PROCEEDINGS OF THE TENTH WESTERN BLACK BEAR WORKSHOP

18-22 May 2009

Peppermill Resort, Reno, Nevada

Hosted by Nevada Department of Wildlife

A *WAFWA* Sanctioned Event

Carl W. Lackey & Richard A. Beausoleil

Editors

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Nevada Department of Wildlife
1100 Valley Road
Reno, NV 89512

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Preface

The 10th Western Black Bear Workshop steering committee included Diana Doan-Crider, Rich Beausoleil, Jon Beckman, Kelly Stewart, Cecily Costello, Jason Holley and Carl Lackey.

The 10th Western Black Bear Workshop (WBBW) was held the week of 18-22 May, 2009 in Reno, Nevada at the Peppermill Hotel-Resort. Despite the untimely downturn in the world economy, the 10th WBBW was well attended, bringing together 150 participants representing 4 countries, 21 U.S. states and 5 Canadian provinces. Given that many agencies had restricted or cancelled out-of-state travel, the workshop committee was concerned that attendance might be low. However, because of the generous donations of our sponsors totaling over $10,000, and the proceeds forwarded from the 9th WBBW in New Mexico, we were able to keep registration costs very low, thereby encouraging some to attend that otherwise may not have been able to. Sanctioning of the workshop by WAFWA (Western Association of Fish and Wildlife Agencies) was instrumental as well in encouraging participation by agency personnel.

Early on in the planning process we were faced with developing a theme for the workshop that would incorporate the issues facing today's black bear populations while emphasizing the biological and socio-political hurdles that come with managing this species. *The Changing Climate for Bear Conservation in Western North America* accomplished this. Following the 7th WBBW's lead we invited brown bear managers to the workshop – a decision that was very well received. Additionally, following the cancellation of the 20th Eastern Black Bear Workshop in April of 2009 we made room for anyone from that workshop that wanted to attend or present. As a result, the participants at the 10th WBBW represented a wide range of disciplines and opinions, providing for several lively discussions! Notably, the workshop was also attended by a few people whose names are synonymous with bear research, conservation and management – Al LeCount (organizer of the 1st WBBW in 1979), David Garshelis, Steve Herrero, Chuck Schwartz, Chris Servheen and Frank Van Manen (president of the IBA).

The workshop opened with a social event and a Mark Twain impersonator who entertained with anecdotes of bears during the Comstock heyday. Along with state status reports and oral and poster presentation sessions, there were three special session workshops incorporated into the agenda as well – *Immobilization and Post-Capture Care; Bear-Human Conflict Management*; and *Monitoring Bear Populations with Genetic Sampling* – which were all recorded and transcribed for these proceedings. Participants benefitted from two presentations by the invited speaker, David Garshelis. The first, titled *Why American Black Bears Thrive While Other Bears Falter,* was presented to workshop registrants only and is included in these proceedings as a transcript. David's second presentation was open to the public and was titled *The Eight Species Of Bears Of The World – Is One Or More Headed For Extinction?* On the final day of the workshop attendees were treated to a catered dinner on the shores of Lake Tahoe.

I am grateful to the Nevada Department of Wildlife for their commitment to host this workshop. Thanks also to Tanya Wells and Jody Wilkinson of NDOW for their help throughout with formatting and transcribing. Jani Ahlvers is the artist who created and donated the logo for the workshop. The success of the workshop would not have been possible without the support and dedication of the IBA, especially my co-chair Diana Doan-Crider and the IBA Treasurer Cecily Costello. Special thanks to my co-editor Rich Beausoleil whose experience with workshops and editing was invaluable. He also took the time to copy all of the previous *Western Black Bear Workshops* and put them on a compact disk. Because of Rich, every registrant, in addition to receiving a copy of these proceedings, will also receive a copy of the *Western Black Bear Workshops* CD. This disk will include proceedings from:

The 1st WBBW	Tempe, AZ	1979
The 2nd WBBW	Logan, UT	1982
The 3rd WBBW	Missoula, MT	1985
The 4th WBBW	Yosemite National Park, CA	1991
The 5th WBBW	Provo, UT	1994
The 6th WBBW	Ocean Shores, WA	1997
The 7th WBBW	Coos Bay, OR	2000
The 8th WBBW	Pray, MT	2003
The 9th WBBW	Raton, NM	2006
The 10th WBBW	Reno, NV	2009

At the beginning of the 10th WBBW in Reno, Al LeCount, who organized the 1st WBBW in Arizona, handed me a copy of Nevada's black bear status report given to him in 1979. The entire report contained the following - *"Nevada has no bear, except for an occasional one that strays in along the Sierra's adjacent to Lake Tahoe in California. Therefore, we have no management responsibilities."* We have definitely come a long way! Advancements have been continuous with bear conservation, management, research and the technology we use, here in Nevada and just about everywhere that bears live. To all that take pride in the work you do with bears, keep up the effort!

The Idaho Department of Fish and Game (Steve Nadeau) has graciously offered to host the 11th WBBW in 2012. We'll see you then!

Carl Lackey
Workshop Chair

Editors note:

We have tried to the best of our ability to maintain the transcripts as they were recorded so that the reader may have the full benefit of the conversations that took place. While reading the transcripts please keep in mind that the lecturers were often times pointing and referring to visual aids while they spoke and you will not have the benefit of viewing these same graphics. At times sentences within the transcripts may appear broken or choppy but we believe we were successful in editing these sentences to make them easier to read without changing the speaker's intended meaning or the flow of the conversation. We view these transcripts as being an invaluable addition to the proceedings and we hope that you the reader will enjoy the information contained herein. We apologize in advance for not being able to identify all speakers but several people did not introduce themselves prior to making statements.

Additionally, the one and only submitted manuscript was not peer-reviewed.

Carl W. Lackey & Rich A. Beausoleil - Editors

State & Provincial Status Reports

OREGON BLACK BEAR STATUS REPORT

Western Black Bear Workshop 10:02-03

Bear Populations

Oregon does not have endemic populations of brown/grizzly bears. Oregon has 25,000–30,000 black bears distributed throughout all suitable habitats in the state.

Interest in black bear hunting continues to increase slightly and number of bears killed during hunting seasons remained essentially stable in Oregon (Table 1). Conflicts associated with black bears have increased recently. The Department believes this increase is primarily a result of two successive years of poor forage availability for bears due to unusually late springs followed by dry summers.

Oregon has historically relied on voluntary check-in and sample collection for black bear monitoring. Because check-in rates were below 30 percent from 2003–2006 (Table 2) the department implemented a mandatory check-in of bear skulls as directed by the Bear Plan. Specifically, successful hunters are now required to bring the skull of any harvested bear in an unfrozen condition to a Department office or a designated check-in site within 10 days of harvest. Biologists or trained volunteers collect a premolar tooth for aging and measure two other teeth to determine sex of the bear. During the first year over 90% of Oregon bear hunters checked in their bears (Table 2). Mandatory check-in also applies to bears killed outside hunting seasons and an additional 370 bears non-hunt bears were sampled during 2008.

Black Bear Tetracycline Marking

In 1999, Department researchers began evaluating use of tetracycline as a way to permanently mark black bear teeth. Using marked and unmarked teeth provided by hunters and collected through other forms of mortality, bear populations can be estimated for an area using mark-resight estimators. Beginning in 2005 the Department began implementing this technique statewide (Table 3).

The technique relies heavily on number of teeth returned. As noted earlier, tooth return rates have been low and have not provided sufficient samples to calculate a reliable estimate. However, the requirement for mandatory check-in of black bears beginning in spring 2008 has dramatically improved sample collection for estimating bear populations. Results for these bears should be available by mid winter 2009-2010. Our hope is to be able to begin estimating regional black bear populations

Table 1. Recent trends in black bear damage, harvest and other mortality in Oregon, 2005-2008.

Year	Number of Conflicts[1]	Bear Tags Sold[2]	Hunter Harvest[3]	Damage Kill[4]	Human Safety Kill[5]	Other Mortality[6]	Total Mortality[7]
2005	298	44,785	1,087	268	19	20	1,394
2006	275	46,482	1,277	197	18	15	1,507
2007	319	51,720	1,225	187	7	17	1,436
2008[7]	569	53,847	1,183	268	45	52	1,548

[1] Number of conflict reports received during the calendar year. Sightings not associated with damage or a public safety concern are not included.

[2] Includes controlled spring, general fall, and additional tags.

[3] Includes controlled spring and general fall seasons.

[4] Number of animals killed as a result of damage during a calendar year.

[5] Animals killed as a result of real or perceived threat to humans or pets.

[6] Includes roadkill, accidental, found dead, or illegal kill.

[7] Includes harvest, damage, and other known mortality.

shortly after results are received.

Significant Public Relations Incidents

There have been two recent black bear-human interactions resulting in injuries. In spring 2008 a licensed bear hunter received minor injuries while trying to recover a wounded black bear. Second, a woman from Sandy, Oregon received minor injuries from a black bear on her porch. Neither individual received life threatening injuries. During both situations, established response protocols and prepared information enabled the Department to quickly and efficiently respond to the situation in a positive manner.

Table 2. Recent trend in bear tooth reporting compliance in Oregon, 2001–2008.

	Spring			Fall			Total		
Year	Harvest	Teeth	%	Harvest.	Teeth	%	Harvest	Teeth	%
2001	263	123	47	621	239	38	884	362	41±2
2002	244	105	44	904	293	32	1,148	398	35±3
2003	300	109	35	829	207	23	1,129	316	26±3
2004	[a]	104	[a]	[a]	239	[a]	[a]	343	[a]
2005	371	127	34	716	185	27	1,087	312	29±3
2006	307	112	36	989	237	23	1,296	349	27±2
2007	477	138	23	748	246	30	1,225	384	31±3
2008	363	357	98	911	826	91	1,274[b]	1,183	93

[a] No harvest survey was conducted for bear seasons during 2004.

[b] Harvest estimate from random telephone survey

Table 3. Number of tetracycline baits deployed and number of bears marked by ecoregion in Oregon, 2005 - 2008.

	N. Coast		SW OR		W. Cascade		E. Cascade		S Central		Blue Mtn.		Wallowa		Statewide	
Year	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked	# Baits	# Marked
'05	452	105	674	292	322	167	92	13	250	25	197	66	124	30	2,111	698
'06	293	45	642	220	265	58	142	41	255	20	313	114	100	35	2,010	533
'07	400	55	670	260	324	107	59	23	89	4	293	105	87	32	1,922	586
'08	278	55	571	202	188	73	112	45	241	24	134	29	82	28	1,606	456

CALIFORNIA BLACK BEAR STATUS REPORT

JASON HOLLEY, California Department of Fish & Game, 1082 Callander WY, Folsom, California, USA.

Western Black Bear Workshop 10:04-07

Background and Population

Black bears (*Ursus americanus*) are recognized as an important component of California's ecosystems and as a valuable resource for the people of California. The black bear has been classified as a game mammal since 1948. Since that time, hunting regulations have become more restrictive, prohibiting trapping, killing of cubs or sows with cubs, and reducing the bag limit from two to one bear per license year. Before the early 1980's, regulation changes were infrequent. However, in 1982, the California Department of Fish and Game (DFG) began recommending regulatory and legislative changes to reduce poaching and increase DFG's ability to monitor bear populations.

Data indicates that California's bear population has increased in recent years. Black bears are being observed in areas where they were not seen 50 years ago along the Central Coast, near the Central Valley floor, and Transverse mountain ranges of Southern California. In 1982, the statewide bear population was estimated to be between 10,000 and 15,000. Today, Between 28,000 and 35,000 black bears are estimated to occupy 52,000 square miles in California.

Perhaps it was the pioneers dislike and fear of grizzly bears that painted the black bear as a pest and generally undesirable inhabitant of the western United States well into the 20th century. California was no exception, while bears were classified as furbearers in 1917, there were no restrictions on how, when or how many bears could be killed until 1948.In 1948 bears were classified as game animals, seasons were established, a license was required to hunt and trap bears, and only two bears per year could be taken by an individual. However, there still were areas in California were bears could be hunted year round. In the northwestern counties of Humboldt and Del Norte, bear hunting was allowed year round from 1953 until 1961. Trapping for other than damage control was outlawed in 1961.

Knowing the number of bears that are killed as well as the sex composition of the kill is essential to managing bear hunting and populations. While hunting was regulated and a license required, there was no system that DFG used to determine how many bears were being taken or what the sex and age ratios were of bears killed by hunters. In 1957 hunters were required to purchase bear tags and those who were successful returned the report card portion of the tag that provided information on locality and date of kill as well as the sex and age (adult or cub) of the bear that was taken. As the information from tags accumulated, the DFG began to form a better idea of the state's bear resources as well as areas that were important to bears and bear hunters.

Along with better information on bears and bear hunting, rapid improvements in DFG's ability to safely capture and handle bears for research were occurring. In the 1970s, DFG and agencies such as the National Park Service began bear research projects that provided a great deal of information about the effects of hunting on bear populations as well as how bears used their habitats and what populations were over large areas. For the first time, important life history information such as the age when females first have cubs was available. Information from these efforts along with data from the tags that were returned by hunters further informed the management of bears in California.

Regulation changes that resulted from our increased knowledge included reducing the bag limit from two bears to one in 1968, prohibiting the killing of cubs or females with cubs in 1972, and prohibiting the practice of training dogs to pursue bears other than during the regular bear season. That information also enabled DFG to

identify areas in the state where the use and training of trailing hounds should be restricted.

DFG's increased efforts to gather information on the biology of bears as well as increasing concerns by the public over bears contributed to the further evolution of DFG's bear management program. DFG felt more information could be obtained from kill data and so we now require the mandatory return of bear tags. Hunters are now required to bring bears that have been killed to DFG for tag validation as well the removal of a premolar tooth from the bear. The tooth is used to determine the bears age and thus develop more precise information about bears that are harvested and how to manage bears and hunting in California. DFG biologists use all of the data that are collected to monitor and assess the effects of hunting on the bear population. Annually, the data are compared to previous years to determine trends that would trigger adjustments to the hunting program.

By sampling and analyzing the age structure of the bear population, DFG can look at past mortality. The presence of bears at all ages in the population indicates that there have not been any catastrophic events which precluded production of cubs or the occurrence of major die-offs. Had these kinds of events occurred, there would be a noticeable gap or absence of animals representing that age classification. Fewer animals representing the first and second age classes in the harvested animals is because killing cubs (bears less than 50 pounds) is illegal, and hunters tend to select larger animals. The distribution of ages in California's bear population shows the population is represented by all age classes and mortality rates are relatively consistent from one year to the next.

Hunting

Currently, the hunting season is closed when there are 1,700 bears reported taken or the last Sunday in December, whichever comes first. In the recent years, the bear hunting season has ended when 1,500 bears were reported taken. This caused the season to end before the last Sunday in December in five of the last six years.

The 2008 black bear hunting season closed nine days earlier than last season when the Department received 1,700 report cards on December 9, 2008. This season is the first since 2001 that harvest numbers have reached their limit in the first two weeks of December. Over the past seven years the season has consistently closed within the last two weeks of the month. The License and Revenue Branch of DFG has reported 25,631 bear tags sold this season: 25,367 resident tags and 264 non-resident tags. Non-resident tag sales increased by .02%over last years reported sales. This season 2,028 black bears were harvested and overall hunter success was 7.9%. The success rate is .5% higher than last year's figures.

The most effective hunters reported 43.9% success using trailing hounds. The use of trailing hounds is consistently reported as the most successful method for harvesting bears. Hunters reporting taking a bear while deer hunting accounted for the second highest success rate at 34.2%. While figures for success rates with trailing hounds have decreased by 3.1% since last season, hunters reporting taking a bear while deer hunting experienced greater success than last year with an increase of 3.1%. Archery hunters reported success rates consistent with previous years' figures at 7.6%.

Comparable to the past, successful hunters spent an average of 4 days in the field and18.6% of these hunters took a bear on private land. Unsuccessful hunters spent an average of 7 days hunting. Harvest opportunities proved to be most abundant in Siskiyou County; figures total 10.6% of the statewide harvest. Shasta and Humboldt counties are not far behind with harvest figures totaling approximately 7.7% each. Reported figures demonstrate that 59.2% of bears harvested were male and 37.3% were female.

General bear season opened concurrently with general deer season in the A, B, C, and D,X8, X9A, X9B, X10 and X12 zones. In the remaining deer hunting X zones, bear season commenced on October 11, 2008. During the general deer season hunters were limited to one dog per hunter.

One important factor for monitoring the bear population in California is the sex ratio of the bear harvest. It is an important indicator of the health of the bear population. Male bears are killed at a higher rate than they occur in the population as a result of hunter selectivity, and

because male bears have larger home ranges and a correspondingly higher probability of being encountered by hunters. So, sex ratios will be biased towards males until fewer males are available for harvest. In the period from 1957 through 1980, the majority of the time the number of females in the harvest exceeded 40 percent. During the 1980s and early 1990s the proportion of females in the harvest was generally lower than 40 percent. This reduction in the proportion of females is believed to be due to reduced mortality in the population because of changes in the regulations and other factors causing the bear population to increase in size. The increase in the proportion of female bears in recent years is believed to be due to a regulatory change in 1996 which opened the bear general season with the deer general season in A,B,C, and D deer hunting zones. Because deer hunters can use only one dog during the deer season, they are less selective for males because they don't have multiple opportunities to select a large bear. These opportunities are often afforded bear hunters using multiple dogs after the deer season has ended. Beginning in 2002, the general bear season will also open with the beginning of deer season in zones X-8 through X-12.

Conflict Management

The Department of Fish and Game (DFG) recognizes that bears react to the environment around them. It is natural for a bear to investigate all attractive smells and consume whatever seems like food. The only real solution to a bear problem is to eliminate the attractant. Black bears are legally designated as a game mammal in California. As such, bear hunting follows a regulated process that includes obtaining a tag and restricting hunting to a specified season. However, Section 4181.1 of the Fish and Game Code states that landowners may kill a bear encountered in the act of molesting or injuring livestock. In the case of a problem bear, the law provides for the issuance of a depredation permit to landowners or tenants who experience property damage from bears. The permit allows the permittee or designee to kill the offending bear regardless of the time of year. But a depredation permit is the last step in a series of steps taken to eliminate the problem.

Along with recent increases in population and hunter success has come more reported human and bear conflicts. It is likely that drought conditions in western states over the past 3 years have exasperated this issue. When water and forage becomes scarce, bears need to travel further to maintain their daily caloric requirements. Such travels can lead wild bears into urbanized fringes where habituation to human food can quickly develop.

In some areas throughout California these conflicts are more pronounced and necessitate a direct management response. In the communities surrounding Lake Tahoe, conflict increases culminated into a "perfect storm" of significant incidents in 2007. During the warm months of this year, hundreds of bear break-ins resulted in structural damages of more than one million dollars. The majority of these reports list windows, doors and various interiors destroyed. However, multi-unit condominium floods and structure fires also occurred due to bears turning on faucets, stoves and damaging electrical equipment. From 2006-2009, a notable increase in occupied dwelling entries/break-ins has also been evident.

These trends have prompted DFG to take a more active management role by quadrupling personnel throughout the Tahoe Basin. Additionally, in 2008, the Directors for both California's and Nevada's Fish and Game Agencies signed a Memorandum of Agreement promising cross-border management of bear conflict issues. Since bears do not recognize political borders, the MOA has allowed DFG biologists a strong cooperative advantage.

Today, special candidate bears in Tahoe are subjected proactive trapping and aversive conditioning (AC) before they can cause significant property damage. The main goal of the AC program is to give bears another chance at being wild. Conditioning is being facilitated with the use of pursuing/barking dogs and less-lethal shotgun ammunition. Cooperation and support of local groups and partner agencies is a key element as well. In contrast to relocation, these bears are being released as close to the initial trapping area as possible with an intent to relate the behavior modifications with a bear's proximity to human dwellings and people. Monitoring will determine whether aversion

program has long-term viability. Thus far, only 1 of 13 averted bears has had to be euthanized by depredation permit due to significant property destruction.

Summary

As previously stated, data indicates that California's bear population has increased in recent years. Black bears are being observed in areas where they were not seen 50 years ago. Between 28,000 and 35,000 black bears are now estimated to occupy 52,000 square miles in California. This population increase has created great hunting opportunities. Hunter success over the past three years has been high and the continued outlook is very favorable. Black bear populations in California are facing unprecedented pressures due to increased human activity. Bears adapt quickly and become habituated to people where food is available. It is everyone's responsibility to become informed of proper food and garbage storage techniques in an effort to keep our bears wild. Population, hunting, and conflict resolution is coordinated on a statewide level through the Department's Bear Management Program.

WASHINGTON BLACK BEAR STATUS REPORT

RICHARD A. BEAUSOLEIL, Bear / Cougar Specialist, Washington Department of Fish and Wildlife, 3515 State Highway 97A, Wenatchee, Washington 98801, USA.
DONALD A. MARTORELLO, Carnivore, Furbearer, and Special Species Section Manager, Washington Department of Fish and Wildlife, 600 Capitol Way North, Olympia, Washington 98501, USA.

Western Black Bear Workshop 10:08-10

Introduction

Adhering to the format of the 10th Western Black Bear Workshop (WBBW), this status report will mostly be an update of black bear activities in Washington since the 9th WBBW. Readers interested in management plans, regulations, hunt seasons, detailed harvest statistics, or status and trend reports can obtain that information online by visiting Washington Department of Fish and Wildlife's (WDFW, or the Department) internet website at: http://wdfw.wa.gov/hunting/game_species/bear_cougar/index.html

Black Bear Legislation

Two bills involving bears were introduced to the 61st Legislature in the 2009 Legislative session. House Bill 1885 (HB1885) was an act related to feeding wildlife. Section 1 of HB1885 stated "It is the intent of the legislature to protect wildlife from becoming habituated to humans and to protect the public against the serious health and safety risk posed by wildlife who are drawn into contact with humans and related infrastructure by individuals who intentionally feed wildlife". The Bill survived the first reading and the House Committee on Agriculture & Natural Resources sent the Bill to the Rules Committee but it failed to be placed on the floor for a second reading. House Bill 1885 was co-sponsored by WDFW.

The second Bill involving bear was House Bill 1778 (HB1778). Section 53 of the Bill stated "the legislature finds that interactions between humans and wildlife can have significant financial impacts on the affected landowner. Although the resulting wildlife damage is felt most closely by the landowner, the general public, as beneficiaries and stewards of healthy wildlife populations, should bear some responsibility, as outlined in and limited by this act, for providing a measure of restitution to the impacted landowner, provided that the landowner has exhausted all legal, practicable self-help methods available to prevent wildlife damage from occurring. The legislature further finds that the commercial agriculture, horticulture, and livestock industries are important components of the state economy that can be negatively impacted by interactions with wildlife. However, the legislature also finds that other landowners, both commercial and residential, may be faced with wildlife interactions that result in property damage. It is the intent of the legislature to craft a solution whereby all property owners have a potential avenue to petition the state for some mitigation of the damages caused by wildlife". The Bill passed the Senate 31 to 17 and passed the House 63 to 35 and was delivered to Governor Christine Gregoire. With some modification, she signed it and the Bill became effective 26 July 2009. Under this Bill, WDFW shall pay claims to the owner of commercial crops for damage caused by bear, deer or elk or to the owners of commercial livestock that have been killed (or injured to such a degree that the market value of the commercial livestock has been diminished). The fund from which payments are dispersed is capped at $120,000 annually. Readers interested in learning more about these bills can visit the Washington State Legislature's internet homepage at http://apps.leg.wa.gov/billinfo/

Black Bear Management Plan

The Department completed the 2009-2015 Game Management Plan for all game species including bear. Public input was solicited on the draft supplemental environmental impact

statement (SEIS), which included updates to the 2003 management plan. Public comments on the draft were used to prepare a final SEIS and the WDFW Commission approved the document in 2009 for the 9 black bear management units (BBMU's) in Washington (Figure 1). The document is available online at http://wdfw.wa.gov/wlm/game/management/2009-2015/index.htm

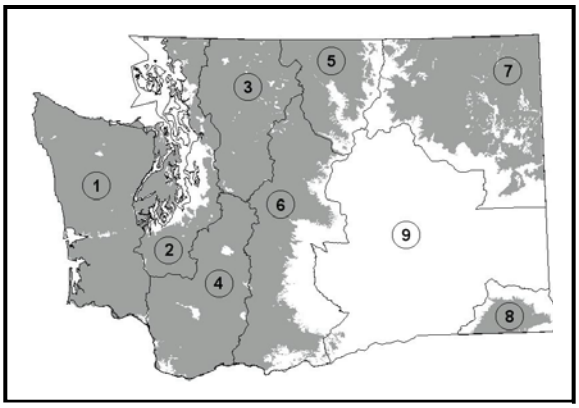

Figure 1. Black bear distribution (in gray) and 7 black bear management units in Washington, WDFW, 2009

Black Bear Mortality Data Collection

Recently, WDFW revisited data collection protocols as they relate to bear and cougar mortalities in Washington and standardized data collection methods. We revised a bear-cougar mortality envelope that incorporates these techniques, eases the burden on field-staff time, and insures a timely transfer of information. On one side, the envelope is self-addressed, labeled with handling instructions, and pre-paid for postage; on the other side is a modified datasheet where many data items are collected (Figure 2). Unlike a mandatory cougar sealing requirement, there are no physical mandatory sealing requirements for bear. However, successful hunters must provide kill statistics and the first upper premolar of their bear kill for ageing via a tooth envelope provided by WDFW. The envelope is delivered to a central location where the data is recorded electronically and the samples are prepared for lab analysis.

Black Bear License Plate

Adopted by the 2005 Washington State Legislature and signed into law by Governor Christine Gregoire, 5 wildlife-themed license plates are available to Washington residents and feature 3 game animals (black bear, elk, and mule deer) and 2 non-game animals (bald eagle and killer whale) images. Since that time 17,200 total plates have been sold; 6,400 are game plates (1,700 bear) and 10,800 are non-game plates. Wildlife-themed backgrounds are available for an additional cost ($40 new, $30

BC0005000

THIS ENVELOPE FOR BEAR AND COUGAR ONLY

Species (circle) Bear Cougar **Seal #** _____ **Transport tag #** _____

Kill Type: General Hunt Special Permit Hunt Depredation Landowner Poached Roadkill Other _____

Wild ID (required): _____ **Date of Kill (MM/DD/YY):** _____/_____/_____

Hunter's Name (Last, First): _____

Weapon Type (circle): Modern Firearm Archery Muzzleloader **Dogs used?** Yes No

GMU (number) of Kill: _____ **County of Kill:** _____

Location of Kill: (please be specific) _____

Sex of Kill (circle): Male Female **If female, was she lactating?** Yes No **Body Condition Score (see guide)** ___

Age Class of Kill (see age guide, circle): Cub / kitten Sub-Adult Adult

Premolar tooth collected? Yes No **Tissue sample collected?** Yes No **Vial Number:** _____

Did animal have an ear tag (or a hole in the ear)? Yes No **Tag Number:** _____ **Tag Color:** _____

Did animal have a radio-collar? (or "wear" marks)? Yes No **Frequency:** _____

Officer / Biologist: _____ **Seal / Check Date (MM/DD/YY):** _____/_____/_____

Graphic shows the location of the first premolar tooth to collect for bear and cougar reporting.

Graphic of the self-addressed, stamped envelope used to collect mortality data and tooth sample for bears killed in Washington, WDFW, 2009.

subsequent renewal) plus fees. As of May 2009, approximately $516,000 was generated annually from these plates and is used for habitat improvements, population monitoring, population restoration and expansion, public access opportunities, and education.

Figure 3. One of 5 wildlife-themed license plates available in Washington featuring a black bear, Washington Department of Fish and Wildlife, 2009.

2009 IDAHO BLACK BEAR STATUS REPORT AND REVIEW OF AGE CRITERIA FOR DETERMINING POPULATION TRENDS

STEVE NADEAU, Idaho Department of Fish and Game, Boise, ID 83707

Abstract: Black bears in Idaho were classified as a big game animal in 1943, with intensity of harvest and regulations varying annually. Bears are distributed widely throughout the coniferous forests of northern and eastern Idaho. The reported harvest of bears was 2,157 during 2008, a decline of 519 from the previous year but may be partly due to incomplete harvest reporting at the time of this analysis. During 2008, 34,404 bear tags were sold, a slight decline in sales. A recent survey of bear tag holders indicated that only 40% of the tag holders actually hunted bears, of those 20% successfully harvested a bear. Bear harvest peaked in 1992, and annually averages about 2,400 over the last 6 years as a result of reduced bear tag prices and 2 bear bag limits in some big game units, longer seasons statewide, and the ability to use a nonresident deer tag for a bear or lion. Bears were monitored using a combination of harvest data, trend surveys, and mark-recapture techniques.

Idaho harvest data were analyzed using criteria established in the 1999 Idaho black bear management plan. These criteria were tested to see if differences and changes in harvest criteria could be ascertained from various management objectives and thus various levels of harvest. Five Data Analysis Units (DAUs) comprised of one or multiple Game Management Units were used to compare and contrast the criteria among general hunt DAUs with increasing, stable, and decreasing populations, a wilderness unit, and a controlled hunt DAU with limited entry. Proportion and numbers of adult males seem to reflect the harvest levels and population trends better than percent female or median age of the harvest. Percent female may have been more representative of the method of take than of actual changes in the population, with percent female being lowest among bears harvested using bait hunting. However, as harvest levels increase within a DAU, percent female tends to increase as well. Understanding the difference between method of take and population status, as well as understanding a variety of other variables along a time continuum are necessary to interpret these results. Measurements of criteria for a single year are not as valuable as pooling data over several years. Black bear populations in Idaho do not seem to change rapidly in response to changing harvest levels

Western Black Bear Workshop 10:11-19

Introduction

Black bears were classified as a big game animal in 1943, with a bag limit of 1 per year. Starting in 1973, resident hunters were required to have a tag in their possession while hunting black bears in those Game Management Units (GMUs) that had summer hunting closures. Resident bear hunters in much of southern Idaho, where seasons remained open to year-round hunting, did not need a tag. Year-round hunting seasons and 2- bear bag limits were eliminated in 1986. The bear harvest peaked in 1992 with 2,800 bears harvested. In 1993, bear season were made more restrictive throughout most of the state, reducing season lengths to protect females. Since 1998, bear seasons in Idaho have become more lenient once again; with 2- bear bag limits imposed in 9 GMUs, and lengthened seasons allowed throughout most of the state.

Distribution and Abundance

Black bear distribution has not changed significantly in the last 30 years. Black bears are distributed within the forested areas of the state, ranging from the Canadian border south to the Snake River Plain. Nearly two thirds of the state is federally owned, with most of the north and central parts of the state managed by the U.S. Forest Service. Most of these federally managed lands are high-density bear habitat.

Habitat conditions range from very wet, maritime influenced conditions in the "Panhandle" area (where bear densities are highest); to the heavily timbered more continental climate of the north interior and central Idaho wilderness areas; southward to the ponderosa pine sagebrush ecotone north and east of Boise (where bear densities are lower). Near Yellowstone National Park in eastern Idaho, bear densities are moderate. The central and southern parts of the state are mostly desert or agricultural and do not provide quality bear habitat (Figure 1).

Population Monitoring

In 1972, research was initiated examining population densities in 6 different areas of the state (Beecham and Rohlman 1994). Mark-recapture estimates were made at that time, and based on habitat quality and quantity the density estimates were extrapolated within occupied black bear habitat in Idaho. A population of 20,000 black bears estimated for Idaho in the late 1970's is still used today.

Currently, population monitoring consists of a variety of techniques. In the Panhandle and McCall regions of the state, density estimates have been derived through mark-recapture trapping efforts. In other parts of the state, tetracycline-laced baits were used to mark bear's teeth; recapture occurred when bears were harvested and a premolar was removed to identify if it had been marked. Southwest Idaho managers have been experimenting with DNA collection grids (hair snares). In all parts of the state, harvested bears were required to be checked, all pertinent management information obtained, a tooth pulled for aging, and the pelt marked with an identification tag. The teeth were aged and subsequent harvest demographics were modeled. Each management area had established criteria for percent males $\geq$ 5 years of age.

Management Plan

The current management plan was finalized and implemented for 1999-2010 (IDFG 1999). The following goals were outlined in the plan:

1) Distribute recreational opportunity throughout black bear habitat in a manner that is consistent with population objectives for each Data Analysis Unit (DAU).
2) Improve harvest information by improving compliance with the mandatory check and report program and by implementing a survey to generate information on hunter numbers, hunter success rates, and hunter effort. Improve compliance level with the mandatory check program.
3) Use an adaptive management approach in developing harvest goals and objectives in select DAU's as a means to further evaluate management criteria.
4) Monitor the black bear population response to changes in season framework using our biological criteria and take steps to increase or reduce harvest when data indicate the opportunity or need.
5) Manage black bears to reduce conflicts among competing user groups.
6) Consider initiating research to:
    a. Develop a long-term population monitoring technique,
    b. Establish the link between harvest criteria and characteristics of the standing population by determining age- and sex-specific vulnerability to different harvest techniques,
    c. Determine black bear mortality patterns and reproductive potential
7) Work with the Idaho Outfitters and Guides Board to set outfitter quotas in DAUs where a harvest reduction is needed.

Hunting Laws and Regulations

A non-resident hunting license costs $141.50; regular bear tag costs $151.75; a reduced bear tag costs $31.75; and a second tag costs $31.75. The reduced and second tags are only good in certain GMUs. Also, a nonresident deer tag ($258.50) can be used for a bear or mountain lion in those GMUs that both a deer season and a bear or mountain lion season are open. Hound hunter permits costs $101.75, and bear baiting permit $12.75.

A resident hunting license costs $12.75, a bear tag costs $11.50, and hound and baiting permits cost 12.75. Resident bear tag is also included in the sportsman package.

Bear harvest varies in intensity in different parts of the state, with the highest harvest in the northern parts of the state (Figure 1). Spring hunting is allowed with seasons starting in April and typically ending in May or June, depending on the unit. Fall seasons usually start in August and run until the end of October or into November, again depending on the unit and density of bears. Hound hunting is allowed, but permits are required. Resident permits are unlimited, but nonresident hound permits are limited. In 2008, the state sold 2,844 resident and 121 nonresident hound permits. Baiting is also allowed, but requires a permit; in 2008, 2,061 baiting permits were sold. In general, hound permits are declining and baiting permits are increasing. There is a bag limit of 1 bear per year in most of Idaho; however, in 9 GMUs, a 2 bear bag limit is allowed.

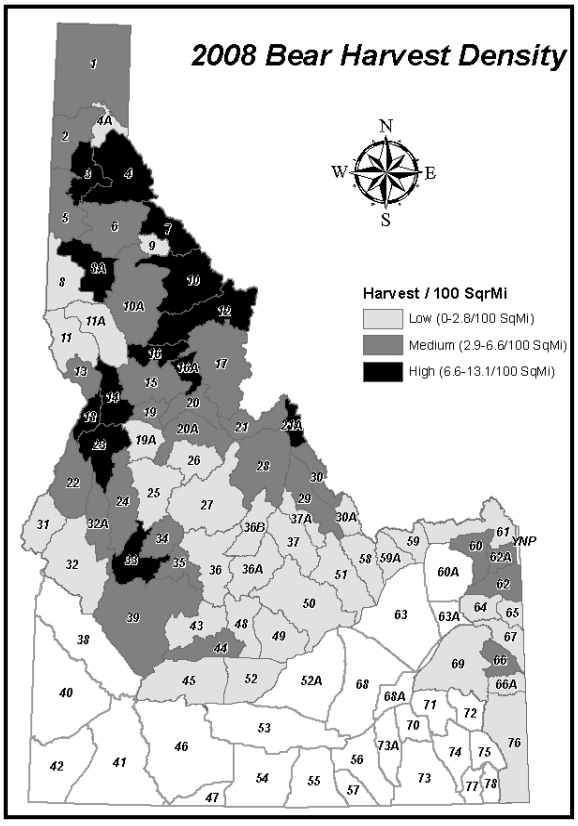

Figure 1. Relative black bear harvest densities by GMU in Idaho. Harvest densities were estimated using harvest levels per square mile. Harvest reflects habitat within ecoregions, bear densities, regulations, and hunter effort.

Harvest Summary and Criteria

Harvest data have been collected on all bears harvested since 1983 when mandatory reporting was implemented. The bear hide and skull must be brought to an official Fish and Game check point, and all pertinent data are recorded, a premolar tooth is extracted for aging, and a pelt tag is placed on the hide. A telephone survey for bear hunters was conducted in 2004.

Legal methods of take include hound hunting and baiting. Spring seasons can run from April 1 – June 30, and fall seasons can run from August 30 – November 18. The season length and bag limit vary by unit. In 9 GMUs, mostly in north central Idaho, a 2 bear bag limit is allowed. The average harvest from 2002-2007 was 2434 bears, a 31% increase from the previous 4 year average (Figure 2). An average of 34,665 black bear tags were sold each year over the last 4 years.

The random telephone survey of bear tag holders conducted recently indicated that only 40% of tag holders actively hunted bears, and of those, 20% harvested a bear. Those hunters spent 109,497 days hunting bears, and averaged 8.3 days per hunter and 41.4 days per bear harvested.

Harvest Criteria Analysis

The 1999 Idaho Black Bear Management Plan (IDFG 1999) stated:

> "No economically feasible methods are available to monitor the abundance of black bears in Idaho. As a result, Department biologists have relied on a variety of indirect measures of harvest data to assess population trends. Management decisions are based upon harvest data collected through the mandatory check and report program. Although population trends are difficult to ascertain from harvest data, it is the only information available to biologists that can be collected in a systematic manner designed to minimize confounding variables such as hunter numbers, hunter effort, and season structure and length. When these variables are standardized or at least

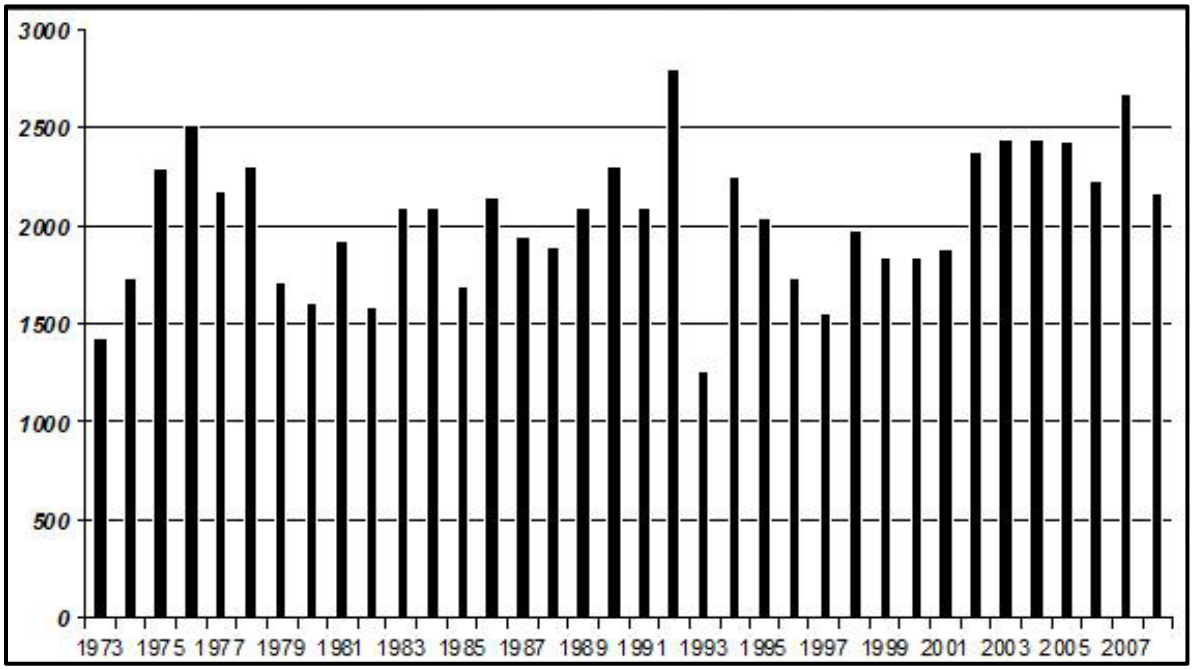

Figure 2. Black bear harvest trends in Idaho from 1973 through 2008.

measured, harvest trends may have value in determining the effects of management actions.

During the 1992-2000 planning period, the Department used the percent females in the harvest, median age of harvested females and males, and, in limited areas, bait station survey results to monitor population trends (IDFG 1992). Specific criteria were established to indicate over-harvest and a desired level of harvest. These monitoring criteria were similar to many western states.

Further analysis of our harvest data suggested that median age may have been a useful tool to distinguish lightly hunted or unhunted populations from those that were hunted at moderate to heavy levels. However, median age did not appear to be very sensitive to population changes on a year-to-year basis to determine trend within a DAU. As a result, the Department eliminated median age as a harvest criterion and began monitoring the percent of males ≥5 years old in the harvest on a 3-5 year running average in 1999. This indicator appeared to be a more sensitive measure of population harvest levels and was supported by data collected by the Department during 12 years of research on black bear ecology (Beecham and Rohlman 1994). The Department's bear team also recommended that the minimum threshold for adult males ≥5 years old in the harvest should not drop below 20% on a 3-year running average.

The Department implemented a 3-tiered set of criteria to evaluate population trend in various DAUs (Table 2). The Department also monitored trends in percent females in the harvest, calculated on a 3-5-year running average depending on changes in regulations that might affect harvest rates.

We also recognize that certain areas in Idaho provide extensive secure habitat (reservoirs) for black bears. Unroaded and/or wilderness areas are prime examples. Hunting pressure is light in these core areas, resulting in relatively high percent males ≥5 years

old and low percent females in the harvest. Because population turnover is low there is little vacant habitat and young black bears, especially males, are forced to disperse into surrounding less secure habitats where harvest rates are often high. These young dispersing males often dominate the harvest statistics in the surrounding areas. Age criteria for the DAU may be violated in these areas, even though the core or reservoir population is secure and will continue to supply a surplus of dispersing black bears (IDFG 1999). Current harvest criteria may not apply in these situations. In such cases, results were based on the discretion and interpretation of a variety of factors including perceived black bear population status, social considerations, and other factors (i.e., weather patterns, changing road access, etc)."

Impacts on harvest criteria vary across the state depending on levels of harvest, baseline bear population, harvest methods, and harvest objectives. Hence, for this analysis, 5 clearly different DAU management goals and conditions were used to illustrate differences in harvest levels and age composition. Determining population changes based on harvest data and criteria has been historically difficult (Caughley 1974, Harris 1984, Miller and Miller 1988). On the other hand, various harvest levels, harvest trends, and age and sex data have been used successfully to determine status of cougar populations in Wyoming (Anderson and Lindzey, 2005). These analyses reflect a similar attempt to illuminate population changes in bears in Idaho. The Department evaluated the usefulness of these criteria in describing changes in harvest criteria that potentially reflect the status of populations during this planning cycle

Lolo DAU (GMU 10,12)

The first DAU analyzed was a bear population in northern Idaho where extensive research on bears, wolves, cougars, and elk over several decades indicated that bears and cougars were heavy predators of neonate elk calves (Zager and White 2003). Bear densities were considered high based on research conducted in the 1970's (Beecham and Rohlman 1994). The area has few roads, is remote, mountainous, and heavily forested, making harvest at times difficult. The Department set an objective to reduce this population through increased harvest in 1999. Harvest regulations were changed by decreasing tag price, allowing 2 bear bag limits, increasing outfitter harvest, allowing nonresidents to use a deer tag to take a bear, and increasing season length. Additionally, baiting and hound hunting were increasingly encouraged. As a result, the bear harvest more than doubled over a period of 2-3 years going from 120 bears per year to over 300. The harvest criteria showed that increased harvest was reflected in the population criteria, and that the population criteria could be indicative of a population decline (Figure 2).

Percent adult males in the harvest initially increased along with initial doubling of harvest from 1997 through the 1998-2002 period. However, as harvest remained high and even increased further during the 2003-2007 period, percent adult males and actual number of adult males began to decline. The percent adult males as a proportion of the total harvest was not significantly different between the 1994-97 period (n=461, 0.26 + 0.04) and the 1998-02 period (n=1,290, 0.30 + 0.03), but was significantly different between both of those

Table 2. Harvest criteria and descriptors for black bears in Idaho.

Criteria	Light Harvest	Moderate Harvest	Heavy Harvest
Percent Females	<30%	30-40%	>40%
Percent Males ≥5	>35%	25-35%	<25%
Bait Station Survey	Increasing	Stable	Decreasing

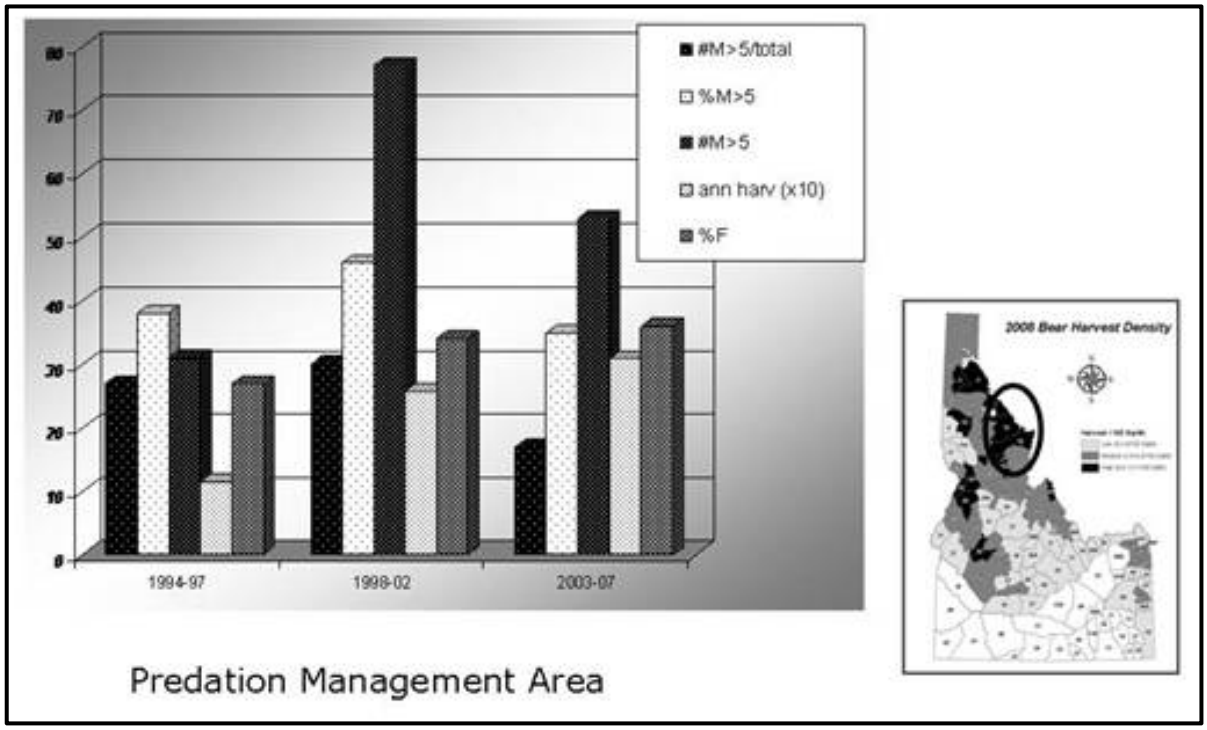

Figure 2. The Lolo DAU high harvest objectives and resultant criterion results from 1994 – 2007. Number of males ≥5 years divided by total harvest, percent males ≥5 years, total number of males ≥5 years, annual harvest (x10), and percent females, Idaho Department of Fish and Game.

periods and the 2003-07 period (n=1,543, 0.17 + 0.02, P< 0.05). This inflection and change in percent adult males and number of adult males having declined along with increased harvest suggests declining populations. Continued increase in percent females in the harvest further suggests decreasing populations. There was a significant difference in the percent female from the 1994-97 period (0.27 + 0.03, P < 0.10), and both of the other periods, but not from the 1998-02 (0.34 + 0.02) and 2003-07 period (0.36 + 0.02, P > 0.10) although the trend was upward. However, taking a snapshot of the demographics of the population in 2007 suggests that the population was still relatively high despite the age structure changing and did not decline to levels wanted in the objectives for high harvest. Part of the dilemma may be due to the proximity to lightly hunted bear populations to the north in Idaho and to the east in Montana, and to the south in the Idaho Wilderness providing continued immigration. Changes in population density were not determined using independent techniques, however bait station surveys conducted during the same period may also

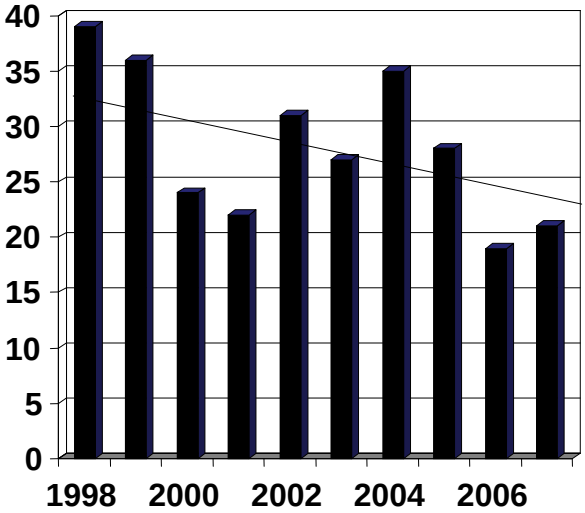

Figure 3. Lolo DAU bear bait stations visited by bears (hits) as a percentage of total stations placed, an average of 292 stations per year, Idaho Department of Fish and Game.

reflect declining populations (Figure 3).

Dworshak DAU (GMU 10A)

The second example is a DAU west of the Lolo DAU. This area is highly roaded, comprised of timber company lands and other private lands, has high hunter densities, and lower bear populations. Trapping and other survey techniques suggest populations significantly lower than in the Lolo DAU (Beecham and Rohlman 1994). However, harvest remained relatively stable from year to year resulting in 130-150 bears being harvested annually (Figure 4).

Harvest criteria indicated percent adult males and number of adult males in the harvest were relatively stable and not significantly different ($P > 0.40$) despite minor increases in harvest. Percent females in the harvest remained high at 40% and were not significantly different between periods ($P > 0.1$). This DAU does not allow baiting. Hunting over bait tends to provide more selectivity to avoid females and smaller bears.

Wood River DAU (GMUs 44, 45, 48, 49)

This DAU is in south central Idaho and is comprised of sagebrush open slopes on southerly aspects and forested northern aspects. This is not considered the highest quality bear habitat in Idaho and bear hunting is not a preferred sport in this area. Harvest levels are light; averaging 35-50 bears annually (Figure 5). Number of adult males increased along with overall harvest and percent adult males in the harvest also increased with annual harvest. Percent females in the harvest remained stable and low. Due to the low sample size the difference was not significant; however the trends show that percent adult males are increasing along with increasing harvest.

Trophy harvest DAU (GMUs 22, 31, 32, 32A)

Managers in this DAU provided a trophy bear hunt opportunity through limited entry (controlled/lottery hunt drawing) and allowed only spot-and-stalk hunting. Baiting and hound hunting were not permitted. This habitat provided old abandoned homestead fruit trees and vines, open slopes and timbered draws. Controlled hunt permits increased from 30 to 50 in 2000 for each season (spring and fall), and from 50 to 75 each season in 2003 that resulted in increased harvest through that period. Annual harvest averaged 64 during the first period and 86 during the second (Figure 6).

The number of adult males as a percentage of the total harvest declined slightly, and the actual number of adult males increased with increased harvest, and percent adult males remained proportional. This would indicate a stable population. Percent females increased slightly which would indicate a declining population. Conflicting data might suggest variability in populations due to bear vulnerability depending on food availability between years, increasing numbers of young animals in parts of the DAU, and other incidental issues such as higher fall harvest being less selective of sex. The changes are not significant ($P > 0.10$) and the population appears to be relatively stable.

Wilderness DAU (GMUs 16A, 17, 19, 20)

The Selway-Bitterroot Wilderness is part of the largest wilderness area in the lower 48 states. Access is very limited and seasonal. There is high quality bear habitat in this DAU with many varieties of berries and forbs, lush cedar groves as well as Ponderosa pine savannas with a frequent fire history. Elk populations have declined in the area in recent years and managers increased harvest on bears, a primary predator of elk calves in this area. Baiting and hound hunting was permitted though hounds were infrequently used due to the remoteness and difficulty of retrieving hounds. Baiting however has become very popular in the last few years and outfitters have been encouraged to increase their harvest of black bears. Harvest has doubled from 80 to 160 bears annually, largely due to regulation changes and increased take by outfitters (Figure 7).

Difficult access and remote conditions tends to keep many hunters away. However, harvest more than doubled between the 2 periods in response to intensified efforts to reduce bear populations. Even so, harvest is half what it is in the Lolo zone adjacent to it to the north. Percent adult males in the male harvest remained high (>50%). The number of males increased proportionally to the overall harvest and the

percent of adult males in relation to the total harvest remained static, all signs of an increasing harvest but stable and large population where annual mortality is still below annual reproductive output. This DAU is likely still acting as a source population despite increased harvest levels. Evidently the surplus is still greater than the harvest.

Discussion

The 1998-2010 black bear plan called for experimenting with various harvest levels and monitoring harvest criteria to determine changes in populations. This paper compared areas with high, moderate, low, and controlled hunt (low) harvest levels to determine variability in criteria across various harvest regimes. The 1999 bear plan identified adult males as the primary criteria for measuring changes in the population. This study indicated that several criteria needed to be monitored simultaneously and interpreted along a time continuum to determine trend. Snapshot data do not show population status as clearly as do changes in criteria data over time.

Percent adult males (>5 yrs) fluctuated based on relative harvest level and resultant age structure of the harvest and thus population. The higher the percent adult males in the population, the older the population was. However, the population could actually be denser with a younger age structure, indicative of a growing population, not a declining one. Therefore, if the percent adult males increased or decreased as a percent of total harvest or as a percent of the males harvested, and the total number of adult males increased or decreased proportionally, then the relationship positively reflects the relative harvest levels that are likely indicative of the changing demographics in the population.

Percent female in the harvest was more problematic. Most hunters cannot identify a female unless accompanied by young. Females, particularly with young, have smaller home ranges and typically are not as vulnerable as males except possibly during the fall (IDFG unpubl. data). Older males are considered most vulnerable because they are bolder and have greater home ranges, but younger males occupy a larger percentage of the population, are at the age of dispersal, and also are very vulnerable (Beecham and Rohlman 1994). The percent females in the harvest appeared to be reflective of harvest technique as much as harvest levels when comparing between DAUs, though within a DAU differences in percent female between years was likely reflective of a harvest or population change if there was trend in data not just annual fluctuation. Initially high female harvest levels (>40%) within a DAU are typically indicative of nonselective harvest such as incidental harvest, particularly in the fall, and lower female levels indicative of general harvest that includes bait hunting. Statewide, hunting over bait produced the lowest percentage of females in the harvest of any technique (33%). However, under any harvest regime within a DAU, percent females should be monitored so if the percentage changes over time, either increasing or decreasing, the data may be indicative of an inverse relationship to the population trend. As percent females in the harvest increases, the population is likely declining. All these variables should be analyzed collectively and in blocks of time reflective of regulation changes, changes in food availability, or major changes in harvest to determine significant trends. Bear populations are extremely robust in Idaho and habitat is mostly contiguous providing opportunity for high dispersal rates to fill in vacancies. Consequently, high harvest levels need to be maintained for many years to impact populations enough to determine changes in the harvest age structure representing a population change.

Management Implications

Managers are often left with few tools for monitoring populations that are cost effective, provide accurate measurements of population size or trends, and can be obtained at various levels across the landscape. Managers typically are asked how many bears are in a particular unit, DAU, or state. The numbers are weak estimates based on intensive research conducted years ago in small study areas, often extrapolated over large areas of somewhat similar habitat. These are wrought with potential errors and assumptions, and need to be continually updated to determine trends. Therefore, the more important question for managers may be how the population is

changing and is it impacting viability or various other objectives set for the area.

Harvest data continue to be the most widespread and easily obtained data available to managers today. These data suggest that sex and age data are a useful tool in determining trends in harvest and in populations, particularly the more sensitive measurement of percent and number of adult males in the population. Managers need to be careful when interpreting the data to understand the different influences of harvest techniques and harvest levels on the composition of the harvest.

It is critical to look at harvest levels across the landscapes being managed, as well as at statewide levels and by management units, to assist in interpreting data. Connectivity and intensity of harvest in adjacent units will assist in interpreting age and sex data in the unit of concern. The use of percent and number of adult males in the harvest provide a more sensitive measure of population changes than do other harvest data previously used in Idaho.

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ALASKA BLACK AND BROWN BEAR STATUS REPORT

Neil Barten, Alaska Department of Fish and Game, P.O. Box 110024, Juneau, AK 99811-0024, USA

Western Black Bear Workshop 10:20-22

Outline

Distribution of black and brown bears

Bear management-consumptive/non-consumptive

- Viewing areas
- Hunter harvest
- Predator control

Bear-human interactions

Research methods for understanding bears and bear populations

Black and Brown Bear Populations

Populations are secure in large areas

Both species occupy historic range, (including large cities)

Difficult access to bear habitat-large areas face little hunting pressure

National Parks – (No hunting)

Viewing and hunting

Throughout Alaska, people are able to view bears in areas where hunting is also a valued use of this resource.

Predator reduction programs

Programs implemented for black and brown bear in limited areas to reduce predation on moose calves.

Bear/human interactions

Urban areas

Landfills, residential areas

Both brown and black bears are common on the outskirts an even within many small communities and some of the largest cities in Alaska.

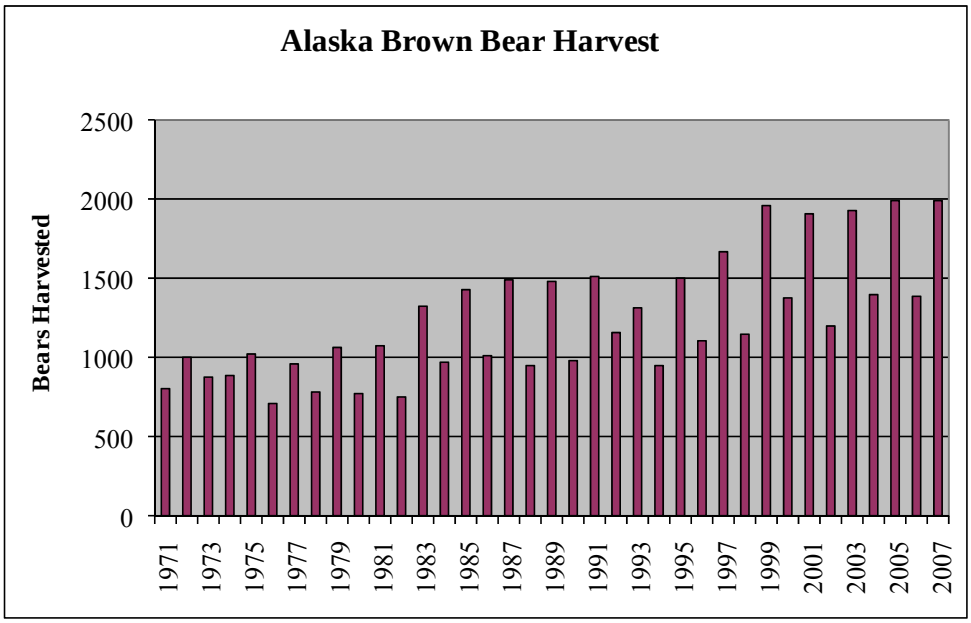
Rural areas

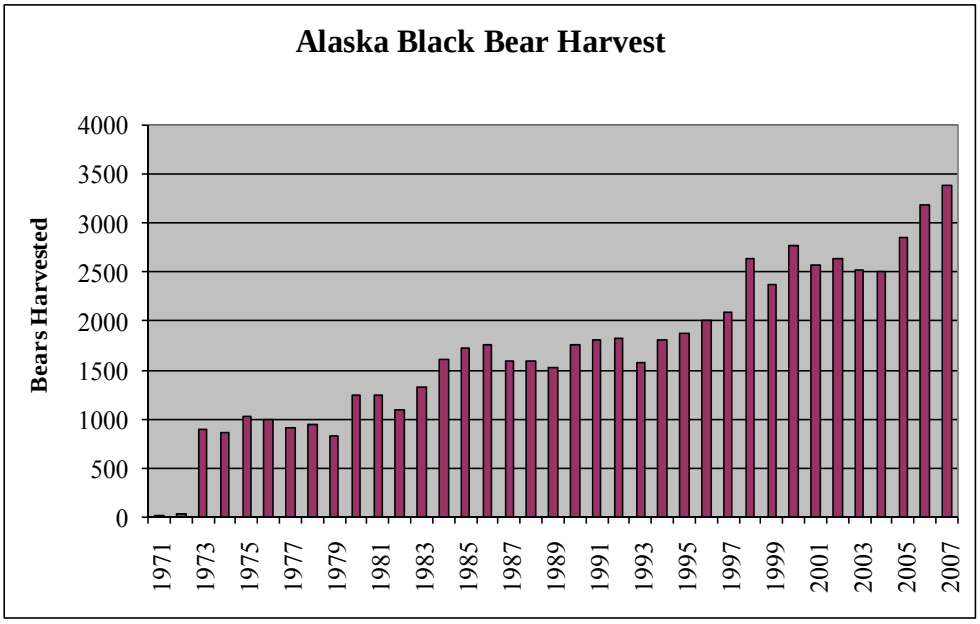
Remote cabins, fish camps

Often the presence of bears in close proximity with people leads to human bear conflicts.

Alaska Department of Fish and Game biologists spend enormous amounts of time dealing with this issue.

Brown and Black Bear Harvest across Alaska 1971-2007



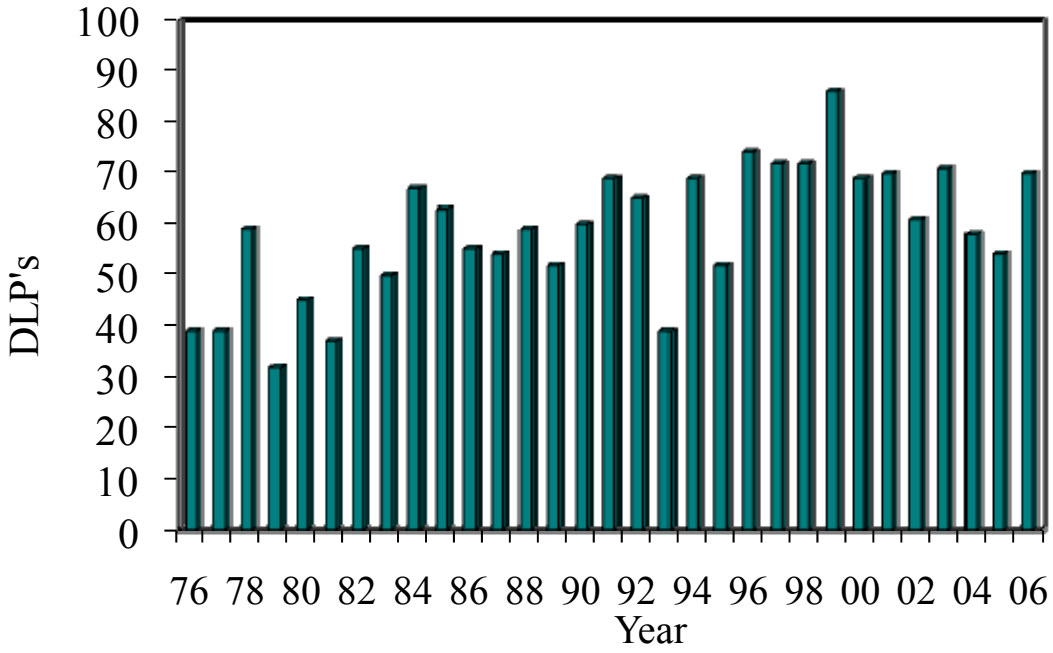


Nonhunting/Viewing Management

Some areas are closed to hunting of bears
National Parks (large areas- 35 million hectares)
Specific Viewing areas (small areas)
- *McNeil River (old)*
- *Pack Creek (old)*
- *Brooks Camp (old)*
- *Kodiak Island (new)*

Wolverine Creek (new)

DLP – Defense of Life or Property kills in Alaska (1976-2006)



Conclusions

Healthy bear populations statewide
Significant intact habitat
Small and large areas with no hunting
Salmon = bears, in coastal areas
Predator-prey ecosystems intact
Important trophy hunting species in many areas
Important subsistence food source in some areas
Concern for "too many" bears in some areas resulting in predator control efforts targeting brown and black bears

ALBERTA BLACK BEAR STATUS REPORT

NATHAN WEBB, Provincial Carnivore Specialist, Wildlife Management Branch, 2nd Floor, Great West Life Building, 9920 108 Street, Edmonton, Alberta T5K

Western Black Bear Workshop 10:23

Abstract: An estimated 40,000 black bears occur over 488,000 km^2 of Alberta, including about 36,500 bears on provincial lands. Population densities are greatest in the mixed-wood boreal forest of northern Alberta and agricultural fringe areas in western, north-central, and eastern Alberta. Black bears have been hunted under unrestricted spring and fall seasons since 1953. Black bears may be hunted with bait during the spring season and only in Bear Management Areas (BMAs) without resident populations of grizzly bears. Hunting with hounds is not allowed. Hunters have the option of purchasing a second tag that may be used in BMAs with higher black bear populations in the agricultural fringe and boreal forest. A total of 23,884 licenses were purchased in 2007. Annual harvests of black bears increased from an estimated 250-400 during the late 1960s to 2,000-2,700 during the mid to late 1980s, and then declined during the early 1990s. An estimated 1790 bears were harvested in 2007. During the 2007 season, success rates in individual BMAs ranged up to 35%. Public complaints regarding black bears have increased from an average of 1,312 complaints/year during the 1980s to 1,992 complaints/year from 2000-2008. General nuisance activity (45%), problematic sightings (37%), and damage to human facilities (8%) are the most common types of complaints.

WYOMING BLACK BEAR STATUS REPORT

DAN BJORNLIE, Trophy Game Biologist, 260 Buena Vista, Lander, Wyoming, USA.
DAVID S. MOODY, Trophy Game Section Coordinator, 260 Buena Vista, Lander, Wyoming, USA.

Western Black Bear Workshop 10:24-31

Black Bear Classification

Prior to 1911, black bears (*Ursus americanus*) and grizzly bears (*Ursus arctos*) were classified as predators throughout Wyoming, meaning they could be taken at anytime, anywhere, and by any means. From 1911 to 1938, both species were classified as game animals on most of the national forests within the state, including the Black Hills, and were classified as predators throughout the remainder of the state. During this time, the majority of bear hunting seasons statewide coincided with those of big game species. In 1938, the first spring seasons were set for most of the state and, the following year, bears were classified as game animals statewide. Game animal classification allowed for the protection of cubs and females with cubs at side, additionally, bears could not be trapped or hunted with dogs without the approval of the local game warden. This lasted until 1957, when bears were once again given predator status in some parts of the state and game animal status in the remainder of the state. In 1967, bears were reclassified as big game animals statewide. In 1968, black bears and grizzly bears were separated and managed as distinct species in order to protect the declining grizzly bear population. Then, in 1976, black bears were given their current status of trophy game animals, which committed the Wyoming Game and Fish Department (WGFD) to reimburse landowners for livestock losses.

Distribution and Abundance

Black bears occupy most of the major mountain ranges within Wyoming, including the Absaroka, Teton, Wyoming, Wind River, Bighorn, Laramie, Sierra Madre, Snowy, and Uinta ranges. They do not inhabit the Black Hills of northeast Wyoming, although their historic range included this area. The 9 occupied mountain ranges comprise approximately 112,000 km2 of suitable black bear habitat and are composed of 4 distinct black bear populations that are geographically isolated from each other by high elevation grasslands and sagebrush dominated deserts. The largest population occurs in the northwest corner of the state, including Yellowstone National Park, and is contiguous with bear populations in Idaho and Montana. The second largest population occurs in the Bighorn Mountains of north central Wyoming. This population primarily resides within the state and only extends into Montana for a short distance. The third population, extending northeast from the south central region of the state, is contiguous to large tracts of black bear habitat in Colorado. Nonetheless, studies conducted in the Snowy Range Mountains indicate that this area exhibits relatively low bear densities compared to densities observed in other portions of the western United States (Grogan 1997). The fourth population exists in the southwest corner of the state and has the smallest distribution and lowest densities of bears found in Wyoming. This region is a small extension of the Uinta Mountains that originates in Utah. Currently, there are few reliable estimates of bear abundance in Wyoming, but all populations are believed to be stable.

Management Plan

In 1993, the WGFD formed a committee to develop a statewide management plan for black bears. This plan was finalized in 1994 and, soon after, new regulations for the management of black bears were in place. Three main objectives were set forth to guide bear management in the state of Wyoming: 1) strive to keep harvest within the desired criteria; 2)

provide a harvest of 200 – 275 bears annually; and 3) provide maximum hunting opportunity while maintaining stable bear populations. It became increasingly difficult to maintain our third objective due to early season closures as female quotas filled. It is difficult to determine if early season closures were the result of an increase in bear populations statewide, if current environmental conditions (i.e., drought) are affecting the bears' susceptibility to hunting, or if hunter selectivity has been altered due to the female mortality quota system (hunters taking the first bear they see).

In 2007 WGFD completed a rewrite of the statewide black bear management plan. New harvest criteria were developed to better assess long-term trends and objectives of the black bear populations in the state. These criteria provide regional managers the ability to choose objectives for population increase, decrease, or stability. Additionally, annual female quotas are now set for three-year cycles in an attempt to better evaluate the impacts of quota levels on the population and harvest trends. This cycle will also help to mitigate the effects of variation in closing dates due to filling the quota due to annual fluctuations in environmental conditions such as early snow melt or drought conditions. The Wyoming Black Bear Management Plan is available on the Wyoming Game & Fish Department's internet website at http://gf.state.wy.us/downloads/pdf/BlackBearMgtPlan-Final.pdf

Population Monitoring

In 1979, Wyoming was divided into 31 black bear hunt areas that closely corresponded with elk hunt areas, but, in 1993, this system was reorganized into 29 hunt areas that more closely resembled known bear distribution. With the completion of Wyoming's black bear management plan in the spring of 1994, the 29 hunt areas were grouped together into 9 bear management units (BMU). Each BMU contains hunt areas with distinct bear populations that are specific to the 9 mountain ranges that occur in the state (Figure 1). Management of black bears is based on harvest within each BMU, not individual hunt areas.

Relatively few changes have occurred with the BMU system of management since 1994 other than a few minor hunt area boundary changes, the addition of 4 new hunt areas, and the opening of 1 BMU that had previously been closed. BMU 402 (Uintas) was opened to the hunting of black bears beginning in 2001. In 2002, hunt area 31 was added to the Wind River BMU, which includes all non-Indian owned fee title lands within the exterior boundaries of the Wind River Indian Reservation. Hunt area 32 was created in 2003. This unit includes primarily privately owned lands in the basin between the Bighorn and the Absaroka Mountains. It allows for limited public take in an attempt to reduce the number of damage situations and human/bear conflicts. In 2008, hunt area 33 was created to address damage issues in the Casper area and hunt area 7 was extended southward to provide hunting opportunity west of Cheyenne (Figure 1).

Information collected from harvested bears is the only source of data presently used to monitor black bear populations in Wyoming. A mandatory reporting system was instituted in 1979. All successful hunters are required to present the skull and pelt of harvested bears to a WGFD employee, who collects 2 teeth for aging and records location of kill, sex, number of days hunted, method of take, and a general description of overall body condition. Skulls and pelts must be presented in an unfrozen condition and proof of sex must remain naturally attached to the pelt for accurate identification.

With the rewriting of the black bear management plan in 2007, new harvest criteria were established to better monitor long-term trends in black bear populations statewide and within each BMU (Table 1). These criteria take advantage of different sex and age class harvest vulnerabilities to help determine trend of black bear populations in Wyoming. These criteria are not assessed independently, but viewed collectively in a hierarchical fashion as a composite of the harvest level for a given BMU.

