Oso!

IBA MEXICO 2007

18th International Conference on Bear Research & Management

18ava Conferencia Mundial Sobre la Investigación y Manejo de Osos

November 4-11, 2007
Monterrey, Nuevo León, México

INTERNATIONAL ASSOCIATION FOR BEAR RESEARCH & MANAGEMENT

The IBA sponsors international conferences and workshops about bear biology, research, and management. The International Conference on Bear Research & Management is the largest of these conferences and is focused on all 8 bear species. The International Conferences are rotated between the Americas and Eurasia on an 18-month rotation.

The International Association for Bear Research and Management (IBA) is a non-profit tax-exempt (USA tax # 94-3102570) organization open to professional biologists, wildlife managers and others dedicated to the conservation of all bear species. The organization has over 550 members from over 50 countries. It supports the scientific management of bears through research and distribution of information. The IBA sponsors international conferences on all aspects of bear biology, ecology and management. Many of the conference papers are published as peer-reviewed scientific papers in the journal Ursus.

The eight bear species of the world pose significant research and management problems to governments, local authorities, wildlife biologists, land managers, park personnel, tribal councils, and private land owners. The public endures hardships caused by bears; the public wants bears to survive. Management responsibility for the bears and their habitats rests with numerous national and local agencies and councils. Encroaching civilization, involving land-use conflicts and resource utilization by human beings, has resulted in the decline or disappearance of bear habitat and bear populations in portions of their ranges. Continued viability of populations and the possible restoration of bears in certain areas, will be largely contingent upon a cooperative approach towards research, management, land use, and education, and will increase in cost as land values escalate. The IBA, an association primarily of professional biologists with an interest in bears, recognizes these difficult bear research and management problems faced by agencies and governments.

Thanks to Our Sponsors

Additional funding was recieved from Grupo Acero del Norte, DORRSA, Parque Ecologico Chipinque, and the Denver Zoo. We would also like to thank our special friends who went beyond the expected to help bring this conference to life: *David Garza Laguera & Norma Alaniz, Elizabeth Spence Sellers, Katharine Armstrong Love, Cina Alexander Forgason, Othon Ruiz Montemayor, and the Martínez / Pámanes family of Monterrey. Special appreciation goes to Maria Guerra, Maria Eugenia Rodriguez, Becky Trant, Chris Reopelle, Jere Sepulveda, Yolanda Ballard, and Charity Lawson for their help. Guillermo Palomares of Impulsora de Rentas y Servicios privided excellent services and went beyond what was required to help us with arrangements. Arturo May provided translation services, as always, with a touch of humor. We also thank all of our volunteers and students from the Universidad Autonoma de Nuevo Leon and Texas A&M University-Kingsville who have worked so hard.*

Conference Committees

Co-chairs
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- Maria Guerra
- David Garza Laguera
- Maria Eugenia Rodriguez

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- Sean Farley
- Elizabeth Peacock
- Marty Obbard
- David G. Hewitt
- Piero Genovesi
- Shenaendoah Garcia-Rangel
- Raymond Skiles
- Jon Arnemo
- Alexandros Karamanlidis
- Mei-Hsiu Hwang

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- Ana Montiel Arreaga

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EXPO OSO!

TETON WELDING

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Table of Contents

Program

Time	Activity / Presentation Title	Location / Author	
	SUNDAY NOVEMBER 4		
All Day	Airport Shuttle	Holiday Inn, other hotels	
All Day	Vendor Setup	Canada (Expo Oso!)	
10:00 - 5:00 pm	IBA Council Meeting	Antarisuites Conference Room	
9:00am - 8:00 pm	Early Check-In	Holiday Inn Fundidora Lobby	
6:00pm - 9:00 pm	Cocktail Welcome	Museo El Obispado (pending)	
	MONDAY NOVEMBER 5		
All Day	Airport Shuttle	Holiday Inn, other hotels	
All Day	Registration Desk	Vestibule - Cintermex	
All Day	Translation Services Desk	Vestibule - Cintermex	
All Day	IBA Membership / URSUS Booth	Vestibule - Cintermex	
All Day	Assistance Table (Help Desk, Travel Information)	Vestibule - Cintermex	
All Day	Information TV Screens	Vestibule - Cintermex	
All Day	Small group discussion tables	Vestibule - Cintermex	
All Day	Expo Oso!	Canada Hall	
All Day	Poster Setup	Canada Hall	
All Day	Workroom, presentation practice room, meeting room	America Hall	
All Day	Presentation Downloads	Africa Hall	
All Day	Office, coordinator work room, storage room	Asia Hall	
SCIENTIFIC SESSIONS			
SESSION 1: BEAR RESEARCH, MANAGEMENT, & CONSERVATION IN MEXICO ***Diana Doan-Crider***		**USA Hall**	
8:30 -9:00 am	Welcome & Inauguration	Dr. Ernesto Enkerlin, Commissioner National Protected Areas of Mexico	
9:00 - 9:20 am	INVITED: Bears in Mexico: Yesterday, Today, and Tomorrow	Diana Doan-Crider, Gilberto Salgado Santos, & Oscar Infante Mercado	1
9:20 - 9:40 am	The Black Bear in a Tropical Cloud Forest: Local Community Participation in the El Cielo Biosphere Reserve Project	Sasha Carvajal Villarreal, David S. Maehr, Arturo Caso, and Guadalupe Marin Berrones	2
9:40 - 10:00 am	Population Dynamics and Corridor Protection for American Black Bears in Northern Coahuila, Mexico, Sky Island	Bonnie R. McKinney and Jonas Delgadillo Villalobos	3
10:00 - 10:20 am	The Use of Non-invasive Techniques to Study the Endangered Black Bear in the Sierra El Tigre, Sonora, Mexico	Cora Varas-Nelson, Carlos Gonzalez Lopez, Paul Krausman, and Melanie Culver	4
10:20 - 10:40 am	***Coffee Break***		
10:40 - 11:00 am	Spatio-temporal Distribution of the Black Bear Population in the State of Chihuahua, Mexico	Pedro Angel Calderon D., Enrique Carreon H., Albert Lafon T., and Juan Guzman A.	5

MONDAY NOVEMBER 5 (continued)			
SESSION 2: BEAR FOODS & NUTRITION - *Sean Farley*		**USA Hall**	
11:00 - 11:20 am	**INVITED:** Stable Isotopes	Merav Ben-David	6
11:20 - 11:45 am	Dietary and Spatial Overlap Between Sympatric Ursids Related to Salmon Use	Jennifer K. Fortin, Sean D. Farley, Karyn D. Rode, and Charles T. Robbins	7
11:45 - 2:00 pm	***Lunch - On Your Own***		
12:05 - 2:00 pm	***Student Lunch - Restaurant El Taco Buey (across from conference site)***		
2:00 - 2:20 pm	The Diet of Brown Bear in Estonia and Comparison with Other Regions in Europe	E. Vulla, M. Korsten, K. Hobson, M. Leht, A.J.Martin, H. Valdmann, P.Mannil, and U. Saarma	8
2:20 - 2:40 pm	Quantifying Berry Production Using Digital Imagery Analysis	Latham, Erin	9
2:40 - 3:00 pm	Effects of Fruit Types and Consumption by Asiatic Black Bears on Seed Dispersal	Mei-Hsiu Hwang and Yu-Cen Jhong	10
3:00 - 3:20 pm	Limits to Growth? Response in Skeletal Growth and Body Mass of Juvenile American Black Bears to Periods of Severe Food Shortage	Karen V. Noyce and David L. Garshelis	11
3:20 - 3:40 pm	***Coffee Break***		
3:40 - 4:00 pm	**INVITED:** Fatty Acid Signature Analysis in Polar Bears	Greg Thiemann	12
SESSION 3: POLAR BEARS - *Elizabeth Peacock*		**USA Hall**	
4:00 - 4:25 pm	**INVITED:** Polar Bears and Climate Change	Marty Obbard	13
4:25 - 4:45 pm	Changing Sea Ice-Scapes and Polar Bear Habitat in Foxe Basin, Nunavut Territory, Canada (1979-2004)	Vicki M. Sahanatien and Andrew E. Derocher	14
4:45 - 5:05 pm	Factors Influencing Spatial and Temporal Distribution of Polar Bears During the Fall Open-Water Period in the Southern Beaufort Sea	Scott Schliebe, Karyn D. Rode, Jeff S. Gleason, James Wilder, Kelly Proffitt, Tom J. Evans, and Susanne Miller	15
5:05 - 6:30 pm	***Dinner - on your own***		
6:30 - 9:00 pm	**Genetics Workshop Part 1 - Density Estimation:** DNA hair snag essentials, issues & strategies in DNA sampling, & Program MARK Overview	Mike Proctor, John Boulanger, and Gary White	

TUESDAY NOVEMBER 6		
All Day	Airport Shuttle	Holiday Inn, other hotels
All Day	Registration Desk	Vestibule - Cintermex
All Day	Translation Services Desk	Vestibule - Cintermex
All Day	IBA Membership / URSUS Booth	Vestibule - Cintermex
All Day	Assistance Table (Help Desk, Travel Information)	Vestibule - Cintermex
All Day	Information TV Screens	Vestibule - Cintermex
All Day	Small group discussion tables	Vestibule - Cintermex

TUESDAY NOVEMBER 6 (continued)			
All Day	Expo Oso!	Canada Hall	
All Day	Poster Setup	Canada Hall	
All Day	Workroom, presentation practice room, meeting room	America Hall	
All Day	Presentation Downloads	Africa Hall	
All Day	Office, coordinator work room, storage room	Asia Hall	

SCIENTIFIC SESSIONS

SESSION 4: POPULATION ESTIMATION - *Marty Obbard*		**USA Hall**	
8:30 - 8:40 am	Announcements		
8:40 - 9:10 am	DNA-Based Density Estimate for Grizzly Bears in Glacier National Park, Montana	K.C. Kendall, J.B. Stetz, D.A. Roon, L.P. Waits, and J.B. Boulanger	16
9:10 - 9:30 am	Influence of Past Live Captures on Detection Probabilities of Grizzly Bears Using DNA Hair Snagging Methods	John Boulanger, Gary C. White, Gordon Stenhouse, Michael Proctor, Grant Machutchon, and Stefan Himmer	17
9:30 - 9:50 am	Optimal Allocation of Resources in a Hierarchical Sampling Design for Estimating Black Bear Density: A Case Study in Middle Georgia, USA	Jamie L. Skvarla Sanderlin and Michael J. Conroy	18
9:50 - 10:10 am	***Coffee Break***		
10:10 - 12:00 pm	***IBA MEMBERS MEETING***	USA Hall	
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12:00 - 1:30 pm	*Climate Change Study Group - Chris Servheen - Working Lunch, Invitation Only*	America Hall	
1:30 - 1:50 pm	Brown Bear Population Size and Distribution in Eastern Interior Alaska	Craig Gardner, Kalin Kellie, John Citta, and Xi Chen	19
1:50 - 2:10 pm	Estimating Reproductive Rates for Female Bears: Ratios Versus Transition Probabilities	Charles C. Schwartz and Gary C. White	20
2:10 - 2:30 pm	***Coffee Break***		
2:30 - 6:30 pm	**Genetics Workshop Part 2 - Monitoring**: DNA sampling basics & design, RT sampling and design, analysis & issues, joint analysis &	John Boulanger, Mike Proctor, Rick Mace, Dave Garshelis,	
6:30 - 7:30 pm	***Mexican Sampler / Dinner While You Visit***	Vestibule - Cintermex	
6:30 - 8:30 pm	***POSTER SESSION & Student Auction***	Canada Hall / America Hall	

WEDNESDAY NOVEMBER 7		
7:00am - 5:00pm	***Field Trips***	Depart from Holiday Inn
9:00am - 5:00pm	**Black Bear Management Workshop: Emphasis Mexico**	Americas Hall am, Field pm
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7:00pm - 8:30pm	Public Bear Night	USA Hall
	:Spirit Bears - Wayne McCrory	USA Hall
	:Polar Bears and the Inuit of Nunavut - Elizabeth Peacock	USA Hall
	:Bears & Culture - Susanna Paisley	USA Hall
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	Effects of Human Use of Bear Trails Informal Discussion Session -	Asia Hall
	Kids N' Bears	Americas Hall

THURSDAY NOVEMBER 8			
All Day	Airport Shuttle	Holiday Inn, other hotels	
All Day	Registration Desk	Vestibule - Cintermex	
All Day	Translation Services Desk	Vestibule - Cintermex	
All Day	IBA Membership / URSUS Booth	Vestibule - Cintermex	
All Day	Assistance Table (Help Desk, Travel Information)	Vestibule - Cintermex	
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All Day	Small group meeting tables	Vestibule - Cintermex	
All Day	Expo Oso!	Canada Hall	
All Day	Workroom, presentation practice room, meeting room	America Hall	
All Day	Presentation Downloads	Africa Hall	
All Day	Office, coordinator work room, storage room	Asia Hall	

SCIENTIFIC SESSIONS

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9:10 - 9:30 am	Regional-Based Research and Management of Small, Fragmented, and Threatened Canada-USA Trans-Border Grizzly Bear Populations	M. Proctor, J. Boulanger, C. Servheen, W.Kasworm, D. Paetkau, S. Nielsen, and M. Boyce	22
9:30 - 9:50 am	Vulnerability of Scandinavian Brown Bears to Hunting - What Distinguishes the More from the Less Vulnerable?	Richard Bischof, Jon E. Swenson, Atle Mysterud, Nigel G. Yoccoz, and Andreas Zedrosser	23
9:50 - 10:10 am	Translocation as an Engine of Conservation	Piero Genovesi, Claudio Groff, and Davide dal Piaz	24
10:10 - 10:30 am	***Coffee Break***		
10:30 - 10:50 am	Incorporating Demographic and Genetic Data to Project Genetic Diversity, Inbreeding and Viability of a Small Translocated Brown Bear Population	Marta de Barba, Lisette Waits, Piero Genovesi, Claudio Groff, and Ettore Randi	25
10:50 - 11:10 am	Rehabilitation and Release Guidelines for Orphan Cubs	J.J. Beecham, C. Parker, S. Pazhetnov, M. Danilova, V. Pazhetnov, and V. Watkins	26
11:10 - 11:30 am	Pragmatic Management Can Conserve Low Productive High-Altitude Brown Bears in Asia	Jon E. Swenson, Muhammad Ali Nawaz, and Vaqar Zakaria	27
11:30 - 11:50 am	Management of Chum Salmon for Brown Bears and Other Fish and Wildlife at McNeil River, Alaska	Joshua M. Peirce, Edward O. Otis, Mark S. Wipfli, and Erich H. Follmann	28
11:50 - 12:10 pm	Grizzly Bear Population Ecology in Denali National Park and Preserve	Pat Owen and Richard Mace	29
12:10 - 12:30 pm	Mapping Bear Distributions: Meshing Hard Data and Expert Opinion	David L. Garshelis, Karen Minkowski, and Eric W. Sanderson	30
12:30 - 2:30 pm	***Lunch***	On Your Own	
12:30 - 2:30 pm	***New IBA Council Lunch***	Holiday Inn Conference Room	

THURSDAY NOVEMBER 8 (continued)			
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2:50 - 3:10 pm	Should I Stay or Should I Go? Natal Dispersal in the Brown Bear	Andreas Zedrosser, Ole-Gunnar Stoen, and Jon E. Swenson	32
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3:50 - 4:10 pm	Marking Behavior of Brown Bears in Greece	Alexandros A. Karamanlidis, Dionisios Youlatos, Stefanos Sgardelis, and Zacharias Scouras	34
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FRIDAY NOVEMBER 9			
All Day	Airport Shuttle	Holiday Inn, other hotels	
All Day	Registration Desk	Vestibule - Cintermex	
All Day	Translation Services Desk	Vestibule - Cintermex	
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All Day	Poster Break Down	Canada Hall	
All Day	Vendor Break Down	Canada Hall	
All Day	Workroom, presentation practice room, meeting room (by	America Hall	
All Day	Presentation Downloads	Africa Hall	
All Day	Office, coordinator work room, storage room	Asia Hall	

FRIDAY NOVEMBER 9 (continued)			
SCIENTIFIC SESSIONS			
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8:40 - 9:10 am	Effectiveness of Hazing in Reducing Bear-Human Conflicts in Alaska's North Slope Oilfields	Richard Shideler	39
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9:50 - 10:10 am	Anesthesia of Grizzly and Black Bears Using Xylazine, Zolazepam, and Tiletamine and Its Reversal Using Yohimbine	Tom Radandt	42
10:10 - 10:30	Anesthetic protocol for free-ranging brown bears	Asa Fahlman and Jon Arnemo	43
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10:50 - 11:10 am	Seasonal and Daily Habitat Use and Movements by American Black Bears in Relations to Human Development, Roads, and Timber Harvest	Jesse S. Lewis, Janet L. Rachlow, Wayne L. Wakkinen, Jim Hayden, and Pete E. Zager	44
11:10 - 11:30 am	Identifying Potential Colonization Patterns for Reintroduced Bear Populations	Jared S. Laufenberg and Frank T. van Manen	45
11:30 - 11:50 am	The Study of Biogeographical Changes of Asiatic Black Bear in Iran by GIS at Recent Fifty and It's Threatened Factors	Gholam Reza Noori, Alireza Shahriari, Tayebeh Arbabi, and Alireza Rashki	46
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1:50 - 2:10 pm	Modeling Variation in Grizzly Bear Density at the Landscape Scale	Tabitha A. Graves, Katherine C. Kendall, Jeffrey B. Stetz, and Amy C. Macleod	48
2:10 - 2:30 pm	Bait Use by American Black Bears in Northeastern Wisconsin: Applications of GIS, GPS Telemetry, and Remote Photography	Marci Johnson	49
2:30 - 2:50 pm	Activity and Resource Use of Male Grizzly Bears Detected by Global Positioning System Satellite Telemetry in Northern Alaska	Patricia E. Reynolds, Richard Shideler, and Harry V. Reynolds	50
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6:30 - 10:30 pm	***IBA dinner and folkloric dance***	Villa de Santiago	

SATURDAY NOVEMBER 10		
7:00am - 12:00pm	**Bear Specialist Group Meetings**	America & Africa Halls
12:00 - 1:00 pm	***Lunch On Your Own***	
1:00pm - 5:30pm	**Student Workshop - Bear Handling at Pastora Zoo**	From Holiday Inn Cintermex Parking Lot

SUNDAY NOVEMBER 11		
All Day	Airport Shuttle	Holiday Inn, other hotels

Session 1

Bear Research, Management, and Conservation in Mexico

Chair: Diana Doan-Crider

PAPER - 1

INVITED PAPER

BEARS IN MEXICO: YESTERDAY, TODAY, AND TOMORROW

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Prior to the 1970's, bear populations, both black (Ursus americanus) and grizzly (Ursus horribilis), suffered dramatic declines due to overharvest and poisoning. The last recorded and verified grizzly bear observation took place circa 1960 in the Sierra del Nido, Chihuahua, and is now considered extinct. The black bear is currently listed as endangered. Recently, however, black bear (ursus americanus) populations have begun to increase and expand into previously occupied historic ranges. Changes in land management philosophies and land tenure patterns have resulted in positive attitudes towards bears, and an increase in public awareness has resulted in increased government attention. Lack of information from previous surveys do not provide a qualitative database to determine how significant this expansion may be, however, reports since the early 1980's indicate that the population may be successfully recovering. Some areas, however, still remain unstable, and deserve research and management attention. We summarize historical patterns in distribution and status of the bear in Mexico, and address current and future needs to secure long-term survival for the species in Mexico.

[1]Formerly at Caesar Kleberg Wildlife Research Institute, MSC 218, Texas A&M University-Kingsville, Kingsville, TX 78363

PAPER - 2

THE BLACK BEAR IN A TROPICAL CLOUD FOREST: LOCAL COMMUNITY PARTICIPATION IN THE EL CIELO BIOSPHERE RESERVE PROJECT

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GUADALUPE MARIN BERRONES. Ejido San Jose, Reserva de la Biosfera El Cielo, Tamaulipas.

The southern limit of the black bear's (Ursus americanus) range in North America likely occurs in the El Cielo Biosphere Reserve (ECBR) of Tamaulipas Mexico. This 1444 km2 area is located in the transition zone between the Neartic and Neotropical bio-geographic regions and represents a unique landscape for the species. The ECBR is dominated by tropical dry forest; tropical semi-deciduous forest; cloud forest; and mixed oak and pine forests. Although the region was selectively logged during 1985, the extensive forests have experienced little fragmentation and support a variety of mast-producing species (e.g., in the genera Quercus and Carya). In addition, the forest supports jaguar (Panthera onca), puma (Puma concolor), and margay (Leopardus wiedii). A primitive road system links scattered human communities that exist in relatively small cleared areas and that make up well under 1% of the area. The juxtaposition of these Ejidos within the forest landscape provides the context for conflicts between people and bears. Crop depredations have led to bear poaching. In June and December 2006, we initiated a project that aims to engage the local community in studying and conserving the bear population. Already, support by local residents has occurred and the primary research technician and assistants live in the Reserve. During August of 2006 we captured and radio-collared (VHF) two adult bears including a female with 2 cubs. We evaluated the condition of both collared adults as poor or fair. All radio-tracking has been conducted by local residents. Preliminary results show crop visitation by collared and uncollared bears (using remote-sensing cameras) when corn is ripening. In one instance 40% of a field's crop was lost. Future work will examine the distribution and abundance of natural bear foods and the potential relationship between nutritional challenges, and body condition and crop depredation. Although food resources ranging from succulent bromeliads and acorns to insects seem abundant, other factors may affect the health and productivity of this peripheral population. Because corn appears to play an important nutritional role in this population, we are examining the use of electric fences and other deterrents to reduce conflict. Part of the solution may be payments to local farmers who set aside limited cropland for use by bears.

PAPER - 3

POPULATION DYNAMICS AND CORRIDOR PROTECTION FOR AMERICAN BLACK BEARS IN NORTHERN COAHUILA, MÉXICO SKY ISLAND

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The American black bear (Ursus americanus) is listed as an endangered species in México, with the exception of the population located in northern Coahuila in the Serranías del Burro, which is listed as a population with “special protection.” Black bear populations began a rapid decline in México during the 1940’s and 1950’s resulting in the extirpation of this species in many states. The decline was attributed to over hunting and loss of habitat. Remnant populations remained in the inaccessible mountain areas of northern Coahuila, particularly in the Maderas del Carmen and Serranías del Burro. Through these populations, natural recovery of black bear populations is occurring, and is evidenced by range expansion into adjacent Mexican mountains and across the Rio Grande into western Texas. Threats to recolonization are poaching, illegal take of cubs, and indiscriminate killing.We initiated a study to assess the population dynamics of black bears and to identify dispersal corridors. Our study site was located in the Maderas del Carmen, a sky island in the Chihuahuan Desert that lies 60 km south of the Texas border and the Big Bend Region of western Texas, and 165 km northwest of Muzquiz, Coahuila. Major objectives of our study are to identify and protect corridors used by black bears during dispersal. Other parameters of our study include determining the reproductive rates, mortality, home range, sex ratios, habitat use, diet and seasonal movement in relation to food availability of this sky island population of black bears. Our study began in 2003 and will continue through 2007. To date, 60 black bears have been captured with 34 being currently monitored with radio collars, in a mosaic of habitats from low Chihuahuan Desert scrub to high elevation montane habitat. Preliminary analysis indicates the population is growing rapidly with subadults making up 50%, adult males 31%, and adult females 19% of the captured population. The protection of ecological corridors in this area will be a major factor in the successful expansion and recolonizing of black bear populations in northern Coahuila and the adjacent Trans-Pecos Region of western Texas. Results of our study will provide additional information on Chihuahuan Desert black bear ecology at an international level that can be used by two countries managing black bears through the protection of vital ecological corridors.

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PAPER - 4

THE USE OF NON-INVASIVE TECHNIQUES TO STUDY THE ENDANGERED BLACK BEAR IN THE SIERRA EL TIGRE, SONORA, MEXICO

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Black bears (Ursus americanus) are considered endangered in Mexico. To preserve this species it is important to understand their movement across natural and artificial barriers. To address this issue we analyzed genetic variability and genetic relationships within the Mexico population, as well as potential connectivity with other black bear populations. We obtained 223 scats from “Rancho el Pinito” (Sierra El Tigre. Northern part of the Sierra Madre Occidental). We extracted DNA, then amplified 300 base pairs of the mitochondrial DNA Control Region and 12 nuclear microsatellite markers to detect genetic variability and the degree of relatedness among individuals within the population. These results were compared with data from other black bear populations in the sky island region of Arizona. The results of these analyses will be discussed.

PAPER - 5

SPATIO-TEMPORAL DISTRIBUTION OF BLACK BEAR (Ursus americanus) POPULATION IN THE CHIHUAHUA STATE

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Data regarding black bear (Ursus americanus) status and distribution in Chihuahua, Mexico are scarce and scattered. Protección de la Fauna Mexicana, A.C. (PROFAUNA) conducted a preliminary study to identify spatio-temporal distribution, preferred habitats and common threats for the species. The study started in December 2004 and finished in December 2005. Seventy five interviews were conducted among personal from federal agencies, hunting clubs, cattlemen associations, universities and research centers in order to map historical ranges for black bear distribution in Chihuahua and to identify current threats for the species. Sixty-seven potential sites for black bear presence were identified through interviews (n=75) in 5 geographic regions: three in the Sierra Madre Occidental, 1 in the central mountains of Sierra del Nido and Sierra de las Tunas, and 1 in the Desert Mountains of Chihuahua. We establish 45 transects (variable distance) in black bear country to estimate black bear abundance based on signs (e.g., scats, footprints, hair) and visual confirmation. Habitat characterization took place in those areas where black bear presence was confirmed. Field data suggest that black bears are present in most of the Sierra Madre Occidental, from Janos county in north-west Chihuahua until the sub-tropical forests of Sierra Tarahumara. In Sierra del Nido black bears are present in most of the area, from the southernmost place such as Riva Palacio county and Cumbres de Majalca National Park until Sierra del Pajarito and in Sierra Las Tunas. Black bear presence data in desert mountains confirmed this area as part of its historical distribution. Four habitat classes were established for forested habitats (i.e., very good, good, regular and poor) and 2 for desert ranges (i.e., good, marginal habitat during droughts). Spatio-temporal distribution data suggest that black bears continue to be present in most of its historical range (50 years), however, some historical range is no longer available due to changes in land use to favor forestry and livestock grassing (habitat fragmentation and disturb). Likewise, there are new areas, not included within its historical range, where black bears are present. Threats to black bear in Chihuahua come as a result of habitat fragmentation and lack of knowledge among rural people regarding black bear biology. As a result of this lack of understanding, wildlife-human interactions create negative attitudes among rural people towards black bears. This is the newer serious black bear research in Chihuahua state since decade of 1970, in that way, the information present here, is the base to future projects relatives to black bear manage, distribution, behavior, biology and populations dynamics into Chihuahuan country. As suggestions in order to conservancy the species, educational campaigns and control of recreational activities are strongly recommended, particularly in those areas found within black bear country. Further research in black bear population dynamics and habitat use are highly recommended.

Session 2

Bear Foods & Nutrition

Chair: Sean Farley

PAPER - 6

INVITED PAPER

WHY STABLE ISOTOPES?

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The use of stable isotope analysis in the study of wildlife migration and diets has dramatically increased in recent years. Nonetheless, the unparalleled advantages of this technique for elucidating the relations between the decisions made by individuals and the consequences of these decisions are rarely employed. In this presentation I will use examples from studies on bears and other carnivores to highlight the potential of using stable isotope analyses to tie the behavior of individuals to emergent properties of populations. I will also provide cautionary notes for the pitfall associated with isotope analyses and describe the newest empirical and analytical advances in the field.

PAPER - 7

DIETARY AND SPATIAL OVERLAP BETWEEN SYMPATRIC URSIDS RELATIVE TO SALMON USE

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We hypothesized that there would be minimal dietary overlap between sympatric brown bears (Ursus arctos) and American black bears (U. americanus) relative to salmon (Oncorhynchus spp.) utilization when alternative foods (e.g., fruits) are abundant. To maximize the chance that we would reject this hypothesis, we examined the diets of brown and black bears known to have visited salmon streams in the Kenai National Wildlife Refuge on the Kenai Peninsula, Alaska. Species, sex, and individual identification of bears visiting salmon streams were determined by DNA analysis of hair and feces collected in 2002–2004 along those streams. Diets were estimated from fecal residues and stable isotope analyses of hair. Assimilated diets of brown bears were 66.0% (SD = 16.7) salmon, 13.9% (SD = 7.5) terrestrial animal matter, and 20.1% (SD = 17.2) plant matter. Assimilated diets of black bears were 8.0% (SD = 5.4) salmon, 8.4% (SD = 9.7) terrestrial animal matter, and 83.6% (SD = 7.7) plant matter. Male and female brown bears did not differ in either the proportion of dietary salmon, terrestrial animal matter, or plant matter. The relative amounts of fruit residues in the feces of brown bears (87.0%, SD = 15.2) and black bears (91.8%, SD = 7.2) did not differ. Both sexes of brown bears visited salmon streams and consumed significant amounts of salmon, but only male American black bears visited streams and then consumed minimal amounts of salmon. Thus, brown bears were largely carnivorous and black bears were largely herbivorous and frugivorous. This reduced dietary overlap relative to salmon and fruit use is understandable in light of the concentrated, defendable nature of salmon in small streams, the widely dispersed, non-defendable nature of abundant fruits, the dominance of brown over black bears, the higher energy requirement of the larger brown bear, and, therefore, the differing ability of the species to efficiently exploit different food resources.

PAPER - 8

THE DIET OF BROWN BEAR IN ESTONIA AND COMPARISON WITH OTHER REGIONS IN EUROPE

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The diet composition and availability of food items influence population productivity, habitat usage and spatial structure of brown bear (Ursus arctos) populations. Moreover, in mosaic landscapes anthropogenic food items are often used by bears, leading usually to conflicts with humans. In Estonia, brown bears are protected, but hunting is allowed to avoid bear-caused damages to human properties. Therefore, information about brown bear food habits is essential for conservation and management purposes. Brown bear diet in Estonia has never been studied and the aim of this study was to examine several aspects of brown bear diet: composition of diet items, both plant and animal species, their seasonal availability and preferences, ratio of plant and animal proteins consumed by brown bears and their contribution to energy balance. We have also analyzed differences of brown bear diet between Estonia and several other countries where brown bear diet studies have been carried out. Taxonomic composition and seasonal variation of consumed food items were found using fecal analysis of 142 excrements, which were collected in 2003-2004 from north-east Estonia (core area for brown bears in Estonia). In addition 20 stomach contents, collected in 2003-2004, were analyzed. We used also a stable isotope method to estimate proportion of animal and herbal food items in bears diet, because of large variety and subjectivity in choosing correction factors in fecal analysis. We found 72 herbal, 1 fungal, and 31 animal taxa in the bear scats, whereas a vast majority of taxa were determined to species level. By energy content the most important food objects in spring were mammals (53% of Estimated Dietary Energy Content - EDEC), vegetation (16%) and cereals (14%). Insects were one of the most important food objects in summer being at the second place after mammals by energy content (EDEC 28% and 57%, respectively). Opposite to spring and summer the most important food objects in autumn were energy rich plants: cereal (53%), berries (19%) and apples (11%). Results of the isotope analysis indicate some degree of underestimation of animal food items in fecal analysis and these results will be discussed in detail. Comparison of brown bear diet of Estonia with those performed earlier in other countries, which use the same fecal-analysis methods, demonstrate that there exist both remarkable similarities and differences between various brown bear populations. These results will be presented and discussed in detail.

PAPER - 9

QUANTIFYING BERRY PRODUCTION USING DIGITAL IMAGERY ANALYSIS

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The link between bear-human conflict and poor berry production is well known by bear researchers and resource managers. Predicting such crop failures may become a significant asset as human activity continues to encroach upon important wildlife habitat. Much of the challenge in documenting year to year berry crop fluctuations has been the time and effort required to systematically count berries in a robust manner. This study investigates a new method to quantify berry production using digital analysis and a basic computer software program. Digital photographs were taken of buffaloberry (Sheperdia canadensis) bushes from sample plots as part of a larger project monitoring berry production in areas mechanically thinned for community fire protection. Berries were picked, and the count was recorded for each sample bush. Digital photographs were analyzed in Adobe Photoshop 5.0 by creating a histogram of the color signature of the berries. Tolerance levels of the color signature can be adjusted to allow more conservative selection thereby reducing error from non-berry pixels, and the berry pixels can then be tallied for the whole image. Results of the tally from the photographs showed good congruence with the actual count from individual berry bushes. Berry resolution was improved with proper lighting conditions and high-quality digital images, and better color signatures resulted from using plants with more than 20 berries with the consistent red color variation. Preliminary analysis indicates that using digital analysis for quantifying berry production has significant potential as a labor saving, low-cost and non-subjective monitoring regime. Further testing in 2007 will establish a standardized methodology.

PAPER - 10

EFFECTS OF FRUIT TYPES AND CONSUMPTION BY ASIATIC BLACK BEARS ON SEED DISPERSAL

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Forest-dwelling bear species are opportunistic foragers and mainly consume vegetation. Bears have been suggested as potentially important seed dispersers, which influence the recruitment, structure, composition, and diversity of plant communities in ecosystems through seed dispersal. However, very little solid evidence is available, especially for the threatened Asiatic black bears (Ursus thibetanus). Our study objective was to explore the role of Asiatic black bears in the mechanism of seed dispersal by examining the effects of fruit types and bear feeding behavior on seed germination. Seeds of seven fruits consumed by wild Asiatic black bears in Taiwan were extracted from fresh fruit (controls) and from scats of 4 captive adult Asiatic black bears (ingestion treatments). These fruits included various types: nut (Cyclobalanopsis glauca), prome (Eriobotrya deflexa, Malus doumeri), capsule (Machilus zuihoensis, Prunus campanulata, Viburnum luzonicum), and berry (Diospyros oldhamii). For each fruit species, each bear was fed the fruit every other day for 6 days. Germination tests for 3 of the fruit species were completed. Effects of the feeding process and fruit types on seed viability, germinability, and germination rate were measured against the controls. Germination tests of seeds, which required 3 months of chilling to break dormancy, were monitored for 3 months under incubator and green house conditions. Our result showed that the level of seed damage caused both by bear foraging and the digestive processes varied by fruit type. For nuts, most seeds were broken and few whole seeds were extracted from scats. Diospyros oldhamii and Machilus zuihoensis, seeds ingested by bears germinated about two times earlier than control groups (including those with the pericarp and without the pericarp), i.e., from 3 to 6 weeks. For control groups, seeds with pericarps removed geminated earlier and had higher germination rate than those without pericarps removed partly because of fungi infection on the latter. Germination rates of ingested seeds negatively related to damage levels (n = 4) of seed testa. For non- or slight-damaged seeds, seeds covered with pericarp remnants had lower germination rates. Among all groups, seeds with serious damage had lowest germination rate. Mean retention time of different seeds in bear digestive tracts was 23-26 hours. We also found that the germination rate of M. zuihoensis seeds, non- and slight-damaged, increased with the retention duration (n = 3 periods, 83%~86%, 83%~91% respectively). This indicated that the digestive process of bears may simulate prewarming of seeds, which generally causes germination enhancement. Further analysis of tested seeds will be presented. Because of the intensive movement and enormous consumption capacity of bears, their role in seed dispersal should not be underestimated. This study will help to evaluate the potential influence of this declining species in forest recruitment and will highlight this specie's importance in future ecosystem management.

PAPER - 11

LIMITS TO GROWTH? RESPONSE IN SKELETAL GROWTH AND BODY MASS OF JUVENILE AMERICAN BLACK BEARS TO PERIODS OF SEVERE FOOD SHORTAGE

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In many parts of their range, American black bears (Ursus americanus) experience periodic and sometimes severe food shortages, due to stochastic variation in wild fruit and nut production. Adult bears typically show little or no lasting effects from such annual fluctuation, though females may sacrifice reproduction following years of particularly poor foods. However, young bears, in addition to building fat reserves each year for hibernation, must also maintain skeletal and muscular growth through unpredictable times; their ability to do so may affect their age of maturity. Hence, food conditions may have both short and long term effects on reproduction and thus, population growth.

PAPER - 12

INVITED PAPER

FATTY ACID SIGNATURE ANALYSIS AND THE STUDY OF BEAR FORAGING: APPLICATION, METHODOLOGY, AND OPPORTUNITIES FOR FUTURE STUDY

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Accurate information on predator diets is essential to understanding the structure and functioning of ecosystems. The diets of many bear species may be extremely diverse and the trophic linkages between bears and other food web components are not always clear. Without accurate information on bear foraging patterns, the development of effective management and conservation strategies, as well as a thorough understanding of the ecological role of bears, may be impossible. Much of our current knowledge of bear diets has come from opportunistic observations of feeding events, identification of prey remains, scat analysis, and the stomach contents of harvested bears. These techniques generally provide an unequivocal identification of food type. However, they are difficult to apply systematically and provide only a snapshot of recent diet that does not necessarily reflect longer-term patterns. Providing a more integrative picture of overall diet, fatty acid signature analysis and stable isotope profiles are based on the molecular incorporation of dietary components into the tissues of the predator. Stable isotope ratios have been widely used to examine the diets of bear species around the world. Less widely-used is fatty acid signature analysis, a technique based on the fact that many dietary fatty acids (FA, the primary components of lipids) are predictably incorporated into the adipose stores of a predator. The overall FA profile (or “signature”) of the predator will therefore reflect the FA composition of its prey and can be used to identify diet composition. To date, FA signature analysis has seen limited use in studies of bear ecology, having been applied only to black bears (Ursus americanus) in the eastern United States and polar bears (U. maritimus) in the Canadian Arctic. However, these few studies have illustrated the robust applicability of this powerful new technique. Here, I will review how FA signature analysis has been used to (1) make inferences about temporal and spatial patterns of bear foraging, (2) identify specific dietary biomarkers that reflect the consumption of particular prey, and (3) generate quantitative estimates of bear diet composition using a statistical mixing model. I will discuss some of the technical and methodological issues surrounding the analysis and interpretation of FA signatures and suggest how this cost-effective technique can be further developed to provide an accurate picture of the ecological role of bears in a variety of habitats.

Session 3

Polar Bears

Chair: Elizabeth Peacock

PAPER - 13

INVITED PAPER

POLAR BEARS AND CLIMATE CHANGE

MARTY OBBARD, Ontario Ministry of Natural Resources

The effect of climate change on polar bear populations remains controversial despite compelling evidence of changes in sea ice that have already occurred and are predicted to occur in the near future. The presentation will briefly discuss the controversy, and summarise the evidence of the influence of climate change on various polar bear populations. Populations in Hudson Bay, the most southerly in the world, will be discussed in detail.

PAPER - 14

CHANGING SEA ICE-SCAPES AND POLAR BEAR HABITAT IN FOXE BASIN, NUNAVUT TERRITORY, CANADA (1979-2004)

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Sea ice conditions have been changing throughout the Canadian Arctic. Recent analyses have shown reduced ice coverage and changes in freeze-up and ice-free dates in Foxe Basin and adjacent Hudson Bay. The observed changes in sea ice have been correlated with climate change. The effects of climate change on available polar bear (Ursus maritimus) sea ice habitat have received little attention to date. Connectivity of habitat in the Foxe Basin study area is important for conservation and management of polar bears, as Foxe Basin has been delineated as a polar bear subpopulation. In this paper we apply approaches used in landscape ecology to quantify the changes in available habitat, to evaluate the importance of changes, and to develop an approach to forecast future available habitat. Available polar bear sea ice habitat in Foxe Basin, Nunavut Territory was studied using trend and landscape fragmentation analyses for the period 1979-2004. Monthly (October – June) sea ice concentration maps, derived from satellite images, were reclassified to four polar bear habitat classes using ArcGIS 9.1: sea ice class 1 (0-30% or open water), sea ice class 2 (30-60% or very open ice), sea ice class 3 (60-85% or open ice) and sea ice class 4 (85-100% or closed ice). The area of each sea ice habitat class was calculated by month and year. Over time, least squares regression analysis showed significant decreases in the total area of available habitat of sea ice classes 3 and 4 in November, December, May and June. Mean annual air temperature was significantly correlated with amount of available sea ice habitat in October, November and December. Landscape metrics were calculated using FRAGSTATS to assess fragmentation of polar bear sea ice habitat. During the study period, the number of patches of all sea ice habitat classes increased and the mean patch size of sea ice classes 3 and 4 decreased in November, December, January, May and June. Overall, available polar bear habitat (sea ice classes 3 and 4) in Foxe Basin during fall and spring is decreasing and becoming increasingly fragmented. These results together with the landscape patterns of sea ice habitat will be discussed within the context of identifying future scenarios for polar bear movements across Foxe Basin.

PAPER - 15

FACTORS INFLUENCING SPATIAL AND TEMPORAL DISTRIBUTION OF POLAR BEARS DURING THE FALL OPEN-WATER PERIOD IN THE SOUTHERN BEAUFORT SEA

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Widespread changes in sea ice conditions have recently been documented throughout the Arctic raising concerns that these changes could impact marine mammal distributions and population health. Polar bears, which are known to be highly dependent on sea ice as a platform for hunting seals, may be particularly susceptible to changes in sea ice conditions. In some parts of their range, such as Western Hudson Bay, increases in the length of the open water period have led to increased duration bears spend on land. Though historically bears in these areas have spent the fall open water period fasting on land, increases in the duration of their stay on land has resulted in declines in body condition and reproduction. In other polar bear populations, such as in the Southern Beaufort Sea, polar bears have historically rarely come onshore, but in recent years have exhibited increased land use during the fall open water period. To better understand the extent of this change in fall distribution and the possible causes and implications, we investigated the relationship between spatial and temporal variation in sea ice conditions and land use by polar bears in the Southern Beaufort Sea. Aerial surveys were conducted once/week for a 5 week period between mid-September and late October in 2000-2005 along the barrier islands and shoreline between Barrow, Alaska and the Canadian border. An average of 55.8 bears were observed per survey representing 3.7% of the Southern Beaufort Sea population and as many of 114 bears or 7.6% of the Southern Beaufort Sea population came on land during the study. Temporal responses both across surveys within a year and among years were negatively correlated with the distance to pack ice of ≥50% concentration from the shoreline in the fall. Thus, the number of bears on land increased when sea ice ≥ 50% concentration was further retracted from the shore. Sixty-nine percent of bears observed occurred within 15 km of subsistence-harvested whale carcasses at Barter Island. However, despite consistent availability of whale carcasses across all years, polar bear abundance on land varied. Spatial distribution did not appear to be related to the presence of whale carcasses alone. Two other communities, Cross Island and Barrow, harvest bowhead whales during this time period, yet bears were highly concentrated at the Barter Island site only. In addition to the availability of whale carcasses at Barter Island, this site had the highest density of ringed seals in offshore waters. We suggest that spatial distribution may be related to availability of whale carcasses and future access to ringed seals once land-fast ice forms. The relationship between annual variation in the distance to pack ice and polar bear density on land suggest that long-term reductions in ice conditions could result in an increasing proportion of the polar bear population in the Southern Beaufort Sea coming on land during the open-water period. The implications of increased land use by polar bears in this area may be mitigated by the opportunity to forage on subsistence-harvested bowhead whale carcasses although other risks such as extended open water swimming and increased potential for intra-specific stress and bear-human interactions may also be involved.

Session 4

Population Estimation

Chair: Marty Obbard

PAPER - 16

DNA-BASED DENSITY ESTIMATE FOR GRIZZLY BEARS IN GLACIER NATIONAL PARK, MONTANA

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Grizzly bear (Ursus arctos) population size in Glacier National Park (GNP) in northwestern Montana, USA, was last estimated in 1971 using sightings of unmarked bears. We estimated the density and describe the distribution of the population in 1998 and 2000 on 8,362 km2 in and around GNP using hair sampling in conjunction with microsatellite analysis to identify individual bears. We employed two methods concurrently to collect bear hair. We distributed ~625 baited barbed-wire hair corrals each year on an 8x8 km grid to systematically sample the study area during 5 14-day sessions. Hair corrals were moved to a new location within cells after each session to decrease the likelihood of a behavioral response to snag sites. The second sampling method collected hair at 2-4 week intervals from over 1,000 unbaited bear rub trees along trails. From the 7,071 and 9,976 hair samples collected in 1998 and 2000, respectively, we identified 204 and 231 individual grizzly bears. Bear rub and hair corral sampling datasets were analyzed independently and jointly with Huggins closed mixture models in program MARK, and using the Lincoln-Peterson estimator. Density was corrected for lack of geographic closure based on the proportion of time that 65 radio-collared bears spent on the sample grid. All models and both datasets produced estimates of similar magnitude, but precision was greatest for the joint data/Huggins model. Grizzly bear density was highest within GNP and lower outside the park where the majority of mortality occurred. Grizzly bear density in GNP is among the highest reported for interior (non-salmon supported) brown bear populations in the world. This study provides baseline information important for managing one of the few remaining populations of grizzlies in the contiguous United States.

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INFLUENCE OF PAST LIVE CAPTURES ON DETECTION PROBABILITIES OF GRIZZLY BEARS USING DNA HAIR SNAGGING METHODS

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The use of hair-snag DNA sampling to estimate large grizzly bear (Ursus arctos) populations has resulted in vastly improved population estimates in Canada and the United States. However, often live capture of carnivores has also occurred in these areas using leg snaring techniques that are similar to the DNA hair snag sites used to sample DNA. This has resulted in some biologists questioning whether previously captured bears are detectable by DNA sampling efforts. We applied occupancy models to compare detection probabilities of previously collared grizzly bears with bears detected in DNA hair-snag sites that were not previously collared. Given the similarity of occupancy model estimators to closed population size estimators it is possible to use bears rather than sites as the sample unit for estimation. By doing this, bears that are suspected to be in the study area but not detected in DNA hair snags can be included in the analysis with subsequent gains in test power (by modeling their probability of occupancy). We applied this method to data from DNA mark-recapture studies conducted in Alberta in 2004 and 2005 where 41 bears had been collared prior to DNA sampling, but only 17 were known to be on the grid during DNA sampling. We found that previously captured bears had lower detection probabilities, although their detection probabilities were still >0, implying that they were still visible to be sampled via the DNA hair snag grid. Bears that were snared for live capture had the lowest detection probabilities and bears that were heli-darted had moderate detection probabilities. This level of power and resolution to detect differences in detection probabilities was not possible with traditional mark-recapture methods. To obtain relatively unbiased population estimates for DNA surveys, this source of individual heterogeneity should be accounted for in the population estimator. We discuss potential methods of modelling this form of heterogeneity variation. We also discuss implications of this work to other radio-collar based studies or studies that use mark-recapture estimation to estimate population parameters and population size.

