ANALYSES OF HUMAN-BEAR CONFLICT IN YUSUFELİ, ARTVİN, TURKEY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

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IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
BIOLOGY

FEBRUARY 2006

Approval of the Graduate School of Natural and Applied Sciences

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Hüseyin AMBARLI

ABSTRACT

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February 2006, 94 pages

Increasing levels of conflict between brown bears and rural people have been reported for Yusufeli (Artvin, Turkey). This study aimed to document the conflict, understand human attitudes and responses, determine local habitat use and daily activity patterns of bears, and evaluate available damage prevention techniques. The study was conducted within landscapes at different scales, ranging from a core area defined by a large valley system to the whole of Artvin Province.

Data on close encounters, injuries and damages caused were collected through government records, published literature and open-ended interviews with the locals. Bear presence and activity were monitored through various techniques, including the capture and radio-collaring of one individual.

Population density was found to range between 11-27 adult bears/100 km^2. Bear activity increased during hyperphagia, with many daytime observations. Interviews (n=67) showed that almost all (95%) locals believed that bears have become more of a

problem lately. Only 6% supported full protection while 38% conditionally accepted it. On more than two-thirds of close encounters, the bear and person(s) involved departed without any harm. Rare bear attacks on humans, usually provoked, sometimes caused non-fatal injuries. Several bears were found to be shot and killed within the study area in 2002-2005.

Damages were mostly in late summer on field crops and orchards, and in spring on beehives. Precautions taken by villagers differed in effectiveness against bears. Bears caused a minimum of US$21,500 worth damages annually at Yusufeli County. Implementation of modern techniques of exclusion and scaring would reduce human-bear conflict in the region.

Keywords: *Ursus*, Brown bear, Conflict, Conservation, Damage

ÖZ

İNSAN – AYI ÇATIŞMASININ ARTVİN YUSUFELİ' DE ANALİZİ, TÜRKİYE

AMBARLI, Hüseyin
Yüksek Lisans, Biyoloji Bölümü
Tez Yöneticisi: Doç.Dr. C. Can BİLGİN

Şubat 2006, 94 sayfa

Türkiye'de, Artvin ili Yusufeli ilçesinde, boz ayı ile kırsalda yaşayan halk arasında son zamanlarda artan çatışmalar rapor edilmiştir. Bu çalışma insan ayı çatışmasını belgelemeyi, insanların tepkilerini ve davranışlarını anlamayı, boz ayıların yerel olarak hangi yaşam alanlarını kullandıklarını ve günlük hareket alışkanlıklarını tespit etmeyi ve zararı önleyici mevcut yöntemleri değerlendirmeyi amaçlamıştır. Çalışma büyük bir vadi sistemince belirlenmiş bir çekirdek alandan bütün Artvin iline uzanan farklı ölçeklerdeki alanlarda yürütüldü.

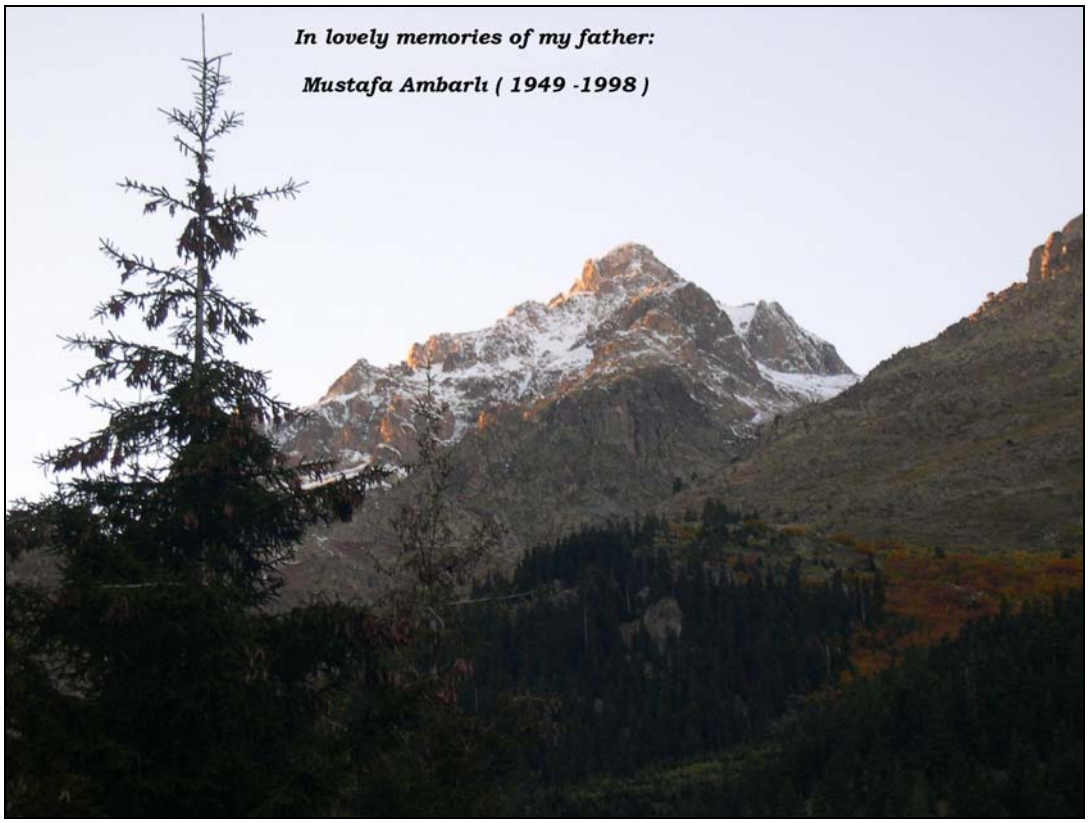
Yakın karşılaşma, yaralanma ve zarar verileri; resmi kayıtlar, literatür ve yörede yaşayan insanlarla sonu-açık görüşmeler yapılarak toplanmıştır. Ayının varlığı ve etkinliği, yakalama ve radyo vericisi takmayı da içeren çeşitli yöntemlerle izlenmiştir.

Alandaki populasyon yoğunluğu 11-27 ergin ayı/100 km^2 aralığında bulunmuştur. Ayı etkinliğinin hiperfaji zamanında arttığı birçok günboyu gözlem ile tespit edilmiştir. Görüşmeler (n=67) göstermiştir ki köylülerin büyük bir kısmı (% 95) boz ayıların son

zamanlarda daha fazla problem haline geldiğine inanmaktadır. Köylülerin %6' sı boz ayının tam korunmasını isterken, %38'i şartlı olarak korunmasını onaylamaktadır. İnsan(lar)la ayıların yakın karşılaşmalarının üçte ikisinden daha fazlasında taraflar zarar görmeden ayrılmaktadır. Nadiren gerçekleşen ayı saldırılarında çoğunlukla kışkırtılmış ayılar, ara sıra insanlarda ölümcül olan yaralanmalara sebep olmaktadır. Çalışma alanında bir kaç ayının 2002-2005 yılları arasında vurularak öldürüldüğü bulunmuştur.

Zarar çoğunlukla yazın sonlarında tarla ürünlerinde ve meyve ağaçlarında, baharda ise arı kovanlarında olmaktadır. Köylüler tarafından alınan ayılara karşı alınan önlemler etkililik açısından çeşitlilik göstermektedir. Yusufeli ilçesinde, ayılar yıllık olarak en az 21,500 dolara karşılık gelen bir zarara sebep olmaktadır. Bu nedenle modern dışlama ve korkutma yöntemlerinin sorunlu alanlarda kullanılması insan-ayı çatışmasını azaltacaktır.

Anahtar kelimeler: *Ursus*, Boz Ayı, Çatışma, Koruma, Zarar


In lovely memories of my father:
Mustafa Ambarlı (1949 -1998)

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Can Bilgin for his support, guidance, advice, help and patience throughout the study particularly when I was lost in subject. I am grateful to him also for providing pleasant and creative learning environment at the Department of Biology.

I have thanks to Casim Cihan for sharing his ideas and first offer for this kind of study in Artvin. I am especially thankful to Özgür Alaçam, Sıtkı Eraydın and their family for providing lovely working medium and sincere friendship through field studies and hard times. I thank to Ersin Durmuş, Mehmet Turan, Alihan Aydın and other managers and employees of the General Directorate of Nature Conservation and National Parks in the Artvin Province and the Yusufeli County for supporting our joint work.

I have also learned many things from Mevlüt Köse and Yaşar Kuşdili, thank you for your invaluable help during field studies. I am also grateful to local veterinarian Mehmet Akıllı in Yusufeli his kind help during anesthetizing captured brown bear.

I also appreciate my colleagues for forming an enjoyable working place, in particular to Didem Çakaroğulları for her help in many subjects and best friendship; Banu Kaya and Ayşegül Domaç for her help in GIS; Senem Tuğ for sharing of her knowledge; Çiğdem Akın, Damla Beton, Özlem Çirli, Yasemin Ergüner and especially to İlker Özbahar did not let me alone in this lab. I also send my appreciation to Ozan Keysan, senior student Aytaç Emecen and veterinarian Özgür Kollu for their participation to field work and help in the field.

I wish to thank my friends especially to members of *amelo* football team for playing football together and getting some relaxation every week, and pleasant and generous friendships, sharing everything. I also thank to Emrah Özgün for his shares and positive friendship from high school times.

I am deeply grateful to my mom Müzeyyen Ambarlı her generous and eternal love, the support she provided to the whole family and endless energy.

Partial financial supports for the project were provided by Wildlife Conservation Society (USA) and Middle East Technical University. Thanks to WCS for their support in conservation activities. Field equipment and some travel support were provided by the Lesser Caucasus GAP Analysis Project. I am also grateful to its manager, Uğur Zeydanlı, for his every kind of support, jokes in the subject and friendship.

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CHAPTER 1

INTRODUCTION

1.1.Conflict Between People and Carnivores

People occasionally come across wildlife either during hunting or while watching documentaries. With the exception of these, confrontations in nature, damage to crops, orchards, other property and people themselves generally lead to conflicts between carnivores and humans. Most common reasons are competition for resources at different levels, fear as a threat to local people, and trade of body parts of animals (Sillero-Zubiri & Laurenson 2001).

Conflicts between humans and predators are the product of socio-economic and political landscapes. The conflicts can be controversial since resources have economic value and carnivores are high in profile or often legally protected. Although humans and carnivores have co-existed for millennia, the frequency of conflicts has increased in recent decades as a result of increased human activities in wildlife areas or on natural habitats (Graham *et al.* 2005, Bulte & Rondeau 2005). People generally get rid of these kinds of (un)usual conflicts by killing the problematic animals. Killing is generally in traditional ways by capturing with a trap, poisoning with meat or shooting with fire arms (Herrero *et al.* 1999).

People either forget presence of wildlife in nature or disregard to their presence even they inhabited wildlife habitats. Similar situations are present around the world. For example, after killing of two young women by a grizzly bear in U.S.A, extreme measures such as extermination of bears from national parks were considered in an

attempt to prevent future bear attacks. However, some scientists insisted on better examining the situation and believed that humans should enter the domain of grizzly bears as cautious and alert visitors, thereby relinquishing the human role as the tamer and reducer of wilderness. So humans can be part of nature instead of dominating it (Bolen & Robinson 2003).

1.1.1. Why is a problem between human and bear called as conflict?

Bears are one of the largest and most frequent conflict causing mammals or most exposed to conflict in the world. Brown bear give damages to farmlands and livestock in Abruzzo National Park and Trentino, Italy and major cause of bear death is due to conflict; brown bear is the major cause of livestock loss in Norway and Sweden; brown bear has also some conflict with trekkers or mountaineer in Tatra National Park in Poland and Slovakia; brown bears are blamed of depredation of livestock in Croatia and Slovenia and it is supposed as a major game animal. Sloth bears are responsible for injuries to people during close encounters in Sri Lanka; Malayan Sun bears (*Helarctos malayanus*) in Manipur state of India again cause some conflict with humans; Andean bear (*Tremarctos ornatus*) is also responsible for damage to agricultural areas and cattle in Intag region of Ecuador. Sloth bear (*Melursus ursınus*) in Chattisgarh State of India were eaten by people or killed due to conflicts. Black bear (*Ursus americanus*) in British Colombia in Canada and U.S.A and Asiatic black bear (*Ursus thibetanus*) in India are supposed to lead many types of conflict. The grizzly bear in Greater Yellowstone Ecosystem and northern Rocky mountains has conflicts with trekkers, and people dealing livestock husbandry (IBA abstracts 2005).

Predation on livestock, on game species in Italy and Norway (since most of them are free ranging domestic animals) creates conflict over land, while consumptive use of carnivores are also common in Asia (Cochrane & Loeffler 2005, Sillero-Zubiri & Laurenson 2001).

Bear populations usually require large areas of land to survive. They typically compete directly with people for resources such as space, food, security and cover. Several bear species will also kill or injure livestock, raid beehives, damage agricultural or forestry crops, or otherwise directly compete with people (Herrero *et al.* 1999). In many countries, especially in Europe, brown bears are either strictly protected by international agreements since it is classified as threatened according to IUCN Red Lists or they are legally protected as game animals in some parts of Europe.

Therefore, if legally protected species damage livestock, property, beehives or agricultural fields, people think that they are at a disadvantage against bears, and since the species is legally protected, they prefer illegal ways of dealing with this problem. Although various wildlife damage compensation mechanisms exist in the world, they can also be harmful for conservation of carnivores (Bulte & Rondeau 2005).

The difficulty in understanding brown bear biology, behavior, and ecology may have precluded sufficient change to prevent the ultimate loss of the species like in the south of Canada. The size of their ranges and their need for safe corridors between habitat units bring them into increasing conflict with people, and there seems to be little guarantee that people will sufficiently limit their activities and land-use patterns to reduce brown bear damage rates and the consequent need for damage control. Therefore, brown bears must be managed at the ecosystem level. (Jonkel 1994).

1.1.2. Conflict types

Humans can unintentionally provide high quality food for bears. Orchards, berry farms, and beehives can be especially popular with bears. Bears have excellent memories that allow them to locate seasonally available foods in their wild habitats. This characteristic also allows them to locate and exploit human food sources, to which they quickly become conditioned. As a result, human behaviors can actually

create human-bear conflicts in the immediate area and the broader community. Knowledge of bear ecology and behavior can provide a basis for solutions to prevent human-bear conflicts. Most conflicts stem from situations where bears have been using human food sources such as garbage, livestock bone yards, pet and livestock foods, orchards, and or when natural foods are in low abundance(Craighead 2000, Davis *et al.* 2002).

Human - bear confrontations can be classified in two categories: Predatory and defensive confrontations. Bear that continues to approach, follow, disappear and reappear or displays other stalking behaviors is acting in a predatory manner in the former one. The latter one occurs when confrontations are usually the result of a sudden encounter with a grizzly bear protecting its space, cubs or food caches. In defensive confrontations, the bear is attacking people because it feels threatened (Center for Wildlife Information 2005).

There are relatively few reports of bears killing people but in just one location in Norway, there were serious confrontations between 1973 and 1987. Grizzly bears can also attack unpredictably in North America (Sillero-Zubiri & Laurenson 2001).

There were no specific studies on brown bears in Turkey until now except one study reflecting general status of brown bear in whole Turkey (Can & Togan 2004), though many reports and petitions were sent to General directory of Nature Conservation and Natural Parks (NCNP) to deal with this problem (NCNP 2005 and Gendarme 2005).

1.2. Study Species

1.2.1. General appearance and behavior

The species belongs to Order Carnivora, Family Ursidae, Subfamily Ursinae. The genus *Ursus* includes four species: *U. arctos, U. americanus, U. maritimus,* and *U. thibetanus*. Most authorities now recognize *U. arctos* as one Holarctic species. Nine

subspecies from the New World and seven from the Old World were described by scientist (Pasitschniak-Arts 1993). Brown bear is the largest carnivore of Turkey and even though it is under Order Carnivora it is generally an omnivore and opportunistic species.

In size, brown bears of Turkey are like small grizzly bears in Yellowstone National park and British Colombia (Ciarniello *et al.* 2003). The mean weight of hunted mature or old male (N = 7) and female (N= 4) bears during 1995 in Artvin was 191.43 kg and 136.25 respectively. The body length means for male bears and females were 191.57 and 170.5 cm accordingly (NCNP of Artvin 1995). However as indicated in various studies male brown bears of North America are almost twice the weight of females and grizzly males are normally around 400 to 600 pounds (200 to 300 kg). Where brown bears live, their sizes are influenced by their subspecies status, food supply, and length of the feeding season (Jonkel 1994).

Brown bears have a massive head with a prominent nose, rounded inconspicuous ears, small eyes, short tail, and powerful body of great size and strength. Brown bears are typically brown in color, but vary from pure white to black. Color varies from pale tan, blond, gold, gray, silver, cinnamon, and all shades of brown to almost black. Generally, head and shoulders are paler in color with darker sides, belly, and legs (Pasitschniak-Arts 1993).

