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Special Section
Freshwater Conservation

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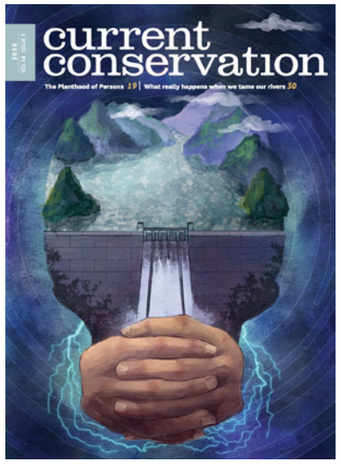


Cover art **Keya Lall**

We've had a long pause between this issue and our previous one which has given us time to ask ourselves – do the stories we tell here in the post-pandemic world dilute in relevance? Considering how the SARS-COV2 virus spread, a critical examination of our interaction with and in the natural world has never been more crucial.

To support this, we have Romulus Whitaker returning to tell us stories about his dextrous Irula friends, highlighting once again, the immeasurable value of communities most vulnerable to global health emergencies. Melissa Marselle and Agathe Colléony bring us a summary of their research in bees and behavioural science. To shoo away our lockdown blues, Priya Ranganathan and Dincy Mariyam carry us to the avian paradise, Ranganathittu. Abhijit Dey takes us down a thrilling afternoon tale of langur adventures in the Himalayas while Amiya Hisham makes a case for co-existing with slimy slugs under our sinks. The Kartel Shockington column returns with trademark cheek and reflections on planthood.

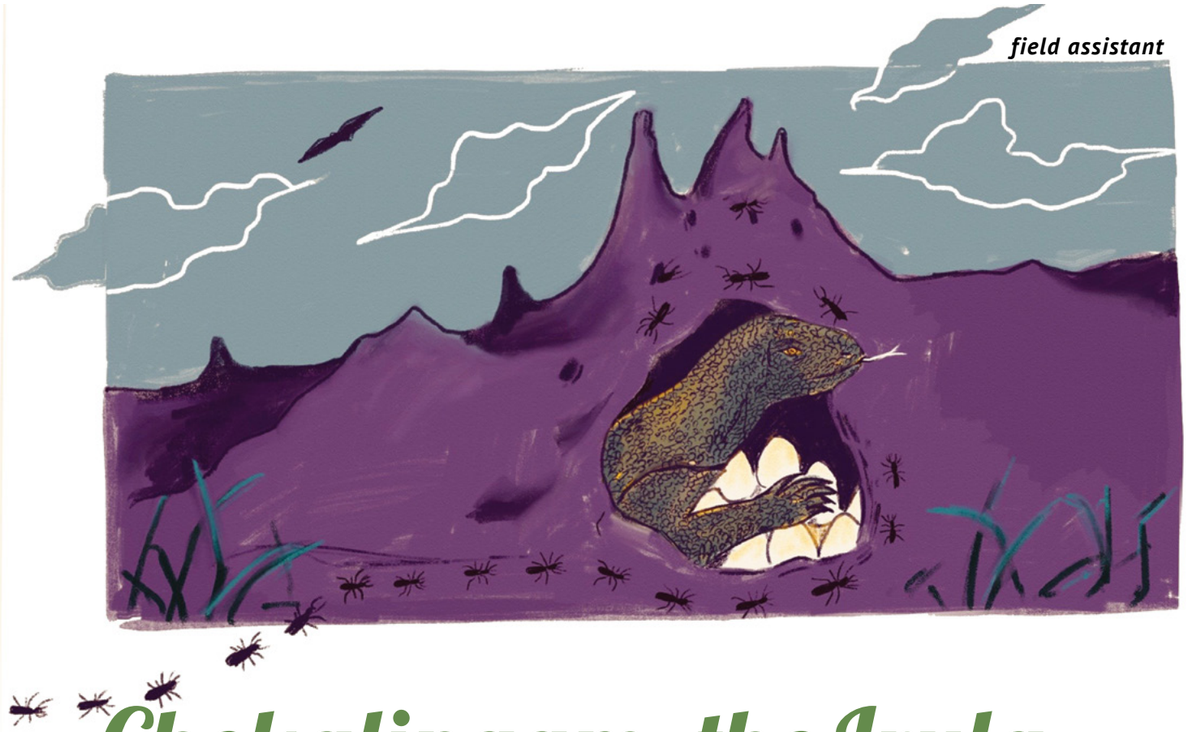
We'd also like to introduce a Special Section in this issue dedicated to freshwater conservation. We had the honour of having Ferenc Jordán, the Director of the Balaton Limnological Institute in Tihany, Hungary, curate and edit this section.

Shruti Sunderraman

During the coronavirus pandemic, people of the World are focused on the tiny, non-living little enemy gripping collective health. Under such circumstances, we see topics of climate change, habitat loss, and extinction in evidence pushed to the back of magazines, media coverage, and collective attention. This is rather counterintuitive and unwise, and goes on to show that we have not learnt our lesson. Global diseases, nature conservation, and social challenges are different facets of the same system, the biosphere. If we continue to fail to process them with interconnectedness, the pandemic is unlikely to be the last of our problems.

Fresh water is a crucial resource for our future health. The health of freshwater ecosystems are crucial for the future of the biosphere. Although rivers and lakes give the impression of separation – discrete blue dots on the map, Life interconnects them too. Terrestrial insects and birds, nutrient cycling and pollution, are examples of factors glueing these systems together. Studying freshwater ecosystems is actually a great exercise for the mind, teaching us to consider connections and their long-ranging effects. In this special section of Current Conservation, we present you an opportunity to read about freshwater conservation among other stories, and think about the nature of connection and your own place in it.

Ferenc Jordán



Chokalingam: the Irula legend, parabiologist, & friend of all things living

Author **Romulus Whitaker** | *Illustrator* **Upasana Agarwal**

Chokalingam was a very special character. Interestingly, his facial features somewhat resembled Australian Aborigine features. Like many Indian tribes, the Irula have become quite diluted as a particular racial type and in many, you have to look hard to see evidence of their Indian aboriginal ancestry. "Chocky" was one of the Irula instrumental in setting up the Irula Snake-Catchers' Industrial Cooperative Society (ISCICS). Based on the Irulas' superb knowledge of snakes, the Society would provide a livelihood for its members. But first, we needed to get them together. Chocky was one of my go-betweens. He also attended early meetings with the Tamil Nadu Government's Industry and Forest Departments. Chocky's younger son, Kali, is the same age as my younger son, Samir, and the sometimes deadly mischief they got up to is a story for another time.

In those days, I was out with the Irula three or four days a week, learning what I could about their techniques in finding and catching rodents, snakes and other creatures of the farmlands and scrub jungle. When the Irula are walking along, they notice things that completely elude even weatherworn and trained researchers: the smelly fresh scat of a monitor lizard, the smooth track of a snake on the edge of a rat hole (going in, or coming out?), a freshly shed skin hidden under the grass (a species we want?), fresh tracks, wisps of hair and live lice at the mouth of a rat hole, and of course, so much more in the way of edible and medicinal plants.

One day Chocky showed me a freshly repaired circular patch on a large termite mound. "*Udumbu kudu*" he said - a monitor lizard had dug a nest hole in the side of a termite mound, gone in, laid her eggs and departed and now, the termites had sealed up the hole. Thus, securing the eggs from predation. Chocky explained that the monitors especially like to use the mound of the 'black termites' for nesting because these soldier termites are so aggressive that predators know not to mess around. Sure enough, we found 10 long, leathery eggs, which we collected and incubated. The eggs hatched a long 5 months later and we released the brilliantly marked young.

Walking along the densely vegetated bund of a small tank, Chocky suddenly stopped and pointed to something in a neem tree. "*Pacha wona*", said Chocky. "A chameleon." I expected to take a long time to find this wizard of camouflage, but there it was, in brilliant purple and yellow. It did not blend in with the surroundings at all! We both felt that there must have been another chameleon somewhere close by, since this was the typical colour of a chameleon who had been fighting with a rival male. I'm pretty colour blind (reds and greens), so I never trust colours. But my eyes and brain seem to have developed a good 'shape-discerning ability'. Sometimes, when there's a group of people with us on a reptile hunt, and a chameleon is located, we'd tell everyone to turn around for a few minutes, and release the chameleon in a small tree. They would then have to find it again. The reptile's ability to 'disappear' makes some of our guests take me seriously when I say, "It has turned into a big leaf on the tree".

