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editor's note

Cover art **Manvi Vakharia**

This time, our feature story examines how a media campaign to protect migratory Amur falcons sparked community-led conservation, highlighting the role of governance, trust-building and local ownership in ensuring long-term sustainability.

Our Research in Translation offerings include a fun experiment to discover how African penguins, who are extremely social and live in colonies of 50–100 individuals, use visual cues to identify their partners in the crowd; and a research study that assessed the conservation and animal welfare risks of wildlife professionals posting selfies with their study animals on social media.

The Field Notes herein—from different parts of India—are guaranteed to delight: Malavika Bhatia and Prithvi Kini attempt to document fast-eroding ethnomycological practices in the Garo and Khasi Hills of Meghalaya; Arjun Kamdar applies Elinor Ostrom's framework for social-ecological systems to understand human-elephant conflict in Assam—with some surprising findings; and Aaron Savio Lobo and his son Noam uncover lessons in natural history while angling for rabbitfish in Goa's Mandovi River.

And finally, we have a couple of thought-provoking pieces on asking and answering sensitive questions when people are the subjects of conservation research, and how well-intentioned actions can actually harm wildlife.

— Devathi Parashuram

When helping wildlife hurts

Author **Kathleen Hankins** | *Illustrator* **Upasana Chadha**

For years, I saw her come and go. She wandered the roads around my neighbourhood, at first cautiously but growing bolder each year. She raised several litters of kits in the woods nearby, finding food scraps humans left out for her, purposefully or not. My family enjoyed seeing the little grey fox family each year. The pups played through backyards and the mother brought food and taught them how to survive the dangers of cars and dogs. Then, she grew too brave, approaching humans and even accepting food from a neighbour's hand. We didn't see her again after that season.

Stories like this happen every day. As cities continue to grow and expand, the space for wild animals shrinks. Many of them adapt to become less and less wild. Humans provide food, through efforts to sustain wildlife and an abundance of waste. Some species, such as coyotes, are becoming braver and adapting to thrive in urban areas surrounded by humans. Urban coyotes behave differently than their rural counterparts, who live where humans are scarcer and more likely to chase them away or harm them. This difference in behaviour may lead urban coyotes to attack humans for food or simply because they do not fear them. Other species, like raccoons and squirrels, also lose their fear of humans when fed, and damage homes and yards as they come closer to find food and shelter.

We may mean well

Some well-intentioned actions, such as putting food out for wildlife, posting cute photos or bringing animals to wildlife rehabilitators, can have harmful effects.

Humans enjoy the connection they gain with wildlife they feed, not realising the dangers they create. Even bird feeders can be hazardous. They expose wild birds to disease by spreading bacteria and parasites if feeders are too crowded or not cleaned regularly. Feeding wildlife increases bold behaviours, puts humans and wildlife in risky situations, and may cause unintended selection of unnatural traits (like begging) that allow animals to gain more food.

Humans who love animals often share photos of them online. However, social media has proven dangerous for wild animals. It has encouraged humans to get too comfortable around wildlife by keeping them as pets or approaching them in the wild. Photos of individuals petting tigers and dressing monkeys in baby clothes support the illegal wildlife trade by increasing the demand for wild animals as pets. This creates dangerous situations when wild animals are obtained without the proper knowledge needed to care for them safely and appropriately.

Additionally, some humans rescue wild animals that do not need rescuing—for example, by separating babies from adults that have left momentarily or moving animals like turtles away from their homes. Deer, for instance, leave their babies alone for several hours while they forage. Fawns are sometimes picked up by well-meaning individuals who think they have been abandoned.

In many areas, keeping wildlife is illegal, though tales of humans raising raccoons and squirrels in their homes abound. Those laws protect humans from exposure to disease and injuries caused when frightened animals lash out. They also protect animals from receiving improper care. Wildlife rehabilitation centres can usually take these animals but will often caution against removing them from the wild if they are not injured.

Seemingly benevolent actions may help an individual animal for a short period of time, but ultimately, they can lead to that animal becoming dependent on humans for survival. Some do not survive. Others are released, only to become nuisances after frequently approaching humans for food. They may be killed to protect humans and pets, or placed in zoos or rescues. Efforts to relocate or haze wildlife, which involves frightening animals away from humans, may be made but often fail when humans continue to feed wild animals.

Knowledge is key

Educators can help provide knowledge and alternative actions to those engaging in dangerous activities with wildlife. They can supply them with better options to support or connect with wild animals, such as planting native plants in their gardens, providing a non-stagnant water source, or observing natural behaviours from afar. Humans are social animals. Many detrimental interactions with wildlife are caused by a desire to feel connected with them. Allowing humans to find that connection through safer avenues, while also providing information to help wild animals remain wild will—pardon the expression—kill two birds with one stone.

When educators cannot interact with other humans face-to-face, the media can provide valuable links between humans, organisations and animals. When used effectively and responsibly, social media can benefit conservation by creating connections to wildlife that humans crave. It can introduce them to animals already in human care and provide their stories as sources of factual information and also help build empathy.

Tips to coexist

The coexistence of humans and wildlife means walking a thin line as we seek to help wildlife without making them dependent on us. One small action we can take to help wild animals is to leave natural areas in our backyards, including food sources, such as flowers or berries, and piles of fallen leaves, which provide invaluable habitat for pollinators, such as bees, during the winter. We can also secure trash containers to limit access for wild animals, clean bird feeders regularly, use healthy food in those feeders (such as sunflower seeds, millet and cracked corn), and keep pets indoors or supervised so they can't harm wild animals.

On a larger scale, we can support conservation organisations like accredited zoos or nature centres, become more aware of what we put into the world that may cause harm—such as pesticides, litter and images presenting wild animals as pets—and spread the word that our world still has hope! We can all continue to learn about best practices regarding interactions with wildlife, knowing that best practices may change in the future. Just as wildlife adapt to coexist with us, we must keep adapting to coexist with them. Together, we have the power to make a positive difference!

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Elephants and Ostrom

Author **Arjun Kamdar**

Most human-elephant conflicts in northeast India are a result of crop damage by elephants, as seen here with this large bull eating ripened paddy. One such event can cause significant economic loss to farmers.

A dense fog envelops us as we sit atop a bamboo mat raised on stilts. Every few minutes, Dhan *da* flicks on the flashlight and tries in vain to penetrate the characteristic winter night fog of the floodplains of the Brahmaputra river in northeast India. We are guarding his paddy fields from elephants that use the cover of darkness to forage on the delicious crop.

Human-elephant conflict in this region claims the lives of a hundred people and tens of elephants every year. Massive deforestation coupled with nutritious paddy grown on the same land that elephants had historically used has led to these clashes becoming more serious each year. In order to understand how better to keep elephants and human beings safe from each other, I chose to study the two species in the floodplains of the Brahmaputra.