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OPTIMAL ALLOCATION OF RESOURCES IN A HIERARCHICAL SAMPLING DESIGN FOR ESTIMATING BLACK BEAR DENSITY: A CASE STUDY IN MIDDLE GEORGIA, USA

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An optimal sampling design, which we define as the design that maximizes the ratio of accuracy to cost, allows limited resources (e.g., time and money) to be allocated efficiently. We present an algorithm for designing an optimal hierarchical study through a mixture of simulated and field data from 5 sampling periods (2004-2006) in a model designed to estimate black bear (Ursus americanus) density in Middle Georgia. The sampling design includes 2 noninvasive techniques (DNA hair snares and digital cameras) placed in a trapping web design, with replicated trapping webs located throughout the study area. The study design incorporates monitoring bears with telemetry collars (n=83) for presence in the webs during sampling periods. Project costs include 2 components (field and laboratory) when genetic noninvasive samples are used. Therefore, optimization occurs both at the field (number of hair snares/ cameras per web, number of webs, and trapping occasions) and laboratory (number of hair samples and loci for genetic analysis) levels. Therefore, density estimates must also account for genetic error present in the study. We found a trade-off between increasing the number of sample observations and percentage of the population sampled, which increases accuracy of density estimates, versus the costs (e.g. money, time) required to obtain those estimates. This algorithm will aid a bear project coordinator with developing an optimal sampling design, based on both project objectives and the amount of resources available.

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BROWN BEAR POPULATION SIZE AND DISTRIBUTION IN EASTERN INTERIOR ALASKA

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In 2004, the Alaska Board of Game authorized a grizzly bear (Ursus arctos) population control program within 10552 km2 (control area) in eastcentral Alaska to increase moose (Alces alces) numbers. The program was initiated in spring 2005 but only 2 grizzly bears were harvested. To evaluate the potential effectiveness of continued management, we sought to obtain an unbiased and precise estimate of grizzly bear numbers and distribution within the control area prior to possible treatment effects. During 1986, a radiotelemetry study of grizzly bear predation on moose calves estimated grizzly bear density in a 4000-km2 portion of the study area at 12-16 grizzly bears/1000 km2 and found that bears were distributed throughout the area. In 2004, wildfires mildly to severely burned 31.2% of the control area. During May-July 2006, we used DNA mark-recapture sampling to obtain population estimates and evaluate coarse-scale distribution of grizzly bears across a 5194-km2 study area (33.2% affected by the 2004 wildfires) within the greater control area. We sampled 106 7x7 km sample unit cells with 1 baited hair trap site in each for 4 sampling periods. We captured hair from 56 individual grizzly bears (28 males; 28 females) 1-6 times. The superpopulation estimate derived from the study area was 78 grizzly bears with an upper 95% confidence limit of 106. The core popu1ation estimate was 53 bears with an upper 95% confidence limit of 70 (10.7-13.4/1000 km2). We identified grizzly bear hair at 77 sites and there were significantly fewer captures in areas that were burned by wildfire or prescribed burns during the last 7 years (P=0.01). We used a generalized linear mixed model to investigate the effects of large scale fire (>120 km2) on capture probabilities. Capture probabilities were significantly less for traps set in burn habitats at least 1.6 km from the edge compared to traps set in non-burned or along the edge of non-burned/burned habitats. Furthermore, the juxtaposition of the minimum convex polygon home ranges and the mean bear capture location of bears caught multiple times indicated that both male and female grizzly bears avoided large recent burns although males did travel across. This avoidance of recent burns apparently has resulted in reduced grizzly bear numbers in the control area. We conclude that large recent burns have been more important than harvest in reducing grizzly bear numbers and may become a more important factor than harvest in reducing grizzly bear predation on moose calves. We infer that the avoidance of burns by grizzly bears is likely the primary cause of increased moose density in the Teslin (Yukon, Canada) and Ladue burns (eastcentral Alaska), where moose densities reached relatively high levels (417-490/1000 km2) without predator control.

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ESTIMATING REPRODUCTIVE RATES FOR FEMALE BEARS: RATIOS VERSUS TRANSITION PROBABILITIES

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Estimating reproductive rate is an important element in understanding the demographic status of any bear population. These rates have been traditionally estimated by marking a sample of individuals with radio collars and tracking them for the life of the transmitter. Rates of reproduction have been estimated in various ways, but all essentially calculate a ratio of female cubs produced by the number of females in the sample. Inherent in these calculations is the assumption that the sample is representative of the female population at large. We compare methods used to estimate reproductive rate, comparing the ratio method with a method that estimates transition probabilities and steady state conditions. The later is unaffected by capture heterogeneity among states. We use examples from 2 study areas (Greater Yellowstone Ecosystem, WY, MT, ID,and Kenai Peninsula, AK), with 2 bear species (grizzly Ursus arctos, and black Ursus americanus) and discuss the effect of capture heterogeneity on both estimators. We concluded that reproductive rates are more accurately estimated using transition probabilities and steady state conditions if studies are short in duration, capture heterogeneity is evident, or individual bears in the sample are not recollared for the duration of the study.

Key words: black bear, grizzly bear, reproductive rates, transition probabilities, Ursus americanus, Ursus arctos.

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BROWN (GRIZZLY) BEAR MANAGEMENT IN ALASKA: PERSPECTIVES OF FOUR RETIRED ALASKA FISH AND GAME DEPARTMENT BIOLOGISTS

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In Alaska, management of brown (grizzly) bears (Ursus arctos) and other large carnivores has undergone marked changes over the last 30 years. These changes result from the increasing influence of some politicians, managers and hunter groups who believe that bears should be managed as undesirable predators and competitors for ungulate game species (primarily moose and caribou). In this paper, we focus on the changes in brown/grizzly bear management over this period from the perspectives of biologists who formerly worked on bears as researchers and managers for the Alaska Department of Fish and Game. We document trends by comparison of regulations in effect during 1975, 1985, 1995, and 2005 with additional information provided to document changes adopted through 2008. We document statewide trends in the geographic extent of liberalized hunting seasons, increased bag limits, elimination of tag fees for resident bear hunters, issuance of “control permits” allowing additional kills by permittees, legalized baiting of grizzly bears, legalization of the sale of bear parts, and the impacts of these changes on harvest numbers. We also document trends in more recent but similar changes in black bear (Ursus americanus) harvest regulations including (effective in 2008) legalization of the killing of females with cubs and cubs unlimited bag limit in one portion of Alaska. We further document declining trends in funding for bear research and monitoring by the Alaska Department of Fish and Game during the period of increasing liberalization of hunting regulations. Trends in hunting regulations and bear management since the late 1970s raise concerns over the conservation and management of Alaskan grizzly bears over the long term. Legal mandates from the Alaska legislature and from members of the Alaska Board of Game give Alaskan game managers little flexibility to reverse the trends toward aggressive management of bear harvests. Since at the same time regulations are being liberalized, funds to assess trends in bear numbers are declining, we are unable to report or document whether liberalizations of regulations are resulting in changes in bear abundance. We recommend new approaches toward bear management in Alaska that we hope will avoid repeating some of the mistakes in bear management that occurred in the lower 48 states during the last century. With enlightened proactive conservation efforts and preventative management, Alaska can remain a stronghold for the grizzly in North America and a model for bear conservation throughout the world.

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REGIONAL-BASED RESEARCH AND MANAGEMENT OF SMALL, FRAGMENTED, AND THREATENED CANADA-USA TRANS-BORDER GRIZZLY BEAR POPULATIONS

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Trans-border grizzly bear (Ursus arctos) populations in the Selkirk and Purcell Mountains across the Canada-US border are small, fragmented, and threatened. As part of recovery efforts, we used DNA survey techniques, GPS radio telemetry, and ecological modeling to update their conservation status and initiate management solutions in the surrounding region. We have learned that it is equally important to research and manage populations immediately adjacent to these threatened populations for effective recovery due their small size and fragmented status. We report 5 years of work to estimate population size, density, and GPS radio collar-derived resource selection function (RSF) modeling used to identify linkage habitat and underpin access management in 2 threatened populations and in adjacent populations. We surveyed 148 individual grizzly bears in 5 DNA surveys and generated population and density estimates with confidence intervals using meta-analysis methods for an extended area across 2 mountain ranges. We used GPS radio telemetry to correct for closure violation in our DNA surveys and ecological modeling to extrapolate estimates to appropriate management units. Beyond determining the current population status of the trans-border populations, our estimates have shown that hunt quotas in areas adjacent to threatened populations are high by a factor of two. Our results have stimulated government managers to lower hunt quotas to appropriate levels and create no hunt buffers around threatened populations (within adjacent areas) to increase population sizes and enhance linkage movements. To further enhance connectivity between threatened populations and adjacent areas we used 18,000 GPS radio location data to develop seasonal RSF models to predict linkage habitat across fracture zones in this fragmented region. With these fine scale models we have identified specific linkage zones that were corroborated with fine scale movement data. We used these results to initiate comprehensive linkage management including direct purchase of important habitat and special management actions by timber companies and government designed to improve security and reduce mortality risk within linkage zones. And finally, we are using our GPS radiocollar-derived RSF models to underpin access management by optimizing high quality bear habitat needs with human economic and recreational needs in habitat within and adjacent to the threatened populations. Our research incorporates both DNA sampling and GPS radio collaring, drawing on the strengths of each methodology. Pour results have led to direct improvements in bear management in the trans-border area, particularly within Canada. Extending our focal area beyond the borders of these threatened populations has demonstrated the need to government managers to apply appropriate management action to both the threatened populations and the surrounding area. We anticipate that our international effort will turn these populations around toward real recovery.

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VULNERABILITY OF SCANDINAVIAN BROWN BEARS TO HUNTING – WHAT DISTINGUISHES THE MORE FROM THE LESS VULNERABLE?

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Although managers are usually concerned with the impact of harvest on population growth through the removal of individuals, selective harvest – based on demography or life history traits – can have additional important consequences for populations. In the short-term, the rate of growth and other features of a population can be impacted through changes in the sex/age structure, and in the long-term, selective processes that favor certain life-history traits over others can alter the genetic and phenotypic makeup of a population, affecting its growth trajectory and survival.
Since the 1980s, the Scandinavian brown bear (Ursus arctos) population has been intensely monitored. Hunting brown bears is legal in Sweden, were a fall season results in the harvest of approximately 5.5% of the estimated population. A recent analysis harvest data from Sweden showed differences between males and females in terms of the variables that explained the age of harvested bears, as well as complex interactions between hunting method (bait, dog, stalk, and still), type of hunt (targeted vs. incidental), and geographic region in terms of the number of bears harvested. While careful analysis of harvest data can provide insight into the relative vulnerability of various population cohorts, an absolute measure of vulnerability can only be attained by incorporating information about the demographic makeup (or other measure of interest) of the population from which the harvest sample was drawn. There are few studies on bears that have been able to interpret harvest data in the context of a known (i.e. marked) population. The Scandinavian brown bear project has collected a unique dataset with information on over 500 individuals (as of 2006), spanning 22 years of capture-mark-recapture, radio-telemetry, and tag-recovery. Here we present the results of an analysis of these data, with focus on differential vulnerability of brown bears to the harvest. Specifically, we identify and discuss demographic and life history traits that make brown bears more or less vulnerable to hunting.

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TRANSLOCATION AS AN ENGINE OF CONSERVATION

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Translocations of bears are complex actions that require a rigorous planning, are in general very costly, and have often limited chances of success. However – apart from the obvious biological effects – translocations can have significant consequences in terms of conservation policy, both at the local and regional scale. In the present paper we synthesise the main results of the translocation carried on in the Central Alps in terms of social, economic, and organisational effects at the local and regional level, as well as for the development of a coordinated policy at the national and transboundary scale. The translocation carried on in the 1999-2002 period in Trentino is having encouraging results in demographic and biological terms. After the release of 9 animals was completed in 2002, the population showed a constant increase and good reproductive rate, and in 2006 we recorded the presence of 24 individuals. In order to carry on the project, the competent local authorities – also to respond to the obligations deriving from the Italian and European legal frameworks - set up, in coordination with the neighbouring administrations, a bear management policy based on damage prevention and compensation, training of staff, creation of an emergency team, monitoring programmes, and a communication strategy. The establishment of such a framework of actions required a revision of the local wildlife legislation, and the approval of an adequate budget. Several opinion polls carried on before and after the translocation show that, largely as a consequence of the communication and management efforts carried out by the competent authorities, the support of the public opinion to the project remained high. Also in regard to the increase of the population and of the consequent movements of individuals outside Trentino, all the Alpine local administrations started the establishment of a coordinated action plan for the Central and Eastern Alps, largely based on the bear management framework developed in Trentino. In 2007 a draft Action Plan has been approved by the Italian Ministry Environment, and by the technical departments of all Alpine local administrations (regions, provinces). The formal endorsement of the plan is being presently discussed at the highest political local and national levels. The movements of some individual bears from Trentino to several neighbouring countries (Switzerland, Austria, Germany) and the impact on the public opinion of the kill in 2006 of a young male (JJ1) in Bavaria (Southern Germany), led the authorities of all the alpine countries (France, Switzerland, Austria, Italy, Liechtenstein and Slovenia) to start discussing a coordinated bear policy in the region, based on agreed procedures for exchanging information on animals movements, coordinated monitoring programs, and agreed basic management criteria. For this aim several international meetings have been organised in Italy, Switzerland, Liechtenstein and Germany. In conclusion, this case shows that a translocation can play a major role for promoting increased commitment and involvement by the competent authorities, capacity building of technical staffs, more effective and sound bear conservation and management, development of coordinated policies at the local, national and transboundary scale.

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INCORPORATING DEMOGRAPHIC AND GENETIC DATA TO PROJECT GENETIC DIVERSITY, INBREEDING AND VIABILITY OF A SMALL TRANSLOCATED BROWN BEAR POPULATION

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The brown bear (Ursus arctos) population currently expanding in the Italian Alps is a translocated population founded by 9 individuals. The founders originated from Slovenia where a larger bear population exists, and were released in the Western Trentino region of Northern Italy between 1999 and 2002. Since the translocation plan was completed, the brown bear population in the Italian Alps has increased to more than 20 individuals. The population is currently geographically isolated from the neighboring brown bear populations of Austria and Slovenia, and habitat fragmentation due to roads, agriculture and developed areas seriously limit connectivity among these regions. If the current conditions of isolation persist for the bear population in the Italian Alps, the initial level of genetic diversity measured at the time of translocation will decrease and inbreeding will increase as a consequence of mating between relatives and reduced effective population size. This can be of great concern for the viability of the population due to the effect of the reduction of genetic diversity on fitness related traits. Therefore monitoring the level of genetic diversity and inbreeding as well as predicting the rate of change for these parameters is of critical importance for ensuring proper conservation and management actions for this population. We will present demographic and genetic data obtained for the small brown bear population of Northern Italy and integrate these data sets to model possible trajectories of genetic diversity, inbreeding and viability with and without migration. The demographic and the genetic data were obtained as a result of a comprehensive monitoring project based on noninvasive genetic sampling carried out between 2002 and 2006. A total of 1549 hair and fecal samples collected in the field were processed for genetic analyses during this study period. Demographic information include: minimum number of bears on the study area, reproductive, survival, and mortality rates, minimum age of reproduction, inter-birth interval, litter size, and sex ratio in each year. No immigration was documented over the course of the study. Genetic data include measures of genetic diversity, inbreeding and effective population size estimates, and the pedigree of the population as reconstructed from parentage analyses of individual bears identified from genetic sampling. The results of this study highlight the importance of connectivity of the Italian population with the neighboring populations in order to maintain genetic diversity and to counteract the negative effects of inbreeding. If natural migration does not occur in the short term, translocation of additional individuals may become necessary. This study is being carried out in co-operation with the University of Idaho, the Italian Wildlife Institute (INFS), the Trento Province (PAT) and the Parco Naturale Adamello Brenta (PNAB). This project received funding from the IBA Grants Program.

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REHABILITATION AND RELEASE GUIDELINES FOR ORPHAN BEAR CUBS

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In recent years, black bear (Ursus americanus) populations have increased in numbers and distribution across much of North America and brown bears (U. arctos) are expanding in Norway, Sweden and other parts of Europe. However, bears in many parts of the world have been eliminated from 50 – 75% of their historic range and population insularization due to habitat fragmentation continues to pose a threat in many countries. Protection of small isolated populations of bears is important, but their chances for long-term survival are diminished without intrusive habitat and population management programs. Biologists in the United States and Canada have been involved in releasing orphaned black bear cubs into occupied bear habitat in North America for more than 3 decades. More recently, biologists in several European, Asian, and South American countries have also experimented with releasing brown bears, Asiatic black bears (U. thibetanus), sun bears (Helarctos malayanus), Giant Pandas (Ailuropoda melanoleuca) and Andean bears (Tremarctos ornatus). Bears are known to survive in the wild after being orphaned at ages greater than 5 months. However, However, much of the information on survival and behavior of released cubs is anecdotal and has not been thoroughly reviewed to assess their conservation implications. During the spring of 2007, scientists and bear rehabilitators with experience raising, releasing and monitoring orphan bear cubs for seven of the eight species of bears in the world gathered in the Tver Region of Russia for a workshop to identify issues related to orphan bear cub releases and to ascertain the critical components of a bear rehabilitation program that have contributed to the successful release of orphaned bears cubs. In this paper, we will discuss the short- and long-term implications of release programs on wild bear populations, factors associated with decisions about the suitability of orphaned bear cubs for rehabilitation and release back to the wild, and components of an intervention plan designed to minimize risks associated with the release of orphaned cubs. We also present guidelines for establishing a model program for raising, releasing, and monitoring orphaned bear cubs released back to the wild.

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PRAGMATIC MANAGEMENT CAN CONSERVE LOW PRODUCTIVE HIGH-ALTITUDE BROWN BEARS IN SOUTH ASIA

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The high-altitude Deosai Plateau was declared as Deosai National Park (DNP) in 1993 to give protection to a declining population of brown bear, a highly threatened species in Pakistan. Although local communities depend on natural resources for their livelihood, present legislation prohibits resource extraction from a national park, raising conflicts between management and local people. However, a pragmatic approach was adopted, recognizing community rights and involving people in management. The population of the brown bear was set as indicator of park success, and monitored annually from 1993 through 2006. We observed growth of the brown bear population (5% annually), which was product of both reproduction and immigration.

We documented extremely low reproductive performance in the Deosai population, due to late age of reproduction (8.25 years), long reproductive interval (5.8 years), and a small litter size (1.33). The family association (4.2 years) is the longest ever reported for brown bears and might have contributed to higher survival of young (0.94 and 0.96 for cubs and yearlings, respectively). The reproductive potential of the Deosai population is about one-fourth of that of the Scandinavian populations. Poor habitat quality, low quality food, high seasonality, and extreme weather conditions in the Himalaya probably explain poor reproductive performance.

The recovery of the brown bear population in Deosai is significant, because brown bears are low productive and declining throughout their range in South Asia. The DNP sets a rare example of successful cooperation between an NGO, people and the park management. Brown bear conservation efforts in South Asia must target controlling human-caused mortalities, particularly of adult females. Involvement of people can increase efficiency in conservation, in addition to reducing cost and conflicts.

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MANAGEMENT OF CHUM SALMON FOR BROWN BEARS AND OTHER FISH AND WILDLIFE AT MCNEIL RIVER, ALASKA

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Salmon are an important food resource for many wildlife species in Alaska, including bears (Ursus spp.). Since 1967, the McNeil River State Game Sanctuary has been managed by the Alaska Department of Fish and Game (ADF&G) to provide permanent protection for brown bears (Ursus arctos). Few places in the world provide such a dramatic example of how direct the relationship between bears and salmon can be. Chum salmon (Oncorhynchus keta) provide the principal food resource for the extraordinarily large number of bears that gather annually along lower McNeil River. Up to 144 brown bears have been identified in one year and 72 have been seen at once in the vicinity of McNeil Falls. However, consistently low chum salmon escapements into McNeil River since 1988 have led to annual closures of the commercial fishery and are implicated as a factor contributing to a recent decline in bear use at McNeil Falls. In 2005 and 2006, 155 chum salmon were radio tagged and tracked daily to monitor time and cause of death. Chum salmon capture rates by bears at McNeil Falls were also recorded over the same time period. Below the falls, bears consumed 99% of all tagged fish, killing 48% of them before they spawned. We recommend an additional 23,000 chum salmon be added to the escapement goal at McNeil River to account for this pre-spawning mortality. Obtaining optimal spawning escapements should help ensure a reliable food resource for McNeil River bears and maintain high chum salmon productivity. Finally, this project may also serve as a model for other systems throughout Alaska where salmon escapement goals may not be adequately accounting for broader wildlife and ecosystem needs.

PAPER - 29

GRIZZLY BEAR POPULATION ECOLOGY IN DENALI NATIONAL PARK AND PRESERVE

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Study of a naturally regulated population of grizzly bears (Ursus arctos) has been ongoing in Denali National Park and Preserve since 1988. Vital rates were calculated based on observations of adult females, subadult females, cubs, and yearlings. The reproductive rate (0.3477), mean litter size (2.02), and adult female and cub mortality rates have remained relatively stable. Mortality of spring cubs (0.65) and yearlings (0.40) was high. Mean adult female and subadult female mortality rates were estimated to be 0.04 and 0.07. The population trend estimated from these vital rates suggested that the population of grizzly bears has declined slightly over the 19 years of study. Management implications for the Park and surrounding areas are provided.

PAPER - 30

MAPPING BEAR DISTRIBUTIONS: MESHING HARD DATA AND EXPERT OPINION

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Delineating the geographic range of species and populations is fundamental to understanding ecological and human-imposed limits on distribution, planning coordinated range-wide conservation efforts, and monitoring effects of conservation initiatives, or the lack thereof. Beginning in late 2006, we collaborated with 67 national experts (on bears and other wildlife) from throughout Asia on a project to demarcate the past and current ranges of four species of Asian bears (Ursus arctos, U. thibetanus, Melursus ursinus, Helarctos malayanus) using a modified version of the range-wide priority-setting methodology that has been previously applied to a number of other species. Published maps and expert knowledge were utilized to define the historic ranges of these four bears, which spanned 35 countries. We then asked the experts to provide known, recent point locations of bears (from sightings, photos, kills, definitive sign, etc.) from their geographical area of expertise, and from these, delineate areas of definite occupied range, probable range, extirpated range, and remaining "unknown" areas within the historic range, following definitions that we provided. A workshop was subsequently convened where the experts could confer with others from their own and neighboring countries to revise their preliminary range maps. After the workshop, we produced revised maps, which were sent back to the experts for review, clarification, and further revision. Ultimately, an up-to-date range map was created, including metadata for each point location and expert-derived range polygon. What became clear and interesting, however, is how differently experts treated their own data and interpreted the defined range categories. On one extreme, definite range was ascribed only to specific reserves where bears were known to occur, whereas all areas outside reserves without recent point observations were considered extirpated. On the other extreme, some experts filled in large areas of probable or even definite range well beyond the extent of their point data. Only a few experts made use of the "unknown" category. These disparities may well be real, as countries differ enormously in suitability of habitat in the areas outside reserves, and also in the extent of existing knowledge about these areas. But it is also apparent that the mapping was influenced by differing personalities of the experts, their level (or self-perceived level) of expertise, and their culture. We discuss the implications of these factors in terms of ecological understanding and conservation monitoring, and compare the pros and cons of expert-based range-mapping to a habitat modeling-based approach to mapping.

Session 6

Bear Behavior

Chair: Piero Genovesi

PAPER - 31

SOCIAL ORGANIZATION IN THE BROWN BEAR; VARIATIONS ON THE THEME OF TERRITORIALITY

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Bears are generally considered to be social, nonterritorial carnivores with overlapping home ranges that can congregate at abundant food resources. Although the results of some recent research have modified this view, we still know very little about the social organization of bears. Here we summarize results from a long-term (>20 years) study of individual brown bears (Ursus arctos) and their progeny, for up to four generations, on two study areas combined with density estimates around each individual bear and relatedness data from DNA analyses from throughout the population. With this data set, we are able to document that females in brown bear populations are genetically structured at the spatial scale of three generations of dispersal. Female matrilines show two levels of organization; matrilinear aggregations with related females defending a common matrilinear territory from unrelated females, and dispersed matrilines, with single females defending territories from other females. The occurrence of two types of matrilines might be one reason that it has been difficult to document female social organization earlier. Within the matrilinear aggregations, hierarchical dominance structures probably form, similar to those observed in concentrations of bears. As expected in such a social structure, young females in matriarchial aggregations show reproductive suppression. Theoretical studies suggest that in territorial species, dispersal should be inversely density dependent, which we have shown for brown bears. In addition, all categories of bears, both adult and subadult, show an inverse relationship between population density and home range size, also suggesting some form of territoriality. We know less about the social organization of males than females, but our results suggest that brown bears, and perhaps other species of bears, are more territorial than previously thought.

PAPER - 32

SHOULD I STAY OR SHOULD I GO? NATAL DISPERSAL IN THE BROWN BEAR.

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We studied the causes of natal dispersal of male and female brown bears (N = 48), Ursus arctos, in two study areas in Sweden from 1989-2002. Males had a higher dispersal probability than females; 94% of the males and 41% of the females dispersed from their natal area. We found no difference in male dispersal probability or mean male age of dispersal between the study areas, in spite of differences in population density and sex ratio. Also, male-male competition did not seem to significantly influence subadult male dispersal probability. These results support the inbreeding avoidance hypothesis as the cause for male natal dispersal. Female dispersal probability decreased with increasing maternal age and decreased with increasing body size, and an interaction between maternal age and body size suggested that the importance of body size decreased with increasing maternal age. Non-dispersing females were closer to their mother than their dispersing sibling sisters in the period between weaning and dispersal. Female litter mates seemed to compete for philopatry, suggesting that a dominance hierarchy among female litter mates based on body size may cause the subdominant sister to disperse. If juvenile females are born into matrilineal assemblages, surrounded mostly by related females, the competition for philopatry may not be as severe as if born into an area surrounded by mostly non-kin females. This is supported by the decreasing importance of body size for dispersal with increasing maternal age. We suggest that natal dispersal in juvenile female brown bears can be explained by the resident fitness hypothesis.

PAPER - 33

PATTERNS OF SCENT MARKING AND CHEMOSIGNAL DISCRIMINATION IN GIANT PANDAS

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As relatively solitary animals, ursids are believed to rely on chemical signals for in absentia communication, yet giant pandas Ailuropoda melanoleuca are the only species known to have specific glands ritualized for communication. While other bears may use urine, feces, general body odors or odors of unknown source for communication, this communication modality is either less well developed or poorly studied. Here we review a series of more than a dozen experimental investigations on chemical communication in giant pandas. A combination of published and new, unpublished results are presented, with the goal of a relatively thorough comprehension of the sophisticated chemical communication system that has evolved in pandas, and a review of its past and future applications for conservation efforts. These results emanate from studies of up to 40 pandas housed at the Wolong Breeding Center in Sichuan, China and are complimented with preliminary data from a nascent research program on wild pandas. We present data from (1) controlled experiments designed to understand the meaning of chemosignals from the receiver's perspective; (2) patterns of scent-marking by individual pandas; and (3) distributions and characteristics of mark sites utilized by wild pandas. These findings demonstrate that chemical signals play a role in identification of sex and reproductive condition, as well as competitor assessment and mate choice. Scent appears instrumental in activating sexual motivation for the brief annual mating season. Different age-sex classes respond to scents differently in a manner that is easily interpreted in its functional context. Seasonal and other contextual influences also modulate the response pattern of the receiver. Signaler behavior is influenced by age, sex, reproductive condition, season, and other contexts. In the wild marking is clustered along ridges and trails such that receivers are likely to encounter marks, maximizing communication opportunities. Several microhabitat features appear to influence selection of mark sites. These findings have been integrated into improved husbandry regimes for captive pandas, contributing to the recent successes in conservation breeding programs and we discuss several proposals for the use of scent in in situ conservation efforts. We discuss briefly implications of our results for what is known—or unknown—about chemical communication in other ursids.

PAPER - 34

MARKING BEHAVIOR OF BROWN BEARS IN GREECE

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The endangered brown bear (Ursus arctos) population in Greece is in urgent need of effective protection and management; that management should be based on information that is both reliable and quickly attained. Following initial observations of bears marking on trees and power poles in the area of Grevena in Northern Greece, we carried out a 2-year long field study aiming to collect information on the marking behavior of brown bears and develop an effective method for documenting their presence in the country. The study was carried out at four locations (one main study and tree additional study areas), thus covering a representative sample of the species distribution and habitat range in Greece. Studying the marking behavior of bears on trees was carried out opportunistically, while traveling through the main study area. During our study we recorded marking behavior on trees (mainly pine and oak trees) only on 56 occasions. We recorded however two aspects of marking behavior, that to our knowledge have not been described for brown bears previously: the first behavior was termed “pine – beheading” and involved the cutting off of the apex of young pine trees by marking bears, while the second one is known as “scat to scat marking” and has been reported so far only from black bears. Power pole-related marking behavior was studied by sampling all power poles in the main study area and by sampling sets of poles in the additional study areas. This behavior was more intense, as it involved 65% of all poles (n = 841) surveyed in the main study area and 26% of all poles (n = 393) surveyed in the additional three and was associated with mud smears, hair deposits, and bite and claw marks. Tracks and scats also have been used to document the presence of brown bears in Greece, but fewer of these were found in all areas surveyed, while deterioration rate of marks on power poles was slower than that of tracks and scats. Finally, genetic analysis of the hair samples collected in the main study area (n = 300) showed that marking of power poles was predominantly carried out by males, while a high number of different individuals was involved in this activity. The results of our study shed new light into this poorly understood aspect of bear behavior and suggest that power pole-related marking behavior is not a localized phenomenon within the country. A monitoring scheme in Greece documenting the presence of the species that would include the regular inspection of power poles could take advantage of the higher abundance and slower deterioration rate of power pole-related signs, be time efficient, and easily staffed by volunteers. We report on the preliminary results of inspecting 6500 power poles and analyzing genetic samples from two of the study areas in order to monitor the species in the country, identify the shortcomings and propose adjustments and further research that has to be carried out in order for this newly devised method to become a valuable conservation tool for brown bears in Greece.

PAPER - 35

ADVERTISING DOMINANCE OR SEXUAL AVAILABILITY: THE USE OF RUB TREES BY BROWN BEARS

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Currently we lack an understanding of olfactory communication in bears. This applies to both opportunistic marking during social interaction and the use of rub trees (trees that are bitten and rubbed by many bears each year) to transfer social information. Both of these forms of communication should be the focus of field and captive studies. I conducted a base line ethological study of olfactory communication in brown bears (Ursus arctos). While bears are often considered solitary, aggregations favouring social learning and complex social interaction are much in evidence. High density populations associated with coastal salmon runs provide an opportunity to study their behavioural response in close proximity to other adult bears, which would be difficult, if not impossible, in low density mountain populations. I will present data on the relationships between use of rub trees and sex/dominance/reproductive availability. Data was recorded over 167 camera-trap-nights in the Glendale valley, British Columbia in May and June 2005 and 2006. To reliably document social interactions and communication in free living wildlife it is essential that individuals can be identified. Photo-identification techniques allow individual bears to be distinguished. Coat coloration and scar patterns were recorded with sketches and descriptions on data sheets, supplemented by a catalogue of reference photographs. Each bear was given a unique numeric code. Sex is determined by urination pattern, direct observation of genitals or the presence of cubs. Since research began at the Glendale field site in 1999 an ongoing record of photo identified bears has been maintained and updated annually and now contains of more than 30 recognisable adult brown bears. I will highlight the potential impact of ecotourism/bear viewing activities on marking, courtship and breeding behaviour: During its initial growth the bear viewing/ecotourism industry in Alaska and British Columbia has focused the majority of activity on autumn salmon feeding aggregations introducing high levels of human activity to some of these sites. With increased demand and repeat visitation bear viewing activities during the spring breeding season are increasing. With studies reporting that large male bears avoid people both temporally and spatially it is critical that we broaden our understanding of olfactory communication, its role in courtship and breeding, and the potential impacts of the rapidly expanding ecotourism industry on normal breeding behaviour. Are large adult males being displaced by spring viewing? Does this reduce their marking or otherwise impact their breeding opportunities? How does this impact the management of bear populations, especially in light of the sexually-selected infanticide? I will draw on data from ongoing telemetry studies in the region to inform this debate.

Session 7

Andean Bear Research, Management, & Conservation

Chair: Shaenandoah Garcia-Rangel

PAPER - 36

INVITED PAPER

ANDEAN BEAR RESEARCH & CONSERVATION: A 3 YEAR DECADE OVERVIEW

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Almost 3 decades have past since the 1980 publication of Bernard Peyton work in Peru. Peyton,s work initiated what can be called the modern era on Andean bear field research. Prior to his work most of the information about the Andean bear natural history was based on data collected basically by museum researchers while doing extensive explorations, and casual and anecdotal information gathered by researchers interested in the species. Since Peytons's, field research on the Andean bear distribution and ecology have been accomplished throughout the bear distribution. In the " Bears, Status Survey and Action Plan' (Servheen et al, 1999), the state of the knowledge throughout the Andean bear distribution was evaluated and the authors concluded that the research on the Andean bear should focus on the study and monitoring of bear distribution, threats and trends to the Andean bear populations, focusing on the most useful information that can be collected with the least capital expenditure. After almost 30 years since Peyton's groundbreaking work, and 10 years since the information for the "Bear, Status Survey and Action Plan" was compiled it will be useful to review the progress done on Andean bear research and its impacts on the conservation of the species. The objective of the present work is to review the available documents on the research done on Andean bears in the last 30 years, analyzing its tendencies regarding numbers, producers of the information, quality and area of interest, in order to identified its contribution to the conservation of the species, as well as identify the gaps of information and most urgently needed research as a tool to manage and conserve Andean bear populations. Each document was categorized according to the year it was produced, general category of knowledge, institutions, authors, academic quality, category of knowledge related to conservation issues, and finally, if the work was oriented to the conservation and management of in situ or ex situ populations. With all the above information a data base was build and a first level of descriptive analysis was done in order to evaluate the trend in number of works through time and the distribution of the products in relation to countries, institutions and categories of general knowledge. A redundancy analysis of all the documents related to research activities was done in order to discard all but one (the last or better quality) of the documents related to a research activity, for example, if a per-reviewed publication is available, all the reports, and congress publication related to that publication are discarded. Once the redundancy analysis was done and the data base "cleaned", a second level analysis was done in order to evaluate the impact of the research in relation with conservation issues, the trend in the number of products through time, distribution of the products through countries or regions, areas of knowledge related to conservation, quality of the work, institutions involved, authors, and in situ or ex situ conservation orientation.

PAPER - 37

MARK-RESIGHT POPULATION ESTIMATES DERIVED FROM OBSERVATIONS OF ANDEAN BEARS USING WATER HOLES IN THE TROPICAL DRY FORESTS OF PERU

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The tropical dry forests of northern Peru, consists of a coastal strip of land approximately 100-150 kilometres wide which extends from the department of Tumbes, Piura, Lambayeque and north of La Libertad and ranges in altitude from 150- 2800 meters above sea level. The climate is hot and dry with average temperatures of 24ºC to 27 ºC and only 100mm on average of precipitation annually in the lower elevations. The tropical dry forest is arid and remains dry for seven months of the year. Small water holes are scattered across a range of elevations and appear to be fundamental for the survival of the Andean bear (Tremarctos ornatus). Populations of bears in this area are considered to be the most threatened in South America. A five week preliminary field observation study of feeding habits and water hole use was conducted during March – April, 2007, in Cerro Del Venado, adjacent to La Zona Reservada Laquipampa and el Área de Conservación Privada Chaparri. This site is remarkable in that bears attracted to the water holes can routinely be observed at very close range. We made observations nearly everyday, for up to 4 hours, at distances of 1-100m. Due to their easily identifiable facial markings, we were easily able to identify nine individual bears, including a female with two cubs and a female with one cub. Close-up photographs were used to reconfirm these identifications. During the next several weeks we plan to construct barbed wire hair traps around each of the 5 water holes in this area, and also set hair traps along trails that bears routinely use to approach these sites. We have 3 objectives: (1) to obtain a tally of individuals using these water holes through visual identification; (2) to obtain an estimate of numbers of bears based on DNA fingerprinting of hair samples; and (3) to ascertain whether these 2 estimates differ, indicating either that our observational sampling was incomplete, or that some bears avoided the barbed wire (in which case we should be able to observe this directly). Estimating population size for the elusive and rare spectacled bear has been an ongoing challenge throughout South America. No reliable estimates have thus far been made, although efforts are underway in some places to use hair sampling to derive mark-recapture estimates. This unique site, which we recently discovered, offers an opportunity to derive a reliable estimate using 2 complementary approaches. Data collected with the hair traps and sight-resight surveys will be analyzed both using mark-recapture (dividing the full observation period into shorter sampling periods) and with an accumulation (or rarefaction) curve, where the total sampling period corresponds to a single sampling session. The aim of this study is to investigate the feasibility of these techniques and to better develop sampling protocols for a future longer-term study that we will conduct next year. We will present population estimates and make preliminary evaluations of their reliability. We will also discuss feeding habitats (as bears are readily observed while they feed), water hole use by different sex-age classes (e.g., females avoiding use while males are present), and efficiency of hair traps. Furthermore, we will address the value (and vulnerability) of this site in terms of bear conservation. Although this year's work is preliminary, we believe the situation is so extraordinarily unique, not only for this species but for bears in general, as to warrant presentation of preliminary results at this time.

PAPER - 38

A RISK MODEL TO DETERMINE THE EFFECTS OF HUMAN EXPANSION ON THE HABITAT DISTRIBUTION OF ANDEAN BEARS ALONG THE EASTERN SLOPE OF TROPICAL ANDES IN BOLIVIA

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Due to the accelerate expansion on human activities and environmental changes, modelling the spatial distribution of the organisms and/or simulate expansion patterns have become an important tool for conservation planning and forecasting. Intensive human activities in the Tropical Andes have left the region with less than three quarters of its original vegetation. However, the eastern slope of Tropical Andes in Bolivia can still be considered “untouched” due to low human density and poor road system. Considered as an umbrella species for the Tropical Andes, the Andean bear (Tremarctos ornatus) has been suffering consequences of human expansion such as habitat loss, hunting and in certain areas local extinction. This paper aims to build a risk model to predict human expansion and its effects on Andean bear habitat in the eastern slope of Tropical Andes in Bolivia. To achieve this goal two models were produced: a human expansion and a bear habitat distribution model. A human expansion model was build identifying expansion patterns based on multi-temporal analysis of MODIS-FIRMS (2000-2007); LANDSAT MSS, TM and ETM+ (93, 97, 2000, 2001), human demographic data (census: 1991 and 2001; projections: 2005 and 2010), and variables to predict that a site is more likely to be deforested (i.e. distance to road, distance to water supply, slope and sun orientation). The bear habitat distribution model was carried out applying two presence-only data models: Ecological Niche Factor Analysis (ENFA) and Maximum entropy (MAXENT). Bear presence data was collected from two years of field work in Carrasco, Amboro national parks and surrounding areas, and habitat requirements from field work, literature review and the output of 19 climate variables derived from BIOCLIM. The ultimate analysis was to build a risk model, which is the combination of both models: human expansion and habitat distribution. This model detects sites where human expansion affect the integrity of bear habitat based on the overlap of the human expansion onto the bear habitat model. The output visualizes both current and potential (five and ten years scenarios) habitat status - in terms of integrity. Therefore it is possible to detect sites where conservation or management actions should be implemented in the near future. Moreover, the risk model provides a tool for governmental and non-governmental institutions about the potential consequences of human expansion in the eastern slope of Tropical Andes, not only for the Andean bear but for other species that inhabit this ecosystem.

Session 8

Human Bear Interaction / Conflict

Chair: Raymond Skiles

PAPER - 39

EFFECTIVENESS OF HAZING IN REDUCING BEAR/HUMAN CONFLICTS IN ALASKA'S NORTH SLOPE OILFIELDS

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Although nonlethal approaches to management of bear/human interactions are popular with the public, there have been few cases in which their effectiveness has been systematically evaluated. Since 1991, we have been using hazing in conjunction with other methods to reduce bear/human conflicts with grizzly bears (Ursus arctos) whose home ranges overlap the North Slope oilfields in Alaska. This area is on the northern extreme of grizzly bear distribution, where bear density is low (1-4 bears/1000km2) and food resources are meager. Under these conditions, attraction to anthropogenic foods which are nutritious, readily available and predictable food would be expected to be especially strong. Prior to 2000, management of anthropogenic foods in the oilfield region was not effective in minimizing access to these foods by bears. By 2001, management of anthropogenic foods had vastly improved and these attractants were no longer widely available. Before and after these changes in attractants management we applied a variety of hazing methods over varying lengths of time to 24 radio-tagged, food-conditioned bears, and 7 of 38 radio-tagged bears that fed solely on natural foods within the oilfields. The food-conditioned bears were all descendants of >=2 adult females that were food-conditioned before our study began, and whose offspring subsequently became food-conditioned. Food-conditioned bears had significantly larger body size and higher reproductive rates than bears feeding solely on natural foods. In spite of being hazed, 21 of 24 food-conditioned bears eventually were killed by humans, mostly in conflict situations away from the oilfields. Two food-conditioned adult females are alive and no longer feed on anthropogenic sources. In contrast, none of the 38 radio-tagged bears feeding entirely on natural foods in the oilfields have become food-conditioned. Clearly, not all bears with access to anthropogenic foods became food-conditioned in spite of the potential nutritional benefit. Hazing by oilfield security and our project personnel appeared to augment the reduction in anthropogenic foods to prevent naïve bears from becoming food-conditioned. However, the persistence of food-conditioning in spite of intense hazing suggests that factors such as early growth rates, tradition, and possibly genetics may predispose some bears to be less responsive to hazing. We will describe our goals and objectives for hazing and recommendations for hazing methods, and discuss differences between hazing and aversive conditioning. We will also compare other bear hazing/aversive conditioning programs with ours, and identify features of our program that may have affected its success. These will feed back into recommendations for future hazing programs.

PAPER - 40

SLOTH BEAR CUBS FROM THE FORESTS TO THE STREETS

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Sloth bear cubs (Melursus ursinus) are poached from the jungles of India and eventually danced on the streets by Kalandars attempting to earn money from tourists and villagers. What happens in between the poaching and dancing? Separate questionnaires for the hunters / traders, and bear owners / trainers were devised. These questionnaires were administered face to face using the native language. The investigators interviewed people who own are involved in training and dancing, medicating and treating the animals, and those who pierce the nose, cut the claws and pull out the teeth. The investigators also interviewed Adivasis and the tribals actively involved in the hunting and poaching. Investigators administered 146 questionnaires. The cubs have a high mortality rate at the market itself; approximately two cubs out of ten succumb to the shock of separation from the mother and simply “fade” away according to the Kalandars. Should the cubs survive, transportation takes its toll as the cubs are carried long distances in a burlap bag; or put into fruit baskets covered with leaves / fruits; or packed with hay in crates. The preferred mode of transport is trucks which obligingly carry the Kalandars through the length of this country. Although the Kalandars insisted their training methods produce no trauma with associated fatalities, they do agree that the percentage of bears lost in the first year can be as high as 40%. 66% of the Kalandars presently dancing bears had actually reared it themselves from a cub. 30% had acquired semi-trained juvenile bears or already trained adults from fellow Kalandars. The bear cub usually reaches the village traumatized and dehydrated. Initially the cub is kept close to its owner in a basket or under a coop and brought out only for feeding. After a couple of weeks it is tied by a rope, to a bamboo pole, close to other cubs, and fed a wheat gruel along with its milk. The mortality rate can be high at this stage. The nose is pierced and a thick rope inserted through the cheek tissue and removed from its mouth. This is the first nose piercing when the rope and needle is pulled through the top of the cheek and out through the mouth. A second nose piercing is done after another four months when the cub’s snout is larger and the cartilage of the upper palate is stronger to withstand a thicker rope. This time the rope is pulled out through either the right or left nostril. The site of the nose piercing was invariably infected. It is significant that this is the optimal training period as the cub will walk and rear up on its hind legs mainly because of the pain it suffers when the rope is tugged. According to the Kalandar the cub or juvenile bear sometimes suffers a form of epileptic fit which attacks before the age of three. Should the bear survive beyond this age it usually lives out its normal life span till thirty years. However, the study revealed that the oldest bears were only 15-16 years old and only 10% reached this age. Respiratory and intestinal infections seem to be responsible for most of the deaths. The results from this study make it apparent that the number of sloth bears danced on the streets of India represents only a small fraction of the total number of bears poached for this express purpose. Additionally, the trauma to the young cubs is extreme and inhumane.

Session 9

Bear Physiology

Chair: Jon Arnemo

PAPER - 41

CARDIAC ADAPTATIONS IN CAPTIVE HIBERNATING BROWN BEARS

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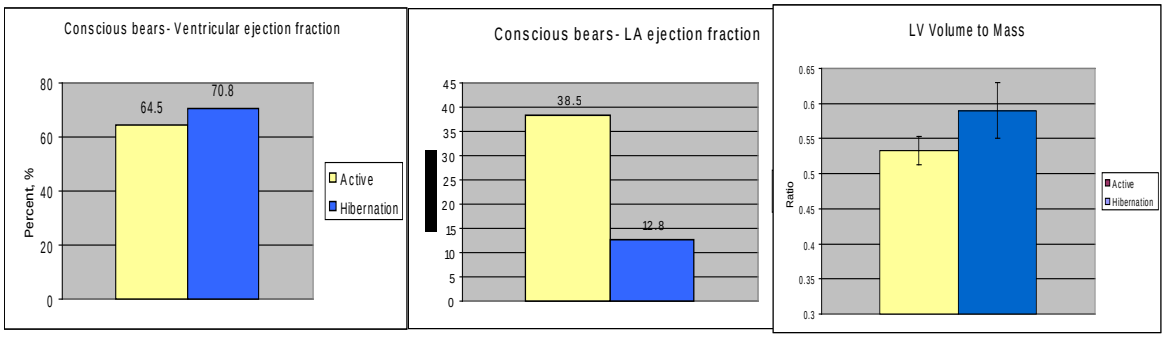
The hibernation phenomenon captures biological interest to understand how organs adapt to this period. Curiosity regarding the cardiovascular physiology of hibernating mammals makes study with these animals very intriguing. However, anesthesia must often be used when handling any wild animal species and these agents may affect the cardiovascular parameters of interest. Thus, accurately describing the hibernation phenotype may be best accomplished by using conscious subjects. Four captive grizzly bears (Ursus arctos horriblis) were human-conditioned and trained to study the effects of hibernation on cardiac function and mass. Cardiac variables were obtained via echocardiography using protocols established for humans and dogs (Appleton 2000; Feigenbaum 1972; Kuecherer et al. 1991; Shiller et al. 1989; Thomas et al. 1993). Variables were compared between active and hibernating, conscious bears. All volume measures were indexed to body weight to account for size variation between bears. There was no significant difference in left ventricular contractility or ejection fraction between active and hibernating periods, but left atrial contractility or ejection fraction was marked reduced during hibernation. In addition, calculation of left ventricular mass revealed decreased cardiac mass during hibernation.



