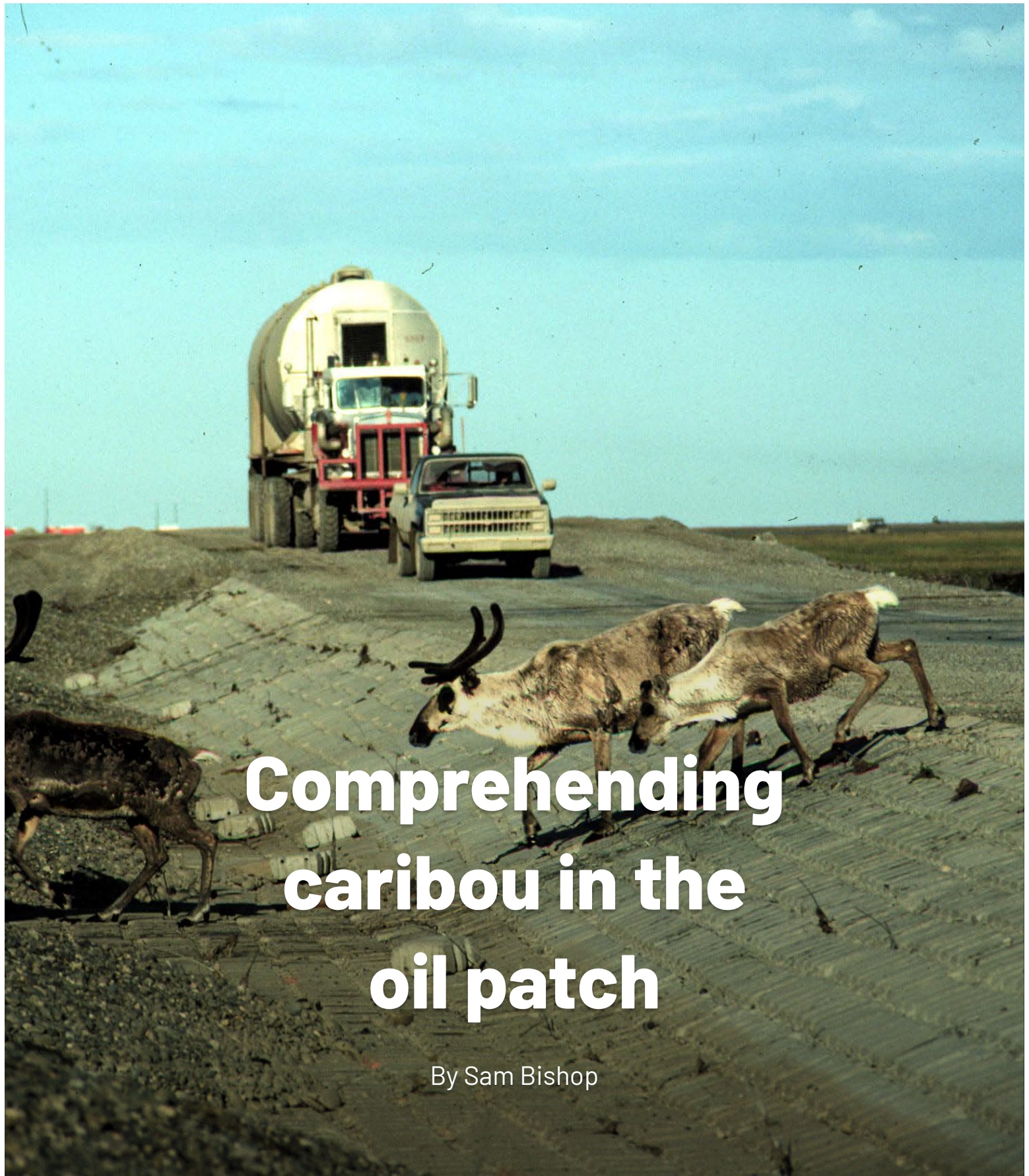


**AURORA**



# Comprehending caribou in the oil patch

By Sam Bishop

*Above: A group of caribou crosses the Spine Road in the Kuparuk River floodplain, west of Prudhoe Bay on Alaska's North Slope, in July 1982. Photo by Brian Lawhead.*

## **Brian Lawhead '83 sat atop a high mound of stockpiled gravel and watched caribou moving along the nearby Kuparuk River.**

Soon, he noticed something watching him.

It was July 1982, and the young biologist and UAF graduate student had just begun observing how caribou interact with Alaska's North Slope oil development.

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Forty years later, Lawhead and other scientists now know that many factors – including that creature whose gaze he felt – drive caribou reactions to the oil fields. That knowledge offers encouragement but caution as the ever-controversial oil work continues to expand.

The creature gazing at Lawhead was nothing so imposing as a polar bear, grizzly or wolf. Rather, it was a fly about the size of a bee.

“They’d land and kind of look up at me,” the now-retired biologist recalled in a recent interview. “My initial thought was, ‘Are they out to get me?’”

