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editor's note

Cover art **Rohan Dahotre**

Everyone coming out of 2020 in reasonable shape deserves a pat on the back. I have lately been making the case to not differentiate mental health from a physical one. When I'm mentally sick, I just say I'm unwell. The need to have inclusive environments, developing emotional intelligence not just in the workspace but also in our work, and redefining our language of health is now more urgent than ever. At CC, we've had quite a year to reflect on these, and hopefully, build and bloom from here into 2021.

As the last issue of the year, Current Conservation 14.4 is a crescendo of efforts from an ever-growing team and diverse initiatives. This made us strengthen our resolve to be an equal opportunities newsroom and include more women as columnists. We kick this off with Caitlin Kight's column in 14.4 on the intricacies of language, culture, and dialect in our understanding of conservation. The Founder and Director of WILD Foundation, Vance Martin, makes a case for diversity strengthening conservation success. Mischael Hardre talks sabre-tooths while Harry Dittrich discusses otters' role in water conservation. Paloma Bhattacharjee reviews Jacob Shell's book on elephants in captivity in Myanmar. We also bring two Research in Translation pieces that discuss mammal control, and road fencing projects respectively. Alyssa Sargent talks owl conservation (with plenty of room to pause for owlet cuteness) and Kartel Shockington ends the year on a note of laughter, as we hope you did too.

—Shruti Sunderraman

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feature

The secret world of owl migration

Author **Alyssa J. Sargent** | *Illustrator* **Aindri C.**

Outside, beyond the frosted windows, things are swathed in darkness. Within the warmth of the research station, all is silent but for the heater purring at your feet, and the rasp of pages being turned idly—your crew member, reading a book that details the patterns in which bird feathers grow. You check your watch. 1:30 AM.

"It's time," you say, and you both get to your feet. A quick zip of the jacket and you head wordlessly into the night, hooked wooden pole in hand and satchel slung over the shoulder.

Instantly, as if waiting impatiently just beyond the barrier of the door, a new sound punctures the air—an insistent too-too-too call, each note fast, even, and shrill. The sound of owls.

As you head for the noise, you leave a trail of breath in your wake, illuminated by the silver moonlight shining weakly through venous treetops. Beneath your feet is the crunch of unseen leaves that have long since forsaken their lonely branches. As one, the two of you switch on your headlamps. The call is louder now, as you wend through the paths that tunnel between towering oak trees. At a split in this trail, you and your partner peel off, and foray deeper into the woods alone.

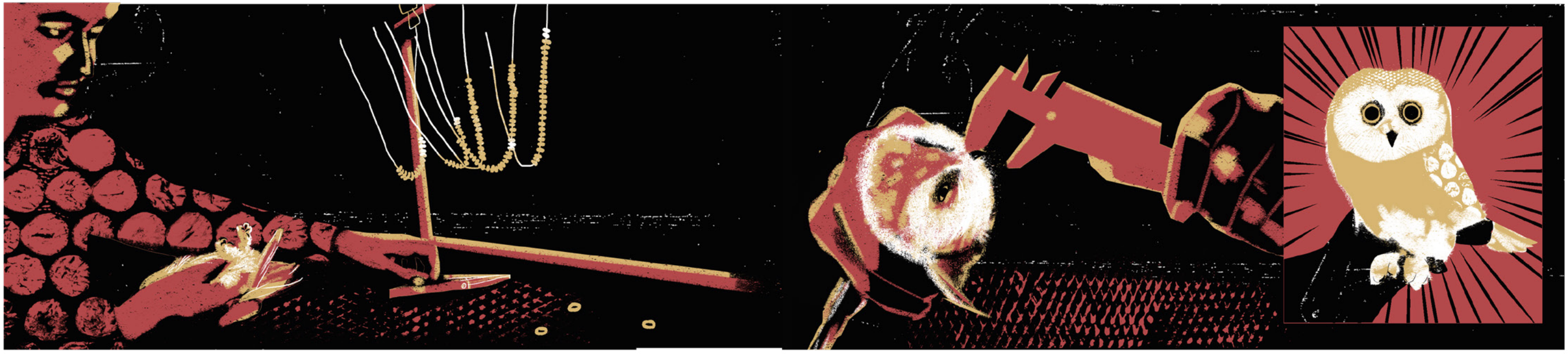
You are very close to your destination now. You slow down, picking your way carefully, attempting consummate silence. The tip of a wide mesh suddenly materializes into view: a mist net, stretching long and tall between two poles, almost too fine to see. Though it's out of sight, you know that a speaker lies just beyond the net playing owl calls on loop; it is this that you've been hearing. This is your setup as an ornithologist, rigorously trained to study and capture wild birds. With the speaker playing a male owl's mating call, you can lure in curious females and pugnacious rivals alike. The net, constructed of tiers of baggy pockets, will catch the owls within. It's important to check the net at frequent intervals, to ensure that all birds are promptly extracted.

With the focused beam of the headlamp you scan the net . . . there! A thrill of excitement shivers through you. Up high is a small shape, suspended in midair via the net. An owl! A Northern Saw-Whet, to be precise.

You lower the pockets of the net to a height that you can reach using your hooked staff, and hastily shift your headlamp to red light. Though owls have incredible night vision—this is thanks in part to light receptors known as "rods" in their eyes, of which owls have a million per square millimeter—they lack almost all color-sensitive "cones", thus allowing you to approach the owl without dazzling it. The large yellow eyes spear you now, peering up from a mottled brown and white head. Its eyes are not "eyeballs" in the true sense of the word, for they are stationary and the owl can only adjust its vision by moving its head—which it now demonstrates, tracking your movement warily. If it chose to, this owl could rotate its head 270° left-to-right, or 90° up-and-down.

With deft fingers, you begin to work the saw-whet free from the net. You're careful to take hold of the feathered legs first—though saw-whets are small, maybe 20 cm in size, they are still fierce little owls, and their claws are their most dangerous asset. With the claws freed, you can then tug the net gently over what approximates as the owl's shoulder, the crook between the humerus and coracoid bones. The saw-whet clacks its beak menacingly at you, a classic intimidation tactic, but you are undeterred.

You procure a cloth bag from your satchel and tuck the owl within, knotting the drawstring tight and looping it around your wrist. With this, you will carry the owl back to your banding station, where you and your partner will quickly determine its age and sex, and fit its leg with a numbered bracelet, or "bird band", which will help you re-identify birds and keep track of those you may have already caught. This is especially important now, during the fall migration season, when owls move in huge and stealthy swaths at night.



Many, though not all, saw-whets migrate. On a fairly good night, the birds come thick and fast, and a banding station can catch hundreds of owls. But numbers are often at the mercy of the weather—wind direction, temperature, cloud cover, and precipitation can all sway the totals—and there are deeper ecological gears at work too. Saw-whet populations fluctuate in response to those of small rodents, their prey, which in turn spike in years when boreal trees have especially abundant cone crops. As such, saw-whet migrations are cyclical, and every few years, a veritable torrent of owls will sweep through North America like a feathery flood.

By dint of banding birds, you therefore can gauge population trends much more easily. Without a way to identify one bird from another, you would have no way of knowing whether that sixth owl of the night was the same owl caught six times, or six different owls! It is also especially helpful to keep track of how many young birds you capture, to get an idea of how well the species is faring. Low numbers of juveniles could spell trouble for the future of those birds—that likely means very few owlets fledged or survived to migrate, which may in turn lead to fewer owlets in the following seasons. Comparing the numbers each year can give you a stronger sense of what is typical—or worrisome.

In this sense, bird banding stations are an essential line of defense in conservation efforts. After cross-examining banding data across many stations, scientists determined that, in the last 50 years, North American bird populations have declined by roughly 30 percent. That equates to over 3 billion birds lost, or over one out of every four. These numbers are incredibly saddening, and very alarming. Without monitoring programs, our understanding of how perilous the world has become for birds—and indeed, all animals—would be hearsay at best. But now we know better.

With awareness comes the responsibility to act. There are many simple actions that can help birds immediately—turning off your lights at night, which otherwise disorient migrating birds; adding window decals to alert birds of glass surfaces and circumvent collisions; keeping domestic cats indoors; planting native species and avoiding pesticide use in your yard, if you have one; recycling your plastics; and simply watching birds, and reporting what you see! Just as bird banding is a critical piece in the conservation puzzle, so are citizen science initiatives, such as globally-renowned eBird.