Some years ago, the ISCICS received an order for five grams of scorpion venom for a pilot project to produce scorpion antivenom. Apparently, the death rate amongst small children from scorpion sting is very high in some parts of India – the main culprit being the oddly-named Hottentotta tamulus, the common red scorpion known to all of us. Well, it was going to take about a 1000 scorpions to produce each gram of venom. How the hell were we going to find them? Chokalingam said, "No problem, if we put out a reward of Rs.5 per scorpion, the Irula will get 5000 within two months". While some scorpions, like the large black ones, are tunnel diggers, the red scorpion seems to prefer hiding under rocks, plant debris and unfortunately, between the tiles on people's roofs. Soon, the scorpions started coming into the ISCICS quarters by the bagful. We worked out a simple system of holding the wriggly little scorpions with a pair of forceps, tail-tip over the side of a petri dish. Then, by delivering a mild electric shock to the scorpion's tail, a drop or two of whitish venom emerged from the sharp, curved tip of the stinger. The process was agonizingly slow but Chockalingam's concentration and extreme patience formed just the right combination to make this venom extraction work really well. Within three months of receiving the scorpion venom order, the Irula had the five grams to send to the antivenom lab where it hopefully helped save children's lives.

Chokalingam was an Irula medicine man as well and I once watched him treat a serious saw-scaled viper bite. An Irula girl had been bitten on the finger by a large one and her hand was badly swollen. I asked if we should take her to a hospital, but Chokalingam was adamant that he knew how to treat her. Wrapping a cord around her forearm, he made tiny slices in the webbing between her fingers with a bit of broken glass. By increasing the pressure of the cord around her arm, drops of blood and clear serum exuded from these little cuts. After that, he wrapped her entire arm in a cloth filled with a poultice of black turmeric leaves, which was to stay on for three days. After the poultice was removed, the swelling had all but disappeared and there was no doubt that the wound at the site of the bite was healing well. The wealth of Irula tribal medicine got a considerable fillip when the Irula Tribal Women's Welfare Society (ITWWS) was started at Thandarai at the instance of Zai Whitaker (educator, writer, and naturalist), and we still have plenty to learn from these amazing people.

A bonus from knowing the land, its plants and creatures were the edible titbits that came our way while walking the countryside with tribesmen like Chokalingam. The yam the Irulas call *kodi velli kizhainghu* is, they say, what they used to survive on before rice became the staple. Finding a vine with typical heart-shaped leaves, Chocky would carefully dig until the fat root was exposed. He would cut the main root off and bury the top of the root to which the vine was attached. "The root will grow again," said Chocky. All I could think of was, "Am I looking at one of those first instances of agriculture? Is this perhaps how

agriculture began?" We collected berries like the syrupy sweet *gunja pazham*, savoured the sharp tartness of small black thorny berries called *sura pazham*, the carrot stick refreshment of gnawing on a bit of '*sappathi kalli*' (a type of spineless cactus flower) and it was all good. But these pale in comparison to the 'honey experience'.

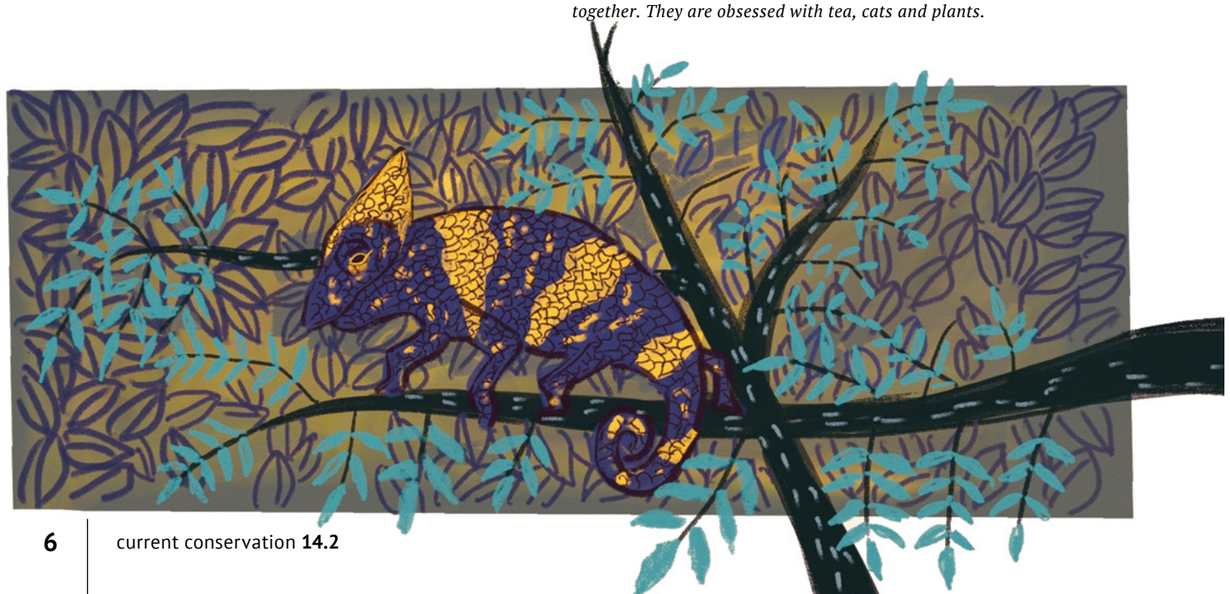
Often, on a long tiring walk, Chokalingam would keep his eyes tuned to finding some '*kutchi then*' (stick honey). These particular bees make their small honey comb on a straight stick conveniently at eye level, not way up in a tree nor in a hole. They sting like most other bees, but by gently blowing on the hive the bees are persuaded to fly away. Chokalingam cut both ends of the stick with his *aruval* (a curved machete) and brought out a turkey drumstick-sized honeycomb…ooof! Under the honey-packed wax cells of the comb, there are often bee larvae, one in each cell and especially prized by Irula children. If we were hot, sweaty, and hungry after half a day of walking, biting into that honeycomb and letting the honey drip down from your lips all the way over your fingers was heaven. I was tempted to slurp like a child. "No, don't do that", warned Chokalingam. "If you slurp the honey like that, you can choke.". That's what happened to me one day and it was fixed by a good slap on the back and a sip of water.

I was and am still amazed at the Irulas' ability to find and capture rodents. For a tribe that made its name in conservation for their scientific love affair with snakes, their knowledge of every other species that they interacted with always astounded me. I was sure they could do a better and safer job of rodent control than the pesticide people that most of us are keen to constantly hire. When Chokalingam and I were invited to the Central Food Technology Research Institute in Mysore, Karnataka, he displayed his skill and understanding of rodent behaviour and caught a batch of 28 lesser bandicoots plus several gerbils in just one afternoon of digging up burrows. After a few more field trials, we received a grant from the Department of Science and Technology for a serious rat project. During the year-long rat hunt, the Irula caught a quarter of a million rats and recovered close to five tonnes of stored grain from rat burrows. We dug out entire rat burrow systems, mapped each one of them and learned a lot about the habits of the four main species affecting crops in our area of Tamil Nadu. The next phase was to set up a bio-control company owned and operated by Irulas, but it never happened. I thought that we had proved the effectiveness of hands-on rodent control without having to use dangerous pesticides, but I guess there is big money in the pesticides industry and our enthusiasm just died without support for the idea of applying the Irulas' tribal technology to a problem that may account for the loss of a quarter of all the grain we produce in India. Is there anybody out there interested in our idea of promoting the Irula Pest Busters?

Note: While this story runs under the category of Field Assistants, learning from Chokalingam always felt like I was the one doing the assisting, and rightly so.

Romulus Whitaker *is an Indian of American origin who has a lifelong obsession with reptiles.*

Upasana Agarwal *is an illustrator based out of Kolkata. When they're not drawing, they organise a LGBTQAI+ art space in the city. Their work is largely influenced by the nostalgia and history of urban landscapes and the fabric of life that ties them together. They are obsessed with tea, cats and plants.*



Slugs have no saviors

Author **Amiya J. Hisham** | *Illustrator* **Veda Thozhur Kolleri**

The quiet wet evening was rattled by a disgusted cry from the kitchen. I had put down the saucepan into the sink only ten minutes ago. I was about to wash the pan, and put on another two cups of tea when I noticed the blasted critter stuck to the bottom! A slimy little slug!

A graphic image akin to those of the toilet cleaning agent advertisements conjured the idea of a slug-paved plumbing! Repulsed, I flicked out the slug with a cane and swirled the pan twice with soap, scrubbed it clean and rinsed again with boiling water and some lethal common salt. Down the drain I sloshed the hot salt-water, melting all the other ones I imagined to be stuck inside the pipe.

