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Should You Fear the Pizzly Bear?

By MOISES VELASQUEZ-MANOFF AUG. 14, 2014

In New England today, trees cover more land than they have at any time since the colonial era. Roughly 80 percent of the region is now forested, compared with just 30 percent in the late 19th century. Moose and turkey again roam the backwoods. Beavers, long ago driven from the area by trappers seeking pelts, once more dam streams. White-tailed deer are so numerous that they are often considered pests. And an unlikely predator has crept back into the woods, too: what some have called the coywolf. It is both old and new — roughly one-quarter wolf and two-thirds coyote, with the rest being dog.

The animal comes from an area above the Great Lakes, where wolves and coyotes live — and sometimes breed — together. At one end of this canid continuum, there are wolves with coyote genes in their makeup; at the other, there are coyotes with wolf genes. Another source of genetic ingredients comes from farther north, where the gray wolf, a migrant species originally from Eurasia, resides. “We call it canis soup,” says Bradley White, a scientist at Trent University in Peterborough, Ontario, referring to the wolf-coyote hybrid population.

The creation story White and his colleagues have pieced together begins during European colonization, when the Eastern wolf was hunted and poisoned out of existence in its native Northeast. A remnant population — “loyalists” is how White refers to them — migrated to Canada. At the same time, coyotes, native to the Great Plains, began pushing eastward and mated with the refugee wolves. Their descendants in turn bred with coyotes and dogs. The result has been a creature with enough strength to hunt the abundant woodland deer, which it followed into the recovering Eastern forests. Coywolves, or Eastern coyotes, as White prefers to call them, have since pushed south to Virginia and east to Newfoundland. The Eastern coyote is a study in the balancing act required to survive as a medium-size predator in a landscape full of people. It can be as much as 40 percent larger than the Western coyote, with powerful wolflike jaws; it has also inherited the wolf's more social nature, which allows for pack hunting. (In 2009, a pack of Eastern coyotes attacked and killed a 19-year-old Canadian folk singer named Taylor Mitchell in Cape Breton, Nova Scotia.) But it shares with coyotes, some 2,000 of which live within Chicago's city limits, a remarkable ability to thrive in humanized landscapes.

"We're kind of privileged in the last 100 years to watch the birth of this entity," White told me, "and now the evolution of this entity across this North American landscape that we've modified." Evolutionarily speaking, coyotes diverged from gray wolves one million to two million years ago, and dogs from wolves roughly 15,000 years ago. Yet over the past century, as agriculture moved to the Midwest and California, farmland in the East reverted to woodlands. The rise of fossil fuels reduced the demand for firewood. Forests spread, and deer and other prey proliferated, while human intolerance for wolves kept a potential competitor at bay.

Thus did humans inadvertently create an ecological niche for a predator in one of the most densely populated regions of the country. In an exceedingly brief period, coyote, wolf and dog genes have been remixed into something new: a predator adapted to a landscape teeming with both prey and another apex predator, us. And this mongrel continues to evolve. Javier Monzon, an evolutionary biologist at Stony Brook University, has found that Eastern coyotes living in areas with the highest densities of deer also carry the greatest number of wolf genes. Another scholar of the Eastern coyote — Roland Kays, a zoologist at the North Carolina Museum of Natural Sciences in Raleigh — estimates that the Eastern coyote's hybrid ancestry has allowed it to expand its range five times as fast as nonhybrid coyotes could have. In the urbanized Northeast, of all places, an abundance of large prey seems to have promoted a predator whose exceptional adaptability has derived, in large part, from the hodgepodge nature of its genome.

In the mid-20th century, the influential evolutionary biologist Ernst Mayr argued that species arise only when individuals become isolated somehow from others of their kind. Since then, the prevailing wisdom among evolutionary biologists has been that interbreeding — the creation of hybrid offspring — is a potentially lineage-ending mistake. Sterility is one known potential outcome. A male donkey that mates with a mare produces a sterile mule, an evolutionary dud. Subspecies of the house mouse have diverged to such an extent that when they mix, they often beget sterile males. Fertile hybrid offspring, meanwhile, may face the problem of maladaption: Because the parent species have usually evolved to exploit different habitats, intermediate hybrids ought to be ill suited to the environs of both parents. Related species are often geographically separate, which prevents intermixing; sister species that share habitats frequently evolve different markings, calls and behaviors through which they distinguish their own kind and avoid crossbreeding.