Birds are beautiful, alluring animals, ones that we must strive to keep safe. Among these, saw-whets still remain somewhat enigmatic, but our knowledge of their movement and behavior is growing.

With the saw-whet in hand, having completed a swift examination and banding, you step once more into the frigid air. You gently place her, standing, on a flat surface nearby and retreat to watch her. For a moment, she's entirely still, letting her eyes adjust. Then she unfolds her graceful wings, and, without a sound, she flies away into the night, off to continue her mysterious journey.

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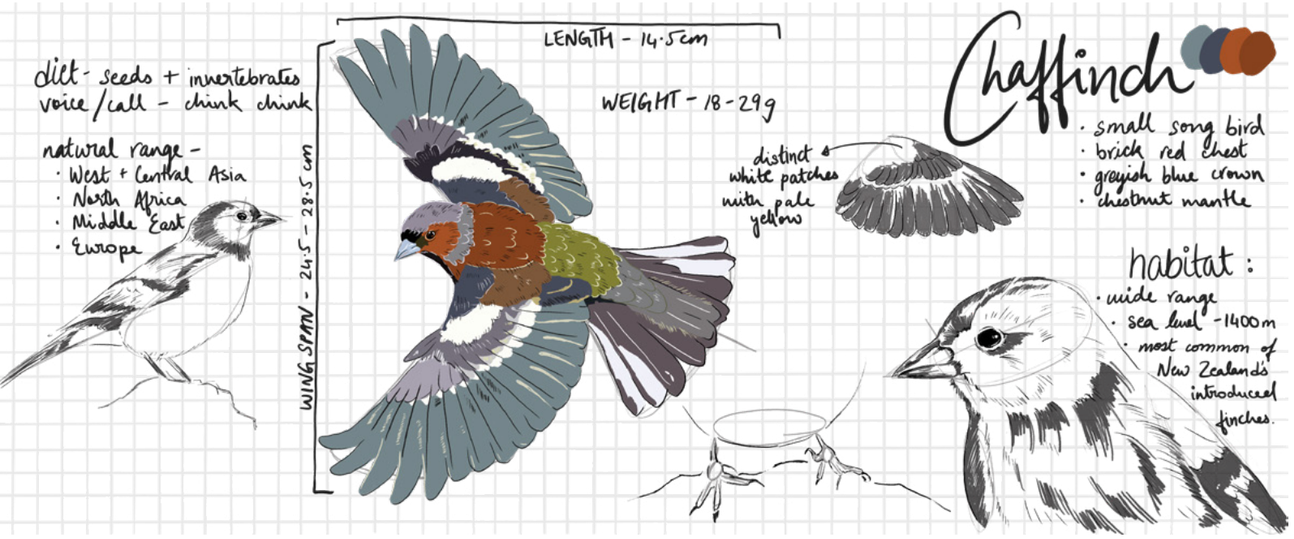

Bird's eye view: A case for mammal control in New Zealand

Author **Nyree Fea** | *Illustrator* **Upasana Chadha**

Over the past 1000 years, New Zealand has lost approximately half of its bird species, with the majority of extinctions attributed to predation by introduced mammals. Populations of many surviving forest bird species continue to be preyed upon by mammals, especially rats, possums, and stoats. Conservationists have pioneered many developments in large-scale control of introduced mammals in New Zealand forests over the last fifty years, which presents a unique opportunity to assess responses of birds to this broad-scale replicated management experiment.

We recently conducted a meta-analysis of 247 population-level responses of forest birds to different levels of mammal control, recorded across the breadth of New Zealand. Analysing data from 32 uniquely treated sites and 20 different bird species, they compared responses to three intensities of invasive mammal control — zero, low and high intensity control. The high intensity treatments included eradication of invasive mammals from fenced sanctuaries and mainland islands, while many of the low intensity treatments involved periodic, but widespread suppression of mammals via aerially-sown toxin.

We examined the average response of each species according to key life history attributes such as body size and degree of endemism. Deep endemics are believed to have a long evolutionary association with New Zealand, potentially stretching back millions of years, and therefore, to have lost adaptations that enable them to co-habit with predatory mammals. For example, five of the eight deeply endemic species nest in cavities, a trait associated with population declines of forest bird species in New Zealand.

Large-bodied endemic species, such as the Kākā (a cavity-nesting forest parrot) and the Kererū (New Zealand Pigeon), regularly showed positive population-level responses to mammal control. The researchers also identified two small species of shallow endemism - Pīwakawaka (Fantail) and Riroriro (Grey warbler), and four non-endemic species - the Blackbird, Chaffinch, Dunnock and Pihipihi (Silvereye) that arrived in New Zealand in the last 200 years, that tended to decline in detections after mammal control. Their study suggests that large, deeply endemic forest birds, especially those that nest in cavities, are the species most at risk of further decline in the absence of mammal control. But equally, these are the species that stand to gain the most when populations of mammals are reduced. Conversely, there are two shallow endemic and four non-endemic species whose evolutionary history allows them to apparently tolerate the presence of introduced mammals, but perhaps makes them less able in facing competition from recovering populations of larger endemic birds.

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Nyree Fea *is a Research Fellow with the Centre for Biodiversity and Restoration Ecology at Victoria University of Wellington*

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Diversity – the secret sauce of conservation success

Author **Vance G. Martin** | *Illustrator* **Shambhavi Singh**

The soft crackling and gentle glow of the small fire on the banks of the iMfolozi river in South Africa was insignificant in the powerful presence of the African night. The sky was bursting with stars, with lions roaring in the distance, as two men listened to the splashing of a bushbuck as it crossed the river.

The future co-founders of the WILD Foundation, Ian Player (a white, senior wildlife conservator) and Zulu elder, Magqubu Ntombela (Ian's mentor/brother/tracker), quietly discussed the difficulties around and ahead of them — chief among these, saving the white rhino from extinction. They were working to protect biodiversity, a term popular in conservation today but not even known at that time. This essentially meant that they needed to build strength and resilience within this species.
Only one small population of the Southern White Rhino remained, all in the small redoubt of Africa's oldest protected area, the iMfolozi Game Reserve in South Africa. The need was clear to them, but not the process, for no one had ever moved at-scale a very large, and sometimes temperamental mammal to far-away locations where they would be safer from the threats of disease and poaching. What's more, this was occurring during the era of apartheid — the white-ruled system of legal segregation of races and the (often violent) subjugation of non-white peoples in South Africa.

Ian told me this story some 25 years later as he, Magqubu, and I sat on the banks of the same river, around the soft crackling and in the fragrance of the small fire made of tamboti wood. "We had to move them," said Ian. "Because a virus could come into the Reserve and wipe them all out. They are safer in small, diverse groups, further apart." They accomplished their goal, with multi-racial groups of experts and uneducated game scouts working together on the ground, in the hot African bush, to develop the first techniques, drugs, and processes that allowed many white rhino to be moved throughout Africa and around the world, and for their population to grow from a few hundred to almost 25,000 by the year 2010. The racially, economically, and culturally diverse team worked with, and learned from each other for the common good of saving an ancient species of animal. Diversity works, even in nature.

Sound familiar? The need for safety from disease, extinction, and violence . . . in the social context of racial or other cultural injustices? There are lessons we can learn now, from what occurred then. I did.
As a young man in my mid-30s, I looked at the elderly Magqubu as we sat there on the riverbank, him quietly singing praise songs as he often did. I asked him how we could help change the unjust law of apartheid. With Ian translating, the old man spoke simply in his typical, low and rumbling voice. "When you die and are buried in the ground, the worms do not care the color of your skin. When we understand nature, our life is strong. It is simple and yet it is difficult. But we must always hope and do what is right."
Nine years later, after 27 years in prison and in a violence-free transition of power, Nelson Mandela was elected President of South Africa. I am reminded today of Mandela's reply when asked how he survived those years in prison: "Hope is a powerful weapon, and no power on earth can deprive you of it."

And here we are now, 2020, with our world in the grip of existential natural crises — climate breakdown, the species extinction emergency, and the viral pandemic — that threaten to upend our future survival, and the world is beset with polarities of religion, race, class, and economy.