In order to better evaluate harvest data, black bear quotas and seasons are set for three-year periods. This process allows for a more complete analysis of the effects of harvest by holding dates and quotas the same for each three-year season cycle. In addition, in order to increase harvest data sample sizes and reduce the influence of abnormally high or low harvest

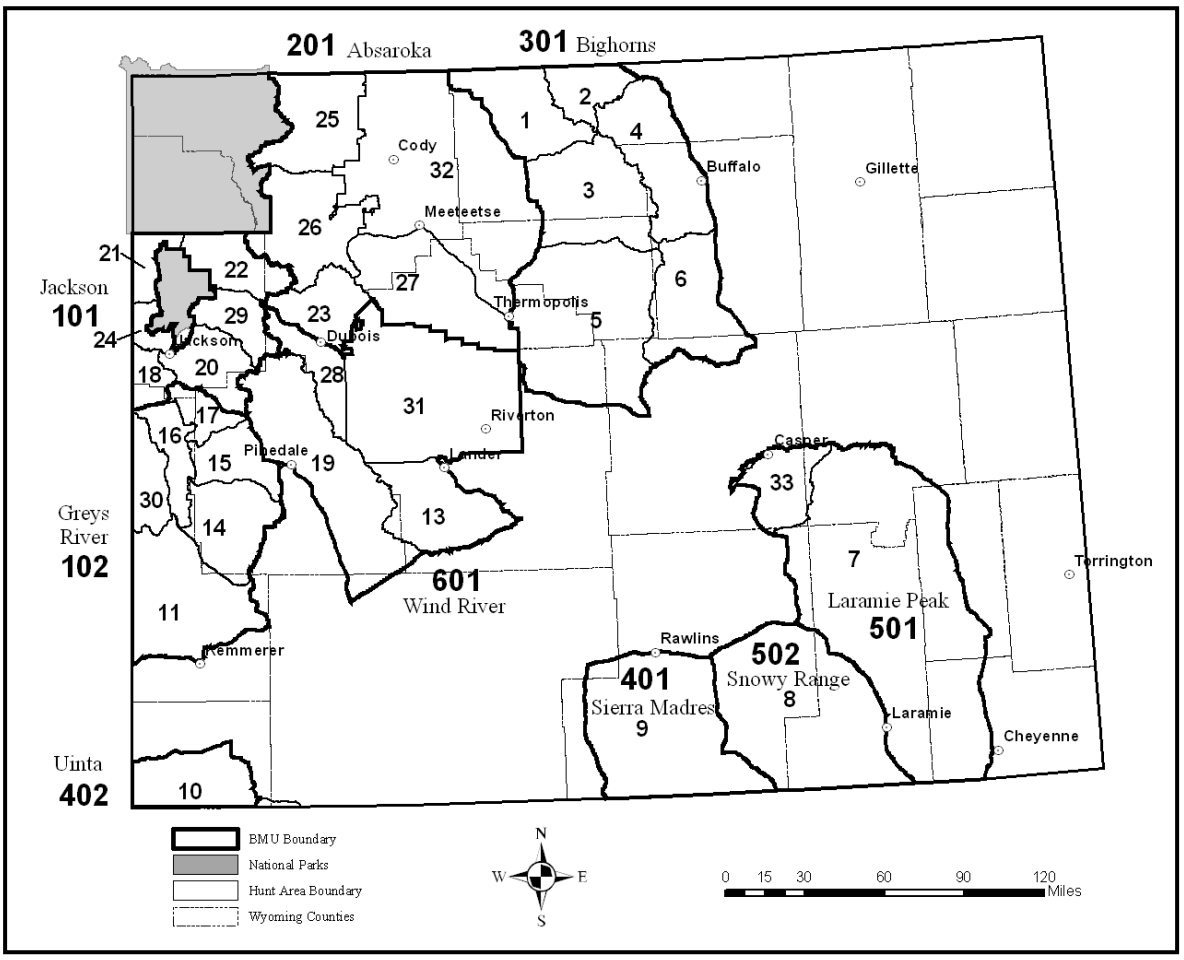


Figure 1. Wyoming black bear hunt areas and bear management units, 2009.

rates due to environmental or other factors, three-year running averages are used in harvest data analyses rather than analyzing annual data independently. While the evaluation of harvest criteria occurs every three years and is analyzed on a three-year average, data from the previous 10 years or longer is analyzed to illustrate longer-term trends in harvest and related population trends.

Harvest Summary

With the implementation of the female mortality quota system in the fall of 1994, a sharp decline in harvest was observed, dropping from 237 in 1993 to 136 in 1996, which was the lowest harvest recorded since 1979 (Figure 2). Since then, harvest has steadily increased, reaching a high of 394 bears in 2008 (Figure 2). The removal of black bears involved in conflicts has been variable over the past 10 years, ranging from 4 in 1999 to 40 in 2001 (Table 3). Bears taken because of conflicts are not counted against the female quota. However, these mortalities are considered when harvest quotas are set for each BMU. These bears account for approximately 6% of the total annual mortality.

From 1999 – 2008, statewide female harvest has accounted for 34% of all harvested bears. Sixty percent of the annual bear harvest recorded for the period of 1999 – 2008 occurred during the spring season even though the number of spring hunter days accounted for only 46% of the total annual hunter days (Table 3). Hunter days per harvested bear is also markedly lower

Table 1. Black bear harvest criteria from 2007 Wyoming Black Bear Management Plan, Wyoming Game and Fish Department.

	Population Objective		
Criteria	**Population Reduction**	**Stable Population**	**Population Increase**
Percent Adult Males in Total Harvest	< 25%	25 – 35%	> 35%
Percent Females	> 40%	30 – 40%	< 30%
Percent Adult Females in Female Harvest	> 55%	45 – 55%	< 45%

during the spring season (spring = 57 days/bear; fall = 99 days/bear). This is likely due to the influence of baiting and the fact that hunters are out hunting bears only in the spring while in the fall most successful hunters incidentally take a bear while pursuing deer and elk. In the spring 83% of all bears harvested since 1999 were killed over bait, compared to 29% in the fall.

Hunting Laws and Regulations

Regulations governing black bear female mortality quotas were enacted in the fall of 1994. Hunt areas with distinct bear populations were combined to form BMUs and assigned annual female mortality quotas, so that once a quota was filled the hunting season in that BMU automatically closed. There are separate quotas for spring and fall seasons each calendar year. This assures that a fall season will occur regardless of spring harvest levels. If female mortality quotas for the spring hunting season are exceeded, the excess is subtracted from the fall mortality quotas. Conversely, if female mortality quotas in the spring are not reached, the portion of the quota remaining is added to the fall mortality quota.

Presently, only legal and illegal female black bear mortalities are counted against the quotas. Female bears that died as a result of vehicle collisions were counted toward the quota through the 2000 hunting season, but this was changed prior to the 2001-hunting season. Bears removed because of conflict activity do not count toward annual female quotas and there are no limits on the number of damage bears that can be removed annually. The separation of damage mortality from bear harvest management is intended to prevent a high conflict year from influencing annual harvest quotas.

Successful black bear hunters must present the skull and pelt from each bear taken to a WGFD employee for inspection within 3 days after the harvest. Legal shooting hours are from

Table 2. Wyoming black bear harvest and damage statistics, 1999-2008

	# Bears Harvested					# Hunter Days[a]			# Damage Bears
	Spring		Fall						
Year	**M**	**F**	**M**	**F**	**Total**	**Spring**	**Fall**	**Total**	**Removed**
1999	83	40	45	26	194	11944	6635	18579	4
2000	99	45	40	19	203	6267	8650	17917	14
2001	96	50	82	32	260	6933	9073	16006	40
2002	106	45	116	56	323	9079	12886	21965	28
2003	103	61	57	41	262	8719	12713	21432	7
2004	135	47	64	50	296	9592	12879	22471	15
2005	119	59	66	38	282	9734	11309	21043	12
2006	130	51	49	51	281	9285	9285	18570	5
2007	115	65	60	50	290	10480	10288	20768	25
2008	159	50	112	73	394	[b]	[b]	[b]	13
Total	1145	513	691	436	2785	82033	93718	178751	163
Mean	114.5	51.3	69.1	43.6	278.5	9114.8	10413.1	19861.2	16.3

[a] One hunter is equal to 1 day hunted/hunter
[b] Data not yet available

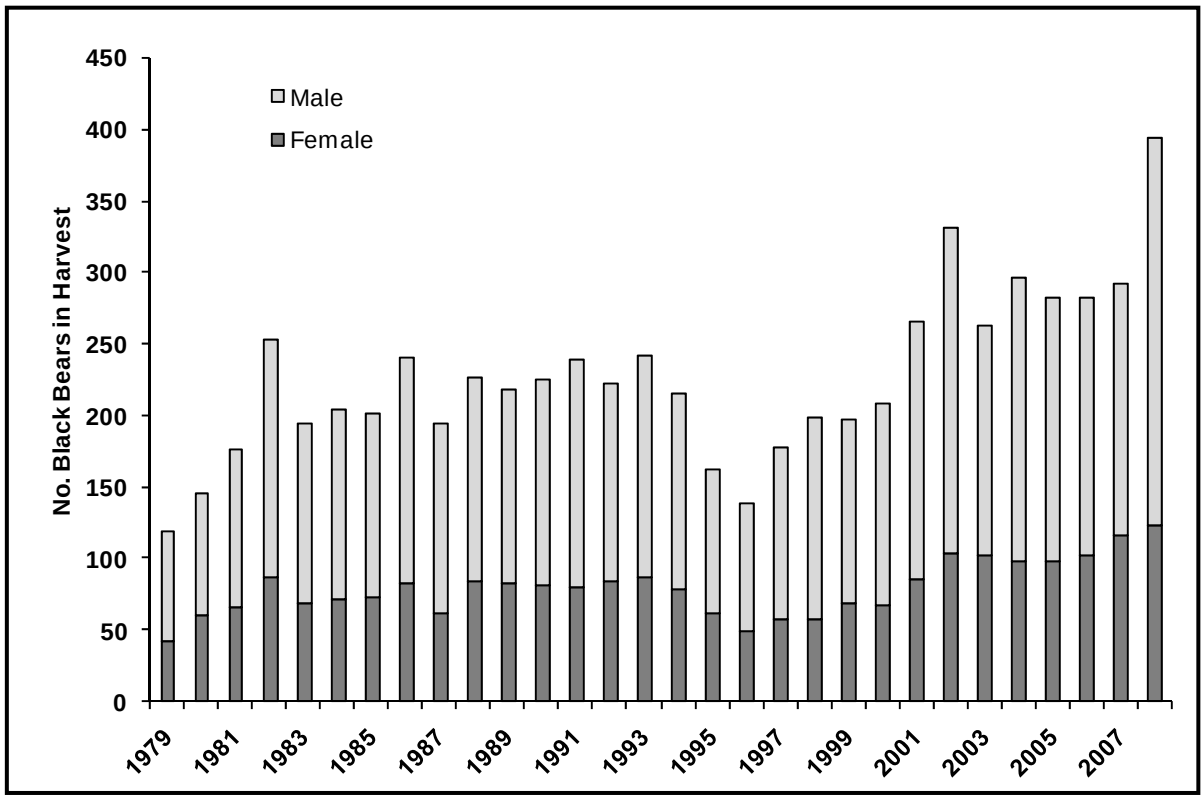


Figure 2. Black bear harvest by sex in Wyoming, 1979-2008.

one half hour before sunrise to one-half hour after sunset. The annual bag and possession limit is 1 bear per hunter per calendar year. Cubs and females with cubs at side are protected from harvest and dogs may not be used to hunt, run, or harass bears. Non-resident hunters are not allowed to hunt black bears in any federal or state designated wilderness areas without a professional or resident guide. Hunters are responsible for inquiring about season closures by calling a toll free telephone number prior to going into the field. For the 2009 black bear hunting season, resident and non-resident bear licenses are $45.00 and $362.00, respectively.

Baiting is allowed for black bears in areas outside the grizzly bear Primary Conservation Area (PCA) and some adjacent areas. Baiting is prohibited in all designated Forest Service wilderness areas in Wyoming. Non-processed baits must be used in most areas where baiting is allowed adjacent to the PCA. Any processed baits may be used elsewhere. Use of game animals or any protected species is prohibited. Regulations dictate size of bait container, amount of bait, density of bait sites, proximity to water, roads, trails, and developed areas, and timing of bait placement. If a grizzly bear uses a site it must be reported to WGFD and the site removed.

Depredation Trends, Policies, and Programs

Currently, Wyoming uses a statewide protocol for managing trophy game depredations and interactions with humans. Each incident is handled on a case-by-case basis and is dealt with accordingly based on the location of the incident, the threat to human safety, the severity of the incident, and the number of incidents the animal has been involved in. Every effort is made to prevent unnecessary escalation of incidents through an ascending order of options and responsibilities:

1. No Management Action Taken (combined with educational efforts)
    a) Educational pamphlets and discussion on how to live safely in bear country are provided

2. Deterrent Methods (combined with educational efforts)
    a) Removal or securing of attractant by the landowner, leasee, or WGFD
    b) Removal of depredated carcass by landowner or leasee
    c) Use of guard dogs (landowner responsibility)
    d) Educational pamphlets and discussion on how to live safely in bear country are provided
3. Aversive Conditioning (combined with educational efforts)
    a) Use of rubber bullets by the WGFD or designated person/agency
    b) Use of pepper spray by the landowner or WGFD
    c) Noise making devices (e.g., explosives) or flashing lights by the landowner, leasee, or WGFD
    d) Educational pamphlets and discussion on how to live safely in bear country are provided
4. Trapping and Relocation (combined with educational efforts)
    a) If the above efforts do not deter the bear from the area, if public safety is compromised, if it is a first offense, or if it has been a lengthy span of time between offenses
    b) Educational pamphlets and discussion on how to live safely in bear country are provided
5. Lethal Removal of the Animal by the WGFD (combined with educational efforts)
    a) If the above methods do not deter the bear, if public safety is compromised, or if the offending bear has been involved in multiple incidents in a short span of time
    b) Wyoming statute also allows for any black bear damaging property to be killed by the owner, employee, or leasee of the property
    c) Educational pamphlets and discussion on how to live safely in bear country are provided

The WGFD works closely with hunters, outfitters, recreationalists, livestock operators, and homeowners in an attempt to minimize conflicts with black bears. Every spring, the WGFD hosts bear and lion workshops throughout the state to educate people about bear and lion biology, front and backcountry food storage techniques, what to do in the event of an encounter with a bear or lion, and the morphological characteristics that differentiate a black bear from a grizzly bear. In addition, numerous presentations are given throughout the year to civic, private, and school groups to educate them about bear biology and how to coexist safely with bears. Media outlets are also used to inform and educate members of the general public about bear safety issues. The WGFD has developed a bear identification test that can be taken online by the public. The test aids in differentiating black bears from grizzly bears in an attempt to reduce the take of grizzly bears because of mistaken identification.

The number of black bear conflicts ranged from a low of 34 reported incidents in 1999 to a high of 360 reported incidents in 2007. The WGFD is fiscally responsible for confirmed livestock losses and apiary damage caused by black bears. The number of black bear damage claims for the last 10 years range from 7 to 24, and payments made to claimants range from $8,922 to $35,397 (Figure 3). Sheep accounted for 53% of the total damage payments made in 2008, while apiaries accounted for 44% (Figure 4).

Public Attitudes Toward Black Bear Hunting and Management

There have been no public attitude surveys conducted in Wyoming concerning black bear hunting and management since 1993. In that year, the USFS prohibited baiting on national forest lands during the fall hunting season. Baiting was allowed on these lands the following spring; however, the temporary restriction heightened awareness and controversy of the baiting issue, and a public attitude survey was conducted in the winter of 1993. The 3 key findings of this survey were 1) approximately half of the respondents had little or no knowledge of black bear management in Wyoming or the controversy surrounding bear baiting and spring hunting; 2) 16% and 32%, respectively, felt that baiting and spring hunting should continue; and 3) 52% agreed that some form of bear hunting should continue. A similar

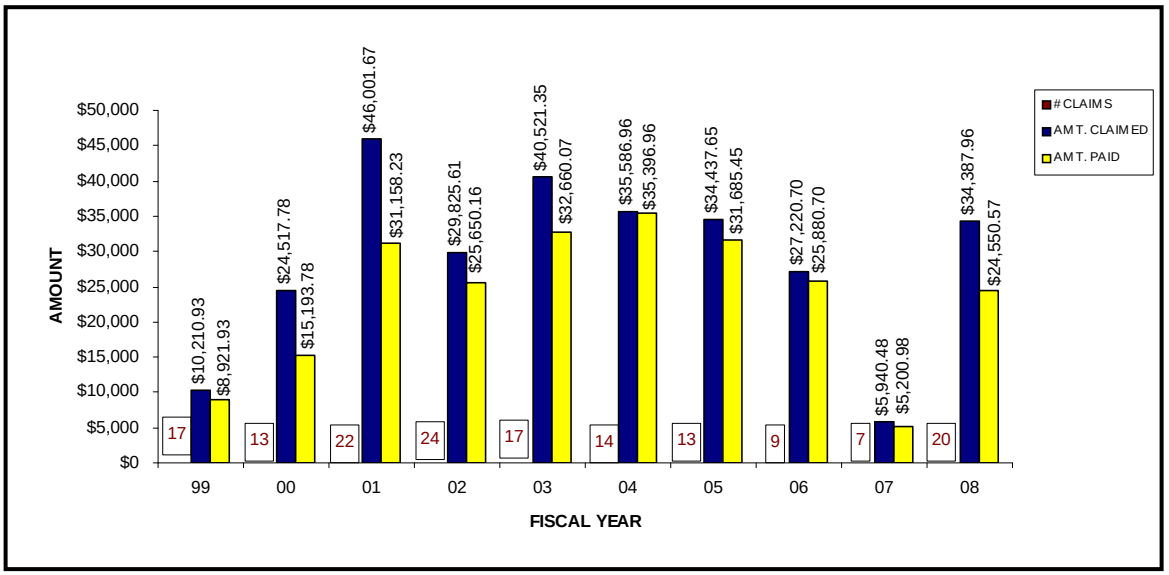


Figure 3. Black bear damage claims and payments, 1999 – 2008.

survey only involving licensed bear hunters was also conducted in 1992, in which, unsurprisingly, only 20% favored elimination of bear baiting. However, 52% of the respondents (licensed bear hunters) favored shortening spring seasons to reduce female harvest. Presently, no referendums or state legislation banning baiting or spring bear hunting have been proposed in Wyoming, although it is apparent that nationwide approval of these activities is declining.

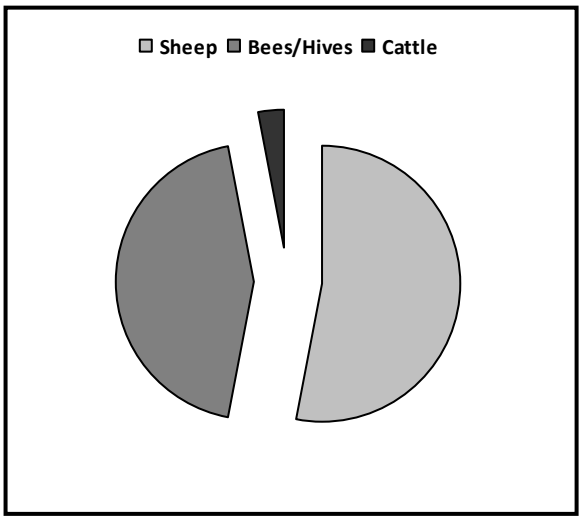


Figure 4. Percent black bear damage payments by type, 2008.

Conclusions

The greatest bear management challenge that the state of Wyoming will face in the future is maximizing hunter opportunity while maintaining stable bear populations. To this end, the validation of the harvest criteria set forth in the 2007 black bear management plan would be very useful in determining the effects of hunting on the population. It is very difficult to determine, strictly from harvest data, if changes in trends are the direct result of an increase in black bear populations, if environmental factors have played a larger role in the vulnerability of bears to hunting, or if hunter selectivity has changed since the implementation of the female mortality quota system. Further research that would better estimate black bear densities and population demographics statewide could help to address this issue.

Black Bear Research and Publications

Current Research by WGFD

1. Monitoring reproductive parameters of female black bears, including age of first reproduction, litter size, cub survival, juvenile female survival, and juvenile female dispersal.
2. Den type selection, size, and habitat use by female black bears.

Publications

Grogan, R. 1997. Black bear ecology in southeast Wyoming: the Snowy Range. Thesis, University of Wyoming, Laramie, Wyoming, USA

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UTAH BLACK BEAR STATUS REPORT

JUSTIN DOLLING, Utah Division of Wildlife Resources, 1594 West North Temple, Salt Lake City, Utah, USA

Abstract: Abstract: American black bears (*Ursus americanus*) are protected game animals in Utah, and are managed through restrictive hunting harvests controlled by limiting the number of hunters pursing bears within geographic regions, and through prevention and control of bear-human conflicts. About 3,500 bears are distributed throughout the forested regions of the State, occupying about 30,665 mi2 of habitat. Harvest-derived estimates of bear survival and age/sex composition of harvests are the primary sources of data for management decisions. A state bear management plan was developed in 2000 using a discussion group representing a range of public interests; this plan will guide bear management efforts through 2010. Bear harvests have increased in recent years, but harvest sex ratios, age composition, and survival have met performance targets designed to maintain bear numbers in concert with competing social, economic and biological interests. A 5-year experimental spring hunt began in 2001 to address concern over perceived high levels of bear/livestock conflict and substantial losses of bears to control efforts. This experimental spring hunt became operational in 2006 showing some usefulness in reducing the number of bear/livestock conflicts and reducing the proportion of females in the harvest. Research has been limited to telemetry-based population studies on 1 site. Additional research is focusing on monitoring reproduction, recruitment and adult female survival on sites in new geographic regions. Better monitoring of annual reproduction and survival is needed for timely detection of extended periods of low cub production and management action. DNA mark-recapture research has been conducted on a pilot scale from 2004 to 2008 and will be expanded statewide beginning in the summer of 2009.

Western Black Bear Workshop 10:32-41

Black Bear Classification

Black bears were considered predators in Utah from the time of settlement until 1967. The Utah Territorial Legislature authorized a bounty on bears in 1888, and bounties were recorded sporadically through the 1960s. In 1967, at the request of houndsmen, the Utah State Legislature changed the status of bears to protected wildlife, and the Utah Fish and Game Commission declared black bears to be game animals with established hunting seasons. Spring and fall hunting seasons of varying length were observed through 1992, when the spring season was terminated. By 1990, hunter numbers were restricted through a limited entry system that used area-specific permits to control harvest numbers and distribution (Table 1).

Distribution and Abundance

Black bears are distributed throughout most of the forested sections of Utah, which contains about 30,665 mi2 of bear habitat (UDWR 2000). Highest bear densities are found along the Wasatch Mountains in central Utah, across the Tavaputs Plateau in eastern Utah, and in the La Sal and Abajo Mountains of southeastern portions of the State, where densities are estimated at 0.1-0.3 bears/mi2 (Figure 1). Bear densities are substantially lower in northern and northeastern Utah. Regional bear abundance and distribution have been derived primarily from harvest records.

Population Monitoring

Each year, adult survival and the sex and age composition of harvests are compared to management criteria to assess population status relative to management objectives. Harvest-based indices of population status are available statewide, but more detailed information on bear densities, survival and productivity (Table 2) has been obtained from the Book Cliffs bear study area, located on southeast edge of the Tavaputs Plateau (Black 2004). This long-term study,

Table 1. Hunting effort, mortality, and pursuit effort for black bear in Utah, 1967-2002.

Year	Permits Sold	Hunters Afield	Hunting Harvest	Percent Success	Bear/ Hunter	Percent Females	Depredation and other mortality	Total Bear Mortality	Pursuit Permits
1967			15				12	27	
1968			12				9	21	
1969	43	31	25	58.1%	0.81		27	52	
1970	155	119	9	5.8%	0.08		18	27	
1971	59	48	17	28.8%	0.35		16	33	
1972	96	77	19	19.8%	0.25		7	26	
1973	125	114	25	20.0%	0.22		0	25	
1974	134	117	29	21.6%	0.25		9	38	
1975	161	144	22	13.7%	0.15	41%	2	24	161
1976	107	96	10	9.3%	0.10	42%	7	17	48
1977	149	127	26	17.4%	0.20	33%	6	32	77
1978	222	185	40	18.0%	0.22	33%	10	50	114
1979	240	196	26	10.8%	0.13	19%	5	31	91
1980	217	177	26	12.0%	0.15	28%	6	32	95
1981	263	227	39	14.8%	0.17	30%	4	43	95
1982	229	188	38	16.6%	0.20	39%	6	44	93
1983	219	176	18	8.2%	0.10	44%	9	27	98
1984	217	184	26	12.0%	0.14	31%	6	32	33
1985	269	230	29	10.8%	0.13	27%	10	39	86
1986	332	302	72	21.7%	0.24	45%	6	78	90
1987	326	262	44	13.5%	0.17	35%	25	69	156
1988	491	394	69	14.1%	0.18	35%	28	97	173
1989	687	556	97	14.1%	0.17	30%	10	107	187
1990	142	119	22	15.5%	0.18	18%	16	38	355
1991	142	119	35	24.6%	0.29	23%	15	50	364
1992	142	124	32	22.5%	0.26	19%	25	57	524
1993	162	136	35	21.6%	0.26	51%	12	47	570
1994	168	153	42	25.0%	0.27	40%	20	62	552
1995	175	156	53	30.3%	0.34	34%	34	87	627
1996	181	174	68	37.6%	0.39	43%	35	103	630
1997	192	176	50	26.0%	0.28	44%	31	81	638
1998	202	181	46	22.8%	0.25	42%	42	88	635
1999	220	199	57	25.9%	0.29	30%	35	92	264
2000	214	194	75	35.0%	0.39	35%	72	147	285
2001	214		68	32.0%		37%	61	129	340
2002	232		83	36.0%		33%	78	161	359
2003	226		86	38.0%		31%	33	119	378
2004	240		105	47.0%		21%	61	166	373
2005	252		80	32.0%		23%	37	117	414
2006	242		86	36.0%		33%	43	129	353
2007	262		127	48.0%		28%	78	205	363
2008	318		134	42.0%		30%	31	165	391
Total	8667		2017				997	3014	10012
Average	217	178	48	24%	0.24	33%	24	72	295

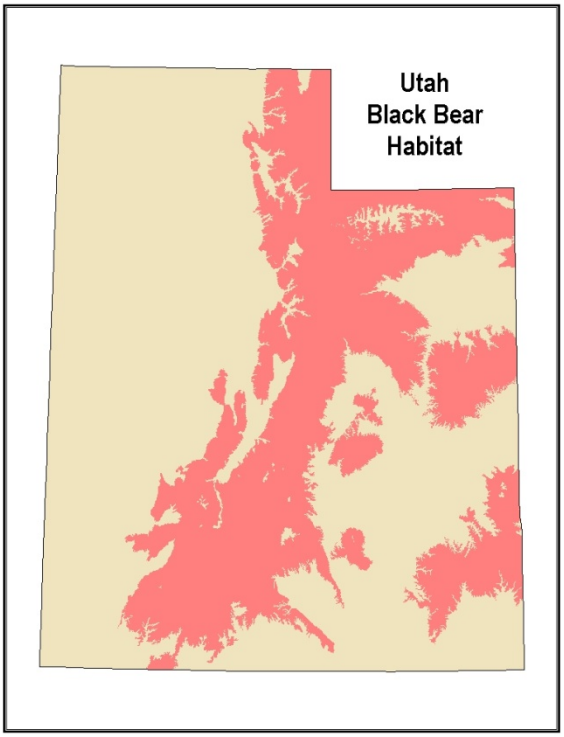

Figure 1. Black bear habitat in Utah, Utah Division of Wildlife Resources.

conducted through a contract with Dr. Hal Black of Brigham Young University, has been underway since 1991. The last statewide bear population estimates were developed in 2000, when the Utah Bear Management Plan (UDWR 2000) was completed. Bear densities from the Book Cliffs telemetry study were modified based upon knowledge of vegetation and topography within each management unit, and extrapolated across units to create one statewide population estimate (density extrapolation method). A second population estimate was generated by calculating bear harvest density within each management unit, then assigning a reasonable population density to each unit based upon calculated sustainable loss on the Book Cliffs study area (sustainable harvest method).

Density Extrapolation: Total bear density on the Book Cliffs study site was estimated at 0.2 bears/mi2 by mapping female bear home ranges, then adding an estimate of the number of cubs and male bears in the immediate population based upon capture and reproductive histories. The amount of bear habitat in Utah was considered to be the sum of area used by bears above 7000 feet elevation. Within each management unit, bear habitat was further classified as medium or high value based upon vegetative types. The area in medium value habitat was assigned a density of 0.1 bears/mi2, and the area of high value habitat was assigned a density of 0.3 bears/mi2. The statewide population estimate of 3,980 bears resulted from the extrapolation of density estimates to the total area within both habitat value categories.

Table 2. Cub Production by Book Cliffs Black Bears 1992-2002

Year	# Breeding Age Females	# with Cubs	% Females with cubs
1992	4	3	75.0%
1993	8	7	87.5%
1994	7	7	100.0%
1995	9	7	77.8%
1996	10	1	10.0%
1997	15	12	80.0%
1998	6	5	83.3%
1999	4	4	100.0%
2000	5	3	60.0%
2001	3	0	0.0%
2002	10	1	10.0%
Total good years	58	48	82.8%
Total bad years	23	2	8.7%
Overall Mean	81	50	62%

Sustainable Harvest: The bear density of each management unit containing bear habitat was also estimated by assuming that annual losses were sustainable and approximated recruitment, resulting in a stable population trend. The mean harvest density was calculated for each management unit, and the unit was assigned a "reasonable" (i.e. sustainable) population density (1 of 7 densities ranging from 0.0001 – 0.3 bears/mi2). The management unit's bear population was estimated by multiplying the assigned density estimate by the amount of bear habitat within the unit. The statewide population estimate of 3,450 bears resulted from the sum of all management unit population estimates. This more conservative estimate of bear numbers has been used by UDWR in most management applications.

The bear harvest is reviewed annually and compared to performance targets developed for the Bear Management Plan. These targets were considered adequate to prevent population declines from over-exploitation, and are general criteria to guide harvest prescriptions. They include: 1) the statewide bear harvest should be comprised of less than 40% females, 2) mean age of harvested bears should exceed 5 years, and 3) adult survival should exceed 78%.

Management Plan

The Division of Wildlife Resources (UDWR) and a Bear Discussion Group composed of diverse public interests created the Utah Black Bear Management Plan in 2000 to guide bear management efforts through 2010. The Black Bear Management Plan included an assessment of bear habitat, management history, bear management methods, and social and political issues concerning bear management in Utah, and established the following goal and objectives to provide management direction.

The bear management goal is to maintain a healthy bear population in existing occupied habitat and expand distribution while considering human safety, economic concerns, and other wildlife species. Six management objectives were developed, along with performance targets and strategies. Individual objectives, targets and objectives include:

Objective A. Maintain current bear distribution, while working to increase bear distribution into suitable unoccupied or low-density areas through 2010;

Performance Targets:

1. Number of wildlife management units that support huntable bear populations will exceed 19.
2. The number of wildlife management units that support bear populations will exceed 22.

Strategies:

1. Develop model estimating black bear numbers and potential by unit.
2. Assess feasibility of reintroducing black bears into areas of suitable habitat statewide not currently occupied.
3. Review current reintroduction efforts and develop methods and policy to establish bears in unoccupied habitat.
4. Maintain migration corridors to allow natural expansion into unoccupied habitat.

Objective B. Maintain current bear populations, with a reasonable proportion of older age animals and breeding females, balancing population numbers with other wildlife species through the year 2010.

Performance Targets:

1. The percent of females in the harvest will be less than 40%.
2. The average age of harvested bears will exceed 5 years.
3. Total adult survival will exceed 0.78.
4. Where feasible, utilize non-lethal methods to reduce conflicts between humans and bears, allowing higher bear population densities

Strategies:

1. Conduct research and implement techniques to determine population levels, such as tracking studies, or DNA marker population assessment.
2. Consider experimental harvest strategies to determine effects on harvest statistics and performance targets, such as: spring hunt to reduce proportion of females in the harvest; spring-hounding, fall-baiting seasons; unlimited permits on season concurrent with big game seasons; spot and stalk only hunts.
3. Make every reasonable effort to collect a tooth and record sex of every known bear mortality, including sport harvest, Wildlife Services' take.
4. Develop unit management plans that balance black bear numbers with available habitat.
5. Monitor bear health and disease and take actions to maintain healthy individuals.
6. If bear predation is documented to be a problem, implement Predator Management Plans in accordance with the Division's policy on Managing Predatory Wildlife Species.

7. Secure funding to accomplish essential elements of Black Bear Management Plan.
8. Educate the public on black bear biology and management to foster public support.
9. Coordinate and cooperate with adjoining states and researchers.
10. Manage pursuit to eliminate detrimental effects on bears, e.g. number of hounds per pack, number of pursuit permits, hunt unit pressure and other controls.

Objective C. Minimize the loss in quality and quantity of critical and high priority bear habitat, including migration corridors between occupied areas through 2010.

Performance Targets:
1. Number of acres of critical and high priority bear habitat.
2. Number of habitat improvement projects completed, with a goal of one per region per year.
3. Suitable migration corridors between areas of occupied habitat.
4. Maintain average bear food value for each unit.

Strategies:
1. Protect critical and high priority bear habitat through consulting with and commenting on other land management agencies' development proposals.
2. Undertake a minimum of 5 habitat improvement projects per year to enhance critical and high value bear habitat, focusing on aspen regeneration, natural fire management, increasing density of food producing plants, and riparian areas.
3. Using GIS, develop map depicting black bear habitat and identify important migration corridors. Work with other agencies to protect those corridors.
4. Conduct research to determine what constitutes, and how to restore, critical and high value bear habitat.
5. Annually monitor bear food plants to determine production.

Objective D. Reduce the risk of loss of human life and reduce chances of injury to humans by bears through the year 2010.

Performance Targets:
1. Number of people injured by bears.
2. Number of incidents reported.

Strategies:
1. Implement guidelines identified in the Division's Managing Nuisance Bears policy (WRWLD-3).
2. Work with federal land management agencies and private landowners to enforce regulations and eliminate attractants that may bring bears and humans into close contact, such as using 'bear-proof' garbage cans in campgrounds, etc.
3. Educate landowners about the dangers associated with living in bear habitat and how to reduce the likelihood of encounters.
4. Educate the public about the dangers associated with recreating in bear habitat and how to avoid problems.

Objective E. Reduce the number of livestock killed by bears.

Performance Target:
1. Number of lambs, ewes, bucks, calves and other livestock killed by bears.

Strategies:
1. Remove depredating bears by targeting offending individuals in accordance with MOU with Wildlife Services signed in 1993.
2. Implement non-lethal methods to reduce conflicts between bears and livestock.
3. Fund research to determine factors that will minimize livestock predation.
4. Work with land management agencies and livestock operators to utilize grazing techniques that will minimize depredation.
5. Implement an experimental spring bear hunt in historic problem areas to determine if it will help reduce livestock depredation while at the same time reducing female bear take.

Objective F. Maintain quality recreational opportunities, both consumptive and nonconsumptive, through the year 2010.

Performance Targets:

1. Number of bear hunters.
2. Number of bear pursuit hunters.
3. Number of bait COR's.
4. Number of days people spend looking or observing bears or sign.
5. Number of reported conflicts between different user groups.

Strategies:

1. Maintain recreational hunting, including hounding, baiting, and pursuit as management tools.
2. Increase watchable wildlife opportunities for black bears, through using the public to conduct bear food surveys, track counts, and other needed efforts.
3. Implement harvest strategies that will tend to reduce conflicts between resource users, such as spot and stalk hunting during big game seasons, or limiting the number of hounds, and other approaches.
4. Work with the public to draft legislation to affect guide regulation.

Hunting Laws and Regulations

Black bears are hunted through a limited entry system that controls harvest on individual management units by limiting numbers of hunters. Most management units are hunted during fall seasons that are open from late August through late September, and again during the month of November. Season dates for 2009 are August 22 – September 30 and October 31 - November 22. An experimental spring season was in place on four management units from 2001-2005. This season runs from mid-April through late May. In 2006, the spring hunt became operational, with the 2009 statewide spring hunt beginning April 11 and closing May 31. Five units with heavy bear/livestock interactions had season extensions of seven days in 2009, until June 7.

Hunters are permitted to use hounds, bait, or spot and stalk bears, and may hunt over natural food sources. Baiting is restricted to hunters who use archery tackle, and is undertaken by relatively few hunters. A Certificate of Registration (COR) is required to document the location of each bait site, and must be obtained from the regional DWR office where the bait station will be located. Written landowner (private) permission is required before a COR for a bait station is issued. On federal land (Forest Service and Bureau of Land Management) the hunter must verify with the land management agency that the land in question is open to baiting. The COR will permit a properly licensed hunter to establish 2 bait stations, and will specify the bait items used, the names of all hunters that are permitted to hunt over the station, and the names of all individuals that will tend the station.

There are no limits on the number of hounds used to take or pursue a bear, but the owner or handler of the hounds must hold a valid limited entry bear permit or a bear pursuit permit while engaged in the activity. Only properly licensed hunters that have been present for the entire hunt, from the time the dogs are released until the bear is treed or brought to bay, may take bears.

Each hunter may take 1 bear/year. Successful permit holders must wait 2 years before applying for another bear hunting permit. Adult females accompanied by cubs are not legal game. Hunters must present bears for permanent tagging to a conservation officer or Division office within 48 hours of the kill. The pelt and skull must be presented to the Division; skinned carcasses may be left in the field, but evidence of sex must remain attached to the pelt or carcass to meet reporting requirements. Legally obtained tanned bear hides are the only parts of bears that may be purchased or sold. Gall bladders, teeth, claws, paws or skulls may not be bartered or sold.

A pursuit-only season exists on most management units, including some that are closed to the taking of bear. The bear pursuit season is separated into spring and fall periods. In 2009, the bear pursuit season runs from April 11 – May 31, from July 11 – August 9, and from October 31- November 22.

Utah has not regulated commercial guiding, and there was no licensing requirement for guides in 2009. This will change in 2010 with newly adopted legislation to begin regulating

guides and outfitters statewide. Future requirements for guides and outfitters were still unfolding at the time of this report. Limited entry bear permits cost $83 for residents and $308 for nonresidents (the same fees apply for limited entry bear archery permits). The handling fee for a bait station Certificate of Registration is $10. Bear pursuit permits cost $30 for both residents and nonresidents but non-residents may be charged a higher fee based on the newly adopted legislation. Currently the number of pursuit permits is not limited.

Harvest Summary

Black bear harvests in Utah climbed above 50 animals for the first time in 1986, and interest in bear hunting surged in the late 1980s (Table 1). By 1989, concern that hunting pressure and harvests had become excessive resulted in a change to limited entry harvest management. In 1990 the Division began issuing a limited number of management unit-specific bear hunting permits to control the size and distribution of harvests. Harvests increased over the following 12 years from a low of 22 bears in 1990 to a high of 134 bears in 2008 (Table 1). Hunting pressure has also increased during this time by 124%, from 142 permits issued in 1990 to 318 permits in 2008. Hunter success has remained high, ranging from 15-48% (Table 1).

Depredation Trends, Policies and Programs

Other losses to the bear population have also increased over the past 12 years. Since 1998, the number of bears killed annually for depredation, from vehicle strikes, in accidents, and in defense of property has ranged from 31 to 78 (Table 1). This trend supports harvest-based indices of population status that suggest Utah's bear population has increased in the past decade, but all indices used to track the State's bear population are subject to bias associated with weather. The past 6 years of drought have probably influenced bears and their interactions with livestock, but the effects are difficult to quantify.

The number of bears killed for livestock depredation increased since 1995. Although the number of sheep grazed in Utah declined about 33% from 445,000 to 295,000 head during 1995-2007 (USDA 1995-2007), numbers of bears killed for livestock depredation increased steadily over the 13-year period from 34 bears in 1995 to 54 bears in 2008. The number of livestock depredation incidents fluctuated from 41 and 99 between 1995 and 2008, but the number of livestock lost has increased in recent years, ranging from 400-650 head annually (Figure 2). The UDWR pays ranchers for losses to bears and mountain lions from an annual appropriation that fluctuates between $100,000 - $200,000. Loss claims recently have not exceeded this amount; in 2006, 2007 and 2008 ranchers were compensated 100% of the value for livestock lost due to confirmed bear depredation (Figure 2).

The number of bears killed for nuisance and in defense of property has fluctuated considerably since 1995, but remains relatively low, ranging from 2 – 16 bears per year. Losses by auto or train collisions ranged from 0-7 bears per year since 1995.

The UDWR policy for handling problem bears was revised in 2008 to clarify the way personnel classify nuisance incidents, respond to the media, carcass preservation procedures and signing areas associated with trap and snares intended to catch nuisance bears (UDWR 2008). In addition, UDWR has a memorandum of understanding with USDA/APHIS, Wildlife Services to address bear depredation problems. Each bear incident is classified into 1 of 3 categories for response. Bears involved in minor incidents and first-time nuisance bears are considered Level I animals and are handled using non-lethal techniques. Repeat offenders and injured bears are classified as Level II and are handled with non-lethal or lethal techniques as required. Aggressive bears, including bears that depredate on livestock or kill pets, bears that pose public safety threats and adult males classified as Level II are considered Level III bears and are handled with lethal methods. Wildlife Services personnel generally respond to livestock depredation incidents and DWR personnel handle most public safety and nuisance incidents. Except in extremely unusual circumstances, all orphaned cubs and malnourished spring yearlings are rehabilitated for release into the wild. Most of these bears are

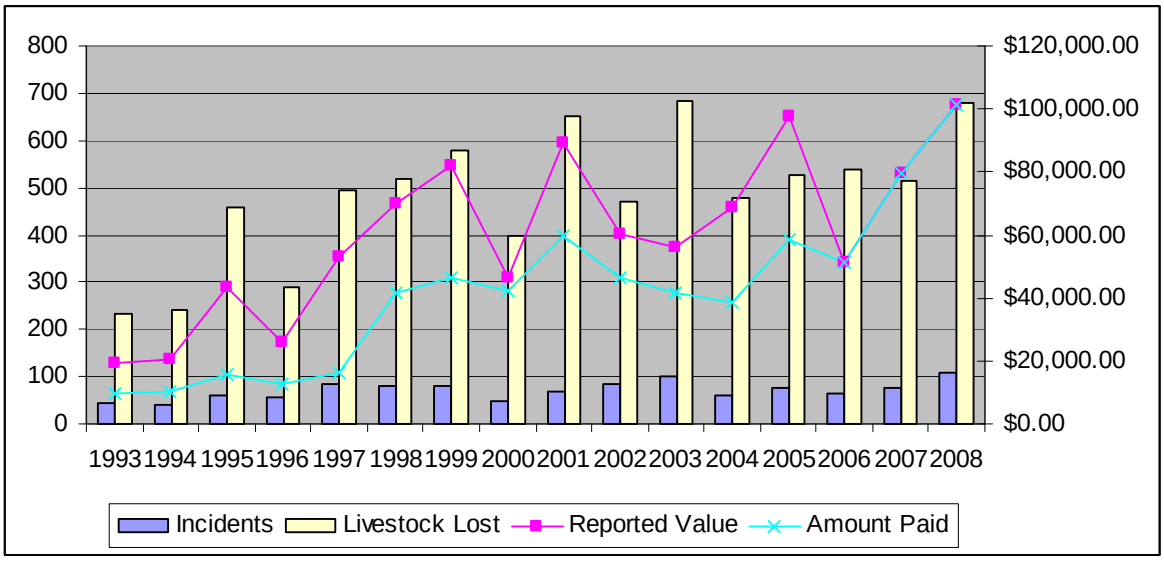

Figure 2. Number of livestock damage incidents and associated monetary values attributed to black bears in Utah, 1993-2008.

cared for by Idaho Black Bear Rehabilitation, Incorporated in Boise, Idaho.

Black Bear Research Programs

In 1991, UDWR contracted with Brigham Young University to conduct research into bear population dynamics to improve management efforts. This contract ended in June 2003, with a final report developed in 2004. The 12-year study investigated survival, productivity (Table 2) and food habits of a sample of radio-collared bears in the Book Cliffs region of eastern Utah (Black 2004). UDWR has continued to monitor the 20-odd bears that are presently radio-collared on the study site as a means to document annual productivity and survival of bears in the region. During 2002, UDWR regional staff radio-collared 4 female bears to monitor reproduction in the La Sal Mountains of southeastern Utah. This sample was augmented with additional collared bears in 2003. In 2007-08, UDWR regional staff radio-collared an additional 16 female bears to monitor reproduction and survival throughout the state in different habitat types.

UDWR also undertook a 5-year experiment to evaluate the potential for using spring bear harvests to reduce bear/livestock conflicts and promote male-dominated harvests. Spring bear hunts were held in 3 management units from 2001-2005. Each of the spring units was paired with a nearby unit of similar characteristics, which were only hunted during the fall. The composition of harvests, numbers of bear/livestock complaints, and numbers of bears killed for depredating livestock in spring-hunt units were compared to the fall-hunt units to determine whether spring hunts can reduce numbers of bear/livestock conflicts and subsequent losses of bears to damage control efforts. In addition the sex-age composition of spring harvests were compared with fall harvests to determine if spring harvests were differentially composed of male bears.

Based on results, following 5 years of study, the spring hunt has not reduced the numbers of bears taken to control livestock depredation, but spring harvests are composed primarily of male bears. Results of this experimental study were instrumental in re-initiating Utah's spring bear hunting season in 2006. In a continued effort to reduce bears taken to control livestock, several of the spring hunts were extended by 7 days beginning in 2008.

From 2004 through 2008 a DNA mark re-capture study was conducted in Northern Utah east of Kamas on the Uinta Mountains. Results of this study are due to be published in late 2009 or early 2010. Preliminary study results suggest this portion of Utah contains a low density of

0.03 bear/mi^2. During the 4 years, population estimates (95% CI) varied annually from 13-21 individuals in 2004 to 17-21 individuals in 2007 over the 100 sq. mile study area. Results of 2008 were not available at the time of this writing. This experimental study will be expanded statewide in the summer of 2009 to include bear habitat which is believed to support a range of densities. This information will be critical to develop a refined statewide population estimate, using the density extrapolation method, for future use and development of Utah's bear management system.

Public Attitudes Towards Black Bear Hunting and Management

Management of black bears in Utah is challenging due to considerable public interest in the welfare of bears, and widely divergent attitudes and values towards bears held by the state's citizens. Utah has a small and well-organized community of bear hunters (mostly houndsmen) that have a vested interest in assuring that black bears are managed for sustainable harvest and pursuit opportunities. The ranching industry is concerned about bear depredation on livestock (primarily sheep) and the economic costs of sharing open range with black bears. Environmental organizations have expressed opposition to bear hunting, and question UDWR's ability and willingness to maintain bear numbers in the face of agricultural conflicts and annual hunting harvests. Recreationalists (campers and hikers) have become more aware and concerned about bear management since the fatal bear attack in 2007.

Environmental organizations continue attempts to outlaw baiting as a hunting method in the State, with little success. Baiting is practiced by about 15% of Utah's bear hunters, resulting in an average of 25 baits placed across the state each year and translating into the harvest of about a dozen bears. The number of bear harvests using this method has increased since 2001.

The popularity of bear pursuit seasons continues to generate discussions about conflicts between houndsmen and other hunting activities in early fall, and about perceptions of excessive pursuit pressure placed on bears by nonresident houndsmen in a few management units near Utah's eastern border. Most pursuit days were expended in the 3 most accessible management units close to Utah's eastern border. All units were closed to pursuit during the early fall season where conflict was alleged, and therefore nearly all pursuit on these high-use units occurred during the spring and summer.

Utah continues to educate their citizens about how to recreate safely in bear habitat. In 2008, a new bear awareness campaign was launched to help improve the type of information provided to the public and improve agency coordination and communication between federal land management agencies, scout and youth camps. This effort standardized the educational materials and signs disseminated by UDWR and federal agencies with the hope of increasing public recognition of the need to recreate responsibly in bear habitat. In addition, over 75 bear safety media stories were initiated by UDWR in 2008.

Conclusions

Utah's black bear population appears to have increased since 1990, as indicated by a) a trend of increasing hunting harvests, coupled with sustained hunter success, b) a preponderance of young age classes in recent bear harvests, c) evidence of reproduction by research bears in the Book Cliffs during most of the period, and d) increasing numbers of bear/livestock conflicts and rising numbers of bears killed in control efforts despite declining numbers of sheep on the State's open range. However, continued drought and subsequent impacts on reproduction and recruitment may curtail population growth and the bear population's ability to sustain harvests in the future. Consequently, UDWR needs to implement an index or measure of annual reproduction to anticipate multi-year suppression of cub production and adjust harvest regulations proactively.

UDWR also will be expanding its monitoring of bear reproduction, recruitment and survival into additional geographic areas to evaluate and manage regional bear populations. In addition, public concern over livestock depredation by bears warrants research and management efforts to reduce bear/livestock conflicts.

Finally, UDWR will be reviewing the harvest-based criteria used in management recommendations and developing a written management system for implementation during the revision of the statewide bear management plan scheduled to be completed in 2010. This system will provide rules of thumb for management action needed to achieve objectives, that is, identify specific actions in response to particular criteria evaluations. A management system will also provide for annual evaluation of UDWR's existing decision-making process to address knowledge gaps and identify data needs that translate into future research objectives. The management system should improve agency decision-making, strengthen public support for programs, provide clear justification for funding initiatives and focus for future research needs, and promote achievement of management goals.

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NEVADA BLACK BEAR STATUS REPORT

CARL LACKEY, Nevada Department of Wildlife, 1282 San Pablo Ct., Minden, Nevada, USA

Western Black Bear Workshop 10:42-44

Legal Harvest

The black bear is classified as a game animal in Nevada; however, the state does not currently have a hunting season for this species (see Mortalities below).

Distribution and Abundance

Historically found throughout the state, viable black bear populations in Nevada have been reduced to suitable habitat in the far western part of the state, and are mainly linked with the Sierra Nevada and other associated mountain ranges. The current population estimate of Nevada's black bear is 200-400 animals and is based on past capture/recapture data analysis and knowledge of the available habitat. In recent years there have been numerous confirmed reports of bears in some of the historically occupied areas. These include individual sightings in the far north, north-west, north-east, south-west and south-east. On those rare circumstances when the bear could be captured they were all younger age-class bears.

Bear Management in Western Nevada

In 1998 the Nevada Department of Wildlife created a program and procedure that addressed the handling of all human/bear conflicts. This document essentially discontinued the relocation of nuisance bears. Under this program and procedure document NDOW personnel have responded to bear complaints in the same manner over the last decade. Consistent with conflict policies in other western states NDOW does not usually set traps unless the human-caused attractant has been removed or exclusionary precautions have been taken. Bear management in Nevada has three main components: conflict management; public education; science & research. And, as noted above, the population is not manipulated via a legal hunt. It is however monitored through capture/recapture data. Specific data on all captured black bears was first recorded in 1997 with a sample size of 12 individuals. Subsequent yearly samples are depicted as follows in Table 1. The figures are comprised of all bears handled including recaptures and mortalities.

Conflicts

Bear complaints decreased in 2008 in comparison to 2007 which was the highest recorded number of bear complaints in Nevada (Figure 1). NDOW employs one full-time bear biologist who is the primary responder to complaint issues. The usual course of action in responding to complaints is to offer advice on reducing bear conflicts, including proper storage and disposal of garbage. In most cases offering advice by referring to the NDOW web site is the only action taken. Common complaints are bears breaking into garbage enclosures or sheds, damage to fruit trees and bears breaking into homes and vehicles. All of these are directly related to the garbage situation, which historically accounts for >95% of the total number of calls received. Other issues are livestock depredation and apiary damage, but these occur at a much lesser rate.

Table 1. Black bears captured in Nevada since 1997, Nevada Department of Wildlife.
(only last ten years shown)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	Total
41	38	43	44	69	74	88	158	68	40	737

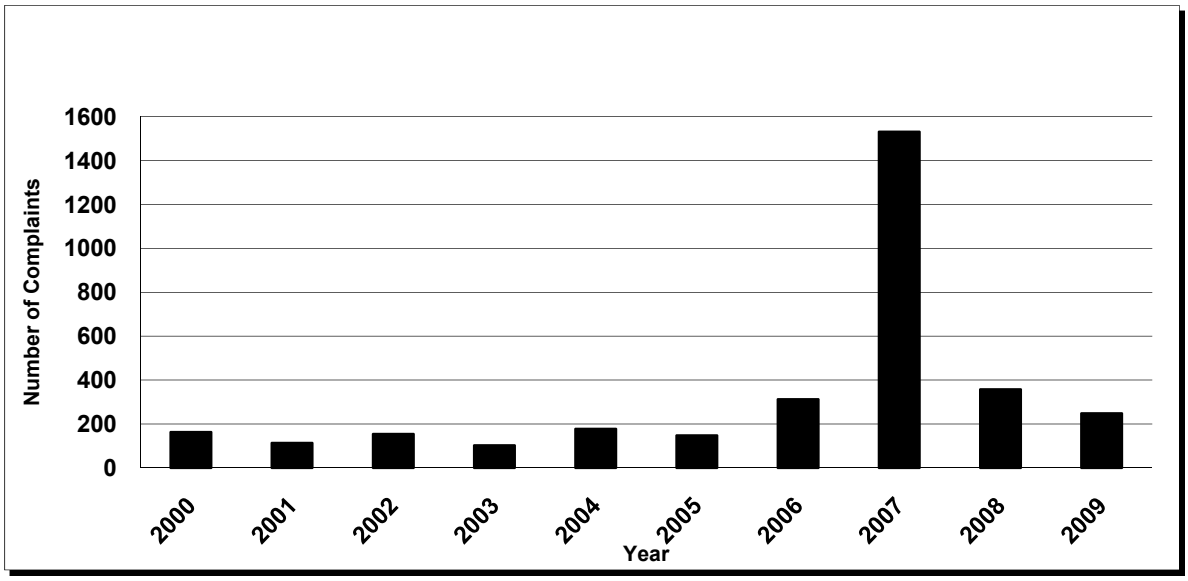

Figure 1. Black bear complaints in Nevada, 2000-2009, Nevada Department of Wildlife.

Mortalities

Even though a legal hunt of the species is not employed data has been kept on all documented mortalities since 1997. Ironically, other than four mortalities for unknown reasons, all other documented mortalities (240) were from anthropogenic causes. Collisions with vehicles is the number one cause of human related bear mortality (54%) (Table 3).

Research

NDOW began collecting data on captured bears in 1997. Structured research was initiated in 1999 with a cooperative project between NDOW and the University of Nevada, Reno (Jon Beckmann). This study, mostly involving habituated and conditioned bears continues into its' 13th season with the Wildlife Conservation Society. The long-term data set was acquired with a sample of 424 different bears, having deployed collars on 72 individuals.

Summary

Nevada's bear population appears to be at healthy and stable numbers, based on data collected from captured bears, from empirical data by NDOW biologists, harvest data collected by other states and acquiesced from sighting data in Nevada. The latter, which may indicate an expanding population, eastward into Nevada, includes reliable sightings of bears and/or bear sign recorded from such places as the Santa Rosa Mountains (2007), Caliente (2005 & 2007), the Bull Run Mountains (2004), Jarbidge (2005), the Vya Rim (2004 & 2006), Fallon (2000), Goldfield (2007) and a few incidences of bears hit by cars on Highway 95 and 95-alternate route.

Table 2. Number sampled, age cohort and sex of all new bears handled 2000-2009 with average age for adults in parentheses, Nevada Department of Wildlife

Age cohort	Sex	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Cubs	♂	3	2	2	4	8	7	9	12	5	5
≤ 12mo.	♀	1	2	5	4	8	3	4	17	2	0
Sub-adults	♂	7	8	4	4	7	9	8	25	12	4
1 – 3 yrs	♀	2	2	3	5	1	5	6	11	4	3
Adults	♂	12 (9.2)	5 (6.4)	6 (8.2)	3 (7.0)	2 (7.5)	2 (6.5)	17 (6.2)	21 (7.6)	5 (5.2)	6 (5.2)
4+ yrs / Avg. Age	♀	5 (7.8)	5 (7.8)	8 (9.4)	2 (7.5)	6 (6.5)	2 (11.0	5 (7.8)	23 (8.9)	1 (6)	2 (13.5)

Table 3. Documented black bear mortalities, 2000-2009, Nevada Department of Wildlife.

Mortality Type	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Hit by Car	8	6	13	4	9	14	22	37	6	8
Public Safety	5	1	6	2	3	1	4	10	17	3
Depredation	1	1	1	0	0	2	5	5	1	0
Illegal		2	0	0	0	0	0	3	0	0
3 - Strikes	NA	NA	NA	NA	NA	NA	NA	1	6	3
Other	6	0	1	4	1	0	1	8	2	1
Total	20	10	21	10	13	17	32	64	32	15
Cumulative Total (since 1997)	49	59	80	90	103	120	152	216	248	263

Information gathered from tagged bears has proven enlightening over the last few years. Not only are some bears captured again in Nevada after being marked several years previous, as occurred this year, but some bears have traveled profound distances from Nevada and the area of initial capture. Harvest data from other states consists of: a dispersal age male bear tagged near Washoe Valley and later killed in the sport hunt two years later 20 miles north of Lakeview, Oregon; a nuisance bear shot by California authorities roughly 80 miles north of Susanville, California; and at least two other bears shot by California hunters after crossing the Sierra Nevada Range, one in Auburn and one closer to Sacramento. When compared with the record number of new bears captured by NDOW in 2007 and the disappearance of this data from subsequent years, this information paints the picture of a Nevada population on the far eastern edge of a core bear population in California. Further genetic analysis is needed to confirm this thought.

Habitat fragmentation however, plus the loss of travel corridors and the resulting potential loss of genetic diversity are concerns for Nevada's black bear population. Currently, viable and reproducing populations are thought to only exist in the Carson Range (eastern Sierra Nevada), and the Pinenut, Sweetwater, Wassuk, Pinegrove and Virginia Mountains. Further studies are needed in the more wildland type areas to determine bear population densities and the age and sex framework, which is the intent of the current research project. It is believed that Nevada's bear population could support a small annual recreational harvest.

ARIZONA BLACK BEAR STATUS REPORT

RON THOMPSON, Arizona Game and Fish Department, Large Carnivore Biologist, 5000 W. Carefree Highway Phoenix, Arizona, USA. rothompson@azgfd.gov
JOHNATHAN O'DELL, Arizona Game and Fish Department, Wildlife Specialist, 5000 W. Carefree Highway, Phoenix, Arizona, USA. jodell@azgfd.gov
CATHY LABERGE, Arizona Game and Fish Department, Data Specialist, 5000 W. Carefree Highway, Phoenix, Arizona, USA. claberge@azgfd.gov
AMBER MUNIG, Arizona Game and Fish Department, Statistician, 5000 W. Carefree Highway Phoenix, Arizona, USA. amunig@azgfd.gov
KIRBY BRISTOW, Research Biologist, 5000 W. Carefree Highway Phoenix, Arizona, USA. kbristow@azgfd.gov

Abstract: Members of the Arizona Game and Fish Commission are responsible for establishing hunting seasons, bag limits and methods of take for black bear (*Ursus americanus*). Black bears occupy a variety of habitats in Arizona, including subalpine and montane conifer forests, riparian forests, evergreen woodlands, chaparral, and Madrean oak habitats. Currently, Arizona's bear population provides a sustainable hunting opportunity for almost 5,000 hunters annually. Since 1990 harvest among bear management units has been highly variable and ranged from 1 to 58 bears in 36 management units. Annual harvest ranged from 101–368 and varied among years ($\bar{x}$=204). Hunters using hounds accounted for 21% of the harvest. Among all units, between the years 1990–2007, hunters harvested 2,146 male and 1,426 female black bears. In 2008 females made up approximately 30% of the total harvest, down from 40% for the period 1990-2008. The age at which female black bears in Arizona have young and the annual proportion of females that reproduce successfully varies considerably with precipitation and resultant food supply and nutritional condition of females. This fluctuation, although similar to what bear researchers throughout North America have documented (Rogers 1987, Eiler et al. 1989, Kolenosky 1990, McLaughlin et al. 1994), can be more pronounced in arid Arizona. Tooth annuli data indicates female black bears in Arizona may breed as early as three years of age and successfully raise litters at four years of age. During extended periods of drought, bears may not reproduce until as late as 6–7 years of age. Past studies in Arizona have shown that the percentage of adult females with cubs averaged 53% per year for a bear population in central Arizona (LeCount 1984) with cubs between 2–3 years of age experiencing a 79% survival (LeCount 1977). Sustainable hunter harvest and population abundance are sensitive to survival of adult females (Taylor et al. 1987, Horino and Miura 2000, Boyce et al. 2001). Management prescriptions in Arizona are therefore directed at protecting adult females. Female harvest limits are set to approximate 5% of the female segment within a hunt unit. Regulations fully protect adult females with cubs-of-the-year which are at the greatest risk of survival due to defense of young from male bears (Garshelis 1994, McLellan 1994, Swenson et al. 2001). Current research is focused on the effects of forest fuel reduction on black bear spatial ecology in the wildland urban interface, DNA sampling to validate estimated hunt unit subpopulations and connectivity between sky island mountain ranges and Sonora, Mexico. Conservation strategies for black bears in Arizona will be discussed.

Western Black Bear Workshop 10:45-48

Current Management in Arizona

Goal: Manage the black bear population, its numbers and distribution, as an important part of Arizona's fauna. Provide bear hunting and other related opportunities.

The Department maintains harvest data records that include age, sex, and kill location to monitor population trend information. Between 1990 and 2008, 3,674 black bears were

harvested in Arizona (includes sport, depredation, and other kills) (Table 1).

On average, hunters using hounds accounted for 21% of the harvest. Among all units from 1990-2008, hunters harvested 2,137 male and 1,424 female bears. The harvest sex ratio of (males: 100 females) proportion of the statewide harvest than did females. Eight units had M:F harvest ratios <1:1 and 26 units had M:F harvest ratios ≥1:1 (Table 1). The proportion of bears taken by hunters with hounds varies by unit and hunt structure (Table 1).

The number of bear tags sold annually has increased from about 2,800 in 1991 to over 5,000 in 2008. Harvest among units is highly variable and ranged from 1 to 58 bears in 36 units (Table 2). Annual harvest ranged from 101–368 and varied among years ($\bar{x}$ = 204).

Based on tooth cementum analysis by age and sex class of harvested black bears statewide during 2005–2007, subadults comprised 51.3% of the samples. Subadult females comprised 15.0% of samples, subadult males comprised 36.3% of samples, adult females comprised 21.4% of samples, and adult males comprised 27.3% of samples.

Sex and age of annual black bear harvests are indicative of harvest rate and population trend. Management objectives target the harvest of the male segment because bears are polygynous and females are more critical to reproductive success. Past studies have determined that in un-hunted or lightly exploited bear populations in Arizona, adults make up 70% or more of the population, with sex ratios near 50:50 and mean ages range from 6–8 years. Harvest data during 1995–2008 demonstrates that mean age for both male and female bears harvested in Arizona is generally 5–6 years (Table 3).

Currently, all western states use some form of the limit management system for management of black bear harvest. The Department has an annual female harvest limit that approximates 10% of the female segment of the estimated population and achieves a median age of harvested females of >5 years of age (Tables 4 and 5). Hunts that include only a subset of a unit also have female harvest limits to distribute opportunity and allow for a closure of specific areas when limits are achieved. Finally, population management hunts may be established to meet management objectives not achieved through standard hunt structures. Arizona's bear hunt structures are designed to direct harvest toward the male segment of the bear population through the use of female harvest limits by unit or across a combination of units. The legal wildlife for all bear hunts is any bear except sows with cubs. Hunters are required to report their harvested bears within 48 hours through a toll-free hot line. Hunting is closed in units where female harvest limits have been met. Closures occur at sundown the Wednesday following the report of the female limit being met.

Beginning in spring 2008, bear harvest limits were further restricted with the implementation of an annual female harvest limit, in addition to the individual season harvest limit, and includes all female bears killed by Department personnel due to human-bear conflicts. This system may close bear hunting in some units before a subsequent season is opened if the annual female harvest limit is reached before the season opens.

In a few units, the female harvest consistently exceeded the established female harvest limit. Harvest limits are exceeded because multiple animals are harvested on a single day or within the time period in which the season remains open (seasons close on Wednesday evening).

Management Strategies

1. Continue with the current conservative management strategy of season and annual female harvest limits to manage Arizona's bear population, while protecting females with cubs.

2. Reduce harvest of females in units that exceed annual female harvest limits on a consistent basis (e.g., 3 out of 5 consecutive years) and median age of harvested females within the hunt area is <5 years by reducing the number of seasons or shortening seasons to less than the current 6-day structures. Use DNA techniques to estimate minimum population sizes in these units.

3. Use DNA studies in conjunction with age and sex data to better estimate minimum population numbers by vegetative communities. Adjust female harvest limits for hunt areas with

Table 1. Black bear harvest in 35 units in Arizona, 2004–2008, Arizona Game and Fish Department, 2009.

	Harvest				Hunter Harvest									
Unit	Hunter	Depredation	Other Kills	% Harvest Using Hounds	Male	Female	M: 100F Ratio	Spring	Aug	Sept	Oct	Nov	Dec	Other Kills: Nuisance Bears
1	74	1	4	64.9	50	24	208	0	41	10	14	8	1	3
3B	35	0	7	71.4	23	12	192	1	19	9	5	1	0	6
3C	17	0	11	5.9	11	6	183	4	1	6	4	1	1	9
4A	20	0	3	22.0	13	7	186	0	0	0	20	0	0	3
4B	14	0	0	35.7	9	5	180	0	8	4	2	0	0	
5A	32	0	0	53.1	19	12	158	0	0	0	26	5	0	
5B	21	0	1	57.1	16	5	320	0	0	0	14	7	0	
6A	44	0	0	25.0	33	11	300	0	14	2	23	5	0	
6B	31	0	0	9.7	21	10	210	1	24	5	1	0	0	
7	7	0	0	0.0	4	3	133	0	0	0	5	2	0	
8	27	0	0	25.9	19	8	238	0	6	1	16	4	0	
9	1	0	0	0.0	0	1	0	0	0	0	1	0	0	
11M	2	0	1	0.0	1	1	100	0	1	1	0	0	0	
17A	2	0	0	50.0	1	1	100	0	0	1	1	0	0	
17B/18A	0	1	1	-	-	-	-	-	-	-	-	-	-	
19A	16	0	0	6.3	12	4	300	0	1	4	8	2	1	
20B	0	0	1	-	-	-	-	-	-	-	-	-	-	1
21	22	0	0	0.0	15	7	214	0	0	7	15	0	0	
22	64	0	1	20.3	40	24	167	1	10	16	27	8	2	1
23	153	0	2	38.6	94	59	159	0	36	33	72	8	1	
24A	36	0	5	0.0	23	13	177	2	20	0	12	2	0	3
24B	10	0	0	0.0	7	3	233	0	9	0	0	0	0	
27	135	4	4	30.4	84	51	165	0	20	37	54	20	4	4
28	10	0	2	0.0	6	4	150	0	0	1	5	4	0	
29	37	0	12	10.8	19	18	106	0	0	13	21	2	0	6
30A	12	0	4	16.7	7	5	140	0	0	1	10	0	0	1
31	28	1	1	3.6	17	11	155	1	0	9	18	0	0	
32	24	2	2	4.2	14	10	140	1	2	11	10	0	0	
33	3	0	4	33.3	2	1	200	2	0	0	0	0	1	3
34A	15	0	4	0.0	10	5	200	14	1	0	0	0	0	2
34B	0	0	1	-	-	-	-	-	-	-	-	-	-	
35A	17	0	9	11.8	9	8	113	11	0	4	0	1	1	7
35B	2	0	0	0.0	2	0	0	1	1	0	0	0	0	
38M	0	0	3	-	-	-	-	-	-	-	-	-	-	
Total	911	9	83	29.2	581	329	177	39	214	175	384	80	12	49

the best available data, including DNA-supported minimum population estimates.

4. Continue to collect genetic material from harvested bears to determine interrelatedness within broad vegetative communities. The degree of interrelatedness can be used to infer population changes within vegetative communities over time.

Relative Abundance of Black Bears: Test of DNA Techniques in Units 35A and 35B

Arizona's female harvest limits were first established in 1992 for a few units and for all units beginning in 1995. Limits are based on the estimated number of females occupying habitats of high, medium, and low quality. Habitat quality is the limiting factor supporting black bear numbers, but factors such as hunting, habitat manipulation, nutrition, predation, and hunting can all be regulators of bear numbers. The productivity of a bear population is primarily related to both habitat quality and the number of adult females in the population. Removal of adult females does not increase the productivity of the remaining females.

It is important to obtain estimated numbers of female bears in similar habitats under consistent female harvest limits. New genetic methods have great potential to provide these estimates. Genetic material is currently being collected from all hunter harvested bears. Regions 5 and 6 currently have on-going pilot projects to evaluate bear abundance using hair snags and DNA analysis. The Department's Research Branch is using hair snag methodology to inventory the bear population in and around Units 35A and 35B. In 2008, a minimum subpopulation figure was obtained using this technique and it yielded an estimate of 35 bears. Interrelatedness determinations developed through DNA analysis will also assist in better defining future bear management areas.

NEW MEXICO BLACK BEAR STATUS REPORT

RICK WINSLOW, Large Carnivore and Furbearer Biologist, New Mexico Department of Game and Fish, Santa Fe, New Mexico, USA.

Western Black Bear Workshop 10:49

Recent developments

- Started zone management in 2004, six zones along biogeographic province boundaries, included harvest limits based upon conservative (<10%) population estimates
- Recalculated habitat estimates in 2008
- Modeling effort using separate models, that agreed, indicates a higher population
- Using habitat and density estimates (Costello et al. 2001) performed a new population estimate, 5,921

2008 Rework and Plan

- Incorporated Black Bear Population Assessment and Harvest Management Matrix into management strategy
- Matrix development
- Basic structure
- Habitat estimate, 3 habitat classifications, only harvest based upon highest habitat class
- Harvest at 7% of estimated population initially, range from 5%-10% depending on mast resources. Evaluate biennially to determine need to adjust harvest percentage
- Harvest females at no more than 40% of total harvest (sows w/cubs protected)
- Close down harvest limit in any zone if: total limit reached (10% below closes to avoid exceeding harvest limit) or female limit reached (10% below).
- Real harvest limit becomes 5-6%
- Over past 4 seasons, hunters/outfitters have avoided female harvest (33% has been the 4 year average)
- Only some zones have met the harvest limits in the last 4 years, no female harvest limit has yet been met
- New maximal harvest limits slightly exceed 5 year average take
- 5 year average across state has been 344 ♂/122 ♀, new potential harvest is 408 ♂ /162 ♀ (10% below is 367 ♂ /146 ♀). We do not anticipate these numbers being met in most years.
- Numbers could be met in drought years when animals are ranging farther for limited resources

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TEXAS BLACK BEAR STATUS REPORT

JOHN YOUNG, Texas Parks and Wildlife, 4200 Smith School Road, Austin, Texas, USA
DAVE HOLDERMANN, Texas Parks and Wildlife, Alpine, Texas, USA
NATHAN GARNER, Texas Parks and Wildlife, 11942 FM 848, Tyler, Texas, USA

Western Black Bear Workshop 10:50-51

Population and Habitat Characteristics

The total statewide population in Texas is estimated at 80-100 black bears. We have documented breeding populations in Guadalupe Mountains, TX (part of greater Sacramento-Guadalupe mountains population in NM), Chisos/Dead Horse mountains, (part of the Burro-Carmen-Chisos meta-population) and Del Rio-Balcones Escarpment. A few breeding females may occur in the Del Norte-Glass mountain complex and in the Davis Mountains, but solid evidence is lacking. Dispersing-vagrant males (sub-adults and adults) are documented regularly in suitable habitats throughout the Trans-Pecos and Pineywoods ecoregions

The Burro and Carmen mountains in Coahuila, Mexico black bear populations have acted as a source for bears in the Chisos-Dead Horse mountain complex in Texas (Doan-Crider and Hellgren 1996, McKinney and Pittman 2001, and Onorato et al. 2004). Bi-directional movement of bears occurs between the Burro-Carmen population and the Chisos-Dead Horse population (McKinney and Pittman 2001, Mitchell et al. 2005). The neighboring states of Arkansas and Oklahoma appear to be the primary source of black bears in east Texas.

The largest contiguous blocks of unoccupied black bear habitat in the Trans-Pecos occur in the Davis, Glass, and Del Norte mountains (Rice 2008). Although habitat suitability modeling in the Pineywoods has shown that overall habitat quality is moderate to high and capable of supporting bears (Willis and Garner 1998), a breeding population has not become established. Human factors such as road density and potential conflict areas appear to be the most significant limiting factors. The best quality habitat areas appear to be in north central Red River County and in areas near the confluence of White Oak Creek and Sulphur River. New habitat suitability studies were begun in 2008 with the initiation of a project titled the "Habitat Suitability and Occupancy of Three Northeast Texas River Systems for Black Bear" with Stephen F. Austin State University. The Red River Basin, Sulphur River Basin, and White Oak Creek are the focal areas for this project.

The bear population in Texas has and continues to go through a natural recolonization process. Black bears recolonization in the Trans-Pecos is progressing slowly because of low female dispersal rates and the natural fragmented nature of suitable, year-round habitat within the region (relatively small montane islands surrounded by long expanses of desert lowlands). In east Texas black bear recolonization appears to be limited by the lack of female dispersal from neighboring states.

Conservation Hallmarks and Opportunities

Texas Parks and Wildlife Department initiated a black bear sightings/mortalities report program in 1990. We have documented 6 reliable black bear sightings in 2008 in five different counties of East Texas and 1 road mortality in southwestern Texas. This compares to 11 reliable bear sightings documented in 2006 and 6 in 2007. Early 2009 we have had bear confirmations in 3 different counties with one road-killed bear in Alpine. We have also documented one black bear at a corn feeder in Red River County in east Texas. Efforts will continue in 2009 to document valid bear sightings with associated GIS reference points identified.

Recently published research on black bears:

- Rice (2008) defines most suitable habitats in the Trans-Pecos
- "Predicting Private Landowner Support Toward Recolonizing Black Bears in the Trans-Pecos region of Texas" (Rice 2007); 45% against and 40% for natural

- recolonization; younger, more educated landowners with < 3-generations of ownership had more positive views about bears. Additionally 2 landowner studies conducted in east Texas by Michigan State University and Stephen F. Austin University documented strong support for bear recolonization.
- Key management implications of habitat modeling and genetic studies are: (1) the best bear habitat in the Trans-Pecos is yet to be recolonized (Del Norte-Glass and Davis mountains); (2) keep natural montane-lowland movement corridors open so that immigration/emigration process can function; and (3) minimize human-bear conflicts in recolonization zone so as to optimize the movement of breeding bear populations northward

Adequate information regarding the habitat and meta-population characteristics of bears and landowner attitudes currently exists to support a viable black bear conservation initiative for the Trans-Pecos; with some strategically oriented research this might also be extended to the South Edwards Plateau and South Texas regions.