Most brown bears in Artvin have a blackish stripe going from posterior of head through the middle of the back and towards shoulders (Figure 1.1). They are very different in color and show morphological adaptation with respect to habitat where they primarily feed on. On the upper, rocky parts they are generally close to gray, brownish, and silver whereas they are close to red, cinnamon at lower parts and more open areas on the land slides and avalanche areas.

Figure 1.1 Pelt of brown bear from Sarıgöl-Yusufeli 2004

Whitish or pale grayish brown bears were also claimed to be seen in various villages of Artvin. (Ayhan Yavuz and Yaşar Köse *pers. comm*. in Camili and Yusufeli 2004). Almost white brown bears (not albinos) are also found in portions of Alberta and Montana, and in south-central British Columbia (Jonkel 1994).

Its pelage is composed of two layers; inner fur and guard hair. Former one is shorter, dense, and functioning in insulation of body temperature whereas latter one is longer and as its name implies protecting body and inner fur from environmental factors. Winter fur is thick, course, moderately long, and appears shaggy. Both length of hair and color are extremely variable. As summer progresses, fur color fades, and guard hair and old inner fur are shed. Brown bears have a fully prime pelt by autumn (Pasitschniak-Arts 1993).

Both fore and hind feet are large, plantigrade, and are cushioned by heavy pads of fibrous connective tissue. The walk is a shuffling gait. All limbs have five digits; the claws often exceed 8 cm in length, are not retractile, and are used to dig up tubers and burrowing rodents (Pasitschniak-Arts 1993).

In temperate and arctic portions of the northern hemisphere, most bear species hibernate when food isn't readily available. Bears do not hibernate in the true sense; they are dormant rather than torpid, their dormancy is continuous for 3-7 months, and they can be aroused easily. Brown bears do not eat, drink, urinate, and defecate while in the den but they loose significantly bone mass and weight. Birth and suckling may occur during hibernation. Brown and black bear metabolic rates are only 68 per cent of normal on average through hibernation (Herrero *et al.* 1999, Floyd & Nelson 1990, Craighead 2000).

Bear hibernation is categorized as prolonged sleep since its body temperature is same during hibernation unlike the animals go hibernation. Winter sleep begins between October and December and spring arousal occurs between March and May. In certain southerly and coastal areas, during years of large harvests of natural foods, or during winters of little snow, winter sleep may be brief or may not take place at all (Pasitschniak-Arts 1993). Bears in captivity or sanctuary usually don't go hibernation as result of continuous feeding (Hürriyet 2004, Yaşar Kuşdili *pers. comm. 2004*).

As the period hibernation approaches, bears greatly increase their food intake in the stage called hyperphagia. The excess food is deposited as fat, or adipose tissue, and they gain weight. Fat is especially critical for the first few weeks after emergence from the den in spring, when food is scarce, but the bear's metabolic demands have increased (Craighead 2000).

Brown bear milk is three times richer in fat and protein than other terrestrial carnivores. They show a long life span, late sexual maturity, and protracted repro-

ductive cycles. Brown bears are polygamous and several males may follow a female, resulting in fights between males. Males may pair with females in estrus, but pairing depends on the male successfully defending the female from other competitors (Craighead 2000).

Breeding occurs from mid-May to July (Pasitschniak-Arts 1993, Craighead 2000). Duration of estrus is 10-30 days, with variation among females and years. Females may mate with two males in a day or a number of different males during the breeding season (Craighead & Mitchell 1982). The fertilized egg during spring mating period does not become attached to the placenta until fall. Then embryo develops and the weak and helpless young are born from January to March (Craighead 2000).

" The brown bears evolved in the northern hemisphere where wolves were the top carnivores in more recent times. Brown bear climbing skills appeared in the early evolutionary steps. While brown bears were evolving, they gained some behavioral adaptations like avoidance, cub-killing, learning, aggressiveness, and some social behaviors. Bears will often fight ferociously with rivals that match them closely and there are impressive scars on heir neck and head. Submissive one accepts the dominant's defeat and relinquishes food and potential mates when dominants come. Aggression is more common in male bears' fighting in order to establish dominance hierarchies in social groups" (Craighead 2000).

The avoidance behavior generally was shown by means of scent marking on trees as result of biting, rubbing and clawing. They can also understand their size by seeing visual clues. A similar behavior is found in bear species; especially in the brown or grizzly bears. Cubs are always at risk of being killed by male bears and females are wary and vigilant. It can be explained as combination of genetic advantage and plain hunger. Learning and memory are the other important behaviors of bears that reflect their extended development period and learning from their mother. Brown bears are often thought of as solitary animals that seldom interact yet brown bears can be found

in high density at rivers, dump deposition area and on concentrated food sources (Craighead 2000, *Pers. obs.* Sarıkamış 2004).

1.2.2. Distribution and numbers in the World

Historically, *U. arctos* ranged from the tundra and forests of the bordering countries of the Commonwealth of Independent States & Russia (formerly USSR) to the Himalayas. Populations and ranges are presently declining from Turkey eastward to China. For example in Lebanon it was once found in the Al Sheikh Mountains, but the species is now extinct; in Syria, Iraq, and Iran, status is unknown (Servheen *et al.*1999). In eastern Europe, populations occur in the Caucasus and Carpathian Mountains, Volga-Vyatka region, and Ural Mountains. In eastern Russia, present-day range is similar to historical range (Servheen 1999).

Table 1.1 Population status of brown bear in the world (modified from IUCN 1999)

IUCN Red List Category	CITES listing	Country	Population status	Species Estimated Numbers
LR -Low risk (lc-Least Concern)	Appendix II	Norway	Very small, threatened	15-20
		Sweden	Increasing	800–1,300
		Finland	Stable	430–600
		Estonia	Stable	300-500
		Belarus	Unknown	?
		Latvia	Very small, threatened	?
		European Russia	Increasing?	450
		Romania	Large numbers,	6,600
		Ukraine	Decreasing	?
		Slovakia	Increasing	96
		Poland	Stable	87-90
		Czech Republic	Very small, threatened	?
		Bosnia and Hercegovina	Decreasing	1,195
		Yugoslav Federation	Decreasing	250
		Croatia	Stable	400
		Slovenia	Stable	350- 450
		Greece	Very small, threatened	110 -1,300
		Macedonia	Very small, threatened	90
		Albania	Stable?	
		Austria	Very small, threatened	8–10
		Italy	Very small, threatened	80-90
		Bulgaria	Decreasing	700–750
		Spain	Very small, threatened	64-79
		France	Very small,	9–11
		Turkey, Georgia, Azerbajhan, Syria, Iraq, Turkmenistan, Tajikistan, Kazakhstan, Uzbekistan Kyrgyzstan, Afghanistan	**Unknown**	?
		Iran	Small?	?
		Pakistan	Very small,	?
		India	Small, threatened	?
	Appendix I	China	Fragmented,	500-1,500
		Mongolia	Very small,	25-30
	Appendix II	Central/eastern Russia	Stable to decreasing	125,000
		Japan	Stable?	174-287
		North USA	Stable to increasing	25,000-39,100
		Canada	Stable?	25,310

1.2.3. Life history traits

Brown bear's diet range is very wide but in Turkey they seem to prefer herbivory in mid and late spring; they also add some fruits and crops when they are mature during summer and autumn. They exactly know when fruits become mature and they utilized when they are highly nutritious, full of fructose, more proteins, and vitamins. Moreover their most of the proteins also come from wasps, bugs, ants and utilized squirrels under the rock or in a hole (Durmuş 2002).

Their habitats are overlapped by other animals such as foxes, martens, wild boars, wolves, wild goat, and chamois. They have inter-specific interactions with wild boar and wolves. They prey on wild boar's cubs and they have some fear and hesitation for male wild boar. Brown bears feeding areas in the afternoon was inhabited by wild boars in early morning. Wild boars generally feed on brown bear habitats in early morning when bears show avoidance to light. They also avoid from wolves during early spring and winter.

Tracks and minor roads are usually selected by bears for roaming around and reaching feeding sites. If they don't have to go out of paths, they walk on these paths. Before approaching the inhabited lands, it appears that they check the paths by throwing small rocks or stones. This is also done when they escape from human in forested areas. Moreover, brown bears communicate with cubs via special sounds. Though experienced females are very careful, younger individuals may behave loudly while near cultivation areas (Macdonald & Barrett 1993).

1.2.4. Current status in Artvin and Turkey

1.2.4.1. Numbers and distribution in Turkey

Brown bear numbers are unknown in Turkey, since there is no real population census except in Yusufeli county in the Artvin province. Their numbers are exaggerated especially in high conflict areas, for instance at Kastamonu, Rize, and Artvin by the media and local people. According to census activities in Kastamonu in 2005, NP directories claim to have counted 2500 bears (Hürriyet 2005). However, a rough estimate by Can (2003) is less than 3000 for all of Turkey.

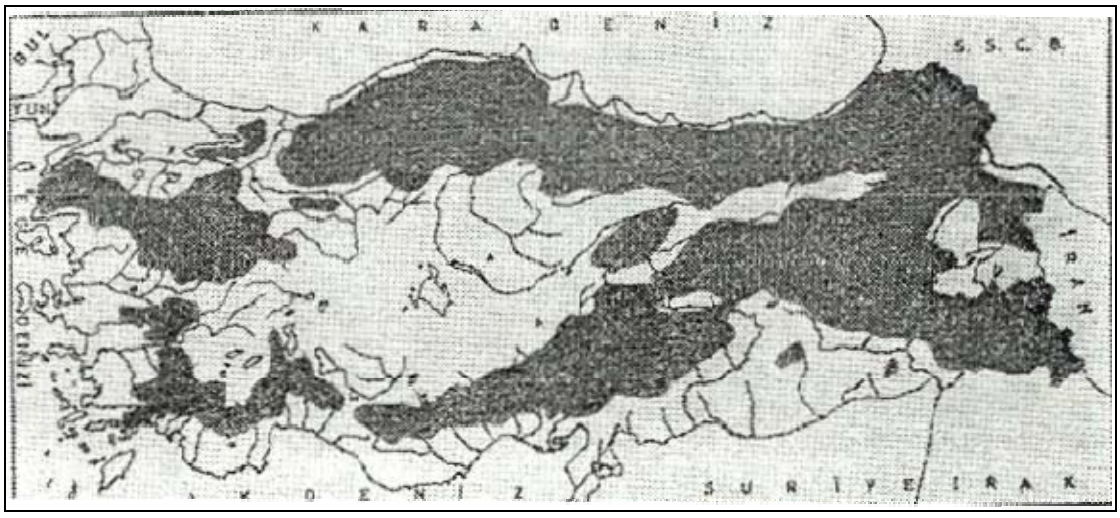

Figure 1.2 Old distribution map of Brown bear in Turkey (Turan 1985)

Brown bear distribution covers the northern part of Ankara, Adana, Antalya, Ardahan, Erzurum, Muğla, Muş; southern part of Isparta, Niğde, Sakarya, Sinop, Bartın, Zonguldak; most parts of Artvin, Rize, Ordu, Trabzon, Gümüşhane, Giresun, Tokat, Kastamonu, Çanakkale, Bolu, Bursa, Hakkari, Tunceli, western and southern parts of Kars, south eastern part of Sivas, etc. (*Unpublished data*, Ambarlı & Bilgin 2005; NCNP directors *per. comm.*)

1.2.4.2. Conservation status and hunting

Signed international agreements by Republic of Turkey and bears status are:

- IUCN 2000 Red list: Not globally threatened
- CITES: Apppendix II
- Bern Convention: Appendix II
- EU Habitats Directive: Annexes II and IV

Until very recently, the brown bear was not legally protected under the now outdated Hunting Law of 1937(Official Gazette of Turkish Republic 1937). It is unknown how many were killed every year but despite the fact that bears are more respected and positively looked than other predators like many countries in Europe (Can 2001, Ermala 2003, Kaczensky 2004, Andersone & Ozolins 2004) a significant proportion of local populations must have been effected. The species was only protected through annual decrees by the Central Hunting Commission. However, in 2003 a new law (No: 4915) was introduced that banned the killing of bears (except for controlled trophy hunting). The fine for illegally killing a bear is now 16,500 YTL (equivalent to about 10,000 Euros) (Turkish Ministry of Forestry 2005). However, there are efforts to ease the ban, at least in particular regions where increased complaints of bear damage are used as an excuse.

In the late 1970's the hunting of brown bears was banned throughout the country, but complaints began to increase about the damage done to livestock by bears. In 1982, hunting was allowed in the areas of Artvin and Yusufeli but only to foreign hunters accompanied by local guides who thus have an economic incentive to maintain bears in their areas (Mursaloğlu 1989).

1.2.4.3. General attitudes

Numerous human cultures around the world symbolically or physically try to incorporate the power of bears into their people. This is done by worshipping bears, eating various parts of bears, wearing their claws or skins as ornaments, taming or displaying bears, photographing them, and even by doing research on them. (Herrero *et al.* 1999)

Different studies concerning the perception of large carnivores especially bears by people are revealed the attitudes of people or locals, tribes. Røskaft *et al.* 2003 described bears as most dangerous and frightening animal in Norway as result of inquiries done by 4300 people. However, decreasing of fear in the rural areas was also expressed. Another study aimed to rank stakeholders along the "ecocentric" to "anthropocentric" scale. In Norway farmers were scored as relatively lowest on the ecocentric and highest on the anthropocentric sub-scales. For all stakeholders, inverse relationships were found between anthropocentrism and attitudes toward carnivores, and positive relationships between ecocentrism and attitudes toward carnivores (Linnell & Bjerke 2002). In Finland, brown bear has been honored and top rated as "king of the Finnish wilderness" since parts or skin of animal used as fur, food and medicinal values. People have showed respect to bears especially as a game or trophy animal for at least four centuries (Ermala 2003). In Slovenia general attitudes to brown bear was positive but they do not support the government's expansion policy. Attitudes of people are independent from knowledge on animal and socio economical characters of people (Kaczensky 2004, Andersone & Ozolins 2004)

Normally, people in Turkey had got used to live with the brown bear from pre-historic times, and at those times probably they respected brown bears much more than now. They had used its figure as a stamp and it represents of power in figures (Figure 1.3)

Figure 1.3 Bear stamp from Turkey found in Çatalhöyük (Çatalhöyük 2005)

1.3.Objectives and Scope of This Study

The objectives of this study is to document the human-bear conflict at Yusufeli, understand human attitudes and responses to conflict there, determine local habitat use and daily activity patterns of bears, and evaluate the suitability of available techniques to reduce the conflict.

CHAPTER 2

MATERIALS AND METHODS

2.1.Study Area

2.1.1. Geographical scope

This study is confined to the Artvin province, in northeastern Black Sea Region. However, due to difficulties in obtaining reliable data at the scale of the province, separate geographical scales for different types of data were used.

The larger scale study area covers the whole Artvin province. At this scale, data were based on collecting information and filtering petitions from Nature Conservation and National Parks (NCNP) archive and Gendarme entries related with bear confrontation and damage. Moreover, information was gathered on bear attacks on humans and damage for the province of Artvin in the web news.

The core study area is relatively small and located in the upper part of Yusufeli county (situated roughly between 40˚ 33’ to 41˚ 06’ N, 41˚ 08’ and 41˚ 54’ E). It covers approximately 800 km² (8 x10x10 km² UTM Square). This area is also called the Kaçkar Mountain Southern Range. Interviews and most of field work were carried out here for two years.