Moments later, a pang of pity struck me. My departed slug had metamorphosed in my mind – it grew glowing wings and a halo, each over its weird antenna eyes. In an unkind busy world, it is the slow ones that get kicked and elbowed – or in this case, killed by salty hell. They do make a frequent case of annoyance, inconvenience and sometimes disgust – but these are ideas from the drain pipes of my conditioning. In any case there is no sympathy for slowness–whether a slug or human being.

I hurried to wash the tea cups. Pity had reddened to guilt. I had recently watched a TED talk on civility in the workplace, which spoke of good allyship leading to good business. '*Listen to the person when he or she is talking to you, put away your phone when someone addresses you, gift a smile when you cross them in the hallway…*' Daily passive and active aggression and verbal abuse creates slugs out of the worker. It hits their productivity in the stomach and chokeslams their esteem into oblivion. Eventually the 'slug' quits. Whoa, I was not going to castigate these poor slugs and snails. Whether an *Ambigolimax* or an *Achinata* whicheverata, I was going to advocate. Every snail must be worth his salt, if you can pardon the pun.

While the slugs and snails might be out in the wet mud, in ditches, and on walls or in the plumbing, their human advocate is spending her wee hours looking for her purpose in life. Now, there is the *Ambigolimax*, the ones without the shell, and then the *Achatina fulica*, the ones who have them and quite a few others like them. The one who suffered my cruelty (wince!) was a Tropical Leatherleaf. After quite some scrolling, I found science and media were generally unkind to these legless blobs of flesh and shell as an invasive species. The truth ought to lie somewhere between the sensationalism and the myths, so my search continued.

Their superpowers included an unbeatable sexuality (they are hermaphrodites who can lay up to 1500 eggs at a time and get away with it) and a hearty appetite for anything from plastered walls (to build calcium homes of their own) to food crops painstakingly grown by *Homo sapiens*. In Kerala, their proliferation is indebted to a certain Homo sapien, a scientist by the name P.N. Radhakrishnan, who introduced the *Achatina fulica*, or more simply known as the Giant African snail. In 1955, he brought them from Singapore to Palakkad, Kerala as his lab subjects, till things got out of hand. A couple of them were slung into the municipality by some other *Homo sapiens*. Today they've settled into 12 of the 14 districts in Kerala.

But science was not the first to marginalize snails for who they are. In fact, they were literally and profusely pushed to the margins of the illustrated medieval manuscripts of Europe, leaving even modern experts perplexed. They were pictured in combat with a knight in shining armor, astride a winged dragon or a white steed – supposedly some form of medieval humour where we are supposed to laugh at the knight for trying to fight something as silly and frail as a snail. In other versions, the snail appears more sinister and menacing, pushing its pronged eyes toward the knight. '*Like a snail that melteth away into slime, they shall be taken away, like a dead-born child, they shall not see the sun*' is the warning of Psalm 58. Maybe the snail was a Biblical allegory for inevitable death and man's futile attempt to fight it. But the shelled monsters were everywhere, not just the corners of the Bible. This leads to the third assumption that they depicted the Lombards, who were at the time despised as an unruly, monopolizing, sinful lot. In any case, nails made for good satire.

The burgeoning number of this slimy lot in our backyards is not because some witty chap threw them into every corner of our lives. It is also one of those environmental imbalances that we propagate. Apparently, due to the excessive light pollution in recent years, there has been a decline of population in the firefly kingdom. Snail larvae are the usual night time snack for fireflies, and with them gone, all 1500 snail eggs are free to hatch and flourish into squirmy slimy progeny; all potential carriers of a deadly nematode capable of causing meningitis in human beings. Talk about karma. For me, this outweighs internet trivia of how Thai women find it beneficial to use snail mucus for cosmetic treatments.

My metamorphosed slug puppied its eyes, sensing an unsavoury verdict. No, that's it! Out went the haloes and the firefly wings. If these critters could fly, my new-found sympathy would have been taken with a pinch of salt.

Amiya Hisham *is an architect and writer based in Trivandrum, Kerala, with interests in design, language, and nature. At the moment, she is gardening her way through life, literally and figuratively.*

Veda Thozhur Kolleri *works with drawing, video, writing, and found material to understand the contexts in which she lives. Her preoccupations center on mortality and the impending sense of loss that is inherent to having a relationship with the world around us.*

Why we can't save the bees without changing our behaviour

Author **Melissa Marselle** and **Agathe Colléony** | *Illustrator* **Ishita Biswas**

It's a commonly acknowledged fact that pollinators such as bees and butterflies are vital for food crops and ultimately, our health and well-being. But, pollinators are declining. As most conservation problems are created by humans, the solution to protecting pollinators lies in changing human behaviour. However, most behaviour change interventions for conservation often lack grounding in psychology.

In an article in *Conservation Biology*, Marselle et al (2020) examined EU national policies for pollinator conservation, and showed that these policies overly rely on behaviour change interventions that are known to be ineffective, and under use interventions known to be effective for changing human behaviour. This may impair the effectiveness of the policies and our ability to conserve pollinators.

Researchers found that the most frequent behaviour change intervention for pollinator conservation was

> **a)** education (23 percent; providing information to increase knowledge or understanding). However, education is not very effective at changing people's conservation behaviour, as information in itself does not always guarantee action. This is because behaviour is also influenced by other factors, such as social pressure, physical opportunity, or motivation to do a behaviour.

The least frequent behaviour change interventions for pollinator conservation were

a) modelling (4 percent; providing an example for people to imitate, like a role model),

b) incentivization (3 percent; creating an expectation of reward), or

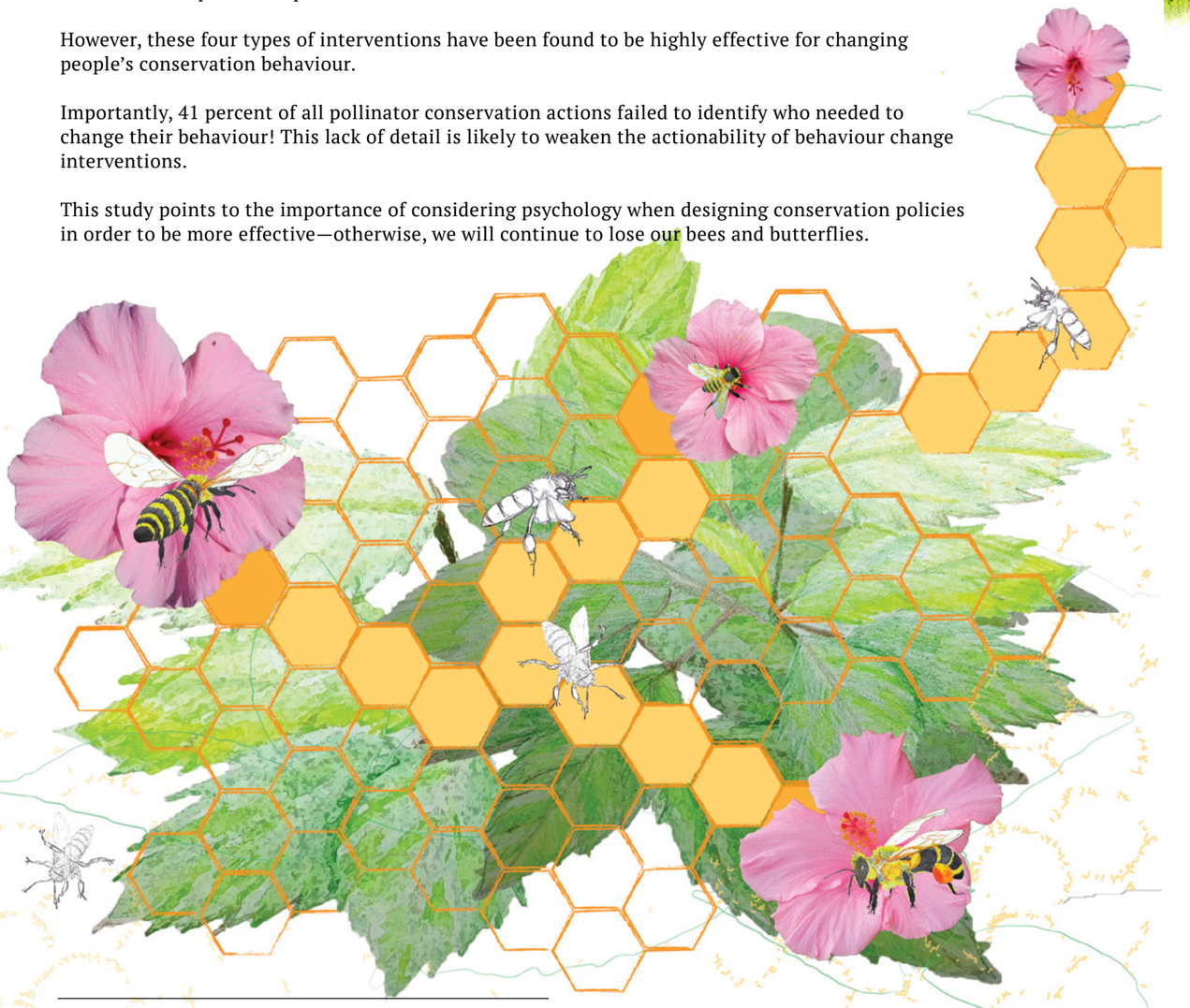
c) restriction (2 percent; using rules to reduce opportunity to engage in the favourable behaviour or the behaviour that is being targeted to achieve), and

c) coercion— designing interventions to create an expectation of punishment or increased cost to discourage behaviour – was not mentioned in any of the pollinator policies.

