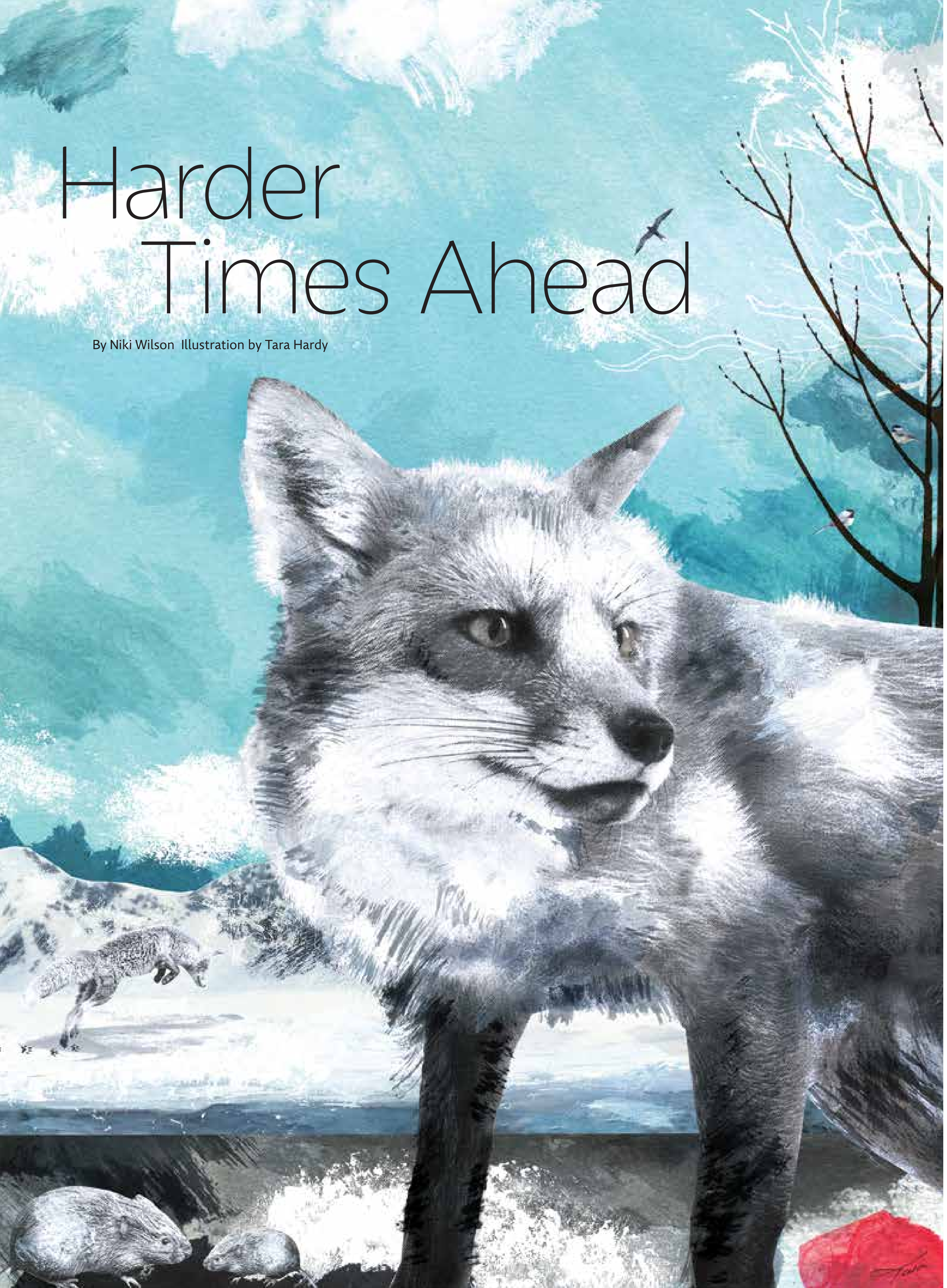


Harder Times Ahead

By Niki Wilson Illustration by Tara Hardy

Climate change brings the threat of warmer winters. How will that affect wildlife in Canada? Scientists have more questions than answers

The red fox creeps into the clearing, nose down to the twinkling hoarfrost that covers the snowpack like jagged chandeliers. Suddenly, the fox stops, cocking its head to one side, then the other, as it zeroes in on its target. With a sudden burst of speed, the fox launches into the air, then dives head first into the snow. Seconds later, it emerges with a fat vole.