Because you are reading this, you likely already understand that protecting nature is a service to both nature and humanity; that peace and prosperity are possible only from a respectful relationship with nature; and that such a reality can never be made manifest if we don't also respect and protect each other.

Where do we go from here? How can nations and communities gain the strength to move beyond the polarities and inequities? We just start simply but profoundly. I suggest we listen to each other respectfully, hopefully and, most importantly, actively. More specifically, two thoughts…

Ubuntu. Ian Player and Magqubu established our organization, the WILD Foundation, and instigated a global movement of cooperation among people and with nature. They infused our organization with the same principles and practice they used to save the white rhino. They worked together for the common good, blind to racial and cultural differences — they followed the example of the worm. By doing so, they practiced ubuntu, that very special Bantu philosophy that asserts the power of mutual respect — "I am because you are" — and confirms a universal bond of sharing that connects all humanity. What also comes to mind in the contemporary western world is the growing awareness of 'co-liberation' — we are not free until we are all free. Ian Player always felt that it was the spirit of ubuntu among the diverse members of the team that saved the white rhino from extinction — all of them working together and respecting each other to accomplish a cause that is for all people and nature was an important element in the success of that pioneering programme.

Hope. Many years ago, I stopped being optimistic because it was not working for me. I needed engagement, connection, and reason. Vaclav Havel captured my feeling perfectly: "Hope is definitely not the same thing as optimism. Hope is not the conviction that something will turn out well, but the certainty that something makes sense, regardless of how it turns out." This is nowhere more evident than in many conservation campaigns, such as if mining were to occur in an area sacred to tribal communities, or a dam were to completely destroy a wide range of essential eco-system services in order to provide water for commercial agriculture. Most of these situations have a small conservation-oriented team facing up to a large multinational corporation and/or major funding and government agencies, all of whom have infinitely more resources to draw upon. The outcome is far from certain, but it is undertaken because it is the right thing to do for the people, for nature, and for a sane and healthy future.

And Mandela certainly got it right when he confirmed that life can strip you of everything except your attitude, and that the attitude of hope is indeed very powerful. But there is more. To me, hope is active, it only fully manifests in doing. In fact, I subscribe fully to that which Kris Tompkins of Tompkins Conservation asserts, that people are only deserving of hope when they act for the common good.

Acting for the common good needs to be our common cause. As we face our common challenges—climate change, pandemics, extinction, and social inequity – achieving this goal means viewing the world through connections rather than differences, and acting accordingly.

Magqubu's words echo loudly in my ears today.

Vance G. Martin *is the President of the WILD Foundation and Wilderness Foundation Global.*

Shambhavi Singh *is an illustrator and visual communication designer based in Helsinki. She enjoys reading poetry and making bad puns.*

What is it you plan to do with your one wild and precious life?

Author **Caitlin Kight** | *Illustrator* **Parinita Dewan**

This is the question Mary Oliver poses at the end of her poem 'The Summer Day', which luxuriates in the wonders of nature: the swan, the black bear, the grasshopper, the grass. Anyone who is familiar with Oliver's oeuvre will know that this is only a small subset of the wonders that Oliver celebrated in her spare but elegant poems and essays —her words inspiring readers not only to value the natural world in its own right, but also to appreciate its ability to help each of us find purpose in our own place in the universe. Her carefully selected words open a door and invite us through, to the new understandings awaiting us on the other side of the threshold.

Profundity is not the exclusive domain of poets, of course, and even the most casual and unrehearsed words can change the course of a life. Another sort of nature interpreter —the sort that guides you through the wilderness on foot rather than through the pages of a book — had this effect on me when I was a young girl. Leading a small group of us through Appalachian woodlands, he translated the song of an ovenbird (Seiurus aurocapilla) into an English-language mnemonic, 'teacher TEACHER TEACHER'. In hindsight, this was unintentionally poetic in its own right, given that the word applied not only to his actions on the day, but also to what they eventually inspired me to become — someone who could carry on that same tradition of bridging the gap between people and nature, choosing the right words to persuade people to value and conserve the planet's other inhabitants.

This, then, was my answer to Oliver's question. Knowing 'what', however, doesn't guarantee an understanding of 'how', and I have spent years exploring different methodologies. Throughout that time, I have frequently revisited another element of that fateful day in the Appalachian woodland. Pointing to a sassafras tree (Sassafras albidum), the guide invited us to note the three different types of leaf that can be found intermingled even on a single branch: some that are elliptical, like an eye; others that are two-lobed, like a mitten; and a third variety with three lobes, like the footprint of a large bird. As if this unique foliage pattern weren't memorable enough, the guide further cemented the sassafras tree in our memories by recounting a captivating Native American tale explaining the origin of the leaves' diversity.

I have repeatedly come up empty-handed when attempting to verify the authenticity of this legend. I have found several renderings of the story online, but all, like the version I heard, are recounted by white people. Each of these versions has also been noticeably lacking in detail — including any signature elements of genuine Native American legends — and has included certain language or characteristics much more reminiscent of European tales. My suspicion is that the myth is heavily bastardised, at best, and completely fabricated, at worst.

I do not think my guide was intentionally complicit in this; I imagine he was acting in good faith, using his remarkable oratorial skills to share an enjoyable and educational narrative that he himself had been told at some point in the past. The problem is that stories are influential; words have resonance, and power. His forever shaped the way I respond to the sassafras tree. To some extent, they also helped create a (probably false) understanding of how Native Americans perceive the tree, the natural world in general, and the relationship between humans and wildlife.

What might an indigenous guide have said about the sassafras? What stories might have been told, what cultural practices described, what unique native words used to convey characteristics overlooked by English-speaking settlers and their descendants? Might a native guide have focused on a different species altogether? How might those views — the culmination of thousands of years of human-nature interactions pre-dating the arrival of colonists — have changed my understanding of and relationship to that environment?

These are not idle queries. They are the sorts of questions that are increasingly being asked in support of decolonisation — the process of examining, challenging, and ultimately removing the remaining legacies of coloniality. Everyone can engage in decolonisation, but it is particularly important for teachers like me, since we can influence (among other things) whose knowledge is valued; which information is taken as 'fact'; and how people interpret various aspects of life experiences. An important part of decolonising your teaching practice is understanding when to take the lead on teaching versus when to cede the platform to others; ensuring that when the platform is ceded, this facilitates the amplification of the right voices; and knowing that when those voices are speaking, it is time to listen and learn from them.

As part of my work towards the third goal, I recently attended an event called Nature Writing: Finding Words to Face the Biodiversity Crisis, featuring two authors who are both women of colour: Jessica J. Lee and Amanda Thomson. Though their works differed substantially in both style and content, they converged in one notable way: exploring how language can bring us closer to nature by offering us precise and sometimes poetic terminology for describing the environment and our responses to it.

Lee, born in Canada to immigrant parents, noted the contrast between her own descriptions of her mother's native Taiwan and those of earlier Western colonists, whose field guides used terms that 'mingled beauty with fear, with curiosity and exoticism, occasionally with disgust.' This begs the question: Whose voice is a better advocate for conserving the local ecosystem? Thomson, a native of Scotland, describes the ways in which learning traditional Scottish natural history terms altered her understandings of places, their features, and herself within those spaces. She notes that losing such language from our vocabularies reveals the changing nature of our relationship to the environment. This forces us to ask: How can the preservation and use of such terms — from other dialects and languages as well — provide a more nuanced and impactful connection with nature?

Both authors recognised that some people and cultures will have a particularly strong connection to certain places, forged from long experience and evident in the very language used to contemplate and describe those locations. Their messages highlight how much is to be gained by immersing yourself in the native ways of capturing the spirit of a place, allowing you to explore new ways not only of verbalising, but also of seeing and feeling. Doing so could help upend colonial hierarchies, requiring the outsider to approach as a learner and receiver, rather than a teacher. This could foster respect and cognitive empathy for the indigenous keepers of knowledge, and provide greater impetus for supporting the preservation of native languages.

Such efforts could lead to multilingual dialogues comprising the multitude of descriptions we humans have devised over the centuries to accurately describe nature's intricacies. Not only could this facilitate conservation, but it could also help us better understand and appreciate what we have conserved. This seems a laudable goal for our wild and precious lives, and one that Mary Oliver would surely have commended.