The East Texas Black Bear Task Force was quite active in 2008 as a working subcommittee of the Black Bear Conservation Coalition (BBCC). It consists of people representing approximately 20 different organizations plus private landowners working together to carry out the Mission of the BBCC in East Texas and to implement elements of the East Texas Black Bear Conservation and Management Plan (2005 – 2015). Three Task Force Meetings were held in March, July and December of 2008 in order to communicate and coordinate fundraising, educational outreach programs and research/management efforts. Significant accomplishments in 2008 include the delivery of several bear programs to the public; the start of the Hardwood Tree Planting Cooperative Project; the development of a Curriculum Guide on bears for school teachers; the expanded creation and delivery of bear education signs for private landowners; and the further development and distribution of Media Kits on black bears to the various media outlets in Texas.

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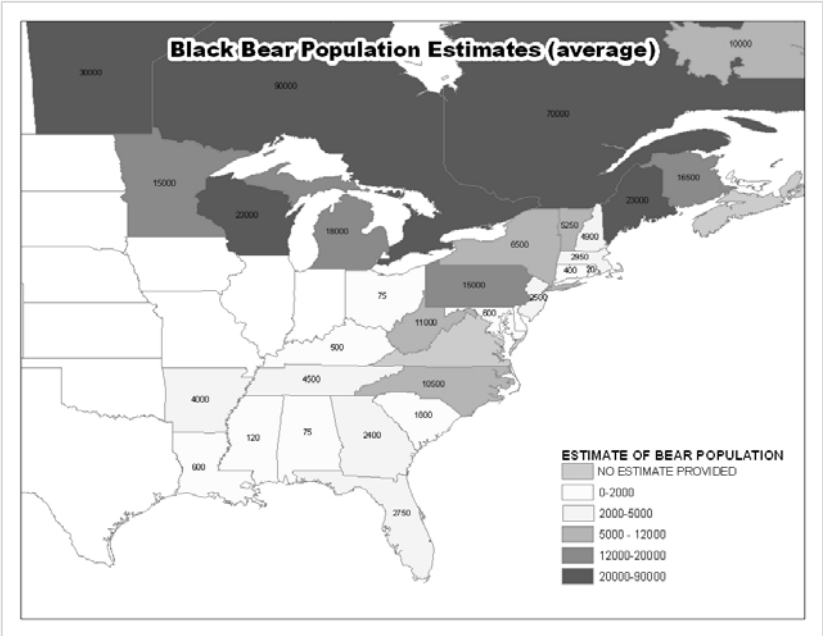
A SURVEY SUMMARY OF AMERICAN BLACK BEAR POPULATION AND HUMAN-BEAR CONFLICT MANAGEMENT ACROSS EASTERN CANADA AND THE UNITED STATES

H. Hristienko, Manitoba Conservation, Wildlife and Ecosystem Protection Branch, Box 24, 200 Saulteaux Cres., Winnipeg, MB, R3J 3W3, Canada.
B.S. Jimenez, Montana Cooperative Wildlife Research Unit, University of Montana, Natural Science Building - Room 205 Missoula, Montana 59812, USA
M.S. Mitchell, U. S. Geological Survey, Montana Cooperative Wildlife Research Unit, The University of Montana, Natural Sciences Building Room 205, Missoula, Montana, 59812, USA.

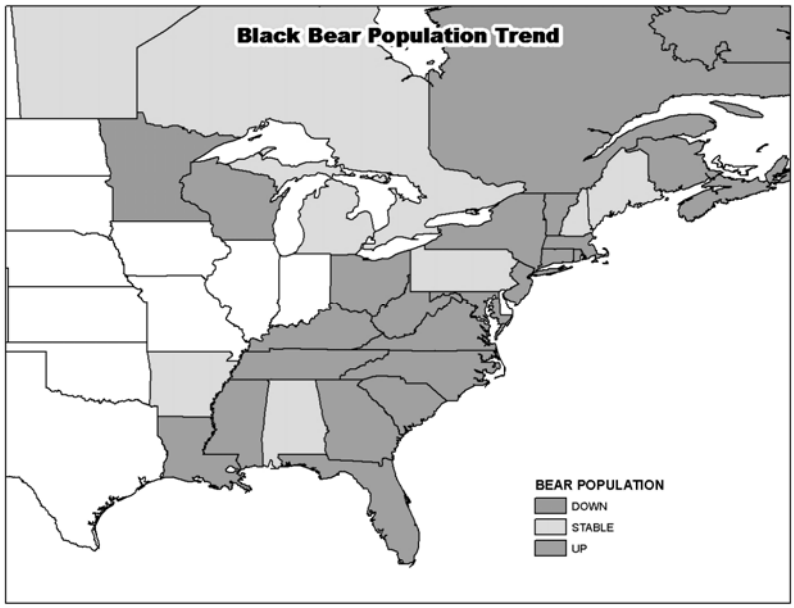
In preparation for the 20th Eastern Black Bear Workshop, a survey of thirty-two eastern jurisdictions was conducted in the fall of 2008 to ascertain which practices were being used by agencies to manage black bear populations. Unfortunately because of the economic downturn and associated travel restrictions, the 2009 workshop had to be cancelled. The co-hosts, Minnesota, Wisconsin and Manitoba, then sought an alternate venue where the survey information could be presented/published. The organizers of the 10th Western Black Bear Workshop were gracious to offer that forum. The following is a short synopsis of the findings.

Western Black Bear Workshop 10:52-59

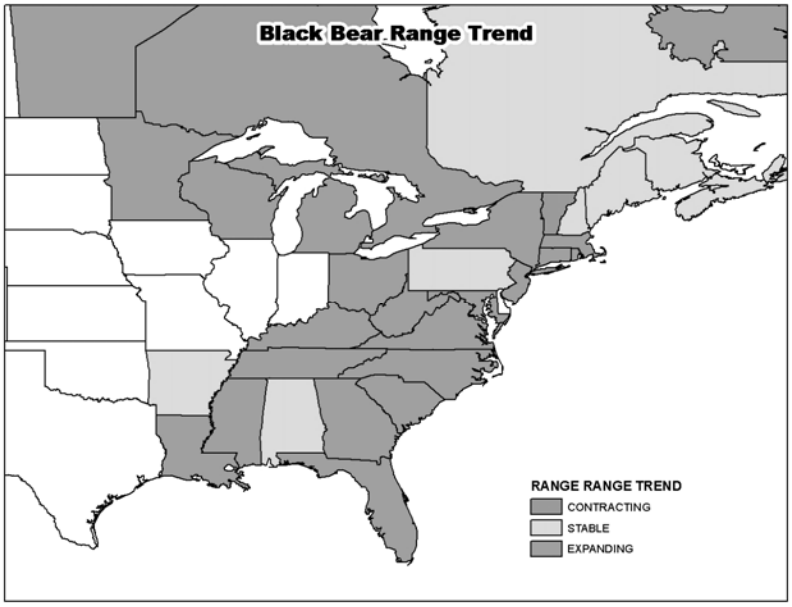
Black Bear Population Estimates – The results of a similar survey conducted in 2001 were published in *Ursus* (Garshelis & Hristienko 2006; Hristienko & McDonald 2007). Based on the mid-point estimates from the 2001 and 2008 surveys, 19 jurisdictions (NB, NF, PQ; CT, FL, KY, LA, MD, MA, MS, NJ, NY, OH, RI, SC, TN, VT, WV, WI) reported population increases while two (MI, MN) indicated population decreases and nine (MB, ON; AL, AR, GA, ME, NH, NC, PA) identified no change. Nova Scotia and Virginia chose not to provide an estimate in 2008. Eighteen (56%) of the estimates were empirically derived.



Black Bear Population Trend – Between 1988 and 2001, the eastern Canadian black bear population (MB, NB, NL, NS, ON, PQ) increased by 9.6% (<1%/year) while the US black bear population (AL, AR, CT, FL, GA, KY, LA, ME, MD, MA, MI, MN, MS, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI) increased by 24.4% (about 2%/year). Between 2001 and 2008, both the eastern Canadian and U.S. black bear populations increased by 6.7% and 6.5% respectively (about 1%/year).



Black Bear Range Trend – Vermont was the only jurisdiction to report that its bear range was contracting. Twenty-four (75%) reported range expansion while seven (NB, NS, PQ; AL, AR, ME, MI, NH, PA – 22%) reported stable range trends. Wherever possible, black bear range maps, commonly found on the internet, should be updated to reflect expanded range occupation.



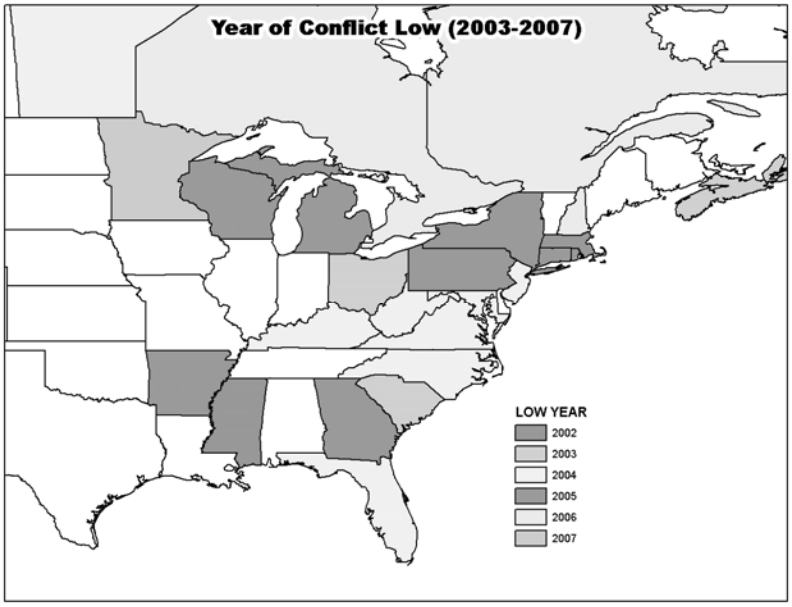
Black Bear Hunting Seasons with % Harvest – Of the 23 jurisdictions (72%) that have a black bear hunting season, all but 4 have bag limits of 1 bear. Newfoundland and West Virginia have bag limits of 2 bears while Ontario and Minnesota have a bag limit of 1 bear but do allow a second bear to be taken in some game management units. There are no spring seasons in the eastern U.S., while in eastern Canada all but Ontario and Nova Scotia have a spring season. Harvest rates vary from a low of 2.5% in South Carolina to a high of 22.4% in Minnesota. On average, the harvest rate for eastern Canada is 7.4% while in eastern US it's about 12.3%.

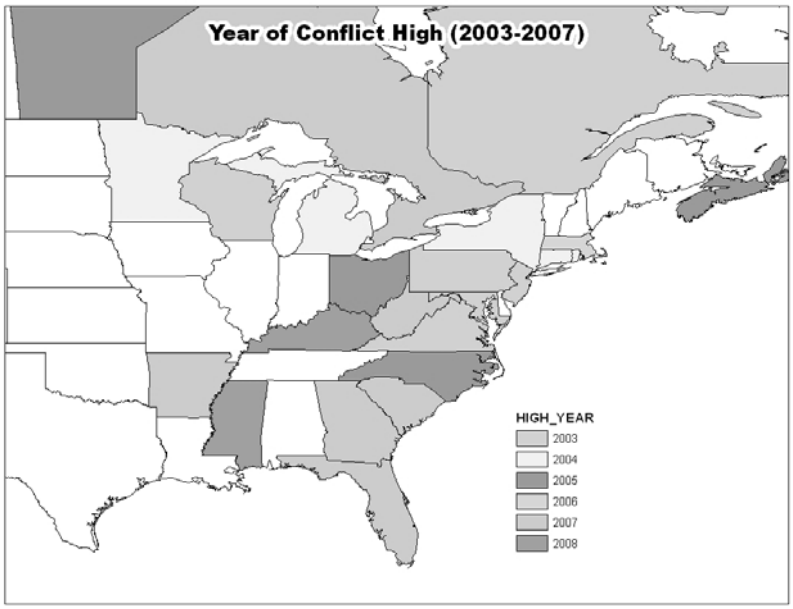
Baiting – All 6 Canadian provinces allow baiting as do 7 states in the U.S. (AL, ME, MI, MN, NH, NC, WI). The remaining ten (43% – GA, MD, MA, NY, PA, SC, TN, VT, VA, WV) prohibit baiting.

Hounds – Only Ontario allows hounds to hunt black bears in eastern Canada while 11 states do in the US (GA,ME,MI,NC,NH,SC,TN,VT,VA,WV,WI). Eleven (48%) prohibit the use of hounds.

Human-Black Bear Conflicts – Twenty-three jurisdictions (72%) report an increasing trend in conflict between humans and black bears over the last ten years. Michigan is the only jurisdiction to report a downward trend. AL, AR, ME, MN, NS, WI report a stable trend. Ontario and Quebec report a variable trend. Although unquantified, it appears that high local densities of people coupled with high densities of bears leads to higher complaint rates (e.g. CT – 545 complaints for 400 bears; FL – 3,067 complaints for 2,750 bears; vs. ON – 12,645 complaints for 87,000 bears).

Low and High Conflict Years – no clear patterns were identified.





Compensation for Damage to Agriculture – MB, ON, MD, NH, PA, VT, WV, WI (22%).

Compensation for Damage to Apiaries – MB, ON, MD, NH, PA, VT, WV, WI (25%).

Compensation for Damage to Livestock – MB, ON, MD, NH, PA, VT, WV, WI (25%).

Providing compensation for damage caused by black bears can be costly as Manitoba can attest to. Between 2003 and 2007, payments ranged from a low of $179,000 (2006) to a high of $480,000 (2007).

Compensation for Damage to Property – Only VT and WV provide compensation.

Anti-Feeding Regulations – Despite increasing trends in human-bear conflict across 70% of the eastern range, only 47% of jurisdictions have regulations to manage non-natural food attractants.

Once a bear becomes hooked on anthropogenic foods, it cannot be rehabilitated. The result is that some bears are needlessly killed to safeguard human welfare and property. People's inaction to deter bears from associating people and dwellings with food is enabling some bears to become problem bears. The most practical solution starts with people management through education, non-natural food management and enforcement of regulations. We have a ways to go as only 10 jurisdictions (MB, ON, NB, NS, CT, KY, LA, MD, NH, NJ) have formal education programs.

Twenty-three agencies provide trap and transport services while another two (Minnesota and Wisconsin) outsource the service. Ontario, Alabama, Florida, Maine, New Hampshire, and Vermont use both private and public agents.

	Estimate of Population	Emphirically derived	Population Trend	Achieved Harvest Level (%)	Range:	Age reconstruction:	Bait stations:	Bear Food Survey	Bio-marking	Density Extrapolation	Depredation Kills	DNA	Mark / Recapture	Roadkills	Telemetry Studies	Teeth	Reproductive Tracts	Questionnaires	Mandatory Registration:	Check Station	Electronic Terminal	Modelling	Hunting Season	Spring	Fall	Baiting	Dogs / Hounds	Bag Limit	Cubs Protected	Species Specific Licence	Combination hunting licence
Canada																															
MANITOBA	25,000 - 35,000	No	stable	6.6	expanding	No	No	No	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	No	1	Yes	Yes	No
NEW BRUNSWICK	16,500	Yes	up	11.9	stable	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	1	Yes	Yes	No
NEWFOUNDLAND	10,000	No	up	5.3	expanding	No	No	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	2	Yes	Yes	No
NOVA SCOTIA	no estimate	Yes	up		stable	Yes	No	No	No	No	No	No	No	Yes	No	Yes	No	Yes	Yes	No	Yes		Yes	No	Yes	Yes	No	1	No	Yes	No
ONTARIO	75,000 - 100,000	Yes	stable	6.5	expanding	No	Yes	Yes	No	Yes	No	Yes	Yes	No	No	Yes	No	Yes	No	No	No	Yes	Yes	No	Yes	Yes	Yes	1 - 2	No	Yes	No
QUEBEC	70,000	Yes	up	6.7	stable	No	No	No	No	No	Yes	No	No	No	No	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	No	1	No	Yes	No
United States																															
ALABAMA	50 - 100	No	stable		stable	No	No	No	No	No	No	No	No	Yes	No	No	No						No								
ARKANSAS	3,500 - 4,500	No	stable	8.6	stable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	1	No	No	Yes
CONNECTICUT	300 - 500	No	up		expanding	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No						No								
FLORIDA	2,500 - 3,000	Yes	up		expanding	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No						No								
GEORGIA	2,300 - 2,500	No	up	13.7	expanding	No	Yes	Yes	No	No	No	No	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No	Yes	1	Yes	No	Yes
KENTUCKY	<500	No	up		expanding	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes					Yes	No								
LOUISIANA	500 - 700	No	up		expanding	No	No	No	No	No	No	Yes	Yes	No	Yes	Yes	No						No								
MAINE	23,000	Yes	stable	14.1	stable	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	1	No	Yes	Yes
MARYLAND	600+	Yes	up	7.3	expanding	No	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	No	No	1/permit	No	Yes	No
MASSACHUSETTS	2,900 - 3,000	Yes	up	4.8	expanding	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	No	No	1	No	No	No
MICHIGAN	18,000	Yes	stable	13	expanding	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	1	Yes	Yes	No
MINNESOTA	15,000	Yes	down	22.4	expanding	Yes	No	Yes	Yes	No	No	No	No	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No	1 - 2	Yes	Yes	No
MISSISSIPPI	120	No	up		expanding	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No						No								
NEW HAMPSHIRE	4,900	Yes	stable	11.8	stable	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	1	No	Yes	Yes
NEW JERSEY	1,800 - 3,200	Yes	up		expanding	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No		No								
NEW YORK	5,000 - 8,000	Yes	up	18	expanding	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	No	No	1	N/Y	No	Yes
NORTH CAROLINA	9,000 - 12,000	Yes	up	16.7	expanding	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	1	Yes	No	Yes
OHIO	50 - 100	No	up		expanding	No	No	No	No	No	No	Yes	No	Yes	No	Yes	No	No	No			No	No								
PENNSYLVANIA	15,000	Yes	stable	20.8	stable	Yes	No	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	1	No	Yes	No
RHODE ISLAND	<20	No	up		expanding	No	No	No	No	No	No	No	No	No	No	No	No					No	No								
SOUTH CAROLINA	1,800	Yes	up	2.5	expanding	No	Yes	No	No	Yes	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	Yes	No	Yes	No	Yes	1	Yes	No	Yes
TENNESSEE	3,000 - 6,000	No	up	6	expanding	No	Yes	Yes	No	No	Yes	No	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	Yes	No	Yes	No	Yes	1	Yes	No	Yes
VERMONT	4,500 - 6,000	Yes	up	10.1	contracting	Yes	No	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	1	No	No	Yes
VIRGINIA	no estimate		up		expanding	Yes	No	No	No	Yes	No	No	No	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	1	Yes	No	Yes
WEST VIRGINIA	10,000 - 12,000	No	up	14.7	expanding	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	Yes	2	Yes	Yes	No
WISCONSIN	23,000	Yes	up	12.6	expanding	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	1	Yes	Yes	No

	Human-Bear Conflict Database	# of Human-Bear Conflicts 2003 - 2007	Low Year	High Year	!0-year Trend	# killed as Problem Animals	# Hit or Killed by Vehicles	Managing Human-Bear Conflict	Education Programming	Compensation for Agriculture	Compensation for Apairies	Compensation for Livestock	Compensation for Property	Services: Advice / Education	Services: Aversive Conditioning	Services: Electric Fencing	Services: Hazing	Services: Rehab Facilities	Services: Trap and Transport	Anti-fedding Regulation	Year Instituted	Regulation Applied:
Canada																						
MANITOBA	Yes	1,142 - 2,394	2004	2005	up 2%	235	24	Medium	Formal	Yes	Yes	Yes	No	Agency	No	Agriculture	No	No	Agency	Yes	2005	provincewide
NEW BRUNSWICK	No	200+			up	45	78	Medium	Formal	Yes	No	No	No	Agency	No	Agriculture	No	Outsourced	Agency	No		
NEWFOUNDLAND	No				up		low	Medium	Both	No	No	No	No	Agency	No	No	No	Agency	Agency	No		
NOVA SCOTIA	Yes	411 - 849	2003	2005	stable	8	63	Low	Formal	No	No	No	No	Agency	Agency	No	No	No	Agency	No		
ONTARIO	Yes	7,016 - 12,645	2006	2007	varies	183	57	High	Formal	No	Yes	Yes	No	Both	Both	No	No	Outsourced	Both	Yes		local
QUEBEC	Yes	233 - 2,126	2006	2003	varies	181	50	High	Both	No	No	No	No	Agency	No	No	No	No	Agency	No		
United States																						
ALABAMA	No	10 - 12			stable	1	3	Low	Informal	No	No	No	No	Both	No	No	No	No	Both	No		
ARKANSAS	Yes	116 - 341	2005	2007	stable	1-2	1-2	High	Informal	No	No	No	No	Agency	Agency	Agency	Agency	Outsourced	Agency	No		
CONNECTICUT	Yes	179 - 545	2005	2004	up	1	9	High	Formal	No	No	No	No	Agency	Agency	No	Agency	No	Agency	No		
FLORIDA	Yes	1,819 - 3,067	2004	2007	up	9	154	High	Both	No	No	No	No	Agency	Agency	Agency	Both	Outsourced	Both	Yes	2002	both
GEORGIA	No	674 - 816	2005	2007	up	1-2	36	High	Informal	No	No	No	No	Agency	Agency	No	Agency	No	Agency	Yes	1981	statewide
KENTUCKY	Yes	37 - 313	2004	2008	up	1	5	High	Formal	No	No	No	No	Agency	Agency	Agency	Agency	No	Agency	Yes	2003	statewide
LOUISIANA	No	~ 300			up	0	15	High	Formal	No	No	No	No	Agency	Agency	USDA WS	Agency	Outsourced	Agency	Yes	2005	statewide
MAINE	Yes	200 - 400			stable	4	3	Low	Informal	No	No	No	No	Agency	Both	Outsourced	No	Outsourced	Both	No		
MARYLAND	No	278 - 496	2004	2003	up	2	55	High	Formal	Yes	Yes	Yes	No	Both	Agency	Both	Agency	No	Agency	Yes	1991	both
MASSACHUSETTS	Yes	102 - 146	2005	2006	up	3	14	High	Informal	No	No	No	No	Agency	No	No	Agency	No	Agency	No		
MICHIGAN	Yes	184 - 366	2005	2004	down	1	?	Medium	Informal	No	No	No	No	Both	Agency	Both	Agency	Outsourced	Agency	No		
MINNESOTA	Yes	443 - 582	2007	2004	stable	24	20	Medium	Informal	No	No	No	No	Agency	No	Agency	No	Agency	Outsourced	No		
MISSISSIPPI	No	0 - 20	2002	2008	up	0	1	High	Informal	No	No	No	No	Agency	No	Outsourced	No	No	Agency	No		
NEW HAMPSHIRE	Yes	419 - 927	2006	2003	up 2%	16	60	High	Formal	Yes	Yes	Yes	No	Both	Both	Both	Both	Outsourced	Both	Yes	2006	statewide
NEW JERSEY	Yes	756 - 1,308	2004	2003	up	17	63	High	Formal	No	No	No	No	Agency	Agency	Agency	Agency	Outsourced	No	Yes	2001	statewide
NEW YORK	Yes	587 - 1,127	2005	2004	up	18	59	High	Informal	No	No	No	No	Agency	Agency	Both	Agency	Outsourced	Agency	partial	1994	statewide
NORTH CAROLINA	Yes	292 - 532	2004	2005	up	3	131	High	Both	No	No	No	No	Agency	Agency	Outsourced	Agency	Both	Agency	No		
OHIO	Yes	13 - 37	2003	2005	up	1	1	High	Informal	No	No	No	No	Agency	No	No	Agency	No	Agency	No		
PENNSYLVANIA	Yes	1,196 - 1,902	2005	2003	up	17	357	High	Informal	No	Yes	Yes	No	Agency	Agency	Agency	Agency	No	Agency	Yes	2003	statewide
RHODE ISLAND	Yes	0 -4	2005	2004	up	0	0	Medium	Informal	No	No	No	No	Agency	Agency	No	Agency	No	Agency	Yes	2006	statewide
SOUTH CAROLINA	Yes	135 - 462	2003	2007	up	3	15	High	Both	No	No	No	No	Agency	Agency	No	No	No	Agency	Yes	2000	statewide
TENNESSEE	No	300 - 1,000			up	8	9	High	Informal	No	No	No	No	Agency	No	No	No	Outsourced	Agency	Yes	2000	local
VERMONT	No				up	12	55	High	Both	Yes	Yes	Yes	Yes	Both	Agency	No	Agency	No	Both	No		
VIRGINIA	Yes	157 - 586	2004	2003	up	100	30	High	Informal	No	No	No	No	Agency	Agency	No	Both	No	Agency	Yes	2003	statewide
WEST VIRGINIA	Yes	567 - 1,598	2004	2007	up	58	62	High	Informal	Yes	Yes	Yes	Yes	Agency	Agency	No	Both	No	Agency	Yes	1950	both
WISCONSIN	Yes	1,003 - 1,383	2005	2003	stable	5	170	Medium	Informal	Yes	Yes	Yes	No	Both	No	Outsourced	No	Outsourced	Outsourced	Yes	2002	statewide

MEXICO BLACK BEAR STATUS REPORT

DIANA DOAN-CRIDER, Department of Ecosystem Science, Texas A&M University, PO Box 185, Comfort, TX 78013; d-crider@tamu.edu
HECTOR VILLALON MORENO, Av. Eugenio Garza Sada 6604, Colonia Lagos del Bosque, Monterrey N.L., C.P. 64890
GILBERTO SALGADO DE LOS SANTOS, Consejo Estatal de Flora y Fauna de Nuevo Leon, Padre Mier No. 545-F Pte. Zona Centro, Monterrey, Nuevo León, C.P. 64000

Western Black Bear Workshop 10:60

Abstract **-** 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, and is also considered as a Priority Species by the federal government. While the black bear technically falls under the management jurisdiction of state governments, federal oversight remains with the Commission of Natural and Protected Areas (CONANP). Recently, however, black bear populations have begun to increase and expand into previously occupied historic ranges. Changes in land management philosophies and land tenure patterns, and an increase in public awareness have resulted in positive attitudes towards bears. 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. Lack of trained personnel and research funds have limited proper assessment of most populations. Bears are currently reported in the states of Sonora, Chihuahua, Durango, Zacatecas, Nuevo Leon, Tamaulipas, San Luis Potosi, Aguas Calientes, and Jalisco. Some areas in Coahuila, Chihuahua, Nuevo Leon, and Sonora report very high numbers of bears, and the Serranias del Burro, Coahuila, has been listed as a special management area due to high densities reported in recent studies. Other areas, even within those same states, however, still appear to remain unstable, and deserve prioritized research and management attention. Recent reports indicate that bears may be expanding into once vacant historic ranges in the states of Zacatecas, San Luis Potosi, and Aguas Calientes. In particular, bear sightings have increased along the Texas border, and are likely of bears emigrating from Mexico. Drought likely plays a critical role in black bear expansion, causing females to relocate to new areas, whereas they typically do not leave natal ranges. Climate models predict longer and more extreme drought patterns for northern Mexico and south Texas. These patterns may be contributing to increased conflicts in both agricultural and urban areas. In the spring of 2008, over 40 bear conflicts were reported within the city limits of Monterrey, Mexico's third largest city. There have been a number of proposals to manage populations to minimize conflicts, and to provide economic incentive for ranchers to continue to participate in bear management programs. If approved, and even if populations are lightly harvested, monitoring programs will be necessary to avoid negative impacts to bear populations. The area of highest need is in capacity building of students and personnel for the development of sound management and research strategies and long-term conservation plans.

Brown Bear Ecology & Management

Session 3: Brown Bear Ecology and Management

Session Chair: Charles Schwartz, U.S. Geological Survey

Session Summary

This was the first year the Western Black Bear Workshop entertained papers dealing with brown bears. The session was chaired by Dr. Chuck Schwartz of the Interagency Grizzly Bear Study Team. There were 3 presentations. The first was a Grizzly Bear Status Report by Dr. Chris Servheen, Grizzly Bear Recovery Coordinator. Chris provided an overview of the status of grizzly bears in the 6 recovery zones in the United States. The second paper entitled "Challenges associated with managing Kenai Peninsula brown bears" was presented by Jeff Selinger, with coauthors T. J. McDonough and L. L. Lewis. Jeff discussed the complex management issues associated with the brown bear on the Kenai Peninsula including research and monitoring programs, varying public perceptions and difficulties associated with management. The third and final paper was presented by Chuck Schwartz and coauthored by Steve Cain, Shannon Produzny, an Steve Cherry. The paper contracted temporal activity patterns between sympatric black and grizzly bears in Grand Teton National Park.

PROGRESS ON GRIZZLY RECOVERY UNDER ENDANGERED SPECIES ACT PROTECTION

C. Servheen, U.S. Fish and Wildlife Service, University Hall 309, University of Montana, Missoula, MT 59812 USA.

Abstract: The grizzly was listed under the Endangered Species Act in 1975. Formal recovery efforts have been in place since 1981. The species currently occupies approximately 2% of its former range in the lower 48 United States in portions of the states of Wyoming, Montana, Idaho, and Washington. In order to recover the species it was necessary to make significant changes in the way populations and habitat were managed. The keys to this effort were to limit human-caused mortality by addressing the causes of this mortality and increase habitat security, particularly from disturbance from motorized activity. We also needed to build a strong level of political and agency commitment toward the common purpose of recovering this species. We have also made intensive efforts to build support and understanding for grizzly recovery in the hearts and minds of the people who live, work, and recreate in grizzly habitat. Outreach efforts with the public have resulted in a real change in the attitudes of people who live in grizzly habitat. Of the 6 areas where grizzlies were thought to exist in 1975, the two largest populations in the Yellowstone ecosystem and the Northern Continental Divide ecosystem have dramatically increased to more than 600 and 765 bears respectively. In these two areas, grizzlies are reoccupying areas where they have been gone for 80-100 years. We now have grizzlies moving 80+ miles east out onto the Great Plains as they follow river corridors away from the mountains. Smaller populations have not increased as successfully as the larger population units. We have about 40 grizzlies in the Cabinet/Yaak area in Northwest Montana and more than 60 in the Selkirk Mountains in north Idaho. We have augmented the approximately 15 grizzlies in the Cabinet Mountains and have documented several generations of reproduction by the bears placed there, but these populations remain small and at risk. The North Cascades is probably the most at risk population and we have done little to aid this population due to lack of funding to implement recovery efforts. We attempted to reintroduce a grizzly population in the Bitterroot ecosystem in east-central Idaho in early 2000, but this effort was never funded due to political "interest" in the issue. This area is the largest contiguous block of designated wilderness in the Rocky Mountains and remains an area with high potential for a new grizzly population. We have advanced the science about grizzly bears and their habitat needs through intense scientific work. We now know much more about population dynamics, ways to count bears, the genetics of populations, and detailed movement and survival patterns in response to human activity. We use this new scientific information in an adaptive management approach to implement management action in response to monitoring information on an annual basis. We are working hard to provide reconnection opportunities between all the large blocks of public land in the northern Rockies and across the border with Canada as our goal is to functionally connect these populations into a larger more robust and resilient unit. We have made significant progress in the past 29 years of recovery efforts and two of our populations are healthy and robust. However more work needs to be done to recover the smaller populations, to reintroduce grizzlies into the Bitterroot and to assure connections between the available habitats in the Northern Rockies.

Western Black Bear Workshop 10:63

CHALLENGES ASSOCIATED WITH MANAGING KENAI PENINSULA BROWN BEARS

J. S. Selinger, Alaska Department of Fish and Game, 43961 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669, USA.
T. J. McDonough, Alaska Department of Fish and Game, 3298 Douglas Place, Homer, AK 99603, USA.
L. L. Lewis, Alaska Department of Fish and Game, 43961 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669, USA.

Abstract: Prior to the mid-1990's, research and management efforts directed towards Kenai Peninsula brown bears were minimal. An increasing human population, related development issues, and subsequent increases in non-hunting human caused brown bear mortalities, prompted Alaska Department of Fish and Game staff to initiate action to address the lack of data for brown bears. Public perceptions relating to these actions and recently published information led to numerous challenges for current management staff. We will provide an overview of some of the initial actions, consequences of varying public perceptions, and difficulties associated with managing Kenai Peninsula brown bears. We will also identify our current management strategy and future direction.

Western Black Bear Workshop 10:64

ACTIVITY PATTERNS OF SYMPATRIC BLACK AND GRIZZLY BEARS IN GRAND TETON NATIONAL PARK

Charles C. Schwartz, U.S. Geological Survey, Northern Rocky Mountain Science Center, Interagency Grizzly Bear Study Team, Forestry Sciences Lab, Montana State University, Bozeman, Montana, 59717, USA.
Steven L. Cain, National Park Service, Grand Teton National Park, P. O. Box 170, Moose, Wyoming 83012, USA.
Shannon Podruzny, U.S. Geological Survey, Northern Rocky Mountain Science Center, Interagency Grizzly Bear Study Team, Forestry Sciences Lab, Montana State University, Bozeman, Montana, 59717, USA.
Steve Cherry, Department of Mathematical Sciences, Montana State University, Bozeman, Montana 59717, USA.

Abstract: The distribution of grizzly bears (*Ursus arctos*) and American black bears (*U. americanus*) overlaps extensively in western North America. Both species are generalist omnivores with niche and diet overlap. To date, most studies of grizzly and black bear activity patterns have focused on grizzly or black bears, but not both. In a national park setting we investigated the relationship between both species' activity patterns and how human influences altered these patterns. We used data collected at 35-190 min. intervals from -15° head to tail activity switches in GPS radio-transmitters to estimate activity for 10 grizzly and 19 black bears. We found that most activity patterns were similar between the species. Both were mainly diurnal, exhibited daily bimodal activity patterns with peaks near sunrise (4:00 to 8:00) and sunset (16:00 to 20:00), reached peak seasonal activity levels in July and August, were less active just after and prior to denning, reduced activity during relatively high and low temperatures, and were more night active and less mid-day active when ≤ 2 km of roads or developments. Black bears were more and less active mid-day and at night, respectively, than grizzly bears, and activity was higher among male than female grizzlies at night. Seasonally, black bears were less active in October than grizzly bears. Since bear attacks on humans in North America are disproportionately more frequent in national parks, we suggest ways that knowledge of bear activity patterns may be useful in attempts to minimize undesirable bear-human encounters.

Western Black Bear Workshop 10:65

Bear & Human Conflict Management

Session 4: Bear and Human Conflict Management

Session Chair: Jon Beckmann, Wildlife Conservation Society

Session Summary

Discussions of bear-human conflicts and ways to manage this complex set of issues was a dominate theme of the 10th Western Black Bear Workshop, not only in this session, but over the course of the entire four days. The wide variety of topics related to bear-human conflicts that presenters in this session covered demonstrated the complexities involved in dealing with these issues. Lori Holmstol began the session by presenting on the role of learning and how understanding learning theory can be useful in understanding the dynamics behind bear-human conflicts. The second presentation by Frank T. van Manen examined the potential ecological impacts of expanding highway infrastructure on black bear populations using pre-construction data as a baseline and a pre- and post-construction comparison. In the third presentation, Sharon Baruch-Mordo presented data from Colorado demonstrating that black bears in their study area are capable of shifting from utilizing anthropogenic food resources in one year to utilizing natural food resources in subsequent years. Thus, she addressed the questions of "what defines an urban bear" and "are we managing the right bear?" The final presentation was by Lynn Rogers who discussed the issue of diversionary feeding as a potential management tool to deal with bear-human conflicts. The presentations in this session were a nice lead-in to the Bear-Human Conflict Management panel and discussion that occurred in the subsequent session of the workshop.

APPLICATIONS OF LEARNING THEORY TO BEARS IN CONFLICT WITH HUMANS

L. Homstol, M.S. student, Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9 Canada.
C. St. Clair, Associate Professor, Biological Sciences, University of Alberta, Edmonton, AB, T6G 2E9, Canada.

Abstract: Human-wildlife conflict results in lethal management for several species, including many species of bear. In British Columbia, Canada, bear managers kill approximately 800 black bears and 35 grizzly bears annually because of conflicts with humans. Bear managers are under increasing pressure, particularly around resort communities, to manage non-lethally, typically using aversive conditioning (AC). To investigate the potential of AC for non-lethal management, we radio-collared black bears, and alternately assigned bears in conflict to one of three treatment groups: one that paired pain with sound (whistles), one with pain alone, and a control group. We paired whistles with pain in one group to capitalize on the ease with which other mammals associate sound with pain. If a whistle alone could subsequently be used to temporarily dissuade bears from attractants, this approach might help to prevent food conditioning, which is often the precursor of conflict. We subjected bears to 3-5 days of AC using both rubber bullets fired from shotguns and marbles fired from a slingshot, and compared pre-treatment measures of wariness to post-treatment measures. Preliminary results indicate that bears easily associated a whistle with pain stimuli, and that marbles fired from a slingshot were effective for use as pain stimuli on most bears. Control bears permitted closer approaches by humans than bears in either treatment category, and bears in the sound category were significantly more wary post-treatment than bears in the no-sound category. We also illustrate the extinction, by week, of post-treatment wariness for both AC categories. Our results will help bear managers to maximize the effectiveness of AC.

Western Black Bear Workshop 10:68

SHORT-TERM IMPACTS OF A 4-LANE HIGHWAY ON BLACK BEARS IN EASTERN NORTH CAROLINA

F. T. van Manen, U.S. Geological Survey, Southern Appalachian Research Branch, 274 Ellington Plant Sciences Building, University of Tennessee, Knoxville, TN 37996, USA.
J. Nicholson; Department of Forestry, Wildlife, and Fisheries; University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37996, USA.
M. F. McCollister; Department of Forestry, Wildlife, and Fisheries; University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37996, USA.
L. M. Thompson; Department of Forestry, Wildlife, and Fisheries; University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37996, USA.
J. L. Kindall; Department of Forestry, Wildlife, and Fisheries; University of Tennessee, 274 Ellington Plant Sciences Building, Knoxville, TN 37996, USA.

Abstract: The potential ecological impacts of the expanding highway infrastructure on wildlife populations have drawn the attention of natural resource managers in recent decades. However, few studies have documented the impacts of highways using pre-construction data as a baseline. During the last decade, the North Carolina Department of Transportation rerouted and upgraded sections of U.S. Highway 64 between Raleigh and the Outer Banks to a 4-lane, divided highway. A new route was selected for a 24.1-km section in Washington County. To mitigate the effects of the highway on wildlife, particularly American black bears (*Ursus americanus*), the new roadway included 3 wildlife underpasses with adjacent wildlife fencing. Additionally, we initiated a study to determine the short-term impacts of the new highway on the spatial ecology, genetic structure, population abundance, and occupancy of black bears. We tested our research hypotheses using a before-after control-impact (BACI) experimental design. Data collection occurred during 2000–2001 (pre-construction phase) and 2006–2007 (post-construction phase) in the highway project area and a nearby control area (each approximately 11,000 ha), resulting in 4 data groups (i.e., pre- or post-construction study phase, treatment or control area). We captured and radiocollared 57 bears and collected 5,775 hourly locations and 4,998 daily locations. Using mixed model analysis of variance and logistic regression, we detected no changes in home-range or movement characteristics of bears because of the new highway, although the power was low for some tests. After the highway was completed, however, bears on the treatment area became more active in morning, when highway traffic was low, compared with bears on the control area. We used DNA from hair samples to determine if population abundance and site occupancy decreased following completion of the new highway. For each study phase, we collected black bear hair from 70 hair-sample sites during 7 weekly sampling periods on each study area and generated genotypes using 10 microsatellite loci. We used the multilocus genotypes to obtain capture histories for 226 different bears and applied multiple mark-recapture models to estimate population abundance. Population abundance on the treatment area decreased from 68 bears before construction to 21 bears after construction, a proportionally greater decrease than we observed on the control area (pre-construction: 144; post-construction: 101). Next, we used bear visits to the hair-sample sites as detections in multi-season occupancy models and used model selection procedures to test if the new highway affected site occupancy (Ψ). We found that occupancy decreased more on the treatment area (pre-construction: $\Psi = 0.84$, post-construction: $\Psi = 0.42$) compared with the control area (pre-construction: $\Psi = 0.91$; post-construction: $\Psi = 0.81$), primarily as a function of a greater probability of site extinctions (ε) on the treatment area ($\varepsilon = 0.57$) compared with the control area ($\varepsilon = 0.17$). Finally, we used permutation tests and mixed model analysis of variance to compare gene flow, isolation by distance, heterozygosity, allelic diversity, and genetic structure (F_{st}) on the 2 study areas before and after completion of the highway. We did not observe any treatment effects for these genetic measures. Black bear use of the 3 wildlife underpasses was infrequent (17 verified crossings based on remote cameras, track surveys, and telemetry). Only 4 of 8 bears with home ranges near the highway were documented crossing the

highway (n = 36 crossings), of which 2 were killed in vehicle collisions. Three additional bears were killed because of vehicle collisions during the post-construction phase. We suggest that the impacts of the new highway occurred at the population level, resulting in declines in population abundance and site occupancy. We speculate that the primary mechanisms for these declines were mortality due to vehicle collisions and displacement. For bears that remained in the area, the only individual-level effect we observed was reduced activity when traffic volumes were greatest, indicating behavioral plasticity. Impacts of the highway on gene flow, genetic variability, and genetic structure were not apparent but may take several generations to manifest themselves. Bear use of the underpasses likely was sufficient to maintain gene flow between areas north and south of the new highway. Future genetic sampling could provide valuable information regarding the potential long-term impacts of the highway.

Western Black Bear Workshop 10:69-70

INVESTIGATING THE URBAN BLACK BEAR LEGEND

S. Baruch-Mordo, Department of Fish, Wildlife, and Conservation Biology & Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523-1474, USA.
S. W. Breck, USDA-WS-National Wildlife Research Center, 4101 LaPorte Ave, Fort Collins, CO 80521, USA.
K. R. Wilson, Dept. of Fish, Wildlife, and Conservation Biology & Graduate Degree Program in Ecology, Colorado State University, Fort Collins, CO 80523-1474, USA.
J. Broderick, Colorado Division of Wildlife, 711 Independent Avenue, Grand Junction, CO 81501, USA.

Abstract: Bear-human conflicts in urban areas have increased with the human population growth in the western U.S. and the subsequent encroachment into bear habitats. A number of myths and theories about urban bear behavior and management have developed; however, to date few studies have been conducted. We present results from a 5-year collaborative study between Colorado State University, USDA-WS-National Wildlife Research Center, and the Colorado Division of Wildlife to improve our understanding of urban black bear ecology and the efficacy of management tools aimed at reducing bear-human conflicts. Our objectives included: 1) evaluating effectiveness of public education efforts about prevention of bear conflicts in altering availability of human foods and bear behavior, 2) gaining knowledge about urban black bear ecology including resource selection at multiple scales, and 3) modeling bear behavior and movement as a function of predictors such as landscape variables, location of human food attractants, and variations in natural food production. We completed three experiments to evaluate the efficacy of two educational (site-specific education and Bear Aware campaign) and one enforcement management tool in reducing availability of trash to bears in Aspen, Colorado. We deployed >30 GPS collars, programmed to collect bear locational data at 30 minute intervals, to monitor bears in the town of Aspen, and backtracked to ~2,000 GPS locations within 24 hours of fix acquisition. We sampled over 200 confirmed feeding locations in Aspen to quantify use of human and natural food resource selection and to model attributes associated with each. We present results from model-based analyses for the three experiments considering covariates specific for each and backtracking and movement data. We discuss how experiment results underscore the need for more evaluations of management practices and the continued need for alternatives tools to reduce bear-human conflicts. In addition we discuss how our results relate to some of the questions and myths surrounding urban bear conflicts including "what defines an urban bear" and "are we managing the right bear?"

Western Black Bear Workshop 10:71

DOES DIVERSIONARY FEEDING CREATE NUISANCE BEARS AND JEOPARDIZE PUBLIC SAFETY?

L. L. ROGERS, Wildlife Research Institute, 1482 Trygg Road, Ely, MN 55731, USA

Abstract: Diversionary feeding of black bears (*Ursus americanus*) around campgrounds and residential areas has received little study because of concerns it might create nuisance bears and jeopardize public safety. To evaluate those concerns and assess its effectiveness in mitigating human-bear conflict, we studied diversionary feeding at a U. S. Forest Service campground/residential complex that had been a perennial focus of human-bear conflict. Before the study began, 6 bears were removed from the complex in 1981-1983. During 8 years of diversionary feeding tests (1984-1991), the only bear removed was a transient sub-adult male that had not yet found the diversionary feeding site. Nuisance problems were greatly reduced throughout the study despite the fact that garbage continued to be available and study bears were intentionally habituated and food-conditioned. The study included 1985—the year with the lowest bear food index recorded for Minnesota. In this study and other examples of diversionary feeding across North America, nuisance complaints, house break-ins, attacks, and bear removals were fewer, often drastically fewer, than elsewhere, and residents became more willing to coexist with bears. Habituated, food-conditioned bears did not become nuisances and did not jeopardize public safety. There is a need to reevaluate policies toward these bears in this light. Further study is needed to determine the situations in which diversionary feeding can be most effective in mitigating human-bear conflict.

KEY WORDS black bear attacks, campgrounds, diversionary feeding, food-conditioning, habituation, house break-ins, natural bear food, nuisance complaints, problem bears, supplemental feeding, *Ursus americanus.*

Western Black Bear Workshop: 10:72-82

As human residences spread into bear habitat, the potential for human-bear conflict increases (Conover 2002). Black bears (*Ursus americanus*) have a high tolerance for anthropogenic activities and readily adapt to artificial food sources (Spencer et al. 2007). It is well known that garbage, bird seed, and other human foods can lure bears into campgrounds and residential areas (McCullough 1982, Garshelis 1989, Beckman and Berger 2003), but there has been little study of how food can be used to lure bears away from problem situations (Rogers 1989). One reason for this lack of study is a concern that habituated, food-conditioned bears might become nuisances or jeopardize public safety. However, in Slovenia, bear damage in diversionary feeding areas was only a third that in non-feeding areas despite bear populations up to 6 times greater (Klenzendorf 1997). Diversionary feeding has proved effective in reducing black bear damage to trees in the Pacific Northwest (Ziegltrum 2004, 2008) and in reducing crop damage by ducks, white-tailed deer (*Odocoileus virginianus*), and rats (*Rattus* sp.) (Conover 2002).

To evaluate diversionary feeding as a means to mitigate human-bear conflict and to evaluate the associated concerns about habituation and food-conditioning, we conducted diversionary feeding tests at a U. S. Forest Service campground and residential complex near Ely, Minnesota, USA, in 1984-1991. We compared conflicts in that area before and during the study, and we compared behavior of bears in the study area with that of bears in an adjacent 25-year study without diversionary feeding.

Habituation, as used in this paper, is the waning of bears' responses to humans. Food-conditioning refers to bears learning that

certain locations, situations, or humans are likely to provide food. We intentionally used food-conditioning to facilitate habituation at the diversionary feeding site.

STUDY AREAS

The diversionary study area was a 4.4 km stretch of residences and campsites along the south shore of the Kawishiwi River in the Superior National Forest, 18 km southeast of Ely, Minnesota. This was an area of perennial bear problems. We placed the diversionary feeding site near the middle of this area at the U. S. Forest Service (USFS) Kawishiwi Field Laboratory (47 degrees 49'N, 91 degrees 44'W). Problem areas were the following distances from the feeding site:

1) 0.25 km to the northeast was a roadside rest area and non-bear-proof dumpster beside Minnesota State Highway 169,

2) 0.5 km to the northeast was a USFS swimming beach and picnic area with a non-bear-proof dumpster and 2 non-bear-proof garbage cans,

3) 0.5 to 1.0 km to the northeast was a 31-site USFS campground with a non-bear-proof dumpster and 3 non-bear-proof garbage cans,

4) 0.3 to 2.0 km to the north and northeast were 16 private residences,

5) 1.2 to 3.4 km to the southwest were 26 residences on leased USFS lots with food attractants including a non-bear-proof dumpster and numerous garbage cans, bird feeders, barbecues, and fish-cleaning areas.

The diversionary study area was adjacent to a study area in which bears were not intentionally given diversionary food and were studied for 25 years (Rogers 1987). For comparative purposes, bears were monitored in both study areas and beyond. The entire region was within the Canadian Shield ecological complex. Vegetation was mixed coniferous/deciduous forest with little oak (*Quercus* spp.) and no beech (*Fagus grandifolia*) or hickory (*Carya* spp.). Soils are shallow and non-calcareous with low fertility (Rogers 1987). Preferred foods included ant brood, hornet larvae, hazelnuts (*Corylus cornuta*), and berries, all of which varied in abundance from year to year due to weather, insect outbreaks, and other factors (Rogers 1987).

METHODS AND MATERIALS

The diversionary feeding site was a box of food placed on a pad of tracking sand 8 meters from an overlooking 35-foot-wide window and flood lights. The building included living quarters for USFS observers and volunteer observers day and night. Beef fat was the primary diversionary food with the exception of 50 kg of grapes added during 6-21 July 1984. We replenished beef fat in unlimited amounts during 1984-1985 and in limited amounts during 1986-1991.

We identified bears by ear-tag number and placement, radio-collar frequency, sex, coat color, muzzle color, chest blaze, eyebrow patches, and scars. In the few instances when observers were not present at night, track characteristics were used for identification.

During 15 July to 30 September 1984, we weighed the box of food before and after each bear fed from it. On nights when observers were not present, we weighed the box in the evening and morning and pro-rated amounts eaten among the 0-3 bears we identified by tracks.

Bears first observed as dependent young were of known age. We determined ages of other bears from cementum annuli in a first upper premolar or by a combination of head shape, baculum length, testicle size, nipple characteristics, weight, body length, width of a forepaw, and distance from gum to the cementum-enamel interface on an upper canine tooth (Brooks et al. 1998, McMillin et al. 1976, McRoberts et al. 1998).

To avoid confounding results, we did not reduce attractants in the study area. Dumpsters and garbage cans remained non-bear-proof and were often over-flowing. Campers were not warned about bears. Residents continued to feed birds. In addition, we intentionally habituated and food-conditioned bears at the diversionary feeding site by acclimating bears to our presence and by hand-feeding and stroking bears that would tolerate it.

We monitored bears by telemetry, ear tag returns, and direct observations. Observers included residents, USFS campground employees, hunters, and researchers. Nearly 200 volunteers and researchers accompanied certain habituated bears up to 48 hours at a time beginning in September 1985 (Rogers 1987; Rogers and Wilker 1990). To the extent possible, we monitored study bears until their deaths to determine the extent to which their behaviors and fates were altered by diversionary feeding, habituation, and food-conditioning. For comparisons, we used DNR statewide bear nuisance summaries and kill records (Garshelis and Noyce 2007), reports from District Wildlife Managers throughout the region, newspaper accounts, and data from the long-term ecological study we conducted simultaneously (Rogers 1987).

RESULTS

1984

Natural food abundance in the region.— Bear food in northeastern Minnesota was moderately abundant in 1984 (Garshelis and Noyce 2007) and included ant pupae in late spring and early summer, and hazelnuts, blueberries (*Vaccinium* spp.) and wild sarsaparilla (*Aralia nudicaulis*) berries in mid to late summer.

Nuisance activity in the region.— There were few nuisance complaints in 1984.

Visits to the feeding site in 1984.— Eight bears visited the feeding site from the time observations began on 1 June until the last bear visit of the year on 30 September. Visitors included 2 adult females (each with 2 yearlings), a 2-year-old male (405), and a 5-year-old male (430) that walked through on 21 June (mating season) without stopping to eat.

One of the mothers, 6-year-old radio-collared female 403, held a territory to the south that included the 26 residences on USFS land. She brought her 2 yearlings (females 401 and 429) to the feeding site 8 times during 1-13 June, separated from them the evening of 13 June, and left for 5 days of the mating season (14-18 June). She returned on 19 June and visited the feeding station briefly on 12 of the 56 days from that date to 13 August. Her longest absences during that period were 13 and 16 days with no visits after 13 August. After family break-up on 13 June, the only visit by either of her daughters was by female 401 on 18 June.

The other mother, 10-year-old female 812, held a territory to the east that included 16 private residences, the highway rest area, and the USFS picnic area, swimming beach, and campground. She had been a nuisance in the campground the year before. She brought her 2 yearlings (a black male and a brown male) to the feeding site on 10 June and separated from them by the end of that day. She left for 4 days of the mating season (11-14 June) and returned on 15 June to visit the feeding site briefly on 26 of the 46 days from that date to 31 July. Her longest absences during that period were 8, 5, and 5 days with no visits after 31 July. By that time, blueberries and sarsaparilla berries were at peak ripeness, and hazelnuts were beginning to ripen.

After family break-up on 10 June, both of 812's sons visited the feeding site. Her black son was twice seen passing by the campground heading toward the feeding site, but he did not approach people or attempt to obtain food from the campground. He visited the feeding site briefly 4 times between 21 June and 18 July with no visits after that. However, 812's brown son visited on 74 of 112 days between family break-up and 30 September and was the only visitor after 13 August. His longest absence was 5 days (17-21 August) during the peak of the hazelnut season. He became the most habituated, food-conditioned visitor at the feeding site, but the one time he was seen passing by the campground heading toward the feeding site he did not approach people or attempt to obtain food from the campground. As he decreased his activity in September in preparation for hibernation, he became increasingly timid, nocturnal, and selective of what he ate, preferring omental fat to subcutaneous fat. On 14 September, he grazed on clover (*Trifolium repens*) at the feeding site and rejected fat. He ate nothing on his final 3 visits 28-30 September. He

grew from an estimated 20 kg at family break-up to 77 kg on 28 September.

Male 405, a 2-year-old male, was first seen in the study area on 10 July when he passed through a yard in the USFS residential area and fed from an open dumpster. Two days later, he found the feeding site and was not seen in a problem area again. He visited the feeding site on 10 of 18 days during 12-29 July with no visits after that.

Average consumption per visit to the feeding site was 0.92 kg/visit. During the period from 15 July to 30 September, when amounts eaten were recorded, 4 bears ate 127 kg of beef fat and 17 kg of grapes. Most of that (93 kg of fat and 13 kg of grapes) was eaten by the brown yearling male. Female 403 ate 12.8 kg of fat and 0.3 kg of grapes. Female 812 and Male 405 shared the remaining 21.2 kg of fat and 3.7 kg of grapes). Beef fat is not a highly preferred food, and most bears abandoned the feeding site when preferred berries and hazelnuts became available.

Nuisance activity before and during the first year of study.— In the 3 years (1981-1983) before diversionary feeding, nuisance activity was common in both the campground and residential area. Open dumpsters, garbage cans, and bird feeders attracted several bears each year. Bears approached people for food. Officials removed 2 bears in each of the 3 years.

In 1984, the first year of diversionary feeding, no bear was considered a problem, including 812 that had been a nuisance in the campground the year before. USFS campground manager Joseph Lekatz wrote in his 1984 year-end report that diversionary feeding is "working well in the Kawishiwi Campground vicinity" and that no bear approached him for food.

Bears that were habituated and food-conditioned at the feeding site avoided campers and residents elsewhere, and none was killed by hunters in the September-October hunting season. Seven of the 8 bears that visited the feeding site did so only briefly and occasionally, especially after berries and hazelnuts ripened. The radio-collared female (403) held a territory similar in size to those of bears without diversionary food in the adjacent study area (Rogers 1987). Behavior at the feeding site varied from timid and nervous to trusting but was not threatening.

1985

Natural food abundance in the region.— 1985 contrasted with 1984 in being the year with the lowest bear food index recorded by the Minnesota Department of Natural Resources (DNR) in 23 years of surveys (Garshelis and Noyce 2007). In May and June, rainfall in the study area was 48% higher than the 32-year average (Doran 2009), hampering ant reproduction and flooding swamplands where wild calla (*Calla palustris*) and blue joint grass (*Calamagrostis canadensis*) would normally be available. Record low temperatures of -6C (Soudan, MN) and -8C (Embarrass, MN) on 3 June killed berry and hazelnut blossoms, reducing mast production in July and August. The food shortage extended throughout northeastern Minnesota (Garshelis and Noyce 2007) and hundreds of kilometers north on the Canadian Shield.

Nuisance activity in the region.— Nuisance complaints in 1985 were the highest recorded by the DNR (2,859) in 22 years of such record-keeping (Garshelis and Noyce 2007). Bears in Canada and northeastern Minnesota migrated south in a pattern similar to migrations of past years of food shortage. They migrated south to Lake Superior and into cities along the shoreline (Schorger 1946, 1949; Rogers 1987). Landowners and officials shot hundreds of nuisance bears around residences, including 70 in Thunder Bay and 90 in Duluth (Rogers 1987).

Three bears killed in Duluth from the 25-year study were 90, 107, and 107 km outside their usual home ranges. Female 664's trip to Duluth was the first known trip this 24-year-old made outside her territory in 11 years of radio-tracking. Of 11 bears killed from that study in 1985, 11 were 20-107 km outside their usual ranges. Study bears were killed in larger numbers and farther from their usual ranges than in any other year of that study (Rogers 1987). They included a

disproportionate number over 14 years of age (Rogers 1987).

Some bears traveled around the tip of Lake Superior into the oak forests of Wisconsin and east central Minnesota (Rogers 1987) as has been observed in the past (Schorger 1946, 1949). Bears were forced to turn to less preferred foods, including human foods, and an unusual numbers were attracted to garbage dumps where fights over food resulted in a broken leg, a 12-cm laceration, and a nose pad bitten off (Rogers 1987). An unusual number were also attracted to hunters' baits during the September-October bear-hunting season. Hunter success rose from 20% in 1984 to 52% in 1985 (Joselyn and Lake 1987). The number killed by hunters in northeastern Minnesota rose from 180 in 1984 to 424 in 1985 (Joselyn and Lake 1987), in addition to the hundreds killed before hunting season began.

Natural mortality in the region.— Food shortage and increased travel caused the greatest annual weight loss among adults and the highest starvation among cubs and yearlings in the 25-year study. Of 10 cubs observed with mothers that did not visit the feeding site, only 4 cubs survived through August. Four females 11-20 years old averaged 68.2 kg (61.4-75.5 kg) in March 1985 and only 51.6 kg (49.5-54.5 kg) in March 1986. Of 7 yearlings that accompanied 3 of those females, only 1 yearling survived. Two cubs that accompanied the fourth female died, and it took the mother until 1988 to produce another litter. Two of the other females also delayed producing cubs for 1-2 years beyond what would be expected. The oldest female of the 4 (20-year-old female 641) fared the best. One of her 2 yearlings was the yearling that survived, and she produced a litter of 3 cubs in 1986, 1 of which survived.

Visits to the Feeding Site.— Natural food shortage and rampant nuisance activity across the region provided an unusual opportunity to study diversionary feeding. Beef fat was made available at the feeding site from early April until late October, which included the period of bear activity.

Seven of the 8 bears that had visited the feeding site in 1984 returned in 1985. Two year-old female 429 arrived shortly after emergence even though she had not visited after family break-up in 1984. Her female sibling (401) arrived 11 May. On 23 May, 11-year-old female 812 arrived with 3 cubs (1 male, 2 females). 3-year-old male 405 arrived 25 May. 812's 2-year-old black son came briefly on 3 and 4 June and then presumably dispersed as would be expected of a male his age. 6-year-old radio-collared female 403 and her 2 cubs (females Patch and Terri) did not arrive until 12 June even though their den was only a kilometer away. 6-year-old male 430 was the last returnee to arrive (20 June). Surprisingly, the most frequent visitor of 1984—812's brown son—did not return in 1985 and is presumed to have dispersed.

Five new young males and no new females (excluding cubs) visited in 1985. The males were first seen on 27 May (Morris), 30 May (4-year-old 428), 12 June (Schnoz), 12 June (Jimmy), and 23 June (Donald).

Each day a bear visited was considered a visitor-day. Visits by 2 bears in a day were 2 visitor-days. Multiple visits by a single bears were a single visitor-day. There were 7 visitor-days during 17-30 April, 52 in May, 138 in June, and 64 during 1-25 July. During the 202 visitor-days from 1June to 25 July, the 12 bears ate 502 pounds of beef fat.

Visits declined during July despite the regional food shortage. All 6 of the immigrant males, including returnee 405, made their last visits by July 25 and never returned. The 5 resident bears (812 and cubs, 403 and cubs, 2-year-old females 401 and 429, and 6-year-old 430) made only 3 visits between 25 July and 8 September. Radio-collared female 401 and radio-collared female 403 and her cubs fed on natural foods, apparently preferring berries and hazelnuts over beef fat despite their scarcity. The berries and hazelnuts essentially disappeared in early September and both these radio-collared bears resumed visits to the feeding site until they denned. Female 403 and her 2 cubs returned on 8 September and denned about 23 September. Female 401 returned on 12 September and denned on 8 October.

Nuisance activity in the study area.— Despite the large number of nuisance complaints across the region, residents and campground workers reported no problem in the study area. Isolated incidents that did not rise to the level of nuisance behavior included an unknown bear feeding once from an open dumpster on 29 June and Schnoz passing through the campground without causing a problem on 13 July.

Nuisance activity in other areas with diversionary food.— Although nuisance activity was rampant throughout the region in 1985, 3 areas in addition to the study area had few or no bear problems, and all 3 had diversionary food. One area was a 10-km radius around the Colville dump near Grand Marais, MN, where the only reported problem was a bear sleeping in a yard (Wm. Peterson, pers. comm. 1985). A record 44 bears were seen at the dump at once (Rogers 1989).

The second area was around Armstrong Lake in Eagles Nest Township where resident Ed Orazem had been feeding bears for 2 decades. On 26 August 1985, the Ely Echo Newspaper stated "*There have been a lot of problems with bears in and around Ely this year, tipping over garbage cans and getting into gardens, but south of town, on Armstrong Lake, the bears just aren't interested in causing problems. The main reason is that the bears are being served at an outdoor restaurant, owned and operated by Ed Orazem"* (Wognum 1985). Orazem is shown sitting next to a bear. The article said that Orazem began feeding bears in the mid-1960's to divert a bear from his neighbor's garbage. The feeding worked, and Orazem and others continued it.

The third area was the neighborhood around the home of Mrs. Toini Salminen who began feeding a mother and 3 cubs that spring. The mother had a withered right front leg and walked on 3 legs, making her easily identifiable. The mother had tried repeatedly to break in until Mrs. Salminen put food outside. The bear stopped damaging her house and developed a trusting relationship that lasted 12 years. Neighbors visited Mrs. Salminen, met the bear, and developed protective attitudes. The bear caused no problem in the neighborhood. It survived far beyond the average age of 3 years at which female bears are killed by hunters in Minnesota. It was in its late teens when it finally succumbed to a hunter's bait several miles from Mrs. Salminen's house.

1986-1991

During these 6 years of follow-up studies, we provided limited food at the feeding site and continued to monitor nuisance activities, diets, travels, and fates of the resident bears.

Natural food abundance.— DNR surveys showed bear foods to be generally normal in northeastern Minnesota throughout this period (Garshelis and Noyce 2007). However, rainfall in the study area in August 1991 was only 20 percent of normal (2.3 cm vs.11.2 cm) (Doran 1009), creating a severe berry shortage in late summer.

Nuisance activities in the study area.— With 2 exceptions, reduced amounts of diversionary food apparently were enough to divert bears from becoming problems in the study area when natural foods were of average abundance. One exception was a captive-raised female (Gerri) released into the study area in 1989 at the request of the Michigan Department of Natural Resources and the Minnesota DNR. She ate mainly natural foods but was enough of a nuisance in 1990 and 1991 that we returned her to captivity in spring 1992. Her antics are excluded from all statements in this paper. The other exception was a sub-adult male that immigrated into the study area and attempted to break into an occupied house before discovering the diversionary feeding site during the berry failure of 1991. We translocated him the next day on 10 September.

Intensive habituation and food-conditioning.— By the end of 1985, we had learned the benign meanings of ferocious-looking displays and began to realize that behaviors we had earlier interpreted as threats or aggression were merely harmless expressions of nervousness. By that time, radio-collared Female 401 had become trusting enough that researchers could walk with her for 24-48 hours at a time as described by Rogers and Wilker (1989). Four other

bears and their cubs provided similar opportunities over the next 6 years. These included the 2 daughters of Female 403 born in 1985 (Patch and Terri) and Terri's 2 adopted daughters (Gerri and Mary) born in 1989. Observations of these bears revealed how habituated, food-conditioned bears with access to supplemental food spend their time in the forest.

In 1989, 3 USFS officials observed the bears and assessed public safety. The officials included Deputy Chief George Leonard (July 30, 1989), North Central Forest Experiment Station Director Ronald Lindmark (July 16, 1989), and Superior National Forest Biologist Edward Lindquist (June 5, 1989). The USFS then enlisted nearly 200 volunteers to walk with the bears and expand research coverage. In 1991, the USFS asked the DNR to close the study area to hunting—an area of 50 square kilometers—to protect the study, bears, and observers. Volunteers were interested members of the general public, including grandmothers, secretaries, hunters, teachers, etc., without close-up experience with bears. When a volunteer joined a bear, he or she gave the bear a handful of food containing a marker and began recording data when the bear went back to foraging on wild foods. Volunteers collected scats to determine passage rates of markers. Volunteers spent hundreds of hours alone with the bears. The bears roamed wild with uncontrolled access to the public. No one was harmed.

The bears maintained territories, daily activity cycles, travel patterns, and diets similar to those described for bears in the 25-year study (Rogers 1987, Rogers and Wilker 1989). In that study, 40 percent of the females and 67 percent of the males made forays more than 7 km outside their usual areas. Bears in the diversionary feeding study made similar forays. For example, on 30 July 1991, 6-year-old Terri and her 2 cubs began traveling 66 km to an unusually productive hazelnut stand where they foraged for the remainder of August before returning to their territory. At the same time, 3 of 6 radio-collared bears from the 25-year study moved similar distances to the same area of hazelnut abundance. On 4 September, the habituated family arrived back in their territory. In another example, 7-year-old male 430 was killed by a hunter 173 km outside his usual area on 6 September 1986.

Fates of study bears.— None of the resident bears (excluding captive-raised Gerri) became nuisances. None of them jeopardized public safety. Of the 8 resident bears, 5 were killed by hunters, a 4-year-old female was killed by an older female in a territorial dispute, and the fates of 2 bears aged 2 and 9 are unknown. Despite being habituated and food-conditioned, the study bears survived over twice as long as bears in the general population. The average age of bears killed by hunters in Minnesota is 2 for males and 3 for females (Garshelis and Noyce 2007). By contrast, resident male 430 was shot by a hunter at the age of 7, and the average age of 4 resident females killed by hunters was 7.

The hunting death of 6-year-old Mary is of special interest. Over 100 people had walked with her and hand-fed her from the time she was a cub (1989-1991). Her radio-collar expired in late 1991 as the project was ending. People watched for this radio-collared bear to show up in the residential area or campground in her territory. Years passed without a sighting. 1995 was the second worst food year in DNR records (Garshelis and Noyce 2007). Still she did not appear. On 4 September 1995, 6-year-old Mary succumbed to a hunter's bait and was killed 58 km southeast of her territory. Presumably, she traveled far outside her territory in that year of poor food, as is usual, preferring to feed on natural food rather than seeking less preferred human food in her territory.

DISCUSSION

Bears that visited the diversionary feeding site continued to forage for natural foods and did not become nuisances. This was in sharp contrast with the frequent bear problems before the study began and the bear problems in other areas during the study—especially in 1985 when natural food reached record lows. The fed bears did nothing to jeopardize public safety despite being habituated and food-

conditioned. The data indicate that hunger—not habituation or food-conditioning—is the driving force behind nuisance behavior.

Probably the most revealing aspects of this study are what the bears did not do. Study bears did not become "hooked" on easy handouts and become lazy and dependent. They continued to demonstrate a strong preference for natural foods as has been found in Minnesota (Rogers 1989), Virginia (Gray et al. 2004), and Washington (Ziegltrum 2008). They sought a variety of natural foods where possible and sought less preferred foods, including human foods at the feeding site, where necessary. Being habituated and food-conditioned did not cause them to change their food preferences. They did not become increasingly aggressive in trying to obtain food from people. Instead, they became more trusting and allowed nearly 200 volunteers to accompany mothers with cubs, day and night, for up to 48 hours at a time. Part of the belief that food-conditioned bears become increasingly aggressive in trying to obtain human foods may stem from misinterpretations of bear behavior. Harmless nervous bluster is often misinterpreted as an indication that a bear is aggressive and a threat to public safety rather than a frightened, nervous bear performing ritualized displays with no intention of attacking. Trustful bears seen in daytime are often misinterpreted as bold rather than as bears exhibiting normal circadian activity patterns. Habituation to humans is the normal response of bears that see many people and are not aversively conditioned.

The belief that habituated bears are a threat to public safety runs contrary to a growing body of data (Tate 1983; Rogers and Wilker 1990; Becklund 1999; DeBruyn 1999; Herrero et al. 2005; Stringham 2009). Habituated bears are less likely to flee and less likely to attack on a per encounter basis (Herrero et al. 2005). The same is true for bears that people observed without being attacked at garbage dumps for decades (Rogers 1989). In 1989, I asked over 200 attendees at an International Bear Conference if they had ever heard of anyone being attacked at a garbage dump. None had. Habituation to people is to be expected as more and more people move into bear habitat.

The fed bears showed no evidence of illness such as might be spread at the feeding site. A broad search of the literature revealed no evidence of any communicable disease epidemics among black bears and no evidence of disease being spread at garbage dumps (Rogers and Rogers 1976, Rogers 1983).

Young males dispersed from their mothers' territories at the same ages as non-fed bears in the 25-year study (Rogers 1987). Female 403 shifted her territory away from the feeding site when her territory became crowded with 3 maturing daughters as was also reported in the 25-year study for mothers with growing daughters (Rogers 1987). Fersterer et al. (2001) reported that home range sizes of bears that ate diversionary food in Washington did not differ from home ranges of bears in other areas.

Both habituation and food-conditioning were specific to location and situation. Any broadening of tolerance beyond the feeding site required additional habituation or conditioning. For example, a mature male that calmly accepted petting and hand-feeding in a specific location feared people who appeared in unexpected locations or behaved in unexpected ways. While being petted and hand-fed by 6 people, he noticed someone approaching over 100 m away on a driveway. He immediately bolted from the area. Even in areas where bears expected to see people, the bears continued to assess the behavior of people as they would assess other bears. Bears that were calm and trusting when people behaved in predictable, non-threatening ways fled when people behaved aggressively or approached too quickly. Each new situation and location required additional habituation.

Some bears were calmer and more easily habituated than others. Some bears eventually became sufficiently habituated to tolerate close observation away from the feeding site. During observation, bears foraged calmly and seldom looked at observers that were close enough for easy identification. However, they were disturbed by observers that fell behind, requiring the observers to re-identify

themselves by speaking. The bears eluded researchers who attempted to approach quietly without voice identification.

While accompanied by observers, the bears eluded or fled from people in unexpected locations. For example, On 20 July 1989, 4-year-old Terri and her cub Mary were accompanied by 2 observers when Terri detected people talking quietly about 200 meters away. Terri stood up, listened, and led Mary over 200 meters away before foraging resumed. Terri and Mary gradually became habituated to any observer that behaved according to expectations. During September 1989 to September 1991, they were accompanied by nearly 200 volunteers.

A problem bears and bear managers faced in the study area before diversionary feeding was that residents would not coexist with animals they feared. The feeding site enabled residents to meet the bears and set aside the ferocious images of the media, the unnatural snarls of taxidermy, and the ubiquitous warnings they had heard. They saw firsthand the timid wariness that typifies black bears, the harmless bluster of nervous bears, and the calm trust some bears developed. They learned firsthand that mothers with cubs are not likely to attack. Residents who visited the feeding site shared their experiences with their neighbors, and mere sighting of a bear was no longer a reason to call the DNR with a complaint.

MANAGEMENT CONSIDERATIONS

Fearful public attitudes and widespread misconceptions are a major detriment to bear management. Diversionary feeding provided an opportunity for residents to meet the bears they feared and to develop more tolerant attitudes. In the study area, diversionary feeding reduced nuisance problems despite the fact that the bears were habituated and food-conditioned. The fact there was also continued availability of garbage in potential problem areas indicates that any efforts to mitigate problems by reducing attractants and/or aversive conditioning are likely to be more successful if coupled with diversionary feeding. There is a need for decision-makers to reevaluate policies toward habituated bears, recognizing that habituation is a normal response to people in the bears increasingly fragmented environment and that habituated bears have not shown themselves to be a greater threat to public safety than non-habituated bears. There is a need for further study to determine the situations in which diversionary feeding can be most effective in mitigating human-bear conflict.

ACKNOWLEDGMENTS

I thank the Minnesota Department of Natural Resources for research permits and the U. S. Forest Service for use of its Kawishiwi Field Laboratory and surrounding facilities for this research. I thank nearly 200 assistants, volunteers, and Earthwatch participants for diligently walking with wild, habituated bears day and night to document their activities. I thank the bears for trusting us enough to reveal their hidden world of foraging, scent-marking, defending territories, caring for cubs, and negotiating the minefields of increasing human presence in their habitat. Finally, I thank my wife Donna and our children Kelly and Colleen for their help and for tolerating my irregular working hours.

