterogeneity, focused mainly on interpreting ecological patterns in terms of bear behavior and individual development traits.

Since early childhood I spent most of my free time in the wilderness, observing nature and wild animals, in an empirical way at the beginning. Predators played a big role in my adventures and personal life history. Later, I had the opportunity to open my horizons towards a scientific approach and I tried to turn towards professional methodologies and techniques. Thus the results presented here are based mainly on my personal observations.

I was very lucky in finding around people with similar interests, and the fastest possible

we formed a constructive team engaged with friendship. With gathered forces our work proved to be more effective, fact that could be observed in short time through our results. Thus I must admit, that everything is shared in this thesis wouldn't have been of the same quality without the help of my family and colleagues: my parents, István Bereczky and Melania Bereczky; and my colleagues: Ximena Anegoraei, Silviu Chiriac, Mihai Pop, Lajos Berde, Sandu Radu, Cosmin Stanga, Alexandra Sallay, Dr John Beecham, Joost de Jong and all who in any way walked together with me on the path of bears.

All our work needed a proper funding. I acknowledge several foundations and European Community Funding Programs for providing the necessary financial support: Foundation Four Paws, Alertis fund for Bear and Nature Conservation, International Bear Association, Life +Nature European Program, World Society for Protection of Animals.

I want to express special thanks to the staff of the University of West Hungary, Faculty of Forestry and Wildlife Management, especially to Prof. Dr. Náhlik András my PhD coordinator, who gave me the impulse to publish, get involved in scientific perspectives and finally bring all together in a PhD degree.

While being on the track of bears I collected information on individuality, personality traits and development of bear cubs and sub-adult bears, their social interaction, habitat selection, home range, juvenile dispersal, factors regulating bear populations in the Carpathians, problems related with human-bear conflicts and many others that are not presented in this thesis. Despite all these led to a better understanding of different problems and challenges related with the management of bears and hence of conflict situations, the results have pointed new questions forward. Probably a human life span is too short to answer all of them, but I believe that I could open some new horizons for next generations in studying bear behavior that close I did in the Carpathian Mountains.

1. Introduction

American Indians in attitude to wild lands and wild places phrased by Sioux Chief Luther Standing Bear (1932, from Deloria 2001):

"We did not think of the great open plains, the beautiful rolling hills, and winding streams with tangled growth as 'wild.' Only to the white man was nature a 'wilderness' and only to him was the land 'infested' with 'wild' animals and 'savage' people. To us it was tame. Earth was bountiful and we were surrounded with the blessings of the Great Mystery."

For men of old times, including aboriginal people of different continents, nomadic hunters and gatherers, who in fact represented our species most of its existence, "wilderness" had no meaning. Everything natural was simply living space, and people perceived themselves to be part of a seamless living community. Lines began to be drawn with the advent of herding, agriculture, and settlement (Nash 1982). At early stage of human's evolution, when hunting played the most important role of existence, hunters had respect for and felt a kinship with predators. This was and is reflected in attitudes of aboriginal people (Schwartz *et al.* 2003). That mentality disappeared and metamorphosed into an aversive perception of carnivores after appearance of "culture" and perception of civilization, in which wilderness started to be perceived as Nash (1982) describes: "something alien to man… an insecure and uncomfortable environment against which civilization had waged an unceasing struggle… Nature lost its significance as something to which people belonged and became an adversary, a target, merely an object for exploitation. Uncontrolled nature became wilderness".

Since the prevailing form of live-stock husbandry was to allow large herds of cattle and sheep to graze freely over vast areas, and man started to consider itself not part of the system, but "master" of it, carnivores, particularly wolves and bears, were considered not only competitors, but an economic and social threat.

As result of this mentality development, the populations of large carnivores around the world have been declining and many of them are listed as in danger of extinction by the

International Union for the Conservation of Nature and Natural Resources (IUCN 1994).

But nowadays, we are witnesses of a changing conception towards the idea of "wilderness". The situation turned 180 degrees: wild places and wild things currently enjoy widespread popularity. Unbelievably, wilderness is in danger of being loved to death (Nash 1976). The preservation of wilderness is now threatened as much from enthusiastic visitation as from economic development. As result in these days humans are even more increasingly entering carnivore habitats and at the same time populations of large carnivores recovering from past extirpation efforts are becoming involved in mutually threatening interactions with humans (Katajitso 2006). Many populations of large carnivores escaped extinction during the twentieth century owning to legal protection, habitat restoration and changes in public attitudes (Breitenmoser 1998; Treves and Karanth 2003). Successful management has resulted in gradual recovery and return of carnivores to their original habitats in several countries, which has lead to carnivore-human conflicts and damages to livestock in many areas worldwide (Mech 1995, Mattson et al. 1996, Breitenmoser 1998, Servheen *et al.* 1999, Kojola & Kuittinen 2002, Garshelis & Hristienko 2006). For large carnivores to have a long term future we have to allow them to occupy their habitats, which means in the same time integrating them into the landscapes transformed for fitting human life necessities. Because these areas are typically not coinciding with favorable resource patches, carnivores are facing a trade-off between resource use and avoidance of humans (Gill & Sutherland 2000, Frid & Dill 2002). Whether or not this trade-off tip towards human avoidance is at the core of the debate on if large carnivores can survive in human-dominated landscapes (Woodroffe 2000, Linnell *et al.* 2001). Thus, conservation of large carnivores becomes a challenging task. The Romanian Carpathians are maybe the best example of that situation, where the surviving of the biggest brown bear (*Ursus arctos*) population of Europe (excluding Russia) was possible due to the well preserved connected habitats and former strict protection status: this was a specific situation for Romania and for former communistic countries that created a characteristic circumstance with benefic results to large carnivores: the forestry management was an extensive one, permitting the survive of large connected wild areas. The lack of modern tools and low economical interest for timber resulted in a low degree of disturbance of the wild habitats. People were forced to leave rural areas and concentrate in big industrial cities and settlements. Everybody had a job, regardless his skills. It was the time of "building the new age". People were drained out from the rural world, and thus brought far from wild habitats. The agriculture in those times was an intensive one, but concentrated only in specific regions (for example the Southern part of the country), far from any wilderness. In the same period, hunting was a sport restricted to the broad public. It was the delectation of only high positioned political leaders. More than that, the brown bear was considered a symbol of the Carpathian fauna, and its harvest was opportunity of only few people. The bear got a strict protected status from this reason, poaching or even accidental kills being seriously punished. But these external factors are changing nowadays together with the transformation of social-political context of the country and infrastructural development required by the modern life. The fall of communism resulted a reverse phenomenon: a big part of the industry collapsed, people lost their jobs and went back to rural life. An intensive exploitation of the natural resources started. The human pressure towards the habitats increased and shows a threatening increasing trend. Major threats or obstacles for bears and large carnivores remained as in older times but at different scale: deterioration of habitats, human caused mortality and negative attitudes (Swenson *et al.* 2000).

Wildlife management is often viewed as a discipline oriented towards seeking sustainable strategies of wildlife exploitation being characterized by a conservation-utilization emphasis (Harry *et al.* 1969), whereas the "opposite" group, characterized by the conservation-preservation emphasis (Harry *et al.* 1969) is more concerned with the long-term preservation of species and their habitats (Festa-Bianchet & Apollonio 2003) but mainly without any involvement of human calculated strategies and relying on the "natural state". Both groups are concerned with the perpetuation of natural resources and therefore could be classed as conservationists. However, people with a utilization emphasis were oriented toward the goal of resource exploitation, such us hunting, with aims of producing sustained yields by cropping surpluses. Their philosophy was that of "wise use" and their doctrine has been adopted by most wildlife and natural resource managers. Although these objectives may appear contradictory, in case of large carnivores the management is an important component of conservation (Katajitso 2006). Nowadays the "wise use" and also the "natural state" conservation strategies seems to be a real challenge since carnivores tend to occupy large home ranges and thus require large areas (Woodroffe *et al.* 2005). In Europe there are few, if any, wilderness areas with suitable habitats and size large enough to maintain populations of large carnivores without facing contradictory situations with humans (Linnell *et al.* 2000; Sillero-Zubiri and Laurenson 2001). Therefore the conservation and management of carnivores is based on their integration into human-dominated multi-use landscapes and the long-term survival of carnivores is dependent on areas outside protected reserves (Linnell *et al.* 2000, Schadt *et al.* 2002). Consequently, better land-use planning and novel approaches such as development of structures for high ways crossing habitats, may turn out essential in carnivore conservation (Noss *et al.* 2002, Carroll *et al.* 2003, Clevenger &Waltho 2005). Of utmost importance in development of different management strategies for large, wide-ranging carnivores is the understanding of species-specific behavior and interactions with surrounding habitats. No conservation measure, land use planning or other strategies, neither “wise use” management can be efficient without that.

The big number of orphan bear cubs (around 15-20/ year) in the Romanian Carpathians is one of the consequences of an expanding human pressure towards wild habitats and animals. The Orphan Bear Rehabilitation Centre has been created as requirement of this circumstance and aims not only to solve the problem of orphan bears, but also to take advantage of that project in scientific researches related with the specie’s ecology and behavior. Many of the observations on bear behavior and interaction of bears with the surrounding habitats were performed in the framework of this project, involving teamwork and volunteers. The post release monitoring of the rehabilitated bears made possible not only the documentation of suitability for reintroduction of rehabilitated bears, but in comparison with observations on wild caught individuals conducted to interesting data on home range, habitat use, estimations of juvenile dispersal of brown bears, together with movement dynamic and mobility. Analyzing the mortality rate and cause together with the survival of the released cubs we obtained also interesting insights in the factors that regulate brown bear populations in the Carpathian Mountains, though for consolidating the relevance of this data we need to gather information on a much bigger sample size.

Habituation process and individuals exhibiting nuisance or abnormal behavior - human food conditioning, is a general phenomenon in countries with expanding bear population. Such bears appear more near tourist resorts and areas where garbage dumps are close to bear habitats. The phenomenon perpetuates itself as far as cubs are learning these habits from their mothers. These cubs remain often orphan, as result of different accidents. The rehabilitation process of such individuals and work in general with garbage habituated bears led to precious observations related with the habituation phenomenon and factors that influence it. Is there a difference in individuality or shyness/boldness between bear individuals? Do subadult bears develop distinctive individual behavior traits which can be perceived as personality? How is this coping with social interaction between individuals? Can we predict later risks based on individuality assessments, for bears getting involved in conflict situations? Can relocation or aversive conditioning treatments be considered as options for “treatment”? These are several questions I try not necessarily answer, but more to discuss. Studying these issues raised more and more questions that can be considered also an important outcome of this thesis.

Bears are the most complex predator species, which show a great ecological plasticity, very diverse diet and adaptability comparable with humans, occupying all kind of habitat ranges from rain forests, sub alpine and alpine mountain areas, tundra, deserts, until arctic regions. Thus a work related with their behavior biology cannot be discussed in one unit. I had to split it to different topics connected to the life stages during early individual development. In each thematic chapter I tried to analyze the existing related literature in order to create the clearest view of the presented issue.

The structure of the thesis is not a “classical” one. It is the outcome of a series of studies I performed on 71 juvenile bears during 10 years of work in the rehabilitation center I have designed and built, observing as much as possible their behavioral characteristics. After the introduction section, each chapter presents a different study, with an introduction to the section, materials/methods, and results/discussions. These studies followed each other, and are somehow connected, but each one can be considered as a different entity and will be published separately in the future. The first section tries to address the question: Can we talk about personality at juvenile brown bears? Exist an individual distinctiveness, are individual profiles distinguishable? Studies of personality have been performed at many mammalian species, but only one exists on bears: adult grizzly bears in Alaska – on a relatively small sample size (only 7 animals). In the second section I analyzed whether the development of the personality profiles is dependent or related with the early life history of the cubs. The third and fourth section tries to find relations between the personality profiles and the later fate: how the behavior trait combinations influence the survival capacity or incapacity of the animals and how these traits affect their natural dispersal. The last section before the final discussions looks for connections between the different personality traits and the habitat selection of the bears, considering the human created artificial surfaces an important component in the trade-off between foraging and their avoidance.

My first attempts to hand rare orphan bear cubs started in 2000 with three cubs, two males and a female. The situation of those times facilitated me to spend lots of hours walking with them in their original habitats: surroundings of the Olt River’s spring. Actually I was living with them in the forest, enjoying every minute of their presence, observing anything could be observed in relation with their behavior. Over the course of my investigations and observations occurred what Gosling (2001) describes: “When observers spend hours recording behavior, they end up not only with behavioral data, but also with a clear impression of individuals”. These three siblings were so different, that I could recognize each of them only by hearing the way they were approaching me from behind. Even more than that: I observed different intelligence level at each of them. A much deeper intelligence than generally animals are rated to possess. Thus the question of a great Hungarian animal behavior biologist, crystallized in my mind: might be there “somebody” (Csányi 2010)? Just few examples of my early experiences: we have a solitary yard in the middle of a forest (the place where my first bears started their “carrier”), with a small hut and several bee hives nearby. Is understandable that these hives were releasing more than interesting odors considering the nose of my friends, so as they gathered enough strength and size to be able of some “labor”, I had to make them understand that approaching these boxes is totally prohibited. Two of them came along easy with the situation (especially after several associating procedures between putting the paws on the hives and some bad feelings provoked by a stick hit on their claws). But the third, Mackó (translated means something like Teddy), seemed to resist easily anything, except temptation (I was often wandering weather was the reincarnation of Oscar Wilde), and in short time I realized that his only life target for that moment was to discover that magic place where the honey comb odor was coming from. This was not a very difficult task to an animal with the patience of a bear (see Jókai's text in the foreword), so he damaged several hives in short time. Anyway the fact that the bees were more challenging to one of them than to the others made already an interesting difference between the cubs. The things went even further: my fellow learned fast that working with bees means punishment from my side, so started to build strategies in order to hide his intentions. For example during the play with his brothers (these plays were so enjoyable, that is very hard to describe the feeling when watching such a scene), he was chasing the other two bears into some bushes near the hives and suddenly sneaked away surrounding the bushes, and coming on the other side to the nearest bee box. Apparently he attempted to make me think that his presence near the bees is more related with some kind of play, and that he is just chasing his mates around. At that time he knew already that doing noises will attract my attention, so hiding behind the box, opened gently the top of it and after stealing one-two combs, closed back the box without breaking it and sneaked back in the bushes with his prey. Of course that the bees did not agree very easy with such an event, so they were forming some sort of cloud over the head of my little friend. He didn't care too much about such a shadow, but the sound of the excessively angry bee colony made me understand fast that something unusual occurred. The same bear discovered fast that the small house we were living in hides delicious items inside, so at the beginning tried to break the door. But such noisy breakings in of course resulted in finding behind the door a fuzzy guy with a stick in his hand. But Mackó learned fast that the door can be opened without enforcements too. I founded him once in the house standing near the table with a plate of tomatoes in front with the last one between his claws (they can use their claws as we do our fingers). His eyes were like looking for some words like: "I was just passing by…..". I will never forget his face. He was so funny, that I even couldn't get angry. I have many similar stories in my memory, but the lack of space here enforce me to keep them in my heart. Anyway, relaying on Morgan's Canon (Csányi, 2010) probably many of us would consider these actions just instinctual responses to external stimuli, but I am quiet convinced that we can talk about some degree of "thinking". Discovering the "somebody" behind such an animal requires some kind of understanding skills of this "thinking".

Living that close to these bears, they became too habituated with humans. Their release wasn't a success, but spending several years with them I learned many things. Most important lessons were maybe related with what not to do if I want to have an orphan cub back in the wild. Working further with bear cubs I focused on recording how can the "somebody" be described in each of them.

Most researchers who have studied individuals of any mammalian species are likely to have subjectively recognized that different individuals appear to behave slightly different even if encounter the same external stimulus (Bekoff 1977, Dutton et al. 1997; Mills 1998, Capitano 1999; Linnell *et al.* 1999, Gosling 2001). In different researches related with primates the expression "personality" was often used to describe individuals with consistent but different behavioral patterns (Stevenson-Hinde 1983, Capitano 1999; Gosling & John 1999; Gosling 2001) and nowadays is defined as the consistent difference in behavior over time and across situations (Réale *et al.* 2007; David *et al.* 2011).

A considerable number of publications on animal personality exist, being dispersed across a wide range of fields, some of them hardly findable. I tried to analyze as much as I could most of the studies related with this topic. In a comprehensive work about mechanisms influencing individual dispersal at social and non social species, Bekoff (1977) highlights the importance of personality profiles and individuality interference in later social organization and dispersal. In 1996 Fagen and Fagen gives examples of individualistically behavior differences among chimpanzees, *Pan troglodytes* (Goodall 1986), mountain gorillas, *Gorilla gorilla* (Fossey 1983), African elephants, *Loxodonta africana* (Moss 1988), domestic cats, *Felis sylvestris catus* (Feaver *et al.* 1986), bears of several species (Herrero 1985; Bledsoe 1987; Walker and Audmiller 1989), yellow bellied marmots, *Marmota flaviventris* (Armitage 1986), pigs, *Sus scrofa* (Hessing *et al.* 1993), octopuses, *Octopus rubescens* (Mather and Anderson 1993), sunfish, *Lepomisgibosus* (Wilson *et al.* 1993) and ant, *Camponatus vagus* (Bonavita-Cougourdan & Morel 1988). In the same work Fagen and Fagen (1996) address a detailed observation of behavioural patterns at 7 free ranging grizzly bears (*Ursus arctos horribilis*) in the South-Eastern Alaska, concluding that bears even if exposed to the same environmental conditions develop individual personality. Their work is the first and at my knowledge, the only one to define overall patterns of individual differences at bears based on direct observations in the wild. Other authors who tried to bring together a large number of papers about personality at many mammalian species, in a comprehensive overview, are Gosling and John (1999) and Gosling (2001), in an attempt to compare animal personality and find how this can fit with researches on human personality. There are also other examples in the literature, supporting the development of individual behavioural traits at predator species. Among a sample of 5 radio collared female cougars, only 1 consistently hunted and killed mountain sheep (*Ovis canadensis*), which were available to all (Ross *et al.* 1997). Claar *et al.* (1986) reported that only 2 of 20 radio collared grizzly bears killed livestock that were available to most of the bears. In Europe, Linnell *et al.* (1999) studying problematic and livestock killer bears states that individual personality might be a cause why particular bears develop preference towards killing livestock. In a similar study (Bereczky *et al.* 2012), in the Romanian Carpathians, we observed that different individuals exhibit particular skills in approaching human resorts and brake in yards, stables, corrals through passing guardians and their dogs. All these express personality based on intelligence level of individuals. In a study on personality stability and predictability over time and situations, Capitano (1999) gives several examples from the literature where substantial consistency across time in personality of different primate species has been found. Generally, in the literature related with the topic of individuality at animals, has been concluded that personality is ususally construed as comprising a limited number of dimensions, which, along with characteristics of the specific situation, contribute to the individual's behavioral expression in that situation. These personality dimensions are measurable and can be perceived as stable, organizing influences on an individual's behavioral responses to the situations in which it finds itself (Capitano 1999).

In general, biologists who have worked with bears have been impressed with how variable the behavior of individuals appears to be (Bereczky *et al.* 2012). There are few quantitative studies about the ability of bears to learn, but generally exists an appreciation in the literature of their ability to learn or remember things (Linnell *et al.* 1999). Personality and behavior differences have broad biological interests at any species (Stevenson-Hinde 1983; Armitage 1986; Mendl & Harcourt 1988) with direct implication in their management. This statement is maybe the best tested in brown bears, whose habitat often overlap with livestock herders and farmers lands. In such environmentally predisposed conditions (Bereczky *et al.* 2012) conflict situations are a general phenomenon, and resolving these problems has always been a challenge. Managing conflicts in bear hosting countries means either elimination of individuals that cause damage or efficient protection. Both require the observation of the implicated bears, thus recognizing individual behavior patterns is not only an advantage, but sometimes crucial in damage prevention. Bears are known to avoid human activity (Martin *et al.* 2010; Nelleman *et al*. 2007), but as they learn to associate human activity with food, they might overcome their shyness and actively seek for food in urban areas becoming so called "garbage bears" or "food conditioned bears". Some research has tried to make predictions of the spatial distribution of bears in urban areas (Martin *et al.* 2010; Merkle *et al.* 2011), but so far animal personalities were not taken into account. Since adaptation starts at the level of the individual, understanding of personality is vital in understanding behaviour (Dutton *et al.* 1997). Better knowledge of individual's personality, might facilitate more precise predictions regarding individuals that are prone of "risky behavior patterns".

At every mammalian species some individuals tend to show an overall higher level of aggression and a more explorative activity which is indicated as bold (Dingemanse and Réale 2005). Another type of personality has opposite characteristics and is indicated as shy. The boldness level may also influence an individual's fitness. As bold individuals may be more explorative, they have a higher probability of arriving early at a new food patch. However, this may co-occur with a trade-off of a higher predation risk (Stankowitch 2003; Hirsch 2011). Considering from every direction personality of bears can be considered an important issue and requires further exploration.

Animal research has played and continues to play a central role in many areas of human psychology including learning, perception, memory, and psychopathology, many scientists examining animal personality envisioning a field with strong bridges linking human and animal research (Gosling 2001). Since diet characteristics and ecology are bringing bears and humans on the same level of the feeding pyramid, studying individuality and personality at bears might facilitate few steps further on that bridge.

Because learning abilities at any species depends on genetically coded intelligence level, I assume that similarly individuals develop different personality profiles. According with Stirling and Derocher (1989) individuals will develop behavioral patterns that are modeled by their own experiences in the surrounding environment. However is just a future view to investigate and understand how genes interact with the environment to determine the biological roots of individual behavioral traits.

First period in life history of brown bears is a complex one, when size of family, length of maternal care, social interaction, learning, offspring size, habitat, food source and other internal and external factors interact in order to ensure a high probability of further survival. Adult brown bears are usually solitary, but they can form loose aggregations to feed on carrion, garbage dumps and salmon streams (Craighead and Craighead 1967), phenomenon explained by the low level of territoriality at bears. Although these aggregations are temporal and differ from social group formation in truly gregarious species, many of the social interactions are comparable to that of group-living species (Egbert and Stokes 1974). Observing personality traits at subadult bears in a circumstance where they live in small groups (the case of the orphan bear rehab center), might reveal some linkages between their social interactions and personality development. I examined the social interaction of same age bear cubs and the development of individuals which were integrated in groups versus individuals which haven't been accepted in gregarious groups. I also investigated the survival of the individuals of the two categories, their individuality behavior differences, shyness and boldness of different individuals, their dispersal after release, the habitat selection patterns, habitat use, and others that are not subject of this thesis. Part of my work addresses the ontogeny of individual behavioral phenotypes in relationship with social interactions and life history of individuals I observed at 71 bear cubs organized in gregarious groups during the first 1-3 years of their lives, between 2001 and 2013.

Because nonhumans cannot fill out questionnaires, the most common procedure for assessment individuality and personality has been to have humans who are familiar with the animals rate them using a number of descriptive adjectives (Capitano 1999). Most researches related with individuality or personality of animals have focused on temperamental traits, behaviors and abilities, but no research has examined the correlation between personal identity, attitudes and life histories of individuals, although these might have significant importance in personality development. Conducting my observations on personality at bears, I tried to investigate how life histories of individuals and social interaction between individuals influence their individuality development and how during this process individuals develop a personal identity. Further, my attempt was to examine relationships between behavior patterns observed during the rehab period and behaviors in situations other than the ones in which the ratings were originally determined. I tried to correlate the observed individual traits with later fate of each individual in terms of dispersal distances, survival, cause of death of those which didn't survive, home range size, approach scale to artificial (human created) surfaces and habitat selection. My attempt was to find out whether is possible to assess behavioral characteristics that can be predicted as later involving the bear in a conflict situation with people or in any other situations that could influence the faith of a specific individual.

1.1 The brown bear in Europe

1.1.1 Taxonomy and genetic distribution in Europe

The Eurasian brown bear (*Ursus arctos arctos*) pertains to the Chordata phylum, Mammalia class (endothermic vertebrates with hair and mammary glands which, in females, secrete milk to nourish young); Placentalia cohort (giving birth to live young after a full internal gestation period); Fissipeda order (carnivore mamifers with developed teeth); Canoidea superfamily (long legs fissipedas, with unretractable claws, and penial bone), Ursidae family (big carnivores with strong claws and short tail).