It was an understandable question, given what Lawhead knew of caribou and flies. Two species from the Oestridae family – warble and nose-bot flies – harass the caribou from mid-July through early August.

When the flies come out, the animals care about little beyond escape, oil development be damned.

Lawhead recently retired from the Fairbanks-based environmental consulting firm ABR Inc., where he contributed to 40 years of caribou research. From data gathered in those studies

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and others that preceded or paralleled his work, scientists now know that Central Arctic Herd caribou react to the oil fields very differently during different seasons.



*Brian Lawhead searches through caribou photos at the ABR office in February 2023. UAF photo by Eric Engman.*

Oestrid flies are one reason – some caribou actually seek out gravel roads and pads, which the flies tend to avoid, Lawhead noted.

But the researchers also have documented how human activities and oil-field designs can create seasonal obstacles and other challenges for caribou, he said.

The research, for example, conclusively shows that female caribou, when calving in spring, avoid roads and gravel pads with oil-field traffic.



*Caribou, including a calf with a collar, move through the Kuparuk oil field in July 2016. Photo by Wendy Mahan, ConocoPhillips.*

Those insights, when used in oil-field design and operations, can reduce the potential negative effects on caribou as development spreads westward on the North Slope, Lawhead said. ABR's caribou research was primarily funded by ConocoPhillips Alaska and its predecessors, major players on the North Slope and in the westward expansion.

"The whole point of a lot of our work is to identify and evaluate mitigative measures," Lawhead said.

## Filling in the details

**Alex Prichard '97, '98** an ABR senior scientist, summarized some of that work at the UAF Institute of Arctic Biology's weekly seminar on Oct. 28, 2022. Prichard, who earned UAF master's degrees in wildlife biology and statistics, worked with Lawhead for over 20 years at ABR.

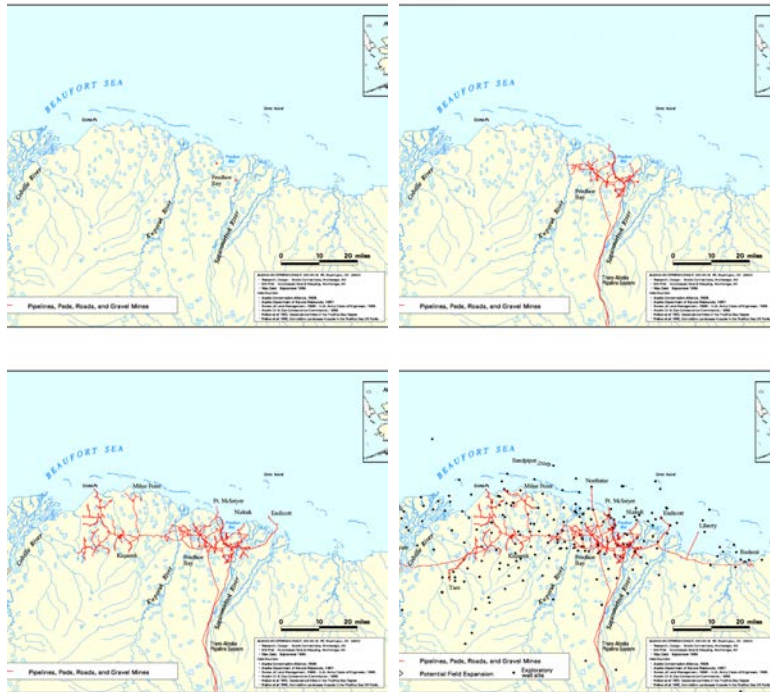


*Biologists Brian Lawhead, left, and Alex Prichard stand outside the ABR office in February 2023. The two scientists and UAF alumni worked on caribou studies together at ABR for more than 20 years. UAF photo by Eric Engman.*

"Any time you look at the herd, you have to think of the seasonal patterns that are occurring, because there are huge differences in behavior and how they respond to development," Prichard told the

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seminar audience at the Murie Building auditorium on the Troth Yeddha' Campus in Fairbanks.



