



April 8, 2010

Eye on the Environment:

Waking Up Groggy

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for Swan Ecosystem Center

There are mornings I can't figure out why my alarm is making noise. There are mornings my brain churns to understand how long it has been since I hit the snooze button. I am slow in the mornings, sitting up, blinking and shaking my head, waiting for the synapses in my brain to start firing. For me this is part of waking up. So when I squatted down to look at the grizzly bear tracks that wandered down the road in front of me, I couldn't help but wonder what it feels like to wake up from 6 months of slumber compared to my usual 8 hours.

Some scientists consider bears to be "superhibernators" considering the complex physiological changes that animal undergoes to sleep through the winter. Montana bears lay dormant in their winter dens for 4-5 months living solely off the fat they have saved after a season of intensive feeding. Understanding a bear must build up enough fat to survive through the entire winter, can lend insight to why these critters are so driven by their stomachs the remainder of their active season.

Bears go through a five-stage annual cycle. The stages are normal activity, hyperphagia, fall transition, hibernation and walking hibernation. Normal activity is exactly

what the name suggests and involves bears feeding and wandering through the mountains, drainages and valley floors. Hyperphagia is the term for the 24-hour-per-day calorie cramming bears undergo in the fall to build up energy reserves that will be consumed in the den during the upcoming winter months. Studies of hyperphagic black bears with unlimited food sources were documented eating 15 -20 thousand kilocalories per day. In the fall transition stage, a bear's metabolism is shifting gears preparing for the necessary physiologic changes to allow the animal to live solely of its fat tissue during the winter months.

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Hibernation in bears is a seasonal response to shortage of food. Depending on the winter season, bears across North America hibernate for varying amounts of time. Black bears in Mexico have been found to hibernate for a few short weeks, while Alaskan brown bears will hibernate for up to seven months.

In the Swan Valley, bears typically enter their dens between the end of November and mid-December, depending on the amount of snow and food availability. Emergence from dens spans from mid-March through mid to late April. Typically, male bears emerge first, followed by solitary females, females with yearlings and finally females with cubs of the year.

The term “hibernation” for the sleep bears undergo during the winter has caused debate. Mammals considered “true” hibernators, such as ground squirrels, undergo plunging body temperatures to around 40° F during the winter denning period. A denning bear’s body temperature is typically around 88°F within 12 degrees of their normal range.

Unlike smaller mammals, lower body-surface-to-mass ratios and highly insulative pelts allow bears to cut metabolic rate during the winter by 50-60 percent, while maintaining a relatively high body temperature. This adaptation gives bears the ability to wake up faster than smaller mammals that must re-warm themselves first before arousal.

Bears do not eat or drink during hibernation. So the animal has a fixed energy budget to survive the winter, and to birth and nurse cubs. Bears therefore decrease their metabolism during hibernation, frugally expending the calories from fat layers laboriously built up over the past months of feeding on berries, plants, insects, nuts, and meat. Heart rates of 40-50 beats per minute drop to 8-19. Normal breathing of 6-10 breaths per minute diminishes to as low as one breathe every 45 seconds. This allows the animal to live on as little as 4000 calories a day.

What are the physical effects of sleeping six months? For comparison, comatose patients are typically subject to osteoporosis or increasingly porous bone structure, weakened by lack of skeletal use. Muscle also atrophies considerably with disuse. Denning bears that lie in one position for months at a time exhibit little weakening of the bones and some research indicates bears enter a hyper-metabolic state where bone formation is increased in the spring perhaps to prepare the

skeleton to carry the weight of the soon- to-be up and moving emerging bear. Similarly, bears lose negligible muscle mass despite remaining recumbent for so many months.

Perhaps the most incredible aspects about hibernation in bears are the animal’s internal recycling mechanisms. Bears do not urinate or defecate while hibernating. A fecal plug of feces, dead intestinal cells, and plant material used to make a bed on the floor of the den is formed during hibernation. In mammals, including humans, blood is filtered through the kidneys, and urine is produced for disposal of some of the body’s metabolic wastes. Without this disposal mechanism, urea and other wastes build up in the blood stream and can cause serious internal damage.

With the help of specialized microbes in the gut, bears break down urea and produce nitrogen that special hormones then convert to protein, which is used to maintain the body’s tissue. Bears may actually increase their lean body mass through this recycling system over the winter.

Furthermore, bears live completely off their own fat base while in the den. Yet these animals do not exhibit signs of hardening of the arteries or high cholesterol as humans would with a strictly fat-based diet. The bears’ ability to retain bone mass, recycle wastes, and fend off heart disease may lead to breakthroughs in human treatments for osteoporosis, heart disease, and hibernation, plus be useful for the development of strategies for long term space travel.

Considering the complex physiological changes that bears undergo for the winter season, I am even more curious to know how they feel when they push their way out of their

snowy dens in the springtime. As bears move into walking hibernation, they typically stick close to the den site for a short time. Despite common perception, bears do not emerge ravenous from the den. As their system slowly returns to normal, bears begin to eat more, searching out greening plants and scavenging animal carcasses in the transition time between winter and spring.

The bear's metabolism soon returns to normal and the race is back on to find enough calories to build the layers of fat for the next winter. These animals are driven by their stomachs, and the springtime often brings high rates of bear conflicts with garbage, birdfeeders, and other attractants around human development. It is important these attractants do not become a "learned" food source for bears that are looking for the least energy-expensive way to build up their caloric intake.

For additional science and up-to-date information on how to prevent bear problems, the Swan Valley Bear Resources is hosting the third annual Spring Bear Wake Up Social on April 22nd. Admission is free, and the doors open at 5:00 p.m. and appetizers will be served throughout the evening.

The event will include presentations by Jeff Stetz from the US Geological Survey and Tim Manley, Montana Fish Wildlife & Parks Region 1 grizzly bear management specialist. The evening promises to be filled with interesting information as well as good food and a community atmosphere. Hope to see you all there.