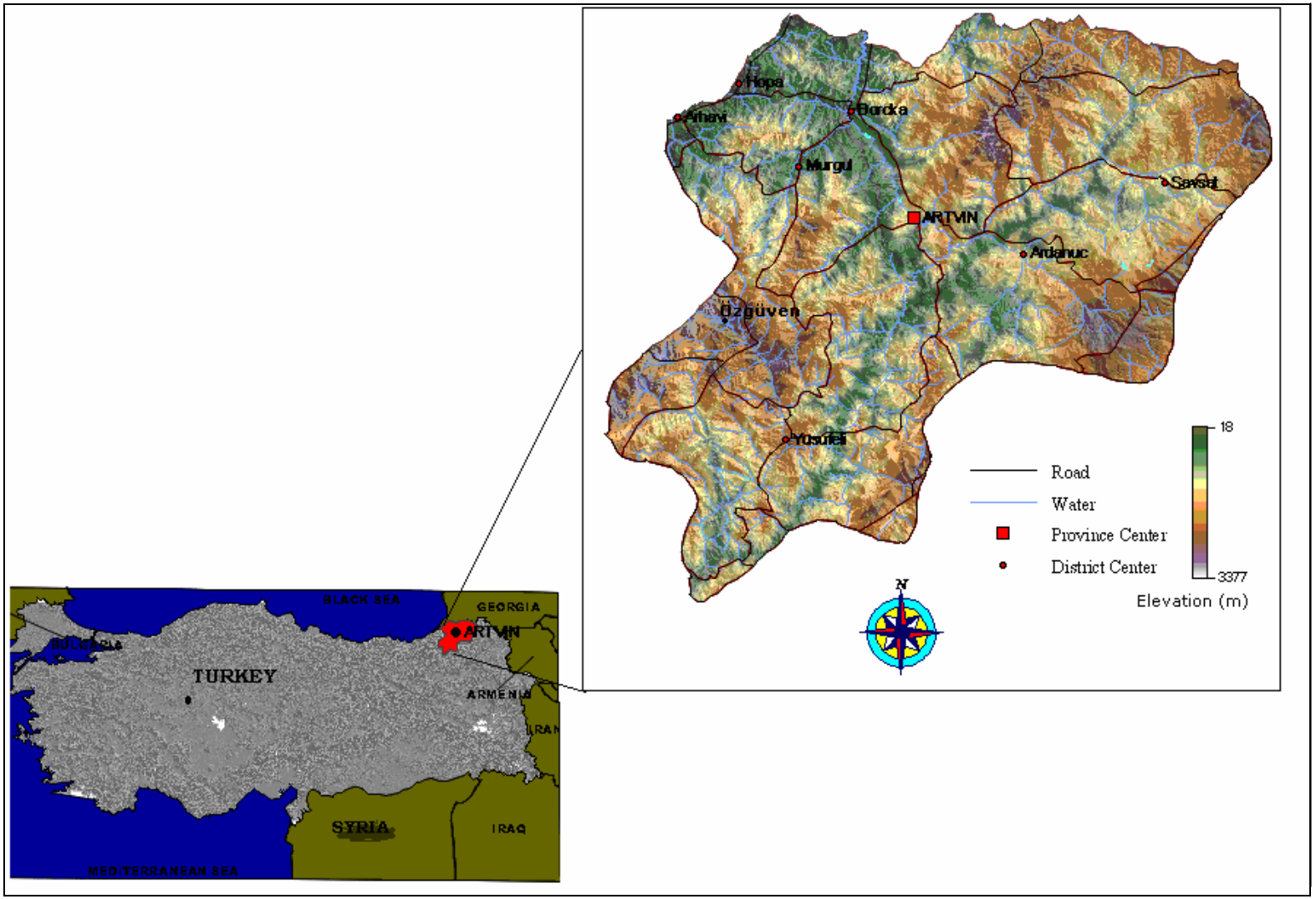

Figure 2.1 Study area

Finally, an even smaller area, the valley that surrounds the Özgüven village, was the focal point for detailed field work. Camera trapping, animal capture and tracking were largely carried out at this geographical scale.

2.1.2. Climate

There is no meteorological station in Yusufeli therefore meteorological records of Tortum, İspir, Erzurum and Oltu stations was used and FAO Climate Estimator is used infer the mean temperature and precipitation with high confidence (Figure 2.2 and 2.3).

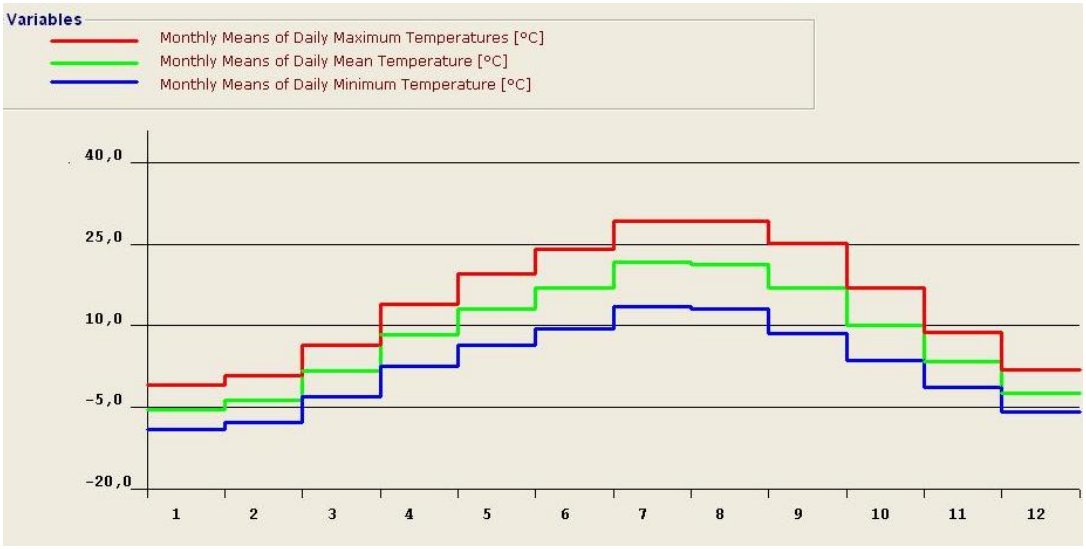

Figure 2.2 Monthly means of temperature values of Yusufeli

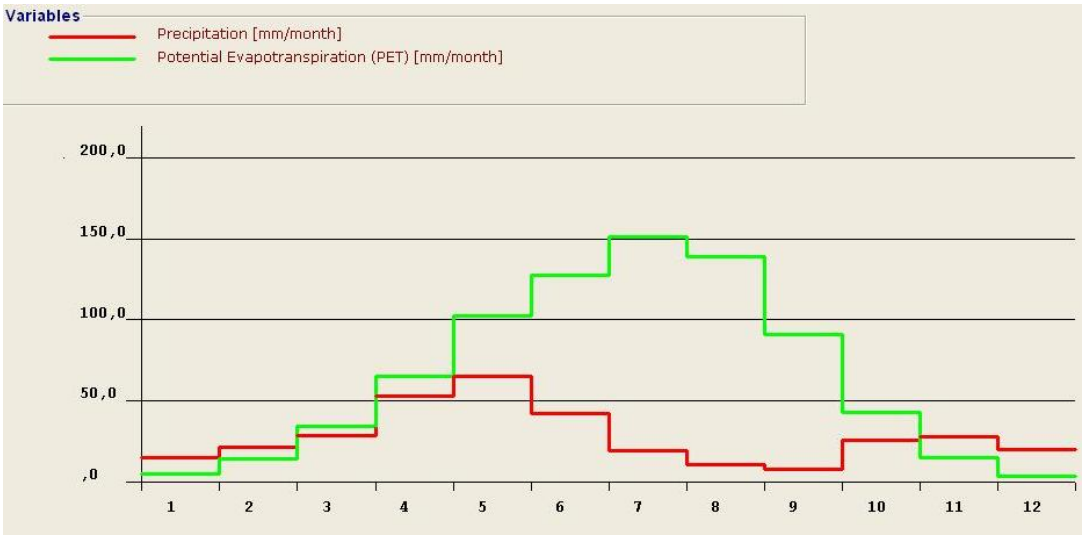

Figure 2.3 Monthly means of precipitation values of Yusufeli

2.1.3. Vegetation

Study area is in Euro-Siberian phytogeographical region. Dominant plant species of this part are *Acer cappadocium, Alnus glutinosa, Betula* sp, *Picea orientalis, Rhamnus imeritonus, Rhododendron* sp, *Sorbus* sp, and *Fagus orientalis*.

In this part, broad-leaved deciduous forests exist between 1000-1500 m. These altitudes of the study region are generally covered with mixed forest composed of *Abies nordmanniana, Fagus orientalis* and other deciduous trees. Coniferous forests which represent a response to a higher part of the mountains are common between 1500-2000 m. The pure and mixed *Picea orientalis, Pinus sylvestris* and *Abies nordmanniana* are dominant tree species. The shrub layer of *Picea orientalis* is associated with *Rhododendron* species in general (Figure 2.4).

The Çoruh valley around Artvin province is the area extending north and nort-eastern section of the study area. This area contains abundant mediterranean elements. Maquis elements exist in the lower part of the area; some of them are *Arbutus*

andrache, Arbutus undeo. The trees seen of shrub appearance are *Ostra carpinifolia*, *Buxus sempervirens, Diospyros lotus, Quercus petraea* subsp *iberica, Carpinus orientalis, Cistus creticus, Laurus nobilis*, and *Juniperus oxycedrus* (Lesser Caucasus GAP Analysis Project 2005).

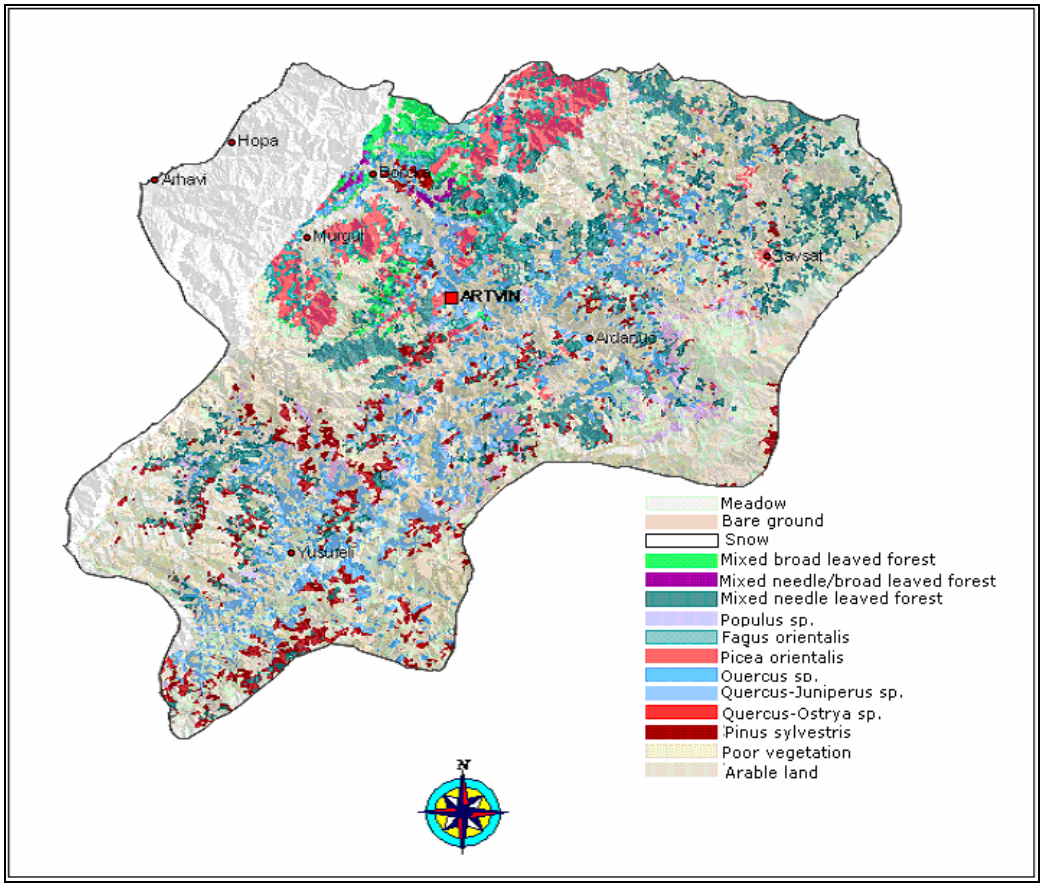

Figure 2.4 Vegetation map of the whole study area (Lesser Caucasus GAP analysis project 2005)

The total forest cover of Turkey is around 20,763,248 ha. and it is equivalent to 26% of its surface area. This ratio is 53% in Artvin since some 390,453 ha. are covered with forest.

The most forested part of Artvin is the Yusufeli Forest District, making up 27% of the forest cover of Artvin. However most of this forest is classified as "unproductive" (see Table 2.1). From Artvin town center through the districts of Ardanuç, Şavşat and Yusufeli, fragmented stands of oak (*Quercus* spp.) and juniper (*Juniper* spp.) can be seen between 200 and 600-800 meters. From 800 to 1900-2000 meters elevation, there are spruce (*Picea orientalis*) and fir (*Abies nordmanniana*) stands on the northern slopes, whereas on southern slopes Scotch Pine (*Pinus sylvestris*) dominates (Governorship of Artvin 2005)

Table 2.1 Forests of Yusufeli

Forestry district director	Productive forest area (ha)	Unproductive forest area (ha)	Total forest area (ha)
Yusufeli	20.171	84.797	104.968

2.1.4. Human population, settlements and economic activities

Forestry activities based on production of timber is an important economical input for development of Artvin province. From that perspective, forestry activities directly or indirectly create crucial economical input for the locals (Güner *et al.* 2001).

The distribution of agricultural plots is very scattered due to very limited suitable land in the rugged mountains. Human population density is not so different from other parts of Turkey but they spread over the land, most of which is considered unsuitable in other regions. However, in the last two decades people started to leave for bigger towns in the west to find better jobs and earn more money (Öztürk & Olgun 2005). Therefore, those fields have become once again suitable habitats of wildlife, especially for the brown bear.

2.1.5. Nature conservation in the study area

Within Yusufeli, there is one national park (a small portion of the Kaçkar Mountains) and parts of two wildlife reserves (Çoruh Valley, Verçenik). Elsewhere in Artvin, there are two more national parks (Hatila Valley, Karagöl-Sahara), one biosphere reserve (Camili), three nature reserves (Efeler, Gorgit, Çamburnu), one nature park (Borçka-Karagöl), and two more wildlife reserves (Balıklı, Verçenik) (GDNCNP 2005). Therefore, in terms of surface area under protection, Artvin is above the country average.

The study area has still pristine and productive habitats. People has lived or inhabited from the lowest altitudes up to 2500 meters (although temporarily in the higher alpine pastures). Most of the places where people live within Yusufeli are also habitats of brown bear, especially between 900 and 2500 meters. About three quarters of potential brown bear habitat overlaps with human settlements.

2.2. Methods

2.2.1. Field studies

The field studies took 87 days totally. The dates are given in Table 2.2.

The phenology of observations, etc was based on different physiological periods for the bear. From emerging from den till end of May it is called hypophagia, between June and July pre-hyperphagia, and from August until hibernation hyperphagia and late hyperphagia (modified from Nielsen 2005). Food intake increases throughout these periods, reaching a maximum in just before denning.

Table 2.2 Study dates during field studies

Months	Dates in 2004	Number of days	Dates in 2005	Number of days
January				
February				
March			12-16	4
April	9-11	3		
May	14-16	3	7-12	5
June	16-28	12	26 -10	5
July	26 -16	6		10
August		16	29 -12	3
September	17-19	3		12
October			5-10	5
November				
December				
Total		**43**		**44**

2.2.1.1. Data collection

Data on human-bear encounters in the last 3-15 years were collected through government records, literature survey and interviews with the locals. Interviews were used to gather data on livelihood patterns, close encounters with bears and current attitudes toward them. Other data sources were used to document claimed damages and human casualties. The geographical and time scope, and main sources for types of information gathered are summarized in Table 2.3.

Table 2.3 The geographical and time scope and main sources for types of information gathered

Data type	Geographical scope	Years	Information source(s)
Direct damage to people	Province of Artvin	1989-1996	Özen (1998)
		2000-2005	All information sources and the internet
Close encounters and damage to property and agricultural fields	Upper part of Yusufeli (core study area)	2003-2005	Interviews
Damage to property and agricultural fields	Artvin	1995, 2000, 2002, 2003, 2004 and 2005	Petitions to NCNP and Gendarme
Attitudes of people	Upper part of Yusufeli (core study area)	2004- 2005	Interviews

2.2.1.2. Interviews

Previous to any interviews, meetings in public places like Turkish style cafes and visits to villages were carried out in order to explain study objectives to local people during 2004 and 2005. Furthermore, five larger meetings were held in different villages: Dereiçi, Sarıgöl, Barhal, Bıçakçılar and Demirdöven. People's complaints about wildlife, especially brown bears were noted.

Following these meetings, a list of open ended questions were developed in line with preliminary interviews in order to document conflict types, people's attitudes, bear population levels, bear caused damage and economical cost of the damage (see Appendix C). Open ended questions have a distinct advantage over closed format questions when the primary goal is to learn behavior and attitudes of respondents (White *et al.* 2005). Interviews were then carried out in several villages, highland pastures, and seasonal settlements that were known to experience frequent conflict

incidents. During the study, 19 villages and more than twenty seasonal settlements were visited. Those villages are Dereiçi, Küplüce, Sarıgöl, Taşkıran, Balcılı, Balalan, Bıçakçılar, Demirdöven, Yaylalar, Olgunlar, Altıparmak, Özgüven, Bostancı, Serinsu, Yüksekoba, Boyalı, Esendal, Çıralı, and Demirköy.

More than a hundred personal interviews were carried out. It was not possible to obtain a formal random sample but interviews were held with any willing person that was encountered during the visits. However, some people who encountered a bear or bear damage were specifically chosen.

A close encounter was defined as any encounter that involved a person and a bear within 50 meters of each other, except when in a building. All human bear close encounters were attempted to be recorded but anecdotes older than 40 years were not taken into account. For conflicts that caused bodily damage to people, gendarme reports were used. Such events are almost always reported to the authorities, while livestock and beehive losses are reported to a lesser extent since there is currently no wildlife damage compensation mechanism. Eight incidents, five of them related with wounded people, were used in this study. These were cross-checked and expanded with relevant news items on the internet.

Unlike as in many other countries, NCNP does not have a proper incident report format in case of a conflict event. They only accept petitions and occasionally visit the damage site to verify the damage. Therefore, such petitions within Artvin have been used as the data based on. The monetary cost of reported damages was calculated according to market value of the product. A final source was a book written by a biologist who collated anecdotal information on human-bear conflict in the upper part of Yusufeli between 1954 and 1996 (Özen 1998).