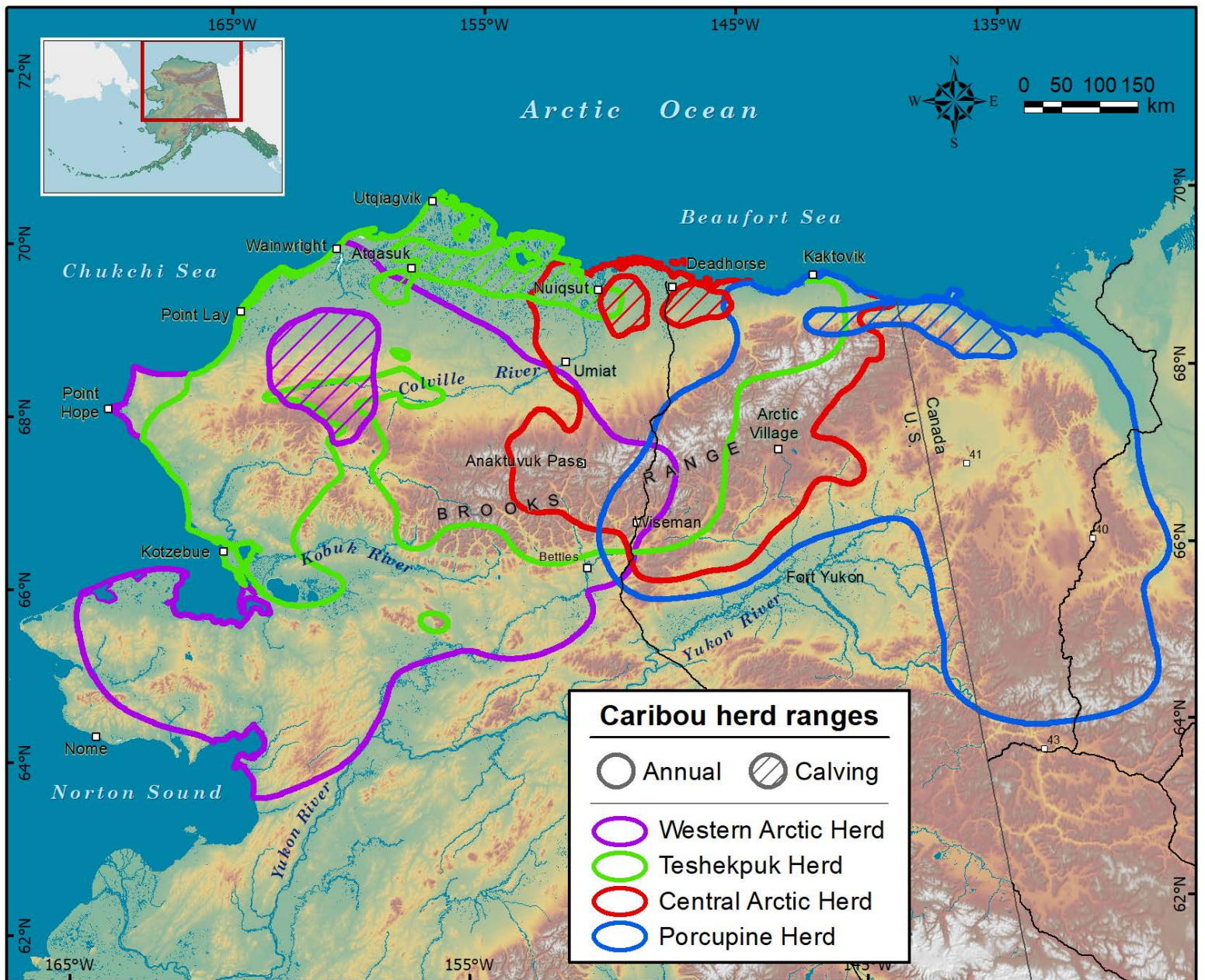
*Maps used by Alex Prichard during his October 2022 presentation show the expansion of oil development from 1968, when the Prudhoe Bay field was discovered, through 1999, when work had moved westward to the Colville River delta. (Black dots on the bottom right map represent all the gravel pads built for exploratory wells, including abandoned sites, since the 1960s.) Maps by the Alaska Wilderness League from public data sources.*

That development began after Arco, ConocoPhillips' predecessor, discovered the massive oil field near Prudhoe Bay in 1968. Companies developed the field near Prudhoe and built the trans-Alaska pipeline. Oil began flowing in July 1977.

By the early 1980s, drilling efforts had spread westward into the Kuparuk and Milne Point areas. By the late 1990s, those fields had been largely completed. Work then moved westward into the Alpine field, about 60 miles from Prudhoe Bay.

Today, more fields could be developed, such as ConocoPhillips' proposed Willow project in the National Petroleum Reserve-Alaska, even farther west beyond the Colville River.





The map shows the traditional ranges of the four caribou herds that use Alaska's North Slope. Map courtesy of ABR.

During 50 years of work, state, federal and private biologists have studied how caribou react to the roads, pipelines, drilling pads, and oil and gas processing centers. The area is inhabited during spring, summer and fall by the Central Arctic Herd. The animals migrate south into the Brooks Range during winter.

Early studies often involved biologists observing caribou from the ground, which required being

near them.