One of the most widespread consequences of human-elephant conflict on people is the constant fear that people live in, with the dread of losing their livelihoods or lives at any moment in the night. In order to remedy this, a simple solution in the form of a non-lethal fence was put into practice by the state of Assam and NGO partners. This fence delivers a sharp but non-lethal jolt to animals that come in contact with it, creating a psychological barrier and effectively securing the area it encloses. However, in order for this to work, it has to be maintained—the technical machinery needs to be checked regularly and undergrowth around the fence needs to be cleared. This is low-intensity, easy and quick work. Since these fences typically enclose villages, the households within the benefitting village are entrusted with the task of this maintenance.

Unexpectedly, and despite the high effectiveness of this solution, 65 percent of the fences in the landscape were not maintained. This was primarily due to the individuals in the community failing to come together and work collectively. I wanted to understand why this was the case for my Masters' thesis. What were we missing that led to such a suboptimal, counter-intuitive and dangerous outcome?

On this journey, I came across the work of Elinor Ostrom, who dedicated her academic life to understanding how people avert the 'tragedy of the commons' in different contexts across the globe. She formulated a framework for social-ecological systems (SES) and wrote extensively on the factors that predicted their sustainable use over time. Not having worked on such problems previously, I was skeptical of whether I would be able to put this wide framework into practice during my fieldwork.

However, within the first few days of being in the field, I was amazed at the power of this system. It proved to be a strong guide to identify factors that influence collective action in these complex, chaotic systems where society and ecology exert such strong influences on each other. For instance, right out of Ostrom's principles, we found that the predictability of the system was of critical importance. There was the incentive to maintain fences when elephant raids were either very frequent or infrequent but unpredictable, as opposed to the cumulative damage incurred by a community (in the form of crop/house damage and human injury or death). This was a novel insight for practitioners who generally went by the yardstick of the total damage to gauge the level of conflict.

We kept refining our provisional models with newer insights from the data being collected. This iterative process was a departure from

The author (second from the right) trying to understand the barriers to collective action by talking to local residents

conventional ecological studies where all the data is collected in one go and then analysed, to prevent one from getting biased by the data. Through this approach, we were able to explore the causal mechanisms driving the outcome of the fences in great detail. In particular, this helped us understand the non-material costs and benefits that people consider.

For instance, all the farmers in a village where a fence had failed due to poor maintenance mentioned that when duly maintained, the fence was 95 percent effective in deterring elephants and they reported a reduction in damage to their crops by at least half. In a purely economic sense, this saved orders of magnitude of crops. However, the fence had fallen into disarray after a tiny minority of households that lived in the center of the village refused to partake in maintenance efforts (which involves walking the perimeter of the fence, about 3 km/30 mins, once a month). This led the other individuals, including those for whom the material benefits greatly outweighed the costs, to voluntarily disengage from maintenance.

Ostrom has aptly termed this the 'sucker effect', where collective action fails because people do not want to feel like 'suckers' for keeping a promise that others are breaking. Over the course of our study, we found that non-material costs and benefits like these played a critical role in securing collective action.

Being an iterative process, we would collect data, analyse it back at the field base with my guides and then return to the field to pick on threads. On one of my visits, just as I made myself comfortable on the mud beside his fishing pond, Dhan *da* saw me, beamed a bright smile and said, "I love it when you come and speak with me—you keep asking the real questions—the most meaningful ones!" which I felt was a compliment to Ostrom's SES and not really to me!

In another village, on discussing the monitoring and governance of these fences with a State Forest Department official, he said: "Actually, I just thought of this now—when we are establishing these fences, we largely think about how good it is, and that it is so much better than staying up all night and chasing elephants. But this is food for thought, we do not actively consider the length of the village, the number of people, and coordination amongst them, which is just as important—and makes or breaks a fence. I am definitely going to think about this next time." This is identical to the layered governance systems aspect of the SES, which recommends looking at the geographic range and size of the system at scale.

We are currently implementing the findings of this study on the ground to create more robust community institutions to further human-elephant coexistence in human-dominated areas. The results so far have been encouraging, with the State actors and community members actively drawing on these results in practice. Other studies from across the Indian subcontinent have used the SES successfully to explore the governance of urban lakes, forests, fisheries and drinking water. Established diagnostic tools like the SES can be of great help when working on interdisciplinary problems, especially in the conservation space.

Arjun Kamdar *is a wildlife scientist exploring the link between economics, anthropology and conservation. He works to help people and elephants share spaces safely in northeast India.*

A large part of elephants' ranges are outside protected forests, and include areas such as tea estates where they interact closely with humans

How African penguins recognise each other

Author **Viola Hallé Ruzzier** | *Illustrator* **Shrobontika Dasgupta**

Penguins are fascinating creatures. Between their inability to fly and their unique vocalisations, is it any wonder that scientists find them a compelling subject of study?

More specifically, one group of scientists sought to understand how African penguins (*Spheniscus demersus*) recognised their partners among all the other penguins who lived nearby. These penguins are one of 18 species found globally and the only one to inhabit southern Africa.

Penguins have a sophisticated identification process based on vocalisations. In other words, they are able to recognise each other based on the sound of their calls—an impressive ability when you consider how loud and crowded penguin colonies can be. In addition to auditory cues, their sharp eyesight may also be important for recognising individuals. However, we still didn't know much about how they use visual cues to identify other members of their species.

This was the question that scientists hoped to answer. Before continuing with our story, there are a few things to know about African penguins. First of all, they have monogamous, life-long partners, meaning that they will only nest with one other penguin throughout their lives. It is, therefore, essential for them to be able to quickly and accurately recognise their mate within the colony. Second, African penguins have a pattern of little dots on their bellies. Each penguin has a different pattern, making them unique to the individual. These are very useful to zookeepers and other humans who need to identify individual penguins.

Our scientists came up with a hypothesis: perhaps African penguins use these ventral dots to recognise their mates. If zookeepers can use these markings to tell penguins apart, isn't it likely that the penguins might do the same?

Using a captive colony of African penguins in Rome, the researchers set up a range of tests. Each adult penguin, who already had a partner, was shown a pair of life-size pictures of two different individuals. Numerous variations of these pictures were presented to the test penguins, but the key variations were as follows:

Test 1 showed full-body pictures of their partner and a non-partner.

Test 2 had full-body pictures of their partner, and their partner but with the little dots removed.

Test 3 had full-body pictures of their partner and a non-partner, both without the dots.

Test 4 showed only the heads of their partner and a non-partner.

Test 5 showed only the bodies of their partner and a non-partner.