The brown bear exists with different subspecies in Europe, North America and Asia, being the most spread of the Ursidae family. Its current distribution in Europe shows a disjunctive pattern of small population in the western part of the continent and larger, continuous population in Scandinavia and the eastern regions including Russia, Romania, and Dinara Mountains in the Balkans (Zachos *et al.* 2008). Population genetic analyzes so far have yielded management and conservation suggestions based on low levels of genetic variability, small population sizes and phylogeographic patterns (Randi *et al.* 1994; Taberlet and Bouvet 1994; Kohn *et al.* 1995; Taberlet et al. 1995; Lorenzini *et al.* 2004). In particular, mitochondrial control region studies on a European scale have shown an interesting phylogeographic dichotomy in brown bears. Taberlet and Bouvet (1994) identified two highly divergent lineages which on average differed by more than 7%. The western lineage was found in Spain, in the Pyrenees, Norway, southern Sweden, Italy (Alps and Apennines), Romania and the Balkans. The other lineage, the, eastern occurs in Slovakia, Estonia, Romania, Russia, Finland, northern Sweden, the Russian Far East, Japan and parts of northwestern North America (Taberlet and Bouvet 1994; Taberlet *et al.* 1995; Miller *et al.* 2006; Saarma *et al.* 2007). The two lineages probably correspond to different glacial refuge during earlier Quaternary (Taberlet and Bouvet 1994).

According with Zachos *et al*. (2008) Scandinavia has been re-colonized by both, the western lineage from the south and the eastern lineage from the north. There is a sharp border between these two lineages in central Sweden (Taberlet *et al.* 1995), although a previous study found nuclear gene flow, suggesting male-biased dispersal (Waits *et al.* 2000).

The Romanian population is the largest brown bear population in Europe outside Russia. While in the 1940's and 1950's there were only about 1000 individuals, the population increased to nearly 7500 by 1990, and numbers dropped to about 6000 animals in the following years as a consequence of higher culling rates (Almasan 1994; Mertens and Ionescu 2000). The Romanian bear population is also unique, being the only one observed where western and eastern lineages occur sympatrically (Kohn *et al.* 1995). Thus, while the European brown bear on the whole displays a typically phylogeographic pattern (large genetic gaps between geographically distinct lineages or clades (Avise *et al.* 1987; Avise 2000), the Romanian brown bears more specifically show a distinct pattern characterized by large genetic gaps between lineages or clades occurring sympatrically.

1.1.2 General biological description of bears

Brown bears are sexually dimorphic, with males about 1.2-2.2 times larger than females (Schwartz *et al.* 2003), and have a multi-year growth pattern. Differences in body size and mass between males and females are influenced by population, age of the individual, season of sampling, and reproductive status (Zedrosser 2006). The size of the bears is a much discussed subject. Normally it is appreciated related with the weight, but this is a hardly appreciable parameter, due to individual variations in tallness, fur thickness, the observatory's position, stress, and others. For an untrained eye the bear is always big, but the reality demonstrated that people tend to exaggerate the size of any animal, even more if it has a “giant's“ reputation. The biometrical data is variable in the literature, and is understandable, since the analyzed sample shows a big variety. In some publications the tallness at the shoulder is mentioned to be 90-150 cm, whereas high on 2 feet is until 250 cm (100-235 cm the females and 150-200 cm the males). According with a large number of biometrical data gathered during several projects, we concluded that the body weight of the brown bears in the Carpathians is between 100-250 kg at females and 140-450 at males (www.carnivoremari.ro). This variations depend on the age, abilities for locating the food and others. The body mass depends also on the season. During the summer is increasing, and in winter period when the animal uses the gathered reserves, the weight is decreasing. (Bereczky & Anegroaei 2011)

The color variation is very diverse, from the light grey to the totally black. Usually the cubs have a white or light collar around the neck and shoulders. In the Carpathians the most occuring collors are the dark brown, grey and black (Bereczky & Anegroaei 2011).

The fur density and thickness is variabble between the summer and winter period. The bears are changing the fur in late summer time. The new hair is growing continually until late fall, when the fur gets very dense and thick. The body temperature is between 37-37,5 Celsius degrees (Nelson *et al* 2013).

Anatomycal characteristics of bears:

Generally, the skulls of bears are massive, typically long, and wide across the forehead with prominent eyebrow ridges, a large jawbone hinge with heavy jaw muscles and broad nostrils. Combined with dentition, the structure of bears' skulls are very much carnivorous, though with omnivore modifications.

The skull may be the most important feature of an animal, housing the brain, providing a major protective and nutritional feature (mouth with teeth), and containing sensory-communication features. Bear skulls undergo a series of changes from early life to old age, and in most species do not attain their mature form until seven or more years of age (Merriam 1918).

Diet and other eating habits have influenced the individual development of the heads and skulls of each bear species. Head shape and size are influenced by dentition and jaw muscles (Shepherd & Sanders 1985). Skulls are shaped to anchor the appropriate muscles. Brown bears normally do not bite to kill, but have grinding, crunching teeth with the massive muscles to accomplish the task. Each of the eight bear species has its own distinctive skull shape and size. A bear's teeth, combined with paws and claws, are its first-line tools for defense and obtaining food. The teeth are large, and though originally carnivorous, are adapted to an omnivorous diet of both meat and plant materials. The major difference between carnivore and omnivore dentition are the molars, which in bears are broad and flat. Dentition-- the size, shape and use of the teeth--and jaw muscles influence the size and shape of a bear's head. Bears have forty-two teeth, except the sloth (*Melursus ursinus*) bear which has only forty. Permanent teeth are normally in place by the time a bear is approximately two and a half years old. For each species the characteristics of the four kinds of teeth (incisors, canines, premolars, and molars) vary depending on diet and habitat.

A bear's paws are important in locomotion (walking, running, climbing, and swimming), killing, feeding, digging, lifting, raking, pulling, turning, sensing, and defense. Bears walk plantigrade like humans, paws with durable pads down flat on the ground, and pigeon-toed, forepaws turning inward. A bear's heat loss (thermoregulation) is primarily through its paws. All the pads (paw soles) are surfaced with tough, cornified epidermis over a substantial mass of resistant connective tissue. (Storer and Tevis 1955). Bears have relatively flat feet (paws) with five toes, except the giant panda, which has six. Hind paws are larger than forepaws and resemble the feet of humans, except the "big toe" is located on the outside of the paw. Bears are renowned for their forepaw dexterity; they can pick pine nuts from cones, unscrew jar lids, and delicately manipulate other small objects. Claws are curved, longer on the hind paws than the forepaws, and unlike a cat's, non-retractable.

The eyesight of bears has long been thought to be generally poor. However, there are studies that have shown it to be reasonably good, though there is still much to be learned of the visual capabilities of each species (Bacon and Burghardt 1974).

Generally, bears' eyes are various shades of brown, small (except those of polar bears), have round pupils (except giant pandas' which are vertical slits), and are widely spaced and face forward. Bears approach objects due to near sightedness and stand upright to increase their sight distance. The eyes are almost as large as human eyes and have an extra eyelid. Depth perception is excellent and they are capable of good under water vision due to nictitating membranes that protect the eyes and serve as lenses.

The ability to distinguish color and activity at all levels of light (day and night) are excellent indicators of good vision. Some biologists believe the vision of bears is at least average, and at least two have expressed the thought that though bears act as if they have poor eyesight, it just may be they do not trust their eyes as well as their trustworthy noses (Bacon and Burghardt 1974). Considering the dense bushy habitats preferred by bears maybe is normal not to rely on the sight. In such habitats sounds and odors can be sensed from much bigger distances than eye contact.

The ears of bears vary between species, both in size and in their location on the head. They range from large and floppy to small and hardly visible, and from those located well forward on the head to low and to the rear (not published self observations on a sample of

150 bears).

In general, a bear's hearing is fair to moderately good. Bears, probably hear in the ultrasonic range of 16-20 megahertz, perhaps higher. According to Shepard and Sanders (1985), at 300 meters the bear can detect human conversation and it responds to the click of a camera shutter or a gun being cocked at 50 meters. Whether low to the ground or held high in the wind, the nose of a bear is its key to its surroundings. Smell, (following Herrero 2009) is the fundamental and most important sense a bear has. A bear's nose is its window into the world just as our eyes are. The keen sense of smell--the olfactory awareness--of bears is excellent. No animal has more acuteness of smell; it allows the location of mates, the avoidance of humans and other bears, the identification of cubs and the location of food sources. The nose provides the leading sense in the search for nourishment (Schullery 1980). The nose of the bear is somewhat "pig-like," with a pad extending a short distance in front of the snout. A bear has been known to detect a human scent more than fourteen hours after the person passed along a trail. The olfactory sense of the bears ranks among the keenest in the animal world, (Laycock 1986). An old, and much related, Indian saying may best describe the olfactory awareness of bears: "A pine needle fell in the forest. The eagle saw it. The deer heard it. The bear smelled it."

Bears possess enormous strength, regardless of species or size. The strength of a bear is difficult to measure, but observations of bears moving rocks, carrying animal carcasses, removing large logs from the side of a cabin, and digging cavernous holes are all indicative of enormous power. No animal of equal size is as powerful. A bear may kill a cow or deer by a single blow to the neck with a powerful foreleg, then lift the carcass in its mouth and carry it for great distances. Strength and power are not only the attributes of large bears but also of the young. There were observed yearling bears, while searching for insects, turn over a flat-shaped rocks (between 100 and 150 kg) with a single foreleg.

Bears have a definite odor, as do other animals, including humans. However, the odor of a bear is quite pronounced, though not necessarily repugnant, and is considered by many hunters as the easiest for a dog to track.

Bears have a simple intestinal tract, of which the colon is the primary site of fermentation. They have a long gut for digesting grass, but do not digest starches well. Their small intestine is longer than that of the true carnivores, and the digestive tract lacks the features of the true herbivores. The barrel-shaped body of a bear is considered an indication of a long intestine. The brown bears' intestinal length (total and small) is greater than that of the American black bear's and giant panda's. Polar bears have the longest intestine (Steven 2003).

Reproduction: The bear is a polygam species, the male being able to mate several females in the same period. The mating season begins in May and lasts until middle of June.

The average age of primiparity in the North American brown/grizzly bear is 6.6 years for interior and 6.4 years for coastal populations (McLellan 1994) whereas in Europe the age of sexual maturity is 4-6 years (Swenson et al. 2000). Female bears are induced ovulators, i.e. eggs are released after behavioral, hormonal or physical stimulation, and may have 2 estrous periods of approximately 10 days (Craighead *et al.* 1995, Boone et al. 1998, Boone *et al.* 2003). The females give birth first time at the age of 4-5 years, the medium cub number being 2,4. After fertilization the embryo develops until the blastocist stage, than the development stops until the end of November. Implantation is delayed until November (Renfree & Calaby 1981, Tsubota *et al.* 1998), and the cubs are born during hibernation in January to March (Pasitschniak-Arts 1993, Schwartz *et al.* 2003). The gestation period is 6-8 weeks, the mother giving birth to 1-4 cubs.

The cubs born during the winter period, in the winter den in January-February, having around 0,5 kg. Their development is very fast, accumulating 70g/day due to the very nutritive mother milk. The cubs leave the den in April-May and remain alone in the second or third year of their life.

Litter sizes range from 1 to 4 cubs, and only females care for the offsprings which follow their mother for 1.4-3.5 years (McLellan 1994, Schwartz et al. 2003a). Females do not mate until their offspring are weaned, which results in long and variable inter-birth intervals. Longevity in the wild is 25 to 30 years, and reproductive senescence in females occurs around 27 years (Schwartz *et al.* 2003).

2. Distribution of the brown bear population in the Romanian Carpathians

2.1. Brief description of the Carpathians

The Carpathians are Europe's largest mountain range, spanning Austria, Slovakia, the Czech Republic, Hungary, Poland, Ukraine, Romania, and Serbia (Ruffini et al. 2006). They hold tributaries of four main European watersheds and, although not glaciated, include distinctly alpine regions (eg Tatra Mountains, Fagaras).

The Carpathian Arch is characterized by a middle altitude (1500-2500) mountain landscape. Although commonly referred as a mountain chain, the Carpathians do not actually form an uninterrupted chain of mountains. Rather they consist of several orographically and geographically distinctive groups, presenting a great structural variety. The highest peaks which only in few places attain an altitude over 2500 m are surrounded by high hill and plateau areas. The whole Carpathian Curve surrounds the Transylvanian meadow, which present the same landscape as the Sub-Carpathian area in the external side of the curve.

From geological and orogenical point of view, the oldest cratonic unit of the Carpathians is represented by the East European Platform, represented by its polodo-moldavian sector. The Lower Proterozoic metamorphic basement of the platform is intruded by gabbros, anorthosites and granites. The basement is covered by sedimentary formations developed in several sedimentary cycles: Vendian - Cambrian, Ordovician – Silurian, Devonian, Upper Jurassic – Cretaceous, Eocene and Oligocene. The platform is fractured by several trans-crustal faults. Those situated at the westernmost boundary represent the Tornquist-Teisseyre Fault Zone (based on M. Sandulescu, 1994 - ALCAPA II, field guidebook).

2.2. The Carpathian habitats

The Carpathian Mountains in Europe are a biodiversity hot spot which harbor many relatively undisturbed ecosystems and are still rich in semi-natural, traditional landscapes. Since the fall of the Iron Curtain, the Carpathians have experienced widespread land use change, affecting biodiversity and ecosystem services. Climate change, as an additional driver, may increase the effect of such changes in the future.

The Romanian range of the Carpathians is divided in three parts: Western, Eastern and Southern ridges. Generally all of them are dominated by a forested landscape in the mountainous areas, forest and bush lands in the hill areas and graze lands or agricultural fields in the meadow areas. The forests are dominated by the following species at different altitude levels: below 800 m different oak species (*Querqus ssp*.), between 800-1200 m is the deciduous level represented by beech (*Fagus sylvaticus*) or beech in mixture with other broad leaved species or Scotts pine (*Pinus sylvestris*) and silver fir (*Abies alba*). On this level the forested areas are intersected with bush lands, covered mainly with shrubs and small tree species as hazel (*Corylus avellana*), wild rose (*Rosa canina*), gelan (*Prunus avium*) and others. Between 1200-1800 m on the boreal level are dominating the coniferous forests, mainly spruce (*Picea abies*) or in mixture with other coniferous species or birch (*Betula alba*).

Over 1800 m is the sub-alpine level, with different specific bush and alpine vegetation covers.

Figure 1. Aerial view of a mountain range in the Eastern Carpathians.

In the different studies where the research topic was connected with classification of different habitat types, I relied on the Romanian Corine Land Cover.

The *Corine Land Cover (CLC)* is an European program establishing a computerized inventory on land cover of the 27 EC member states and other European countries, at an original scale of 1: 100 000, using 44 classes of the 3-level Corine nomenclature. It is produced by the European Environment Agency (EEA) and its member countries and is based on the results of IMAGE2000, a satellite imaging program undertaken jointly by the Joint Research Center of the European Commission and the EEA.

Different habitat types in Romania have been classified as seen in **Figure 2**.

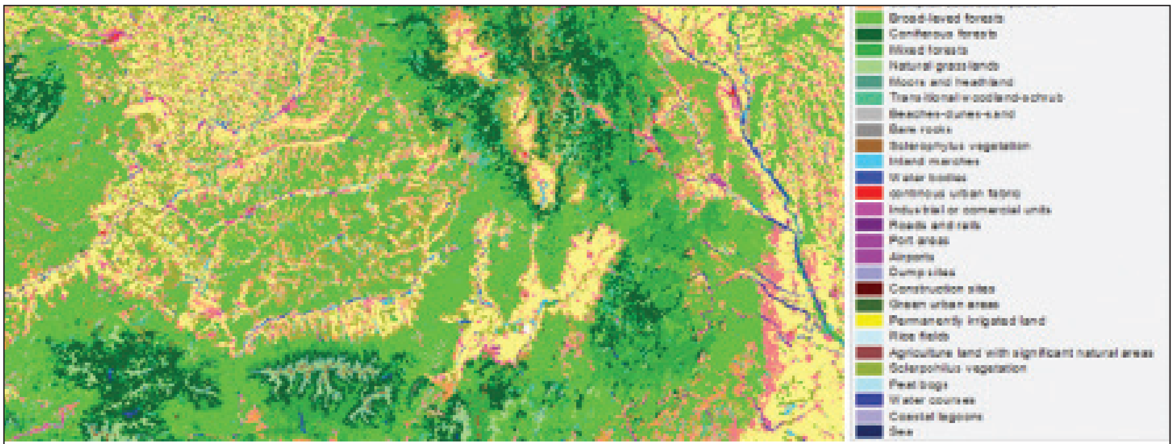

Figure 2. Habitat classifications in the Romanian Carpathians according Corine Land Cover of Romania.

2.3. Distribution of bear densities in the Romanian Carpathians

Although the quality of habitats is quiet similar in many areas, and so the human disturbance, the counting of bears conducted every year by game management units indicates that the bear population distribution is not homogeny in the Carpathians. The relative density varies between 1-4 bears/km^2 in different regions (**Figure 3**). The core areas with abundance over 4 bears/km^2 are situated from administrative point of view in Bistrita, Mures, Harghita, Covasna, Vrancea, Buzau, Prahova, Brasov, Arges, Sibiu, Valcea counties. These core areas are mainly overlapping the highest mountain massifs where human disturbance is minimal especially during the winter sleep.

Though the distribution map of the bear populations in the Romanian habitats has been realized by the Romanian Wildlife Institute (ICAS), the density of 0 bears on km^2 is questionable in several places. Our field observations and monitoring results showed that bears often occurred in areas classified with no bear presence, especially in the Transylvanian meadow and other sub-Carpathian regions.

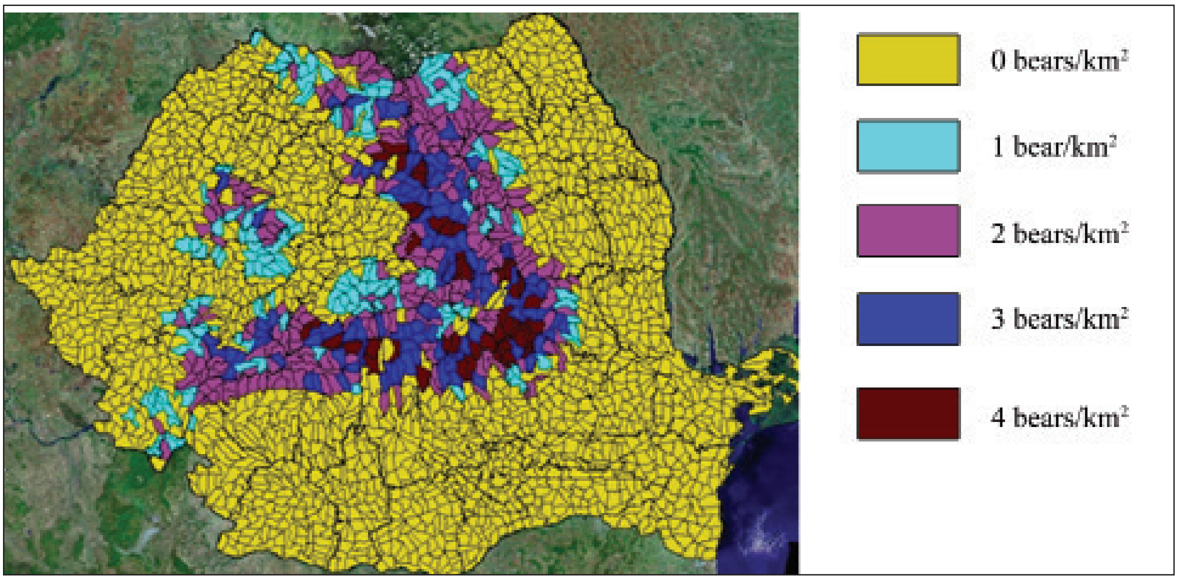

Figure 3. Bear distribution in Romania at different density levels according to ICAS Romania.

3. The orphan bear rehabilitation center

Figure 4. Bears in the Orphan Bear Rehab Centre.

The orphan bear rehab center is a pilot project which aims to reintroduce orphan bear cubs from the Carpathians into the natural habitats, after a professionally developed rehabilitation process. The causes why bear cubs remain orphan are diverse and most of them unknown. The known cases usually are bad organized huntings, forest exploiting, road or railway accidents, winter den disturbance and others. Because there is no clear definition of what is the difference between hand rearing and rehabilitation, we defined rehabilitation as bringing an orphaned bear cub to self sufficiency using methods which will allow its reintroduction into the natural habitats without developing nuisance behavior (Bereczky 2010).

The project is located in the Eastern Carpathians (Harghita County), in the Hasmas Mountains, at 3 km's from the spring of Olt river (**Figure 5**).

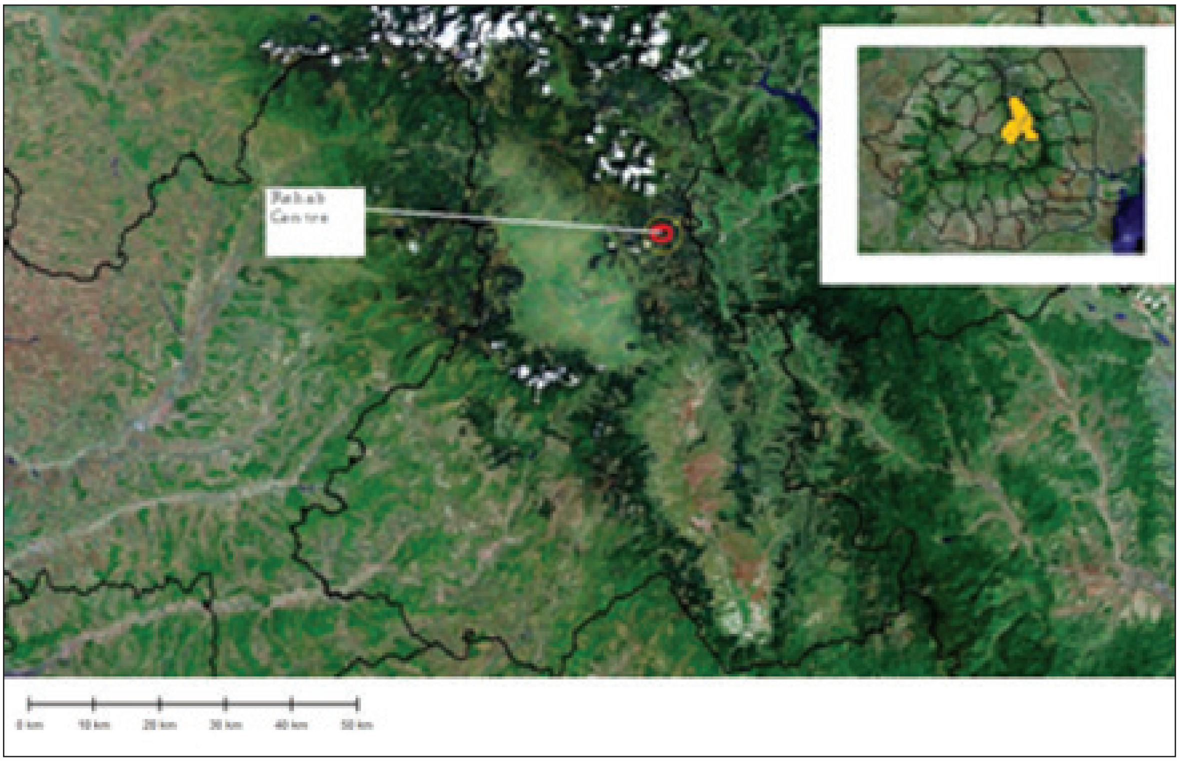

Figure 5. Location of the Orphan Bear Rehab Center

The rehab methods:

During several years of studies on brown bear cubs, we observed that essential behavior patterns which ensure the cub's survival are not learned from the mother but are inborn. Observations showed that how to obtain food, what to eat, how, when and where to hibernate (winter sleep), running on trees when a threat comes and many others are part of their inborn instincts. These instincts are developed continually during their life in interaction with the external factors. The biggest role of the mother is protection.

The rehabilitation method is based on offering large facilities with complex natural habitat where the cubs can develop their inborn instincts as would do in the wilderness. During the rehab period the feeding is partly based on the natural food sources of the facilities (berries, grass, ants, tree larva, etc.) and partly on artificially offered food. The bears find the additionally placed food randomly. The size of the facilities permit the introduction of food items with minimal human-bear encounter, thus the animals can't associate food source with human presence. The offered food is always natural, never artificially processed and its abundance increase or decrease accordingly with the food source in the nature. Human traffic in the area is restricted, thus the cubs never come in contact with people.

Figure 6. Bear feeding in the Rehab Center.

The facilities: at first stage (milking period with cubs ranging between 1-5 months) the bear cubs are placed in a 200 m^2 enclosure equipped with an artificial den. Here the small size of the facility enforces them to socialize and form gregarious groups. In 1-2 weeks they accept each other as would be brothers and sisters. After 1-1,5 months the cubs are moved in a 15 000 m^2 enclosure, surrounded with electrical fence, offering totally natural habitat. This relatively small sized facility enhances their accommodation with the electrical fence, and facilitates easier observation during the accommodation process. In this stage the feeding is switched from milky food to the solid natural food (seeds, fruits, larva, eggs, and meat). After 2 months the bears are moved into a 3rd facility (100 000 m^2 size) with complex habitats (dense bushy areas, open field areas, mature forest, raspberry areas, southern oriented slope with rotted timber trunks and tilted tree roots adequate for den digging, etc). This is the place of their first winter sleep. Placing from one facility into the other is done without sedation, by opening the gate of the facilities (successive enclosures being connected). Second year (after first hibernation), the bears are placed into a 4th enclosure (200 000 m^2 size) with a very dense willow and raspberry bush habitats overlapping young spruce forest). Release is performed from this final facility by simply opening one of the gates which permits the exploring of surrounding areas. Dispersal of bears from here is similar of juveniles' dispersal after separation from their mothers in the nature. In this stage individuals are sometimes captured and transported to different regions (usually provenience area).