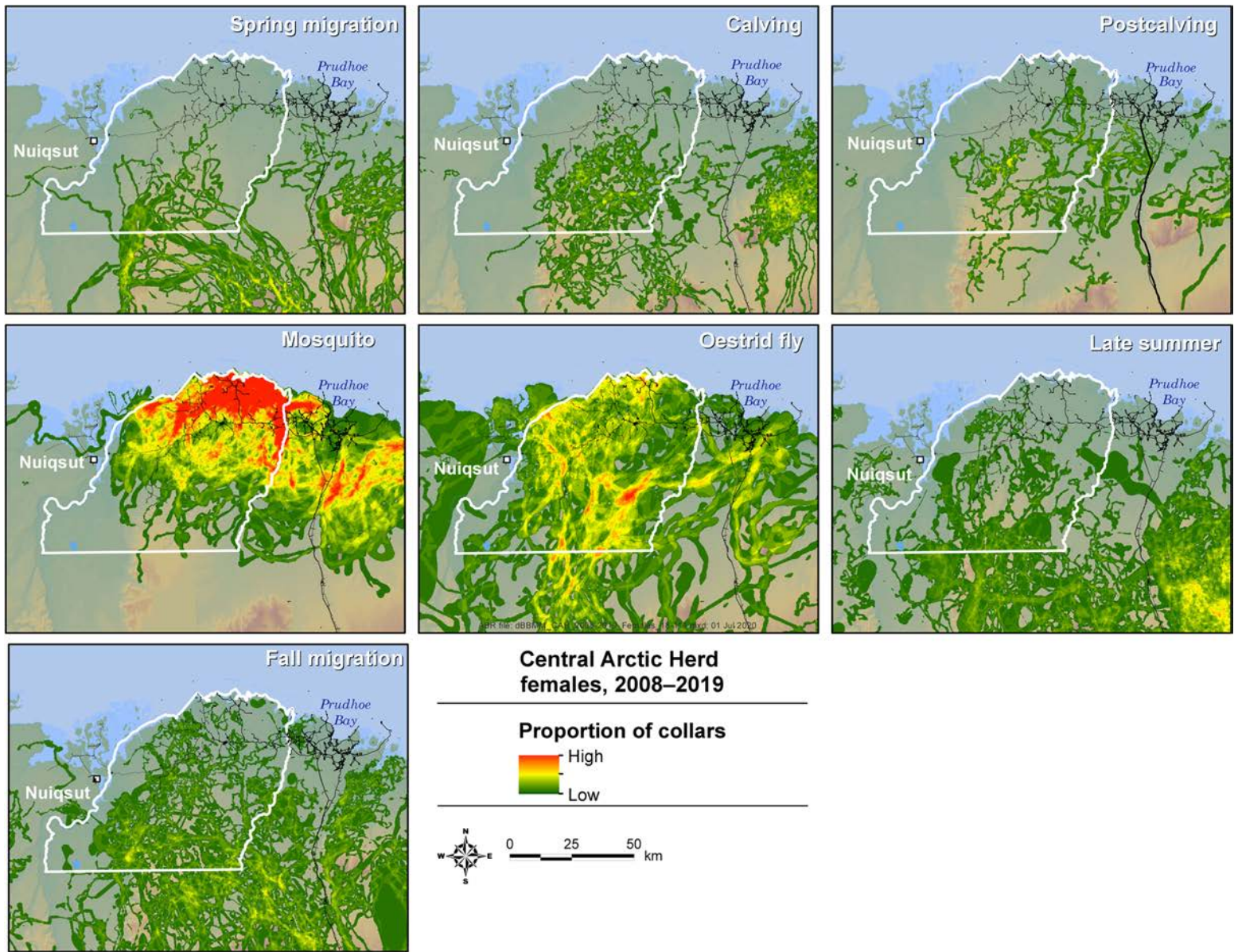
“We were able to camp right near study areas on these abandoned exploratory pads, which was great,” Lawhead said of his visits 40 years ago. “You didn’t have to listen to backup beepers on equipment or smell exhaust, and you got to hear the birds.”

Much of the recent work has been collaborative and focused on GPS data from collared caribou, Prichard noted.

The Alaska Department of Fish and Game places the collars on caribou, with funding help from the oil industry and U.S. Geological Survey. The number of collars has grown significantly in recent years, Prichard said. As of February 2023, location information was being broadcast from 96 collared animals to satellites and relayed back to Earth.

“But then the data are used by all these different entities,” Prichard said. “It’s been a really productive collaboration.”

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Colors on these maps reflect the proportion of GPS-collared female caribou from the Central Arctic Herd that were found during different seasons at locations across a study area between the Kuparuk and Colville rivers from 2008–2019. Maps courtesy of ABR.

Prichard and Lawhead, along with fellow ABR scientist **Joe Welch '13** and ADFG's Beth Lenart, used the data for a study published in the Journal of Wildlife Management in 2020. The team analyzed location information collected every two hours between 2008 and 2019 from global positioning system radio collars on female caribou between the Kuparuk and Colville rivers. They ended up with 51,124 GPS-collar locations.

“This has been a huge development in wildlife biology – the ability to have collars that can give you so many more locations at such tight fix intervals, and then the availability of really powerful analytical software,” Lawhead said. “But again it helps to have some knowledge of the natural history of the animal and to have spent some time on the ground and not just phone it in from your computer.”

The results in the 2020 paper confirmed, in great detail, much of what Lawhead and other earlier researchers had documented from the ground and in aircraft surveys before satellite collars were available.