The penguins were shown these life-size pictures side by side, and the scientists measured the time they spent looking at each picture. The idea was that they would look at their partner longer than at a non-partner, because their partner would be more interesting to them than a neighbour with whom they had no particular attachment. The scientists also hypothesised that if the little belly dots were missing, the penguins wouldn't be able to distinguish their partner from a non-partner, and would pay equal attention to both pictures.

And that's pretty much what ended up happening—when given the choice between their partner and a non-partner, they spent more time looking at their partner. But when the dots were removed, they didn't exhibit any preference towards either of the pictures.

While this experiment doesn't show that penguins depend exclusively on the dots to recognise their partners, it does demonstrate that these dots are an important visual cue and a feature that African penguins use to recognise each other.

This may seem like a small and insignificant conclusion, but in fact it is very useful for conservation biology. African penguins are unfortunately endangered, and anything we learn about them can inform conservation efforts. The possibility of understanding individual recognition—which is important for their breeding strategy—is essential for us. By connecting the dots between various studies, we can piece together a broader picture that will hopefully lead us to reversing the endangered status of African penguins.

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The path to community-led conservation:

The Amur falcon story

Author **Sahila Kudalkar and Diogo Veríssimo** | *Illustrator* **Manvi Vakharia**

"Falcon hunters become fervent preservationists" declared the *New York Times* in 2015. Just three years earlier, reports of thousands of Amur falcons being hunted in northeastern India shook environmentalists across the world. Today, the Amur falcon story is a well-known example of conservation delivering change. The rapid shift of the local community from hunters to protectors has been widely celebrated. But how was this change negotiated? How was such urgent and long-term change achieved?

The Amur falcon (*Falco amurensis*) is known for its journey from breeding grounds in northeastern China, Mongolia and eastern Russia (Amurland) to wintering grounds in Africa. During their migration, the birds stop in northeastern India and Myanmar and then the Indian subcontinent, before flying nonstop over 4000 km across the Arabian Sea to Africa—the longest continuous ocean crossing among birds of prey. A significant stopover site in northeastern India is the Doyang reservoir in the state of Nagaland. Amidst hills covered in swidden agriculture, millions of falcons come together and feed on insects over the large artificial reservoir.

This stopover site became famous in November 2012 when a group of conservationists discovered widespread hunting of the migrating falcons. The environmental portal Conservation India launched a media campaign against falcon hunting at the Doyang reservoir. Activists estimated that 120,000 to 140,000 birds were caught in 10 days, about 10% of the global population of adult birds. The media campaign and associated video titled 'The Amur Falcon Massacre' drew national and global criticism. India is a signatory to the Convention on Migratory Species; the government was obliged to protect the species.

Following the campaign, the Nagaland state government warned that they would stop funding development projects unless villagers stopped hunting falcons. Most hunters were said to be from the village of Pangti, so it was closely monitored. The Pangti Village Council—the apex governing body in the village—gave in to the pressure. Village leaders banned falcon hunting two months before the 2013 falcon migration season. The hunting and sale of falcons had been highly profitable because hunters would earn up to 10 times their monthly incomes in a single season.

Unsurprisingly, the ban on trapping and hunting falcons was deeply unpopular. Yet, the hunting ban has since been widely praised as successful. Why is this so?

What can the Amur falcon story teach us?

The Pangti case study raises questions about whether and how a conservation initiative starts can shape future outcomes. At Pangti, Amur falcon conservation began with the government forcing villagers to stop hunting. Over time, villagers took over conservation efforts. How did Pangti shift towards community-led conservation? What changes can empower community leaders to protect biodiversity?

Environmental groups often use emotional wildlife imagery in media campaigns to pressure governments into action. Like in Pangti, these campaigns can lead to quick law enforcement. But they may also isolate and vilify local people, and create enmity within stakeholders. It can be challenging to meaningfully engage with the local community after such campaigns. Even harder is helping people feel pride and ownership towards biodiversity. To achieve such change, conservationists need to identify opportunities and gaps in local governance practices that can support environment-friendly rules.

Governance transitions for sustainability have been explored across various fields. So far, science has focused on efforts started and managed by local people or those started by governments. What makes Pangti unique is that conservation rapidly evolved from a government-pressured ban to a community-based conservation programme. Thus, Pangti can offer a unique perspective on how conservation can shift towards bottom-up community-led models.

We recently published a paper that studies how governance evolved at Pangti since the first reports of falcon hunting in the journal *Conservation Science and Practice*. We interviewed 17 key stakeholders who shaped falcon conservation in Pangti village from 2012–19. These stakeholders included local and national NGO representatives, village leaders and government officers. The study provides an in-depth perspective into how the decisions that shaped one of the most well-known conservation programmes in the world were made. A complete picture of conservation governance at Pangti can emerge by examining changes across time and complexity.

The Evolution of Governance in Pangti

Falcons aplenty (pre-November 2012):

Recognising scarcity is key to getting communities to agree to act for conservation, especially in areas like Pangti where hunting is integral to the local culture. However, the millions of congregating falcons made this difficult. As a respondent reported, "They [villagers] referred to it [falcons] as manna from heaven."

Forging partnerships (November 2012–August 2013):

The Pangti Village Council was faced with a carrot and stick approach—NGOs offered financial incentives and awareness programmes, while the government warned it would cut funds if hunting did not stop. Finally, the Village Council took the bold, unpopular decision to ban hunting.

Shifting power dynamics (August 2013–17):

The Village Council declared the hunting ban without any public consultation, which eroded villagers' trust. This led to the formation of a local opposition group called the Amur Falcon Roosting Area Union. The Union was made up of villagers who owned land at the falcon roosting site.

A power struggle over limited NGO funds arose between the Village Council and the Union. The Union demanded compensation for protecting the roosting site and control over selecting patrol guards during migration season. Relationships with NGOs soured as Union leaders protested perceived bias in fund distribution to the Council's candidates.

Changing mindsets

NGOs and the State Forest Department shared knowledge, built capacity and facilitated dialogue through various awareness activities such as exposure tours, marathons, meetings, a Church-led signature campaign and eco-clubs. The impacts of these programmes on the local community are unassessed and unclear. However, over time, the falcon hunting ban gained praise, won awards, attracted scientists and tourists, and led to development promises by senior government functionaries, building a sense of pride among villagers. A stakeholder commented on the villagers' response to a falcon satellite-tagging government programme: "[Villagers] decided … to have a prayer for this [satellite-tagged] bird before releasing [it] … that kind of emotional bond was there."

Positive spillovers (2017 onwards):

The initiative stabilised after the Village Council put the Union in charge of falcon conservation and management. External actors' involvement reduced, and the community took ownership of falcon conservation. The Council also banned air guns for hunting small birds, extended the hunting ban to all wildlife for six months, and explored the development of a Community Conserved Area in the village.

