Northland OUTDOORS

Published March 13, 2010, 07:21 AM

Learning from the bears

NEAR PLUMMER, Minn. — She's not really aware of it, but the mother bear hibernating with her three cubs in this inconspicuous den in southern Pennington County is one high-tech mama.

By: **Brad Dokken**, Grand Forks Herald

NEAR PLUMMER, Minn. — She's not really aware of it, but the mother bear hibernating with her three cubs in this inconspicuous den in southern Pennington County is one high-tech mama.

The most obvious sign of technology is the orange GPS collar she sports around her neck. The GPS unit charts her movements, in the form of latitude and longitude coordinates, every couple of hours as part of a three-year study the Department of Natural Resources is undertaking to learn more about bears in northwestern Minnesota, which lies on the fringe of traditional black bear range.

The northwest study is scheduled to continue through the winter of 2011.

Less conspicuous, but just as significant, are the tiny heart monitors — each about the size of a pack of Wrigley's chewing gum — the mother bear wears in her chest just underneath her skin.

For the past several years, the University of Minnesota and Medtronic, the Twin Cities-based medical technology and research firm, have partnered with the DNR to study bears in the field. While DNR researchers study bear movement and the habitat they prefer at certain times of the year, the scientists from Medtronic and the U of M's Visible Heart Lab are taking the opportunity to work with the bears, up-close-and-personal, to learn more about their physiology.

The DNR studies are a perfect fit with Medtronic's research mission.

One of the goals is to better understand how bears can emerge from months of hibernation and hit the ground running, so to speak. According to Tim Laske, a biomedical engineer at Medtronic, researchers hope to apply what they've learned to lessen the physical effects on bedridden patients, who typically lose about 1 percent of their muscle strength daily.

Bears, by comparison, maintain more than 70 percent of their muscle strength over the five months they're hibernating. And, "70 percent still leaves you with a lot" when you're as strong as a bear, Laske said.

Back to the dens

Laske and Paul Iaizzo, of the U of M's medical school and a Medtronic professor of visible heart research, were in northwestern Minnesota earlier this week with DNR crews checking on several denned-up bears. While DNR bear biologist and team leader Dave Garshelis tranquilized the bears to remove them from the den and change out the GPS collars, Laske and Iaizzo checked on heart implants, downloaded data and wired up the bears for EKG and ultrasound tests.

In the case of the 300-pound bear near Plummer, the rest of the crew, including a Herald reporter, took turns keeping the three cubs — tiny fur balls with alert blue eyes — warm.

Tough job, but someone had to do it.

The cubs, which weighed nearly 8 pounds each, remained calm outside the den and didn't seem to mind the human attention.

According to Laske, the heart implants are a relatively new aspect of the bear research. Researchers first inserted heart implants in 10 northwestern Minnesota bears in March 2009 to log their cardiac functions.

"We wondered what was happening to the heart with no food, water or exercise," Laske said. "If you were in this state even a month, you wouldn't be able to walk. And you long ago would have starved to death and died of dehydration."

Several of the implants were rejected by the bears' immune systems and expelled; another bear simply disappeared and the researchers aren't sure what happened.

On the plus side, four implants stayed in the bears, and the researchers now have 12 months of continuous cardiac data from the northwestern Minnesota study.

"We think it's the first time anyone has recorded the heart rate of a wild animal," Laske said.

Iaizzo, whose specialty is physiology, said the same rejection response has occurred in previous bear studies around the world.

"We've seen a really unique body response before when we've tried other implants with bears in the wild," Iaizzo said. "They have an amazing ability to heal their wounds."

Early findings

The four implants that stayed in the bears already have provided significant information on their heart rates. During the summer, for example, Laske said the

heart rate averages 60 to 100 beats per minute, with bouts of more than 180 beats per minute, and the data has shown the bears become increasingly nocturnal in the fall.

While hibernating, the heart rate slows to as little as four to six beats per minute, although it temporarily will accelerate as much as 800 percent when the bear breathes, which can be as little as two times per minute in the den.

This phenomenon, known as respiratory sinus arrhythmia, allows the hibernating bears to circulate oxygen through the blood with maximum efficiency even in a near-vegetative state.

“We’ve seen breaks as long as 15 seconds” between heartbeats, Laske said. “A human would faint if there was a two- to three-second pause.”

The hibernating bears don’t lose cardiac function, either.

“Human hearts would shrink,” Iaizzo said. “These guys are in a state of starvation, and they’re not losing anything. It’s just amazing.”

According to Laske, Medtronic donates the heart implants, which are the same as those used in humans and cost thousands of dollars each. The implants’ shelf life has expired, which means they’re no longer suitable for human use but are ideal for bear research.

“We’re a pretty low-budget operation,” Laske said — “science on a dime.”

The researchers are installing two different types of implants in the bears. The one type, Laske said, provides three years of continuous data on heart rates. The other offers more detailed information on the heart’s electrical signals, but only during the short window when the bear is roused from hibernation and sedated.

“We put that in so we could see what happens in great detail when a bear is waking up,” Laske said.

The bears — and their cubs, for those that have them — are returned to their dens when the tests are complete.

Ever aware

Proof of the bears’ ability to awaken from hibernation was readily apparent this week, Laske said, when two bears bolted from their dens as the researchers approached.

“There are long pauses (between heartbeats), yet they’re remaining alert,” he said. “They’re aware of our presence in almost every circumstance.”

The crew was able to catch and sedate the bears to finish their work, but it certainly made the job more challenging. No wonder, then, that Laske prefers to work in colder temperatures instead of the warm, sloppy conditions they encountered this week.

“The bears are more sedate in the colder temperatures and when they don’t have water running into their den,” he said.

The bear near Plummer had the short-term logger implanted in December. Tuesday afternoon, with the assistance of three graduate students, Laske and Iaizzo went to work activating the unit, downloading data and surgically implanting one of the longer-term devices.

They then cleared the memory of the short-term unit so they could get new information when they find the bear again next December.

“We’re using them as different tools,” Laske said. “Every tool in your toolbox has a slightly different purpose, and that’s why we require two devices — one to store electrical signals to memory in great detail and the other just to count heartbeats.”

When the northwestern Minnesota bear study is complete, Medtronic will continue its research with the DNR in other parts of the state.

“We’re thrilled that (Garshelis) lets us come along,” Laske said. “Dave, Paul and I bring complementary expertise to the project, and it’s fun to be out in the field together.”

The bears, it seems, still have much to teach — especially when they’re hibernating.

“We don’t know what all of the applications will be” for medicine, Laske said. “If we can understand how the bear accomplishes these things, maybe it will trigger new ideas for therapies. Our goal is basic science here.

“We’re just scratching the surface.”

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