The fox's ability to locate prey under the snow is impressive, but so is the ability of voles to live in the subnivean — the world beneath. It's warmer there, in the space between the soil and the dense bottom of the snowpack. Voles can be active throughout the winter without the costs of staying warm in the colder temperatures above.

But what would happen to these animals, bound in a natural cycle, if the snowpack slowly disappeared? Would voles simply vanish, unable to manage extreme temperatures without their snow buffer, or would they eke out a living in abandoned burrows, or would they find some other way to adapt? Would foxes be able find voles in a different world, or would they simply turn their tastes elsewhere?

These are the types of questions biologists now face as climate change models predict warmer winters in the years to come. But understanding the impacts of that likelihood on wildlife is a complex business.

So says Brent Sinclair, an associate professor in the department of biology at the University of Western Ontario. "Winter has a lot of moving parts, and they're all interacting with each other." But one thing is certain: there will be winners and losers, species that benefit, even proliferate, and those that struggle.

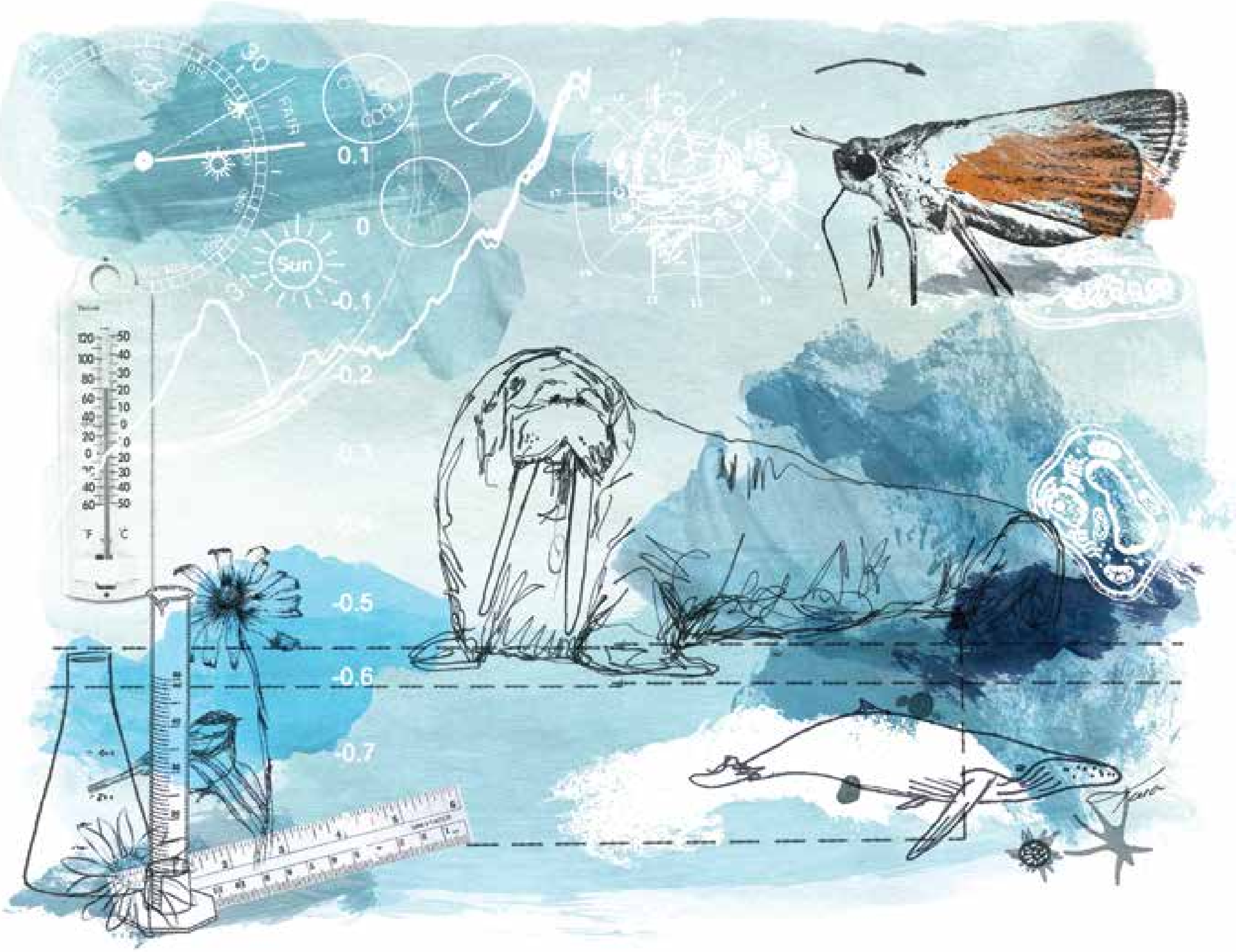
Determining which species will boom and which will bust, however, is a difficult task. For starters, winter is not a monolithic force. It is a varied and regional event, one that also changes from year to year. So, biologists who study animals adapted to winter look at how species interact with different factors — temperature, weather conditions, food availability and more — searching for clues to how the animals will fare in the future.