The bargain for development

"We conserve this bird for the sake of development and employment." Local leaders always expected development in return for conservation. Discontent arose due to road funds being diverted to powerful neighbours, an NGO holding an 'Amur falcon' tourist festival in another village, and publicity favouring the Doyang reservoir over Pangti's achievements, leading to a mistrust of outside actors. At the same time, the Union and the Village Council began working together to secure development benefits from the government by capitalising on Pangti's popularity.

Lessons for Conservation Practitioners

Pangti has come a long way since the first reports of falcon hunting, but challenges still exist. Villagers have often felt disappointed because their hopes for development remain unfulfilled. Road infrastructure remains poor, limiting tourism. Equity issues may persist if those who lost seasonal incomes after the ban cannot benefit from tourism. The lack of alternative livelihoods and untapped tourism potential in a region with high deforestation and water scarcity are a missed opportunity for conservation. However, the falcons offer a promising chance to turn things around—not only in Pangti, but also at roosting sites across Nagaland, Manipur and Mizoram.

The case study of Pangti makes it clear that community support can be built even when conservation begins with criticism and threats. But this transition needs an open dialogue with local stakeholders. Outside actors, such NGOs and government officers, must respect the legitimacy of existing local institutions and the rights of local actors. While negotiating for conservation, it is important to be fair and transparent.

Further, rapid shifts towards conservation will often create losers and winners. Hence, managers should identify people who were negatively impacted by conservation. Minimising economic losses is critical to win broad popular support. Recognise local demands (e.g. development) that may be at odds with conservation, and design approaches to meet these demands in a clear, equitable manner. Equally important is fostering leaders who can cut through the red tape, share information and build institutional memory for future generations.

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Exploring fungal relationships:
Lessons from ethnomycology

Author **Malavika Bhatia & Prithvi Kini** | *Illustrator* **Athulya Pillai**

Note: This is an artistic rendering of fungi and their habitats, and is not intended to represent any specific species or habitats.

The blazing sun beat down on our backs as we knelt over a dry mound of earth in the village of Sadolpara, nestled in the heart of Meghalaya's West Garo Hills. Nikre, a diminutive woman whose frame belied her powerful presence, dragged her sickle across the top layers of the mound to reveal indents. She bowed her head, speaking with barely concealed anguish. "This is where we find the *dambongg* (mushrooms)—gifts from our Creator. But this year, there is no rain. The *dambongg* are rotting underneath the earth." With those words, she walked on with her bamboo foraging basket, as large as her and conspicuously empty.

We—Malavika and Prithvi—were staying in Sadolpara, graciously hosted by village elders Nikre and her husband Sotging. With a population of around 800, Sadolpara is one of the last remaining bastions of Songsarek, the local religion. As a part of the Fungi Foundation's Elders Programme, we were there to learn about their relationships with fungi—from traditional foraging practices, recipes handed down over generations, and even their use of yeasts to brew *bitchi*, a fermented rice beer central to their spiritual and cultural practices.

The Elders Programme strives to bridge the gap between generations and preserve the ecological knowledge that is passed down through the ages. The continuation of this knowledge, concerning the relationships between human beings and fungal species, is at risk as social and environmental changes erode generational traditions.

The preservation of this ethnomycological knowledge is more than a cultural endeavour; it's a vital strategy for climate resilience. This ancestral knowledge serves as a living map, guiding communities through changing environments with time-tested practices. As climate shifts alter familiar landscapes, the insights passed down through generations become invaluable tools for adaptation. Moreover, this knowledge embodies a profound connection to the land, teaching sustainable harvesting methods that maintain ecological balance. By safeguarding and passing on ethnomycological traditions, we aim not only to preserve the past, but also to equip future generations with the skills to navigate an uncertain climate future, rooted in ancestral wisdom.

Observation through absence

When we had first visited Sadolpara the previous winter to introduce ourselves and our work, Sotging and Nikre excitedly told us about different mushrooms they eat, such as *dambongg*. In A·chikku, the local language, *dambongg* is the word most commonly used for mushrooms belonging to the genus *Termitomyces*—a unique genus of fungi that are cultivated by termites, in elaborate subterranean fungal combs. The termites cultivate this fungus to help them digest plant matter, and have no use for the mushrooms that it produces. Those mushrooms, the *dambongg*, are instead harvested by people like Nikre and her family. Though *Termitomyces* species are the most prized edibles in the region, they are far from being the only ones consumed. They also told us about *bol nachal* (which translates to 'wood ear'), a species from the *Auricularia* genus, and *wa·gambal*, an edible species from the *Lentinus* genus.

During this visit, however, the region was experiencing an extreme heatwave. Ordinarily, May would bring regular pre-monsoon showers to soak the earth and enable mushrooms from the *Termitomyces* genus to emerge. But as we walked the regular foraging routes with our guides, their faces reflected the bleak landscape.

"The *dambongg* would have been here," Nikre muttered, the crack in her voice mirroring the cracks in the parched earth. Deeper in the jungle, she gathered roselle leaves and banana flowers, describing how she would cook them with mushrooms—if any were found.

Back in the *nok-A·chik*, the traditional thatched-grass house, we listened to Nikre and Sotging talk about how the forests had changed since their childhoods. "The gods are angry with us, because we don't practise Songsarek the way we used to," Nikre lamented.

"When our ancestors came, they took care to preserve the traditions and not a single seed was lost, but no more," the pain in Sotging's voice is evident. He narrated the Songsarek creation myth for us once again. Nuru Mande, the first human, followed divinities as they rose through seven layers of the earth. He mimi-

cked their songs and their dances, learning their ways to honour the land. In a community so deeply rooted in the cycles of the land, it stands to reason that the changing of culture is seen as inextricably linked to the changing of forests.

As Nikre passed us a gourd of *bitchi*, we were reminded that our aim is to understand the multiplicity of relationships between native communities and their landscapes, ensuring they have a voice in the larger conversations around fungal conservation.

Sustaining generational practices

The following week, we watched the landscape transition as we travelled from the Garo Hills to the Khasi Hills. In contrast to the former's subtropical to tropical climate, the Khasi Hills experience a more temperate climate in higher altitudes and a subtropical climate in lower regions, fostering lush evergreen forests, montane grasslands and subtropical pine forests. Areas such as Mawsynram and Sohra in the Khasi Hills have long held the title of 'wettest place on earth', but here too, heatwaves have become more frequent.

In a young forest near Miarang in the Khasi Hills, we walked through *Pinus kesiya* trees with Kong Queency Thiangkhew and her group of elder foragers. Kong Queency is worlds apart from Nikre—a devout Christian woman and a retired horticulturist, she forages not for subsistence but for the pleasure of the act itself. Over the years, she has gathered a group of nearly 20 women, who collect only enough mushrooms for their own kitchens and to share with their friends, keeping this traditional practice alive.

