Polar bear den detection methods work less than half the time, finds bear expert

March 13 2020, by Todd Hollingshead

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When fuel companies explore northern Alaska for oil, federal regulations require them to steer clear of polar bears. To locate the endangered species during winter months, fixed-wing planes mounted

with forward-looking infrared technology, or FLIR, are sent out to scan for dens hidden under the ice.

These aerial FLIR surveys have been used for more than 15 years now as the tool of choice for locating polar bear dens, but a new study by Brigham Young University biologist and bear expert Tom Smith finds they correctly identify maternal dens less than half the time.

According to the study, published in the journal *PLOS One*, infrared technology used by oil-field operators between 2004 and 2016 located only 45% of the dens known to exist along a 139-mile stretch of Alaska's Beaufort Sea coastal areas that extend east and west of Prudhoe Bay.

"We were literally on the ground, looking at survey data reporting no dens in the area and then, boom, we'd see a bear come out of a den," Smith said. "Why spend tens of thousands of dollars on surveys that have a low percentage of success? FLIR still has its utility, but 45%? That's pretty low."

Polar bear populations along the Beaufort Sea declined 40% between 2000 and 2010, so protecting the endangered species is a critical priority. Federal regulations require human activities like oil and gas development to be at least one mile away from any maternal dens, so knowing their location is essential in those preservation efforts. All of this is top of mind again with petroleum exploration and development now proposed for the Coastal Plains of the Arctic National Wildlife Refuge, an area designated a critical polar bear denning habitat.

For their study, Smith and coauthors from Polar Bears International traveled to northern Alaska to monitor the bear dens in person, comparing the data from FLIR surveys with on-the-ground observation. Over the course of several weeks (in brutally cold conditions, no less), they learned only 15 of the 33 dens in the area had been properly

identified.

They also learned 19 locations identified as dens by aerial FLIR survey were false positives. According to their on-site review, a number of heat signatures recorded by FLIR and assumed as dens were actually other things: cracks in the sea ice, exposed soil, large rocks, and even manmade objects like an abandoned 55-gallon steel drum.

Smith said part of the problem is that flight operators are ignoring data that points to the best operational windows and conducting surveys without taking guidelines seriously. Those guidelines detail appropriate wind conditions, relative humidity, sun location and other factors.

"This research is not just a shot at the technology; there are so many confounding factors," Smith said. "Yes, the technology has limitations—it's impossible to see a heat signature under four meters of snow—but the increasingly variable weather conditions caused by global warming are also increasing complications for accurate readings."

One improvement Smith suggests is the use of helicopters rather than fixed-wing aircraft. Although it is more expensive, previous research has found helicopters to be more accurate in FLIR surveying.

Smith also said the technology must improve. Working with BYU engineering professor David Long, Smith and others are now exploring the use of synthetic aperture radar for polar bear den detection. This type of radar has already shown the ability to penetrate dense jungle tundra to locate and identify hidden ancient structures.

"We're not anti-oil exploration; this is not advocacy science. We didn't go into it with any sort of agenda. We're just saying you need to up your game here," Smith said. "We're hoping to encourage them to improve their accuracy to protect bears and find better technology for their

operations."

More information: Tom S. Smith et al. Efficacy of aerial forward-looking infrared surveys for detecting polar bear maternal dens, *PLOS ONE* (2020). DOI: 10.1371/journal.pone.0222744

Provided by Brigham Young University