However, these four types of interventions have been found to be highly effective for changing people's conservation behaviour.

Importantly, 41 percent of all pollinator conservation actions failed to identify who needed to change their behaviour! This lack of detail is likely to weaken the actionability of behaviour change interventions.

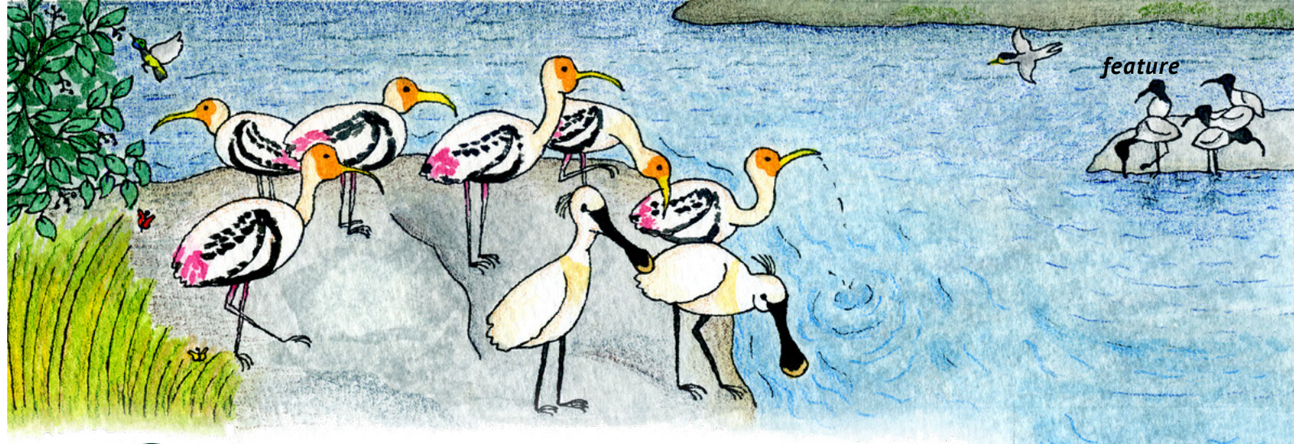
This study points to the importance of considering psychology when designing conservation policies in order to be more effective—otherwise, we will continue to lose our bees and butterflies.



Melissa Marselle *is an environmental psychologist at the Helmholtz Centre for Environmental Research investigating the pro-environmental behavior change, and the influence of biodiversity on human health.*

Agathe Colléony *is a conservation scientist exploring the links between biodiversity, nature interactions, individual well-being and biodiversity conservation behaviors*

Ishita Biswas *is a Visual Artist and children's book Designer. She wanders at the intersection of the natural and civilised worlds, intervening reality with myth and imagination through the mediums of drawing, animation, and installation.*



Ranganathittu: the Kaveri's quiet jewel

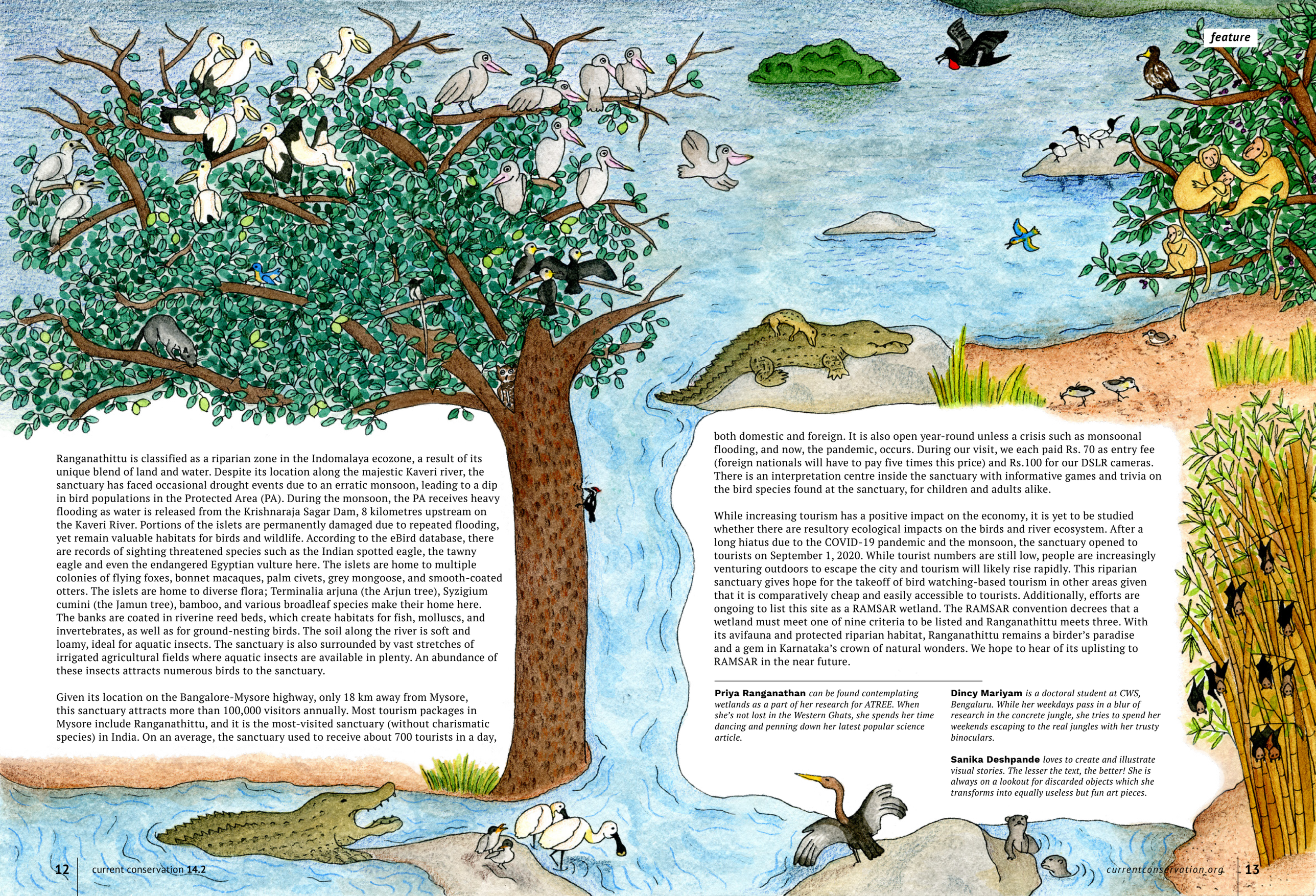
Author **Dincy Mariyam & Priya Ranganathan** | *Illustrator* **Sanika Deshpande**

From the parking lot, there is nothing special about this isolated patch of greenery on the outskirts of Mysore, three kilometres from the quaint temple town of Srirangapatna. But a closer look reveals a quiet riparian wetland, comprising six islands and six islets on the banks of the mighty Kaveri.

The Ranganathittu Bird Sanctuary, sprawling over 67 hectares of protected land, is the oldest bird sanctuary in Karnataka, and one of India's first sanctuaries. The islets of Ranganathittu formed when an embankment was built over the Kaveri river between the years 1645 and 1648. The wetland was declared a protected area (PA) in 1940 by the King of Mysore under the insistence of esteemed ornithologist Salim Ali, who noticed that high numbers of birds arrived at Ranganathittu to nest on the islets. In 2017, an eco-sensitive zone of 28.04 sq. km. was declared around the PA, disallowing commercial activities without government permission.