The reason for the reduced left atrial function in hibernating bears is unknown. It is especially curious given the long ventricular diastole in hibernation. Reduced atrial function during the prolonged bradycardia of hibernation may represent an adaptation to avoid 'overfilling' the ventricle and to minimize atrial chamber work and dilation that could occur by atrial contraction against an already optimally filled ventricle. During hibernation, reduced cardiac mass despite normal filling volume would suggest that changes are occurring in the compliance of the heart muscle. These findings may represent cardiac adaptations to prolonged bradycardia, which may minimize energy requirements and stress on the heart muscle during this period.

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ANESTHESIA OF GRIZZLY AND BLACK BEARS USING XYLAZINE, ZOLAZEPAM, AND TILETAMINE AND ITS REVESAL USING YOHIMBINE

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Wildlife managers and research biologists are continuously looking to improve their field methods and reduce mortality to study animals during capture. This is especially true when handling individual bears from isolated, declining populations. Bear researchers require an anesthetic that is not dangerous to humans, provides a wide safety margin for bears, requires a low volume dose for efficient delivery, maintains physiological homeostasis, and is reversible. No one chemical can meet all these requirements. We tested the use of Xylazine, Zolazepam and Tiletamine (XZT) in combination on grizzly bears (Ursus arctos) and black bears (Ursus americanus) to determine the quality of anesthesia it produces and its potential to be reversed. Bears were captured as part of on going research in western Montana, northern Idaho, and southeast British Columbia. Bears were captured in foot snares, and delivery systems varied according to capture episode. All bears were administered supplemental oxygen at 3 liter/hour. Bears anesthetized with XZT and reversed with yohimbine recovered from anesthesia faster than bears anesthetized with Tiletamine/Zolazepam combinations. They required smaller dose volume, showed similar induction rates, and were able to maintain physical parameters close to homeostasis. The XZT combination tested is a viable option for safe, effective handling of bears. The synergistic effect of these three drugs allows some of the anesthesia to be reversed allowing bears to recover faster. This permits bears to return to normal body function sooner, reduces vulnerability to predation and allows animals to resume normal behavior quicker. Having such an anesthetic agent is critical to the safe handling of rare individuals within vulnerable populations throughout the world.

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CHEMICAL CAPTURE AND ANESTHETIC MONITORING OF BROWN BEARS

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Capture and anesthesia of wild animals should in addition to low mortality also ensure stable physiology to minimize the risk of complications during and after the capture event. From 1992 through 2006, a total of 1,067 immobilizations of 372 individual brown bears (Ursus arctos) has been carried out for the Scandinavian Brown Bear Project with a combination of medetomidine (M) and tiletamine-zolazepam (TZ). The bears were darted from a helicopter in April-June using a remote drug delivery system. Current dose recommendations are: yearlings (15-45 kg) 1.25 mg M + 62.5 mg TZ; subadults (2-3 years, 45-70 kg) 2.5 mg M + 125 mg TZ; adult females and small adult males (70-120 kg) 5 mg M + 250 mg TZ; medium-sized adult males (120-200 kg) 10 mg M + 500 mg TZ; large adult males (> 200 kg) 15 mg M + 750 mg TZ. Animals that were not recumbent within 10 minutes after the intial dose were redarted with a full dose. During anesthesia, rectal temperature, heart rate, respiratory rate, and hemoglobin oxygen saturation (measured by pulse oximetry) were recorded. If necessary to extend the period of anesthesia, supplemental medetomidine (0.05 mg/kg) and ketamine (1-2 mg/kg) were given intramuscularly. For anesthetic reversal, 5 mg of atipamezole per mg of medetomidine was given intramuscularly. Detailed physiological parameters were evaluated in 49 free-ranging bears immobilized for radio-marking, and 6 captive bears immobilized for micro-chipping in enclosures at Orsa Bear Park, Sweden. Based on actual body weight obtained during anesthesia (range 12-241 kg), M at 0.03-0.15 mg/kg, and TZ at 1.5-7.3 mg/kg were used in these bears. Serial arterial blood samples were collected for evaluation of pulmonary gas exchange, acid-base status and selected hematological and plasma parameters. The first blood sample was collected as soon as possible after recumbency, followed by sampling approximately 30 and 60 min after darting. The blood samples (n = 136) were immediately processed for 15 different parameters with a portable i-STAT® analyzer. Mortality during capture and anesthesia was 0.5% (5 of 1,067 immobilizations). This is the first study to report detailed physiological parameters in both free-ranging and captive brown bears. Lactate levels and rectal temperatures were higher and pH values were lower in free-ranging animals than in captive animals, as a result of physical exertion during the induction period when darting bears in the wild. Free-ranging bears initially experienced lactic acidemia (pH <7.35, lactate up to 16.4 mmol/L), but pH increased and lactate decreased over time and was not further impaired during anesthesia. The highest lactate level measured in captive bears was 2.7 mmol/L. Arterial carbon dioxide tensions ranged between 28-54 mmHg in all bears. Seven free-ranging and two captive bears developed hypoxemia (arterial oxygen tensions <60 mmHg), but intranasal oxygen supplementation at 2-5 L/min markedly improved oxygenation. In conclusion, with the drugs and doses used, alterations in the acid-base status were identified during anesthesia of free-ranging brown bears. Since hypoxemia was documented in nine bears, we recommend a portable oxygen cylinder as part of the standard anesthesia equipment. To reduce stress and physical exertion, helicopter pursuit should be as short as possible. Additional darts during capture did not impair the physiological parameters measured, indicating that the drug combination has a wide margin of safety in the species. Acknowledgments: Many thanks to the Swedish Environmental Protection Agency, the Norwegian Directorate for Nature Management, and the Michael Forsgren Foundation for generous support of this study. Also, thanks to our pilot Ulf Grinde - Jämtlands Flyg, and to Orsa Bear Park for collaboration.

Session 10 A

Spatial Analysis & Spatio Temporal Relationships

Chair: Alexandros Karamanlidis

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SEASONAL AND DAILY HABITAT USE AND MOVEMENTS BY AMERICAN BLACK BEARS IN RELATION TO HUMAN DEVELOPMENT, ROADS, AND TIMBER HARVEST

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Understanding how human modification of habitat influences habitat use is important for management and conservation of wildlife. Habitat selection by American black bears (Ursus americanus) has been evaluated across North America, and studies have demonstrated remarkable flexibility in this species' ability to survive in a variety of forested habitats. We evaluated the influence of human activities on habitat use by black bears in the Purcell Mountains of northern Idaho and southern British Columbia. Our objectives were to evaluate: 1. daily movement rates; 2. seasonal habitat use at 2 spatial scales; and 3. temporal variation (day, night, crepuscular) in daily habitat selection. We fitted 20 black bears (15 males, 5 females) with GPS collars programmed to record a location every 20 minutes. We contrasted patterns of habitat use among 3 age/sex categories (adult males, sub-adult males, and females) during 2 seasons (spring/early summer: den emergence to July 15; late summer/autumn: July 16 to den entrance). Based on daily movement rates, bears were most active during crepuscular periods, moderately active during daylight hours, and least active at night. All bears exhibited similar daily movement rates except for adult males who demonstrated greater movements compared to females and sub-adult males during crepuscular periods in the spring/early summer season. Habitat use differed by sex, season, and time of day. Bears consistently avoided areas of human development. However, during spring/early summer males selected for areas with higher secondary road densities, but avoided those areas in late summer and fall. Females avoided roads during both seasons. Bears tended to avoid areas near highways during day, but used those areas during night and crepuscular periods. Both males and females selected areas with berry producing shrubs during late summer and fall, including habitats consisting of moderately aged timber harvest and cold forest types, which contained abundant huckleberry (Vaccinium) shrubs. Our results indicated that bears used habitat based on density of roads and human development and timber harvest strategies.

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IDENTIFYING POTENTIAL COLONIZATION PATTERNS FOR REINTRODUCED BEAR POPULATIONS

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As fragmentation of bear habitat increases in many portions of the world, reintroduction may become an increasingly important tool for the conservation of bear populations. The development of new release and monitoring techniques in North America and Europe has been effective in improving short-term success of bear reintroductions. However, longer-term success also is an important consideration and may depend on the ability to predict future patterns of colonization and to identify potential zones of potential human-bear interactions so that conflicts can be mitigated. Our objective was to develop and test a data-based approach to predict recolonization patterns of a reintroduced American black bear (Ursus americanus) population on the Cumberland Plateau, Tennessee, USA. We used radio-telemetry data of 20 bears (10M, 10F; 1978–1983) within the Cherokee National Forest, Tennessee to estimate home ranges. We then calculated Mahalanobis distance (D2), using bears as the sampling unit, to determine which habitat conditions on the Cumberland Plateau matched the habitat conditions we sampled in the home ranges. We based those habitat comparisons on 4 habitat variables (terrain ruggedness index, percent forest cover, road density, human population density) derived using moving windows based on average home-range sizes and mapped at a 90-m resolution. Low D2 values represented habitat conditions similar to those of the sampled home ranges, whereas larger values represented increasingly different conditions. Because Mahalanobis distance is a measure of dissimilarity, we used the D2 values as a cost measure to calculate, for each pixel, the lowest accumulated-cost distance from the area where bears were reintroduced. The mean home-range size was 15 km2 for females and 165 km2 for males. The range of Mahalanobis distance values for the Cumberland Plateau ranged from 2.6 to 12,766,047. The mean D2 value for individual home ranges was 81.4. Spatial patterns of cost-weighted distances indicated two primary directions of range expansion. The potential recolonization route with the lowest associated cost had a southeastern direction and extended into a large expanse (1,516 km2) of suitable habitat identified by our habitat model. A secondary route had a southwestern direction, potentially leading to occupation of an additional 447 km2 of bear habitat. Application of the technique we present here can provide important information during the planning stages of reintroduction projects by identifying both spatial and temporal patterns of recolonization. That information may help managers be better prepared to address public concerns and perceptions by identifying where potential human-bear interactions are most likely to occur first, which is critical to the success of bear reintroductions. Finally, our techniques may also be useful to assess the possible magnitude and direction of range expansion of established populations that are increasing.

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THE STUDY OF BIOGEOGRAPHICAL CHANGES OF ASIATIC BLACK BEAR IN IRAN BY GIS AT RECENT FIFTY AND ITS THREATENED FACTORS

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Asiatic black bear exists in more than 15 countries including Iran but the name of Iran hasn't been mentioned in many references. Black bear distributes in Sistan and Baluchestan, Kerman and Hormozgan provinces but satellite data show that its range has decreased to less than 30% at the present (2007) and restricted to Jiroft, Kahnooj, Sarbaz, Nikshahr, ghasr-e-ghand and Minab; its population has also decreased to 20 bears. The most important factor of decreasing population of this species in Iran is increasing human population, recent nine-year drought and its decreasing habitat. Ursus thibetanus gedrosianus classifies as critically endangered in IUCN red list. In spite of none compiled report of existing of black bear in Iran from 1990 until 2001, it's skeleton near Khash town in Sistan and Baluchestan Province in 2004 that had been killed by native people shows that this species isn't extinct in Iran; also population of Iranian black bear has biocomunications with population black bear (Baluchestan) of Pakistan and there are some migrations between boundaries of two countries. This research that has been prepared by GIS, field observations and reports of recent half century shows that long-term drought period has severely decreased useful factors of the habitat such as food, shelter and water.

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A NEW TECHNOLOGY SOLUTION FOR THE STUDY OF BEAR MOVEMENT AND HABITAT USE (ANIMAL PATHFINDER)

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The advent of GPS technologies have provided wildlife researchers new insights into the movement and use patterns of bear species with vast quantities of detailed location data. However the current wildlife tracking techniques have limitations as GPS locations can be biased to some unknown extent because animals move through habitats that are often denied GPS signals. This can result in some habitat types being under sampled or not sampled at all. Researchers using GPS tracking systems cannot understand what behaviour an animal is exhibiting at each GPS position without either relying on extensive field data or statistical techniques that may infer behaviour. Overall these issues, and others, limit the knowledge that can be derived from the data currently being collected by GPS collars alone. To address these issues, we have developed a dead reckoning solution to augment GPS tracking collars (Animal PathFinder), which enables both the acquisition of continuous movement trajectories for animals under study and the collection of digital images on a user-defined schedule along travel routes. Analysis of an animal's velocity allows one to identify different types of movement behaviours that can be associated with foraging, searching for food, and locomotion between patches. In addition, the ability to capture continuous paths allows researchers to identify habitat that is important to a species, and habitat that is not – something that is not possible when relying solely on GPS. This new system weighs approximately 220g and can be deployed on most conventional collar systems for a wide range of species. This paper will present an overview of the research and development of this new system over the past 4 years and preliminary findings from field work carried out on grizzly bears (Ursus arctos) in the Foothills of the Canadian Rocky Mountains.

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MODELING VARIATION IN GRIZZLY BEAR DENSITY AT THE LANDSCAPE SCALE

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The Northern Divide Grizzly Bear Project used noninvasive genetic sampling to estimate the size of the grizzly bear (Ursus arctos) population within a ~31,500 km2 study area in northwestern Montana, USA. We distributed 2,558 baited barbed-wire hair corrals on a 7x7 km grid to systematically sample the study area during 4 14-day sessions during the summer of 2004. Distribution of the 545 individuals detected varied widely across the study area, with over half of the bears found in the northern third of the ecosystem. The five grid cells with the highest number of grizzly bear detections (9 - 16 individuals/49 km2 cell) occurred within Glacier National Park. We assessed differences in bear density relative to vegetation type, human density, road density, historical bear mortality, food storage regulations, topographical complexity, protein availability, and climate. We developed models a priori to examine the influence of these potential explanatory variables at multiple spatial scales. We present results of the model selection process and discuss how our increased understanding of the distribution of bears in this ecosystem will aid development of a conservation strategy for recovery of this and other threatened bear populations.

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BAIT USE BY AMERICAN BLACK BEARS IN NORTHEASTERN WISCONSIN: APPLICATIONS OF GIS, GPS TELEMETRY, AND REMOTE PHOTOGRAPHY

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American black bears (Ursus americanus) in the Chequamegon-Nicolet National Forest of northeastern Wisconsin have available to them a substantial quantity of bait from the time they emerge in spring until they den in winter. The state's six-month baiting season may facilitate a dependence upon this artificial food source and alter natural movement patterns, habitat use, reproduction, physiology, and health; this study aims to document the extent to which this resource is used. 190 bait sites were located within two study areas (87,217 hectares in size) with a density of 0.22 per km2. Using 14,296 locations collected via GPS collars on 12 bears (3M:9F) in 2003 and 2004, it was found that the males had available to them an average of 28.7 baits within their 100% MCP home range and females had access to an average of 6.7 baits. Using conservative criteria, bears were located within 100m of a bait site on 307 days out of 1793 days that collars were worn (17.1%). To show that bait visitation was purposeful, the number of baits found within each bear's 80% volume adaptive kernel home range estimate was randomly generated six times. Bait visitation recorded within 100m of the random points was significantly lower ($F=64.36$; $P<0.0001$) than when applied to actual bait sites. Remote cameras deployed at bait sites for 327 trap nights in 2006 yielded 4171 photographs, including 2320 (55.6%) with bears present. Of these, 526 individual bait visits were identified, including 50 (9.51%) by sows accompanied by cubs, 48 (9.13%) of marked bears with ear tags or collars, and 8 (1.52%) large bears assumed to be males and of interest to trophy hunters. Temporal patterns of daily and seasonal use, the relationship to the phenology of natural bear foods, and the implications of disease transmission to other species are also explored. Baiting may play a significant role in the lives of bears in this region, and these data will serve to aid in population and harvest management.

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ACTIVITY AND RESOURCE USE OF MALE GRIZZLY BEARS DETECTED BY GLOBAL POSITIONING SYSTEM SATELLITE TELEMETRY IN NORTHER ALASKA

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Grizzly bears (Ursus arctos) are living at the edge of their biological range in northern Alaska. The summer growing season is very short, large numbers of ungulates are present only seasonally, and bears spend at least half the year in winter dens. Objectives of this study were to determine if frequent locations of bears could be used to identify activity patterns and resource use, including incidents of predation or scavenging in this remote environment. We used Global Positioning System (GPS) satellite collars on 4 adult male grizzly bears and obtained up to 6 locations per day from each bear from May 2006 until July 2007. We downloaded location data daily and investigated areas where bears were stationary for more than 12 hours to determine if bears were on carcasses. We identified high use areas using GIS analysis, visited these areas to determine what resources were present, and correlated resource use with patterns of locations obtained from the GPS collars. We calculated rates of movement and distances moved at 2 week intervals and determined activity patterns. Activity and resource use changed seasonally. Bears emerged from dens in the mountains in late April and moved over wide areas in uplands and mountains and along rivers in early summer. One bear spent most of the summer of 2006 feeding on brown lemmings (Lemmus sibiricus) which had increased to high densities on the arctic coastal plain that year. In late summer, bears reduced their movements and concentrated their activity in relatively small areas, primarily along rivers. In October, all 4 bears returned to the mountains to den. Two of the 4 bears had overlapping home ranges and spend time in close proximity. GPS satellite collars are useful tools to assess activity and resource use of grizzly bears in remote areas where logistical costs and weather can limit data collection.

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Spatial Analysis & Spatio Temporal Relationships

Chair: Alexandros Karamanlidis

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SPATIAL-TEMPORAL MOVEMENT PATTERNS OF GRIZZLY BEARS IN AN INDUSTRY IMPACTED LANDSCAPE

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In Alberta, habitat loss resulting from oil and gas exploration, resource extraction, and increased human activities has threatened the long term survival of grizzly bear populations. In the case of the Foothills Model Forest Grizzly Bear Research Project, understanding movement rates and related activity patterns is necessary to provide management with the scientific information needed to balance industry requirements with conservation imperatives. Between 1999 and 2005, 148 grizzly bears (Ursus arctos) were captured and radio-collared across western Alberta, Canada. Using global positioning system (GPS) telemetry locations (n = 49,987), we studied the relationship between level of human activity and grizzly bear movement rate across multiple spatial and temporal scales. Several data filtering tasks were preformed to retain the most accurate GPS location data. Analysis of variance (ANOVA) was used to test for significant differences in distributions. We further explored movement characteristics for individuals through the use of kernel home ranges and three-dimensional movement trajectories. Individual kernel home range size varied from 42 km2 for a female with cubs to 7,263 km2 for a subadult male with a population mean of 878 km2. Overall, bears were found to occupy significantly larger home ranges in foothill environments (1,395 km2) when compared to mountain environments (382 km2). On average, females occupied 75% less landscape than males while subadult bears (1,337 km2) occupied significantly larger home ranges than adult bears (721 km2). The average hourly movement rate for all bears across the province was 0.3 km/h. More specifically, males (0.39 km/h) demonstrated significantly higher movement rates over females (0.25 km/h) or females with COY's (0.19km/h). We found that grizzly bears residing in mountain environments (0.25 km/h) moved significantly slower than bears in foothill environments (0.35 km/h). This was especially true for grizzly bears residing north of Highway 16 where industry levels are greater. Overall, movement rates were highest during early hyperphagia (Jun 15 – Aug 15) with individual males moving fastest (0.6 km/h) during the month of June. Finally, bears demonstrated increased activity levels during the dusk or evening crepuscular time of day. These findings have significance for modeling efforts which attempt to replicate grizzly bear spatial and temporal movement patterns across Alberta landscapes. Furthermore, identifying the relationship between movement and level of human activity will aid management in making localized site-specific conservation decisions. Future work will involve assessing movement rates as they relate to underlying landscape features.

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LANDSCAPE CHARACTERISTICS INFLUENCING A RECOLONIZING BLACK BEAR POPULATION IN SOUTHEASTERN OKLAHOMA

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Historically, black bears (Ursus americanus) were present in Oklahoma but were extripated in the early 1900s due to habitat loss and unregulated hunting. Reintroduction of black bears in the Ozark and Ouachita national forests of Arkansas between 1958–1968 by the Arkansas Game and Fish Commission successfully reestablished populations. Recent expansion of this black bear population into eastern Oklahoma has led to management questions regarding abundance and distribution. To learn more about the population in Oklahoma, 128 hair snares were set in 4.8 x 4.8 km grid cells over approximately 3,700 km2 of the Ouachita Mountains. After 7 weeks of sampling in June–August, 2004, 2005, and 2006, 1166 hair samples were collected. 332 samples were sexed and genotyped at ≥ 7 of 10 microsatellite loci. Of these, 161 (48.5%) are unique individuals and 52 (32.3%) were recaptures. The remaining 119 (35.8%) were duplicate samples. We performed GIS analysis to determine the influence of cover type, elevation, and human disturbance levels on unique bear identification. Buffers approximating the size of the average home range of female bears (23 km2) in the study area were used to calculate zonal statistics of each variable. Black bears in the study area were typically associated in areas with higher elevation, slope, and forested habitat. Bears were associated less in areas with higher agriculture, human development, and roads. Landscape characteristics are useful for a recolonizing population to determine limitations to expansion and possible areas for growth.

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THE USE OF DIGESTIBLE ENERGY AS A CURRENCY TO EVALUATE SHIFTS IN BEAR FOOD PRODUCTION OVER A LANDSCAPE

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Black bear habitat use based on available digestible energy was investigated in the Serranias del Burro, Coahuila, Mexico, during 1998-2001. Production of key bear foods was estimated and plotted based on a GIS vegetation map. Foods were also analyzed for digestible energy content, and then interpolated onto the GIS map using ArcMap and ERDAS, adjusting for percent canopy cover of species within different vegetation associations. Average digestible energy within female black bear home ranges were compared to digestible energy of seasonal locations for 1999 and 2000. Adult females used areas that contained 27% more digestible energy than areas not used within their overall home ranges during fall 1999, and 20% more than areas not used during fall 2000. Patterns of food production across a landscape may influence effective density of bears within food patches, thus exposing adult females and cubs to high risk of mortality from other bears. Density dependence of bears may be directly affected by food availability through altered social dynamics, particularly in a desert environment where vegetation fluctuates with weather patterns.

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SEASONAL USE PATTERNS BY FEMALE GRIZZLY BEARS IN THE CENTRAL ROCKIES ECOSYSTEM: IMPACT OF REPRODUCTIVE CATEGORY AND SECURITY AREAS

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The seasonal importance of security areas to adult female grizzly bears of differing reproductive status was examined in the Central Rockies Ecosystem, Alberta, Canada. Logistic regression was used to derive resource selection functions (RSFs) for 31 female bears radio-collared and monitored between 1994 and 2004. Resource selection by female bears with cubs during the pre-berry season was positively associated with security cover. The categorization of cubs into young-of-year (YOY) cubs and older cubs revealed the importance of secure areas for females with YOY cubs in the pre-berry season and for females with older cubs in the berry season. Strong selection for herbaceous habitats and edges occurred across all groupings of bears by reproductive status and season. Female grizzly bears were also associated with riparian areas during the berry season and vegetative phenology as measured using the normalized difference vegetation index (NDVI).

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RELATIONSHIPS BETWEEN SPATIAL ENVIRONMENTAL VARIABILITY AND BLACK BEAR OCCURRENCE IN THE CONTINENTAL UNITED STATES OF AMERICA

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Past research efforts have investigated the habitat preferences of black bears (Ursus americanus) in several regions of the continental USA, but these studies were either limited to relatively small geographic areas or focused on selection preferences of individual bears. There is a general lack of knowledge about the composition of environmental conditions that demarcate suitable bear range or how bears respond to environmental variability at the macro-scale. To that end, we investigated the relationship between spatial environmental variability and black bear occurrence in the continental USA. The objectives of this study were to determine if spatial environmental variability influences the distribution of black bears, identify spatial environmental variables correlated with black bear distribution, and develop a model to predict the spatial distribution of suitable bear habitat and potential relocation areas. We used logistic regression and AIC model selection to assess the correlation between spatial environmental variability and bear occurrence, and to develop a model predicting the spatial occurrence of bears. We divided the continental USA into two areas; bottomland hardwood areas of the Southeastern coastal plain, termed lowland environments, and the remainder of the continental USA, termed upland environments. The upland model was based on a sample size of 144,217 cells, of which 41,881 were classified as bear presence and 102,336 as bear absence. The likelihood ratio chi-square test indicated a significant fit for the overall model ($\chi 2$ = 75,030.9, 17 df, $P < 0.0001$) and each independent variable was significant (except one macrohabitat type). The lowland model was based on a sample size of 11,225 cells, with 2,134 cells classified as bear presence and 9,091 cells as bear absence. The likelihood ratio chi-square test indicated a significant fit for the overall model ($\chi 2$ = 2,477.5533, 21 df, $P < 0.0001$) and each independent variable was significant (except 1 forest fragmentation level and two macrohabitat types). We found that bear presence was correlated with 10 landscape-scale variables in upland and lowland environments of the continental USA. In upland environments, bear presence was positively correlated with all macrohabitat types (except grassland–shrubland mosaic), lands actively managed as wild lands, snowfall >122 cm, and increasing levels of spring-summer normalized difference vegetation index (NDVI). In contrast, bear presence was negatively correlated with forest fragmentation, road density index, human densities >10 persons/km2, greater distances from streams, and increasing levels of wetness. In lowland environments, bear presence was positively correlated with deciduous and evergreen forests, grassland–shrubland mosaic, perforated through edge levels of forest fragmentation, lands actively managed as wild lands, human density <43 persons/km2, increasing soil nitrogen levels, and increasing levels of spring NDVI. In contrast, bear presence was negatively correlated with herbaceous–woodland wetland, sparsely vegetated areas, increasing road density index, and increasing levels of wetness. The relative probability of bear occurrence models indicated that there is about 2.8 million square kilometers of suitable bear habitat in the continental USA, distributed in about 1,400 distinct patches. However, only 306 of the suitable habitat patches are >200 km2, corresponding to 2,721,803 km2 of suitable habitat. The models identified 981,061 km2 of vacant suitable bear habitat in the continental USA. These habitats are distributed in 394 patches, of which 155 (743,558 km2) are adjacent to occupied bear range and 239 (237,503 km2) are isolated from occupied range. The probability of occurrence models identified 34 habitat patches as priority (>5,000 km2) reintroduction areas. This study describes bear-habitat use patterns across a broad spatial extent and identified landscape variables that may influence bear occurrence. In so doing, the study provides a interactive model that can be adapted and used to predict the relative probability of bear occurrence due to changing spatial conditions and identify potential reintroduction areas.

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WORKSHOPS

Genetics Workshop, Part 1 - Fundamentals of DNA Sampling and Estimation of Population Size and Density

Genetics Workshop, Part 2 - Monitoring Bear Population Trends in Forested Environments

Genetics Workshop, Part 3 - Planning and Conducting Noninvasive Genetic Research

Bear Management in Mexico

Anaesthesia and Monitoring

PART 1

FUNDAMENTALS OF DNA SAMPLING AND ESTIMATION OF POPULATION SIZE AND DENSITY

JOHN BOULANGER, Integrated Ecological Research, Nelson, BC, Canada boulange@ecological.bc.ca
GARY WHITE, Colorado State University, Ft. Collins, CO, USA, gwhite@warnercnr.colostate.edu

Duration: 2.5 hours

Over the past 10 years DNA sampling for bears has evolved in terms of field implementation, and study design. At the same time many more estimation methods have become available for DNA data. We present a workshop that highlights the main developments in the application of DNA mark-recapture methods. This includes optimization of attractants, site selection, and study design including sampling intensity, minimizing closure violation, session length, moving or not moving sites, incorporating DNA errors into population estimation procedures, occupancy models, and other important topics. We also highlight the main estimation methods available in program MARK and how these have been applied to grizzly bear populations. Talks for this workshop include:

Introduction-Workshop objectives - John Boulanger
DNA hair snag sampling essentials - Mike Proctor
Issues and strategies in DNA sampling of bears: an overview - John Boulanger
Program MARK-an overview - Gary White
Discussion

PART 2

MONITORING BEAR POPULATION TRENDS IN FORESTED ENVIRONMENTS

JOHN BOULANGER, Integrated Ecological Research, Nelson, BC, Canada boulange@ecological.bc.ca
MIKE PROCTOR, Birchdale Ecological, Kaslo, BC, Canada mproctor@netidea.com

Duration: 4 hours

Monitoring population trends over time can be an important component of managing for long-term persistence of species that are susceptible to population declines where they co-exist with human populations. Radiotelemetry and DNA-surveys standout as methods to estimate trend. Radiotelemetry has been the traditional method for estimating population trend in grizzly bears. DNA survey methods have been recently developed that estimate population size very effectively and efficiently within one season and offer the potential to estimate trend if designed appropriately. Because long-term monitoring efforts require significant commitments of resources over time, it is in the best interests of managers to fully consider the advantages and disadvantages of each method. In this workshop we suggest optimal designs for DNA and radio telemetry methods. We present analysis strategies with an emphasis on the strengths and weakness of each method and how these relate to management or research objectives. We consider uncertainty, simultaneously measuring causes of trends, a basic comparison of costs to allow further evaluation of methodologies, estimation of process variances, as well as discussion on where each technique may be most appropriate.

Introduction-workshop objectives - John Boulanger & Mike Proctor
DNA sampling-basics and design - Mike Proctor
Radio telemetry sampling-implementation of a large- scale sampling design - Rick Mace
Some issues related to recent monitoring methods - Dave Garshelis
Estimation of population parameters from radiotelemetry data - Mark Boyce
Monitoring grizzly bear populations using DNA data - John Boulanger
Joint analysis of radio telemetry and DNA data - Gary White
Discussion - Bruce McLellan (moderator)

PART 3

PLANNING AND CONDUCTING NONINVASIVE GENETIC RESEARCH

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Workshop duration: 3 hours

While the noninvasive genetic sampling (NGS) literature has been dominated by papers on genotyping error and statistical methodology, weaknesses with project design, implementation, and data management can be significant sources of error yet often receive inadequate attention. We describe the design process, planning, and management of the Northern Divide Grizzly Bear Project, a landmark NGS study to estimate the size and distribution of the grizzly bear (Ursus arctos) population on 31,410 km2 in northwestern Montana, USA. Logistical challenges included a large, diverse study area ranging from prairie/agricultural fields to rugged, largely roadless mountains. Coordination among 12 federal, state, and tribal land management agencies, and cooperation of hundreds of private and corporate landowners, was also essential. Because of the scale and visibility of this study, we incorporated rigorous quality assurance measures at every stage. We developed protocols such as using bar codes to track and enter field sample numbers, integrated database error checking queries, and used GIS to identify suspicious results to minimize these sources of error. Custom maps and pre-programmed GPS units helped field personnel adhere to study protocols.

We emphasize five topics of special concern when conducting large-scale research projects: planning, training, field work quality control, data and sample management, and analytical quality control. For each topic we provide recommendations and examples based on our experiences. While methods described here were developed for a massive NGS project, they can be applied to any study to increase efficiency and credibility of results. This workshop will reinforce the materials covered in the other NGS workshops being offered during the 17th IBA conference.

INVITED ONLY - MEXICO BLACK BEAR MANAGEMENT WORKSHOP
AMERICAS ROOM CINTERMEX / Nov. 7, 2007

OBJECTIVE: TO ASSIST MEXICAN BLACK BEAR MANAGERS IN THE DEVELOPMENT OF MANAGEMENT STRATEGIES THAT HELP RESOLVE CONFLICT BETWEEN HUMANS AND BEARS.

TIME	TITLE	SPEAKER
9:00 - 9:10 am	Background of Human-Bear Conflict in Mexico	Diana Doan-Crider, Mexican Black Bear Project
9:10 - 9:20	PACE Oso Negro Program in Mexico	Oscar Ramirez, Director de Especies Prioritarias, CONANP
9:20 - 9:40 am	Basic Understanding about Bear Behavior	Steve Herrero, University of Calgary
9:40 - 9:55 am	Bears and Food	David Hewitt, Caesar Kleberg Wildlife Research Institute
9:55 - 10:10 am	Bears Teach Other Bears	Rachel Mazur, University of California Berkeley; Sequoia and Kings Canyon National Parks
10:10 - 10:30 am	Managing Bears in Urban Areas	Diana Doan-Crider, Proyecto Oso Negro Mexicano
10:30 - 10:45 am	Coffee Break	
10:45 - 11:00 am	Bears and Agriculture	John Beecham, Beringia South
11:00 - 10:40 am	Agency Outreach Programs	Derek Stonorov, Alaska
10:40 - 10:50 am	Public Outreach and Education Programs	Wendy Gardner, Seattle Zoo
10:50 - 11:10 am	Big Bend National Park - a Success Story	Raymond Skiles, BBNP
11:00 - 11:20 am	Balancing Public Recreation and Bear Conservation	Sean Farley, Alaska Department of Fish & Game
11:20 - 1145 am	Management After-the-Fact; Translocation, Aversive Conditioning, and Removal	John Hechtel, Alaska Department of Fish & Game
11:45 - 12:00 am	Summary of Conflicts in Mexican States	Oscar Infante - Coordinator, PACE Oso Negro
12:00 - 1:30 pm	Discussion & Lunch	
2:00 - 5:00 pm	Field Trip to Estanzuela	

Biomedical Protocol for Free-ranging Brown Bears (*Ursus arctos*) in Scandinavia

Editors
Jon M. Arnemo & Åsa Fahlman

Contributors
Per Ahlqvist, Sven Brunberg, Peter Segerström & Jon E. Swenson

Workshop on Bear Anesthesia, Handling and Monitoring
IBA Conference, Monterrey, Mexico, 2007

PREFACE

The current protocol is based on more than 1,300 captures of free-ranging brown bears carried out during the last two decades in Scandinavia. Some of the results have been published as peer reviewed papers, conference presentations, theses, and reports. However, a large amount of data are still on file and will be published in the future. In addition, a comprehensive review of the world literature has been carried out in order to include pertinent information from other sources.

This document is based on:
Arnemo JM, Fahlman Å, eds. 2007. *Biomedical Protocols for Free-ranging Brown Bears, Gray Wolves, Wolverines and Lynx.* (http://www.bearproject.info)

Tromsø and Uppsala, 24 September 2007

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All photos: Scandinavian Brown Bear Research Project©

INTRODUCTION

Chemical immobilization of wild animals is a form of veterinary anesthesia conducted under the most difficult circumstances. Anesthetic drugs are never completely devoid of toxicity and induction of anesthesia invariably carries a risk to the life of even healthy patients. The risk of severe side effects, injuries and death can never be completely eliminated. In addition, several immobilizing drugs are toxic and potentially lethal to humans.

Chemical immobilization of free-ranging wildlife should only be considered if it is necessary to accomplish research or management goals, and should be carried out by a team of professionals with proper training, experience and expertise in wildlife capture, veterinary anesthesia, animal handling and basic first aid and CPR techniques. If captures are carried out by darting from a helicopter, the skill of the pilot and the crew members is of paramount importance for a successful outcome.

All captures need to be properly planned. If possible, chemical immobilization of brown bears should be carried out in winter or spring, on snow-covered ground. High ambient temperatures, open water, and bare ground make captures more difficult and will increase the risk of accidents and mortality. Although a number of different capture techniques are available, darting from a helicopter is the most efficient, safest and probably least stressful method in most situations. Net-gun capture of wild animals is not recommended due to the extreme risk of helicopter accidents and due to animal welfare considerations.

Darting from a helicopter is the most efficient, safest and probably least stressful capture method for free-ranging brown bears.

Brown bears

Brown bears are usually captured in early spring, shortly after they emerge from their dens. Although brown bears are sometimes chemically immobilized during summer or shortly before denning, such captures are more difficult due the lack of snow cover, and due to open water, high ambient temperatures and increased dose requirements.

Brown bears are darted from a helicopter using a remote drug delivery system (Dan-Inject®). Currently, the following standard doses of medetomidine (M) (Domitor®, Zalopine®) and tiletamine-zolazepam (TZ) (Zoletil®) are used for immobilization of free-ranging bears in April-May: yearlings (15-45 kg) 1.25 mg M + 62.5 mg TZ; subadult bears (2-3 years, 45-70 kg) 2.5 mg M + 125 mg TZ; adult females and small adult males (70-120 kg) 5 mg M + 250 mg TZ; medium-sized adult males (120-200 kg) 10 mg M + 500 mg TZ; large adult males (> 200 kg) 15 mg M + 750 mg TZ. A fixed M:TZ ratio is used so that doses can be split or combined. The doses and darts are made up as follows:

- 1.25 mg M + 62.5 mg TZ (yearlings): 1 ml of Zalopine® and 1.8 ml of sterile water are used to dissolve 500 mg of Zoletil®; split into 8 doses; use 2 ml darts with 1.5 x 25 mm barbed needles (Dan-Inject®)
- 2.5 mg M + 125 mg ZT (subadult bears): 5 ml of Domitor® and 0.8 ml of sterile water are used to dissolve 500 mg of Zoletil®; split into 4 doses; use 2 ml darts with 2.0 x 30 mm barbed needles (Dan-Inject®)
- 5 mg M + 250 mg ZT (adult females and small adult males): 5 ml of Domitor® and 0.5 ml of Zalopine® are used to dissolve 500 mg of Zoletil®; split into 2 doses; use 3 ml darts and 2.0 x 40 mm barbed needles (Dan-Inject®)
- 10 mg M + 500 mg TZ (medium-sized adult males): 1 ml of Zalopine® and 1.5 ml of sterile water are used to dissolve 500 mg of Zoletil®; one dose; use 3 ml dart and 2.0 x 40 mm barbed needle (Dan-Inject®)
- 15 mg M + 750 mg TZ (large adult males): 1 ml of Zalopine® and 0.5 ml of sterile water are used to dissolve 500 mg of TZ; make up three vials that are split into two doses; use 3 ml darts and 2.0 x 40 mm barbed needles (Dan-Inject®)
- For capture of bears late in the fall: consider increasing the dose by 25-50% and using longer needles.

Drugs of choice for brown bear immobilization and anesthesia: medetomidine (Domitor® 1 mg/ml and Zalopine® 10 mg/ml) and tiletamine-zolazepam (Zoletil® 50 mg powder). Reversal of the effects of medetomidine with atipamezole (Antisedan® 5 mg/ml).

Tiletamine-zolazepam used to be the drug combination of choice for immobilization of several bear species. Tiletamine-zolazepam has a wide margin of safety and has no major cardiopulmonary or thermoregulatory side effects in bears. The main disadvantage of this combination is extended recoveries. There is no reversal agent for tiletamine, and the use of a benzodiazepine antagonist like flumazenil (Anexate®), for reversal of zolazepam, in animals immobilized with high doses of

tiletamine-zolazepam is not recommended. However, in combination with medetomidine, the effective dose of tiletamine-zolazepam can be reduced by as much as 75%, and atipamezole can then be used to shorten the recoveries by reversing the effects of medetomidine. The physiologic effects of medetomidine-tiletamine-zolazepam have been studied in several bear species, and this drug combination is well tolerated by healthy individuals. Based on trials in captive brown bears scheduled for euthanasia, we consider that toxic effects from standard doses of medetomidine-tiletamine-zolazepam in healthy bears are very unlikely. A life-threatening situation should not be expected, even if a massive overdose (i.e. five times more than recommended) is administered by accident.

Supplemental dose

Supplemental dosing depends on the situation and whether anesthesia is required or not. Animals that are not down within 15 minutes after the intial dose are redarted with a full dose. If the animal is down but incompletely immobilized, administration of additional drugs is usually necessary. In large bears (adult females, subadult and adult males), darting with either a full dose or half the initial dose is recommended for safety reasons. In yearling bears and small bears 1 mg medetomidine (Domitor®) can be given i.m. by hand syringe injection.

In case of a prolonged procedure or signs of spontaneous recovery, 0.5-1.0 mg medetomidine (Domitor®) i.m. can be used to keep yearling bears immobilized for another 15-30 minutes. For safety reasons, 2 mg medetomidine (Domitor®) should be combined with 1-2 mg/kg ketamine (Narketan 10®) in adult bears. If extra time is needed to finish surgery or other painful procedures, medetomidine-ketamine should always be administered. Due to the long elimination time, additional tiletamine-zolazepam should not be used, unless for safety reasons in large bears.

HELICOPTER DARTING

Animals that have not been captured from (or chased by) a helicopter, are usually naïve when approached and darting can be performed within a few minutes of observation if the snow condition and the area are optimal (ice-covered lakes, clear-cuts, open terrain etc.). Animals that have been captured before will usually run for cover when they hear the helicopter and are much more difficult to approach. To avoid stress and physiological side effects (hyperthermia, lactic acidemia) during immobilization, intensive pursuit should be kept to a minimum, and the total time of pursuit should never exceed 30 minutes.

Darting of brown bears from a helicopter.

HANDLING AND MONITORING OF IMMOBILIZED ANIMALS

Immobilized animals should be monitored and clinically examined by professionals with experience in wildlife medicine. Possible side effects include respiratory depression (drug overdose in individuals with poor body condition, aspiration of vomitus/saliva, pneumothorax due to misplaced dart), and thermoregulatory dysfunction. If several animals are being captured at the same time (e.g.: family group), they should be brought together for monitoring and processing.


Immobilized animals should be carried horizontally to avoid blood pressure fall. Monitoring rectal temperature by the use of a thermometer with continuous reading (Welch Allyn Diatec 600).

To prevent aspiration of saliva or vomitus, immobilized animals should be kept in lateral recumbency with the mouth and head low relative to the body. An eye gel (Viscotears®) should be applied to the cornea to prevent drying. Animals should be protected from direct sunlight into the eyes. Preferably, a blind-fold and ear plugs should be used.

Thermoregulation should be monitored by frequent measurements of the rectal temperature (RT). "Normal" RT in brown bears is thought to be 38.0-39.0°C. Hyperthermic animals (RT > 40.0°C) should be cooled by applying snow (or water in summertime) to the axilla, groin, and/or tongue. In case of persistent hyperthermia or RT > 41.0°C i.v. fluid therapy should be initiated (10-15 ml/kg/hr of Ringer®-acetat). Oxygen supplementation is recommended to hyperthermic animals since the oxygen demand increases 10% for each ºC increase in body temperature. Hypothermic animals


Intravenous drip in the jugular vein. Intranasal oxygen supplementation and monitoring of the hemoglobin oxygen saturation and pulse rate by using a pulse oximeter with the sensor applied to the tongue.

(RT < 36.0°C) should be protected from wind and cold surfaces to avoid further cooling using a Wolverine Bag®. In case of prolonged immobilization and recovery, hypothermic animals should be warmed, and prewarmed fluid (38°C) (Ringer®-acetat) should be administered intravenously. Cardiorespiratory function should be monitored using a pulse oximeter (Nellcor®) with the sensor (VetSat®) applied to the tongue. A relative arterial oxygen saturation (SpO_2) > 90% is considered to be clinically acceptable in a field situation. A decreasing trend or SpO_2 < 90% indicate hypoxemia and supplementation with intranasal oxygen (2-5 liter/min) should be given to improve oxygenation. A portable oxygen cylinder should be part of the standard field equipment, as well as a laryngoscope, endotracheal tubes and a ventilation bag.



Endotracheal intubation and a laryngoscope. Monitoring of the eyelid reflex and capillary refill time.

The color of the mucous membranes in the mouth can be used to assess blood oxygenation. A pink or red color is normal; bluish membranes indicate hypoxemia. The capillary refill time (CRT) can be used to assess peripheral circulation. Normal CRT is 2 sec or less.

A small surgical kit for treating wounds and an electrical clipper should be part of the standard equipment.

TAGGING, SAMPLING AND DOCUMENTATION

Most bears are captured for tagging or sampling purposes and should be processed according to the aim of the project. Capture data should be recorded according to an established animal capture form and photos should be taken.

Radiocollars (VHF, GPS or sattelite) should be fitted according to the size, age and sex of the animal. The weight of the radiocollar should not exceed 2% of the animal's body mass. The collar should be fitted so that it can be pulled on over the head. Drop-off collars or a break-away zone (double webbing in males, single in females) should be used on all growing bears and on bears of unknown age. For adult males, which may have a greater circumference of the neck than the head, clipping of hair on the neck to avoid loosing the collar should be considered. Ensure that it is possible to pass a flat hand between the collar and the neck. The transmitter (VHF) should be activated by removing the magnet and should be tested with the receiver before the animal is released. Ensure that the GPS unit is working properly before any capture is initiated.

A microchip (e.g. Indexel®) should be implanted s.c. in the hump of brown bears. The microchip should be tested with the scanner (Indexel®) after implantation. In addition, one plastic ear tag (with a unique number) and a lip tattoo corresponding to the individual’s project ID number.

Immobilized brown bear and well organized field equipment.

Radiocollar for brown bear.

Body measurements should be recorded according to the animal capture form.

Blood can be sampled from the jugular or the femoral vein using evacuated plastic tubes and multisample needles (e.g. VenoSafe®, Venoject® II). The number of samples are specified in Appendix 1. Blood for genetic studies (5 ml EDTA) should be stored at –20°C until shipment to the laboratory. Tubes without anticoagulant for serology should be kept at room temperature for 1-2 hours to ensure complete coagulation. Serum should then be separated by centrifugation (1500 g for at least 15 minutes) and transferred to 2 ml cryogenic vials (Nalgene®). Serum for banking (serology and back-up) is stored at –20°C until shipment to the laboratory.

In unknown bears, the rudimentary first premolar is extracted for age determination. Local anesthesia (Lidokel-Adrenalin®) and carprofen (Rimadyl®) should be administered before tooth extraction. The tooth is preserved in 96% alcohol in a 2 ml cryogenic vial (Nalgene®).

Ear tagging, hair sampling and tooth extraction.

Hair should be collected with pliers and transferred to 15 ml sterile plastic tubes (Sarstedt®). Hair samples are preserved by drying (in paper envelopes). Skin biopsies are taken from the inside of the ear using a sterile dermal biopsy punch (6 mm, Miltex®) and transferred to 2 ml cryogenic vials (Nalgene®) and preserved by adding 96% ethanol.

Feces is collected by inserting the index finger into the rectum using latex gloves. The feces is transferred to 50 ml sterile plastic tubes (Sarstedt®).