The emergence of the Eastern coyote, however, shows how human activity can break down the barriers that separate species. Perhaps the most obvious way in which humanity is altering the natural world is through climate change. The Arctic, where its effects are especially evident, is warming between two and four times as fast as the rest of the planet. Spring thaws now arrive weeks earlier; winter freezes come weeks later. Shrubs are invading once-barren tundra. Animals at high latitudes — where related species tend to have diverged more recently and can therefore interbreed more easily — are shifting their ranges in response to rising temperatures and melting sea ice. As they do, they may encounter cousins and hybridize.

In Maine, Minnesota and New Brunswick, Canadian lynx have lately produced cubs with the more southerly bobcat. A Southern flying squirrel has pushed north into southern Ontario and begun mating with its larger, boreal cousin. The best-known examples of this process are the polar bear-grizzly hybrids, sometimes referred to as grolar or pizzly bears, four of which have been shot by hunters in recent years; genetic testing indicated that one of them was a second-generation animal. There have been several other sightings of bears suspected of being hybrids, and this spring a mother thought to be one, accompanied by grizzly-looking cubs, was captured (tests are pending). Better management of grizzly hunting may have also contributed to this mixing by enabling males to advance into polar-bear country. "A warming Arctic is not a bad thing for grizzly bears," says Andrew Derocher, a biologist at the University of Alberta.

We might regard these developments as unintended consequences of intensifying human activity on the planet. Yet in the past decade or so, scientists have discovered that the genomes of many species — far more than previously thought — contain what seem to be snippets of DNA from other species, suggesting they were shaped not only through divergent evolution but also by occasional hybridization. The small warm- and temperate-water clymene dolphin apparently evolved out of a hybrid mix of two other Atlantic dolphins. A bat native to the Lesser Antilles seems to come from three species — one in Central America, one in South America and one that's extinct. Even most people carry a small quantity of DNA from archaic humans like Neanderthals; in other words, our species, Homo sapiens, has also been influenced by hybridization.

Polar bears and grizzlies appear to have hybridized before. Descendants from past intermixing live off the southeastern coast of Alaska, on the Admiralty, Baranof and Chichagof Islands. The ABC bears, as they're called, look outwardly like brown bears, but their mitochondrial DNA comes from polar bears, as does a portion of their X-chromosome. No one agrees when exactly the ancestors of these bears — one an omnivore, the other a carnivore that specializes in eating seals — bred. But it seems to have happened only occasionally, which suggests to some that natural climatic fluctuations, in the form of advancing and retreating glaciers, pushed the bears together, encouraging intermixture.

The widespread evidence of intermixing has spurred a reassessment of the notion that hybrids are born failures. In its place a more nuanced view has taken hold: While hybridization can certainly be destructive, it may also expedite adaptation. New creatures may emerge seemingly overnight from cross-species mating. "Long after speciation, even nonsister species can actually exchange genes, some of which are useful," James Mallet, an evolutionary biologist at Harvard, told me.

Indeed, today's hybrids may signify more than just the erosion of biodiversity. They may signal a kind of resilience in the face of sudden environmental change.

In 1973, two biologists, Peter and Rosemary Grant, began studying four species of finches on Daphne Major, a volcanic island in the Galápagos. Each species had a different beak size, which determined how well it could eat seeds of various sizes. The finches recognized their own kind through song, but some individuals learned the incorrect song, either because they lived close to another species or because they ended up in the wrong nest when young. Every year, some of these individuals ended up mating outside their species, producing a small number of hybrids. These hybrids failed to survive long enough to mate.

Then in the early 1980s the ecology of the island shifted, following an extreme El Niño that brought torrential rain. Hybrid offspring from a large-beaked finch (Geospiza fortis) and a finch with a more pointed beak (Geospiza scandens) flourished and bred with both parental species. Over the years that followed, the genetic exchange pulled the mean beak size of the two parental species — which remained distinct — closer together.

At the time, scientists thought that because genetic diversity came from spontaneous mutations and because useful variants arose only after thousands of generations, evolution had to proceed slowly. But as the Grants watched the finches' beaks change over a few generations, they realized that the process of hybridization could speed up evolution. The birds were exchanging genetic traits that had been, in effect, already field-tested.