The rehab process lasts maximum two years, the release moment being evaluated according with the animal's physical and behavioral development. Bears under 30 kg's are not reintroduced since we observed a strong correlation between cub survival success and body size. The experiences showed that the bears come back to the facility to obtain extra food for a certain period, and in 2-3 months they naturally disperse to the surrounding habitats or further in order to establish a new home range.

Until 2014 a number of 80 rehabilitated bear cubs have been reared to self sufficiency in the Rehab Center.

Applications of the project in the scientific research:

The rehab project offers not only a good solution for the orphan bear problem, but also many opportunities for scientific research related with the behavior and ecology of bears. For example: studies on juvenile natural dispersal, habitat use and home range analyze of brown bears, regulating factors in brown bear populations in the Carpathians, factors influencing the winter sleep and denning behavior, the habituation process and factors influencing it, diet of the brown bears and several others.

4. Individual distinctiveness at sub adult brown bears. Are they "somebody"?

4.1. Introduction to the section

Evaluating the validity of personality measure is a conceptually and methodologically challenging task. Several research groups have been developing techniques to score personalities in non-human mammals: for example at primates (Buirski *et al.* 1973, 1978; Stevenson-Hinde & Zunz 1978; Stevenson-Hinde *et al.* 1980) and cats (Feaver *et al.* 1986). In human psychology was introduced the Tupes and Christal technique of scoring personalities by means of adjectives, in self-rating as well as in rating third parties (Briggs 1992), a technique that has proved to be robust enough to be replicated by other research groups. Stevenson-Hinde *et al.* (1980) and Feaver *et al.* (1985) have developed techniques, based on explicitly defined adjectives, to assess non human personalities. Gosling (2001) gives examples from the literature of two methods of personality trait ratings studied on different mammalian species: one of the solutions is based on principles of construct validation (Cronbach and Meehl 1955; John & Benet-Martinez 2000), that is, search for convergence across independent measures of the same construct (convergent validity) and for divergence across independent measures of different constructs (discriminant validity) (Gosling 2001). As an example for this method: in a study of spotted hyenas, in which there is a strong matriarchal dominance hierarchy, the assertiveness dimension was strongly correlated with rank in the dominance hierarchy and with sex (Gosling 1998). In a study of cats, Feaver *et al.* (1986) validated personality ratings using behavioral coding of each cat's behaviors. For example, did a cat rated as aggressive actually hit, chase, and stare at other cats more than a cat rated as unaggressive?

The second method for measuring validity of personality ratings of animals is based on studies of personality structures. In fact this method relies on ethological observations or behavioral tests, recording individual differences in specific situations. For example, Forkman et al. (1995) studied individual differences in piglets by recording their behavior in specific situations: a Sociability factor was defined by number of vocalizations, nose contacts, and location in the pen, and Aggression factor was defined by number of bites, immediacy of attack, and approach to the feeding trough.

Fagen and Fagen (1996) in their study assessed individual distinctiveness at grizzly bears in two ways: analysis of observer ratings and direct observations of behavior, including regular scan samples. They defined 69 personality items, but many of these items expressed similar behavior patterns.

The fact that psychologists are also providing quantitative evidence supporting that personality traits qualified by means of subjective scoring adjectives reflects fairly the five-factor model of human personality (McCrae & Costa 1999), strengthens the idea that observers "notions about animals" personalities are reliable enough to be taken into account in behavioral studies.

4. 2. Materials and methods

In my study I adopted the scoring adjective method in accordance with the second method described by Gosling (2001) for measuring validity of personality ratings, based on personality structures and directly observing the behavior as in Fagen and Fagen (1996).

The observations were conducted on 71 bears with ages between 1 month – 2,5 years. The bears grew in the Orphan Bear Rehab Center under the methods described in the introduction section. All observations have been performed by me in average of 2 hours per day from a minimum distance of 30 m avoiding as much as possible any interaction with the bears or any other activity that might influence their behavior. No other persons were allowed to approach, feed, or interact with the bears in any way during their rehabilitation period.

The terms/adjectives generating personality constructs that are meaningful are adopted from different sources, mainly from Fagen and Fagen (1996) but also from other authors assessing personality differences at primates, hyenas or domestic animals, including my own subjective impressions or intuitions of observed behavioral acts. As result I adopted 60 adjectives adequate to my circumstance. The behavior definitions of the rating adjectives are shown in **Table 1**.

Many behavior characteristics are generally observable at most individuals, such as aggression, defense or responsiveness, but in the same time these traits can be placed in a scaled dimension. In order to have a measurable rating system at each individual, I generated pairs of bipolar dimensions, such as aggressive—submissive or confident—fearful, via the repertory grid technique of Kelly (1955), adopted by Dutton *et al.* (1997) on chimpanzees. Judgment on each individual's rating occurred after a whole observation stage (average 1 year). In my ratings I tried to place each bear in a 1-6 scale dimension. Those which reached the scale 4 have been rated in the specific adjective category. My data indicates that subjective personality attributions can be quantified since the bears appeared to display marked individual differences.

1	Absent minded	Behaves forgetfully, as though unaware of the recent past or immediate future
2	Active	Moves about frequently
3	Aggressive with other bears	Actively causes harm to other bears by making them leave the area; provokes fights with other bears
4	Agile	Moves lithely in a well coordinated manner
5	Alert	Pays attention to surroundings and changes in surroundings
6	Aloof	Unconcerned and uninvolved with the interactions of other bears
7	Amiable	Pleasant and good natured
8	Assertive	Pushy: forces its ways into situations and tries to control them into its own advantage
9	Bashful	Hesitant to make social contact, respond to social opportunities, or enter social situations
10	Bold	Approaches new or threatening situations without hesitating
11	Bully	Likes to threaten, intimidate, or run off smaller or weaker bears
12	Calm	Reacts in a measured and appropriate way to new experiences and situations
13	Careful	Does things as though considering their possible consequences, behaves cautiously in a variety of situations
14	Careless	Does things without paying attention to their possible consequences
15	Conceited	Has an inflated conception of its abilities or accomplishments
16	Confident with bears	Does not hesitate to move closer to other bears or to a bear holding a food item
17	Confident with people	Shows little reaction to people during a human approach; travels past or around when a man show up
18	Curious about other bears	Pays attention to other bears and watches what they do
19	Curious about people	Pays attention to people and watches what they do
20	Curious about surroundings	Approaches and explores a change or new feature in the environment
21	Determined	Acts with forcefulness and intense immediate purpose; lets nothing get in its way; stops for nothing until it achieves its intended object; not easily distracted once it starts a task; unstoppable; relentless.
22	Devious	Acts to conceal its real motives
23	Dissociated	Often seems to be trying to do several tasks; pay attention to several situations, or think about several things at the same time but with little success
24	Dopey	Reacts slowly or not at all to simple situations simple stimuli

25	Equable with other bears	Reacts to others evenly and calmly, not easily disturbed
26	Fearful of other bears	Reacts to other bears by fleeing
27	Fearful of people	Reacts to people by fleeing
28	Successful at finding food	Discovers very fast new food items
29	Focused	Concentrates purposefully on the situation at hand
30	Greedy	Eats voraciously and/or in large quantities
31	Gregarious with other bears	Approaches and seeks contact with a variety of other bears
32	Grumpy	Reacts negatively or does not react at all to friendly or pleasurable situations
33	Tendentious	Goes around acting superior or hostile; behaves so as to give the impression that it will respond to others, or will act aggressively, but in fact will not attack
34	Hostile with other bears	Reacts with a threat and/or causes harm if approached by another bear
35	Impulsive	Acts without thinking
36	Incompetent at finding food	Not very successful in discovering new food items
37	Insecure	Interprets neutral situations and other individuals as potentially harmful or threatening
38	Irritable	Reacts excessively and defensively to events and situations
39	Lazy	Behaves so as to make as little effort as possible and avoids situations where effort is necessary
40	Oblivious	Unresponsive to and seemingly unaware of significant events and situations
41	Opportunistic	Responds to invitations to play and to make physical contact; takes any chances to get more food or escape from a facility
42	Playful	Engages in play with other bears, surroundings, or by performing expressive locomotor and rotational movements
43	Responsive	Reacts readily to situations or events that call for some sort of action
44	Secure	Judges potentially threatening or harmful situations correctly
45	Show-off	Does things to attract attention of other bears or people
46	Shy	Reluctant to engage in social situations
47	Skittish	Withdraws abruptly but not completely from many different kinds of situations

Table 1. Beahvioural definitions used in the rating adjectives.

48	Sleepy	Seems tired and half awake
49	Slow	Moves less than situations call for
50	Sneaky	Behaves intelligent, but intentionally deceptive and manipulative ways
51	Sociable with other bears	Seeks companionship of other bears
52	Spirited	Vivacious, animated and energetic, approaches life with abundant physical and mental energy
53	Stodgy	Unreactive, stuffy and complacent
54	Tense	Shows restraint and lack of easy in postures and movements
55	Solitary with respect to other bears	Avoids other bears; avoids traveling near other bears; comes out when other bears are not around
56	Spacey	Unable to concentrate attention or effort; behaves unpredictably; fails to react in appropriate manner to situations
57	Timid	Avoids situations or hesitates to enter them
58	Vague	Behaves as though unsure of what it is doing
59	Vain	Likes and pays excessive attention to its own personal appearance, postures and movements
60	Watchful	Anxiously vigilant; looks at and orientates readily to changes in its surroundings

Table 1. Beahvioural definitions used in the rating adjectives.

4. 3. Statistical analyzes and results

The most complex and adequate statistical method for testing whether the variables are determined by common factors is the Multiple Factor Analysis. Having a normal distribution of the data (analyses performed with SPSS 17.0), I conducted a Kaiser-Meyer-Olkin measure for verifying the sampling adequacy for a Multiple Factor Analysis (MFA) and a Barlett's test of sphericity to verify whether the correlations between the items are sufficiently large for a Principal Component Analysis (PCA). The KMO test indicated the necessity of excluding three variables (aloof, slow and vague) due to negative eigenvalues. After excluding these variables the KMO was 0.61 (acceptable according to Field 2009) indicating the sampling adequacy (according to Field 2009) for Factor Analysis. The Barlett's test of sphericity X^2 (1596) = 5243.207, $p<0.001$, indicated that correlations between items were sufficiently large for a Principal Component Analysis. As result I conducted a MFA and PCA for 57 items (rating adjectives).

The steps of the analysis consisted in:

1. A Pearson correlation has been done for all variables.

2. The data was arranged in a correlation matrix (R-matrix) **Table 2**. The off diagonal elements are the correlation coefficients between pairs of variables. The existence of clusters of large correlation coefficients (minimum 0.35) between subsets of variables suggests that those variables could be measuring aspects of the same underlying dimension, called '*factor*'.
3. In Factor Analysis we strive to reduce the R-matrix down to its underlying dimensions by looking at which variables seem to cluster together in a meaningful way. By reducing the data set from a group of interrelated variables to a smaller set of factors, factor analysis achieves parsimony by explaining the maximum amount of common variance in a correlation matrix using the smallest number of explanatory constructs (Field 2009).
4. I performed an equamax orthogonal rotation with Kaiser Normalization of the factors at 40 maximum itinerations for convergence, in order to discriminate the high loadings to the most important factors (rotated correlation matrix in **Table 2**.).
5. An initial analysis was run to obtain eigenvalues for each component in the data. Ten components had eigenvalues over Kaiser's criterion of 1 and in combination explained 81.37% of the variance. The Scree Plot (**Figure 7**) showed inflexions that justified the retaining of 10 components. Given the large sample size, and the convergence of the scree plot and Kaiser's criterion on ten components, this is the number of components that were retained in the final analysis. **Table 2** shows the factor loadings after rotation.

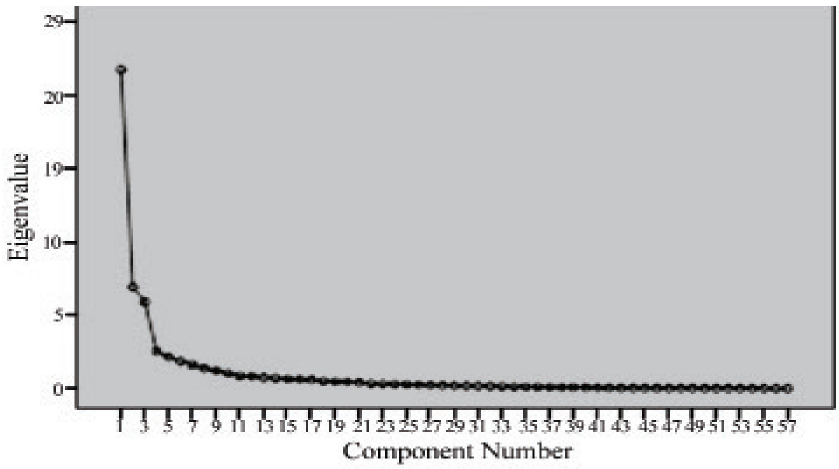

Figure 7. The Scree Plot between the eigenvalues and component nr.

	Component									
	1	2	3	4	5	6	7	8	9	10
Bashful			.503				-.459			.351
curious about people								.727		
Determined				.675						
Devious		.505	.610							
Dissociated		.618	.495							
Dopey		.756								
Focused				.695						
Greedy									.739	
hostile to other bears	.770									
Impulsive	.478			.526						
incompetent at finding food			.667			-.400				
Insecure					-.392		-.511			
Lazy		.739	.366							
Oblivious		.396	.600							
Opportunistic					.450		.421			
Playful						.383		.624		
show-off									.767	
Shy							-.562			.489
Skittish								.515		
Sleepy		.401			-.605					
Sneaky										.849

Table 2. Rotated correlation matrix.

sociable with bears						.891				
Tense						-.437	-.510			
solitary with respect to other bears						-.850				
Stodgy		.773								
Spirited			-.511			.374				
Spacey			.554		-.483					
Timid							-.566			
Vain	.457								.570	
Watchful				.610						
Careless		.737								
Bold			-.399				.368			
absent minded		.744								
aggressive with other bears	.834									
Amiable	-.788									
active		-.415	-.474		.407		.412			
Agile		-.497	-.539		.424					
Alert			-.559		.519					
confident with people								.734		
careful		-.720								
Assertive	.732								.411	
Bully	.815								.355	
Calm	-.789									
Conceited									.616	-.350
confident with bears					.493	.433		.483		
curious about other bears					.374			.710		
curious about surroundings					.676			.380		
equable with other bears	-.874									
fearful of other bears				.351	-.498					
fearful of people				.656					-.482	

Table 2. Rotated correlation matrix.

successful at finding food		-.449	-.544	.391						
gregarious with other bears						.920				
Grumpy									.780	
Tendentious							.641			
Irritable	.755									
Responsive				.357			.433	.563		
Secure				.510			.490			

Table 2. Rotated correlation matrix.

The items that clustered on the same components suggested the following:

Component 1 clustered the hostile, impulsive, vain, aggressive, assertive, bully and irritable items suggesting an interrelationship related with aggressiveness and impulsiveness. These components correlated negatively with: amiable, calm, equable with other bears. Therefore I called this factor “**irritable-aggressive**”.

Component 2 clustered the devious, dissociated, dopey, lazy, oblivious, sleepy, stodgy, careless and absent minded items, interrelated in the dimension of slow reaction to environmental stimuli. These components correlated negatively with active, agile, careful, successful at finding food. I called this factor “**absent minded**”.

Component 3 gathered the bashful, devious, dissociated, incompetent at finding food, lazy, oblivious and spacey items, suggesting that those bears were less competent in discovering new food items and lazy. These components correlated negatively with spirited, bold, active, agile, alert, successful at finding food. I called this factor “**lazy**”.

Component 4 clustered the determined, focused, impulsive, watchful, fearful of other bears, fearful of people, successful at finding food, responsive and secure items. These adjectives express attitudes of much care about what happens in the surroundings and readiness for reaction or escape (but only when really necessary), together with good adapting skills. I called this factor “**focused**”.

Component 5 clustered the opportunistic, active, agile, alert, confident with bears, curious about other bears and curious about surroundings, suggesting high activeness but also high confidentiality and curiosity about the environment. These components correlated negatively with insecure, sleepy, spacey and fearful of other bears. I called this factor “**opportunistic-bold**”.

Component 6 brought together the playful, sociable with bears, spirited, confident with bears and gregarious with bears items suggesting traits of attachment with other group mates and playfulness. These components correlated negatively with incompetent at finding food, tense, solitary. I called this factor "**playful-sociable**".

Component 7 clustered opportunistic, careless, active, tendentious, responsive and secure items, indicating traits related with high self confidence and fast responsiveness to any incoming stimuli. I called this factor "**self confident**".

Component 8 gathered curious about people, playful, skittish, confident with people, confident with bears, curious about other bears, curious about surroundings and responsive items. These indicate signs of high level of curiosity and decreased level of shyness towards people or other animals. I called this factor "**curious-confident**".

Component 9 clustered the greedy, show off, vain, assertive, bully, conceited and grumpy items, suggesting relatedness with greediness and proneness to take by force anything from the others. These components correlated negatively with fearful. I named this factor "**greedy-assertive**".

Component 10 clustered the bashful, shy and sneaky items, indicating bears that where shy and hesitating to make any contact with other bears. These components correlated negatively with conceited. I called this factor "**shy**".

As a reliability analysis I conducted a Cronbach's α test for each sub-scale. As observable in **Table 3**, the subscales irritable-aggressive, absent minded, lazy, focused, opportunistic-bold, playful-sociable, self confident, curious-confident, greedy-assertive all had high reliabilities (all Cronbach's $\alpha > 0.80$) and the shy subscale a lower reliability (Cronbach's $\alpha = 0.59$).

Scale	Cronbach's α
Irritable-aggressive	0.87
Absent minded	0.97
Lazy	0.96
Focused	0.84
Opportunistic-bold	0.87
Playful-sociable	0.85
Self confident	0.83
Curious-confident	0.88
Greedy-assertive	0.85
Shy	0.59

Table 3. Cronbach's α reliability test for each scale.

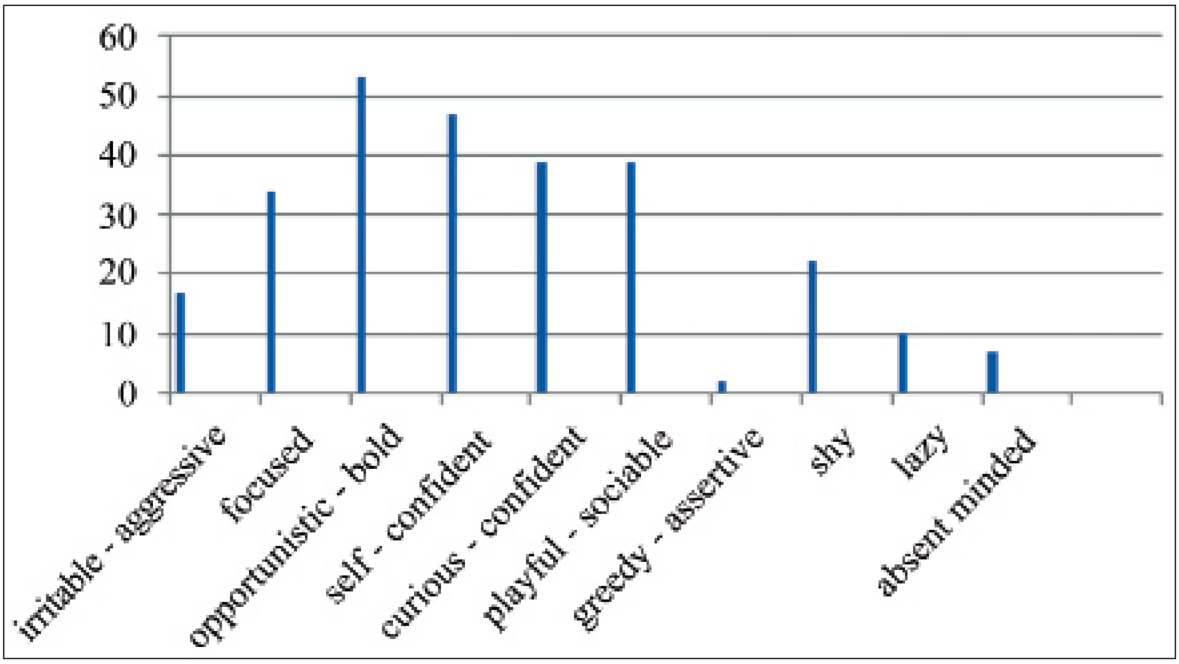

Figure 8. distribution of personality dimensions among the bears.

bear	1	2	3	4	5
	Irritable-aggressive Playful-sociable Opportunistic-bold Self confident Curious-confident Greedy-assertive	Lazy Shy	Opportunistic-bold Playful-sociable Self confident Curious-confident	Absent minded	Focused Opportunistic-bold Self confident
bear	**6**	**7**	**8**	**9**	**10**
	Opportunistic-bold Playful-sociable Self confident Curious-confident Greedy-assertive	Absent minded Lazy Shy	Focused Opportunistic-bold Curious-confident	Focused Opportunistic-bold Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident
bear	**11**	**12**	**13**	**14**	**15**
	Opportunistic-bold Self confident	Focused Opportunistic-bold Self confident	Focused Opportunistic-bold Self confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident

Table 3. Profiles recorded at each bear in the Rehabilitation Center during the rehab period.

bear	16	17	18	19	20
	Opportunistic-bold Playful sociable	Opportunistic-bold Playful-sociable Self confident Curious confident	Absent minded Lazy Shy	Absent minded Lazy Shy	Opportunistic-bold Playful-sociable Self confident Curious-confident
bear	**21**	**22**	**23**	**24**	**25**
	Focused opportunistic-bold Playful-sociable Self confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Absent minded Lazy shy	Opportunistic-bold Playful-sociable Self confident Curious-confident	Opportunistic-bold Playful-sociable Curious-confident
bear	**26**	**27**	**28**	**29**	**30**
	Opportunistic-bold Playful-sociable Curious-confident	Opportunistic-bold Playful-sociable Self confident Curious-confident	Opportunistic-bold	Focused Opportunistic-bold Playful-sociable Self confident Curious-confident	Focused Opportunistic-bold Playful-sociable Self confident Curious-confident

Table 3. Profiles recorded at each bear in the Rehabilitation Center during the rehab period.

bear	31	32	33	34	35
	Focused Opportunistic-bold Playful-sociable Self confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Absent minded Lazy shy	Focused Opportunistic-bold Self confident	Opportunistic-bold Self confident
bear	**36**	**37**	**38**	**39**	**40**
	Focused Opportunistic-bold Playful-sociable Self confident Curious confiden	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Shy	Focused Opportunistic-bold Self confident Shy
bear	**41**	**42**	**43**	**44**	**45**
	Opportunistic-bold Playful-sociable Curious confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Opportunistic-bold Playful-sociable Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Shy	Opportunistic-bold Playful-sociable Self confident Curious confident

Table 3. Profiles recorded at each bear in the Rehabilitation Center during the rehab period.

bear	46	47	48	49	50
	Focused Self confident	Focused Self confident	Focused Opportunistic-bold Playful-sociable Self confident Curious confident Shy	Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Self confident
bear	**51**	**52**	**53**	**54**	**55**
	Irritable-aggressive Focused Opportunistic-bold Playful-sociable Self confident	Irritable-aggressive Focused Shy	Opportunistic-bold Playful-sociable Self confident Curious confident Shy	Irritable-aggressive Focused Opportunistic-bold Playful-sociable Self confident Curious confident Shy	Focused Opportunistic-bold Playful-sociable Self confident
bear	**56**	**57**	**58**	**59**	**60**
	Irritable-aggressive Shy	Irritable-aggressive Shy	Absent minded Lazy Playful-sociable Curious confident Shy	Absent minded Lazy Self confident Curious confident	Curious confident Shy

Table 3. Profiles recorded at each bear in the Rehabilitation Center during the rehab period.

bear	61	62	63	64	65
	Opportunistic-bold Playful-sociable Self confident Curious confident	Opportunistic-bold Playful-sociable Self confident Curious confident	Irritable-aggressive Focused Opportunistic-bold Playful-sociable Self confident Curious confident	Focused Opportunistic-bold Playful-sociable Self confident	Opportunistic-bold Curious confident Shy
bear	**66**	**67**	**68**	**69**	**70**
	Opportunistic-bold Curious confident Self confident Shy	Lazy	Lazy Shy	Irritable-aggressive Focused Opportunistic-bold Self confident Curious confident Shy	Irritable-aggressive Focused Opportunistic-bold Self confident Curious confident Shy
bear	**71**				
	Opportunistic-bold				

Table 3. Profiles recorded at each bear in the Rehabilitation Center during the rehab period.