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Population Ecology & Genetics

Session 5: Population Ecology and Genetics

Session Chair: Stewart Breck, U.S.D.A. Wildlife Services, National Wildlife Research Center

Session Summary

The Thursday morning session "Population Ecology and Genetics" featured 8 speakers. Benjamin Jimenez from the University of Montana presented results of a study investigating how a network of gravel and paved roads influenced habitat selection and activity patterns of black bears in Idaho. Keith Hamm from Green Diamond Resource Co. gave a paper on results from a study in Northern California relating black bear population size, seasonal and annual damage to conifers, and seasonal movement of bears. Rachael Mazur from the Toiyabe National Forest presented results from her work on food conditioning of young black bears to rearing conditions they experienced with their mothers in Sequoia National Park. Jon Beckmann from the Wildlife Conservation Society gave an update of an ongoing 10 year study investigating the impact of urban development on black bear demography, movement, and ecology in the Great Basin Desert and Sierra-Nevada Range of Nevada. Barb McCall from the University of Montana demonstrated the importance of considering natural food productivity when considering population dynamics of black bears and the use of mark-recapture analyses to monitor populations trends. Cora Varas from the University of Arizona used genetic techniques to investigate the population structure and phylogeographic patterns of black bears in the Sky Island region of Mexico and Arizona. Joseph Northrup from the University of Alberta illustrated that importance of considering individual variation when modeling grizzly bear movement and decision making in heterogeneous habitat. And finally, Kate Kendall from the USGS provided an update and results from the ground breaking effort to monitor the abundance, distribution and genetic structure of grizzly bears in northwestern Montana.

MULTI-SCALE EFFECTS OF FOREST ROADS ON BLACK BEARS

B.S. Jimenez, Montana Cooperative Wildlife Research Unit, University of Montana, Natural Science Building - Room 205 Missoula, Montana 59812, USA
M.S. Mitchell, U. S. Geological Survey, Montana Cooperative Wildlife Research Unit, The University of Montana, Natural Sciences Building Room 205, Missoula, Montana 59812, USA.

***Abstract*:** The black bear population within the Coeur d'Alene River watershed of northern Idaho is exposed to high hunting and recreational pressure facilitated by a dense network of gravel and paved forest roads. Bears are hunted using bait and dogs in spring and fall, and non-lethal pursuit with dogs is allowed during a summer season. To understand the effects of these pressures on black bear behavior we used data collected from 28 adult bears fitted with Global Positioning Systems (GPS) collars from June 1 2007 through the fall of 2008. We used locations acquired at 20 minute intervals to assess habitat selection and activity patterns of males and females at home range (2^{nd} order) and within home range (3^{rd} order) scales, both annually and seasonally. We tested the hypotheses that black bears 1) will show a functional response to roads in 3^{rd} order habitat selection, i.e. use of habitat near roads will be inversely proportional to traffic volume, 2) avoid areas with high road density and high traffic volumes, reflecting a functional loss of habitat containing suitable or important resources, and 3) show seasonal shifts in activity patterns and movement rates in areas of high road density and high traffic volumes, in contrast to previous findings. To assess fine scale habitat selection and movement patterns, as well as the influence of roads, we used matched case-control logistic regression analysis, where available habitat was defined by movement rates of a given animal. We also calculated average movement rates of bears throughout the year to see if activity patterns changed seasonally as well as in response varying traffic volumes. Avoidance of areas containing primary food sources or increased activity and energy expenditure may have profound consequences for bears. Understanding how traffic volume and road density influences habitat selection and movement patterns can therefore play an important role in management of the species.

Western Black Bear Workshop 10:85

RESEARCHING CONIFER DAMAGE FROM AMERICAN BLACK BEAR *(URSUS AMERICANUS)* ON MANAGED TIMBERLANDS IN NORTHERN CALIFORNIA

K. A. Hamm, Conservation Planning Department, Green Diamond Resource Co, Korbel, California, 95550, USA.
R. T. Golightly, Dept. of Wildlife, Humboldt State University, Arcata, California, 95521, USA.
P. P. Zimmerman, Conservation Planning Department, Green Diamond Resource Co, Korbel, California, 95550, USA.
L. V. Diller, Conservation Planning Department, Green Diamond Resource Co, Korbel, California, 95550, USA.
C. H. Arias, Resource Science Center, Missouri Department of Conservation, Columbia, Missouri, 65201, USA.

Abstract: Green Diamond Resource Co has been researching black bear damage to conifers in Northern California focusing on population estimates, identification of individuals that forage on vascular tissues, scat surveys to index seasonal and annual variation in tree damage, and seasonal movements of radio collared bears. Two 30 km^2 study areas were used to estimate black bear populations. Mark-resight estimates in Klamath (Nhat = 47, 95% CI 27 - 80) were significantly different from estimates in Korbel (Nhat = 14, 95% CI 7 - 27). Twenty-one percent of captured males and 44% of captured females were categorized as bears foraging on conifers. From 2003-2008, twenty-five percent of bear scats collected (n = 2,719) from April to August on two forty km transects had vascular tissue with the highest proportion occurring in late June and July of each year. During 2007 and 2008, we radio collared a total of 92 bears and routinely tracked them on the study areas. Bear movements have shown no clear patterns with some traveling great distances (>70km) while others moved very little. Based on the unpredictable movements of collared bears, sport hunting in the fall may not be a realistic management tool. Any potential for mitigating this problem will require a continued collaborative research effort.

Western Black Bear Workshop 10:86

SOCIALLY LEARNED FORAGING BEHAVIOR IN WILD BLACK BEARS (*URSUS AMERICANUS*)

R. L. Mazur, Humboldt-Toiyabe National Forest, 1200 Franklin Way, Sparks, Nevada, 89431, USA.
V. Seher, P. O. Box 577, Yosemite National Park, California, 95389, USA.

Abstract: To date, research on social learning has largely been limited to a small number of taxa in captive or seminatural settings. We undertook a quantitative study of social learning in free-ranging black bears (*Ursus americanus*) at Sequoia and Yosemite National Parks, USA, from 1995-2006. We tested the hypothesis that food-conditioned foraging behavior (foraging on human food in developed areas) by some bears is transmitted vertically from sows to cubs. Food conditioning in young bears was strongly related to their rearing conditions. Nine wild sows raised 20 cubs in the wild, with 18 (90%) of the cubs remaining wild by the end of their second year. By contrast, of 79 cubs raised by food-conditioned mothers, 31 were raised in the wild, and 48 were raised on anthropogenic food sources. Eighty-four percent (26/31) of those reared in the wild foraged in the wild as independents, and 81% (39/48) of those reared on anthropogenic food continued to exploit this resource later in life. The outcome of the cubs was determined by where the cubs were raised, more than whether the sow was food-conditioned.

Western Black Bear Workshop 10:87

CARNIVORES, REDISTRIBUTION AND HUMANS: PATTERNS AND PROCESS

Beckmann, J. P., Wildlife Conservation Society, North America Program, 301 N. Willson Ave., Bozeman, Montana, 59715, USA
C. W. Lackey, Nevada Department of Wildlife, 1100 Valley Road, Reno, Nevada, 89512, USA.

***Abstract*:** The disappearance or removal of carnivores from systems across the globe results in degraded or simplified ecosystems. However, the more subtle impacts of redistributions of carnivores at more localized scales on ecological functionality have received scant attention. At the interface of the Great Basin Desert and Sierra-Nevada Range including the Lake Tahoe Basin, black bears (*Ursus americanus*) have historically been ecologically restricted but they have recently experienced a rapid non-equilibrium response to increasing humans. To assess possible effects at contact zones, we tested predictions of resource-based models, first by contrasting biological features of individual bears between urban (experimental areas) and wildland areas (control areas), and second by considering temporal changes in life-histories and ecology that span almost 20 years. Among documented changes for bears from the 1990s to 2009 were: (i) declines of mean home range size for urban males and females relative to wildland bears; (ii) increases in mean body mass for urban bears relative to wildland animals; (iii) alterations of denning chronology for urban bears; (iv) shifts in the pattern and amount of daily activity for bears in urban areas relative to wildland conspecifics; (v) alterations of fecundity levels for urban females; (vi) bear densities which increased 3+fold in urban areas compared to baseline, historical densities; and (vii) the creation of sink habitats in urban areas ($\lambda = 0.75$). We address the question of whether an increase in the prevalence of individuals in a geographical region reflects a population increase or a landscape-level redistribution. The results indicate that expanding but clumped urban foods facilitated a rapid redistribution of bears across this arid landscape. We will discuss the impacts of this redistribution on ecological functionality of bears in this system. The careless provisioning of food, whether deliberate or unintended, may be operating at scales substantially larger than those we describe.

Western Black Bear Workshop 10:88

NON-INVASIVE GENETIC SAMPLING REVEALS BLACK BEAR POPULATION DYNAMICS DRIVEN BY CHANGES IN FOOD PRODUCTIVITY

B. McCall, Montana Cooperative Wildlife Research Unit, University of Montana, Natural Sciences Building Room 205, Missoula, Montana 59812, USA.
M. Mitchell, U.S. Geological Survey, Montana Cooperative Wildlife Research Unit, University of Montana, Natural Sciences Building Room 205, Missoula, Montana, 59812, USA

Abstract: We conducted research to explore the demographics of a black bear population, to determine the underlying dynamics of changes in population abundance, and to evaluate how these processes could influence inferences based on mark-recapture analysis. In cooperation with Idaho Department of Fish and Game and the USDA Forest Service, we used barb-wire corrals to collect black bear DNA during 2003-2006 in the Purcell Mountains of Idaho. We considered the number of uniquely identified individuals as an index of population abundance each year. We used a combination of both genetic and mark-recapture analyses to evaluate the sources of variation in population abundance over the four years and to what extent this variation was driven by changes in productivity of foods on the landscape. Specifically, we investigated variation in allele frequencies and genetic diversity in relation to changes in abundance, and whether immigration and emigration rates were a function of changing berry productivity in the study area. We found significant variation of allele frequencies over the years and a heterozygote deficiency indicating we sampled ≤ 4 subpopulations within the same area over the four years (a Wahlund Effect). Our mark-recapture analyses suggest this pattern was probably due to high rates of immigration from outside our study area in response to landscape changes in berry abundance. Our results suggest important variation in population dynamics driven by changes in food productivity, which should be considered when using mark-recapture analyses to monitor population trends for black bears.

Western Black Bear Workshop 10:89

EVALUATING POPULATION STRUCTURE OF BLACK BEARS IN THE SKY ISLANDS REGION OF ARIZONA AND NORTHERN MEXICO USING MITOCHONDRIAL AND NUCLEAR DNA ANALYSES

C. Varas, AZ Fish and Wildlife Research Unit, University of Arizona, Tucson, Arizona, 85721, USA.
P. Krausman, Department of Ecosystem and Conservation Sciences University of Montana, Missoula, Montana, USA.
C. Gonzalez Lopez, Escuela de Biología, Universidad Autónoma de Querétaro, Querétaro, Mexico.
M. Culver, AZ Fish and Wildlife Research Unit, University of Arizona, Tucson, Arizona, 85721, USA.

***Abstract*:** The Sky Island region of the southwestern United States and northern Mexico is an area of naturally fragmented habitat for black bears; bears only inhabit mountainous "Sky Islands" which are surrounded by expanses of lowland desert. Historically these Sky Island black bear populations maintained some level of connectivity to neighboring populations, as bears traveled through the desert lowlands when emigrating or dispersing. Increasing human impacts on the sky island region in southwestern US and northern Mexico, in particular - urban development, new road construction, and land use changes in the lowland areas, have raised questions about the potential impacts on the bears' ability to maintain their connectivity among populations. If populations are becoming more fragmented with limited gene flow, there may be negative implications on the genetic diversity and population structure of black bears in the southwest. In this study we employed noninvasive sampling methods to obtain DNA samples from black bear populations in southern Arizona and northern Mexico. Genotypes from 10 nuclear DNA microsatellite loci and sequence data from the mitochondrial DNA control region were used to investigate the population structure and phylogeographic patterns for black bears in the sky islands of southern Arizona and northern Mexico. Results of these analyses have given insights into the evolutionary history, current population structure, and population size estimation for southwestern black bears. These results will be discussed.

Western Black Bear Workshop 10:90

BEAR MOVEMENT IN HUMAN-ALTERED LANDSCAPES

J.M. Northrup, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9, Canada.
B. Cristescu, Department of Biological Sciences, University of Alberta, Edmonton, AB T6G 2E9 Canada.
G.B. Stenhouse, Foothills Research Institute Grizzly Bear Program, PO Box 6330, 1176 Switzer Drive, Hinton, Alberta T7V 1X6, Canada.
M.S. Boyce, Department of Biological Sciences, University of Alberta, Edmonton, Alberta, T6G 2E9 Canada.

Abstract: Habitat selection and movement models are useful tools in the management and conservation of bears and their habitats. However, individual bears vary greatly in their response to natural and anthropogenic habitat features of the landscape. To effectively manage these animals in changing landscapes it is crucial that we incorporate this individual variation into our analyses. We illustrate individual complexity using an autoregressive modeling technique of grizzly bear movement decisions in the central foothills of Alberta, Canada. We incorporated landscape covariates into individual movement models across 3 temporal scales, allowing for a comparison of how habitat characteristics influence animal movement decisions. Grizzly bears responded to habitats differentially across all 3 scales. Best-fit model coefficients were highly variable indicating differences between individual animals related to age, sex or past experience of individual bears. Movement models like those we describe are ideally suited for the identification of movement corridors and for landscape management to reduce human-bear conflicts.

Western Black Bear Workshop 10:91

DEMOGRAPHY AND GENETIC STRUCTURE OF A RECOVERING GRIZZLY BEAR POPULATION

K. Kendall, U. S. Geological Survey–Northern Rocky Mountain Science Center, Glacier Field Station, Glacier National Park, West Glacier, Montana, 59936, USA.
J. Stetz, University of Montana Cooperative Ecosystem Studies Unit, Glacier Field Station, Glacier National Park, West Glacier, Montana, 59936, USA.
J. Boulanger, Integrated Ecological Research, 924 Innes Street, Nelson, BC V1L 4L4, Canada
A. Macleod, University of Montana Cooperative Ecosystem Studies Unit, Glacier Field Station, Glacier National Park, West Glacier, Montana, 59936, USA.
D. Paetkau, Wildlife Genetics International, Box 274, Nelson, BC, V1L 5P9, Canada
G. White, Department of Fish, Wildlife and Conservation Biology, Colorado State University, Fort Collins, Colorado, 80523.

Abstract: The threatened grizzly bear (*Ursus arctos*) population in northwestern Montana has been managed for recovery since 1975, yet no rigorous data were available to monitor program success. We used data from a large noninvasive genetic sampling effort conducted in 2004 and 33 years of physical captures to assess the abundance, distribution, and genetic structure of this population. We combined data from 3 sampling methods (hair trap, bear rub, and physical capture) to construct individual bear encounter histories for use in Huggins–Pledger closed mark–recapture models. Our population estimate, $\ddot{N} = 765$ (CV = 3.8%) was more than double the existing estimate derived from sightings of females with young. Based on our results, the estimated known, human–caused mortality rate in 2004 was a 4.6% (95% CI: 4.2–4.9%), slightly above the 4% considered sustainable; however, the high proportion of female mortalities raises concern. Using location data from genetic sampling, telemetry, and confirmed sightings, we found that grizzly bears occupied 33,480 km^2 in the NCDE during 1994–2007, including 10,340 km^2 outside the recovery zone. Our results suggested that genetic interchange recently increased in areas with low gene flow; however, we also detected evidence of incipient fragmentation across the major transportation corridor in this ecosystem. Our results suggest that the NCDE population is faring better than previously thought, and highlight the need for a more rigorous monitoring program than the Grizzly Bear Recovery Plan specifies.

Western Black Bear Workshop 10:92

Special Session Transcripts

WHY AMERICAN BLACK BEARS THRIVE WHILE OTHER BEARS FALTER

Invited Speaker – David Garshelis, Minnesota Department of Natural Resources

Western Black Bear Workshop 10:94-104

(Introduction by Diana Doan-Crider) - I have been asked to give a little introduction to Dave. Most of us know Dave but for those of you who don't I just wanted to say a few things about him so you know where he is coming from. Dave Garshelis is working with the Minnesota Department of Natural Resources and has been there for a very, very long time. Right now Dave is one of the co-chairs of the ICN bear specialist group along with Bruce McLellan. He is also on the expert team for the Asiatic black bear. Dave is well known for his ability to attract students and get them involved in adventuro2us and interesting projects. He has worked on 6 out of the 8 bears and he has students in China and Mexico, all over the world. He is very well known for his population monitoring methodologies and writings. I think what he has to say is pretty valuable.

(Dave Garshelis) - Okay, so I am going to be talking about why black bears thrive while others falter. When Carl asked me to give a talk I wanted to come up with something that was more professional rather than just informational. I like to engage with people, and if you would like to engage with me afterwards feel very free. If you strongly disagree with something that is great because I am really positive about disagreements. I am going to say something maybe a little probing here, and that is American black bears are on the rise and I think that the status reports that we have heard today are evidence of that. This is basically occurring all across North America. We have resident populations in 41 US states, all across Canada, and of all 12 Provinces and Territories that have bears, there is only one area that has not had bears in a long time.

Sixty percent of the jurisdictions report increasing populations. They are legally hunted in 28 states and all across Canada. There have been a lot of recent sightings of bears that might be termed migrants or whatever and in some cases we have had females in sort of odd states like Rhode Island and Connecticut. Ohio, North Dakota, both ends of South Dakota now, and Nebraska have reported black bears. If you add up all of the jurisdiction population estimates it is roughly a 2% increase per year and if you add all of these up, including Alaska, it comes out to be about 900,000 bears. Alaska has had kind of a really difficult time investigating bears. Nevertheless, 900,000 black bears is something to think about. There are more than twice as many black bears in three countries than there are as many of all of the other species of bears in the rest of the world put together. That is a lot of black bears and they are increasing at a pretty rapid rate.

I asked several of you to give me some harvest data for the western states. Looking at these trends, harvest doesn't necessarily match what the population is doing. Six of these states have significant increases in black bears. Looking at harvest in the western states, it is about a 2% increase for American black bears. So what are some of the reasons why American black bears are thriving compared to grizzly bears? I am going to go through all the other species but I am going to concentrate on grizzly bears because that is the one right next to black bears in North America. One event would of course be the reproductive rate. What I have done here is I have gone back into the literature and taken out the reproductive information from a whole bunch of different populations of bears. As you know with American black bears, you basically divide them into eastern black bears and western black bears. It is not just for these types of workshops and things, there really are differences reproductively between eastern black bears and western black bears and that is why it is divided this way. What you see here is the average or the number of cubs that a female will produce in her lifetime. They can go beyond that but for argument sake say it lives 25 years. What we have here is eastern black bears and a maximum of 36 cubs in a lifetime. The way that I got that number is you take the youngest reported average age of first reproduction for a

given study area, the shortest reported interval between litters in a study area, and the maximum average litter size reported in the study area. Those three things might not appear all in the same study but you put all of those together and you get 36 cubs. Then we do the same thing to get the minimum number, and then again to get the average. Average litter size across North America, average interval between litters and the average age of first reproduction. You can see with western black bears, it is interesting that the mean for western black bear reproduction is equal to a minimum for eastern black bear reproduction, roughly about 18 cubs.

Then over here we have grizzly bears. You can see for grizzly bears it is roughly equal to the mean for western black bears and the minimum for eastern black bears. So quite a bit of reproductive difference among these species. I kind of wondered how this shook out as far as population dynamics and what if we took out human sources of mortality. This is kind of hard to do because there really aren't any populations around that have no human sources of mortality. I am going to say that with no density dependent effects and with no human sources of mortality we are going to have 70% survival for cubs, 90% for yearlings, 95% for sub-adult and 98% for adults. With the average reproductive rates I gave you before, it gives us a growth rate of 1.17 for eastern black bears. So every year it is increasing by 17%. Western black bears would be increasing every year by 11% and grizzly bears by 7%.

We are going to start off with 5 males and 5 females and run this out for 10 years and see how these come out. What you see is after 10 years there are now 20 grizzly bears. Grizzly bears have doubled in 10 years. For western black bears it is in about 6 ½ years that they double and eastern black bears double in about 4 ½ years.. Now, I want to go and extend this for a longer period of time. I also want to reduce it to one male, one female. So two colonizing bears come into an area and they are there for 50 years. You can see the spread that we get between the eastern black bears and western black bears. What if we send this out for 100 years? Now we have 2,000 grizzly bears. We have almost 90,000 western black bears and eastern black bears are off the chart. Anybody want to venture a guess on what eastern black bears will be in 100 years? Remember, in 4 ½ years they double. There are 8 bears in 9 years. There are 10 million bears in 100 years! An order of magnitude bigger than the number of black bears that we actually have on earth presently. This is 100 years, one male and one female, without human sources of mortality and without any density dependent effects. So obviously, extensive density dependent effects throughout their evolutionary history and human sources of mortality are the reasons that we don't have millions of black bears.

The other thing has to do with carrying capacity. If you look at individual study areas where there are both grizzly bears and black bears in the same area, look at the differences in density. It comes out to extremely consistent averages - about 8 times or so as many black bears as there are grizzly bears. That same piece of land can hold 8 times as many black bears as grizzly bears and this kind of explains why black bear home range sizes average about $1/8^{th}$ of that of grizzly bears. It doesn't exactly follow this example because it could have to do with home range overlap and things like that, but in reality the black bear ranges really are quite a bit smaller; they live on smaller pieces of land than grizzly bears do. Because of that people that manage grizzly bears are really concerned about saving grizzly bears, saving individual animals. It is very important to save reproductive females. Both here in North America and in Europe there are extraordinary efforts and expenses going into saving grizzly bears. We don't do this kind of thing for black bears, at least for the most part. In the very extreme case we have a bear crossing the road and a warden comes out and stops traffic.

That leads us to human sources of mortality. It wasn't always the case that black bears were thriving across North America. Human sources of mortality used to be quite a bit higher than they are. In fact, bears were killed for bounties throughout a lot of North America until about 1965. This guy here was in Minnesota, the picture was taken in 1951 I believe, and these people were paid $25.00 for that sow and $5.00 for each of those cubs - they are shot and they are dead. Our government paid them to do that. The only rule was that you had to sign a piece of

paper saying that you wouldn't bypass shooting any other bears on your way to shooting this one. So things have come a long way, mostly by making bears a big game species which occurred between 1902 and 1983 across North America. Hunters then became involved in a regulated harvest, both for sport and for meat and American black bear populations subsequently increased. It increased rather dramatically and now there are lots of American black bears around in rural areas, in urban areas and areas where people are feeding bears. Which brings up sort of another point and that is these bears can kind of live around people. They are comfortable living around people and people's things in order to get nourishment. People are also more comfortable living around black bears. We don't see them as very dangerous. When you do things like this with a black bear - you can release a bear out of a trap and not feel threatened that the bear is going to turn around and bite you. You would not obviously do this with a grizzly bear or go into its den. People don't do this with grizzly bears.

One of the things about grizzly bears is they are obviously a lot more aggressive, a lot more dangerous. People have speculated on this, but one of the reasons is they live in a little bit more open environment. Grizzly bears have become more carnivorous, more aggressive, more threatening to people. People have always felt that the bears were more dangerous to themselves and also to wild game populations. Obviously, grizzly bears are more carnivorous to livestock and all of this played into the earlier settlers that came across the West and were trying to raise cattle. They felt threatened by the grizzly bears, they saw grizzly bears killing elk and things like that, and they thought the bears were going to kill them. At that point they thought they really needed to get rid of grizzly bears. So individuals asked for government programs, basically a forced eradication of grizzly bears in the West. People killing grizzly bears with guns, on horseback and through trapping became kind of a macho thing. It really is kind of a macho thing to go after a big dangerous animal, not only in North America or the United States but this occurs around the world. And of course with the Native Americans it became a source of pride to have killed a grizzly bear and to decorate yourself with parts from grizzly bears, particularly the claws of the grizzly bears. This is a grizzly bear necklace that was brought back by the Lewis and Clark Expedition. You didn't see this kind of thing or this sort of pride in killing black bears. You don't see black bear necklaces and things like that. We still have that kind of macho image today of killing a big dangerous bear. It is also true for black bears but not nearly to the extent I would say as it is for grizzly bears. This occurs not only here in North America but also in Russia and various other places around the world.

Here is a range map from the Grizzly Bear Recovery Plan from 1922. You have got all of these little tiny populations here that were left. These were all wiped out intentionally by people trying to wipe out these bears. They knew that the last bear, Old Scar Face, lived up in the mountains there and there were rewards for killing that particular bear. There was heroism involved in killing that particular last bear and you would have a picture of yourself like this hanging in a bar somewhere as the person who killed the last grizzly bear in some particular mountain range. In this case, the guy who killed the last grizzly bear in Mexico, and being proud of it. Imagine today somebody being proud of being the person who killed the last grizzly bear in a certain country. This was 1960. The same thing occurred all the way throughout Europe throughout European history, this kind of fear of grizzly bears, that they were very dangerous animals and there was fear walking through the woods. So throughout Europe over a long span of time brown bears were eventually exterminated. We have for example a bear in Denmark 5,000 years ago that was exterminated; 900 years ago in the UK; in the Netherlands about 1,000 years ago. The latest ones being killed were in Germany in 1838 and in Switzerland in 1904. There have been a few bears that have tried to come back to those two countries but they were killed because people did not have the tolerance for these bears anymore.

I have covered a lot on human caused mortality and reproduction, let's talk a little bit about habitat. Obviously, American black bears live in the forest, all different kinds of forests

from dense, wet forest to open, dry forests. But when they are in the forest you really don't see them very much. It is so different than a bear out on the plains where you can see them, like grizzly bears. Black bears are kind of hidden in the forest. This is a forest cover map from 1873 in the U.S. and this actually matches the historic range of black bears pretty well. There are obviously some black bears out here in the plains and in the river bottoms, which you can't really see with this scale. The interesting thing about this map is you think in 1873 the forest was pristine. That is actually not the case at all. Back in 1873 there were already a lot of places where the forest had diminished to a great extent, particularly in New England. This is a state that many of you would think would be a highly industrial state, Massachusetts. This is an 1830 map and all of the black represents forests in 1830. This is 1999, all of the black is forests, and you can see its way better. If you look at this chart here, a few counties up North, the change in forest coverage got a lot better. What happened is when people first came to New England they started farming and they cleared the forest. They thought that this would be a great place to farm and then they discovered the Midwest and said we aren't going to compete with that. At that point they said we may as well let the forest grow back and that is what happened. By 1870 we are at a minimum forest level and now it has regained. This is the case throughout New England, in fact a lot of the East coast. The other thing is that the forest composition has changed tremendously. This is in Minnesota and the main forest in Minnesota was pine and oak before people got there, which always sounds pretty good for bears. In the summer there are actual very little natural foods on the forest floor. Now we have this very diverse forest because people do a lot of hunting, and a lot of management for deer, which actually helps bears. What I am arguing is that forest condition in a lot of places in North America actually got better.

This is the current forest covered map of the United States and except for this area here, this is all sort of pine forest over here where we really don't have many bears, but otherwise this matches up pretty well to the current black bear distribution in North America. I want to point out this little spot up here. We are doing a study up here in this little point in Northwestern Minnesota which I like to think is the western most eastern black bear. As you zoom in on that little spot there to see what these western most eastern black bears are living in, it looks like this. Basically, as you come to the front of the screen it ends. There are no more forest patches. You go all the way out to North Dakota and there is nothing, there is zero forest. They go as far as they can, living in the last patch of forest that they can. What researchers do is put GPS collars on these bears, and they bop around in the forest like this until the agricultural crops come out like corn, sunflowers, oats and things, and then they take advantage of those. They are sitting over here in this and then they come out and eat a little corn. So they are a pretty opportunistic species. So is a grizzly bear and so is a brown bear.

Brown bears actually range much greater with habitat than do black bears, from coastal areas all the way up to over 18,000 feet in the Himalayas. They certainly live in forests. They lived in forests in Russia. They lived in forests all the way throughout Europe. So why does the historic distribution map of grizzly bears look like this? What is the deal here? What is holding them up on this end? There are a few records in Ohio and Kentucky and such but whether those were actually bears that lived there is a little bit unknown. What is holding the bears up? Anybody venture to guess?

(Answer) – Humans

(Garshelis) – Okay, humans are certainly part of it. There are higher human densities towards the east. But, I think that I would argue that the other thing that was a part of it was a massive wall of American black bears that lived in the eastern United States. The black bears being there first repelled the grizzly bears. The grizzly bears wouldn't make it through this because there were so many black bears over in eastern North America. Here are some quotes:

- 1699 -Salem, Massachusetts – "100's of bears were infesting the road that I was about to travel."
- 1800 - Eastern North Dakota – "They lie about in the wood as plentiful as that of

the buffalo in the meadow. This is not grizzly bears, this is black bears."

- 1804 – Missouri – "10 bears were killed in one week by the Lewis and Clark expedition. They were eaten and made into 600 feet of rope."
- 1805 – West Virginia – "Hunters took 8,000 bear skins during three winters along two rivers."
- 1825 – Tennessee – "As soon as the time come for them to quit their houses, come out of their dens, and come out again this spring, I took a notion to hunt a little more" - Davy Crockett
- 1827 – Wisconsin – "50 Indians in one band killed 994 bears in one winter"
- 1878 – Southeast Texas – "The old bear hunter killed 83 bears last season, so far this season has killed 49 bears."

I think there were a staggering number of American black bears, probably not 10 million but there probably were quite a few. These bears were living around people. It was very common for these bears to be living around colonial homesteads, etcetera, even with people trying to kill them. Eventually they were killed off from a lot of places that people lived in but they still have this temperament where they can live around people. Eventually, when people started feeling more comfortable about having bears living near them then the bears kind of came back and they kind of hung around houses and things like that; getting in people's bird feeders and would kind of take a snooze on the lawn. The opposite is true for grizzly bears and as Dave said grizzly bears kind of shunned humans. That is why you see grizzly bear range in places where human density tends to be low. They were all wiped out from this area here and now they presently live up in here and if we look at the other side of the globe they were wiped out in Europe pretty much.

Another subject now – let's talk about diet. Black bears can live on very small food elements such as a lot of berries. Obviously grizzly bears can't just eat berries and things. A bear is limited by how big of bites it can take and by how many hours a day it can feed. If you look at a 100 kilogram bear, that is the turning point for when their increasing change of mass can't go up anymore. As a 200 kilogram bear, if you are going to feed for only 12 hours a day you basically cannot gain mass eating just berries. The thing is that most black bears are not that big. Obviously there are some that are that big but based on this study I would argue the bigger you get the harder it is to just live on berries. Eventually you will have to start eating some meat. So, that is one of the things that this map shows. This is the percent of day that they are foraging on fruit for bears living at a salmon stream. So they have a choice, they can go feed on the salmon or they can go feed on the fruit that is around the salmon stream. You can see that the adult male here spends less than 50% of his time eating berries whereas the adult females spend about 75% of the time eating berries. You might argue that well that is just a social considerate; the male is just keeping the female from being at the salmon stream and certainly that is part of it. But the other part of it is the females can live on berries alone and the males really can't. Recent data has shown through analysis, throughout North America, that grizzly bears are a lot more carnivorous than people had actually ever thought based on this type of scat analysis. They really do eat not only a lot of salmon but a lot of terrestrial vertebrates, like rodents, caribou, deer and elk. They are predators and they have to be predators.

So, I have covered a contrast between black bears and grizzly bears. I would like to now talk about the other species, obviously not in the same depth I just went through for grizzly bears but comparing them and get an idea as to why they are not doing as well as American black bears. I have set this up so that the top row are the species that I feel may be limited by habitat conditions and the bottom row are species that may be limited by human exploitation. Within each row there is greater human exploitation from the left to the right. So, even though polar bears actually do have a great deal of human exploitation that is certainly not what is limiting their populations now. In fact polar bears for a number of years were really thriving. It wasn't until recently with global warming conditions that polar bears are having kind of a problem. I am going to talk a lot more about that in my talk tomorrow night so I am not going to spend a lot of time on that here.

The other species is giant pandas. Giant pandas at one point were heavily poached. For hundreds of years they were heavily poached for their skins. But, the Chinese have really cracked down on that and it is really very difficult to try and sell a panda skin at this point. In fact, it is either a life sentence or possibly even a death sentence if somebody poaches a giant panda. So, that is not the main issue with giant pandas; the main issue is habitat. The historic range of giant pandas comes all the way out here to eastern China, northern Vietnam, etc, and all of this is wiped out by agriculture and eventually pushed back here into the corner of their range. The absolute worst habitat in the range is what they got pushed back into. We now think of these bamboo forests as prime panda habitat. Actually, it's what used to be marginal habitat for giant pandas and that habitat looks like this. The other aspect with giant pandas besides these habitat conditions has to do with their reproduction. They generally give birth to two tiny cubs at once but they are not actually born synchronously. Sometimes they are born several hours apart and the mother only raises one. Whether this is normal we don't know. Whether it is the fact that they only live in this extreme marginal habitat we don't know. Maybe earlier they could have raised two cubs but they don't anymore. Because of this the reproductive rate with giant pandas actually falls right in here at about 7-9 giant panda cubs born to a female in her lifetime, which is a really kind of close to a remote and marginal grizzly bear population.

The next species is sloth bears. Sloth bears like giant pandas at one point were heavily taken by people, mainly nobility. They would go out on these massive tiger hunts and wild bear hunts. Sometimes the Duke of England or someone like that would go out and kill 40-50 sloth bears in one hunt. The main problem with sloth bears now is definitely their habitat. They live on the India sub-country, five continents, this area in here is where they were all extirpated. The dark green areas are the only places that we know that they exist. These big spots here are where we don't really know if they live there or not but if they do it's at possibly pretty low densities. What happened to their habitat is basically this; they like low lying habitats like this and that is the same places that people can farm. People went through and eradicated the sloth bears and took out malaria and then swarms of people moved in and farmed these places. Then they basically took out all of the trees, the places where sloth bears lived, and the sloth bears were pushed back up into the hills. So, they are living up in these hills and the problem with sloth bears is that they eat primarily termites. The higher elevation you get the less and less termites that there are. So, we have sloth bears living in some places like this. This is a place in India where there are basically no trees left, so there is no shade, and it is 110° and they basically are crawling into these rock crevices during the middle of the day to escape the heat and then they come out at night and they go try to forage on some termites and some bushes with some fruits and then some peoples crops. People would try to scare them away or kill them with traps or poison. With this technique here they chase a sloth bear up into a tree and once it is up there they put some wires around the base of the tree and when the sloth bear comes down they get their feet tangled in the wires that you see over here.

Sun bears are a species of southeast Asia. The same codes apply here. We have massive areas of extirpation. There are huge areas where we don't even know if there are any sun bears, and if there are they're very, very few. The stronghold for sun bears would be down here, somewhat in Sumatra or more so here in Borneo. But we really don't know much about all this area here in the interior of Borneo. We just presume they are there based on the habitat. This is what prime habitat for Sun bears looks like, low lush tropical rain forest. What is happening in this area is it is all turning into palm oil plantations. It was palm oil for cooking oil in the past but now palm oil for biofuels. So we think we are doing a good conservation thing in the U.S. by promoting biofuel use but the Indonesians are turning around and cutting forests and growing palm oil to supply places like the U.S. We have massive destruction of the tropical forests there and this shows you the difference between 1980 and the year 2000 in Sumatra and Borneo. Look at some of these big chunks here that have disappeared in just those 20 years.

The other unusual thing that happens with sun bears has more to do with their food supply. If you look particularly in Malaysia and Borneo they have these periods where basically all fruits come out at the same time. This massive boom of fruits is called masi. There are huge amounts of stuff available for the sun bears and they constantly eat. They are overeating. There is tons of food available. Then all of a sudden, all of the food basically disappears and there is nothing left anymore. This can go on for a couple of years or it can go on for like 5-6 years with basically nothing around. Obviously the bears are somewhat adapted to that kind of period in their food supplies so then they become insectivorous and they can feed on insects and things like that but as it goes on for longer and longer what has been known is that these bears start to starve. They get very skinny and eventually die. The same thing was witnessed in Borneo. It is really the only species of bear that actually has this issue with starvation in kind of a normal environmental fluctuation. But, what is compounding this whole thing is they are cutting the forests so the bears have nowhere to go. Additionally, there are massive fires that occur there where people intentionally burn stuff in order to set a national park on fire. The idea is that the national park will be no good anymore and then they can move in and plant crops. Finally, the sort of nail in the coffin for sun bears is that they also have a low reproductive rate. Generally, they almost never have more than two cubs and they generally only have one cub. The other thing is that people seem to think that sun bears make kind of cool pets. So, they only have one cub and people go in the forests and will actually try to trap the cub for use in the pet trade.

Andean bears, which used to be called spectacled bears, live along the spine of the Andes Mountains. All of these red places represent national parks. So, it looks like they are in pretty good shape having all of these national parks throughout their range. The problem is that a lot of these are just parks but they are not protected, so people are actually cutting the forest like crazy in some of these national parks. They not only cut the forest but then they plant crops. They have these crop fields and the bears, just like our bears, are attracted to these crop fields and then the people will either set traps or set poison for them. Or they set these set guns - they have a gun here and a little trip wire and you walk through there and it tries to shoot the bear. I actually almost walked into a set gun one time. The other thing facing these bears has to do with killing cattle. For a long time it was believed that Andean bears were not cattle killers and that it was just always mountain lions that killed the cattle. Recent studies have shown that they really are cattle killers and people that are raising the cattle were right in blaming these bears for killing the cattle. But, the thing is they graze their cattle through these national parks. Then these bears that are living in the parks kill the cattle and then the farmer or rancher comes out, sees this dead cow here and sprinkles a little poison on the cow and the bear comes back and it kills the bear.

Finally, the Asiatic black bear. The Asiatic black bear is harvested kind of like our American black bear in two countries, Russia and Japan. This is actually kind of a gruesome picture here in Russia which got a lot of press. This was a bear in a den over here and they smoked them out of the den and then they shot the bear. But, they have a very small harvest of bears in Russia. In Japan they kind of have a massive harvest there but they still have a lot of bears. This is not really the main issue with Asiatic black bears. The main issue with Asiatic black bears is the illegal parts trade. In this picture, the guy is actually setting a trap for some wild boar and for some dear. But the bears will stumble into the trap nevertheless and then they harvest the bear for their gall bladder and for their paws. As you can see down here, this is some paws being shipped inside of a car door to smuggle across lines. They use the dry bile as a medicine or as an aphrodisiac. The medicine has been in the Chinese cornucopia for 3,000 years or so and actually does have medicinal benefits, but the problem with it of course is that you can sell this for a lot of money and this was impetus for people to take a lot of these bears in an uncontrolled kind of harvest. You would think or I would think as you look at Southeast Asia and you think of what has happened with sun bears and the low reproductive rate that sun bears would be far less abundant, at least I did. There are fewer Asiatic black bears throughout

southeast Asia. There are many cameras that have been set in all of these different national parks in southeast Asia primarily to look for tigers. They get a lot of other pictures as well of all of these other species. They really looked at all of these different pictures and actually found out it is actually 2:1, sun bears over Asiatic black bears, even though Asiatic black bears have a higher reproductive rate. They live in more habitat than sun bears do and obviously are being selectively poached out of this area. The other thing that happens with Asiatic black bears is that just like the other species of bears they go into farmer's fields. But they don't just get shooed away very easily. These are more aggressive bears. This guy is talking about how he had a bear jumping on his back and biting on his back. Here is a guy that had his face torn off by an Asiatic black bear. So, a number of maulings occur every year in China and India. As far as the reproductive rate of this species - it is actually quite similar to western black bears, so you would think that it should be doing just as well as western black bears but it is not - it is so different because of all of this poaching. I have no real way of presenting how this species is doing because we really don't have hard information. So, just bear with me on this kind of comparison. We had an estimated world population of 900,000 American black bears. Estimated density range from literature is from 7-165 bears for 100 square kilometers, and a median of a whole bunch of different studies is about 25 bears for a 100 square kilometers. The density of Asiatic black bears is 65,000 but that is just my guess so don't hold me to it. It is the best that I could do after going through all of the different countries and what they say they have and a few countries that never reported. That is taking my best guess; it is just kind of a wild number. The estimated total range is based on a big mapping project we did and people filled in where they said these Asiatic black bears are found. But, if you do the division of the estimated range and the total number of bears you come out with an estimated average density of 5 bears per 100 square kilometers throughout the range, so 5 times the density for American black bears than Asiatic black bears. Certainly, all of that is due to human caused mortality - uncontrolled human caused mortality.

I would like to sum up and answer the question why do American Black bears thrive while other bears falter. I made the seven points; obviously there could be more as this is just my categorization.

- Habitat – present and former forest cover throughout the world. Secondly there are a lot more intact original forests for American black bears then there are any other bear species except for up here in Russia.
- Historic extirpation – Basically, if you extirpated an animal from a huge area it is very difficult for it to come back. You basically can't come back unless you are reintroduced. American black bears were never extirpated from a huge area; they were always sprinkled throughout the entire range except here in the middle. This area never had huge populations anyway.
- Diet – They can live on very small food items. They don't have to be carnivorous for the most part. They have big fluctuations in their food supply but there is usually enough around. They are not like the sun bear where there are these big massive events and then crashes and things like that.
- Carrying capacity – They have extremely high densities.
- Tolerance for and by humans – the "by" part is even fairly recent.
- Reproduction – they are certainly the most productive of the bear species.
- Control of human sources of mortality.

If I was giving this presentation to a kind of anti-hunting group they would think that "good, this guys been talking of hunting as kind of a bad thing". Well, I am not going to say that. What I am going to say, and I think you all know this because a lot of people here are agency people just like myself, is that basically what hunting did is this: not only did we restrict what time of the year you can kill bears, but you have to buy a license and you can only kill one bear per year, etc. But, it did a lot more than that, it created a whole agency system to manage these species. Soon we had these big agencies monitoring populations and creating habitat,

maybe not for bears but a lot of other animals like deer, and the bears that use those things. Then we also changed the whole kind of mindset of people in North America. You just go back to the 1950's and people were like "bears are bad" and now all of the sudden they have become this important thing that hunters go out and kill. Even if you live in the city environment you respect the fact that we have agencies that set up laws that are very restrictive. We set up things like hotlines where people can report poachers. A totally foreign concept for example in Asia, nobody would ever call a government authority and say you know my neighbor is poaching a bear. First of all they would be like "who cares" and secondly they'd say "that is great, get rid of that bear". This is a totally different thing that has changed; the entire set of societal values has changed by setting up this kind of thing. So I submit to you that basically by making bears a big game animal we have pre-dated the conservation movement across North America, and I would say that that is one of the big reasons why American Black bears thrive and other species such as their Asian counterpart falter.

(Question) - What are the big challenges given the trend in black bear numbers in distribution?

(Garshelis) - I think a lot of this could be over abundance. Obviously, we have plenty of bears and I showed you what their reproduction potential is. They really can become over abundant. The question is how you know we don't want bear populations to go beyond *this* geographically. Maybe numerically we have, but I think geographically we have limits on where we are going to draw lines. Or do we just want more and more and more. People are going to be sitting in a room like this 50 years from now saying we still want more bears. Where eventually people will be saying, kind of like deer and geese, well I think we have enough of them now.

(Question) - Two things. One is that picture you have of the half eaten guy with the palm fronds in foreground… *(Inaudible)*

(Garshelis) - That was your friend right?

(Question) - Yeah it was. The concept that grizzly bears shun areas of humans, I don't buy. Partially my bias coming from Alaska but I really think that people are less tolerant of grizzly bears… *(Inaudible)*

(Garshelis) - Can everybody hear that? Basically, what John is saying that he sees it from the stand point of grizzly bears and that is not that they shun humans but it is just that humans have a low tolerance of them. If we didn't have such a low tolerance with them they would live just as close to humans as black bears do.

(Question) - (Inaudible)

(Garshelis) - They did live throughout forest areas of Europe and Asia and they were eating some deer and stuff in Europe but obviously there is nothing like bison there. In fact the forests of Europe and the things that brown bears eat in Europe, there is an 80% similarity between current brown bear diets in Europe and American black bears. So, they are eating basically the same things in Europe as American black bears are eating in eastern US. So, I would argue why couldn't grizzly bears have moved into the eastern US and just be smaller and live in a forested environment just like they did in Europe.

(Question) - (Inaudible)

(Garshelis) - Well, sure and eventually we have some maximum level, but I think that in some places we are losing habitat. What I try to show is that the concept that we are constantly losing habitat is not totally true. I thought when we started doing this study in northwestern Minnesota that there really wasn't any habitat for bears because it is just these little tiny patches of forest and yet the bears seemed to do okay there because they can eat a lot of anthropogenic foods. I think that is part of it. We could lose a lot of habitat and we had actually an estimate of 10 or 12 black bears that were residents of Duluth. Black bears here are obviously urban black bears, just what Carl and John have showed in Tahoe, that basically they can live in a very small home range; very tiny

areas that aren't just totally habitat. They are not getting their nutritional things from the habitat. Obviously bears can live in a zoo - they don't have to habitat they just have to have food.

(Question/Comment) - I would also like to comment about some of the things we have seen in Mexico and what people define as habitat. I think we know so very little about it because in Mexico people ask me what is good bear habitat and I don't even know. I have seen them on the most overgrazed piece of dirt with nothing on it but prickly pear; where they are eating and they actually seem to do better in areas that are overgrazed because it produces these invasive plants and shrubs and succulents and that sort of thing. So really in my mind what means is habitat loss. Look at Mexico; we are more fragmented than we have ever been. We have quoted "loss of habitat". In my whole mind the concept of what is bear habitat I really don't know, I think the range is much wider that what we might think.

(Garshelis) - Let me summarize what Jan has said. She is working in Mexico and she is saying that in places where you wouldn't even think that a black bear could live, because of what it looked like; her experience is it would be marginal or non-bear habitat, and the bears are finding a way to live there. It is kind of surprising. They are actually finding a way to live there. There are some foods that they are finding that they can exist on. Maybe we don't, with the current expertise, know what minimal black bear habitat is.

(Question) - (Inaudible -)

(Garshelis) - The question is whether Asian cultures, and of course there are multiple cultures in Asia, it would be hard to say one or the other - whether they might change and view bears differently at some point. To give the Asians credit there are people in Asia that are trying to change the culture. They are in schools just like we are trying to teach people about conservation. I have been to some of those places, some of those schools and you see all of these little kids and they are all excited and they are all drawing moon bear pictures and writing "save me" on it and stuff like that. So maybe the next generation will be more cognoscente of environmental issues and conservation issues, and I think we can only hope that the whole poaching thing will eventually die out. Obviously, in North America we had a giant commercial trade in bird feathers and things like that, but we eventually got laws passed, so maybe eventually they will be the same way.

(Question) - I guess I wonder a little bit about the reproductive success of the eastern versus the western black bear. Generally if you looked at it I would say the western states were killing 10 times as many bears as the eastern states. I wonder if possibly this loss and poaching is also 10 times greater, and could that added mortality be masking the difference in the reproductive success?

(Garshelis) - He is saying that maybe it is the harvest and sort of incidental loss of wounding etc. that is having a bigger impact on western black bears. Are you saying that you don't believe that there really is a reproductive difference between east and west?

(Question) - Yeah, I think the reproduction might be a little bit different but I am kind of a unique person where I have worked in several eastern and several western states and in the research I have done I have not seen that.

(Garshelis) - Those numbers are based on basically a fairly exhaustive review of the literature. I am sure that there would be some study areas in the west that are better than some places in the east for sure. That is mainly just kind of an average that you would have in general. Most of the places throughout the east have average litter sizes around 2 ½. There are actually some places that are 2.8 and a few small study sites that are actually 3.0. I don't think there are any western places that have that.

(Question) - (Inaudible -)

(Garshelis) - I think they could do very well and maybe there is another explanation, but this is just one possibility. I really think that we don't really know necessarily what high black bear

densities are. There are a few places where it has been measured at 150 or more bears per 100 square kilometers and these are places that even have human exploitation. Imagine what they really could get to. There really are no national parks where there isn't some human exploitation. They leave the park - they are eventually killed. Even in the biggest national parks in the east human sources of mortalities are still the number one source of mortality for bears. Okay, thank you very much.

BEAR IMMOBILIZATION AND POST-CAPTURE CARE

Workshop Chair - Dr. Mark Atkinson, DVM, Nevada Department of Wildlife

Summary: Dr. Mark Atkinson, DVM, Game Division Chief from the Nevada Department of Wildlife chaired the May 19th session on Bear Immobilization and Post-Capture Care. Two Canadian wildlife veterinarians, Drs. Marc Cattet and Nigel Caulkett, were invited to present their thoughts on bear capture and handling protocols and how such procedures may impact health and welfare of free-ranging animals. Dr. Cattet, from the Canadian Cooperative Wildlife Health Centre in Saskatchewan, discussed the potential negative effects of immobilization events on bears and described the importance of developing adaptable capture and handling protocols to minimize these impacts. Dr. Cattet also discussed welfare considerations in the design and implementation of bear research and management. Dr. Caulkett, from the University of Calgary, presented an in-depth discussion of bear immobilization and anesthesia, current immobilization techniques and supportive care. Excellent presentations by both veterinarians generated a number of interesting questions from the audience and stimulated lively discussion during and after the session.

Western Black Bear Workshop 10:105-139

Transcript

(Dr. Mark Atkinson) - Today as you know we are going to focus on bear immobilization, handling, post capture care and all of the issues that surround immobilization of bears. A few years ago I was the wildlife veterinarian in Montana with Montana Fish and Wildlife and Parks and I had the opportunity to put together a similar workshop focused on immobilization of grizzly bears. Being, as you can tell, I am not a native of bear country, so I was fairly new to the whole bear thing and I was looking around to figure out who the experts out there were; who I could get to give me a hand. The wildlife veterinarian world is kind of small; a lot of us know each other somehow. And someone that I know, that a lot of you may have met and worked with or had read about, is Dr. Jon Arnemo in Norway. At the time he was doing a Scandinavian brown bear project and they had just completed their one-thousandth immobilization using Medetomidine-Telazol combination. Now, in North America, at the time, Medetomidine-Telazol was considered a new drug but they'd been using it in Scandinavia for 20 years. Jon came out and spent some time in Montana and we had a great time and we learned a lot from him at a very successful workshop. When he left he said, "You know I didn't want to tell you this beforehand but really you have in the bear world two of the top bear immobilization experts right in your state. But, I really wanted to come out to Montana so I decided not to tell you anything about them before I got here." He said, "Those two guys are Dr. Marc Cattet and Dr. Nigel Caulkett." So, I figured, at the end of that workshop, I thought if I ever find myself in this situation again I am going to see if I can get these guys to come. So, I am very excited that not one of them but both of them agreed to come out and join us today at this workshop and present their thoughts on bear immobilization and everything that goes with it.

I would say to something that Paul and Director Mayer had mentioned this morning, spend as much time as you can, those of you who are involved in immobilization of bears, and that is probably quite a fair proportion of you, take advantage of this. These guys have an enormous amount of experience and while we can listen to them talk and make a presentation, what we learned from our experience in Montana was the people who do this on a daily basis, like you guys, can learn so much from picking the brains of folks like this. So, I would encourage you more than just listening to them today to try and seek them out outside of this session and really pick their brains the best you can. So, without further ado I think let's start with our first presentation, Marc Cattet, is going to give a presentation on evaluation of long term

capture effects versus implications for wildlife welfare and research. Marc Cattet.

An evaluation of long-term capture effects in Ursids: implications for wildlife welfare and research - Marc Cattet, DVM. Thanks very much for the introduction Mark, I thought it was just you finding my name on Google and going from there! First off, I wanted to thank both Mark and Carl for the invitation and opportunity to come down here and give this presentation; with that said the presentation.

First off I want to say the title of the presentation is slightly different than what is in the agenda. I deviated slightly from the title in the agenda, which in fact is the title of a recent report that was published last year. What I want to do in this presentation is cover some of the findings specifically from that report but I also want to provide a broader context giving you some of the events both preceding and following the preparation of the report. My intent with this presentation is to hopefully convince you of the importance of evaluating potential negative effects of capture and handling animals and doing it in a way that is integrated right into your research program. That is, not doing it in hindsight after research is done but instead right from the get go, building into the design of your research study or management activities. Designing methods, techniques and procedures that will allow you to evaluate the potential effect you are having on the species that you are studying or managing. This quotation that I put up here comes from an international meeting that was called last year in Norway and I will have more to say about that international meeting a bit later this afternoon. What it really reflects is the current situation in Scandinavia and parts of Europe but I think the quotation well applies to the situation in North America as well.

So, kind of an overview of my presentation, first I need to give you an introduction to the context in which we are working on evaluating the effects and that is the study known as the Foothills Research Institute Grizzly Bear Project. So I will give you a brief overview of that project, then I want to cover some of the short term negative effects and some of the long term negative effects that we have identified over the years, and lastly I want to cover responses to these effects and responses not just within our research program but also responses by outside sources via researchers, media whatever. So let me start with the Foothills Research Institute Grizzly Bear Project. For some of you attending these conferences and workshops over the years, you may be familiar with this project under the name of Foothills & Forest Grizzly Bear Research Project. It underwent a name change two years ago, which would be a lengthy digression if we got into it now. But, basically this is a long term, large scale, multi-disciplinary visitor research project that is taking place in Alberta. It started in 1999 in a very small-course area of 5500 square kilometers. After a few years the research effort expanded to cover basically the whole distribution range of grizzly bears in Alberta. The primary goal of the project is to provide land resource managers the necessary knowledge and tools they need to ensure the conservation of grizzly bears within the Providence. Under this broad primary goal there are many different research objectives. Some research objectives come into being and take effect over a period of one or two years. Other research objectives have lasted a much longer time. One research objective that was really identified from the onset of the project in 1999 and continues to this day is the evaluation of possible negative effects of handled bears. When we identified this objective we also had to identify a list of what I will call intrusive actions; things that we were doing to bears that could potentially have a negative effect. The effect is perhaps not solely due to one particular activity or procedure but to the cumulative effect of numerous procedures. So, I just want to right now, just kind of briefly take you through a list of our intrusive actions and I think for many of you involved in bear research programs, you will probably see that there is considerable overlap to what I identify on many projects.

Capture and restraint of bears - we have three methods by which we are capturing bears. The method used is largely dictated by the landscape that we are working in at the current time. Capture by barrel trap tends to be in areas that are fairly heavily treed but have lots of road access. We have capture of bears by remote drug delivery from a helicopter and this would

be in open areas, outlying areas, perhaps large clear cuts. And the other method of capture is capture by leg hold snare, which is largely done in remote heavily wooded areas where road access is either negligible or very minimal.

Once bears are captured we have our handling protocol that we go through. Lots of different steps in all, probably involves somewhere in the range of 45-60 minutes of handling. So obviously the bears are anesthetized. Anesthesia in itself is potentially an intrusive action on animals. We measure body weight with lots morphometric measures that we take. We extract a tooth for the purposes of aging the animals. There is an insertion of a transponder microchip for long term identification. Collection of a whole range of samples that are used to meet the needs of a wide range of research objectives, not just evaluating the effects of the captured animal. Applications of various things, tattoos and ear tags, telemetry devices, in some cases administration of additional drugs and in some cases actual treatment of capture induced injury. This all occurs during the handling process and following that we release the animals. Most of the animals we release walk away from the capture site wearing a GPS (global positional system) radio collar as well as a VHF radio ear transmitter. Some of the bears that are captured are captured more than once. We have had 324 captures to date involving 195 unique individuals and approximately a third of those individuals have been captured two to eight times. Sometimes accidentally, sometimes as an effect of using trapping methods that has been non-specific. But in other cases we have attempted to recapture the individuals perhaps to remove a collar or change a faulty radio collar. So let's elicit intrusive actions now, when we started the project in 1999 the first three or four years we were limited, or we limited our focus for the short term negative effects. When I say short term I am talking about effects that have manifested the entire range in minutes, hours, to several days, and negative; negative are the effects that are potentially negative to health and welfare of the animals we handle. Specific research objectives we had probably within the first four or five years, we had arranged probably four or five projects that we are going to do currently. But, I will just draw attention to two specific projects.

One is where we were comparing physiological responses of bears to two different immobilizing drugs. One being Telazol, the other being a combination of Xylazine and Telazol, which is abbreviated XZT. The other thing that we did is we looked at comparing methods of capture with comparing physiological responses of animals to different methods of capture and we focused on two methods; remote drug delivery by helicopter and capture by leg hold snare. At the time we started the project we were doing very few captures with barrel traps so this was really left out of the study.

Now as a brief digression, I just wanted to explain not just these two studies but many of the studies that we have done, have been done in a comparative fashion. As you are probably well aware when you are doing field based research, large variation and a lack of baseline information is something that you have to deal with. You are not dealing with controlled laboratory studies. So, what we have done with our evaluations over the years is we have taken really two approaches concurrently. We have done comparative approaches where we use different multiple treatment groups and we look at relative effects between treatment groups. In some cases we have done it the same old blind fashion where neither the person that is administering the treatment is unaware as to whether they are actually administering the treatment or a placebo. In some cases, we have used cross-over designs where an individual animal may be exposed to multiple treatments with a timeline between, and this is just another way of really controlling some of the wide range of variation we are faced with. In some cases we've also made comparisons to reference values for bears that are maintained in zoos. But by and large zoo bears are a different breed, or even species, then what we encounter in the wild and a lot of these comparisons are somewhat questionable. The other approach is we have taken is a correlative approach where we look at the amount or intensity of the treatment relative to the magnitude of response of an animal; so that evaluation of short term handling effects. So in those first three or four years what we

really focused on is we focused on behavioral measurements, so we were looking at drugs. How long does it take before a bear is safely immobilized? How long does it take for a bear to recover from the drugs when we are done handling? We looked at a range of physiological measurements; so largely your vital signs, respiratory and pulse rate. We looked at rectal temperature, saturation and oxygen saturation in blood. We also looked at a wide range of blood constituents - the kinds of things that you would have routinely measured if you went into a physician for a checkup prior to surgery; so, things involving how many different types of blood cells you have or quantity, they also measure different constituents that occur in the serum.

So, some of our findings, just to highlight some of them, there is no fancy graphs or tables to go with this, just kind of a verbal summary. With drugs, when we looked at Xylazine and Telazol relative to using Telazol alone we found that the combination XZT can contribute to elevated body temperature under some conditions. So, if you have got a bear that has let's say, a free range capture, it has gone through a lot of exertion in the capture process, its body temperature has gone up, you have got a couple of degrees 39 – 39.5 C. If you have XZT as the anesthetic it is a challenge, or that animal is faced with some challenges in bringing its body temperature back down. We also found that XZT relative to using Telazol alone would sometimes result in low levels of oxygen in the blood, turning hypoxemia. This is often temporary. It occurs generally for the first 15-20 minutes of capture and it is not a concern for most animals but I guess if you did have an aged and decrepit animal with a respiratory illness it could be a matter of concern.

(Inaudible question)

(Dr. Cattet) - I guess our guide for that was a culmination of looking at the pulse oximeter reading, so anything below 85%. But combined with that we also would be looking at the mucous membrane color and if we saw the mucous membranes were not pink but appeared slightly blue or grayish, those two things combined would be an indication of hypoxemia. When we looked at Telazol we found that with Telazol we would have to use large volumes for large bears and when using large volumes, volumes of 5 ml or greater, there are two things. One is the accuracy of dart placement becomes a little more iffy. The other thing is just the volume of injection at the injection site certainly leads to local damage of tissue. The other thing that we found with Telazol relative to XZT is that Telazol alone can lead to prolonged recoveries, especially in situations where you had to administer additional Telazol as a top off somewhere during the handling procedure. So, these results were subsequently published.

Again, to highlight some of the findings with methods of capture and comparing methods of capture. When we looked at remote drug delivery by helicopter relative to capture by leg hold snare, we found that in general bears require more drug to safely immobilize them and the induction period, that is the time between administering the drug and the animal being safely immobilized, tends to be longer. We found free ranging bears that were again darted from a helicopter tend to have elevated body temperature, so more at risk of hyperthermia. In addition, we also found that in some bears there was a disruption of their acid base balance in their blood, probably due to accumulation of lactic acid in tissues in the blood. When we looked at leg hold snares relative to capture by remote drug delivery from a helicopter we noted both blood results as well as gross examination of the site where the snare was hanging down. There were obvious indications of stress and inflammation. Looking at our blood results, we found that bears captured by the snare would sometimes lose body water and become dehydrated. The last thing is looking at some of our serum measurements, specifically muscle enzymes; these are things that are released when muscle is potentially injured. These can be quite high and suggest that the bears caught by snare were undergoing some level of muscle injury. It was this last finding that got us to start thinking of longer term effects because where most of the effects that I have described, both with drugs and methods of capture, these effects of fairly short duration, muscle injury is significant and can last days, weeks and sometimes even longer. So, that prompted us to think about what is the significance of severity of muscle injury. But, we are also in a tough spot because what we are

basing our assessment on was really just on blood results and if we had a bear that had a high level of a particular muscle enzyme it was difficult to translate that into what we would see under the skin. Would that involve one muscle, or even a small area of one muscle? Would that involve many muscles? We really had no way of gauging the severity and the frequency of the muscle injury.

Some insight came to us in an unfortunate way in June 2003. We had a 10 year old male grizzly bear that had been captured and died approximately 10 days later; and it certainly died as a result of our capture and handling procedures for that animal. So, a brief history on the animal; captured by leg hold snare and at the time of capture and handling its physiological responses appeared typical of bears caught by snare - that is there were no red flags saying this animal is in trouble. Blood work that was done on the animal was for the most part normal relative to other animals captured by snare. We did note, however, that the serum levels of muscle enzymes were quite high, but certainly not the highest that we measured in the project; there were at least a handful of other bears that had muscle enzyme levels that were higher. So, the animal was captured, it was released with a GPS collar, and it was sighted twice over five days following. In both cases it appears to be moving well. It was within a distance of 2-3 kilometers of the capture site and then after the five days it is not seen any longer. Fifteen days later with a fixed wing plane up that gives locations on all of our bears, picks up a mortality signal from this particular animal. A capture crew goes in and recovers the carcass. It was fortunate that the carcass was in a very cool place; this was in June, but it was in a heavily wooded area on fairly cool ground, cool substrate. There had been no scavenging. So, the carcass was then transported to the western veterinarian I called in Saskatchewan and a post-mortem evaluation or examination was done with the animal.

There were three significant findings. One was that the animal had a broken bone in its wrist at the site where the snare cable had been attached and the capture crew had, as is common practice, checked the site where the snare was tightly attached. But, you are looking at an adult male bear that has a very robust forelimb and the ability to detect a fracture, unless that fracture is right at the surface and almost protruding through, it is pretty limited. So, the animal had a fracture that had in a period of 10 days following capture, part of the bone had actually protruded through the skin and a large infection had set in there. The other finding was that the animal had a large abscess at the point where the dart had entered the body. The third finding is what I want to illustrate in this image here. This arrow up here is pointing to normal muscle, which is typically pink to red. This arrow is pointing to the chest muscle, shoulder, biceps, right down to the forearm, muscle that has essentially turned white and if you cut through, which is done here, you cut through the biceps you see that that color change is right down through the thickness of the muscle. What you are looking at here is what is known as exertional myopathy. So, you are looking at muscle that has been injured and not just injured but is actually dying or dead and this is a type of injury that you may be familiar with and under the term capture myopathy and it is obviously fairly extensive in this animal. So, what we learned from this is that, first of all, we had blood measurements to compare these findings to. We also learned that the cause of death in this animal was probably not exertional myopathy, it was probably a systemic infection that came on from both the fracture and the dart injury. This finding really is an incidental finding. It raised the question, in our mind, is it possible that we have got lots of other bears out there that have varying degrees of exertional myopathy but we are just unaware of it? So, that unfortunate finding really was a pivotal point for us in the project. This is where we realized that we really had to look at much greater detail and what effects we were having on the animals and by this point in the research project we had collected enough data that was now possible.

So, next we shift into long term negative effects. When I say long term we are talking about weeks, months, or longer. We had three objectives. First, was to evaluate the frequency and severity of the capture related muscle injury. The next objective then came from the prediction that if we did have animals that had significant muscle injury in all likelihood that was going to affect their mobility for some

period of time following capture. The second objective was to evaluate the mobility of bears following capture. The third thing is, we started thinking, well you know if we have animals that have significant muscle injury and if their mobility is impaired in all likelihood it is going to affect the ability of that animal to store energy. It is going to be using the energy to try and treat these injuries and deal with these injuries but is also probably because of reduced mobility, being unable to bring in energy that it would under normal conditions. So our third objective then was to look at the body conditions of bears and see if it was affected by repeated captures. We knew that we would not be able to do anything with a single capture, but if we had bears that had been captured multiple times then we could compare body conditions to bears that have been captured once we thought we might be able to address this objective. So, to evaluate handling effects from long term effects in addition to the insular physiological and blood measurements that I have described for the short term effects, we extended our data. We also had physical measurements. In particular, we looked at the body condition of animals. We looked at movement rates, which we were estimating from global positioning system locations that were in the range of frequency at every 20 minutes to every four hours. And, we also looked at recapture and resighting of individual animals to try and get some sense of what impact we may be having on survival.

So we will now highlight some of the findings from that work. So, with muscle injury, in general, we looked at about 50% of the captures we had, we concluded that muscle injury was significant. What that means is we took a muscle enzyme, serum AST (aspirate aminotransferase), it can be an indicator of muscle injury but can also be an indicator of leakage from other tissues. However, what we had done initially is that we looked at the association between this measure and serum, which is a much more sensitive indicator of muscle injury. After doing that assessment we were confident that serum AST reflects muscle injury quite well. We then looked at values from captive animals maintained in zoos and a typical reference range for animals in zoos is somewhere less than 142 units per liter. So, what we said is okay anything over that value with our animals, the animals we are handling, we will consider as significant muscle injury. So, in general in about 50% of our captures we had animals with significant muscle injury by those criteria. But when we weigh it down by both methods of capture, we found that with remote drug delivery by helicopter, probably about 20% of the animals we handled had significant muscle injury; capture by leg hold snare, probably about 70%; capture by culvert trap, we had very few to look at there, we just had 1 out of 7 animals that had values in excess of 142 units per liter.

The next link then was to look at these values relative to the survival of individual bears. In this graph here I am just showing the predicted survival rate for male grizzly bears, a relatively small sample size. These are bears that were recaptured or resighted sufficient times to give us the data we needed for this type of analysis. We looked at game serum AST levels and what we did is we constructed two models. We constructed one where serum AST was not entered into the range of potential variables and we found that in general survival for male grizzly bears was somewhere in the range of, at least in the area we were working in, somewhere in the range of 50-75%. The next thing we did was that we determined if AST was a significant predictor variable of the model and it was. We then plugged it in and what we came out with was basically the survival curve, showing that the higher the levels of serum AST the lower the probability of survival. Now, you will see a wide range, in white, 95% confidence, centered on this *(explaining slide)*. Our conclusions from this are that exertional myopathy, and when I say exertional myopathy I am talking about levels that are greater than five times what we would measure in a captive bear, occurred in about seven bears that were handled and in all likelihood bears that did die probably didn't die as a direct result of the exertional myopathy, but more likely indirectly as a result of the effects that exertional myopathy had on other aspects of their life.

The next objective was to look at what effect captures had on mobility. What we did was we measured average daily movement rates. We corrected for time, year, sex, age and on down

the list and we found in general that movement rates were reduced for a period of about 3-5 weeks following capture before actually returning to normal rates. What is important to note here is that this effect, although we were thinking that this effect would probably just show up with animals captured by leg hold snare, showed up with all animals regardless of method of capture. That said, however, the effect was increased in severity of muscle injury; which is to say that an animal that was caught by leg hold snare was more likely to have muscle injury. They are also more likely to have a more profound effect on their movement rates following capture. In this draft here it is showing basically the average of the entire trajectory, the movement trajectories for all of the individual bears handled over the project, and roughly the period of 3-5 weeks of movement. Rates are subnormal before leveling off and returning to what we would call a normal rate.

The last thing that we looked at was the body condition and the effect of repeated captures on the body condition. And what we found was that the age specific body condition, and when I say age specific as you are probably well aware that body condition normally changes throughout the lifetime of the animal, tends to be fairly low when they are at a juvenile stage and tends to reach a maximum when they are a prime adult and then tends to peter off later into life. So, there is an age specific body condition trajectory and what we found is that animals that were captured in excess of two times tend to be poor. They tended to have a lower trajectory than bears that were captured only once. We found that the magnitude of the effect was directly proportional to the number of times the animal was captured. So, the effect would be greater on an animal that was captured five times versus an animal that was captured twice. And last year we found that the effect was more evident with age. That is to say that repeated captures in a young animal had a relative small effect versus repeated captures in an older bear. If we look at a graphical representation of these results, predicted BCI, BCI stands for body condition index, and the way to view it is essentially a standardized measurement which looks at the weight of the animal that controls for variation of body size. It ranges in values from negative 3 to plus 3; and negative 3 to plus 3 you are really representing standard deviations below or above the sample mean, which is above zero. The sample mean in this case is about 720 bears. This was done from not only this grizzly bear study but also some previous studies. So, what we find when we look at a bear captured once would be its body condition trajectory, or being specific, body condition trajectory compared that to an animal caught five times. If you look at three times it is going to fit somewhere in the middle. If you look at seven times it is going to be somewhere lower.

So, we had identified these effects and we were pretty confident on the significance, it was around 2005, but we were posed with another dilemma. We had a number of opportunities where we presented these findings in part or in whole at various workshops or meetings and while some people said, "You know what, these are interesting results", we had others that said these are interesting results but they are results specific to your project. It has to do with the way you are doing things and we wouldn't find those types of results in our project. So then you are in a bit of a quandary because if you go and publish these results, certainly you are going to be leveled those same criticisms by the reviewers and we felt that what we were going to do is that we were going to end up publishing results that were going to be quite respective in their significance. But, in 2002 I had the good luck of running into a fellow, Roger Powell out of North Carolina University, and Roger was in Sasacatu for some meetings and I had to pick him up at the airport. The meetings were certainly unrelated to what I am talking about today, but in a course of various conversations with Roger I learned more about his activities. He did a long term black bear project in North Carolina for a period of 20-22 years. His data set was pretty much comparable to the type of data we had been collecting and when I told Roger about the results we were finding, he said, "Boy, I would be skeptical about finding those types of results in our data set." That said, however, I certainly want to know if they are in there. So, at that point Roger suggested collaboration between us on this grizzly bear

project and himself, and let's look into this in greater detail to find out if it is indeed something specific for our project or is it something that also occurred in his project. So, we carried through with that analysis and low and behold found basically the same findings in the data from Roger's study. We subsequently published and that publication came out last year.

I want to now shift to the responses to negative effects, not only within our research program but also just more broad. So, I will start with the journal response. I can tell you this was one extremely difficult paper to publish and it was not because of reviewers comments. We went through three rounds of reviews and in each correction we had pretty positive reviews. The usual thing, "change here, change there", but nobody reviewed the findings. But, we did run into problems basically with the associate manager who was concerned about the publishing of the results and then he wanted us to water these results down to the point that their significance was basically diluted down. But, anyways after a year and half we did get that published. Media response when this paper which came out in the Journal of Mammology, they featured it as a feature article for that particular issue, was astounding. There were TV interviews, there were radio interviews and there was widespread publication in newspapers across the country. I thought "why is that?" and I think one thing without question has to do with the species, because this was not the first time these research findings themselves were uncovered. There have been great studies and written reports that have come out over the last 10 years identifying similar findings in other species that are less glamorous. So we got a lot of media attention on it. Within the wildlife community, generally a favorable response. I did hear second hand that what were we doing was we were basically cutting the branch that we were standing on. That is, as a result of these findings it may shut down operations and so on. But almost a year later that hasn't happened and if anything, what I have seen is several agencies in Canada and abroad look at these findings and have their researchers and their enforcement staff review procedures within the agencies with the intent of making improvements.

So, within the research project, the response within our project, where we have evaluated negative effects all along, it has necessitated the very flexible capture and handling protocols and has led to various improvements. We have made improvements in our drug protocols. Not just from the standpoint of immobilization but also pain control. One example here is applying a long acting local anesthetic into the mandible of a bear providing a nerve block prior to tooth extraction. We have made some improvements in the way we deliver drugs to animals. When we first started the project we were using darts that we would describe as rapid injection darts; darts that have an explosive mechanism inside that pushes the plunger forward. These darts also had end ported needles, so the needles with a hole at the end of the needle, and were barbed. And what we found, not necessarily just with the grizzly bear study but others studies we were doing concurrently, is that these types of darts often when that explosive mechanism went off it went off with enough force to yank the skin back, basically tearing it from the underlying tissue. We would then end up with substantial bleeding under the skin. In addition to that there was often a plug of contaminated tissue that would be inside that area of bleeding or hemorrhage and there was a potential for that to eventually lead to an abscess, which is in fact what we found on that grizzly bear that died. Over the course of the project we moved to using different types of darts; darts that use a slow injection mechanism, injections typically in about 1-3 seconds. We have also made changes in our ground base captures. Now we are using barrel traps to a proportion of a greater extent than we had when we started the project. We have kind of overcome the problem of reduced road access by purchasing traps that are very light weight, traps that could be slung in by helicopter to various remote sites. We have also been working on developing a trap monitoring alarm system and what this system does is whenever a culvert trap or a leg hold snare is activated, it by wireless communication sends a signal to a transmitter, which in turn sends us a message by cell phone, satellite phone and email that we have a bear trapped or at least a trap sprung at a particular site at a particular time.

So, that has enabled us to get to sites much quicker.

There have been other improvements, I think you kind of get the gist of where I am going with this, there have been other improvements over the years. But rather than listing improvements I just want to make a few final points. One is that although we made lots of changes over the years these changes are not always successful. We have certainly run into our share of dead ends and had to back off and take different approaches. We have had to forfeit data, data that we thought was in 1999-2000 and we thought was useful data; given the changes that we have made we have had to exclude that data. Lastly, seeking improvements in this project is not the domain of any one person. In particular it is not the domain of the wildlife veterinarian. It has become everybody's domain or everybody's challenge and this is, really make the work a lot more enjoyable because you have got people from all different backgrounds; we have researchers, field researchers, veterinarians, pilots, trappers, enforcement people and they have all got this goal in mind each season to say, look you know I am concerned about what we are doing here, is there any way we can change it, and they have got ideas. So this has been an ongoing thing that I think is yielding very favorable results in what we are doing with the animals. Are there any questions?