The Khasi name of each of the species refers to its shape. For example, *tit thnat syiar* means 'chicken foot mushroom' and refers to the chicken-foot shape of the *Clavulina* species. The prized *Turbinellus floccosus* is called *tit tyndong*, referring to its funnel-like shape. The foragers rattled off a dozen different names, as we scrambled to note them down.

Picking up a massive specimen of *Neolentinus lepideus*, Kong Queency beckoned us over for a lesson. "You see, before the monsoon, the mushrooms are full of poison, even the edible ones," she explained. "When the rain is intermittent, the ground is full of snakes and insects, who bite the mushroom and leave their poison in it. That's why we wait for the storms—the thunder and lightning imbue the mushrooms with vitality, and the rain washes out the poison."

Kong Mem, another forager explained that when they were children, such lessons about identifying edible and poisonous mushrooms were a part of daily life in the monsoon, especially for the women of the home. They went into the forests with their mothers and grandmothers, learning how to identify around 30 different edible species. But with the changing economic landscapes, younger generations are no longer able to learn and practise these traditions. Without the wisdom of generations, many fall into the trap of misidentifying poisonous species as edible ones.

A recent spate of poisonings was one of the reasons we had come to learn more about the traditional methods of mushroom identification. In the face of climate catastrophes that can leave communities isolated and cut off supply chains, traditional knowledge of wild foods is a lifeline. Yet, it is in those desperate times that people are most vulnerable to misidentification and subsequent poisoning. That's why the preservation and continuation of such oral traditions are so important.

On our drive back to Shillong, Kong Queency gazed wistfully at the pines that rushed past us. "Every year, the forest shrinks…" her voice was barely above a whisper. "Logging is ruining our traditions." With these words, the joy that usually emanates from Kong Queency took on a poignant tinge. Illegal logging, particularly for charcoal production, has become a severe threat to the forest cover and environment in the West Khasi Hills district. The region is a hotbed for the illegal charcoal mafia, producing and transporting over 6000 tons of charcoal annually. This rampant felling of trees, including pine, for charcoal-making has led to a reduction in forest cover, loss of biodiversity and habitat fragmentation.

Though she has cultivated a foraging practice steeped in leisure, the grief of losing the landscapes that sustained the generational tradition of foraging is clear in her voice. To Kong Queency, the felling of trees is more than the degradation of biodiversity—it's the destruction of a multi-species relationship between the pines, the mushrooms, and the communities that rely on them.

"These days, young people don't have time to learn foraging. Even my children don't have time—they are busy with their jobs. That's why I keep going, keep teaching others," Kong Queency tells us. Despite the changes all around her, she is determined to protect the practices of her ancestors, and we are privileged to be allies in her efforts.

Indigenous wisdom influences scientific inquiry

Reflecting on our experiences in the Khasi and Garo Hills, we are humbled by Kong Queency's unwavering passion and the resilience of the residents of Sadolpara. They both serve as poignant reminders of the importance of integrating indigenous perspectives into scientific inquiries. After all, the depths of the inter-species relationships cultivated by cultures like the Garo and Khasi place India in a unique position. Unlike the West, where ethnomycological practices are being revived after being nearly lost, cultures around India are at a transition phase where these traditions need to be sustained rather than rediscovered.

Documenting and preserving this indigenous knowledge is therefore not only an academic exercise, but also an attempt to cultivate new perspectives on conservation that shape our future actions. Given that mycology is a relatively young science, an interdisciplinary approach such as this one may offer us a path to better comprehend the intricacies of fungal relationships with other species.

By integrating ancient wisdom with modern academic knowledge, we can ensure these invaluable traditions continue to thrive, enriching our understanding and guiding our conservation efforts. In doing so, we aim not only to preserve the past but also to equip future generations with the skills to navigate an uncertain climate future, rooted in ancestral wisdom.

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Stop! Don't post that wildlife selfie

Author **Cassie Freund** | *Illustrator* **Karunya Baskar**

More than 5 billion people across the world use social media, including many wildlife scientists, conservation practitioners, and zoo and aquarium professionals. There are many reasons for a wildlife professional to be on social media—it can be a great platform for science communication, fundraising and educating the public about conservation threats to species.

But there is also a downside to it. Posts showing people interacting directly with wildlife can inadvertently set a bad example for the public about how to behave around wild animals. These include "wildlife selfies"—photos wildlife professionals intentionally take and post with the goal of sharing their work. Such selfies are often posted with captions stating the professionals' qualifications to interact with wildlife as a disclaimer for the public that they should not do the same.

Images and videos depicting people interacting with primates are particularly risky. For example, a 2013 study examined the comments of a YouTube video of a pygmy slow loris (a CITES-I listed species) being "tickled". The video went viral because the loris' natural threat response behaviours were perceived by the audience as being cute and funny. It accumulated over 12,000 comments, with more than 11 percent of commenters stating without prompting that they would like one as a pet.

Social media facilitates the primate pet trade, by connecting sellers and buyers and by fuelling demand for animal photo opportunities. Previous research has demonstrated that simply seeing images of humans interacting with endangered primates has negative effects on their conservation by decreasing viewers' perception that these animals are endangered and increasing their desire to physically interact with the animals, including keeping them as pets. Primates, like other wild animals, should never be kept as pets: primates sold in the pet trade are often taken directly from their mothers in the wild, a traumatic experience. Not only are they deprived of their natural existence, but they can also pass diseases back and forth with their human owners. Larger primates, such as chimpanzees, are extremely strong and can seriously injure people.

To investigate whether wildlife professionals can responsibly post images of themselves with primates on social media, we designed an experiment to test whether "disclaimer" captions are effective in mitigating the potentially harmful perceptions generated by these images. We created two sets of mock Instagram posts, one set showing an image of a person near a mountain gorilla and the other an image of a person holding a slender loris. Each set of posts, designed to appear as if they were posted by a generic user, 'mark545', was identical except for the captions. One set had a very simple caption introducing the animal in the image. The other had a longer caption introducing the animal and stating that the "poster" was a researcher who had proper permits and training to interact with the animal. Then, using an online survey platform, we presented one of these four mock Instagram posts to each of 2,977 survey respondents, asking them questions about their perceptions of the animal in the image.

We discovered that disclaimer captions do not mitigate the potential harm of posting images of people alongside primates. Respondents who saw one of the mock Instagram posts with a disclaimer caption were 9.5 percent more likely to strongly agree that the image depicted wildlife research, so we know they read the captions. However, these respondents were just as likely to report they would seek out an opportunity to interact with the gorilla or loris—around 70 percent of survey respondents agreed or strongly agreed with this statement. Around 57 percent of survey-takers who were shown the gorilla image responded they would like it as a pet, with about 62 percent of respondents who saw the loris image stating the same.