“They had it pretty correct in the first 30 years,” Prichard said. “We’re just filling in some of the details now.”

## **Calving displacement**

One of the clearest seasonal signals in the study came from location data during the calving season, about May 30–June 15. Female caribou tended to avoid areas within about 5 kilometers of roads and pads.

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“In a variety of studies and methods over the years, it’s come in at that 2–5 kilometer range,” Lawhead said. “You can think of it as a decreasing gradient. It’s not an area of total exclusion. It’s a general response, which is not surprising at all.”

Lawhead said the avoidance seems to be tied most strongly to activity on the roads and pads.

“A moving vehicle really gets their attention, perceived probably as a predator,” he said, “which is totally understandable for cows with very young calves. And that persists for two to three weeks.”

During the second half of June, the effect begins to wane.

“The caribou are fully mobile by that time, so you see less displacement (by roads and pads),” Prichard said at the seminar. “This is a pretty important time for caribou, because it’s this brief window where the snow is gone and the mosquitoes haven’t come out. Life as a caribou is pretty miserable most of the year, but this is one of the few times when they can actually enjoy themselves.”

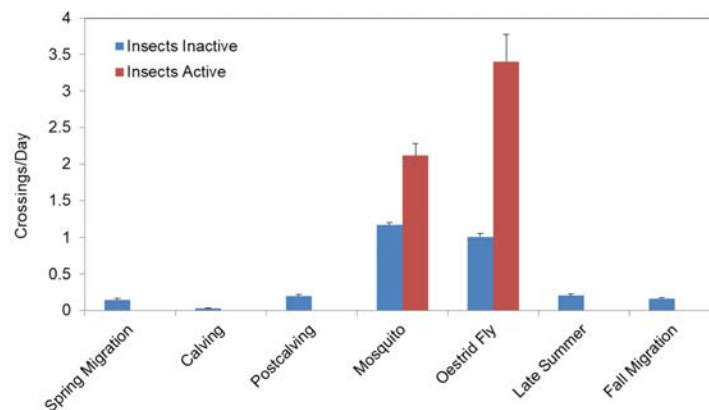
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## Mosquito season

Lawhead has spent many years both on the ground and in aircraft, watching what happens when mosquitoes arrive. The caribou often aggregate into tight groups.

“They’re all oriented in one direction,” he said. “You see them shaking. And they’re headed upwind or to the coast.”

Prichard noted that the GPS collars revealed that caribou move even faster on average during mosquito season than while migrating between their summer and winter ranges.



*The graph shows daily road crossing rates in various seasons and insect conditions for collared female caribou in the Kuparuk oil field area between 2008 and 2019. Graph courtesy of ABR.*

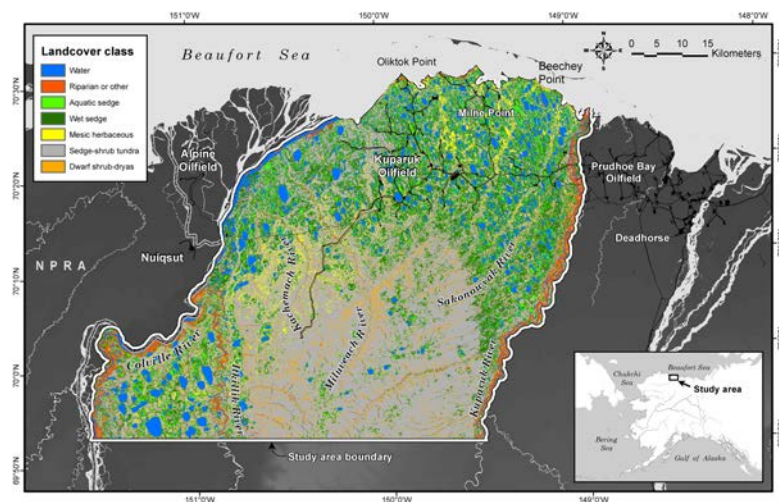
“That’s what brings them into contact with so much infrastructure,” Lawhead said. “They have to navigate that.”

Although caribou cross roads and pads more readily in this season, the data showed they still aren’t entirely comfortable doing so.

“Caribou crossed roads and pads and moved through the Kuparuk oil field frequently during the mosquito season but did not remain near roads after crossing,” the researchers reported in the 2020 paper. “Caribou movements during road crossings did tend to be faster and more directional, indicating that caribou crossed roads rapidly and then departed the immediate area near roads.”

## Fly season

Lawhead said caribou find relief from mosquitoes along the coast because it’s usually windy and cooler there. But oestrid flies are less deterred by wind, he said. And the better forage for caribou is inland. So caribou disperse widely across the coastal plain starting in late July when mosquitoes begin to wane and oestrid flies remain active.



*A map of the area between the Colville and Kuparuk rivers shows the different land cover types. Caribou tracked from 2008-2019 preferred different land cover types during different seasons. Map courtesy of ABR.*

In doing so, they show a preference for the gravel bars found along the area's large braided rivers — primarily the Colville, Kuparuk and Itkillik, the collar data revealed.