All information obtained was rigorously checked for authenticity and correctness. Only data from reliable sources were used for the analyses.

2.2.1.3. Damages

Costs of damages were estimated based on assumptions in Table 2.4. Cost of the damage was calculated by using verified damages reported to NCNP and from interviews.

Table 2.4 Approximate costs of damages (Real costs can change in accordance with inflation or years)

Type of Damage	Price
1 sheep	200 $
1 cow	1000 $
1 beehive	250 $
1 fruit tree	25 $
1000 m^2 of cultivated crop	100 $
1 calf	500 $
1 goat	250 $
1 queen beehive	20$

2.2.2. Field monitoring

Monitoring provides valuable information for conservation of animals: estimating population size with different techniques, activity patterns and identification of animals individually and movements of them (Sanderson & Trolle 2005, Kaczensky 2004).

During field work, all preventive measures were taken for safety (repellent sprays, flashing lights, and whistle). Noise or singings were used during surveys to warn bears and show presence of human. Throughout the night in the field, researchers stayed in the tent.

2.2.2.1. Direct observations and inventories (visual bear sightings)

Visual observations were attempted in the upper part of Yusufeli during suitable periods from June 2004 until mid October 2005. Observations were attempted when weather conditions and season permit. However, they are generally before sunrise and one hour following it. In the afternoon, observations were usually 4 hours before sunset and continued for 1- 4 hours. Occasionally, night surveys were conducted by three people on vehicle by using powerful spotlights. They were generally around 22:00- 24:00 or before sunrise in the morning.

Binoculars, a field-scope and digital cameras were used during observations. Binoculars were used for general survey and the field-scope was used for focusing on individual bears. Digi-scoping enabled photographs or short video to be taken through a digital camera mounted to a field-scope via attachment. Monitoring were carried out mostly at southern aspects, riparian areas, mixed bushes, mountain ridges, avalanche areas and openings in the forested areas, but not at openings around cultivation areas.

2.2.2.2. Scat and other sign surveys

Surveys were conducted in Taşkıran, Özgüven, Bıçakçılar, Yaylalar, Demirdöven and Barhal villages. Scats were both collected and kept in a zipped nylon bag until brought to the laboratory or close-up photos were taken that provided information on scat contents. Photos and some dried specimens were used to determine diets (Wemer *et al.* 1996). Collected scats were put into 98% alcohol and +4 °C until further investigation (Skrbinsek *et al.* 2005). This is one of methods supplying valuable information about bear presence and diet where forest canopy is high and the landscape is rugged.

Other bear signs such as hairs, scent markings, foot prints, gnawed trees and electric poles, broken stalks on fruit trees, eaten or raided beehives, hidden carcasses, and collected pine needles and young branches under a big tree or hollow were searched

for and documented. A penknife 8.3 cm. in length was used as a reference scale during collecting of specimens and taking photos.

Track surveys were carried out especially near riparian areas or small water canals and on soft soil after rain. Track prints were photographed, measured and they are categorized by using a guide (Macdonald 1993).

Rubbing surveys have been used recently to monitor bear populations. Noninvasive sampling using hair or feces provides a powerful new tool for monitoring bear populations (Waits *et al.* 2005). Rubbing trees surveys were conducted at the same time with scat and track surveys. Hair were collected either directly from rubbing trees, on over fences around beehives, and from a captured bear. They were preserved within eppendorf vials from 2 ml up to 10 ml with 98% ethanol.

2.2.2.3. Camera-trap surveys

Camera traps are utilized recently for monitoring of shy, nocturnal and especially hiding animals. They are moderately non-intrusive and large areas can be monitored by a few people (Wemer *et al.* 1996). Its range covers from a point to 9 meters expanding with 30 degrees angle and it shoots whatever passes within this scope. It is triggered by a motion and its battery life ranges between 4-7 days; adjustments can be made to switch into active or passive mode. These devices can be set up easily according to requirements of animals. Using camera traps provides an advantage of continuous monitoring of an area where bears are probably present.

At least 10 units should be randomly distributed to monitor an area in systematically planned studies. Their usage changes according to what the scientist's aim is, e.g. showing presence or absence of animals, estimating population size, doing mark recapture techniques or addressing other ecological and conservation-related questions (Sanderson & Trolle 2005). Generally two camera traps of CAM-Tracker® model were used in this study and they were set up in different places to increase chances of shooting more bear photos.

2.2.2.4. Modified culvert trap

At least an individual was attempted to be captured for fitting a radio collar so that it can be followed remotely. Different kinds of traps from box traps to snares can be used to capture bears. Each has some advantages and disadvantages over others. However, culvert traps or box traps are effective for capturing big mammals when properly baited.

Figure 2.5 Modified culvert trap for brown bears

Ordinarily culvert traps for large mammals must be designed and constructed with a particular species and field situation in mind; many designs are possible (Jones *et al.* 1996). A modified culvert trap was constructed by workers in the Artvin Forestry District Directorate's repair shop after plans were provided by the researcher (Figure 2.5).

A trap with a dropping door was selected as design. A triggering mechanism activated by pulling of a rod from inside through attach of the dropping door was used (See Figure 2.6). A kind of latch releases the door when it is pulled through backward. A 4x4 vehicle was needed to pull it. After trigger mechanism was setup, the trap was rechecked every 6 hours.

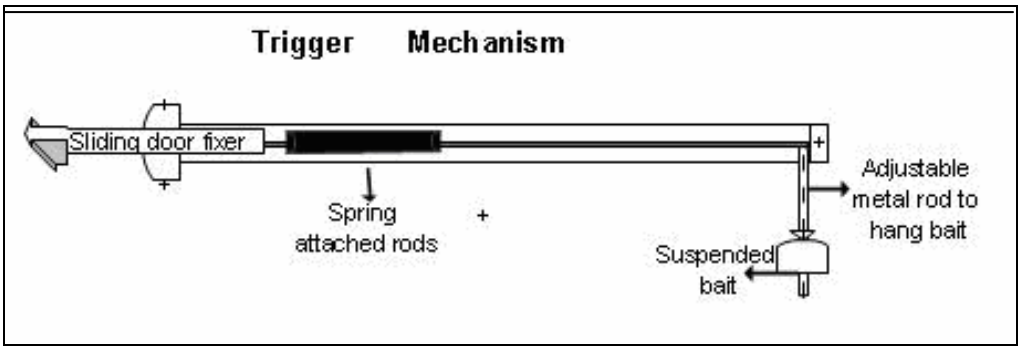

Figure 2.6 Trigger mechanism of trap

Baits are used to attract animals into a trap which is unusual to them. Bears can utilize almost all kinds of food, so carcasses, fresh fruits, internal organs of other animals, lure etc. may be used. Sometimes beehives are also used to capture brown bear in Greece and Italy (G. Mertzanis, *per. comm*. 2005).

During capturing, firstly backbone and internal organs of a cow and a honey frame were used. At the second attempt, internal organs and hind leg of illegally hunted wild goat by a hunter were used. They were tied up and hanged on to tubular piece of the triggering mechanism.

The first attempt to capture and radio collar a bear was in early July 2005 but it did not succeed since bears were not used to enter into something metal. While leaving the trap in the field, the trigger mechanism was removed so that the trap door would not drop even when bear eats some bait. At least one bear got used to this trap.

Eventually, this bear entered the trap and ate all the bait. At the end of August, the trigger mechanism was set and the trap was regularly monitored. During October 2005, the trap was again set for 5 days, but no additional individuals were captured.

2.2.3. Immobilization of the captured bear

Brown bears are highly variable in response to sedatives; therefore, sedated animals should be closely monitored and should not to be released until they recover normal loco-motor capabilities. There should be a veterinarian in capture team or accessible within a few hours. Each immobilization has some effect on the behavior, other activities or life of an animal; therefore minimum restraint should be used from humane and moral stand points (ad hoc Committee 1987).

Anesthesia of brown bears can be done by a variety of techniques. Reliable and potent drug combinations should be used in their range to decrease tissues trauma. Grizzly bears in North America are generally anesthetized by using mixture of drugs. Most commonly used mixture is Xylazine HCl with Ketamine HCl at a ratio of 2 to 4-5. Another mixture is Tiletamine HCl and Zolezapam HCl, requiring 4 mg/kg, while Ketamine HCl requires 8-15 mg/ kg (Pond & O'Gara 1994). However in Europe and Turkey brown bears are smaller than grizzlies and with a slightly different metabolism, therefore dosage changes in various studies done in Europe (Kaczensky 2002, Caulkett & Cattet 2002).

Captive bears in culvert traps, or small enclosures may be injected with a pole syringe or blow dart. Volume limitations with blow darts necessitate the use of potent drug combinations, or the bear must be small (Caulkett & Cattet 2002) (see Table 2.5).

Table 2.5 Dosage of Selected Immobilizing Agents Used for Brown Bear (*Ursus arctos*) (modified from Caulkett & Cattet 2002)

Tiletamine-zolazepam (mg/kg)	**Medetomidine** (µg/kg) + **Tiletamine-zolazepam** (mg/kg)	**Xylazine** (mg/kg) + **Tiletamine-zolazepam** (mg/kg)	**Xylazine** (mg/kg) + **ketamine** (mg/kg)	Oral **carfentanil** (µg/kg)
7 - 10	35(m) + 4.8(tz)	2(x) + 3(tz)	not recommended in this species	8

Drugs used in immobilization should be compatible with other drugs and drug dosage should be estimated with respect to animal body weight before darting it. Most of drugs used for anesthetizing large mammals are injected intramuscularly therefore they require drug delivery systems such as jab stick, projected darts, blowguns and dart guns. Most projection systems use CO_2 – powered pistols with a range of about 10 m or rifles up to 50 meters in range. However when powder- charged hand gun is used, the large heavy darts travel at high velocity, resulting in high impact force (Pond & O'Gara 1994). Drug is discharged less than 0.1 second and darts goes back out after discharging so sometimes it couldn't be understood whether drug is delivered successfully or not delivered.

Bears will demonstrate seasonal variation in fat distribution; for example, they will deposit a thick layer of fat over the rump in fall. At this time of the year, the shoulder or neck is the preferred location for dart placement. In the spring, these animals can be darted in the rump or hind limb. With xylazine-ketamine or medetomidine-ketamine, head lifting or limb movement signal that the bear is extremely light and should not be approached or manipulated. Increased intensity of the palpebral reflex or nystagmus are earlier indicators that the bear is light (Caulkett & Cattet 2002).

During immobilization of the captured bear, it had to be anesthetized twice by the field team (a veterinarian, a biologist and a guard). Powder-charged hand guns having 2-3 ml drug delivery capacity were used. The first attempt was at night and Zoletil was used as the immobilizing drug. Five shots containing 10 ml drug were delivered to bear but probably one of them was missed. Then, a hand made jab stick with a thick needle was used to deliver an additional 5 ml drug after the bear got relaxed. However, total drug dosage was not sufficient for a sufficient level of anesthesia. During the five minutes it slept, it could not be fitted with the radio collar. The captured brown bear was then left in the trap while checking vital traits around. Water and some food were left into the trap.

A second attempt was made the next day around 15:00. For this attempt Xylazine HCl and Ketamine HCl mixture was used. Again a hand gun and a hand made jab-stick were utilized for anesthesia. The individual slept deeply for 45 minutes and more than 1 hour in total. After checking eye and head movements and controlling motor activities by tickling the foot, a radio collar was fitted and measurements were done. The animal was released 20 minutes afterwards.

2.2.4. Radio tracking

Telemetry studies provide rapid and more reliable information with respect to study objectives. However, it should be well designed otherwise it can be expensive in personnel and equipment costs. Radio telemetry has been used to study the movement patterns of animals like habitat use patterns, survival, and behavioral studies. Additionally it simply used to determine presence or absence of animals in particular places or habitats e.g. den or nest sites (Samuel and Fuller 1994).

In this study, monitoring of an animal via radio tracking was to be used as a tool for understanding human-bear conflicts spatially and temporally. Additionally, it also

provides indirect information like activity patterns and movements, most commonly changes in radio-signal characteristics of collared bears (Kaczensky *et al.* 2004).

Three big mammal's radio collars were purchased from Wildlife Materials in U.S.A. The two stage transmitter model is HLPM-31100 with reverse mortality option. Other properties are as follows:

- Mounted weight.....400-450 grams
- Pulse width.....30 milliseconds
- Pulse per minute.....80 ppm
- Peak Current.....16 mah
- Approximate Days Life.....940 days
- Frequency 149.866

Receiving antennas are connected to the receiver via cable and pulses can be listened directly or by using earphones. The receiver must amplify the relatively weak signals from radio transmitters and reject the stronger signals coming from different sources. Receivers generally include gain control button to fix sensitivity of receivers to radio waves. Receiving antennas produce a 3D scheme so signals can be received more properly when the antenna was turned toward to transmitters. A Yagi antenna is the most commonly used wildlife receiving antenna, supplying direction and preferable gain. It includes three or more elements and should be ±5% of 0.5 λ, the reflector is longest, the driver intermediate, and the directors shortest. A Yagi antenna has more gain in the front than behind part and provides bearing accuracy of about ±5°. It can be increased by means of increasing elements of antenna (Samuel & Fuller 1994).

At least 1/25.000 scaled hard copy maps covered with digi-fix, a compass, a GPS device, a ruler, a permanent marker, eraser, note book, and a open area are required for triangulation. Triangulation is used to obtain estimated locations of animals that can move rapidly that use large areas. It may simply be done by turning around a fixed point with a Yagi antenna while listening sound coming from transmitters.

When the sound disappears, the angle was recorded and turns to other side again until it disappears. Then taking their mid point gives one direction of collared animals. By repeating this for three times and drawing three lines from fixed point result in intersection with each other on the maps where bear is probably present. The description of animal's space use pattern traditionally has been called as home range and its territory is the defended portions of it. Bears' home ranges generally overlap but they do not show so much territorial behavior, except mothers with cubs and males in mating season (Samuel & Fuller 1994).

Data was collected by using radio telemetry in September and October 2005. The collared bear was monitored for five days in September and for four days in October. During data acquisition more fixes were tried to be taken from different locations.

CHAPTER 3

RESULTS

3.1. Population Parameters

3.1.1. Population size and density

Three population censuses were carried out by NCNP in 2001, 2002 and 2004 (Table 3.1). Although the census area was the same (450 km^2, coinciding with most of the area of this study), effort changed considerably (101 in 2001 vs. 38 in 2004) so results are not fully comparable. Assuming no redundant counts of individuals (which is unlikely), the number of observed adults and sub-adults combined ranged between 49 and 121. These correspond to an average density of 10.9 and 26.9 per 100 square kilometers. Unknown

Table 3.1 Censuses done by NCNP

	Num of observation units	♂	♀	Cubs	Unknown	Adult	Total number of seen	Num.of seen / Obs. Units
2001	101	27	20	32	74	121	153	1,20
2002	70	20	18	28	28	66	94	0,94
2004	38	16	9	18	14	49	57	1,29

Field work and visual observations within Özgüven Valley during this study have shown that at least 10 adults (excluding independent subadults) are present within approximately 40 km^2. This number corresponds to 25 adults per 100 km^2. Interpreted population size in the core study area is between 100-150 individuals; they only regularly occur in areas above 900 meters.

Sex and adult-offspring ratios observed during NCNP censuses and during observations in this study for 2004-2005 seasons are rather similar to each other, except for the NCNP census in 2004. The average sex ratio is (1:1.50) based on observations and is close to average of census sex ratio (1:1.41). It can be said that female brown bears with young in Artvin are generally seen with 1 or 2 cubs (Figure 3.1).

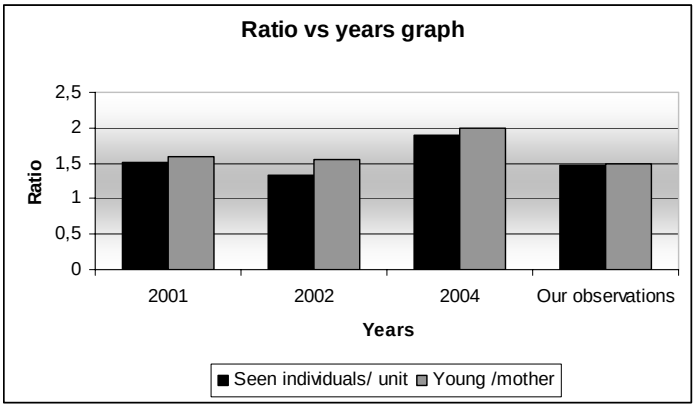

Figure 3.1 Comparison of seen females with young and observation / # of seen ratio

3.1.2. Observed Animals

Throughout the surveys 4 males, 6 females with cubs (n=9), 5 subadults, and 9 adults of unknown sex were observed in the field (Appendix A). Additionally, two bears with unknown sex and one cub were determined from photos taken by camera trap.