4.4. Discussions

Analyzing **Figure 8** and **Table 3**, is noticeable that there are several personality profiles at each bear. Most of bears are opportunistic - bold, self confident, curious-confident and playful - sociable. Probably these are the most known characteristics of bears in the mind of all who has dealt with bear species. But not all of them fall under the 'focused' dimension. This characteristic seems to appear at only half of them. Approximately a quart of the bears showed a high level of aggressiveness and irritability and also a quart showed a high degree of shyness. Only few were lazy or absent minded and even fewer were greedy-assertive. The high occurrence displayed by the 'playful-sociable' profile is explained probably by the fact that the bears I observed were juveniles under the age of 2.5 years. As natural characteristic of bears, they live a family life until 1.5-2.5 years with their mothers. Needs of socialization and playfulness is observable at every bear cub to a certain extent as result of the natural biological development of the cubs at early ages. Opportunistic, self-confident and curiosity is a general characteristic of bear species, and these profiles appear at most of the individuals. But as seen in **Table 3**, even if several profiles match at many bears, nearly each bear presents some differences. Actually we can speak about a combination of profiles, building up a "profile configuration" at each individual. As an example: bears 1; 3; 5; 6 were opportunistic, playful, self confident and curious, but only bear 1 was irritable-aggressive, bear 3 was not greedy, nor aggressive, bear 5 was focused, but not curious and bear 6 was greedy, but not irritable. Scanning the **Table 3**, we might assume that most of the bears are opportunistic, curious, bold and self confident at large extent, but aggressiveness, shyness, laziness, focused and absent-mindness are "ingredients" which might influence or predispose individuals to something in certain circumstances. My studies presented in this section are intended to be a contribution to the development of knowledge about quantifying the distinctiveness among brown bears. I would consider it an extension of the methods pioneered by Fagen and Fagen in 1996, in which I have shown that by observer's ratings, individual's distinctiveness can be assessed at bears. My intention was simply to test whether my impressions of the bears could be quantified with reliability and, where possible, to check how well the measures correlated with direct recording of further behavior. However, the methods of direct observation of the animals involve a substantial subjective judgment, but when measuring such "un-measurable" variables the use of a skilled pair of human eyes or ears is the only way in which the frequency and duration of complex behavioral events can be recorded (Feaver *et al.* 1986). In the following sections of the thesis I will present the results of my investigations on whether exists a relation between the personality profiles of the observed bears and their life history in early development stage. In one word, is there a reason why a bear became as became?

5. The relation between the life history of bear cubs and their personality profile development

5.1. Introduction to the section

Personality traits have been described for many animal species. But why some traits are dominant in certain individuals? Why some individuals are consistently bolder or shyer than others, for example, is currently obscure. Recently it has been shown theoretically (Wolf et al. 2007) and empirically (Biro & Stamps, 2008; Reale et al. 2009) that personality differences can be construed as facets of different life-history strategies. Such an idea has also been pursued in the field of evolutionary psychology (Figueredo et al. 2007). For example, aggression and boldness might be associated with fast growth, early maturation and reproduction, and short lifespan, whereas less aggressive, shy individuals might enjoy highest fitness when they extend their development period, delay their reproduction (Buss & Hawley 2011).

Connections between life-history and evolution of personality traits have been investigated extensively in humans, where antagonistic selection pressures on personality traits at different life stages are expected (Buss & Hawley 2011). This means that for example, selection favoring high value for a trait early in life should favor low value of that trait later in life. This expectation should be reflected by the co-variation between personality and life-history among populations (Buss & Hawley 2011).

A survey of empirical studies indicates that boldness, activity and/or aggressiveness are positively related to food intake rates, productivity and other life-history traits in a wide range of taxa (Biro and Stamps, 2008).

Although social factors are generally considered to be important, it is as yet unclear how they might select for personality. The influence of social interrelations of individuals on animal personality has been indirectly described in few species. For example in their study of dominance in stumptailed macaques (Macaca arctoides), Nash & Chamove (1981) concluded, "It is clear from the results that some of the behaviors which initially seemed to be correlated with dominance are a function of the personality of the individual in that dominance position and not of dominance per se" (p. 91). Similarly, on the basis of his research on olive baboons, Sapolsky (1990) suggested, "Social primates do not merely come in two flavors--dominant or subordinate--nor can they be reduced to a simple rank. These complex individuals differ in their behavioral traits" (p. 872).

Given that life-history tradeoffs are common and known to promote inter-individual differences in behavior (Biro and Stamps, 2008), I attempted to investigate whether elements from the past of the bear cubs can influence in any way the development of their personality.

A bigger sample size would have increased the statistical strength of the results, but even with this sample size, there were indicators that the considered variables have a strong effect on the development of the young bears.

5.2. Materials and methods

As part of my data collection, I recorded the following variables related with the life history of each bear:

1. Did the bear interact with other bears during the rearing process? This question might be important in evaluating whether socialization plays any role in the personality development.
2. Was or not the cub of a problematic (habituated to human food source) bear? I considered this question interesting assuming that learning some "bad habits" in the first few months of life might influence later behavior.
3. Was the bear kept more than 5 months in captivity by humans before its arrival in the rehab center? 5 months is approximately the half of a vegetation period in which bears are active. I considered this time long enough to influence the personality of an individual if it does. This question is important from the point of view of human influence on the behavior at early development stage.

As the previous chapter concluded, personality constructs are ratable at sub-adult bears. I assumed the up mentioned variables to have a certain degree of influence on personality development. In order to test whether is this true, I analyzed each dimension separately using a Pearson chi square cross tabulation with Phi and Crammer's V test. I considered all cross tabulation cases with maximum 25% expected values in the contingency tables to meet the requirements of the Chi square test (according to Field 2009). All standard residuals over the value of 1.96 were considered to indicate significant relation between the cross tabulated items according with Field 2009.

5.3. Results

The relation between the "irritable-aggressive" profile and life history variables:

Table 6 presents the cross-tabulation between life history variables and the "irritable-aggressive" bears. As visible, the "irritable-aggressive bears" nearly all (94.1%) interacted with other cubs during cub stage, and were less than 5 months in captivity (88.2%). Oppositely, only 2 bears that were kept more than 5 months became aggressive. 7 bears rated as irritable-aggressive out of 17 were cubs of problematic females (58.8%). Pearson chi-square test results a significant relation between life history variables and whether or not a bear was "irritable-aggressive". $X^2(3) = 32.543$, $p < 0.001$.

All expected counts were more than 5 (minimum expected count is 7), thus the assumption for the chi square test was met (Table 4). The high phi value (0.692) and high Crammer's V test value (0.692) indicates a relatively high relation degree between the life history variables and the aggressiveness (Table 5). The standardized residuals show the significance level of each category (1.9 or bigger standardized residual is significant at $p<0.05$): in the category of bears that did not interact with other bears during cub stage significantly less (SR= -2.3) became "irritable-aggressive" than those that interacted (SR=1.9).

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.543[a]	3	.000
Likelihood Ratio	36.868	3	.000
N of Valid Cases	68		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.00.			

Table 4. Chi square test results of irritable-aggressive-life story variables.

		Value	Approx. Sig.
Nominal by Nominal	Phi	.692	.000
	Cramer's V	.692	.000
	Contingency Coefficient	.569	.000
N of Valid Cases		68	

Table 5. Symmetric Measures.

			irritableaggressive		Total
			no	yes	
Lifehistory	interact	Count	1	16	17
		Expected Count	7.0	10.0	17.0
		% within lifehistory	5.9%	94.1%	100.0%
		% within irritableaggressive	3.6%	40.0%	25.0%
		% of Total	1.5%	23.5%	25.0%
		Std. Residual	-2.3	1.9	
	less5mo	Count	2	15	17
		Expected Count	7.0	10.0	17.0
		% within lifehistory	11.8%	88.2%	100.0%
		% within irritableaggressive	7.1%	37.5%	25.0%
		% of Total	2.9%	22.1%	25.0%
		Std. Residual	-1.9	1.6	
	more5mo	Count	15	2	17
		Expected Count	7.0	10.0	17.0
		% within lifehistory	88.2%	11.8%	100.0%
		% within irritableaggressive	53.6%	5.0%	25.0%
		% of Total	22.1%	2.9%	25.0%
		Std. Residual	3.0	-2.5	
	problem	Count	10	7	17
		Expected Count	7.0	10.0	17.0
		% within lifehistory	58.8%	41.2%	100.0%
		% within irritableaggressive	35.7%	17.5%	25.0%
		% of Total	14.7%	10.3%	25.0%
		Std. Residual	1.1	-.9	

Table 6. Lifehistory * irritableaggressive Crosstabulation.

Among the bears that were kept more than 5 months in captivity significantly less became irritable-aggressive (SR=3.0).

The standard residual values at the bears with problematic (food conditioned or garbage bear) mothers shows that there is not a strong relation between whether the cub had a problematic mother or not and became irritable aggressive.

Seems that in order to develop aggressiveness, the bears need to socialize during cub stage and if are kept more than 5 months in captivity, their aggressiveness level decreases.

The relation between the "absent mind" profile and life history variables

Table 6. shows the relation between the life history variables and the "absent minded" profile. The chi square test and the minimum expected counts (most of them <5) indicates that there is no relation between whether the bear had the considered life history and became "absent minded" (X^2=8.173; p>0.001). We will understand why in the next section of the thesis, where I

present the relation between personality profiles and survival rate: most of the bears that presented absent minded profile died due to a central nervous disease. This is why there is a strong correlation in the standard residuals between the bears that were kept more than 5 months and became absent minded (2.00) (The ill bears needed to be kept more than 5 months in captivity and human care). At the "lazy" profile occurs the same situation (more in the discussions section).

			absentminded		Total
			no	yes	
Lifehistory	interact	Count	6	2	8
		Expected Count	5.3	2.8	8.0
		% within lifehistory	75.0%	25.0%	100.0%
		% within absentminded	28.6%	18.2%	25.0%
		% of Total	18.8%	6.3%	25.0%
		Std. Residual	.3	-.5	
	less5mo	Count	6	2	8
		Expected Count	5.3	2.8	8.0
		% within lifehistory	75.0%	25.0%	100.0%
		% within absentminded	28.6%	18.2%	25.0%
		% of Total	18.8%	6.3%	25.0%
		Std. Residual	.3	-.5	
	more5mo	Count	2	6	8
		Expected Count	5.3	2.8	8.0
		% within lifehistory	25.0%	75.0%	100.0%
		% within absentminded	9.5%	54.5%	25.0%
		% of Total	6.3%	18.8%	25.0%
		Std. Residual	-1.4	2.0	
	problem	Count	7	1	8
		Expected Count	5.3	2.8	8.0
		% within lifehistory	87.5%	12.5%	100.0%
		% within absentminded	33.3%	9.1%	25.0%
		% of Total	21.9%	3.1%	25.0%
		Std. Residual	.8	-1.1	

Table 6. Lifehistory * absentminded Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.173[a]	3	.043
Likelihood Ratio	8.163	3	.043
N of Valid Cases	32		
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 2.75.			

Table 7. Chi-Square Tests (absent minded-life history variables).

The relation between the "lazy" profile and life history variables

Table 8. displays the relation between the "lazy" profile and the life history variables. Similarly with the absent minded profile, just few of the "lazy" bears interacted with other bears, or were cubs of problematic females and most of them were kept more than 5 months in captivity. Chi square test (**Table 9**) and the expected counts (4 cells have expected counts <5) indicates no relation between the variables and whether a bear became "lazy" or not (X^2 =8.352; p>0.001). Standard residuals show significance only between the keeping more than 5 months and laziness.

			lazy		Total
			no	yes	
Lifehistory	interact	Count	7	3	10
		Expected Count	6.5	3.5	10.0
		% within lifehistory	70.0%	30.0%	100.0%
		% within lazy	26.9%	21.4%	25.0%
		% of Total	17.5%	7.5%	25.0%
		Std. Residual	.2	-.3	
	less5mo	Count	7	3	10
		Expected Count	6.5	3.5	10.0
		% within lifehistory	70.0%	30.0%	100.0%
		% within lazy	26.9%	21.4%	25.0%
		% of Total	17.5%	7.5%	25.0%
		Std. Residual	.2	-.3	
	more5mo	Count	3	7	10
		Expected Count	6.5	3.5	10.0
		% within lifehistory	30.0%	70.0%	100.0%
		% within lazy	11.5%	50.0%	25.0%
		% of Total	7.5%	17.5%	25.0%
		Std. Residual	-1.4	1.9	
	problem	Count	9	1	10
		Expected Count	6.5	3.5	10.0
		% within lifehistory	90.0%	10.0%	100.0%
		% within lazy	34.6%	7.1%	25.0%
		% of Total	22.5%	2.5%	25.0%
		Std. Residual	1.0	-1.3	

Table 8. Lifehistory * lazy Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.352[a]	3	.039
Likelihood Ratio	8.642	3	.034
N of Valid Cases	40		
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 3.50.			

Table 9. Chi-Square Tests (lazy-life history variables).

The relation between the "focused" profile and life history variables

Table 10 indicates the relation between the "focused" profiled bears and the life history variables. As observable, most of the bears which were "focused", interacted with other bears during cub stage (91.2%), most of them were kept less than 5 months in captivity (94.1%) and most of them (73.5%) were not cubs of problematic females. All expected counts exceed 5 and the chi square test (**Table 11**) and phi test indicate strong relation between whether a bear became "focused" and the life history variables: (X^2 =83.118 (3); p<0.001). (Phi=0.782; Crammer's V=0.782). The standard residual values indicate a very strong relation between the "focused" profile and whether the bear interacted with other bears during cub stage (SR=2.9) and also a very strong relation with the "kept less than 5 months" variable (SR=3.1). According to the standard residual values, the cubs coming from problematic mothers, are less focused than those which don't (SR=-2.2).

			focused		**Total**
			no	**yes**	
Lifehistory	interact	Count	3	31	34
		Expected Count	15.5	18.5	34.0
		% within lifehistory	8.8%	91.2%	100.0%
		% within focused	4.8%	41.9%	25.0%
		% of Total	2.2%	22.8%	25.0%
		Std. Residual	-3.2	2.9	
	less5mo	Count	2	32	34
		Expected Count	15.5	18.5	34.0
		% within lifehistory	5.9%	94.1%	100.0%
		% within focused	3.2%	43.2%	25.0%
		% of Total	1.5%	23.5%	25.0%
		Std. Residual	-3.4	3.1	

Table 10. Lifehistory * focused Crosstabulation.

			focused		Total
			no	yes	
Lifehistory	more5mo	Count	32	2	34
		Expected Count	15.5	18.5	34.0
		% within lifehistory	94.1%	5.9%	100.0%
		% within focused	51.6%	2.7%	25.0%
		% of Total	23.5%	1.5%	25.0%
		Std. Residual	4.2	-3.8	
	problem	Count	25	9	34
		Expected Count	15.5	18.5	34.0
		% within lifehistory	73.5%	26.5%	100.0%
		% within focused	40.3%	12.2%	25.0%
		% of Total	18.4%	6.6%	25.0%
		Std. Residual	2.4	-2.2	

Table 10. Lifehistory * focused Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	83.118[a]	3	.000
Likelihood Ratio	97.458	3	.000
N of Valid Cases	136		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.50.			

Table 11. Chi-Square Tests (focused-life history variables).

		Value	Approx. Sig.
Nominal by Nominal	Phi	.782	.000
	Cramer's V	.782	.000
	Contingency Coefficient	.616	.000
N of Valid Cases		136	

Tabe 12. Symmetric Measures (focused-life history variables).

The relation between the "opportunistic-bold" profile and life history variables

Table 13 indicates the relation between the "opportunistic-bold" profile and the life history variables: the situation is similar with the "focused" profile. Most of the bears that were "opportunistic-bold", interacted with bears during cub stage (94.3%), were kept less than 5 months in captivity (84.9%) and most of them were not cubs of problematic female mothers (77.4%). Expected counts (all less than 5), the chi square test (**Table 14**) and the phi test (**Table 15**) indicate a strong relation between the life history of the bears and whether they became “opportunistic-bold” or not: (X^2=108.461 (3); p<0.001). (Phi=0.715; Crammer’s V=0.715). The standard residuals indicate that boldness strongly depends on interaction with other cubs (SR=4.00), captivity period (SR=3.00) and also a strong relation between boldness and a problematic mother (SR=-3.1).

			opportunistic bold		**Total**
			no	**yes**	
Lifehistory	interact	Count	3	50	53
		Expected Count	24.3	28.8	53.0
		% within lifehistory	5.7%	94.3%	100.0%
		% within opportunisticbold	3.1%	43.5%	25.0%
		% of Total	1.4%	23.6%	25.0%
		Std. Residual	-4.3	4.0	
	less5mo	Count	8	45	53
		Expected Count	24.3	28.8	53.0
		% within lifehistory	15.1%	84.9%	100.0%
		% within opportunisticbold	8.2%	39.1%	25.0%
		% of Total	3.8%	21.2%	25.0%
		Std. Residual	-3.3	3.0	
	more5mo	Count	45	8	53
		Expected Count	24.3	28.8	53.0
		% within lifehistory	84.9%	15.1%	100.0%
		% within opportunisticbold	46.4%	7.0%	25.0%
		% of Total	21.2%	3.8%	25.0%
		Std. Residual	4.2	-3.9	
	problem	Count	41	12	53
		Expected Count	24.3	28.8	53.0
		% within lifehistory	77.4%	22.6%	100.0%
		% within opportunisticbold	42.3%	10.4%	25.0%
		% of Total	19.3%	5.7%	25.0%
		Std. Residual	3.4	-3.1	

Table 13. Lifehistory * opportunisticbold Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	108.461[a]	3	.000
Likelihood Ratio	122.647	3	.000
N of Valid Cases	212		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 24.25.			

Table 14. Chi-Square Tests (opportunistic-bold/life history variables).

		Value	Approx. Sig.
Nominal by Nominal	Phi	.715	.000
	Cramer's V	.715	.000
	Contingency Coefficient	.582	.000
N of Valid Cases		212	

Table 15. Symmetric Measures (opportunistic-bold/life history variables).

The relation between the "playful-sociable" profile and life history variables

Table 16 indicates the relation between the "playful-sociable" profile and the life history variables: the situation is similar with the "bold" profile. Most of the bears that were "playful-sociable", interacted with bears during cub stage (94.9%), were kept less than 5 months in captivity (87.2%) and most of them were not cubs of problematic female mothers (87.2%). Expected counts (all less than 5), the chi square test (**Table 17**) and the phi test (**Table 18**) indicate a strong relation between the life history of the bears and whether they became "playful-sociable" or not: (X^2 =96.014 (3); p<0.001). (Phi=0.785; Crammer's V=0.785). The standard residuals indicate that playfulness and sociability strongly depends on interaction with other cubs (SR=3.7) and captivity period (SR=3.1). According with the standard residuals there is a strong negative relation between playfulness and whether the mother was a problematic bear (SR=-3.4).

			Playfulsociable		Total
			no	Yes	
Lifehistory	interact	Count	2	37	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	5.1%	94.9%	100.0%
		% within playfulsociable	2.7%	45.7%	25.0%
		% of Total	1.3%	23.7%	25.0%
		Std. Residual	-3.9	3.7	
	less5mo	Count	5	34	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	12.8%	87.2%	100.0%
		% within playfulsociable	6.7%	42.0%	25.0%
		% of Total	3.2%	21.8%	25.0%
		Std. Residual	-3.2	3.1	
	more5mo	Count	34	5	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	87.2%	12.8%	100.0%
		% within playfulsociable	45.3%	6.2%	25.0%
		% of Total	21.8%	3.2%	25.0%
		Std. Residual	3.5	-3.4	
	problem	Count	34	5	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	87.2%	12.8%	100.0%
		% within playfulsociable	45.3%	6.2%	25.0%
		% of Total	21.8%	3.2%	25.0%
		Std. Residual	3.5	-3.4	

Table 16. Lifehistory * playfulsociable Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	96.014[a]	3	.000
Likelihood Ratio	110.641	3	.000
N of Valid Cases	156		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.75.			

Table 17. Chi-Square Tests (playful-sociable/life history variables).

		Value	Approx. Sig.
Nominal by Nominal	Phi	.785	.000
	Cramer's V	.785	.000
	Contingency Coefficient	.617	.000
N of Valid Cases		156	

Table 18. Symmetric Measures (playful-sociable/life history variables).

The relation between the self "confident profile" and life history variables

Interaction with other cubs, captivity period and the mother seems to have significant influence also on the "self confident" category (**Table 19**). 93.6% of the "self confident" bears interacted with other cubs, 78.7% were kept less than 5 months and 78.7% were not cubs of problematic females. Expected counts (all less than 5), the chi square test (**Table 20**) and the phi test (**Table 21**) indicate a strong relation between the life history and self confidence: (X^2 =81.708 (3); p<0.001). (Phi=0.659; Crammer's V=0.659). The standard residuals indicate that self confidence depends strongly on interaction with other cubs (SR=3.7), captivity period (SR=2.3) and also a strong relation with the mother (SR=-3.0).

			selfconfident		Total
			no	yes	
Lifehistory	interact	Count	3	44	47
		Expected Count	21.8	25.3	47.0
		% within lifehistory	6.4%	93.6%	100.0%
		% within selfconfident	3.4%	43.6%	25.0%
		% of Total	1.6%	23.4%	25.0%
		Std. Residual	-4.0	3.7	
	less5mo	Count	10	37	47
		Expected Count	21.8	25.3	47.0
		% within lifehistory	21.3%	78.7%	100.0%
		% within selfconfident	11.5%	36.6%	25.0%
		% of Total	5.3%	19.7%	25.0%
		Std. Residual	-2.5	2.3	

Table 19. Lifehistory * selfconfident Crosstabulation.

			selfconfident		Total
			no	yes	
Lifehistory	more5mo	Count	37	10	47
		Expected Count	21.8	25.3	47.0
		% within lifehistory	78.7%	21.3%	100.0%
		% within selfconfident	42.5%	9.9%	25.0%
		% of Total	19.7%	5.3%	25.0%
		Std. Residual	3.3	-3.0	
	problem	Count	37	10	47
		Expected Count	21.8	25.3	47.0
		% within lifehistory	78.7%	21.3%	100.0%
		% within selfconfident	42.5%	9.9%	25.0%
		% of Total	19.7%	5.3%	25.0%
		Std. Residual	3.3	-3.0	

Table 19. Lifehistory * selfconfident Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	81.708[a]	3	.000
Likelihood Ratio	91.304	3	.000
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 21.75.			

Table 20. Chi-Square Tests (self confident-life history variables).

		Value	Approx. Sig.
Nominal by Nominal	Phi	.659	.000
	Cramer's V	.659	.000
	Contingency Coefficient	.550	.000

Table 21. Symmetric Measures (self confident-life history variables)

The relation between the "curious confident" profile and life history variables

89.7% of the curious-confident bears interacted with other bears in the first year of their life (**Table 22**); 79.5% were kept less than 5 months in captivity and 17.9% were cubs of problematic females. Pearson chi square test (**Table 23**) and phi test (**Table 24**) indicate a strong relation between the life history variables and the curious profile (X^2 =67.664 (3);

$p<0.001$). (Phi=0.659; Crammer's V=0.659). According the standard residuals there is a strong relation between interactions with other cubs (SR=3.3); captivity shortness (SR=2.4); curiosity profile development and behavior of the mother (SR=-2.9).

			curiousconfident		Total
			no	yes	
Lifehistory	Interacted with bears	Count	4	35	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	10.3%	89.7%	100.0%
		% within curiousconfident	5.3%	43.2%	25.0%
		% of Total	2.6%	22.4%	25.0%
		Std. Residual	-3.4	3.3	
	Kept less than 5months	Count	8	31	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	20.5%	79.5%	100.0%
		% within curiousconfident	10.7%	38.3%	25.0%
		% of Total	5.1%	19.9%	25.0%
		Std. Residual	-2.5	2.4	
	Kept more than 5months	Count	31	8	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	79.5%	20.5%	100.0%
		% within curiousconfident	41.3%	9.9%	25.0%
		% of Total	19.9%	5.1%	25.0%
		Std. Residual	2.8	-2.7	
	Cub of problem-atic female	Count	32	7	39
		Expected Count	18.8	20.3	39.0
		% within lifehistory	82.1%	17.9%	100.0%
		% within curiousconfident	42.7%	8.6%	25.0%
		% of Total	20.5%	4.5%	25.0%
		Std. Residual	3.1	-2.9	

Table 22. Lifehistory * curiousconfident Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67.664[a]	3	.000
Likelihood Ratio	74.371	3	.000
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.75.			

Table 23. Chi-Square Tests (curious-confident/life history variables).