Depending on the situation and the study protocol, other biological materials should be sampled according to current standards in veterinary medicine or specific instructions from the laboratory.

ANALGESIA AND ANESTHESIA FOR SURGERY

In brown bears, surgical anesthesia is induced by the recommended immobilizing drugs and doses. For post operative analgesia, 4 mg/kg carprofen (Rimadyl®) is administered s.c. as soon as possible after immobilization is induced and before surgery.

SURGICAL PROCEDURES FOR IMPLANTATION OF INTRAPERITONEAL RADIOTRANSMITTERS

For surgery, the animal is kept in dorsal recumbency. An appropriate area caudal to the umbilicus is clipped and swabbed with chlorhexidine in 60% ethyl alcohol (Klorhexidin®). For access to the peritoneal cavity, a ventral midline incision is made using standard surgical procedures. The weight of the implant (Telonics®) should not exceed 2% of the body mass of the animal. The radiotransmitter should be tested with the receiver before implantation. Implants should be gas sterilized (ethylene oxide) or disinfected by soaking in 10 mg/ml benzalkonium chloride (non proprietary) for at least 24 hours. They should be prewarmed and, in the case of chemically disinfected implants, thoroughly rinsed with sterile saline before being placed aseptically into the peritoneal cavity. The incision is closed in two layers with absorbable sutures (Vicryl®), using a simple interrupted pattern for the *Linea alba* (US o in yearligs and US 1 in all other bears; use round needle) and a interrupted horizontal mattress pattern for the skin (US 2-0 in yearlings and US 0 in all other bears; use cutting needle). The skin wound is covered with a spraydressing (OpSite®). Before surgery the animal is injected with a "long-acting" combination of procaine penicillin and benzathine penicillin at 100.000 IU/kg (100 mg/kg) i.m. (PENI-kél L.A. 15+15®) to reduce the risk of postoperative wound infections.

REVERSAL OF IMMOBILIZATION

For reversal of immobilization, 5 mg of atipamezole (Antisedan®) per mg of the total dose of medetomidine is administered i.m. or s.c. Due to the long elimation time of tiletamine-zolazepam, atipamezole should not be given until earliest 50-60 min after darting. In an emergency, atipamezole can be given at any time but recovery may then be rough with possible incoordination, excitation and convulsions. Such an animal can be calmed by administration of midazolam (Midazolam®) i.m. (suggested dose 0.1-0.2 mg/kg).

Immobilized animals can usually be left to recover undisturbed at the site of capture. Possible side effects and dangers during and immediately after recovery include hypothermia (especially in yearlings in cold/wet weather), hyperthermia (due to extensive chasing prior to capture, sun and/or high ambient temperatures), intraspecific strife (males attacking other males, males trying to mount immobilized females in estrus, males attacking dependent young), open water, lack of fear, traffic, and poaching. It is highly recommended that all radio-instrumented animals are checked the day after capture.

OTHER TREATMENTS

Captured animals with health-threatening diseases should be treated according to accepted standards in veterinary medicine. In animals with severe or terminal illness, euthanasia should be considered.

NECROPSY PROCEDURES

In case of a capture-related mortality, the carcass should be sent to a diagnostic laboratory for a complete necropsy (Sweden: Statens Veterinärmedicinska Anstalt, Uppsala; Phone: + 46 18674000. Norway: Veterinærinstituttet, Trondheim; Phone: + 47 73580727). To ensure rapid cooling, skinning and evisceration should be considered. If transportation to the laboratory is not possible within 24-48 hours, the carcass should be frozen. As an alternative, a field necropsy can be carried out by a veterinarian after consultation with the laboratory.

LEGAL ASPECTS IN SCANDINAVIA

All captures have to be approved by the appropriate animal etichal committee (Norway: Utvalg for forsøk med dyr; Sweden: Försöksdjursetiska nämnden) and the wildlife management authorities (Norway: Direktoratet for naturforvaltningen; Sweden: Naturvårdsverket). The use of motor vehicles may require special permits from local, regional and/or national authorities. Prior to starting capture activities, the police, animal welfare and wildlife authorities should be informed according to the permit. The use of radio-tememetry equipment reguires a permit (Norway: Post- og teletilsynet; Sweden: Post- och telestyrelsen).

Immobilizing agents are prescription drugs and must be used by or on the the order of a licensed veterinarian (Norway: Statens legemiddelverk; Sweden: Läkemedelsverket). Some of these drugs are also controlled substances, i.e. drugs that can be abused, for which specific regulations apply. In Norway, non-veterinarians can legally use immobilizing agents if a valid veterinarian/client/patient relationship is established; i.e. the veterinarian should ensure that the animal in question is under his/her care (Mattilsynet). In Sweden a special permit is required for non-veterinarians (Jordbruksverket).

Withdrawal times (brown bears): According to the current legislation in force in the European Union (EU), any substance to be used in food producing animals must be assessed by the European Medicines Evaluation Agency (EMEA) in order to establish Maximum Residue Limits (MRLs). After assessment, substances may be listed in one of four Annexes of Council Regulation (EEC) No 2377/90 of 26 June 1990: Annex I – substances for which a full MRL has been fixed; Annex II – substances for which an MRL is not required; Annex III – substances for which a provisional MRL has been fixed; Annex IV – substances for which no MRL can be fixed. If the animal is a "food producing animal" (i.e. an animal, domestic or wild, captive or free-living, whose flesh or products are intended for human consumption), the veterinarian or the person acting under his/her direction may *only* administer a substance listed in Annex I, II, or III. Substances in Annex IV or substances that do not have an Annex entry (I, II, or III) may *not* be used in food producing animals. As of August 2007, very few of the drugs currently used for wildlife immobilization are authorized for use in food producing animals in the EU. In the EU, a withdrawal period is set within the procedure of granting a marketing authorization, i.e. either by the national authority concerned (Norway: Mattilsynet; Sweden: Läkemedelsverket) or, in case of a centrally authorized product, by the EMEA. However, for substances that do not have an Annex entry, no marketing authorization can be granted for use in food producing animals.

RECOMMENDED DRUGS AND EQUIPMENT

Disclaimer: The list does not indicate approval by any authorities or manufacturer for use in wildlife. Drugs and equipment mentioned in the text can be purchased from other manufacturers than those listed.

Anexate®, 0.1 mg/ml, F. Hoffmann-La Roche, Basel, Switzerland
Antisedan®, 5 mg/ml, Orion Pharma Animal Health, Turku, Finland
Brulidine®, Aventis Pharma, Oslo, Norway
Dan-Inject®, Børkop, Denmark
Domitor®, 1 mg/ml, and Zalopine® 10 mg/ml, Orion Pharma Animal Health, Turku, Finland
Dopram®, Wyeth Lederle, Wyeth-Ayerst International Inc., Philadelphia, PA, USA
Indexel®, Merial, Lyon, France
Ketalar®, 50 mg/ml, Warner Lambert, Morris Plains, New Jersey, USA
Klorhexidin, 5 mg/ml, Galderma Svenska AB, Bromma, Sweden
Lidokel-Adrenalin® Kela Laboratoria NV, Hoogstraten, Belgium
Midazolam®, 5 mg/ml, Alpharma AS, Oslo, Norway
Miltex®, Miltex GmbH, Tuttlingen, Germany
Nalgene®, Nalge Company, Rochester, NY, USA
Narketan 10®, 100 mg/ml, Chassot, Dublin, Ireland
Nellcor® NP-20, Nellcor Inc., Pleasanton, CA, USA
OpSite®, Smith & Nephew Medical Limited, Hull, England
PENI-kél L.A. 15+15®, Kela Laboratoria NV, Hoogstraten, Belgium
Rimadyl®, 50 mg/ml, Orion Pharma Animal Health, Turku, Finland
Ringer®-acetat, Pharmacia & Upjohn, Oslo, Norway
Sartsedt®, Sarstedt AS, Ski, Norway
Telonics®, Telonics Inc., Meza, AZ, USA
Transwab®, Medical Wire & Equipment Co. Ltd., Corsham, Wiltshire, UK
VetSat®, Nellcor Inc., Pleasanton, CA, USA
Venoject® II, Terumo Europe N.V., Leuven, Belgium
Vicryl®, Ethicon, Norderstadt, Germany
Viscotears®, CIBA Vision AG, Hetlingen, Switzerland
Welch Allyn Diatec 600, Welch Allyn, Inc., New York, USA
Wolverine Bag®, Jerven AS, Odda, Norway
Zoletil®, 500 mg/vial, Virbac, Carros, France
Zalopine®, 10 mg/ml, Orion Pharma Animal Health, Turku, Finland

SCANDINAVIAN AUTHORITIES

Direktoratet for naturforvaltning, Norge: http://www.dirnat.no/
EMEA: http://www.emea.eu.int/
Försöksdjursetiska nämnden, Sverige: http://www.djurskyddsmyndigheten.se/jahia/Jahia/pid/2
Läkemedelsverket, Sverige: http://www.mpa.se/index.shtml
Jordbruksverket, Sverige: http://www.sjv.se/
Mattilsynet, Norge: http://www.mattilsynet.no/
Naturvårdsverket, Sverige: http://www.naturvardsverket.se/
Post- og teletilsynet, Norway: http://www.npt.no/
Statens legemiddelverk, Norge: http://www.legemiddelverket.no/
Statens Veterinärmedicinska Anstalt, Sverige: http://www.sva.se/
Utvalg for forsøk med dyr, Norge - http://www.fdu.no/fdu/om/
Veterinærinstituttet, Norge: http://www.vetinst.no/

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PHYSIOLOGIC RESPONSES OF GRIZZLY BEARS TO DIFFERENT METHODS OF CAPTURE

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ABSTRACT: The physiologic effects of two methods of capture, chemical immobilization of free-ranging (FR) bears by remote injection from a helicopter and physical restraint (PR) by leg-hold snare prior to chemical immobilization, were compared in 46 grizzly bears (*Ursus arctos*) handled during 90 captures between 1999 and 2001. Induction dosages and times were greater for FR bears than PR bears, a finding consistent with depletion of, or decreased sensitivity to, catecholamines. Free-ranging bears also had higher rectal temperatures 15 min following immobilization and temperatures throughout handling that correlated positively with induction time. Physically restrained bears had higher white blood cell counts, with more neutrophils and fewer lymphocytes and eosinophils, than did FR bears. This white blood cell profile was consistent with a stress leukogram, possibly affected by elevated levels of serum cortisol. Serum concentrations of alanine aminotransferase, aspartate aminotransferase, and creatine kinase were higher in PR bears that suggested muscle injury. Serum concentrations of sodium and chloride also were higher in PR bears and attributed to reduced body water volume through water deprivation and increased insensible water loss. Overall, different methods of capture resulted in different patterns of physiologic disturbance. Reducing pursuit and drug induction times should help to minimize increase in body temperature and alteration of acid-base balance in bears immobilized by remote injection. Minimizing restraint time and ensuring snare-anchoring cables are short should help to minimize loss of body water and prevent serious muscle injury in bears captured by leg-hold snare.

Key words: Capture, chemical immobilization, grizzly bear, leg-hold snare, physical restraint, physiologic effects, stress.

INTRODUCTION

In many situations, capture and handling wildlife imposes stress, a normal adaptive response in which the target animal uses energy to cope with some threat to its welfare. However, when a threat is extreme or prolonged, the stress response can have a deleterious effect on an animal's health and result in a physiologic state known as "distress" (Moberg, 1999). In distress, energy is used at the expense of other biologic functions including reproduction, tissue growth and maintenance, or immune response and, if unchecked, can result in death. The consequences of capture-related stress have implications for both wildlife health (Kock et al., 1987b; Spraker, 1993; Douglass et al., 2000; Haulton et al., 2001; Jessup, 2001) and interpretation of research results (St. Aubin and Geraci, 1989; Hellgren et al., 1993; Huber et al., 1997). Understanding the physiologic responses to different methods of capture and handling enables appropriate selection of methods to minimize the amount of stress imposed on animals, and to reduce the risk of distress or death at the time of capture and in the days that follow.

Here, data are presented comparing physiologic effects of two methods of capture on wild grizzly bears (*Ursus arctos*). With one method, free-ranging bears were located from a helicopter and immobilized

by remote injection. With the other method, bears were captured and restrained by leg-hold snare for as long as 24 hr prior to chemical immobilization.

MATERIALS AND METHODS

Forty-six free-ranging grizzly bears were handled during 90 captures that occurred in west-central Alberta (Canada; 52°40′–53°60′N, 116°50′–118°00′W) between April 1999 and August 2001 as part of the Foothills Model Forest Grizzly Bear Research Project. For 41 captures, free-ranging (FR) grizzly bears were located by helicopter and immobilized using remote injection (Pneudart® Inc., Williamsport, Pennsylvania, USA and Paxarms® N.Z. Ltd., Timaru, New Zealand) with combinations of zolazepam and tiletamine (ZT; Telazol®, Fort Dodge Laboratories, Inc., Fort Dodge, Iowa, USA) at 8–10 mg/kg estimated body weight, or xylazine-zolazepam-tiletamine (XZT; Cervizine 300®, Wildlife Pharmaceuticals, Inc., Fort Collins, Colorado, USA) administered as xylazine at 2 mg/kg and Telazol® at 3 mg/kg. For 49 captures, grizzly bears were first captured and physically restrained (PR) by spring-activated leg-hold snare (Margo Supplies Ltd., High River, Alberta) for as long as 24 hr before immobilization with ZT or XZT. The capture and handling protocol was approved through the Animal Care Committee at the University of Saskatchewan (Saskatchewan, Canada; protocol number 19990023).

Pulse and respiratory rates, and rectal temperature (Excel 10® digital thermometer, AMG Medical, Montreal, Quebec, Canada), were recorded for all bears at onset of handling and every 15 min afterwards during the 75 min of handling. Blood was drawn from the medial saphenous vein into sterile tube for biochemical analysis, and into an ethylenediaminetetraacetic acid (EDTA) tube for hematology. Blood samples for serum biochemistry were centrifuged and the serum extracted and stored frozen (−18 C) until laboratory analysis within 1 mo using a biochemistry analyzer (Abbott Specrum® Series II, Abbott Laboratories Diagnostic Division, Abbott Park, Illinois, USA). Blood samples in EDTA were chilled and analyzed for complete blood cell profiles within 24 hr using a hematology analyzer (Abbott Cell-Dyn® 3200, Abbott Laboratories Diagnostic Division). To determine actual drug dosages, bears were weighed in a sling suspended beneath a load scale (MSI-7200 Dynalink, Precision Giant Systems Inc., Edmonton, Alberta, Canada).

All data were analyzed using SPSS® 10.0 for Windows® (SPSS Inc., Chicago, Illinois, USA). Two-way ANOVA was used to compare induction features, physiologic measures, hematology, and serum biochemistry between methods of capture (FR vs. PR) and between drugs (Zar, 1996). Julian date of capture and age of bear in years were included as covariates for all analyses. Where assumptions of parametric statistics were violated, data were transformed to their natural logarithm and analyzed accordingly. Statistical significance was assigned when the probability (P) of a type I error was ≤ 0.05. All results are reported as the mean ± standard error (SE).

RESULTS

Although induction dosages (mg/kg based on actual body weight) did not differ statistically between free-ranging bears immobilized by remote injection from a helicopter (FR) and bears that were captured and physically restrained by spring-activated leg-hold snare (PR) prior to chemical immobilization, dosages tended to be higher in FR bears (8.70±0.80 mg/kg vs. 7.79±0.69 mg/kg; $F=2.79$, $P=0.10$). Induction times also were greater in FR bears than in PR bears (6.64±0.62 min vs. 5.18±0.47 min; $F=4.23$, $P\leq 0.05$).

Pulse and respiratory rates at 15 min following immobilization were similar between groups (pulse rate: $F=0.14$, $P=0.71$; respiratory rate: $F=1.26$, $P=0.27$), but rectal temperatures were higher in FR bears (38.9±0.22 vs. 38.0±0.15, $F=9.13$, $P\leq 0.01$). Rectal temperatures throughout the handling period also were significantly correlated with induction time in FR bears (post-injection times: 15 min—$r=0.60$, $P\leq 0.01$, $n=28$; 30 min—$r=0.36$, $P\leq 0.05$, $n=38$; 45 min—$r=0.45$, $P\leq 0.05$, $n=39$; and 60 min—$r=0.77$, $P\leq 0.001$, $n=21$).

The proportions of white blood cell subpopulations were affected by method of capture. White blood cell counts (WBC) and neutrophil proportions were higher in PR bears than in FR bears (WBC: $12.2\pm0.74\times10^9$/l vs. $6.9\pm0.46\times10^9$/l, $F=33.0$, $P\leq 0.001$; neutrophils: 90±0.9% vs. 75±2.0%, $F=48.7$, $P\leq 0.001$). Conversely, proportions of lymphocytes and eosinophils were lower in PR bears (lymphocytes: 5±0.6% vs. 16±1.4, $F=46.9$,

$P \leq 0.001$; eosinophils: 0.8±0.14% vs. 3.4±0.50%, $F=19.5$, $P \leq 0.001$).

Numerous serum biochemistry values were affected by method of capture. Serum concentrations of sodium and chloride were higher, and concentrations of potassium and calcium and the anion gap were lower, in PR bears than in FR bears (sodium: 144±0.7 mmol/l vs. 139±0.8 mmol/l, $F=26.6$, $P \leq 0.001$; chloride: 109±1.1 mmol/l vs. 102±1.2 mmol/l, $F=15.9$, $P \leq 0.001$; potassium: 3.9±0.10 mmol/l vs. 4.2±0.10 mmol/l, $F=4.9$, $P \leq 0.05$; calcium: 2.31±0.027 mmol/l vs. 2.40±0.031 mmol/l, $F=4.5$, $P \leq 0.05$; anion gap: 21±0.6 mmol/l vs. 23±0.9 mmol/l, $F=6.6$, $P \leq 0.05$). Serum concentrations of the enzymes alanine aminotransferase (ALT), aspartate aminotransferase (AST), and creatine kinase (CK) were higher, and γ-glutamyltransferase (γ-GT) was lower, in PR bears (ALT: 63±5.3 U/l vs. 41±5.9 U/l, $F=5.3$, $P \leq 0.05$; AST: 264±36.0 U/l vs. 125±23.4 U/l, $F=16.6$, $P \leq 0.001$; CK: 2,202±653 U/l vs. 189±29.5 U/l, $F=5.3$, $P \leq 0.05$; γ-GT: 18±1.6 U/l vs. 29±4.3 U/l, $F=9.3$, $P \leq 0.01$). Further, glucose and total cortisol concentrations were higher, and creatinine concentration was lower, in PR bears (glucose: 8.0±0.35 mmol/l vs. 7.3±0.56 mmol/l, $F=6.8$, $P \leq 0.01$; total cortisol: 222±25.3 nmol/l vs. 147±16.6 nmol/l, $F=4.7$, $P \leq 0.05$; creatinine: 90±4.7 μmol/l vs. 130±8.0 μmol/l, $F=12.8$, $P \leq 0.001$). Among all bears, γ-GT concentration was correlated with rectal temperature at 15 min following immobilization ($r=0.27$, $P \leq 0.05$, $n=76$).

Although induction features, physiologic measures, and blood values also were affected by immobilizing drug, these results are presented elsewhere (Cattet et al., 2003).

DISCUSSION

Chemical immobilization of free-ranging (FR) grizzly bears by remote injection from a helicopter resulted in longer induction times and tended to require higher drug dosages than did chemical immobilization of bears captured and physically-restrained (PR) by leg-hold snare. In general, high circulating levels of catecholamines (epinephrine and norepinephrine) modify the effects of immobilizing drugs and result in delayed induction of immobilization and increased drug requirement or, in some situations, ineffective immobilization (Fowler, 1995; Kreeger, 1996; Nielsen, 1999). In laboratory rats, prolonged physical restraint of 30–240 min results in progressive depletion of catecholamine stores (Dronjak et al., 1999) and decreased sensitivity to catecholamines (Satoh, 1998). Although catecholamine levels were not determined in this study, extending these results to grizzly bears would suggest catecholamine activity was lower in PR bears than in FR bears as a result of the stress associated with a prolonged period of physical restraint prior to chemical immobilization. As a result, PR bears were more sensitive to the effects of immobilizing drugs than were FR bears. In this study, continual effort was made to reduce the duration of physical restraint experienced by bears captured in snares, e.g., deployment of trap transmitters, frequent site visits, etc. Nevertheless, the remote locations of some sites limited the frequency of site visits to once per 24 hr, therefore some bears may have been restrained for as long as 24 hr prior to chemical immobilization.

Rectal temperatures at 15 min following chemical immobilization were higher in FR bears than in PR bears. Further, induction time was positively correlated with rectal temperatures recorded throughout the handling period. This was likely a result of strenuous activity by FR bears while fleeing from the helicopter in the moments prior to chemical immobilization or while progressively succumbing to the effects of the immobilizing drugs. As well, increases in circulating levels of norepinephrine produce vasoconstriction, which decreases heat loss and leads to a rise in body temperature (Ganong, 1995), a factor that may also have contributed to the higher temperatures in FR bears. Observations

of extensive damage to standing vegetation in the immediate vicinity of leg-hold snare sites indicated intense physical exertion was also characteristic of some PR bears. Nevertheless, many of these bears were chemically immobilized hours following their bout of intense activity and it is likely that sufficient time had elapsed for their body temperature to return toward normal. In addition, snare sites were typically constructed in areas that were well shaded and unlikely to contribute to thermal stress.

Bears captured by leg-hold snare had higher concentrations of white blood cells, higher proportions of neutrophils, and lower proportions of lymphocytes and eosinophils than did FR bears. This pattern of white cell proportions is a typical stress leukogram observed in domestic species following adrenal stimulation or glucocorticoid administration (Feldman et al., 2000). This physiologic stress response was likely mediated by elevated levels of cortisol in the blood of PR bears relative to levels in FR bears. Higher serum concentrations of glucose in PR bears may have also occurred as a result of cortisol-mediated reduction in peripheral utilization of glucose and stimulation of gluconeogenesis (Goldstein et al., 1993; Ganong, 1995). Similar results (stress leukogram and high serum cortisol and glucose concentrations) have also been reported for red foxes (*Vulpes vulpes*) caught by padded-jaw foothold traps relative to foxes captured in box traps (White et al., 1991).

Bears captured by leg-hold snare had higher serum concentrations of ALT, AST, and CK than did FR bears. These enzymes are found in large quantity in muscle and high concentrations of all three enzymes in serum at the same time typically signify degenerative or necrotizing muscle injury (Duncan et al., 1994). Muscle injury in PR bears likely occurred in association with tightening of the snare cable around the distal forelimb and excessive strain on muscles and joints of the forelimb proximal to the closed snare. Elevated levels of muscle enzymes in association with physical capture have also been reported for black bears (*U. americanus*), brown bears, and polar bears (*U. maritimus*) captured by leg-hold snare (Lee et al., 1977; Schroeder, 1987; Huber et al., 1997), and for red foxes captured by foothold trap (White et al., 1991). Although muscle injury may be common when using leg-hold snares, chemical immobilization by remote injection from helicopter may also result in significant muscle injury as indicated by the high levels of muscle enzymes that occurred in some of the FR bears.

Elevated levels of muscle enzymes, potassium, and creatinine in some FR bears may have also occurred as a result of muscle activity during capture. Intense muscular activity can result in release of intracellular potassium, creatinine, and enzymes from muscle cells without any pathologic consequences. In exercising humans, potassium efflux from muscle cells is mediated by catecholamines and results in elevated serum levels for a short time before returning to normal (Williams et al., 1985). Similarly, circulating creatinine can be elevated temporarily by exercise (Refsum and Stromme, 1974). It is unlikely that the higher concentrations of creatinine in FR bears reflected renal dysfunction since urea, which is also cleared by the kidneys, was similar between FR and PR bears. Elevations in serum potassium, creatinine, and muscle enzymes have also been documented in beluga whales (*Delphinapterus leucas*) during capture from the wild (St. Aubin and Geraci, 1989), and in bighorn sheep (*Ovis canadensis*) captured by drop-net or chemical immobilization by remote injection from a helicopter (Kock et al., 1987a).

Serum concentrations of γ-GT were higher in FR bears than in PR bears. Increased levels of γ-GT are typically associated with liver disease, specifically biliary stasis (Meyer, 1983; Duncan et al., 1994). In normal health, however, γ-GT can leak into plasma from other tissues because it occurs as a membrane bound enzyme in a

variety of tissues that include liver, heart, kidney, skeletal muscles, and tissues of the reproductive organs (Viña et al., 1989; Hanigan and Frierson, 1996; Leeuwenburgh et al., 1997). Although the tissue source of γ-GT was not determined for grizzly bears, the higher concentration in FR bears was speculated to occur as a result of increased metabolic activity during pursuit and capture based on the observation that γ-GT concentration was directly correlated with rectal temperature. Elevated levels of γ-GT have also been reported in beluga whales following capture, but in this case were suggested to result from inadequate perfusion and anoxia of liver tissue caused by stress-induced circulatory insufficiency (St. Aubin and Geraci, 1989).

Intense muscle activity immediately preceding chemical immobilization also explained the observation that anion gap and serum calcium concentration were higher in FR bears than in PR bears. The release of energy through anaerobic glycolysis would be expected to result in increased levels of lactic acid, or more generally unmeasured anions, in the circulation. As the anion gap increased, the release of calcium into circulation increased as a physiologic response to offset any acid-base disturbance caused by the accumulation of lactic acid.

Reduced body water volume was the most probable explanation for the higher concentrations of sodium and chloride in PR bears. Bears captured by leg-hold snare were deprived of water for prolonged periods (2–23 hr), and likely had increased insensible water loss associated with the struggle to escape. Although dehydration was mild in most cases, it was significant enough in a few bears to result in moderate elevations (≥mean+2SD) in sodium (≥152 mmol/l), chloride (≥121 mmol/l), urea (≥19.8 mmol/l), and total protein (≥81 g/l). Without the insight provided by serum biochemistry, this level of dehydration (i.e., ≤5% of body weight in fluid loss) would likely go undetected in most captured bears. Nevertheless, intravenous fluid therapy (e.g., lactated Ringer's solution) could be of benefit to some PR bears.

In conclusion, immobilization by remote drug injection from a helicopter and capture and physical restraint by leg-hold snare caused different patterns of physiologic disturbance in grizzly bears. Disturbances observed in bears immobilized by remote injection from a helicopter were increased body temperature and slight alteration of acid-base balance. Reducing pursuit and drug induction times should help to minimize occurrence of these types of disturbances. The main physiologic disturbances in bears captured by leg-hold snare were muscle injury and dehydration. In addition, many bears developed a stress leukogram, likely as a consequence of their longer duration of stress relative to that experienced by free-ranging bears immobilized from a helicopter, i.e., subacute vs. acute stress. Minimizing the time bears are restrained in snares prior to chemical immobilization and ensuring that snare-anchoring cables are kept short should help to minimize loss of body water and prevent serious muscle injury.

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ANESTHESIA OF POLAR BEARS USING XYLAZINE-ZOLAZEPAM-TILETAMINE OR ZOLAZEPAM-TILETAMINE

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ABSTRACT: Immobilization features and physiologic effects of combinations of xylazine-zolazepam-tiletamine (XZT) and zolazepam-tiletamine (ZT or Telazol®) were compared in nine captive and 17 free-ranging polar bears (*Ursus maritimus*) between 1998 and 2001. Although induction time was similar between drugs, induction dosage and volume were less with XZT. Induction of immobilization with XZT was predictable and smooth, muscle relaxation was good, and all bears remained completely immobilized and unresponsive to stimuli throughout a 1 hr handling period. The combination XZT was safely tolerated at two to three times the recommended dosage of 5 mg/kg (i.e., xylazine at 2 mg/kg + Telazol® at 3 mg/kg). Bears immobilized with XZT had slower pulse rates, higher mean arterial pressures, and lower arterial oxygen tensions than bears immobilized with ZT. Rectal temperature increased slowly over time (~0.5 C per hr) following immobilization with XZT. Based on response to a painful stimulus (compression of a claw bed), XZT was a more effective analgesic than ZT. Although the immobilization effects of XZT could not be reversed with the α_2-antagonist drug tolazoline, they were reversed with yohimbine or atipamezole. However, the time to complete reversal of effects (i.e., standing and ambulatory) was highly variable among bears.

Key words: Anesthesia, atipamezole, polar bear, Telazol®, tiletamine, tolazoline, xylazine, yohimbine, zolazepam.

INTRODUCTION

A 1:1 mixture of zolazepam and tiletamine (Telazol®, Fort Dodge Laboratories, Inc., Fort Dodge, Iowa, USA or Zoletil®, Virbac S.A., Carros, France) has long been recognized as the drug of choice for the chemical immobilization of bears (Stirling et al., 1989; Taylor et al., 1989; Gibeau and Paquet, 1991; White et al., 1996). Its advantages relative to other drug mixtures is that its anesthetic effects are highly predictable, it causes minimal depression of physiologic function, and it can be administered safely over a wide range of dosages (Cattet et al., 1999; Caulkett et al., 1999).

However, although generally effective and safe, the combination of zolazepam and tiletamine (ZT) does have some disadvantages (Cattet et al., 1999). For larger bears, ZT must be administered in relatively large volumes (≥7 ml), which can result in loss of accuracy with remote injection systems (dart rifles and darts) as well as increased tissue trauma at the site of drug injection. The analgesic effect of ZT is poor and inadequate for painful procedures such as the extraction of a premolar for aging (Caulkett et al., 1999). The effects of ZT cannot be reversed because, although flumazenil may be used to reverse the effects of zolazepam, an antagonist drug for tiletamine does not exist. Finally, bears immobilized with ZT may have prolonged recoveries lasting many hours, especially if multiple doses are administered (Cattet et al., 1997).

Some limitations can be counteracted through the addition of an α_2-agonist drug. Medetomidine has been mixed with ZT and used effectively to immobilize brown (*Ursus arctos*), polar (*U. maritimus*), and black bears (*U. americanus*) (Cattet et al., 1997; Caulkett and Cattet, 1997; Röken, 1997; Arnemo, 2001). The combination is administered at approximately 25% of the volume that would be required if using ZT alone. Further, medetomidine has potent analgesic effect and the combination of

medetomidine and ZT can be effectively and reliably reversed with the α_2-antagonist atipamezole. Nevertheless, the widespread use of medetomidine in wildlife chemical immobilization is limited by its high cost and limited commercial availability in North America as a concentrated solution (>1 mg/ml).

In recent years, another α_2-agonist drug, xylazine, has been used in combination with ZT to effectively and safely immobilize a variety of wildlife (Millspaugh et al., 1995; Sweitzer et al., 1997; Galka et al., 1999; Caulkett et al., 2000). In contrast to medetomidine, xylazine is relatively inexpensive, available widely, and has been used routinely for wildlife chemical immobilization. Here, data are presented from captive and free-ranging polar comparing the immobilization features and physiologic effects of combinations of xylazine-zolazepam-tiletamine (XZT) and zolazepam-tiletamine. Further, data are also presented regarding the effectiveness of the α_2-antagonist drugs tolazoline, yohimbine, and atipamezole to reverse immobilization with XZT.

MATERIALS AND METHODS

Captive polar bears

Nine captive polar bears were immobilized with combinations of XZT or ZT at Churchill (Manitoba, Canada; 58°45′N, 94°06′W) in November 1998. These bears were considered problem animals and captured by government personnel with baited culvert traps or chemical immobilization (ZT, Telazol®, intramuscular at 6–8 mg/kg) and maintained in a holding facility for 3–23 days prior to this study. While held captive, each bear was immobilized on two occasions with 7 days between first and second immobilization. The protocols and type of data collected were identical for each immobilization event except that the drug combinations used differed between events with the sequence (i.e., ZT followed by XZT or vice versa) determined randomly.

Zolazepam-tiletamine was administered in a 1:1 combination by weight at an induction dose of 7–9 mg/kg based on estimated body weight. The drug was prepared as a solution (227 mg/ml) by adding 1.8 ml of sterile water for injection to 500 mg of lyophilized ZT resulting in a final volume of 2.2 ml per vial. The lyophilized drug contributed approximately 0.4 ml to the final volume hence the greater volume of drug solution than added water. Xylazine-zolazepam-tiletamine was administered as xylazine (X, Xylamax®, MTC Pharmaceuticals Ltd., Cambridge, Ontario, Canada) and ZT in a 2:3 combination by weight at an induction dose of 5 mg/kg (i.e., 2 mg/kg X+3 mg/kg ZT). The drug was prepared as a solution (224 mg/ml) by adding 3.3 ml of X (100 mg/ml) to 500 mg of lyophilized ZT resulting in a final volume of 3.7 ml per vial. The lyophilized drug powder contributed approximately 0.4 ml to the final volume. Both combinations were delivered by pole syringe or blowpipe into the muscles of the shoulder or neck.

Within 15 min of immobilization the femoral artery was cannulated with a 20 ga×5 cm intra-arterial catheter (Surflo®, Terumo Medical Corp., Irvine, California, USA). The catheter was connected via non-compliant plastic tubing filled with heparinized saline to a pressure transducer (Uniflow®, Baxter Healthcare Corp., Irvine, California) that was, in turn, connected to a physiologic monitor (Propaq 400 EL, Protocol Systems Inc., Beaverton, Oregon, USA). The arterial line was used to measure pulse rate and direct arterial pressure and to remove arterial blood samples for blood gas analysis.

Pulse and respiratory rates and direct arterial pressures were recorded at 15 min following drug administration, and every 5 min afterwards until final measurements at 60 min following drug administration. Tidal volume (Wright's Respirometer, Haloscale, Penlon USA, Cleveland, Ohio, USA), percent hemoglobin saturation (SpO_2; 4402 Vet/Ox™ pulse oximeter system, Sensor Devices, Waukesha, Wisconsin, USA), and rectal temperature (Excel 10® digital thermometer, AMG Medical, Montreal, Quebec, Canada) were recorded, and arterial blood samples (2–3 ml) were collected at 15, 30, 45, and 60 min following drug administration. For tidal volume measurement the respirometer was attached to a form-fitting facemask that was placed over the rostrum and mouth of the anesthetized bear. Blood samples were analyzed immediately after collection using a portable analyzer and blood gas cartridges (I-STAT Portable Clinical Analyzer and I-STAT G3+ Blood Gas Cartridges, I-STAT Corporation, East Windsor, New Jersey, USA). At 60 min, blood was collected from the jugular vein into sterile tubes for biochemical analysis and measurement of serum cortisol concentration and into an ethylenediaminetetraacetic acid (EDTA) tube for measurement of the complete blood count. Blood samples for serum biochemistry and cortisol were centrifuged and the serum was extracted and stored frozen until

laboratory analysis within 2 wk. Blood samples in EDTA were placed on ice and analyzed for complete blood cell profiles within 3 hr. Blood was analyzed on a biochemistry analyzer (Abbott Spectrum® Series II, Abbott Laboratories Diagnostic Division, Abbott, Abbott Park, Illinois, USA) and a hematology analyzer (Abbott Cell-Dyn® 3200, Abbott Laboratories Diagnostic Division).

To quantify the analgesic effects of XZT and ZT, the pulse rate and mean arterial pressure (MAP) were recorded at 20 and 50 min after administration of each drug. Hemostats were then applied with full compression to the base of the lateral-most claw on the right forelimb for 10 sec immediately after baseline measurements. Pulse rate and MAP was then recorded again 20 sec after removal of the hemostat. Any significant increase in pulse rate or MAP was interpreted as a response to pain, with the magnitude of change correlated directly with the amount of pain perceived.

One hour after drug administration, all physiologic monitors were disconnected and the bear was weighed on a platform overlying electronic load bars (Senstek, Norac Systems, Saskatoon, Saskatchewan, Canada). Bears receiving XZT were administered tolazoline (Tolazine®, Lloyd Laboratories, Shenandoah, Iowa, USA) at twice the xylazine dosage with half the dose given intravenously and the other half given intramuscularly. Bears receiving ZT were allowed to recover undisturbed.

The immobilization and handling protocol for captive polar bears was approved through the Animal Care Committee at the University of Saskatchewan (protocol number 980036).

Free-ranging polar bears

Seventeen free-ranging polar bears were located from a helicopter along the west coast of Hudson Bay near Churchill (57°00′–58°50′N, 92°25′–94°15′W) in August 2001. They were immobilized from the helicopter using remote injection (Cap-Chur®, Palmer Equipment Co., Douglasville, Georgia, USA) with XZT administered as X (Cervizine 300®, Wildlife Pharmaceuticals, Inc., Fort Collins, Colorado, USA) and ZT in a 2:3 combination by weight at an induction dose of 5–6 mg/kg based on estimated body weight. The drug was prepared as a solution (300 mg/ml) by adding 1.1 ml of X (300 mg/ml) and 1.3 ml of sterile water for injection to 500 mg of lyophilized ZT, resulting in a final volume of 2.8 ml per vial. The lyophilized drug powder contributed approximately 0.4 ml to the final volume.

Pulse and respiratory rates, SpO_2, and rectal temperature were recorded at 15 min following drug administration, and every 10 min afterwards during 45 min of handling. At the conclusion of handling, bears were administered either yohimbine (Antagonil®, Wildlife Pharmaceuticals, Inc.) at 0.2 mg/kg, or atipamezole (Antisedan®, Orion Corporation, Animal Health, Turku, Finland) at 0.15 mg/kg, with half the dose given intravenously and the other half given intramuscularly. Tolazoline was not administered to free-ranging polar bears because it had proven ineffective with captive bears during earlier testing of XZT.

The capture and handling protocol for free-ranging polar bears was approved through the Canadian Wildlife Service, Prairie and Northern Region, Animal Care Committee (protocol number 2001PNR013).

Statistical analyses

All data were analyzed using SPSS® 10.0 for Windows® (SPSS Inc., Chicago, Illinois). Two-way analysis of variance (ANOVA) for repeated measures was used to compare physiologic measures between drugs (XZT versus ZT), between captive bears and free-ranging bears immobilized with XZT, and among time points following drug administration (Zar, 1996). Hematology and serum biochemistry values were compared between drug treatments using paired *t*-tests. To assess analgesic effect within each drug treatment, one-sample *t*-tests were used to determine if change in physiologic measures and blood gas values differed significantly from zero. Where assumptions of parametric statistics were violated, data were transformed to their natural logarithm and analyzed accordingly. Statistical significance was assigned when the probability (P) of Type I error was ≤ 0.05. All results are reported as the mean±standard error (SE).

RESULTS

Captive polar bears

Although induction time was similar between drugs, induction dosage and volume were less with XZT (Table 1). There was no correlation between induction time and dosage with either combination (Spearman rank correlation: ZT—$r_s=0.03$, $P=0.93$; XZT—$r_s=0.36$, $P=0.34$). Dosages based on measured body weight ranged almost two-fold with each combination (Table 1). The time to reverse the effects of XZT immobilization with tolazoline was prolonged (>22 min) and did not appear to differ

TABLE 1. Anesthetic characteristics[a] of captive polar bears receiving either xylazine-zolazepam-tiletamine (XZT) or zolazepam-tiletamine (ZT).

		Induction			Reversal[b]
Drug	*n*	Time (min)	Dosage (mg/kg)	Volume (ml/300 kg)	Time (min)
XZT	9	4.1 ± 0.9 (1.5–10.5)	4.8 ± 0.3*** (2.7–5.6)	6.5 ± 0.4*** (3.7–7.6)	33.9 ± 1.6 (22.5–70.5)
ZT	9	5.7 ± 1.4 (2.3–15.3)	7.2 ± 0.5*** (5.3–9.5)	9.5 ± 0.7*** (7.0–12.6)	NA

[a] Results presented as mean ± standard error with minimum and maximum values in brackets. '***' indicates a significant difference ($P \leq 0.001$) between drug combinations, NA = not applicable.

[b] Anesthesia with XZT was reversed with tolazoline at 3.8 ± 0.6 mg/kg with half the volume given intravenous and the other half given intramuscular.

from time for recovery without antagonist following ZT immobilization.

Bears immobilized with XZT had slower pulse rates and higher mean arterial pressures than bears immobilized with ZT (Fig. 1). There was no significant difference in rectal temperature between drug groups (Fig. 1). Nevertheless, rectal temperature increased over time in bears immobilized with XZT (repeated measures ANOVA: $F=7.1$, $P\leq0.01$) and decreased over time in bears immobilized with ZT ($F=13.3$, $P\leq0.001$).

Respiratory rates and minute volumes were similar between drug combinations (Fig. 1). However, bears immobilized with XZT had lower arterial oxygen tension (P_aO_2), SpO_2, and blood pH than bears immobilized with ZT (Figs. 1, 2). Arterial oxygen tension (XZT—$F=16.5$, $P\leq0.001$; ZT—$F=6.9$, $P\leq0.01$) and SpO_2 (XZT—$F=7.4$, $P\leq0.001$; ZT—$F=6.6$, $P\leq0.01$) increased over time with both combinations. In bears immobilized with ZT, arterial carbon dioxide tension ($F=5.1$, $P\leq0.01$) decreased and arterial blood pH ($F=5.3$, $P\leq0.01$) increased over time.

Many hematologic values were greater in bears immobilized with XZT (paired *t*-test, $p\leq0.05$ for the following variables: red blood cells—$7.0\pm0.12\times10^{12}$/l vs. $6.5\pm0.28\times10^{12}$/l; hemoglobin—166±1.3 g/l vs. 150±3.9 g/l; packed cell volume—47±0.5 l/l vs. 43±0.2 l/l; platelets—$365\pm30.6\times10^{9}$/l vs. $250\pm33.0\times10^{9}$/l; and white blood cells—$5.9\pm0.49\times10^{9}$/l vs. $5.0\pm0.51\times10^{9}$/l). Nevertheless, there were no differences in the proportions of different white cell populations between drugs. Serum concentrations of potassium (4.0±0.09 mmol/l vs. 3.5±0.05 mmol/l), glucose (10.1±0.44 mmol/l vs. 6.7±0.19 mmol/l), creatinine (121±9.5 μmol/l vs. 105±6.9 μmol/l), and albumin (32±0.5 g/l vs. 31±0.6 g/l) were also greater in bears immobilized with XZT (paired *t*-test, $P\leq0.05$).

Pulse rate and mean arterial pressure increased in bears immobilized with ZT immediately following the compression of a claw with hemostats but did not change in bears immobilized with XZT (Fig. 3).

Free-ranging polar bears

Induction dosages (based on estimated body weight) and times with XZT were similar between free-ranging and captive bears (mean±standard deviation: dose—5.5±1.81 mg/kg vs. 4.8±0.95 mg/kg, $t=0.99$, $P=0.34$; time—4.5±1.29 min vs. 4.1±2.81 min, $t=0.53$, $P=0.60$). Induction dosages ranged from 3.0–15.3 mg/kg. There was no significant correlation between induction time and dosage (Pearson correlation: $r=0.39$, $P=0.12$, $n=17$). Physiologic values following the administration of XZT were similar between free-ranging and captive bears (Fig. 1). Full reversal of XZT immobilization was not induced with either yohimbine or atipamezole, and all animals remained recumbent 15 min following drug administration.

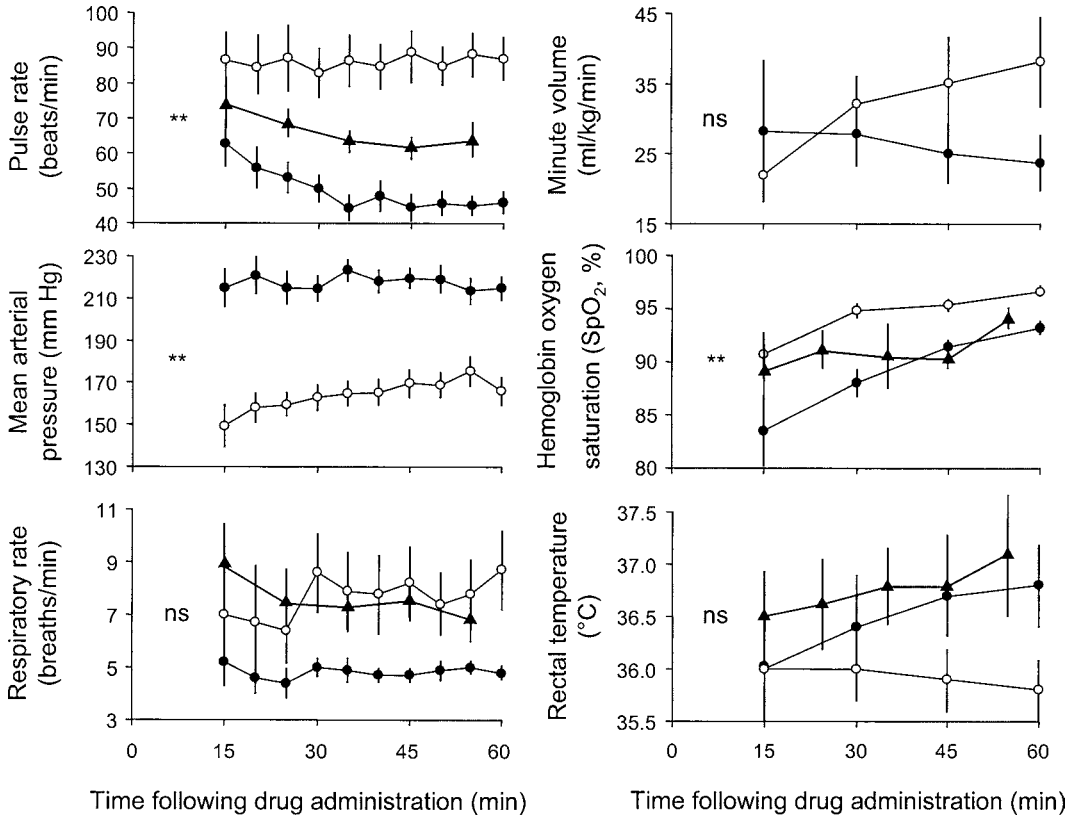

FIGURE 1. Physiologic responses of nine captive polar bears during immobilization with XZT (●) and with ZT (○), and 17 free-ranging polar bears during immobilization with XZT (▲). Means and standard error bars are shown. Differences between drug treatments over time in captive bears are indicated by '**' for $P \leq 0.01$, or 'ns' for non-significant. No significant differences were observed in any of the measured responses between captive bears and free-ranging bears immobilized with XZT. SpO_2 increased over time in captive bears during immobilization with XZT ($P \leq 0.001$) and with ZT ($P \leq 0.01$). Rectal temperature changed over time in captive bears, increasing during XZT immobilization ($P \leq 0.01$) and decreasing during ZT immobilization ($P \leq 0.001$).