Figure 3.2 Bear observed during hyperphagia in October 2005

Bear observations were made for a total of 62 hours. Bears were more active between 10 -16 hours in hyperphagia than within the same time interval before hyperphagia (Figure 3.2). Mostly bears were seen between 16-22 hours before hyperphagia. 10-16 hours were most effective period to see a bear in hyperphagia. A bear was never seen in early morning 04 -10 hours (Table 3.2, Figure 3.2-3).

Table 3.2 Bear observations before and during hyperphagia

Hyperphagia (after 1 August)				
Observation time periods (hours)	**04-10**	**10-16**	**16-22**	**22-04**
Total hours	4	9	20	1
# bear seen during hyperphagia	0	6	8	1
Before hyperphagia (before 31 July)				
Total hours	4	0	22	2
# bear seen before hyperphagia	0	0	10	1

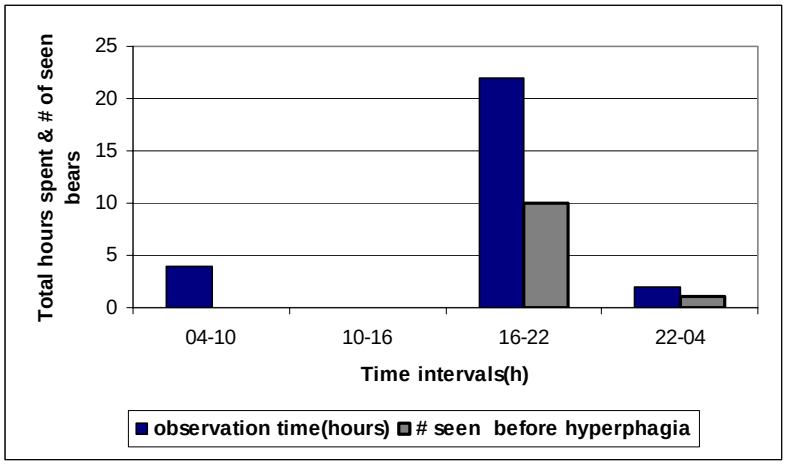

Figure 3.3 Comparison of bears seen according to observation hours before hyperphagia

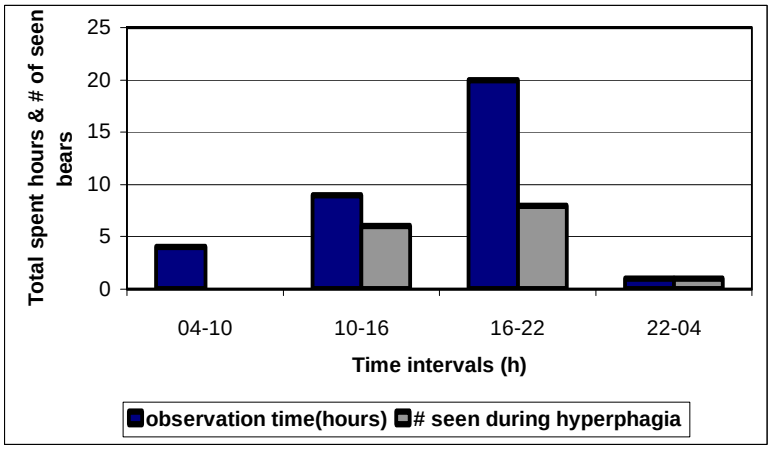

Figure 3.4 Comparison of bears seen according to observations hours during hyperphagia

Table 3.3 Number of bears seen per hour of observation

	10:00-15:59	16:00-21:59	22:00-03:59
Before hyperphagia (before 31 July)	0.00	0,45	0.50
Hyperphagia (after 1 August)	0.67	0.40	1

3.1.3. Camera trap results

Photos of two adults and one cub were taken by camera traps separately in different villages. The two adults were each photographed twice (Figure 3.5). The ratio for total hours spent per bear photographed is 114 hours/ brown bear. It is relatively higher with respect to other studies but there were only two camera units (See appendix B).

Figure 3.5 Bear photographed by a camera trap September 2005 in the village Özgüven

3.1.4. Physically captured bear

On 8th September 2005, for the first time in Turkey, a male brown bear were captured in the wild and fitted with radio-collar in Özgüven village. This adult male bear was named "Karabey" after its unusually dark pelage. Its measurements are shown on table 3.4 and its body mass around 130-150 kg. After release, it went to a hiding place in the steep rocky and forested area. It stayed there for at least 8 hours without moving. In the next morning it moved 200 meters, but again came back to bed. After 2 days it came near to the village and waited silently in bushes during the evening. On

the 8th of October 2005, signals from the animal suddenly were cut off (Figure 3.6). It was supposed to pass behind the mountain.

Table 3.4 Measurements of radio-collared brown bear

Measurements	**cm.**	
Contour length	150	
Girth	120	
Height	65	
Neck girth	74	
Head length	46	
Head width	27	
Tail length	12	
Ear length	14	
	Left hind	**Left rear**
Paw width		15
Paw length	17	23
Paw length with claws	22	26

Figure 3.6 Radio-collared brown bear (*Karabey*)

3.2. Habitat and Feeding Habits of Brown Bear in Yusufeli

During field trips and censuses, brown bear habitats were observed to range from lowland to alpine pastures, mixed and evergreen forests, broad leaved bushes and dwarf beech patches, and also open rocky areas (Figure 3.7). Brown bears preferred to go down to cultivation areas while sunset by following either ridges or trails on mountainous areas (Figure3.8).

Figure 3.7 Habitats of brown bear near Özgüven Village

Brown bears wait silently until all sounds disappear around the feeding areas then come cultivation areas or orchards. After feeding they generally leave before sun rise. Generally they swing trees (except cherry trees) and cause to fruits drop down, then they feed on those. Once a brown bear cub was observed to come down from a tree by taking its head between its legs and jumping to ground crouched when it detected humans nearby.

Figure 3.8 Habitats and paths of brown bear containing oaks, pine and poplar trees near Özgüven Village

Based on observations and on interviews with locals and NCNP personnel, brown bear diet mostly included wild and cultivated fruits such as pears (*Pyrus* spp.*)*, apples (*Malus* spp.), apricots, plums, peaches and cherries (*Prunus* spp.*),* grapes (*Vitis spp.)*, figs (*Ficus spp.),* cornelian cherries (*Cornus spp.*), raspberries (*Rubus spp)*, dog roses (*Rosa spp.*), hawthorn (*Crategeus* spp.), acorns (*Quercus* spp.), bearberry (*Vaccinium spp.*), hazelnuts (*Corylus* spp), walnut (*Juglans spp.)*, maize (*Zea mays*), various vegetables including beans and carrots, and clovers (*Trifolium* spp.). The main food items during hyperphagia at high altitude pastures was observed to be acorns and rose hips which are very nutritious and contain fats.

Figure 3.9 Various brown bear's scats founded in the study area

Scats of brown bear showed high discrepancy with respect to what they ate and where they live (Figure 3.9). Bears in humid climates and broad leaved forest and near alpine grass pastures defecated with less solid scats with no clear shape. However, in drier places and in pine forests their scats were generally rounded in shape. Size changed according to age. Their scats and tracks were found up to 2800 m. altitude (Figure 3.9-10).

Figure 3.10 Tracks of brown bears: Left front paw length -14 cm, paw length with claws - 18 cm, rear left paw length - 22 cm, distance between left hind and rear foot - 19 cm.

3.3. Conflict

67 people were interviewed by open ended questions and the interviews were mostly made with the more accessible men, but women (n=7) were also represented among the interviewed whenever possible. Interviewed people ranged in age from 11 to 82 (mean age 50.2) and were mostly farmers, but also included other professions (see Figure 3.11). That corresponded to the fact that most of the people in the region are elderly people with rural livelihoods (see Figure 3.12). Most of them graduated from primary school and income sources are very limited

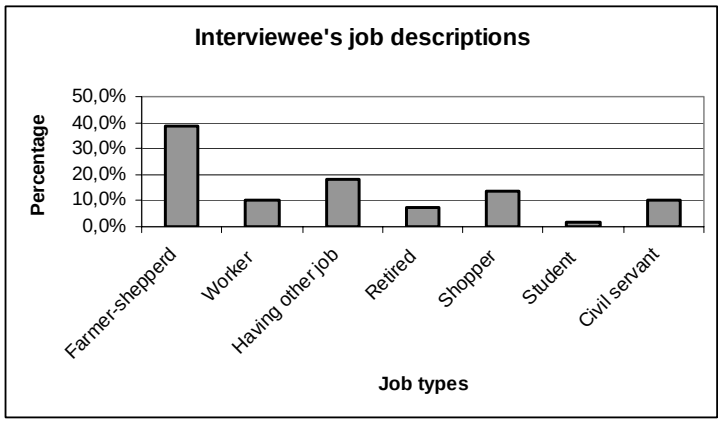

Figure 3.11 Job descriptions of interviewee

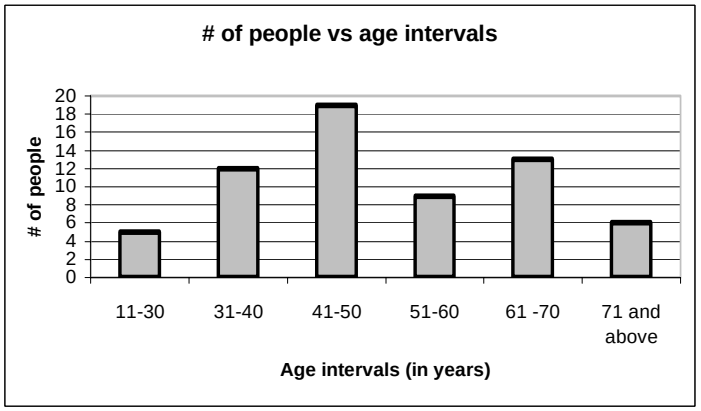

Figure 3.12 Ages of interviewed people

People have stopped keeping large herds of livestock since about 1990. Livestock numbers per household average 3-5 sheep or goats and 2-3 cows, which can provide sufficient food for subsistence. Additionally they are interested in keeping bulls if they have enough money to feed them since bull fight is a traditional activity in Artvin.

All agricultural fields in the upper part of Yusufeli were cleared from forest areas or by terracing hill slopes or land slides. Therefore they are very small in size (~0.5-1 ha.) and orchard trees surround them.

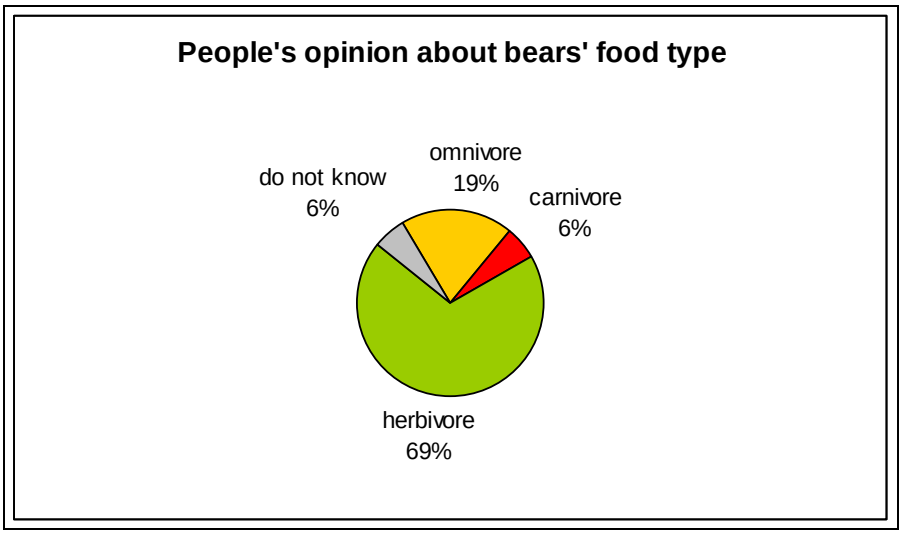

Figure 3.13 People's opinion about bears' food type

70% of people believed that bears in Yusufeli are mostly herbivore and they can graze with their animals if the weather was not so harsh (Figure 3.13). Only 6 % was reported by interviewee as carnivore since a large amount of the brown bear damage occurred in the Yusufeli, was on agricultural fields. 19 % of them agreed that bears are omnivore animals.

3.3.1. Types of conflict

3.3.1.1. Human-bear close encounters

Through interviews, 24 close human-brown bear encounters were recorded in the study period 2003-2005; an additional 3 encounters (belonging to years 1990, 1992 and 1995) were taken from Özen (1998). Of these encounters, six were while in a vehicle and the rest on foot. On more than two-thirds of such encounters, the bear and person(s) involved departed without any harm, but in another 7 cases the bear was either attempted to be shot at or run over (Table 3.5).

Table 3.5 Reactions in human-bear close encounters

Type of reaction in human-bear close encounters		**Total number of Close encounters**
Bear attack	Nobody harmed	**1**
Bear attack	Human harmed	**1**
Human harassment	Human harmed	**1**
Human harassment	Bear harmed	**6**
Human harassment	Nobody harmed	**4**
No interaction	Nobody harmed	**14**

Between 2002 and 2005, five cases of bears injuring humans were reported to the gendarme. All were from outside the core study area, Yusufeli. All seem to be unprovoked attacks. Two men were injured in Şavşat district of Artvin by the same bear in their gardens in 2005 and they were taken to hospital since they had some open wounds from bites on their body. They were not fatally injured and were discharged from hospital the same day. In 2004 one man was wounded at various part of his body by a bear in the same district.

There were two cases in 2003: One man again was injured by a bear while he was visiting the graveyard. His finger was bitten and lost as a result of the struggle with bear. The second event happened while a man was collecting bushes for making brooms in the forest. He was rescued by his dog as it tried to chase the bear and the bear just gave up the man. A last attack was one in 2002: It occurred while a woman was irrigating her maize field in the village. She was attacked by a bear coming out from the inside of the cultivated area. The bear was frightened by her relatives but she was seriously injured so that she was taken to hospital in another city (Gendarme reports 2005).

Moreover, one woman was hospitalized in 2005 due to shock after she lost her consciousness when she encountered a bear in the agricultural field at Borçka. The woman was not injured by the bear apparently she was not seen as a threat after she fainted (Kent Haber 2005).

However, from the core study area and between 1998 and 2005, three close encounters have been recorded which people were harmed but not reported to the gendarme. In 1998, a female bear had injured a woman while apparently trying to protect her cubs from the woman unaware of the bear cubs' presence next to the agricultural plot she had been working. A man had a slight injury when he approached a mortally ill bear that he assumed dead in 2002. Another woman was hospitalized due to shock after she met a bear inside a barn in 2004.

Five or six bears were reported to be wounded between 2002 and 2005, with at least four of those consequently dying. The cause of death was shooting with fire arms in three bears with no indication of self defense by the shooter. At least one individual was overrun by a van intentionally although it managed to escape. Another probable case of human-caused bear mortality is indicated by two small (<2 months old) bear cubs founded in the forest. Such cases usually mean that their mother was killed (Kent Haber 2005).

3.3.1.2. People's reactions and precautions in a close encounter

Only half of the interviewed knew how to react in case of a close encounter (i.e. stay calm and move away without haste) while the other half were either ignorant or put themselves into unnecessary risk by running away or shooting at the animal (see Table 3.6). Unusual tactics were utilized by four of the respondents such as shining light into the eyes of the bear. Even though people did not state so much, they were frightened when they came across by a bear. If a bear is far away from a person, he or she preferred to stay away and watch.

Table 3.6 People's reactions and precautions in a close encounter

People's reactions	Percentage
Escape	15%
Shoot to scare	9%
Stay calm	38%
Do not know	32%
Others	6%

61% of the interviewed villagers (N=61) carried either a fire arm or a hatchet, and/or was accompanied by a dog for protection during working at or traveling outdoors, while the rest did not resort to any safety measures (see Table 3.7).

Table 3.7 Personal protections preventing from likelihood encounters with bears

Precautions	Percentage
Hatchet	8,2%
Fire arms and dog	45,9%
No precautions	39,3%
Others	6,6%

3.3.2. Attitudes of local people to brown bear

Majority of the interviewed concluded that bear population has increased in number due to banning of hunting. Although almost all (82 %) believed that bears have become more of a problem lately, they thought differently for conservation of bears. When asked about options for bear conservation, only (21%) support full protection while (49%) are against any protection; a significant proportion (26%) accepts protection if the population is regulated or if damages are compensated. Some conservation opponents suggest total extermination of the species.

When they were asked about limited trophy hunting, half the respondents (57 %) thought it as a solution to limit brown bear damage. Others thought that it would not work or it would cause conflict among local guides who gain from trophy hunting and others who do not. Solution to this problem was expected from the government. They also offered opening of hunting, compensation of damages, and reduction of brown bears population as possible solutions.

3.3.3. Damage statistics

More than 61% of the interviewed reported bear damage to agricultural fields, beehives or livestock between 2003 and 2004. Field crops and orchards were most vulnerable (67% combined) followed by beehives (24%) and 9 % of livestock losses (Table 3.8). Fresh parts and twigs of beans, maize, clover, barley, cherry trees and pear were most frequently damaged plants. Within five years (2000, 2002-2005), only 19 sheep and 4 cows were reported to be depredated. These losses were on the upper part of Yusufeli and generally on the high altitude pastures.