		Value	Approx. Sig.
Nominal by Nominal	Phi	.659	.000
	Cramer's V	.659	.000
	Contingency Coefficient	.550	.000

Table 24. Symmetric Measures (curious-confident/life history variables).

The relation between the "greedy-assertive" profile and life history variables

The number of "greedy-assertive" bear cases seemed to be too small (only 2 bears) for meeting the test requirements (all expected values < 5). According the Pearson chi square test ran with low expected values, there was no significant association between the "greedy-assertive" profile and the life history variables (X^2=8000 (3); p>0.001); (**Table 24; Table 25**). However this test rejects the null hypothesis of any relation between the "greedy assertiveness" and life history, thus cannot be taken in consideration due to the too low values of the expected results.

			greedyassertive		Total
			no	yes	
Lifehistory	interact	Count	0	2	2
		Expected Count	1.0	1.0	2.0
		% within lifehistory	.0%	100.0%	100.0%
		% within greedyassertive	.0%	50.0%	25.0%
		Std. Residual	-1.0	1.0	

Table 25. Lifehistory * greedyassertive Crosstabulation.

			greedyassertive		Total
			no	yes	
	less5mo	Count	2	0	2
		Expected Count	1.0	1.0	2.0
		% within lifehistory	100.0%	.0%	100.0%
		% within greedyassertive	50.0%	.0%	25.0%
		Std. Residual	1.0	-1.0	
	more5mo	Count	0	2	2
		Expected Count	1.0	1.0	2.0
		% within lifehistory	.0%	100.0%	100.0%
		% within greedyassertive	.0%	50.0%	25.0%
		Std. Residual	-1.0	1.0	
	problem	Count	2	0	2
		Expected Count	1.0	1.0	2.0
		% within lifehistory	100.0%	.0%	100.0%
		% within greedyassertive	50.0%	.0%	25.0%
		Std. Residual	1.0	-1.0	

Table 25. Lifehistory * greedyassertive Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.000[a]	3	.046
Likelihood Ratio	11.090	3	.011
N of Valid Cases	8		
a. 8 cells (100.0%) have expected count less than 5. The minimum expected count is 1.00.			

Table 26. Chi-Square Tests (greedy-assertive/life history variables).

The relation between the "shy" profile and life history variables

Pearson chi square test rejected the null hypothesis that there is a relation between the "shy" profile and the life story variables. (X^2=5958 (3); p>0.001) (**Table 27; Table 28**). The standard residuals at all categories is less than 1.9 (critical value according to Field 2009) indicating no relation, although the requirements for the test were met (all expected values greater than 5)..

			shy		Total
			no	yes	
Lifehistory	interact	Count	7	15	22
		Expected Count	10.8	11.3	22.0
		% within lifehistory	31.8%	68.2%	100.0%
		% within shy	16.3%	33.3%	25.0%
		Std. Residual	-1.1	1.1	
	less5mo	Count	9	13	22
		Expected Count	10.8	11.3	22.0
		% within lifehistory	40.9%	59.1%	100.0%
		% within shy	20.9%	28.9%	25.0%
		Std. Residual	-.5	.5	
	more5mo	Count	13	9	22
		Expected Count	10.8	11.3	22.0
		% within lifehistory	59.1%	40.9%	100.0%
		% within shy	30.2%	20.0%	25.0%
		Std. Residual	.7	-.7	
	problem	Count	14	8	22
		Expected Count	10.8	11.3	22.0
		% within lifehistory	63.6%	36.4%	100.0%
		% within shy	32.6%	17.8%	25.0%
		Std. Residual	1.0	-1.0	

Table 27. Lifehistory * shy Crosstabulation.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.958[a]	3	.114
Likelihood Ratio	6.051	3	.109
N of Valid Cases	88		
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.75.			

Table 28. Chi-Square Tests (shy-life history variables).

5.4. Discussion and Conclusions

The Pearson chi square test, the phi test, the Crammer's V test and the standard residuals indicated that in the first year of their life, the interaction with other bears (mother or other cubs) is important in the development of the aggressiveness, focused, opportunistic-bold, playful-sociable, self confident and curious confident profiles at sub-adult bears. Absent mind, lazy, greedy and shyness seems to be in no relation with whether the bears interacted with other bears or not during cub stage.

If a bear cub arrives in captivity due to the loss of mother or other reasons, the further development of its personality profile seems to depend strongly on the captivity period. Working with a considerably number of orphan bear cubs until now, I observed that 2-3 months of captivity doesn't affect visibly the behavior, even if captivity occurs at very early age. But if the cub spends more than 5 months with people, many of behavioral characteristics suffer alterations. The tests performed in the context of personality profile development indicated that those bears which spent less than 5 months in captivity became with a bigger chance aggressive, focused, bold, self-confident and playful than the bears kept more than 5 months in artificial conditions. This means that long captivity alters the "bear characteristics" which enhance the survival in the wild. We might ask why? The answer is somehow subjective, and requires further studies: I observed that bear cubs under 1 year are capable to very strong emotional bonds with man if are reared by people. Similar phenomenon was observed at dogs: if a bear cub kept more than 5 months by humans is placed in a facility with other same aged bear cubs, a quasi aggressive avoidance of each other can be observed. But immediately a human being comes in the facility, this cub will come and climb on the man as would have been its mother (even if is not the person who reared the cub, but a totally foreign one). The more the bear is kept with humans, the more this emotional bond provokes alterations in the "wild" behavior. Probably such bears are more prone to become problematic bears if released back into the wild.

The contingency tables show that absent minded and lazy bears were kept more than 5 months in captivity, but there was no relation between this and the “greedy” and “shy” profiles.

16 bears of 71 were cubs of problematically behaving females. They were captured, separated from the mothers and rehabilitated due to the not desirable behavior of these females (visiting garbage dumps, braking in yards and houses, etc.). All these cubs spent more than 5 months with their mothers. From the test resulted that “aggressiveness”, “absent minded”, “lazy”, “greedy-assertive” and “shy” profiles have no relation with the behavior of the mother. Oppositely, there was a relation between the “focused”, “opportunistic-bold”, “playful”, “self confident” and “curious confident” profiles and the behavior of the mother. Is interesting that the cubs of problematic mothers were less focused, bold, playful and curious than those of normal mothers.

The absent minded, lazy and shy profiles seem to represent a separate category in relation with life history. As the next section will describe, the bears which presented all three profiles, had a degenerative nervous illness, and died under the age of 1 year. Knowing this, is clear why such an individual has a so different personality profile than most of the bears. After 1-2 such cases, I already was able to predict that a bear will develop this disease, even if at that moment wasn’t noticeable any physical symptom. Only the clear absent mind and lazy profile signs revealed that something is wrong with those individuals.

6. Can personality profiles influence the later fate of juvenile bears?

6.1. Introduction to the section

Although important in understanding the dynamics of bear populations, the factors influencing cub survival are poorly documented and may vary among species, areas, and years (Swenson *et al.* 2001). One reason is, of course, the difficulty of determining the cause of death of cubs or sub-adults and of separating proximate and ultimate causes (Swenson 2001). In addition, variables affecting cub survival may interact (Derocher & Stirling 1995). Survival of bear cubs and sub adult bears has been found to vary temporally within an area (LeCount 1982, Rogers 1987; Miller 1990; Derocher and Stirling 1995,1996; Swenson *et al.* 1997) and spatially among areas (Clark & Smith 1994, Derocher and Taylor 1994, Garshelis 1994, McLellan 1994, Mattson & Reinhart1995, Swenson *et al.* 1997). There are different factors influencing cub's survival, such as social factors, nutritional factors and disturbance. Swenson (2001) describes the most important social factor to be the intra specific predation caused by males or females. The literature describes many cases where males are killing cubs or juveniles. This predation is usually linked to competition for limited resources (Swenson 2001). When these resources are the mates, the competition is intra sexual and the infanticide is sexually selected. But sexual selection is not a general case. Males kill in unselective way both sexes, just to determine shortening of the period until next ovulation at females (Hardy 1977). Intra specific predation has been observed to occur also on sub adults of over 1 year of age in Sweden (Swenson 2001).

Though bears are solitary animals, studies on the population structure of bear populations have revealed that direct and indirect social interactions (i.e. dominant versus sub-dominant, percentage of home range overlap of related animals, territoriality, acceptance, and mating avoidance) together with food abundance play a crucial role in the population dynamics of bears (Rogers 1987, Swenson *et al.* 1997, Stonorov & Stokes 1972). The severity of social intolerance is, according to Stokes (1970), directly related to the number of bears already present in the area in relation to its carrying capacity and saturation. The period of maternal care varies not only between bear species, but also varies within species, (Palomero *et al.* 1997). According to Swenson *et al.* (1998), the age of self sufficiency in brown bear cubs can take place already in July, at around six months of age. Other records on self sufficiency have shown that in Alaska (Loyal & LeRoux, 1973) 7 months old bear cubs survived until maturity. Length of maternal care is an important factor explaining the variation in reproductive rate among brown bear populations (Dahle & Swenson 2003). The weaning moment has an important influence on the development stage and body mass of the cub and thus on its later survival. Craighead *et al.* (1995) presented a conditional model based on theories of behavioral polymorphism (Maynard 1982) to explain the age of weaning in North American brown bears. They argued that females in good condition could wean yearling offspring (at least small litters), whereas females in poor condition weaned their offspring as 2.5-year-olds. However, they failed to determine the factors influencing the cessation of maternal care.

There are many questions related with cub's survival rate, mortality, intra specific predation and behavior patterns connected with these. Until now all studies related with cub survival and mortality cause at bear species were concerned about questions like: are bears in certain age or categories vulnerable to intra specific predation? Are there specific individuals exhibiting infanticide behavior? When does the mortality occur in bear populations? What other external factors influence cub survival? Nobody at my knowledge looked for connections between behavioral characteristics and survival/mortality at bears. My study on survival of rehabilitated and released yearling and sub adult brown bears is the only attempt in Romania to analyze sub adult mortality and the only attempt worldwide to analyze the relation between personality profiles at bears and their later fate.

6.2. Materials and methods

As seen in the previous section, a number of 71 bears were reared up in the period between 2001-2013 under the rehab methods described in chapter 3. Release moment of the cubs occurred at ages between 1.3-2.5 years. 4 individuals have been released with a yellow year tag for later identification purpose; 56 individuals were equipped with VHF radio transmitters and 11 with GPS/GSM systems at release. The fate of 61 individuals could be assessed with the help of the mentioned monitoring techniques. The other 11 lost the collars, or disappeared in the first 2 weeks of the monitoring, thus their fate was rated as unknown. 43 bears of the 61 tracked survived more than 6 months, being rated as "survived". Of the 18 individuals which died, 11 were killed by adult bears, 4 died due to a degenerative nervous system disease (not exactly identified yet), 2 were killed by poachers and 1 died hit by train.

In order to test whether there is a relation between personality profiles and later fate, I cross tabulated the fate frequencies with each personality profile, using a chi square test together with Phi and Crammer's V test. I considered all cross tabulation cases with maximum 25% expected values in the contingency tables to meet the requirements of the Chi square test (according to Field 2009). All standard residuals over the value of 1.96 were considered to indicate significant relation between the cross tabulated items according with Field 200

6.3. Results

The relation between the personality profiles and survival:

All expected counts over 5 in the contingency tables indicate that the requirements for the chi square test were met, and there is a relation between the personality profiles and survival success.

Tables 31; 32; 33; 34; 35; 36; 37; 38; 39 display the cross tabulation between the personality profiles and survival.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	61.000[a]	1	.000	.000	.000
Continuity Correction[b]	56.287	1	.000		
Likelihood Ratio	74.010	1	.000	.000	.000
Fisher's Exact Test				.000	.000
N of Valid Cases	61				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 5.31.					

Table 29. Chi-Square Tests irritable-aggressive/survival.

		Value	Approx. Sig.	Exact Sig.
Nominal by Nominal	Phi	1.000	.000	.000
	Cramer's V	1.000	.000	.000
	Contingency Coefficient	.707	.000	.000
N of Valid Cases		61		

Table 30. Symmetric Measures irritable-aggressive/survival.

The Pearson chi square tests and the phi with Crammer's V tests (X^2 =61.000 (1); p<0.001; Phi=1.000; Crammer's V=1.000; **Tables 29** and **30**) indicate a strong relation between each personality profile and whether the bear survived or not.

According with the standard residuals, there is a strong positive relation (SR=2.3) between survival and "irritable-aggressive", "focused", "opportunistic-bold", "playful-sociable", "self confident", "curious confident", "greedy-assertive" and "shy" profiles, and a strong negative relation (SR=-3.6) between death and the same profiles.

The “absent minded” and “lazy” profiles show an opposite situation: a strong negative relation between survival and “absent minded”/”lazy” profiles (SR=-3.6) and a strong positive one between death and the same profiles (SR=2.3).

			irritableaggress		Total
			0	13	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within irritableaggress	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within irritableaggress	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within irritableaggress	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table31. Crosstab irritable-aggressive/survival

			absentminded		Total
			1	6	
fate	notsurvived	Count	0	18	18
		Expected Count	12.7	5.3	18.0
		% within fate	0.0%	100.0%	100.0%
		% within absentminded	0.0%	100.0%	29.5%
		% of Total	0.0%	29.5%	29.5%
		Std. Residual	-3.6	5.5	
	suvived	Count	43	0	43
		Expected Count	30.3	12.7	43.0
		% within fate	100.0%	0.0%	100.0%
		% within absentminded	100.0%	0.0%	70.5%
		% of Total	70.5%	0.0%	70.5%
		Std. Residual	2.3	-3.6	
Total		Count	43	18	61
		Expected Count	43.0	18.0	61.0
		% within fate	70.5%	29.5%	100.0%
		% within absentminded	100.0%	100.0%	100.0%
		% of Total	70.5%	29.5%	100.0%

Table 32. Crosstab absentminded/survival

			lazy		Total
			2	7	
fate	notsurvived	Count	0	18	18
		Expected Count	12.7	5.3	18.0
		% within fate	0.0%	100.0%	100.0%
		% within lazy	0.0%	100.0%	29.5%
		% of Total	0.0%	29.5%	29.5%
		Std. Residual	-3.6	5.5	
	suvived	Count	43	0	43
		Expected Count	30.3	12.7	43.0
		% within fate	100.0%	0.0%	100.0%
		% within lazy	100.0%	0.0%	70.5%
		% of Total	70.5%	0.0%	70.5%
		Std. Residual	2.3	-3.6	
Total		Count	43	18	61
		Expected Count	43.0	18.0	61.0
		% within fate	70.5%	29.5%	100.0%
		% within lazy	100.0%	100.0%	100.0%
		% of Total	70.5%	29.5%	100.0%

Table 33. Crosstab survival/lazy profile

			focused		Total
			3	24	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within focused	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within focused	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within focused	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 34. Crosstab survival/focused profile

			opportunisticbold		Total
			9	36	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within opportunisticbold	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within opportunisticbold	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within opportunisticbold	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 35. Crosstab survival/opportunistic bold profile

			playfulsociable		Total
			6	26	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within playfulsociable	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within playfulsociable	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within playfulsociable	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 36. Crosstab survival/playful sociable profile

			selfconfident		Total
			7	33	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within selfconfident	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within selfconfident	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within selfconfident	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 37. Crosstab survival/self confident profile

			greedyassertive		Total
			0	2	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within greedyassertive	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within greedyassertive	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within greedyassertive	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 38. Crosstab survival/greedy-assertive profile

			shy		Total
			6	11	
fate	notsurvived	Count	18	0	18
		Expected Count	5.3	12.7	18.0
		% within fate	100.0%	0.0%	100.0%
		% within shy	100.0%	0.0%	29.5%
		% of Total	29.5%	0.0%	29.5%
		Std. Residual	5.5	-3.6	
	suvived	Count	0	43	43
		Expected Count	12.7	30.3	43.0
		% within fate	0.0%	100.0%	100.0%
		% within shy	0.0%	100.0%	70.5%
		% of Total	0.0%	70.5%	70.5%
		Std. Residual	-3.6	2.3	
Total		Count	18	43	61
		Expected Count	18.0	43.0	61.0
		% within fate	29.5%	70.5%	100.0%
		% within shy	100.0%	100.0%	100.0%
		% of Total	29.5%	70.5%	100.0%

Table 39. Crosstab survival/shy profile

The death of those bears which didn't survive was caused by 4 factors: predator kill, disease kill, poacher kill and traffic accident. The last 3 factors (disease, poacher and traffic caused deaths) occurred in too small numbers to meet any statistical testing requirements (4 bears died due to a degenerative nervous system disease, 2 bears were poached and only one killed by train), thus I could statistically test only the null hypothesis that there might be a relation between the personality profiles and predator kill fate: Pearson chi square tests and phi with Crammer's V tests (X^2=54.000 (1); p<0.001; Phi=1.000; Crammer's V=1.000; **Tables 40** and **41**) indicate a strong relation between each personality profile and whether the bear was killed by adult bears.

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	54.000[a]	1	.000	.000	.000
Continuity Correction[b]	48.011	1	.000		
Likelihood Ratio	54.593	1	.000	.000	.000
Fisher's Exact Test				.000	.000
N of Valid Cases	54				
a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.24.					

Table 40. Chi-Square Tests (similar for all cross tabulations between personality profiles and predator kill fate).

		Value	Approx. Sig.	Exact Sig.
Nominal by Nominal	Phi	1.000	.000	.000
	Cramer's V	1.000	.000	.000
	Contingency Coefficient	.707	.000	.000
N of Valid Cases		54		

Table 41. Symmetric Measures (same for all cross tabulations between personality profiles and predator kill fate).

			irritableaggress		Total
			0	13	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within irritableaggress	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within irritableaggress	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within irritableaggress	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 42. Crosstab irritable-aggressive profile/predator kill fate

			absentminded		Total
			1	5	
fate	predkill	Count	0	11	11
		Expected Count	8.8	2.2	11.0
		% within fate	0.0%	100.0%	100.0%
		% within absentminded	0.0%	100.0%	20.4%
		% of Total	0.0%	20.4%	20.4%
		Std. Residual	-3.0	5.9	
	suvived	Count	43	0	43
		Expected Count	34.2	8.8	43.0
		% within fate	100.0%	0.0%	100.0%
		% within absentminded	100.0%	0.0%	79.6%
		% of Total	79.6%	0.0%	79.6%
		Std. Residual	1.5	-3.0	
Total		Count	43	11	54
		Expected Count	43.0	11.0	54.0
		% within fate	79.6%	20.4%	100.0%
		% within absentminded	100.0%	100.0%	100.0%
		% of Total	79.6%	20.4%	100.0%

Table 43. Crosstab absent minded profile/predator kill fate

			lazy		Total
			2	4	
fate	predkill	Count	0	11	11
		Expected Count	8.8	2.2	11.0
		% within fate	0.0%	100.0%	100.0%
		% within lazy	0.0%	100.0%	20.4%
		% of Total	0.0%	20.4%	20.4%
		Std. Residual	-3.0	5.9	
	suvived	Count	43	0	43
		Expected Count	34.2	8.8	43.0
		% within fate	100.0%	0.0%	100.0%
		% within lazy	100.0%	0.0%	79.6%
		% of Total	79.6%	0.0%	79.6%
		Std. Residual	1.5	-3.0	
Total		Count	43	11	54
		Expected Count	43.0	11.0	54.0
		% within fate	79.6%	20.4%	100.0%
		% within lazy	100.0%	100.0%	100.0%
		% of Total	79.6%	20.4%	100.0%

Table 44. Crosstab lazyprofile/predator kill fate

			focused		Total
			2	24	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within focused	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within focused	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within focused	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 45. Crosstab focused/predator kill fate

			opportunisticbold		Total
			6	36	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within opportunisticbold	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within opportunisticbold	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within opportunisticbold	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 46. Crosstab opportunistic bold/predator kill fate

			playfulsociable		Total
			4	26	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within playfulsociable	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within playfulsociable	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within playfulsociable	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 47. Crosstab playful sociable/predator kill fate

			selfconfident		Total
			5	33	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within selfconfident	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within selfconfident	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within selfconfident	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 48. Crosstab self confident/predator kill fate

			curiousconfident		Total
			6	25	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within curiousconfident	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within curiousconfident	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within curiousconfident	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 49. Crosstab curious confident/predator kill fate

			greedyassertive		Total
			0	2	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within greedyassertive	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within greedyassertive	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within greedyassertive	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 50. Crosstab greedy assertive/predator kill fate

			shy		Total
			4	11	
fate	predkill	Count	11	0	11
		Expected Count	2.2	8.8	11.0
		% within fate	100.0%	0.0%	100.0%
		% within shy	100.0%	0.0%	20.4%
		% of Total	20.4%	0.0%	20.4%
		Std. Residual	5.9	-3.0	
	suvived	Count	0	43	43
		Expected Count	8.8	34.2	43.0
		% within fate	0.0%	100.0%	100.0%
		% within shy	0.0%	100.0%	79.6%
		% of Total	0.0%	79.6%	79.6%
		Std. Residual	-3.0	1.5	
Total		Count	11	43	54
		Expected Count	11.0	43.0	54.0
		% within fate	20.4%	79.6%	100.0%
		% within shy	100.0%	100.0%	100.0%
		% of Total	20.4%	79.6%	100.0%

Table 51. Crosstab shy/predator kill fate

Tables from 42 to **51** display the cross tabulation results for each personality profile and predator killed fate. Analyzing the standard residuals in the contingency tables is observable that similarly with the survival-personality profile relationship, the absent minded and lazy are the only profiles that show a strong positive relation with predation. With other words, the bears with these profiles are clearly more vulnerable to predation.

6.4. Discussions and conclusions

Until now 2 of 10 personality profiles, seems to have smaller survival chance: the absent minded and lazy profiles (**Table 45**). All other profiles show strong relatedness with survival capacity and less chance to be caught by a predator or vulnerable to other risks.

Bears that displayed the lazy and absent minded profiles	**Fate**
Bear 2	Unknown
Bear 4	Disease killed
Bear 7	Predator killed
Bear 18	Disease killed
Bear 19	Predator killed
Bear 23	Predator killed
Bear 33	Survived
Bear 58	Predator killed
Bear 59	Predator killed
Bear 67	Disease killed
Bear 68	Disease killed

Table 52. Fate of the bears with absent minded and lazy profiles.

Going back to **Table 3**, let's mark those individuals which displayed the "bad" profiles: The results are in **Table 52**.

As observable in **Table 52**, only one of the bears with any of these "bad" profiles survived. The fate of one is unknown. All the others died due to either disease or killed by adult bears. Although the disease killed, poacher killed and traffic killed bears can't be considered of any statistical significance, the lazy and absent-minded profiles might be predictors of vulnerability.

The only bears killed by poachers were Bear 20 with opportunistic-bold, playful-sociable, self confident, curious-confident profiles and Bear 29 with focused, opportunistic-bold, playful-sociable, self confident and curious-confident profiles. The traffic killed bear (Bear 28) was opportunistic-bold. Since these numbers are way too small to any prediction capability, still there might be a question whether any of these profiles or combination of profiles could be responsible for bringing the individual "in a bad place in bad time". Is a generally accepted statement, that opportunism and curiosity of bears are the most important characteristics that predispose bears to involve them in conflict situations or become habituated to anthropogenic food sources. If these basic bear traits come together with a big self confidence and high curiosity level, I assume that is not exaggerated to predict a higher chance for getting involved in risky circumstances.

7. Is there any relation between personality profiles and later individual dispersal patterns?

7. 1. Introduction to the section

For juvenile individuals prior to their first mating, dispersal may be defined as the movement of an individual from his natal site out of the home range of its parent(s) to another site at which it breeds, or at least attempts to pair with conspecifics of the opposite sex for purpose of breeding (Bekoff 1977). Short term exploratory movements or changes in the boundaries of a home range are not included (Lidicker & Stensen 1992). At adult individuals the term of dispersal have a slightly different meaning, referring more to the movement of the individual out of its group or home range (Bekoff 1977). Several hypotheses have been proposed to explain the ultimate causes of natal dispersal in a wide range of species: the inbreeding avoidance hypothesis, where individuals disperse to avoid inbreeding with close relatives (Greenwood 1980; Cockburn *et al*. 1985; Pusey 1987; Wolff 1993, 1994); the intra sexual mate competition hypothesis, where individuals disperse to avoid competition for mates (Dobson 1982; Moore & Ali 1984); the resource competition hypothesis, where individuals disperse to increase access to environmental resources (Greenwood 1980; Waser & Jones 1983; Pusey 1987); and the resident fitness hypothesis, where juveniles compete for phylopatry (Andersen & Ims 2001). However, the causes of dispersal differ between species, and also between populations and sexes of the same species (Waser and Jones 1983; Moore & Ali 1984; Lidicker & Stensen 1992). In the case of my study, the natal home range of the juveniles is identified with the home range around the nursing area (the rehab center). I used the dispersal definition of Zedrosser *et al* (2006) as being individuals that left the natal (nursing) area and did not return before reproducing or reaching reproductive age (4 years).