When we last visited Ranganathittu, in February 2018, the islets were densely packed with nesting birds, so thickly crowded together that we could not sight the trees upon which the birds had built their nests. Their mingled cries filled the air, deafening us and forcing us to shout to be heard above the cacophony. Mugger (marsh) crocodiles basked on the sunny rocks protruding from the water, their young clambering clumsily onto their scaly backs as tourist boats drew nearer for prime photo opportunities. The avian life was particularly thrilling; we spotted painted storks, Asian openbill storks, Eurasian spoonbills, Oriental darters (snake bird), spot-billed pelicans, black-crowned night herons, black-headed ibises, cormorants, brilliantly-coloured kingfishers, and even river terns, which nest in Ranganathittu during peak winter season.

The main island is also a birder's paradise; we spotted the Tickell's blue flycatcher, the Indian grey hornbill, the Asian paradise flycatcher, and a spot-breasted fantail that danced about like a little peacock spreading its wings and tail. In 2007, birders sighted a lesser frigate bird nesting in Ranganathittu, a rare event indeed! At home over the ocean, frigate birds are swept over India's coasts during stormy events or gusty monsoon winds. Over 40,000 birds spanning nearly 222 species were recorded at this sanctuary during the winter months (December through February) over the past decade, so our visit coincided neatly with that of migratory birds from different corners of the globe. Signage at the park informed us that certain species migrated from as far as Siberia and Latin America!



Ranganathittu is classified as a riparian zone in the Indomalaya ecozone, a result of its unique blend of land and water. Despite its location along the majestic Kaveri river, the sanctuary has faced occasional drought events due to an erratic monsoon, leading to a dip in bird populations in the Protected Area (PA). During the monsoon, the PA receives heavy flooding as water is released from the Krishnaraja Sagar Dam, 8 kilometres upstream on the Kaveri River. Portions of the islets are permanently damaged due to repeated flooding, yet remain valuable habitats for birds and wildlife. According to the eBird database, there are records of sighting threatened species such as the Indian spotted eagle, the tawny eagle and even the endangered Egyptian vulture here. The islets are home to multiple colonies of flying foxes, bonnet macaques, palm civets, grey mongoose, and smooth-coated otters. The islets are home to diverse flora; Terminalia arjuna (the Arjun tree), Syzigium cumini (the Jamun tree), bamboo, and various broadleaf species make their home here. The banks are coated in riverine reed beds, which create habitats for fish, molluscs, and invertebrates, as well as for ground-nesting birds. The soil along the river is soft and loamy, ideal for aquatic insects. The sanctuary is also surrounded by vast stretches of irrigated agricultural fields where aquatic insects are available in plenty. An abundance of these insects attracts numerous birds to the sanctuary.

Given its location on the Bangalore-Mysore highway, only 18 km away from Mysore, this sanctuary attracts more than 100,000 visitors annually. Most tourism packages in Mysore include Ranganathittu, and it is the most-visited sanctuary (without charismatic species) in India. On an average, the sanctuary used to receive about 700 tourists in a day, both domestic and foreign. It is also open year-round unless a crisis such as monsoonal flooding, and now, the pandemic, occurs. During our visit, we each paid Rs. 70 as entry fee (foreign nationals will have to pay five times this price) and Rs.100 for our DSLR cameras. There is an interpretation centre inside the sanctuary with informative games and trivia on the bird species found at the sanctuary, for children and adults alike.

While increasing tourism has a positive impact on the economy, it is yet to be studied whether there are resultory ecological impacts on the birds and river ecosystem. After a long hiatus due to the COVID-19 pandemic and the monsoon, the sanctuary opened to tourists on September 1, 2020. While tourist numbers are still low, people are increasingly venturing outdoors to escape the city and tourism will likely rise rapidly. This riparian sanctuary gives hope for the takeoff of bird watching-based tourism in other areas given that it is comparatively cheap and easily accessible to tourists. Additionally, efforts are ongoing to list this site as a RAMSAR wetland. The RAMSAR convention decrees that a wetland must meet one of nine criteria to be listed and Ranganathittu meets three. With its avifauna and protected riparian habitat, Ranganathittu remains a birder's paradise and a gem in Karnataka's crown of natural wonders. We hope to hear of its uplisting to RAMSAR in the near future.

Priya Ranganathan *can be found contemplating wetlands as a part of her research for ATREE. When she's not lost in the Western Ghats, she spends her time dancing and penning down her latest popular science article.*

Dincy Mariyam *is a doctoral student at CWS, Bengaluru. While her weekdays pass in a blur of research in the concrete jungle, she tries to spend her weekends escaping to the real jungles with her trusty binoculars.*

Sanika Deshpande *loves to create and illustrate visual stories. The lesser the text, the better! She is always on a lookout for discarded objects which she transforms into equally useless but fun art pieces.*

The Rescue Mission

Author **Abhijit Dey** | *Illustrator* **Manini Bansal**

It started like any other day. By 8 am, we were in a field in a community forest near Mandal, a sleepy little village at the base of a steep valley of the Garhwal Himalayas, India. The rays of the sun had only just begun kissing the hill tops. But my Central Himalayan Langur troops were deprived of their warmth.

To stay warm, the langurs my fellow researchers and I were studying, huddled together, sharing body heat on the forest floor. We made note of this kleptothermy – a behavioral adaptation to fight the chilling temperature — in our data sheets.

The Central Himalayan langur (*Semnopithecus schistaceus*) was a relatively unknown species even amid primate research. In India, langurs can be found in high Himalayan elevations (1,500-4,000 m) from Jammu & Kashmir to the peaks of Sikkim. This species of langur is primarily greyish in appearance with a whitish head and tail tip, with a relatively larger body size (an average of 70cm) than langurs found in other regions. In addition, female langurs are generally smaller than males. In this species, multiple males share dominion. Dominion, as we know, is usually a distinguishing variable of behavioural study in most ape and primate groups. The langur group we were following was a large one, with five adult males, 12 adult females, seven sub-adults, eight juveniles, and few infants. To observe such a large group this early into our field study was quite a privilege.

Our motive was to better understand the langurs' behavioural ecology. This required following the troop throughout the day – from morning (when they were still resting and not active enough to study well) till the evening (when they were moving towards their resting/sleeping site for the night).

This particular morning, as the clock ticked forward and sunrays reached treetops, all our huddling langurs started moving towards the hilltop for a nice little sun bath. I don't blame them. The cold in these parts gets bad enough to warrant a nice hike up the hill to soak up some warmth. So what if you've to invite the whole family? Speaking of family, some langurs in this particular troop who wished to stay in bed, stayed behind. Some others were busy feeding their young.

We had been following the langurs for a month and were fairly acquainted with their behavior. We anticipated that they would move on to some other location after having 'breakfast'. They didn't disappoint. As was expected, they soon started to move towards the village. Their intention was clear: to feed on the crops!

The troop travelled along the upper edge of the hill. There were hardly any houses over there. Even the villagers didn't frequent that place often. The terrain was somewhat steep and had denser tree cover. At around 10 a.m., part of the langur troop climbed down the cliff and settled themselves in the crop field. The field provided them a cool place, a short distance from the village, helping them munch on fresh green mustard and wheat leaves. Other langurs were on their way to join in. Quite a party.

The raid

All was well until, quite suddenly, a few langurs ran away. They frantically began looking for cover amongst high tree branches. We knew this scurrying commotion must have been a reaction to the dogs 'employed' by the villagers to keep the langurs at bay. Dogs generally raid silently: you'd never really see or hear them. The only way you'd know they were there would be through the frantic running of langurs in this region..

But what happened next will shock your data sheets.

Two or three dogs invaded the troop, scattering the langur. They also managed to trap a few langurs in an area near the cliff. At one point, over a dozen infants and juveniles with just one or two adult females were isolated on the cliff, cornered by a dog that was determined to prevent them from moving into the crop field.

Whenever they feel threatened or isolated, non-adult langurs make a certain prolonged low pitched sounding call for rescue, and scan their immediate surroundings intensely for signs of help. Being primarily composed of younglings, the group of trapped langurs started to vocalize, shouting for help!

Almost as though straight out of a thriller, an adult male langur suddenly sprang into view. He was sitting on a high tree branch on the other side of the crop field, facing the sub-group left behind, with a second dog at his tail. He was scanning the landscape, worried, looking for a chance to join the rest of the troop, wanting to fall behind safety in numbers. Could he initiate a rescue mission?

Rescue mission – phase A

The adult male was only about a 100 meters from the cliff – not much of a distance, but with two dogs lined up in between, the langurs would need to come up with a good plan.

A second adult male appeared within a minute or so, positioning himself on a high branch of another tree to the left of the first male monkey who jumped into the picture, maintaining a little distance in between. A few other langurs were also scattered around here, where a third dog was on duty.