Another striking result was that about 60 percent of respondents agreed or strongly agreed that they would like to have a gorilla or loris as a pet. While this doesn't mean all those people are actively trying to obtain a primate pet, the prevalence of that sentiment is much higher than we expected.

The real-world implication of our findings is clear: wildlife professionals—particularly those who work with primates—should refrain from posting selfies with their study animals on social media. While we cannot say for sure whether our findings extend to images of other animals, in the absence of evidence that they do not, we highly recommend they act with the animals' best interests in mind. The conservation and animal welfare risks simply do not outweigh the science communication benefits.

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How to ask and answer sensitive questions

Author **Harriet Ibbett & Freya St John**
Illustrator **Karunya Baskar**

Imagine going about your day, when a researcher approaches and asks if they can ask you a few questions about your life. You agree. However, the questions aren't quite what you were expecting.

"Have you had a child die? Or have you lost a family member in traumatic circumstances?" "Have you ever done something illegal?" "Have you ever lost livestock to predators?"

Perhaps you feel a bit affronted at being asked these questions, or you don't feel like answering. Perhaps you have complex feelings such as distress, shame or grief associated with your 'true' answer. You might be worried about the consequences of sharing information and try to avoid further questions or potential repercussions by evading the question. Or perhaps you tell the researcher what you think they want to hear, so that they will leave you alone sooner.

These are all examples of questions asked by conservationists interested in understanding human behaviour. Child mortality is often used as a measure of household poverty; there is an increased interest in understanding people's compliance with conservation rules, meanwhile extreme climatic events and interactions between wildlife and people are increasing, sometimes resulting in the loss of livelihoods, property and even life.

Failing to consider how questions make people feel can affect participants negatively and cause psychological distress. In turn, such a lack of consideration can raise ethical questions, result in poor quality data, and harm both the research process and the success of conservation outcomes. It is therefore important that as conservationists we first consider whether such questions are necessary to ask, we ensure our questions are appropriately phrased, and we consider how asking these questions may affect participants.

So, what makes a topic sensitive?

Social scientists recognise that while any topic has the potential to become sensitive, some are more likely than others, particularly if they present some kind of threat to participants. For example, if topics ask about breaking of rules, people may fear legal or social repercussions, or if providing information potentially impinges on the interests of powerful elites, people may have concerns about their safety. In many contexts, discussing logging, mining or land ownership can be risky. Alternatively, topics that include deeply personal experiences, such as violence, loss of life or property, may be sensitive because they evoke strong emotional responses. Finally, some topics may be sacred and simply not discussable with strangers.

To be safe, we may err on the side of caution, and assume a topic is sensitive. In recent years, this has led to an increase in the use of specialised questioning techniques in conservation. While these methods may offer participants more protection, they may also mean that we use more complex methods than necessary. Yet, there is relatively little guidance for formally assessing sensitivity in advance of asking questions. Recognising the need for guidance in this area, we, members of the Conservation and Human Behaviour Research Group based at Bangor University (UK), wanted to develop and test tools to help researchers assess topic sensitivity.

To do so, we used a case study of rule breaking around protected areas and assessed several different approaches. First, we developed five questions that could be asked of individuals about specific behaviours. These questions aimed to capture information about things such as prevailing social norms, personal morals as well as general comfort discussing specific topics. For example, we asked individuals whether they thought specific behaviours were 'good' or 'bad', and whether important people in their lives, such as their friends and family, would approve of these behaviours. We then combined answers from these questions to create a Sensitivity Index for each behaviour, where higher scores represented more sensitive topics.

We also developed two group exercises. The first involved asking groups of people to list all the reasons they went to protected areas, and all the challenges they faced from living alongside them. Here, we wanted to generate discussion to see whether people mentioned forbidden activities of their own accord, and to assess any costs of living alongside protected areas. The second group exercise consisted of a pile-sort: here participants were provided with cards showing a range of different livelihood activities (including some prohibited ones, such as killing certain wildlife species). Collectively, groups were asked to discuss each card and sort them into piles depending on how willing they thought people in their community would be to discuss the topic.

We tested these methods in two locations: the Leuser Ecosystem in northern Sumatra, Indonesia, and the Ruaha-Rungwa ecosystem in central-southern Tanzania. Both landscapes are of global importance for biodiversity. Gunung Leuser is the last place on Earth where Sumatran rhinos, elephants, tigers and orangutans coexist. Ruaha-Rungwa is home to some of the largest remaining populations of carnivores found in Africa, including lions, leopards and hunting dogs. Each landscape comprises multiple protected areas, each with different regulations. Importantly, both landscapes are culturally diverse and are home to thousands of people, many of whom use natural resources from within the protected areas to support their households.

What did we find?

Overall, we found topics to be much more sensitive in Tanzania than Indonesia. All four behaviours investigated using our Sensitivity Index in Tanzania (hunting wildlife, grazing livestock, eating bushmeat and entering the protected area without a permit) were considered more sensitive than the most sensitive behaviour, logging, in Indonesia. Similarly, the pile-sort revealed that groups in Tanzania categorised a higher proportion of topics as very sensitive or sensitive, compared to groups in Indonesia.