In most of studies related with juvenile dispersal at mammalian species, behavioral polymorphism and dispersal strategies are considered to be in strong relation. Some studies suggest a strong relation between traits as aggressiveness or dominance between individuals and juvenile dispersal at small mammalian species as various *Microtus spp.* or ground squirrels (*Spermophilus columbianus*), whereas others didn't support the idea that juvenile dispersal directly results from socially dominant individuals driving out more subordinate individuals through aggression (Christian 1970; Yeaton 1972).

In roe deer (*Capreolus capreolus*), subadult males with large antlers experience more aggression from resident males, and thus disperse more often (Wahlstrom 1994). In solitary felids such as Florida panter (*Puma concolor*) and tiger (*Panthera tigris*), aggression by resident adult males towards subadults has been cited as the proximate cause of male dispersal (Smith 1993; Maehr *et al.* 2002). In a study on juvenile dispersal of Scandinavian brown bears, Zedrosser *et al.* (2006) found no significant influence between dispersal probability and number of males around sub-adult males. In their study the results supported the inbreeding avoidance hypothesis as main cause of natal dispersal at male bears. A logical explanation of this phenomenon might be the low territoriality of bears compared with the strongly territorial roe deer and felids.

Most of the studies revealed that at many species natal dispersal between males and females follow different patterns. At most of mammals has been observed that at females natal dispersal is more related with philopatry. Evidence from several squirrel species shows that daughters compete among themselves for access to the natal site (Wiggett & Boag 1992). At Scandinavian brown bears the probability of female natal dispersal decreased with increasing maternal age, which may be related to the formation of matrilinear assemblages among bears (Zedrosser *et al.* 2006). The increased overlap in a matriarchy indicates that related females are tolerant of each other (Stoen *et al.* 2005) and related neighboring individuals should be more likely facilitate philopatric behavior of juvenile females than neighboring non-kin females. Such a tolerance could decrease the probability of female natal dispersal. The Scandinavian studies on juvenile natal dispersal revealed that older brown bear mothers should be surrounded by a higher number of related females than younger mothers, therefore the daughters of older mothers may face less antagonism (Zedrosser *et al.* 2006). This implies that brown bears can distinguish between related and unrelated individuals (Stoen *et al.* 2005). Though is unknown how this phenomenon may occur at bears, there are similar specifications in the literature at other species: Mateo (2002) showed that Belding's ground squirrels (*Spermophilus beldingi*) produced odors that correlated with relatedness and Tegt (2004) showed that coyotes (*Canis latrans*) were able to recognize relatedness by using odor cues in faces, urine and anal sack secretion.

Body size can also influence juvenile dispersal. For example at Belding's squirrels fat males dispersed earlier than lean males (Holekamp et al. 1996). In red dear (*Cervus elaphus*) the birth weight of dispersing stags was higher than that of non-dispersers (Clutton-Brock *et al.* 1982). At roe dear dispersers were on average heavier than philopatric individuals (Wahlstrom & Liberg 1995). Craighead *et al.* (1995) observed dominance hierarchies based on body size in adult brown bears at garbage dumps in Yellowstone National Park which might influence dispersal.

In small mammals and ungulates juvenile dispersal is appreciated to be a density dependent phenomenon (Boonstra 1989; Jones 1986; Lambin 1994; Linnell *et al.* 1998; Andreassen & Ims 2001). Among badgers (*Meles meles*) there seems to be a lower male dispersal rate in populations with high density compared to low density populations, although female immigration did not correlate with density (Woodroffe *et al.* 1995). Stoen et al. (2006) founded that natal dispersal probability and dispersal distances at Scandinavian brown bears were inversely density dependent. The inverse density dependent dispersal probably contributes to an increased spatially heterogeneous abundance of bears in the landscape.

The relations between individual behavioral differences and later dispersal patterns is low documented at mammals, but at fish and birds the field of personality-dependent dispersal is expanding rapidly as greater evidence emerges of the relationship between personality types and dispersal (Cote et al. 2010). For example, mosquitofish (Gambusia affinis) that were identified as more asocial than the population norm, tended to disperse greater distances (Cote et al. 2010), and mosquitofish from populations characterized as more asocial or bold overall also dispersed more often regardless of their individual personality type (Cote et al. 2011). Boldness of Trinidad killifish (*Rivulus hartii*) was also found to be positively correlated with dispersal distance (Frase et al. 2001). Duckworth & Badyaev (2007) also showed that dispersal tendencies and aggression were linked in western bluebirds (*Sialia mexicana*). In a recent study on an North American minnow (*Lepidomeda aliciae*), Rasmusen & Belk (2012) found strong relations between exploratory behavior and dispersal patterns. Quantitative data collected both for coyotes and wolves, and qualitative observations of other canids, strongly suggest that the range of individual differences in the early behavioral ontogeny of littermates may be related to later species typical social organization. In this section of the thesis I examined the dispersal dynamics of the same sample of 61 juvenile bears (the once which I was able to track) and tried to find out whether exist a relation between dispersal of individuals and their personality profiles. As seen in the previous sections, personality dimensions are measurable and ratable at juvenile bears. My hypothesis was that some of these profiles or combination of profiles might determine some individuals to leave the natal home range with higher probability or to disperse farther than others.

7.2. Materials and methods

61 juvenile bears (out of the 71 released) could be tracked with VHF and GPS tracking systems (11 GPS collared and 50 VHF collared individuals). But even if the tracking systems were helpful for assessing survival data, unfortunately due to hard terrain conditions most of the VHF tracked individuals couldn't be relocated enough time for an accurate dispersal or habitat use estimation. Thus the dispersal of only 14 individuals (8 males and 6 females) has been taken in consideration for the present study. I measured dispersal distance from the release area to the middle of the 95% Kernel home range which fell at the most extremities of the distribution of the fixes.

Since there was a significant difference between males and females ($t(12)=-2.13$, $p<0.05$), I performed the analyze separately on males and females. **Table 53** displays the dispersal distances and profile ratings of the males and **Table 54** of the females. Code '1' represents that the individual was rated with that profile whereas '0' indicates that wasn't. In order to test the influence of each personality profile on the dispersal distance, I divided the data into subgroups, considering each personality profile a variable. For example the group of males (and separately of females) that were rated with a specific profile versus the group that didn't present that profile, etc. I performed an independent *t* test in order to calculate the effect size (*r*) (Rosenthal 1991; Rosnov & Rosenthal 2005), of the different profiles on the dispersal distance.

"r" =√(t^2)/(t^2+df);

The effect size of a variable is weak if "*r*" is below 0.3, medium if is between 0.3 and 0.5, strong if falls between 0.5- 0.7 and substantial if above 0.7, regardless the value of "*t*" (Field 2009). Thus, regardless the significance of the differences between the groups that presented a profile versus those that didn't, the effect of the profiles on the dispersal distance could be measured.

7.3. Results

On average males expressed bigger dispersal distances (M=147.75 km, SE=37.56) than females (M=53.16 km, SE=7.43). This difference was significant $t(12)=-2.13$, $p<0.05$ representing a large sized effect: correlation coefficient r = 0.52.

The "irritable-aggressive" and "shy" profiles at males and the "irritable-aggressive" with the "curious-confident" profiles at females had to be excluded from this analyze, because only one bear was rated with them in both groups.

The relation between the personality profiles and the dispersal distances at males:

- The "focused" profile explained only in 3% the variance of the dispersal distance at males **(r = 0.**03), representing no effect on the dispersal distance of males.
- The "playful" and "sociable" traits explained in 39% the variance of the dispersal distance of males, the effect size of these profiles being medium (r=0.39).
- The "self confident" profile had similarly a medium effect on the dispersal distance, explaining in 37% the variance of male dispersal (r=0.37%)
- The biggest effect of all profiles was indicated by the "curious-confident" profile, with a substantial effect on the dispersal of the males (r=0.78).

Bear individual	**Dispersal distance**	**Irritable-aggressive profile**	**Focused profile**	**Opportunistic-bold profile**	**Playful-sociable profile**	**Self confident profile**	**Curious confident profile**	**Shy profile**
bear 9	98	0	1	1	0	1	1	0
bear 10	140	0	1	1	1	1	1	0
bear 13	60	0	1	1	0	1	0	0
bear 16	50	0	0	1	1	0	0	0
bear 20	104	0	0	1	1	1	1	0
bear 24	276	0	0	1	1	1	1	0
bear 29	346	0	1	1	1	1	1	0
bear 54	108	1	1	1	1	1	1	1

Table 53. Dispersal distances of males with personality profile ratings of each individual.

The relation between the personality profiles and the dispersal distances at females:

- The "playful-sociable", "focused" and "self-confident" profiles showed a substantial effect on the dispersal of females, "playful-sociable" explaining 63%

(r=0.63) , the "focused" 69% (r=0.69) and the "self-confident" 74% (r=0.74) of the variance.

Bear individual	Dispersal distance	Irritable-aggressive profile	Focused profile	Opportunistic-bold profile	Playful-sociable profile	Self confident profile	Curious confident profile
bear 11	58	0	0	1	0	1	0
bear 12	52	0	1	1	0	1	0
bear 22	57	0	1	1	1	1	1
bear 21	46	0	1	1	1	1	0
bear 28	81	0	0	1	0	0	0
bear 31	25	1	1	1	1	1	0

Table 54. Dispersal distances of females with personality profile ratings of each individual.

7.4. Discussion and conclusions

As in most of mammalian species, juvenile dispersal of bears show a similar dispersal probability biased towards males. In our case mean dispersal of females was 53.1 km (Median = 54.5) and male's mean dispersal 147.7 km (Median = 106.0). Comparing the groups presenting certain profiles versus those that were not rated with that profile, is observable that some of the profiles have at least medium or even substantial effect on the dispersal distance, this effect being indicated by the Pearson's correlation coefficient '*r'*. According to Field (2009), there might be a measurable effect quantifiable with the Pearson's *r* or with the Cohen's *d* coefficient, as a measure of the strength of relationships between variables. At the male bears playfulness and self confident profiles had a medium sized effect whereas curiosity had a substantial effect on dispersal. Is interesting that at females all profiles had substantial effects. Logical question would be "why this difference"?. The answer might stay exactly in the strategies between dispersal differences between males and females described in the introduction of this section: females dispersal related with philopatry and matrilinear assemblages where aggressiveness, playfulness and self confidence differences between females might influence their special relation between each other, whereas at males the most important factor, according with most of the researches, seems to be the exploring for food or other non-kin related females.

8. The relations between personality profiles and habitat selection

8.1. Introduction to the section

Activity patterns are important components of behavioral ecology, and their mechanisms are defined by a complex trade-off between the internal physiological system of the organism and its interactions with several properties of the environment (Palmer 1976). Behavioral flexibility is often regarded to be unlimited, immediate, and reversible (Sih *et al.* 2004), allowing individuals to maximize their fitness in the many different environments they encounter during life (Dingemanse & Reale 2005).

A basic question when studying habitat exploration of any species is whether the animals occur randomly within their home range (no habitat selection occurs), or there is a constraint in the habitat use (the animals select the habitat constrained by internal or external factors). Assuming random habitat use, the habitat used by the animal would be similar to the habitat composition of an area considered available to the animal in its home range (Martin et al. 2008). The use of this null model strongly relies on the assumption of independence between animal relocations which implies that the animal could be found anywhere within its home range at any time. Implicitly such a model supposes that any area of high relocation density is a result of the animal's habitat choices. In fact it is difficult to dissociate the effect of the movement constraints from that of habitat choice behavior.

Every study with this topic at most of the species identifies some sort of habitat choice of the individuals, since in no study where individuals were marked with transmitters they occurred randomly, but areas with high relocation density were visible. It seems that some factors induce constraints in the habitat preference. Most of the studies related with animal's habitat choices have focused on selection induced by the changes in the environment or on the structure of the habitat (food or shelter place availability) on the individual space occupancy. Factors that may influence animal behavior at fine scale have rarely been investigated. The changes at individual level even less. Contrary to the notion of behavioral plasticity as the major adaptive cause of phenotypic variation in behavior (Houston & McNamara 1999; Dall et al. 2004; Neff & Sherman 2004), animals often show very limited behavioral plasticity (Sih et al. 2004) and commonly differ consistently in their reaction towards the same environmental stimuli (Clark & Ehlinger 1987; Wilson *et al.* 1994; Boissy 1995; Gosling 2001). Since these individual differences in behavior are frequently expressed across a wide range of contexts and situations, as fact individuals differing consistently in whole suites of functionality-distinct behavioral traits (Sih et al. 2004), more than probably this brings a considerable influence in how the habitat is used by the individuals of the same population.

Conservation and management planning at any wild animal species require not only an understanding of how wildlife use habitat in space and time, but how habitat use changes in response to the changes of the constraining factors (Berland *et al.* 2008). The Carpathian Mountains and their surrounding habitats is subject of excessive human influence, such as forest exploiting (timber and secondary forest products as berries and mushrooms), agriculture, hunting, tourism, mining, gas exploration and diverse recreational activities. As this area also provides vital habitat for large carnivores and other wildlife, it is an appropriate region for understanding the interaction between the structure of these habitats and wildlife use.

In areas where anthropogenic habitats provide abundant food resources, large carnivores face a trade-off between food intake and risk avoidance. Since this is a proven fact in one of our studies performed on bears, recently submitted (Krijn *et al.* 2014), the question goes further: which individual is prone to risk more? Are there any influences on this? There are likely few populations of bears anywhere in the world whose behaviour has not been significantly influenced by man (Stirling & Derocher 1989). This may confound our understanding of their behaviour and ecology. Remaining populations of bears may not be able to adapt successfully to the combined effects of human predation, disappearing habitat, and climatic change unless profiting on their learning capacity and plasticity to different food sources even if the result is a compromise called by us "habituation" or "problem individual". Bears are omnivorous animals, with the most complex diet, feeding behavior and ecological plasticity among large carnivores (Swenson *et al.* 2000). Their predatory or vegetarian feeding seems to show a big variation among geographical distribution ranges and also a great deal of individual variation in feeding strategies as a result of learning (Stirling & Derocher 1989). The variability in the way bears from the same population behave within a particular area may be influenced by both genetic factors and learning (Mazur & Seher 2008; Breck *et al.* 2008). It is generally accepted that bears vary their feeding manners according to habitat and the presence of human (Zunino & Herrero 1972; Swenson *et al.* 2000). Thus, through learning, some bears may develop individual differences in food preference, vary in the degree to which they prey on live animals, or respond to human disturbance (Bereczky *et al.* 2011). Individuals will develop behavioural patterns that are modelled by their own experiences (Stirling & Derocher 1989). In a study on habitat use of two Scandinavian brown bears Martin *et al.* (2008) observed a clear pattern in the movement of the animals, which rejected the null hypothesis that relocations are random in the home range, the model indicating a clear habitat choice.

In another study, Martin *et al.* (2010) have found a clear pattern in habitat selection within home ranges of brown bears in Scandinavia considering slope steepness and distances to forests, but in the same time there was a high variability in habitat selection in relation to anthropogenic structures (distances to houses and traffic roads) between individuals. This indicates a difference between individuals when considering fine scale habitat selection. Human disturbance within the home ranges was positively correlated with the strength of selection for slopes: individuals with more human disturbance within their home range showed greater selection for steeper slopes (Martin *et al.* 2010). Surprisingly, in the up mentioned Scandinavian study there was no relationship between disturbance in the home range and selection for either undisturbed areas or regenerating forests. In the same time bears experiencing a higher degree of disturbance in their home range showed more variability in the use of slopes. In the same study there was found an interesting reverse pattern on the use of disturbed areas: bears with lower degree of disturbance tended to show more pronounced diurnal patterns and individuals with less disturbance in their home range tend to show stronger differences in their avoidance of disturbance between day and night, all these suggesting a behavioral response by bears to human activity.

One of our studies (Krijn *et al.* 2014) showed that food availability is a basic influencing factor of habitat selection by bears. Many food plant species (hazelnut, beech, raspberry, blackberry, blueberry, spruce, oak, maple and hawthorn) had a relatively large effect size on bear occurrence, which indicates that these species can explain the presence or absence of the brown bear. Most tree species had a positive effect on bear presence which indicates that they provide either food or shelter (or both). The abundance of these species had a positive effect also on the occurrence near artificial human created surfaces, indicating a trade-off between food availability and human avoidance.

Since human-bear conflict is a growing phenomenon due to human and bear habitats overlap, and public acceptance is a key element in conserving large carnivore populations, a better understanding of the factors enhancing the development of conflict situations is essential. According to Willson *et al.* (2006) human-grizzly bear conflicts were directly influenced by different environment predisposing factors, most of them related to human foods as attractants, livestock-raising operations and other human access in the bear habitat.

Researchers have often observed that bears show a big variation in their behavioral response to the existing multi-use landscape conditions characteristic for Europe (Swenson *et al.* 2000).

In a study on trouble making brown bears in the Romanian Carpathians (Bereczky *et al.* 2011), we have identified several behavior patterns indicating the predisposition of different bears to become problem individuals causing problems to farmers or livestock holders at different extent. All these aspects indicate some sort of individual difference on how bears adapt to the changing environment, and thus select the habitat.

Is obvious that habitat selection of any species, including bears, is a complex phenomenon, influenced by many factors some of them probably unknown to us. According to some authors, bears inherit behavioral or temperamental predispositions to forage in certain areas (Mazur *et al.* 2008).This hypothesis is based on the theoretical expectation that animals inherit behavioral tendencies that predispose them to respond in particular ways to environmental challenges (Boissy 1995; Dingenmanse *et al.* 2002; Reale *et al.* 2007).

Most of the studies related with habitat selection of bears focus on the relations between the up mentioned factors or others like home range size, and population density. The present study is the first attempt, to my knowledge, to investigate the relations between individual behavioral phenotypes at bears and their relationship with the habitat selection.

As part of my investigations and topic of this section of the thesis, I assumed that individual personality profiles of bears might influence their habitat selection ecology. My intention was to find out whether there are identifiable patterns in how individuals with distinct personality profiles respond to environmental variables, including anthropogenic factors, in an attempt to find out if could be a certain degree of predictability in these patterns.

Using GPS tracking, I did a case study on the habitat selection of 9 juvenile brown bears (out of my initial sample of 70) in the human-dominated landscape of the Eastern Carpathian Mountains of Romania. Although these mountains provide one of the largest, un-fragmented forests of Europe, they are surrounded by human-altered landscapes and are impacted by anthropogenic pressures such as logging, livestock herding and recreational use. I assumed that human-induced changes in food availability and patch safety increase the heterogeneity of a bear habitat, which in interaction with individual differences in terms of personality traits increases the diversity of habitat selection.

The study has also a management perspective: to investigate how flexible the habitat use patterns of brown bears are and how large carnivores can adapt to and persist in human-dominated landscapes. Having measured distinct personality profiles or combination of profiles at each individual, I tried to find out whether these profiles have prediction power in later habitat selection.

As seen in the previous section, personality profiles can influence dispersal distance of the juveniles; especially the explorative-curious profile has a strong impact on dispersion distance of males. In this section I analyzed whether the personality profiles influence the selection of different habitat variables as altitude, slope, forest type, CLC habitat type and approach scale to artificial, human created surfaces (settlements, roads, etc). I assumed that behavior patterns (such as explorative or curious characteristics) that bring bears closer to human proximities, might predict behavioral traits that make individuals more vulnerable to get involved in human-bear conflicts.

8.2. Materials and methods

The study area

The study was conducted mainly in the Middle Eastern range of the Carpathian Mountains- in the area of Calimani, Gurghiului, Giurgeului, Hasmas, Tarcau, Harghita, Nemirei massifs, the South Eastern Carpathian range- the area of Ciomad, Bodocului, Vrancea, Piatra Craiului massifs (Figure 2.1), the meadow area of middle-South-East and Eastern part of Transylvania and the bordering rural landscapes of the Transylvanian Basin and the Moldovian Plain. This area lies between 100 to 2500 m a.s.l. and has a bimodal distribution of elevation with one modus for the plains at around 425 m and another modus for the mountains at 1000 m. Topography is characterized by alternating big massifs and valleys and more or less steep slopes with elevation ranges from 500 m to 2500 m. The climate is temperate-continental, characterized by hot summers and long, cold winters with abundant snowfall. Annual precipitation is approximately 700 mm, though in the mountains it can be as high as 1000 mm. The plain regions are moderately populated and consist of a mixture of orchards and vineyards, agricultural fields and forested hills. The mountains have a low human population density and are mainly used for forestry.

The rolling landscape in the study area is dominated by forests with the following main vegetation levels: until 800m the main vegetation is dominated by oak and oak mixtures (*Querqus ssp*.); between 800-1200 m is the deciduous level, the main specie being represented by beech (*fagus sylvaticus*) or beech in mixture with other broad leaved species and Scots pine (*pinus sylvestris*) or silver fir (*Abies alba*). On this level the forested areas are intersected with bush lands, covered mainly with shrubs and small tree species as hazel (*Corylus avellana*), wild rose (*Rosa canina*), gelan (*Prunus avium*) and others; between 1200-1800 m on the boreal level are dominating the coniferous forests, mainly spruce (*Picea abies*) or in mixture with other coniferous species; over 1800m is the sub-alpine level, with different specific bush and alpine vegetation covers, whereas the landscape is mainly mountainous with altitudes up to 2000 m.

All the forested area is mixed with bush covered and shrub lands or grasslands, being used by bears in summer period due to the wild forest fruit abundance, mainly rasp berry (*Rubus idaeus*) and blue berry (*Vaccinium mirtillus*). The rates between forest covered and opened grass lands or shrub covered areas is approximately 80/20 % at elevations between 800-1800 m and 50/50% at lower altitudes 300-800 m. In the regions of lower altitude (300-800 m) there is an abundance of agricultural fields in bear range or very near the bear habitats. The study area is sparsely populated by humans at elevations over 1000 m, but densely inhabited below this elevation. Isolated houses and mid-traffic roads are also dense at altitudes below 1000 m. On the study area totally exists 173 human settlements, occupying a total area of 3 293 square km's, 90% of them being situated below 1000 m altitude elevation.

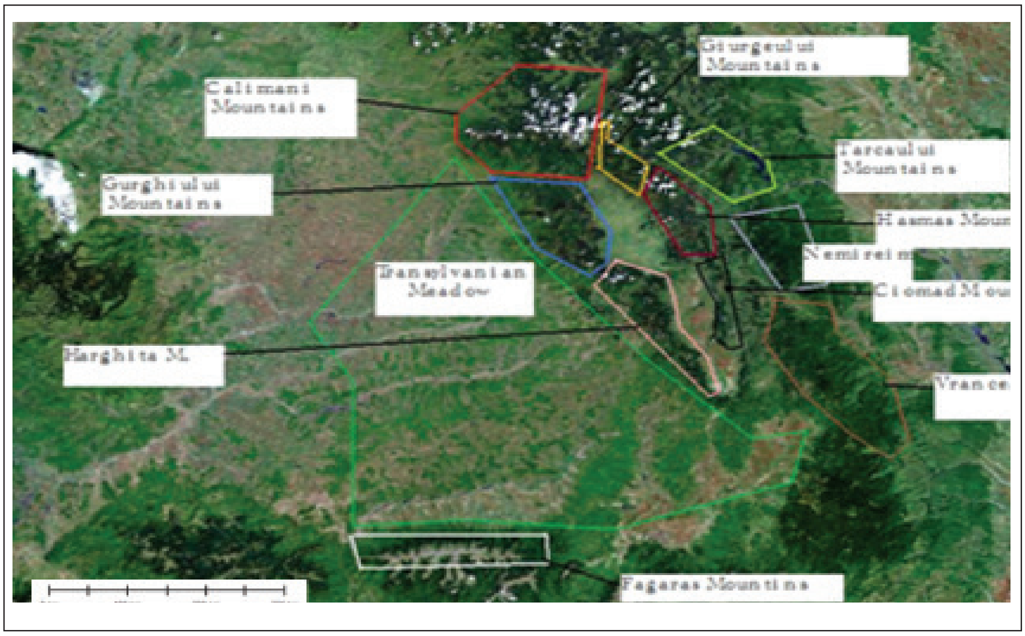

Figure 15. Locations of the post release study areain the Carpathian Mountains.

Study animals

I focused this section of the thesis on the telemetry results obtained from the GPS collared bears, this system offering incomparably better data than the VHF one, in terms of abundance of registered fixes, permitting complex and exact studies on movement dynamic, habitat and home range selection. In the study are included 9 juvenile bears below 4 years age. The used GPS collars were manufactured by Vectronic Aerospace Gmbh in Germany (GPS Pro Light), and were tuned to register fixes every 4 hours. Additionally data provided by the collars were: elevation and temperature. Data deliverance of the collars was GSM mobile network type (Orange Romania), being able to send short message packages at each 7th registered coordinate. Due to hunting, intra-specific killing, a traffic accident and collar shedding, collars gave information for average 12 months. Winter relocations were not considered in this study. Positional precision and fix rate of the GPS locations was approximately 25 m and 38 %, respectively.

