

Behavior-based Bear Husbandry for Winter Denning: A practical application at Fortress of the Bear, Sitka, Alaska

*Paper presented at the Advancing Bear Care Conference
November 2009, San Francisco, CA*

*By Christine Fenwick, Bear Manager
Fortress of the Bear
PO Box 2337, Sitka, AK 99835
oso.ursa@yahoo.com*

Abstract

*Behaviors were closely monitored for two, two-year old, male brown bear (*Ursus arctos*) cubs at Fortress of the Bear in Sitka, Alaska during the fall, winter, and spring of 2008 and 2009. Denning behaviors became evident in early November with changes in food consumption, and activity periods. Food consumption decreased from 14,000 kilocalories per day per bear in September to 4,100 kilocalories per day per bear in November. Killisnoo and Chaik weighed 200 and 225 kilograms respectively in September. Daylight hours and daily temperatures decreased in November; however the fall was atypically warm by two to seven degrees Celsius. Diet consumption reached a low of 1,696 kilocalories per day per bear in late December. Each bear exhibited its own unique behavioral response to the changes in the captive environment. Keeper routines changed in response to changes in bear behavior. Visitor attendance decreased, and other disturbances were also reduced. In the deepest part of winter, the bears were still eating, defecating, and urinating. The cubs had decreased activity for parts of the day, and were spending 18 to 20 hours in the den. Food consumption and activity levels returned to normal with the increase in daylight hours and temperatures of March and April. Most influential on their behavior, was the dynamic relationship between the two cubs. Although allowed to feed to satiation during the hyperphagia stage of late summer, they may not have had enough fat on them for winter denning. As cubs, their bodies continued to grow through the winter as they lost fat and gained length and height, emerging from the den 1.5cm taller than when they entered. There were also uncontrollable outside disturbances, and there may have been other factors affecting their denning behavior. The bears were fed according to their consumptive needs, given denning space and denning material.*

Behavior-based husbandry utilizes the natural history of an animal to determine the appropriate husbandry practices to best meet their needs. For brown bears and black bears, there are seasonal changes that affect their behaviors, most notably during the winter, which is naturally a time of denning. In wild bears that have a sufficient fat layer to allow winter denning, there are three main behavioral cues of winter denning: 1. Decreased food and water consumption, often times ceasing to eat and drink completely; 2. Decreased activity, often spending more time near the den site as winter approaches; and 3. Entering a den and remaining in the den for prolonged periods of time, some bears will enter a winter den and remain there for up to six months in the far north (Brown, 2009). Winter denning is a complex biological and biochemical process influenced by many variables that include, but are not limited to: acquisition of a sufficient fat layer to survive a winter without food, decreased daylight hours, decreased average daily temperatures, and an appropriate denning site and denning materials. When all of the factors are present, they produce predictable winter denning behaviors. These factors are variable and are necessary to meet the changing environment from year to year as winters will differ. In captive communities, keepers are tasked with making decisions for the animals in their care to best meet the needs of those animals and the management needs of the facility. Often times keepers are required to maintain protocols that do not allow the animals to choose what is best for themselves. For winter denning in bears, many factors must align for denning to occur, and no one knows better than the bears themselves if all those factors are in line (Poulsen, 2008). The onset of winter is a time of reduced food abundance, and food reduction for denning should follow the bears' cues.

Fortress of the Bear is home to two male, brother, brown bear cubs, Killisnoo and Chaik, who turned two in the winter of 2008-2009. The exhibit has full exposure to the elements, and the bears are

exposed to year-round weather patterns, vegetation changes, and temperature changes. The den is completely enclosed providing a private, quiet, dark, and dry space. The den is not temperature controlled, and its temperature is roughly the same as the ambient temperature. The bears were observed closely throughout the year to identify behavior patterns, and husbandry protocols were modified based on the behavioral cues from the bears.