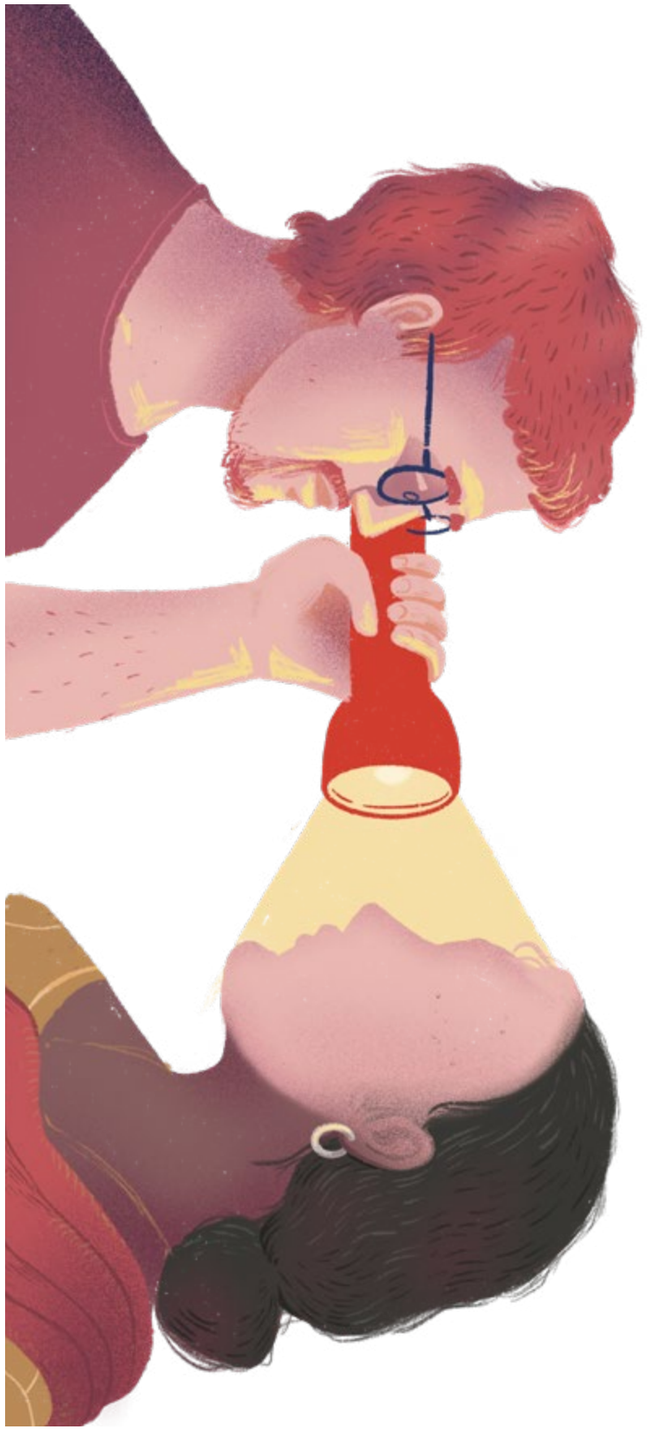
Varying perceptions of sensitivity could be attributed to several factors including differences in legislation, communities' awareness of laws, their experiences of law enforcement, as well as varying cultural perspectives and norms regarding these behaviours. For example, in general, knowledge of conservation rules was higher amongst participants in Tanzania than

Indonesia. During group exercises, Tanzanian participants often cited laws that outlined how all wildlife belongs to the state and described rules which prohibit entering National Parks or Game Reserves for any reason. They also believed that if they did so, it was highly likely they would incur sanctions. For example, one participant outlined that if they killed elephants for their ivory they would "stay in jail until the bars broke". In other groups, sensitivity became apparent through silence. For example, participants were reticent to engage in the exercise, looked uncomfortable, or cautioned others from speaking.

In Indonesia, rules were generally not as well known, but talking about activities that were known to be prohibited was generally considered sensitive. Interestingly, in Indonesia, some behaviours which were illegal (e.g., hunting sambar (*Rusa unicolor*)) were openly discussed, possibly because of poor knowledge of rules, but also perhaps because low levels of enforcement meant participants associated less risk with discussing the behaviour.

Importantly, participants in Tanzania reported various challenges with living alongside protected areas, which might explain some of why people there may find it difficult to discuss topics such as hunting wildlife openly. For example, communities living near Game Reserves reported more challenges coexisting alongside wildlife, with crop damage, livestock depredation and human fatalities listed. Discussions often became emotive, with participants describing the grief, trauma and anxiety they experienced from living alongside large and dangerous species.

In contrast, participants near Ruaha National Park focussed more on how the park was managed, including negative interactions with park rangers and uncertainty associated with changes to the park boundary. Such topics were sensitive because participants were suspicious of our research motives, and conservation actors more broadly. While participants in Indonesia also reported challenges associated with living alongside wildlife and protected



areas, these were not reported as often by participants, and conversations did not evoke such strong emotional responses. While this may reflect cultural differences in how emotion is portrayed, it may also be an artefact of our sampling strategy and unequal coverage across the landscape.

Which method worked best?

It depends on what you want to learn! All three of the methods that we tried elicited useful information, but the type of information differed. The Sensitivity Index provided a quantitative assessment per person for specific behaviours. While this data can be modelled against predictors, and direct comparisons can be made across behaviours and study sites, it requires larger sample sizes (>200) than group exercises and doesn't reveal why specific topics are sensitive. In contrast, the group exercises are more flexible, require fewer participants and provide much richer insights about what people think.

Importantly, who asks questions really matters. When we enter communities as researchers, people often have preconceptions about who we are, what we want and the power we hold. These ideas can influence their willingness both to engage in research, but also to share information. Equally, we also have our own preconceptions about how topics will be construed, and why. As individuals we belong to and identify with a range of different groups (e.g., depending on our gender, age, class, religion, ethnicity, nationality, etc), and our experiences in these groups inform our norms and values, and therefore our conceptualisations of sensitivity. To recognise these biases, it is important to take a step back and critically assess our own assumptions, to inwardly reflect on our own identity, and to assess how these factors may affect the research process and outcomes. Known as reflexivity, this process is increasingly promoted in conservation, alongside practices that require researchers to consider their positionality, and the power-relations between themselves and participants.

Perhaps your next piece of research will focus on understanding what people do, and why. It may involve some topics that you think could be perceived as sensitive. What should you do? First, make sure you include enough time and money in your research project so that you can spend time in the research context first, learn what people think and feel about different topics. Not only will this help you to decide which methods to use, but it will also help to identify any specific ethical issues and risks that may emerge. Also spend time thinking carefully about who is most appropriate to collect the data, is it you? Or might someone else be better placed? Doing so could help produce more informed, more accountable and more accurate findings. To this end, we encourage others to engage with the tools we developed and tested when making decisions about how to research potentially sensitive topics.

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PAINFULLY DELICIOUS: DISCOVERING NATURAL HISTORY KNOWLEDGE THROUGH ANGLING

Author **Aaron Savio Lobo**

My red and white float vanished beneath the laterite-orange waters of the Mandovi River, not with the usual bobbing of small fish but with a steady pull—I had hooked something! Instead of jerking the line, with a firm grip I guided the rod towards the steps, carefully hauling the fish out in a long single drag. The rabbitfish thrashed on the steps at Reis Magos, where my son Noam and I, along with three other anglers, had been fishing. Its venomous spines fanned out as it fluttered. I stopped it with a gentle step on its head, gripping it by the gills to safely remove the hook without being pricked.

I held up the fish, admiring its beautiful maze pattern of golden-brown lines. Aptly called the maze rabbitfish (*Siganus vermiculatus*), locally *escrivão*, the Portuguese name for clerk/writer attributed to the same maze script.

The fish jerked and fluttered, making me loosen my grip. It fell on the steps and began bouncing its way down the stairs once again. I made the mistake of sticking out my hand to prevent it from falling back into the river—which I successfully did, but one of its erect spines jabbed my little finger, a sting that I felt instantly. Similar to a hypodermic needle, each spine of the rabbitfish has a groove that runs along its edge which delivers a toxic venom. My finger was bleeding, and the pain got worse with every passing minute. Its Konkani name *baanoshi* is attributed to its toxic spines—where *baan* refers to an arrow.