Table 55 shows the individuals selected in this study together with the personality profiles of each one.

Table 55. Personality profiles of the tracked bears in the habitat use study.

Bear	**Personality profiles**
16	opportunistic-bold, playful-sociable
20	opportunistic-bold, playful-sociable, self confident, curious-confident
21	focused, opportunistic-bold, playful-sociable,
	self confident
22	focused, opportunistic-bold, playful-sociable
	self confident, curious confident
24	opportunistic-bold, playful-sociable, self confident, curious-confident
28	opportunistic-bold
29	focused, opportunistic-bold, playful-sociable
	self confident, curious-confident
33	absent minded, lazy, shy
54	Irritable-aggressive, focused, opportunistic-bold, playful-sociable, self confident, curious confident

Environmental variables

I used seven environmental variables to describe the habitats with respect to food availability, shelter availability and human activity. These variables were processed with ESRI ArcGis 10.1 and included five landscape scale variables: elevation, ruggedness, slope, land cover type, forest succession stage, and two local scale variables: buffers of 500 m and 1500m around human settlements and artificial surfaces. The first three topographic variables were derived from the Shuttle Radar Topography Mission digital elevation model data (DEM, resolution approximately 50 m) of the Consultative Group on International Agricultural Research (USGS 2010). Elevation was considered a proxy for human activity, as human population density decreases with altitude, but also for seasonal food availability since food is more abundant above 1000 m in summer and below 1000 m during autumn period. The elevation was divided into four categories: "low elevation" (0-400 m); "middle range" (400-800 m); "high" (800-1200 m); "very high" (1200-1800 m).

Ruggedness can be considered also a proxy for human activity (more rugged means less activity) and was quantified as the standard deviation in elevation in a neighborhood with radius of 500 m. Ruggedness was divided also in 4 categories: "deep valley" (cat.1); "gently rugged" (cat 2); "very rugged" (cat 3); "crest" (cat 4).

The land cover type variable and the buffers around settlements were obtained from the Corine Land Cover classification map (CLC, resolution 100 m) of the European Environmental Agency (EEA 2010). To describe the land use, I reduced the number of categories as follows: "artificial surfaces" (CLC codes: 111,112,121,122,123,124,131,132 ,133,141,142); "agricultural areas" (CLC codes: 211, 213, 221, 222, 231, 242, 243, 244); "forests" (CLC codes: 311, 312, 313, 321, 322, 324, 331, 332, 333); "wet lands" (CLC codes: 411, 412); "water bodies" (CLC codes: 511, 512, 523).

Regarding the buffers around human settlements, I considered the 1500 m buffer area where conflicts between man and bears occur with high potential (High Potential Conflict Area) and the 500 m buffer to be the area where the bear was critically close or in the settlement, not only around it. I assume these values to be appropriate and realistic to display bear presence near or in residential areas. Former findings (Sallay 2007) revealed that bedding/resting sites in Romania tend to be at least at a 1.5 km distance from streets or homesteads. Pop (2011) stated that 65% of damages appeared at a distance less than 1.5 km to human settlements.

I used the Romanian forest succession map of De Jong (2012) to consider the within-forest heterogeneity caused by logging. This map was generated by means of an object-based classification of bi-temporal Landsat TM data and distinguishes three succession stage classes with an overall accuracy of 80%. These classes were: 1- clear-cut and shrub-land areas, which do not yet have closed canopy but covered with dense ground cover vegetation; 2-young forest stands with low canopy height and high stem density; and 3-mature forests, which have not undergone clear cutting interventions in the past 40 years or so and have passed through the stem exclusion phase. Stands were classified as mature forest when reflections of both recent and past TM band red images were low. Class 1 and 2 were detected by relatively high reflections in red band images of either 2009 or 1989 and are therefore referred to as open 2009 and open 1989, respectively. The class open 1989 provides ideal conditions to shelter but has low food availability. Open 2009, on the other hand, has conditions that are favorable for forest fruits, especially blackberries (*Rubus fructicosus*) and raspberries

(*Rubus idaeus*) (Nielsen *et al.* 2004) but offers low protective cover.

Habitat selection analyzes

I analyzed the habitat selection using the sample protocol of Manley *et al.* (2002) which considers as basic concept that the area can be discretized into resource units (RU). The resource units correspond to pixels of a raster map or patches of a vector map. Each RU is characterized by several environmental variables (in my case the seven variables considered). Each available RU may be characterized by an availability weight describing how the RU is available to the species.

The data collection technique of collaring and tracking individual bears, that resulted in many observations of only a small number of animals, prescribed the use of either design II or III analyses (Thomas & Taylor 1990, Manley *et al.* 2002). Compared with the design I study, the design II and III consider the animal as the experimental unit. I adopted the design II study for which the animals are identified and the habitat use is measured for each one, but availability is considered the same for all animals of the population. For each animal, the set of used RU defines a "niche" in the ecological space. So there are as many niches in the ecological space as there are animals. A given RU may possibly be used by several animals. I analyzed the data with the R package Adehabitat HS (Calenge & Dufour 2006). The graphical possibilities of this package and the combinations of the "adehabitat" functions, with the powerful analysis environment provided by R allows the user to design a large diversity of analyses of the relationships between animals and their environment. The functions of the package make an extensive use of the marginality vectors which connect the mean of the distribution of available points to the mean of the niches. In other words these vectors measure the distance between what is available in average and what is used in average by an animal.

I studied the selection scale of the different variables by use of the Manley selection ratios (Manley *et al.* 2002) which equals 1 if the proportion of relocations within a certain habitat class is identical to the proportional availability of that class. Selection ratios between 0 and 1 indicate avoidance, values above 1 indicate preference. The significance of the deviation from 1 is tested for each variable separately by use of Chi-Square tests with one degree of freedom. Hence, p values should be compared to a significance level that is corrected for the number of habitat classes. Although the calculation of the selection ratio is pooled over all relocations, the standard error accounts for variation among individuals (Manley *et al.* 2002).

Next to the calculation and testing of the selection ratios, the package Adehabitat HS has the option for an exploratory eigenanalysis of design II selection ratios. This eigenanalysis is helpful in revealing the major patterns within the complex matrix of selection ratios of multiple individuals and habitat classes. The factorial plane of the eigenanalysis shows which habitat classes are most strongly selected and enables identification of groups of individuals that select habitat in a similar way. High explained variances of the first axes indicate individuals select similar habitat types. When successive axes contribute to the explanation of the variance, selection is variable among individuals (Calenge & Dufour 2006).

Considering the resource selection differences at individual scale, and looking at the individual personality profile combinations of the tracked bears, I built up several suppositions inspired by the poor logic. In other words what would be expectable in terms of habitat preference from each profile? Analyzing the environmental variables considered in this study, there are several environmental aspects that enhance the presence of humans, whereas others make the habitat less suitable for people. For example milder slope steepness, not very rugged terrain, lower elevation, the presence of agricultural areas, the presence of water bodies and less forest are the areas with high anthropogenic influence and bigger risks in terms of human-bear conflict situations.

Bears with "negative" profiles ("shy", "absent minded", "lazy") in their personality structure would be expectable to be prone in selecting environmental variables with decreased human use at higher rates than those with "positive" profiles. I would expect that such bears prefer habitats with dense vegetation cover, since there is more shelter and better hiding possibilities, higher elevations, steeper slopes and rugged terrain with less human access. Though there is only one "shy" individual in the study (bear 33), I looked whether there is a substantial difference in the selection ratio for these variables between this bear and the others. Although most of the bears include the opportunistic-bold profile in their profile configuration, some opportunistic-bold bears were curious-confident but others not (**Table 55**). Some were "focused" whereas others not. Only some bears were "curious-confident" or "self-confident". In one word, near the "opportunistic-bold" profile the personality structure of each individual included or missed additionally other profiles. Theoretically curiosity could drive them closer to human areas at higher ratio compared with those that had not this profile, since it induce an explorative trait in the behavior. Self confidence might have the same effect. Probably such bears explore more heterogenic habitat types compared with others. I expected that irritable-aggressive profile would influence towards avoidance of the human proximities whereas self confidence might determine the individual to come closer.

Is obvious that most of bears are opportunistic, since this is a basic bear characteristic, but some of them are more explorative or confident than the others. If the tests reveal that these characteristics bring bears closer to human proximities, it could mean that some "risky" profiles are able to involve some animals in conflict situations.

8.3. Results

Though the habitat selection showed a strong heterogeneity, clear trends were observable in the habitat selection. The first information is visible from the factorial plane of the eigenanalysis that shows which landscape variables were most strongly selected. The eigenanalysis of selection ratios (Calenge & Dufour, 2006) has been developed to explore graphically habitat selection by the wildlife when habitat is defined by several categories.

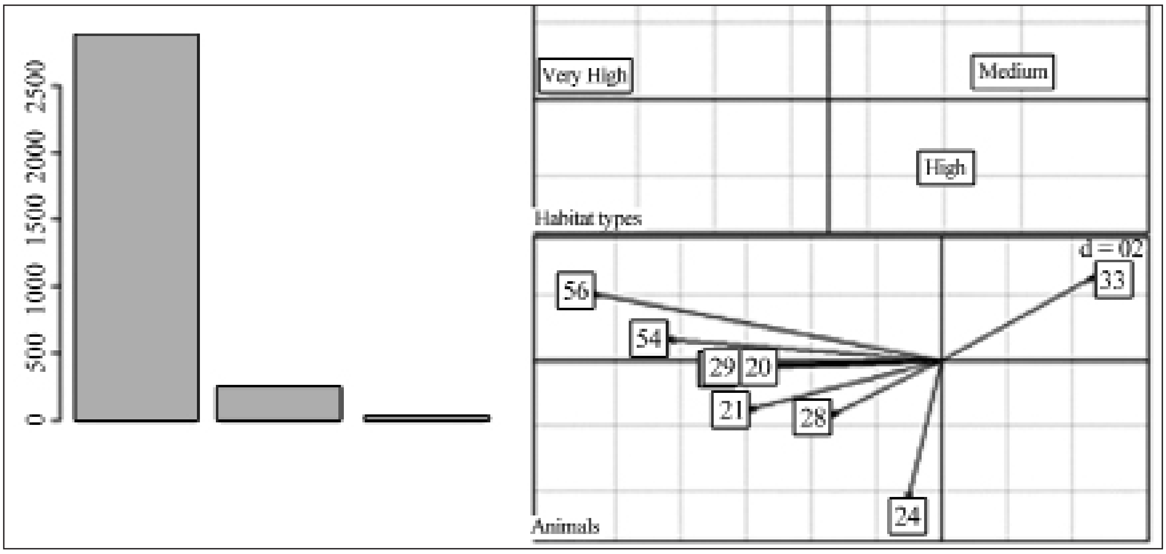

Fig. 16. The eigenanalysis for slope selection.

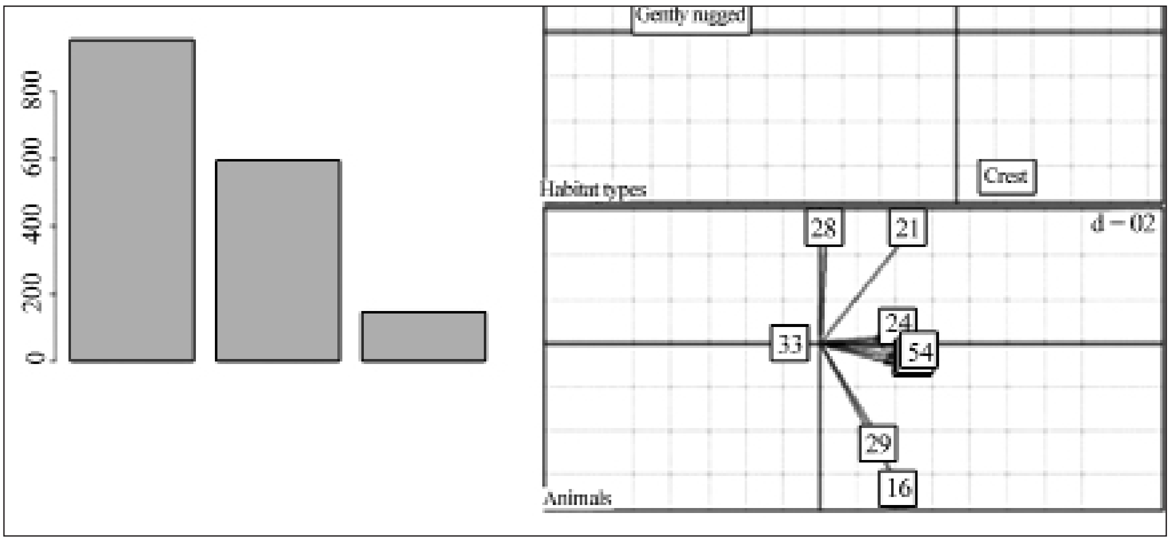

Figure 17. The eigenanalysis for ruggedness selection.

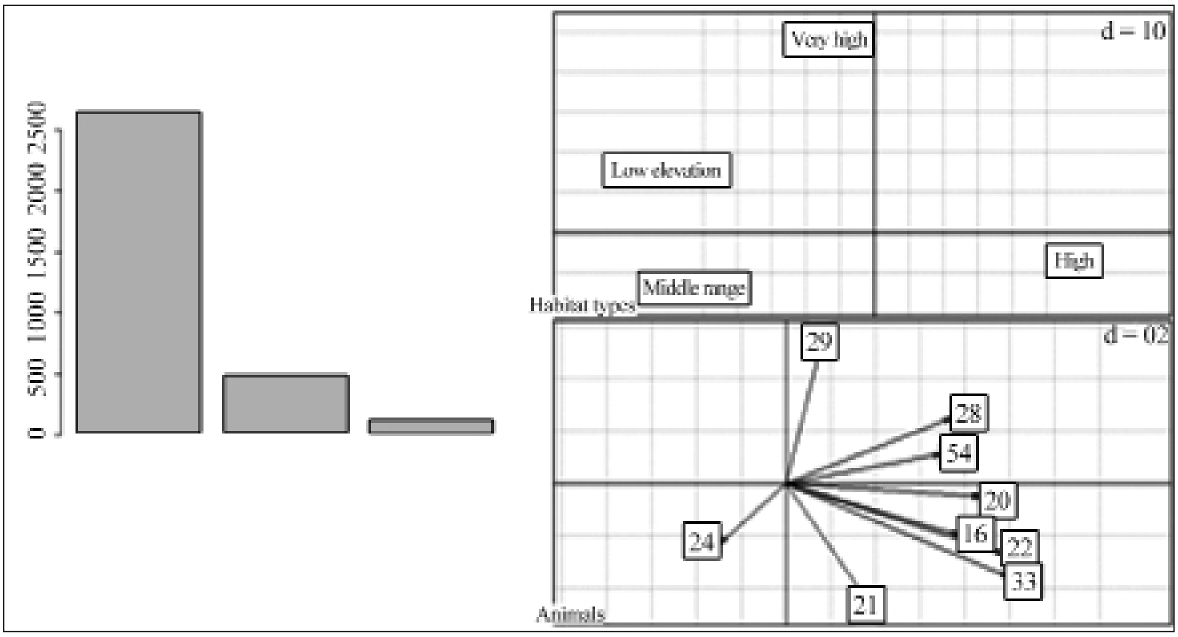

Figure 18. The eigenanalysis for elevation.

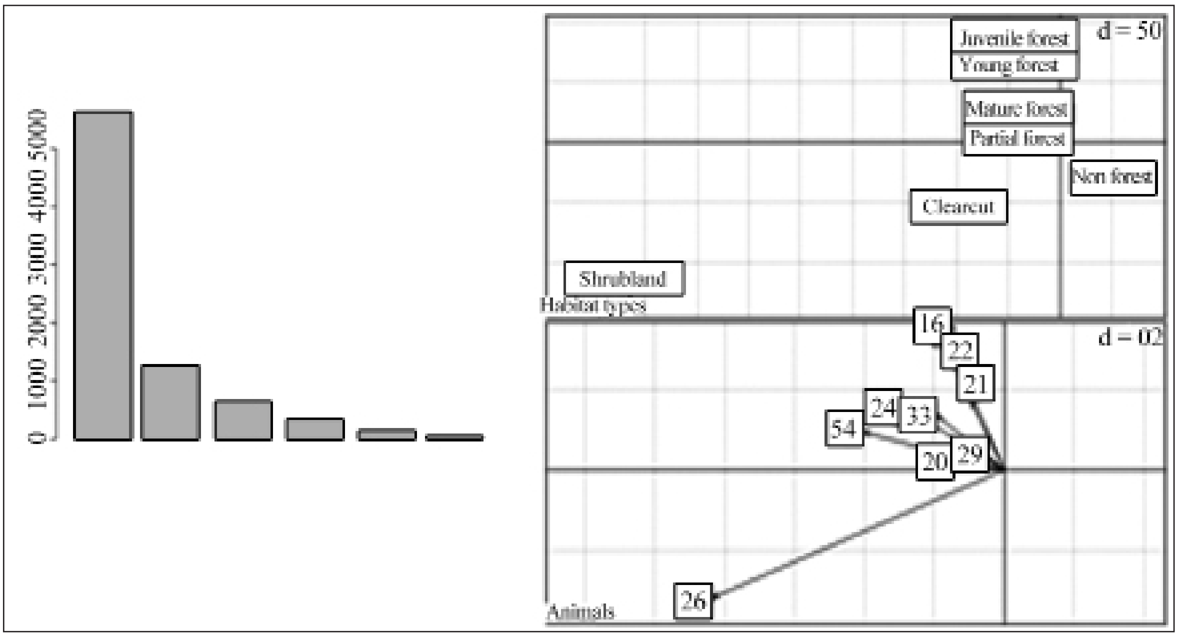

Figure 19. The eigenanalysis for forest succession stage.

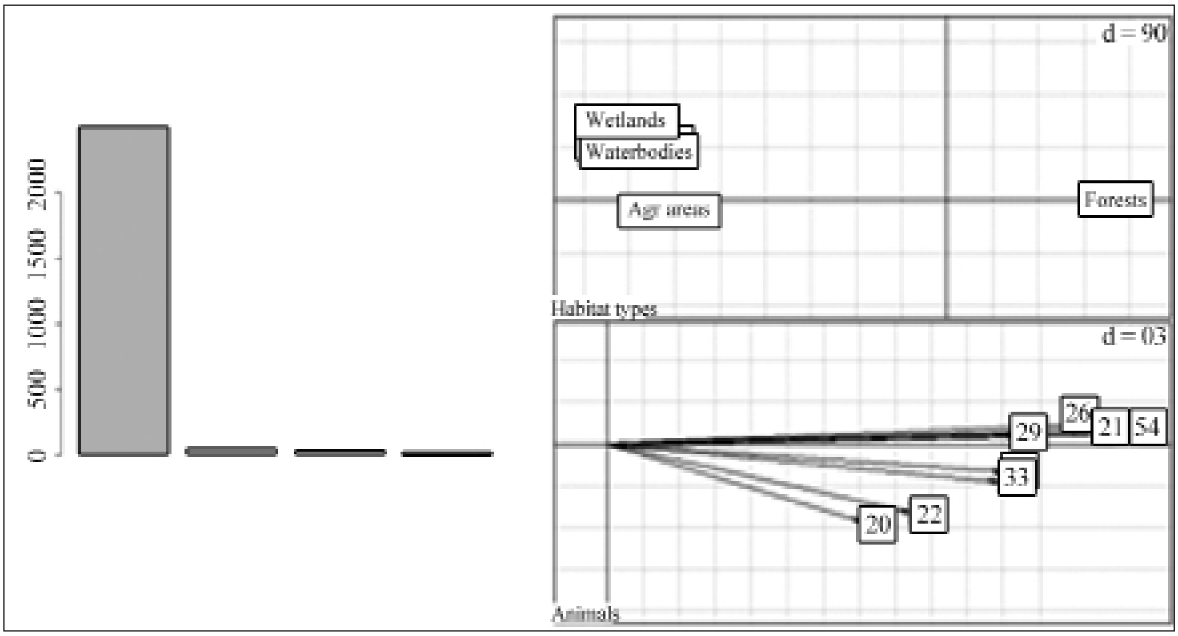

Figure 20. The eigenanalysis for Corine Land Cover.

Considering the landscape variables (“slope” **Fig 16**, “ruggedness” **Fig 17**, “elevation” **Fig 18**, “forest succession stage **Fig. 19**” and “CLC **Fig 20**”), we can see a clear brake in the decrease of the eigenvalues after the first and second one (the barplot of the eigenanalyzis at left side of Figures 16-20). The first two axes therefore express a clear pattern.

Let’s analyze each factorial plane diagram for the variables separately:

A clear preference for “very high” and “high” slopes in the eigenanalyzis of the “slope” vriable is visible (**Figure 16)**. The average Manley selection ratios for this variable were: 0.06298225 for “low”; 0.43799918 for “medium”; 0.73802965 for “high” and 1.69635011 for “very high” slopes. Values below 1 indicate avoidance and preferance above 1. One of the bears (“bear 33”) seems to behave differently: it significantly prefered the low slopes. The Manley selection ratio for low slopes was above 1 (**Table 56**) at this bear. This was the only bear with the “absent-minded”, “shy” and “lazy” profiles (**Table 55**).

Bear	Low	Medium	High	Very high
16	0.000000000	0.0000000	0.1559029	2.3424273
20	0.250780283	0.4740993	0.7126200	1.6453773
21	0.027621270	0.1566537	0.8740809	1.6680847
22	0.072190786	0.4386743	0.6553763	1.7646389
24	0 0.088673523	0.6465998	1.4649989	1.0007024
28	0.035218217	1.0415002	0.9461775	1.3588363
29	0.082503755	0.5681876	0.6393916	1.7392650
33	1.1914392696	1.9942271	0.9007725	0.5046585
54	0.003516231	0.2606740	0.4455417	2.0185031

Table 56. Manley selection ratios for the “slope” variable.

Although the eigenanalysis diagrams show the pattern of the habitat preference (in this case a clear selection towards high slopes and avoidance of low and medium slopes for most of the bears), the Manley selection ratios indicate more accurately the difference between the individuals. Analyzing tables 55 and 56 is observable that all the bears that preferred the very high slopes had the “opportunistic-bold” and “playful-sociable” profiles, most of them being additionally “focused” and “self confident”. Two individuals showed preference to “medium” and “high” slopes too (Bears 24 and 28). These bears had not the “focused” profile in their profile configuration. According these results for “slope” selection we might speculate that those traits that make bears focused, together with those that make them bold and confident might influence the animals to prefer very high slopes. The individuals who preferred the very high slopes, but had not the “focused” characteristic, were more prone to explore areas with lower slopes at a higher degree.

The diagrams in **Figure 17** indicate the same pattern for “ruggedness” selection: most of the bears preferred very rugged terrain with deep valleys and crests, excluding bear 33 which went for “gently rugged”. Average Manley selection ratio for “deep valleys” was 1.2133696; for “gently rugged” 0.1567157; for “very rugged” 1.1430181 and for “crest” 1.1005760.

Bear	Deep valey	Gently rugged	Very rugged	Crest
16	0.632915	0	0.602435	2.036313
20	1.102009	0.09662	1.089254	1.271897
21	1.83799	0.007981	1.071377	0.53184
22	1.192524	0.07152	0.956299	1.245597
24	0.992874	0.139762	1.773481	1.064809
28	1.361889	0.915894	1.760921	0.312977
29	0.673303	0.214561	1.075055	1.683015
33	1.133106	1.303923	0.372936	0.994256
54	1.274082	0.009144	0.898243	1.212992

Table 57. Manley selection ratios for “ruggedness”.

Bear 28 avoided the gently rugged terrain conditions at the lowest scale (Manley selection ratio for “gently rugged” was 0.9, see **Table 57**). This is the only bear with only one personality profile (“opportunistic bold”) in its profile configuration, whereas the others present combination of several profiles.

Considering the “elevation” variable, the diagrams in **Figure 18**. indicate a clear preference for high elevation areas. Average Manley selection ratios were: 0.06023498 for “low elevation”, 0.42493022 for “middle range”, 1.54898398 for “high” and 0.90940656 for “very high”.

Bear	Low elevation	Middle range	High	Very high
16	0	0.271015	1.903306	0.44025
20	0	0.074453	1.947836	0.753937
21	0	0.920776	1.532137	0.01557
22	0	0.082667	2.140421	0.209281
24	0.02315	1.592563	0.726376	0.723295
28	0	0.053772	1.699358	1.478994
29	0.670586	0.53012	0.973982	2.209074
33	0	0.104391	2.199375	0
54	0	0.194615	1.694486	1.180326

Table 58. Manely selection ratios for “elevation”.

Analyzing the Manley selection ratios (**Figure 51**), only 3 bears selected very high elevations (bears 28, 29 and 54), but the combination of their profiles seems not to give explanation for this phenomenon, since bears with similar profiles preferred high elevations as well (800-1200 m altitude ranges). The lack of influence of the personality profiles on elevation selection might be explainable with the seasonal food abundance on different altitudes (wild berries and fruits in summer above 1000 m's and acorns in fall below 1000 m's). This supports the theory of trade-off between food availability and avoidance of human inhabited areas.

