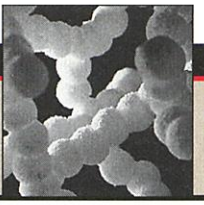
PAGE 447
New suspect in frog declines



449
A paradoxical membrane

CONSERVATION SCIENCE

Caribou Study Fuels Debate on Drilling in Arctic Refuge

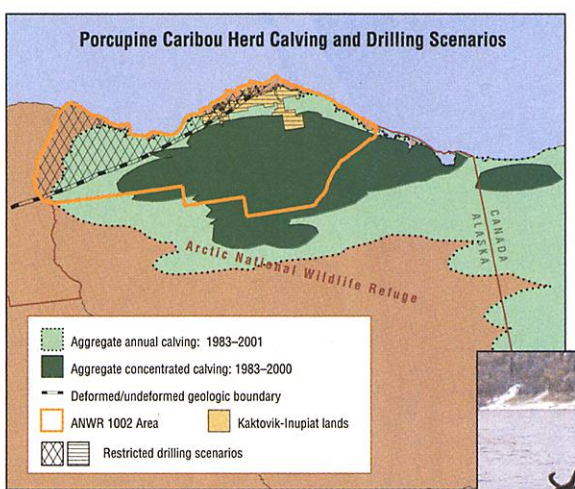
One week, experts say that oil drilling will harm caribou in the Arctic National Wildlife Refuge (ANWR). The next week, they say it won't. That is how the press and some lawmakers have portrayed a recent federal study and hastily done addendum by Department of the Interior (DOI) biologists that came out on the eve of a Senate vote on drilling. The apparent turnabout is the latest example of how Interior Secretary Gail Norton is manipulating science to promote the Bush Administration's views, drilling opponents say. But the scientists involved tell a more complicated story.

The analysis that triggered this furor is quite limited, says ecologist Brad Griffith of DOI's U.S. Geological Survey (USGS), who is its author. Griffith explains that a superior asked him to prepare an addendum to a major report on Alaskan wildlife focusing on one issue: how drilling in a scaled-back area might affect caribou. And he modeled just one behavior: calving. But everyone pounced on those details. Some caribou experts outside USGS, for example, say that DOI has erroneously concluded on the basis only of this calving study that drilling would be safe for caribou. "Other authors think [this] is an inappropriate use of the model," says Ken Whitten, a retired Alaska state biologist who contributed to the original report. Griffith believes that his addendum is relevant—but only if drilling is actually limited to the scaled-back area.

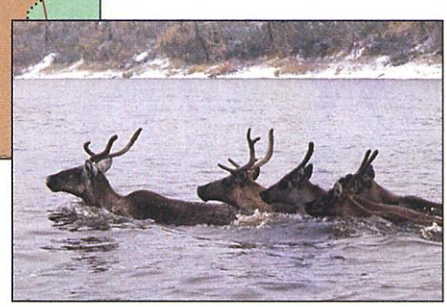
The notion that caribou won't be harmed may prove pivotal in Congress. The Senate was expected to block drilling earlier this week and, together with the House, which passed a bill last summer allowing it, will now work out a compromise. The House bill says drilling can proceed only if there is "no significant adverse effect" on wildlife.

The USGS report sent to Norton 29 March, which reviews published papers and includes new peer-reviewed studies, says drilling could adversely affect a number of species such as polar bears and musk oxen, but it notes that many of these impacts could be reduced. However, the report raises serious concerns about the 123,000-strong Porcupine caribou herd, whose June calving ground in most years overlaps the 600,000 hectares in the north of the refuge, the so-called 1002 area, where drilling was originally proposed.

To prepare for this report, Griffith began working 6 years ago on a model to assess how oil development would affect calf survival. The model uses 17 years of radio-tracking data on where females calve in the 1002 area. It also incorporates data on how many calves survive in a given year, which depends on how much good forage the mothers had available and the abundance of predators. Using these data, Griffith developed an equation that predicts calf survival if the concentrated calving area were nudged in one direction by oil development.



Disputed territory. One proposal would restrict drilling in the Arctic refuges 1002 area to the northwest quadrant. Caribou generally don't calve there but do use the area to seek relief from insects.



A Modest Drop in a Big Bucket

Geologists and resource economists are understandably loath to weigh in on the calving habits of caribou (see main text), but they have their opinions about the oil that may lie below the contested 1002 area of the Arctic National Wildlife Refuge (ANWR). In all likelihood, there's a good bit there, geologists say. However, add the economists, even if it were drilled, it would do little to improve the nation's energy security.

Geologists at the U.S. Geological Survey have estimated that the 1002 area of ANWR most likely holds 7.7 billion barrels of recoverable oil. But estimating as-yet-undiscovered oil is rife with uncertainty. Only one exploratory well has been drilled, so geologists fall back on wells outside the area, surface geology, and especially seismic probing of the subsurface. Folding in all the uncertainties, they estimate there's a 5% chance that area 1002 holds 11.8 billion barrels and a 95% chance that there are at least 4.2 billion barrels.

Whatever the actual amount of ANWR oil, say economists, it wouldn't insulate the United States from a volatile world oil market. In February, analysts at the Department of Energy's Energy Information Administration reported that in 2020, when production would be starting to decline if development were authorized this year, ANWR's estimated 7.7 billion barrels would reduce U.S. dependence on foreign oil from 62% to 60%.

"The energy security argument for drilling in ANWR is at best weak," writes economist Michael Toman of the Washington, D.C., think tank Resources for the Future. Among a number of economic limitations, he says, the Organization of Petroleum Exporting Countries (OPEC) has the upper hand in the long term given its huge deposits of cheaply extractable oil. Whatever the fate of ANWR oil, he says, more efficiently using the oil we do consume is key.