An angler standing nearby said that the pain can get so intense that some even wet their pants, giving the rabbitfish its other name: *muthri* in Konkani, pisser in English.

Rabbitfish venom is similar in its makeup to that of the highly venomous stonefish, which is often considered the most dangerous fish in the sea, sometimes causing lethal stings. While rabbitfish venom isn't as severe, that sting will be difficult to forget.

A fish of the monsoon

The best time to fish for rabbitfish in Goa is soon after the onset of the monsoon. In 2023, they arrived unusually late, but when they did it poured incessantly—so much so that the state received half its average annual rainfall in less than a month (by the end of July). The monsoons in Goa have traditionally always been a time for anglers because the seas are just too rough for commercial fisheries to be venturing out to sea, besides being a great "time pass".

Most coastal states in India have a two-month monsoon fishing ban, which was put in place to prevent the industrial (mechanised) fishing sector—including trawlers and purse seiners—from overfishing resources during this period. This ban excludes the traditional fishers who use passive and less destructive techniques. Goa has six major rivers/backwaters and a large network of waterways which come alive with both fish and anglers during the monsoons.

In this season, high levels of nutrients washed by the rains are carried down by the rivers, all the way from the hills to the ocean. While there are a large number of marine algae species in Goa, particularly luxuriant is the growth of a long, stringy, bright green algae which can be seen growing on and coating the intertidal rocky shores of Goa. This seaweed *Ulva intestinalis*, locally called *shelo* in Konkani, is an ephemeral resource, abundant only for a short period during the monsoon. A diversity of herbivorous fish including rabbitfish, surgeonfish and rudderfish arrive in mixed shoals to graze on the tender blooms of marine algae.

Ingenious anglers have figured out the value of this fast-dwindling seaweed resource. Fattened on the seaweed, these fish venture up the estuary where they deposit thousands of eggs among the tangle of mangrove roots upriver, which provide the young refuge and food. The trick used by the anglers is to follow the *baanoshi* as they migrate up the river. In the muddy backwaters, the seasonal *shelo* which thrives on the rocky shoreline becomes a scarce commodity and using it upriver invites bites in rapid succession.

In search of *shelo*

Noam and I had spent the previous evening stripping *shelo* off exposed rocks that had not yet been discove-

red by other anglers. We managed to collect two fistfuls, which we stored in a small plastic box with a little water collected from the vicinity to prevent it from drying up. As divine fate would have it, the skies opened up the following afternoon, which unsurprisingly brought out a large number of anglers from their homes. Our rig setup was relatively simple—a bamboo rod with line float, a small lead shot weight and a small treble hook attached to each line. A treble hook looks like an anchor with three evenly spaced barbed prongs extending from a single shaft. The hair-like seaweed bait is wrapped along all three prongs to disguise the hook and increase the chances of catching a rabbitfish during angling.

However, for reasons I am unsure of, using *shelo* as bait only works in the early half of the monsoon. Anglers who know their rabbitfish switch to using small pieces of fish or shrimp as bait, because they won't take to *shelo* when the monsoon begins to wane. I don't know the ecological basis, but it could just be because the algal blooms at the onset of the monsoons are tender and possibly more nutritious and digestible, as compared to the more mature patches. Another reason is that the algal resource tends to dwindle as the season progresses.

Successful fish

There are approximately 30 species of rabbitfish that are distributed in the Indo-Pacific and the Eastern Mediterranean. They are important to fisheries in most of their range, particularly artisanal fisheries, and constitute an important source of food to many coastal communities.

Being herbivores and the fact that seaweed is ubiquitous, rabbitfish occur in a range of environments from brackish estuaries like the Mandovi to marine environments, including clear coral reefs, and are even found in very degraded marine habitats. There are also other aspects of their biology such as their high fecundities (they lay a large number of eggs) that allow them to withstand even heavy fishing pressures. Rabbitfish are also known to be highly adaptable, moulding their behaviour and biology to adapt to a new environment, making them "phenotypically plastic".

In fact, these species have been so successful that they've colonised regions where they were once non-native. When the Suez Canal opened in 1869, connecting the Mediterranean and the Red Sea, it drastically shortened travel time and reduced shipping costs between Europe and Asia. However, few considered the long-term ecological consequences. Over the years, hundreds of species migrated from the Red Sea to the Mediterranean—a process known as the Lessepsian migration, named after Ferdinand de Lesseps, who oversaw the canal's construction. Many of these species have outcompeted the native Mediterranean fish, becoming dominant in local ecosystems. Today, they form a significant part of regional fisheries and have even become integral to local cuisine.

Among the Lessepsian migrants are two species of rabbitfish—the marbled rabbitfish (*Siganus rivulatus*) and the dusky rabbitfish (*Siganus luridus*), both native to the Red Sea. These species entered the Mediterranean via the Suez Canal, first recorded in 1924 and 1956, respectively. Since then, they've established large populations in the Eastern Mediterranean, outcompeting native herbivorous fish by the early 2000s. In Lebanon's coastal lagoons, for example, they make up 80 percent of the herbivorous fish population. Marbled rabbitfish have even been recorded as far west as Malta, and in parts of Turkey and Crete, they've overgrazed marine algae, creating barren areas. They now constitute a significant portion of fish catches in the Eastern Mediterranean.

Climate change is also driving the movement of the tropical rabbitfish to temperate parts of the world which they have now happily made their homes.

Eating the rabbitfish

We took our rabbitfish home. Noam, like he typically does, insisted he wanted it cooked the same

evening. I steamed it as is done in many parts of Southeast Asia—in a colander with finely chopped ginger and garlic in soy sauce. He decided to use chopsticks, deftly peeling back the skin to reveal the steaming white flesh. I always found the skin of rabbitfish bitter. It was cooked to perfection, the flesh tender yet firm.

While I have eaten rabbitfish for some years now, they are among a few species whose consumption during a particular season can cause what is called hallucinogenic fish inebriation or ichthyoallyeinotoxism. I haven't yet heard of cases such as these from Goa yet. We slept well that night.

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Page 28: Aaron displays a freshly caught rabbitfish, which raises its venomous spines in a defensive response.

Page 29: Fresh blooms of filamentous seaweed, known locally as *shelo*, flourish on Goa's rocky shores during monsoons, fuelled by nutrient-rich runoff from land to sea.

Page 30-31: The maze rabbitfish (*Siganus vermiculatus*) is named for the intricate maze-like patterns that adorn its body.

Page 32: Aaron and his son Noam on one of their regular fishing trips.