The diagrams of the "forest succession" (**Figure 19**), show preference of forested areas or shrub lands versus the non forests (average Manley selection ratio for non forests: 0.2827154). Among different forest succession stages the most preferred areas were the "shrub-lands" (average Manley selection ratio: 4.7481695). After that followed the "juvenile forests" (1.8972076); "clear cuts" (1.7830546); "young forests" (1.7323538); "mature forests" (1.4390040) and "partial forests" (1.2732231).

Bear	Non forest	Partial forest	Clearcut	Shrubland	Young forest	Juvenile forest	Mature forest
16	0.352354	0	1.676131	1.440411	0.91638	7.257018	1.140283
20	0.69223	1.207237	1.101458	3.105886	1.354933	1.192224	1.184715
21	0.424196	0.167732	0.714162	0.604138	0.87851	1.384982	1.659427
22	0.416163	2.393158	0.804435	1.285395	6.322174	2.648457	1.076598
24	0.185313	0.540836	3.768145	2.77441	0.944227	1.727767	1.665535
28	0.143068	1.49705	6.374096	16.34746	0.808987	1.067758	1.050441
29	0.81337	1.085517	0.266647	2.005041	2.113841	1.106378	1.099045
33	0.121937	4.151872	5.303315	0.996951	0.724861	0.478362	1.698192
54	0.075289	1.730375	0.68218	6.360729	1.212131	1.722922	1.650085

Table 59. Manleyselection ratios for "forest succession".

Analyzing the Manley selection ratios in Table 59, is visible that Bear 28 again shows extreme values at selecting shrub-lands (16.34746) and clearcuts (6.374096). Bear 33 shows extreme value for clearcut (5.303315), Bear 22 also extreme values for young forests (6.322174) and Bear 16 for juvenile forests (7.257018).

The eigenanalysis for Corine Land Cover habitat types (Figure 20) indicate again the preference of forests, with main Manley selection ratios: 0.05357584 for "artificial surfaces", 0.22388873 for "agricultural areas", 1.47303307 for "forests", 0.04862842 for "wetlands", 0.12025505 for “water bodies”.

Bear	Art surf	Agr areas	Forests	Wetlands	Waterbodies
16	0	0.098548	1.542264	0	0
20	0.091426	0.614941	1.268653	0	0
21	0.060418	0.134183	1.519824	0	0
22	0.033838	0.523902	1.319617	0	0
24	0.02645	0.328953	1.419387	0	0.415576
28	0.154072	0.161312	1.499607	0	0
29	0.180467	0.274834	1.436076	0.573308	0
33	0	0.341634	1.416295	0	0
54	0.011537	0.081992	1.549326	0	0.18127

Table 60. Manely selection ratios for Corine Land Cover habitat types.

Bear	Out of the 1500 buf	In the 1500 buf
16	0.9571364	1.2050748
20	0.9854608	1.0695607
21	0.8366621	1.7814672
22	0.7531012	2.1812527
24	0.7470548	2.2101809
28	1.1494286	0.2850797
29	0.9523521	1.2279645
33	1.1642361	0.2142355
54	1.1531695	0.2671823

Table 61. Manley selection ratios for the 1500 m buffer around settlements.

Bear	Out of the 500 m buffer	In the 500 m buffer
16	1.112138	0.46349031
20	1.158829	0.24010547
21	1.065802	0.6851797
22	1.14316	0.31506984
24	1.174697	0.16418487
28	1.184027	0.11954955
29	1.040158	0.80787139
33	1.209014	0
54	1.199803	0.04407131

Table 62. Manley selection ratios for 500 m buffer around settlements.

According to **Table 60**, the Manley selection ratios indicate the avoidance of artificial surfaces, water bodies, wetlands and agricultural areas at each bear. Still at bears 24, 29 and 54 is observable a bigger selection ratio for wetlands and water bodies. Bears 28 and 29 showed biggest selection ratio for artificial surfaces and Bears 16 and 54 had the biggest avoidance ratio for agricultural areas compared with the other bears (**Table 60**).

Some bears showed positive selection ratios for habitats in the 1500m buffers around human settlements (Table 61), while others avoided it. The heterogeneity of the habitats in the study area result extensive overlaps between human areas and bear habitats, the areas in 1500 m perimeter being hardly avoidable by wild animals. Avoidance of such buffers might indicate a clear reason for it. Bears 28, 33 and 54 showed strong avoidance of these areas (Manley selection ratios were below 1).

The Manley selection ratios for the 500m buffer (Table 62) indicate avoidance of these areas, all values being below 1, but the values between 0 and 1 indicate at fine scale at what extent the animals avoided close proximity with humans. Bear 33 is the only which avoided these buffers 100%, followed by Bear 54 (0.04407131), Bear 28 (0.11954955) and Bear 24 (0.16418487). All the other individuals had selection ratios above 0.2.

8.4. Discussions

The most important factors influencing habitat selection at bears are the food availability and human disturbance, the animals facing a clear trade-off between them. The Manley selection ratios indicate at fine scale at what extent individuals selected different habitat types, but considering the human activity in habitats with different access difficulty degrees, actually these ratios indicate at what extent individuals were prone to take some risks. The average selection ratios indicate avoidance of easy human accessible habitat types, the bears selecting mainly variables with low human access (high slopes and elevations, rugged terrain conditions, forested areas, shrub lands, and habitats out of 500 m perimeters of human settlements). The “shy”, “lazy” and “absent minded” profile combination of Bear 33 seems to have a clear effect: this bear strongly avoided human settled areas, but did it at lower slope conditions and less rugged terrain. Analyzing chapter 3.2.2. where different components clustering the personality profiles is described, might be useful in understanding how these profiles could influence the animals in their habitat selection. The “Lazy” profile is clustered by: “bashful”, “devious”, “dissociated”, “incompetent at finding food”, “lazy”, “oblivious” and "spacey" items, suggesting that the bears with this profile were less competent in exploring the surroundings. The "absent minded" profile gathered similar components: the "devious", "dissociated", "dopey", "lazy", "oblivious", "sleepy", "stodgy", "careless" and "absent minded", items interrelated in the dimension of slow reaction to the environmental stimuli. The "shy" profile clustered "bashful", "shy" and "sneaky" items, indicating extensive shyness and hesitation to come in contact with any disturbing factor. We could speculate that the profile combinations that clustered several "negative" traits made this bear less capable of exploring difficult terrain conditions, but the traits gathered by the "shy" profile somewhat contra-balanced these impediments. Despite his profile characteristics, in some periods of the year Bear 33 had to overcome his reticence and explore high altitude habitats in periods when food abundance requested it at these elevations. Fact is that despite his "bad" profile, Bear 33 survived.

Bear 28 was the only one in this study, with the simplest personality structure: only one profile - "opportunistic-bold". This profile clustered the "opportunistic", "active", "agile", "alert", "confident with bears", "curious about surroundings" components, suggesting high activeness and explorative behavior. Despite this profile recall such "strong" characteristics, Bear 28 preferred medium slopes, and also avoided the "gently rugged" areas at the lowest scale (0.9 indicates avoidance, but compared with the other bears, was the smallest avoidance ratio). This bear went for very high elevations, preferred clear cuts and shrub lands (areas with high vegetation cover) and strongly avoided both buffers around human settlements. The only plausible explanation for this phenomenon is that the "alert" component from the "opportunistic-bold" profile had a deep influence on this bear, probably due to earlier experiences. Though this could be an explanation, it is only speculative, since against it comes the fact that other bears with the "focused" profile in their configuration expressed bigger proneness to take risks. The "focused" profile clustered the "determined", "focused", "impulsive", "watchful", "fearful of other bears", "fearful of people", "successful at finding food", "responsive" and "secure" items. These adjectives express attitudes of much care about what happens in the surroundings and readiness for reaction or escape.
Similar habitat selection was observable at Bear 24 (another one with the lack of "focused" profile).

Considering the extreme Manley selection ratios regarding different variables: Bears 33, 24 and 28 showed different patterns from the "average" regarding "slope" selection; Bears 33 and 28 regarding "ruggedness" selection; Bears 28, 29, 54 behaved differently considering "elevation" variable; Bears 33 and 28 showed extreme values for "shrublands" and "clearcut" in "forest succession" selection; Bears 24, 29 and 54 showed extreme ratios at "CLC" selection; Bears 22 and 24 selected strongly in the 1500m buffer; Bears 21 and 29 avoided less the 500m buffers.

Considering the Manley selection ratios tables, a big heterogeneity is observable among the bears. Some bears that preferred high slopes and rugged terrains, went for lower elevation and selected more for areas in 1500m buffers, whereas others behaved totally differently: preferred more areas with higher human access (gently rugged terrain and milder slopes at lower elevations), but in the same time occurred less in the buffers and preferred habitats with dense bushes and shrub cover. This is underlying the presumption that some personality construction traits can induce the apparition of different surviving strategies in similar habitat conditions. The sample size of this study is way too small to be able of clear definitions in terms of habitat selection characteristics induced by certain behavioral traits, but at least demonstrates the influencing power of them, testing the hypothesis of individual differences in terms of their reactions towards the same environmental stimuli.

The study revealed a high variability between individuals even with similar personality profiles, considering habitat selection in relation to anthropogenic structures and human influence on the surrounding habitats, indicating a high degree of habitat use flexibility at brown bears, with a considerable adapting capacity and persistence in human dominated landscapes. In these heterogeneous habitat conditions different personality traits gathered in distinct profiles might influence the decision of the individuals in their response to the changing habitat.

The strong differences in the habitat selection could indicate variation in selection strategies of the individuals. I argue the trade-off between food intake and risk avoidance which are amplified in human dominated landscapes, plays a role. In such landscapes, land use practices as agriculture, livestock herding, logging, tourism and others, strongly alters the distribution of resources. In addition, human disturbance increases levels of perceived predation risk (Beale & Monaghan 2004).

The following bears had “curious-confident” profiles in their configuration: Bears 20; 22; 24; 29; 54. One of my presumptions was that curiosity might drive bears closer to human settlements. Of these individuals Bears 22 and 24 had the highest selection ratio for 1500 m buffers (above 2.). Bears 20 and 29 showed also strong selection for the buffers (selection ratios above 1.). Bear 54 strongly avoided these buffers. Another supposition was that the “self-confidence” might have the same effect: selection towards areas closer to human proximities. Analyzing the Table 61 with the Manley selection ratios for the 1500 buffer, is observable that exactly the bears with the “self-confident” and “curious-confident” profiles were those that selected positively the areas in the buffer. Exception is Bear 54. My initial supposition was that the “irritable-aggressive” profile will have an influence towards avoidance of human proximities. The Manley selection tables for 1500m buffer test this assumption: Bear 54 avoided the buffer, even though in his profile configuration the “self confident” and “curious confident” profiles were present.

None of the tracked bears got involved in conflict situations, to my knowledge, during the monitoring period. Since these bears were juveniles, less than 4 years age, such individuals have not yet their physical condition prepared to resist guarding dogs or other guardians, neither life experience in which they could learn that near human resorts there might be an easy obtainable food source. They explored the surroundings led by their instincts. Still such “explorative” or “self-confident” profiles seems to bring them closer to “new” areas, that might seem too dangerous to other con-specifics. I would call these profiles “risky” profiles, which might lead the animals towards risky or conflict situations with higher chance than those that have not these “ingredients” in their profile configuration.

Within the heterogeneous landscapes of the study area, the temporal divergence of habitat use, caused by the dueling motivations of predator avoidance (also in terms of human avoidance) and food intake, the detection of habitat preference is likely complicated and appears as a trade-off between easy search of food patches and avoidance of risky or disturbed areas. In highly anthropogenic areas, finding shelter in small forest refuges implicates some abilities or qualities. Some individuals (ex Bear 33 or 28) were successful in hiding and co-existing with people in such regions without being noticed or cause any conflicts. I assume that their personality profiles influenced these abilities.

Even though the sample size of this study is small, and there is no existing literature about how personality traits of bears influence their habitat preference and selection (the only literature about personality at bears is related with habituated grizzly bears in Alaska), I consider this study a pioneer one which indicates that personality traits have an influence on how bears respond to environmental and habitat changes in a human dominated landscape, even if is impossible to give clear definitions yet.

9. Final discussions and conclusions

The animal literature provides strong evidence that personality does exist in animals (Gosling & Vazire 2002) in a wide range of species (Wilson et al. 1994; Pervin & John, 1997, Wolf et al. 2007) so individual differences between bear cubs was expectable. In the beginning my intention was simply to test whether the impressions of the cubs on their individuality could be quantified with reliability and, if possible, to check how well the measures correlated. Multiply observer’s ratings would have increased the reliability of the study (Feaver et al. 1986, Gosling & Vazire, 2002), but in my case was inappropriate to study individual variations in a rehabilitation center since the avoidance of human approach is one of the basic requirements of the rehab technique. Nevertheless the direct recording method adopted was useful in providing information, not easily obtainable in other ways, about subtle aspects of individual behavioral styles. Even though the methods of direct observations are less often checked for reliability than is desirable, they are rightly regarded as being powerful and scientifically reputable (Feaver et al. 1986).

The PCA revealed ten components, which can be interpreted as dimensions of bear personality. The total variance (81,37%) explained by the ten components is comparable to that found in other animal personality studies: Momozawa et al. 2003, 84%; Martin, 2005, 78%, Lloyd et al. 2007, 79,3%, and is higher than found in some other studies: Stevenson-Hinde and Zunz, 1978, 60%; King & Figueredo, 1997, 72,4%; Gosling, 1998, 75%; Momozawa et al. 2005, 71,4% and 75,5%;

The sample size used for the PCA is slightly lower than that recommended by Kline (1994) who suggests the use of twice as many individuals as variables. This does not, however, appear to have affected the model produced by the PCA, which may provide a solid foundation for further bear personality research.

The only study until now on measuring personality distinctiveness in bears has been performed by Fagen and Fagen (1996), who considers that consistent behavioral differences suggest that each bear has its own distinct personality. In the up mentioned study the authors described 5 bipolar variations: lively-dull, irascible-uninvolved, expert in fishing-ineptly in fishing, confident with other bears-lack of confidence in social situations, active/alert – lazy. The ten profiles described by me can be placed similarly on a polarity line as the up mentioned authors did. Actually they are the bipolar variations of 5 aspects: irritable/aggressive– playful/sociable; focused -- absent minded; opportunistic/bold -- shy; playful/sociable -- greedy/ assertive; self or curious confident -- lazy. The profiles are similar with those of Fagen and Fagen and refer to basic behavioral traits (aggressiveness, shyness, etc), but at a deeper specificity level. This somehow comes against the recommendations of Gosling (1998), who considers that it doesn't make sense to focus on specific behavior (e.g. bit or scratch another individual), but researchers rather should aggregate these behaviors in broader categories. In other words, the broader trait terms summarize the behavioral history of animals in an efficient and meaningful way (Hampson et al. 1986; Gosling 1998).

The personality components discovered in juvenile bears are comparable to that found in other species too: traits related with "dominance", "anxiousness", "excitability", "sociability", "curiosity", "irascibility", "boldness" (Feaver et al. 1986; Costa & McCrae 1992; Fagen & Fagen 1996;; Gosling 1998; Gosling 2001; Lloyd et al. 2007) and follows the 5 axis of personality suggested by Reale et al. (2007). The further consistency of these profiles across time and situations would be testable with further repeated ratings, but the given circumstances allowed it only during the rehabilitation period. The differences between the cubs, with other words their individual personality characteristics that were visible from the beginning could be observed and recorded during the whole study. The everyday observations performed during the rehab period can be considered as repeated ratings and the outcome results are based on multiple observations performed during this period. Thus the results refer to more than individual differences in specific behaviors during a single testing situation.

Is expectable that personality of individuals to be dynamic and change to a certain degree in time as the individuals pass through life experiences. Relationships, situations and experience can all affect expressions of individuality (Stevenson-Hinde 1983, 1986, Feaver et al. 1986). Actually the large set of data, in my case the many adjective ratings during the rehab process (minimum one year), underlines the consistence of personality constructs. The correlations between the components that cluster in a meaningful way suggest that the observed traits have a long term effect on the behavior. We can speculate that even if the personality of some individuals change as result of the modeling effect of life situations, the final result will be a development of the observed profile and not a change of it. Actually we can't talk about final result during the lifetime of the individual since he will face new situations during all his life. Maybe the best examples are the large adult bears observed at hunter's feeding sites which are characterized by an extensive shyness in respect with the environment (especially humans), but boldness towards con-specifics. Very often in large males that were harvested at such feeding sites, old plumb pellets or bullets were found in different parts of the body (self observations). Is expectable that the personality constructs of such bears facilitated their survival, but likely such bad experiences were lessons that induced some changes in it. However, how much will the personality of a juvenile change during his life can be assessed only with long term monitoring.

The personality of the juvenile bears is a central element among the studies that were put together in this thesis. It points towards two directions: back, towards the past of the cubs, investigating their life history, and towards the future, trying to predict how the personality profiles might influence survival, habitat selection and dispersal strategies.

Life history seems to play an important role in the development of personality constructs of the young bears. The results of the statistical tests suggest a high degree of influence of the social interactions on the development of traits related with boldness and aggressiveness. This is in line with the life-history theory of Wolf et al. (2007) who demonstrates that boldness and aggressiveness are generally correlated traits in most of the taxa, and are results of a complex evolutionary mechanism in a life-history trade-off that favors the evolution of animal personality. This could be a reason why the captivity period had also a strong influence on the development of most personality profiles of the study bears. The fact that in the first year of their lives, the interaction with other bears (mother or other cubs) is important in the development of the aggressiveness, focused, opportunistic-bold, playful-sociable, self confident and curious confident profiles strengthens the idea that there is a strong bond between development of personality and social interactions.

Wolf et al. (2007) describes two types of behaviors in respect with aggressiveness and boldness: the "risk-prone" and "risk-averse" typologies. The "risk-prone" type individuals are considered to be those with low future reproduction expectations, who are more aggressive with con-specifics and bolder towards the environment. The "risk-averse" individuals are those with high future reproduction expectations that avoid risky situations. They are less aggressive and less bold. With other words they won't "risk" not to accomplish their expectations. These reproduction/survival strategies demonstrated with complex mathematical models by the up mentioned authors, might apply for bears too. Female bears that take a high risk by visiting garbage dump sites or other urban related areas together with their off-springs might be the result of "risk-prone" evolved genetics. This could be an explanation of why several personality profiles are in relation with the problematic behavior of the mothers.

The predictive power and potential applications of personality in animals are discussed in several studies such as the use of personality assessment in donkeys for improving re-homing success (French, 1993) or the use of horse personality assessment to predict future performance in show-jumping horses (Visser et al. 2003). Similar studies performed on predator species were performed on cheetahs by Wielebnowski (1999) who was looking for predictors of breeding status in captive animals. Similar links between personality and performance have already been demonstrated in humans. For example Egloff and Gruhn (1996) demonstrated links between human personality and performance in endurance sports.

The predictive power of the personality constructs at bears across time and situations can be considered as being tested in this thesis, even if only at basic level. Even if the small sample size makes the results of the study questionable, regarding the effect of personality architectures on the survival at bears, the findings are similar to those on other species too. For example in a study on Canadian bighorn sheep (*Ovis Canadensis*), Reale et al. (2000) finds a substantial effect of boldness over survival in high cougar (*Puma concolor*) predation years, but no effect in low predation years. Another example illustrating the ecological importance of personality traits is the extensive studies on free-ranging and captive rhesus monkeys (*Macaca mulatta*). These studies have shown that many behavioral traits are related with the rate of turn-over of a neurotransmitter (serotonin: 5-HT) in the central nervous system, and affect individual fitness (Clark & Ehlinger 1987; Clarke & Boinski 1995; Clarke et al. 1995;

Cleveland et al. 2003)

It seems that the bear profiles or combination of profiles might be responsible for bringing the individual “in a bad place in bad time”. Is a generally accepted statement, that opportunism and curiosity of bears are the most important characteristics that predispose bears to involve them in conflict situations or become habituated to anthropogenic food sources. If these basic bear traits come together with a big self confidence and high curiosity level, I assume that is not exaggerated to predict a higher chance for getting involved in risky circumstances. Some personality phenotypes might be more fit than others in particular conditions according to some intuition of the function of personality (Dingemanse & Reale 2005), but this would be testable only by comparing correlations between several populations that experience different environments (Lande, 1979, 1986). In the future, with the increase in the number of estimates on personality traits it will be possible to compare the strength of selection on those traits with other behavior, and with life history or morphological traits (Kingsolver et al., 2001, Dingemanse & Reale, 2005).

Several adaptive hypotheses to explain the maintenance of variance of personality traits rely on particular assumptions regarding the selection pressures acting on those traits, but these selection patterns could only be detected statistically with large sample sizes (Kingsolver et al. 2001).

Multivariate selection analyses, coupled with long term studies of selection in the wild (e.g., populations experiencing different environments, experimental modification of environmental conditions and of phenotypic variations would allow us to examine the generality of evolutionary mechanisms shaping the distribution of personality traits and their co-variation in animals (Dingemanse & Reale 2005).

Personality seems to play an important role, with complex influence on the individual’s fitness and adaptation capability in bears considering their spatial dispersal too. Regarding dispersal patterns, seems that at bears there is a significant difference between males and females: males disperse average 3 times farther compared with females. Zedrosser (2006) explains this difference with philopatry and matrilinear assemblages, where females remain close to the mother’s home range, but males leave it. The divergence in dispersal strategies seems to appear also in the relation between the personality profiles and dispersal strategies: female dispersal is influenced by traits related with aggressiveness, playfulness and self confidence whereas male dispersal is influenced only by the explorative behaviors. If we consider the findings of Zedrosser (2006), it makes sense: in a circumstance where females do not leave their natal home range, or disperse only in neighbor areas due to philopatry, aggressiveness and traits related with social interactions can play an important role and may significantly influence their spatial relation with each other. At males who definitely leave their natal area, the explorative behavior increases their success. Similar influence of the explorative behavior on the dispersal was found in a North American minnow (*Lepidomeda aliciae*)(Rasmussen & Belk, 2012). Cote et al. (2010) describes personality-bias of dispersal at mosquitofish (*Gambusia affinis*) where sociability, boldness and explore had the most significant influence.

The phenomenon of animal personalities is one of the most intriguing challenges to the adaptations program in behavioral research. The behavioral/personality architecture of the bears show a high degree of influence on their habitat selection strategies and on their adaptation to the environmental characteristics. The Manley selection ratios indicate at fine scale at what extent individuals selected different habitat types. But considering the human activity in habitats with different access difficulty degrees, actually these ratios indicate at what extent individuals were prone to take some risks, coming again in line with the categorization of Wolf et al. (2007) and other authors who refer to risk-taking strategies. According to some authors individuals adjust their risk-taking behavior to their residual reproductive value (Roff 2002; Clark 1994) that is their expected future fitness. Consequently, whenever individuals differ in their fitness expectations, we should expect stable individual differences and correlated behavioral traits: some individuals are consistently risk-prone whereas others are consistently risk-averse. The Manley selection ratios are exactly the fine scale indicators of the degree of risk-taking, or risk-averse behavioral constructs.

As outcomes of the thesis:

(1) Juvenile brown bears have measurable distinct personality profiles, built by traits that correlate with each other in a meaningful way. The traits that characterize most of the bears are those related with “curiosity”, “opportunism”, “playfulness” and “boldness”. Besides these basic “bear characteristics” there are so called “bad” constructions that induct predispositions for significantly different reactions in similar life circumstances.

(2) The development of the personality constructs depends on the life history of the individuals, thus social interactions during early development and the captivity period has a significant influence on the formation of personality. These findings have important applications in designing rehabilitation centers and rehab methods in the future, where life history information on the newly accepted individuals should be taken in consideration.

(3) Though the sample size is small, the results on the cubs of problematically behaving females give insights on the influence of the mother’s behavior on later personality development of the offspring: the basic “bear traits” are influenced by the risk-proneness or risk-aversiveness of the mother.

(4) Survival capacity of the juvenile bears is dependent on their personality

profiles. "Boldness", "explorative behavior", "self confidence" and "focused" traits have high predictability power in involving the individual in later risky situations. This information can be helpful for wildlife managers who have decision power in solving conflict situations.

(5) There are connections between personality constructs and natural dispersal of the juvenile bears. Female dispersal is influenced mainly by traits related with aggressiveness and sociability, whereas male dispersal is influenced only by curiosity and explorer behavior.

(6) In heterogeneous habitat conditions different personality architectures influence the decision of the individuals in their response to the changing habitat, but further investigations are necessary to have clear patterns of high conflict prone individuals.

The studies put together in this thesis reveal first time in the field of carnivore research that personality constructs measurable at juvenile brown bears have a predictive power across time and situations. It is a pioneer work, which need further investigations in order to have clearer view on many findings that gave a little insight on several problems related with the brown bear.

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