(Question) - The bear that died in 2003, do we know how long it was in the snare prior to anesthetizing and handling?

(Dr. Cattet) - The short answer is no. We know the time range. We know it was within a period of 12 hours. But, it could have been there 11.5 hours it could have been there 2 hours. Judging by the extent of injuries, I would say it was more towards the longer range.

(Question) - Did you notice any differences in the serum levels…? *(rest of question was inaudible)*?

(Dr. Cattet) - No, and that is it, it was after that point there that we started working more with developing trap monitors that would not send us a signal but when we came onto the trap site it was a timer. It would tell us when the animal was captured. What we found was that we had a lot of animals that were probably captured; they had been 4-6 hours in the snare prior to anesthesia and handling. But we did also have some bears that were 12 hours and in fact some bears that were in excess of that because in some of these remote locations we were limited to check once a day.

(Beausoleil) - The thing that pops out to me is the really high level of injury using the snare. The construction of the snare, as everyone here knows, is monumental in preventing injury. We didn't talk about that at all and I would like to. I saw one picture with the snare cable riding high up on the tree. That was a red flag for me. Do you notch your trees so cables stay low? Do you use swivels at the tree and within your setup? And how long are your leads?

(Dr. Cattet) - I am not a trapper, but I can tell you that we have our very experienced trappers and they have been doing this for years and years and they are on top of their stuff. That picture you saw was an animal that had been captured in a bucket. So, you didn't see the bucket. The bucket was actually up higher. So, this is a snare set up. There is a five gallon bucket affixed to the tree, and there is bait inside and the animal reaches in, sets off the trigger and a noose around the forelimb. There were improvements made over the years. I mean the length of the cable was shortened so that when animals were captured they only have two feet to fall. There were swivels. I know there are all kinds of improvements. I am just not the person to address that. We have tried other things too and we have tried a shock absorber built in. We have tried sections of rubber tubing on the snare and at the end of the day it is a tough one.

(Garshelis) - I think that anybody that has trapped bears recognizes that there are just some individuals, particularly animals that are not in very good body condition, that tend to be the ones that you catch a lot. I am wondering how you can sort out those animals that tend to be caught a lot and tend to hang around the captive area. So their movements are going to be less

than other animals. They are also more prone to be killed by hunters and not die naturally. So, you have bears that are already more prone to be caught a lot, have smaller movements, and were prone to be killed by hunters. Those are the animals being tested a lot and of course they are going to have this muscle…. I am not sure you have showed the cause and effect of the … *(inaudible)*.

(Dr. Cattet) - Okay, it is going to sound like I am evading the question but I am not a vital statistician, but I will tell you on the effects of repeated captures one of the things that we looked at was did the body condition of an animal influence the probability of capture. Because we were concerned about trap happy animals. What if we have got animals that are in relatively poor body condition that are hanging around trapping areas waiting for the next site to be set? And we could find no influence of body condition. At the end of it all we don't think that there is any data to suggest that we have got biases in our data that way.

(Garshelis) - I actually believe that you do have biases in your data. Whether it is body condition or behavioral, certain bears are more prone to be caught a lot or to hang around the captive area and are also more likely to be killed by hunters. I am not denying the fact that they do get some muscle injury from your traps.

(Dr. Cattet) - I can't say more than that, thank you.

(Question) - I take it you guys were quantifying the amount of the exertional myopathy. I am just wondering, did you compare those values? Were they significantly different than the natural mortalities? How much natural mortality has been compared?

(Dr. Cattet) - The first question, the extent of the muscle injury we looked at. It was a single necropsy, but our other basis of comparison was the published literature. There was very little on bears; there are certainly lots on other species. The second question, looking at values in animals that had died, if all exertional myopathy bears had actually died from exertional myopathy and looking at those values relative to the normal range, that is really how we looked at muscle injury, we drew our conclusions on the significance, or the extent of the injury. I can't tell you if an animal has a value of 750 units per liter of AST. I can't describe to you does that involve one muscle, two muscles, does it involve the whole length of the muscle. All I can say is that's a high value and it is significant.

(Question) - When you are talking about impacts from repeated captures, just two quick questions. One was with traps and snares? Or was that including helicopter captures? If it is with helicopter captures, how far apart between capture events were you measuring the difference?

(Dr. Cattet) - The first question, repeated captures didn't involve just snared animals but involved all animals, so animals captured by helicopters as well. In terms of frequency of recapture, our kind of minimal frequency that we looked at was twice in a one year period with generally a year between, anything more than that; we had some animals that were captured 3-4 times in their first six years of life and we had other animals that we had captured three or four times as late adults.

(Mark Atkinson) - Thanks Marc, a fascinating presentation. I would encourage you that if you do have questions to hold onto them. If we finish up in time I think we will have a few minutes for a few additional questions afterwards. Next speaker is Dr. Nigel Caulkett who is going to talk to us about bear immobilization and anesthesia. I think this is done in two parts; we are going to have a break in between.

Invited Speaker – Immobilization techniques and supportive care of bears- Dr. Nigel Caulkett, DVM. I am sure glad Marc had the hard stuff; I got the easy stuff, so I feel better about that. Thank you very much Mark for the invitation to come talk here. My background is I am a veterinarian anesthesiologist. I do anesthesia on all species and I have been fortunate enough to a great a bit of work particularly on bear anesthesia, but a lot of my

work right now is actually ungulates as well. So some of the stuff you will see is based on wildlife in general and some of it is much more specific to bears. I am going to try and shorten this one a little bit to make sure that we all get a break in the middle of this. But to start with I am going to actually focus on the drugs themselves, then we will have a break, and I will focus on some of the monitoring techniques and maybe some of the advances in monitoring and supportive care that have happened in the past few years. First off, I am going to ask you guys a question. If you were looking for the ideal drug or drug combination for a bear capture what qualities would it have?

(Response) - Quick knock down.

Okay, usually when asked this question at conferences, particularly with conservation officers, park wardens that is usually the first thing that comes up, is quick knock down. The situations where you have public safety concerns in particular or where you have got terrain where the animal could potentially in situations fall off a cliff or go into a river. I was fortunate enough to go on a Swedish bear capture project a couple of weeks ago and we had a big brown bear male who on induction decided to go sit in a river. He sat there as he induced and luckily we were able to get the helicopter pretty much landed in front of him and then he moved out of the river and went down probably about 30 meters from the river. So, quick knock down is really important. Drugs we are looking at in bears, if you are looking at Telazol, Xylazine-Telazol, or even Metetomidine-Telazol mixtures you are probably looking at about five minutes to about eight minutes. With some of the newer potent narcotics you can get some amazingly quick knock downs. But, 5-8 minutes can seem like a very long time while you are waiting for the animal to go down. What other qualities would you look for in a drug mixture?

(Response) - Safety.

Safety, so a high margin of safety for the animal. That is an area that I have worked on quite a bit with Marc a lot. Basically, we tried to evaluate some of the current combinations and look at other combinations. Look at them from the perspective of an anesthesiologist, so you would be able to measure blood oxygenation, to get an idea of oxygen delivery. You get an idea of safety for the animal. The good thing about bears, I think, is that a lot of the drugs we use have a very high margin of safety. Telazol in particular has a very high margin of safety. In my clinical practice with small animals we have critically ill patients, shocked patients who have had a lot of blood loss; I will often anesthetize them with a very similar mixture to Telazol, or Diazepam-Ketamine because it does have a very high margin of safety. Safety for the handlers as well is a concern. I don't work with potent narcotics a lot with bears but with ungulates I certainly work with potent narcotics and some of these drugs are hazardous to handle and exposure to a small amount can cause significant problems in people. So again, I think the drugs that we use in bears we have to use very cautiously. You don't want to get them on your mucous membranes, in your mouth or eyes. But generally, they have a high margin of safety to handle as long as you are careful. Any other things to look for?

(Response) - Reversible.

Reversible, sure and that is I think one of the potential draw backs of Telazol alone, although it is a very good drug mixture, is lack of a specific reversal agent. Where we tend to run into trouble was if we were topping up with Telazol, for prolonged procedures, then we could have some very prolonged recoveries. Actually, Marc and I, that is where we started working together when Marc was using Telazol up in Manitoba on the polar bears around the Hudson Bay and we started working together, looking for a reversible combination for the polar bears because we would see some very prolonged recoveries there. And also, if you run into complications, reversibility is also very good. It can get you out of a bind sometimes. What else might you look for?

(Response) - Recovery.

Recovery times. If you don't have a reversal agent, having rapid recovery times can be good.

It can be a bit of a catch-22 in bears. The combination that I started working with was Xylazine-Ketamine, and we sometimes have very rapid and unpredictable recoveries. So, it is a bit of a balance and I think that is where Telazol has really found its niche in bears, is with the reliability of the drug. Anything else?

(Response) - Potency and ease of delivery.

As Marc said, we have switched to air inject darts and with black bears I often used to use a blow pipe where we would have about a 1-3 ml volume. So the volume itself can be a factor, particularly if you have got high speed injection, so the fact that you can give a low volume there is a potential for less trauma, and also with dart flight, that is potentially better. So, that is another good factor, focusing on volume. Anything else?

(Response) - Analgesic properties.

More and more we tend to do surgical procedures on these animals and that could be anything from a tooth extraction to putting in an abdominal transmitter. So, having some degree of analgesia and we can provide that with other drugs as well, but certainly one of the benefits of some of these mixtures, and I will talk about it, is that it does increase pain control. Lots of studies in people and animal models over the past decade pretty clearly show your better off preventing pain traffic from going up to the central nervous system. So if you use an anesthetic technique that has good pain control during the procedure there is a potential for less post-operative pain as well. Other little factors like if you are pulling a tooth on a lightly anesthetized bear, if it is Telazol, there is potential for jaw movement or the animal waking up with a painful procedure, so analgesia is another thing. Anything else?

(Response) - Low cost

A lot of the drug combinations we looked at in the past have been great but then when you are looking at them in management situations and universities situations too, cost is a factor, so economical combinations. Some of the drugs that we have worked with that kind of became our work horses; the biggest factor was probably cost. Cost is another issue, and availability. Some of the drugs that I will talk about - one of the reasons in Sweden they did so many captures ahead of us with Medetomidine-Telazol was availability of Medetomidine in North America. We had difficulties sourcing it and that is part of the reason we looked at other alpha II base mixtures. Availability is another potential issue. Just to wrap up, there are a few others, stability in solution. Working on the foothills project we might be working anywhere from, this time of year, it could be + 5 to + 10 degrees Celsius. In the winter in that part of the world it gets down to about -30 and then in the summer it can be +30. So, stability in solution is an issue. Unfortunately we haven't found the ideal drug yet. There is still a lot of work to do. I will just talk about some of the drugs we have used and maybe some of the directions things may be going.

Historically, one of the first groups of drugs used in bears was the muscle relaxants. The drug in particular that was used was a drug called Succinylcholine. It is still used as part of anesthetic techniques in people and animals but it is used when they are adequately anesthetized with other drugs. Used by itself it produces immobilization without anesthesia so there is a high risk of death from paralysis of the respiratory muscles. With this group of drugs, to use them for capture you attempt to titrate the dose so you will paralyze the limbs but don't paralyze the muscles of respiration. That is often very difficult to do. So, there is a high risk of death from respiratory paralysis or capture myopathy. It is very stressful to be immobilized and not anesthetized so with some of the ungulate species there was a much higher risk of capture myopathy. So again, Succinylcholine was the drug that was used in this situation, I don't think anybody is still using it in bears, it is still used occasionally in some difficult species and actually wild horses at one place. In general the use of a muscle relaxant without say, an anesthetic agent, is considered inhumane.

Phencyclidine was one of the next drugs that were used. Phencyclidine is a dissociative anesthetic, very similar to Ketamine or Tiletamine; Tiletamine being one of the drugs in

Telazol. Dissociative anesthesia is described in people as disassociating the person from their environment. It produces very light anesthesia. So, it is usually not adequate for surgery by itself. Unfortunately with Phencyclidine it was often used by itself and you would see a lot of muscle rigidity and also potentially convulsive activity, which would lead to a high body temperature, to hyperthermia. The other big problem with Phencyclidine was prolonged duration. Ultimately, the biggest problem with Phencyclidine was recreational use of the drug. So, the veterinarian product was getting out and being used. Angel dust was the street name and one of the biggest problems with Phencyclidine was people exhibited delusional behavior and hallucinations, and people attempted to fly off buildings, that sort of thing, under the influence of this drug. It was taken off the market and unfortunately. A drug that has replaced it is Ketamine. A lot of us use Ketamine as part of our immobilization protocols. It is a very targeted drug in veterinary clinics and quite a bit of abuse of the veterinarian compound, so it is something we need to really keep a close eye on and keep it locked up.

After Phencyclidine, another group of drugs that were used for bear capture were the potent narcotics. So, Etorphine and M99. For those of you that have used the Etorphine, some of the issues are muscle rigidity, again leading to high body temperature and really decreased oxygenation, some pretty significant hypoxemia. The nice thing about Etorphine is it is readily reversible. There are also issues with handler safety. You have to be quite careful handling Etorphine. I still use Etorphine. Currently we are doing a study looking at Etorphine in Przewalski horses at the Calgary Zoo and comparing it to some of the newer narcotics. But, probably not a great drug in bears. I will talk a little more about narcotics in bears further down in the presentation then Xylazine-Ketamine. I am sure a lot of people in the room have worked with Xylazine and Ketamine. There are still researchers, biologists working with Xylazine and Ketamine. Some of the advantages, is it is readily available. I think that is the real advantage. The disadvantage is potentially a high volume if you are using the commercial mixture. So if you are not using concentrated Ketamine it does tend to be unreliable in bears.

My first experience with Xylazine–Ketamine was when I worked for Saskatchewan Parks. I worked as an interpreter, so I just lost all creditability with everyone in the room, before I actually went into veterinary medicine. But, I was involved in a lot of the bear captures. I actually started working with this drug before I had really any formal training. We were given the drug, told a few signs to watch for and the one thing that stood out with that mixture was sudden recoveries. Even though we thought we were watching the animal closely I had a number of times where we had a bear get up and, luckily most of the time, we were able to get it into a culvert trap. So, sudden recoveries were an issue in bears and something people working with this drug knew to watch for. It's also a bit difficult to antagonize and that the problem with the mix is, you need to use a relatively high dose of Ketamine with this mixture. So if you antagonize the Xylazine too early you can see muscle rigidity and convulsive activity from the Ketamine. Again, people have antagonized the drug but it can be a problem if you antagonize it early. Like I say Xylazine-Ketamine is still used today and certainly I use it in a lot of other species and it still has a niche.

I am going to talk a little bit about pharmacology of some of the drugs we use these days in wildlife capture, particularly in bears, and some of the combinations that have been used in bears. When you are classifying drugs one of the classifications of drugs that we tend to use is the tranquilizers. The tranquilizers are drugs that have a calming effect on the animal. It won't induce unconsciousness so the animal won't become unconscious. They are certainly not adequate for immobilization used by themselves. They are sometimes used in combination with other mixtures. They are synergistic with other drugs. You can decrease the dose requirements of other sedatives of dissociative anesthetics. So, that is one place where tranquilizers are used. The place where I have used them more commonly these days is as long acting drugs for transport and holding. In bison we have used them for acutely post capture if we have had to put them into a pen situation and we also use it for transport. The

drug we used in bison lasts about four days and is called Clopixol-Acuphase. With translocation of ungulates we often give them a drug called Stresnil or Azaperone, so after reversal they have this drug on board during transport. That is the kind of place we tend to use these drugs. Again, not so much as part of the immobilization protocol. The drugs that are used these days, there are a bunch of them, Phenothiazines and Butorphanol. Has anybody used the BAM mixture in bears? Someone at the back, how did it work for you?

(Response) - It actually works real well with the bear.

(Dr. Caulkett) - So, it has been working pretty well and no sudden recoveries on your bears?

(Response) - We had one incident where we under dosed actually, and the bear actually stood up and we just shoved him back in the trap.

(Dr. Caulkett) - I haven't used it yet. I am not brave enough right now, but I know people have been using it very successfully in a variety of species. I sometimes wonder a little about the fact that it is a sedative analgesic based protocol, but certainly I have been hearing good things in ungulate captures and I know people have been starting to use it in bears and in some other carnivores as well. That mixture includes these drugs. BAM is Butorphanol, Azaperone and Medetomidine. So the Butorphanol combined with Medetomidine and Butorphanol produces a very deep state of sedation. So again, it is part of that protocol. The other group of drugs that are not typically classified just as tranquilizers or classified as tranquilizer sedatives are the Benzodiazepines. This group of drugs includes the Zolazepam, which is part of the Telazol combination, Diazepam, Valium and Midazolam. The two that I tend to use in wildlife are of course Zolazepam and Diazepam. Unfortunately, it is given IM, in the muscle, and it is very irritating and potentially isn't absorbed as well as some of the other drugs. So, Benzodiazepines are classified as sedative tranquilizers. The nice thing about these drugs is that they have a very high margin of safety. Again, if I am working with some domestic animal patients, with small animals or horses, if I have a critically ill animal, I will reach for the Benzodiazepines over a lot of other drugs that subdue and break my margin of safety. They also produce very good muscle relaxation.

Anytime you use the Medetomidine and you are used to using Telazol the animal look a lot more depressed. Their heart rates tends to be a lot slower, their mucous membranes are a lot grayer. It does take some getting used to and I find that not just in the wildlife world but in dealing with animals in general. When you add Medetomidine they do look a lot more depressed and in the BAM mixture the Medetomidine is at a pretty high dose, so it does tend to be more defined. I will talk about Medetomidine and some of the side effects but certainly it takes some getting used to.

Moving on to sedatives. So, Medetomidine was one that we were just talking about. The biggest group of sedatives we tend to use in bears and wildlife in general are the Alpha II agonists. The Alpha II agonists work on the Alpha II receptor, and in a nutshell what they really do is they decrease sympathetic drive. So, they decrease the fight or flight response. Because of that, since they do occupy similar receptors in the central nervous system, if you have an animal that is worked up or stressed you will find that they can potentially override these drugs. So, you do need higher dosages in excited animals. In wildlife we tend to dose these drugs quite high compared to domestic animals. I know that when I present wildlife stuff, particularly at meetings where we talk about domestic mammals they are always fairly shocked at some of the dosages we use and I think part of it is just the higher sympathetic tone in the animals that we are working with. Last week I wasn't working in a wildlife situation but I had five horses that we had to castrate. We put them all in a pen together and I had some students with me and as the horses got off the trailer, we did the first two and we found that in the first two animals we needed a 50% higher dose of the drug we were using. Fifty percent higher of the Rompun (Xylazine) and then when the animal was down we needed 50% Rompun (Xylazine) and 50% more Ketamine to keep these animals down. Although they didn't look that stressed, there was a lot of noise in the

room, and we had just moved them off of the trailer. With the next three horses a bunch of people had moved out, it was a lot quieter and calmer, the animals had time to accommodate and we got away with routine dosages. We certainly see this a lot. Where I used to see this a lot was when I worked on farmed deer. Often in those situations I would just use Xylazine alone, or Xylazine plus Azaperone and you definitely found that your handling had a big impact on the drug dosage it would take to knock the animal down. So, higher doses are required in excited animals. That is something to be aware of. The nice thing about the Alpha II's is that you get pretty profound synergism with narcotics. Dissociative and Benzodiazepines, tend to use lower dosages of all of those drugs when you add an Alpha II.

Ok so, some of the side effects: hypoxemia, we talked about. Marc mentioned it with Xylazine-Telazol. Certainly, whenever we add an Alpha II agonist to Telazol we see some degree of hypoxemia. Fortunately, in bears it is usually not that severe. If I were to give Xylazine-Telazol to a white tailed deer or an elk I would expect much lower oxygen than I tend to see with an equivalent plane of anesthesia in bears. It may be a bit debatable, do you need to treat it in bears or not? I think there is certainly some arguments for treating it, but it is a common side effect if given an Alpha II agonist to ungulates in particular, but also to bears. The other thing that we do tend to see, if you are looking for it when you give an Alpha II agonist, is hypertension. So with the dosages that we use, their blood pressure tends to go up. It is a biphasic effect. If we were to leave the animal and let the drug distribute throughout the body, the high blood pressure is actually a peripheral effect and constricts the blood vessels and that is what gives you the high blood pressure. But as that peripheral effect wanes the actual central effect is to drop the blood pressure. So if you are looking for it you will see their blood pressure go up and then it will go down to baseline and then it will actually go below baseline and then become hypertensive. Most of the time when we are working in wildlife species it is all done in reverse before we see the low blood pressure.

The other thing that is common when you give an Alpha II agonist is bradycardia, a slow heart rate. And again, as Marc mentioned, thermo-regulatory inhibition. These drugs have an effect right at the level of the hypothalamus and depending on the species, or often the size of the animal, what they do is they tend to compare thermal regulation. So in hot environments we tend to see hyperthermia, if it is really cold we may run into hypothermia, particularly in small animals. So we do see thermo-regulatory inhibition in every study we have done where we have had an Alpha II agonist of Telazol.

The drugs that we use these days, Xylazine was the one that was used first, Rompun was the trade name, Medetomidine has been used quite a lot, particularly in Europe, and is being used more and more in North America as it is more readily available. One that is not really used very much, and we did a very brief preliminary study with it in black bears, is Detomidine. Detomidine is an intermediary potency between Xylazine and Medetomidine. One of the reasons that we were looking at it, particularly in ungulates, is availability. We had a difficult time in sourcing Medetomidine so we were looking at Detomidine as an alternative.

The nice thing about Alpha II agonists is we do have specific antagonists of these drugs, so the Alpha II agonist antagonist will bind well with two receptors and displace the agonist drugs. So it reverses the beneficial effects of the Alpha II agonist - the sedation, the pain control, and the muscle relaxation. But, they also reverse the adverse effects. In bears the adverse effects on thermo-regulation can potentially be reversed and adverse effects on heart rate if there is a very slow heart rate. In ungulates, the big problem that we run into is bloat. Their rumen becomes static and that is often an indication we will have to reverse the Alpha II agonist. We do see some specie specificity with the antagonist drugs we use. In bears we tend to stick to Yohimbine and Atipamezole, and these are the two drugs that we use the most for this purpose.

Lets talk about dissociative anesthetics, I alluded to them a bit. The two that we tend to use are Ketamine and Tiletamine. They produce minimal pain relief. I should put a qualifier on

that. There are a lot of different types of pain and these drugs are actually good for producing pain control in the face with burns and in the face of some types of nerve injury. In general, if you have got an animal down, let's say you just had a feline down with Ketamine, and certainly we used to do that, we give 20 mg per kilogram of Ketamine to these cats and it would be enough for immobilization. But, if you start to do surgery it would start to crawl away on you. So what people did in the face of that was they added an Alpha II agonist like Xylazine, and with Xylazine-Ketamine; once you add the Xylazine, which does induce good visceral pain control, then you could do a minor surgical procedure. People even did more major procedures under that mixture. So, used by itself for surgical procedures it is often not really that adequate; by themselves they don't produce good muscle relaxation. They do have a high margin of safety and one of the reasons that we like them in wildlife compared to some of the other drugs we use is that they do tend to maintain some of their airway protective reflexes. One of the big problems with gas anesthesia or with injectable barbiturates is that they will lose their airway protective reflexes and have more potential to aspirate.

Ketamine is one that we certainly used first in bears and it still does have a place. Ketamine is pretty short acting and depending on the species; you might be looking at 20 minutes to an hour of activity; it is dose dependent duration. Given IM, one way people get around its short activity is to give a lot of it intramuscularly. Certainly, that can extend its duration but since it is not reversible you do end up babysitting the animal for quite a long time. It has a very high margin of safety. Again, I use this in fairly critically ill patients. I think that where I tend to use it most in bears is intravenously or an intramuscular top off for bears anesthetized with Tiletamine and Zolazepam based protocols. On what used to be the foothills project, we often used it at high heat, and say if we needed an extra 15-20 minutes of anesthesia towards the end of the procedure and we didn't want to give more Telazol we would give 1-2 mg per kilogram of Ketamine intravenously and that would pretty reliably give us an extra 15-20 minutes of anesthesia. When I was just over in Sweden with Jon Arnemo they often use it as an IM top off, intramuscularly. They will use it earlier than we did so if they think they might need even half an hour they will give it intramuscularly and monitor the bear closely. I think that is where we tend to use this drug most commonly.

Carfentanil has been used in bears and primates. Usually it is in a sticky kind of bait where they will lick it. It goes on the oral mucous membranes and then gets absorbed across the oral mucosa. That is important, if it goes into the stomach, a lot of it is metabolized by the liver. It is called a first pass metabolism, so it hits the liver before it hits the rest of the body. It is in sticky bait so it actually absorbs across the oral mucous membranes. You do tend to need extremely high dosages of narcotics for anesthesia and when you use them particularly in bears, you see a lot of depression of the respiratory centers. We certainly see that in ungulates too. Low doses are synergistic with other drugs, so recently we tried using them in combination with other drugs without benefit. One of the reasons some of the newer opiates are pretty exciting. A drug that we have been working with in Uganda is thiopental. The thing that I find really exciting about is that we were given 30 seconds to a minute and a half induction times and I have not seen that with any intramuscular drug. So nice in ungulates but I have talked to some people before that have used these drugs in bears and I think that I would agree that there is more potential for depression of respiration in bears with these drugs.

Combination anesthetics: We talked about a lot of individual drugs and we don't tend to use them individually, we tend to use them together. A lot of reasons for this as synergism lower the dose of the drugs used in mixture, dose reduction components combating desirable affects of other drugs. Xylazine with Ketamine we have talked about. Again, if you are using it in bears use it very cautiously. It tends to be reliable in ungulates. Medetomidine and Ketamine is an excellent combination. The nice thing about Medetomidine is that when you use Medetomidine you can use a lower dose of Ketamine. In most species where I have used 4-6 mg per kilogram of Ketamine, like I would

with a tiger with Xylazine, with Medetomidine I can get it down to about 2 mg per kilogram. That makes it more reversible because when you reverse the Medetomidine you don't get the adverse affects of Ketamine. The nice thing about this mixture is it is used in a wide range of wildlife species, unfortunately not so useful in bears. Marc and I learned that when this particular polar bear woke up very suddenly. We were monitoring it, what I thought was quite closely, and just went to lift him and weigh him and saw the eyes start to flake; then he was pretty much wide awake and actually put the run on us. So, they also found out the same thing on a Scandinavian brown bear project when they had a couple of spontaneous recoveries with this mixture and actually even a mauling related to using this mixture. Certainly, it looked good initially and when we had bears down in a captive situation for an hour it looked very good but the true test was using it in the field and it wasn't good and I would not recommend it in bears for that reason. It is still a very good drug. It shows that context is important.

I have been helping with some bighorn sheep captures, two projects, and one of the projects we work in a big wide valley and actually captured most of our sheep on a golf course. We have been using a mixture of Medetomidine and Telazol or Detomidine and Telazol. It worked really great in that situation. We had rapid inductions, rapid recoveries. Last year, I started working with a group out of the University of Calgary and their bighorns are in much more rocky terrain, and they would often run up the cliffs as they induced. The researchers are from Switzerland, and I am from Saskatchewan, and I wasn't used to cliffs at all so that is not a good position for me to be in and not really a great position for the sheep. The drug mixture I was working with was this mixture that we had used in British Columbia in these big valleys. It had worked great there, but as the animals recovered with the residual Telazol they would be ataxic and, although they were standing, they would stagger a bit. So if you were on a cliff edge doing that, as opposed to a golf course, it was worrisome. We ended up switching to Medetomidine-Ketamine in that situation because once we reversed the Medetomidine we had very little residual effect from the Ketamine and it worked better in that situation.

I guess it brings home the point that we often talk about these drugs and you don't always look at the context that these drugs are used in. Another place where context is important, I worked with zoo vets at the Calgary Zoo and in their brown bears and black bears they use a mixture of Medetomidine, Midazolam and Ketamine. So, Midazolam again equates with Diazepam. It does tend to increase the efficacy of this mixture and less risk of sudden recoveries. But, again I have seen a few immobilizations done with this and I know that when my students were out there they did have one wolf jump up on this mixture. So, it is a kind of thing that I would be less comfortable using in a field situation as well, unless I was constantly watching the animal. Even then, I have been burned with these mixtures when I thought I was watching them closely.

Telazol, I am sure that most of the people in the room have used this drug mixture. It is a one to one mixture of Tiletamine and Zolazepam. This is currently the drug of choice for bear management. It produces very good anesthesia alone in carnivores. It is not ideal in ungulates, and again, has a wide margin of safety. Some disadvantages is that it is not that good at pain control. I think that one of the times it was brought home to me was when I was working on the tundra in Cape Churchill with Marc and I was watching the monitor. I was watching the blood pressure monitor and all of the sudden the blood pressure just shot up and I was really worried that something serious was going on. I looked over and Marc was just starting on a tooth extraction. The blood pressure shot up, so we did not really have adequate pain control for that procedure and we think of that as being a relatively benign procedure. So, that is part of the reason we started looking at Alpha II agonists combined with Telazol. Not reversible and a high volume requirement when used alone, and again, repeat injection often results in prolonged recovery. The mixtures that we have actually used: Xylazine-Telazol, Marc talked about, only a relatively small volume needed. Tend to get it down to half the volume of Telazol. You can use it in a wide variety of species. I really like this drug for wildlife

managers because you can use it in a variety of ungulate species, you can use it in cats, you can use it in bears. I think it is very good for that reason. They do tend to get analgesic and reliable anesthesia, but you have to get used to it though. I think when we first started using this and then we started application. One of the problems was, if you were used to using Telazol, you were used to approaching an animal that might have some head lifting with this mixture. If there is head lifting they are too light and you definitely need to deepen them up; you should put another dart into them. I know that we had some issues early on where people didn't have a high comfort level with it, and again, you can antagonize with Alpha II agonists. Some of the disadvantages, again, is hypoxemia. It is not as severe as it is in ungulates in permanent thermal regulation. I will talk about that when I talk about monitoring. Certainly, we have run into that with this mixture. We tend to use a pretty high dose of Telazol with this mixture, about 3-4 mg per kilogram, so when you reverse with Xylazine you can still have longer recoveries with this mixture. So, although, it is better than Telazol alone they are not up and moving within 15-20 minutes.

With Medetomidine-Telazol, smaller volumes are required than Xylazine-Telazol. Again, you can use it in a wide variety of species, good pain control, rapid induction and reliable anesthesia. You do need to use Atipamezole to antagonize this and you need a more specific antagonist. I would say it is probably the most useful combination in bears. Like Marc said, they used it in Scandinavia for about 20 years. It gives a very reliable immobilization in their brown bears. Marc and I looked at this mixture in black bears quite a few years back too. We did use a lower dose than they used in brown bears, about 1.5-2 mg per kilo of Telazol and .05 mg mixed with Medetomidine in black bears. We had quite reliable anesthesia and we were able to get these guys up and moving very quickly; it is a nice mixture. The nice thing about Medetomidine is it is available in both Canada and the US; it has become much more available. It has been taken off patent so it is also a lot cheaper than it used to be. I think this is a really good drug to use in bears and other species. We did do some preliminary studies with Detomidine; we added a narcotic, Hydromorphone and Telazol. We didn't do many black bears, we only did seven. On one of the first bears we did, the dose of Hydromorphone that we ended up using wasn't what I would consider a very high dose; it was .4 mg per kilogram. Extrapolated from use in dogs it wasn't huge but certainly we ran into respiratory depression with that bear, classic narcotic respiratory depression and a very slow respiratory rate. Again, it brings home that you do have to be cautious with a narcotic in bears. Once we halved that dose, it really, as far as the physiological effects goes, wasn't that different than our other mixtures. But, once you add a narcotic in the mix it is more controlled and probably no real advantage over Medetomidine-Telazol.

A volatile anesthetic, or gas anesthesia, is not that useful in field situations but certainly with prolonged procedures we still tend to use them. We used it on a performing bear that was in our clinic for a variety of work ups, but we had to keep him down for a long time so he was on gas anesthesia.

I will just finish up talking a little bit about analgesics. Again, I am an anesthesiologist and the last thing that you ever want is your anesthesiologist doing surgery on you and that is what unfortunately happened in this situation. This was a brown bear that was in a snare and had self mutilated, partially amputated two of its digits, so we had to make a call whether to destroy the bear or do surgery. Unfortunately the wound was already dirty, so that is always an issue if you do have dirt in the wound. We actually elected to amputate the digits and do surgery, left as many openings that we could to let the wound drain. We were able to follow the bear for couple of years and it actually did okay. But it certainly illustrates a situation where you need good pain control. There are a few ways of providing analgesia, local anesthesia. Marc showed you a picture of injecting in the lower mandible, or into the mandibular foramen. This is actually in the maxilla in a deer, so we are going through another foramen called the infraorbital foramen and that blocks the upper teeth. This was a brief study that we did a few months back, as you can see we actually got some electrodes on the teeth of this wapiti and it

was sedated with intranasal Xylazine. We were stimulating around the tooth to find out how quickly that block would take effect, and also titrating our dosage. We were able to find, in the wapiti, with a 6 ml volume we could get very rapid anesthesia in about a minute. In bears, the other thing that you can do if there is an opportunity is to just infiltrate the anesthetic around the tooth. With lower teeth on the mandible it does not tend to work as well. But, certainly there are a lot of ways that we can use local anesthetic for pain control. When you choose a local anesthetic there are a lot of factors. Marc talked about a long acting local anesthetic in that situation, a drug called Bupivacaine, which will last about 6-8 hours. Some of the drugs only last an hour, some two hours. In this surgery on the Scandinavian brown bear project we were talking about putting local anesthetic around the incision. One of the things that they were concerned about was after the bear woke up, if that area was numb. The bear would itself mutilate and actually open up the incision. That is actually a genuine concern but you could choose a drug like Lidocaine, which only lasts about 45 minutes to an hour; it would get you through the surgery and just into the recovery and then start to wear off. Toxicity in small animals is another issue, if you are doing dental blocks, or bone penetration. So, if you are actually infiltrating around a tooth there are local anesthetics designed for that purpose, a drug called Articaine. Then you can add vasoconstrictors, or you can certainly use local anesthesia, in a lot of situations for pain control.

Let's talk about non-steroidal anti-inflammatory drugs, or NSAIDs. On the Scandinavian brown bear project they used a drug called Carprofen. It is a drug that is like aspirin but much more potent and lasts for about 24 hours. We have been using Meloxicam, or Metacam, in our bears post-snaring and post-tooth extraction; and again that drug lasts about 24 hours. Where I really saw these drugs used, I went to Chandu on the Animals-Asia project where they have captive Asiatic black bears, a lot of them with chronic arthritis, and they rely very heavily on this classic drug for chronic pain control. Unfortunately, we are extrapolating these doses from other species. We don't have any good controlled studies in bears and I would hope that down the road that is something that we could do. They are relatively safe but not good in animals with severe kidney or liver disease.

Finally, opiate analgesics, we don't have a lot of information about efficacy or side effects in bears. Our biggest concern is residual sedation. The BAM mixture includes one of these drugs, Butorphanol, but people tend to reverse it once the procedure is done. I will skip emergency drugs because hopefully you won't have any emergency, and I guess we will have questions at the end. We will take a break now.

I am going to switch the focus a little and talk about monitoring in supportive care during the capture and handling of bears. When you look at anesthetic risks as an anesthesiologist, probably one of the biggest things I do is look at the risk of morbidity or mortality from anesthesia. If I am dealing with a patient, next week I have got a dog coming in who's sibling died after anesthesia, they might have an underlying heart condition, so one of the things that I will do is a lot of work up on the dog first. Get an ultrasound of the heart, actually assess cardiac function, and do blood gases to look at his oxygenation because he had a prior history of pneumonia. Based on that, I try and get an idea of risk so that we can tell the owner the risk of doing the procedure or not doing the procedure; what the risk of anesthesia is. A lot of what I do with horses, dogs and cats is look at an anesthetic risk and being able to talk to the client about the risk of the procedure. When you look at anesthetic risk in humans the risk of mortality from anesthesia is about 1 in 30,000 to 1 in 100,000, so that is not really bad odds. I would certainly go for anesthesia in those sorts of odds, it is not too bad. When you look in small animals, there was a study done in Canada, there was another one done in the UK, where they actually assessed anesthetic risks or the risk of mortality in small animals. It was 1 in 1,000; that is not as good. Depending on the study, if you were a dog or a cat, you were about 30-100 times more likely to die as a result of anesthesia than people are. If you are looking at horses, a lot of what I do these days is anesthesia of horses as far as my clinical practice, it is about 1 in 100. One of the big differences with

horses, it is kind of the nature of the beast, is when they are recovering. That is where we tend to run into most trouble, they tend to traumatize themselves in recovery and also they have a quite high risk of myopathy. We have talked about myopathy earlier in bears. It is not a disease that we think of as much in carnivores. We are just starting to realize that it is there, but in horses it has been recognized for a long time and can result in significant mortality.

When you look at studies in wildlife it is a bit harder sometimes to assess mortality and morbidity. I have been on some projects where we have looked at where mortalities have been as high as 10 percent. With some of the species that we deal with, the ones that I always shutter if anyone asks me to help on are pronghorn antelope. If anyone has anesthetized those guys they are stressing incarnate and we tend to run into a lot of trouble with them. I don't think we have a really good idea of the risk of death from anesthesia in bears, but I would argue that it probably actually isn't that high. On a lot of the studies Marc and I did together where we would look at the physiological effects of these drugs, and when I look back over captures I have been involved with, on the Foothills project and other projects, we actually didn't lose many bears from the anesthetic drugs themselves. We lost many more bears from trauma, so either snare induced trauma or dart induced trauma. The other place where I have certainly heard of it is animals on recovery going into water or other situations where they lose their airway. I would argue that the risk in bears is probably actually lower than we see in horses. In general, they are not terribly difficult to anesthetize. That being said, I think when you look at the difference between people and healthy dogs and cats, I think the biggest difference is that we use the same drugs in people as we do in dogs and cats but the monitoring is a lot different. In dogs and cats in general, a veterinarian whose got some training in anesthesia, or veterinarian technician that does the anesthesia on the animal, there is no real minimum of standards for monitoring the animal in the US or in Canada. My specialty college is the American College of Veterinary Anesthesiologists; the vast majority of those anesthesiologists are in the US. This is something that we have been grappling with some of the veterinary associations in Canada and the US, and that is trying to get minimum standards of care. With people, the monitoring in Canada, and I am not sure of the US standards, is an electrocardiogram, measurement of blood pressure, non-invasive blood pressure, pulse oximeter to measure oxygenation and capnography to measure carbon dioxide and make sure the patient is ventilating well. I think a lot of the reduction in mortality of people is part of this training for the anesthesiologist but another big thing is close monitoring.

So when I anesthetize a domestic mammal, if you look here, that whole set up is to just provide anesthesia. There are monitors there, there is gas anesthetic, there are ventilators, and there is a temperature controlled environment that we monitor very closely. We monitor at least every 5 minutes, and in general these days, we continuously monitor our patient. So, most of the monitors that have come on in the last 10 years will give you a continuous read out of their heart rate, blood pressure, and oxygenation. So if I have got a horse coming in, or again a small animal patient, depending on the condition I do a work-up up front; we look at bloods, we might do x-rays, we might do ultrasounds, and pretty much the same stuff they will do with people before anesthesia. It is equipment intensive. We always put them on intravenous fluids and supportive care, so we will often have to give them drugs to keep their blood pressure or their heart rate up in these situations and they are always oxygenated and ventilated. Whether it is sedation or anesthesia they are always on oxygen and if their ventilation slows under anesthesia we can support their ventilation.

With wild bears it is a much bigger challenge. When I am teaching my vet students I try to bring this home that in the environment they are working in they still have issues with anesthesia. But when you do the same thing out in an uncontrolled environment, there is the weather to worry about. Working in the mountains we are often looking for rapidly changing weather conditions; high ambient temperature, low ambient temperature. A couple of weeks ago when I was working on the Swedish bear project it was a nice spring day, I wouldn't say it was that warm, and we ran into trouble with one of our bear cubs that started to

become pretty hypothermic. We don't have a pre-workup so we are hoping these animals are healthy ahead of time, but that is not always the case. Often there is underlying conditions that can interfere with anesthesia. They can be difficult to monitor. We don't have equipment like in a hospital. It can be difficult to provide supportive care. So, even if in this situation we put an intravenous line in the bear and we were giving fluids to the bear. But generally, we cannot carry a lot of fluids and even if we could we might not have the expertise to put in the intravenous line and administer the fluids. It is an extremely challenging environment. It is much more challenging than the environment that most veterinarians work in and it often requires a lot of innovation.

Here is a list of common complications. I think the most common is hypoxemia, or low oxygenation. Trauma isn't that uncommon, depending on the system you are using to capture your animals. High $C0_2$ or hypoventilation is an issue. Hyperthermia or hypothermia are also quite common, particularly hyperthermia. Then lower on the list are capture myopathy, acidosis, and regurgitation. So if the animal regurgitates and breathes in the vomitous it can have pretty devastating consequences. Whether I am working with domestic animals or with wildlife, the first things that I think of are my ABC's; ABC's translate into airway, breathing and circulation. Whenever I walk up on an animal, whether it is a bear or an ungulate that is the first thing that I am looking at. When I monitor the animal, I notice what the head position is, and if the airway is compromised. Certainly, we have run into situations where the animal has had its head pressed against a tree or down in a hollow or its nose has gone down into the snow. I told you about the bear a couple of weeks ago in Sweden that went straight to anesthetize in the river. We had another one that went down in a pool of water and put his head up on a rock, so then it was moving his head from side to side and luckily he decided to position his head on the rock before it became anesthetized. Certainly animals with their heads going down in the water lose their airway and then obviously can drown in that situation. So, the first thing that I look at is the airway and then breathing. Do you notice normal ventilatory patterns, is the chest rising and falling and what is the rate and then circulation? After that is done I will move and feel a pulse. On a bear often the easiest one I find is on the inside of the leg, the femoral pulse. If I am having a hard time feeling a pulse, if it is really fat, then grab my stethoscope and listen to the heart. Those are the very first things that I will do and it is really basic monitoring.

Basic supportive care such as position and comfort should be addressed. What that really means is this, if I wouldn't want my shoulders lying on a root or my arm back, or my head against a rock, or that sort of thing if I was anesthetized, I just extrapolate it to the bear. Additionally, we will insulate the animal from the ground.

What about eye lubrication? With most of the drugs that we use the animals don't blink very well so one of the early things that we do is put eye lubrication in. Do a quick physical exam of the animal and, when you get time, do a more in depth physical exam. As much as possible, particularly at this time of year, try to protect from direct sunlight and definitely recover away from water. Whenever possible make sure the animal is away from water during recovery. So those are really just basic things that I am sure everybody is doing with their animals anyway.

It is always hard to come up with minimum monitoring standards. In small animals and people the minimum monitoring standard used to be every five minutes, and what that was based on was if the animal or person went into cardiac arrest you still might have time to resuscitate them. In people, the trend really went to continuous monitoring and that's has been the same with our veterinary patients. In wildlife situations what I find as an anesthesiologist is I am often doing a lot of other jobs on the animal and sometimes I have difficulty trying to adhere to minimum monitoring standards. But I think what we try to strive for is taking a pulse every 5-10 minutes, respiration every 5-10 minutes, temperature probably every 10-15 minutes. If the temperature is on the rise you might want to do that more frequently. It is also important to record the values and look for trends. In anesthesia the absolute value means something

but the trends are just as important. So, is the heart rate going up or down, is the respiratory rate going up or down? That can be a warning sign that you are running into impending problems. One of the things that I will see with a severely hypoxic animal, when it is really not oxygenating very well, is their heart rate may very well shoot up and they become tachycardic. So in a bear you might be looking, with Telazol, at a rate of 150, with an Alpha II-Telazol mixture over 120, and I'm just kind of pulling this out of my hat. The tachycardia is one thing but if you see the high heart rate followed by a very sudden drop in heart rate, by a sudden bradycardia where it drops down to 30 or 20, that can be an impending sign of cardiac arrest from hypoxia. I have seen that mostly in wild ungulates over the years but it is really important to look for trends, so not just the absolute number.

I am going to focus a bit on hypoxemia. Someone asked Marc, "How hypoxic do the bears get?" and we have got a few ways of measuring oxygenation. One way is to actually look at the dissolved oxygen in the blood. To do that we actually take a sample from the femoral artery and analyze it. It is dependent on altitude and temperature and a few other factors. What most people are using is a pulse oximeter. A pulse oximeter, in a nutshell, has a light omitting diode. It shines red and infrared light across the tissue bed across the tongue and it has a photo detector on the other side. It looks at the amount of red light reflected and absorbed compared to the infrared light. Basically, all this is doing is looking at how red the blood is. It also looks at pulsatile flow, so it turns on and off very rapidly. It maps the pulse weight form and it takes that at the top of the pulse weight form, so that tells you arterial saturation. They are a really good tool but unfortunately there are a lot of things we do during anesthesia of bears that will interfere with pulse oximetry. We see some degree of hypoxemia during any immobilization with any Alpha II-Telazol mixture. In bears it is typically what I would say is a mild hypoxemia. Saturation usually around 85-90% and a partial pressure of oxygen in the low to mid 50's up into the 60's, and like Marc said, that improves over time. In ungulates we tend to see more of a moderate to severe hypoxemia. I think in ungulates there is definitely a lot more argument to treat the hypoxemia. It is rarely fatal and doesn't have any adverse effects. I think that one of the problems is that we don't know. I have often run into the argument when I am speaking at conferences and talking about ungulates, that people with anesthetized elk or whitetail get hypoxemic but they get up and run away, it doesn't seem to have any adverse effect. I guess I would argue that we haven't been looking. Lots of causes, I won't go into the path of physiology but the one at the top, ventilation profusion mismatching is what we see the most followed by hypoventilation. So, with hypoventilation their carbon dioxide goes up and that drops their oxygenation. Ventilation profusion mismatching is changes in blood flow and blood flow through the lungs and ventilation at the level of the lungs. Those are the two biggest reasons we see hypoxemia. So, what do you see? Clinical signs include cyanosis, so blue mucous membranes, and we have talked about that; typically, you are not going to see that until the percent saturation drops below 80 or even into the 70's or 60's. One of the things that we do that tends to increase the instance of cyanosis is giving drugs like Medetomidine that produce a lot of constriction at the level of the gums, vasoconstriction and a lot of stasis of the blood. So, the blood tends to kind of stay around that area, it deoxygenates and you get that blue color. One of the problems with Medetomidine is they will get that coloration but it is not necessarily what is happening throughout the rest of the body. So, that is one reason that the Alpha II's will actually interfere with pulse oximetry. Other signs include high blood pressure. Again we see this with the Alpha II agonists as part of their action. Tachycardia is a high heart rate with bradycardia as a terminal event with severe hypoxia. Once we add an Alpha II agonist we usually see a slower heart rate, so with Xylazine-Telazol I am used to seeing heart rates more in the 50's and 60's with our bears where as when I used to use Telazol alone, 70's, 80's, 90's might be more common. Again, it is typical you will find saturation, a pulse oximeter reading to the low 85% or a partial pressure of oxygen below 60. So, pulse oximetry again measures percent hemoglobin saturation. It is affected by movement. So, if

you have bears that are light on Telazol and they are chewing or their tongue is moving, unfortunately that will affect the reading. With ambient light, the photo detector is kind of skewed away so it is actually reading ambient light, which can affect it. Vasoconstriction is the biggest one. So, if you add an Alpha II agonist to the mix, particularly early in the anesthetic period it will lead your pulse oximeter to read erroneously low. It does tend to read lower than it actually is. Normal saturation is about 97%. That being said, even though this error is present, it is good for looking at trends. As bears redistribute the Alpha II agonist over time you will tend to get a better reading, so you will get a better signal on your pulse oximeter and also response to therapy. If you put them on oxygen are they responding to the oxygen?

For research purposes I never rely on pulse oximetry. Again, there are too many things that interfere with it so for research we will actually take the sample right from usually the femoral artery in bears, take an arterial blood sample. So, I could put a catheter right in the artery or do an open needle puncture and that gives you a definitive measurement of the partial pressure of oxygen and the partial pressure of carbon dioxide. So, for all of the studies that we have done looking at these anesthetic immobilizing agents in bears, that is what we have to rely on for the oxygenation. Again, the pulse oximeter we tend to take with a grain of salt. It also gives us a good measurement of metabolic status; is the animal acidotic as well? So that is another thing that we can look at. The analysis we use to do that is called an i-Stat analyzer. It is a nice analyzer. You can see that my last grad student is working with it in Africa. The only problem with this unit is its temperature range is between 15 and I think it is about 25° Celsius. In Africa it is always too hot, in Canada it is always too cold. We spend most of our time just trying to keep the instrument at the right temperature.

So, do we need to treat hypoxemia in bears? We know that when we add an Alpha II agonist, like Telazol alone they have a mild impairment of oxygenation. But once we add an Alpha II agonist we do tend to see some hypoxemia. Again, we don't notice any adverse effects; certainly we have heard that argument. I have even used it myself even just as recently as a couple of weeks ago and we got taken to task on it. I know I have worked on several animals that probably would have died without supplemental oxygen. Certainly in ungulates I have had this situation where their heart rate has shot up, they have had this terminal bradycardia, they have stopped breathing, and they have become anemic. We got oxygen into them and initiated ventilation. I have had two bears over the course of the years that I am pretty sure would have died without supplemental oxygen. One, I still don't know the underlying reason but she was just very blue. She wouldn't oxygenate very well. We were able to keep her on oxygen throughout the procedure because we had it. We had a pulse oximeter measuring oxygenation. We reversed her and we worried about her but she actually did okay. The other bear was a lone yearling; he got darted in the chest and punctured a lung so he developed a pneumothorax, which is basically air in the chest cavity around the lungs that collapse the lungs. He got severely hypoxemic. His oxygen went to very low levels. Luckily, we had the stuff with us and we were able to drain the chest. We managed to do that twice and keep him on oxygen during the procedure. We reversed him and really thought we probably lost this guy but he was picked up on a DNA census three years later. So extrapolating from my experience with small animals, working with anesthesia and with emergency medicine, I was pretty sure that guy probably wouldn't have made it without oxygen.

Then the other issue is the morbidity where we are not detecting it and maybe we should give the animals the benefit of the doubt. This is not bears, this is in ungulates and this again is my last grad student in Saskatoon. This study just recently that came out in the Journal of Zoo and Wildlife Medicine, but we had elk with a cross over design. The same anesthetic protocol, fully reversible narcotic based anesthetic protocol. These ungulates do get much more hypoxic than bears. We noticed a lot of things but one of the things that I found striking was when you looked at recovery times in the animals that were oxygenated compared to the animals that we just had medical air, there was a definite difference. It was significantly longer but also when you look at the spread, and this was just recovery to standing, you don't have to

look hard to see that there is something there and you have got to wonder what an effect that might have on behavior for the next 24 or next 48 hours.

As the next step, this summer we are actually training reindeer to go through a handling facility a certain way. We are going to be using a similar mixture with a cross over design, oxygenated and deoxygenated, and then seeing how long it takes them to negotiate the handling facility. I think all it does is illustrate, I don't have any answers here, that we need to take a closer look at this. Again, I am arguing that ungulates get much more hypoxic, so I tried to argue that with Dr. Asa Fahlman in Sweden a couple of weeks ago. Her argument was these bears are hypoxic, if this was a dog or a cat with these levels would you give them oxygen? I said, "Yes." She said, "If it was a human, would they get oxygen? Definitely they would". She said, "Well, why wouldn't you do it for a bear?" And I think that is honestly a good argument. We tend to focus on the mean a lot and I know a lot of the studies that Marc and I did we looked at the mean values of oxygenation. But, in anesthesia it is often the outliers that we need to worry about. So with outliers we have certainly seen bears that do get severely hypoxemic and they definitely have more potential for problems. Asa's argument is we should give them the benefit of the doubt and we know that they are hypoxic early in anesthesia so we should give them all supplemental oxygen.

As far as treatment of hypoxemia, it does depend on the underlying condition. Again, always check the airway and position of the animal. When I do anesthesia in any animal supplemental oxygen is pretty much a fundamental requirement during deep anesthesia and it is certainly the first line treatment in all cases of hypoxemia. So, what I tend to use is an E-oxygen cylinder; it is a steel cylinder. When I am in the field I use an aluminum cylinder and just a little regulator that costs $120.00 that you stick on the oxygen and you can adjust your flow. We certainly need more work on oxygen flows. I have often extrapolated from other veterinary literature and our flows that we use in other species. We may be able to get away with a much lower flow. Asa has looked at flows so I won't steal her thunder, but she certainly found that she can oxygenate bears with much lower flows. She has done some really good work on this topic and the nice thing about that is you don't have to haul as many cylinders. I know where Marc and I have worked for years we have had some real issues hauling a lot of cylinders in on those situations. Being able to get away with low flows makes our cylinders last longer. The technique that we use is that we put a line up the nose and we advance it to the level of the eye. It is not too hard to do. You should get somebody to show you how to do it first, but you put it towards the inside of the medial aspect of the nasal cavity and advance it up the nose. The E or D cylinders and a regulator are what we have typically used. Unfortunately, there are some issues related to transport of compressed gas. When I used to live back in Saskatchewan I was a first responder, so I would go out on human car accidents and things like that, and we always carried these in an insulated container behind the seat of our truck. Obviously, you don't want to smoke in there. If there is any oxygen leakage there have been accidents related to that. But also the cylinder itself, if you break the neck it does become a missile, so, certainly some considerations there. I ran into it this winter when I went up to the Northwest Territories to do some bison work and we were looking at a study where we were adjusting our flows down to see what our minimum flow would be. When we got there unfortunately, one of those bad communication problems, we hadn't talked to the helicopter pilot about carrying compressed gas. What we did was we grabbed a human mask and they could carry it in a helicopter for a human medical emergency. That was the approach that we took in case somebody needed it that we were trained in human oxygen therapy. But, it did bring up a bigger issue. You know, I can sit here and advocate these things but there are real issues with working with these things in the field. Very recently we did kind of a pilot proof of concepts study on the Swedish bear projects and Asa Fahlman is going to be working on this more in ungulates and hopefully in bears. We just started working with an oxygen concentrator, so that little black bag there is the concentrator, it weighs about 10 pounds, it is not a compressed gas, it concentrates oxygen out of

the air and removes nitrogen. At least on the bears that we tried it on, we could get them back to normal oxemia so we could get their oxygen up to normal. We do need to do a fair more work with this device but I think it has got a lot of potential for free range and wildlife situations, except it costs a lot of money.

Oxygen concentrators might address the issues with compressed gases. There are a few other things that we do run into. Hypoventilation, I won't talk about it too much, tends to be seen more in ungulates than bears but typically drug induced. So, when you give Telazol or Xylazine-Telazol to a bear their carbon dioxide goes up and then in the face of that their oxygenation drops. Certainly, we see that more with potent narcotics and again I think particularly in bears and with volatile anesthetics or dissociative Alpha II combinations. The biggest problem with high carbon dioxide is also decreased oxygenation, so that is probably the worst thing. It also makes the animal more acidotic. So, that can be more of an issue on a prolonged chase. Where I see this more is in ungulates that get very big metabolic acidosis and a lot of lactic acid building up and if you induce a respiratory acidosis on top of that it can make is much more severe. It is also a stressor that you will get for the catecholamine and a stress response.

So, the final thing I am going to focus on is thermoregulation and the reason I will focus on that is I think, other than hypoxemia, it is what we tend to run into most as a complication in bears. Definitely there are drug effects on thermoregulation. We have talked about the Alpha II agonists, Rompun, Medetomidine, and Detomidine, all have the ability to impair thermoregulation. When you anesthetize an animal you no longer get movement. Muscle movement is one of the things that will actually lead to heat conservation. They are basically exposed to the environment so in cold conditions we tend to face hypothermia more. Warmer ambient conditions or in very large animals we actually tend to face hyperthermia more. In adult bears more often than not it is high body temperature, hyperthermia we are dealing with. In cubs they have got a greater body surface area relative to their body mass and in cubs we may be dealing with hypothermia or hyperthermia.

As far as risk factors, I tend to see this much more again in antelope species. In Canada, the two species I see it a lot in are whitetail deer and bison. We are often working in -10 to -15° Celsius and we still have to deal with hyperthermia. When I went over to Uganda to work on Ugandan kob we didn't run into hyperthermia in any of our animals and we were using drug combinations typically, and I have used them in some of our Canadian species, they would induce hyperthermia. So, definitely some species differences with thermoregulation in different environments. With ambient temperature, we definitely worry more with our bears in high temperatures than we do with cold temperatures. Again, drugs we have talked about narcotics, dissociative anesthetics, if the Alpha II agonist wears off they start to get convulsive activity. Pursuit times are the other thing that definitely has a link with higher body temperatures; longer pursuit times with aerial capture.

As far as monitoring and treatment, we should try to monitor core temperature as much as possible. We tend to use often little digital thermometers that when you put them in the rectum of a larger bear you are probably measuring actual shell temperature. To actually measure core temperature you need to probe, in a bear it would probably go in more like about 8 inches, so that is more of a monitor of core temperature. The most severe problem is as the body temperature goes up a few things happen. One of them is that the metabolic oxygen demand really goes up. So, if you have got an animal that already has decreased oxygenation and has hypoxemia they will suffer more in the face of hyperthermia because their tissue demand goes up. So, certainly if you have got a hypothermic animal you want to consider supplemental oxygen as a first line of defense, so that is one of the first things you can do. Unfortunately, once seizure starts, if anyone has ever run into an animal that has been so hyperthermic, that starts the positive feedback loop. So, with the seizures their metabolic rate shoots up in the face of seizures, oxygen demand also shoots up and their temperature goes up in the face of that. So, once seizures start they are very difficult to control, even in a very controlled environment. So, in the field it is

even harder. You want to avoid getting to that point. What do people use as a cutoff where they will start to actively treat hyperthermia, at what temperature? I can't think in terms of Fahrenheit either. Does anybody have a cutoff?

(Answer from back) - 106°

(Dr. Caulkett) - We have got a communication thing across the border here but where we tend to worry is certainly as they start to go above 40° and between 40-41° Celsius is where we will start actively treating. If they get up to 42° that is really the danger zone for any species. Depending on the time of the year too bears will have more fluctuations in body temperature than ungulates. But, certainly anything as it starts to go above 40° Celsius, at 41° Celsius we will be actively treating.

The way to treat it, it does depend on the situation you are in. Often I have been an advocate of just finishing what you are doing and reversing the Alpha II agonists. It has worked for me in domestic animals and when I used to work a lot with game farm deer. Sometimes you are not in that situation. When I was in Sweden we had a family group down and the mom was remote from the cubs. So, if we reversed the cubs, they were bigger cubs, we didn't anyway of really restraining them. So, we had to start actively cooling these guys. Antagonism of the Alpha II agonist or a narcotic, if they have got a narcotic on board, is certainly something to consider but active cooling is the other thing that you can try. With active cooling, if you can establish an intravenous line and give cold intravenous fluids that is one way to bring the core temperature down. Often it does take a lot of fluids to actually bring the core temperature down. It is just part of what you can do. The other thing that you could try is a cold water enema. On the Swedish bear project they had this stuff along. They had run into this quite a number of times with their family groups. Basically, it is inserting usually it is a soft rubber tube into the rectum and then flushing cold water into the rectum to try and cool the core. The problem is once you have done that you are not going to get reliable body temperature rectally anymore. The other two sites you can rely on are, you can use tympanic temperature if you have a tympanic temperature measuring device. That is one that actually looks at the ear drum or the other one is using a longer line and threading it down the nasal cavity actually into the esophagus, so that is another place you can measure core temperature. In a pinch, if you are careful you can actually measure from the nasal cavity. The problem is that you do tend to get some pooling with respiration so with a regular digital thermometer.

(Question): Is there any pattern to core and shell temperature with a long enough thermometer? Is there any pattern as to whether that is typically less than core temperature or higher?

(Dr. Caulkett): There is not. Usually it tends to be cooler than core temperature but there is not a good pattern and unfortunately where you can run into problems is if you have used vassal constricting drugs like Medetomidine and that can really cause a difference between shell and core. For all intense and purposes, to be honest, pretty much everyone is using the digital thermometers. For research I will carry longer temperature probes where I can do this. So, I would just rely on your digital thermometers and take your readings off there. I guess the scary thing is that you may have as much as a degree difference between the two, so you have to take that into consideration when you are treating them.

In case of cold water enema, if you have an animal that had a tube in their airway, the other thing that we will do is actually lavage the stomach with cold water, a gastric lavage. But in these field situations cold fluids, packing the axilla so the arm pits and the inguinal area with snow, if snow is available works well. The other thing that you can do is actually put cold water on the animal and try to get evaporative losses. Those are also some things that you can do in a pinch as well.

So, as far as sources of heat loss, or hypothermia, there are really four big sources of heat loss. They have done studies in people and animal models where they have looked at heat loss. I remember when I went through veterinary school we were always taught that the most important thing was to insulate the animal

from the ground. And what we were thinking is that if you put an animal on a cold table they are going to lose a lot of heat to the table. That type of loss is called a conductive loss. That is conduction of heat from the animal to the ground. It is actually the least source of heat loss. When they did studies and critically evaluated it that was the lowest source of heat loss. That being said, it is still important to insulate them from the ground because it is a source of heat loss. But, the other three areas where heat is lost, evaporative losses; that can be from the airway or from an open body cavity if you are doing surgery, that is the second least source of heat loss. The two biggest are losses from radiation and convective losses. So radiation is heat radiating off the animal and convective losses, which is cold air currents going across the animal and taking heat away. Because of that our therapy for preventing heat loss has really changed. The losses from radiation you can use a solar blanket, so a reflective blanket to help decrease those losses. Convective losses, the best way to prevent those is covering the animal up. In the past few years I always found hyperthermia very difficult to treat in my patients even in a controlled environment but based on this research they came up with a warmer called a Bear Hugger, which uses warm convective air to heat the patient and that really helps to prevent heat loss and will also actively warm the patients. But, unfortunately they are not conducive to use in field situations. The bottom line is to prevent heat loss, insulate the animal from the ground, but just as important or probably more important to actually cover the animal. The other thing with hypothermia is it is definitely easier to prevent than treat. It can be really difficult to increase body temperature once it is started on a downward slide. Again, it is a good thing to think of if you have got young animals, if you have got small animals they have decreased glycogen stores compared to adults and when they are anesthetized that is one of the few mechanisms they have in producing heat. So, young animals have increased body surface area relative to body mass and they are going to tend to get colder quicker. Cubs or very small animals in poor condition just make sure you cover them and insulate them from the ground.

Probably one of the biggest and what I tend to see the most clinically is prolonged recovery. So, as animal body temperatures drop their metabolism slows down, their recovery can be very prolonged. Lactic acidosis not uncommon during capture of bears and other species and hypothermia can decrease the body PH, increase acidosis arrhythmia, so changes in rhythm of the heart and once the animal gets below 32° it can actually be severe arrhythmias which can actually result in cardiac arrest, particularly if they drop below 30° C. Then, not usually as big of an issue in the animals we are dealing with, if you are doing surgery hypothermia can lead to an increased blood loss because the blood doesn't clot as well, coagulopathy.

In conclusion, again, this is a very challenging environment. I would argue that is much more challenging than what most veterinaries deal with on a day to day basis so we need to develop immobilizing techniques with a high margin of safety. I think we have come a long way and particularly in bears. I think a lot of the techniques today are very good. In most of these situations prevention is better than treatment and I would consider using oxygen on your patients. Again, we are not dealing with severe hypoxemia in the majority of these individuals but certainly we have outliers that are and even if you are not using it routinely it is a good idea to have it there when you really need it.

(Mark Atkinson) - We have time for a couple of questions if anyone has a question now.

(Question) - Before the break you were talking about Lidocaine….(unable to hear). I really wonder about that. If you look at it, just around the world with people, probably like 20% of the people in the world get their teeth pulled without any kind of pain killer. People clinch on the chair that they are sitting in and maybe cry a little bit but they get up and walk away. Now we are worried about it in bears, in an animal that has far less pain sensation. I have seen bears that have got hit by cars and had two legs knocked off, lying in a ditch for a week, get up and walk away and live for a few years. I have seen bears with their whole lower jaw gone with nothing to chew with. I have seen bears with

arrows in their nose and walk around like that for a couple of years. Now we are being concerned about a little tiny tube, the bears are already under anesthesia?

(Dr. Caulkett) - Well, I have had surgery without Lidocaine. When I was in practice I sliced my finger open with my post mortem knife and I went into the hospital and it was actually an anesthesiologist, but I think a bit of sadist, who was on call that night. He said that he was going to suture my finger up. He said, "You know Lidocaine stings, it takes some time to take effect. Do you want the Lidocaine?" And I was 24 years old and figured I didn't need the Lidocaine. So, he sutured my finger up and it was a big thick needle that he used to suture it. When he put the needle under my fingernail and pulled the needle through, the door to the waiting room was open and I was tearing at that point and he looked at me and he said, "How did you rate that pain on a scale of 1-10?" Again, not maybe the nicest individual but I have been sutured up without it too and I would argue that if you go for a dental procedure, use it.

Also, the argument that bears feel less pain than us, I don't know if that is valid. To be honest, I deal with that all of the time with farm animals too because the other area of research that I do is in farm animal pain and I think that they just express it differently. Because there are people who are shot up, there are people who have multiple injuries and they still go around but they do go around in chronic pain. So, I don't know if that argument is valid. I guess the philosophy that I always have is *primo nos macheri*, first of all cause no harm. And if there is a situation, again extrapolating from people and extrapolating from other species, we know that there is benefit to preemptive analgesia to give them adequate pain control before the surgical procedure and I guess that is what I would advocate. I have pulled teeth without analgesia, castrated lots of animals without analgesia, but I don't think it is the right thing to do anymore.

(Statement from audience) - This isn't without analgesia.

(Dr. Caulkett) - Well, it is without adequate analgesia.

(Statement from audience) - I questioned whether it is enough analgesia. You are saying that the drug itself is not enough. What I am saying is that these animals will do light…*(inaudible).* Their normal light is far more superior than anything that…*(inaudible).*

(Dr. Caulkett) - And I wouldn't argue that but I guess if I am working on the animal at that time, I am taking responsibility for the procedures that I am doing on the animal. Say, if I am doing something that is painful I am inducing it, I can control the pain. I think it would be a better argument if you were using an Alpha II agonist and Telazol, that you do get better analgesia. We have actually looked at that and we have looked at it, based on heart rate, blood pressure, pain response there, but it is not giving you anything post op. It is the same in people, if you get a tooth pulled just under a volatile anesthetic you will have more post operative pain. The local anesthetic lasts into the post operative period and again the studies that have been done have shown that you can fully block that with a local anesthetic. You can partially block it with an Alpha II agonist or a narcotic. So, I buy your argument that I guess they do often go through more painful things than we do, but again I counter with the argument that if I am inducing it I am going to do my best to control the pain too.

(Question) - In your treatment of hypothermia you didn't mention the chemical warming packs.

(Dr. Caulkett) - Yeah, I didn't mention them and they are a good idea as well. We certainly carry those. The one thing you have got to be a little careful of is if you are using chemical warming packs or hot water bottles is how hot they can sometimes get. Because directly on the skin, particularly if you have got vasoconstriction, anything that is over 44° C has the potential to produce burns. So if you are using the packs just be a little cautious as to how hot they are getting and you might have to put them over the top of a blanket too. Again, if you are using the

packs in the inguinal or auxiliary areas are often a good place to put them, Thanks.

(Question) - (inaudible)

(Dr. Caulkett) - It is a bit better reflection of core temperature. The problem with tympanic thermometers is they tend to work on smaller animals and I have used them on bears in zoos a couple of times. When you get a long ear canal they don't tend to function as well. That is one of the issues. They are made for people so in some of the animals we deal with they are not as good.

(Question) - What are your thoughts on using an NSAID, like Banamine for hyperthermic animals, particularly in a captive situation while you are using animal restraint?

(Dr. Caulkett) - Honestly, I wouldn't have the evidence to back up them working in this situation. The drug that I have used actually in critical care is Dipyrone, a few times and actually had it work. The one thing that I would worry about with any of the non-steroidals is they take a fair bit of time to get good tissue levels and often up to about a half an hour. So, that is where I would worry. Usually we are dealing with this acutely. Like I say, in animals that have had a very high fever, which has been hard to break in real emergency situations, I have used Dipyrone a few times and it has worked in those situations, so there may be some benefit to using NSAIDs too. I just haven't critically assessed the newer NSAIDs like Meloxicam or Carprofen.

(Question) - (inaudible)

(Dr. Caulkett) - It might not take 30 minutes but it still takes time to get tissue levels. That is the other thing, the NSAIDs that I just spoke about, Meloxicam or Carprofen, work by a little different intrinsic pathway. I am not sure if the thermoregulatory effects of Dipyrone were oxygenase 1. But again, I couldn't tell you, I haven't critically looked at it.

(Question) - (inaudible)

(Dr. Caulkett) - That has been a bit of a contentious thing I guess. It has been very contentious in Canada and I guess even amongst us on our projects that we have worked on. One of the issues is having an antibiotic that works long enough. So, if you are giving something that is only lasting 24-48 hours are you doing any good anyway? I think that is one of the things. There are antibiotics and now some cephalosporin drugs that actually last up to 7 days. I think that tends to counter that argument a bit. The other issue is the potential for drug residues. We always run into potential issues whenever we are using immobilization agents, particularly our First Nations Community about drug residues. If you actually look at most of the drugs we use there is not a high instance for allergic reaction in people. There is not a high instance of allergic reaction in animals that we work with these drugs but when you look at the Penicillin's in particular there is and from meat residues. That is one of the arguments why we haven't tended to use them routinely. So on the bear project we haven't used them routinely. I have been on other projects that have used antibiotics and for the reason you are talking about. It may be more important with ungulates but again its issue is with having therapeutic levels of the antibiotic for long enough. On the Swedish bear project I was just on, they do use them.

(Question) - (inaudible)

(Dr. Caulkett) - For euthanasia? With anesthetized animals we will shoot them. A head shot. There are other things that you can use if given properly at a high concentration in the jugular vein, potassium chloride at 2 ml equivalents per kilogram. Again, in anesthetized animals it should induce cardiac arrest. I think Marc is smiling there because I remember once we tried that in a polar bear and we actually couldn't get it to die, which was unfortunate because we had a big audience. But, in other species if you can get it intravenously, I have been able to stop the heart pretty quickly but it does have to be in anesthetized animals. But, often when we have had to destroy animals most of ours have been animals that have been

anesthetized with potassium and that it has been a gunshot to the head.

(Question) - (inaudible)

(Dr. Caulkett) - Again, in anesthetized animals the big thing with potassium chloride is you have got to get a high concentration in the heart. So, in a cardiac puncture it would be a fair volume of the saturated solution. It is another way that you can administer the potassium chloride. The big thing is that you need to get a good bolus in there quickly. One of the reasons that we use potassium chloride was that the alternative, Euthanol, is a barbiturate and if you euthanize the animal with that it will induce environmental toxicity to other animals that scavenge on it and they can become anesthetized by the barbiturate. So, potassium chloride in an anesthetized animal is potentially a better option. Like I say, more often than not we have used gunshot.

(Mark Atkinson) - I think we are doing okay on time, about 15 minutes behind, but our final presentation in this session, Dr. Marc Cattet again, consideration of welfare in the design and implementation of bear research and management.

Invited Speaker – The consideration of wildlife welfare in the design and implementation of bear research and management - *Dr. Marc Cattet, DVM.* This talk is really an extension of the talk that I gave earlier this afternoon. Although, I have titled it in reference to bear research and management. If I was at a moose workshop or caribou workshop or whatever it would just change the species name. The things that I am going to talk about are broadly plentiful to wildlife research and management in North America in general. My intent with this presentation is to convince you, if you are not already convinced, that wildlife welfare, consideration of wildlife welfare, should probably take a higher priority than it currently does in the research and management of wildlife species. Again, the statement I put up here in quotations comes from an international meeting I attended last year in Norway. It provides, I think, an explanation in part for maybe why wildlife welfare generally hasn't been a high consideration in Scandinavia or parts of Europe. It suggest that as field researchers we are often more focused on populations than individuals and perhaps we have just been remiss in overlooking things in individuals. I think there are other things that feed into this as well and I will cross these later as we go through the presentation.

A quick overview of what the presentation will entail. First of all, I wanted to clarify what wildlife welfare is versus wildlife rights or what animal welfare is versus animal rights. I wanted to give my personal opinion on what I think the importance of wildlife welfare in North America currently is. I want to make a case for why I think we should consider wildlife welfare as a higher priority. I will talk briefly about this International Consensus meeting that I have referred to a few times. Lastly, I will talk about a way of integrating wildlife welfare concerns into the development and implementation of research and management activities. The bases for that are what I call the three "R's". Just a quick question here but can I get a show of hands on who is familiar with the three "R's?. Less than a handful of people. I will talk about that.

First of all the distinction between animal welfare and animal rights and I think the distinction for many people is often blurry at best and at worst not present. People think that they are synonymous with each other. So animal welfare, what is it? Animal welfare is that we can use animals for various purposes but in doing so we bear responsibility for ensuring that their welfare isn't compromised, or is minimally compromised. So, if we extend this to wildlife, wildlife welfare is basically saying okay, we can do research and we can do management on wild species but in doing so we also bear responsibility ensuring the welfare of the animal is minimally compromised. A definition of welfare - the definition has been really derived from work and study with experimental animals and with farm animals but welfare in general implies freedom from various things, hunger, and thirst, thermal and physical discomfort. But, as well, as freedom for an animal to express its normal behavior. Obviously, in the context of wildlife research

and management we can't ensure all of these freedoms and the way we really should look at these is we should look at these as goals to try and attain. Animal welfare interests are represented by a number of groups in North America. I put a few examples there. In Canada we have what is known as Canadian Counsel on Animal Care. In the United States there is a Scientist Center for Animal Welfare and then most people are familiar with Institutional Animal Care Use Committees. If I was to present this 10 years ago, I would say that the Wildlife Canadian Counsel on Animal Care and the Scientist Center for Animal Welfare didn't have wildlife on the radar. But, in the last 6-7 years, although I can't say for the Scientist Center for Animal Welfare, I can certainly say the Canadian Counsel for Animal Care has been increasingly more focused toward wildlife and wildlife issues.