Although most free-ranging bears recovered uneventfully from immobilization, a 9-yr old female died approximately 24 hr following the administration of XZT and atipamezole. Serum collected within 30 min of XZT administration contained high concentrations of total bilirubin (76 μmol/l), alanine aminotransferase (76 U/l), aspartate aminotransferase (1120 U/l), and γ-glutamyltransferase (183 U/l). A necropsy was performed within 1 hr following death with the major finding being marked pallor of all visceral organs. Subsequent histologic examination of collected tissues revealed a generalized paucity of cells in blood vessels and diffuse multifocal hepatic necrosis and pericholangiohepatitis.

DISCUSSION

Polar bears were immobilized effectively XZT at an average dosage of 4.8 mg/kg (i.e., X at 1.9 mg/kg + ZT at 2.9 mg/kg) in captivity and at an average dosage of 5.5 mg/kg (i.e., X at 2.2 mg/kg + ZT at 3.3 mg/kg) when free-ranging. In addition, XZT was safe at two to three times greater than the mean dosage.

In general, induction of immobilization with XZT was predictable and smooth, muscle relaxation was good, and all bears

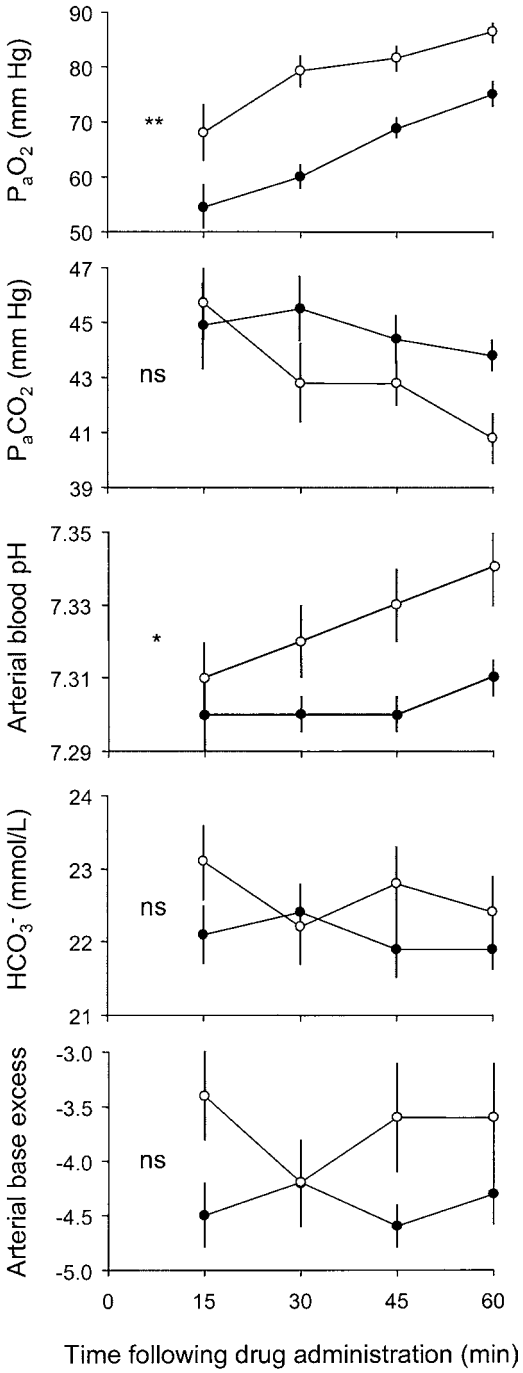

FIGURE 2. Blood gas values for nine captive polar bears during immobilization with XZT (●) and with ZT (○). Means and standard error bars are presented. Differences between drug treatments over time are indicated by '*' for $P \leq 0.05$, '**' for $P \leq 0.01$, and 'ns' for non-significant. P_aO_2 increased over time during immobilization with XZT ($P \leq 0.001$) and with ZT ($P \leq 0.01$). P_aCO_2 decreased ($P \leq 0.01$) and arterial pH increased ($P \leq 0.01$) over time during immobilization with ZT.

remained completely immobilized and unresponsive to stimuli throughout the immobilization period. However, behavioral effects of XZT during induction were different than with ZT. Ataxia was not always apparent, as bears often remained standing still for a time before sinking into recumbency. Further, in contrast to ZT, bears administered XZT could not be approached safely while still able to raise their head. Some bears that were approached while still able to raise their head also were able to return to standing with some difficulty and move toward or away from field personnel. Delaying approach toward an immobilized bear until a minute or two after its head was down increased safety greatly.

Relative to ZT XZT was delivered in smaller volumes. The preparation of XZT with concentrated X permitted delivery of a volume that was approximately 45% of that required if ZT was administered alone. Thus for example, where a 10 ml dart would be required to deliver enough ZT to immobilize a 300 kg polar bear (based on the drug concentration and dose used for this study), only a 5 ml dart would be required to deliver an effective volume of XZT. The smaller volumes required with XZT enable the use of slow-injection dart systems (air or gas pressurized darts) instead of the more traumatic rapid-injection systems (darts with explosive internal charges) that are commonly used for drug volumes >6 ml. Although slow-injection dart systems were not used in this study, they have proven reliable in previous studies of polar and grizzly bears using both XZT and medetomidine-ZT (MZT) under a wide range of ambient temperatures (−10 to 20 C; Cattet et al., 1999, 2003).

Bears immobilized with XZT had slower pulse rates and higher mean arterial pressures than bears immobilized with ZT.

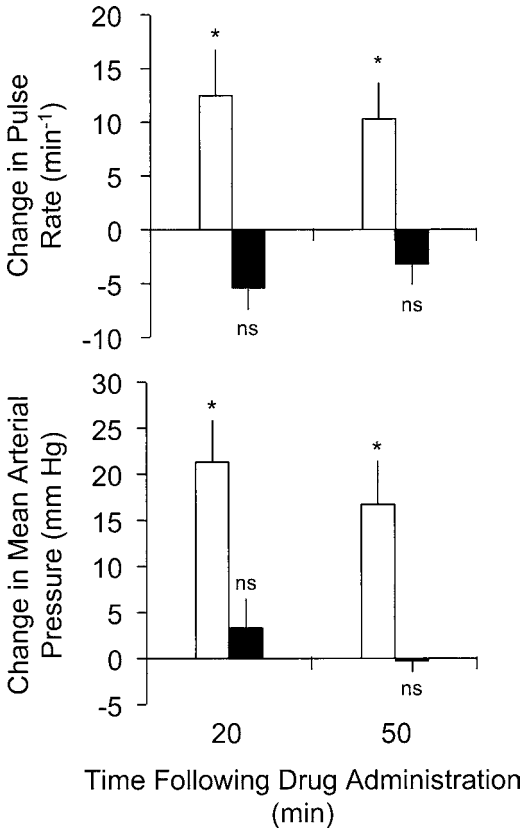

FIGURE 3. Change in heart rate and mean arterial pressure of nine captive polar bears after clamping the claw bed with a hemostat during immobilization with XZT (closed box) and ZT (open box). Boxes indicate mean change with standard error bar at 20 sec after clamping at 20 min and 50 min following drug administration. Changes in heart rate and arterial pressure at each time are indicated by '*' for $P \leq 0.05$ and 'ns' for non-significant.

Pulse rates also tended to be slower in captive bears than in free-ranging bears. Similar pulse rates have been reported in polar bears following immobilization with MZT (Cattet et al., 1997, 1999), and in non-anesthetized, resting polar bears (Øritsland, 1970). High mean arterial pressures likely resulted from increased vascular resistance caused by X (Klein and Klide, 1989). However, ZT may have also affected blood pressure through stimulation of the sympathetic nervous system (Hellyer et al., 1988; Lin et al., 1989). Similarly high values have also been reported for polar bears immobilized with MZT (Caulkett et al., 1999).

Rectal temperature increased slowly over time (~0.5 C per hr) following immobilization with XZT (Fig. 1), a pattern that was evident over a wide range of ambient temperatures (−10 to 18 C). The cause for this rise in temperature is unknown; it may be that the dissipation of body heat was impaired by the X-induced vasoconstriction of peripheral blood vessels (Doherty, 1988; Kline and Klide, 1989). Whatever the underlying mechanism, the slow rise in body temperature was not significant enough to cause hyperthermia, but could inhibit the effective cooling of an already hyperthermic animal.

Although respiratory rates and minute volumes were similar between bears immobilized with XZT and those immobilized with ZT, the blood gas data indicated the P_aO_2 was less with XZT. It improved over time, but was at hypoxemic values (≤60 mm Hg) in some bears during the first 30 min following drug administration. Hypoxemia was probably due to increased venous admixture from ventilation-perfusion (V/Q) mismatch. Increased pulmonary venous admixture resulting in V/Q mismatch contributed to hypoxemia during medetomidine-ketamine immobilization in sheep (Caulkett et al., 1996). Similar changes in P_aO_2 were found in polar bears immobilized with MZT (Caulkett et al., 1999). Where hypoventilation typically increases arterial carbon dioxide tension (P_aCO_2) and decreases P_aO_2, the P_aCO_2 values for polar bears immobilized with XZT were normal, e.g., 35–45 mm Hg. Further, P_aCO_2 values did not differ between drug combinations, and yet oxygenation was good with ZT. This suggests that hypoventilation contributed little to hypoxemia during immobilization with XZT.

Arterial pH, bicarbonate (HCO_3^-), and base excess (BE) values were slightly lower in immobilized polar bears than would be expected under normal conditions (pH=7.4, HCO_3^-=25 mmol/l, and BE=0) and likely reflect an overall increase in an-

aerobic metabolism. This mild acidosis improved with time in bears immobilized with ZT, but remained unchanged in bears immobilized with XZT. Similarly, bears immobilized with MZT developed a mild acidosis that persisted throughout a 1 hr period following drug administration (Caulkett et al., 1999).

Together, the physiologic and blood gas data provide evidence to indicate oxygen delivery to tissues was lower during immobilization with XZT than with ZT. Sheep immobilized with medetomidine-ketamine demonstrate similar depression in heart rate and increase in blood pressure (Caulkett et al., 1996). They also show a significant decrease in cardiac output and oxygen delivery when compared to baseline values prior to immobilization. Although oxygen delivery appears to be reduced in polar bears immobilized with XZT, the disturbance to physiologic function and blood gas values is not severe enough to compromise the health of most bears. There is potential, however, for bears with pre-existing disease to experience problems with XZT. In these animals, the provision of supplemental oxygen by intranasal route helps to prevent or treat hypoxemia (Read et al., 2001; Cattet et al., 2003). Although medical grade oxygen is not a standard component of many field kits, a "D" size aluminum oxygen cylinder with mini-regulator and nasal cannula can be carried in the field under many environmental conditions with little difficulty and was used with some free-ranging bears in this study. This equipment provides an invaluable aid to assisting field anesthesia, especially when used in conjunction with a pulse oximeter and, in our opinion, should be included as a standard component of field gear.

Serum glucose concentrations in bears immobilized with XZT were almost two-fold greater than values measured in bears immobilized with ZT. This was likely caused by the effect of X at α_1-adrenergic receptors to increase hepatic glucose production through glycogenolysis, and at α_2-adrenergic receptors to decrease the pancreatic release of insulin into the blood (Klein and Klide, 1989; Gross and Tranquilli, 1989).

All blood cell counts were greater in bears immobilized with XZT than in those immobilized with ZT. A plausible explanation is that plasma was forced from blood vessels into the surrounding tissue space as a result of the significant rise in arterial blood pressure following XZT administration. Accordingly, an imbalance of forces developed at the capillary membrane as mean capillary pressure increased (Guyton, 1986). The net force favored filtration of fluid from the capillaries into the surrounding tissue space. As a result, the blood concentration of cells and large molecules such as albumin increased.

Xylazine-zolazepam-tiletamine appeared to provide good analgesia because neither pulse rate nor MAP changed in response to painful stimulus. In contrast, significant increases in pulse rate and MAP were observed in bears immobilized with ZT, even at higher dosages >9 mg/kg. This reinforces observations made in a previous study in which it was concluded that ZT provided poor analgesia (Caulkett et al., 1999).

The effects of XZT immobilization were not reversed effectively or reliably with the α_2-antagonist drugs tolazoline, yohimbine, or atipamezole. There wasn't any indication of reversal effects with tolazoline at 3.5–4.0 mg/kg and recovery times did not appear to differ from times observed in bears following ZT immobilization where no antagonist drug was administered. In contrast, partial reversal occurred in some bears (raising of head, purposeful movement of limbs) following administration of atipamezole at 150 μg/kg and, to a lesser extent, yohimbine at 200 μg/kg. Further, physiologic responses to these drugs including increases in pulse and respiratory rates and reflex activity were often observed within minutes following injection. This suggests administration of atipamezole or yohimbine could provide effective treatment of potential adverse responses

during anesthesia with XZT, e.g., bradycardia, hypoxemia, and hyperthermia. Lack of complete reversibility (i.e., return to standing) may be particular to polar bears captured during fall. At this time of year, many polar bears are fasting and in a depressed metabolic state; rectal temperatures as low as 33.5 C are not an uncommon finding (Cattet, 2000). In such a state, it is conceivable that drug metabolism could be reduced to the extent that a low dose of ZT (3–5 mg/kg) may be sufficient to maintain some polar bears in an immobilized state even after the effects of X have been reversed. Xylazine-zolazepam-tiletamine has not been administered to polar bears during other times of the year when their metabolic rate is higher. However, it has been administered to grizzly bears under normal metabolic conditions (feeding and rectal temperature ≥37 C) and, in this species, the effects of XZT were reversed more effectively by yohimbine (Cattet et al., 2003). As well, MZT has been administered to free-ranging fasting polar bears captured during summer and fall and the effects of MZT (medetomidine at 60 μg/kg + ZT at 2 mg/kg) could be reversed safely and reliably with atipamezole at 240 μg/kg (Cattet et al., 1997).

The results of serum biochemistry, necropsy, and histopathology on the female polar bear that died following immobilization with XZT were consistent with marked anemia and severe liver disease, pathologic processes of chronic duration (>1 wk) that were not caused by XZT or other elements of the handling process. Instead, it seems the compromised health of this animal prevented its successful recovery from the additional physiologic stresses imposed by capture and handling.

In conclusion, polar bears can be immobilized effectively and reliably with XZT at a dosage of 4–6 mg/kg (with a 2:3 ratio of X to ZT). This combination is tolerated safely by polar bears at two to three times the recommended dose, but relative to ZT the physiologic effects of immobilization with XZT are more pronounced. High blood pressure (MAP≥200 mm Hg) and transient hypoxemia ($P_aO_2 \leq 60$ mm Hg) immediately following immobilization are common findings, but these conditions do not appear to pose significant risk to healthy bears. Xylazine-zolazepam-tiletamine provided analgesia superior to ZT and is preferable for painful procedures such as tooth extraction or tissue biopsy. For polar bears, the effects of immobilization with XZT cannot be reversed with the α_2-antagonist drug tolazoline. However, they can be reversed to some extent with yohimbine or atipamezole, but the time to complete reversal of effects is highly variable among bears.

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3 - COLOMBIA	New Spectacled Bear Finding in the National Park Volcanic Complex Dona Juana in the Departments Narino and The Cauca (Southern Colombia)	Edgar I. Gomez and Jose V. Sandoval
4 - COLOMBIA	Classification and Compilation of Conflicts Man-Spectacled Bear, Characterization of Practice of Cattle Ranch & Agriculture of the Local Communities in the Department of the Cauca Andean Zone, Southern Colombia.	Edgar I. Gomez & Juan C. Amezquita
5 - COLOMBIA	Description, Preliminary Evaluation of the Habitat and Distribution of Spectacled Bear from the Landscape Ecology Perspective in the National Natural Park Volcanic Complex Dona Juana Cascabel in Southern Colombia	Edgar I. Gomez
6 - ECUADOR	Andean Bear Consumption of a Large Ground Bromeliad Relative to Flowering Status	Kristina Timmerman
7 - MEXICO	Diet of Three Black Bear Populations in the Chihuahuan Desert Region of Northern Coahuila, Mexico and Western Texas	Jonas Delgadillo V., Bonnie McKinney, Dave Onorato, Scott Mitchell, Michael Pittman, Raymond Skiles Jr., and Louis Harveson
8 - MEXICO	Prospective Analysis of Food Habits and Habitat Characterization for Black Bears in the Sierra del Gato, Sonora	Juan Pablo Gallo-Reynoso, Carmen Gabriela Suarez-Gracida, Horacio Cabrera-Santiago, y Florentino Garza-Salazar
9 - MEXICO	Hematology and Blood Chemistry Range Values for Female Giant Pandas at the Chapultepec Zoo, Mexico	M.R. Campos, S. F. Gual, E. M. A. Pintado, and R. I. C. Rangel
10 - MEXICO	Project for Conservation and Recovery Plan of the Black Bear Habitat in Nuevo Leon State, Mexico	Hebert K. Nieto-Pliego, Horacio J. Urbano-Castillo, Alan Sergio Lopez-Villareal, Juan Antonio Garcia-Salas, and Armando J. Contreras-Balderas
11 - MEXICO	Food Habits of the Black Bear in Sierra Picachos, Nuevo Leon, Mexico	L. A. Juarez-Casillas, J. L. Pena-Mondragon, E. I. de la Pena-Cuellar, and F. A. Cervantes-Reza
12 - MEXICO	Seasonal Distribution and the Diet of the Black Bear in Chipinque Ecological Park, Nuevo Leon, Mexico	Sandra Rocio Zavala Romero, Juan Homero Lopez Soto, Jose Antonio Nino Ramirez
13 - MEXICO	Black Bear Diet in Cumbres National Park	Fernando Serina

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15 - PERU	Morphological Study of Reproductive Tract in a Female Spectacled Bear	Marco A. Enciso and Martha Vasquez
16 - VENEZUELA	Andean Bear Habitat Availability Assessment Across Sierra De Portuguesa, Venezuelan Andes, Using Remote-Sensing, GIS and Landscape Ecology	Shaenandhoa Garcia-Rangel
17 - VENEZUELA	Andean Bear Distribution and Status in the Area of Influence of the Camburito-Caparo Reservoir, Venezuela	Dumas Ocana, Arfilio Montilva, Emmanual Pereira, Nelson Sanchez, Jesus Mora, Jack Molina, Oscar Benitez, Robert Marquez, Victor Guerrero, and Isaac Goldstein
18 - VENEZUELA PANAMA	Are There Andean Bears in Panama?	Isaac Goldstein, Victor Guerrero, and Ricardo Moreno
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22 - CANADA	The Distribution and Ecology of Grizzly Bear Towards Their Southern Extent in the Coastal Mountains of North American	Clayton Apps, Michelle McLellan, Tony Hamilton, Sue Senger, Bruce McLellan, David Paetkau, Bryce Bateman, and Steve Rochetta
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24 - CANADA	Climate Change and Habitat Selection: What Does it Mean for Grizzly Bears?	Karine E. Pigeon, Gordon Stenhouse, and Steeve D. Cote
25 - CANADA	Is Mortality Related to the Landscape Structure of a Grizzly Bear's Home Range?	Karen Graham and Gordon Stenhouse
26 - CANADA	Human Use Activity and Changes in Grizzly Bear Habitat Selection Patterns: Does Intensity Level Matter?	Terrence A. Larsen, Gordon Stenhouse, and Erin Bayne
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28 - CANADA	Applications of Aversive Conditioning on Bears in Conflict with Humans	Lori Homstol, Colleen Cassady St. Clair, Nicola Brabyn, and Tony Hamilton

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30 - CANADA	Record of Reproduction and Physical Condition in Cementum of Polar Bears	Sarah A. Medill, Andrew E. Derocher, Nick Lunn, and Ian Stirling
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52 - JAPAN	Identification of Individual Asiatic Black Bears Using DNA Analysis of Collected Damaged Crops	Masae Saito, Kiyoshi Yamauchi, Hirokazo Takahashi, and Toshiki Aoi
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54 - JAPAN	Seasonal Home Ranges and Land Use of Asiatic Black Bears Living Near Human Habitations	Hirokazu Takahashi, Masae Saito, and Toshiki Aoi
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87 - S. KOREA	Complete Mitochondrial Genome of the Asian Black Bear	Jang-Seu Ki, Dae-Sik Hwang, Dong-Hyuk Jeong, Bae-Keun Lee, and Jae-Seong Lee

1 - ARGENTINA

J. FERNANDO DEL MORAL, Eduardo Wilde Nº 450, Vª Soledad, Dpto. A, (4400) Salta, Argentina, Escuela de Biología, Facultad de Ciencias Naturales, Universidad Nacional de Salta (UNSa), Salta-Argentina; fernando_delmoral05@yahoo.com.ar ; jfdelmoral@gmail.com

PROYECTO JUCO AND THE ANDEAN BEAR

The presence of Andean bears Tremarctos ornatus in Argentina has been disputed due to the absence of corroborated evidence; presently many Andean bear experts doubt their presence in this country. Nevertheless, the Tucuman-Bolivian Forest or Yungas is typical of ecosystems where this animal is found, in the particular area studied, the habitat appears to be of high quality. Between 2002 and 2006, we recorded 45 cases of evidence of the presence of Andean bears in the provinces of Salta and Jujuy in northern Argentina. Food remains, footprints, scats and sights were recorded. In addition, we interviewed indigenous residents, farmers, and hunters in the area and obtained reports of ancestral knowledge of the species. We conclude that the Yungas forest of the extreme northwest of Argentina must be considered an area with a high probability of maintaining a resident population of bears. Although this is probably an extremely small and perhaps isolated population, the permanent presence of Andean bears in the north of Argentina can no longer be doubted.

2 - BOLIVIA

DIET CHARACTERIZATION OF THE ANDEAN BEAR IN TWO HABITAT TYPES IN THE ZONES OF: SILLAR, SAN JACINTO AND T-7, CARRASCO NATIONAL PARK

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To know the feeding habits of any animal provides important information for the design of conservation actions for a species. The Andean bear (Tremarctos ornatus) is the only South American bear, and is considered as an umbrella species since its conservation includes the protection of the biodiversity of the habitats that occupies. Poaching and habitat destruction have caused the decline of their populations to the extent that it is included in Appendix I of the CITES and is considered “vulnerable” by the IUCN. In Bolivia, little research has been done with this species; therefore it is necessary to make studies that offer information on its biology, in order to have basic information for the creation of management and conservation plans within the Carrasco National Park. The goal of this research was to characterize the diet of the Andean bear by means of the scats analysis, direct observations, and indirect data of the use of resources, in two habitat types: grassland and montane forest. The study was conducted in three localities; Sillar, San Jacinto and T-7, all within the Carrasco National Park, between October 2004 and July 2005. We collected scats and other data of the behavior of the Andean Bear like: rest of feeding, rip on trees, direct observations and nests. Sixteen food items were identified, being Bromeliaceae the most frequently found family. The fruits of Symplocos sp., Pernettya prostrata and three morpho-species no identified, these comprised the second most frequently found item. We also reported Pitcarnia sp. and Erymgyum nudicaule, as well as components of animal origin: Bos taurus and Lagidium viscasia. The diet of the Andean bear was made up of 99, 5% of vegetal matter and the rest of animal matter. The analysis of variance determined that within the three localities, there is a greater probability of finding lees of greater weight in forest than in the grassland. The analysis of operation and availability of bromeliads showed that the Andean bear, in the zone of the Sillar, uses the resources in relation to their availability.

3 - COLOMBIA

NEW SPECTACLED BEAR FINDING (TREMARCTOS ORNATUS) IN THE DOÑA JUANA CASCABEL VOLCANIC COMPLEX NATURAL NATIONAL PARK IN THE COLOMBIAN SOUTHEAST

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This research was carried out in the Andean Southeastern of the Center-East Cordillera of the Macizo Colombiano, specifically in the new conservation area: Doña Juana Cascabel Volcanic Complex Natural National Park. Since August of 2005 to February of 2006, we determined the occurrence zones of the spectacled bear with the help of local people who used to hunt. Once we located those zones, we made field trips to verify the occurrence of the spectacled bear. These evidences were classified by indirect records (sites were the bear sleeps or feed, feces, tracks) and direct records (sights). We described the zones where we found evidences of the bear, considering biophysical, ecological and anthropogenical variables and we located places with the help of a GPS. We achieved 104 indirect records and one direct record of the occurrence of the Spectacled Bear in an area of 3571 hectares of the 6675 explored hectares in a range 3200 to 3599 m over the sea level. The 88.46% of the records were in paramo and ecotones, the remaining records (11.54%) were achieved in high Andean forest. In paramo and ecotones we recorded 74 feeders (58 principally Puya cuatrecasassi, 14 Puya sp. and two feeders with tracks of beetle larvae eating in Espeletia pycnophylla), 12 tracks of feces with signs of small rodents in them, two temporary sites of resting, two footprints and two pathways. In high Andean forest we recorded six feeders (four of Guzmania sp., one of Ficus sp. fruits and one of Chusquea sp.), three tracks of feces, two of footprints and one pathway. As a result, we made a map with the geographical distribution of the Spectacled Bear in the study area with the achieved records. All this information have an special interest, being the first for this country region, and a significant contribution to the establishment and consolidation of this area as a new Natural National Park, as well as the active involvement of local people in conservation and monitoring of Spectacled bear and the approach to the actual distribution of the species in this area of Colombia and South America.

4 - COLOMBIA

CLASSIFICATION, TIPIFY, AND COMPILATION OF CONFLICTS MAN -SPECTACLED BEAR, CHARACTERIZATION OF PRACTICE OF CATTLE RANCH AND AGRICULTURE OF THE LOCAL COMMUNITIES IN THE OF THE DEPARTMENT OF THE CAUCA ANDEAN ZONE, SOUTHERN COLOMBIA

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In an Andean high area at south of Colombia, in the Cauca department were classified, typify and registered the Man-Bear conflicts were located geographically. Through meetings with the indigenous communities and colonies with historical reports of conflicts man - Bear (Tremarctos ornatus) and communitarian work were located the conflicts and were classified in two variables, one by agriculture and other by cattle ranch. The conflicts Man - Bear tipify itself by peek at the cattle, by predation of Cattle, look for leftovers, peek at the growing and consumption the growing. Were elaborated at that moment information open fields trips where practices at cattle ranch and agriculture were characterized. In the same way, we worked in the diffusion of the Biology and ecology of the species with special interest in the children of the localities that presented conflicts. The diffusion work through traveling exhibitions, talkings, flying and the elaboration of an annual calendar for the participative biological monitoring. 10 conflicts were reported and located geographically Man-Bear, 100% were product of you practice unsuitable of cattle ranch, 50% represents look for leftovers and peek at the cattle for part of the Tremarctos ornatus and a big percentage were possible Puma(Puma concolor) attacks, only 10% (1 case) is possible predation of cattle on the part of the Tremarctos ornatus and 40% of the cases represent another type of events (2 deaths of bear, one by natural cause and another one by a booby trap). The cattle ranch at the conflict sites it is characterized by invasive, expansive processes and without control in all the cases, this means that we found cattle in areas opened for feeding cattle places in very high zones until of 3000 msnm and in the middle of zones with cover of forest high Andean and paramus. In 90% of the conflicts the cattle was ovine and goat, a 10% were bovine. In 90% of the cases there were no established feeding cattle places. Linear distances from the feeding cattle places to the houses in average 3000 mt, which does not allow a constant monitoring of the cattle. The agriculture processes are characterized, by the agricultural border extension without measures of control, the presence of illicit cultures of poppy (Papaver somneriferum) and the wood extraction that increases the possibilities of conflicts and deteriorate the natural habitats. This research contributes dynamic information of Man-Bear for the zone that in addition contains viable populations of Tremarctos ornatus in this part of the country. The study also represents a first approach to the threats that appear for the survival of the Tremarctos ornatus in the south of Colombia. The information in future serves for will support a plan of handling of the species and the generation of strategies and solutions arranged with the communities for the survival of the Tremarctos ornatus. The information of diffusion with the children, contribute to new elements of easy recognition in the local communities for the knowledge of biological and ecological aspects of Tremarctos ornatus. The study was made from August 2005 to January 2006 and financed by the CRC (Regional Independent Corporation of the Cauca).

5 - COLOMBIA

DESCRIPTIÓN, PRELIMINARY EVALUATIÓN OF THE HÁBITAT AND DISTRIBUTION OF SPECTACLED BEAR, FROM THE LANDSCAPE ECOLOGY PERSPECTIVE IN THE NATIONAL NATURAL PARK VOLCANIC COMPLEX DOÑA JUANA CASCABEL, IN THE DEPARTAMENTS NARIÑO AND CAUCA (SOUTHERN COLOMBIA)

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This research was carried out in high Andean ecosystems at the Doña Juana Volcanic Complex (CVDJC) – Cascabel since august 2005 until febraury 2006, located in bordering zones of Cauca, Nariño departments in south Colombia country, where I made a preliminary evaluation and description of the spectacled bear (Tremarctos ornatus) habitat. I applied and adjustment of the methodologies used in conservation researches by The Natural Conservancy (Rapid Biodiversity Assessment RAP, Conservation International), Instituto de Investigaciones Biológicas Alexander von Humboldt (methods for Biodiversity inventory) and Methods for study the habitat availability for the spectacled bear (Tremarctos ornatus) Ecociencia 2001. The development of the methodology used here followed the physiographical classification of terrain according to Villota (1997) and the landscape ecology of Etter (1990) as intergrating tools. The methodology had three stages: Preliminar phase, field phase and information analysis phase. In each phase I took the information from: community work, the use of software of geographical information system and record of foot prints and vestiges; then I made and described a map of ecological landscape units, which integrate 24 units, 11 of witch were spectacled bear habitat and were immersed in three large landscapes and seven physiographic landscapes that have a matrix of paramo vegetation with high andes, subparamo, paramo and superparamo margins. There is an special interest in 3 landscape units that show the biggest quantity of records and that have plant species from paramo, ecotonical subparamo and high andes forest, respectively that are immersed in steep terrain with altitudes between 3200 and 3599 m. and show natural connectivity and continuity between natural units with little or none intervention. Those ecological units have vegetation that facilitates the altitudinal and periodical use by T. ornatus, and provides an omnivore diet with the trend of the consumption of plants, specially of bromeliads family, using intensively Puya cuatrecasassi. This study shows general subjects about the relationship between humans and the spectacled bear, as well as a map with reports of hunting in the CVDJC (Dona juana Volcanic complex) National Natural Park. This research is park of the full constitution and consolidation this area who national natural park number 52. Finally the research presents maps of the ecological units located with the sites where spectacled bears are present and the areas identified as potential corridors for the spectacled bear in the study area and in the CVDJC and Colombian South.

6 - ECUADOR

ANDEAN BEAR CONSUMPTION OF A LARGE GROUND BROMELIAD RELATIVE TO FLOWERING STATUS

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In the southern Ecuadorian Andes, Spectacled or Andean bears (Tremarctos ornatus) utilize the montane cloud forest as their primary habitat. In addition, animals venture into the structurally-open paramo grassland to feed on the large ground bromeliad, Puya clava-herculis. Commonly referred to as the puya, these plants are quite large; adult plant dimensions are about 150 cm across by 120 cm tall. At maturity, plants produce a single inflorescence, after which the plant enters senescence. Andean bears consume the leaf bases and the central meristematic material often referred to as the “heart”. In the Mazar Wildlife Reserve, a privately owned and managed conservation area located about 50 km east of Cuenca, bears appear to only utilize puya that are blooming or have completed the flowering process. Since puya is considered to be an important food resource during times of limited forest fruit availability, the possibility that bears only eat puya tissue during the bloom or post-bloom phases has an important implication relative to total resource availability. If bears consume only mature, post-flowering plants, then actual availability of this food resource is considerably less than if we assume tissue consumption occurs independent of flowering status. In order to quantify if bears are selecting only inflorescent plants, eleven plots were established on the Mazar Wildlife Reserve from September to October 2006. Typically, puya bloom between June and September annually; therefore, initial plot establishment occurred at the end of the 2006 bloom cycle and plants were tracked up to the onset of the next bloom cycle. Plot boundaries were identified with UTM points. On each plot, the location and flowering status of all available puya were mapped (availability is defined as a mature plant with a 2006 inflorescence or in the 2006 post-bloom phase). Plots were sampled five times between September 2006 and May 2007 to quantify the following questions: 1) Are bears consuming only mature plants with inflorescences or plants in the post-bloom phase? 2) Is there a seasonal pattern to puya consumption? and 3) What proportion of the available puya is consumed annually (sampled from end of bloom season to onset of the next bloom season)? Of the 113 plants mapped as available for consumption on eleven plots, thirty-two (28%) were consumed as of January 2007. During the first three sampling sessions, the numbers of plants consumed by bears were 7, 5, and 2, respectively (5%, 4% and 1%). In contrast, plants consumed as of the fourth sampling session (January 2007) were 18 (16%). All consumed plants were in the post-bloom phase. Since there was not a single observation of non-reproductive plants being consumed during the sampling period, this suggests that Andean bears, at least on the Mazar Wildlife Reserve, are selecting mature plants in the active or post reproductive phases. In addition, there appears to be a seasonality to the consumption pattern as relatively few plants were consumed during the first three sampling sessions and a significant increase in the number of plants consumed was observed in the fourth sampling session ($\chi 2 = 16.67$, $p = 0.00004$, $df = 1$). This study, while relatively small in scope, identifies that, as a food resource, giant puya availability may be more limited than previously thought. In addition, the observation of variable use of this resource supports the concept that this bromeliad may be an important seasonal food resource when other forest foods are not available. Conservation and management implications will be discussed as they relate to the data results.

7 - MEXICO

DIET OF THREE BLACK BEAR POPULATIONS IN THE CHIHUAHUAN DESERT REGION OF NOTHERN COAHUILA, MÉXICO AND WESTERN TEXAS

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The American black bear (Ursus americanus) is a resident of the Chihuahuan Desert in northern México and western Texas. We compared the diet of three distinct populations of bears within one Chihuahuan Desert ecosystem. The Maderas del Carmen (MDC) mountain range represents a vast sky-island located in northern Coahuila, México directly south of the Big Bend Region of western Texas. This area ranges in elevation from > 1000 m to > 2700 m and is characterized by 5 major vegetation associations. The Black Gap Wildlife Management Area (BGWMA) is located in southern Brewster County, Texas and borders the state of Coahuila, along the Rio Grande to the south, and Big Bend National Park to the west. Elevation ranges from 484 m to > 1403 m and is characterized by 3 major vegetation associations. North of the Maderas del Carmen and sharing an eastern boundary with the Black Gap Wildlife Management Area, the Big Bend National Park (BIBE) is also located in Brewster County, Texas. The park is characterized by 6 major vegetation associations, with elevation ranging from 563 m along the Rio Grande to > 2385 m in the pine-oak woodlands. Food items in the diet of black bears were identified and quantified via the point-frame method of Chamrad et al. (1964). A total of 886 scats were sampled in the 3 study areas between June 1998 and August 2001. Results indicated similarities in the diets of all 3 populations, but, differences were apparent. Bears in the MDC selected from a wide diversity of food sources associated with the mosaic of habitats available to them, whereas, the diet of the BGWMA bear population was restricted to plant varieties representative of very xeric habitats. Bears in BIBE exhibited a diet that incorporated food items present in both BGWMA and MDC; however, food items were mainly associated with vegetation indicative of pine-oak woodlands. The diet in all 3 populations consisted mainly of plant material, ranging from 98% in the MDC, 96% in BGWMA and 82-98 % in BIBE. Our results highlight how bears survive and prosper in a myriad of habitats and altitudinal gradients within the harsh landscape of the Chihuahuan Desert.

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8 - MEXICO

PROSPECTIVE ANALYSIS OF FOOD HABITS AND HABITAT CHARACTERIZATION FOR BLACK BEARS IN THE SIERRA DEL GATO, SONORA

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From August 2001 to October 2004, we have made 6 visits to Sierra del Gato, Huachinera Municipality, Sonora, México. We collected information on the conservation status of the habitat, feeding habits and black bear (Ursus americanus machetes) presence. Our records of black bear consist in scats, tracks, marked trees, overturned rocks, and excavated ant nests. Each record was georeferenciated with a GPS. For the habitat characterization, we collected data on the plant species present, vegetation type, slope and altitude. Weather type, precipitation, mean annual temperature, soil type and distance to towns and ranches were determined with cartography. To complement the information in each site we made several Canfield lines, from 1,200 m to 2,600 m to obtain the vegetation cover and an index of dominance of trees and shrubs. Additionally we conducted several interviews with ranchers, which indicated places where black bears have been observed or hunted. To this moment we have recorded 56 sites with black bear presence. We have also collected three skulls of adult black bears from the ranchers. The first, a male hunted in 1989 and the other two of adult females hunted in 1991 and 1997. Data gathered to date, indicates that black bear presence is more frequent in areas far from towns. The majority of records were found in areas with gentle slopes between the 1,200 – 2,600 m. From thorn shrub to pine – oak vegetation. In areas where the weather is temperate, sub humid. The soils are hard with great content of gravel and of gross texture. Preliminary determination of feeding habits was obtained by analyzing 24 black bear scats collected from Spring – Summer to Fall - Winter. In Fall – Winter they feed mainly on táscate (Juniperus deppeana) and manzanita (Artcostaphylos pungens) fruits, and in lesser degree on the fruits of madroño (Arbutus arizonica), dátil (Nolina sp.), peach (Prunus persica), grasses (genus Muhlenbergia and Eragrostis), prickly pear (Opuntia sp.), as well as reptiles, insects and mammals, black bear also enter ranches were there are apples, peaches and walnuts. In Spring – Summer they feed on manzanita and acorns (Quercus spp.), also on ants (genus Camponotus sp. and Formica sp.). Black bear population at Sierra del Gato is apparently stable, in areas of difficult access and with few roads. We have found their records all along this sierra; this also can be due that their hunting is not intensive and merely incidental, owed to the activities in the sierra which are mainly grow of cattle and wood extraction, all the ranches are private of great extension. Even though black bears are regarded as bad due that they eat corn and fruits from the ranches and in certain occasions they have been found breaking the roofs and doors of ranch houses to spend the winter. The data generated until now will be used for a thorough study of the ecology of the black bear at Sierra del Gato giving support for the conservation of black bears and black bear habitat in Sonora.

9 - MEXICO

HEMATOLOGY AND BLOOD CHEMISTRY RANGE VALUES FOR FEMALE GIANT PANDAS AT THE CHAPULTEPEC ZOO, MÉXICO

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Reference intervals are essential to provide a baseline on health information on different animal populations. These values frequently show some degree of variation between populations (mainly under captive conditions), so it is better to obtain the reference ranges from healthy animals that compose subpopulation of interest. From 1992 to 2002, annual blood samples were obtained from 3 healthy female giant pandas Ailuropoda melanoleuca, (age range between 2 to 12 year old) at the Chapultepec Zoo, these data were analyzed to establish reference values for this species. A total of 19 different variables were registered for hematology and 24 variables for chemistry. All the samples were obtained under general anesthesia (ketamine / xilazine combination). By graphical exploratory data analysis some values were discarded (atypical data); the mean, standard deviation (SD) and range (mean $\pm$ 2 SD) were obtained for each blood parameter. Some of the obtained blood parameters (expressed as: mean (SD; sample size)) are showed next: 1) hematology: hematocrit 39.7 % (4.0; n = 14), red blood cell count 7.4 x 106 $\pm$l (0.5; n = 14), total hemoglobin 14.7 g/dl (1.5; n = 14), mean corpuscular volume 53.8 fl (4.12; n = 14), with blood cell count 14.3 x 103 $\pm$l (5.4; n = 14), segmented neutrophils 11.2 x 103 $\pm$l (4.5; n = 4.5), band neutrophils 0.4 x 103 $\pm$l (0.4; n = 13), platelet count 787 x 103 $\pm$l (147; n = 5), total plasma protein 7.8 g/dl (0.4; n = 3) and erythrocyte sedimentation rate 40 mm/h (8.0; n = 11); 2) blood chemistry we found: glucose 110.5 mg/dl (17.5, n = 14), blood urea nitrogen (BUN) 9.6 mg/dl (2; n = 4), creatinine 1.7 mg/dl (0.6; n = 15), total serum protein 6.5 g/dl (1; n = 11), albumin 3.1 g/dl (0.8; n = 11), globulin 3.4 g/dl, 1.1, n = 11), total bilirubin 0.31 mg/dl (0.16; n = 11), direct bilirubin 0.11 mg/dl (0.03; n = 8), aspartate aminotranferase (AST) 63.8 UI/l (16.9; n = 12), calcium 9.12 mg/dl (1.18; n = 6), phosphorus 5.9 mg/dl (1.7; n = 3), chloride 96 mEq/l (1.4; n = 2), sodium 129.7 mEq/l (5.7; n = 4) and potassium 5.2 mEq/l (1.0; n = 5). Although these ranges seem to be limited by the small number of animals (n = 3), it is counterbalanced by a relatively big number of samples. Some of the obtained parameters were very similar to those obtained for other captive populations like those in Europe, USA and China; it was particularly certain for parameters like lymphocytes, monocytes, eosinophils and basophils. This information has been really useful to evaluate the health status of our female giant pandas. Finally, these data contribute as a complement to the existing information on hematology and blood chemistry for this critically endangered species.

10 - MEXICO

PROJECT FOR CONSERVATION ANDY RECOVERY PLAN OF THE BLACK BEAR (Ursus americanus eremicus) HÁBITAT, IN NUEVO LEÓN STATE, MÉXICO

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In the last 50 years, in our country, the habitat and populations of Black Bear (Ursus americanus) is in detriment, for this reason the laws in Mexico, include this species in the NOM-059-SEMARNAT-2001 as endangered species. Now the estimate population in our state is near to the 20% of the original population of Nuevo Leon. The studies of Black Bear are poor, but we think is possible and the feasibility of the restoration the habitat and populations, include other important species. For this reason, the main objective of this project is the conservation and recovery of the habitat of the Black Bear in Nuevo Leon. To reach this objective is necessary to know the actual distribution of Ursus americanus eremicus in this State. Methods: During a period of tour months, were visited 28 of the 51 municipalities, in all of them we applied interviews with long-term local residents, also municipality's authorities that include questions about: punctual presence of bear, conflicts with domestic animals, human and others. Results: Within this information, was possible to elaborate a distribution map actualized. Now with the data base, is possible to show the main zones of the realization of census and the establishment of potential biological corridors for this species between México and United States of North America. The goal of this project is the save the Black Bear, and it's habitat in both countries.

11 - MEXICO

FOOD HABITS THE BLACK BEAR (URSUS AMERICANUS EREMICUS) IN SIERRA PICACHOS, NUEVO LEON, MEXICO

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Habitat loss and poaching have reduced the populations of black bears (Ursus americanus). In order to conserve to this species it is necessary to know habitat requirements of this mammal, factors related directly with population growth. In the present study we determined the food habits of black bears in Sierra Picachos located to the northeast of the state of Nuevo León, Mexico. Field work produced 169 scats between december 2004 and november 2005, we calculated the percentage of occurrence and the percentage of volume of each food item consumed by black bears. The results revealed the presence of 13 vegetable items, two species of mammals and four families of insects. Vegetable matter composed 73.43% of the diet of the black bear, and animal matter a smaller percentage (16.08% insects; 0.70% mammals). Other materials consumed were debris (including wood fragments; 9.79%). According to the variations in the percentage of occurrence, debris (37.33%), acorns (Quercus sp; 33.33%), vegetable fiber (20%) and ants (17.33%) were the major food items consumed during the dry season. The maximum values of percentage of volume were (in decreasing order) debris (53.11%), acorns (16,84%), and vegetable fiber (15,17%). During the wet season, the food items that appeared with greater percentage were the Texas persimmon (Diospyros texanum; 50.98%), prickly pear fruit (Opuntia engelmannii; 33.33%), vegetable fibre (27.45%), wild grapes (Vitis cinerea; 23.53%) and beetles (21.57%), being the Texas persimmon the element with more volume (48.62%), followed by the elbow bush (Forestiera racemosa; 22.34%) and acorns (9.46%). In the late-wet season, acorns (48.84%), per of the virgin (Chiococca pachyphylla; 30.20%) and beetles (20.93%) were the most frequent items in the analyzed scats. The values in volume revealed that those of the greater than value were per of the virgin (35,29%), red bay (Persea pachypoda; 22.52%) and acorns (21.77%). The trophic diversity did not display statistically significant differences between the three different seasons sampled. In conclusion the black bear of Sierra Picachos is omnivorous, whose diet is dominated by vegetable items.

12 - MEXICO

SEASONAL DISTRIBUTION AND THE DIET OF THE BLACK BEAR IN CHIPINQUE ECOLOGICAL PARK, NUEVO LEON, MEXICO

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The Chipinque Ecological Park is located 8 km south of Monterrey, in the municipality of San Pedro Garza Garcia. It is a natural reserve of 1,625 ha of woody vegetation that receives approximately 600,000 visitors annually. Recently, Chipinque Park has experienced an increase in bear observations by visitors and park personnel. Since that time, the Park has established a GIS database based on 28 locations (based on tracks and other sign), which is being used to develop indices on seasonal use. Diet is also being studied through the evaluation of feces (n = 10). Using the GIS database, we will determine whether patterns exist for bear distribution and which factors affect these movements. The study will end in July 2007. With this information, we hope to contribute to the ecological understanding of this species, and provide alternative management options for the Park.

13 - MEXICO

BLACK BEAR (*Ursus americanus*) PRELIMINAR SURVEY IN THE NATIONAL PARK CUMBRES DE MONTERREY (EJIDO SAN ANTONIO DE LA OSAMENTA, SANTA CATARINA, NUEVO LEON, MEXICO)

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The Cumbres Monterrey National Park (PNCM), is a federal protected area (ANP) in Nuevo Leon State, as part of the Sierra Madre Oriental with 177,395 hectares. The PNCM is an important conservation center, because native wildlife species, finds a refuge in this place. One of the most charismatic and controversial organism that lives here is the black bear (Ursus amercianus eremicus), and is an endangered species, protected by Mexican laws (NOM-059-SEMARNAT-2001). One of the goals of the PNCM is to get the most possible information about the present species there, and can coexist in harmony with local people (rural communities), the tourism, and natural resources. As part of this program, we started with a pre-liminar project, to find photographic records of the black bear, and to elaborate a geographic information system at the same time workshop enrolling local people in the project through environmental education. The study area was in Santa Catarina county in the locality of San Antonio de la Osamenta. We assessed presence-absence of black bear, with remote sensitive cameras (Camtrakker), during 6 months. Comparing the black bear pictures we got, we could find five different individuals (3 males and 2 females) in a 660 hectares, and we could demonstrate that the black bear caused damage with corn crops and apple trees (Malus pumila) crops. We gave environmental education to local people, using videos and other materials about how to prevent bear attack. We also gave a presentation regarding the black bear biology, conservation with some recommendation about the castle loses. We will continuous monitoring black bear with other methods.