Inside the bear den. Nesting materials include straw, sticks, and shredded paper. Chaik worked meticulously to get the nest just right for winter denning. (Photo: Christine Fenwick)

The bears' behaviors were closely monitored on a daily basis, with observations logged in the daily paperwork. Keepers watched for: aggressive behavior, play behaviors, general activity levels, food consumption, and weight fluctuations. In the fall and winter, behaviors were monitored for denning specific cues that would indicate a change in husbandry. Denning behavior cues included: decreased activity levels, decreased play behavior, increased nest building behavior, increased time within the den, and decreased food consumption. Decreases in behaviors were determined based on a comparison to summer behaviors

exhibited by the bears. Husbandry changed as bear behavior changed. Average temperatures, daylight hours, and precipitation were recorded for each month. Kilocalorie content of the diet was figured using averages for kilocalorie content of foods normally fed. All food is donated, so the types of produce, dog food brand, and meat sources were highly variable. Average kilocalorie content for food was broken down into produce, dog food, and meat. With kilocalorie content of all types of produce averaged, all types of possible dog food brands averaged, and all types of meat sources averaged. Daily nutritional logs were kept to track the diet levels. Diets consisted of dog food, produce, and meat fed in a 1:1:2 ratio respectively. Diets were decreased in the fall based on cues from the bears, and kilocalorie content of diet changes was logged. No supplements were given, and enrichment food was counted as part of the overall diet and calculated into their overall kilocalorie intake.

August and September were months of hyperphagia for the bears, and they consumed 14,022 kilocalories per day. August and September had 16 and 12.5 hours of daylight respectively, and temperatures were 10°C [50°F]. Due to security concerns the bears were locked within a secure night holding area every night. They were released into the exhibit at 0730 in the morning, and brought back in for the night at 1930. The night holding area was set up with extensive enrichment every night to allow them the option to play and interact if they chose to. They were most active in the morning upon release into the area. They spent an average of two hours moving around the area, interacting with enrichment and with each other. They often slept at some point in the middle of the day between 1100 and 1400, and they spent upward of six hours a day playing in the pond, both with each other, or entertaining themselves on their own. Many factors influenced their behavior on a daily basis and included: weather, temperature, visitor interaction, and interactions among themselves. They were generally active again in the late afternoon, through to the evening. At night, they interacted with the enrichment, fed, and slept. Keepers arrived in the morning at 0700 for training sessions, enrichment preparation, and release of bears out into the exhibit. This was a typical routine for the bears and keepers through spring summer and fall.

In October diet consumption decreased to 10,700 kilocalories per day per bear, as they were leaving an average of a quarter of their diet uneaten. Daylight hours decreased to 10.5 hours a day, and this

affected keeper schedules. October is also the rainiest month of the year averaging 37 cm of rain for the month. The bears were let out into the exhibit at 0800 and brought back in at night at 1800. The activity pattern of the bears remained the same during the day. They were consuming all of their enrichment food in the area in the morning, but were less interested in food provided by keepers throughout the day. When brought into the night holding, the bears would eat the dog food, most of the meat, and most of the produce, leaving some produce uneaten. The bears were usually still sleeping when keepers came in the next morning to let them back into the exhibit.

In November, the greatest reduction in food consumption occurred from 10,752 to 4,100 kilocalories per day per bear. This fell further mid-month to 3,400 kilocalories per day per bear. Keepers reduced feedings based on uneaten diets. Temperatures for this month were slightly warmer than previous years at 4°C [39.2°F]. Daylight hours decreased to eight hours each day. The activity patterns of the bears changed dramatically this month, and they were given unlimited access to the den at all times so they could choose where they wanted to spend their time. The bears exhibited increased lethargy, decreased play behavior, and decreased interactions between the two bears. The common behaviors in the exhibit were laying around, walking for short periods of time followed by laying down, yawning, resting their heads on logs, increased time within the den, and increased nesting

behavior. Reduction in daylight hours and temperature influenced the bears' behavior with an increased desire to nest build, spend more time sleeping within the den, and to consume less food. The bears appeared to have sufficient fat layers, bellies hanging below their knees at the start of fall, and their reduced consumption indicated that they may have had sufficient fat to den. Chaik (shy-eeek) also showed an increase in nest building behavior, which prompted keepers to prepare the denning area. The bears were given straw, sticks, and shredded paper within the den. Chaik was meticulous with the den each day, breaking trees in the exhibit to bring them inside the den for the nest, and keepers responded by providing more sticks and twigs as nesting material.