But making predictions is a whole other story. To date, research has succeeded mainly in identifying issues, outlining scenarios and raising questions. What is known is that we have much to learn. The question is whether we can learn it in time.

One of the most important factors in starting to assess the impact of warmer winters on wildlife is understanding that each species has its own vulnerabilities and adaptations to the season. An animal that is easily killed by extreme cold, for example, may benefit from warmer temperatures. Consider small birds that have to forage like crazy just to make it through the season. "We'd expect them to do much better [in warmer weather] because they won't have to expend so much energy just to stay warm," Sinclair says.

But temperature is not a simple variable, and the larger picture is much more complicated. Take the black-capped chickadee. This small but mighty bird uses up to 30 per cent of its body weight each winter night, burng fat to stay warm. Warmer temperatures may mean less energy is required to stay alive in the winter (though recent studies suggest chickadees are well-adapted to survive short-term extreme cold and bad weather). However, the world of climate change responses is rarely that straightforward — warmer weather could also increase the frequency of severe weather events like ice storms. These can encase chickadee food in ice and starve them. An increased frequency of this type of event would leave the chickadees more vulnerable, even as the warm weather helped them save on their internal energy bills.

As if the range of possible responses weren't complicated enough, add to that the effect temperature change could



have on the ability of viruses, bacteria and other parasites to infect wildlife. Pathogens may do better in warmer weather, Sinclair says, and infected animals will likely have to spend more energy fighting them off. Kevin McKelvey, an ecologist with the U.S. Forest Service, agrees: "We will cross pathogen and disease thresholds that we just don't know about right now."

On the other hand, if there is a temperature below which an animal's immune system doesn't work very well, and that animal no longer has to fight off invaders in those low temperatures, that animal may get fewer infections, Sinclair says. Biologists, for example, suspect that squirrels may arise periodically from winter torpor to kick-start their immune systems to beat the cold, he says. But this costs energy — a cost squirrels may not have to pay in warmer conditions.

While some animals will be directly affected by temperature — either positively or negatively — others will feel the heat from melting snow and ice. The insulating blanket of snow that carpets many Canadian ecosystems is important to many species. Wolverines, for instance, need deep snow in which to build their dens in late winter and early spring. Changes will likely dictate how far afield they will disperse. A disappearing snowpack could lead to a reduction in wolverine range in some regions, though the extent to which snowpack is vanishing is tricky to predict, McKelvey says. Specific effects on regional snowpacks will become more accurate as climate change models improve, he says.

For some species, however, scientists may not have time to make use of the climate data to help with conservation efforts. Consider the poweshiek skipperling, a critically endangered butterfly found only in southeastern Manitoba and parts of the United States that was once an important pollinator for brown-eyed susans and other flowering plants.

Like many insects, the skipperling's larvae survive winter by tucking in with the autumn leaf litter. They rely on a blanket of snow to keep them warm — relatively speaking — as they pass the season in a state of torpor. Recent warmer winters in their range have reduced snowpacks, dangerously exposing the larvae to extremely low temperatures. According to the Nature Conservancy of Canada, fewer than 50 individuals were recorded at last count, making the butterfly vulnerable to winking out.