The data also shows that caribou like another sort of gravel as well — that found on the manmade roads and pads of the oil field.

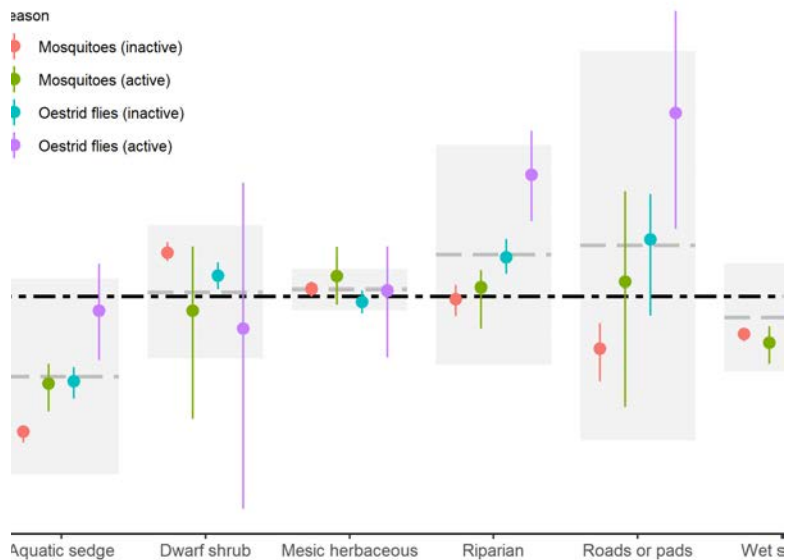
One reason: Oestrid flies aren't as abundant on bare and elevated ground. And caribou hate oestrid flies.

"It's miserable. The warbles are laying eggs on their flanks, and their larvae are boring into their skin," Lawhead said. "And then the nose bots, which are maybe more bothersome, get right up in the front of the nose and spray a solution of live larvae into the nostrils, which then migrate up the nasal passages."

(Flies don't do this to humans, to answer Lawhead's question from his perch upon the gravel mound in 1982. He suspects the flies watching him were males waiting for females to fly by.)

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Top: A warble fly pauses on the ground at Denali National Park in 2015. On Alaska's North Slope, warble flies emerge beginning in mid-July and lay their eggs on caribou. The eggs hatch into larvae, which pierce and enter the caribou's skin. The larvae eventually develop into nodules or "warbles" under the skin before cutting back through to the surface to emerge as adults. The nose bot fly, a close relative of the warble fly that is active in the same season, injects larvae into a caribou's nasal passages. The larvae then live in the caribou's throat until being sneezed out the next spring. Both flies are in the Oestridae family. Photo by Derek Sikes, UA Museum of the North. Bottom: Dots on the graph show landscape types preferred by GPS-collared female caribou relative to mosquito and oestrid fly activity in a study area between the Kuparuk and Colville rivers from 2008-2019. The

*position of the dots reflects how caribou prefer riparian areas (river gravel bars) and oil-field roads and pads when oestrid flies are present and especially when the insects are active. Graph courtesy of ABR.*

Caribou don't react to flies like they do to mosquitoes.

"The response to flies is like panic running," Lawhead said. "They'll often be standing still, head down, stamping, twitching. And then they just take off, just wild running in any direction."

On cloudless days, the caribou seek out shade; the flies prefer sun. So it's even common to see bull caribou under buildings and pipelines, Lawhead said.

Such seasonal behavior sometimes gets interpreted too broadly, he added.

"You can find some pretty interesting comments by congressmen about caribou and oil fields," he said. "Every year they are on recess during August, which happens to coincide with oestrid fly season. So many congressmen who have gone up there say 'They love oil development.' Well, there's a reason for that."

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## 'Hotter than a torch'

The presence of congressmen illustrates how closely the nation watches the mixing of caribou and oil on the North Slope. Lawhead remembered a fellow biologist calling him one day to say "Man, this caribou stuff is hotter than a torch!"

The researchers' 2020 paper explained the intense interest: "Globally, numerous caribou herds have experienced declines across much of their ranges, possibly as a result of climate change..., and the effects of industrial activity on this species have been of particular concern for current and proposed development in Arctic Alaska."



*A mosquito-harassed mixed-sex group of caribou move toward the coast just west of the Kuparuk River on July 15, 2002. Photo by Brian Lawhead.*

An estimated 5,000 caribou made up the Central Arctic Herd in the late 1970s, when oil

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development began to spread westward from Prudhoe Bay.

The herd grew with only a brief interruption until 2010, when it reached about 70,000 animals. It then dropped to about 20,000 animals within just five years. "Now they seem to be increasing or stable," Prichard said.