14 - PERU

USE OF ELECTROEJACULATION AND SEMINAL VALUES IN CAPTIVE SPECTACLED BEARS

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The Spectacled bear (Tremarctos ornatus) is the only species of the Ursidae family who lives in South America. This species is in danger of extinction because their populations have declined severely. Is classified like Vulnerable by the World Conservation Union and considered by the CITES in the Appendix I. As still it continues being threatened species, many studies for their conservation are required. There is a little information about the reproductive physiology of the male T. ornatus. The aim of the this study was develop a protocol for semen collection using electroejaculation technique and to evaluate seminal characteristics. The two males (134 kg and 145 kg) used in the study were located at the Huachipa Zoological Park, Lima, Peru. The electroejaculation procedure was carried out under general anesthesia. The combination of xilacine (2 mg/kg) and atropine (0.04 mg/kg) for induction, and for maintenance, ketamine (5 mg/kg) and midazolam (0.2 mg/kg) were used. In both animals the use of isofluorane (3%) to continue maintaining the anesthesia was necessary. Semen collection was carried out with an electroejaculator with a 50 cm x 2 cm (length x diameter) probe with 3 ventral electrodes spaced about 1 cm apart (Eletrojet®, Eletrovet, Brazil). With the animal in ventral recumbent position, the lubricated probe was inserted 17 to 20 cm into the rectum. Progressive electrical stimulation from 2 to 12 V by space of 15 to 25 minutes was applied. Pulses over 6 V brought about penile erection and ejaculation lasted 5 minutes with 10 to 12 V. The ejaculates were collected in warmed Falcon tubes to 37 °C. Seminal values of the ejaculates obtained from two males were as follow: volume (2.6 and 9.5 ml); color (whitish in both); pH (7.0 and 6.8); sperm concentration (22.5 x 107 and 81 x 107 spermatozoa/ml) and sperm motility percentage (45% and 65%). These results, in spite of being a small number of animals used for this experience, demonstrate that it is possible to collect semen from this wild species and provides basic information of Spectacled bear´s seminal values; but further research is necessary to improve the collection technique and obtain more information about semen characteristics, including their ability to survive the cryopreservation procedure.

15 - PERU

MORPHOLOGICAL STUDY OF REPRODUCTIVE TRACT IN A FEMALE SPECTACLED BEAR

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The Spectacled bear (Tremarctos ornatus) is classified as Vulnerable on a world-wide scale by the World Conservation Union, due to factors such as the hunting and habitat destruction, what it has originated their populations decline. Moreover it is an important specie from the conservation point of view, due to the roll that fulfill in the ecosystem where lives and to its influence on the Andean culture. One way to help manage and conserve the Spectacled bear is to know the basic reproductive aspects, soon to use the assisted reproduction techniques. For this reason it is necessary to carry out studies to increase the knowledge about reproductive anatomy and physiology on T.ornatus. The aim of this work was realized the morphological study of the reproductive tract of a female Spectacled bear. The reproductive tract of an adult female of 20 years old were collected and examinated. This animal was coming from the zoo of the Immaculada School, in Lima, Peru; was kept in captivity during all its life and it was never mated. Hepatic disease was the main cause of death and it was taken to the Faculty of Veterinary Medicine, San Marcos University, in Lima, Peru. The collected organs were fixated in buffered formalin, sectioned, dehydrated and including in paraffin. The 6 µm sections were cut from paraffin blocks stained with HE and HE-Orange G. Macroscopically the vulva was rudimentary and limited by two folds scarcely developed. Its external surface showed a cover with scarce and long hairs while the internal surface had a smooth cover and without pigmentation. The vagina (6 cm length) and uterine corpus (7.5 cm length) appeared as a tubular organs separated by a cervix. In the same way it was observed the uterine horns (8 cm) and oviduct (2 cm). The ovaries presented an ellipsoid shape (Right: 2 cm length x 1 cm wide x 0.8 cm of thickness; Left: 1.9 cm length x 1.2 cm wide x 0.9 cm of thickness), being lightly hard to the tact; they were covered with abundant fat tissue and wrapped by ovarian bursa, which were wrapped to the oviduct too. Microscopically, the female reproductive tract presented the same pattern of cell morphology description those others mammals species. In conclusion, the general description of this female T. ornatus reproductive organs resembles the morphologic pattern reported for domestic carnivores and ursids like a Airulopoda melanoleuca and Ursus arctos. Complementary studies are required to determine the stages and the morphology of reproductive development in younger and pregnant individuals. Also it is necessary to extend the number of reproductive tracts samples to observe. This study provides basic information on reproductive morphology of the Spectacled bear, and it is a contribution to the knowledge of the reproductive anatomy of this species.

ANDEAN BEAR HABITAT AVAILABILITY ASSESSMENT ACROSS SIERRA DE PORTUGUESA, VENEZUELAN ANDES, USING REMOTE-SENSING, GIS AND LANDSCAPE ECOLOGY

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Sierra de Portuguesa (4,323km2), northeast end of the Andean bear (Tremarctos ornatus) distribution, is home to one of the smallest and most threatened bear populations within the Venezuelan Andes. The species habitat on this site is highly fragmented and possibly isolated from the rest of the mountain range, due to continuous expansion of the agricultural frontier over the past 200 years. Since the year 2000, concern about the species' status in Sierra de Portuguesa has increased, leading local governments, universities, zoos, NGOs and community groups to develop management programs, together research and education projects targeting the species conservation. Andean bear habitat availability across Sierra de Portuguesa is being assessed on a landscape scale, to provide updated information for existing conservation initiatives, and to set-up a baseline for undergoing research. Preliminary results of these analyses are presented here. A vegetation and land-use cover map for Sierra de Portuguesa was generated based on a supervised classification of 4 ETM+ and 1 TM5 satellite images on Idrisi32, using 555 ground control points. Suitable Andean bear habitat was identified, size of the fragments was determined and both connectivity and inclusion within the National Park (NP) system were evaluated using ArcView GIS 3.2. A total of 322km2 of primary forest, key Andean bear habitat, was found across Sierra de Portuguesa. The habitat available comprises a total of 172 fragments, only 4.6% of which are larger than 7km2 and represent an area of 223.8km2. The largest patch (128.6km2) could be acting as the principal refuge for the local bear population. Fragments are surrounded by a complex matrix of secondary forest (> 15 years after disturbance), secondary shrubs (< 15 years after disturbance) and agriculture. Three of the 8 largest fragments are less than 200m apart, but the species tolerance to move across disturbed habitats is crucial to assure this connectivity. Distance between the remaining 5 patches is over 2km, thus they could be to totally isolated, unless the smaller patches can act as stepping stones. Only 50% of the remnant habitat is currently protected inside NPs. Connectivity between Yacambú and Terepaima NPs depends on a large belt of non-protected habitat. A project to secure legal protection for this area is currently under development. Fragment connectivity within Sierra de Portuguesa, and even more its connection to the rest of the Andes, is critical for the persistence of this local population, because the remaining habitat is probably not large enough to sustain a viable population. Further GIS analysis involving interpolation of clouded-areas, and map accuracy assessments are required to confirm the results found. Questions regarding Andean bear patterns of landscape-use are being addressed by an ongoing research carried out by the author.

17 - VENEZUELA

ANDEAN BEAR DISTRIBUTION AND STATUS IN THE AREA OF INFLUENCE OF THE CAMBURITO-CAPARO RESERVOIR, VENEZUELA

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During 2005, several sightings of Andean bears swimming across the Camburito-Caparo reservoir, and feeding on the water-forest edger were done by the personnel of the Environmental Management Unit of DESURCA raised the interest of the Environmental Management Unit of DESURCA in knowing the distribution and status of the Andean bear population in the wilderness areas surrounding the Camburito-Caparo reservoir. The Northern Andes Andean Bear Program of the Wildlife Conservation Society was contacted in order to provide advice and research support, based on its experience conducting Andean bear distribution and status surveys. The wilderness areas surrounding the reservoir are in an altitudinal range between the 300 and the 1200 m. above sea level. The information of Andean bear presence and use of such low elevation areas throughout its distribution is scant, and the interest of the Environmental Management Unit of DESURCA gives a rare opportunity of gathering Andean bear data at such low elevations. The study area was defined by the watersheds of the Caparo and the Mucuchachi rivers. The wilderness areas were delimited based on LANDSAT satellite images. A total of 44 quadrants, 4 km² each, were delimited within the wilderness areas. Twelve working stations were positioned within the wilderness areas in order to visit as many of 4 quadrants per field survey of between 4 to 6 days. Within each quadrant the “game’ trail survey technique developed and used by the Northern Andes Andean Bear Program of the Wildlife Conservation Society was used to gather information about the Andean bear presence and habitat use. A total of 9 field surveys were done from September 2005 to October 2006, covering 47,86 km of “game” trails, gathering 422 Andean bear activity signs, and average of 8,8 signs/km of trail. Only in one area, out of the 9 visited, we found no Andean bear activity at all. Even though the area was defined as wilderness in our analysis, we found the area as having permanent human use (cattle herding activities), and separated with the other wilderness areas by areas with agricultural use. All the other 8 areas visited presented Andean bear signs, however, the rate of encounter of Andean bear signs differed greatly from one area to the other. We found a clear relationship between the amount of forest fragmentation and human use and the rate of encounter of bear signs. Areas showing forest fragmentation and some degree of human use had the lowest rates of encounter of bear signs (between 3,26 and 7,46 signs/km of trail), while areas with large forest tracks and no human intervention showed the highest rates of encounter of bear signs (between 14,10 and 18,40 signs/km of trail). Andean bear activity was found only within forest tracks even in

areas with small forest patches and some degree of human intervention, showing the importance of forest remnants to the bears in such areas. Even though we had areas with higher rates of encounter, the rate of encounter is still much lower than the rates found, for example, in the southern slopes of the Sierra Nevada de Mérida national park (between 30 to 60 signs/ km of trail). With the amount of data gathered it is difficult to discern if the lowest rate of encounter of bear signs is the result of the a less frequent use of such low altitude areas by the Andean bears or the consequence of a low number of resident animals due to the fragmentation and intervention of the wilderness areas.

18 - VENEZUELA / PANAMA

ARE THERE ANDEAN BEARS IN PANAMA?

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There has been an ongoing discussion over the Andean bear's range distribution regarding its southern and northern-most boundaries, particularly the presence of Andean bear in eastern Panama and northern Argentina. In this work we present the results of an Andean bear survey at Serranía de Pirre, Panamá, carried out between the 26 and the 30 of January, 2007. Using the "game" trail methodology developed by the Andean Bear Program of Wildlife Conservation Society a total of 25 km of trail were surveyed. Only four trees with possible Andean bear claw signs were found. In Venezuela, Colombia, Ecuador and Bolivia, when using the "game" trail survey methodology, between 4 to 60 bear signs/km on any game trail were encountered. The frequency of different bear signs depends on how the bears use each particular "game" trail. Some trails are heavily used for feeding, thus food remnants such as bromeliad leafs are the most frequently bear sign found; other trails are mainly used for tree marking, with claw marks on trees being by far the most frequent sign. Still, regardless of the use given to a particular "game" trail, all kind of bear signs (tracks, signs of tree climbing, feeding and resting sites, tree nest, scats) are encountered at each trail. Contrary to that trend, at Serranía de Pirre, only one type of bear sign, claw marks on trees, was found. Compared to other bear signs, marked trees can last longer in the environment, remaining many years unaltered. At Cerro Pirre, we have found no other kind of bear signs that might confirm the recent or actual presence of bears in the area. Furthermore, the sign frequency per each km. of trail was much lower (0.16 signs/km) than the lowest frequency of encounter of such signs at any other study site with a similar sampling regime. The type and rate of encounter of the bear activity signs found at Serranía de Pirre indicate either a very sporadic and brief presence of bears in the area or the misidentification of the claw marks as Andean bear signs. Overall it is clear that there is no permanent population of Andean bears at the Serranía de Pirre. Serranía de Jingurudo and Serranía de Pirre are part of the same mountain range, only separated by the upper basin of the Balsas river. The absence of Andean bears at Serranía de Pirre is probably a sign of the absence at Serranía de Jingurudo as well. The other mountain range at the Panama-Colombia border is the Serranía de Darién where Eisenberg (1989) reports the presence of Andean bears. The Serranía de Darién is an isolated mountain range, considered geologically as different from the Andes, separated from the Serranía de Pirre by the lowland areas of the Darién and separated from the mountainous areas of Colombia by the middle and lower Atrato river basin. If there are no Andean bears at the Serranía de Pirre, one of the best conserved and less intervened areas in Panama, the possibilities of Andean bear presence at Serranía de Jingurudo and Serranía de Darien are much lower. However, in view of the historic reports of sightings of Andean bears in the upper Peye river, at the Katios National park just across the border in Colombia, indicates that both the Serranía de Jingurudo and Serranía the Darien should be surveyed before overruling the possibility of Andean bear presence in Panama.

19 - CANADA

INFLUENCES OF THE SUMMER USE PROGRAM AT LAKE LOUISE MOUNTAIN RESORT ON THE SURROUNDING GRIZZLY BEAR POPULATION

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The Lake Louise area is a centre of tourism activities, including Lake Louise Mountain Resort (LLMR), within Banff National Park (BNP), Alberta, Canada. This area is also within a critical wildlife corridor, and due to the prevalence of high quality habitat, particularly around LLMR, a significant population of grizzly bears (Ursus arctos) inhabits the Lake Louise area. LLMR is world-renowned ski resort covering approximately 18 km2. The summer tourism operations at LLMR include a base lodge facility and a summer sight-seeing gondola to the mid-mountain area. New guidelines for the summer operations have been implemented either as conditions of the summer use license with Parks Canada, or as voluntary environmental stewardship initiatives to reduce human impacts to the local grizzly bear population and decrease potential for human-bear encounters. These have included initiating protocols for how and when construction and operational procedures are conducted in 1997, installation of electric fencing around the base facilities in 2001, restricting human access to areas of prevalent grizzly bear activity on the leasehold, and the development of public education programs on grizzly bear behaviour and ecology. This paper uses previous studies and current knowledge to assess how the summer use program currently in operation at LLMR may influence the local grizzly bear population and to evaluate the effectiveness of the bear management initiatives implemented there. Based on the results of interviews with grizzly bear researchers and other wildlife experts, as well as Parks Canada and LLMR management, perspectives on the effectiveness of current management strategies and the ecological, social and economic factors that form the basis of management decisions are also discussed. Considerations of human influences on grizzly bears outside of the LLMR leasehold are included as these are influential to management decisions at LLMR. Based on the results, a number of important themes for managing human uses within areas of grizzly bear habitat are evident, and it was found that aspects of many of these have been incorporated into the current grizzly bear management strategy at LLMR. Areas of further study and potential additional management initiatives at LLMR and the greater Lake Louise area that may contribute to decreased human influences on the grizzly bear population in this area are also suggested. The findings from this study may be useful in implementing grizzly bear management strategies at recreational facilities in other areas, providing local ecological parameters and grizzly bear demographics are accounted for.

20 - CANADA

FACTORS LIMITING DISPERSAL OF GRIZZLY BEARS

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The dispersal of grizzly bears (Ursus arctos) from their natal home range is critical to the reoccupation of former habitat, and to reducing genetic isolation between populations. This paper will examine whether areas with high levels of human activity act as barriers to dispersal. Movement vectors from 72 GPS-collared grizzly bears, collected over eight years (1999-2006) in the eastern slopes of the Alberta Rockies, will be classified as either dispersal into new territory (expansive movement) or revisiting previously used territory (intensive movement) through iterative generation of home range polygons. Areas where inflection points occur, in which expansive movement changes to intensive movement, will be examined for factors limiting dispersal. The various methods of home range estimation (Minimum Convex Polygon, kernel, buffered path) will also be compared in their interpretation of inflection points.

21 - CANADA

INCORPORATING THE VALUE OF WATCHABLE WILDLIFE IN THE LANDUSE PLANNING PROCESS – VALUES AND IMPACTS OF BRITISH COLUMBIA'S BEAR-VIEWING INDUSTRY

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We examined the economic impact of commercial grizzly bear viewing in British Columbia and the potential impact it could have on the new land-use planning process. Surveys of operators described economic rents attributed to bear viewing and identified barriers to success and positive elements within the industry. We incorporated a tourist motivation questionnaire to describe the importance of bear viewing on choice to visit the region and province in order to accurately allocate visitor expenditures. Responses support the presence of a wildlife-viewer tourist typology. Responses from bear viewing operators were not sufficient to enable a full industry economic analysis but were adequate for the creation of a set of parameters for future planning of grizzly bear viewing operations in the province, as is required by the land-use planning process. A map of possible grizzly bear viewing locations on the coast was produced and compared to known biodiversity values and presence of old growth forest, with a discussion on the potential commercial bear viewing has to preserve high value landscape. Mean values of bear viewing operations indicated they were worth the equivalent of 1290 Hectares of Old-growth forest when measured on a simple financial basis. Legislative, operational and other barriers to success are discussed in the context of expanding the commercial grizzly bear viewing industry.

22 - CANADA

THE DISTRIBUTION AND ECOLOGY OF GRIZZLY BEARS TOWARDS THEIR SOUTHERN EXTENT IN THE COASTAL MOUNTAINS OF NORTH AMERICA

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Towards their southern distribution in North America, grizzly bears are generally found in the rugged mountain ranges were relatively few people live. In the interior mountain ranges, there have been over 30 grizzly bear studies while in the coastal ranges, there have been 3 and these were localized on salmon spawning rivers where bear densities were high. Very little is known of the distribution and ecology of grizzly bears toward the southern extent of their distribution in British Columbia's Coast Mountains. In 2004 we initiated a research project to gain knowledge of the distribution and ecology of grizzly bears in this area. Our research focuses at a variety of spatial scales. Over a 4 year period, we sampled the distribution and abundance of bears over a 40,000 km2 area using DNA hair-traps distributed using a grid with10 x 10 km cells. We also captured 13 grizzly bears from helicopter and on 12 of these in 2 separate subpopulations put on GPS radio-collars that located the bear at intervals of 1 to 3 hours, resulting in 18,204 locations. We visited a sample (n = 199) of these GPS locations on the ground and compared ecological characteristics at these sites to random sites. Results to date show that the most southerly grizzly bears detections were about 40 km north of the city of Vancouver, B.C. (population 2.1 million). Grizzly bear distribution is fragmented and subpopulations have the lowest genetic diversity on the mainland of North America. There is great individual variation in habitat use and apparent diet. No radio-collared bears were known to feed on spawning salmon although these fish do occur in the study area. Six litters of either cubs, yearlings, or older offspring have averaged 2.16. One collared female bear apparently died of old age.

23 - CANADA

GRIZZLY BEAR USE OF AVALANCHE CHUTES: IMPLICATIONS FOR FOREST MANAGEMENT

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Avalanche chutes are an important component of spring grizzly bear habitat and thus have been afforded some protection under regional land-use plans. The primary means of protecting chutes has been to retain adjacent forest buffers to reduce the potential impacts of nearby forest management activities. This project had two objectives: 1) determine the effectiveness of these buffers at maintaining the level of use of avalanche chutes by grizzly bears, and 2) determine the location and structural characteristics of bear beds within the forest adjacent to avalanche chutes with the hope to gain an understanding on which to base the management of buffers adjacent to avalanche chutes. For our first objective, we quantified the relationship between buffer width and bear use, while accounting for other factors that may affect the level of bear use such as forage content and other physical attributes. We did a retrospective analysis on a data set centered on golden, BC, using vhf data from 61 grizzly bears. We mapped a sample of avalanche chutes (731) and quantified the amount of forb, shrub, tree, and non-vegetated cover within each chute. We also measured forested buffer width on each side of the chute, solar radiation, chute size, chute density (number of chutes per km) and quantified the amount of logging adjacent to the chutes. Each chute was the sample unit and the intensity of use by bears was the response metric. We found that natural biophysical attributes were the strongest factors predicting the level of chute use. The density of large chutes (>100m wide), chute size, forb content, and solar radiation were all positively associated with chute use by bears. Larger chutes tend to have well-developed forb communities, and more of these chutes per unit area provide increased forage opportunities. Snow melts sooner in chutes with higher levels of solar radiation, thereby lengthening the growing season. Forested buffer width or the amount of logging was not a strong factor predicting the level of chute use by bears. For our second objective, we quantified the location and structural characteristics of bear beds within buffers and compared them to matched random sites within the same forest buffers. Relative to random plots, bear beds were more often located closer to an individual tree and that tree had on average more than double the basal area. Depending upon the BEC zone, bed sites had 12-46% higher live tree density. Beds were also associated with sites that had 23-81% more canopy cover, 19-38% fewer shrubs, 22-52% fewer forbs and 47-96% less moss cover. Ninety-five percent of all beds were located within 100 m from the edges of openings, and 20 m of forest width included 70% of bear beds. Conditional logistic regression revealed that higher levels of canopy cover was the most important structural attribute surrounding bear beds. Experimental manipulations of buffer widths will be required to further clarify the relationship between buffer width and the level of grizzly bear use.

24 - CANADA

CLIMATE CHANGE AND HABITAT SELECTION: WHAT DOES IT MEAN FOR GRIZZLY BEARS?

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According to the most recent Intergovernmental Panel on Climate Change (IPCC), global temperature has been increasing by 0.15°C/decade since 1976 and the largest rates of warming are found in the mid to high-latitude of the continental Northern hemisphere. Precipitation has increased in the mid to high-latitude but decreased in the tropics and subtropics and a number of changes predicted by global warming models have already been observed: these include increased rainfall intensity and decreased diurnal temperature ranges due to warmer minimum temperatures. Recent studies now provide convincing evidence that our changing climate has impacted several natural systems. In 2003, the Alberta Endangered Species Scientific Committee recommended that the Grizzly bear (Ursus arctos) be considered a species at risk. Habitat loss from industry and high human-caused mortalities are the two main factors threatening grizzly bear populations in Alberta, Canada. The current management plan prioritizes the conservation of critical grizzly bear habitats but does not consider climate change as a factor for habitat selection. Grizzly bears select habitats in response to food availability but we hypothesize that other weather-related factors affect their choice of habitat and that these factors may play a larger role in the conservation of grizzly bears as climate change occurs. In this study, we acquire an understanding of grizzly bear habitat selection-response to weather variables by using an extensive data set (1999-2006) from the Foothills Model Forest Grizzly Bear Research Project and available remote weather station data. Potential relationships between seasonal habitat selection and weather variables are investigated. In 2007, additional local weather stations and temperature dataloggers will be positioned in nine different land cover classes near and within bear's home ranges in order to document temperature, humidity, and solar radiation variations amongst habitat types. Grizzly bears response to climate change will have implications on previously established management plans and policies and understanding weather-related grizzly bear behavior will allow for the development of effective forest management practices aiming towards the long-term conservation of grizzly bears.

25 - CANADA

IS MORTALITY RELATED TO THE LANDSCAPE STRUCTURE OF A GRIZZLY BEAR'S HOME RANGE?

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The home range of a grizzly bear (Ursus arctos) is where all its biological requirements for resources like food, water, shelter and mates are found. The quality and quantity of these resources available to an individual grizzly bear will depend on its age, sex, and reproductive status. Survival of the animal is dependent on the quality and quantity of these resources but other factors such as the amount of anthropogenic features on the landscape may play an important role. Anthropogenic features such as roads, pipelines, well sites and cutblocks may increase the number of human and bear encounters and increase the mortality risk of grizzly bears. In Alberta, Canada, grizzly bear mortalities are often a result of poaching, legal hunting or management actions, and could increase as bears come into more contact with people. The Foothills Model Forest Grizzly Bear Project is currently looking at possible relationships between the mortality of grizzly bears and landscape features within their home ranges. Using over 65,000 GPS collar location data from 1999-2006 for over 50 grizzly bears, we will examine the landscape within grizzly bears annual home ranges to determine whether a relationship exists with landscape features, mortality and a bear's age, sex and reproductive status. Results from this study could provide anthropogenic thresholds that could be used to better manage grizzly bears in west central Alberta, Canada.

26 - CANADA

HUMAN USE ACTIVITY AND CHANGES IN GRIZZLY BEAR HABITAT SELECTION PATTERNS: DOES INTENSITY LEVEL MATTER?

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Grizzly bears (Ursus arctos) in Alberta are under tremendous pressure from increasing levels of human industrial activity. Consequently, because they are at the periphery of their current range in Canada, Alberta's grizzly bears may be more sensitive to changes in habitat and may also be at a higher risk of mortality. Current population estimates in portions of the province where DNA surveys have recently taken place suggest that Alberta has far fewer grizzly bears than previously assumed. Beginning in 2007, Alberta grizzlies will face a new challenge with the incursion of mountain pine beetle (MPB) along the Eastern Slopes of the Rocky Mountains where the vast majority of lodgepole pine can be found. In an effort to control the spread of MPB, forest harvesting will increase significantly over the next 20 years with a goal of reducing susceptible pine stands by seventy-five percent within the Eastern Slopes. This raises particular concern, as the Eastern Slopes are Alberta's primary grizzly bear habitat. With current oil and gas development intensity and the expected increase in forest harvesting, the extent which grizzly bears will tolerate human activity is uncertain. To better understand how grizzly bears respond to industrial development, we will quantify the progression of large-scale human use activities (forestry and oil and gas) from bi-monthly satellite imagery, daily haul road information from logging trucks, and landcover classification maps. Our study area encompasses Weyerhaeuser Grande Prairie Forest Management Agreement (WGPFMA). Using grizzly bear GPS data collected from 2005-2006 in WGPFMA (n=9) and study animals to be collared in 2007 (n=10), we will assess whether or not human activity and intensity level causes grizzly bears to change their habitat selection patterns at different spatial scales. All GPS collars deployed in 2007 will have a digital camera unit equipped with gyrocompass and pedometer that are capable of recording detailed movement information. Not only will this information be useful in guiding future management decisions related to acceptable levels of industrial development in grizzly bear range, but it will also provide new scientific methodology for analyzing fine scale wildlife movements.

27 - CANADA

USE OF A PHYSIOLOGICAL INDEX OF FASTING TO MONITOR THE FEEDING ECOLOGY OF POLAR BEARS IN THE BEAUFORT SEA

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There is recent evidence that long term unidirectional decreases in sea ice extent and concentration could affect the ability of polar bears (Ursus maritimus) to capture seals, their main food. Changes in sea ice conditions could also affect polar bears through bottom up alterations to Arctic marine ecosystems. In some populations, polar bears come ashore during summer when the sea ice melts, do not feed on seals, and fast on stored fat reserves. In the eastern Beaufort Sea, polar bears are not forced ashore in the summer because the sea ice does not completely melt. However, these bears may still face short term fasts throughout the year when weather or ice conditions are not conducive to capturing seals. To avoid net loss of muscle tissue during a fast, polar bears do not urinate or defecate and are able to build proteins from recycling nitrogen that would normally be excreted in nitrogenous wastes. This nitrogen recycling phenomenon has been shown to occur when polar bears go approximately 10 days without food and can be detected by measuring the ratio of serum urea to serum creatinine (U/C) in their blood. Our study used U/C values to examine polar bear fasting physiology in the eastern Beaufort Sea, where bears have access to sea ice habitat throughout the year. The goal of the study was to determine if any changes can be detected in the proportion of individuals that are in a fasting state (U/C < 10) during spring sampling periods separated by 2 decades. We determined U/C values for 464 polar bears during 2 periods (1985-86 and 2005-06) which differed in both atmospheric temperature and sea ice composition. In 1985-86 fasting was observed in 9.1% (22/241) of bears and in 2005-06, 24.2% (54/223) of the bears were in a fasting state. The increased proportion of bears fasting during 2005 and 2006 could be a factor of climate induced changes in sea ice dynamics, prey density, and/or temporal shifts in seasonal polar bear feeding activity.

28 - CANADA

APPLICATIONS OF AVERSIVE CONDITIONING ON BEARS IN CONFLICT WITH HUMANS

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Human-wildlife conflict is a contributing factor in the global decline of many wildlife species. For bears, human wildlife-conflict frequently results in lethal wildlife management – destruction of the bears -- to reduce the conflict. Such lethal management destabilizes local population structure, may cause population declines, and raises a series of ethical issues. For these reasons, many managers are seeking non-lethal methods for solving bear-human conflict. Common tools for non-lethal management of bears are hazing and aversive conditioning. We define hazing as the use of deterrents at the site of a conflict and aversive conditioning as a learning process by which bears are taught to associate some negative stimulus (e.g., being shot with rubber bullets) with a conditioned stimulus (e.g., human infrastructure). Despite informal use over several decades, the efficacy of these techniques as tools for managing bear-human conflict has not been subjected to much systematic study. To learn more about how bears in conflict respond to hazing and aversive conditioning, we captured and radio-collared 22 black bears (Ursus americanus), including 15 males and 7 females in Whistler, BC. This ongoing project works closely with the BC Conservation Officer Service and uses both human dominance (i.e., purposeful approaches that maintain eye contact with the target bear) and pain from shotgun-fired projectiles to discourage conflict behaviour and to deter bears from locations where conflict has occurred. In 2005, we applied hazing and aversive conditioning 111 times, and in 2006, we applied hazing and aversive conditioning 285 times. In both years, we subjected one subadult male bear (n = 2) to an intensive 10-day aversive conditioning program. Additionally, we are documenting the spatial and temporal patterns of bear conflicts to identify correlates related to bears (e.g., sex and age classes, social dynamics, variation in tolerance), humans (e.g., presence of anthropogenic attractants) and the environment (e.g., season, availability of natural foods). . Preliminary results suggest that conflicts with humans are highest in the spring and fall when natural food is limited, that conflict behaviour is difficult to discourage while target bears are able to access anthropogenic attractants, and that conflicts are more likely to involve subadult male bears. Bears were less responsive to people using human dominance than to people using shotgun-fired projectiles. Aversive conditioning was extremely labour-intensive and did not prevent subsequent conflicts for the targeted individuals. In 2005, the target bear stopped entering the Village for 6 days after 9 days of aversive conditioning, but thereafter resumed conflict behaviour, and conservation officers translocated him 35 km north. His carcass was found near a campground in January, but the cause of death is unknown. In 2006, we subjected a three-year old male to 10 days of aversive conditioning. He continued to access anthropogenic attractants, and exhibited bold behaviour after the program. One reason that aversive conditioning was not more effective may be that existing protocols did not align with the principles of learning theory, particularly those of immediacy, evolutionary relevance, and initial intensity. The importance of these principles will be assessed in two experiments in the summer of 2007. One will assess the ability of bears to associate particular attractants (e.g., garbage) with nausea to determine whether an emetic agent could be used to teach avoidance. A second experiment will determine whether bears can associate a warning sound (e.g., an airhorn) with a pain stimulus. If successful, this association might later allow a broader cross-section of Whistler residents to deter bears from anthropogenic attractants, thereby buying time for aversive conditioning programs while preventing the food conditioning that characterizes most bears in conflict. We will describe our preliminary results and further modifications to our protocols.

29 - CANADA

WIRELESS SENSOR NETWORK WITH SATELITE UPLINK TO MONITOR GRIZZLY BEAR CAPTURE SITES

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Ground capture using snares and culvert traps is stressful on Grizzly Bears (Ursus arctos). Reduction of restraint time is a major factor in reducing capture stress levels. The majority of ground captures occur in remote areas and in locations that conventional alarm systems fail. An early detection system was developed using a Satellite uplink to help reduce restraint time. The system consists of an AXW-BASE-001 Simplex Wireless base Station, together with 1 or more AXW-D-001 wireless Digital Input Alarm sensors. The sensor reports a contact alarm to the base station which in turn routes the alarm through a Simplex Service Server. During 2006 and 2007 this new system was tested in field capture efforts on grizzly bears along the eastern slopes of Alberta. The systems were tested on both culvert traps and ground snare applications. Once traps were activated, messages identifying the specific trap site and individual snares triggered are delivered to the researchers via e-mail, FTP or cellular phone using SMS. Using this alarm system provided researchers with a quicker response time to capture sites and hence the ability to reduce restraint time thus reducing stress on captured bears. This system is seen as a significant improvement in improving animal care in capture programs that occur in remote or widely distributed trapping areas.

RECORD OF REPRODUCTION AND PHYSICAL CONDITION IN CEMENTUM OF POLAR BEARS

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The amount and quality of nutritional intake in mammals is known to influence the deposition of cementum, the highly mineralized tissue surrounding the roots of mammalian teeth. The link between nutrition, energetic demands, and cementum deposition provide for life history information to be potentially recorded in the pattern of cementum deposition of polar bears (Ursus maritimus). In black bear (U. americanus) and some grizzly bear (U. arctos) populations, reduced cementum deposition has been observed in females rearing cubs and attributed to the increased calcium and other energetic demands of lactation. Thus, it seems likely that the effects of nutritional changes resulting from major events such as climatic variation, that have a significant influence on the abundance or availability of prey, may also be reflected in cementum pattern of polar bears. In western Hudson Bay, Canada, polar bears spend the winter out on the sea ice hunting seals but are forced to spend from 4-8 months ashore fasting each summer during the ice-free season. Long-term observations of this polar bear population by the Canadian Wildlife Service (late 1960s – present) has not only documented declines in condition, reproduction, cub survival, and population size due in part to significant change in environmental conditions, but has also resulted in a unique collection of archived tooth samples and an extensive reproductive and physical condition data set for individual bears with multiple capture histories. The ability to use data collected from the cementum to investigate two hypotheses will be discussed. First, whether major physiological events such as age of first reproduction and subsequent reproductive events can be detected and, second, whether food limitations and associated stress brought about by known changes in climate and ice conditions correlate with patterns of cementum deposition in polar bears from western Hudson Bay. Digital images of sectioned and stained roots are analyzed using measuring software. Critical values for width and/or pattern of cementum deposition may be identified as indications of individual or population stress. Successful cementum analysis would improve the monitoring of population dynamics and health by accessing the recorded history of physical condition and reproduction of individuals.

31- CANADA

ONTARIO'S BEAR WISE PROGRAM

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Ontario's Bear Wise program was launched in March 2004 in response to recommendations from the ministerial-appointed Nuisance Bear Review Committee that the Ontario Ministry of Natural Resources (OMNR) take the lead role in coordinating the management of problem black bears (Ursus americanus) in the province. Previously, dealing with problem black bears was a poorly coordinated combination of response by OMNR, municipalities, private service providers, and municipal and provincial police forces. The Bear Wise program rests on 4 cornerstones: Prevention, Awareness and Education, Reporting, and Response—all aimed at reducing human-bear conflicts. Prevention focuses on community-based projects such as hazard assessments, electric fencing at landfills, and bear-resistant containers. A small research program has evaluated the effectiveness of electric fencing (installed at landfills, apiaries, and field crops), bear-resistant food lockers in campgrounds, and aversive conditioning of problem bears as an alternative to relocation or destruction. Awareness and Education efforts include public education programs to increase public safety in bear country. Available products include a variety of fact sheets, articles, and technical notes plus educational materials aimed at elementary school-aged children including an e-book, curriculum units for Grades 2, 4, and 7, and a short video "Bear With Me: a Young Person's Guide to Black Bear Safety". Other materials include advertisements for print media, and radio and television public service announcements. The main feature of the Reporting cornerstone is a toll-free hotline that is operational 24-h a day from 1 April to 30 November each year. Callers seeking information on black bears can receive advice and brief educational messages from an automated system. Callers reporting a problem bear provide information on the incident to a live operator who passes on the information to the appropriate OMNR office for response. This service has enabled coordinated, consistent tracking of human-bear conflicts and reliable data on annual variation in problem bear activity. Under Response more than 50 seasonal Bear Technicians are hired across the province annually, and staff training courses in chemical immobilization and problem bear handling are delivered. Districts were provided with traps and chemical immobilization equipment to trap and relocate problem bears when necessary. Memoranda of understanding were reached with municipal and provincial police forces to clarify roles and responsibilities of OMNR and the police. Successes and short-comings of the program will be discussed. Bear Wise is making a difference, but it remains to be seen how public attitudes will change in the future.

32 - CANADA

DAVIS STRAIT POLAR BEARS: POPULATION STATUS

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We will present new population parameters and body condition information on a little studied polar bear population in the eastern subarctic of Canada – Davis Strait. We caught and tagged 1,564 polar bears (Ursus maritimus) in the Davis Strait population in 2005 and 2006, which ranges from Labrador, the northern coast of Quebec and southeast Baffin Island of Nunavut. During the winter months, polar bears disperse eastward on across the ice to the southern corner of Greenland. Our recapture rate is approximately 29%, and our initial population estimate is 2380 ± 186 (7.9% CV). In the summer and autumn of 2007 we will conduct a third year of mark-recapture tagging to confirm the population estimate, estimate population growth and determine whether a continuing harvest is sustainable. We will present this information to the IBA. The previous population estimate of the area was conducted in the late 1970's, however the estimate of 770 bears was considered biased low, and only represented subsections of the current population designation. Nevertheless, the population has likely increased during a period of warming, during which other polar bear populations have decreased. At the conclusion of the study in 2007, we will determine whether the population is indeed growing, despite significant decreases body condition metrics in comparison to early studies of polar bears in Davis Strait.

33 - CANADA / USA

INTERNATIONAL COLLABORATIVE MANAGEMENT OF BEAR-HUMAN INTERACTIONS ON THE TATSHENSHINI AND ALSEK RIVERS, CANADA AND UNITED STATES

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The Alsek and Tatshenshini Rivers are located within a UNESCO World Heritage Site and part of the largest internationally protected land-based ecosystem in the world. They provide a world-class wilderness experience as rafters participate in six to 12 day trips on one or both rivers. Their remote location makes effective bear management, including public education, food and garbage management, bear observation monitoring and enforcement of regulations problematic. Depending on where visitors begin their trip, they typically pass through two nations, two or three different provincial and state park jurisdictions (Kluane National Park and Reserve (KNP&R), Tatshenshini-Alsek Provincial Park (TAPP), and Glacier Bay National Park (GBNP), each of which have their own systems of registration and bear-human interaction management programs. Coordinating the exchange of information and collaboration on management activities has been a long-term process involving annual meetings, consultation with commercial guiding companies and interagency cooperation. During the mid-1990's, a significant collaborative effort was made involving mapping the entire river corridor as well as conducting campsite bear-human interaction risk assessments and developing recommendations for strategies to minimize bear-human interaction and conflict. A variety of recreational use management strategies were implemented in response to research findings and in conjunction with ongoing consultation with commercial rafting companies. In Kluane National Park and Reserve, these included a transition to designated campsites with lower risk for bear-human encounter and displacement of bears along the upper Alsek River, campsite closures, one-night stay restrictions on other sites, departures every second day, enhancements to the trip preparation information package, maximum group size limits, mandatory human waste removal, and requiring that rafts not be left unattended. KNP&R started a long-term database of bear-human interactions 1994 and GBNP created a database in 2000. The KNP&R monitoring database collected data on 523 reported interactions between 1994-2005, with a 39% response rate (52% from commercial groups and 25% from private groups). Formal steps to apply the same food and garbage management practices along the entire river corridor are now being undertaken in consultation with all concerned parties including testing of electric fence designed for food storage by the US Forest Service. Additionally, in the summer of 2007, a bear observation form will be tested that has been developed for use along the entire river corridor. The Tatshenshini-Alsek Bear Management Group is working to develop realistic food storage options for commercial groups including development of bear-resistant food boxes, electric mats for on top of food boxes in rafts. Plans for future collaboration include an entire river bear-human encounter analysis of Overt Reaction Distance from interior to coast. We discuss the implementation of management recommendations, analysis of bear-human interactions data for effective monitoring. We address the accomplishments and challenges of this significant interagency and international effort to minimize bear-human interactions and conflict along these wilderness rivers which are highly valued for grizzly bear conservation and recreation.

34 - CHINA

ASIATIC BLACK BEARS FOOD HABIT IN XIAOXINGAN'AN MOUNTAINS

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During the period between April 2004 to November 2005, to research the food and habitat of black bears in Xiaoxing'anling area, northeast of China, we have collected and analysed 51 piles of black bear (*Ursus thibetanus*) feces using wireless radio technologies. The results show that the main habitats for the black bears are the conifer forest or the mixed forest of conifer and deciduous (at 400-560 meter elevation) for the beginning of the spring and the end of fall; the deciduous forest or the mixed forest of conifer and deciduous for the end of spring and the beginning of summer; the deciduous forest, the mixed forest of conifer and deciduous or the mixed species forest (by the river) for the rest of summer and the beginning of the fall. The main foods for the black bears are plants and 70% of the diet in the summer when more plants are available. The species and parts of the plants for the food of black bears change from seasons to seasons. The number of species of plants for the food of black bears is the least in the spring, the food diversity indicator is 2.317 and the evenness indicator is 0.5923; the number of species of plants for the food of black bears is the most in the summer, the food diversity indicator is 2.628 and the evenness indicator is 0.6367; and the food diversity indicator is 2.361 and the evenness indicator is 0.5173 for the fall. The most preferred food for the black bears is the seeds of Korean Pine, Quercus mongolica, Juglans mandshurica and Actinidia kolomikta,, Prunus. While the least preferred foods are Hippochaete hyemale, Gramineae, Ulmus, Carex siderosricra, Acer mono, Betulla, Populus, Salix.

35 - CROATIA

APPLICATION OF GENETIC TOOLS IN BROWN BEAR MANAGEMENT IN CROATIA

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Brown bears in Croatia are a game species and through the hunting management since the 1950s the population grew from less than 100 bears to the current estimate of 600 to 1000. According to the management plan, hunting of bears is done through yearly quotas. However, presently, the decision of quota size is made without the necessary knowledge on the scientifically based population estimate and it's genetic status. This is the source of various complains: some believe that the quota should be much higher, believing that there are too many bears, and the others are against any quota fearing the population can not sustain such losses. As the bear range is also inhabited by humans, typically the capacity of the habitat is above the social capacity, i.e. above the point when the conflict (damages and threats to human safety) is perceived as unacceptably high. Hence, knowledge about the actual population size of the brown bear population is a prerequisite for the gaining and maintaining of public acceptance of the bear in Croatia. To investigate the genetic diversity of Croatian brown bear population, we surveyed 13 polymorphic microsatellite loci for 90 bears and obtained partial mitochondrial DNA control region sequences (267 bp) for 71 bears that had been hunted or accidentally killed during 2005/06 and whose muscle tissue samples we had received. The mean allelic diversity per microsatellite locus was 6.54, ranging from three to 10 alleles, which is relatively high. The analysis of mtDNA control region sequences revealed only two haplotypes that differ by two nucleotides, and whose frequencies were 0.18 and 0.82. This extremely low mtDNA haplotype and nucleotide diversity may indicate population bottleneck in the recent past by severe hunting and should be explored further. Genotyping of bear scat samples using six microsatellite loci for individual identification is now in progress with DNA extracted from over 500 samples. The procedure will be followed with statistical elaboration and population viability modeling. With more samples coming in and further analysis, genetic data shall provide scientific guidelines for brown bear management in the future. Traditionally bear managers counted the animals at feeding sites. That method suffered of biases but the genetic method and standardization of hunter's counts will allow the calibration of traditional methods and the continuous insight in the population trend. On the international level the results of this study will help conserve the brown bear on the European level, and will help Croatia to comply with conventions signed (Bern, Habitat directive, CITES).

36 - ESTONIA

ANTS IN DIET OF BROWN BEAR IN ESTONIA, COMPARISION FITH OTHER STUDY AREAS

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Brown bears (Ursus arctos) are opportunistic omnivores using large variety of different food items. Ants, as demonstrated by several earlier investigations in other countries, hold a prominent role as a brown bear diet item. Brown bear populations consume ants as they are stable, abundant and predictable food resource, rich in protein and energy, providing also essential amino acids. Bears myrmecophagy is well studied in Scandinavia, Slovenia and in North-America, also in some parts of Russia. Yet, studies where composition of ants in bear faeces is identified in species level are quite rare. The aim of this study was to conduct a detailed analysis to investigate the availability and role of different ant species in brown bear diet during different seasons in Estonia and to compare the results with those obtained in other regions. The study of brown bear myrmecophagy was carried out in Estonia during 2003-2005. We analysed 142 bear faeces, 73 of them contained ants, which were determined to species level. In all, we identified 18 species of ants during excrement analysis. We also determined the importance of ants in bear's diet (faecal volume and frequency of occurrence), ant groups/species composition and also ant availability on study area. The seasonal importance of ants was highest in summer, when faecal volume (FV) was 14.2% and 75% of faeces contained ants. In summer ants contribute almost third of Estimated Dietary Content (EDC). In spring and autumn importance of ants declined and faecal volume vas respectively 2.1% and 4.2%, frequency of occurrence was 50% and 47%. Formica and Lasius ants dominate in bear's diet by volume and by frequency also. Camponotus, Myrmica and Serviformica ants were consumed lesser volumes, firstly named mostly during summer and lastly mentioned during autumn. In species level F. polyctena, F. rufa and L. niger dominated. In study area, the biomass of ants was 7.6kg/ha. Biomass of Formica ants was vastly greater than biomass of other ant groups (93.7%), but they have fewer colonies and these colonies are aggregated. On the other hand Myrmica and Lasius ants had the highest density of colonies. Positive correlation was found between number of colonies per ha and the frequency of occurrence in autumn faeces. Our results are closest to Scandinavian, Slovenian and other Eastern-Europe studies, but the pattern of myrmecophagy is unique in all of these study areas. Almost in all areas the greatest consumption of ants occurs in summer, even in North-America, where consumption of ants is almost negligible. Consumption pattern of various ant groups depend on their availability in particular region, but it seems that factors affecting consumption of ants are regionally somewhat different. These results will be discussed in detail.

37 - ROMANIA

HABITUATED BEARS BEHAVIOR AND HUMAN – BEAR CONFLICTS IN RACADAU AREA – BRASOV, ROMANIA, DURING PERIOD 2004-2007

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The habituated bears are the bears that are used with human's presence, they live in wilderness but they have a feeding behavior based on human's presence. Thus, they do not search for food in their natural environment, but they look for food close to human settlements, for an easy accessible food sources. The issues related to habituated bears cover a wide range of aspects from which are ensuring and maintaining the security of human population that live in habituated bears areas, conservation of the ethological and ecological characteristics of the species protected under EU legislation and waste management in urban areas. In order to find solutions for such problems, our activities where focused on two main areas:

- Study and management of the habituated bear population
- Waste management combined with public awareness and information of local communities.