Table 3.8 Damage statictics

Damage types	Percentage
Field crops	36%
Orchards	31%
Beehives	24%
Livestock	9%

People thought that two common damage period are June and September while the least damage period was believed to be November. Few of them mostly beekeepers also thought that damage started at the beginning of April (Figure3.14)

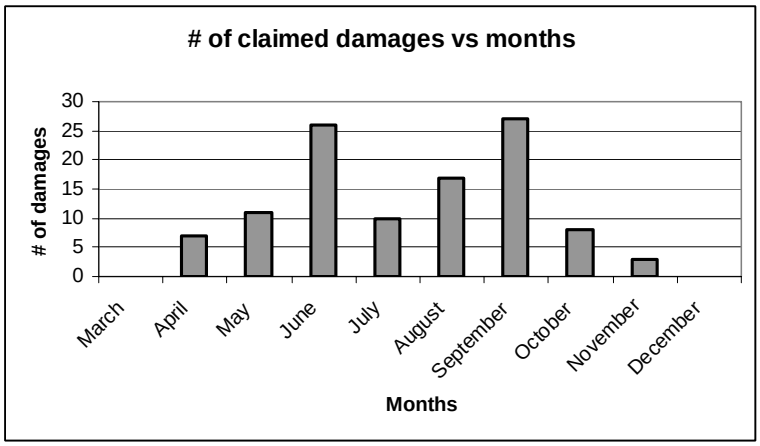

Figure 3.14 Distributions of damages through months

Based on claims made officially and the interviews, damages took place most often in June and July (n=36) and in August and September (n=44) (Figure 3.15)

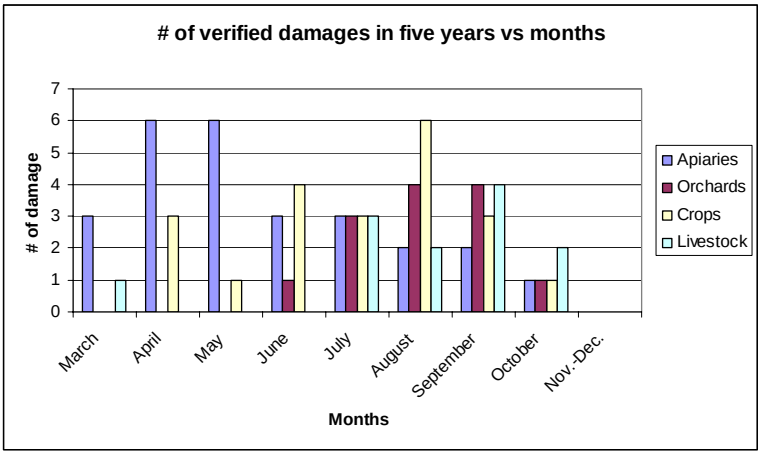

Figure 3.15 Most common period of damage (data)

April and May was dominated by beehive damage and small crop damage like on clovers. During June, orchards started to be broken whereas in July all kind of damages were recorded with the same frequency. Crop and orchards damage reached its peak in August and September. All damages started to decline after September.

Based on petitions given to NCNP and damages reported by interviews, 61% of the interviewed experienced some bear-caused damage within the last two years. Totally 72 event was recorded and its details are in Table 3.9.

Table 3.9 Number of verified damages through months

Months	Apiaries	Orchards	Crops	Livestock	Total events (n=72)
March	3	0	0	1	**4**
April	6	0	3	0	**9**
May	6	0	1	0	**7**
June	3	1	4	0	**8**
July	3	3	3	3	**12**
August	2	4	6	2	**14**
September	2	4	3	4	**13**
October	1	1	1	2	**5**
Nov.-Dec.	0	0	0	0	**0**

When damage intensity is graphed against brown bear physiological seasons, most damages occurred during hyperphagia. Minimum damage period was just before denning (Table 3.10)

Table 3.10 Comparison of verified and claimed damages

Months	Petitions and verified damages	Only using interviewed people's opinion	Physiological seasons of brown bear
March	**28%**	**17%**	Hypophagia
April			
May			
June	**28%**	**33%**	Pre-hyperphagia
July			
August	**38%**	**40%**	Hyperphagia
September			
October	**7%**	**10%**	Late hyperphagia
November			
December			

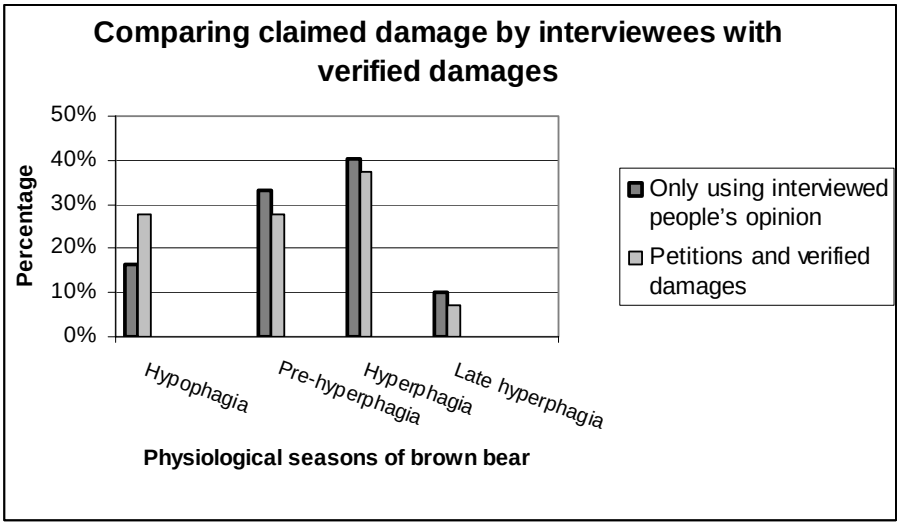

Figure 3.16 Comparison of damages with respect to bear season

People ideas are compatible with real damage, although they generally overestimated damages. Only the perceived damage given during hypophagia is less than real recorded damages (Figure 3.16).

3.3.3.1. Protective measures against damage

Villagers took precautions with differing levels of sophistication and effectiveness against bear damage (Figure 3.17). Most locals use one or more types of preventive measures against bears. 41 % used simple exclusion methods, like simple fences enclosing small fields or metal sheets placed around tree trunks in orchards. 25 % relied on frightening devices such as automated sirens, flashlights or random noisemakers fueled with LPG canisters, while 13% used deterrents, such as dogs, clothing with human smell, or human presence near ripe crops. Only 21% of the interviewed did not take any measure against bear damage.

Figure 3.17 Protective measures

3.3.3.2. Economical Cost of Damage

Using current average values for damaged livestock and property, a cost of about US$ 64,830 was calculated for the whole province between 2000 and 2005. However, two-thirds of that damage cost originated from Yusufeli county only during the latter two years, probably due to better coverage and higher reporting rates. Therefore, the annual cost of bear-caused damage may actually exceed US$ 25,000 for the Artvin province.

There were also many petitions and complains during 1994 and 1995. 57 different petitions coming from different villages were found in NCNP archives. One of them had 70 people's signature to prevent from brown bear damage. People reported livestock damages done by brown bear in this period. At least 4 cows, 7 oxen were depredated and all cultivation areas in some villages were damaged by brown bears (Archives of NCNP 1995).

Table 3.11 Economical cost of damage

	Cost	Period
Cost of Damage in whole Artvin	64830 $	2002-2005
Cost of Damage in Yusufeli	43000$	2004-2005
	4750$	2002-2003

3.3.3.3. Income from legal hunting

Brown bear was firstly opened to trophy hunting in 1993 and systematic trophy hunting without discrimination continued in Yusufeli county until 1997. During 1993, 8 bears were hunted and one bear was wounded. In 1994, 8 bears were hunted and 3 bears were wounded. One hunted bear's cost to a hunter was around US$ 2300.

NCNP set 15 bears as the quota for trophy hunting by foreign hunters during the autumn of 1995. 13 of them were hunted and one of them was wounded. Based on hunting reports, it is understood that only old or big brown bears were hunted, but without sex discrimination. In the following year, 1996 seven bears were hunted and one bear was wounded. Meanwhile, 10 chamois were also hunted by trophy hunters in the autumn season of 1996. NCNP took US $ 4,000 for one bear and $1,500 for one chamois. Then NCNP transferred 20% money gained from trophy hunting to village committee. A total of $ 9,890 coming from trophy hunting in 1996 were distributed to 12 villages, and mostly to Barhal village ($ 2,500) and least to the Küplüce village ($ 80) (Archives of NCNP 1993, 1994, 1995, 1996, 1997).

CHAPTER 4

DISCUSSION

4.1. Population Size and Density

The most detailed study on the numbers of brown bears has been carried out in Yusufeli by NCNP personnel in the last several years. Numbers obtained in those censuses are not totally reliable since the quality and quantity of the effort spent are not comparable, and redundant counts might have occurred. Nevertheless, they are compatible with each other according to observed bears per observation station. While censused bear numbers grow as observation stations increase, there is no increase in the observed bears/observation station ratio. Their average implies that at least one individual were seen from each observation station.

Based on censuses, a population density between 10.9 and 26.9 independent individuals per 100 square kilometers was found for Yusufeli while the same value was 25.0 for Özgüven valley. The latter figure is certainly more reliable since individual bears and their approximate home ranges were known. However, Özgüven valley might provide optimum habitat for bears, and hence an unusually high number of bears may be present there. The population densities estimated are higher than reported for many countries in Europe. For example, it is 14–19 in Abruzzo National Park in Italy, 1-2 in Sweden and in isolated populations of northern Russia, and 10 to 30 in the Caucasus Nature Reserve in southern Russia (Macdonald 1993). The densities for Yusufeli clearly fall at the higher end of this range, and are in good agreement with those reported for the Russian Caucasus.

Female bears without cubs were not easily identified as such; therefore it was not possible to calculate a true female to cub ratio. On the other hand, all cubs (<1year old), and yearlings before they become independent (1-3 years old) were assumed as young. Female with young ratios were very close to 1.5 for both censuses and field observations.

4.1.1. Observed bears

The most appropriate time periods to observe bears were before and during hyperphagia phases between 22:00-04:00 and 10:00–16:00, respectively. No individuals were seen in early morning (04:00-10:00) although this may be partly due to less time spent looking for them during that period. Bears generally appear to be active one or two hours before sunset and noticing them may become a challenge due to poor light conditions. Bears came out to visit orchards at night but if the fruits had not matured, they left it to return later in the following weeks. On the other hand, bears seemed to reduce their retiring habits during hyperphagia since they needed to find more food. Thus, observation efficiency increased and more bears were seen in less time.

The observation efficiency of bears can also be increased by using camera traps. However, placing and checking them within the 10 km^2 valley in remote areas turned out to be troublesome. That is why they were used only to determine presence of bears in the study area. Only in one case they were used for determining damages on beehives, and a probable nuisance bear was photographed. Therefore, their efficiency was really low if sufficient numbers of them are not placed, because camera traps can not cover the whole area and they indiscriminately take photos of other animals, birds, and people.

4.1.2. Radio-collared brown bear

Although most local villagers and National Park personnel were skeptical about the idea of capturing a brown bear in a culvert trap, after one month a bear got habituated to the trap. It was an important step to show people that bears can be monitored in Turkey too, with the help of collaboration among local community, NCNP and universities. Although some difficulties were come across while tranquilizing, '*Karabey*' was eventually released without being harmed.

The captured bear could not have been weighed since volunteers were afraid of the early arousal of anesthetized bear, and it was a procedure impossible to carry out by only one person. However, based on data in hunting guides and according to Jonkel's chest girth vs. weight ratio (Ciarniello *et al.* 2003), *Karabey* was estimated to weight around 175 kg. Additionally, the estimate was compared with chest girth vs. weight relations in the Parsnip Grizzly Bear Population and Habitat Project (Ciarniello *et al.* 2003). Grizzlies are generally more massive than European brown bears but the estimated weight of '*Karabey*' is probably correct.

Monitoring activities subsequent to release could not have been done effectively due to remoteness of the field, insufficient funds and time limitations. Only once the bear was detected very close to the village (within less than 50 meters for two hours). Therefore, so far it has been only monitored for short period of time. In spring 2006, radio-tracking studies will commence again and more chances will be available to monitor them.

4.1.3. Habitat and diet of brown bear in Yusufeli

In order to study habitat preferences, many locations from several radio-tracked individuals obtained over a considerable time are necessary. However, habitat selection with preference and quality may also be studied by using site attribute

design, i.e based on whether sites are used or not (Garshelis 2000). GPS coordinates of scats and tracks can be used for this analysis, again requiring a large sample size for meaningful results. Nonetheless, some inferences can be made about the seasonal movements of bears around the valley: Bears frequently visit oak (acorn) patches during the hyperphagia period; in spring, they graze on green vegetation just below the snow line where snow has newly melted; they probably memorize orchards both spatially and temporally, and visit them every year at the right time of maturation; they probably select cooler regions with greener vegetation during summer, climbing to upper elevations of their home range (~2800 m.).

Based on the preliminary scat content analysis and direct observations, it can be said that most of the bears in the region almost exclusively feed on plants when they provide sufficient nourishment. They also forage for invertebrates and rodents under rocks or inside holes along the tracks they use. However, there may be some overestimation of feeding with plants since they are more difficult to digest by the digestive system of brown bears. Thus, they are more likely to be seen and identified with respect to digestible parts of animal prey.

4.2. Status and Conservation

Threats to the brown bear population in the region are of two types: The first one is direct human damage to bears; the second side-effects of human activities on bear populations. The former arises due to conflict or the high interest in hunting among the locals. Contrary to Can & Togan (2004) there were no records of bear persecution since 1920s or 1930s for obtaining bear fat either for use as medicine or as raw material for soap production. Bear fat was used as such only when soap was not easily obtainable from markets due to poverty of the country after World wars. It has been reported that some cooked bear parts, especially of cubs, were served to guests by some people living near the Georgian border to show their hospitality (Hasan Yavuz *pers. comm.*). During 1980s up to mid 1990s, there was a big trade of animal pelts

among locals to sell outside the province but then it was given up due to low profitability. Moreover, that kind of trade was strictly forbidden, and now even exhibition of such pelts is banned according new legislation (Official Gazette of Turkish Republic 2003).

As a result of direct persecution, habitat loss and habitat degradation from 1950s until 1990s brown bear population has decreased so much (Mursaloğlu 1988). In the last decade, however, it can be said that the situation has changed to the advantage of the bears. Although habitat degradation may be a major problem in many regions of Turkey (Can & Togan 2004), there is no study that shows this habitat degradation is affecting bear populations in Turkey; making generalizations about the whole country based on a study in one region does not give reliable results for bear populations. For instance, in Artvin, especially in the study area, habitat degradation is not a significant threat since there was no recent commercial timber production and it might have provided useful feeding habitats for bears in Yusufeli.

4.3. Attitudes and Opinions of the Local People on Brown Bear

It is common to assess the nature of the conflict and attitudes of people by using interviews (Kaczensky 2004, Andersone & Ozolins 2004, Roshaft *et al.* 2003, Ermala 2003). The use of open ended questions in such interviews gives more chance to understand people's ideas, but it also leads to more difficulty when analyzing raw data. Open ended questions have a distinct advantage over closed format questions when the primary goal is to learn behavior and attitudes of respondents (White *et al.* 2005).

Selection of people to be interviewed was not a thoroughly random process since they were carried out in settlements that were especially known to experience frequent conflict incidents. The interviews were held with any willing person that was encountered during the visits. Therefore, sampling is probably biased towards people

with previous bear experience, but since obtaining a spatial pattern of the conflict was not aimed, this is not limiting, and making relative comparisons will be legitimate.

The average age of people interviewed (50.2) is rather high but this can be explained with local demographics; it also gives a better chance to understand and learn human–bear relationship and conflicts that occurred up to 50 years ago. Most seem to be knowledgeable about bear behavior, especially about its largely herbivorous character.

The majority of those interviewed concluded that the bear population has increased in number over the past decade after the banning of hunting. Almost all (82 %) also believed that bears have become more of a problem lately. It is difficult to assess the accuracy of these assertions since there are no population data comparable over the years. However, even if a significant increase in bear population size did not really take place in Yusufeli, it is important that the local people perceive so and link this to the hunting ban.

Therefore, it should not be surprising that at least half and perhaps more (up to 79%) of those interviewed prefer a management approach that involves population regulation. It is interesting that the 21% who support full protection includes locals who had in the past responsibilities for wildlife protection. Some locals suggested that if damages were compensated, they would agree for full protection of the species. This shows that economic considerations are probably the most important. Some people that were religious also believed that bears should be protected because they were created by God and people had no right to put an end to their life.

Slightly more than half (57%) of the interviewed people considered commercial trophy hunting as a solution to limit brown bear damage. Most opponents of conservation are from villages that gain much more money from trophy hunting than other villages. Other people thought it will not work, or will probably cause conflict among those locals who gain from trophy hunting and those who do not.