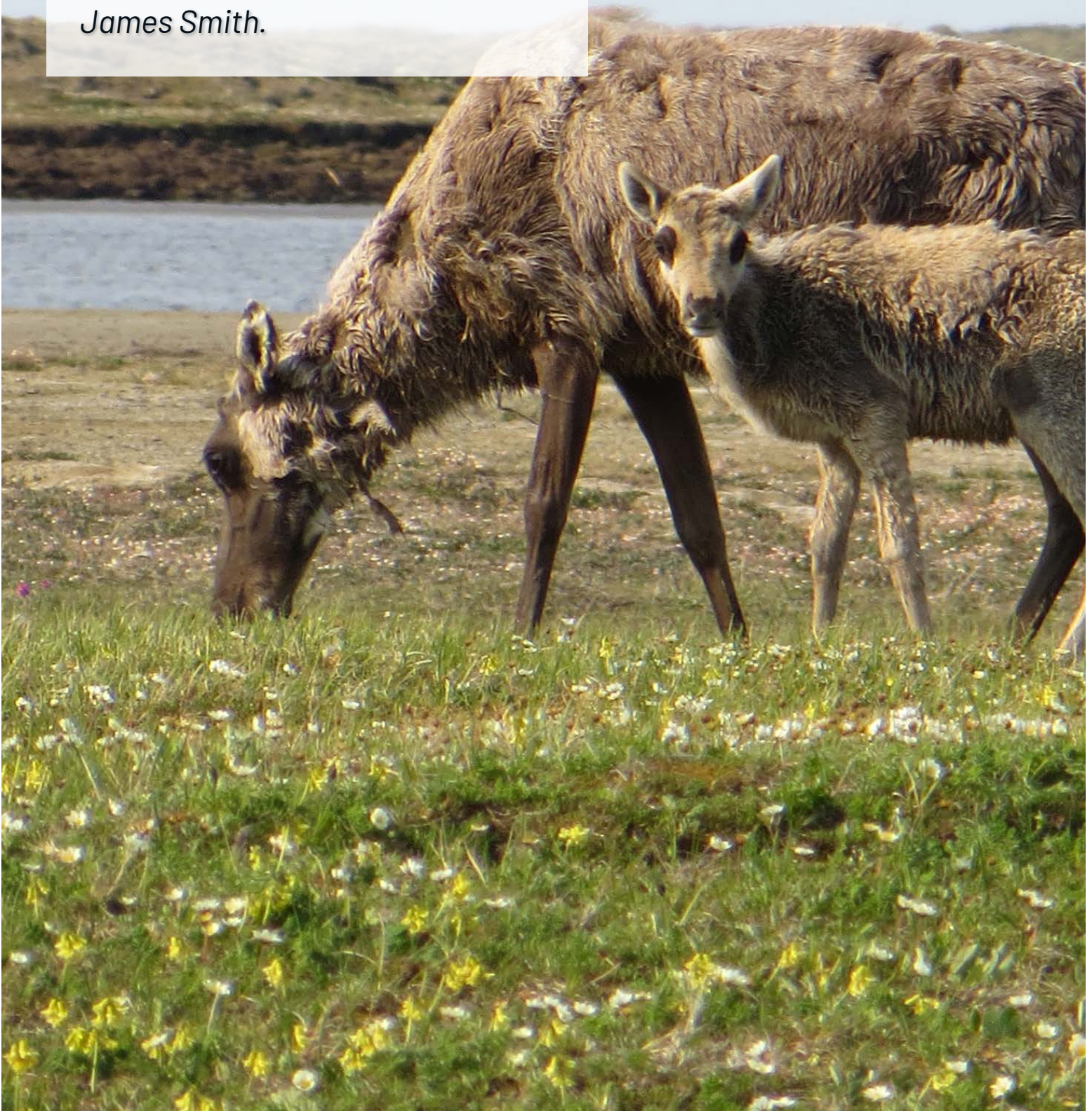
The herd's steady growth in parallel with the steady growth in oil work might suggest to some that the development had little negative effect on the population.

But might the Central Arctic Herd have grown even faster and larger in the absence of the oil development?

"It's been a huge question," Lawhead said. "The concerns were always, well, if we increase the energetic demands on these animals by causing them to not get to insect-relief habitat fast enough or displacing them from preferred habitat, does that translate into some kind of a demographic effect? At best, the evidence is equivocal."

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*A cow and calf caribou graze on the North Slope during the early July mosquito season. Photo by James Smith.*

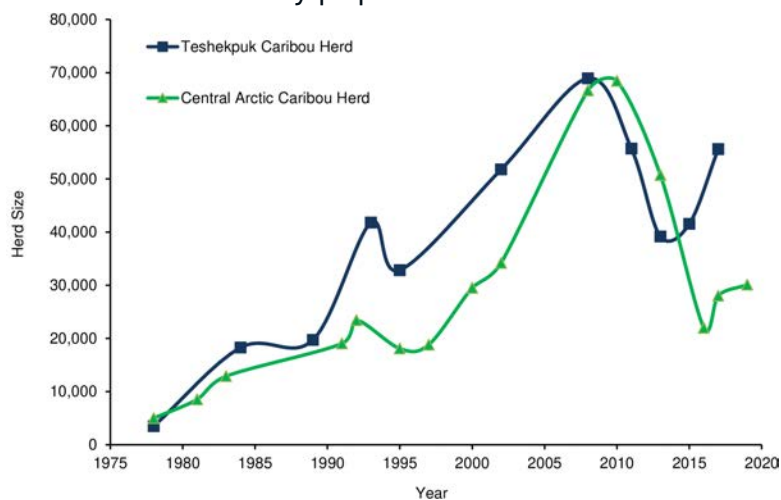


For starters, the herd grew “at near theoretical maximum” during the expansion of the oil fields, he said.