–RICHARD A. KERR

CREDITS: (TOP TO BOTTOM) ADAPTED FROM GRIFFITH *ET AL.*, SECTION 3 OF BIOLOGICAL SCIENCE REPORT, USGS/BRD BSR-2002-0001; TOM NEBBIA/CORBIS

453
Change of the guard at Wellcome

LEAD STORY 454
Glaciers yield archaeological bounty

458
Fisheries biologist makes a splash

Griffith then ran this model, assuming that the caribou would behave like another herd to the west of ANWR, staying 4 kilometers away from oil pipelines and roads.

The initial USGS report released last month discusses the model's predictions mainly for just one scenario: developing the entire 1002 region. "That's what was on the table" when the report was prepared, Griffith explains. Development of 1002 could lead to an 8.2% decline in calf survival that would likely cause a decline in the herd population, the report says.

But a few days before the report was released, USGS director Chip Groat asked Griffith to model two new scenarios. These are based on a 2001 USGS report estimating that about 85% of the oil lies northwest of a geological fold, so drilling would likely be limited to this wedge of coast (see map) and some native lands. Griffith says that one need only look at the calving map to see that the impact would be minimal, as almost no concentrated calving occurs there. As expected, under these new scenarios the model predicted essentially no decline in calf survival.

Drilling supporters have trumpeted this result, which DOI spokesperson Mark Pfeifle says "concludes that energy production would have little to no effect on caribou." But Whitten and other caribou biologists whose data went into Griffith's model say their work is being misinterpreted. Although the herd doesn't calve close to the coast, up to 19% of the herd congregates there a few weeks after calving to avoid mosquitoes and flies. If mothers spend energy avoiding the oil infrastructure, they could lose weight and produce less milk or fail to get pregnant the following year. "You've got to look at the other half of the picture"—after calving—says biologist Don Russell of the Canadian Wildlife Service, who like Whitten is a co-author on the original report's Porcupine herd chapter.

Griffith agrees, partly. Postcalving use of the land "could turn out to be unimportant or very important," he says: "There's not enough data to evaluate it." His own hunch is that "calving is most of the story." But he notes that current legislative proposals don't limit development to the northwestern part of the 1002 area. If it were written into law, "I would feel a lot more comfortable as a scientist" saying that drilling won't harm caribou, Griffith says.

The USGS "reversal," as some media reports have described it, has added fuel to allegations that Norton is distorting the science on ANWR. In a 4 April letter to Norton, Senator Joe Lieberman (D–CT), a drilling opponent, wrote that he was "gravely concerned" about Norton's request for the follow-up report and demanded an explanation for why she sought a new analysis that was not peer reviewed. For his part, Griffith—who once signed a letter ("as a citizen," he says) urging that the 1002 area be protected permanently—hasn't felt pressured to come up with a particular answer and feels free to do his science.

But even Griffith is frustrated that the Porcupine herd is getting all the attention. Several scientific societies, most recently the Ecological Society of America, have weighed in against drilling because of the overall impacts on many species and the boreal ecosystem itself. "This issue is more than caribou. There's way too much hung on this one piece," Griffith says. Unfortunately, that's not the way ANWR politics works.

–JOCELYN KAISER

ENTOMOLOGY

New Insect Order Speaks to Life's Diversity

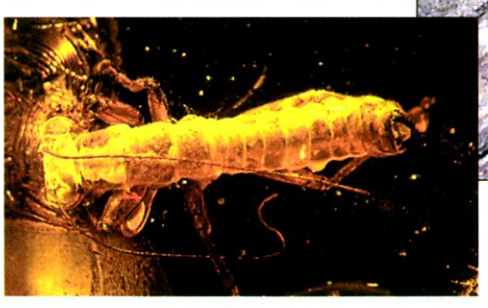
A graduate student sifting through collections in natural history museums has made the discovery of a lifetime: a new insect order. The last time the insect kingdom gained a new order was almost a century ago.

The new classification is based on just three known specimens. Two of them—one collected in 1909 and the other in 1950—have for the most part been languishing in museum drawers for decades, and the third is a 45-million-year-old fossil encased in amber. The discovery of these odd, sticklike, carnivorous creatures "is an extraordinary event," says Harvard entomologist Edward O. Wilson.

The work, reported in a paper published online by *Science* this week (www.sciencexpress.org), has spurred systematists and entomologists to comb their collections and search in the wild for additional members of this newly recognized group. Some living candidates have already turned up. Says David Grimaldi, an entomologist at the American Museum of Natural History in New York City, the naming of a new order "illustrates how poorly known the [small organisms] really are."

A series of chance encounters led to the new classification. In June 2001, Oliver Zompro, a graduate student at the Max Planck Institute for Limnology in Plön, Germany, was visiting London's Natural History Museum as part of a project looking for new species among collections of preserved stick insects. A curator showed him one that had been a mystery since it was first collected in Tanzania in 1950. In the 1980s, Roy Danielsson, a curator at the University of Lund, Sweden, had spotted this baffling male insect among his museum's collections and shipped it to the London museum for study. Even there, no one had been able to figure out its place in the tree of life, and Zompro, too, was stumped.

Just weeks later, however, an amber collector sent Zompro a similar looking amber-encased fossil, and Zompro began to suspect that he had come across a new order. That suspicion was strengthened when he soon came across a third specimen, a female from Namibia, warehoused at the Berlin Natural History Museum since 1909. Zompro's connection of the fossil to modern insects was like unearthing long-hidden treasure. "How often do you get to investigate a fossil that has



Imposing order. A recently discovered specimen from Africa (*above*) and an amber-encased fossil from Europe (*left*) indicate the new order's wide distribution.

CREDIT: THOMAS KUJAWSKI/ASA-MULTIMEDIA