Caitlin Kight *is an educator, communicator, and scientist. She is the author of the natural history book Flamingo and tweets as @specialagentCK.*

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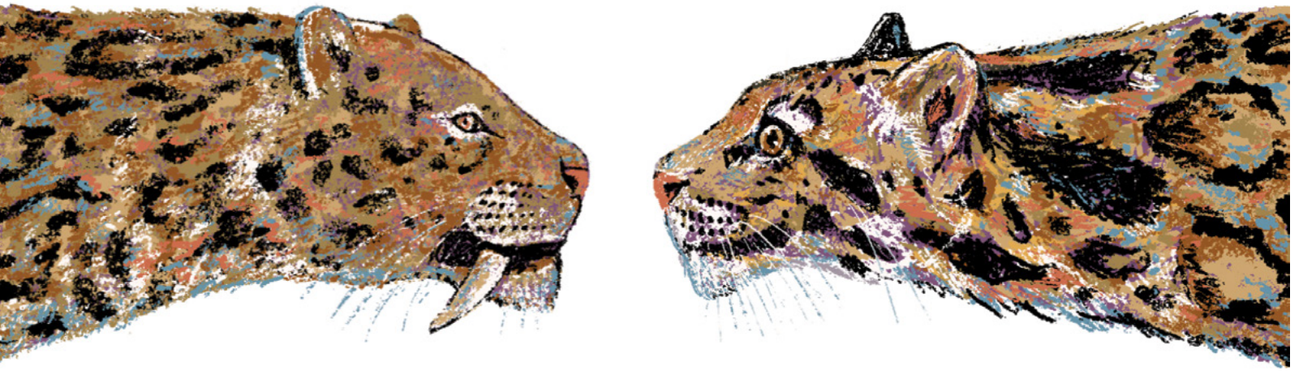


The new sabre-toothed cat: when pre-history comes alive!

Author **Mischael Hardre** | *Illustrator* **Rohan Dahotre**

Have you ever wondered if there still are creatures in the world that we haven't found yet? Perhaps in places that have yet to be discovered? Hidden in the jungles of Southeast Asia is a cat that most people in the world have never seen. Even though it was first reported to the western world 200 years ago by a naturalist named Edward Griffith, this cat has stayed as mysterious and hidden as its name suggests. The clouded leopard has the scientific name *Neofelis nebulosa*, which actually means 'new cat, cloud'! It is medium-sized, lives in trees, and is named for the large cloud-shaped patterns on its fur. This creature is less than three feet long and weighs between 25 and 50 pounds, which is quite small compared to larger cats like South American jaguars (200 pounds), African lions (400 pounds), and Asian tigers (up to 600 pounds). For this reason, the clouded leopard is known as "the smallest big cat". Like its cousin, the snow leopard, the clouded leopard does not roar, and has many other unusual and unique characteristics.

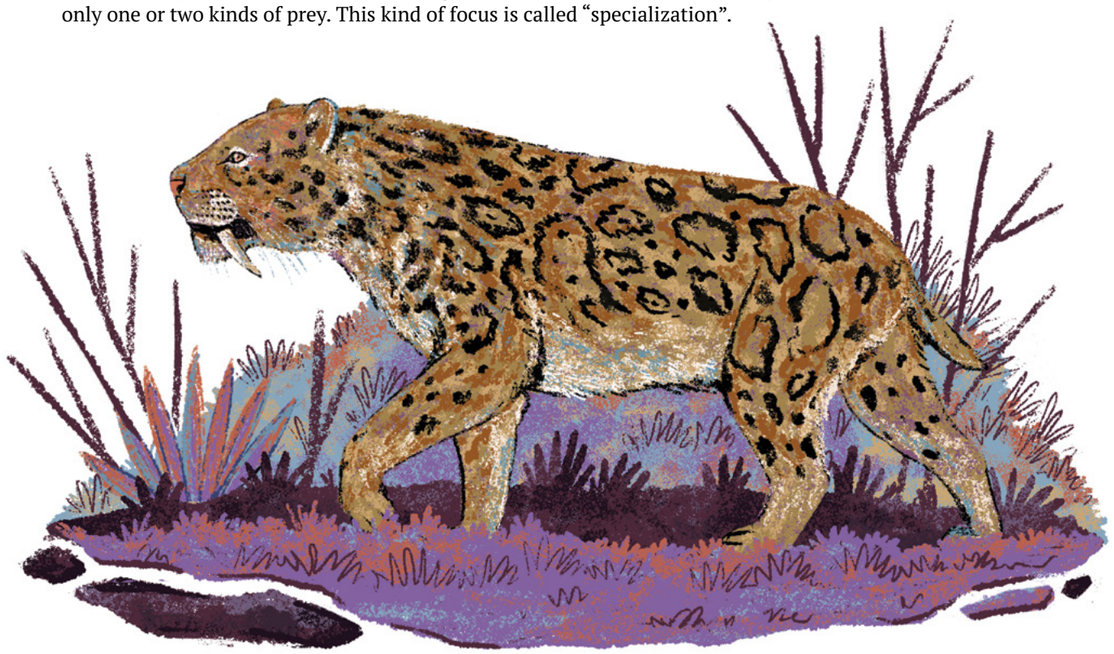
Even though people have known about these beautiful creatures for a long time, there is still a lot of mystery surrounding them. In 2006, scientists discovered that the clouded leopard species we knew about were actually two different species - the clouded leopard on the mainland continent of Asia called the mainland clouded leopard, and another species isolated on two islands, Borneo and Sumatra in the country of Indonesia. They named this the Sunda clouded leopard. They may look the same at a glance, but under close inspection, there are many differences between these two cats, from the size and shape of their teeth to small pattern differences in their fur. The surest way to tell them apart came from DNA testing. By comparing the DNA of clouded leopards from mainland Asia and the DNA of those from the island of Borneo, a team of researchers found that these two species of clouded leopard are as different as lions and jaguars.

Many traits make the clouded leopard special in the larger world of cats as well. They have a unique pattern to their fur, unlike any other of its kind. Their ankles can rotate backward like a squirrel's, allowing them to climb down tree trunks head-first! They also have incredibly long teeth. When compared to the overall size of their bodies or the tooth-to-body ratio, both species of clouded leopards have the largest canines of any living cat. The newest species — the Sunda clouded leopard — has canines that are longer and thinner than even their cousins on the mainland. However, if you look at one, you won't see their front teeth hanging out of their mouths like the sabre-toothed cats we see in movies. Their teeth are just short enough to stay tucked under their lips, hidden most of the time.

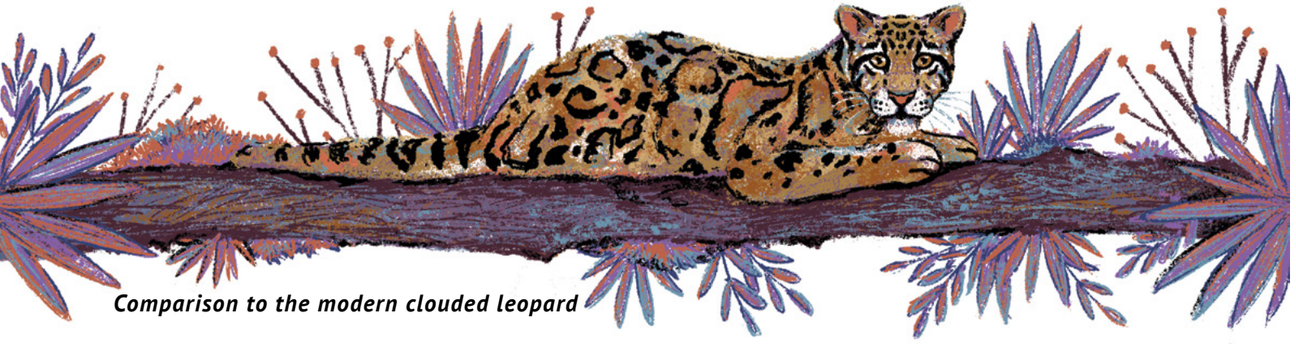
In pop culture, the words sabre-toothed cat might make one think of Diego from the move Ice Age. While Diego and his kind did exist, their name comes from (you guessed it) their sabre-shaped canines. A saber is a sword that is long and slightly curved, like those of pirates we see in regular pop culture. Like most swords, the blade is flat, which is important when we are comparing them to teeth. Cats today have cone-shaped teeth, which allow them to attack and hold onto their struggling prey for elongated long. Flat teeth are no good here because they are weaker in one direction. If you push against the flat side of a blade, it is likelier to break than if you push against the thick edge. Think of trying to break a wooden board in karate. If you hit the flat side it might crack, but if you tried to break the edge, it would only hurt you! Sabre-toothed cats' sabre teeth were flatter and less cone shaped. If a sabre-toothed cat were to attack an animal and that animal struggled, there was a good chance his teeth might actually crack like the wooden board.