Back where the action was unpacking, one langur moved towards a lower branch, within possible reach of the dogs, but at a sufficient distance to maintain safety. He acted as a distraction to get the dogs away from the first langur, and to make room for an opportunity for himself – to run to the cliff like there's no tomorrow. Without wasting another moment, langur number 1 climbed down and sprinted. He swerved to avoid the dogs brilliantly and arrived at the cliff, where other members of his family were waiting for help.

Rescue mission – phase B

Outsmarted and confused, the two dogs were now scurrying around to reconvene. But it appeared the second langur had more moves left in his master plan. He provoked the dogs again, tricking them into chasing him, eventually moving further away and out of sight. The dogs took the bait, followed him, but all we could hear, at this point, was a little bit of barking.

The first male langur, now sitting with his family, appeared quite relaxed. Indeed, he looked like he was having the time of his life. The dog that was assigned to his case, not so much. Most of the langurs in the troop were reunited. They could now wait out any threat without hurry. They kept an eye on the horizon for another opportunity to retreat under cover. For almost five minutes, nothing happened. Finally, after a couple more minutes, one of the dogs couldn't resist the possibility of more action, and ran away towards the point where one langur was still waiting out the threat alone. This gave the troop the opportunity to run away. With a mixture of caution and speed, they sprinted towards a safe exit, and kept moving on to a much safer location. Possibly somewhere without dogs. Dogs were not the langurs' best friends.

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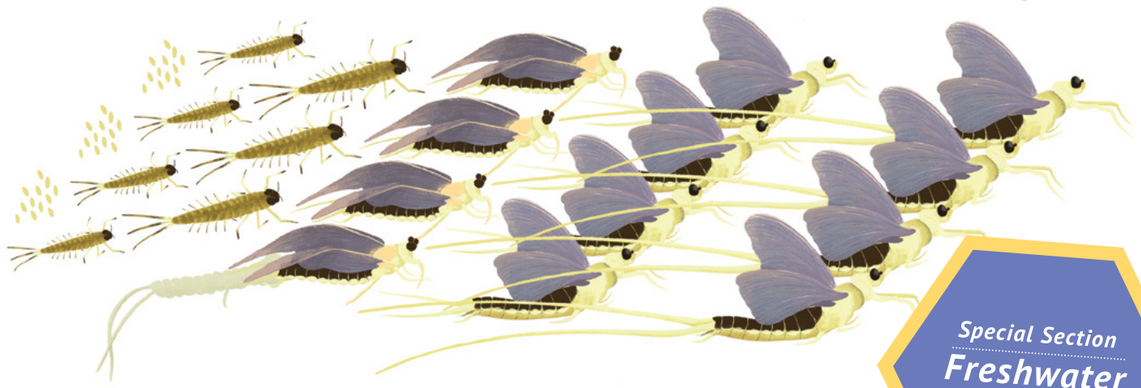


Special Section
Freshwater Conservation

Meet the hidden beauty of meandering rivers

Author **Szabolcs Lengyel** | *Illustrator* **Leeza John**

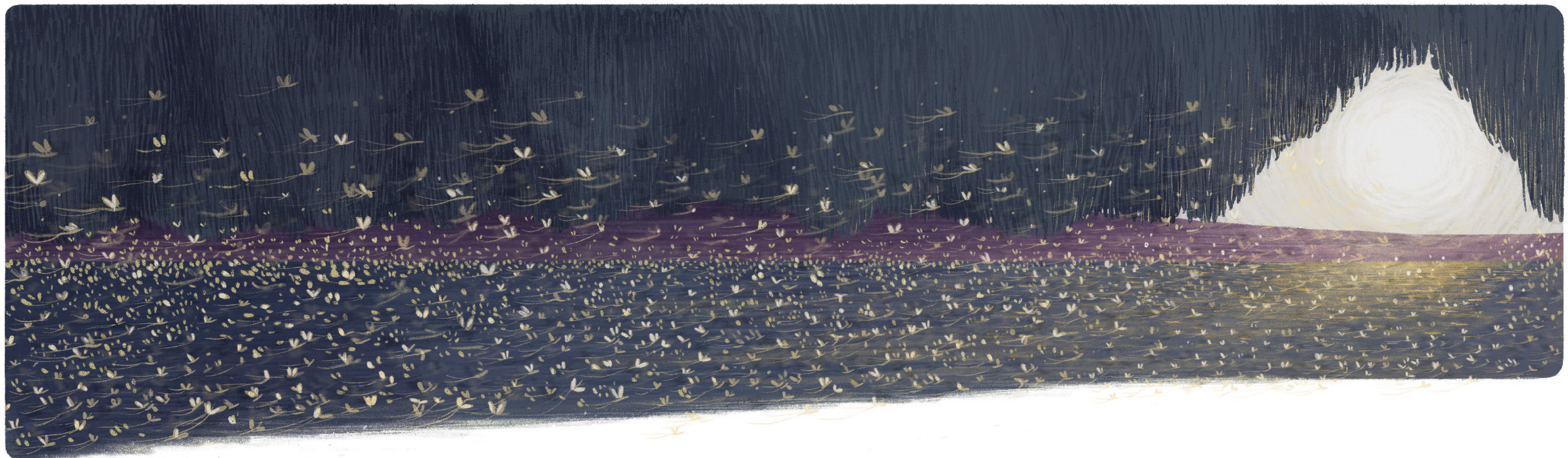
Millions of 10-cm-long yellow insects emerge from the river and scramble onto the water surface to mate. Then, these little beauties fly 'en masse' upriver for several kilometres to lay eggs, all in a span of 2-3 hours on a calm early-summer evening. To people fortunate to catch it, this will always be a wondrous, peculiar phenomenon. This is the spectacular swarming of the long-tailed mayfly (*Palingenia longicauda*), a species in the insect order Ephemeroptera.

In the past, the long-tailed mayfly was common in middle sections of lowland rivers all over Europe. The species is now confined to the catchment (an area of water collection and drainage) of the river Tisza in eastern Hungary, the Rába river in western Hungary, the Prut river in Moldova, and some other rivers in Ukraine.

Somewhere, this confinement is a tragedy. What happened to this spectacular mayfly, whose swarming was first documented as early as 1634 in north-west Europe? Recent studies show that the species has lost more than 95 percent of its geographical range in a few centuries. It went extinct in France in 1922, Germany in 1953, and disappeared from Danube, the largest river in central Europe, in 1974.

Causes of loss

The most likely reasons for this loss are river regulation, riverbank modifications such as riprap stone structures, and water pollution. The larvae of this species live in burrows that are dug in eroding clay riverbanks underwater. They undergo 20 moults (the process of shedding skin, feather etc.) during their three-year development period. They come above the water surface to become imagoes — sexually mature adult insects post metamorphosis — in a final moult, reproduce and die, all within a few hours.



A chance for the mayflies

Eroding clay riverbanks typically form on the outer arches of river bends, and the progression of erosion often threatens densely populated human settlements or agricultural areas in Europe. As a result, structures to prevent erosion were built by water management agencies. But this led to the disappearance of the classic habitat of *Palingenia* mayflies in many river systems. The larvae feed by filtering organic matter and algae from the water moving through their burrow and serve as an important food base for a variety of fish. Water pollution further exacerbates the effect of habitat loss, and the decline of larvae also threatens higher trophic levels along the food web.

New threats

The mayflies, however, had found their fortune in traditionally "unfortunate" countries in Eastern Europe, where rivers were more or less left alone. However, new developments threaten even the remaining range of the species. The unpredictability of water supply and long periods of drought increasing with frequency under climate change are resulting in an absence of the spring and early-summer floods that once rejuvenated the eroding clay riverbanks. As a result, sediment was deposited in the outer arches of riverbanks. This prevented the larvae from digging their burrows in the riverbank.

Another recent threat is that swarming often occurs now over several days, rather than on one "big day". When there are fewer individuals swarming over several days, predators can catch more of them proportionally than they would during one big, swooping swarming. If predators are able to take, say, 50,000 individual mayflies per day, a swarming of 1 million mayflies distributed over 10 days will leave half a million mayflies to reproduce. But if the swarming occurs on one day, this number will be 950,000. This is a huge difference in the number of individual mayflies reproducing in the population. These processes may explain recent observations that the number of individual mayfly swarming has declined in many sections of the Tisza.

While the mayfly swarming has long been a celebrated local event along the rivers where it is still found, large-scale conservation attention has evaded this species. For example, the species is not listed in the Habitats Directive, the cornerstone of non-bird species conservation in the European Union. However, the recent listing of the mayflies and their spectacular swarming as a "hungaricum" (worthy of distinction unique to the country of Hungary), may change this. We expect increased attention to the species and its declining conservation status.