4.3.1. Why did the conflict worsen?

Crucial changes have been occurring since 19th century when people became more isolated from nature and wildlife and lost their goodwill for wildlife and became intolerant of any damages or nuisance caused by carnivores. Because agricultural fields are limited in size, people always try to enlarge them by converting natural forest into farm patches. Therefore, any loss of crops or other property changed people's attitudes against brown bears. However, people usually respect bears and enjoy observing them from a distance while they are grazing or roaming. In the past, they had attempted many times to tame bear cubs in Yusufeli (Özen 1998).

Precautions were taken by the authorities in the last few decades in order to reduce pressure on wildlife. After about 1990, in many places near national parks and wildlife reserves, all hunting activities were forbidden. Even when people had experienced damage caused by wildlife, they now do not have a right to defend themselves through killing, wounding or even scaring them. People's perceptions seem to have changed, and now the bear is thought to have higher value than people in the eye of the state. Since it is not allowed to harm "problem" bears, some local people probably resorted to illegal means. As elsewhere in the world where bear related conflicts are common, there is growing resentment among local villagers, who usually blame conservation authorities for the present situation (Treves *et al.* 2004, Woodroffe 2000, Rao *et al.* 2002, Kaczensky 2004, Gunther *et al.* 2004).

4.3.2. Close encounters between bears and people: The human perspective

By making use of all available data sources, a moderate number of close encounters were recorded for the last several years. On more than two-thirds of such encounters, the bear and person(s) involved departed without any physical interaction, hence without any harm. This indicates that usually such close encounters do not represent a threat to either side. However, in 26% of the cases, the bear was either attempted to be shot at or run over with a vehicle. These cases are clearly an indication of the hostile

attitude by some of the local villagers. A minor but important part of close encounters occurred while a person was driving a vehicle. These were situations when people could (and sometimes did) harm the animal.

Within the core study area, bears attacked people in only two cases and harmed someone in only one of those encounters. Therefore, the probability of a person being injured as a result of a close encounter with a bear seemed to be quite low (<4%). If people involved posed no threat to the bear, for example because they faint, the bear generally left without any further harm. Elsewhere in Artvin, five cases of bears injuring humans were reported to gendarme between 2002 and 2005. All seemed to be unprovoked attacks.

There is reliable information on only two bear-caused human deaths in Artvin. The first one dates from 1970s and involved a hunter who was probably killed by the bear he wounded (Özen 1998). The second one was a shepherd who was killed by a bear with cubs that attacked his flock in 1999 (Gendarme archives 1999). Both attacks that led to human death involved provocation by the person.

In Turkey, human death due to a bear attack is a rare event. In the last five years, only one documented death was recorded: A villager was apparently killed in July 2005 by a bear in the forest near Sarıkamış, eastern Turkey (Ö. Çirli, *pers. comm*). The circumstances of this death are not clear but the victim probably surprised the bear (which might have had cubs) at close range. While several grizzly attacks in Yellowstone National Park in USA and two fatal cases in Romania in 2004 are examples of predatory or rabid attacks by bears on people, there are no records of such predatory attacks in Turkey (The Johnsville News 2004, Shelton 1997, Merriman 1997, Gunther *et al*. 2004, Gunther 1994).

4.3.3. Precautions against close encounters

When a bear and a human being get close to one another, the bear usually detects the person and leaves the area to avoid any confrontation. However, sometimes a close encounter is unavoidable. In such a case, the person needs to slowly back off and leave the area. If physical contact is imminent, then it is safest to lay face down, cover the neck with hands, and play dead (Center for Wildlife Information 2005). When questioned about what they would do in case of finding oneself within 50 meters of a bear, only half of the interviewed knew how to react in such a situation. The other half either did not have any idea or they suggested reactions (running away, shouting, etc) that would put themselves into unnecessary risk. To feel safe, and perhaps in order to utilize when threatened, 61% carried either a fire arm or a hatchet, and/or was accompanied by a dog during working at or traveling outdoors.

These results imply that the local people should be informed on what to do if a close encounter occurs; nobody seems to know exactly the right response since they either use unusual tactics or apply self improvised methods. They may also overestimate the protection that a fire arm, a hatchet or a dog may provide against a bear. The most widely recommended precaution against bear attack is pepper spray (Center for Wildlife Information 2005, Shelton 1997) about which the villagers seem to know nothing. In conclusion, it seems that most human-bear close encounters result in no harm to either side if people know what and when to do.

4.3.4. Close encounters between bears and people: The bears' perspective

At least 5 or 6 bears were wounded (2002-2005) within the core study area, with at least 4 of those consequently dying. Illegal killing of brown bears is not present only in Artvin but also in neighboring provinces, although such information is usually kept secret by the perpetrators. The last reported such kills were from the Ardahan province where two big bears were either poisoned or shot (Kent Haber 2005). In the

core study area, killing of bears appear to be a solution to dispose of problem bears, as was illustrated by the killing of an individual in Barhal village in 2005.

Sometimes when a mother bear is killed, the villagers (probably exactly those who were responsible for its death) report to NCNP or the media that they have found "abandoned bear cubs"; two such very young (<2 months old) cubs were found near Arhavi (Hürriyet Archives 2002). Another recent case happened in Şavşat county (Artvin), where an injured bear cub was "rescued by local villagers". However, an examination in a veterinary hospital revealed twelve buckshot pellets embedded in the head, and also evidence of beating (Kent Haber 2005). This again illustrates that its mother was probably illegally killed by villagers, and some of them (not knowing what to do with the abused cub) presented themselves as the rescuer of an unprotected cub.

4.4. Bear-caused Damages

Damages caused by marauding bears are probably the most important current wildlife issue in the study area. More than 61% of the interviewed reported bear damage to agricultural fields, beehives or livestock. Field crops and orchards were most vulnerable and made up two-thirds of the reported cases. This was followed by damaged beehives and depredated livestock.

These findings are somewhat different than the findings of conflict studies in Europe. For example, in this study, in a single year (2004) and within 800 sq. km., an estimated 100-150 adult bears have depredated only 19 sheep/goats and 3 cattle. Even though the coverage of depredation events is not complete, the rate of livestock depredation is very low in comparison to the European or North American situation. For comparison, a brown bear in Norway kills approximately 100 sheep in one year or in Yellowstone ecosystem as an average 28.62 incidents of livestock depradation occurs every year and bear kills 4.3 sheep/ incident (Sagør *et al.* 1997, Linnel *et al.*

2002, Wilson *et al.* 2005, Gunther *et al.*). This is probably explained by the much better protection of livestock in Turkey by owners, shepherds or sheep dogs.

The damage events were most often recorded from June to September. These months cover the pre-hyperphagia and hyperphagia phases. They also coincide with the maturation of agricultural crops and fruits at orchards, with a peak in September. However, damage to beehives and to clover plots occurred most often in April and May, coinciding with highest availability.

Local people's opinions on timing of bear damage generally fitted well with the recorded data, except for the mid-spring period when they have overestimated the damage. However, this might be due to a sampling bias, since most of the people were interviewed in May-July when people might have experienced recent damage. Additionally, it might be a consequence of a bias towards beekeepers being interviewed in the spring. As expected, bear damage increases from April to June and July to September, as hyperphagia sets in towards the end.

The damage to agricultural fields, orchards, and apiaries are higher than in most parts of Europe since villagers do not take any effective preventive measures (except for killing the bear), despite the fact that they have been living with bears for centuries. Illegal killing of bears is also a problem in Europe and elsewhere in the world, where farmers, national park agencies, and NGOs are aware of the problem and implement various mechanisms to reduce conflict such as compensation, restrictions in dump depositions, use of bear-proof materials, and education of people about bear behavior and how to avoid them (Center for Wildlife Information 2005, Primm & Murray 2005).

In the last decade, human caused habitat loss has stopped in most of rural Turkey and the reverse process of forest recovery in abandoned pastures and fields has started to the advantage of brown bears, especially in northeastern Black Sea, because local

people have begun to leave for larger towns (DİE 2001). Clearings have started to revert back to forest trees, shrubs and wild herbs, and these have become indispensable feeding areas for bears, especially near riparian areas. Meanwhile, cultivated areas have decreased in the last decade. Besides, people started to do other economic activities like beekeeping by which they can earn more money with the same labor. This socio-cultural change from a traditional subsistence-economy oriented livelihood into market or monetary economy has been escalating in or near protected areas around the world (Rao *et al.* 2002).

4.4.1. Protective measures against bear damage

Many people living in 'bear country' around Artvin have been utilizing different methods to protect from bear damages. The most common method involves simple exclusion, followed by frightening devices, and by deterrents. A fifth of the interviewed people did not resort to any measures. Traditional methods like wrapping barbed wire and covering metal sheet around trees are not seemed to protect orchards since the bears, unable to climb the tree, pull down branches or sway trees, and eat the fruits that fall to the ground.

Although the local people do not know about temporary electrical fencing as a preventive method, they place traditional beehives (*karakovan*) on trees at least 10 meters high from the ground. Damage on such beehives is infrequent. Another method that is used for protection of beehives is elevated platforms which are simply adapted from *serenders* commonly used to store foods away from mice. When their base is covered with metal sheets to prevent climbing, they are really efficient in terms of protection from bears. The only drawback of this method is that building it requires so much lumber.

Cultivated plots are most vulnerable to damage and really hard to protect against wildlife damage. Many methods have been tried by the local people, such as explosive LPG that sounds like rifle fire, sound producing metal cans hung on sticks, scarecrows clad with clothes with human smell, fences of unbarbed wire, and various noise generators, but the bears seem to get accustomed to most. The ineffectiveness of most preventive measures may lead some to guard their crops armed overnight or place traps to kill nuisance bears.

The least damage occurs to livestock partly because people have left large scale livestock husbandry on the highland pastures (*yayla*) for more than a decade. Households either keep a few cows and sheep in barns or use the first floor of their house as a barn. Some also keep guard dogs to protect herds, which seem to work well as dogs warn the shepherd and keep bears away from the herd.

4.4.2. Economic cost of damage

The annual cost of damages caused by bears was estimated to amount to approximately US$ 25,000 for the Artvin province. About three fourths of this damage stems from Yusufeli. Although this may be an acceptable figure for the whole province, damage levels for individual farmers are probably intolerable for them.

Bear-caused damages sometimes have brought about higher economic losses than anticipated since people seem to underestimate the brown bear's ability to locate any defenseless beehives and other food sources, especially in unpredictable cold spells in mid spring. For instance, apiaries placed in an open area at around 900 meters in spring 2005 were visited weekly by a brown bear through April, when at least 10 beehives were lost. After a while, the beekeeper took precautions like tying a dog near the apiary, strengthening the fences and guarding with rifles through the nights. However, probably the same bear came again near the beehives in May and ate three of them. During the second visit in May, the beekeeper saw the bear from 200 meters

away while breaking a beehive and fired his rifle into air from opposite side of a stream. However, the bear get accustomed to raid beehives due to harsh environmental conditions of spring 2005. Consequently, the beekeeper had to move his 135 beehives to another place.

Industrialized beekeeping practices require larger sites for apiaries and more flowering plants (Governorship of Artvin 2005). As a result of this, bear habitats and beehive locations often overlap. Therefore, bears have been visiting these habitat patches and raided beehives. It could be that although the brown bear population size stayed the same, damage frequency to smaller numbers of cultivated plots, orchards and beehives has increased. Therefore, people were led to think that bear damage has become more prominent lately in Yusufeli.

To reduce economic damage NCNP province director proposed trophy hunting as an income source for locals so that NCNP not only overcome the complaints by locals but also provide an extra income to locals. The Governorship of Artvin also supports trophy hunting as stated in the Provincial Development Plan of 2005. However, the assumptions were far from reality as 15,000 hunters were supposed to visit Artvin in two years and spend an average of $ 750. Assuming the village would get 40% of that money, approximately $ 11,250,000 is expected as an extra income (Governorship of Artvin 2005). Clearly, such an amount of money could not be gained from limited trophy hunting in Artvin.

Our results are somewhat different than the results of conflict studies, especially damage to livestock, in western and central Europe such as Spain, Norway, Sweden, Italy, Croatia, Finland etc. For example, in a single year (2004) and within 800 sq.km., an estimated 100-150 adult bears are known to have depredated only 19 sheep/goats and 3 cattle. Even though our coverage of depredation events is not complete, the rate of livestock depredation is very low in comparison to the European or North American situation (Sagør *et al.* 1997, Linnel *et al.* 2002, Wilson *et al.* 2005).

The northeastern part of Turkey, where settlements are small and scattered, is known for its relatively high levels of bear-related conflict. Bear damage, such as killing or injuring livestock, raiding beehives, agricultural fields and orchards are on the increase there (Ambarlı & Bilgin 2005). As elsewhere in the world where such conflicts are common, there is growing resentment among local villagers, who usually blame conservation authorities and may use illegal means to get rid of "problem" bears (Treves *et al.* 2004, Woodroffe 2000, Rao *et al.* 2002, Kaczensky 2004, Gunther *et al.* 2004).

Sound scientific data is necessary for making management decisions related to bears and for sustainable managing bear populations (Servheen *et al.* 1999). However, there is yet no detailed field research carried out on the bears of northeastern Turkey. The only quantitative data available are that of fixed point counts carried out intermittently since 2001 by the Directorate of NCNP in the Artvin province (Anonymous 2001-2004).

Implementing modern techniques of exclusion and scaring used effectively all around the world were recommended to use and it should be extended and supported by NCNP (Swenson *et al.* 2002). We conclude that education of local people on bear facts and on the importance of bears in the nature are crucial. NGOs, local authorities and university researchers should join forces to prepare a bear management plan with a participatory approach.

CHAPTER 5

CONCLUSION

5.1. Management Implications and Suggestions

Sound scientific data is necessary for making management decisions related to bears and for sustainable managing bear populations (Servheen *et al.* 1999). However, before this study there was no detailed field research carried out on bears of Turkey. The only quantitative data available were that of fixed point counts carried out intermittently since 2001 by the Directorate of NCNP in the Artvin province (Anonymous 2001-2004). It is clear that such censuses by NCNP are useful although they need to be improved through standardizing the effort, reducing redundant counts, and enhancing identification skills.

This study has proven that various methods, including use of camera traps, monitoring scat and other signs, capturing wild individuals and radio-tracking them, and even direct observations in the field can contribute significant data to understand the ecology and behavior of the species.

Implementing modern techniques of exclusion and scaring that are used effectively all around the world are also recommended for use in problem areas. Their use should be extended and supported by NCNP. The education of local people on bear facts and on the importance of bears in the nature is crucial. NGOs, local authorities and university researchers should join forces to prepare a regional bear management plan with a participatory approach.

Methods to reduce human - carnivore conflict are widely used in developed countries (Servheen *et al.* 1999, Swenson *et al.* 2000). One effective method is electrical fencing around beehives, small agricultural plots and garbage dumps. These fences can be powered by mains power or through batteries that can be charged with solar panels. Exclosures would especially work well for beehives since they are prone to bear raids when placed on open areas near the forest (Meadows *et al.*, MAAREC 2004). The problem is that there are no inexpensive fencing systems in Turkey. On the other hand, damage experienced by a single beekeeper in a year may well exceed the cost of the fence. Secondly, such fences can be used to enclose important parts of cultivated areas since these are very patchy, but in this case set up costs may exceed the real damage costs. Therefore implementing electrical fences to all apiaries may be a good solution for reducing conflict because costs of damage regarding beehives are relatively high.

Random noise generators and motion activated explosive deterrents can be used to diminish conflicts in agricultural fields, too. Although bears can get accustomed to noises after a while and continue to feed, they should be practiced due to low cost and easy set up.

Guard dog, especially the Kangal breed might be very helpful for shepherds and those who want to deter bears since this special dog has high innate protection skills to defeat anyone who it accepts as foreigner. This methodology was also practiced for black bears and some grizzlies with different dog races (Treves & Karanth 2003). Wind River Bear Institute (2000) also offered the new term “bear shepperding” for reducing conflicts.

However, the problem is that villagers in Yusufeli do not want to feed an animal which they consider useless for them. They suppose that all dogs will be scared when they come across a bear. This might be true for most dogs but this special breed has

less fear than others. Locals also prefer a compensation mechanism to feeding a dog. Compensation of depredated livestock elsewhere has actually leaded to increases in herd sizes and consequent high grazing pressure and competition with wild herbivores (Bulte & Rondeau 2005). In brief, guard dogs should be demonstrated as an effective damage prevention method, and NCNP or NGOs should support or subsidize people for getting a guard dog.

Compensation mechanisms with total or partial coverage of damages can be offered as another method to remedy the conflict. However, although it will reduce resentment among farmers and help finance damages, compensation will not solve the real problem. Nevertheless, a compensation scheme can be established singly or jointly by the Ministry of Environment and Forestry, Ministry of Agriculture or Ministry of Interior, which can decrease the increasing antagonism toward the bear among villagers. Implementing such a compensation plan may reduce human-caused bear mortality. It may also be applied for depredated livestock near high-altitude pastures. For this approach to be successful, it should be widely introduced to people in conflict areas, and experts like the 'bear advocates' in Austria (Kaczensky *et al.* 2004) should examine the measures taken by people against damages and support implementation of new methods as a mediator among NCNP, locals and bears.