Sabre-toothed cats of old

There are many extinct species that represent what we might think of when we hear of "sabre-toothed cats". Although there were others, two of these groups were especially dominant at different times. As early as 35 million years ago, an early group called Nimravids (Nim-ra-vids) roamed the plains of North America, Europe and Asia. Although they were not related to true sabrecats at all, these creatures were shaped like later sabre-toothed cats, bulky, with big forelimbs and thick necks. A long time later, only 2.5 million years ago, a group of true sabrecats, called Smilodons (Smile-o-dons) arose. They too had thick limbs and strong necks, and hunted all over — not just the plains, but in the forests and mountains as well. Along with them were other large predators hunting the ancient versions of deer and buffalo. In fact, there were so many different animals competing for food that scientists believe they were forced to focus on only one or two kinds of prey. This kind of focus is called "specialization".



When an animal specializes, it often leads to exaggerated features like brighter colors, larger eyes, or longer fangs. In the case of sabrecats, specializing made their canine teeth longer and thinner over time. With such amazing canines, attacking prey could put their teeth in jeopardy. Scientists aren't sure about how they actually hunted yet, but there are some excellent ideas. One common theory suggests that they would surprise their meal and attack them with a single kill bite, holding them still with their strong forelimbs rather than their teeth. After they killed their prey, they would have faced another problem. In order to be able to fit anything in their mouths, their jaws would also need to open extremely wide to clear those long teeth. And that is what researchers found — that Smilodons and other sabre-toothed cats could open their mouths extremely wide, a measurement in science called the "gape angle". It was this large gape angle that clued one researcher to the similarities between these incredible extinct cats, and the modern-day clouded leopard.



Comparison to the modern clouded leopard

Per Christiansen, a Norwegian paleontologist who studies prehistoric cats, noticed that clouded leopards have the amazing ability to open their mouths wider than any other living cat — to a staggering 100 degrees or more! In comparison, a human has a gape angle that averages 75 degrees. This got him thinking about their teeth, and the reason for those wide mouths. He found that along with their incredible gape angle, their canine teeth were somewhat sabre-shaped, just like the cats he studied. First, he measured the width and length of the canines from many different clouded leopards, as well as lions, leopards, tigers, and other living cats. Then he compared them to the canines of many different extinct sabre-toothed cats. He found that the canines of the clouded leopard are more like the massive canines of those prehistoric cats than they are to any other living cats today! And the similarities don't stop there.

Clouded leopards live in the dense jungles of Southeast Asia, where they spend most of their time high in the trees. There, they do everything from eating to sleeping. They even hunt monkeys high in the trees! Being in the trees so much, they have incredibly strong front legs, which they use to climb up, down, sideways, and even on the underside of tree branches! Remember how the Smilodons and the Nimravids have strong front legs to capture prey and hold them down? Clouded leopards do the same thing. It makes sense, too. Clouded leopards feed on many different types of animals, from porcupines and monkeys to pigs and deer on the forest floor. Some of their prey are even bigger than the clouded leopards are! Since the leopard's teeth are long and narrow, attacking such large prey will increase the risk of breaking those long teeth. Their powerful front legs allow them to hold down prey while they use a strong killing bite. Scientists have also discovered that just as strong front legs make the clouded leopard good at both climbing trees and catching prey, many of the ancient sabrecats were good at climbing trees too.

Clouded leopards, and especially the Sunda clouded leopards in Borneo, are still much of a mystery because of their remote locations and hidden, solitary nature. There is still much to learn about the way they hunt and how they use their long fangs. However, we do know that the Sunda clouded leopard is the largest predator in the jungles it calls home. This means that there is less competition for prey, and less need for specialization. But if another animal comes along that hunts the same prey as the Sunda clouded leopard, there is a chance that their teeth would need to grow even longer and thinner for more specialized hunting, and they would end up looking just like the extinct sabrecats' teeth!

Right now, Sunda clouded leopards hold the record for having the longest and most sabre-like teeth for their body size in the cat world today, crowning them the new sabre-toothed cats of the animal kingdom! The massive canine teeth, along with other incredible and beautiful features, make this animal one of the most interesting creatures there is still so much to learn about. How amazing is it that there are still extant sabre-toothed cats living among us today?

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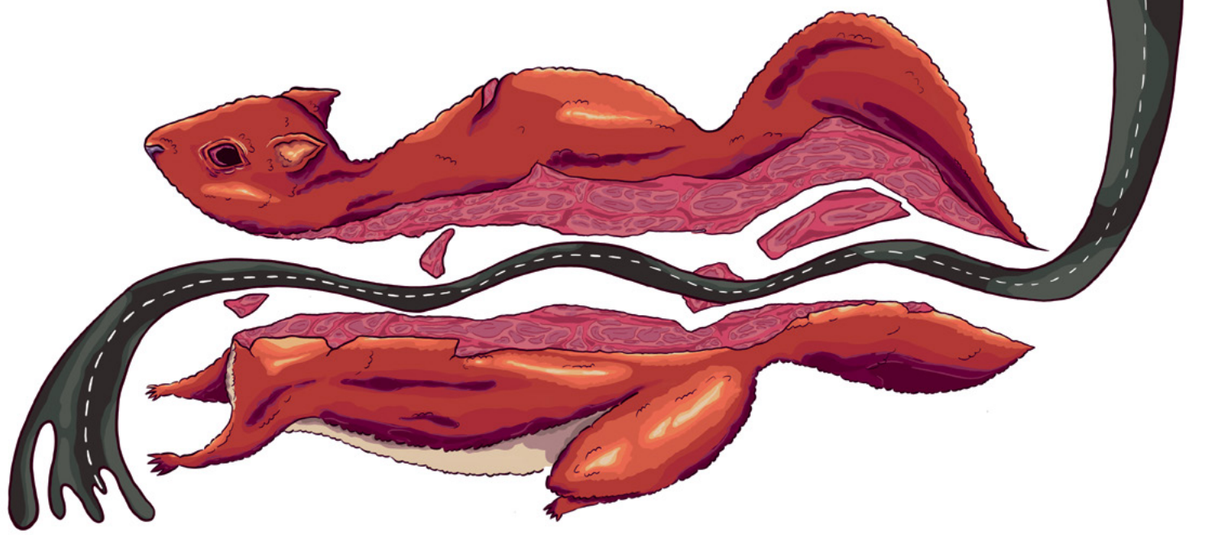
How to prioritize road sections for fencing to reduce animal mortality

Author **Ariel G. Spanowicz, Jochen A.G. Jaeger** & **Fernanda Z. Teixeira** | *Illustrator* **Upasana Chadha**

Roads help us move from one place to another. However, roads also pose a major threat to wildlife as it attempts to move across roads. According to national estimates, millions of mammals, birds, reptiles, and amphibians are killed due to vehicle collisions on roads each year. As a result, many wildlife populations are severely depleted by roadkill, causing local extinctions and contributing to biodiversity loss. The best-known method to prevent roadkill is to put wildlife fences along roads to block animals from crossing.

Although fencing creates barriers for animal movement, animal mortality due to road-kill is often a much bigger threat to the survival of animal populations than the restrictions caused on their movement.

Fences are costly to install, and these costs increase with the length of the road that needs to be fenced. The next best solution therefore is to fence only along stretches with a high frequency of road-kills. To address this, we present a step-by-step approach to reduce animal road mortality, known as the 'Adaptive Fence-Implementation Plan'. Our plan provides guidance on



roadkill surveys, hotspot analysis at multiple scales, and mitigation measures such as fencing and wildlife passages. The adaptive nature of the plan ensures that assessments account for shifting of hotspots in response to the installation of fences. The plan provides a systematic framework for prioritizing road sections for fencing, and can be used in combination with other mitigation measures such as wildlife overpasses and underpasses, to alleviate the problem of restricted movement.