For studying the habituated bears behavior, there were used several methods::

- direct observation on garbage platforms visited by bears,
- capturing and marking with radio collars of bears that were relocated and monitored by telemetry
- capturing and marking with a GPS collar of a bears released in the wilderness and monitored by using GSM, GPS, VHS.
- capturing and marking with a GPS collar of a bear monitored in the same area,
- capturing and marking with ear tags of 6 bears monitored at the feeding places,
- capturing of 4 orphan bears and transfer into a renaturation center.
- data collection together with personnel of AJVS Brasov,
- data collection from Racadau area, by using students and volunteer teams,
- data collection regarding direct bear-human conflicts.

These studies provided needed information for carrying out information campaigns and for establishing an active working group formed by ICAS, Carpati Wildlife Foundation Faculty of Silviculture and Forest Engineering, AJVS, Town Hall, Community Police, LEPA, URBAN, WSPA, CPNT, etc.

38 - RUSSIA

BEAR'S DENDROACTIVITY AND THE CLASSIFICATION OF ITS TARGETS

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Author and its colleagues have collected the science materials about the brown bear's (Ursus arctos) biology at the Udmurtia Republic territory (1983-1995), at Pechoro-Ilichsky State Zapovednik (1999, 2002-2006), and by episodic works at the forest ecosystems from Vologodskaya oblast' on the west to Sayano-Shushensky Zapovednik on the east. The results of these researches and the published science data about the dendroactivity of the brown bear and other bear species (Ursidae) are discussed. Every forms of the animals influence to the isolated trees or the forest stand are qualified as the dendroactivity. Such activity generate on the trees the signs which may be inspected by the researcher. The main forms of dendroactivity are divided: nutritional, defensive, playing, comfort and social (Puchkovskiy, 1998; 2005). It is not easily to distinguish accurately the signs, which characterize the different forms of dendroactivity in the field conditions. My presentation aim is to show a wide spreading of different forms dendroactivity in the bears populations and to line out the possible ways for an creation of an classification of the trees with the bear's activity signs. The methods of the bear's dendroactivity study are described in our publications (Puchkovskiy, 1991; 2003; 2005; Puchkovskiy & Neifeld, 2005). We have used the conceptions of three information environments (Tembrock, 1977) and biological signal fields (Naumov, 1977). The part of the forest trees support the nonspecific activity signs, and the "marks" also. The marks are the specific signs, which have their main biological importance – signal. The trees with the marks are named as the bear trees. The bear trees was divided in the rub-trees and the signal trees. The last, for one's part, was divided to the indicator trees and the victim trees (the most seldom category). One tree may unite the signs of the different dendroactivity forms. Our classification is the pilot variant and can be develop. The named form of the dendroactivity are proper for American black and Himalayan bears; the fragmental data are about other bear species (except the white bear). Other carnivorous and artiodactyl mammals may generate the signs of activity to bear trees by common habitat. The dendroactivity are proper for the many other mammals; they may damage the forest trees, leave on the trees a dirt, a urine, the chafes, a hair etc. Our knowledge about the dendroactivity and the communicative systems of the bears in whole are modest. But the dendroactivity study may have importance for the monitoring system development.

39 - GERMANY

THERMOREGULATION IN POLAR BEARS – PRELIMINARY RESULTS

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The aim of the study is to investigate the effect of different ambient conditions on both behavioural and physiological thermoregulatory mechanisms of polar bears (Ursus maritimus) and to determine to which degree behavioural regulation complements physiological mechanisms to keep energy expenditure low. Bears are homeotherms and thus able to maintain a relatively stable core temperature, despite large variations in ambient conditions and internal heat production. The thermoneutral zone, the range of ambient temperature inside of which the rate of metabolism remains constant, is mainly determined by physiological features like body insulation through fur and subcutaneous fat layers. Below and above the critical temperatures, regulation of body temperature, which adds to the physiological costs, is achieved by both behavioural and physiological means. The activation of the various thermoregulatory mechanisms follows a hierarchical system that aims at minimising energy expenditure. Polar bears have adapted to the arctic environment by effective thermal insulation. These heat-conserving adaptations must be circumvented when excess heat needs to be dissipated during elevated ambient temperatures in summer or during increased activity. Whereas the insulation properties and their advantages in a cold climate are well studied, it is still unclear whether there are special physiological mechanisms to avoid overheating. It is assumed that heat loss in polar bears is restricted to eyes, ears, snout and the inside of the thighs. To determine whether there are other parts of the surface specialized for the dissipation of excess heat, we examine polar bears in European zoos under various ambient temperatures by using infrared thermography. This method allows to detect vasodilation and to infer on heat dissipation via body surface. First infrared images, taken in summer, provide evidence that polar bears are able to open thermal windows. These are defined as areas with temperatures higher than the surrounding body surface as well as ambient temperature. Thermal windows were observed in the back region. According to literature, dissections of polar bears have shown thin layers of muscles, richly supplied with blood vessels, lying under the skin in the shoulder region. This network might transport warm blood from the body core to the surface, where heat may dissipate. Our findings are consistent with that assumption and strongly suggest a thermoregulatory role of the interscapular region in polar bears. The ongoing study takes place in five European zoos, which provide appropriate conditions for behavioural thermoregulation, between latitudes of 45 ° and 57°, during summer and winter. Data are recorded by a combination of behavioural observations and infrared photography. The results can provide the basis for improving husbandry concerning requirements for thermoregulation. These findings might also help to estimate whether and to which extent polar bears are able to cope with climate change and under which conditions their adaptability is exceeded.

40 - GREECE

BROWN BEAR PREDATION ON TORTOISES IN GREECE

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The brown bear (Ursus arctos) is critically endangered in Greece and very little is known regarding its biology and ecology. During the Arctos project, which was implemented by the Greek NGO ARCTUROS, we initiated a study aiming to determine the significance of tortoises (Testudo spp.) in the diet of the species in the country. We divided brown bear distribution into three distinct geographical units, each one with a different vegetation structure. The Rodopi unit was dominated by conifer forests, the Peristeri unit dominated by broadleaved forests and the Pindos unit by mixed conifer and broadleaved forests. During a full annual cycle we collected and analyzed on a monthly basis 1308 scats, while at the same time estimating the relative abundance of tortoises in the respective study areas, through mark-recapture analysis and transect counts. Analysis of the scat samples indicated an unusual high percentage of tortoise remains in the diet of brown bears. The contribution of tortoises in the species diet, as an absolute frequency of presence, was between 0.8 and 6.3%, while the frequency per volume was between 0.2 and 0.6%. The higher percentage of samples with tortoise remains originated from areas with open deciduous forests (Peristeri unit). We estimated the population densities of tortoises in the open oak wood forest of this region at 37 individuals/ha. In the scats analyzed, the tortoise remains comprised mainly of bones and tissues from the limbs and only in one case did we find remains of tissue, indicating that the tortoise's shell was broken. In the area with the highest predation on tortoises we found several individuals, mainly of the species Testudo hermanni, with one of their limbs missing and scars on the shell, which could indicate incidents of an attack from a bear. Cases of brown bear predation on tortoises have been rarely documented in scientific literature. The results of this study deepen our knowledge on the biology of the species in Greece, designate however at the same time further investigation into the causes of this unusual behavior.

41 - GREECE

USING HISTORICAL RECORDS TO EVALUATE THE PAST DISTRIBUTION OF BROWN BEARS IN GREECE

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During the last century political and economic changes in Europe widely influenced wildlife species and their habitats. The impact of human activities has been greatest on large and wide ranging land mammals, such as the brown bear (Ursus arctos). Little is currently known on the past distribution of brown bears in Greece; such knowledge is however necessary in order to understand and assess the current conservation status of the species in the country and in order to design effective conservation measures. We analysed data from a wildlife survey carried out in 1903, the game chronicles of the Hellenic State of 1927 and 1960, as well as data from the bear survey carried out by the Hellenic Ministry of Agriculture in 1970 in order to evaluate the distribution of brown bears in Greece prior to the initiation of the ongoing conservation efforts for the species. These data were then compared with bibliographic data regarding the current distribution of the species in the country. Analysis of the data prior to 1930 suggested that the Greek brown bear population was restricted to the northwestern mountains of the country, with some occasional sightings occurring at the western Olympus massif. In the early and late 1960s however, the distribution of the species appeared to have contracted, as bear sightings were reported only from the northwestern mountains of the country and not from the western Olympus massif. Based on such information, brown bears were considered back then to be endangered in Greece; a legal status that is still in force. A comparison between the results of our analysis and the current distribution of brown bears in Greece, shows that the range of the species has expanded since the 1970s and that it is currently occupying the largest area in the country for almost a century. This has taken place through the re-colonization of localities in which brown bears went extinct within this time frame, as well as the expansion of the range of the species into areas where it was previously absent. We suggest that the expansion of brown bears in Greece was facilitated by the abandonment of the countryside, due to the massive immigration of rural people to urban areas, and the conservation measures applied in the last century, which focused on reducing human caused mortality and creating safe habitat for the species.

42 - GREECE

THE STATUS OF THE BROWN BEAR IN NORTHWESTERN GREECE

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Despite intense conservation actions over the past two decades, the brown bear (Ursus arctos) is still considered to be critically endangered in Greece. Evaluating its current distribution and population status is considered to be amongst the priority actions for its effective protection. From May to December 2006 the nothwestern part of the distribution of the species in Greece was surveyed. The study area covered approximately 1200 km2 and included six Natura 2000 sites as well as the internationally protected Prespa National Park. Vegetation consisted mainly of beech and oak forests (69%), partially forested areas (15%), pastures (9%) agricultural land (6%) and other (1%). The aim of the study was to record the presence and gain basic information on population size and reproductive parameters of brown bears in the area. The study area was divided in grids of 5x5 km2 and forest roads within each grid were selected randomly; these were scanned on a regular basis, especially 24-48h after precipitation, in search of bear signs. This data was supplemented by opportunistic data and reliable information regarding bear presence from the public. In addition, two areas were selected, where bears were observed to mark power poles, and hair samples for genetic analysis were collected every 15 days. In total, 205 transects were carried out covering approximately 928km; we recorded 355 signs of recent bear presence (tracks, scats, hair, foraging indicators, marking on trees, damage to crops and power poles) in our study area, as well as a minimum of seven reproductive units (females with COY) and one death. This evidence suggests that the species is widespread in northwestern Greece and reproductively active. The analysis of 57 of the 295 hair samples collected suggests that the population in our study area is small. The findings of our study enabled us to update, for the first time in over a decade, the conservation status of the brown bear in Northwestern Greece. We conclude that the species remains endangered and propose a set of concrete management and conservation actions towards its effective protection.

43 - GREECE

THE ENVIRONMENTAL FACTORS AFFECTING POWER POLE-RELATED MARKING BEHAVIOUR BY BROWN BEARS IN GREECE

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Brown bears (Ursus arctos) survive in the western and Mediterranean parts of Europe in small and fragmented populations and are in urgent need of effective conservation measures. In Greece, brown bears reach their southernmost European distribution and exist in two disjunct population nuclei. In the larger population in the Pindos mountains, bears have been noted to mark power poles by biting, clawing and rubbing. The environmental factors influencing this behaviour were studied in July/August 2005 using line transects of power poles. In the Grevena and Nestorio area of the Pindos mountains in the western population nucleus of the species we examined 162 and 175 respectively. In the Rhodope mountains, in the eastern population nucleus, 146 poles were examined. The environmental factors considered included the dominant forest habitat, dominant crops, landscape position, visibility and other disturbance from human activity and the presence of debris around the pole or tar on the pole. Decision tree analysis of the environmental factors surrounding sampled poles reveals that the behaviour is influenced by habitat type, the presence of a food source and disturbance from human populations, with bears in the Pindos mountains more likely to mark poles in optimal foraging habitat away from human disturbance. Bears in the smaller Rhodope population also exhibit power pole marking behaviour but far less frequently than in the Pindos population, despite similar environmental conditions. It is therefore suggested that this behaviour (though apparently multi-functional) may be density dependant and have a function as a territorial marker. The results of this study provide valuable new insights into the ecology of the marking behaviour of brown bears and address one of the main shortcomings identified when using power pole-related marking behaviour in order to document the presence of the species in Greece.

44 - IRAN

A MORPHOMETRIC STUDY OF BKACK BEAR IN SISTAN AND BALUCHESTAN PROVINCE (IRAN)

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Information regarding of Asiatic black bear Ursus thibetanus gedrosianus in Iran is so limited and there are few reports on its observations by native people and environmental experts. Pocock (1941) mentioned biometrical data of a male, two females and an immature bear in his reports. In 2001 a mature male bear in Ahmadabad village, near Khash town, was killed and buried by native people because an attack on a ship herd; afterward in 2004 it brought out by the authors and transferred to museum of collage of natural resources of Zabol University. A total of 27 skull and teeth characteristics were measured. Distribution of black bear limited to southeast of Iran including Sistan and Baluchestan, Kerman and Hormozgan provinces. Because of few collected specimens, poor information and decreasing population (critically endangered in IUCN red list), the peresent research can be useful for national and international researchers as a preliminary study.

45 - IRAN

THE STUDY OF HABITAT VEGETATION OF BLACK BEAR IN IRAN

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Iranian black bear Ursus thibetanus gedrosianus is listed as critically endangered in the Red Data Book (IUCN). Because of direct relationship between fauna and flora in ecosystem, study of habitat vegetation of black bear seems to be very important in its survival. Field observations on its habitat such as Bashagard mountains, Kalat, Kalmorad, Gebalalbarez, Birg, Sarbaz, Ghasr-e-ghand and Sardueeye showed that there are various bushes, grasses and also more than 30 tree and shrub species from 21 family. Ziziphus jujube, Nannorhops ritchieana, Olea europaea, Lycium shawii, Prosopis cineraria, Amygdalus scoparia, Pistacia atlontica, Ficus plamata, Berberis calliantha, Amygdalus cioides, Acer monspessulanum, Crataegus atrosanguinea have the most frequency. Long-term drought period, cutting trees and shrubs to obtain fuel, change of land use and grazing have severely decreased vegetarian diversity and density, habitat quality and finally the number of black bear in Iran in recent decades.

46 - ITALY

ACTIVITY OF PARCO NATURA VIVA – GARDA ZOOLOGICAL PARK FOR THE CONSERVATION OF SPECTACLE BEAR.

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Parco Natura Viva is involved in the conservation of the spectacled bear by promoting and presenting the Biodiversity Project. The purpose of this project is to provide information on conservation and biodiversity and raise funds to buy forest areas, the only way to safeguard these habitats from complete destruction. Funds are raised selling vegetal ivory products manufactured by the Indian populations of Ecuador. This material is made with the seeds of a palm growing in the tropical forests of Ecuador, and is known as tagua. Funds also come from the sale of a beautiful ecological fairy-tale titled "The Golden Beetle", that tells the adventures of three animals (one of which is a spectacled bear) looking for a peaceful place to live. During 2006 this fairy-tale has inspired the staff of Parco Natura Viva to realize a spectacle and in cooperation with the italian association AIDA has started a tour to perform it in Europe. Thanks to the OTONGA foundation the funds collected to date made it possible to establish the Otonga Reserve, approximately 1,500 hectares of forest and all its biological wealth. In this portion of tropical forest, several new species are identified every year. Moreover during 2006 Parco Natura Viva has started a cooperation with the "Espiritu del Bosque" Foundation to study the behaviour and the status of spectlacled bear in Ecuador.

NUTRITIONAL CONDITION AND FOOD HABIT OF JAPANESE BLACK BEARS KILLED FOR INTRUDING HUMAN SETTLEMENTS IN THE AUTUMN OF 2004

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Many Japanese black bears (Ursus thibetanus) are killed for intruding human settlements in the autumn every several years. The low forest fruit production is considered to be the putative cause of this behavior. In the autumn of 2004, many bears intruded human settlements in Hiroshima prefecture situated in the southern part of Honshu, Japan. We evaluated the nutritional conditions of these intruders that were killed because they were a nuisance, by calculating the modified body mass index (modified BMI): body weight in kilograms/ (head and body length in meters) 2. We estimated their diachronic food habits by measuring the carbon and nitrogen stable isotope ratios (δ13C, δ15N) of bear hairs by growth section analysis (Nakashita et al, 2005). With the help of the Hiroshima prefecture government, samples and body measurements were obtained from all of the bears killed in October and November when many bears intruded human settlements. A total of 56 bears were analyzed, excepting cubs because they follow their mother and depend on her food habits. Modified BMIs ranged from 17 (the individual with a body and head length of 1.3 m, and body weight of 29kg) to 63 (the individual with a body and head length of 1.3 m, and body weight of 89 kg) (x=35.1, SD=9.6), which indicated that the bears showed a wide range of nutritional conditions. Fifty-two percent of the individuals showed a BMI lower than the average. δ13C ranged from -24.1 to -19.3 per mil, which implies that the bears consumed both C3 and C4 plants, and δ15N values ranged from 1.4 to 6.5 per mil, which implies that the bears consumed both plant and animal matter. 13 of the individuals showed a high δ13C which might be the result of consumption of the anthropogenic food such as agricultural crops, cattle food, and kitchen garbage that contained C4 plants. 20 percent of the individuals showed a high δ15N which implies that a substantial amount of food of the bears might have been animal matter. The individuals with a higher BMI tended to show a higher δ15N, or a higher δ13C than the individuals with a lower BMI. This implied that feeding on anthropogenic food and animal matter might explain the good nutritional condition of some bears in the year of low forest fruit production.

48 - JAPAN

IDENTIFICATION OF MHC CLASS II LOCI OF THE ASIATIC BLACK BEAR IN JAPAN

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The Asiatic black bear in Japan, Ursus thibetanus, is recognized as a subspecies; the Japanese black bear, Ursus thibetanus japonicus. The habitat of the Japanese population ranges from Honshu to Shikoku region, but the animals have not been observed in Kyushu region over the last several decades. Local populations of the black bear in Japan are divided into 19 conservation and management units. Several populations in the western part of Japan have been listed as endangered local populations in the Red Data Book from Ministry of the Environment of Japan, because their populations have fragmented and isolated. Black bears in Japan often cause serious damage to agricultural and forest industry, beekeeping, and sometimes attack local people. Consequently, nuisance animal control has been widely applied. We have to consider not only the ecological aspect of the wild animals but also genetic aspect of those in order to enhance the appropriate conservation and management program. Our previous study indicated that the black bears in Japan divided into two genetic groups, the eastern group and the western group, by analyisis for about 240 bp of whole left domain in the mitochondrial DNA (mtDNA) control region for 333 individuals from 15 management units. Moreover, our previous study indicated that the black bears in Japan are highly endemic compared with the black bears in the Asian continent. The Major Histocompatibility Complex (MHC) is a set of molecules expressed on cell surfaced that are responsible for antigen presentation to T lymphocyte, and it is one of the most important genetic systems for infectious disease resistance in vertebrates. The high level of MHC genetic variation is thought to be an adaptation to various pathogens encountered by natural populations. Therefore, genetic diversity of MHC in each management unit can think to be important index in conservation genetics. In the case of human, the MHC region codes for at least three functionally and structurally different types of molecules; class I, class II and class III regions. There are no published the study of MHC for Ursidae except for the Giant panda, Ailuropoda melanoleuca, and the Polar bear, Ursus maritimus, of which was only published the sequences. In this study, we tried to identify the nucleotide sequence of MHC class II locus of the Asiatic black bear. We analyzed MHC sequences using gene specific primers which were designed to amplify MHC class II DQB, a part of exon2 (142 bp), based on sequences of Carnivora. We detected 11 alleles from 15 individuals in 6 management units of the bear after we confirm the detection of transcripted mRNA of MHC using designed primers. Although the sample size was small, we detected unique alleles in each management unit of the western and the eastern Japan. The result suggested that the Asiatic black bears in Japan might have high level of genetic diversity of MHC. However, it was difficult to identify a specific locus of MHC because the detected sequences were similar to DQB or DRB of Carnivora by homology search. We assumed that the short analysis region caused low resolution. Therefore, we used RACE (rapid amplification of cDNA ends) technical method, which obtain full-length 5' and 3' ends of cDNA using known cDNA sequence from expressed sequence, to determine entire sequence of a locus of MHC region, using the fresh blood. Here we show methodology of the MHC analysis with preliminary data.

49 - JAPAN

DENNING HABITS AND ENVIRONMENTAL CONDITION AROUND THE DEN SITE OF FEMALE ASIATIC BLACK BEAR IN MISAKA MOUNTAINS, JAPAN

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We investigated the denning ecology of 14 Asiatic black bears (Ursus thibetanus) from 2001 to 2004 in the Misaka mountains (Mm), central Japan. Thirty dens (93%) were made in natural ground caves from which soil flows out from under the tree roots growing at the edge of precipices, and 1 den (7%) was made in a rock crevice. Our access to additional 23 dens of radio-collared bears was hindered because of the steep slopes and long distances from the access roads. We measured and compared 10 microhabitat characteristics around the den sites and in the randomly picked sites, and determine specific microhabitat characteristics requirements for den sites in female bears. Some characteristics significantly differed between the den sites and the random sites. The sites where the bears denned were geographically steeper and characterized by longer distance from the road than the random sites. The crown cover, total basal area, and tree density of the overstory vegetation were greater at random sites than den sites, because most den sites located at the edge of precipices of the valley. The shrub density was greater at den sites than random sites. The regression tree analysis suggests that female bears tended to use den sites with steeper slope, longer distance from the road, and with greater density of shrubs. Although hunting period overlaps with the denning period, these environments are not suitable for hunting and bears therefore may prefer to manage parturition and lactation. The present paper demonstrates that female Asiatic black bears in the Mm avoid being hunted or being disturbed by the forestry by choosing den sites other from tree caves. This selection by bears also reflects an environmental situation that there is few tree caves.

ASSESSMENT OF BEAR/HUMAN CONFLICTS AND A NEW MOVE TOWARD BEAR/HUMAN COEXISTENCE IN A SMALL TOWN "ASSABU" IN HOKKAIDO, JAPAN

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Many communities in Hokkaido, a northernmost island in Japan, have been facing conflicts with brown bears despite the enforcement of the first Brown Bear Management Plan by the Hokkaido government in 2000. The authors started a research project in 2005 through interviews with local people and literature research in Assabu which is among the most affected areas in Hokkaido by the bear/human conflicts. The goal mainly includes two points: to investigate into the historical background and the actual conditions with regard to bear/human conflicts, and to create safer neighborhoods for both humans and bears on the basis of locals' voluntary activities. The Japanese society has given priority to productivity in both agriculture and forestry over the traditionally sustainable use of natural resources based on biodiversity since the modernization. This resulted in the fragmentation and decimation of bear population and the subsequent increase of bear/human conflicts. In recent years the conflicts between bears and humans frequently take place in the farmland rather than in the forest. There are thought to be two main reasons behind the scene. Firstly, the bushy area between farmland and forest, which contributed to the decrease of bear/human conflicts, has been exploited due to the expansion of farmland. Secondly, the bear habitat has been devastated in the wake of deforestation in particular in the deciduous forest. The overall impact of bears on crops is negligible in terms of money despite a number of bear sightings. In addition, no bear-related fatalities have been reported for the past four decades. The local people have had no hesitation to require hunters to solve the problem in case of encounter with bears. As far as farmers are concerned, the huge majority take no account of self-defense against bears. In fact, they are ignorant even as to whether their crops are favored by bears. However, some of them tolerate the presence of bears as long as they don't come too close to their territory. The division of the municipality for agriculture and forestry is in charge of bear management on behalf of an established section for wildlife management. On the one hand, the division of the town depends on hunters for the on-site handling of bears. On the other hand, it expects the farmers to defend themselves against bears, though taking no effective measures to encourage them to do so. The Hokkaido government, under the 2000 Brown Bear Management Plan, has implemented few proactive measures. Meanwhile, it gives permission for nuisance killing without setting any limits. While many of the local people are unaware of wildlife, some of them including new comers have respect for it. In 2003, a controversy took place in an advisory committee over how to deal with wildlife in a municipal forest park. Since then, such environmentalists have begun taking the initiative in conserving the environment. A new wave is emerging. The likelihood of creating bear/human coexistence in Assabu might lie in the sympathy for bears among some farmers and the new wave emerging among the new comers. We authors are in the middle of carefully waiting and seeing how things go in a voluntary meeting led by the new comers of how the municipality and locals work together to run the municipal forest park. We are also on the way to encouraging the grassroots movement to put pressure on their community to improve the current circumstances of bears, and urging authorities to review the modern policies of agriculture and forestry in addition to the current brown bear management plan from the viewpoint of bear/human coexistence.

RESIDENTS' ATTITUDES TOWARD THE BROWN BEAR AND THE POSSIBILITY OF COMMUNITY-BASED, PROACTIVE BEAR MANAGEMENT IN ASSABU, HOKKAIDO, JAPAN

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Abstract: The Oshima Peninsula of Hokkaido, Japan, has an estimated over 500 brown bear (Ursus Arctos) population, and a lot of communities there have been facing conflicts with them. The ongoing bear management significantly depends on nuisance kill and so cannot effectively prevent bears from coming down into human territory. The authors started a research project in 2005 in Assabu, one of the small communities experiencing frequent bear-human conflicts. The goal is to help the locals create safer neighborhoods for both humans and bears through building up a framework of community- based preventive activities. As a first step, besides interviewing with some of the residents and officials in charge, the authors implemented a mail survey with the residents with the aim of giving a quantitative analysis of the present situation of bear-human relations in Assabu. We developed a questionnaire to provide information about residents' experiences with bears, their attitudes toward bears, their behaviors related to bears, and their opinions about bear management. Questionnaires were sent out to 391 randomly selected residents during January and February 2007. Adjusted response rate was 48% (n=177). The result of the survey includes some useful findings and implications as follows. (1) As many as 79% of respondents have a variety of direct experiences with brown bears, including encountering (25%), being attacked (3%), sighting bears (36%), finding bear traces by chance (47%), seeing captured bears (48%), and property damages (16%). In addition, 24% of respondents have relatives or acquaintances that have experiences of the same kinds. (2) A majority of respondents (81%) are intolerant of bears making appearances in human territory. A half of respondents (50%) are intolerant of bears inhabiting forests around them. Although they both showed high percentages, there is also a difference by 31 percentage points between them. In fact, 44% of those who are intolerant to bears' appearances in human territory aren't intolerant to their presence itself. (3) When entering forests, 68% of respondents get prepared against bears while only 23% of those who live in areas where bears potentially make appearances take some preventive measures around their houses, and only 22% of those who have farmlands which bears could invade take some preventive measures for their farmlands. (4) Respondents' preferences of reactions by local officials to bears' appearances vary according to situations. Only 27% of respondents want bears to be killed when only sighted in forests, whereas over 80% want bears that attacked humans in any situation to be killed, and 71% want bears that caused damage to crops or livestock to be killed. (5) As proactive measures, every one of the following was favored by more than a half of respondents: garbage control (87%), public education programs (75%), compensation programs (67%), enrichment of forests (62%), assisting preventive activities of residents (62%), and bear population control in the forest in springtime (52%). Although the majority of Assabu residents are intolerant to the bear appearance especially in human territory, a substantial proportion of them don't necessarily want to extinguish the local bear population. That fact prepares the ground for building up a framework of bear management with a variety of preventive activities in place of the ongoing bear management that heavily depends on nuisance kill. A majority of residents favor some of the preventive measures, and there is room for them to be implemented.

IDENTIFICATION OF INDIVIDUAL ASIATIC BLACK BEARS USING DNA ANALYSIS OF COLLECTED DAMAGED CROPS

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Asiatic black bears (Ursus thibetanus) greatly damage agricultural crops in the Tohoku region of northern Japan. Local governments permit killing of those bears as a pest control measure, mainly using box traps. However, crop damage has not diminished. Confirmation of the number of problem bears is the most important information for damage control. For this study, conducted in Tono city, Iwate prefecture, Japan, we examined damage sites such as bite marks by bears on crops. We estimated the minimum number of problem bears using DNA analysis. We collected crop samples (n=57) from 18 damaged fields during summer 2005 and 2006. By wiping a cotton swab on the surface of damaged crops, we obtained cells excreated from bears' inner mouth cavities. Subsequently, DNA was extracted using phenol/chloroform method; polysaccharides were removed by treatment with CTAB. We used a suite of six microsatellite loci (G10C, G10L, G10B, G10P, G10X, and G10M) for individual identification, and amelogenin gene (SE47 and SE48) for sex determination. The PCR success rate was 84%, but only 15 samples (31%) among them provided sufficient DNA for complete genotypes at six loci. Among those 15 samples, 12 individual genotypes were obtained. These results will contribute to damage control on scientific grounds. We shall show additional details about the number of problem bears in separate damaged fields.

53 - JAPAN

VALIDATION OF ACTIVITY SENSORS BUILT INTO GPS COLLARS ON CAPTIVE ASIATIC BLACK BEARS

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The activity patterns of bears have been studied using the signal strength or liner distance between relocation points from tracking of the radio-collared individuals. However, these researches require a considerable amount of time and effort. The activity sensors built into GPS collars, on the other hand, are expected to be an efficiency tool for evaluation of bear's activities because the sensors record the data automatically and continuously. The authors have been researched the relationship between the activity sensor values and actual behaviors of GPS collared Asiatic black bears (Ursus thibetanus) in the field. There were, however, insufficient data to generalize activity criteria using the values of activity sensor. In this paper, we attempted to establish more robust and detail criteria of bear's activities using the sensor value. Experiments were carried out at the Institute of the Japanese Black Bear in Ani, Japan, on May or Aug 2006. We fitted the GPS collars with built-in activity sensor (GPS3300 and GPS4400: Lotek Wireless Inc., Canada) on captive, 2 female and 1 male, Asiatic black bears and recorded their behaviors by video cameras for continuous 24-hour. Compare of the sensor values (recorded every 5 minutes) and the observed behaviors of the 3 captive bears indicated that 95-100% of the inactive samples (1,420 minutes = 5 minutes interval × 284 times) and 93-99% of the active samples (1,325 minutes = 5 minutes interval × 265 times) were correctly classified (98%, in the total of 3 bears). Although the reliability of activity sensors value is limited to scan the particular behaviors (i.e., walking, feeding), it is enough to classify inactive and active. We believed that the GPS collars with built-in activity sensors are effective tools for further Asiatic black bears researches.

54 - JAPAN

SEASONAL HOME RANGES AND LAND USE OF ASIATIC BLACK BEARS (Ursus thibetanus) LIVING NEAR HUMAN HABITATIONS

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Physical injuries to humans and agricultural and forestry damage caused by Asiatic black bears have become problems in many parts of Japan. In Tono City, which is located at the foot of the Kitakami Range in Iwate Prefecture on Honshu Island, bears reside in high-density near human habitations. Along with frequent occurrences of agricultural damage caused by Asiatic black bears, the population of harmful controlled bears continues to increase. Primarily, accumulation of ecological knowledge of Asiatic black bears is necessary to facilitate coexistence of human beings and Asiatic black bears. However, published ecological reports of Asiatic black bears living near human habitations are very few in Japan. Furthermore, few reports have described seasonal activity changes of Asiatic black bears, even though agricultural damage caused by Asiatic black bears tends to occur frequently during summer. Therefore, examination of the case of Tono City in the Kitakami Range is useful as a model: habitats of Asiatic black bears there lie adjacent to human living environments. This study is intended to elucidate the following: (1) home ranges of Asiatic black bears; (2) seasonal environment use by Asiatic black bears; and (3) relationships between seasonal activities of Asiatic black bears and farmlands. After investigating home ranges of surveyed Asiatic black bears using radiotelemetry, we analyzed them using a GIS system (ArcMap ver. 9.1; Esri, Co., Ltd.). The investigations were conducted throughout southern Tono City and the northern part of Sumita Town, Iwate Prefecture from April 2005 to November 2006. After capturing Asiatic black bears (four male bears and four female bears), we fixed radio communicators on them and released them. Consequently, we obtained 935 points of bears' estimated locations in all during the investigation period. During spring–summer, home range areas of all individuals expanded, perhaps because bears depend on feed resources that are dispersed throughout groves, such as ants and bees in summer, and the amounts of their activities increased to secure food. Through comparison of the vegetation environmental ratio within home ranges of bears and the vegetation environmental ratio which bears used, it became clear that the usage frequency in the Japanese cedar cryptomeria community and Japanese red pain community, in addition to those of Japanese chestnut, Japanese oak, oak, and beech communities increased significantly more in fall than in other seasons. Nuts in fall were important as feed resources; bears got much use of Japanese chestnut, Japanese oak, oak, and beech communities. It was also identified that bears have high usage frequency for the Japanese cedar cryptomeria community and Japanese red pain community in fall. In contrast, few reports have described Japanese cedar cryptomeria and Japanese red pain, and feed resources for bears. It is assumed that, because few types of understory vegetation exist in those grove communities, they were used for purposes of travel and resting, and were not used as places to keep feed resources. No environment shows a significantly high usage frequency by bears in spring and summer. Farmlands and the birch community showed significantly low use in all seasons. From the fact that follow-up investigations were conducted during the daytime, it is conceivable that bears conspicuously avoided open farmlands. Birch communities have poor feed resources for bears; for that reason, they might be not used. Next, calculating the shortest distance between estimated locations of Asiatic black bears and farmlands using GIS, we compared them seasonally using one-way analysis of variance. We investigated seasonal changes of the shortest distance between estimated locations of Asiatic black bears and farmlands. Results clarified that Asiatic black bears approach farmlands in summer more than in spring, fall, or winter. Nonetheless, little agricultural damage is observed within the

investigation regions. Consequently, the possibility exists of feed resources for bears in the marginal parts of groves near farmlands rather than dependence upon agricultural crops themselves. Expansion of bears' home ranges caused by decreased density of feed resources in summertime might also have encouraged their approach to farmlands.

55 - JAPAN

USING ACTIVITY SENSORS BUILT INTO GPS RADIO COLLARS FOR THE EVALUATION OF THE SUMMER DAILY ACTIVITY PATTERNS OF FREE RANGING JAPANESE BLACK BEARS IN THE ASHIO MTS. OF CENTRAL JAPAN

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The Japanese black bear, Ursus thibetanus japonicus, is a forest dwelling species and can be very difficult to observe directly in most of their habitats. Therefore, as a research tool for the evaluation of their activity patterns and time budgets, we fitted GPS radio collars with activity sensor built into them on a total of 7 Japanese black bears, 3 males and 4 females, during 2003-2006 in Ashio Mts., which is characterized as an open environment. Through comparison of the direct observation results using a video camera and the obtained activity sensor values, we try to determine their activities. Although the results shown in this paper are focused on the summer behavioral habits of bears that have been feeding on things such as ants in the open environment, the bears were diurnal except one adult male, and they displayed activity peaks at dawn and dusk. As for the diel time budgets of inactivity and activity (two categories: A and B), all of the bears indicated around 50% (Mean: 647-858min.) inactivity, however the activity of A, which represents activities such as feeding, time ranged broadly from 4-28% (Mean: 58-406min) depending on the bear. For an adult female, there were no significant differences between the diel inactive time during her solitary year and nursing year with her yearlings, however A type diel active time during the solitary year significantly declined in comparison to the nursing year. For a sub-adult male, his A type diel active time significantly decreased with his growth. Future research is necessary for the activity values in relation to age and sex in a variety of habitats (e.g. while a bear feeds on acorns from a tree), however, we strongly emphasized the effectiveness of the GPS collar, with a built-in activity sensor, as a research tool for clarifying the living habits of Japanese black bears. Assuming that in future studies the sensor values are categorized to a further degree, diel energy costs for Japanese black bears may also be evaluated.

INFANT BEHAVIORAL DEVELOPMENT AND MOTHER-YOUNG RELATIONSHIP OF CAPTIVE ASIATIC BLACK BEARS

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Asiatic black bear (Ursus thibetanus) cubs are late-maturing, making maternal care important for cub growth and behavioral development. Our objective was to document cub growth and the mother-young relationship in captive Asiatic black bears during the first year of cubs' lives. We videotaped and made on-sight observations of one and two pairs of mother-cubs, for a total of 145 24-hr observation days, at the Shoushan Zoo and the low altitude experimental station of the Endemic Species Research Institute in Taiwan, respectively. Bear cubs started to open their eyes at one-month old, crawl at 1.5-2 months and walk after two months old. Mothers seldom left dens until cubs were two months old. Both mothers and cubs were very inactive in the first two months, and then their daily active proportion increased over time. For both mothers and cubs, inactivity and play accounted for the largest (77.7% vs. 67.3%) and the second (5.7% vs. 13.6%) proportions of the daily activity budget, respectively. Both mothers and cubs were mainly diurnal, with activities peaked at dawn and dusk. Activity levels of mothers during daytime and nighttime were 37.6% and 8.6%, respectively, and those of cubs were 53.2% and 14.2%. Mother-cub body contacts were >50% during the first six months of a cub's life, indicating an intimate relationship between them during this period. The daily average nursing bouts of bears were 8.8 (±2.7) for a total of 42.9 (±11.3) minutes. Daily nursing bouts and time were greater when cubs were 3-4 and 9-12 months old than 5-8 months old. This might be related to restricted supply of artificial food during the 9-12 month period, which may drive cubs to demand more food and milk from their mothers. Both feeding-related mother-cub agonistic behaviors and mother agonistic reactions toward cub's begging for milk increased with cub's age. The parent-offspring conflict was therefore asserted. here were no significant differences in daily nursing bouts and time between the single cub and the twin. However, the twin spent more of each day playing and playing with other bears (20.1% and 15%, respectively) than the single cub did (17.3% and 9.6%, respectively). Besides, the twin played more with siblings (7.7%) than with their mother (2.2%). The single cub had less body contact (49.7%) and more no-reaction (47.8%) with the mother than the twin (64.4% and 19.3%, respectively), indicating a more intimate mother-cub relationship for twins than for single cubs. The mother and cub kept in environmentally more complex and larger space provided with more food spent more time foraging, and less time in feeding anticipation and stereotypes. Bears kept in spatially richer environment and without a curfew also started their activities earlier in the morning. Our study suggested that both mother and cub behaviors and their interaction were affected by physical environment and management.

57 - NORWAY

COMPARISON OF METHODS TO MEASURE BROWN BEAR CONCEALMENT

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Within an ongoing study on the influence of human disturbance on brown bear activity pattern and behaviour, we tested different devices to measure concealment, i.e. ground and canopy cover. The objectives of the comparison were (1) to choose the most convenient and effective device to use in the field and, (2) to find the correlation formulas between different devices that would allow us to use data gathered by different methods. The study was conducted in 2006 and 2007 in Sweden, near the southernmost distribution of the Scandinavian brown bear population. The area is mainly forested, 80% covered by highly managed productive forest. Bogs and lakes cover the remaining area, and human settlements consisted of some scattered villages. We used locations from female bears with GPS collars - GSM modems programmed to save one location of the bear every half an hour. Locations were downloaded on a GIS application. We visited plots in which at least 5 locations of the bear where within a 30 m radio, using locations older than 48 hours to avoid disturbances to the bears. We chose one of the locations closest to the centre of that radio to be the 0 position and measured concealment of the closest bed. We tested a board 1.5 meter high and 30 cm. wide and a cylinder of the same size, with sections of different colours every 50 cm; two plastic bags placed 30 and 60 cm. above the ground respectively; an umbrella with 8 triangular sections alternating colours, a 30x40 cm cover board with 40 grid cells (5x6 cm), a cover pole and a cardboard profile of a bear. We measured visibility 10 meters away from the device, from the four cardinal points, and also measured the minimum distance required for the device to be completely hidden. The measurements were done both standing and kneeling down to 70 cm. over the ground. We repeated the procedure from the same points for all devices. For canopy cover, we used a visual percentage of cover represented by the main tree species, a densiometer and hemispherical photography. To make the comparison among methods, we used the percentage observed of the maximum possible value for each device and scale, thus avoiding differences related to the scale. Correlation values (R2) were estimated for pairs of devices. We will further explore this issue during the field season of 2007.

58 - NORWAY

POPULATION MONITORING OF THE BORDERLANDS BROWN BEAR IN THE PASVIK-INARI REGION OF NORWAY, FINLAND AND RUSSIA USING NON-INVASIVE HAIR SAMPLING

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The Pasvik Valley is located in northeastern Norway in Sør-Varanger Commune, Finnmark County (69.4 °N., 29.8 °E.). It is bordered on the east by Russia and on the south and west by Finland. The Pasvik Valley probably comprises the densest population of brown bears in Norway. Studies of the bear population here have been limited to investigations of reported bear sightings or other sign; regular track surveys during the spring; and information collected in association with bear-human conflicts. These data have been systematically collected more or less continuously in Norway since the late 1970s, giving a long-term data set of population monitoring. Track surveys and observations in the Pasvik Valley have been used since the early 1990s to provide an annual minimum population estimate. Since 2004 these methods were supplemented by analyzing DNA from brown bear scats. However in order to obtain a more complete and accurate estimate of the population it was necessary to expand the sampling protocol into both Russia and Finland. Also, better techniques of obtaining random samples uniformly throughout the entire study area must be developed and implemented to obtain a statistically valid estimator for modeling the population. Our objectives were to identify and test methods that allow collection of ecological data under practical conditions using non-invasive techniques; To further develop DNA analysis of hair collected from a system of hair snares; and finally, to help quantify the brown bear population and identify general - as well as any sex-related differences in movement patterns and habitat use. In Norway we established 26 - 5x5 km grids located in the upper Pasvik Valley, from the Russian border to the Finnish border and encompassing about 625 km2. In Russia we established 10 - 5x5 km grids located south and east of the Pasvik State Strict Nature Reserve (Pasvik zapovednik) and concentrated along the Russia – Norwegian/Finnish border. In Finland we established 20 - 5x5 km grids adjacent to the Norwegian and Russian sampling areas and extending southward. Within each grid one hair trap consisting of ca. 30 m of barbed wire strung between several trees was established with a strong smelling scent lure in the center of each trap. From 14 June - 15 August we established 56 hair snare grids encompassing an area of ca. 1400 km2 in Norway, Russia and Finland. The traps were checked four times each and yielded more than 150 hair samples. We recorded activity in at least 22 of the 56 grids and noted a gradual shift in activity away from the Pasvik River habitats over the course of the summer. Genetic analysis of individuals is ongoing but we expect to document border crossing by bears in spite of substantial barriers including heavy fencing and the Pasvik River separating Russia from Norway and Finland. The number of samples obtained exceeded expectations, however, some of the samples were probably composed of too few hairs to allow successful analysis, and some of the samples are probably from red fox. We have developed a species-specific test for fox, and any such samples will be identified and excluded from further analysis at an early stage. One of the concerns of the Research Animal Committee was that having a single strand of barbed wire would present a hazard not only to bears but also to other non-target animals. We have inspected each hair snare regularly and found that not one has been destroyed or disturbed in any way, except of course for digging at the scent lure location, indicating no incidents or problems with the wire by bears or any other animals.

59 - POLAND

THE IMPACT OF THE EXTERNAL FACTORS ON THE STEREOTYPIC BEHAVIOUR IN BEARS (FAMILY: URSIDAE) IN WROCLAW ZOO – CASE STUDY

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Stereotypic behaviour of 10 individuals among four bear species (European brown bear Ursus arctos – 5 individuals, Asiatic black bear Ursus thibetanus – 3 individuals, polar bear Ursus maritimus – 1 individual and spectacled bear Tremarctos ornatus – 1 individual) kept in Wroclaw Zoo, was scanned at constant intervals and recording was continuous. Bears were observed from 7.30 a.m. till 5.30 p.m. Research lasted two seasons from April 2006 till September 2007. The main aim of this research is to assess the influence of visitors on the frequency and intensity of stereotypy. Zoo visitors contribute to stress in many species of zoo mammals and chronic stress implies poor welfare. In case of bears, this may be visible in increased intensity of stereotypical pacing and other forms of abnormal behaviour. As part of this study of the impact of visitors, the cortisol levels are measured in faeces. This non-invasive method allow to determine daily stress levels as well as changes in adrenal activity in correlation with the nubers of visitors. Another part of this research is concerned with the enclosure effect on stereotypies. Some of the observed bears are kept behind shatter-proof glass and others are separated by dry moats and electric wires. This study may answer the question of how the impact of visitors is affected by the sound dampening effects of the glass barrier. This study also investigate other factors such as temperature, season, time of day and time spent outdoors. Relevant information, for exampe age of observed individual or its relationship to other members of a group are also considered. This study may provide useful information on factors responsible for stereotypic behaviour and this information may be used to improve welfare of captive bears.

60 - USA / TURKEY

HUMAN-BEAR CONFLICTS: A REVIEW OF APPROACHES USED TO RESOLVE AGRICULTURAL CONFLICTS

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In many ways, the basic structure of human-bear conflicts has changed very little for thousands of years. However, modern technology has increased our understanding of many of the components of these conflicts, and given us new tools for addressing conflicts with bears. Traditionally, agricultural producers used lethal methods (set-guns, traps, bounties, and poison) to eradicate large carnivores from the landscape, including bears. In many parts of the world they were quite successful in eliminating depredations on livestock and crops. However, the loss of major components of natural ecosystems (predators) often resulted in equally damaging environmental costs, such as rapidly expanding wild ungulate populations that over-grazed important rangelands, or the proliferation of small and mid-sized predators that targeted other species of livestock (poultry) or crops. In some cases, ineffective lethal control methods have exacerbated depredation problems (e.g. removing older bears has led to increase in the number of subadult male bears in an area and more conflict incidents). In other areas, attempts to eliminate bears and other large predators were less successful and depredations continued to cause significant economic damage, especially to small, rural producers. The general public has recently taken a more holistic view with regard to the ecological importance of bears and their role in the environment and come to believe that lethal control of bears, particularly threatened species, is at odds with their conservation values. Along with this shift in attitudes, people have begun to recognize that humans play an important role in enabling conflicts with bears. This recognition led to the development of more humane, non-lethal methods for managing conflicts. Much of this effort focused on 2 primary options: 1) changing human behavior patterns and 2) changing the behavior of conflict animals. Altering human behavior includes many aspects other than livestock husbandry or crop management practices, where much of the emphasis has been placed in the past. Attempts to alter the behavior of depredating animals to minimize agricultural losses have also been practiced for centuries. Research into changing animal behavior has focused on the use of repellents: 1) primary and 2) secondary. Primary repellents can be effective short-term deterrents to depredation activity, but their use is limited by the tendency of many animals to habituate to them over time. Secondary repellents can also be effective, but are often limited by the difficulty of applying them consistently under field conditions. In this paper, we review the viability of methods that are currently being used to resolve human-bear conflicts in the agricultural community and present recommendations for a systematic approach to resolving these conflicts.

61 - USA

DO EDUCATION AND RESEARCH OPPORTUNITIES JUSTIFY FEEDING BEARS?