Nearly a decade ago, after a drought, the Grants began to see speciation in real time. The population of a finch called Geospizamagnirostris crashed, and a single remaining pair of descendants from a hybrid that came from nearby Santa Cruz Island years earlier were at last able to multiply. "They had more eco-space, if you like," Peter Grant told me by email. "They and their offspring prospered."

The Grants, who tell these stories in their new book, "40 Years of Evolution," saw hybridization help species adjust to new conditions. Before the extreme El Niño modified the island's ecology, hybrids there did not live long enough to reproduce. But afterward they thrived and became important conduits of genetic exchange for their parental species, accelerating their adaptation. The ecological context determined whether the hybrids succeeded or failed.

Substitute any disturbance for El Niño, including those linked to human activity, and we have a way to think about other hybrids, like the coywolves or grolar bears or, in fact, ourselves. Some argue that Homo sapiens left Africa when its northern deserts were passable — that is, at a moment when the climate changed. We bumped into long-lost relatives in Eurasia, the equivalent of today's polar bears in the grolar bears' story, and mated.

We may, in turn, have adapted to Eurasian conditions by borrowing genes from these "locals." Everyone except sub-Saharan Africans carry a small quantity of Neanderthal DNA that includes traits possibly important for survival in Eurasian environments — immune-system and skin-pigmentation genes, among others. And our current genome warehouses DNA from archaic humans that have otherwise disappeared. A recent study estimated that, in the same way that coywolves can be said to store wolf DNA that might have otherwise vanished from the Northeast, one-fifth of the Neanderthal genome endures, dispersed throughout humanity.

Recent genetic analysis has highlighted, to a degree that is impossible to ignore, the fact that the barriers between species have never been impermeable. As Brendan Kelly, the chief scientist at the Monterey Bay Aquarium, told me: "The dirty secret of biology is that the fundamental unit of science — i.e., species — in fact can't be adequately defined." Clearly, there are powerful forces that drive life-forms to differentiate, to speciate. If not, sameness would prevail on earth. But just as clearly, evolutionary pressures push not only toward fission, as Peter and Rosemary Grant put it, but also sometimes toward fusion.

That realization is more than one of scientific clarity; it goes to the heart of conservation efforts, offering new ways to think about what we're trying to conserve. If two or more once-distinct species completely collapse into a hybrid swarm, that's a net loss, an outcome to be avoided. But as with the Eastern coyote, hybrids can also yield a net gain. Or as happened among the Galápagos finches, hybrids can facilitate genetic exchange and help parental species adapt to challenges.

Conservationists have long sought to preserve the genetic diversity of animals, in order to avoid inbreeding as well as to maintain the capacity for future adaptation. New, though, is the recognition that some potential genetic diversity may exist in close relatives, in genomes once considered inaccessible. Indeed, the Grants speculate that families of closely related species like the Galápagos finches, which can adapt rapidly by interbreeding, may endure better than lone species.

Several scientists told me that, in some cases, conservation efforts might include families of species and subspecies across a diverse landscape, mongrels included. The "canis soup" in Canada may deserve to be considered as more than just a sideshow, but also as a fount of innovation that helps the greater family adapt, even if it's adapting to us.

Last fall, I visited the home of one hybrid swarm, the sort that scientists worry about. Enos Lake is small, just over 43 acres, or 40 percent the size of the reservoir in Central Park, nestled in the fir-covered hills of Vancouver Island. Two stickleback fishes once lived there — one pencil-thin and adapted to open water, the other thicker and suited to water near the shore. In the 1990s, however, the two species, which had probably been distinct for thousands of years, mysteriously converged. A single hybrid population now prevails. When scientists warn of the danger posed by hybridization, this is what they mean: speciation in reverse, the loss of biodiversity.

The day of my visit, Eric Taylor, a zoologist at the University of British Columbia, Vancouver, who first described the stickleback collapse, was collecting fish to document the extent of the swarm. We paddled out in a red canoe to retrieve traps he baited with cheddar cheese the night before. “Holy smackin’ dipsticks!” he said when we pulled up traps full of fingerling sticklebacks. But when we drew in traps that were mostly crayfish, he said, “If you fall in unconscious, they’d pick you clean in an hour.”