The distinction, the other definition or the other side is animal rights. People that are advocates of animal rights view animals as basically legal persons, not property and they should not be used as food, clothing, research or entertainment. Animal and wildlife rights interests are represented by a number of groups that people are perhaps familiar with. I know some of these groups have tainted images because some of the actions they carry out to get their message across. Again, what I am talking about today is wildlife welfare or wildlife rights.

Next thing I want to cover is, I guess what I will say is my personal opinion on where wildlife welfare stands right now in terms of consideration or priority in wildlife management research. I think this picture to some extent says it all, but to put it in words, my opinion is that probably the importance of wildlife welfare is fairly low and I base that opinion largely on my own experience as a researcher and a wildlife veterinarian. I am engaged in lots of meetings and discussions with other researchers, with the general public, and it is based on these interactions that you start to form a picture. Some of the reasons, I would say, that support this opinion is first animal care and use committees. Animal care and use committees sound like a good thing and the intent is certainly good but in general animal care and use committees have been ineffective at addressing wildlife welfare concerns largely because the expertise on these committees does not include people that are familiar or work in the context of wildlife research and management. I will also say in Canada I know that there is a lot of lip service that goes towards animal care and use committees but at the same time we have several provincial territorial government agencies that do not have animal care committees overlooking their research management activities. In fact, I can say in the last 5 years or so, the pressure to engage animal care committees or create animal care committees has come out of the recognition that it is getting more and more difficult to publish papers now, publish research reports on animals without showing some evidence of having your protocol reviewed prior to the research by an animal care committee.

Other reasons I would suggest that wildlife welfare is at a fairly low status right is difficulty in publishing welfare related reports. Earlier this afternoon I talked about the difficulty in publishing the report on long term effects. I have also been involved, over the past 10-15 years, on several other studies where we have questioned the status quo, where we have looked deeper into it and come up with some findings that say well perhaps common practice isn't the best practice, and we have run into lots of obstacles that go beyond just reviewers in terms of getting things published. There are inconsistencies within agencies between words and actions. I know in Canada, and I can easily list a half dozen examples, where agencies will say one thing on websites but it is not the same in practice. Just a very recent example, a couple of weeks ago in Canada there was a meeting with what is known as the Canadian Wildlife Directors Committee which is basically the wildlife directors for all of the provincial, territorial and federal government agencies that have wildlife in their mandate. One of the representatives from the group that I am in, Canadian Cooperative Wildlife Health Center, was talking about a workshop that we are potentially hosting next year and one focus in that workshop would be wildlife welfare. The person that was telling me about presenting this idea said that the response was not a favorable response. In general, the term wildlife welfare

was viewed as quite unpalatable by the directors sitting around the table.

Another reason that I would say that I believe wildlife welfare has a very low priority in North America is by contrasting the North American and Scandinavian-European views of wildlife welfare. The contrast really comes from a meeting that I attended last year in Norway and I will talk a little bit more about this later, but I would say now that Scandinavia and parts of Europe are many years ahead of us with respect to looking at wildlife welfare considerations and building them into the design for research and management procedures.

So, why consider wildlife welfare? I think first and foremost is a sense of moral duty. I think most of us got into this work because we had a strong passion for the animals we are working on and the last thing that we want to be doing is causing unnecessary pain and distress to the animals. That said, however, I think that we have also been quite remiss at looking closer at what effects we are having on animals. In general, if you look through the literature, mortality is often used as the end point. If you have got animals dying it is a bad thing. If there are no animals dying things are well. Another way of looking at this is I know a fairly senior researcher that made a comment to me once about one of the projects we were carrying out looking at effects of some procedures and his comment was, "Why fix it if it isn't broken?" My argument to that would be that we often don't know if it is broken. We see these animals for such a short period of time, capture them, handle them, they get back up on their feet, they disappear. We might get a sighting or get a radio call that tells us they are still moving around but that is the tip of the iceberg. We have no sense at all, for the most part, on what kind of morbidity that we are causing these animals. So, a sense of moral duty is one reason. If you don't buy into that or if you do buy into that another thing to consider too is that as researchers, by the nature of what we are doing to these animals we may be unknowingly creating biases in our research results. I showed this graph earlier this afternoon, the effects of capture and handling on movement rates, and if we weren't aware of this we would be using all of these data from moments after capture to weeks down the line and we would be incorporating that into our analysis of movement rates under various questions. Based on the research that we have done we know that for the most part we have to exclude probably the first three weeks of movement data; so, to identify potential biases in research results.

Another reason is to maintain a positive image with the public. I know that this happened a couple years ago, not too far from Reno, most people have probably seen these images over the Internet. My understanding is that it was a bear basically caught in a bridge with traffic coming from both directions, the bear leaps over the side of the bridge, lucky enough not to fall to the bottom, catches on to some of the concrete girder and remains there for the next 24 hours until there is a heroic dramatic rescue of this animal. That creates a very positive image in the public eye and you contrast it with something like this which showed up in a newspaper in Alaska last year. I don't show this image to target any individuals or anything but here you have got an animal being dragged by four people, it has been carried by the limb, and its head is bouncing along behind. The story goes that it was earlier dropped from the tree. These kinds of images and the stories that go with them bring questions to people's minds and I again often have interactions with the public and I have people ask me about these things. Was this really right, should we be dropping bears like that? Is that very respectful? Should that bear be dragged, should it not be carried? Should it not be blind folded? I know the theme of the workshop is "changing climate" and I think one of the aspects of changing the climate is that there is a change in people's attitudes towards how wild species should be handled.

Lastly, another reason I will present is to address the concerns of user groups. Two examples I will draw from are very recent examples in Canada involving two of our Northern Territories and the Northwest Territories. In both areas we have had formal resolutions signed by First Nations or Aboriginal peoples groups that have made basically a declaration against capture and handling of wildlife. So, in Nunavut much of the focus has been on polar bears and caribou. In the

Northwest Territories a lot of focus on caribou and the sad thing is that these wildlife agencies have known that these issues were of importance to the user groups for many, many years and have chosen to neglect them or pay lip service to them and the repercussion has been now that we have got some pretty nasty situations between government wildlife agencies and user groups in trying to resolve these issues. So, that's the reasons why. Now, how do you incorporate or how do you integrate considerations of wildlife welfare into the design and implementation of wildlife research and management activities? I think a good starting point on this would be for me to give you a bit of background on this meeting that I attended last year. So, this was a meeting that was titled Harmonization of the Care and Use of Animals in Field Research. It was under the auspices of a group which is a Norwegian consensus platform for replacement, reduction and refinement of animal experiments. The meeting had 52 participants, mostly from Norway, but a few scattered from other places. Specific aims of the meeting were to provide a forum for dialog on wildlife welfare issues between various stakeholders so at the meetings there were field researchers, there were enforcement staff, there were veterinarians, there were animal welfarists, there were managers and there were policy makers. The other thing was to increase the focus on the three "R's". The three "R's" are replacement, reduction and refinement. I will describe these or define these for you in a little more detail in a few moments here. What really struck me at this meeting though was that, there were two things, one is that you had a wide group of expertise, wide group of perspectives around the table and yet there was consensus right across the board that wildlife welfare is a high priority consideration in wildlife research and management. No arguments about it at all. It was just accepted right from the get go. The other thing that really struck me is that everybody sitting around the table was well versed in what the three "R's" are. There was no time required in the beginning to define the three "R's" for everybody and then go from there. Everybody was aware of the three "R's". The dialog was more on how best to implement or how best to use the three "R's" in our work. So, what are the three "R's"? The three "R's" were I guess kind of formalized by two people, Russell and Birch. In the late 1950's they wrote a book on the principles of humane experimental technique and they described the three "R's" in reference to experimentation basically with laboratory animals. The three "R's" - Replacement, says that animals may be used only if the researchers best efforts to find a replacement by which to attain their required information have failed. Reduction is using the fewest animals appropriate to provide valid information and meet statistical requirements. Refinement is using the most humane and least invasive or least intrusive techniques with the goal of minimizing pain or distress.

How do we apply the three "R's" to wildlife research and management? I think a necessary starting point has to be appropriate training and continuing education. In North America this is a relatively new concept in the context of wildlife research and management. You have got a lot of people that are experienced, they have developed habits, they have developed views over the years and for people to buy into this is going to require changing attitudes. It is going to require changing habits and this isn't something that is going to happen overnight. So, that is the first step. Then with each of the specific "R's" - we start with replacement. Replacement is probably the most difficult of the three "R's" to apply in wildlife research and management. That said however, there are lots of examples of replacement that are done day to day. I mean, in the literature there has been a number of papers in recent years, analysis of published results. Basically, collating and using information that is already gained. Acquisition and use of archived tissue samples - I am involved in a number of projects, not just with grizzly bears and that but also polar bears and as standard practice we archive tissues because if there isn't a demand today there is going to be a demand tomorrow for some of these tissues for new studies coming out. The use of mathematical computer models to simulate wildlife population dynamics, which is something that has been done over the years.

Reductions - how to apply it in wildlife research and management? Seek the services of a biostatistician right from the get go to design

studies with maximal efficiency. Maximizing the information collected per animal without compromising their welfare. In a design and capture program it minimizes the likelihood of capturing non-targeted animals. I put this image in here; I made reference a few months ago of being involved with polar bear projects over the years and by the nature of these studies they are done in remote places. They are done generally by helicopter, and they are extensive studies to carry out so we are often piggy backing the objectives of several studies into our study and we are collecting samples and collecting measurements that are used by others. So, maximizing the amount of information we are getting from animals but at the same time being aware that we are not compromising their welfare any further than what is going on.

Refinement - this is the easiest of the three "R's" to apply in wildlife research and management and there are lots of examples of that. There are lots of examples that show up in the published literature from year to year. Some of the examples, you know assessment reduction of potential sources of harming captured animals. This would be the talk I gave earlier today, evaluating potential negative effects. Use of analgesic type drugs to control pain and invasive procedures, Nigel spoke extensively about that a short while ago. He mentioned already about the use of local an anesthetic to provide pain control in bears prior to extracting a tooth. A key thing in this is that yes, immobilizing drugs we are using do provide analgesia or pain killing quality but at the end of the handling procedure we often reverse these drugs. That pain killing quality is gone. But, by adding a local anesthetic with a long period of activity, we enhance our ability to control pain or minimize pain and distress of the animal.

Use of less intrusive procedures in capture to collect biological and genetic samples. Using the shortest possible time necessary for procedures being undertaken. Just as an example there on using less obtrusive methods other than just capture for obtaining biological samples. Of course it is going to be dictated by the questions you have in mind. In recent years we have been working with more biopsy sampling to collect clumps of tissue that are used to analyze stress profiles in wild species. The hair, same thing, most people are familiar with that being used for genetic studies in animals but hair is also a potential rich source of other information. Over the last few years we have been developing and validating a technique to measure cortisol levels in hair as an indicator of long term stress. There are also reproductive hormones that show up in hair. There are other potentials in hair. There are lots of things that can be gained by less intrusive methods of sampling. Other ways of applying refinement is by collaborating with manufacturers to produce research equipment that is less likely to cause pain and distress to an animal. Then, publishing descriptions on the use for refining techniques for review in scientific literature.

On the first point there, an example, 4-5 years ago I was involved with a research project where we were looking at a potential for injury with different types of remote drug delivery equipment, specifically darting systems. We collaborated with a number of manufacturers as well as forensic specialists with the Royal Canadian Mounted Police. We carried out a study in which we were able to identify different factors with different types of darting systems that were less likely or more likely to cause injury.

There is more to these wildlife welfare considerations than just the three "R's" and what I invite you to do if you are interested on following up on this is to look at the website that came out of this meeting, The Harmonization and Care and Use of Animals In Field Research, and in particular there is a consensus document put together by 52 attendees that provides an overview of their views on the strengths and weaknesses of field research as it is carried out today and provides recommendations for improvement. At another website I direct your attention to you if you want to learn more on the three "R's" is at the Canadian Counsel for Animal Care as quite an informative website that they have put up in the last year describing the application of the three "R's" in wildlife research and management. I will leave it at that and invite any questions or comments.

(Question/Comment) - I noticed surprisingly in several presentations today pictures of bears lying on their backs…*(inaudible)*

(Dr. Cattet) - No, it isn't but I will qualify that. Nigel and I, actually a good number of years back, we did a study where we looked at body position in bears and the influence it had on cardiopulmonary function. In particular we were interested in blood gases. Did it influence blood gases in the bears breathing on its back versus on its sternum and we found no difference at all. The pictures you have seen are kind of mid way through handling procedures where sometimes we turn an animal over because we have to take certain measurements there. With that said, at the end of handling we always leave the animals on their sternum and the reason is, and in particular with large or heavy bears, the concern is that if you have got an animal on its side or on its back you are going to have pressure necrosis. You are basically going to have so much pressure on the underlying muscles that it is not going to get sufficient blood oxygen and may cause damage. So, if you have the animal on its sternum you have got the weight that is born largely by pressure points.

Question/Comment) - I don't think that you portrayed the situation….*(inaudible)*. You may disagree with me, but my opinion is, and I know the people that work with polar bears, polar bear biologists and polar bear scientists have in the past 30 years routinely interacted with numerous …*(inaudible)*. They do all of the season setting and such and they work with people very, very closely. It is reflective…*(inaudible)*…certainly that is not true. It is just recently…*(inaudible)*. I think it is a major component of them lashing out.

(Dr. Cattet) - I would agree with you it is a component but it is not a major component. The researchers you are talking about, I think, I have been involved with those researchers as well for a long period of time. I have been involved with meetings that go back almost 30 years with local people in these communities and something that has always been expressed is concern about lack of respect for the animals. There are certainly cultural things and without question there are different agendas out there. You know, there may be people pushing it now as an issue because of the things you have addressed but welfare considerations have always been there and these researchers and the agencies are well aware of that and a lot of times it has been lip service that has been paid to them.

Question/Comment (cont'd.) - On the other hand you have to also weigh the scientific information that has been obtained either from… (inaudible)…and where would we be had that whole science project focused on the fact that we can't do that because of animal welfare.

(Dr. Cattet) - No, without question this type of information that you have just outlined there, you wouldn't get that information without radio collars and you wouldn't get it without capture and handling. But, this is not saying we should abolish wildlife capture and handling. It is just saying that we should do it better and we can do it better. There are a lot of examples of people doing it better. We should be striving continually to do it better. That is all it is saying.

Any other questions? Okay. Thank you.

(Mark Atkinson) - Okay that is it for this session. I would just like to say again thanks to Nigel and Marc for coming down here. We really appreciate your input and look out for them after this session and continue those questions.

PANEL DISCUSSION - BEAR AND HUMAN CONFLICT MANAGEMENT

Workshop Chair – John Hechtel, Alaska Department of Fish and Game-Retired

Summary: Quite a few of the presentations during the main sessions touched on conflict, so everyone was primed for the workshop and a large crowd attended. We were able to recruit a diverse panel with varied backgrounds and perspectives and there was a lot of experience in the audience as well; John Hechtel (Alaska Department of Fish and Game, Retired) chaired the session. The panel had expertise dealing with conflicts in the U.S., Canada, and Russia. Members included: Neil Barten (Alaska Fish and Game, Juneau); Sharon Baruch-Mordo (Grad student, Colorado State, Urban black bear ecology); Rich Beausoleil (Washington Department of Fish and Wildlife); Jon Beckmann (Wildlife Conservation Society); Stewart Breck (National Wildlife Research Center, USDA); Mark Bruscino (Wyoming Game and Fish); Lori Homstol (Grad student, University of Alberta working in Whistler B.C.); Linda Masterson (author of "Living With Bears: A Practical Guide to Bear Country"); John Paczkowski (Kamchatka Field Coordinator, WCS); Mike Paulson (Tahoe Homeowners Association); and Tori Seher (Yosemite National Park). We could have easily filled a lot more time. The main challenge was keeping the discussion somewhat focused while trying not to stifle good off-topic discussions. Bear-human conflict is a large subject with many common elements, as well as unique aspects. Not surprisingly, the biggest shared challenge is securing human food and garbage, something requiring different approaches in parks versus in towns, resorts or rural areas. The panel and audience shared some of their experiences and approaches to both people and bear management. We are all looking for creative solutions while avoiding trying to reinvent the wheel. A common theme was that successful approaches take a lot of time and energy, and we cannot hope to solve conflicts by printing another pamphlet. I think everyone appreciated the opportunity to discuss with others successes and frustrations, hear about things that have worked, and some that haven't. One important point that came out and that I think is worth emphasizing is that in the short-term, day-to-day frustrations we face, we sometimes forget that really major changes in public awareness and attitudes have occurred in the last 20 years. Maybe changes in behavior haven't always been as great, but we are making progress and we need a strong commitment to continue the work. Everyone didn't agree about how to deal with human-bear conflicts, but I think most felt that the session was worthwhile.

Western Black Bear Workshop 10:140-171

Transcript

(John Hechtel) - Hello everybody. It has been interesting going through the presentations so far. From my standpoint one of the slightly frustrating things about some of these meetings is the paper after paper and listening to people. So, what we are going to do this afternoon is try to have a forum to discuss a lot of the stuff that was brought up and hopefully, based on the questions that start to develop after some of the papers and expertise of the panel and people in the audience I think we should be able to have a pretty good discussion about bears and conflicts this afternoon. As I said it will be mostly interactive, it is a little bit of a challenge with a bigger group like this but that is what we want to do. The bottom line is I think bear conflicts are a really pretty exciting area to discuss just because of the diverse complex nature of a lot of the challenges they face. Everything from some of the urban stuff, agricultural lifestyle, and industrial, there is a total wide range of things. From my standpoint too it is not the impacts on bears in conservation but there are also human safety aspects to that. I think there are a lot of common challenges that we face, as well as really unique aspects in different contexts. I doubt we are going to get consensus on a lot of things here but what I do expect is that we will look forward to a good exchange of ideas and some spirited debates hopefully. I think we have

an excellent diverse panel of people here and there is a tremendous pool of expertise and experience in the audience as well. We have got some researchers from the Department of Agriculture, a couple of universities and we have people from fish and game agencies in Wyoming, Alaska and Washington. We have got a National Park person from Yosemite and a couple of private citizens. So, I think we have a good core group of people here.

What I am going to do after I make a couple of introductory remarks is I am going to have everybody introduce themselves, just take a couple of minutes so you know who they are. The other thing is if it gets to be a challenge when we start getting into a more interactive discussion I think we can sort of remind somebody sometimes a little bit about your background as an agency person or whatever, it could be helpful. I think sometimes there is this concept that somewhere there is this nirvana, the land of no conflicts that we can strive for. The bears are wild, well fed and productive and genetically diverse, they don't seek out people or freak out when they bump into one, and all of the humans are enlightened and well informed and careful with their attractants and support of the bear managers. But we all know that is not probably going to happen in our lifetime. I think that one of the challenges that we face as managers is the diversity of approaches that we are constantly being hit with. I have heard people in meetings saying every single bear in the world is worth one human life, we need to get rid of the bears in some of the areas where there are some of these conflicts and then I have had friends that have had to do a very legitimate control kill in a National Park and received press because they killed a bear. Then there is always that in the background some people, why not just leave the bears alone, don't bother them, they were here first. It presents a kind of interesting sort of context for what we do but over time the number of people living and working in bear habitats increased. Bear populations are up and expanding ranges. I think over time, at least the last 20-30 years that I have been involved in it, we have made good progress at bear proofing dumps and some of those things and increasing emphasis on attractant control and restriction of food. I think there is a lot less public support for lots of control kills. I think there is an increasing interest on the part of a lot of the members of the public on individual bears versus management of populations and along with that kind of a push for more economy to management. Another interesting trend has been sort of the rise of the citizens grass roots organizations that have stepped up to help supplement what we do or sometimes take the lead when some of the agencies weren't around to do it. I always tend to think that with bear/ human conflicts, there are sort of three things. We are really competitors for the same food and space. If you look at our niches they are very similar. We have competed for a very long time. The bottom line is that humans have won and now essentially we have the ability to decide whether or not bears are around, where we allow them and even how many bears we allow to live. There is a couple of challenges. There are some areas where we have been trying to promote increased acceptance of bears. As Dave was talking about the other night, maybe we're headed to a zone of dealing with an overabundance of bears and some issues as well. But, one of the things that also occur with people and bears is alternating predator and prey rules. I think that is a kind of an interesting aspect of conflicts, we probably aren't going to talk about that too much at this time.

The final one from my standpoint and part of it comes from working in a lot of bear viewing areas in Alaska is that the curiosity that people have about bears. I think there is also a curiosity on the part of bears about human activity. There is a lot of talk about the natural state of bears is to be really wary and if a bear isn't there is something wrong with it. What I tend to see in a lot of situations is there is actually part of the bears natural history that involves testing our environment. There is a lot of different approaches that you can take to some of these problems. Whether you are trying to manage bears or manage people or manage habitat. I think that is what we are going to focus a little bit on the panel discussion. Within each of those categories you can either concentrate on trying to prevent some of the problems or reacting to ongoing problems. There is an issue of managing populations

versus individuals and as I said, agency efforts versus some of the grass roots groups. Those are not necessarily the mutually exclusive sorts of things either. A lot of times there is a combination of those.

I personally tend to believe that when you are looking for solutions to some of the bear/human conflicts is what we really have to do is we have to work with human nature and with bear behavior. We have to find solutions that make it kind of easy for both people and bears to do the right thing. You can come up with strategies to address some of the problems but what happens ultimately is if they are really difficult you may get a small group of people who feel so strongly that they will go out of their way to do it. Then you may have a short period where you can convince some people to do it but that kind of stuff is going to rapidly fade. Personally, this is just my take, but I think humans are not as rational as we would like to believe and a lot of times we are really prone to sort of agenda driven approaches based on your feelings and values and so people already make up their mind what they want to believe relative to some of this stuff or what is acceptable and not acceptable approaches to some of these issues. It is pretty hard when you are dealing with people's feelings and emotions to come in as a biologist and rationally try to explain to them why doing this kind of approach is not going to hurt the population. Self interest is huge, people have talked about it in some of the other presentations. You know easy and cheap is really a good way to go. I think that we are finding in some of these places where we can come up with pretty good storage solutions for garbage cans and things but if somebody has got to kick in $400.00 even if they are buying a $350,000.00 house it becomes a difficult sort of thing. By subsidizing and doing things with some incentives it really works. I think the other thing about it is in general people prefer not to have to think about, thereby making it easy to do the right thing.

On the bear side of the equation, bears are really focused on what is immediately going on. The food and foraging drive is much of their activity. Their intelligence and curiosity we all know that, quick learners. I think the other thing to me that is significant about bears and bear conflicts is the fact that bears do a great job of time sharing to exploit concentrated resources, whether it is a salmon stream or it is a dump. It is not this territorial thing where they exclude these other animals but they work around each other. I think a lot times what we see is dependency when you try to address bear conflicts is you get them to work around you to do what they want to do anyway and you have to keep that in mind.

There are lots of different aspects to consider as a conflicts manager. You have human behavior, bear behavior, human turf and the bear's home range the combination of these things I think gives us a lot of different approaches that we need to keep thinking about. I think some of the people have talked about clearing brush and berry patches within areas they don't want bears to be in subdivisions versus doing some of the other things. This is just a random thing that I put up but it sort of the meat of things and I doubt that anybody would really disagree with me too much, is always going to come back to preventing problems. You need to educate people a bit but I think we are going to talk about that as one of the topics. So much of the attention gets focused on the, I call it, educating bears. What we are going to try and do in this panel discussion is have two sorts of major areas for discussion. The first one is going to be strategies for preventing problems and I suspect that this is the one where we are going to have most of the consensus on what we do and what we think but it is an opportunity for people to really share insights and things you have tried and things that may or may not work in some of these kind of contexts. The second sort of major chunk is, okay you have got a conflict bear, how do you deal with it? So from that standpoint I think there is going to be a lot more variation in how people approach things but I expect a little more controversy and a little less consensus but I think it should be an opportunity.

So, the panel has identified a number of general topics within these two categories and under the preventive problem ones, I am going to just throw this out to plant seeds a little bit. One is large scale management planning or other advanced planning as a way to prevent conflicts, which I think is important. Two is legislation

and ordinances regarding intentional or unintentional feeding. Third is how you promote compliance with the rules that you already have in place., education, short term and long term, changing behaviors and attitudes about this, the role of grass root system groups in conflicts and the other one, which is a little different topic but I think it is also important is probably the role of hunting related to conflict bear management because that is one that a lot of agencies sometimes are pressured doing. The problem on the bear management side of things is bear behavior. How do conflict behaviors build? What is a problem bear? That sort of topic I think is a good one. Relocation, what are the criteria? Do you collar and mark? What about the stresses and liability; that is another potential topic.

Third is lethal management. Most of you are limited to sort of rigid two, three strike kind of things or should there be more opportunity for some flexibility on the part of managers, taking into consideration things like good and bad food years. Also, related to that we have done a good job of selling people with the concept that we don't want bears to die from a conservation standpoint but the flip side of that in a lot of these situations now where we have got fairly abundant bear populations and lots of conflicts, the concept that a certain amount of lethal control of animals is a necessary part and how do we increase public acceptance of that. Adverse conditioning and bear deterrence, I think there is a lot of interest in that that we can discuss. Then lastly, I would throw into that, what are the criteria for success in our addressing some of these conflicts. I have seen some situations where people say well we had a successful program because we went from so many bears for the year to less bears for the year. I have seen individual conservation officers in an area switch places and it dramatically changes the number of bears. If you lower the number of bears that die and the number of conflicts increase is that a successful number.

What I am basically going to do is have everybody go around the table, introduce themselves and spend a couple minutes just telling you who they are, their background and things and then we will open it up. The last thing I wanted to do is talk about the importance of perspective in these sorts of discussions. To me this is key. How you look at things and how you perceive them. There are a lot of people with agendas that try to give you a certain perspective on what is going on but I honestly believe we have a pretty good group of people here so we should be able to have some pretty good discussions. With that I will let people start introducing themselves.

Panel Introductions

Sharon Baruch-Mordo, I am a PhD. student at Colorado State University. I also completed my M.S. looking at long term datasets of bear human conflicts in Colorado and predicting conflict occurrence.

Stewart Breck, I work for USDA Wildlife Services, I am a carnivore ecologist at National Wildlife Research Center. The focus of all of my work is conflict and I primarily work in two systems. I work a lot with wolf/human conflict, doing a lot of work with Mexican wolf currently and then a lot of work with urban bears. I have seen Sharon's work and I am involved in that. I have also worked with Tori from Yosemite National Park in the past and I guess my focus in the research is development of non-lethal tools. More recently I'm getting a lot of interest in looking at conflict in terms of what people can do in terms of changing behaviors of people and how we might go about that. So, some new areas for me in terms of human dimensions type work and how we think about conflict instead of solving it via working with animals instead of working with people.

Tori Seher, I am a wildlife biologist in Yosemite National Park. I oversee the human/bear management program in the park and I have been in Yosemite for about 17 years. Just to give you a quick overview of the park. It is about 1200 square miles. We have about four million visitors to the park every year. About 95% of those visitors come only to Yosemite Valley and we have about 91% of our bear incidents occurring in Yosemite Valley. When I first started with bear management in 1997 we had one of the worst years in the parks history. We had over 1500 bear incidents and over $600,000 worth of damage caused by bears and since then we have gotten some additional

funding and I would say we have a pretty successful program now with an interdivisional approach including employees working in the park and have been able to reduce incidents by about 85%. We have tried many things in the park throughout history. We have done a lot of conditioning, of course bear proofing everything in the park, a lot of education.

Mark Bruscino, I work for Wyoming Game and Fish Department. I have worked for that agency for 29 years with mountain lions, wolves, black bears and grizzly bears to some extent during the entire 29 year period. I have been with the bear program coming on about 20 years now. I manage the human/bear conflict side of that program in the Northwest corner of the state. I supervise a staff of five year round people and one seasonal person and we deal with grizzly bear, black bear conflicts outside of the National Park system in Northwest Wyoming. We handle everywhere from 100-200 grizzly bear conflicts where property was damaged, people were injured, livestock was killed; not just a bear eating bluegrass in somebody's front yard. Of course I work with black bear conflicts as well.

Linda Masterson, I am probably one of the few people here who is not a bear expert. I am a human communication expert with an avid interest in bears and helping people understand better how to get along with the bears. I spent probably 25 years in communications, marketing and advertising in Chicago and my husband and I moved to Colorado about 10 years ago and I decided that I wanted to spend my life trying to make decisions that really were a matter of life and death. You know instead of what kind of shampoo you are going to use or what kind of cereal you are going to buy. I joined the Colorado Division of Wildlife's brand new bear aware team. I have been a member for 9 years. I have been a volunteer with the Division for 9 years and then in 2006 I finished my research and wrote, Living with Bears - a Practical Guide to Bear Country. So, I kind of consider myself a hunter gatherer of facts and information, everything from all of the research you do and published to antidotal success stories to all of the nuggets of wonderful information that are buried in your brains that you never have time to actually communicate to the people. I take all of that stuff and I try to disseminate it back out into the world and come up with ways to educate people but beyond that to inspire them and then to motivate them to do the right thing.

Neil Barten, I am with the Department of Fish and Game in Juno, Alaska and I am a wildlife biologist; I have been there about 12 years. Juno is a community of about 30,000 people and we have a lot of black bears in and around the community. Me and my staff over many years we have spent often 2-3 hours a day throughout the months of May through September talking to people about bear concerns, bears getting into trash, bears eating bird feeders, chasing kids through parking lots, the whole thing. So, we spend many, many hundreds of hours talking to people on phones with that kind of situation, almost entirely black bears but we have also got other communities where we are dealing with brown bears in landfills and brown bears on fish streams going through people's backpacks and getting into smokers and all of the things regarding ways people can get in trouble with bears and vice a versa. We come from an area where we have to deal with both species and a lot of wide variety of conflicts.

Lori Homstol, I am a M.S. student at the University of Alberta. I started working with grizzly bears in 1995 on the Eastern Slopes Grizzly Bear Project in the National Park. I worked there off and on for about 10 years. I also worked in Montana with grizzly bear and black bear conflicts as a technician, and then on a short contract the agency had with Asian black bears. I started working with urban black bears and started my masters in 2007. I have a special interest in bear behavior and learned conflict behavior in aversive condition.

Jon Beckman, I am a research ecologist with the Wildlife Conservation Society. For those of you who are not familiar with WCS we were originally established in 1895. We are one of the largest conservation organizations on the globe. In fact, outside of the US Government, we are the largest employer of ecologists and biologists in the world. We currently have over 500 projects in 62 countries across the globe. Our goal is simply to take a science based approach to resolving the issues that wildlife and wild lands face across the globe. My particular

background is working on bears over approximately the past decade to twelve years. Most of my research has been right here in western Nevada along with Carl Lackey at the Nevada Department of Wildlife.

John Paczkowski, I have been doing bear work for about 15 years for a number of different agencies in Canada and internationally. I will just give you a bit of an array of some of the experience I have had. I have been working with the Wildlife Conservation Society since 2002 in Kamchatka and I have been there since the collapse of the Soviet Union. There used to be a well funded conflict resolution system and that is completely gone now so they have regressed about 40 years and now they have no political or social wealth to do anything about bear/human conflicts. We are working now to try and plant seeds to maybe slowly develop some sort of conflict resolution systems in the Russian Far East. We are also working with tigers there looking at tiger and conflict resolution and also some aversive conditioning for tigers. More recently, I lived in a town called Prince George, Canada where we started a grass roots group to reduce bear/human conflicts or to reduce bear deaths. On average there is about 50 bears getting killed a year. Because of that, we started pushing the mayor for reform; as a result the mayor was seen supporting bear work. That resulted in bylaws that are drafted and will be enforceable so that they can actually look at garbage management produced that as a huge problem there in a town of 100,000 people. There is garbage littering the streets and they are slowly, slowly working towards removing that. Right now for the last number of years I have been mainly based in Canmore and Banff, Alberta and these are what we call the shining examples of bear-proof towns. Canmore is completely bear proofed in terms of garbage. I would say compliance for garbage management is over 99%; same with Banff and the whole Canadian Park system and the Provincial Park system around us. So, that is a very unique example where a town has really sort of moved forward. Also, we've got laws and bylaws there or ordinances that make sure that people are compliant with garbage management. I think that one of the common threats I have seen in programs that are successful in Canmore, Prince George and even in Russia, is when you can get to the level of government and have some sort of laws come into place that are enforceable and have that stick rather than a carrot I would trade a thousand education programs for a couple of good bylaws that could be enforced because that is the only way you are going to get the 100% compliance to make sure that people are not leaving garbage out.

Rich Beausoleil, I am the bear and cougar specialist for Washington Department of Fish and Wildlife. For those of you that don't know, Washington has a management branch, a research branch, and an enforcement branch; folks within those branches are broken up into districts and detachments all around the state. My position was a new one that was created about seven years ago and it's unique because I kind of bridge all of those disciplines. So, I won't pretend that I'll have a balanced approach, but more often than not I will be bouncing around, within and amongst those arenas, so when that does happen you will know why I did.

Mike Paulson, I run a homeowner's association on top of a mountain in Tahoe surrounded by forest lands. I have a lot more luck teaching the bears how to behave than the tourists that come to see me. So, my job is always ongoing. But, we have been very successful at keeping the bears out on top of the hill as they cross back and forth.

John Hechtel, I spent about 30 years in Alaska working on all sorts of different issues but I gravitated more toward bear/human conflicts later in my career. Probably the most relevant project I worked on was an interesting one in Prudhoe Bay that I worked on with Dick Shydler. When Prudhoe Bay was originally put in, there were no grizzly bears really in the area. It was out on the tundra out along the coast so there really wasn't much thought given to the bear problems at all. Over time, the open landfill at Prudhoe started to attract more and more bears and about the time there were about a dozen grizzlies in and around the oil fields people got concerned. Because of the sort of desire on the part of the companies to not have a lot of controlled kills of bears they funded a fish and game project to kind of look at ways to address the problem by cleaning up some of the attractants and rewards and attempting to use

aversive conditioning to let the bears forage, actually around the oil fields, without causing problems.

Panel Discussion

(Hechtel) - Anyway, as you can see we have a pretty good diverse group of people up here. I know that there is a tremendous amount of interest as well in the audience and it is a little bit of a challenge when we have got this big of a group to try to make it as interactive as possible. One of the first things, the challenge is always trying to find a few topics that are of enough interest that we can talk about rather than getting too scattered. So that is why I kind of went through a list of some of the stuff and one of the ones that I personally think is important, but I don't know if it was Mark or not, did you bring up the one about land use planning?

(Bruscino) -Yes, I did.

(Hechtel) - Do you want to talk a little bit about that, set that up and start a little discussion on that?

(Bruscino) - Well, in the Yellowstone area, we were just talking at lunch; we have got a lot of grizzly bears. Grizzly bears are back in the Yellowstone area in large numbers. They are widely distributed. I think one of our big challenges into the near future, and long term I guess, is working with development primarily on private lands. There is a lot of really important bear habitat and other wildlife habitat on private land. There is still relatively open spaces, farming and ranching, around the park that is still relatively intact, although it is going fairly fast. So, I think both at the planning level and the land conservation habitat level, whether that be easements or acquisitions, I think the bear managers in the Yellowstone area need to look really hard at maybe shifting some of their resources and some of their energy towards the land use planning through the county and easements and acquisitions of private lands in order to keep that habitat from being fragmented and keeping it intact. I don't have the answers certainly. I will tell you a few things we have been doing. We try to go at the county level to get some regulation in place for bear resistant waste management systems. We were embraced in Teton County and sent packing literally by a crowd of people that didn't want the local government telling them how to store their garbage. But, what we do is run it right back with a lot of data we have kept a database. We started a database in the early 1990's so we started putting dots on maps, going to the important people in local government and going to every single planning and zoning meeting and commenting. We chose a few really important proposed developments and just asked for a few things. We showed our data and said this subdivision of 150 homes is going in here and look at the bear count around this area. There is none right there because it is nothing but hay fields and cows but where there is housing around this area we have had tons of conflicts. Could you guys maybe consider a condition of approving the subdivision? We are not going to oppose the subdivision at this point, but maybe a condition of approval that they have bear proof waste management. We have been successful but not everyone. Depending on the developers opposition to it and some of the local residents opposition to it, but on a case by case basis we have been successful with some of them. I will tell you it takes a lot of time and energy. I would much rather have regulations in place that just requires everyone in the county in bear habitat to have some sort of bear proof waste management system. These are small steps, I guess, at this point. I think, it is becoming more of a social norm even where it isn't required and I think the county might warm up to the idea in the future. In addition to that things like the sighting of developments can lay out the development themselves. Can you cluster some homes for example away from the river, just putting a little more space between bears and people? Either work with the developer or the county to require or prohibit fruit producing trees and shrubs as ornamentals. I think development is going to happen in Yellowstone period; and it is happening quickly already. I think whatever scale, whether it is working one on one with the developer or working with the counties or even at the state government level, it is really important that we shift some of the resources in that direction. I am sure there are some other experiences on this panel.

(Question) - It sounds like you are in the same situation project by project so I was interested in you speaking about what is zoning in that area?

(Bruscino) - In Park County we got in just after the planning process where they went through a lengthy planning process and somehow we were not involved. So, to actually amend the county plan to include that regulation would take action by the county or the commissioners. They are not willing to do that. But, they tried at Douglas, the county I was referring to. In Teton County we were able, based on showing them the data, to get them to zone the county as conflict priority zone one and conflict priority two. Conflict priority zone one has to have bear proof garbage storage and we gave them a whole set of options, which they did adopt, such as storing it inside a closed building or having a certified bear proof bear resistant container to store their garbage in. In conflict priority zone two there are no requirements yet we still endorse the use and people follow those rules. We feel it is real important, I guess, to be able to justify what you are asking for and so being able to show them the data that this area, like Teton Village for example, has tons of bear conflicts. It is kind of a no brainer when you cannot even see any of the development on Google Earth map because there is so many dots on top of dots where there has been bear conflicts. I think a couple other things that are important, along with data from a data standpoint, it is really important that you collect that data so that you can show people, these decision makers, where the problems are occurring. Another thing that is important when you go to these local governments over land use issues, something like waste management, is make sure that you have good practical alternatives for the public. If you just say we want everyone to store their garbage in a bear resistant manner and you don't say here are the products that work or are tested. Here is where you get them. Here is where the waste management companies can get them. That is going to be a huge concern of theirs. What we have learned is that you are likely to fail if you haven't prepared in that manner as well. As far as the zoning stuff goes that is what we are asking for. Our state, just to fill in a little more, we have gone three times to the legislature to ask for legislation prohibiting people from feeding bears and it comes down to that if you squeak your wheels, quite frankly, you know that if I throw some grain to my horses and a bear finds them in the corral I am going to get arrested so I am not in favor of it, that sort of thing we think is completely unrealistic. So we are working at the county level now.

(Beausoleil) - I definitely agree with that. Actually where I live in Washington, in Chelan County, we have a group called The Foothill Lands Conservancy and they are addressing a lot of the things that Mark is talking about at county commissioner meetings. But, for the agency folks out there in the audience, and I am going to take this back to Washington with me, please get the word out to your district biologists and have them attend those commission meetings; I think that would really go along way. For the graduate students in the audience, as you can see, politics come in quite a bit of in all of this decision making. So, when you are taking your coursework and you have elective credits to fill, don't take basket weaving, take a political science course if it is not required, or if it is, take a human dimensions course because people management is really what wildlife management is all about, and politics are probably second. They are both essential skills to have as a biologist.

(Comment) - I will just add to that in the town of Canmore back in the 1980's and 1990's people like Mike Shebow(sp?) and Steve Herrero were involved in planning and suggesting these garbage management techniques. Bear proofing in whole is kind of displayed here where the community based garbage bins and everybody is required to run up and put your garbage in the bin. In 1995 it really polarized the community; people were saying it would never go through, it is politically unpopular. Somehow it managed to get pulled through, but now 10-12 years later people don't even think twice about it. It is just 100% compliance. There are laws that if I were to put my bag of garbage out on my driveway my neighbor would rat me out within a couple of hours and I would have a $150.00 ticket pinned to my door right away. Now everybody is pretty much buying in. There are a few exceptions, but

like I said before that is probably well over 99% compliance. It takes a long time but in the end people buy into it.

(Comment) - I just want to add one quick thing to tack onto that. I would say that the compliance comes from the fact that those ordinances are enforced. I think enforcement is the key that a lot of times gets left out of the equation. In a lot of places you will get ordinances or regulations, but there is no enforcement to follow them up, then I think they are not as effective.

(Comment) - Another thing that appealed to a lot of people about the Canmore approach was that it clearly shows that by going from curbside pick up to centralized containers, they saved a bunch of money and when you can say this is costing less and much more effective then you have got a pretty strong package delivered.

(Comment) - I would just like to add to that as well that I really find that if you make it easy for people to get rid of their trash properly they will do it. As long as it is easy they do whatever is easiest. If it is easier to put it outside your door that is what they do. If it is easier to just walk half a block away and put it in a bear proof bin they will do it. So whatever you are considering bear proofing things consider how easy it is for the public to comply with that as well.

(Baruch-Mordo) - I was just about to make the same comment. The other comment I had was regarding land use planning and development. One of the things that we are seeing in Aspen that is killing us is the fact that we don't have one day of the week when garbage is being collected on and I think that is something that might be easy to establish early on, not only centralized dumpsters but maybe just one day of the week so that garbage is less available to the bears.

(Beausoleil) - I was just going to mention real quick, and I think this garbage issue is next on John's list, but, I was going to ask if there is anyone from the Colorado state agency here? I don't know if it has been passed yet, but their real estate disclosure legislation went through, where it is mandatory that their real estate companies have to let incoming homeowners know that they are buying a home in bear and cougar country. I thought that was just an incredible idea and I am looking into that in Washington. People move into the end of a box canyon and within a few weeks they are calling fish and wildlife to come get rid of that bear that has just walked by in the foothills. I think that if they knew ahead of time they may not have bought there. Like I said in my presentation, we see the real estate ads for rolling hills, meadows, ski resorts, and deer and elk abound, well guess what there is bear and cougar there too. A lot of folks just don't put those two things together. I don't know enough about Colorado's deal and how far along it is.

(Breck) - It is not too far along but we do have some pilot programs going, this is an interesting thing, because of course realtors have absolutely no desire to tell people they are selling homes to that as soon as they move in there is going to be a bear on their back porch. But, we have found that mortgage closing companies <u>are</u> willing to distribute literature, and if you can prepare packages and get them to closing companies, they will hand them out at closing. You can put together big welcome packages that go in at closing and some of the things we have recommended are a letter from someone very important in state government, or in county government, that says "welcome to so and so you are living bear country"; this is what we expect of you as a resident in bear country". I haven't got that part through yet but still think that one of the keys is to let people know that this is important. Their responsibilities, by living here, have changed. You know, you don't live in Nebraska anymore. The other thing about getting people education right away when they move in so those kinds of programs work. Sometimes you can hook up with welcome wagons and those will work. We have also found that volunteer fire departments and fire wise programs and things like that are very happy to distribute wildlife information.

(Comment) - Working as a realtor in the state of California up in Lake Tahoe, it is part of our real estate disclosure act to provide notification that

they are not only in a wildlife area but in a bear area and a high fire danger area. So, California rates on the contiguous scale but part of the CAR (California Association of Realtors) that is our standard disclosure. Not that anybody reads them but they are in the details.

(Jason Holley-audience) - I would like to further Tahoe experience a little bit. We have ordinances for trash in both counties on the California side in Eldorado and Placer and we found it has a lot to do with the way it comes across. To the Tahoe Counsel for Wild Bears, we got the ordinance passed but it seemed like Eldorado was saying look you have to do this, we are going to get you, we are going to fine you if this doesn't go through. In Placer on the other hand it kind of worked more as a community effort and was directly proportional with the way the success has been going with these burns. Placer seems to be going along better and we have more follow up. We have got to make it come across in a way that we are all doing it as a community effort, etc. Another quick thing about California is we are so concentrated on Tahoe that the ordinance we made only applies to areas at 5,000 feet or 4,000 feet. Immediately we are having so many problems at 500 feet. So if you go with a broad reaching ordinance that is not just a case by case basis or site by site construction basis, make sure it encompasses all possible future things or try to make it as broad reaching as you can without asking for the world.

(Carl Lackey-audience) -I want to comment along those same lines. I think part of this discussion needs to point out that we can distribute flyers via real estate agents, we can create the ordinances, we can have this out in the media all the time. The majority of the people will not care and will not take the actions necessary until that bear is actually knocking on their front door, until they have the problem. To most people it is a non-issue even though there are problems in the neighborhood.

(Comment) - We have a point of sale legislation; I don't know where we are in terms of mandatory, but point of sale states they have to have bear proof garbage cans installed. So, for every house that is turned over in Tahoe, they have to provide bear proof garbage cans.

(Hechtel) - One of the things that I want to get back to is the planning aspect and getting ahead of the curve. Because what I have seen also, even with agencies like parks and things, there is kind of a disconnect between the recreation planners and the people putting in campgrounds and trails. I worked in the Yukon Territory for a couple of years and there were campgrounds put in the middle of out washed soap berry patches that were really important grizzly bear habitat. It's a nice place, it is nice and dry, but the people that are looking and thinking in terms of recreation a lot of times don't have bears in mind. Then, after the fact, you're trying to deal with this with campground closures and things like that if you can. Within your agency or within fellow agencies, try to connect with some of the recreation planners. It is not just about towns and things and get a little bit ahead of the curve, a lot of times it doesn't take huge amounts of money to do this planning. If you have got a little bear sense you can walk a path, you can look at the understory, you can look at site distances and things and help find better places to put campgrounds or put trails and stuff like that. I really have seen so many times where a little bit of thought would have helped, and a lot of times you sometimes talk to the people who designed the campground say I wish I would have known that, or I didn't think about that. You know, it is not like they are even hostile to the concept. So, some of these planning issues I think are really the first step and I think some of this other discussion is fine too because that is the next thing but I just wanted to remind people to think about that before some of this stuff goes in.

(Ann Bryant-Bear League) - Excuse me, going back to the Board of Realtors, I am with the Bear League, we are based in Tahoe and we have been in operation for about 11 years and just quickly to correct Jason who I work very closely with and have a great deal of respect for. It was the Bear League who was instrumental in getting the bear ordinances adopted in all of the counties around, especially the California side. Going back to the realtors we were just

contacted about a year ago from the South Lake Tahoe Board of Realtors asking us that we help them provide a test for anybody who sells real estate in the Tahoe Basin that they must first pass a test so that when they are showing real estate the realtor must know that there are not only bears but other wildlife, coyotes, squirrels, raccoons, whatever. So, we developed a huge list of questions and we will be going down and doing a seminar and training anybody who wants to be licensed to sell real estate in the Tahoe Basin. They will have to be educated and then when they sell real estate before they get their license they have to pass that test. We were capable of that because not only are we working with bears we are working with other wildlife. Also, the fire departments and the sheriff departments around the basin have called us and asked us to please educate and train all of the officers and the fire department. We just did one about two weeks ago in Northstar. We trained 30 firefighters because a lot of times they are first responders and it helps to get all of the people who would be perhaps getting these phone calls to come on board and understand that a bear walking through your yard isn't an emergency and it doesn't mean that your grandchildren are going to be eaten and killed, it is just education and that is what we all need to be working on. Thank you very much for everybody being here.

(Comment) - I think maybe one of the goals of a little larger scale land use planning should be some spatial separation between bears and people. We kind of went down the road of what we do when in the backyard but I guess going back to my original thought, on a grander scale thinking about how we keep important open space. I think some of the way to do that is through incentives, you know easements, acquisitions, dangle a big enough carrot in front of whoever controls that open space to get it wrapped up. You guys, it is cheap. Paying eight million dollars for a conservation easement on a large ranch over the next 100 years will pay for itself a thousand times in conservation. It is a lot of money up front but I think those are some of the things we need to look as people are trying to conserve bear populations and minimize conflicts. If you don't have 800 people living in condos on that ranch and only to have maybe a family or two and some livestock, the potential for conflict is dramatically decreased. Like I said, I don't have the answers but it is certainly something that we can't ignore, now is the time. We aren't going to bulldoze those houses down after they are built and I think it is maybe getting at the root cause at that level is maybe where our best money and energy is spent right now, at least in my jurisdiction.

(Comment) - I wanted to jump in just real quick on this planning issue and I think that one of the things that can really help, and to me seems like a knowledge in data gap, is that there is few if any studies that have looked at the effectiveness of various urban planning designs. The clumping of houses, the distribution of houses on the landscape, whether you leave open space between them or if you cluster houses into certain areas, and that seems to be an area where we are lacking data. To give information to the decision makers and the planning processors is the best way to maintain landscape permeability for a large carnivore such as bears and so it seems like if there is a need for this data. I think this is the kind of data they are really missing out there.

(Hechtel) - Anybody have any final comments on some of the planning issues? We have sort of been slumping a little bit into ordinances and garbage compliance and I think that is important and I am trying to not stifle the discussion but keep us a little bit focused.

(Comment) - I suspect there is a lot of variation. In Alaska where I live zoning is communism. I mean it really is. People are willing to put up with having no zoning and having somebody put a cement factory next door to their little remote cabin than having somebody try to tell them what they can do with their land. It is really going to be variable.

(Hechtel) - Neil would you talk a little bit about moving on to ordinances, will you talk a little bit about the Juno experience.

(Comment) - John, excuse me just for a second. As a member of the audience it would be a lot

easier to follow who is saying what and what they are saying if you hold the microphone up close because there is so much valuable stuff being voiced, thanks.

(Barten) - If I get to wordy let me know. I am going to get towards some of the ordinance stuff but I will give you a little background first. When I got to Juno in 1997, fish and game, the state agency I work for, had been blamed, targeted, pointed at, anytime a bear did anything in the community everybody called fish and game. Even the police department would run into an angry person on the street and they would dump the call on us. For years my predecessors went through this, you know we would get hundreds if not thousands of phone calls a summer, a lot of them from the police department saying something about "your bears" and they don't have fish and game stenciled on their foreheads so they are not "our bears". Well, we struggled with this and we got up in 1999 and 2000 and we just had crazy bear years, literally probably more than a thousand calls to the department and it took our time away from all of the other responsibilities and duties we have and just by luck we ended up with a new mayor who got elected mostly because she said that she would address the bear concern. She got in and that was our political anvil, we couldn't dent the politics for years, they just threw it back on us because the city didn't want to take on the responsibility of bears. If the fish and game dealt with it they didn't have to worry and they weren't about to open the door a crack. Well, she only could get elected by promising to form a bear committee and we got a toe hold and the first thing we did was we went to the police chief and got the police chief involved and got him to go in front of the city assembler, who actually runs the police department to tell them how much time his officers were spending chasing bears around. So the assembly, who for years didn't give a rat about bears, could see that their employees in the police department who were supposed to be protecting the people were spending $150,000 in officer time chasing bears and that laid it all out for us. We got ordinances together; we sat down in committee, laid it all out and looked at what are the real problems. We got an ordinance passed in a matter of a year and a half to two years. You don't put out your garbage cans before 4:00 a.m. in the morning for pickup. Some people would put garbage cans out two days ahead of time. Even if they didn't they would put it out at 9:00 at night because they were too lazy to get up in the morning before work. That was a big key. Then we got people to put their trash in bear resistant trash containers. Well, we kind of talked about it a little here; you can kind of set yourself up for failure in a way, well as soon as we said you are going to have to have bear resistant trash containers they didn't know what they were supposed to look like. We had come up with these concoctions made out of plywood that the bears would rip apart immediately. We are slowly still working on that with all of these new conditions of carts that are almost bear proof to some degree but then we also have over 700 dumpsters in town. We have an ordinance that said if you put your trustful waste in the dumpster, many of you if you don't know what trustful waste is many of us on the committee didn't either until the lawyer told us and it is stuff that rots basically, anyway, we have about 650 dumpsters in town with metal locking lids that replaced the plastic ones that bears broke off all of the time. So we have got all of these ordinances where these things passed but none of it does any good unless you have a hook; and the hook was the police department hiring somebody who actually goes around every day in the summer and that is their job to cite people or at least to educate people about the ordinances and what they have to do. The beauty of having the community, the police department, and the city assembly buy into this, is that they run the city so to speak and they put notices in bills sent out to people. They put signs up downtown for the tourists. There are a lot of those people around the community where there are only 3-4 fish and game people. So, the police department drive all over town every night and they bump into people all of the time, and trash and bears is a big part of their message all of the time and its really reverberated around the community. Now, we still have problems, but that has been a big part of what we had some successes with and for every hole you plug in the dike another one springs up to some degree eventually until you plug every possible hole.

As soon as you cap metal on the dumpsters they try to find one that is not metal. Some bears are smart enough to push them across parking lots and flip them upside down and that kind of thing but still we plugged a lot of the holes and listening to the discussion today we are doing pretty well in Juno. A lot of other communities, Anchorage as an example, the city wants nothing to do with bears. Rick said, who used to be my counterpart and is a great biologist in Anchorage, he is up against a brick wall in many ways even after the mauling last summer that is maybe going to open the door a crack but the city leaders don't want to acknowledge that bears are their concern because as soon as they do they have got to do something about it and that is a big chore. Bottom line is, if you can get the roots of the upper level and get the upper leaders involved and get buy in, then you have to have enforcement and then you are still going to have to work on things, like right now trailer parks in Juno they don't have garages. Well, it is easy for someone in a $300,000 home to roll their tipper cart in the garage and only take it out on the morning of pick up but if you have a trailer court you put it against the trailer and bears have figured out how to get into some, so we are working on getting better tipper type carts to solve that little piece of the puzzle. So, I think we have made a lot of end roads and I have got a zillion things to say if it comes out during the course of this discussion today but that is kind of the picture I wanted to paint to give you some sense of optimism.

(Question) - Neil, I just wanted to ask you, and I hear this all of the time in these conferences, you know it has worked, are you guys are feeling better about what is going on or do you have data to back up what you are saying, have conflicts gone down and can you link it back to your actions? I keep hearing over and over go out and educate and do bear aware campaigns and you know it worked great, prove it. Show us some data because I think this aspect of conflict really lacks that and until we can prove that aspect of it we are just going to throw money at things we think works because it makes us feel better.

(Barten) - That is a good question on the data part because that is always the hard part. I am going to have to spread out a little bit in discussion here to just kind of put a noose around this. We did use data when we went to the city year after year trying to get additional checks and balances with the ordinances because it didn't all happen at once. It happened over a 2-3 year period. We were able to show that by putting out trash late, only at 4:00 in the morning, these areas that forever had been problem areas started decreasing and we had fewer phone calls etc, etc. Now the dumpsters were a big thing. Instead of having 400 calls a year on dumpsters we have 14; we actually have data with that. But, last summer we had a lot of calls. The calls went back up but that kind of gets to what John brought up several times today that I hadn't really given a whole lot of thought to, is at some point I think from my standpoint and the people I work with, we always looked at every bear we have to move or kill as a failure. It is showing that all of our ordinances and all of our efforts to some degree aren't doing any good because see we still have to move bears and we are still having to kill them. For instance last summer, we probably had 400-500 calls to our department but I would wager that maybe 80% of them were because of like 3 bears. At some point you have to come up with a plan whether it is strike one, strike two, strike three to kind of find that balance where you are trying to get people to do what they need to do and be responsible. But afterwards, there is always going to be some animals that just kind of erode the whole structure of the program and the confidence in the fact that it is really working, So, I think either we couldn't catch up to them because they were too busy or we didn't want to right away and show people that that's the answer to the problem because that is a double edged sword. People say why we should bother with trash, you took the bear out and everything is okay again. That is kind of the area where I think you really have to use some thought and planning to try to come up with the perfect mix to be successful. We do have some data that I didn't bring today but we certainly have it to show some successes.

(Beausoleil) - Neil's comments in Washington would really go along way. Our wildlife officers are a general law enforcement agency, so they have all of the same powers as state patrol or a sheriff's department employee. Instead of bringing on one or two person for enforcement of bear issues, if legislation has passed in Washington, we would have had 120 game wardens out there enforcing the issue. The benefit to that is not only in enforcement. If it was a city or county police officer, there would still be a little bit of separation between where the phone calls of the bear complaints are going and where the enforcement of the trash cans were going. If you put the two together, which is how it would work in Washington, the game wardens would cover both because they know the hot spots of where all of these bear problems are happening. So, if we could merge those two in other areas that is something to think about. But I think Neil's points are very positive.

(Seher) - I am from Yosemite as well and I just have two points. One, Yosemite is much smaller scale I think. We have a lot of visitors but it is not as big of an area as you are talking about. We have some examples of that actually with what we are talking about where this interdivisional cooperation has actually proven to work at a high level. You get people involved at a high level it trickles down to all of the employees. So I think that is an example where it has actually worked. Just like you were saying, get the media involved. The second part is we actually do have some data so today we will be presenting a poster and you can come and look at it. We have been keeping track of these actions, showing the data before and here is what it is now. Yosemite is kind of a smaller area but it is a good representation of progress. So if you would like, come check out our poster later.

(Comment) - My name is Madonna Dunbar and I am with Incline Village General Improvement District up at Lake Tahoe and I just wanted to share a couple of points similar to the Juno experience but we have got a couple of different things. In 2007 we had a really bad year with bears. Carl was up in our neighborhood all of the time and the community reacted in a really positive manner and actually our local town government acted in a really positive manner. We are a water district but we oversee trash so the first thing we did was we made sure Waste Management provided bear proof dumpsters in town. We actually rejected their first design and worked with them to come up with a better design. Linked with that, was a big education campaign and a big jump in our ordinances. In 2007 if you had an animal violation with trash, it was a $10.00 fine. In 2008 it went to $300.00 and we delivered a bear saver tote to your door if it was a residential problem. I think that is the biggest strength we have is having local compliance and giving people the solution to the problem right away. Basically, within 24 hours they have a tote delivered to their door. They can get their fine refunded if they use the money to put in a permanent bear box. The second strike on that trash violation, if an animal gets into it, is a $1,000.00 fine and it is a mandatory installation of a bear box. If you don't do it we cut your water off. It is a very unique situation; we control their water service, so if you don't pay the bill you don't just get to ignore it. We have had such a decrease in our problems. We still have issues, we still have people who don't know how to use a bear tote right, or use a bear box, but all of those problem locations where our compliance guys who usually deal with water issues were always going after trash people it solved the problem right then that you can go back to the location four or five times and just throw a $10.00 fine on it. The only other point that I wanted to talk about is that we also instituted a 24 hour trash hotline. So, somebody within the community can call if they see somebody put their trash out too early, like the day before, they can call this hotline and during the day one of our utility people will deal with the problem, take it away and if the animal doesn't get in it is only $100.00 fine, kind of as a warning fine. If it is at night and there is nobody around in our utility district we contracted with a local property management company, they take the garbage away, the homeowner gets $100.00 fine plus the cost of the clean ups and if the animal did get in it is a $300.00 fine. The property management's words and photographs are verification of that. Hardly anybody can argue these reported problems because we

document it with photo documentation and we follow it up. I really think linking the solution to an ordinance was one of our strengths.

(Question) - That is exactly right, I have a quick question for you though before you pass the microphone. How many actual fines have been issued to date?

(Dunbar-audience) - In 2007 when we weren't issuing the bear totes, I don't have the numbers in front of me and I am not in the compliance department, but we had close to 200 trash complaints. The following year the complaints went down with the delivery of the totes and this year we seem to be down a little more. I don't have the numbers right in front of me but it seems to have been effective. The community members who care about bears are really glad that we have a 24-hour hotline. They used to call and two days later something would happen. This is taking care of it really fast and we haven't had to add any additional staff. We basically redistributed what staff duties were and contracted with this property management company and all of those costs of the property management company are passed back on to the person who had the violation.

(Question) - What is the population?

(Dunbar) - Lake Tahoe is kind of similar to Aspen; in Incline Village it is a little under 10,000 year round residents. We get 40,000-50,000 people on a weekend.; alot of seasonal residents and a lot of visitation.

(Baruch-Mordo) - Just to make one more point, Stewart lent to, I am sure those efforts have consequences but one of the problems is there are so many compounding variables when you think about research. So, yes you have more complaints maybe, but is it because Carl has translocated or killed about 23 bears, or is it because of this year the natural food production is pretty good? So I think what Stewart is trying to say, and what we are trying to do with our study, is to really look at the effectiveness. But the response variable of what we are trying to change is people's behavior. I wish everybody could do what you do and control water supply against bear proofing but I think that is the key, it would be great if more people would look at that. Are people really doing what we want them to do?

(Beausoleil) - Sharon's point is a good one. I wanted to mention something and kind of bring it back to an agency perspective. When we did our bear survey of all of the wildlife agencies in North America, about half of the agencies out there had the ability to fine people; the premise of the fine is that people are creating a public safety situation by leaving food attractants out and attracting bears. The interesting part of that section of the survey is when we asked agency folks what they would like to see more of, the folks that didn't have the ability to fine wanted to be able to fine, and the people who did have the ability to fine wanted the ability to make fines stiffer, because they knew it was working. So, I think hitting people in the pocket book is unfortunately the direction that I think it should be going to make a difference. Anyway, I just figured I would throw that out there from the agency perspective.

(Hechtel) - I think one other aspect of sort of promoting compliance is, that what seems to work in some communities, and smaller communities, is peer pressure. I think that, and I like that concept of somebody can have a hotline to do it, in some of the smaller communities in Alaska where people got fed up about some of the garbage problems, they ended up creating something and really working with their neighbors. So, the agencies were coming in and doing things, but there was a simultaneous effort by the people in the neighborhood trying to work with the people that were doing this as well.

(Comment) - I think that is a really good point, about peer pressure John. I think in some of these communities where we can't get regulations in place, you really don't have a heck of a lot of options. I do think over time you can affect some pretty substantial cultural norms within the community in a positive way towards storing attractants and those sorts of things by staying very high profile within those communities, and getting neighbors to do some

things. For example, we started providing reduced priced bear resistant carts to people and a giant sticker on it that said "bear resistant garbage container" or something along those lines. So, that every time the other neighbors rode down the street they saw that big sticker on the cart and pretty soon the calls started coming in on how do I get one of those. I would love to have the information to show that we are doing something by doing that; let's say in this community maybe about 50% of the rural homeowners have some sort of storage now. We don't have that information. I would love to have it but intuitively I got to believe that we are at least to some degree helping with the problem by getting that stuff out even though we lack the data to support it.

(Comment) - I just want to add a little bit to that. In Prince George before there was any bylaws or ordinances put in, right after garbage day we would cruise around and see where bears were hitting garbage containers. Then the next day we had an education crew, students that we would hire for the summer, run out and go door to door and basically say that we had a problem here last night because your neighbor was putting garbage out. Also, bears were destroyed, the CO's there used to immobilize the bear, knock it down, put it in a culvert, drive it to the edge of town and then destroy it there so they didn't upset anyone. Now, they started destroying bears on site, making it pretty visual and the public attitudes were changing because of it. So, if somebody put garbage out all of the neighbors sort of ganged up and got on them. That was before there was some sort of ordinance in place.

(Comment) - I find also as a member of the Bear League, I live down in Alpine County on the Eastern Sierra, and people like us I think feel a little less human-centered and we need to start taking a broader perspective. Things are changing, our climate is changing, and habitat is changing. These are enormous stresses on all wildlife that we have to take into consideration and I understand how hard it is to change attitudes. But, I think one tool could be people like us, we don't have degrees in biology but we have lived here a long time and we understand what is going on. We are passionate about protecting these animals and we are hampered so much by agencies that won't even listen to anything like diversionary feeding they don't want to hear any alternatives. I really think we have got to start thinking more forward because our planet is in peril and this wildlife is in peril. The stresses are enormous. Bears range for over 120 square miles. So, even if our trash is put away in a bear proof container, they are still going to smell it and they are still going to wander through, that is what bears do. I think, their ranges are shrinking and the population is shrinking. It is really hard for me to accept that they are over populated, maybe in comparison to habitat sure but they are being poached. If we want to protect these animals we have to start thinking broader, but agencies also have to change.

(Hechtel) - One of the other topics and I think it is one of Stewart's, is kind of the concept of education and what actually can we accomplish with education short and long term. Do you want to start off?

(Breck) - I will keep this short and I will say education in the sense of bear awareness and handing out flyers is a waste of time and money. An example of this is this lady tried to educate our panel here to stand up and I would say that we had about 50% compliance.

(Comment) - Can I ask a real quick question? I don't know if I am looking for advice or I am just curious, getting back to ordinances. My name is Heather Reich, I am a private contractor, and I work with Montana Fish and Wildlife and Parks alongside grizzly bear managers to help with conflict resolutions. We have a situation where we have some people that own larger tracts of land, 20 acres or so, we have a situation in a couple of places where we have folks that have properties and we have ordinances about feeding bears and we have visited a few of these properties numerous times. I think we would be well within our rights to call in law enforcement and have them at lease cite these people. But, the managers that we work alongside with are actually hesitant to call in law enforcement for the fear that these people might

just stop calling the agency when the bears come in and I am just wondering if anyone has experience with either following along with this. Or, in fact, you have called in law enforcement and maybe not had this negative effect. I am just kind of curious.

(Beausoleil) - I guess my initial reaction to that is, and like I said in Washington our game wardens are the same as all other enforcement agencies in the state, I would actually turn our well known two or three strike policy on bears back onto people. Depending on the severity of the attractants that they are putting out there, and how cooperative they are being in resolving the problem, either on strike two or strike three you get hit with a fine. I think that is a good way to introduce this legislation to law makers, who may view it as this is just another way for Fish and Wildlife to make a buck. You go through a multi-step process before you actually issue that fine but I think it is a good idea and we are definitely looking into it and from my perspective I see it as a much needed tool.

(Seher) - I just want to comment a little bit on the education stuff. I don't know if education is affecting the number of human/bear conflicts that we have in the Yellowstone area. I know it is changing human behavior and if I use that as an indirect measure of maybe affecting conflicts then maybe we are making some progress in that area. I have to say though the Yellowstone area, as Chris Ravine mentioned earlier, has had a lot of resources focused on it, and a lot of money spent. We have had an incredibly aggressive education program for 25 years. We have some laws, not so much on private land at the county level, but in the National Parks that require people to do a lot of things to avoid bear conflicts. Those things in combination, maybe the length that the education programs have been in place, have changed human behavior and people know, even in my career, a lot more about how to prevent bear conflicts when you sit down and have a cup of coffee with them than they did when I started. Whether they are using that information or not I don't know, some are I believe but certainly a lot of them have that information.

(Holmstol) - I just wanted to add a little to that. I think education can be really valuable in terms of changing people's attitudes. I noticed in Whistler, since I moved there, we have a lot of turnover. The different people are from all over the world; some have no experience with bears or very little experience with bears and usually by the end of the summer a lot of them have seen a lot of bears and their fear of bears is reduced. They don't see them as such dangerous animals, they understand better about how to prevent conflicts because of some of the educational campaigns that we have got going on. But, just as important, is all of stuff that we talk about with enforcing the bylaws and enforcing the wildlife act in order to protect bears and people from those of us who don't respond to education. If you remember one of the slides I showed, were principles of effective punishment. I think we can turn that over to people as well and there should be immediate and consistent, and initially intense punishment. Maybe it is better if we hit them with big fines right off the bat, then if they comply you can lessen those and give them a chance to get their money back so to speak.

(Beausoleil) - I just have one quick comment about the education thing as well. Another benefit of education is that it makes it more understandable to people when law enforcement officers to go out and actually cite someone. When folks know that people have received information preventatively, like they received the flyer coming into the campground, or they have received flyers in their mailbox about storing their trash properly, I think it definitely makes it easier for law enforcement officers to issue that citation, and for community members to understand why the citation was issued; they know an effort has been made to educate and his is the next step.

(Comment) - My name is Phi, I am from Mammoth, California. We have Steve, our wildlife specialist, which has done an incredible job for our town. The problem was politics got involved and they fired Steve, because of that the whole system just kind of went caput because Steve pretty much had a system that worked well. So, what we had to do is we had

to go in and reinvent the wheel. You would not believe the process; you know this whole thing with getting the agencies, and getting the towns and the government to be on your side. Instead, we competed with them last year. We were pretty much doing stuff that we felt they needed to do. What I was doing was anytime there was a cougar or bear in a neighborhood I would go post a sign saying bear alert, lock your door, keep your dog food well sealed, and close your garage doors. You would be amazed at how many people would just forget about that kind of stuff and when they did they got hit by a bear and received some damage. Then, that makes that creates a warrant bear for a bear to be killed. So, I did events to get people to come to us. It does work the problem, with Tahoe and Mammoth you have got so many transient people in and out of there that it is a continuous education every time. When one person leaves you have got a new person that replaces them from somewhere else and they are used to just putting their trash cans out and don't even realize something is going to hit it. We also had about 700 dumpsters in our area and what I am working on is to get rid of the dumpsters. Because, my opinion is a dumpster is a pool for a bear because they can get into it. What I am trying to really push with my program is work a deal with the property owners and managers that are renting these places, you know a lot of times in these areas everybody has got a truck, well you work a deal with that guy to take the trash in his truck to the transfer station and dump it. That is the type of stuff where you get one person involved and trash is not laying around. If I have a trash bag that is full it goes in my car and I will take it to the transfer station. I don't even think twice about it. I don't leave it in the garage or anything else because every day that trash is in there it is that much more of a scent, making it easier for a bear to track it down. This is the kind of stuff that I am working on and I am hoping to see if some other people can give me ideas as well.

(Comment) - I guess just one comment is that I wouldn't rely on people to haul stuff in a truck because truck beds are notoriously bad bear resistant storage. There are good bear proof dumpsters. I think that is the way to go personally. The only thing that I would say about Stewart and his anti-education, is that I think that general educational things, like scattering a bunch of information out there, doesn't do a lot but what I have seen I think is it works for some people. I think sometimes as professionals we forget how little people do know about bears when they start out, and you throw out a bunch of information and maybe 5% of the people who are really predisposed to be receptive to it get it and then they start to use it and it has been the seeds of some of the grassroots movements. In some communities, people started to take it, and they came up with some cool ideas. In Alaska, we have no garbage pick-up in some of these small communities and people don't want to pay $2.00 to take a load of garbage to the dump. So what they would do is they would save up huge piles of garbage all winter to wait for the free dump day in June, then haul it to the dump. After we started talking about some of this stuff the people in this community said why not move the free dump day to mid April to just before the bears come out and at least we will get these massive piles garbage out of here. I have seen it, it is frustrating, and I think we do throw out a lot of educational information just as a form of displacement behavior because we really can't address the real issues but I think there is some potential there. I agree completely with Mark, that it is amazing if you can look back over the last 30 years the level of information, even if people don't act on it, is changing behavior and that is a different thing.

(Beausoleil) – Another comment on messages real quick. I think the feds did one of the most genius campaigns that I can think of. Len mentioned "a fed bear is a dead bear". It is those one-liner messages like "Smoky Bear says no to fire" and "Be smart with food" that really hit home with the general public. Unfortunately, most people just aren't going to read a detailed brochure until they actually have a bear problem themselves. So, to me, it is the fast visuals and concise messages that work very well. The Smoky Bear campaign was incredibly genius. We are learning now that the message wasn't always right, but it worked and people still talk about it today. So think about that.

(Comment) - I had a question for Mark. Why don't you have data to tell you whether your efforts have been successful or not. We have numerical data and other data on every single conflict that we have. I think there are so many variables that influence the number of conflicts on any given year and I don't think you can say "well we have reduced conflicts because we did this education effort" because it may have been a great natural food year that year a whole suite of other things may have occurred that for me at my level that it is difficult to measure and be able to relate to what we are actually seeing or doing. But, at least you could have data that addresses whether there have been trends or not right? I mean, you may not be able to say on the annual basis all the reasons and how important they were for the trend, but you can comment on over all trends. I mean, can you document that the bear problems have gone down or not?

(Comment) - I think my feeling is that if you plotted our number of conflicts with the increase in the grizzly bear population in the Yellowstone area they are almost parallel. But, I will say there is some different things that happened there too that maybe influencing that. A lot of these conflicts now are occurring on private land. There is a lot more potential for conflict on private lands as that population pushes out. I don't know how to adjust that to compensate for the potential and so I have to believe that it would be worse if we weren't doing what we are doing. But I am going to have to ask these guys to tease that out of the data because I certainly can't.

(Breck) - I guess before we break I just want to make sure I don't have a reputation of anti-education. My take is, if we are going to invest this much effort, and if you look across the country how much effort we have invested in something like a bear aware campaign, I would argue we need a better way to evaluate how that works. Sharon and I were very surprised at the lack of response we saw in Aspen. There is all kinds of criticisms you can throw out at this study and we recognize those, but what it did was it helped us rethink how we are going to do this in the future and what the goals and the methods are going to be. It is such a critical aspect and it is almost always ignored.

(Lackey-audience) - I know there is a big tendency for people in the agency positions to avoid contact with the camera or the radio of any kind. I can say that we have operated our bear aware program on a very, very tiny budget for years. Where we have been able to get that message out is when we hired the media as our agent. Make yourself accessible, take them out on releases, take them out on captures whatever. The media is great venue for getting your message out and it is free.

(Comment) - One comment if I may on education is that too often education relies on scare tactics to try and get people to take care of something and very often agencies feel that they must warn the public about bears and this often is counterproductive because people do not want to coexist with animals they fear. It would be a major policy to just tell the truth about data with what we put out that bears are not the dangerous animals that people are led to think. I think people would be much more willing to try to coexist with them.