There is reason to hope that water management interventions that damage classic habitats will not be implemented. In areas where this is possible, restoration of the mayflies' habitats by removing riprap and other stone structures will also become necessary. However, larger-scale thinking and coordination are necessary to ensure the long-term persistence of the species. We need to preserve or restore natural and semi-natural habitats, mainly forests, in the upstream areas of the catchment to reduce the unpredictability in water discharge. All this requires trans-boundary cooperation between the countries sharing the Tisza catchment area. Such cooperation has proven successful in alleviating the effects of river pollution recently. We need similar, consistent efforts of cooperation to address the threats to the mayfly – the hidden beauty of many meandering rivers.

Szabolcs Lengyel *is a conservation ecologist at the Centre for Ecological Research in Hungary,and conducts research to inform the protection of threatened grassland and wetland species and habitats.*

Leeza John *is a Kerala-based freelance illustrator who loves exploring natural textures and the possibilities of creating art with everyday objects. Hence, her work is varied and constantly evolving.*

Special Section
Freshwater Conservation

'Why we need fresh water – and also what lives in it

Author **Ferenc Jordan** | *Illustrator* **Parul Sinha**

Freshwater ecosystems have two important features.

First, they are surrounded by land and very strongly embedded in terrestrial ecosystems. Second, they generally face strong human interaction, stronger than the high seas. These factors mean that we can utilize them in many ways. It also means that they are important for the rest of the biosphere in many ways. Being socio-ecological systems that interconnect distant areas and offer multiple ecosystem services, the conservation of freshwater bodies is full of compromise.

A lake, a river or a pond has clear borders. In a sense, these are island-like locations, isolated in terrestrial landscapes. Yet, in a functional sense, the ecological processes in freshwater communities quite strongly link them to the surrounding terrestrial systems. In fact, the size proportion of coastal areas is much larger than in the sea and these riparian habitats host a huge diversity of organisms.

Instead of creating better and more accurate definitions, and trying to conceptually separate freshwater bodies from the terrestrial world (see the traditions of limnology or hydrobiology), it would be wiser to explicitly study their soft borders and recognize the importance of the cross-disciplinary grey zones between water and land.

Freshwater ecosystems and their networks

Whenever several components are linked and we wish to understand the consequences of these connections, network analysis is a good first step.

Freshwater ecosystems are parts of two kinds of networks:

a) The habitat network, where water bodies are linked to each other across landscape ecology.
b) The food web, containing clearly aquatic, clearly terrestrial and shared components (either living organisms or nutrient flows).

The freshwater habitat network, at the first glance, is a continuous system of wet habitats, creeks turning to rivers and lakes. The continuity is not absolutely necessary (e.g. tarns). But materials and organisms can also jump between wet locations. For example, transported by water birds, travelling either on their legs or in their guts. This is one reason why rivers should not be regarded as perfectly directed systems. Organisms clearly travel in both directions, either in the air or in the water. Moreover, clearly, several aquatic organisms can survive on land. So they are simply able to move across the dry matrix (i.e. amphibians, snakes). In order to better understand the conservation challenges for freshwater ecosystems and aquatic organisms, it is crucial to better monitor, model and really assess these processes and spatial aspects. It does make a big difference to be really isolated or just embedded in a heterogeneous and mixed landscape.

Freshwater ecosystems, just like any other, have no clear borders. The fish and the mole have really poorly overlapping habitats, but even they can be indirectly interacting across a chain of other organisms. Several studies have shown surprisingly strong interactions between aquatic and terrestrial species. These are cascading and, after all, the aquatic food web and the terrestrial one are just two compartments of the big one. In fact, this recognition was one of the motivations for creating landscape ecology. Apart from the geographical one, this was its functional *raison d'être*. Researchers have shown how trophic cascades across the water-land boundary: predatory fish reduced the amount of dragonfly larvae, less adult dragonflies consumed less pollinator insects, and terrestrial plants were less pollen-limited and flourished. The myriads of cascades like these connect the two officially totally different habitats and, given the diversity of riparian communities, this is more the rule than the exception.

For people interested in categorical thinking and classification, landscape ecology and all processes inter-connecting different systems are disturbing. For people who prefer to think functionally, this is ecology – and not surprising at all.

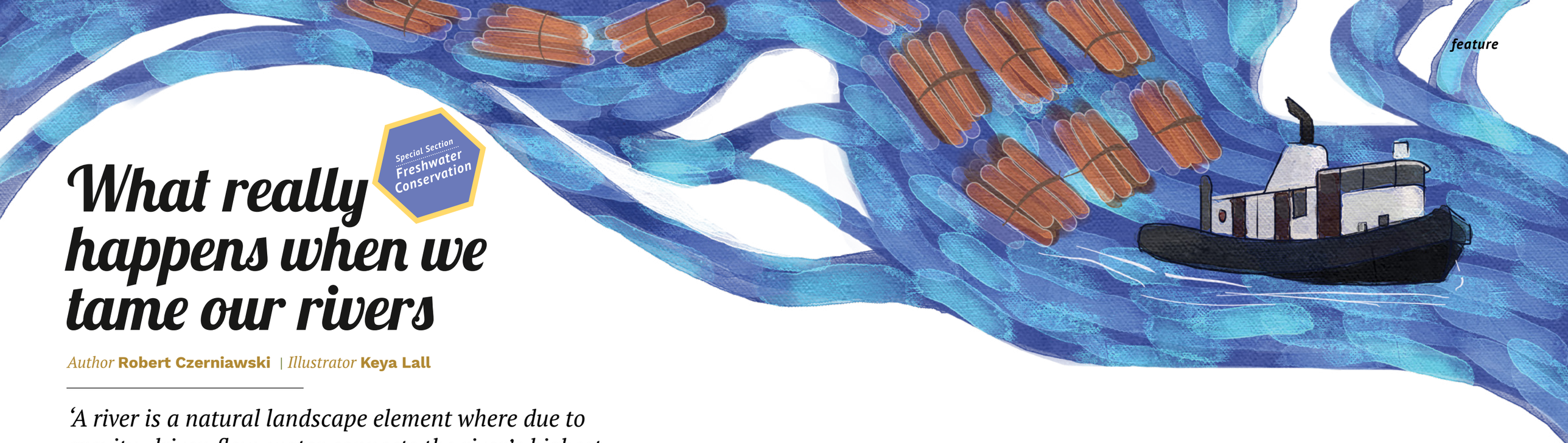
Positive and negative, as well as strong and weak effects are spreading in these interconnected networks. Perturbations (e.g. invasion, pollution) generate point-like or system-wise effects. In order to monitor, assess or predict these, one can perform modelling efforts. Better understanding their complementary nature will only help to make ecosystem models really predictive and applicable.

Extinction and invasion are often considered as two major symptoms of climate change; two major dangers for natural ecosystems. Global extinction is clearly a tragic loss. Local extinction and invasion are mechanisms of compositional shifts in any ecosystem and, ultimately, these are the ways in which ecosystems adapt to altered conditions. In a sense, these are not the problem, but the solution.

As a key ecosystem service from a human perspective, the healthy functioning of the whole, spatially and functionally interconnected system is crucial for water quality. The cycling of nitrogen and phosphorus strongly influences algal production and the composition of the aquatic microbiome is strongly sensitive to water chemistry and affects several higher-level organisms. Overall, the whole food web (or trophic network) is a stage where key players act, either facing the challenges or buffering and balancing external effects. But, after all this, what is external? This is the question.

Ferenc Jordan *links the parts to the whole. He is searching for the most important species. Otherwise, he is the director of a research institute.*

Parul Sinha *is an illustrator/visual artist based in Delhi. She works primarily in watercolour. Her works are usually an amalgamation of illustration with a hint of absurd that makes familiar things appear estranged from day to day experience.*



Special Section
Freshwater Conservation

What really happens when we tame our rivers

Author **Robert Czerniawski** | *Illustrator* **Keya Lall**

'A river is a natural landscape element where due to gravity-driven flow, water connects the river's highest point with the lowest one.'

Even though this definition sounds complicated, it is not difficult to imagine such a structure.

But the simplest and the shortest definition I have ever heard was that of a student's response to an exam question, "What is a river?" One of my students replied, "A river is an area of flowing water whose length is greater than its width." This short and simple response covered all the concepts necessary to imagine this landscape element. By considering this definition from the lens of how water systems actually work, we can see how this natural element presents an immense potential for use. All this is possible due to the energy produced by gravity-driven water flow, commonly known as 'the water current'. The greater the current velocity, the higher the energy that may be harvested from the river.