However, damage compensation is susceptible to misuse and exaggeration of damages. Moreover, recent studies have shown that compensation can be bad for conservation of animals since human-wildlife conflict usually does not decrease, but instead increases due to continued intrusion into natural habitats. It has also a risk of slowing the exodus from villages by creating an artificial livelihood resource, and maintaining an unnaturally high level of human-wildlife conflict (Bulte & Rondeau 2005).

Once appropriate damage prevention methods are applied and there are no other choices left to reduce conflict, identified nuisance bears might need to be eliminated

from the population either through relocation or culling. It may be possible that this may be used to (at least partly) replace trophy hunting of bears. This approach might have a positive effect on conservation and management if eliminations are highly selective. However, there is widespread skepticism among researchers about lethal control because a survey on the conducted systematic lethal control showed that 11 to 77% of the carnivores killed as "problem" individuals showed no evidence of having been involved in recent conflicts (Treves & Karanth 2003). Furthermore, identifying and then tracking and hunting the problem bear are hard to put into practice in Turkey since NCNP do not have trained rangers or relevant institutional capacity.

The Governorship of Artvin and NCNP Province Directorate are the only government authorities that implement hunting laws, therefore having a mandate for the conservation of brown bears. Nonetheless, these authorities have prepared many reports since 1997 to the Central Hunting Commission and the Ministry of Environment and Forestry asking for brown bears to be delisted as a protected species locally (unpub. data). They have also attempted to influence Central Hunting Commission decisions by nominating supporters of trophy hunting to vote in the commissions.

It is highly probable that any delisting of the species to open hunting of problem bears will result in irreversible population decline. This was practiced in Yusufeli first in 1982 (Mursaloglu 1988) and ended in 1990-91. Hunting was again open to all hunters from 1993 until 1997. This second episode was like carnage of bears: 10 animals were shot and killed within two months, without regarding their sex or whether they were indeed nuisance bears. If hunting of nuisance bears would be opened after so much lobbying by hunting firms, then it should be only for foreign hunters so as to increase income levels of locals and keep annual numbers shot low.

Another methodology before implementing lethal techniques can be translocation of problem individuals. Linnell *et al.* (2004) has indicated that it is not a preferred

method and rarely used in Europe. Yet, public acceptance shows great variance with respect to people's education level and participation to conservation activities. Its effectiveness in Turkey might be very small since people in the translocation destination would blame NCNP from any damages by wildlife. But another strategy like bear sanctuaries such as dancing bears enclosure near Bursa in Turkey might be effective for conservation of bear population. Nuisance bears can be taken to these sanctuaries for the sake of wild populations but the problem is related with no trained personnel on this subject, construction costs and economic costs of continuously feeding these bears.

As a conclusion, human - bear conflict can be reduced by implementing strict damage prevention and other ecological and social approaches mentioned above. Additionally people should respect brown bears as they have a right to live, and they should give up seeing bears as a source of income. The important thing is that good relations and collaboration should be consistent between locals, NCNP, and researchers. Thus, a good conservation strategy including long term viability of brown bears in Turkey and sympathy of locals can be prepared as beneficial to both sides by a commission consisting of all interested parties since successful conservation of brown bears and other carnivores depends on sociopolitical landscapes and favorable ecological conditions (Treves & Karanth 2003).

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APPENDIX A

Observed Animals

Table A. Observed animals

Date	Place	Observation time range	Total Hour	The time of observed animal	Name of the species
27 July 04	Özgüven-northern aspect	16.00-19.00	3	16.45	**B.bear**
28 July 04	Marsis	04.30-06.30	2	-	**-**
		17.20-19.15	2.55	19.50	**B.bear and Chamois**
29 July 04	Özgüven-Marsis	05.00-07.00	2	-	**-**
		17.00-19.20	2.20	19.00	**B.bear with two cubs**
30 July 04	Yaylalar village	18:30-19.30	1	-	**-**
31 July 04	Yaylalar	16.30 – 19. 00	2.30	-	**-**
01 August 04	Yaylalar	05.00- 07.00	2	5.25	**7 adult and 4 immature wild boars**
	Demirdöven - Zekaret	18.30-19.45	1.15	18.45	**1 adult bear**
02 August 04	Zekaret	05.30-07.00	1.30	-	**-**
07 August 04	Cancak high pasture-Demirköy	16.00-18.30	2.30	-	**-**
11 August 04	Cevizli-Ardanuç	20:00-23.00	3	22.10	1 adult bear

Table A. Observed animals (cont'd.)

Date	Place	Observation time range	Total Hour	The time of observed animal	Name of the animal
18 Sept. 04	Taşkıran-Yusufeli	16:30 – 19:00	2.30	18.45	**1 young bear**
30 June 05	Village Özgüven	19.00-20.00	1	19.30	**1 bear**
	Bıçakçılar st.	15.00-17.30	2.30	-	**-**
01 July 05	Kışla street	21.00-24.00	3	21.50	**1 bear with two cubs**
	Barhal village			23.45	**1 bear**
02 July 05	Özgüven-Marsis ridge	16.00-19.00	3	17.15	**1 bear**
	1 km apart			17.30	**1 different bear**
03 July 05	Özgüven Köyü-Landslide area	16.15-18.00	1.45	17.45	**1 immature bear**
					1 female bear
07 july 05	Marsis ridges	18.00-19.45	1.15	19.15	**1 female with two cubs**
1 Sept. 05	Marsis-Yet ridges	16.30-18.45	2.15	18.00	**1 female with two cubs**
3 Sept. 05	Landslide area -Özgüven	10.00-10.30	30 min.	10.00	**1 bear**
		16.00-18.30	2.30	15.55	**2 different sub adults**
4 Sept. 05	Around slopes of Marsis	14.30-16.15	1.45	14.55	**1 female with two cubs**
7 Sept. 05	Captured by a trap				**1 male bear**
7 Sept. 05	Upper part of Özgüven	19.00-20.30	1.30	19.45	**1 female with two cubs**

Table A. Observed animals (cont'd.)

Date	Place	Observation time range	Total Hour	The time of observed animal	Name of the animal
10 Sept. 05	Landslide area	15.30-18.30	2.30	17.30	**1 adult bear**
	Oak forests of Landslide area			18.10	**1 female with big two cubs**
11 Sept. 05	Through Bıçakçılar	15.30-17.00	1.30	15.50	**1 female with one cub and immature**
6 November 05	Oak forests of Landslide area	14.00-17.00	3	14.15	**1 female with two cubs**
				15.00	**1 probably male chased by female**
7 November 05	Özgüven	14.00-16.00	2	-	**-**
9 November 05	At the southern slope of Özgüven	14.00-16.30	2.30	14.30	**1 probably male bear**

APPENDIX B

Camera trap days

Table B. Camera trap days

Place	Date	Total time (hour)	Photographed Animals	Number of Camera Traps	Elevation (m)
Murgul – Damar		20	-	2	
Karagöl - Borçka		11	-	1	
Ekşinar - Ardanuç		17	-	2	
Özgüven - Yusufeli	28/08/04	76	1 bear cub	2	
Yaylalar-Demirdöven	31/08/04	28	-	2	**1400**
Zekaret - Demirdöven	01/10/04	26	-	2	**1879**
Kutul -Ardanuç	10/10/04	13	-	1	**2146**
Cevizli-Ardanuç	11/10/04	36	At least 10 wild boars	2	**1000**
Mısırlı –Şavşat	15/10/04	7.5	-	1	
Karagöl - Şavşat	16/10/04	22	-	2	
Altıparmak – Yusufeli	19/10/04	16	-	2	
Dereiçi-Yusufeli	09/05/05	41	1 adult bear	1	**950**
Dolupınar-Yusufeli	01/07/05	36	-	1	**1150**
Özgüven – Yusufeli	01/09/05	55	1 adult bear	1	**2000**
Özgüven-Yusufeli	01/09/05	33	-	1	**1900**
Özgüven - Yusufeli	06/09/05	33	-	1	**1900**

APPENDIX C

Interview Questions

Table C. Interview Questions

Identity informations and village name
Jobs
Age of respondents
Date of interview
Have you ever seen a bear either death or alive?
Are bears herbivores or carnivores?
How many beehives have you got?
How many acres of agricultural fields do you have? What do you sow or plant?
If you have orchards, how many and what kind of orchards?
How many cattle or sheep do you have?
If you previously had bear damage, What type of methods do you use to prevent from damage or keep bears far away from resources?
Do bears give damage at particular places like in the forest, temporary settlements?
Is there any likely period for brown bear damage?
If you have bear damage, did you give a petition to local directors?
What should be done when bear attack you or when you came across a bear?
What do you carry for personal protection?
What do you think about bear population in your village?
Is the number of bears increasing or decreasing?
What can be done preventing from bear damage, if you have it?
Do you think hunting in a given area solves the problem?
Should protection of bears continue? Why?
Human - Bear Close Encounters
Name of the person
When did you confront with a bear?
How many meters were present between bear and you?
How many were they?
Where did you see them, indicate on the map?
What time was it when you saw bears?
What did bear do?
What did you do?
Damage Statistics
Damage type [agricultural fields/orchards/animal/beehive]
Where did damage occur? Place on the map.
Size of the damage(ratio of damage to total)

APPENDIX D

Bear Sightings

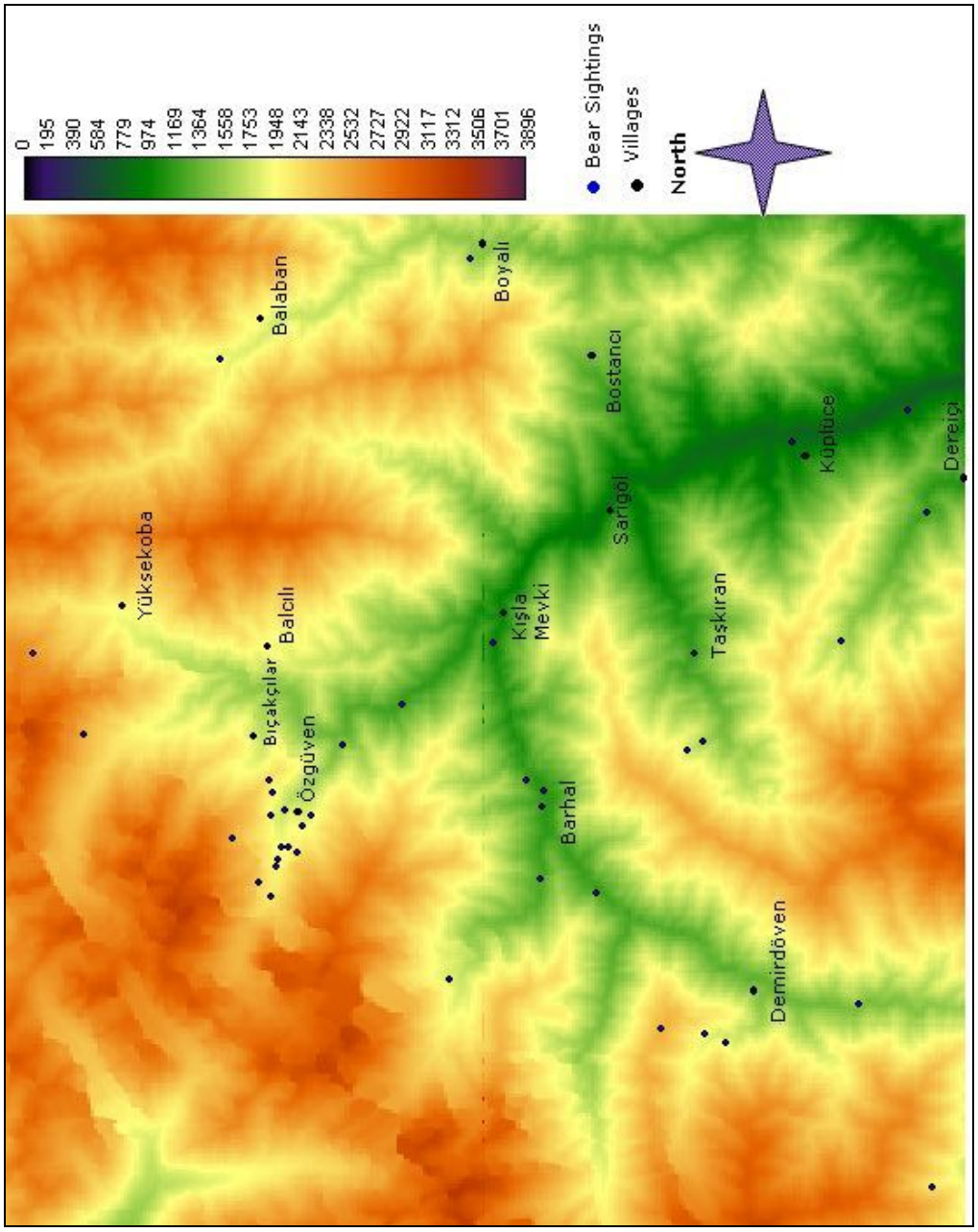

Figure D. Bear Sightings in Yusufeli

APPENDIX E

Human-Bear conflict Photos

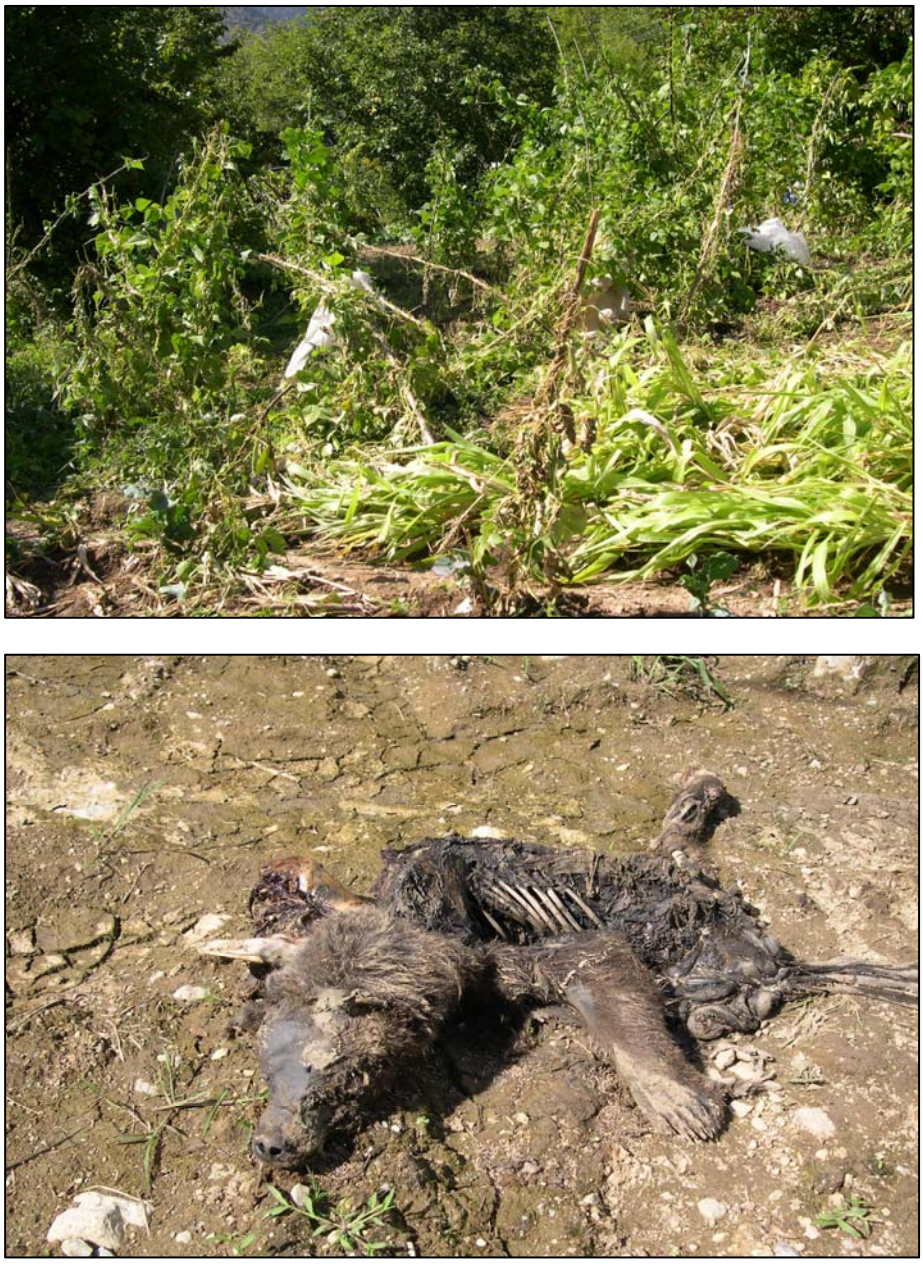

Figure E. Poached brown bear in village Barhal, August 2005 as a result of crop damage