(Comment) - I honestly don't think Len that we are in that phase now anymore. I think we have progressed beyond that phase where as a whole in a lot of communities that what is driving us is fear of bears. I really don't think so, and I think as agencies, I have been in this business for 30 years and I have seen it, I have seen the consequences of both sides and I think we try to do a pretty balanced job. I don't think fear mongering is a huge part of what we do anymore. I think the very fact that the demand for the public, somebody was talking about the bear broke into their house and did all of this stuff and the guy said, "I don't want the bear killed", I think that is pretty common across the United States now where we have done a good job of selling conservation and protecting individual bears and the population.

(Comment) -I think the trend is in the direction you are saying. I think that is the basis for bear numbers expanding all across North America. Because people are starting to realize that bears

are not the dangerous animals once thought and people don't feel that they need to shoot every bear that crosses their property. But, there is still a big problem with all of it. The trend, yes, at www.bear.org we have been monitoring agency propaganda and in the last 5 years there has been a major improvement.

(Hechtel) - What we are going to do now is move on to a second general subject matter, which gets down to discussing some of the problem bear management techniques and things that we try to use in some of these situations. There are a number of different approaches but I think there is a fair amount of interest and discussion that began on some of the things and some of the talks like Laurie's talk on some of the aversive conditioning and the topic of bear deterrents. The concept of when do you need to get lethal with conflict bears and can we change some of the public attitudes towards some of these strategies. The other one that I would like to kind of touch on is how we gauge the success or what criteria do we use for trying to figure out if our efforts are working. I wish Stewart was here because I think that it is important to have some kind of measure of what we are doing. I am not always convinced that the number of bears killed in a community is a good indication of this because you can change that very easily without doing anything other than just deciding to kill a few of the bears and whether or not that has the desired effect is what we want to do. I suspect we have about an hour and 10 minutes in this slot. If we slop over a little bit it is not a big problem but I would like to jump in. Does anybody on the panel want to introduce the topic of problem bears and aversive conditioning? I can talk the whole time but… You had mentioned early on the concept of how does a problem behavior in a bear evolve. I think that is one of the things we need. I worked in 1980 to look at the Trans Alaska Pipeline and its impact on bears. In 1980 they were thinking of building a gas pipeline, we came up with some recommendations of fencing for camps and doing things. When I look back at this report, we were dealing with some hard core bears and trying to bear proof camps in the face of bears that had really hard core problem behavior we had to come up with some designs for electric fences. If you are starting out with naïve animals, it is overkill and I don't think you need to spend that kind of money. I am sure somebody might grab that off the shelf sometime and look at that and I think that the concept that there is a progression of problem behavior that occurs may be lost. You know that it is not a bear one day and all of the sudden decides to start ripping cars open in Yosemite and pealing doors, or some of the more extreme kinds of problem behavior, it develops over time.

(Holmstol) - One of the things that I am interested in is bear behavior and I kind of started out doing this conflict work working with aversive conditioning. How do bears respond to this kind of management? Just talking with different managers, some people would say this would work and other people would say this didn't work, but something else did. I ended up in Whistler, which some of you may know, has some pretty significant conflicts and there is a lot of, as I mentioned in my talk, tolerance towards bears and bear tolerance towards humans. One of the things that I just noticed along the way, I don't exactly have the data to support it but I think it is some interesting food for thought, is how the bears seem to learn some of the behaviors that they learn. We have bears that learn how to open up the doors at the garbage compactor. They come up, pull the handle down and they pull it open with their teeth and the go in and they pick up which smelly garbage bag they want and they leave with it. Some bears learn this and some bears don't. Len mentioned this in his talk as well, how behaviors seem to be really quite specific and the stories about how bears will be surrounded by people at feeding station and they will see somebody walking down the road and be afraid of that person and run away. Which seems to us a little bit surprising but when you think about it from a bears perspective this may not be as surprising as you might think and thinking about how specific learning can be when they are first figuring things out. I will just pepper it with a couple of little antidotes. I had a neighbor who had garbage in her truck and a bear got into it one day and that bear was back, as you might expect, every day trying to get

garbage in her truck, but, only if it was parked in that same parking location. If she parked her truck in the next parking stall he didn't try. He didn't try to get into my car parked on the other side but if she parked any vehicle in that stall he went for that vehicle. After a little while he must have got garbage from somebody else's truck and he started breaking into vehicles more often. Then he got garbage from houses and started breaking into houses and then got shot. We have seen this pattern a few times in Whistler where we are looking at bears breaking into houses and their going through an open window into a really smelly house because there is food and garbage inside. We don't have curbside pickup in Whistler, you have to drive your garbage to the compactor and lots of transient residences in Whistler don't have a vehicle. So, they stockpile their garbage. It is hot in the summer and they leave their windows and doors open and bears get into it. So we would have these instances where bears would get into people's houses to get this kind of food and the house would be one that you could smell halfway down the street so no wonder a bears in there. But, we had a few break-ins where the house was immaculate and it looked like the bear went straight for the refrigerator. He knew what a refrigerator was; I am guessing the stove smelled a lot like food as well. So, I just think is interesting how this progression of conflict can really establish itself and that maybe we have a better chance at cutting it off at some point if we recognize at what point can we turn this bear around and at what point we can't. I think we have a long ways to go in learning how these animals figure things out. I am guessing there are a lot of people in the audience that have similar experiences and probably different experiences as well.

(Comment) - I found it interesting that she said the bear went into an immaculate house and went for the refrigerator. When I was working with the police in a town in Colorado we investigated several break-ins. One morning one of them was on the fourth floor of a high rise and the bear found a way to get in through a screen window and went right for the refrigerator. One of the people there said to the policeman that they had a theory, and I believe it, that old refrigerators with deteriorating insulation, which have formaldehyde in it gives off acid, which may smell like an ant colony. What happened in this case is that a bear didn't care so much about the contents of the refrigerator; it tore the refrigerator apart to get to the insulation. They really prefer ants as food; it's one of their favorite foods. So, if something smells like an ant colony it would be very attractive.

(Comment) - Ron started by talking about problem bear management and aversive condition together. I don't think those two are always going to go together. For the last number of years I've been working with the Wind River Bear Institute, Carrie Hunt, and doing aversive conditioning work around the town of Canmore in provincial parts in Alberta and their garbage management is pretty much under control. There is a political and social will to have grizzly bears in that area and there is also 5,000-6,000 people who come out every weekend and use the same area particularly during berry season and we just want to make it work and have the bears there. So, we are doing aversive conditioning, Carrie Hunt would call it bear shepherding, but we are using these aversive conditioning techniques to make sure these bears aren't getting into trouble. We are acting as sort of glorified crossing guards as these bears move in and around these areas, but we are also facilitating some education at the same time. In that situation 10-20 years ago they were killing a lot of bears that were doing exactly what they are doing now but now we just understand a little bit more about the bears behavior. There are grizzly bears moving besides tents, through campgrounds, in the middle of the night and now we understand that they will feed on some of the natural vegetation and they are not getting access to any human food and it is getting to the point where aversive conditioning is just allowing us to maintain those bears, avoid some conflicts and we are not really having to destroy those bears as they would have been done a number of years ago.

(Ann Bryant-Bear League) - My comment is to the gentleman who said that cars were good for keeping bears out of garbage. Not in Yosemite

and not in Tahoe. They love Cliff bars and they love toothpaste. So cars are not a safe place to store your garbage. I made the mistake that I forgot I bought a bag of birdseed, I left it in the back of my truck, which I don't lock and came out the next morning with birdseed on the driveway and the truck disturbed but not messed up. So, I took a small paper cup and filled it full of moth balls, not the unscented kind but the regular kind, and set it inside the rear of my truck and the next night of course he or she came back to try again for some more birdseed. She got a face full of moth balls and I haven't seen her since. Pine-Sol soaked socks tied to garbage cans also works. There are little things that everybody can do. I will make this short but I want to hearken back to the education factor. If you teach the children you teach the grownups, and one of the things that Bear League does is make sure that we get the school-aged children involved in understanding and protecting our bears and they grow up to become respectful adults, not just for the bears but in conservation in general.

(Comment) - Yosemite bears breaking into cars. We do have, I think, the smartest bears in the world. We have had bears that have learned to open car doors, so they don't even have to go through the window. There is so much I can say on this subject. I have seen it all. I have seen all kinds of tactics. I have seen people use moth balls. I have seen people urinate around their cars. I have seen people trying ammonia or bear spray on their cars. I hadn't seen anything that really keeps bears out of cars if there is food inside. It is not uncommon for bears to break into a car and dig through a back seat to get into the trunk for a can of food. So, I don't think we should be surprised that a bear can smell food inside of a refrigerator as it passes by a house. Bears know that homes have food. There is residual smells. I don't care how clean your house is. I also don't think there is any such thing as a bear proof structure, or car, or dumpster. Bears will eventually learn to figure things out. I will stop there for now.

(Holmstol) - I agree with you Jen, there are a lot of smart bears in communities, we have the same problems in Whistler. I think one of the problems in Whistler, it's one of my theories, is that we have made things a little worse for some of the bears. We tend to justify things; by saying oh the bear broke into this, maybe if we just add a little grate here then it will prevent the bear from doing that. Then the bear figures out the grate and I wonder sometimes if we are teaching the bears how to figure out our contraptions. If we made more of a leap from things that are really dirty rather than gradually bear proofing, if we put a lot of effort in right at the start to go from this bear proof to this bear proof, rather than gradually bear proofing as is sometimes necessary because of budgets, we might be a lot more successful.

(Comment) - I think you have a good point there and one of the things that I wanted to add is what is this aversive conditioning doing and what is your goal. If it is a small case, are you trying to keep bears away? I have heard that being suggested for Aspen and I think it is not going to succeed because you are never going to keep bears away from Aspen as long as you have the natural bear habitat that you have there. So, the next question is well what the root of the problem? Sometimes there could be a problem there that needs to get that aversive conditioning but again a lot of the time the problem is food sources, and that is what we need to go after.

(Comment) - I would like to get back to John's question and talk about when removal is warranted. I think the Federal is probably different than the State, I am not sure about that but I would like to talk about it. Maybe we can get John to use his dual bat and take down some of the things that some of these agency folks think are activities that lead to removal, like day active versus night active. Is that something that we all consider? What is the bear's reaction when you approach? Does it only leave after you get out and fire off a couple cracker shells? Does it leave immediately when the vehicle approaches? All of those things are behavioral things that I think we all should be using. How far from cover are they? How old were they in their movement into where the people are? I think this would be a good thing to talk about and what are all of these factors that lead up to this two or three strike policy?

(Comment) - One thing I wanted to say, not as an agency person but as an NGO, is that I think it's becoming striking to me is that at times the pendulum swings too far to one side or the other and I think in cases you see where the public gets more concerned with an individual instead of the entire population. I think that if wildlife managers and the folks in agencies are focused on wildlife management from the population level, I think that is something maybe we can do a better job in trying to educate the public that the population is really important as well.

(Comment) - I think the emphasis on conservation of bears in an area is crucial and from my standpoint I do think the pendulum does swing back and forth. Personally, having spent decades chasing bears and harassing them. I remember in the old days we used to think, oh we just need a projectile that would hit them harder and inflict more pain but you know there are problems with penetration. That wasn't the key. Finesse is more important than throwing marbles and things. There are a lot of other aspects other than the context and timing and things but I think there are some situations where we are getting enough of a track record that we know where a high proportion of animals reach a certain stage and what I would call incorrigible. One of the criteria I would use for lethal control is a bear that physically breaks into a building, knocks down the door, rips out a window, gets into a dwelling and gets into food. There may be an occasional bear in a bad food year that does it one time and otherwise is great, but I think if you have a male black bear in a situation like that and does it I honestly believe that that bear has reached a point where there is not a heck of a lot we can do assuming that there is now a 100% compliance with garbage and all of the other stuff and that sooner or later that bear is dead anyway. It is just a matter of whether that bears breaks into 10, 12 or 15 houses before we do it. God forbid that someone gets injured. I think that as wildlife managers the burden is on us. I like bears just about as much or more than everybody in this room, but as a biologist, death occurs in nature too and interfaced with bears and people there is never going to be a time where we have non-lethal bear management where there isn't going to be a need to take some bears out of the population. It is a tragedy in some of these situations. If I was working in the Pyrenees it is one thing, you have got the last handful of grizzly bears there, but if you have got a reasonable population of hundreds of animals in an area, I think with a long term best interest of conservation sometimes is taking out some real problem individuals that are causing a lot of problems. One of the criteria I really would use is I would love to prevent it, and keep as many animals as possible from getting to the point where they are breaking into a house. But if they do something like that and get a food reward, you know if I am a manager in that area, I would kick the bear out and I would be willing to take the consequences and argue with anybody that disagrees with me that that's not a good thing to do.

(Lackey) - I want to agree with you. I would actually agree with both you and John. This is something we have talked about and discussed. That has pretty much been our policy over the last 10 years, even before it was a written policy; it was a policy that we followed. I call them bears that are aggressively seeking human foods. When they start breaking into homes and breaking into cars that is a bear that needs to be removed from the system. A lot of people fail to realize that as an agency representative if I know I have a bear that has broken into a home and I catch it and release it the liability on me personally and on my agency is huge. We have seen it time and again in states like Arizona. We almost saw it last year in Utah; a little bit different type situation, but a bear that had been reported and/or handled, the same thing in Arizona, and the liability on the agency came into question or was challenged. And of course, there are a lot of different aspects to that. There are different things that we need to look at, a lot of things leading up to that behavior. Our policy actually states that there are several things that, whether singly or combined, can lead to taking the bear out of the system; daytime active, aggressive behavior towards people, entering a structure, etc. It could be one or it could be all of those things. A lot of that responsibility is left to the person in the field, which I think is good. The other thing I want to comment on is

John's thing; a lot of people really need to look at the big picture. If you were to remove one bear from the system does that really have an impact on the population? In a place like Nevada it is obviously going to have more of an impact than a place like California where you have 100 times the number of bears. But still even in Nevada what is the impact equal out to be on that population? Probably not significant at all. Now, I am not talking about the value of the life of the bear, obviously we all like bears, we all like wildlife, that is why we are doing what we are doing. The value of that animal is important to all of us, the value of the life of the animal. I am just talking about the impact of removing that bear from the system.

(Beausoleil) - Carl, I agree with you and I think one of the things that agency people need to do is, if we are going to handle that animal and relocate it, is we have got to mark the animals. We have got to start thinking about some kind of data storage area where we can all access this data and find out if it works. What are the behaviors associated with a successful relocation and what are the behaviors associated with a non-successful relocation? John brought it up earlier, what defines success? I don't know, for me it is probably a within-year repeat "offense". If it doesn't happen again that year for me it is a success. If we don't see that bear until the following year I think that is a bear that we might be able to give the three strike rule to. I don't know how other states are doing it, but from our survey only about half of the states are marking bears. We need to be more consistent in marking bears and seeing if this capture relocation, aversive conditioning, and all of the other things we are doing work. The only way we are going to find that out is if the animals are marked and we maintain a database. And wouldn't it be nice if we had it all centralized where we could all access it and make better decisions.

(Comment) - This is Steve and I am with a fish and game agency perspective. One of the things that we have difficulty with is agreeing among ourselves what constitutes a strike. The reality is there is a lot of field interpretation that is required in making the determinations of whether or not it was really a strike. And as far as behavior characteristics, for years I have been listening to the same discussions. But the bottom line is daytime activity may not matter. From what we saw from Chuck Schwartz's presentation today bears are very active. Maybe there is a new bear coming into the area that was just exploring during the daytime and not a highly habituated, it's foraging naturally. We just got done writing a conflict policy for the state and we have the three strike policy. But we made it very clear that that was to be interpreted at the field. Secondly, regarding marking, I noticed there are some game wardens in the back is that right? Do you like being told what to do at every field situation? We all realize that those guys that are going out and picking up bears at 10:30 at night or whatever, to get a bear out of a trap, they are not going to drug it and mark it and put an ear tag in it. They are going to haul it away from there and turn it loose somewhere safe. As a manager, I would like to be able to to tell people in our agency what to do and have them do it, just like anybody, but that is never the case, you just can't do that. Policies are there to protect the agencies and provide guidelines but the guys like Mark over here have been doing this long enough to know that every situation might be different and requires the person in the field to make the decision. All I am saying is that you write a list of things, you know daytime, nighttime, three strikes or whatever, we have all been doing this for a long time and it gets down to understanding the situation in the field and making the decision there and doing the best we can. Regarding Dr. Breck and education, we have been trying, trying and trying with very limited success, mostly because you have to agree with what you are being educated. Obviously, there is going to be some people, no matter how much you educate them, that are going to disagree. They will think that they shouldn't be told what to do on their own private property and they just don't care about it. So, the educational aspect is very good for those people that want to be educated; that might be a hint to listening to what your message is, otherwise there will always be a failure rate to education. Expecting 100% success, no matter how good your program is, or even how good your enforcement is, is

unattainable. We have very good enforcement of our fish and game laws but we still have people breaking the laws. That doesn't mean that we shouldn't try, but to expect 100% success is not appropriate.

(Hechtel) - Steve I appreciate that, those are excellent comments and I think if we all did something together and formed a plan, daytime active and downtown Reno is a whole lot different activity for a bear than daytime active feeding on berries in the back country. If I draw up those terms and I send it to all of the agencies we could fine tune that to a level where we were all saying the same thing. As far as the game wardens go, in my state anyway, it was a huge separation between wildlife and the enforcement officers, but what I had found out real quick is when you give them information and you don't just ask them to do something without giving them results of what they did these guys love it; now they put me on speed dial, which is great. The calls should be made in the field, I agree with that 100%. Wouldn't it be nice if they were making calls based on science and based on data and results and they could make that decision at strike one that that bear is just a waste of time and it will be right back at 2:00 in the morning a week from Friday; then you are going to get called out again to re-respond to the problem. So, you made excellent points and they just need to be finessed a little bit, and with all of the minds that we have in here if we could somehow collaborate on an intra-state protocol for doing so. Diana, we have another project for you by the way. But, I know what you are saying and I think there is a solution at the end of the road.

(Ann Bryant-Bear League) - I would like to offer another perspective. We really need to look at the broad picture. Most of us who are living among bears, like Lake Tahoe, Aspen, and Mammoth, are very privileged. And if all we have to deal with is a bear breaking a window, breaking into our car, we don't know how lucky we are. We could live somewhere where you have to deal with people breaking into your home and then raping or murdering you, being mugged on the street. We could live in a war zone for Pete's sake. Let's put things in perspective. Is it that big of a deal, I mean can't we learn to live with our wildlife. We could be facing much graver problems. We are so privileged.

(Comment) - I think the bottom line is cost/benefit analysis on whether does it work and what do I do on the first strike; is it more effective to remove that bear or try and give it a chance. Does education work? Or any other means of management whether it is managing bears or managing people and I think that is the key. Gathering more data and trying to do more analysis so we can infer just beyond the little study in Aspen, or wherever, I think that is the bottom line really, cost/benefit/analysis.

(Seher) - In Yosemite we do not have a three strikes policy. I think bears are individuals, every situation is different and I think you have to manage that way. We have bears that will break into cars, but the way we look at it is that there is no reason for people to store food inside their vehicle; we have lockers available. So, if a bear breaks into a car and it has food we are not going to remove the bear from the population for that reason. However, just a few weeks ago we had an injury occur in a campground where a bear approached an occupied site and aggressively swiped at a person and injured them pretty badly. We are not going to give three strikes for a bear like that; that is a bear we have to take immediate action on. But, we are also very careful in marking our bears. We know for the most part which bears are causing what incidents. I also think you have to look at every situation. For bears breaking into homes, I agree with you that if a bear is breaking down a door that is a one strike, however, you have to look at the situation and can that bear be moved, has it done it before, have you ever seen the bear before, is it marked, can you possibly try aversive conditioning for a week and see if it does anything. We have shown that for highly food conditioned bears aversive conditioning does not work very well but if it is a bear that is not from the area, it came in from outside the park, maybe it would work so I think you have to look at each situation.

(Comment) - I have a question for the panel. Unfortunately, I am going to contribute to the

fact that the discussion is kind of jumping around a lot but it's something that has come up a lot today. In fact, I have counted the words successful program 14 times (14 different people) and I am just interested if you could have folks from the panel sort of give their synopsis of what a successful human bear management program is. I think that commonly in human/bear management we have all of these terms that we use and we throw them around like crazy but we really don't have solid definitions that are sort of accepted across agencies and stuff like that. I think one of them is success and it has come up as a topic for John and I would just like to take a few moments, I think it would be very insightful for folks in the audience to hear what different agencies success is.

(Beckmann) - I guess I can take a stab not being an agency person, but I am one of those bears that you would have to do over and over again. From my perspective, and this is just me so representing myself, a successful program to me would be where you have people on the landscape and also bears; you would have ecologically functioning populations of bears in those areas. That doesn't mean that you will have complete elimination of conflicts, that wouldn't be reality, but you would have some combination of people doing their activities and being part of the landscape and part of the ecosystem, and at the same time ecologically functioning bear populations.

(Comment) - Can I expand on that further, back to what Stewart was saying earlier? How is that valuable? How do you value that? How do you evaluate different methods and how do you decide what is a better strategy or what is a better method? I think that is really lacking in human/bear management.

(Beausoleil) - Yes, it definitely is, but I don't have that answer 100%. I know the aspects that make up a successful bear management program. I mean, we are at a conference on making management more successful right now, but there is no way I can summarize this meeting that in a statement to you right now, it is just impossible. But, it's like John said, how do we monitor success of the decisions we make? My agency does it through the game management plan process; we put the plan through public review in Washington by holding 16 public meetings throughout the state every three years. We give people questionnaires, all broken up into sections by species, and they tell us what they like and what they don't like. We also record verbal statements, like we are recording right this conference right now, every word that they say goes into a giant document and every wildlife biologist in Washington gets an electronic copy. So, we look at it, and we review it, and make changes and move on, but there is no end in sight to the process. There is no light at the end of the tunnel because people influence the management. It is dynamic, and it always should be a living document, it is never going to be perfect.

(Seher) - I think one way to measure success, at least in the Yellowstone area, is we took a bear population that was critically low, we managed mortality, a lot of that which was occurring because of conflicts with humans, and we reduced that level of mortality to the point where the population was allowed to respond and is currently increasing; probably at capacity or near capacity. So, I think there is lots of ways to measure success. But, that is certainly an example of a conflict management program that resulted in something measurable in success and that was the recovery of the Yellowstone bear population.

(Holmstol) - I think it could be one of the ways to measure success because different groups are going to have different definitions of success. In Whistler we have what we call the Black Bear Working Group and it is a bunch of different stakeholders from municipality, local agency, and local non-profit group. We all get together once a month and talk about a lot of these problems and I think if each user group or stakeholder is allowed to present one or two, as Sharon talked about, dependent variables they would define it as success. You can kind of track these trends, and I think overall success might be where everybody is happy about having their say and having some impact going into what their definition of success is; and that

vastly different user groups working together in order to define where human-bear management is going.

(Hechtel) - Okay, I am going to go back a little bit if it is okay to hopefully get the thought out more about when bears need to be removed. Like an ant colony, we all think alike, but if you go to other colonies they think differently. I think one of the real important facts that you need to consider in this discussion is we spend a lot of time thinking we should get other people to think like we do. Again, I am all for preservation of bears, but like everybody else in here, I think one of the things that we really have got to work into our thought process is that we are not going to convince everybody to think like we do. If we try to convince people to think like we do a lot of times we irritate them even more. We have got to realize that there is a lot of other thought processes out there and you can try to give them the information, and hopefully they will change their minds, but we should not get too frustrated if they don't and find ways to address those issues. I am not talking about areas where we have low bear populations and we are trying to reestablish bear populations, but where we have healthy bear populations. If we stick to a three strike type rule before we eliminate bears, we will lose our ability to reduce bear numbers when we want to, In addition to biological carrying capacity, I also firmly believe there is a social carrying capacity for bears in some areas; again, this is areas with healthy bear populations. I hope I made that point the way I wanted to. I haven't seen any chairs thrown at me so it must be alright.

(Unknown speaker) - Just real quick because I didn't get a chance to address the strike policy and when I have an opinion I damn sure want everyone to hear it. Anyway I am with Tori and Nadeau, I don't like strike policies, I don't know how you could write one with all of the variables involved in a human bear conflict. The thing would look like Chris Servheen's flow charts from our mortality committee meeting. Anyway those of you who were involved in that know exactly what I am talking about. I think there is so much variation in cause and severity of each conflict, and individual's behavior within the bear population regarding a strike policy. I am going to pick on Rich for a second, a bear in Reno in the daylight maybe a bear that wandered into Reno under the cover of darkness thinking he was following a nice riparian area and the sun came up and he found himself in the middle of Reno. That bear is doing nothing probably but trying to get back out of town. If you have staff that are experienced and well trained, and can use good judgment, I think that is the optimal situation to get yourself into. But saying that to some of the NGO's and other folks here that may mean the bears removed on the first strike, the first incident. If they use their judgment and say this bear is dangerous to the public, or it is highly destructive, it is sick, it is injured, it has no teeth, it is 25 years old, it needs to go, it may go on the first incident. I think that is just something that the folks need to know as well. I agree we should hesitate to remove bears that we think need to be removed and I would even throw out that we may want to manage bears maybe a little more commensurate with the carrying capacity of their wild land habitat so that, in some situations anyway, we are not forcing them into sub optimal areas where we know that removal and conflict are just going to be constant. So, I am sure that is a controversial statement to make but I think that needs to be discussed at some point anyway.

(Beausoleil) – Real quick, I wasn't saying that a day active bear always needs to be removed. I was saying that a day active bear around people should raise your level of concern regarding removal.

(Unknown speaker) - I just wanted to question you guys a little bit about factors of communication. I go to UNR and was born and raised in Reno. I know about bears and I found Carl Lackey and I love it. I love wildlife out here, but I happen to also work at a retail store where I work with people who drive down from Tahoe and they have no idea what to do around bears. There are groups, like you guys have Bear League, and you are great for getting that information out there, but sometimes it is not the best suggestions. I had someone come in and ask me if they should just throw their garbage across the way so that bears don't enter their

yard. I mean, somebody told them that. What is the agencies communication between actually knowing which methods are working and how do you get that out to people who are having these issues? How can you make that more available in the pamphlets, which I think is a great idea, but how do we make it more accessible? Do we send people that are going to these conferences, students like us, volunteers, or people that go out with Carl and have a little bit more knowledge, and say to them I think throwing the garbage across the street is not a good idea, but here is another easy method that seems to be working.

(Beckmann) - I will take a stab at that. I guess from my perspective one of the things that I would say is that this is where a system can work together, so I don't think the onus should always be on agencies. I think that that is the role that WCS and non-profits can play, but having said that the counteract would be that there needs to be quality control of the information that is going out there. So, one of the ways that can work is that we have agencies and trained wildlife professionals review the information that is going out there to make sure that is accurate information. I think to put that onus completely on the agencies for the education and the dissemination of the information, I think, would be a mistake.

(Bryant) - The Bear League doesn't tell anybody to throw their garbage in their neighbor's yard.

(Kevin Lansford) - I just wanted to say in a place like Reno, you cannot bear proof Reno; it is not going to happen. What you can do is you can reduce the amount of conflicts to a tolerable level and then once you get it to that level then you decide how you are going to deal with those conflict bears. So, even if your message is a fed bear is a dead bear, put all of your garbage in a lock container, there is still going to be bears. And Mr. Beckman is exactly right, anybody can look out the window over here and there is going to be bears, so there is always going to be a level of conflict. How you deal with that level of conflict and come from a coordinated research approach on how to deal with effectively manage problems bears? If you reduce the problem then you manage what is left of the problem bears. First of all, you have to have ordinances, and education is good, but we educate a lot of people to do a lot of things and people still do stupid things out there. Education is an aspect of the overall picture. Stewart and I worked for Wildlife Services a long time, I now work for Nevada Department of Wildlife, I have dealt with problem animals in a lot of different states and realized that Pine-Sol works for those who want it to work. They gave sugar pills to guys in World War II with legs blown off and their pain went down, because they wanted their pain to go away. Pine-Sol and moth balls work for people who want it to work so giving those kinds of suggestions to people is not a good method. It doesn't work everywhere, and applying Pine-Sol at the level to the environment that it may take to keep bears out may result in bigger issues than the bear. So, it is an effort of management to reduce the conflict to a manageable level then. When it gets to a level where it is tolerable, then you make individual decisions on the rest of the bears, and that is what it is. So, if anybody thinks that every town is going to be bear proof, it is not going to happen. There is still going to be bears that will be euthanized. There is still going to be aversion techniques that are successfully applied to certain bears. So, I guess what we need to preach is an ecologically viable population of bears and the sustainable and livable number of conflicts. That is as good as we can hope for and that is the reality.

(Unknown speaker) - I am going to sort of flip the coin a little and put the emphasis on some of the gains that can be made from trying to prohibit conflicts. We are now completing a study of seriously fatal injuries of black bears, and have similar data for grizzly bears, and if you look at how prepared people were of these contacts there is not a single incident where people were even carrying bear spray. We know that bear spray has a high level of effectiveness in situations where you really want to have bear spray. There is a little preparedness that you have to operate at in order to have people have happy experiences with bears. I want to make sure to emphasize that there is a wrong way that

we can go and must go with preparedness with bear/human conflict.

(Holmstol) - Just to follow up on that a little bit. I think you are going to get to a sustainable level where you are going to have to maintain aversive conditioning. I know in Canmore we are constantly bombarded with education programs. It is continuous, not only in the newspapers but education programs for people telling them if you are going to walk on this trail you need bear spray, here is a pamphlet. In some cases, they just walk past three signs that say bear are in the area. We are going to have to do that forever if we want to maintain bears there. There is going to have to be some sort of aversive conditioning, and yes, there certainly will be problems down the road, but we are getting to the level where it is going to be, I think, at a sustainable level.

(Unknown speaker) - I would just like to ask all of you as bear professionals to think about what we could do, what you all can do, to shift the responsibility from you, from the agencies, from wildlife professionals, to the people who can prevent the problems in the first place. Because to me that is the ultimate long term goal is for people to realize that they have a responsibility if they are going to live in bear country. They have a responsibility to do what is expected of them to try and prevent conflicts, to coexist with the wildlife. It doesn't mean there aren't going to be any conflicts. It doesn't mean there aren't going to be bears that need to be removed from the population, but one of the things I found in talking to so many people and so many agency people is you unconsciously put the responsibility on yourself and on the bears. It is not really a nuisance bear or a problem bear, it is people who have created problems and now the bear is going to pay. Of course, the bear is behaving in a way that it is going to have to be removed or have action taken on it. We were talking about individuals versus populations, the fact that people think about bears as individuals is something that can be used. I don't really think it is something you are going to change but it can be something that can be used to motivate them to behave in the ways that you want them to behave in. Now, if they care about and doing the right thing so the bears in my neighborhood will have a better chance of living that is good for the population as a whole. You know, they are not going to think like biologists but if they think I am doing the right thing, or my neighbor is doing the wrong thing, and I am going to rat on him because they are going to get that bear in trouble, that's good. And they should know when bears are destroyed, in most cases the bear just sort of disappears off the face of the earth in the middle of the night and most of the time nobody even knows. But, many places in our country when a bear is destroyed, you will see people say that is enough, we were responsible for that, we need to do something to prevent this from happening. Most bears that are euthanized are being destroyed needlessly. They are being destroyed because people turned them into problems. If you can just start to think about how can I put that back on the people, somewhere down the road thing attitudes will change. With people it will become expected behavior instead of occasional behavior. It is just like we were talking before the break, 25 years ago if we had all been sitting in this meeting half of you would be smoking; nobody would do that now. Half of the people would have gone outside and tossed all of your trash out somewhere, nobody was recycling. You think about all of the things that have changed over the years, we just have to believe right now you guys are all part of that change. I guess, I just really feel it is so important because you are the beginning and if you can get people to think about the bears, the animals and the wildlife that they coexist with it is their responsibility, not yours, maybe someday people will stop calling up and say come get your bear.

(Unknown speaker) - I think part of the problem we have seen with that in the few places that I have worked is we talk about this disconnect in government, and within and amongst departments in the same government. Generally, at least where I live in Canada, the municipality has the responsibility of garbage management and the province has the responsibility of bear management. So there is this finger pointing of the municipalities saying the problem is the bears and the province saying the problem is the garbage. People are starting

to recognize more and more that the garbage is a lot of the problem and we need to address this at the municipality level. But getting some of that buy in at the municipality level seems to be one of the real road blocks to improving that situation. I guess, I heard a little bit about how they have had success with that in Juno. I am wondering if anyone else has had success in getting those governments to work together both financially and in spirit in order to solve some of the bigger issue.

(Unknown speaker) - I just had a question concerning preventing future problem bears and orphaning cubs. I was wondering what the panel's feeling is on these bear rehab facilities who claim to take orphan cubs, rehab them up until a certain age, and then they deliver back to the state to release; is there any hard data that says these bears actually live or how long? Or are we just creating another problem there?

(Seher) - Yosemite has rehabbed six bear cubs, five of those bears were cubs of mothers that we had to kill for being aggressive. They were sent to rehab in June and brought back in the winter, placed in a den and all five of them had radio collars. We know that all five survived the winter and survived at least the early part of the spring. We had one bear that kept the collar on through the summer so we know that it survived the full year. The rest of the bears dropped their radio collars so we don't actually know what happened. They were tagged and they did not show up in any developed areas inside the park. We usually know about bears that leave the park, usually fish and game calls us, and we did not hear anything about those bears. We are usually notified when a hunter takes a tagged bear and we were not notified that that happened. Last year, we did place one cub into rehab, the mother was hit and killed by a car. It was the first bear that we would say it was a truly wild bear. We had never seen this bear before and its mother, untagged, was not near any developed area. We brought the cub back and placed it in a den and it came out of its den right away and traveled to one of our facilities where it decided to den underneath the building. Just last week this bear came back to the facility and got inside the building and we have pictures of it standing on a table. Small sample size but I would say these cubs that we put into rehab did ok. It was a surprise to us.

(Nadeau) - Idaho has had a pretty active rehab program. It is not actually the fish and game program, they are just rehab facilities that fish and game has been working with. John Beecham, who was the bear manager for fish and game for a number of years, helped facilitate that and we have a fairly active rehab program where we get orphan cubs from not only from Idaho, we get orphan cubs from outside the state as well. With a proper veterinary check from us they are sent back and released into Idaho or the other states. There has been a pretty high success rate of it. They radio collar these yearlings and what we call success is if they don't get recaptured or do something stupid. If they are shot that is a success. If you never heard from that bear again that is a success. But if they are picked up for panhandling that is not a success. As far as I know it, I talked to Jeff Goldman, who is a biologist who is kind of overseeing that here, and he said that they have only really had one bear that was a problem. Unlike the park service scenario, our scenario is orphan cubs from hunting, wild bears that haven't had those sorts of habituation or food conditioning problems. Our concern has always been that the facilities actually foster bad behavior through feeding the bears to get them up to weight before they put them in the dens and evidently they do a good enough job that that hasn't really been a problem. Fish and Game does not fully support those activities but they do buy licenses and so forth. As far as I know it is fairly successful, particularly socially. A lot of the states want to get rid of their cubs rather than kill them. We have actually looked into the possibility, and I think there is a couple of facilities in D.C., you might be aware of, of looking at rehabbing grizzly bear cubs to put back out into the wild and Idaho.

(Unknown speaker) - I think there is a reasonably good track record for rehabbing cubs. I think there are bigger issues. The problem I have with it, and it is probably not going to go over well with some people, is the amount of time and energy we are spending on a couple of

individual bears, especially when we know a lot of these cases 30% mortality in cubs is fairly common. I guess what bothers me about it is you get a little orphan cub, and you show it to a bunch of people, and they will give you money and they will contribute and do all sorts of stuff. Try to talk to those same people about supporting bear resistant dumpsters in communities and things like that and they will yawn, they will walk away and they won't care. The concept of long term benefits they can do for bears by bear proof garbage cans or dumpsters, vs rehabbing a cub and putting it out in the wild and spending thousands of dollars to help that individual bear in areas where there is thousands of bears and lots of cubs dying every year, to me, it is sort of misdirected. It is kind of playing into this whole concept again of what I think is a disconnect that a lot of people who care about bears feel for nature. You say that you really think it is a privilege to have your car broken into by a bear, or that you lives in a place like that? As a member of an agency I have got just as many people on the other side, regardless of what we do we have got a certain proportion of the people who are going to be unhappy with what we do when it comes to managing bears. Trying to find some kind of a balance and getting back to the question about success, what is a successful bear/human conflict program? I think thriving healthy bear populations. I agree that we are not going to eliminate conflicts but minimizing them to the degree that we can, on the prevention side of things, find ways to deal with the ones that occur. But, I think we have to be realistic with people when we talk about what is going on in nature. Other biologists that have studied bears for decades have seen bears kill each other and bear cubs orphaned and killed by other bears and all sorts of stuff like that. When we end up with a cub that happens to come to our attention, the concept that I can't take that to a vet and have it humanely put down the way we could do with a puppy or a cat is lost. To be perfectly honest, I fought rehab in Alaska for a long time. But, if people had overruled me and said we don't care what you say there will be a bear rehab program in Alaska, I would have probably volunteered to be a rehabber because I like bears. I have dealt with orphan cubs and I think there is a lot to be learned. I think that it does frustrate me to a degree that we are so taken in by a little fuzzy cub that we can spend a lot of time and energy on that when we could, I feel, devote our energy to other things. I think that you can do rehab that is not going to create a lot of problem bears.

(Unknown speaker) - I just wanted to back up to the comment a little while ago about what is being done in communities. I work for Bear Saver, we make the bear enclosures. We are in a unique position where we work with the Federal, State, Municipal and private people and everybody in between and see all of the different scenarios about what they are trying to do to reduce the conflicts and it is really pretty entertaining and interesting. Basically, there are a few models that are great, the one in Incline, what they are doing in Juno with the ordinances, are two I can think of, and Tahoe worked great. A good model is Vail, Colorado because we spent a lot of time there. The ordinance was so good we put it on the website for other people to copy and it actually works. It is really the only one that I have seen that works consistently, and I think the ticket is more than just the container, its ordinances too. Vail devoted a whole year to let people know this was coming. On trash day, the people that didn't have containers had little yellow things telling them to get them now, because we will enforce this. It really got people thinking in the community to where they put pressure on the municipality themselves to get bear resistant containers all throughout the city, which it just works all the way around. It works but it is hard to get people to do it. You have got to tell them they have to pay $150.00 for a container instead of $60.00 for one that is not bear resistant. It is just a lot of money; they can do it $6.00 a month for three years or buy it all up front. Whatever way it's done, the municipality and the trash haulers cannot being stuck with the expense. That is what stops everything, because nobody wants to pay for it. If there is an ordinance, it puts it on the community and spreads it out.

(Beausoleil) - I wanted to ask you a quick question. One of the road blocks that we have run into in the past is that the waste

management's collection equipment was not compatible with the device. Has that changed?

(Unknown speaker) - It is a moving target. Most people use front load dumpsters, rear load is kind of the old school kind, we are not doing those, although you can get them. The carts, the poly carts, the kipper carts, whatever you want to call them, those are the main challenge. These guys want to move to automated systems and they want to take the man power out and I don't blame them. It costs a lot of money to dump these things at every house. So, we finally came up with one that is in testing mode now, but it is a constant moving target. The equipment never matches the solution but you have to cover all bases and make something more generic, which is what we are doing. I am not a biologist, I am an engineer, it is great listening to all of this but we have to take everything that we learn from you and make it work in the real world. We are good listeners but it is always a challenge because the next level up from presenting something to the customer is getting through to waste management companies because they always have some obscure piece of equipment that dumps it and you kind of have to adjust to them and you have to offer enough variety so it fits all applications. We pretty much have it all covered by now but it is that automated system that is going to really change things.

(Holley) - One more comment. From a California perspective we have what I would call a successful cub rehab program. It is successful in that the majority of the bear cubs that go through and spend a winter in a rehab facility and then are released seem to become wild, normal bears. We don't end up with them much the way that Tori was describing. We either don't see of them in the future or know of any problems associated with the situation. We actually take some steps prior to placing the animal to try and eliminate those that would potentially be poor candidates. The whole notion of cub rehab from a population ecologist perspective is a difficult one to wrap your mind around and I am sure that for we ecologists to look at that kind of concept as a hard one because it is such a small portion of the population relative to natural mortality and the way that things are actually occurring out in the real world. Much is the same, I think, for trying to evaluate whether or not you have a successful program or human conflict with bears, bear/human conflicts. From the resource perspective having enough bears that they are doing well, populations are stable or growing and they are filling habitat that is available that is the important thing. That is the perspective that I come from first, but I think the important thing about the conflict is that the perception of the public; and the public is the one I think that has to be able to make the calls to whether it is successful. I think you do that through surveys and I think you do that through acceptance. When the public feels that you have an acceptable level then you can claim it as a success. We provide information and for the people that look for it. They can find similar information either through Bear League, our program is called Keep Me Wild. I am trying to teach everybody this but for people that really want the information they can find it and I think they get information that seems often times very simple but people just don't get the connection.

(Unknown speaker) - John, can I say one thing on that before… On the orphan cub stuff, I think that is an area where we need more research. I think it would be nice to have some research, so that is a hint to some of you students out there. I think Mother Nature will raise some of these cubs if we had better information on what cub survival was like, based on maybe the weight, habitat conditions, time of year, whatever, we may be able to just turn them right back in the wild. But we have certainly had bears or cubs that were orphaned as cubs a year ago show up the following year and years after that, so maybe Mother Nature can raise a whole bunch of these.

(Hechtel) - I thank everybody for coming and participating and obviously we are not all going to agree on everything.

MONITORING BEAR POPULATIONS WITH GENETIC SAMPLING
Workshop Chair – Kate Kendall, U.S. Geological Survey

Kendall, K.C., Northern Divide Project, USGS, West Glacier, MT, 59936 USA, kkendall@usgs.gov
Stetz, J.B., Northern Divide Project, University of Montana, Missoula, MT, USA, jstetz@usgs.gov
Macleod, A.C., Northern Divide Project, University of Montana, Missoula, MT, USA, amacleod@usgs.gov

Summary: 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 provide recommendations for designing, conducting and managing DNA-based hair sampling studies to estimate bear population abundance, trend, and genetic structure. We emphasized five areas of special concern: planning, training, field work quality control, data and sample management, and analytical quality control. We outlined quality assurance measures for field, office and laboratory work. Protocols such as using bar codes to track and enter field sample numbers, integrated database error checking queries, and use of GIS to identify suspicious results help minimize sources of error. Custom maps and pre-programmed GPS units help field personnel adhere to study protocols.

Western Black Bear Workshop 10:172-189

Transcript

(Kate Kendall) - The intent of this workshop was to help anybody that is going to plan one of these hair snaring studies for bears to avoid some of the problems that we had since we learned the hard way over the course of doing basically five years of these studies; an earlier project, the one I talked about this morning, as well as this really big one. First of all, I want to acknowledge the other people on my staff that helped put this together. This is actually taken from a similar workshop that we did at the IBA Conference in Monterey, Mexico a year and a half ago. So Jeff Stetz and Amy McCloud were instrumental in putting these materials together too.

A lot of the recommendations that I will talk about today is based on our experience in this huge bear project. I guess I just want to say that I think that most of the things that I will be talking about are still applicable for smaller scale studies and for other bear species besides grizzly bears. I do want to go over some of our challenges; having had 80 employees in 2003 on a set up year and then 230 full time employees and hundreds of volunteers in 2004. Once you are working at that scale you learn a lot of things that you should have done differently. We did string up 80 miles of barbed wire and we had crews hike in off trail through some really difficult conditions and we needed a lot of water; we made 2200 gallons of bait so we have got some recommendations on the best way to go about that. We had a lot of data entry despite the fact that we had these bar code labels for all of the sampling numbers.

I am going to start out by talking about lessons we learned in planning one of these projects and try to focus on things that get overlooked in literature or just aren't appropriate for scientific literature because that is not really the intent; but it can really help people in pulling off one of these things successfully. As I said, we actually have all of our field forms and protocols available to download at our FTP site and that is one of the links that is on the handout that Carl just passed out. First of all, I guess I would like to talk about getting one of these projects started and I think what happens to a lot of us is that all of the sudden you will get the go ahead and funding for one of these projects and it is going to start right away because that is when the funding is available. It really doesn't allow you adequate time to properly plan one of these things.

One of the things that I did right is that when our project was first proposed and people got serious about going after funding for it, it was in 2002 and I had a lot of pressure to go ahead and do our sampling. We only had one shot at sampling and had a lot of pressure to do it in 2003. I just really stood my ground and said, "That is not enough time to put a project of this scope successfully on the ground." So, we actually had most of 2002 to do the kind of background planning and then in 2003 we had the time to get things prepared in the field so that in 2004 we were really ready to sample. Even though it is unlikely that most of you will deal with something at this scale I would just encourage you to try to ensure that you do have an adequate amount of time to plan. One thing that we did is convene a science design workshop in the fall of 2002 and I convened experts in bear biology and oncology, statistical modeling, genetic analysis and a couple of people that had experience in huge projects. We sat down for three days and I compiled a list of all of the science questions, the design questions that I could think of that would have to be addressed in this study and we just talked about it in a room for three days. It was a great experience. In the materials that are on the FTP site is a record of that discussion, what we discussed, the pros and cons or different perspective on what we decided on and the rational for that. That provided an excellent foundation for our study plan. In USGS all study plans have to be peer reviewed and you have to document the response with comments; just like you would have to on peer reviewed journal article and I guess I would encourage you to do that. The whole peer review process is really intended to help you make your document, whether it is an article or a study plan, better. You are taking advantage of the expertise out there and it is really constructive criticism to help you improve things. I would really encourage you to do that.

Some of the issues that we addressed; you know I asked the question, "Do we really need a population estimate or is the minimum count going to be good enough for this? If we only need minimum count we can do it for a whole lot less money than a population estimate. We definitely decided that we needed an estimate of abundance with a measure of precision and information about distribution across the whole grizzly bear recovery zone for this particular process. You need to give a lot of thought about what you really need and not just do a kind of "standard study". Another question I asked is, "Do we need to sample the whole ecosystem?" I actually did an earlier hair sampling project estimating population size on the northern quarter of our study area, which is 2 million acres. We did that in 1998 and 2000. So, my question for this group is do we need to sample that again or can we just sample the other three quarters of the area? Because once again, even though I got a lot of money for this, it was a huge area to sample and we were unsure if we had enough money to do this whole area. Really, there was no real way to combine two estimates made four years apart so we really needed to sample the whole area again. I addressed a little bit in the question and answer period this morning about how precise should your estimate be.

These are really important study design questions and it is not always something that the researchers are going to know the answer to. But, usually you at least have to advise the managers on how to think about this in order to get a feel for what the answer is going to be. Sometimes it is arbitrary, but like I said we decided that the coefficient variation on this estimate had to be at least 20%, which is pretty wide. In order to be useful for the purposes, the estimate would determine whether this bear population had recovered and could be delisted. It is really hard to get precise estimates of bear populations because they are difficult to capture and sample adequately. But, we did have some information from both our earlier projects in the northern part of our study area as well as other studies, in particularly Canada, on other grizzly bear populations that allowed us to look at this other question in order to get those levels of precision; how intensively we had to sample. I had used an 8 by 8 kilometer grid in that earlier project and we had pretty low recapture rates and from that and these other studies that John Boulanger had summarized in an analysis, and it was published in the journal *Ursus*, it was pretty clear that we could expect to get less than a 20% CV with a 6 by 6 kilometer grid and slightly

over that with a 7 kilometer grid. So, initially I said that we want to do a 5 or 6 kilometer grid but we didn't have enough money to do that. So, we settled on a 7 kilometer grid hoping that we could improve our recapture rates by using more lure. We used 3 liters per site on this new project compared to one on the early one. We also wanted to try to do a better job with site selection.

Another design issue is how many sample indications are you going to have? You know, you have to have at least three to do mark-recapture estimates but the more you do the better off you are. We would have liked to have done five but we couldn't afford to do that so we settled on four. It is also good before you start to really explore how you are going to use your data to estimate your population size, and what kind of models are out there, and what you want to use. I did consult early on with some authors and we decided we were going to use the Huggins-Pledger closed population model. We needed to do a closed model because we were only sampling one year; we couldn't use a robust model. There was a question about how the funding was going to flow to us over the period of the study and initially it looked like we were not going to have money for the genetic analysis until the following year; I had concerns about that because the fresher the sample is the higher the genotype success rate. But, we actually got additional funding so that we could start the genetic analysis the year that we collected the samples. If you are keeping the samples dry and treating them well this isn't a huge issue but when you have so much money invested in a project like we did you really want to maximize those genotype and success rates and so it is worth considering when you can start the analysis. It is pretty clear from the Canadian work, and comparisons we have done with that, that accessing remote sites with helicopters, having fewer people that can just zip out to these sites, plop down nearby in a helicopter and throw that out and then go to the next site, is a cheaper way to go. Even though you are spending money on flight time you are spending a lot less staff time doing that. So, it is less expensive but in our area we had approximately 35% of the study area that was designated wilderness, where using helicopters wasn't an option. Instead of trying to do a little bit by helicopter, we just opted to do the whole thing on foot and access the sites that way. It depends on whether you have got landing sites, what kind of regulations are in force, but that is another consideration for areas that are really remote. Some of our sites were 30 miles from the closest road. By far the vast amount of personnel time was spent heading to a site, not on constructing a hair trap or collecting hair.

Another decision that I addressed in our science design workshop was whether we were just going to put out a grid of hair traps or whether we were also going to sample at the sites that I had defined in and around Glacier. The reason that we decided to include them, actually there were several reasons, one is that we increased the estimate of precision because we had better sample coverage. If you are sampling in a different way, it provides an alternate means of estimating population size in case one or more of your hair trap sessions fail. A potential example of something that could happen is that in 2003 we had a huge fire year, very dry conditions, almost half a million acres burned within my study area that year. It curtailed where we could get our field crews to in that year. Vast areas were off limits for sending our crews into due to the fire danger. If that had happened in 2004 when we were sampling that could have really caused some serious problems about getting out four hair trap sessions that were really well done. In that scenario if we hadn't been able to pull off all of our sampling sessions we could have pulled our hair trap results and then used our rub trees in a Lincoln Petersen index and had an alternate way to estimate population size. We had so much riding on one sample season it was quite risky to try to pull this off with just one sampling season. It made me feel a lot better that we had an alternate way to estimate population size should something happen. We also generally increased our minimum count of individuals by 25% by sampling on these sites. I guess it probably doesn't need to be said that your field protocols need to be driven by your study objectives. You shouldn't just do something because everybody else did it; make sure you really need to do it. I would really encourage you to make them as simple as possible. Only ask your crews to

collect the data that you absolutely need and if you know what you are going to do with it. You don't need to have them collect any data that doesn't have immediate application or isn't absolutely necessary. It really minimizes the potential for errors and variation in data if you can keep it very simple; use multiple choices where they circle the right answer. The methods that other people have used may not be the best for you and nobody had used these directory surveys before we did it in 1998 in this context; it has been a really good deal for our studies. I would encourage you to be creative. People are coming up with new methods of sampling and approaches and customizing them for a particular species or a particular area and habitat. An example of this is sampling bears along salmon spawning runs with these break-away body snares that LaVern Beier developed up in Alaska. It is a single capture technique so that you are just sampling one individual and you are not getting mixed samples on these heavily used salmon streams and it has been very effective. I encourage you to just think about how you might optimize things for your particular situation.

Genetic protocols: We did a pilot study to select a suite of markers that was not only the most variable for our population but were optimized to produce high chain typing success rates because not all markers amplify as well as others; some work better for some populations than others. Some labs have optimized certain markers in the way that make them preferable to use. If this isn't established for your area, like what are the most variable markers and the ones that work the best, do a pilot study to guide your marker selection. This is really important because if you are not using the most powerful or variable markers you will have more problems with keeping gene typing error out of your data set. I will say that our pilot study was much larger than what most people would have to do on a standard study. Thirty samples are enough to assess each marker and do a selection for your particular population. We needed to do seven loci to identify individuals but the number is dependent on the variation in your population. We also did nine additional loci so that we could look at relatedness between individuals. One consideration in selecting those additional markers was to ensure that they were the same ones used in other studies that we wanted to compare our results to and that was primarily the ones that had been done in Southern Alberta and British Columbia. Being comparable to other studies for cross study comparison is also a consideration.

I think in any study, of course, good communication with your partners is necessary and really important for getting good cooperation. It is also important to let the public know what the study was about to get their cooperation because we needed written permission from each individual landowner to work on their property. I was actually apprehensive about this but pleasantly surprised that virtually no one denied us access. They wanted us to sample on their property and really cooperated with the hundreds of private landowners that we contacted about this. We spent tons and tons of time going through very elaborate detail budget projections because I needed to let the congressional staff know how much money we needed to do this project and we needed very realistic defensible numbers that would ensure that we could do the job that we were promising to do and not be padded or in any way inflated because that would have compromised our ability to get the job done at all, or get the money at all. We tried, and it is difficult to do this, to decide how many cells can one crew cover? It is certainly different when you have front country access versus thirty miles from the closest road with varying terrain. But, we have in the materials on the FTP site a budget template that should help guide you through this process, not only in personnel costs but also to project the genetic analysis costs, what things to consider, in our case we had to not only have the hair split and DNA extracted and amplified we had to do our first locus that we analyzed was for species because we needed to exclude the black bears because we only had money to genotype the grizzly bears. At each stage we provided information on what the dropout rate was, how much the sample decreased once you looked for follicles and decided whether the sample was big enough to extract DNA from and what the genotyping success rate was at each stage. Hopefully, that

will help you project costs for undertaking something like this.

Also, I guess here are a few more tips for planning for the unexpected. Vehicle damages - we had $35,000.00 in vehicle damages in 2004 that we had to pay for with the rental company and actually that was kind of our worst case scenario. We had actually budgeted to replace one of these trucks. Nobody totaled a truck, although it certainly could have happened. These were just damages, dents, bumps and a stolen tailgate or two and that sort of thing. But, that was out of 76 rental vehicles that we had so really a small percentage. But all of the different agencies that we worked with had different overhead rates. In year two we actually had to pay the worker comp claims from the previous year. I had never had to deal with that before so that is something that you might have to factor in.

Now I want to talk about site selection, rub tree ID, and lure. We spent months doing our site selection and we got experts for each area within our study area that were familiar with the access, bear activity patterns, and the facilities. We had GIS layers for all of the trails, campgrounds, and facilities. We also had seasonal grizzly bear habitat quality maps. We used all of those to sit down and for each cell we selected the preferred site and an alternate site for each cell, for each session, so eight sites for every one of our good cells. The reason why we wanted to do that is to do the site selection ahead of time, because we wanted to ensure consistency and how they were selected so we didn't want to leave any of these decisions up to individual field crews. They needed to go into the site that we pre-selected rather than kind of using their own judgment because everybody's judgment would be different. We had the alternate site that was a little easier to get to in case they couldn't make it to the primary site. That actually worked out really well, most crews got to the preferred site, some crews did use the alternate site, and we had virtually no people putting up sites in just some area of their own choosing.

How did we locate the bear rubs? In 2003, the year before we sampled, we had crews hike all of the trail system; 7,000 kilometers of trails. We drove roads and checked out power lines and fence lines, gate posts, all that sort of thing. We just looked for places that had bear hair and a lot of them were not real obvious. Time and time again we have gone into areas looking for rub trees or rub objects in places where people told us, but we just don't have those in our area and we find them all over the place. A lot of them are pretty subtle but they have enough hair on them that you can get a genotype off of them. It takes being focused on that when you are looking for them because they often times won't jump out at you. Literally all of the sign posts, almost without exception with the sign posts on trails and horse roads, were bitten and rubbed on by bears. I have talked to some of you that have seen this as well. I think in part it is the novelty of having something that kind of stands out in the landscape but also the creosote treatment as well as paint on objects seems to attract bears.

We used a fish lure, all liquid scent lure to attract bears to our hair trap sites; we wanted non-consumable bait. We wanted to just be able to pour it on the ground, on a pile of debris on the ground because we didn't want to have to take the time to hang something up in the tree to keep it away from bears. In the spring of 2003 we rented a barn and got one hundred 55-gallon steel drums and filled them up with fish and blood and then let it age for a year. We only took liquid off the decomposed fish, mixed it in a one to two mixture with cattle blood to make our lure and that works really, really well for both grizzly bears and black bears in our area. It probably isn't the best lure to use everywhere. There were regional differences in what bears like so you should research what works in your area. Most of you probably have already done that for live capture trapping, but for years people in our area have been using road kill deer carcasses to bait with in live capture situations and this scent lure works way better and almost all bear managers use this if they have got it available. It is just way more effective than sticking a rancid raunchy deer leg in a trap. You do want to seal it so flies can't get in because the maggots produce ammonia and that doesn't work, it isn't nearly as effective so you need to have some fly control.

We needed to make scent lure cashes in the backcountry, which meant we had to install hanging poles and we actually retrofitted some

medical supply boxes from Army Surplus to make them bear resistant; they really weren't bear proof. That is how we stored our lure in the backcountry and it worked really well, we didn't have any issues with bears getting into this stuff.

Now I want to cover just a little background on the process, for those of you who might not be familiar with the genetic analysis process. I will then talk about how you select a lab for having your samples analyzed and how do prevent errors in your genotyping. As a little background, I just wanted to outline the technical landmarks in this field because for a lot of us all of this has happened way after we got out of school and these techniques were not even dreamed of when we took genetics in college. In 1985, the polymerase chain reaction was kind of invented - PCR and what that does is clone or amplify DNA, makes more copies of DNA so you can use these tiny samples from a hair trap or rub tree with just a few hairs and you can take these minute DNA samples and make them big enough so that you can work with them and get a genotype. That was based actually on a bacterium that was taken from the hot springs in Yellowstone National Park that has an enzyme that is really stable in high temperature and so the PCR reaction actually cycles temperatures up and down. The high temperature makes the DNA unravel and then the low temperature allows it to heal and clone another two copies of it and it is this geometric increase in the copies of DNA all due to something that came out of a hot spring in Yellowstone National Park.

In 1992, microsatellite markers became available for use in wildlife and they are non-coding DNA but they are highly, highly variable and that is what allows them to reveal variation within a population, and it allows us to identify individuals. Because they are very short pieces of DNA that is what allows us to use degraded DNA. We can use stuff that has set out in the woods for two weeks or more, or a sample that has been sitting in somebody's office drawer for 5 years. As DNA degrades it breaks down into small segments but microsatellites are so small that still works.

In 1995 some Canadian researchers put out the first grid of barbed wire hair snaps to use this method of sampling in a mark-recapture population estimate. As a result of all that we can identify the individuals and sex from these little hair samples that we collect and we can use them in this mark-recapture model testing population size and it has been a real revolution, especially for bear research because bears are hard to study.

Just real quickly, I will go through the process in real simple terms. Once you have got your sample and it goes to the lab, they clip off the roots because that is where most of the DNA is; it is tissue that has adhered to the root end of the hair. Hairs that have been ripped out by the roots have a lot more tissue adhering to them than hair that was ready to shed and comes out real easily. That is why barbed wire is a good deal because it is ripping hair out. The lab extracts the DNA, amplifies it with the PCR reaction. The next step is electrophoresis, and that is passing an electrical current basically through the sample. The different sized fragments migrate at different rates so it actually allows you to measure the size of these fragments and that tells you what you have at each locus. The machines that are generally used have automated genotyping capability. They basically call the peaks in these electrophoresis runs and identify genotype, but it is always good to have a human check on whether the machine called that correctly. Then the lab will go through a number of re-analyses to try to detect incorrect genotyping error. The type of error checking and number of steps that are taken is kind of variable and can depend on how much you want to pay. The individual ID is based on the fact that at each locus or location on the chromosome you have two different copies of the genetic material, one from each parent. Bears are no different, so if we just look at two different loc sign for two different bears, we have locus A and locus B and we have got these two bears and we look and see that on locus B these two bears are identical and in fact these are bears that were at the Washington State Universities Captive Facility and they were closely related. They are homozygous, they only have one copy at locus B and they are both identical. But at locus A they are homozygous and all four alleles are different and basically that is the process you use for identifying individuals. In our population of grizzly bears

we used seven loci, which was 14 different pieces of information to identify individuals. Generally, black bears are much more genetically variable than grizzly bears and you usually don't need to have that many loci to identify individuals.

How do you select a lab? This is my personal opinion - you want to have a lab that has got experience in genotyping non-invasively collected bear hair samples. You want experience using genotyping of small samples of DNA, degraded samples of DNA and you want them to have optimized their protocols to work with the particular loci that you are working with; specifically, bear markers. You want experienced technicians conducting the work. This is something that is not cut and dry it takes experience. Every person that I know that does genotyping of this kind says that in the first year or two that they were doing it - if they ever went back and checked their results they often would have called things differently based on their years of experience. So, experience makes a huge difference. In addition, you want all of the results scrutinized by a second technician just to make sure that you're catching any potential for error. I think that those are the real keys for me. I want to have a lab that has documented their genotyping success rate and error rates and of course you would want those within acceptable levels. You want to have a lab with a track record like that and of course they should be using state of the art error control protocols. Finally, you want to make sure they have got a good track record for producing timely results. In a lot of studies whoever is funding your project expects timely results and if it takes forever to get those results back it can compromise future funding and create some bad relationships. So, it is really important to check out their credentials, and in our request for proposals for genetic analysis that was one of the things that we asked for. We asked for former clients that we could contact and interview them just like you would for a job interview. We contacted people to see how satisfied they were with the timeliness of the results as well as the accuracy.

I have already talked about doing a pilot study to see what kind of frequencies you have in your population and to optimize the power of genotyping success rate and figuring out how many loci you need to use for an individual ID. You will also need to, depending on what questions you are, be asking about population structure or relatedness that will determine how many additional loci you need to do on each individual.

The standard methods for controlling for genotyping error are using positive negative controls, re-genotyping closely related individuals, and individuals only identified once to make sure that that was not due to error. Re-genotyping closely related individuals consists of any genotype that only varies at one or two loci, so you re-genotype two samples to confirm that those are correct. Any genotype that only varies at three loci is consistent with allelic drop-out, and that is when one or more of those loci are homozygous. You want to re-genotype those because a dropout means that just by chance sampling you could miss one of the two labels at a loci and you want to confirm that really is a homozygous locus and not just that you failed to detect one of the labels. Once you get your results, plot out the locations for each individual and see if anything looks fishy. If you see something miles, miles and miles away from an individual found maybe during the same sampling period really far from where the rest of the locations are clustered, re-genotype it. It is a really good way to find errors. Actually, you can detect not just genotyping errors; you can detect other errors in your location data that way.

We are big proponents of using these bar code labels because in our first project we had a lot of problems relating our field data to our laboratory results from just by legible handwriting or transcription errors; data entry errors. One number off and you won't be able to link your genetic data to your field data and this just dramatically simplified and improved the quality of our professional life by having bar code labels. They are cheap. The bar code scanner you can get for under $100.00. It is an inexpensive way to insure quality in your data base. You should generate all of your sample labels from the database with a computer. Don't transcribe anything by hand. You are just asking for trouble. Also, discuss in advance with the lab how you are going to transfer the data. What

we did, and what I recommend, is providing the genetics lab with your field database so that they can simply dump their genetic results into your database and that seems to be best for not having any disconnects within your database. We did encounter some problems because we are on PC's and our lab was on Macs but that is relatively simple to address. But it is always good to cover that stuff in advance. I would say you should, I guess, only consider a blind sample test if your lab is kind of an unknown or your results are going to be intensely scrutinized and you know that up front. If you are going to do it, make sure you take samples from bears within your study area so that the genetic profile matches and doesn't stand out and doesn't give away the fact that it is a blind sample. I talked about some of these other things, such as getting closely related individuals. We varied the number so they would look like the field sample, so not all of our blind samples actually worked. Some of them were actually too small to actually produce a genotype but we felt that that was important in making them look real. We inserted them randomly with a random number generator to put them into the analysis stream, but make sure you keep impeccable records about which ones are test samples and which ones are your real data. A number of years ago there was a big scandal with the national lynx survey in which some of the people participating submitted what they considered a blind sample test. They didn't trust the genetic analysis of those samples and they were testing them. They took either captive animal samples or mounted animal samples and put them in sample envelopes and just conducted their own independent test. The way that it played through politicians and the media was that they were trying to make it look like there was an endangered species in these national forests to prevent development and it did enormous damage with this whole field of DNA sampling and studying populations that way. There was a lot of concern. Make sure the lab knows you are doing the test and make sure your employees understand that you are conducting this so that they have confidence that the genetic results are going to be reliable.

I am going to talk a little bit about personnel, hiring and training and that sort of thing. You want to make sure that you provide all of the tools that your crews need to be successful in the job. You know, I think that can take a lot of different forms. I am just going to talk about a few of these but one thing that we were careful to do is to really research our equipment and supplies. We looked up everything that was known about this sort of sampling from literature, expert opinion, wherever we could find information and we tested a lot of it under field conditions, not just the technology but field forms, your pencils and labels. With labels in particular, we found that the generic labels that we thought we were going to use for our sample envelopes actually didn't hold up well when it got wet and didn't stay on the envelopes. So try them out before you're sorry that you didn't because a whole batch of samples got rained on and all of the labels fell off and you had to throw the samples out. Another example is in the genetics lab the labels that they put on the tubes of extracted DNA. Our lab had once used some labels that worked fine as long as they were at room temperature and as soon as they were put in the freezer they lost all of their stick-um and sprang off of the tube.

On your field forms try to limit your narratives. They are time consuming to enter and they are difficult to analyze and interpret. You have to go back and scribe that information manually so whenever possible have multiple choice or categorical responses. Test it, go and try these forms out before you print off a couple thousand of them and send them to the people out in the field. And of course the flow of the data form should match the flow in your database and entry program. It just makes it easier to have accurate and fast data entry.

I talked about pre-selecting sites. So we have these pre-selected sites but we also made custom maps for all of them with a topographic map, and then the same thing with a photo version to help them navigate to the sites to help them get there because most of these sites are not easy to find and they were all off trail. So, these custom maps really helped. It also helps the person understand why you selected the site. It really wasn't to torture them to make them go into some awful place but there was some rational there; so it just increases the quality of

data that you end up getting. What we used, which worked really well, was on each hair sample envelope we had two bar code labels with identical numbers and that was the unique sample number. This one stayed and was permanently attached to the sample and this one was a peel off label (they are also called piggy back labels). You peel it off and stick it on the field form. You never have to worry about not getting transcription errors or not being able to read somebody's writing. We did print the number in case something happened to the code and the scanner couldn't read it, we did have the actual number there that could be entered manually. I don't think we ever had to use that alternative method. But, this was a great way to go and we used it both for our field data and for labeling the extracted DNA in the lab. It just all got scanned in and it was really slick.

We made field notebooks that had a complete description of the protocols in case our crews had a question and they were 20 miles from the trailhead and couldn't reach anybody on radio. We had examples of properly completed forms. We had contact information, both radio and cell phones and satellite phone numbers. We had copies of all of the relevant permits, which for us numbered dozens of permits because we were dealing with so many agencies and different permit requirements but they always had that with them. We also had cheat sheets for first aid, communication systems, how to use the GPS, and a checklist of equipment so that hopefully you check that off before you leave the truck so that you don't end up at the end of the trail or on top of the mountain with no pencil, or whatever.

We found that even though we expected to collect between 20,000 and 40,000 hair samples we have had to make many, many, many more sample envelopes than that because every crew had to be prepared for the maximum number of samples every time that could possibly be collected every time they went out. Otherwise, you can end up with crews out there and they have got sample envelopes but they only have 10 of them and they have 40 hair samples at a hair snag site. You don't want them improvising or trying to collect hair samples without envelopes. So, you really need to over supply your crews. It avoids a lot of lost data in the tail end even though it is time consuming and somewhat costly it is worth the investment. We felt that inspiring and training was going to be critical. We needed people that were highly motivated to be bushwhacking all over these remote areas and mountains and kind of daunting logistics. We had to find a lot of technicians and a lot of people were amazed that we could find enough well qualified people. One thing that we did was we advertised early, we started back in November. Normally people are hiring technicians in January, February or March and we felt like we needed to get ahead of the curve so we started early and we advertised really broadly and we hit a lot of these list-serves, Texas A&M, any school that specializes in wildlife programs. We got lots of well qualified applicants. You might consider trying to hire locals because then you can take advantage of their knowledge of the study area. Landowners are more familiar with the weather conditions and maybe even your study species if they have some bears in their area. We developed a website to inform our potential applicants of what exactly they were getting into. We wanted them to know that they might be living 30 miles from the closest road and not coming out all summer. That is some people's nightmare and somebody else's dream job and we wanted to try and get a good match with that. This worked as well for letting everybody know what they should bring with them and what to expect in their living accommodations and whatnot.

We spent two weeks training people and we went through, of course, the field protocols and filling out the forms and GPS protocols, how to handle the samples and what we were doing with the blind sample test. We really think that letting them know the background and rational and the study design really helps crews do a better job for a number of reasons. If for example, they understand the implications of cross contamination and not completely cleaning the barbed wire off between different trap sets. They are really much more motivated to follow your protocols if they understand that it could result in mixed samples and the samples being worthless for the project. It is just going to make them want to do a better job or know the importance of doing a better job. We felt like

teaching them the basics of DNA and how degradation happens and what the consequences are and how to prevent it is of course really important. We also taught the basics of mark recapture modeling because we wanted them to, for instance, understand the importance of negative data, and that if they went to a site and looked for hair and didn't find any, it was very important to record that. Just not finding hair and going on and not documenting it makes a huge difference when you are doing a mark recapture population. Also, because we were under intense political scrutiny, we wanted to make sure that our crews were winning over the public and landowners, and that they could really be good representatives of what we were trying to do so that it limited the amount of misinformation that was going to be out there; this was funded by tax dollars and people want to know that their money is being spent responsibly. Finally, I guess for large projects in particular, I saw all of the employees during our two weeks of training and for many of them I didn't see them until the end of the summer. When you have seasonal employees that are working fairly independently or spread out over a large area I think knowing more about the project just makes them feel more vested in it.

Of course, we had a lot of field work challenges. A lot of people felt like the most dangerous thing we were going to have our people do was carrying this scent lure out in the backcountry on a backpacking trip and that there are probably going to be a lot of bear maulings. That was not the case, we were very careful about how we handled the lure but I never felt like that was the most dangerous thing they were doing. I was most concerned about our creek and river crossings; there were a lot of big streams to cross and then high elevation snow fields and a lot of bushwhacking through very difficult terrain and heavy packs. While I was very concerned about the heavy packs in the bushwhacking at least those were not things that were likely to result in any kind of lethal accidents. The stream crossings in particular really had me worried. We concentrated on wilderness first aid and everybody got certified in a wilderness first aid course. We did actual stream crossing protocols that I actually hadn't encountered before and they were really a good deal to have practiced and put into use. We spent a lot of time training people with navigating and orienting and using the GPS units correctly, which is important when you have low visibility in habitats, which a lot of people do. You know, you don't have a lot of landmarks in some areas so you really have to know how to use this stuff to get where you need to go. We spent a lot of time training people. We made sure that everybody was fluent with using the GPS units. Probably part of it was luck but we had very few injuries and most of them were minor. I actually breathed a huge sigh of relief at the end of the season. More and more agencies are becoming very concerned about safety records and there is just more and more emphasis put on it every year. So, I don't think you can minimize the importance of trying to limit injuries and just really getting your employees to not be cavalier about things and taking it seriously. It is becoming a huge deal, worker's comp expenses on a project can really be crippling.

One of the things that we did to minimize problems with our database is to download the GPS units directly into the database so that all of the locations of trees and traps were put in there automatically. But, we did hand record, hand transcribe UTM locations on the field forms just in case there was some failure with the GPS unit so you want some kind of back up. We didn't actually have any problems with the GPS units but I am actually kind of surprised that it wasn't an issue at some point and time, with battery failure or whatever. I would encourage you to consider some of these field computers for entering your data. We couldn't afford to do it, it would have been a huge expense but for smaller projects they are really a great way to go. We felt that it was important to have dedicated personnel out there doing quality control, so we actually divided our study area into nine sub units and had a sub unit leader that was responsible for directing and supervising the crews, making sure that all of the cells got a hair trap and all of the rub trees got surveyed but we also, in addition to the sub unit leader, we had a QC person and it was their job to circulate out with the field crews, work with them, kind of circulating around to make sure that the protocols were being followed correctly and

consistently throughout this whole area. We tried to solicit feedback from the crews and then worked to address their concerns or questions and tried to get consistent interpretations out to the other field crews.

Another thing that I think it is important to do, and I have been guilty of this in the past, is not allowing adequate time for the crews to assemble and submit their data and samples at the end of a field session. So, we would send them out, they were working nine days on and five days off, so nine, nine hour days, and we pretty much planned that the last day they were in the office getting everything all cleaned up and ready to submit and all of the forms; making sure they were completely filled out and legible and all of that. We also really felt like to get a good feel of what kind of quality data your field person are collecting you have to have real time data entry. So, we actually had two data entry people working the whole time from the get go as soon as the data started coming in so that we could do some preliminary error checking, making sure there weren't blank fields or problems with how the data forms were filled out, and we would get back to them right away. Because of the nature of our project we had post field hitch conference calls, because we couldn't all assemble because people were hundreds of miles away. But we would have a conference call and the first couple of ones were five and six hours long, just going over all of the issues that came up and trying to get everybody on the same page. We would do that the day the field hitch ended and then we would have four days before the next field hitch started in which to relay that information back to the field crews and the questions that came up. It also allows you to monitor the supplies and find out what they need. Finally, you spend a lot of money going out and getting these samples, they are really valuable. They are the gold that you are mining from this project so you want to make sure that you take really good care of them. In our case we stored them in a vault that was an old jail cell in Glacier National Park. We kept the original data forms in a locked file in a locked room because if something happens to the samples or data forms you have just lost, in my case millions of dollars worth of data. We also backed up the electronic files daily and we stored the backup's offsite and that was true in the genetics lab as well.