Chaik spent 20-45 minutes nest building, and would build, add to, or modify the nest at least two or three times a day at the beginning of the month. Killisnoo did not participate in nest building behavior this month. He would watch Chaik rake and drag the branches in, but was never observed collecting or raking branches into the den himself.



Chaik Bear showing increased lethargy in December 2008 by resting his head on a log after a short walk in the exhibit. (Photo: Christine Fenwick)

In December, food consumption fell from 3,400 to 1,696 kilocalories and then slightly increased in January to 2,876 kilocalories, and they continued to eat through this time. Each day averaged six hours of daylight, and 0°C [32°F] through these two months. They spent an average of 20 hours within the den, most of that time was spent sleeping, but they would always get up for food fed in the exhibit, and when they could hear people. There was less snow fall than the previous two years, and temperatures were warmer than the previous two years. As growing two-year-olds, there may have been more pressure on their system to keep eating through the winter, although at greatly reduced levels. The dynamic relationship between the cubs also greatly affected their denning behavior. Chaik spent more time nest building, and was also more lethargic than Killisnoo, who only started to nest build more than a month after Chaik. Killisnoo would also lay in the den with Chaik, but would not let Chaik sleep. Killisnoo would slap or bite his brother in the den.

As the months progressed, Killisnoo calmed down, responding to his brother's decreased activity. Chaik was more active, responding to his brother's activity patterns. Diets were increased when there

was an increase of aggressive behavior from Chaik toward Killisnoo, which was usually uncommon. Increased consumptive needs may have been due to sporadic periods of clear sunny weather, which resulted in increased activity periods in the exhibit during the day. When more food was provided, the aggressive behaviors subsided. Aggressive behaviors observed included hard biting and growling with head shaking while biting whenever Killisnoo got close to Chaik in the exhibit. Chaik would engage Killisnoo in a full body wrestling match with biting and growling whenever Killisnoo approached, and an overall short temper from Chaik, which was different from his usual passive tolerant behavior toward his brother. Once more food was offered these behaviors subsided. As the nest was already made in November, they spent less time nest building, but more time in the den using the nest. Chaik would periodically take branches from the exhibit to add to the den, and keepers added nesting materials as necessary to ensure the nest remained dry, as the bears were out in the snow and their warm snow covered bodies would make the nesting materials damp. The bears came out of the den when they heard keepers working in other parts of the facility, and would re-enter the den when keepers left for the day. The bears came out of the night holding after 1000hrs most days, and would go back in around 0230hrs in the afternoon. Enrichment was removed from the daily schedule, and training was put on hold to resume in the spring.

Table 1: A comparison of daylight hours, precipitation, daily temperatures, and kilocalorie consumption. Amount of precipitation did not seem to affect or correlate with behavior changes overall.

Month	Hours of Daylight	Precipitation in cm	Daily Temp in °C	Kcal consumption First of month	Kcal consumption Last of month
September	13	28	10	14,022	12,589
October	12	37	7	10,752	10,752
November	8	28	4	4,106	3,702
December	7	24	0	3,419	1,696
January	6.5	22	0	2,876	2,876
February	9	18	1	3,771	4,257
March	11	17	2	4,823	8,021
April	14	15	4	8,520	14,890
May	16	14	8	14,890	14,890

In February, food consumption increased late in the month to 4,257 kilocalories. Daylight hours increased to nine hours a day, and the bears became more active. They came out of the den earlier in the day, stayed out longer, played more together, played on their own, and more time moving around the area, and less time within the den. There were reports of wild bears emerging from their dens in the surrounding area and on adjacent islands as early as mid-February, which is not common for this area. Wild bears typically start to emerge from their dens in April (Schoen, Gende, 2007). The end of February was cold at 1°C [33.8°F], but a week and a half of sunny weather correlated to behavior change in the bears. Increased activity and aggression from Chaik was a definite indicator that hunger was increasing, and diets were increased. Chaik would growl and aggressively attack Killisnoo if he even came close to food. As food was increased, this behavior again subsided. Training was offered if the bears were up to participating in sessions.