Our hotspot analysis identifies locations where fences need to be installed to reduce animal deaths due to roadkill. We define 'hotspots' as locations with significantly higher roadkill numbers than expected (as compared to numbers obtained from a random distribution), and 'coldspots' as locations with significantly fewer roadkill events than expected. We collected data from recorded roadkill locations on three roads: one in Quebec, Canada, and two in Rio Grande do Sul in southern Brazil. We used a 'moving-window' approach along roads to count roadkill. The window, 200 m - 2000 m in diameter, was used to account for a range of spatial scales at which hotspots and coldspots could be identified.

We found that the scale of assessment influences the location, number, and spatial extent of hotspots identified. Interestingly, a roadkill hotspot identified at a particular scale may not necessarily be a hotspot at another scale. We then explored the potential reduction in road mortality if fences were installed, starting with the hotspots with highest recorded incidents of roadkill.

The relationship between the length of fence installed and reduction in roadkill can be displayed in mortality-reduction graphs, which show steeper slopes at fine scales. This means that the total length of the road sections that need to be fenced is shorter when considering hotspots at fine scales, compared to that required when assessments are made at coarser scales. Accordingly, using many short fences might be more effective than using a few long fences. However, if fences are too short, animals could move around the fence to cross the road. This results in an important trade-off between the use of a few long or many short (FLOMS) fences. Fencing only hotspots identified at fine scales with many short fences might appear to be less expensive, but it may result in ineffective mitigation if animals can move around the fences. A balance needs to be found between a few long and many short fences. This balance depends on the movement behavior of the species and mortality reduction targets, and may also depend on the landscape structure in the vicinity of the road. The insights from our results help understand the influence of fences on roadkill at multiple spatial scales, and the trade-offs therein.

Further reading

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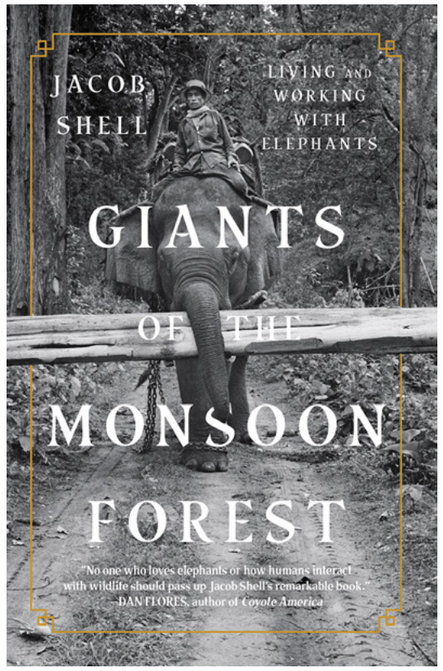
Not just a cute picture: what elephant conservation is really like

Author **Paloma Bhattacharjee** | *Illustrator* **Shivani Shenoy**

Of what was once the Asian elephant's landscape, extending from Syria all the way up to China, India, and Pakistan, only few isolated pockets now remain in South and Southeast Asia. Among them the trans-Patkai region of Asia still offers an unfragmented stretch of forests for this migratory species, which by the end of this century is estimated to succumb to the sixth mass extinction. Jacob Shell's book, Giants of the Monsoon Forest: Living and Working with Elephants, walks us through an ethnographic and historical work life situated in this region of the Indo-Burmese border across the crescent of the Patkai Hills, even as the regions of central Myanmar, and Vietnam fall within its scope. Shell narrates an intimate account of a unique working relationship between humans and elephants in this region, in the pressing context of habitation loss that looms large over the future of the species.

The narrative summons attention to the specific nature of this geography. It is untraceable through satellite imaging due to canopy and monsoon clouds, and unreachable through roads or vehicles due to dense forests, torrential rivers and thick monsoons. This attentiveness is critical to gauge the inseparable relationship between the place, people and the elephants. The forest-based economies of the communities inhabiting the region are deeply dependent on the elephants for all kinds of movement. The only way to navigate these regions is via the elephant trails and their dexterity to move through the forests. The author tells us that this dependency is mutual. It is not just the people who need the elephants. The forest-based economy in the present times is what keeps the forest cover intact, without which the lands will fall prey to agricultural expansion. At the heart of the book is the argument that surviving in this harsh environment has led to a historically developed working relationship between the people and Asian elephants.



In this relationship, the elephants live a life of semi-captivity; they work by day and are set free at night. In contemporary times, with a ban on timber logging, the inevitability of settled farming, and large scale deforestation, perhaps the only way to secure the future of the species is through holding on to this cultural practice of working with elephants. The book suggests that instead of colonizing this geography through calamitous infrastructure-building projects or expanding agriculture, the states of these regions could incorporate the elephants into forest-based economy, such as transportation and rescue operations, which could be a workable way to secure forest cover, livelihoods and the lives of elephants.

Despite the moral contradictions of the relationship between humans and elephants, these are somewhat lesser obstacles, the author argues, when the larger issue is that of securing the habitat of a species in the throes of extinction. Moreover, the presence of the semi-domesticated elephant ensures the forest cover remains intact. This in turn protects against the fragmentation of migratory routes of wild herds. It also improves the scope of inter-breeding, thereby maintaining the overall health of the species.

The backbone of the book is an animated narrative which effortlessly tethers ethnography to folklore, behavioural sciences and history. This fleshes out lively, tense and thought provoking encounters and anecdotes about what constitutes this co-working relationship between the people from various tribes of the region and the elephants. Both share complicated and deep histories of migration from the plains to the hills. This complex relationship has room to recognize the needs of the elephants.

An important part of semi-domesticated life of the elephants is the fetters tied between their forelegs, so that they can freely walk in the forests at night but not run. They are strong, yet deliberately not as strong so as to be conducive to breaking, if an elephant's urge to leave to join a herd is extreme. These 'breakable chains'; a safety valve to balance the needs of the humans and their elephants becomes a metaphor for the reader to understand the complicated relationship between the elephants, their mahouts (handlers) and fandis (catchers). The reader however, is also made aware of the fact that this relationship is as much one of cruelty as it is of care and love, right from the process of elephant catching, disciplining and the burden of overworking.

A journey along this relationship is nonetheless an invitation to critique, that which is the corner-stone of humanity's moral claim to supremacy – the hierarchies that distinguish humans and nonhuman lives. Such critique lies at the heart of ethno-elephantology, an interdisciplinary approach that responds to the urgency of rethinking issues of human-elephant co-living. Jacob Schell's work ascertains that many exceptional abilities we have learnt to associate specifically to humans – a complex social world, the ability to think and act creatively, and lead a sentient life – are in fact not unique to humans but shared across life forms; in this case, by elephants. The book persuasively depicts their kinaesthetic intelligence, perceptual abilities and unique geographical cognition, something which people who live in close proximity with them recognise (recognition takes many forms including stories, songs and animistic beliefs), and on which they depend to thrive in this ecology. The author goes to the extent of arguing that given the innovation, creativity and ability to develop solutions in emergency situations that the elephants demonstrate in their work (in logging, transportation or rescue operations to save people stranded in floods).

One can ask to what effect the work performed are actually methods and manoeuvres innovated solely by the mahouts? The case for the insightfulness of the elephants is made by depicting their methods of resistance to work, or ways in which they don't just obey, but rather rely on their ability to assess. If the initial step towards a critique of a world deeply entrenched in hierarchical relations is to recognise the myriad life — worlds of other beings, across similarities and differences, then this book enables us to cultivate such a recognition, through the many moments of wonderment it offers.

This unique working relationship between mahout and elephant, built on ambiguities, complexities and profoundness is after all, a coming together of two perceptual worlds. This is something the book compels one to recognise. It is movingly explored as the author retraces the historical events of the Burmese exodus to India during the Second World War, through the key role played by elephants in the process of migration. One realizes how the historical episode would have unfolded rather differently, without the exhaustive collaborative labour between elephants and their mahouts — transporting and rescuing people and their belongings across difficult topography, dangerously steep mountains, torrential rivers and jungle paths where the monsoon wipes away all familiar routes. The book, by including several other such accounts of historical events, including the Ho Chi Minh Trails, the Kha Resistance and United States-Vietnam war, insists on revisiting the histories of the region through the indispensable presence of elephants, both as subjects and victims. This is done in a way that both nourishes an understanding of the past and offers a blueprint for the future.