However, across the decades, researchers did document a shift of calving activity southward and away from the Kuparuk oil field, he noted.

“But the whole question all along is ‘Is suitable alternative habitat available?’” Lawhead said. “And in that case, at least, it was. There aren’t many predators up there, and the calf production is really good.”

Alaska Department of Fish and Game researchers found evidence that caribou calves in the western portion of the calving grounds were smaller than those in less-developed areas to the east, Lawhead said. However, the calves survived at similar rates, he said, so it’s unclear whether the differences had any population-level effect.



*This graph shows the similarity in expansion and contraction of the Central Arctic and Teshekpuk herds from the late 1970s through 2019. Map courtesy of ABR using ADFG data.*

Finally, consider the Teshekpuk Herd. It uses a year-round range with no oil development just west of the Central Arctic Herd's range. From the 1970s through 2008, the Teshekpuk Herd grew and crashed with a trajectory and population count almost identical to the Central Arctic's.

"Both these herds grew really rapidly, which suggests good climatic conditions and good forage conditions," Prichard said.

Since 2008, the Teshekpuk Herd has grown more rapidly than the Central Arctic Herd and had about 55,000 animals in 2017.

The difference in today's herd numbers may be in part due to out-migration. State Fish and Game research found evidence that some Central Arctic Herd animals may have joined the Porcupine Herd, a much larger group that uses regions to the east and south, extending well into Canada.

"It would make sense when you look at the numbers," Lawhead said.

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## Lessons for the future

Lawhead and Prichard said research by ABR and others across the decades has driven the adoption of several measures to reduce negative effects of oil development on caribou.

“We know a lot about properly designing infrastructure now to minimize delays and deflections,” Prichard said.

Measures include:

- Pipelines are elevated at least 5 feet in the Kuparuk area and 7 feet in newer developments, allowing caribou to move underneath. Pipelines from the earlier Prudhoe work are low to the ground, preventing caribou passage.
  - Wherever possible, roads and pipelines are now separated by at least 150 yards, reducing the hesitancy of caribou to cross them by eliminating synergistic effects.
  - Oil-field roads are designed to avoid creating closed loops that can corral caribou. Also, more recent developments have used, at least in part, temporary winter ice roads that melt away in summer.
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- Drivers are trained to stop to let caribou cross roads in summer. (However, trucks don't regularly convoy as a way to allow better caribou passage. A recent ABR analysis, Prichard said, "somewhat surprisingly" found that bunching trucks into convoys actually increased caribou reactions to traffic during calving – either because "traffic is more unusual, so they respond more strongly, or the sensitive animals are drifting closer to the road and then being disturbed by the unusual traffic.")

The 2020 study summarized the beneficial effect of the mitigation measures.

"Our results suggest that, with the exception of the calving season, current best management practices...appear to facilitate some level of tolerance of infrastructure and ensure that caribou ... can navigate infrastructure to reach essential foraging areas and insect-relief terrain," the study said.



*Top: A group of caribou being harassed by mosquitoes crosses the Spine Road in the Kuparuk River floodplain on July 14, 2014.*

*Bottom: On a July day in the late 1980s, a mixed-sex group of caribou moves to coastal mosquito-relief habitat on the Sagavanirktok River delta east of Prudhoe Bay. Photos by Brian Lawhead.*

Prichard said such practices could help reduce the effects of oil development if it spreads into areas used by other herds, such as the

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Teshekpuk. However, no herd occupies identical ground, he noted.

"I think you have to assume that calving displacement is going to occur, so you have to wonder, are alternative calving areas available?" he said.

The Kuparuk area also has other features that won't necessarily be duplicated elsewhere.

"Kuparuk is a little unusual for development because it does have predictable traffic. It has limited off-road activity, and there's little or no hunting," he said. "A lot of other developments probably won't meet all those criteria."

Also, he noted, about two-thirds of the Teshekpuk Herd, unlike the Central Arctic, remains on the North Slope's coastal plain in winter.

"We don't have much information on [caribou reactions to development during] the winter," Prichard said. "So that's kind of an unknown."

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*A mixed-sex aggregation of caribou gathers on the North Slope during the early July mosquito season. Photo by James Smith.*



*Writer Sam Bishop is a writer/editor for UAF  
University Relations.*



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