These small crustaceans are presumed to have triggered the stickleback collapse. They’re native to the coastal mainland but probably not Vancouver Island; humans most likely carried them there. They devoured much of the vegetation in Enos Lake, turning its bottom into bare, boot-sucking mud. What had been two stickleback species became one.

A few years ago, one of Taylor’s graduate students tested a possible explanation for what happened. In order to attract females, male sticklebacks build nests from plant material on the lake bottom. Using fish from a pair of species native to a lake nearby, Taylor’s student tested how the presence of crayfish interfered with this ritual. Males that lived away from the shore, he found, became anxious in the presence of crayfish. Their nest-building suffered. The females wandered off and mated with the less-troubled species closer to shore. Anxiety, it seemed, could break down the barrier between sister species that live alongside one another.

Scientists have observed versions of this phenomenon — called flexible mate choice — in other animals. The Central American tungara frog, which selects mates based on croaks, is more likely to choose one from a different species when it also hears the cries of a predator frog. During extreme weather, females of various monogamous bird species tend to cheat more. For two spadefoot toad species whose ranges overlap in the American Southwest, the water levels in seasonal ponds affect their mating habits. In experiments, hybridization begins when the water runs low.

"This is a behavior that breaks all the rules of evolution," says Karin Pfennig, a biologist at the University of North Carolina who studies the spadefoots. Yet it evinces a kind of pragmatism when it comes to reproduction, which might be anthropomorphized thus: When times are tough, it's better to mate with someone — even the wrong one — than with no one at all.

Humans are increasing the stresses on wildlife in myriad ways. Oil spills and agricultural runoff, each linked to fish hybridization, are not uncommon. Hunting and habitat alteration, of the sort that spurred coyote and wolf to mate in Canada, abound. Then, of course, there's climate change. The list goes on, which leads to the following conclusion: One way we affect animals is by inadvertently enlarging their circles of sexual consideration, to the point that it even includes other species.

Along the eastern coast of Australia, where a warm ocean current has expanded southward in recent years, scientists have found shark hybrids, first- and second-generation offspring from an Australian blacktip species adapted to tropical waters and a wider-ranging blacktip. Offspring from the Antarctic blue whale, the largest animal ever, and its smaller, warmer-water pygmy cousin recently showed up in Antarctic waters south of Africa.

Stranger still has been the appearance of first- and second-generation hybrid offspring from Antarctic minke whales and minke whales in the North Atlantic. The two whales' feeding ranges lie thousands of miles apart, near the top and bottom of the globe. The northern minke whale diverged from the southern minke some five million years ago — roughly when what became the human lineage diverged from that of chimpanzees. But southern minke whales were found to be crossing the Equator in the late 1990s.

It's possible, of course, that this sort of interbreeding has always occurred and that we're detecting it only now because we possess the tools to do so. But newly minted hybrids may also be a sign of warming temperatures, overfishing, whaling, shifts in the food web and so on.

By no means should we regard hybrids as an ecological panacea. The flexibility they can provide depends on the continued existence of at least two parental species, after all — hardly a given for many creatures. But the growing evidence of productive hybridization does seem to call for a reconsideration of how we think about species. In some respects, the emerging view is closer to Charles Darwin's original thinking than to the one we have been living with for nearly a century. Darwin dedicated a chapter to "hybridism" in his book "On the Origin of Species." And he was vague on how to define species, referring to "the vain search for the undiscovered and undiscoverable essence of the term." He seemed, that is, to see varieties and species as existing on a loose continuum.

Then in the early- and mid-20th century, the concept of species hardened. Botanists could never ignore hybridization — it occurs between plants too frequently — but interbreeding among animals became the "grossest blunder in sexual preference which we can conceive of," as one author wrote in 1930.

Looking back, Michael Arnold, a geneticist at the University of Georgia, and long a gadfly to the species orthodoxy, attributes this attitude to worries about miscegenation. Anxiety over racial "purity" perhaps affected how we thought about nature. If this is the case, biology is finally shedding the lingering influence of pseudoscience.

"Biodiversity has developed in a web of life rather than a tree of life," Arnold told me. That interconnectedness lends strength. "It's sort of cool that evolution is really messy."

The scientists I spoke to expressed often a combination of anxiety and awe as they talked about watching animal life respond to multiple pressures with a plasticity they're only now coming to appreciate. The abiding question is: Will hybridization further erode biodiversity, preserve it, augment it — or some combination of all three?

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