If one begins reading the book with an expectation of an isolated account of animal-human companionship, halfway through the book, they will realise that such relationships are incomprehensible in isolation. Through a detailed discussion of both the spatial and social organization built around working with elephants, and a study of the regions controlled by the Kachin Independence Army — the only bureaucratic administration in the world that is elephant-run — the author leaves the readers with two important thoughts. First, that an account of a human-animal relationship, is not supplementary to, but intrinsic to the complex political-economic fabric of the region, and any attempt at understanding a place, its culture and politics thrive in relations of co-dependencies. Second, he urges for these models of co-working as an effective solution for states in South and South-East Asia to incorporate.

However, several aspects of the deeply engaging text lend themselves to further probing. First, the elephants' existence in a state of semi-captivity, the book argues, may help in their continual existence and preservation of their habitat as opposed to more critical situations. It also ensures the continuation of the rich cultural knowledge about elephants. However, to make an argument for semi-captivity into one about the survival of the species seems fraught with generalizations. This becomes clearer when one looks at studies conducted to understand the entangled lives of free-roaming elephants and people. One could turn to Ursüla Munster's work which looks at conflict and negotiations between humans and elephants in Wayanad district of southern India. Her work offers possibilities of thinking about shared spaces between humans and elephants (in a situation of conflict and co-existence) by engaging in ways of knowing and understanding the elephant's perceptual world. She, like Niclas Klixbüll, who works on human-elephant relationships in Sri Lanka, emphasizes the importance of practical knowledge in mediating co-living. Such practical knowledge recognizes elephants as socially intelligent, intentional animals, whose lives alongside humans have been impacted by ecological disruptions. Studies offer alternative arguments emphasizing captivity as the only possible course towards thinking about co-existence and in turn, the future of elephants.

Second, the book offers a perspective that this co-working could also be read as a conscious decision on the part of the elephants to survive the changing landscape. Towards this, it interestingly points to the subjective capacity of elephants as negotiators of their social environment. However, one is also moved to ask, when the proportions of ecological ramifications we face today are those of earthly survival, can it be ironed out through solutions of accommodating elephants as co-workers within the existing economic infrastructure? Proving that the infallibility of the changing landscape, the assumptions of landscape as a colony of humans, forests as a resource, or animals as labour for economy, are premises that beckon discomfort to think about survival in a shared world. Given forest-based economies don't operate in isolation; they are linked to larger commercial nexuses built around resource extraction, mining being the primary.

Lastly, can an ethical implication of recognizing personhood in another species and a shared world seem to co-exist with a language of the 'guardianship of human keepers', as the text tends to imply, despite its recognition of the subjectivities of elephants? These are some larger contradictions this otherwise deeply immersive book leaves one to think about.

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Otters: Evolution for Water Quality

Author **Harry Dittrich** | *Illustrator* **Annada Menon**

Mist curls in rising ribbons from the Northern Michigan lake early in the morning. The sun peaks over the horizon just as the world awakes. As I watch this breathtaking sight, I notice something moving in the underbrush along the shoreline. A family of North American river otters emerges from the shrubbery and enters the crisp early spring water. This was one of my first encounters with the subfamily Lutrinae. Watching this cute little family swimming together had me hooked.

I have crossed paths with otters many times since, and my love for them has only grown. As I grew older and advanced my knowledge, I learned that their peaceful existence is anything but. Water quality around the globe has become a pressing concern for all of Earth's inhabitants. No country is immune to issues concerning the quality of the water we drink and that which is in the ecosystems that surround us.

Of the thirteen extant species of otters in the world, all but the North American river otter is either threatened or endangered. The life history of the subfamily has uniquely tied them to aquatic regions, and nothing is more integral to their survival than the quality of the waterways in which they reside. Otters have evolved over millions of years specifically for aquatic life. Their relationship with water places them in a prime position to be the spokes-family for water quality conservation.

The issue

Nearly one third of the world's population is drinking from water contaminated with feces and other pollutants. This is not restricted to third-world countries either. Even in the developed world, this remains an issue. During severe weather in most cities, sewer systems discharge directly into waterways without being treated. I remember living in Traverse City, Michigan, and being unable to go swimming in the bay due to heavy rains and E. coli being found in the water. This is a common occurrence in many cities as older sewage systems are unable to keep up with demand especially in larger cities and dump untreated wastewater directly into waterways.

Our relationship with water is very unhealthy. It is the second most important thing to our survival yet we have such a disparaging report with our water resources. Regulation is often lacking and, in many cases, difficult as much of the pollution entering the waterways is from nonpoint-source pollution. This pollution does not have a single source like the discharge from an outflow pipe. There are many places in the world where people are simply struggling to survive every day and don't have the forethought to worry about longevity when the immediate is much more pressing.

As decreased water quality becomes more prevalent, especially in impoverished or indigent societies, ecosystems deteriorate causing a compounding calamity. The ecosystem's health declines leading to decreased resources causing the inhabitants to make more catastrophic decisions, thus accelerating the decline. This is where otters can play a crucial role, but it is imperative to understand their evolutionary history to comprehend their significance today.

Evolution of the subfamily

The origins of the subfamily lie somewhere between 13.5 million and 14.1 million years ago. Sivaonyx was the initial genus that arose and diverged from the Mustelidae family around this time in Southeast Asia, based on fossil evidence. A lot of speciation and emigration occurred during this time period as the newly formed subfamily moved westward following aquatic ecosystems. It would reach all the way into Africa and Europe during the same time. The largest ever species of the subfamily was found in Africa, and weighed between 200 and 400 lbs.

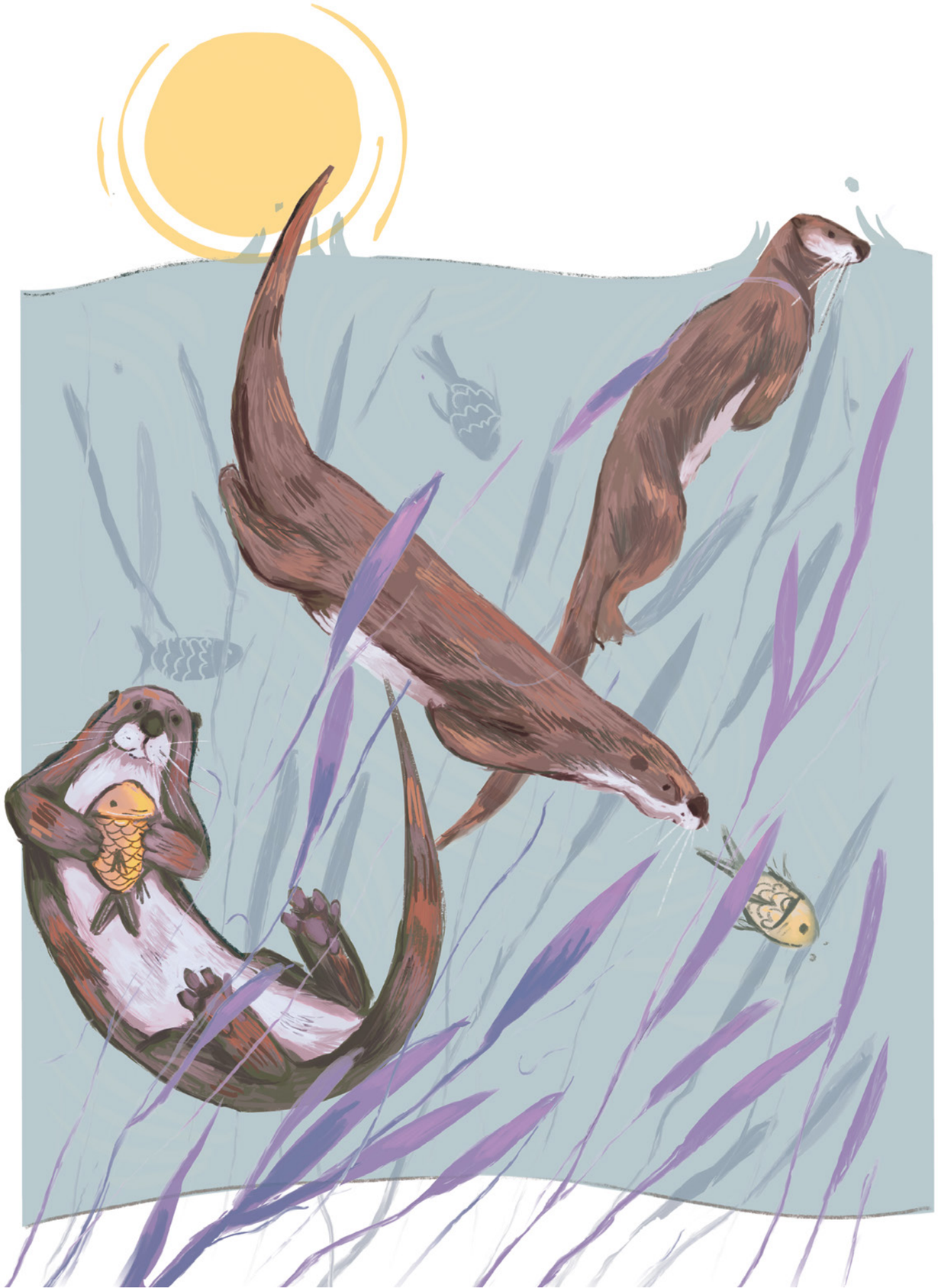
The Pliocene saw an immense explosion of diversity, especially in Europe. Many species evolved, with a large majority going extinct. It appears that the subfamily migrated to North America and spread down to South America from Asia. Much like a large portion of the fauna that came to the Americas, otters crossed the land bridge of Beringia. Later during the Pleistocene, much of the extant species arose. At some point during this time, they developed fur that had water resistant qualities helping them move more easily in water, and shed water

