Grolar Bears and Narlugas: Rise of the Arctic Hybrids

By Bruce Barcott, Science & Technology Nature & Wildlife

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Four years ago photographer Steven Kazlowski shot this image of a strangely colored bear east of Barrow, Alaska. “Locals told me it was a cross-breed,” Kazlowski says, but it’s impossible to know without DNA testing. There was a lot of discussion about whether Kazlowski’s photo should accompany a new report on Arctic hybridization in the journal Nature. “It looks compelling," co-author Brendan Kelly says, "but the discoloring in the fur could, for all we know, be dried seal blood.” The picture ultimately ran with the article. Steven Kazlowski

Climate change appears to be igniting a sexual revolution among Arctic mammals -- and that’s not good news for some endangered species.

In 2006 an American hunter shot an animal in the far north of Canada’s Northwest Territories that shared characteristics of a polar bear and a grizzly. Earlier this year, a similar bear was killed less than 200 miles away, and DNA tests confirmed it was a mixture of the two species. The "grolar bear" thus joined a growing list of cross-species couplings -- beluga whales and narwhals, right whales and bowhead whales, various seal mixtures -- all confirmed to varying degrees by scientists in the Arctic over the past two decades.

What’s going on here?

In the December 16 issue of Nature, three American researchers argue that global warming is encouraging the formation of hybrid offspring among Arctic mammals. "The rapid disappearance of the Arctic ice cap is removing the barrier that’s kept a number of species isolated from each other for at least ten thousand years," says the article’s lead author, University of Alaska evolutionary biologist Brendan Kelly. That’s leading to some unusual pairings that could have dire consequences for endangered species in the Arctic.

As formerly isolated animals come into contact, write Kelly and co-authors Andrew Whiteley and David Tallmon, "they will mate, hybrids will form and rare species are likely to go extinct." As the genes of Arctic species mix through successive generations, they write, the adaptive gene combinations that allow species to flourish in the extreme environmental conditions of the far north "will be lost."

"By melting the seasonal ice cap," Kelly says, "we’re speeding up evolution."

Brendan Kelly Q&A: Expect "a Lot More" Arctic Hybrids

The grizzly-polar bear mixtures provide some of the study’s most compelling evidence. The most recent confirmed hybrid was killed on April 2010 by a native Inuvialuit hunter who observed it scavenging through unoccupied cabins. Biologists used DNA tests to confirm that the bear -- which had thick white fur but a wide grizzly-like head, brown legs, and brown paws-- was indeed a cross between the two species.

But those tests revealed something more: The 2010 specimen was a second-generation hybrid. "That clearly indicates that these hybrids are fertile in the wild," Kelly says. One of the common complications of cross-breeding is infertility; the lineage of the horse and donkey, for example, stops at the mule. A fertile grolar bear "suggests that we’re not just seeing one or two crosses, but something more common," Kelly says. "This has been going on for a matter of decades now" as the Arctic has warmed.

The same could be true in marine mammals, which are more prone to hybridization because of their genetic makeup, Kelly says. Many pinnipeds (seals, sea lions, and walruses), for example, share the same number of chromosomes, which helps produce fertile offspring. Donkeys and horses have a different number of chromosomes, which prevents their mule offspring from producing sperm or eggs.

In their Nature article, Kelly, Whiteley, and Tallmon list 34 potential hybridizations between discrete populations, species, and genera of marine mammals in the Arctic and near-Arctic. Some of those potential matings have already been realized. Using photographic evidence, whale experts last year confirmed the existence of a bowhead-right whale hybrid in the Bering Sea. A narwhal-beluga whale mix has been found in Greenland. Its intermediate form, however, raises questions about the potential success of its genetic line. The narwhal-beluga (narluga?), write the authors, "had teeth combining qualities of each species, but lacked the narwhal's tusk -- an important determinant of narwhal breeding success."

Hybridization occurs occasionally in nature, of course, and cross-breeds have proven to be box office draws at zoos. (Think the lion-tiger hybrid, the liger.) What's different about the Arctic is that melting ice is erasing a continent-size geographic barrier between isolated species. That kind of thing usually happens gradually, over geologic time; now it's happening over a matter of decades.

Sudden contact may lead to an endangered species being subsumed by a higher-population species. "It's partly a numbers game," says Whiteley, a conservation geneticist at the University of Massachusetts at Amherst. If a lonely narwhal encounters nothing but beluga whales during mating season, cross-species sparks may fly. Repeat enough times, and pretty soon you're left with few pure narwhals. "At the very least [the rarer species] is wasting its reproductive efforts," Whiteley says. "It's one more factor in the species' decline."

It's happened before. Mallard ducks, introduced to New Zealand in the 1860s, mated with native gray ducks and overwhelmed the gray duck species, which is now listed by New Zealand as critically endangered. In the southeastern United States, the decimated red wolf population began mating with coyotes in the mid-20th century -- because lonely wolves, bereft of mates, decided coyotes were better than nothing -- leading to the loss of nearly all genetically pure red wolf populations.

Could polar bears suffer the same fate? Melting sea ice is forcing more polar bears to come ashore, and the warming climate is making Arctic habitat more welcoming to grizzly bears. Result: More grizzly-polar bear meetings, and, perhaps, opportunities for mating. The concern is that polar bears could be subsumed into the larger grizzly population, which is better adapted for warmer temperatures, and essentially disappear as a separate species.

"The main question we want to raise for scientists and policy makers is this: How do we handle hybrids?" Whiteley says. The Endangered Species Act has no official policy for dealing with hybrid species. In some cases, wildlife managers have culled hybrid offspring in order to keep the genetic line of an endangered species pure. "What we need is a widescale genetic monitoring program," Whiteley says -- something overseen by an international organization like the IUCN (World Conservation Union) -- "to get a sense of what's going on up there."

Hybridization could, in theory, lead to fitter, more well-adapted animals. But that's not likely, Kelly says. First-generation hybrids often exhibit excellent survival characteristics. Biologists call it "hybrid vigor." But successive generations rapidly fall off in fitness, which is known as "outbreeding depression."

"People often talk about species adapting to climate change," Kelly says. "But the kind of adaptation that's necessary is a change toward genes that fit the new climatic environment better than the old genes. Individuals don't adapt genetically. Populations do. That requires generations, which requires time. Bears, seals, whales -- these are long-lived animals. They need decades and centuries to adapt. But we're talking about losing the Arctic summer sea ice in a matter of a few decades. So the time for adaptive response may not be there."