I was talking about plotting your data as soon as you can get it entered to do some quality control on data entry and transcription errors so you can find where that error was and try to get that corrected while things are still fresh enough that you can actually interpret and figure out what it was. This is a huge issue for us and we know that a lot of people manage their data in spreadsheets. Spreadsheets are not databases. Databases have a lot of qualities that make them superior to spreadsheets for managing your data. Relational data bases like Microsoft Access create relationships between the multiple tables so that you reduce data entry redundancy and then they allow you to do a lot of different things. I know that I have seen people scramble their data when they have entered it in a database just by pressing the key and not selecting all of the fields. That can't happen in a database but it sure can happen in a spreadsheet. Databases you can have drop down lists that restrict entries and it eliminates typos and it speeds the entry time. You can constrain the allowable values to reduce errors so you know what the range of acceptable UTM coordinates are or dates and it will automatically flag that as you enter it and then you can have sub-forms that allow data bound for multiple tables to be entered only once and you can integrate queries to proof the data and treat in real time for a whole number of errors and that really worked out well for us. You can also use one of these databases to generate reports that can be used as field forms or to present results and they have the advantage of being dynamic, so as soon as the data is entered, your form or report is updated.

We literally had a professional data entry person, somebody that was highly motivated, highly experienced in doing this and we had her do a presentation at our training on data entry and filling out field forms. So, we emphasized to our field crews that if your handwriting is bad or if you have erased and crossed something out and you can't read it then it is worthless and you might as well not have even collected the data. It is really important to complete all of the fields because otherwise the data entry person is in the position of trying to interpret what you saw and

they don't have a clue. Really important to let the field crews know that zeros and blanks are not the same thing and really do everything you can to make the date entry in a consistent format. We really wanted them to use a leading zero before a decimal point, otherwise that little decimal point is easy to get lost and it is a really good habit to get into. Don't mix English and metric units. It is just a recipe for disaster. Just ask the people in the Hubble Telescope design team on that. Make sure that crews know that when you have a multiple choice field that they only get to choose one. Furthermore, we let them know that the quality of how they filled out the data forms affects the usefulness of the data but also their future recommendations and we actually have really excellent data entry for this particular project.

I am going to talk about sample management, handling, tracking and reporting. So, maybe not all of you have to deal with permits and compliance but I bet most of you have had to deal with this a little bit. We had to deal with tons of it. You really need to research in advance the entire Federal, State, local and site specific permits before the field work begins. A lot of agencies need to review the applications for their scientific merit and they issue permits that authorize the number of samples and methods allowed and period of study. So, you often need a study plan developed as well as a safety plan and a description of protocol before you can get these permits. So, you want to complete them as early as possible. Some permits cost money. This was the first time I have run into that but we hadn't budgeted for that so that was a little bit of a surprise. They all have different deadlines and different time limits. You need to keep track of all of those. Everybody has particular specifics that relate to just their particular lands. For instance, on the state DNR sea lands, before we could work on them we had to buy pressure washers for each vehicle that was going to be crossing their lands so that we could pressure wash the undercarriage to prevent the spread of wheat seeds before we could even work on their lands. So, that is a little example of the unexpected requirement. Usually for any permit you have reporting responsibilities during and then after your study has been completed, you have to pay attention to those deadlines to keep your relationship in good shape with that particular agency. You should also discuss the ownership of the data and samples collected and the access to them with each agency to prevent any future misunderstandings about them. Whose samples they are and who has access to them. You might need multiple permits for each landowner and some permits are required to attain other permits. For instance, we had to get CITES permits to transport our samples over the border to the genetics lab in Canada. You can never start too early trying to get sites permit - that is one dysfunctional process. But this website, *The Animal Legal and Historical Center* has tools to help you figure out what laws apply to each county, country, state and species. So, that might help you out.

Managing samples - what types of sample and what quantity needs to be collected? What is the best container? Are additional media needed for preservation? How do you label your sample and transport them from the field to the lab? I will talk about that a little bit. Samples really vary in quantity and quality of DNA according to sample type and the storage method. Kind of going from a large quantity of DNA to a very small quantity of DNA, muscle tissue has tons of DNA in it. Hair with five or more follicles for hair is a pretty darn good source of DNA. Considerably less when you get fewer hard hairs or fewer follicles. Scat has actually a large amount of DNA but is much degraded and so you end up with a small amount of useful DNA.

The storage methods - the very best way you can store any of these samples is to put it in a -80°C freezer but virtually none of us have access to one of those. By extracting the DNA immediately you can really conserve the maximum amount of DNA you are going to be able to use. If you can't do that, drying the sample is almost always a very good option for hair or scat. You want to limit the exposure to sun because UV radiation breaks down DNA and that is why in some areas exposure, leaving them out in the field for any period of time can reduce genotyping success rates. The big destroyer of DNA quality is moisture and you want to get these samples as dry as possible as fast as possible. So, even though we are in very

dry environment in Northwest Montana in the summer, we actually stored all of our samples on the silica just to make sure they stayed dry. If you freeze your samples don't let them thaw out because freeze/thaw cycles are really damaging and really degrade DNA. Obviously, you have got to determine what type and quantity of sample. You need to answer your questions. But all sorts of different sources of DNA samples can be used not just for their genetics but you can use it to look at reproductive and stress hormones. You can look at diet through isotope analysis and fatty acids. You can look at contaminant loading through analysis of the hair shafts and any number of other samples as well as looking at bacterial and viral diseases. You know, there is a whole wealth of information you can get, even from just hair samples, and we are hoping to exploit it in our samples if we can get funding to pursue some of these other things.

Just a little discussion about sampling using attractants. You really want to research the best way to collect a sample for your particular situation. Research your lures as I said before. I have done testing of different scent lures on a variety of different captive bear populations and they all responded differently. I couldn't really come up with any consistent trends and they were from different areas - bears from Montana, bears from Alaska and bears from Washington. So, do background research on what might work best for you. Also, research what kind of sample devices are going to work best for you, you know multiple versus single capture. In some cases, the single capture options are definitely the way to go but in our case these barbed wire hair traps allowed very few bears to enter the traps in exactly the same place so we were able to sample multiple individuals at one site and of course that increased our sample coverage. But, you need to customize it for your particular situation. Whenever, you are using a lure or bait you are going to have some sort of behavioral effects because you are luring the animal into a site and inducing it to leave a sample so you're modifying its behavior and your success is dependent on how well you can modify their behavior. But, then you have to take into consideration in your population modeling, or whatever you are doing, the effects of altering that behavior. Bears are really a great species to work with when you are baiting because they respond so well to any sort of scent. So, we do have this luxury with bears that they are extremely responsive to baiting. Basically, finding a place they use and collecting what they leave behind, you know like hair or scat, is a great way to go because you are not affecting their behavior in anyway. It can be a good option for primary sampling or a good compliment to baited sampling because you have different vises involved.

As I said, we stored our samples on silica. We used indicators to look at gel beads because they tell you when they are saturated with moisture and are no longer doing their job. Then you just have to put in the oven to dry the moisture out and rejuvenate them. So, you can reuse it over and over but it is really nice to know when it is being affected so I really recommend that. Having uniformed sample containers, whether they are envelopes or scat tubes, really enforces consistency and facilitates organizing samples and it is probably a no brainer but it really helps keep things organized.

Here is something that we really didn't realize was a problem until we started getting all of these thousands of samples to the genetics lab. They have thousands of samples from other people, so make sure your sample numbers are unique. Actually, ours were for the DNA samples that we collected, but the management bear samples that we had genotyped at the same time weren't because almost every bear study that has been in Montana by each individual researcher starts out with grizzly bear #1 and goes up. There are completely overlapping numbering systems for a number of samples from different sources, so look into that before you have settled on a numbering system and coordinate with your lab and see how your system is going to work with their system of keeping track of numbers. I already talked about how your labels are going to hold up and the fact that the labels on the tubes in the lab kind of sprang off as soon as they got in the freezer. So test them, make sure that they are going to hold up long term or under all different conditions. The piggy back labels, I think they are worth the investment.

In literature there is actually a lot of talk about the chain of custody of samples and this is

particularly important if you are documenting a rare species. There might be some challenge to validity of that sample because a lot is riding on it, perhaps closing down a timber sale because some endangered species is there. So, you really need to be careful about informing your field crews about when, where and to whom the samples go and documenting where they have gone and who has custody of them at any particular time. Make sure that the protocols are followed not only by your crews but the genetics lab and have that all spelled out in the contract before you start.

Ways to check for errors in your genetic data - You can go in and have somebody do an independent check to confirm the peaks that were called on a randomly selected sample of the electropharograms. That is what our independent analysis did. You can also do a geographical dispersal of individual capture points and see if they raise any red flags about the genotyping. Another thing is to put your data into a program like Genetics that basically maps your genetic signatures in a geographic distribution and see if it is consistent with the other populations in the area whether they cluster and make sense geographically. You can check to see if the labs database matches your database. I really encourage you to use this technique of confirming the individual ID's with an independent set of loci. If you are already going to extend your individual ID's out to a number of additional loci you can use that technique and it is very powerful and hard to argue. I have already fended off one challenge to my research data by some academics that were saying my population estimate couldn't possibly be unbiased because of genotyping error. They hadn't bothered to read my paper first and when I outlined the measures that we took for genotyping error detection and control they withdrew the paper they had submitted. That is the position you definitely don't want to be in.

Only consider a blind sample test if you don't know the performance of the lab. It can be a lot of money otherwise. You can graph the number of genotypes that differ at one, two and three loci and there ought to be this exponential increase in that, so if you see a different pattern with a higher number of genotypes that differ at one or two loci that is an indication of genotyping error in your data set. That is basically the premise that program dropout, that was published in 2005 by McKelty and Schwartz, uses to confirm that genotyping error has been controlled.

I don't know about you guys but I think that this field of modeling populations is evolving so quickly that it is very difficult to keep up with the latest and best techniques. My feeling on that was confirmed when I was working with Gary White who developed a Program Mark and Program Capture and he made the comment it was difficult to keep current in the field and I thought what prayer do I have in keeping up with things. So, I would encourage you to try to budget for some consultation on population modeling, unless you are very exceptional and can totally handle this, which is the exception. Otherwise your analyses tend to get limited by what you knew from school or what you are familiar with and may not be taking advantage of the best techniques that have been recently developed. Using the Huggins Pledger mixture models and using all of these different covariates is just way more powerful than just a simple program capture analysis. They are difficult programs to run. I don't know how many of you have gone and taken Gary White's Program Mark boot camp for a week, which is very intensive, but it is a bit overwhelming for someone that is not really fluent with the techniques and using them all of the time. But, I would encourage you to consider using these multiple sampling techniques if you can because you can increase your sampling coverage and these new models can accommodate those and help increase the precision of your estimates and increase the minimum number and all of those good things.

You can use this data for a lot of other things than just a population abundance estimate. You can use them in programs like Program Presence to model presence absence or occupancy and using models that incorporate estimates of detection probability. That is a whole new field that has a lot of strengths and advantages and can be very useful. You can use those models to look at relative density and explore explanatory variables that explain those differences in density. For grizzly bears and

black bears you can use the Peterson index as well as Program Mark models if you are sampling over multiple years you can use the robust design and all sorts of things that you can do. If you really need to know population density you are going to need some way to correct your super population estimate for the lack of geographic closure that almost all of us have when we are studying bear populations. We have basic closure on 82% of our study area boundary and so the little bit of movement that we had at the American border really didn't make a difference. But in my earlier study we used radio telemetry. Bears that were captured for other purposes to estimate the percent time and reduced the super population estimate by 75%. So that is something that you should take into consideration because it really limits how much you can compare your data to other studies, if you can't account for this lack of closure. There is another method, a core method, and it was published in 2002 in which you exclude progressively larger buffer areas until your capture probability and your estimates don't change much anymore to develop a density estimate. But, I think you need a fairly large sample size or study area to do that.

I have already talked about how we were able to use our data to document genetic population structure, genetic diversity and all of those things. There is a whole host of landscape genetics programs out there; there are actually an overwhelming number. You might want to get some consultation on that as well. That is a little harder to keep up with since it is a really rapidly moving field. But certainly you can use it to look between population structure and connectivity to other populations.

I have already talked about being able to look at diet and contaminates but also you can use this data for forensic and law enforcement to identify individuals responsible for conflicts. We actually used our data to save a bears life a few years ago. There were cabin break-ins in part of our study area. They were able to get samples from the blood from the broken window where the bear went through and they caught three bears in the immediate area of this whole series of cabin break-ins. They held them long enough to get the DNA analysis and found out that none of those bears were responsible for the break ins and instead it was a bear that we caught way in the backcountry. The bears were released to live another day. You can also identify a source population of illegally killed animals through their frequencies. It is how we were able to identify that the bear that showed up in the ecosystem where bears were extirpated in the 1930's came from Idaho rather than the closest source population. Actually, it has been used in a number of law enforcement cases to nail poachers.

Just real briefly, this is the last thing I am going to talk about. We are starting a new project to use collections off of rub trees to monitor long term population trend and basically it is a research project to look at the efficacy of this approach and see if it is not only a reliable way but a practical way to monitor population trend. Not only can we get population growth rate but we will also be able to look at survival rates and animal estimates of abundance and be able to look at a whole host of other things because we will have this relatively large sample. We think just by sampling the rub trees we will be able to sample between three and four hundred bears a year, almost half of our population. And at a fraction of the cost that it would take to monitor trend with live capture radio telemetry or with even the grip hair traps. In addition, the Forest Service is interested in this because they want area specific information on grizzly bear occurrence, relative density and counts for their planning activities for doing biological assessment for timber sales and we will be evaluating those to optimize those results. We know that males dominate the rub trees during the breeding season in May and June but females are 50% of the sample by late summer. So, we will be concentrating on sampling later in the year than we did in our earlier projects. We expect to get a CV on our land estimate of less than 4% for males after three years of monitoring and four years for females because we don't sample them as readily as males. Some of the advantages are that this is all going to be on trailer travel routes so that it is easier to accomplish than hair trap or live capture. Field crews require a little training and you are not affecting bear behavior much at all.

Simulations - this is just as a master's thesis, using our data from our two previous projects. This simulation suggested that we have adequate power to detect even slight and gender specific declines in abundance, so that is pretty cool. We will be able to do a lot of other things. We think there is a potential for reducing costs with this approach by using existing agency personnel as well as volunteers and you can do that because it is low tech, it is not rocket science to do this.

Just a little more, we have a two-page front and back information sheet that we prepared on this new project as well as our old project and we thought that that was really useful. We put it up on the website, we made it available on the FTP site and it really helps the crews when they go to a landowner to get permission to work on their lands to have this. So, it is a really inexpensive easy thing to do to communicate to the public and other agency personnel about your project.

Here is the bottom line, start planning early, get your study design prepared, peer reviewed and approved. It is never too early to start group work production if you are doing what we did and wanting to assess things. Visit with other projects and talk with other researchers. Many study details aren't published or they are new enough that they just aren't out there yet and this sort of conference or workshop is the perfect place to make some of those contacts and have those discussions. Consider doing a pilot study to assess the feasibility and design requirements. You know what kind of counts you probably are going to get in your hair traps and how densely you have to sample. Maybe a pilot survey on year one is the way to go. Consider multiple sampling methods. Use a database not a spreadsheet for the data. Invest in crew training, it is a good investment. Don't skimp on QA/QC. Use a lab with a good record for data quality for non-invasive hair samples and timely results. Budget for statistical consultation on population, I really recommend all these.

This gets me to this handout that all of you now have and I just want to go through it. This northern divide grizzly bear project consultation package, that is where all of our field forms, our protocols, our warning signs, everything that we put together for that project is available to use as a guide or however it might be useful to you. Our northern divide grizzly bear project website is there. The remote camera web page address is next. We also have a website on this new project for monitoring trend use in bear rub sampling. Then we also have our recent publications on our FTP site as well so you can download the PDF's of the JWM article of our Glacier National Park estimate that was published in November JWM.

Finally, I just wanted to mention this genetic monitoring web page for managers, I am part of a group of geneticists and field biologists that were convened. It is actually being funded by an NSF grant. We have met three of the four times to develop tools to make genetic monitoring and genetic techniques available for managers. One thing that I have been involved in as well is a website, trying to provide the background information as well as applications and we haven't actually finished populating it but there is a fair amount of material in there. What we are interested in inviting you to do is to visit this website and try it out and give us your feedback about what was useful and what wasn't useful, what you would like to see that isn't addressed. We would love some feedback on how it works. Right now you can only get to it if you know the website. We would love to hear from you, so if you could just email me your comments that would be great. You can find my email address either on my website or it is actually kkendall@usgs.gov. With that does anybody have any questions?

(Question) - What was the difference between use on rub trees by black bears and grizzly bears?

(Kate Kendall) - That is interesting. Where we had the densest population of grizzly bears we actually had a large concentration of black bears as well. But, grizzly bears did dominate the rub trees. It was approximately 70% of the hair we got on rub trees in Glacier National Park were grizzly bear. In areas that are dominated by black bears the percentage increases for black bear obviously. We do have video footage of black bears rubbing on the same trees that a whole bunch of grizzly bears are rubbing on, during the same time period, like shortly after a grizzly bear has been there. So, we don't really

understand that mechanism. I do think grizzly use inhibits some degree of black bear use.

(Question) - I was just curious, what are the estimates of capture probability?

(Kate Kendall) - Let me think if I can remember that. They ranged from the mid 0.15 to a little over 0.22 and that is the per session capture probability. I take that back, that was the total capture probability. If you can get your re-capture rate above 0.2 you are going to be in fairly good shape. Unless, it gets down to 0.1 that is going to be tough, especially if you have a relatively small area and a small population that you are sampling.

(Question) - Was there a large time gap between the installation of the first snag sites versus the last snag site and did it have any impact on the collection of data?

(Kate Kendall) - I am not sure I quite got that. Was there a large gap between when we put out the first hair trap site and the last hair trap site within a session?

(Response) - Just the entire area.

(Kate Kendall) - We put out hair traps in every one of our 641 grid cells. The first hair trap was set out in all of those cells within nine days. Then exactly 14 days later we came back and collected the hair and then each session ran that way. So we had nine days to put them out and 14 days to come back to them. There is actually, because it is rolling, the last hair trap was set up in the first session only five days before the first hair collection was going to happen in the first set. There are overlapping sessions in that way and it used to really worry me but the statisticians and the modelers are not concerned about that so I decided to stop worrying about that. I don't really understand why that is not a problem but it doesn't appear to be.

(Question) - They were built and baited at the same time?

(Kate Kendall) - Yes. We always baited them when we put them up and generally from the video that we have gotten from remote cameras most of the bears come and visit during the first week, the first seven days. Really there is very little stink at these sites when you come back on day 14.

(Question) - Did the weather patterns affect the samples? You said heat and moisture were detrimental to DNA, was that 14 day period not a concern?

(Kate Kendall) - We didn't have any indication. Fourteen days in the kind of environment that we have, which is very dry during the summer, it just doesn't seem to be a factor. We haven't detected any issue with that. Of course, we don't really know exactly how long, whether they were deposited on day one or day 14 but that doesn't seem to be an issue. It does seem to be an issue in really wet climates like Southeast Alaska, after 14 days that might be an issue. They do seem to have lower genotyping success rate, so you might want to consider in really wet climates a shorter sample period.

(Question) - In my project I was very limited and you guys really didn't have that sort of limitation. What kind of advise or insight can you provide for those who would like to set up a similar kind of study but don't have the kind of funding. Besides perhaps setting up the rub trees or a survey, incorporating agency personnel, provide insight on sub-sampling and other methods that can reduce costs.

(Kate Kendall) - For those of you that have a less generous budget than I had. I guess, you mentioned trying to get agency support and certainly we took advantage of that in our earlier project. That is fraught with difficulties because some of the agency personnel were better at adding these duties to their jobs than others. Others were great about collecting hair samples and others were really bad. So, you have to have some sort of mechanism, it has got to be reflected in their job performance rating, their participation in order to be reliable I think and they need to be trained. I guess, I would try to educate the people that are funding the project on what the trade-offs are. If the funding is at this level this is what we can and cannot do, or

this is the precision we will have around the estimate or the imprecision. Make it known up front so that they are not getting into something that they are not going to be surprised at the end result. Sub-sampling is certainly what we all use. We did a minimal amount of that on the big project because it is really high profile, a one shot deal and we just felt like we had to get the maximum amount of information out of the samples. In our new project based on what we know about sampling of rub trees we are only going to do one sample per rub tree per visit. In our study we genotyped the black bear samples that we collected as part of the grizzly bear study in 2004. We had money to do the samples at Glacier National Park and we stratified the sampling based on the G-10-J locus, which we used for determining species. So, all of the black bear samples had this one locus genotype. It happens that in black bears that is highly variable. There is like, in our population, there are 27 alleles. We are taking one sample of each allele from each visit for this. That is the strategy. You can look at adjacency on the barbed wire and just take the largest sample with adjacent samples. There are a lot of ways you can go.

(Question) - You talked a lot about criteria for selecting a genetics lab. Are there a lot of options for doing bear genetics in North America?

(Kate Kendall) - A lot of university labs do it and they have students doing it and I just want to caution people about the realities of having a student that is learning the techniques do your samples. There will be a learning curve and it is a steep one. I have had issues about timely results because students have to take classes, they have got other responsibilities. They are sharing a machine with lots of other people. There are issues of security of the samples within a lab where many people are passing through and have access to your samples; even unintentionally somebody might pick up some of your samples. Those are my concerns about university labs, not supervising as closely as a commercial lab or an agency lab. No, I don't feel like there are a lot of options unless you are willing to go with a university lab. Almost every university does this sort of thing but in our experience you can get better results and you can get them more cheaply than even using graduate students by using a commercial lab.

(Question) - If you had it all to do again, do you have any regrets?

(Kate Kendall) - If I had the big project to do again I would make much more of an effort to sample rub trees on the 20% of the study area that we were not able to get to and the field crews kind of dropped the ball. They should have been able to get that done. We just didn't get it done and I didn't realize it in time. We got great results. That is my one regret on that. We did learn tons and tons, and I hope I was able to communicate to you today from the mistakes we made on our first project and if we hadn't had that experience I don't think the big project would have been nearly as clean and successful as it turned out to be. I had lots of things I would have done differently on that but I feel like we kind of nailed this big project. Some of that is luck but some of it was just experience and good people working for me. Ok, thank you.

Poster Session

EVALUATING THE LINK BETWEEN HYDROLOGIC DROUGHT AND BEAR SIGHTINGS AND CAPTURES IN SIERRA NEVADA MONTANE ECOSYSTEMS

Mark Walker, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
A. Lipka, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
S. Lossing, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
C. Boyd, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
G. Ray, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
R. Gillingham, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
J. Ivins, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
S. Fowers, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
M. Walker, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.
K. Stewart, Natural Resources and Environmental Sciences Department, University of Nevada, MS 370/FA 132, 1664 N. Virginia Street, Reno, Nevada, USA.

Abstract: The American black bear (*Ursus americanus*), inhabits a variety of ecotomes, with their main dependence on season and availability of food. Several available habitats in the Lake Tahoe Basin include mixed conifer forests, lodgepole pine forests, montane riparian areas, wet meadows, and montane chaparral. Black bears consume up to 20,000 calories per day (95% of which consist of plants) during hyperphagia in preparation for hibernation during winter months. During times of low food availability black bears typically increase foraging area, commonly including the fringes of urban and suburban areas, where bears consume garbage – a high calorie food source that demands little foraging. Since 1997, periodic hydrologic droughts (assessed by streamflow records) have occurred in the Sierra Nevada Mountains, near Reno, NV and other towns near Lake Tahoe in Nevada and California. During the drought periods, the Nevada Division of Wildlife noted dramatic increases in black bear sightings and captures in communities around the Sierra Nevada Mountains. This poster examines the relationship between increased bear sightings and captures and hydrologic droughts, with inferences about the relationship between food source availability and drought periods. We examine the statistical significance of magnitude of drought conditions with the number of bear sightings and captures on a month-by-month basis during eleven years of record, from 1997—2008. Our analysis indicates a strong correlation between bear sightings and captures and magnitude of streamflow deficit, based on records from seven streams that rise in the Sierra Nevada Mountains, as tributary to the Truckee River. We pose the hypothesis that streamflow deficits indicate depleted soil moisture, which in turn affects plant productivity and food availability in bear habitat.

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BEAR MANAGEMENT IN YOSEMITE NATIONAL PARK: A COMPREHENSIVE APPROACH

R. M. Leahy, Wildlife Management Branch, Yosemite National Park, 9036 Village Drive, Yosemite, California, USA.
C. Lee-Roney, Wildlife Management Branch, Yosemite National Park, 9036 Village Drive, Yosemite, California, USA.
T. Seher, Wildlife Management Branch, Yosemite National Park, 9036 Village Drive, Yosemite, California, USA.

Abstract: Initiated in 1975, Yosemite National Park's Human-Bear Management Program has aimed to restore and protect the natural characteristics of the Yosemite black bear population, and provide increased safety to visitors and their property. In 2009, the Yosemite Bear Council (YBC) enters its twelfth year of service overseeing the Interdivisional Bear Team (IBT). The YBC is composed of representatives from each division and park partners who meet monthly to address ongoing human-bear problems. In 2008, the IBT completed its ninth year under the guidance of the YBC and was composed of a Campground Ranger, two Protection Rangers, two Facilities Management employees, and many Interpretation Rangers and Wildlife Technicians. The team conducted nightly patrols focusing on visitor education, mitigation of food storage violations, response to wildlife sightings and incidents, negative conditioning of bears in developed areas and many other activities throughout their shifts. Since 2007, the team has used PDA's in the field to log relevant information into the Bear Patrol Log Database which was created in 2005 to effectively manage collected data. During the 2008 field season, the IBT performed 1,175 patrols throughout the park resulting in 32,468 visitor contacts, and 2,232 bear observations. Throughout the summer months the team also inspected 49,285 vehicles and 27,846 campsites, along with all concession facilities. Over 10,000 food storage violations were found resulting in 4,340 verbal and 3,552 written warnings, 120 citations, and 43 vehicle impounds. Bears were negatively conditioned on 711 occasions, including both high level (bean bags, rubber slugs, paintballs) and low level (chasing, yelling).

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BLACK BEAR (*URSUS AMERICANUS*) ACTIVITY PATTERNS IN SOUTHERN GRAND TETON NATIONAL PARK

L. M. Frattaroli, Department of Ecology, Montana State University, P.O. Box 173460, Bozeman Montana, USA.
C.C. Schwartz, Interagency Grizzly Bear Study Team, Montana State University, P.O. Box 172780, Bozeman, Montana, USA.
S. L. Cain, Grand Teton National Park, P.O. Box 170, Moose, Wyoming, USA.

Abstract: Black bears (*Ursus americanus*) in Grand Teton National Park (GRTE), Wyoming face a dynamic environment. Black bears that inhabit the northern part of the Park are sympatric with a relatively high density of grizzly bears while their southern counterparts live in an area with few grizzly bears. We studied activity patterns of black bears in the southern GRTE. We fitted 9 black bears with Telonics spread spectrum technology (SST) GPS radio collars from June 2005 to June 2006. Collars contained -15º head to tail activity switches and recorded date, time and activity level plus GPS location. We used logistic regression to determine the break point where bears were either classified as resting or active based upon field visits of bear locations where we determined activity. We calculated that bears were resting if their recorded activity count was below 18. We used logistic regression to determine which factors were most responsible for missed GPS fixes. Results showed activity count, collar age, and hour of the day were predictive of fix success. Black bears in southern GRTE exhibited bimodal activity peaks at the crepuscular time periods from June through August. During nocturnal hours, black bears' activity levels were consistent with resting. Bears were least active after den emergence (April) and before den entrance (October), with a peak in activity in July. Collars were more likely to have unsuccessful fix attempts if the bear was resting than if the bear was active. Black bear activity in southern GRTE was similar to black bear activity throughout their range where grizzly bears are absent.

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HUMAN-BEAR CONFLICTS IN A BEAR-HABITUATED COMMUNITY: MEDIATION, MEASURING THE OUTCOME, AND EDUCATION

M. Reynolds-Hogland, Bear Trust International, PO Box 4006, Missoula, Montana, USA.
M. S. Mitchell, Montana Cooperative Wildlife Research Unit, University of Montana, Missoula, Montana, USA.
J. J. Jonkel, Montana Fish Wildlife and Parks, 3201 Spurgin Road, Missoula, Montana, USA.

Abstract: We are launching a comprehensive conservation, research, and education project in western Montana. We will help a bear-habituated community become bear-resistant, measure the outcome scientifically, and use data we collect on research bears as a vehicle to provide innovative education programs for children locally, regionally, and nationwide. For the research component of our project, we will test multiple suites of hypotheses to improve our understanding of how black bears respond behaviorally when a bear-habituated community becomes bear-resistant. Some questions we seek to answer include: 1) When bear-resistant capability is achieved, do bears begin or increase alternative nuisance behaviors such as breaking into homes and vehicles? 2) To what extent does the installation of bear-resistant containers affect bear response, relative to the fluctuating availability of natural bear foods? 3) If homeowners in the community do not remove alternative bear attractants (e.g. bird feeders, unfenced bee yards, etc.), do bears continue to use the study area? As the interface between humans and wildlife increases, the answers to these questions will have significant implications for wildlife conservation and community planning. For our pre- and post-treatment study, we will use ARGOS/GPS collars to track 15 black bears both before and after bear-resistant capability is achieved in the study community. We will use kernel density estimators to develop behavioral algorithms. We will incorporate measures of seasonal availability of natural bear foods, as well as spatio-temporal data regarding presence of alternative bear attractants, into the algorithms. To measure the project outcome in terms of human dimensions, we will develop and distribute a survey to each home in the community twice: once before and once after bear-resistant capability is achieved. Finally, we will use some of the data we collect on research bears as a tool to provide mini research projects to children.

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THE CORRELATION BETWEEN GROSS FECAL ANALYSIS OF ARCHIVED BLACK BEAR SCATS AND ISOTOPIC SIGNATURES

R. S. Buckman, Department of Biology, 163 WIDB, Brigham Young University, Provo, Utah, USA.
B. H. Gale, Department of Biology, 401 WIDB, Brigham Young University, Provo, Utah, USA.
M. K. Wilson, Department of Biology, 275 WIDB, Brigham Young University, Provo, Utah, USA.
K. A. Hatch, Department of Biology, C.W. Post Campus, Long Island University, Brookville, New York, USA.
B. L. Roeder, Department of Biology, 697 WIDB, Brigham Young University, Provo, Utah, USA.
S. T. Bunnell, Department of Zoology, Brigham Young University, Provo, UT 84602-5255
J. Auger, Department of Plant & Wildlife Sciences, 190 MBLM, Brigham Young University, Provo, Utah, USA.
H. L. Black, Department of Plant & Wildlife Sciences, 142 WIDB, Brigham Young University, Provo, Utah, USA.

Abstract: The diet and feeding behavior of free-ranging black bears (*Ursus americanus*) in the Utah East Tavaputs Plateau (ETP) was classified by gross fecal analysis (GFA) on scats collected from May-August 1991-1997 within a defined latitudinal and altitudinal gradient. Dried scats were kept as archived samples in light protected, low humidity cabinets at ~ 25C. In an effort to develop a retrospective tracing method that can be used with harvested bears to infer spatial movement or to serve as a predictive tool for extant bear movement, homogenized scats (n = 61) from known GPS locations were analyzed by light isotope ratio mass spectrometry (IRMS) for association with GFA categorized predominant diet. GFA classification had vertebrate (mammal), ant, other insect, green vegetation (i.e. hard mast, grass, soft mast, dicotyledonous species, labeled dicot), fruit or flowers, and other miscellaneous (garbage, aves, unknown) food items. Categories were condensed into five groups for IRMS analysis: ant, fruit/flowers, green vegetation, vertebrate, and other insect. The homogenized scats were analyzed for stable isotopes of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$). The correlation between the isotopic signatures in the homogenized scats and GFA by quadrant tray categorization was determined. Results indicated that some of the dietary components are significant regressors of $\delta^{13}C$ and $\delta^{15}N$. However, their low R^2 values indicated that the $\delta^{13}C$ and $\delta^{15}N$ values from homogenized feces are not in good agreement with the proportion of the dietary components determined by GFA, and do not predict the same percentage of the components within the sample. Other matter, such as debris or other material in a scat that could not be reliably identified by GFA, may overwhelm the signal of food items (e.g. vertebrate matter and ants) that are below a certain percentage of the total scat as analyzed by GFA.

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THE CAPABILITY AND NEARLY UNLIMITED RESOURCES OF A TAHOE BASED NGO TO ASSIST THE CALIFORNIA AND NEVADA WILDLIFE AGENCIES IN EDUCATING THE PUBLIC REGARDING LIVING AND VACATIONING IN BEAR TERRITORY

A. Bryant, BEAR League, P.O. Box 393, Homewood CA 96141, USA

Abstract: Due to the increasingly enormous numbers of people living and recreating in what was historically strictly bear and wildlife habitat, problems continuously arise as the two species collide during each other's quests to survive and thrive. Humans have arrived to stay and the bears have quickly adapted and learned to profit from our presence. They are evolving at previously unanticipated rates of speed in order to take advantage of our every mistake so they can obtain easy but un-natural food. In the past the only source of information and public assistance was from the already over-burdened state and federal wildlife agencies. Now local groups such as the BEAR League of Lake Tahoe can take advantage of the large numbers of local citizens who wish to help solve 'Bear Problem' with a non-lethal and neighbor-to-neighbor method. After undergoing extensive training these people are assigned to their own localized team and are available for immediate dispatch to the scene when 'Bear Calls' come in to the BEAR League's 24/7 hot line. With strict guidance from BEAR League headquarters these volunteers are able to coach and educate thousands more residents and visitors than previously imagined. Most often the problem is not the bear; it is an error in judgment by the reporting party (believing bears aren't attracted to birdseed, garbage, pet food etc) and the situation can be easily resolved by making the bear feel unwelcome and then explaining to the person that all attractants must be permanently removed. It has been determined that people will be more tolerant of bears and more willing to act responsibly if they understand the animal, dismiss their fear-based misconceptions, and realize why he is there. It is the goal of the BEAR League to help educate as many residents and visitors as possible regarding proper protocol for spending time in bear habitat. This Poster and accompanying 'slide show' illustrates the BEAR League's methods and educational materials for achieving its mission.

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Workshop Participants

List of Participants

TOM ALAKSA
ANIMAL ARK
P.O. BOX 60057
RENO, NV 89506
775-970-3111
animalark@aol.com

JAN ALAKSA
ANIMAL ARK
P.O. BOX 60057
RENO, NV 89506
775-970-3111
animalark@aol.com

ALYSON ANDREASEN
UNIVERSITY OF NEVADA
1664 NORTH VIRGINIA
RENO, NV 89557
775-530-9153
amandrea@unr.nevada.edu

MELANY ATEN
UNIVERSITY OF NEVADA
885 W 11TH ST
RENO, NV 89503
775-848-9686
mellbell4u@aol.com

MARK ATKINSON
NEVADA DEPT OF WILDLIFE
1100 VALLEY RD
RENO, NV 89512
775-688-1520
matkinson@ndow.org

JANENE AUGER
BRIGHAM YOUNG UNIVERSTIY
190 MLBM
PROVO, UT 84602
801-422-6688
janene_auger@byu.edu

SUSAN BAILEY
BEAR LEAGUE
PO BOX 915
HOMEWOOD, CA 96141
530-412-2602

NEIL BARTEN
ALASKA DEPT OF FISH AND GAME
P.O. BOX 110024
JUNEAU, AK 99811-0024
907-465-4267
neil.barten@alaska.gov

BRIAN BARTON
CALIFORNIA STATE PARKS
PO BOX 878
CARNELIAN BAY, CA 96140
530-525-1263
bbarton@parks.ca.gov

SHARON BARUCH-MORDO
COLORADO STATE UNIVERSITY
DEPT OF FISH, WILDLIFE,AND CONSERVATION BIOLOGY
CAMPUS MAIL 1474
FORT COLLINS, CO 80523-1474
970-222-8295
sharonbm@warnercnr.colostate.edu

RICH BEAUSOLEIL
WASHINGTON DEPARTMENT OF FISH & WILDLIFE
3515 STATE HWY 97A
WENATCHEE, WA 98801
509-664-1227
richard.beausoleil@dfw.wa.gov

JON BECKMANN
WILDLIFE CONSERVATION SOCIETY
301 N. WILLSON AVE.
BOZEMAN, MT 59715
316-992-2927
jbeckmann@wcs.org

DAN BJORNLIE
WYOMING GAME AND FISH
260 BUENA VISTA
LANDER, WY 82520
307-332-2686
dan.bjornlie@wgf.state.wy.us

KRIS BOATNER
USFS - TAHOE NATIONAL FOREST
9646 DONNER PASS ROAD
TRUCKEE, CA 96161
530-587-3558
kboatner@fs.fed.us

CHASE BODKIN
236 NORTH COLONY DRIVE
EDGEWOOD, KY 41017
859-816-8350
considermuch@gmail.com

BONNIE BOIEEIE
18356 63W AVE
LURREY, B.C.
V3S8A8
CANADA
604-574-4381
bboieeie@hotmail.com

WILLIAM BOIEEIE
1737 BROADWAY ST
PORT COQUITLAM, B.C.
V3C2M9
CANADA
604-927-5447
boieeieb@portcoquitlam.com

STEWART BRECK
USDA WS NATIONAL WILDLIFE RESEARCH CENTER
4101 LA PORTE AVE
FORT COLLINS, CO 80526
970-266-6092
stewart.w.breck@aphis.usda.gov

KIRBY BRISTOW
ARIZONA GAME AND FISH DEPT
5000 WEST CAREFREE HWY
PHOENIX ,AZ 85086
520-850-7729
kbristow@azgfd.gov

BENJAMIN BROWER
UNR CAST & BLAST - VP
1579 DISC DR
SPARKS, NV 89436
775-450-7719
browerb@unr.nevada.edu

MARK BRUSCINO
WYOMING GAME AND FISH
2820 STATE HWY 120
CODY, WY 82414
307-899-8157
mark.bruscino@wgf.state.wy.us

ANN BRYANT
BEAR LEAGUE
PO BOX 502
HOMEWOOD, CA 96141
530-525-7297
bearsnsquirrels@sbcglobal.net

REBECCA BUCKMAN
BRIGHAM YOUNG UNIVERSITY
BIOLOGY DEPT
PROVO, UT 84602

JOSHUA BUSH
CALIFORNIA DEPT FISH & GAME
1701 NIMBUS ROAD
RANCH CORDOVA, CA 95670
916-541-9781
jbush@dfg.ca.gov

LYNNE CANN
2623 EAST CARAMILLO STREET
COLORADO SPRINGS, CO 80909
719-460-9963
lynne.cann@yahoo.com

MICHAEL CARION
CALIFORNIA DEPT FISH & GAME
6150 HEAVENLY VALLEY LANE
ANDERSON, CA 96007
530-227-3231
mcarion@dfg.ca.gov

MARC CATTET
CANADIAN COOPERTIVE
WILDLIFE HEALTH CENTRE,
UNIVERSITY OF
SASKATCHEWAN
52 CAMPUS DRIVE
SASKATOON, SASKATCHEWAN
S7N 5B4
CANADA
306-966-2162
marc.cattet@usask.ca

NIGEL CAULKETT
WILDLIFE CONSERVATION
SOCIETY
CANADA
nacaulke@ucalgary.ca

DANIELLE CHI
U.S. FOREST SERVICE
324 25TH ST
OGDEN, UT 84401
801-625-5667
dkchi@fs.fed.us

ANTHONY COLONESSE
SAN FRANCISCO ZOO
1 ZOO ROAD
SAN FRANCISCO, CA 94132
415-244-4098
tony@sfzoo.org

CECILY COSTELLO
INTERNATIONAL BEAR ASSN
PO BOX 567
MANHATTAN, MT 59741
406-284-3477
ccostello@bresnan.net

JEFF CRIGHTON
HAUL-ALL EQUIPMENT
4115 18TH AVE NORTH
LETHBRIDGE, ALBERTA T1H5G1
CANADA
888-428-5255
twyla@haulall.com

MELANIE CULVER
UNIVERSITY OF ARIZONA
325 BSE
TUCSON, AZ 85721
520-743-2379
culver@ag.arizona.edu

ANNE DAVIS
NORTH SHORE BLACK BEAR
SOCIETY
4028 ROSE CRESCENT
N. VANCOUVER, BC V7V2N7
CANADA
604-926-5184
davis522@shaw.ca

DIANA DOAN-CRIDER
INTERNATIONAL BEAR ASSN
PO BOX 185
COMFORT, TX 78013-0185
361-455-3241
diana.crider@gmail.com

JUSTIN DOLLING
UTAH DIVISION OF WILDLIFE
RESOURCES
1594 WEST NORTH TEMPLE
SUITE 2110
SALT LAKE CITY, UT 84114-6301
801-538-4781
justindolling@utah.gov

JOHAN DU TOIT
BERRYMAN INSTITUTE
UTAH STATE UNIVERSITY
LOGAN, UT 84322
435-760-4853
johan.dutoit@usu.edu

MADONNA DUNBAR
INCLINE VILLAGE G.I.D.
1220 SWEETWATER RD.
INCLINE VILLAGE, NV 89451
775-832-1212
mod@ivgid.org

MAUREEN EASTON
USFS
HUMBOLDT-TOIYABE
NATIONAL FOREST
1536 S. CARSON
CARSON CITY, NV 89701
775-884-8151
measton@fs.fed.us

BOB FACKLAM
TETON WELDING
66 AIRPORT RD
CHOTEAU, MT 59422
406-466-2124
tetonwelding@montana.com

LISA FIELDS
CALIFORNIA ST PARKS
PO BOX 16
TAHOE CITY, CA 96145
530-981-3856
lfields@parks.ca.gov

LESLIE FRATTAROLI
MONTANA STATE UNIVERSITY
PO BOX 13832
JACKSON ,WY 83002
307-690-8353
frattarolib@hotmail.com

TYLER GAMSBY
312-1790 W 10TH AVE
VANCOUVER, BC V6J2A6
CANADA
778-554-4383
tyler@dvdworks.ca

DAVID GARSHELIS
MINNESOTA DEPT NATURAL
RESOURCES
1201 E. HWY 2
GRAND RAPIDS, MN 55744
218-327-4146
dave.garshelis@dnr.state.mn.us

SHERRY GUZZI
BEAR LEAGUE
P.O. BOX 7763
TAHOE CITY, CA 96145
530-583-9573
tahoeguzzi@gmail.com

TED GUZZI
BEAR LEAGUE
P.O. BOX 7763
TAHOE CITY, CA 96145
530-583-9573
tahoeguzzi@gmail.com

KEITH HAMM
GREEN DIAMOND RESOURCE
COMPANY
P.O. BOX 68
KORBEL, CA 95550
707-688-4437
Khamm@greendiamond.com

DAVE HANNA
ALBERTA PROVINCIAL PARKS
800 ACCESS ROAD
SUITE 201 - PROVINCIAL BUILDING
CANMORE, ALBERTA T1W 1E8
CANADA
403-678-7837
dave.hanna@gov.ab.ca

SHANNON HARTLEY
312-1790 W 10TH AVE
VANCOUVER, BC V6J2A6
CANADA
778-554-3348
shannon@shannonhartley.com

PAUL HATTON
UNIVERSITY OF TEXAS
15801 CHASE HILL BLVD #909
SAN ANTONIO, TX 78256
210-378-2941
pablohat@satx.rr.com

THAD HEATER
NEVADA DEPT OF WILDLIFE
2920 CASTLE SAGE CT
RENO, NV 89503
775-747-6297
heater_thad@hotmail.com

JOHN HECHTEL
INTERNATIONAL BEAR ASSN
13305 RACHEL ROAD SE
ALBUQUERQUE, NM 87123
231-631-6094
john.hechtel@gmail.com

DON HELDOORN
NO-BEAR-CAN.COM
CARSON VALLEY WELDING
1046 MALLORY WAY
CARSON CITY, NV 89701
775-884-9353
don@nobearcan.com

BLAKE HENKE
NORTH STAR SCIENCE AND TECH
8219 GALLANT GREEN DR
KING GEORGE, VA 22485
410-961-6692
blakehenke@msn.com

MARIO HENRIQUES
LOTEK WIRELESS INC
115 PONY DRIVE
NEWMARKET, ONTARIO L3Y7B5
CANADA
905-836-6680
mhenriques@lotek.com

STEVE HERRERO
UNIVERSITY OF CALGARY
3621 - 7TH ST SW
CALGARY, ALBERTA T2T2Y2
CANADA
403-243-3614
herrero@ucalgary.ca

JASON HOLLEY
CALIFORNIA DEPT FISH & GAME
1082 CALLANDER WY
FOLSOM, CA 95630
916-212-1663
jholley@dfg.ca.gov

SARA HOLM
CALIFORNIA DEPT FISH & GAME
PO BOX 1123
MEADOW VISTA, CA 95722
530-878-3858
sholm@dfg.ca.gov

LORI HOMSTOL
UNIVERSITY OF ALBERTA
46-6800 CRABAPPLE DR
WHISTLER, B.C. V0N1B6
CANADA
604-698-5425
homstol@ualberta.ca

MIKE HOOKER
UNIVERSITY OF TENNESSEE
1618 LUNOY RD.
KNOXVILLE, TN 37920
307-349-2382
mhooker1@utk.edu

JACK HOPKINS
MONTANA STATE UNIVERSITY
401 1/2 NORTH 5TH AVE
BOZEMAN, MT 59715
330-703-4280
jbhopkins3@gmail.com

JAY HOWARD
NEVADA STATE PARKS

HANK HRISTIENKO
MANITOBA CONSERVATION
200 SAULTEAUX CRES
BOX 24
WINNIPEG, MANITOBA R3J3W3
CANADA
204-945-7771
hank.hristienko@gas.mb.ca

BENJAMIN JIMENEZ
UNIVERSITY OF MONTANA
MT COOPERATIVE WILDLIFE RESEARCH UNIT
32 CAMPUS DRIVE 2304
MISSOULA, MT 59812
406-546-4210
bensjimenez@gmail.com

MATTHEW JOHNSTON
2019 WARWICK LANE
COLORADO SPRINGS, CO 80909
719-650-5054
matthewjohnstonnd@yahoo.com

DELYNN KAMPS
UNIVERSITY OF NEVADA
9503 AUTUMN LEAF WAY
RENO, NV 89506
775-313-6964
delynn.kamps@gmail.com

KATHERINE KASTEN
UNIVERSITY OF NEVADA
P.O. BOX 13441
RENO, NV 89507
775-397-1170
kastenk@gbcnv.edu

JADE KEEHN
UNIVERSITY OF NEVADA
1071 AMBASSADOR DR
RENO, NV 89523
775-240-0253
keehnj@unr.nevada.edu

KATE KENDALL
USGS GLACIER FIELD STATION
GLACIER NATIONAL PARK
WEST GLACIER, MT 59936
406-888-7994
kkendall@usgs.gov

QUINTIN KERMEEN
TELEMETRY SOLUTIONS
5063 COMMERCIAL CIRCLE
SUITE E
CONCORD, CA 94520
925-798-1942
qkermeen@telemetrysolutions.com

MARIO KLIP
STUDENT LOOKING FOR RESEARCH OPPORTUNITIES
255 ETHEL
MILL VALLEY, CA 94941
650-996-2230
mailto:mk_klip@yahoo.com

CHRIS KOCHANY
SIRTRACK NORTH AMERICA
845 PHEASANT LANE
NORTH LIBERTY, IA 52317
319-665-2542
kochannyc@sirtrack.com

THEA KRISTENSEN
UNIVERSITY OF ARKANSAS
740 E LAFAYETTE ST
FAYETTEVILLE ,AR 72701
479-200-8993
tkristen@uark.edu

CARL LACKEY
NEVADA DEPT OF WILDLIFE
1282 SAN PABLO CT
MINDEN, NV 89423
775-720-6130
carllackey@charter.net

KEVIN LANSFORD
NEVADA DEPT OF WILDLIFE
1100 VALLEY RD
RENO, NV 89512
775-688-1676
klansford@ndow.org

AL LE COUNT
HOCKING COLLEGE
75743 LEMAY RD
ALBANY, OH 45710
740-698-6761
cherylandal@ohiohills.com

RYAN LEAHY
NATIONAL PARK SERVICE
P.O. BOX 577
WILDLIFE MANAGEMENT
YOSEMITE , CA 95384
209-372-0474
ryan_leahy@nps.gov

CAITLIN LEE-RONEY
NATIONAL PARK SERVICE
BOX 577
YOSEMITE NATIONAL PARK
YOSEMITE, CA 95389
209-372-0476
caitlin_lee-roney@nps.gov

LINDA MASTERSON
AUTHOR "LIVING WITH BEARS"
PO BOX 440
MASONVILLE, CO 80541
970-493-7788
lmastercom@aol.com

KATHRYN MAZAIKA
GEO MASON UNIVERSITY -ICAR
5 PETERS AVE
SAN FRANCISCO, CA 94110
415-271-2560
kmazaika@comcast.net

RACHEL MAZUR
HUMBOLDT-TOIYABE
NATIONAL FOREST
1200 FRANKLIN WY
SPARKS, NV 89431
775-3555386
rmazur@fs.fed.us

BARB MCCALL
UNIVERSITY OF MONTANA
MT COOPERATIVE WILDLIFE
RESEARCH UNIT
32 CAMPUS DRIVE 2304
MISSOULA, MT 59812
208-755-6835
barbmccall@gmail.com

RYAN MCDONALD
UNIVERSITY OF WYOMING
508 EAST GARFIELD #3
LARAMIE, WY 82070
307-460-1334
ryanmcd@uwyo.edu

CODY MCKEE
UNIVERSITY OF NEVADA, RENO
1000 VALLEY ROAD
RENO, NV 89512
775-784-1467
cmckee@cabnr.unr.edu

JEROD MERKLE
UNIVERSITY OF MONTANA
32 CAMPUS DRIVE, FORESTRY
BLDG
MISSOULA, MT 59812
406-247-3499
jerod.merkle@umontana.edu

CHRISTINE MILLER
NORTH SHORE BLACK BEAR
SOCIETY
1490 EMERSON WAY
N. VANCOUVER, BC V7H2B8
CANADA
604-929-0411
christine-miller@telus.net

TOM MILLHAM
LAKE TAHOE WILDLIFE CARE
1485 CHERRY HILLS CIRCLE
S LAKE TAHOE, CA 96150
530-577-2273
tmillham@jps.net

CHERYL MILLHAM
LAKE TAHOE WILDLIFE CARE
1485 CHERRY HILLS CIRCLE
S LAKE TAHOE, CA 96150
530-577-2273
tmillham@jps.net

SABRINA MORANO
UNIVERSITY OF NEVADA
1000 VALLEY ROAD
RENO, NV 89512
775-784-1370
smorano@cabnr.unr.edu

CHRIS MORRIS
UNIVERSITY OF NEVADA
7505 RORY CIR
RENO, NV 89511
775-376-2496
morrisct@tmcc.nevada.edu

MICHAEL MORRISON
CALIFORNIA DEPT FISH & GAME
407 W LINE ST
BISHOP, CA 93514
760-872-6585
mmorrison@dfg.ca.gov

GREG MORTON
WILDLIFE PEST MANAGEMENT
P.O. BOX 8022 BS
RED BLUFF, CA 96080
888-409-7378
gmorton46@sbcglobal.net

STEVE NADEAU
IDAHO FISH AND GAME
600 S WALNUT
BOX 25
BOISE, ID 83709
208-287-2752
snadeav@idfg.idaho.gov

JOSEPH NORTHRUP
UNIVERSITY OF ALBERTA
CW 405 BIOLOGICAL SCIENCES
BUILDING
UNIVERSITY OF ALBERTA
EDMONTON, ALBERTA T6G0P6
CANADA
403-627-9463
jnorthru@ualberta.ca

MARIANNE O'CONNOR
BEAR-WITH-US.ORG
PO BOX 3985
MAMMOTH LAKES, CA 93547
760-934-6300
joe@bear-with-us.org

JOHN PACZKOWSKI
WILDLIFE CONSERVATION
SOCIETY
120 COUGAR POINT ROAD
CANMORE, ALBERTA T1W 1A1
CANADA
403-678-6331
thebearsare@hotmail.com

JOE PARRINO
BEAR-WITH-US.ORG
PO BOX 3984
MAMMOTH LAKES, CA 93546
760-934-6299
joe@bear-with-us.org

MIKE PAULSON
TAHOE VILLAGE HOMEOWNERS ASSN
STATELINE, NV
775-588-7820

JORDAN PEDERSON
UTAH DIVISION OF WILDLIFE RESOURCES
PO BOX 968
KAMAS, UT 84036
435-783-2429
jcped@allwest.net

BRYAN PETERSON
BEAR SMART DURANGO
PO BOX 2291
DURANGO, CO 81302
970-749-4262
bp@frontier.net

CORY PHILLIPS
PO BOX 440
MASONVILLE, CO 80541
970-493-7788
lmastercom@aol.com

HEATHER REICH
PRIVATE CONTRACTOR W/ MONTANA FISH, WILDLIFE, AND PARKS
1315 EAST 1650 NORTH
HEBER CITY, UT 84032
435-503-1783
hmarstall@earthlink.net

BOB RICKLEFS
PHILMONT SCOUT RANCH
17 DEER RUN ROAD
CIMARRON, NM 87714
575-376-2281
bob.ricklefs@scouting.org

BEVERLY ROEDER
BRIGHAM YOUNG UNIVERSTIY
BIOLOGY DEPT
PROVO, UT 84602
801-422-6873
beverly_roeder@byu.edu

DONNA ROGERS
NORTH AMERICAN BEAR CENTER
145 WEST CONAN ST
ELY, MN 55731
218-365-4480
lrogers@bearstudy.org

LYNN ROGERS
NORTH AMERICAN BEAR CENTER
145 WEST CONAN ST
ELY, MN 55731
218-365-4480
lrogers@bearstudy.org

GILBERTO SALGADO DE LOS SANTOS
CONSEJO ESTATAL DE FLORA Y FAUNA DE NUEVO LEON
PO BOX 185
COMFORT, TX 78014
MEXICO
818-344-6444

REBECCA SAYER
INCLINE VILLAGE G.I.D.
1220 SWEETWATER RD.
INCLINE VILLAGE, NV 89451
775-832-1284
rms@ivgid.org

ROBERT SCHULTE
VECTRONIC AEROSPACE GMBH
CARL-SCHEELE-STR 12
BERLIN 12489
GERMANY
4.9306789499e+011
schulte@vactronic_aerospace.com

CHUCK SCHWARTZ
U.S.G.S. GRIZZLY BEAR STUDY TEAM
P.O. BOX 172780 /
MONTANA STATE UNIVERSITY
BOZEMAN, MT 59717-2780
406-994-5043
chuck_schwartz@usgs.gov

WILLIAM SEEGAR
NORTH STAR SCIENCE AND TECH
12265 HARFORD ROAD
GLEN ARM, MD 21057
410-598-3156
wsswwgar@aol.com

TORI SEHER
YOSEMITE NATIONAL PARK
PO BOX 577
YOSEMITE ,CA 95389
209-372-0476
victoria_seher@nps.gov

JEFF SELINGER
ALASKA DEPT OF FISH AND GAME
43961 K - BEACH ROAD, SUITE B
SOLDOTNA, AK 99669
907-260-2905
jeff.selinger@alaska.gov

CHRIS SERVHEEN
U.S. FISH & WILDLIFE SERVICE
UNIVERSITY OF MONTANA
UNIVERSITY HALL, ROOM 309
MISSOULA, MT 59812
406-243-4903
chris_servheen@fws.gov

THOMAS SHARP
SWCA ENV CONSULTANTS
257 EAST 200 SOUTH, STE 200
SALT LAKE CITY, UT 84111
801-898-7514
tsharp@swca.com

MATTHEW SIFUENTES
TEXAS A&M UNIVERSITY
8191 HAZY HALLOW LANE
ANDERSON, TX 77830
210-954-2252
formatt50@tamu.edu

NOVA SIMPSON
UNIVERSITY OF NEVADA
1000 VALLEY ROAD
RENO, NV 89512
775-720-1093
simpsonn@tmcc.nevada.edu

RACHEL SMITH
ANIMAL ARK
P.O. BOX 60057
RENO, NV 89506
775-970-3111
animalark@aol.com

TIM SNYDER
BEAR LEAGUE
PO BOX 583
CARNELIAN BAY, CA 96140
530-546-4046
simsea247@aol.com

RACHEL SNYDER
BEAR LEAGUE
PO BOX 112
TAHOE VISTA, CA 96148
530-525-7297
bearsonmymind@yahoo.com

PATTI SOWKA
LIVING WITH WILDLIFE FOUNDATION
MT FISH, WILDLIFE & PARKS
5080 HIDDEN VALLEY DR
HELENA, MT 59602
406-544-5307
psowka@mt.net

RANDY STANAWAY
TAHOE BEAR BOX COMPANY
PO BOX 1345
CARNELIAN BAY, CA 96140
530-546-3154
randy@bearbox.org

CARISA STANSBURY
UNIVERSITY OF WYOMING
BOX 52
267 NORTH PIERCE
LARAMIE, WY 82073
307-760-2908
carisa_s@hotmail.com

TOM STEPHENSON
CALIFORNIA DEPT FISH & GAME
407 W LINE ST
BISHOP, CA 93514
760-872-1171
tstephenson@dfg.ca.gov

CONSTANCE STEVENS
WILDLIFE SHELTER, INC.
PO BOX 226
HOMEWOOD, CA 96141
530-546-1211
wildlifeshelter@yahoo.com

KELLEY STEWART
UNIVERSITY OF NEVADA
NATURAL RESOURCES & ENV SCIENCE
1000 VALLEY ROAD, MS 186
RENO NV 89512
775-784-4314
kstewart@cabnr.unr.edu

ROSEMARY STUSSY
OREGON DEPT OF FISH & GAME
1495 EAST GREGORY ROAD
CENTRAL POINT, OR 97502
541-826-8774, EXT 227
rosemary.j.stussy@state.or.us

LYNDA SUGASA
SAFE HAVEN
BOX 184
IMLAY, NV 89418
775-538-7093
safehavenwildlife1@yahoo.com

TESSA SUSTACHA
UNIVERSITY OF NEVADA
P.O. BOX 13172
RENO, NV 89507
775-397-2764
tsustacha87@yahoo.com

TIM TAYLOR
CALIFORNIA DEPT FISH & GAME
PO BOX 497
BRIDGEPORT, CA 93517
760-932-5749
ttaylor@dfg.ca.gov

JENNAPHER TEUNISSEN VAN MANEN
UNIVERISTY OF TENNESSEE
274 ELLINGTON HALL
KNOXVILLE, TN 37996
865-323-9311
jennapher.vanmanen@gmail.com

RON THOMPSON
ARIZONA GAME AND FISH DEPT
5000 WEST CAREFREE HWY
PHOENIX, AZ 85086
623-236-7354
rothompson@azgfd.gov

STEVE THOMPSON
BEARSAVER
1390 S. MILLIKEN AVE
ONTARIO, CA 91761
909-605-1697
sales@bearsaver.com

ANDREW TRI
CEASAR KLEBERG WILDLIFE RESEARCH INSTITUTE
720 WEST KLEBERG
KINGSVILLE, TX 78363
763-210-8939
andrew.n.tri@gmail.com

DOUG UPDIKE
CALIFORNIA DEPT FISH & GAME
WILDLIFE DEPARTMENT
1812 9TH ST
SACRAMENTO, CA 95811
916-799-3952
dupdike@dfg.ca.gov

AMY VAN DER MOLEN
FOLSOM ZOO SANCTUARY
100 #B HOXSIE COURT
FOLSOM, CA 95630
916-496-0028
avandermolen@folsom.ca.us

FRANK VAN MANEN
UNIVERSITY OF TENNESSEE
274 ELLINGTON HALL
KNOXVILLE, TN 37996
865-974-0200
vanmanen@utk.edu

CORA VARAS
UNIVERSTIY OF ARIZONA
BIO EAST 205
TUCSON, AZ 85721
520-621-2161
cora@email.arizona.edu

HECTOR VILLALON-MORENO
DEPARTAMENTO DE PARQUES Y VIDA SILVESTRE DE NUEVO LEON
PO BOX 185
COMFORT, TX 78013
MEXICO
812-033-1230

LUKE WARTGOW
UNIVERSITY OF NEVADA
1399 MEADOW LANE
GARDNERVILLE, NV 89410
775-901-1878
wartkid@charter.net

TERRI WIEST
CALIFORNIA DEPT FISH & GAME
P.O. BOX 238
GRAEAGLE, CA 96103
530-836-0889
tweist@dfg.ca.gov

LINDA WIGGINS
3621 - 7TH ST SW
CALGARY, ALBERTA T2T2Y2
CANADA
403-243-3614
wigs@telus.net

LINDA WIGHT
YOSEMITE NATIONAL PARK
15380 LUPE ROAD
PINE GROVE, CA 95665
209-296-1663
sierra@volcano.net

TONY WIGHT
YOSEMITE NATIONAL PARK
15380 LUPE ROAD
PINE GROV,E CA 95665
209-296-1663
sierra@volcano.net

MEGAN WILSON
BRIGHAM YOUNG UNIVERSTIY
BIOLOGY DEPT
PROVO, UT 84602

RICK WINSLOW
NEW MEXICO DEPARTMENT OF GAME & FISH
ONE WILDLIFE WAY
PO BOX 25112
SANTE FE, NM 87504
505-476-8037
frederic.winslow@state.nm.us

PEREGRINE WOLFF
NEVADA DEPT OF WILDLIFE
1100 VALLEY RD
RENO, NV 89512
541-207-7305
falcolupus@earthlink.net

JOHN YOUNG
TEXAS PARKS & WILDLIFE
4200 SMITH SCHOOL RD
AUSTIN, TX 78744
512-389-8047
john.young@tpwd.state.tx.us

PAT ZIMMERMAN
GREEN DIAMOND RESOURCE
COMPANY
2474 HAWKS VIEW COURT
MIKINLEYVILLE, CA 95519
707-688-4461
pzimmerman@greendiamond.com

HEIDI ZURAWKA
CALIFORNIA DEPT FISH & GAME
WILDLIFE INVESTIGATIONS LAB
1701 NIMBUS ROAD, D
RANCH CORDOVA, CA 95670
917-280-3489
hzurawka@wildmail.com

WAFWA Sanctioning Guidelines

&

Workshop Bylaws

WAFWA Sanctioned Workshop Procedures and Guidelines

Purpose of Workshops

The Western Association of Fish and Wildlife Agencies (WAFWA) began sanctioning workshops in the mid-1970s. There currently are 10 sanctioned workshops recognized by the Directors of the Association (see Attachment #1). These workshops include ones that are species' specific and others that are tailored to certain disciplines within the wildlife profession. These workshops are established to provide a forum for wildlife professionals to interact with each other on new research, management, enforcement and administrative practices, and to use this new information to promote better management of species or administration of member agencies. The Directors annually review applications for workshops and the schedules of those already sanctioned, and also hear from workshop hosts about significant findings, developments, accomplishments and concerns emanating from the workshops, including the policy ramifications of any recommended actions. Simply put, the Directors see this "sanctioning" process as an ongoing means to keep abreast of important issues. As such, these workshops generally receive the highest priority for attendance by agency personnel. Once "sanctioned", these workshops are authorized to use the name and logo of the Western Association of Fish and Wildlife Agencies on printed materials related to the workshop, and hosts are encouraged to acknowledge the Association's participation. This participation, however, does not extend to direct financial assistance. The financial activities of the sanctioned workshops shall be conducted through a bank account established by and under the general direction of the WAFWA Treasurer.

The Directors of the Western Association of Fish and Wildlife Agencies have established application and approval procedures, as well as operating guidelines and reporting requirements for sanctioned workshops. These procedures and guidelines are designed to provide for timely review and action on the Directors' part, and the applicant the opportunity to learn what it takes to host a successful workshop and understand the feedback mechanisms that are required to the Association.

Application Procedures

Each workshop, technical committee or other entity initially seeking the approval and recognition of the WAFWA as a "sanctioned" forum must complete and provide the requested information (refer to Attachment #2) on the application form to the Secretary and Treasurer of the Association. That information shall include the following:

1. The purpose and objectives of the workshop/committee/organization and any adopted by-laws or operating procedure, including frequency and location of meetings and dues schedule, if such exists.

2. A brief summary statement of past accomplishments; attach copies of the most recent business meeting minutes, financial statement and proceedings, if such have been published. In the case of a newly proposed workshop, a summary of proposed activities will suffice.

3. A statement indicating the expected benefits to the WAFWA if the Directors agree to "sanction" the applicant, including the workshop's anticipated recognition for the Association's participation.

4. A statement indicating the expected benefits that will accrue to the applicant if the Directors agree to approve the application.

5. A statement that describes how officers are selected.

6. A statement that describes the selection process for workshops, including location and frequency.

7. Agreement (via signature of authorized agent) to WAFWA's reporting and financial requirements and assurance these will be adhered to by the original and subsequent workshop hosts.

Approval Procedures

Once an application for an initial sanctioned workshop is received, the following procedures will be followed:

1. Upon receipt of an application, the Secretary will notify the Chairman of the Executive Committee. The full committee will review all application materials at the annual meeting and recommend approving or disapproving each application. Attendance by someone representing the applicant is suggested.

2. The Executive Committee will submit its recommendations for consideration at a business meeting of WAFWA and action to approve or disapprove each application will be made by the entire membership.

3. The Secretary will notify the applicant and each member agency of the action taken at the business meeting regarding the request for "sanctioning".

Operating Guidelines

Once "sanctioned", here are some suggested guidelines to help insure a successful workshop:

Responsibilities for the Outgoing Chair

The Outgoing Chairs' responsibilities do not end at the conclusion of the workshop. Here are some other responsibilities that require follow-through:

- Provide a written and oral report at the next WAFWA summer meeting.
- Submit to the Incoming Chair, a copy of the mailing list (in electronic format) used in announcements distributed for the workshop. Complete within one month of the conclusion of the workshop.
- Submit a brief summary of recommendations to the Incoming Chair that identify considerations for hosting a successful workshop. Complete within one month of the conclusion of the workshop.
- If proceedings are to be published from the workshop, these need to be completed and printed within one year of the conclusion of the workshop. Manuscripts should be peer-reviewed to improve quality of the proceedings.
- Provide the WAFWA Directors and Secretary and Treasurer with a copy of the proceedings.
- Notify the WAFWA Treasurer when all financial transactions have been completed and access to the bank account is no longer needed.

Responsibilities for the Incoming Chair

The Incoming Chair has the burden of organizing the upcoming workshop. Among his/her duties are the following:

- Secure a host facility (i.e. hotel, motel or resort) where the workshop will be held. The following criteria should be considered when selecting a facility:
  - ✓ Sufficient rooms to accommodate at least the average number of attendees from the last two workshops.
  - ✓ Have a meeting room sufficient in size to accommodate at least the average number of attendees from the last two workshops in a setting suitable for this meeting.
  - ✓ Have room rates within government per diem rates.
  - ✓ Be located where air access is reasonable.
- Coordinate access to the workshop's bank account with the WAFWA Treasurer to establish signature authority, debit cards and confirm account balances.
- Develop and distribute a copy of the workshop announcement to:
  - ✓ The registrants from the previous workshop (list provided by previous chair).
  - ✓ All Directors of WAFWA state/province wildlife management agencies, and to the Directors of any state/province wildlife management agencies that have populations of the species addressed at the workshop.
  - ✓ The WAFWA Secretary and Treasurer.

This mailing should be completed no later than 10 months before the workshop. The announcement should include the dates and location of the workshop, the host resort with information on making reservations, and any other pertinent information available at the time of this mailing.

- Send out a call for papers at least six months before the meeting.
- Send out a second call for papers at least three months before the meeting.
- Send a request for state/province status reports two months before the meeting. It is preferred that this request be sent in electronic format so the respondents fill in blanks for consistent reporting from all agencies.
- Finalize the agenda at least one month before the meeting and submit the agenda to:
  - ✓ All registered attendees
  - ✓ Agency Directors in those states/provinces with the species targeted for this workshop
  - ✓ The Secretary and Treasurer of WAFWA
- Maintain adequate financial record to allow audit of the records.

Reporting Requirements

As stated previously, in order for this sanctioned workshop process to work as envisioned by the Directors, there must be regular communications from the workshop host(s). Listed below are the minimal reporting requirements that must be adhered to in order to retain "sanctioned" workshop status (refer to Attachment #2):

1. Provide copies of all announcements and agendas to all Directors and the Secretary and Treasurer of WAFWA.
2. Provide a copy of the minutes and/or proceedings to all Directors and the Secretary and Treasurer of WAFWA as soon as they are printed.
3. Provide a written and oral report at the next WAFWA summer meeting which includes, the following:
   - Number of registered participants.

- Copy of the agenda from the meeting.
- Financial report.
- Summary of key issues reviewed in the workshop, including policy ramifications of recommended actions.
- When available, a copy of the workshop proceedings if one is completed.
- Time, place host agency and contact person for the next workshop.
- Any additional items that would be of interest to the WAFWA leadership.

Financial Requirements

All financial accounts for all sanctioned workshops except the Desert Bighorn Council will be held in WAFWA bank accounts and under the general direction of the WAFWA Treasurer. The WAFWA Treasurer will maintain separate funds for each sanctioned workshop in the WAFWA accounting system. The WAFWA Treasurer will establish bank (checking) accounts for each sanctioned workshop as needed for conducting the workshop. The WAFWA Treasurer will coordinate with the outgoing workshop chair and the incoming workshop chair the cancellation of signature authority and the establishment of signature authority. The WAFWA Treasurer may periodically audit a workshop's financial records.

ORGANIZATION AND FUNCTION
OF THE
WESTERN BLACK BEAR WORKSHOP

BYLAWS

Designation:

This organization shall be known as the "Western Black Bear Workshop" hereafter referred to as the "Workshop". The official publication of the Workshop shall be known as the *Proceedings of the Western Black Bear Workshop* hereafter referred to as Proceedings.

Goal:

The goal of the Workshop is to provide information relative to and encourage the perpetuation of bear populations as an ecological, aesthetic, and recreational natural resource in western North America consistent with other proper land uses for public and private lands.

Objectives:

- To provide an opportunity for all persons interested in bears to meet and discuss current research and management of bears and their habitat.
- To provide a vehicle for disseminating research and management finding to various agencies and organizations concerned with bear management.
- To promote research for development of new information on all aspects of bear ecology, life history, and management in western North America.
- To identify particular problems associated with bear management and to formulate recommendations and resolutions to the appropriate agency or organization, including the Western Association of Fish and Wildlife Agencies.
- To promote cooperation among all agencies and organizations concerned with bear management and research, particularly among the various provincial, state, and federal agencies with primary responsibilities of managing bears and their habitats.

Organization:

The Workshop will be open to any person interested in bears and their management.

Voting:

Voting members shall consist of one representative from each of the following:

- Western states, provinces, and countries where bears are present including: Alaska, Alberta, Arizona, British Columbia, California, Colorado, Idaho, Mexico, Montana, Nevada, New Mexico, North Dakota, Northwest Territories, Oklahoma, Oregon, Texas, Utah, Washington, Wyoming, and the Yukon.
- Federal Agencies: U.S. Bureau of Land Management, Canadian Wildlife Services, U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. National Park Service, U.S. Natural Resources Conservation Service, Parks Canada, and the Director General de Fauna Silvestre.
- Universities, Colleges, and Research Institutions: The chair may appoint up to three people to represent colleges, universities, and research institutions. Appointees shall

come from any college, university or research institution actively conducting bear research.

Voting representatives for all the states, provinces, countries, or organizations shall be appointed by the agency directly responsible for wildlife management within the above named states, provinces and countries.

- The chair shall request that each of the above named federal agencies appoint one voting member. This request shall be directed to one of the regional offices or service centers in the western United States, Canada, and Mexico.

Voting shall be accomplished only by those authorized representatives in attendance at the business meeting of the workshop.

The Workshop will be scheduled triennially:

- The new host state, providence, country, or organization shall be selected and announced at the business meeting of the Workshop. It is the intent of the Workshop that the host state, province, country or organization will be volunteered on a rotating basis among the actively participating member states, provinces, countries, and organizations.
- The host state, province, county, or organization shall select the time and place of the meeting. The host shall appoint one of its representatives who will act as chair. Responsibilities of the chair shall be:

  - ✓ To serve as chair for the three-year period following his/her appointment.
  - ✓ To call for papers and prepare an agenda for the Workshop and assemble and distribute any recommendation or resolutions passed at the Workshop.
  - ✓ To prepare and distribute the proceedings of the Workshop for which he/she has been responsible.
  - ✓ To organize and conduct the meeting and business of the Workshop.
  - ✓ To appoint committees as necessary.
  - ✓ To maintain the goals and objective of the Workshop.
  - ✓ To prepare and make a formal report to the Western Association of Fish and Wildlife Agencies (WAFWA).

The mailing list of the Workshop shall be:

- The Western Association of Fish and Wildlife Agencies,
- The Director and Game or Wildlife Chief of every member state, province, and country.
- All Biologists known to be conducting bear research.
- All Bureau of Land Management State Offices and Regional Service Centers in the western United States
- All Regional Forest Service Offices in the western United States.
- All Fish and Wildlife Service Regional Offices in the western United States.
- All Natural Resource Conservation Service Offices in the western United States.
- All Cooperative Wildlife Research Units in the western United States.
- All persons attending the last Workshop**.**
- Any person or organization requesting a copy of the proceedings.

The chair shall forward the mailing list and other pertinent material to the new Workshop chair upon completion of his/her responsibilities as chair of the current Workshop.