quickly upon exiting. In the case of otters living in cooler climates, they even developed natural "dry suits" with the outer fur protecting the underfur and keeping it dry. Their paws also developed webbing to help them swim in water. A commonality as a species that arose and went extinct is their proximity to aquatic ecosystems. Nearly all of them were located in or near aquatic ecosystems. The subfamily had become uniquely adapted to riparian regions, and a very effective predator within that region. There are two distinct groups, those that are bunodonts (crab-eating), and those that eat fish. They fill a role much like the wolves in Yellowstone National Park and Isle Royale. As a small predator, they control overpopulation by prey species and prevent the collapse of many ecosystems. They are very efficient hunters and due to their unique semi-aquatic nature, they are able to maintain healthy populations within their communities and stabilize the ecosystem. Unfortunately, a majority of the species are in decline. One cause of this decline in temperate climates is due to poor water quality leading to unsuitable habitats.

Creating a flagship

Temperate climate otters have positioned themselves to become the primary flagship species for discussing water quality. Water quality can be discussed with tropical otter species too, though threats such as hunting or poaching and habitat loss are more considerable. Should otter species in general be turned into the flagship for water quality, it could afford tropical species some protection from these threats.

Millions of years of evolution has created a charismatic species that can be utilized to engage citizens and organizations in the development of better water quality and ecological conservation efforts. The subfamily allows for people to engage in the discussion of water quality and conservation in a different way. It also allows for a symbiotic relationship between human health and ecosystem health. As communities engage in increasing their water quality for their own health, otters will benefit from the cleaner waters and healthier ecosystems. Increased attention towards otters will enhance the protection of waters used for drinking by citizens.



This new symbiotic relationship can be used to create new relationships across the globe and create a cohesive program to protect and revitalize the world's water supply. As threats to the ecosystems of the world and human health increase, developing flagship species that can turn the tides are pivotal to conservation success. The need for such a species is great, and investing in one that has tangible benefits for humans is an easy sell for gaining organizational and governmental support. Otters are primed to be the flagship to save our planet.

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Annada Menon *is a Visual Artist. She loves drawing the surrealistic beauty of nature and sometimes also imagining how it should peacefully coexist in the presence of humans.*

All Hail the Nature Zoo

Author **Kartel Shockington** | *Illustrator* **Amit Kaikini**

We have often argued against locking Nature away from people. But we must recant. Nature needs to be locked up, for her own good. Nature is dangerous, and we need to protect her from herself.

Let us explain. Judging by our previous writing, you will have guessed that we are somewhat sceptical about the Half-Earth movement, which seeks to set aside half of the planet for Nature.[1] Our doubts arise because it is not clear how these areas will be set aside or what levels of protection they will afford. It is not clear who will need to move, and who should restrict their livelihoods. It is not clear whose version and vision for Nature is getting the designated half. It is not at all clear that this will deal with the root of the problem that has driven the degradation and despoliation of Nature – namely economies governed by greed.

And one could argue that actually these are merely quibbles. We have a more fundamental point of agreement with Half-Earthers, namely a desire for less despoliation of Nature. Our disagreement is largely about means. In fact, we would all welcome many of the same general ends.

But that very agreement may, in fact, have been our most serious mistake. We are assuming that Nature can be trusted. That if you leave things to Nature, if you allow the wild to flourish, then that will be a good thing. And now it appears that our faith and optimism was hopelessly naïve.

[1] Shockington, K. 2018. Half-Earth is half-hearted: make way for Thanos and the half-universe. *Current Conservation* 12(4): 32-34.

Some philosophers argue that anyone who delights in seeing wild animals flourishing must be appalled by the death, destruction and sheer misery that is deliberately built into so many creatures' reproduction strategies. Simply put, many species (so called 'r-strategists') deliberately have gazillions of children fully expecting most to die after short miserable lives. For example, Oscar Horta has estimated that the breeding population of cod in the Gulf of Maine creates over 6300 years of suffering in doomed codlings every breeding cycle.[2]

For some, this suffering is unacceptable. We need to find ways to intervene, to separate predators from prey and to stop prey species from being so incredibly fecund. This will be quite far-reaching, because it requires setting up a new Nature Zoo, in which the wild is carefully segregated away from itself. Specifically, it would entail separating predators from prey, providing dietary alternatives for predators based on non-sentient species like plants, and mass sterilisation or gene therapy for r-strategists so that they produce far fewer young. And gene therapy could also be used to modify plants so that they are fit for consumption by carnivores.[3]

Philosophers insist that we take this vision seriously. As Horta writes: "it would be strange not to think about ways in which we could act to improve the situation of animals in the wild once we are aware of the immense amount of suffering present in it." We must admit that it is a stimulating vision which prompts a large number of reactions but we will restrict ourselves to two observations at this point.

First, it should be plainly obvious that allowing Nature to unleash herself on herself in this wanton fashion all over the planet is grossly irresponsible. The suffering and death of the wild are intolerable. Nature needs half? Poppycock! Until Atlantic cod, ridley turtles and others learn to control their frankly disgusting breeding impulse, they do not deserve anything. Evicting all life forms from the Gulfs of Maine to Mexico until they can treat each other kindly is a moral priority. Nature cannot be trusted to look after herself humanely.

[2]Horta, O. 2010. Debunking The Idyllic View Of Natural Processes: Population Dynamics And Suffering In The Wild. Télos 17(1): 73–88. [3]Johannsen, K. 2017. Animal Rights and the Problem of r-Strategists. *Ethical Theory and Moral Practice* 20: 333-345.

evolved from somewhere. And it is hardly necessary to remind readers that we are now entering, with the Anthropocene, the sixth mass extinction. This one's on us, but the previous five were all Nature's fault. At the end of the Permian (a bad hair era), she knocked off over 90 percent of species, and at the K-T boundary, all dinosaurs barring birds. Nature seems to revel in death and extinction.

It is purely logical therefore to insist that Nature only be given space when it has been properly segregated into different domains that permit more dignified and wholesome inter-species interaction which exclude predation, parasitism, infestation, competition, aggression, minor nibbling and any other form of harassment.

Second, we must also recognise its inevitability. This is coming down the pipe, folks. Just look at the speed made in scientific progress towards mapping and editing genes. It's exponential. Indeed, given the accelerating progress being made in gene mapping and modification, we predict that the arrival of the means to establish new humane nature zoos will be achieved by Monday 4th of July 2024.

Nature, do not fear, we will nurture you back to life!

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