The fall webworm, a moth species, has similar challenges. Warm spells during the winter may be causing them to periodically awaken from their torpor — a process that requires a lot of energy. "These guys often have only one generation a year, so the energy they take into winter is all the energy they have for their overwintering costs, for development in the spring and for reproduction," says Sinclair, who studies the species. Adult webworms also don't have mouthparts so there is no way they can feed once they transform, Sinclair continues. In their compromised state, the caterpillars will grow into smaller adults with less energy left over to make offspring. They will produce fewer eggs, and "the Darwinian fitness of [the species] goes down," he says.

The key going forward, McKelvey says, is to make better choices about what scientists need to measure, so that we can move from less to more certainty — and faster

As snowpacks vanish, so too does sea ice. A recent U.S. National Oceanic and Atmospheric Administration (NOAA) report lists increasing Arctic air and sea temperatures and decreasing sea ice extent as some of its key findings. In 2015, air temperatures across the Arctic were the highest since record-keeping began in 1900.

The resulting warmer water is causing behavioural changes in some species of fish. The report points to work by scientists in Norway and Russia who have observed northward movement of subarctic species, like cod, beaked redfish and long rough dab, into Arctic waters. The sudden presence of these big predators may pose problems for the smaller Arctic fish that will have to very quickly adapt to new threats in the neighbourhood.

With vanishing sea ice comes disappearing habitat for animals like walrus and polar bears, as well. Both species use floating pack ice as platforms for mating, giving birth to young, finding food and taking breaks from life in the sea.

As ice floes have become more rare, walrus in Alaska have been observed hauling out on land, creating massive, crowded colonies that, at times, have been plagued with stampeding behaviour resulting in crushed young. Obviously, this is a negative development for walrus, and there may be more to come as their habitat changes. On the other hand, new research has revealed that walrus have an evolutionary history of adapting to feed on different food sources in response to environmental changes. Whether or not this history of being flexible feeders helps them remains to be seen.

Another species showing the potential for adapting to at least some of its changing Arctic habitat is polar bears. Without an ice platform from which to hunt, polar bears are thought to have less success making meals out of seals. Based on this behaviour, years ago it was thought that polar bears would be critically endangered by now, starving without access to prey. But while their population numbers still warrant concern, they've proven more adaptable than once thought, McKelvey says. For example, in some areas they've shifted to feeding on the eggs of snow geese, whose populations have boomed because of their ability to feed in the farmers' fields of their southern, non-breeding range. "Whether [the bears] can actually make a go on snow goose eggs is not clear, but what it shows is that they are more adaptable then we would give them credit for."

McKelvey, however, points out that this feeding adaptation is directly linked to the proliferation of agriculture. "The bears wouldn't have been able to make that shift in the 1800s had the climate warmed up then," he says. Two hundred years ago, the polar bear's reaction would have been impossible to predict.

Again, while there will be challenges for some species as sea ice vanishes, for others there may be benefits. Underwater microphone surveys conducted by the U.S. National Oceanic and Atmospheric Administration suggest that as sea ice recedes, humpback and fin whales — known previously to range into the Arctic only in the summer — may take advantage of newly open waters further north for feeding in the winter. This could in turn lead to food competition with other species, like the elusive bowhead whale.

This may or may not be bad news for the long-lived bowhead, which over millennia has built up a reputation for being incredibly tough. Though the southern Arctic waters may become more fraught with competition, some climate models also suggest the bowhead will gain habitat in the waters at the very northern ends of Greenland and Iceland. Whether this new habitat will be enough to sustain them has yet to be seen.

With so many unknowns and possible surprises, these examples demonstrate just how complicated it is to predict the outcomes of climate change on wildlife. It's difficult to be proactive with so many factors to consider, and yet for some species, time is ticking.

For those watching closely as animals like the poweshiek skipperling teeter on the brink of extinction, this uncertainty can be disheartening. The key going forward, McKelvey says, is to better choose what scientists need to measure, so that we can move from less to more certainty, and faster. "We need to start watching for changes in the system, and not expect that we'll know what those changes are before they show up." That way, McKelvey says, when changes do show up, we'll detect them, and be ready to act.

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4. Plant a tree at home. It will help keep your house cool and will soak up carbon.