Killisnoo Bear showing increasing lethargy by resting on a log in the exhibit in January 2009.
(Photo by Christine Fenwick)

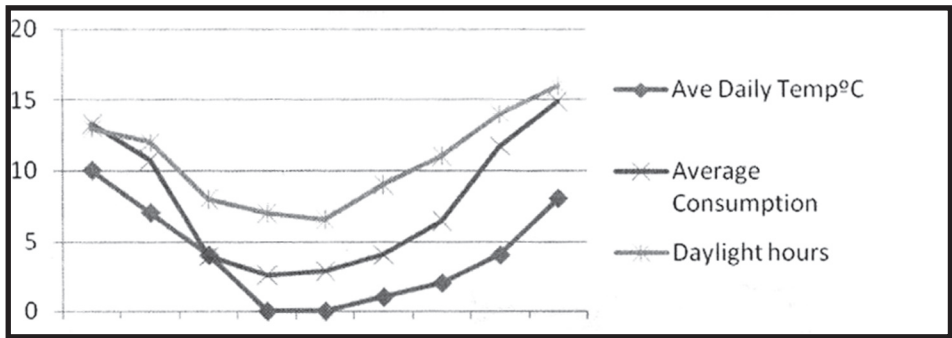


Chart 1: A comparison of daylight hours, food consumption at 1/100 scale, and daily temperature in degrees Celsius for September through May.

Consumption almost doubled in late March from 4,823 to 8,021 kilocalories. Daylight hours increased to 11 hours a day, temperatures increased to 2°C [35.6°F], and the activity level also increased. They spent only a few hours a night within the den, and transitioned to sleeping out in the exhibit space. They had completely abandoned their den by late March, choosing to sleep out in the exhibit at night as well. Their activity levels were increasing. They were more playful and active in the area so more food was necessary since they were burning more calories each day. They also showed more aggressive behaviors around food, which dissipated as food was increased. Training and enrichment was fully integrated into their daily schedule.

There was another jump in consumption in late April from 8,021 to 14,890 kilocalories, which was above kilocalorie intake of hyperphagia of last summer with a high at that time of 14,022 kilocalories. There was a growth spurt in both of the bears, increasing in height by more than 1cm. In May, kilocalorie consumption leveled off and they exhibited their normal behavior patterns consistent with last year in spring and early summer. There were 16 hours of daylight each day, and increasing daylight each day. Temperatures were unusually warm at 8°C [46.4°F], with mild weather. Enrichment schedules continued at full scale, and training and keeper interaction also remained at high levels as winter denning behaviors had completely ended, and the bears were back to their normal spring and summer behavior patterns.

There are many factors that trigger hibernation in wild bears, and the situation becomes more complicated in a captive environment. As keepers, it is necessary to understand the natural behaviors that are displayed by the bears, and make decisions to enhance and allow the behaviors to develop. The bears know best what needs to happen to meet their needs, especially when it comes to winter denning. Winter denning in brown bears and black bears is a natural process, and is triggered in part by decreases in day light and temperatures. These changes take place even in warm climates, and they can affect the behaviors of the bears in these climates as well. It is very important to know the bears well, and be able to identify the behaviors that are indicative of winter denning. Once the behaviors are identified, the behavioral cues offered by the bears should be used to guide the husbandry practices. It is difficult to meet the management needs of a facility and the animals needs as well, and a successful balance must be struck to meet all of those needs.

References

- Brown, G. The Bear Almanac, A Comprehensive Guide to Bears of the World. 2nd Edition. Guilford, CT. Lyons Press. 2009. Pg.152 - 160.
- Poulsen, E. Denning Processes. Listserve communication, March 2008.
- Schoen, J. and Gende, S. The Coastal Forests and Mountains Ecoregion of Southeast Alaska and the Tongas National Forest. A Conservation Assessment and Resource Synthesis. Anchorage AK. Audubon Society and Nature Conservancy. Chapter 6.2 Mammals: Brown Bear. 2007 Pg 7-9.