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There may be some exceptions to the dictum that feeding is bad for bears. The Vince Shute Wildlife Sanctuary (VSWS), a privately-owned area in rural, northern Minnesota, USA, includes a small forest clearing where wild American black bears (Ursus americanus) have been fed for more than 3 decades. Vince Shute, a retired logger, started the feeding in an attempt to keep bears from breaking into his cabin. Generations of bears became regular seasonal visitors to the homestead, and by the early 1980's, dozens of bears visited daily and the site became a popular local attraction. When Vince Shute became ill, friends purchased the land, created The American Bear Association, and established the VSWS to preserve it for educational and research purposes. Although the habituation of any wild animal has serious negative implications, it enables close-up observations that are not normally possible. The VSWS provides unprecedented learning opportunities for researchers and the public at large, who can observe bears breeding, nursing, play-fighting, establishing dominance, scent marking, protecting young, dispersing yearlings, posturing, and producing a wide array of distinctive vocalizations. Most visiting bears are individually-identifiable (by their natural markings) to the VSWS staff, enabling long-term record keeping of when they came and departed each year, their reproductive history, social dominance, and senescent decline. Some bears that were ear-tagged >100 km away became transient, but consistent visitors, passing through the sanctuary at the same time each year. Viewing bears where they gather to feed at concentrated food sources is an increasingly popular pastime for people. Natural bear feeding sites along salmon streams have been promoted for tourists, serving as a captivating experience and learning opportunity. Conversely, human-created "ecocenters" (sensu Craighead et al. 1995), like dumps or feeding areas, have fallen into disfavor due to their unnaturalness as well as possible adverse effects on the survival or social system of the bears. We were aware of these concerns when we chose to continue to feed bears at the sanctuary, but we felt that the benefits of drawing bears into this area as an open-air classroom and potential research facility outweighed the criticisms related to the feeding. Today this is one of the largest and most accessible ecocenters for American black bears, attracting thousands of visitors annually. We emphasize that our purpose is not entertainment. Visitors are provided not only a distinctive viewing experience from an elevated observational platform, but also hear regular narrations about bear behavior and management by experienced staff. The seeming paradox of using food-attracted bears to attract a human audience, who are then told how to keep bears away from human foods, may be bothersome for some, particularly those who have not actually visited the site. Our presentation is a frank, warts-and-all depiction of this unique site. We address the criticisms related to feeding, but counter these with the benefits gained through education and collaborative research. Our aim is to resurrect and broaden Craighead's ecocenter concept by providing examples of the types of unique observations that have been witnessed, the long-term data that have been gathered, and the rich research opportunities that exist.

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NUTRITIONAL CONSEQUENCES OF EXPERIMENTALLY INTRODUCED TOURISM IN BROWN BEARS

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Although numerous studies have documented behavioral effects of nature-based tourism on wildlife populations, few studies have determined whether behavioral changes translate to effects on individual condition and population health. This issue is currently a concern for wildlife managers in Alaska and Canada where bear-viewing is a rapidly growing industry expanding into previously undisturbed bear habitats. Rather than record observations at long established tourism sites, we experimentally introduced bear-viewing into two, relatively undisturbed brown bear (Ursus arctos) populations in south-central Alaska. We used Global Positioning System (GPS) collars, monitored food resource availability, and quantified individual resource use and condition for a year prior to and during the introduction of bear viewing. At one of the two sites, we also used scan and focal observations to quantify foraging efficiency, vigilance behavior, and bear use of salmon streams and a salt marsh habitat. Total food intake was quantified by combining data on food resource use based on GPS locations and foraging efficiency was measured using spotting scopes from long distances. Seasonal food availability and quality were monitored and utilized as co-variates in comparisons between pre-treatment and treatment years. Though both populations exhibited significant changes in spatial-temporal resource use patterns between the presence and absence of humans, changes in behavior generally mediated effects on total food intake. During treatment in which viewers visited bear feeding areas during the day-time only, adult males at a salt marsh viewing area were the only sex/age class to exhibit reduced food intake resulting from a 15% decline in foraging time when viewers were present. Reduced salmon intake and stream use resulted only when 24-hour daily human activity occurred. Energy expenditure, indexed as daily travel distances, was significantly higher when bears responded by altering spatial rather than temporal resource use which resulted from 24-hour human activity. However, body weight and composition were unaffected by all treatments as bears shifted their foraging to other locations or times. Managers can minimize nutritional impacts of bear-viewing programs by avoiding spatial displacement and providing predictable time periods when bears can access food resources free of human activity. Though some displacement can occur with minimal nutritional effects, managers should consider several site-specific factors including carrying capacity of the site relative to the existing bear population, availability of alternative food resources, and the distance and energy needed to travel to alternative sources when estimating the impacts of human activity on local bear populations.

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ANCHOR MODIFICATION FOR A SPRING-ACTIVATED FOOT-HOLD SNARE TO CAPTURE AMERICAN BLACK BEARS

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During 7 research projects in Florida and Kentucky, USA between 1995 and 2006, we captured 191 American black bears (Ursus Americanus) 251 times (72F: 119M) using modified Aldrich spring-activated snares. In our modification, the swivel at the base of the foot loop is attached to two cables which ran in opposite directions to anchor trees. This shortens the loose cable to only the foot loop, reducing the area in which the captured animal could move. The smaller area facilitated immobilization and prevented the bear from climbing or reaching trees, including the anchor trees. Reducing the distance that a captured bear could run when attempting to charge or escape may reduce stress on their limbs, which may reduce capture injuries. Some trees that would be inadequate as a single anchor because of negative attributes like low branches, forked or crooked trunks, or because they were too small could be used with this method. Other anchors such as trailer pins could also be used. We believe this alternative anchor method is an improvement particularly for snares set on trails, because they often require longer anchor cables to reach the desired location. This design should also work when foot snares are used to capture other wildlife.

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SAN FRANCISCO ZOO OPENS NEW GRIZZLY BEAR EXHIBIT

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Grizzly Gulch, a modern bear exhibit costing $5 million, displays two rescued Montana grizzlies. Orphaned yearlings of a depredating mother, the cubs were dramatically saved from euthanasia after a failed rehabilitation. Arriving in San Francisco in October 2004, the sisters were first residents of a new quarantine facility. Cleared to exhibition, the yearlings were initially housed in an old Hagenbach-style moated exhibit. But fundraising and design for a modern exhibit began immediately, climaxing in opening Grizzly Gulch in June 2007. Utilizing electric restraints, the new exhibit increases daytime exhibit space by 1500 percent, while retaining access to the old exhibit for secure night-time holding. Features include glass viewing pavilions allowing close observation of enlarged foraging areas planted with native plant species, underwater viewing of the bears in a stream containing live trout, and a spy rock mound from which the grizzlies can look out and be seen from most of the zoo. Innovative educational features include graphics explaining the grizzly's biology, conservation status in the intermountain American West, the historic significance of grizzlies in California and at the Zoo, and description of grizzlies' senses of smell and hearing utilizing a resin skull as a less controversial biofact. Protocols establish procedures for enrichment and interaction between public, staff, and bears. Grizzly Gulch provides a close encounter with an icon of the American West, California's State Mammal, as portrayed on the State's California Bear Republic Flag.

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MATERNAL CARE AND INFANT DEVELOPMENT DURING THE DENNING PHASE IN THE BORNEAN SUN BEAR

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The Bornean sun bear Helarctos malayanus euryspilus is the smallest member of the Ursidae. A tropical mammal, it is currently vulnerable to extinction. Unfortunately, the Sun bear is also among the least studied of the bear species, as even the most basic parameters of their life history have yet to be well documented. Maternal care and cub development have yet to be studied systematically. To begin to make inroads into this dearth of information, we studied a Bornean Sun bear dam and cub, capitalizing on the first of this subspecies to be born in North America. Throughout the denning phase, we documented developmental milestones and quantitative changes in mother-cub behavior. In the early postpartum period the dam secluded herself in the den, foregoing food and water for a period of five days. The dam rested often and the most frequently observed activity centered on interactions with the cub. Maternal behaviors that contributed to cub warmth and reduced its' exposure to ambient air were prevalent in the early weeks, but declined as the cub aged ($p = -.657$, $P = .0001$). The dam maintained a high degree of physical contact with the cub throughout the denning phase. Regular, high levels of feeding by the dam did not occur until more than 60 days postpartum. The cub vocalized at a high rate in the early postpartum period, but this rate declined as the cub aged ($p = -.420$, $P = .0079$). The cub began to walk at 58 days of age, and began to engage in exploratory behavior at 68 days. He did not leave the den under his own power until 81 days, and began mouthing the dam's food items at 89 days. Suckling was observed throughout the den phase and beyond, though this behavior decreased in frequency as the cub aged. The denning phase was terminated at 105 days. This research not only addresses the dearth of scientific information on maternal care in this bear species, but will also provide managers in captive facilities information necessary for making wise management decisions regarding the care and handling of the Sun bear dam and her offspring. Adequate maternal care is a prerequisite to any successful captive-breeding program. In many species the survival rate of mother-reared infants is higher than that for hand-reared infants. Mother-reared offspring display more competent social, sexual and parental behavior as adults. These factors will all play a role in developing and maintaining a healthy captive population of Sun bears, an important consideration given that the wild population suffers from severe pressures due to habitat loss and hunting.

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THE BEHAVIORAL DEVELOPMENT OF MOTHER-REARED GIANT PANDA CUBS IN A CAPTIVE FACILITY

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An understanding of the development of bear cubs from birth to maturity is generally complicated by the fact that neonates are born into dens where they are sequestered until they emerge months after their birth. Even after the denning phase has ended, the dam will tend to seek safety for her offspring, which generally limits the ability of researchers to study young. However, the period of dam and cub association is important for the behavioral and physiological development of cubs, and an understanding of this phase of a bear's life is relevant to conservation efforts for the species as a whole. The giant panda (Ailuropoda melanoleuca) is an endangered Asian bear that has enjoyed considerable attention from the conservation community in recent years. Captive breeding of this species has been a success of late, with 34 cubs being born in captive facilities worldwide in 2006. Most of these cubs, however, are born to facilities whose management practices aim to reduce the inter-birth interval from two years to one by removing cubs from their mother at six months of age. As such, understanding of the development of a panda cub reared exclusively by its mother is limited. We studied three captive-born singleton panda cubs that were reared exclusively by a panda dam. We documented developmental changes and milestones of cubs from birth to weaning at 18 months of age. The denning phase, defined as the period from birth to about four months of age, was observed via remote monitoring using cameras and microphones installed in the birthing den. Behavioral data was collected for eight to 168 hours each week and was used to assess cub activity budgets and track the development of important behaviors. Rates of high intensity vocalizations such as crying and squawking diminished rapidly as the cubs aged, and were nearly absent after three months of age. Occurrences of suckling also declined over time. Social play first occurred at three months of age, but peaked in frequency and intensity in the last quarter of the cubs' first year. Although mouthing and interacting with bamboo occurred as early as the fourth month, bamboo consumption did not regularly occur until around the one-year mark. Scent marking activity began in the eighth month. Though many aspects of behavioral development were consistent for each of the cubs studied, variability occurred in the achievement of some milestones.

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USE OF DOGS TO DETECT GRIZZLY BEAR DENS ON ALASKA'S NORTH SLOPE

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Exploration and construction activities associated with the oil and gas development on Alaska's North Slope often are scheduled during winter when the frozen substrate and snow cover allow off-road travel with minimal environmental damage and construction cost. However, disturbance by these activities could adversely affect denning grizzly bears (Ursus arctos) and polar bears (Ursus maritimus). To mitigate this potential effect, land use agencies have required that industry activities remain a minimum of 1.0 km from active grizzly bear dens and 1.6 km from active polar bear dens. This requirement presumes that the true den location can be detected. Current methods of den detection may have large errors associated with them. Error associated with detecting the den location by aerial radio-tracking has been up to 0.4 km from the true den location. Both airborne and hand-held Forward Looking Infra-red (FLIR) imagers have been variously successful in detecting polar bear dens when conditions were ideal. FLIR has not been systematically evaluated on grizzly bear dens, but initial results have been mixed and have suggested that grizzly bear dens are more difficult to detect with FLIR. As part of the continuing North Slope Oilfield Grizzly Bear Project we have begun investigating the effectiveness of using Karelian Bear Dogs to locate active grizzly bear dens in the winter. We initially located the dens in late fall by radio tracking from aircraft. In late winter we visited the den site on snowmachines and loosed the dogs within 50-100m downwind of the putative den location. We recorded weather conditions and dog behavior. We re-visited the dens in summer when the excavations were visible and recorded the distance between the true den location and the location of the dog alert. The dogs successfully located 19 of 20 grizzly bear dens. The mean distance between their alert and the true den location of 10 of these dens was 4 m (range=0-10m). Weather conditions ranged from mild (temperatures >-25 C and wind chills >-30 C) to severe (temperatures <-40 C and wind chills >-55 C). Data are insufficient to determine the upper limit of wind velocity at which dogs can detect dens, but dogs were successful at 16-18 km/hr. The behavior of the dogs suggested they were detecting bear scent at distances up to 0.5 km. However, in 3 cases the dog alerted only mildly until the handler walked across the area, breaking the surface crust. Thus, presence of a dense wind- or thaw-generated surface layer appeared to affect precision of the alert. The only den the dogs failed to discover was later determined to be more than 110m from the aerial location and the dog was mistakenly positioned upwind from the den. Dogs located grizzly bear dens even when the dens are buried under 5-6m of dense drifted snow, normal conditions for the North Slope. Although dogs can be worked in weather conditions that are beyond the operational limits of the existing FLIR imagers, dogs have limitations as well. The advantages and limitations on the use of dogs, and recommendations for their management during a den search will be presented.

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THE EFFECT OF EXHIBIT DESIGN ON BEHAVIOR AND FECAL GLUCOCORTICOID LEVELS IN GRIZZLY BEARS

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The modern zoo plays an important role in the conservation and protection of threatened and endangered species; however, the psychological impact of captivity can be damaging for the individual animal. This study is looking at the effect of enclosure design on grizzly bears (Ursus arctos horribilis) at the Oklahoma City Zoo. There have been numerous studies done on captive animals that have found that the stress of captivity is demonstrated by stereotypical behavior such as pacing, self-mutilation, and other aberrant behaviors. Stress can also be quantified using fecal glucocorticoid levels. The goals of this study are to determine whether behavior and glucocorticoid levels will significantly differ in grizzly bears in two types of zoo enclosures. Two male grizzly bears lived in a traditional enclosure built in the 1930's for three years and recently moved to a newly built naturalistic enclosure. One hundred hours of behavioral observations will be collected over the course of the study (September 2006 – June 2007), 50 hours in each exhibit. The results of my study will be used to determine whether a naturalistic exhibit truly impacts behaviors for the better in captive Ursus arctos horribilis. If the bears do indeed demonstrate fewer stereotypical behaviors as I've hypothesized, the collected data will then be used to investigate the effects of specific design aspects in promoting different behaviors. Analysis of glucocorticoid levels will be used to validate assumptions of stress experienced by the bears and will aid in determining if there is a positive correlation between the presence of stereotypical behaviors and fecal glucocorticoid levels based on enclosure design.

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LANDSCAPE ECOLOGY OF TWO LARGE CARNIVORES IN THE CHIHUAHUAN DESERT: CHALLENGES OF CROSS-BORDER WILDLIFE CONSERVATION

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The preservation of large carnivores is one of the most important and difficult challenges facing conservationists today. Carnivore populations have been declining for a myriad of reasons including predator control and landscape changes. Top predators are necessary for healthy ecosystem function and their removal or reduction can have severe consequences including loss of species diversity at all trophic levels. As the human population continues to grow, competition for resources between wildlife and people will also increase (i.e., urbanization, habitat fragmentation, and land use changes). Habitat fragmentation at large scales can have profound effects on carnivores. Small changes at the bottom of food webs (i.e., vegetation and habitat) can significantly harm carnivore populations. A better understanding between landscape ecology and large carnivore ecology is needed to address current conservation challenges. The Chihuahuan Desert is one of the most biologically diverse ecosystems of the world and was once rich in mega-carnivores. Due to extensive predator control, jaguars (Panthera onca), grizzly bears (Ursus arctos), and Mexican wolves (Canis lupus mexicanus) have been extirpated from Texas. Mountain lion (Puma concolor) and American black bear (Ursus americanus) are the only 2 remaining large carnivores. Our project focused on 2 main objectives. First, we identify suitable habitat for 2 umbrella species: mountain lion and black bear. Second, we highlight the need for cross-border collaboration in natural resource conservation. Conservation and research initiatives are often restricted by political boundaries due to the challenges associated with cross-border collaborations. However, large scale ecosystems (such as those used by large carnivores) often include habitats that cross political boundaries and must be addressed as a whole. International collaborations are essential for ecosystem conservation across political boundaries and our project outlines a model for private and public partnerships in transboundary conservation.

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ANTENNA ANGLE AND BEHAVIOR AFFECT GPS FIX SUCCESS IN CAPTIVE BEARS

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GPS collars have greatly increased the number of locations obtained for individual animals, but missed location attempts (missed fixes) may create a bias in habitat analyses unless properly modeled. We placed GPS collars on bears in the captive research facility at Washington State University and observed their behavior while the collars attempted to obtain locations. We examined whether fix success was influenced by angle of the GPS antenna to the horizon, collar height above the ground, and bear behavior using a model selection and information theoretic approach. A model with both antenna angle and collar height was best supported, but models with antenna angle alone and both antenna angle and bear behavior were also well supported. We recommend fitting GPS collars such that the GPS antenna is exactly opposite the battery pack (i.e. at the top) for highest fix success. We also recommend use of activity (from activity sensors) and bear movement rates to describe bear behavior and reduce bias in habitat analyses of GPS collar data.

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CAN POLAR BEARS DISCRIMINATE SEX AND ESTRUS STATUS FROM OLFACTORY CUES?

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Theoretically polar bears should rely on olfactory cues to communicate with conspecifics during the mating season. As a solitary species, polar bears must communicate over distance and time, and scent signals are the only means of communication that meet these criteria. Thus, it seems probable that polar bears use scent signals to locate mates, assess female reproductive status, and perhaps prime sexual motivation prior to face-to-face meetings. Although an obvious scent gland and marking behavior are absent, it is possible that a concentration between the digits of the paws of urinary and body secretions or odors allow polar bears to leave a continuous olfactory trail, documenting the presence and perhaps estrous status of the female as she walks. We collected daily urine samples and swabs of pedal scent from 2 females and one male throughout the mating season. Samples obtained were categorized in reference to the stage of the estrus cycle, as determined by vaginal cytology. Each bear was given paired samples of different origin and their behavioral response compared in discrimination trials. We attempted to give each bear the same discrimination task on multiple trials to allow statistical testing within each individual, but fell short of this goal in the first season of testing. Our results are therefore preliminary and will be supplemented in the future. There was a strong seasonal effect on male response to conspecific odors, with greater interest displayed during the breeding than non-breeding season. The females discriminated between male and female pedal scent—preferring male scent—but did not discriminate urine based on sex of the scent donor. We also examined differential responsiveness to conspecific scent during 3 phases of the ovarian cycle during estrus. We found that females discriminated between male and female pedal scent during all three phases. Females did not discriminate between male and female urine, but they did spend twice as much time investigating urine during the early follicular phase. Our results suggest that pedal scent plays an important role in olfactory communication. This study marks a first attempt to systematically investigate olfactory behavior in this species and to understand the role it plays in inter-sexual communication during the breeding season. This information can be used to understand the polar bear mating strategy, and applied to reproductive management in situ or ex situ, as we have done previously with giant pandas. Although captive breeding currently plays almost no role in polar bear conservation, there has been recent discussion regarding the potential need to establish breeding centers to salvage some polar bear populations predicted to be decimated by global warming and loss of the arctic ice floes on which the polar bears depend. Thus, it is important to work out the details of reproduction in this species in the event that a major captive breeding program becomes necessary on relatively short notice.

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AUDITORY SENSITIVITY OF THE POLAR BEAR: PRELIMINARY RESULTS FROM BEHAVIORAL TESTING

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Models for the impact of anthropogenic noise on wildlife will have greater sensitivity if species-specific data on hearing sensitivity are incorporated. To date, there are no adequate data on the auditory sensitivity across the range of hearing for any bear species. We measured the hearing sensitivity of two adult female polar bears (Ursus maritimus) at the San Diego Zoo. We used positive behavioral techniques to measure hearing thresholds between 125Hz and 31.5 kHz. We expended considerable effort to reduce noise levels to ensure the best possible estimates of sensitivity. Behavioral training began in March of 2006 and was completed in November. Between November 2006 and April 2007 approximately 90 experimental sessions were completed on both bears, including over 4,500 experimental trials, 25% of which were blank or 'catch' trials. Tone presentations were made using the Method of Limits. Stimuli were shaped tones 500ms in duration. Tests were conducted using a 'go/no-go' paradigm with a 'step-down/step-up' sequence repeated three to five times per frequency during a session. Results thus far indicate that the bears could detect sounds between 125 Hz and 25,000 Hz. Best sensitivity was limited by noise in the test facility, but was at least -13 dB SPL at the upper end of the best range, where noise masking was minimal. Analysis of the threshold data and ambient noise levels is not complete, but the raw data indicate that the best range will extend up to 14,000 Hz. Results thus far indicate that the hearing curve of the polar bear is shifted towards low frequencies or narrower than the hearing of small carnivores like dogs and raccoons. Detailed knowledge of this facet of polar bear perception is an important first step enabling wildlife managers to estimate how noise stimuli from human activities may impact the lives of polar bears. Appropriate management tools are needed because human intrusion into the Arctic is only expected to increase in the coming decades, while polar bears will be forced into increasing contact with them by changes in habitat.

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COMPREHENSIVE DATABASES: A POWERFUL WILDLIFE MANAGEMENT TOOL

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Agencies have long recognized a need for a comprehensive grizzly bear database for the Northern Continental Divide Ecosystem (NCDE) in northwestern Montana, but have had insufficient resources to implement one. Two ongoing research projects in the NCDE renewed the push for such a database: (1) the Northern Divide Grizzly Bear Project, an ecosystem–wide study to estimate population size using noninvasive genetic sampling, requires information on movements, mortalities, and relocations to assess population closure and density patterns; and (2) a long–term population trend monitoring program requires similar information to accurately document bear life histories and track management actions. These tasks would have been easily facilitated by a comprehensive database, unfortunately it did not exist. Working with federal, state, and tribal agencies, we developed a comprehensive database of current and historic handled, dead, and DNA study grizzly bears that, for the first time, pieces together individual bear histories obtained by dozens of bear managers and researchers across the ecosystem. The development of this database has lead to standardized data and biological sample collection protocols for captures, relocations, mortalities, and bear–human conflicts across the ecosystem. It also has the potential to integrate ArcGIS mapping capabilities and generate automated reports. In conjunction with the database we are establishing a centralized biological sample repository. Emerging technologies in genetic, hormone, isotope, and other molecular analyses create opportunities to obtain valuable information from historic and recent biological samples. Our database is a powerful tool that allows consolidation of information into one dynamic system that will facilitate exchange of information and foster synergistic relationships between managers and scientists. This enables managers to make informed decisions regarding allocation of finite conservation resources. Although ours is developed for grizzly bears, the design, construction, and benefits of a comprehensive, multi–user database are applicable to all species.

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BEAR AFFAIR - A ZOO CONSERVATION/EDUCATION EVENT

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With the growing number of people moving into and recreating in areas where bears live there is a potential for conflicts between the two. In order to reduce and prevent these conflicts from happening, people need to have accurate information on being safe and “bear smart” so that bears and people can co-exist in an ever shrinking environment. This is where zoos play an important role in bear conservation and education. Zoos have a captive audience of thousands of people each year passing through their gates ranging from individuals, families, school groups and members that return to the zoo frequently. Unfortunately, many of these people are in a hurry and they go through the zoo barely stopping long enough to see an animal let alone read anything about it. Studies have shown that the average zoo visitor will spend less than a minute reading an informational sign about an animal so zoos need to be creative in the way they educate their guest. One way zoos have done this is by having a special event dedicated to a specific animal such as Bear Affair at the Woodland Park Zoo. The Woodland Park Zoo is very fortunate to have The Grizzly Bear Outreach Project (GBOP) as one of our conservation partners and they play a vital role in our Bear Affair Event. We also have participants from REI, various federal and state agencies, conservation organizations, and a representative from Counter Assault that provides us with the bear resistant food containers (BRFC). Our local library participated this year, making April Bear Awareness month. The event takes place on a Saturday and Sunday and it goes from 0930 till 1530 with various activities, informational booths and the much anticipated non-bear safe campsite demonstration followed by the bear resistant food container demonstration. The day starts off with a non-bear safe campsite being set up in the brown bear (Ursus arctos) exhibit. We put out a tent, sleeping bags, coolers, shoes, table and chairs, backpacks and a campfire pit. Food is placed either in or on all of these camping items. Dry food bags are hung up in a tree but are not put up high enough. All of this is done to show how not to set up a campsite in bear country. We interact with the zoo visitors as we set all of this up so that they learn what we are doing, why it is wrong and to get their attention in hopes they will want to stay and learn more plus return in the afternoon to see the bears get the bear resistant food containers. The visitors pack into the 3 viewing area as the two 900 pound bears are let out into their exhibit where they explore, eat and destroy many of the items in the campsite, entertaining the visitors as they do so. In the afternoon, many of the visitors return to see the bears get a BRFC. We show how to use the bear resistant food containers; talk to the visitors about the importance of using them in bear country, reiterate the importance of properly securing food, smelly items, cooking equipment etc. Food is placed inside a container and again the bears are let out into their exhibit to investigate the device. Unfortunately it does not take them more than a couple minutes to break into the canister. Thousands of people come to the event and it has become a fun creative way for the zoo to educate people on bear conservation and to teach them how to be “bear smart”.

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DNA AND STABLE ISOTOPE ANALYSIS TO DETECT HUMAN FOOD-CONDITIONED BLACK BEARS AT YOSEMITE NATIONAL PARK, CALIFORNIA

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Annual visitation in Yosemite National Park (YNP) currently exceeds 3.5 million people. During the summer months, 90% of the public visits Yosemite Valley (YV), an area that comprises only 0.6% of the Park. In addition to supporting millions of people per year, the small valley contains critical black bear habitat. Many bears search out natural foods items in the spring and fall when available and human food throughout the summer months when natural food is scarce. This co-existence often results in humans and bears colliding in developed areas during the summer. These human-bear interactions (i.e. car break-ins, property damage, personal injury) also occur in other areas throughout YNP, due to most developed areas (i.e. campgrounds, parking lots, campsites) being situated in prime black bear habitat. Due to limited resources and the high level of human-bear interactions in YV, Yosemite's Bear Management Team has established a management strategy that concentrates efforts in YV. As a result, bears routinely run rampant throughout other areas of the park, causing thousands of dollars in reported property damage per year. Although the bear management program has been effective at decreasing human-bear incidents and bear destructions, the YV-focused strategy has left over 99% of YNP without concentrated management. Collecting hair samples throughout the Greater Yosemite Ecosystem this past year has initiated a bear monitoring study that could aid in the establishment of new park-wide adaptive management strategies. DNA analysis will be used to identify individual black bears, aid in determining relatedness among bears, and allow managers to track their temporal fluctuations in food habits. Stable isotope analysis will detect the food assimilated by black bears, and identify whether bears have been consuming human food. Research findings will ascertain the number of human food-conditioned bears in YNP by comparing bear hair samples' enriched nitrogen and carbon isotopic values to isotopic values (1) found from the analysis of foods black bears naturally and unnaturally consume; (2) of human food-conditioned management bears; and (3) of "wild" backcountry bears. The purpose of this study is to combine the use of DNA and stable isotope analysis in order to (1) detect human food-conditioned bears throughout YNP; (2) determine relatedness of human food-conditioned bears; and (3) supplement the current bear management plan by increasing park-wide proactive management efforts.

Keywords: black bear, noninvasive sampling, bear management, stable isotopes, DNA, relatedness

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BEAR VIEWING: RECREATION, INDUSTRY AND MANAGEMENT

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An estimated 60,000-70,000 people view bears at close range annually in North America. Viewer numbers have risen rapidly in recent decades, and the total is likely in excess of 1 million. Viewing has become an important cottage industry in many areas, especially on the Pacific coasts of British Columbia and Alaska, bringing in millions of dollars annually to areas where traditional industries (e.g., logging, fishing) may be declining. As the ratio of bear viewers to bear hunters increases, state and federal management practices should adapt accordingly to assure public satisfaction and public safety. Conservation of prime viewing opportunities might sometimes require restrictions in the timing, location or manner of hunting. Management would also benefit from a deeper understanding of bear behavior, such as communication (e.g., body language), aggression, and habituation. Conventional wisdom that increased “friendly” human contact makes bears more dangerous may be valid under certain conditions, but not under those typical for viewing. Indeed, most serious maulings are defensive, not offensive or predatory; and the rate of maulings is much higher for hunters than for viewers. As government agencies upgrade viewing management, they should be cautious about imposing regulations on viewers and guides. Rather, every opportunity should be taken to learn from viewing guides, viewers, and researchers with extensive experience watching and perhaps interacting with bears in harmonious ways. Management should be flexible enough to adapt to local variations in bear ecology and behavior, and in viewing conditions and opportunities. One “size” will not fit all. To facilitate these adaptive processes, the Bear Viewing Association was created. It promotes research and dissemination of findings through journal papers, books, videos, a website and other media. An overview of key materials is provided, including the books Bear Viewing in Alaska and the Alaska Magnum Bear Safety Manual. The website can be visited at www.bear-viewing-in-alaska.info.

Key words: bear behavior, bear viewing, economics, habituation, industry, management, recreation, research

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THE ROLE OF CITIZEN VOLUNTEERS IN PREVENTION AND MANAGEMENT OF BEAR NUISANCE BEHAVIOR

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Forests surrounding Lake Tahoe in northeastern California host a substantial population of black bears (Ursus americanus). Even during years when natural foods abound, many of these bears visit developed areas. Visitation is especially high during droughts and when large portions of habitat are decimated by fire. Bears enter yards and sometimes homes where they obtain pet food, wild bird feed, garbage, or human groceries. Historically across North America, management of bear depredation has been done primarily by state or federal wildlife and wildland agencies. They have taken a lead role in teaching the public how to minimize availability of those foods. Agencies have also depended heavily on management techniques that are costly and either ineffective (transporting bears to remote locations) or unpopular with the public (killing the bears). In recent years, a number of volunteer groups have assumed much of the prevention burden in certain parts of the continent. These include the Bear Smart Society in Whistler, B.C. and the Bear League at Tahoe. These groups provide public education and promote availability of bear-resistant containers for garbage. Specially trained members also work directly with bears to win their cooperation. Negotiation and intimidation are used to gently remove bears from yards and homes, and to reduce repeat offenses. Similar methods are used at Mammoth, California. This paper and its accompanying “slide show” describe the Bear League’s successes and the methods that make this possible. The more that government agencies facilitate such volunteer organizations in these and other communities, the less burden those agencies must shoulder for nuisance management.

Key words: black bears, bear management, bear depredation, citizen management, nuisance behavior, volunteers

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PREDICTING GRIZZLY BEAR DENSITY IN NORTH AMERICA

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Hunting of grizzly bears, and other species with very low reproduction, must be conservatively managed to avoid population declines. Conservation of grizzly bears is often controversial and the balance of disagreement is focused on the estimates of density that are used to calculate allowable kill. Thanks to the development of aerial survey and genetic identification techniques, many recent estimates of grizzly bear density are now available. But, grizzly bears are hunted across vast areas and field-based estimates will never be available for more than a small portion of the hunted populations. Current methods of extrapolating density to areas of management interest are subjective and untested. Objective methods have been proposed (e.g., using RSF's) but these statistical models are so dependent on results from individual study areas that the models do not generalize well. We examined the relationship of grizzly bear density to ultimate measures of ecosystem productivity and mortality. We found grizzly bear density in non-coastal environments was related to mean annual rainfall and temperature, human-caused mortality, human density and the presence of salmon. In coastal areas where black bears were present density was positively related to precipitation and salmon and negatively with tree cover. Our models can be used to predict current density across interior North America but grizzly bear density in coastal areas is generally much higher but not predictable from the available data. Our interior model was based on more and better quality data and although the fit was poorer, we expect this model will generate more accurate predictions. Our coastal model was based on only 8 measures of density and 5 of these were not estimates but minimum counts. We believe this model only roughly predicts density.

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USE OF REMOTELY TRIGGERED CAMERAS TO REDUCE LIVE CAPTURES OF NON-TARGET BEARS

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Live capture of bears is necessary to meet many research and management objectives. Non-target captures are an unfortunate and sometimes common outcome of trapping efforts. Non-target captures result in lost opportunities to capture target animals, wasted resources such as anethesetizing drugs and labor, and unnecessary stress and potential harm to the animals. To limit non-target captures, bear managers and researchers in northwest Montana have applied a range of remotely triggered camera models to determine if the individual(s) visiting a trap site meet their needs. Use of cameras has resulted in a significant reduction in non-target captures, meaning fewer individual bears having been drugged and processed. Further, by keeping traps inactive and avoiding non-target animals, trappers are able to increase the number of sites, allowing for greater density and/or distribution of traps. To assist other trappers, we review our experiences with various models of remote cameras, including 35 mm film, digital still, and video systems. We offer recommendations for applying these rapidly improving technologies to benefit both resource managers/researchers and their study subjects.

79 - INDIA

SLOTH BEARS AND THE KALANDAR COMMUNITY

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The Kalandars (a nomadic wandering gypsy community) have been dancing sloth bears (Melursus ursinus) for roughly 400 years. But what part do bears play within the Kalandar Community? With the assistance of the Kalandars, Wildlife SOS visited 29 Kalandar villages in four North India and 7 Kalandar villages in South India. Investigators administered 146 questionnaires. A large quantity of detailed descriptive data was collected from the discussions that ensued. Separate questionnaires were devised for the hunters/traders and bear owners/trainers. These questionnaires were administered face to face and in the native language of the people. The Kalandar Community was originally Muslim gypsies with a highly nomadic life style. They earned a living from a large number of performing animals, including the sloth bear, and kept other exotic animals (civets, monkeys, mongoose etc) as pets to display to their audience. This mastery over animals created an appropriate awe when they tried to sell medicines, good luck charms and talismans as cures for illnesses, nightmares, the evil eye or tried to hold their audiences' attention during the performance of magic tricks and acrobatic stunts. The Kalandars belong to the OBC category i.e. they are included in the category of OTHER BACKWARD TRIBES by the Government of India, along with the Adivasis, forest tribals, and all those communities which make their living from the forest and its resources, or work with animals as entertainers. It implies the government has recognized their economically deprived status and that they have in a way become displaced in the present development of this country and special assistance is to be rendered to them through government schemes. However the government has largely failed to help these people. According to the Kalandars, they have been dancing bears since the 16th century. The Kalandar community claim to be the descendants of the Multanis or Pakhtoons that originated in the mountainous areas beyond Pakistan. They were once richly patronized by the Rajput Kings and the Mughal emperors who enjoyed watching the bears dance and wrestle with men. The villagers respected the Bear as the Protector of little children and a defense against spirits and ghosts. The Kalandars use the religious texts like the Ramayana to add to the mythical dimension of the bear. The Bear tribe assisted Lord Rama in his search for Sita when she was kidnapped by King Ravana. This reference gives the bear a special status and it is regarded as an animal of power and strength, one that can frighten away evil spirits, keep a child free of nightmares, cure certain psychological ailments, exorcise spirits from possessed individuals and grant blessings of good health and peace particularly to little children. A typical Kalandar village is well set back from the national highways or main roads and generally camouflaged by dense, thorny, tree growth or scrub. In urban areas it is usually hidden behind the worst slums or in the peripheries of the town. Usually the village has a set of paths in the back set up to assist escapes should there be a police raid. Owning a bear definitely continues to be a source of pride and holds significance for the Kalandar. Most of the Kalandars, about 83%, have been dancing bears in their family for 5-7 generations, however only 10% had visited the forests. A dancing bear works on an average 6 hours a day according to the Kalandar.

80 - INDIA

HEMATOLOGY AND SERUM CHEMISTRY OF SLOTH BEARS (MELURSUS URSINUS URSINUS) FROM TWO LOCATIONS IN THE INDIAN PENINSULA

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Standard hematologic and serum chemistry parameters were determined from 122 sloth bears (Melursus ursinus ursinus) at the Sur Sarovar Bird Sanctuary, Uttar Pradesh, India (77˚ 45' E; 27˚ 0' N), and the Bannerghatta National Park, Karnataka, India (12°48'N; 77°34'E) from March 2003 to July 2006. These two protected areas within the habitat range for sloth bears have distinct climatic conditions; this provided an opportunity to not only study physiological blood parameters in native environments but also compare the effect of overall climatic conditions on these parameters. We primarily analyzed the influence of age, sex, season and body weight on the different parameters. Cubs (≤1 year) combined from both locations had a lower erythrocyte count and a higher leukocyte count compared to adult/sub-adult bears (>1 year). A sexually dimorphic difference in leukocyte count was identified in adult/sub-adult bears where females had higher counts than males. This difference was a result of higher numbers of circulating neutrophils in female bears. Platelet counts were also higher in females compared to males. Female bears also had higher creatinine levels compared to males and ALP was higher in males compared to females; however, when compared within each location, these were true only for bears at Sur Sarovar. On comparing the different seasons, leukocyte counts were higher in Winter compared to Summer and Monsoon, again due to a higher neutrophil count. Seasonal differences were not detected for any of the serum chemistry parameters. When analyzed based on location, erythrocyte and leukocyte counts were higher in adult/sub-adult bears at Bannerghatta which was at a higher elevation with fairly steady temperature and humidity recordings throughout the year compared to Sur Sarovar that had hotter arid summers and colder winters. Mean ESRs were significantly delayed in Sur Sarovar compared to Bannerghatta. Serum creatinine levels were higher in Bannerghatta compared to Sur Sarovar. However, the individual ratios of urea to creatinine were not different between the two locations and a seasonal variation was not observed indicating continual food availability and a steady biochemical state unlike the hibernating bears. In this study we have obtained mean values to serve as a reference for this species in their native habitat. This report will be useful to develop and evaluate health profiles of sloth bears under various ecological conditions.

Key words: sloth bear, blood, hematology, serum chemistry, serology, metabolism, Melursus ursinus ursinus, India

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DISSEMINATING WILDLIFE AWARENESS TO REDUCE HUMAN-HIMALAYAN BLACK BEAR CONFLICT -A CASE STUDY FROM JAMMU AND KASHMIR, INDIA

ROHIT SINGH

A preliminary survey was conducted on human-black bear (Selenarctos thibetanus) conflict in the state of Jammu and Kashmir. The questionnaire survey method was used to collect the information. More than 150 personnel were interviewed and the attitude of the local people towards black bears was also assessed and the possible solutions to the problem were also discussed with the local villagers, Wildlife officials and the army personnel. The attitude of the locals was extremely negative towards the behavior of black bears. The possible reasons of the conflict were also discussed with the locals. The survey provides a set of recommendations to reduce the conflict. It was found that wildlife awareness is a high priority activity which needs to take place in the state. Conservation education is totally lacking in the state. So there is an urgent need to start a wildlife awareness program. The program should focus on the following issues; (1) Changing the attitude of the locals towards wildlife (2) Increasing awareness towards the importance of wildlife (3) Precautions to avoid close encounters with the black bears and avoidance techniques. (4) To train locals to handle the situation, when the black bears come in to their settlements without harming or resorting to killing the animal. This paper suggests public education as the better way to reduce the conflict with the help of government and non government agencies.

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THE CHARACTERISTICS OF THE DEN SITES OF RELEASED ASIATIC BLACK BEAR IN JIRISAN NATIONAL PARK, SOUTH KOREA

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To identify the characteristics of den sites of Asiatic Black Bear(Ursus thibetanus ussuricus) in Jirisan National Park of South Korea, the survey on the den site toward nine released bears imported from North Korea and Russia during the last five months, from Dec. 2005 to Apr. 2006 resulted in as follows: the released bears denned at the three types of sites, hollow tree, rock cavity, and nest. The denning duration was averagely about a hundred days, in range of 87days to 118 days. The elevation of denning site was averagely 977m, in range of 475m to 1,360m. The bears went into dormancy after moving 3.28km from the first released point. The average distance of den sites from the nearest villages was 2.31km, from the park trails was 1.28km, and from the roads was 2.21km respectively.
The den sites were situated in mainly oak (Quercus family) dominant communities whose human beings are hardly to access or enclosed sites. It is assumed that the bears inhabited in the sites with affluent foods and denned at the secure sites with protecting themselves from enemies. Also, the den sites were very close to the villages or artificial facilities. It is assured that those villages are encroached in Jirisan National Park and park trails are installed all around.

83 - SOUTH KOREA

SURGICAL TREATMENT OF SNARE TRAUMA ON THE ASIATIC BLACK BEAR IN SOUTH KOREA

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For the restoration of Asiatic black bear(Ursus thibetanus ussuricus), 12cubs from Russia from 2004 to 2005 twice were released to Jiri mount, and 8cubs from North Korea in 2005.
However, many illegal snares by hunters and local residents (communities) who got apiary damage have been installed to Jiri mount area and it becomes a big threshold for released bears security and leading a successful project. Since the beginning of this project, the three cubs have been recaptured with some unexpected reasons. One released cub was trapped to death and another cub was cured but dead within 7hours by the reason of exhaustion and hypothermia. Despite the rest cub was recovered by proper surgical treatment, the high familiarity with people in the process of cure and recovery block to be released. The trauma characteristics by snares are the damage of skin and abdominal muscle, myiasis, and sever dehydration etc. To solve these problems, Hatman linger was administrated and instructed the suture after disinfection, making of fresh wound, and antibiotic treatment.

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BODY WEIGHT CHANGE OF RELEASED ASIATIC BLACK BEAR IN THE JIRISAN NATIONAL PARK, SOUTH KOREA

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Korean National Parks Service released 3 Asiatic Black Bears in the Jirisan National Park to accumulate ecological data between 2001 and 2004 as an experimental attempt. And then we have launched the restoration project for Asiatic Black Bear since 2004. Until now, 20 Asiatic Black Bears(6 cubs from Russia in Oct 2004, 8 cubs from North Korea in Apr 2005, and 6 cubs from Russia in Sept 2005) were released in the Jirisan National Park and we have being conducting continuously ecological and physiological studies by using the radio telemetry method. As a part of these studies, we have researched body weight change of them to estimate indirectly the condition of their adaptation to our eco-system and to apply those results for our restoration project as physiological data. Although 8 bears (6 of them from North Korea, the others from Russia) were in growth period, their body weight were decreased or almost no changed after releasing them. It seems to have a problem with searching food in the wild and we suspect it as a course of adaptation to our eco-system. In case of 8 bears which (1 bear for the experimental attempt, 3 bears from Russia, 5 bears from North Korea) were heavier than the other bears in same age, it can be explained from their eating habits. Unlike other bears, they ate lots of honey and larvae in apiaries or human food containing high calorie. In case of captive bears harvested from wild due to becoming a problem bear, they had high body weigh compare to the bears in wild. We found the reason in less exercise and regular food supply. And all male bears had higher body weight than all female bears ($t=0.009$, $p<0.01$). The gap of body weight was 50kg maximally.

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ANALYSIS FOR THE HOME RANGE OF RELEASED ASIATIC BLACK BEAR IN THE JIRISAN NATIONAL PARK, SOUTH KOREA

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It is difficult to research ecology of wildlife included bears in the wild state. This study reveals the result of radio telemetry of 11 Asiatic Black Bears reintroduced to restore the endangered species.
We attached ear transmitters(M3620, USA) and ear tags(Allflex) bearing particular number and color. We have collected 1798 location data of them living in the Jirisan National Park between April, 2006 and December, 2006, and we analyzed each migration distance and home range with the data. The seasonal average of migration distance was 21.24±9.67Km in Spring(April - June), 33.28±14.40 Km in Summer(July - September) and 33.28±14.40Km in Autumn(October - before hibernation). The bears also showed the widest movement in Summer compare to other season. The analysis of total home-range calculated 612.302km^2 in case of MCP 95%, and 430.731km^2 in case of Kernel 95%. The yearly mean of altitude was 775.14±286.31m in their habitat.

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ANALYSIS OF ASIATIC BLACK BEAR'S FOODS BY USING FECES

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In the past, as the Asiatic Black Bears (Ursus thibetanus ussuricus) in the Jirisan National Park were assumed to be there only 5~6 wild individuals, if there were no such action as the introduction of outside bears into the Jirisan area, they were maintained to be extinct. The Korean National Park Service (KNPS) released 20 cubs that were imported from Ussurisk Reserve of Russia and North Korea in 2004 and 2005. The author and the team monitored the bears and analyzed the feces of the bears to study the diets of the bears in the Jirisan National Park. Feces of Asiatic Black Bears were observed on 71 occasions during the field studies of radio-marked bears and by chance in the Jirisan National Park, from October 2002 to September 2006. Before the analysis, the feces were kept in cold storage, thawed for about 3 days, filtered through mesh-sieves with water, and subsequently dried for 24 hours at 70^{O} with a drying oven. Dried materials from feces samples were sorted by using either a hand lens or a microscope. Taxonomically, they were sorted as the classes of organisms (e.g. plant, mammal, insects, etc.) and grouped for further identification. After the analysis of the 71 feces collected from 2002 to 2006 in the Jirisan National Park, the foods of bears were identified as the plants (21 families, 39 species), mammalia (3 families, 3 species), insect (3 families, 5 species), birds (1 species), crustacea (1 species) and amphibia (1 family, 1 species). The prey items of Asiatic Black Bears in the Jirisan National Park were with decreasing orders of Plants (77.10%)> Insect (14.17%) > Mammalia (4.33%) > Crustacea (1.33%) > Amphibia (0.33) > Birds(0.33%). Asiatic black bears are omnivorous but most of foods were found to be plant materials. Although there is a limitation in interpretation due to small number of samples, it is reasonable to conclude that hard plant materials represent the food of the bears in the Jirisan National Park.

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COMPLETE MITOCHONDRIAL GENOME OF THE ASIAN BLACK BEAR

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We isolated the mitochondrial DNA of Asian black bear(Ursus thibetanus ussuricus) by long and accurate-polymerase chain reaction (LA-PCR) with conserved primers, and sequenced the mitogenome with 11 sets of conserved primers. The mitochondrial DNA of U. thibetanus ussuricus is 16,701 bp in length and its structural organization is similar to the mitochondrial DNAs of other bears and mammals. We analyzed phyogenetic relationships derived from the mitochondrial cytochrome b gene and D-loop region (control region, CR). We report here the basic characteristics of the U. thibetanus ussuricus mitochondrial genome including its structural organization and the base composition of the rRNAs, tRNAs and protein-coding genes as well as characteristics of tRNAs.


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