But utilizing high-speed water currents is not always profitable. If it was, rushing mountain streams would have been massively used for this purpose. What matters is also the amount of water, or the 'flow discharge'. Therefore, humans more often use the energy of larger rivers, rather than small mountain streams.

Rivers constantly generate energy. Hence, for millennia, humans have used rivers as inland waterways for carrying goods on vessels, and for transporting goods straight to the water surface, e.g. by timber floating. Lower water tables ensured that water is transferred via aqueducts to rich mineral grounds. Here, the extra amount of water ensures a good crop. In the past, such practices were implemented in areas adjacent to the Nile, the Tigris-Euphrates river system, and more recently, in the Volga basin in Russia. Finally, electric energy harvested from the water current has been used for centuries to power structures and devices that facilitate the production of various goods, such as watermills, fishponds, forges, and today, modern hydroelectric power stations.

Without a doubt, the river current is one of the cleanest unconventional energy sources. Given current declarations and actions taken by key energy production units, and the fact that coal is the largest energy source worldwide, it seems unlikely that other unconventional energy sources might be used more widely than coal in global energy production.

Contrary to other unconventional energy sources, such as solar and wind power stations and biogas plants, water is a constant resource whose power depends on the aforementioned water flow. The more water there is in the riverbed, the greater the flow. To keep the water at a level sufficient enough to fulfill power requirements, humans apply water lifting methods and create dams in riverbeds. Falling from a certain height at high speed, water strikes the turbines and propels them. Then the energy produced by the generator flows into a power network.

The energy harvested from shifting river current speed is a crucial aspect of the economy.

The question is whether environmental losses caused by the harvesting of this pro-ecological energy can be offset by the profits. Given all this, shouldn't this energy harvesting practice not stir controversy? It appears, it does. River ecologists believe that any changes to the riverbed, such as river damming, leads to a transformation in the habitats of plants and animals. This, in my opinion, is not even the most detrimental consequence of all. A river is a type of an ecological corridor where active and passive organisms swim or drift in search for food, and seasonal or reproductive habitats. Organisms like fish and tiny invertebrates cannot migrate when dams are constructed.One of the greatest and most well-known impacts of dams is on the population of migratory fish.

Migratory fish travel from seawater to freshwater, or the other way around, for spawning (release of sperm and eggs into the water for reproduction). Among these, we can distinguish anadromous and catadromous fish. Anadromous (from ana - 'up' and dromos - 'running' in Greek) fish, such as salmonids, migrate from the sea to shallow rivers and streams for spawning. Whereas catadromous (from cata - 'down' and dromos - 'running' in Greek) fish, such as the eel, migrate from freshwater to seawater for spawning.

Anadromous fish face the most difficulties in their spawning migrations. Dams pose a grave danger to these fish, because if they cannot swim upstream to their spawning grounds, they will not be able to reproduce. The fish will not have the chance to propagate the species, and in nature, this leads to the weakening of one link of the food chain. This creates irreversible alterations in the entire ecosystem.

The situation of migratory fish, especially anadromous fish, wherever river dams have been constructed is alarming. In numerous countries, the population of these fish is critically endangered, and their existence depends solely on human activity. Poorly constructed dams that do not allow for fish migration to spawning grounds are the main cause of this situation. The survival of the species in its environment primarily depends on whether they reproduce in the natural habitat. Today, in numerous countries, the existence of anadromous fish depends on anthropic activity because humans literally obtain the fish by artificial spawning. The situation of the eel is far less dramatic because the species cannot be produced by artificial spawning.

Today, it is crucial for dams to be equipped with fishpasses that allow fish to successfully reach the upstream to spawn. A fishpass functions like a corridor that allows fish to bypass a river dam. Currently, regulations in several developed countries prevent the construction of impoundments for energy harvesting without a fishpass in riverbeds with migration. Fishpasses are not a new solution and have been incorporated into dam construction over the last few decades. Nevertheless, it should be noted that these passes do not guarantee that all fish migrating upstream reach their destination.

Some consider dam reservoirs to positively impact rivers. This is true on one hand because river dams may increase water retention. However, this also means that a larger quantity of water evaporates than it reaches downstream. Sure, dam reservoirs allow for the river to be used for energy harvesting. But without a doubt, they negatively affect the river's natural state. Not only do they present migration obstacles, but also increase the amount of suspension in the water. Sediments of drifting organic matter accumulate in dam reservoirs and annually increase in amount. Consequently, dead organic matter releases biogenic compounds that change the trophic state of water. If river damming was a beneficial process, then nature would have already created a mechanism allowing for the creation of such conditions.

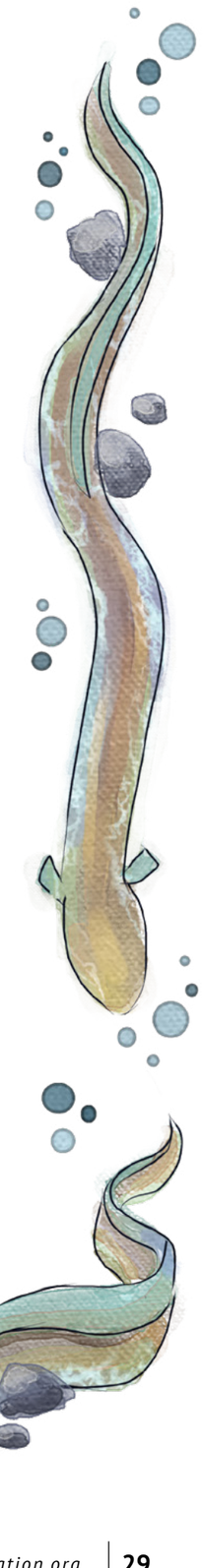
Water retention in dams and reservoirs is not even the slightest bit as effective as retention in soil or marshlands. In addition, the costs of constructing enormous structures for this purpose are remarkably high. Nevertheless, efficient water retention in soil is not possible today due to extensive drainage and construction on land. We can achieve water retention for navigability by restoring the natural state of the riverbeds (renaturalization). Straightening and deepening of channels, and regulation of catchment areas pose further problems for rivers.

Such maintenance practices are performed either to reduce flood risks or to improve transport conditions. But in reality, they achieve the opposite. Certain maintenance practices that change the natural state of rivers directly or indirectly impact previous renaturalization efforts. We could say that these contrary practices are performed in the same areas, which seems irrational. First, vast sums are invested into naturalization, and then considerable financial resources are invested in destroying it.

The potential of rivers should be utilised. However, this should not be done everywhere and at all times, and especially not using means that depend on human convenience. Nature is not our partner. It is us, humans, who are part of nature and not the other way around. Even though the human brains is more developed than those of other animals, this does not give us the right to make decisions for them. And most certainly humans should not make decisions in the name of natural processes that take place in well-functioning ecosystems. It is as if someone tried to make healthy humans happy by imposing on them unnecessary experimental treatments. While humans can refuse such treatment, animals cannot. Of course, public consultations and talks with objectors of various investment projects are being held. And at some point, both parties of the dispute reach a consensus through compromise. But at the end of the day, even those parties are deciding for nature. But this is merely a compromise between both parties of the dispute, and not the investment supporters or the natural state of things. Nature never agrees to compromise with humans. At the very most, nature compromises with itself.

Even the slightest alterations to the natural environment are still alterations. If an alteration changes the river, nature, as the unconsulted party, will surely show its strength. Currently, we are witnessing the revenge of rivers. Draining and land melioration leads to low levels of water in rivers during the year, and sharp rises during periods of rainfall. Regulation, straightening, and laying concrete in numerous sections of rivers increase the speed of water currents. This leads to the destruction of existing structures, such as bridges at narrower parts of the river. Talk about digging your own grave.

But probably the worst thing is that supporters of such negative undertakings try their best to fool the world of their actions' deadly consequences on nature.. According to numerous articles quoted by the supporters of river transformations, barges and dams increase biodiversity. Even if this is true, it is still a fraudulent manipulation. This is because typical riverine species are replaced with more ubiquist species, i.e. species that tolerate transformation. This is artificial manipulation.



Any experienced aquatic ecologist or aquatic environmental engineer can easily make changes that will lead to an increase in biodiversity. Even a vehicle tire left at the bottom of a stream has an impact on the number of animal species found in that section. It is plain and simple. The bigger the number of habitats and niches, the more the species present. A tire is an example of such a niche. Pondings, meanders, overdeepenings, and rapids caused by renaturalization are other examples of niches.

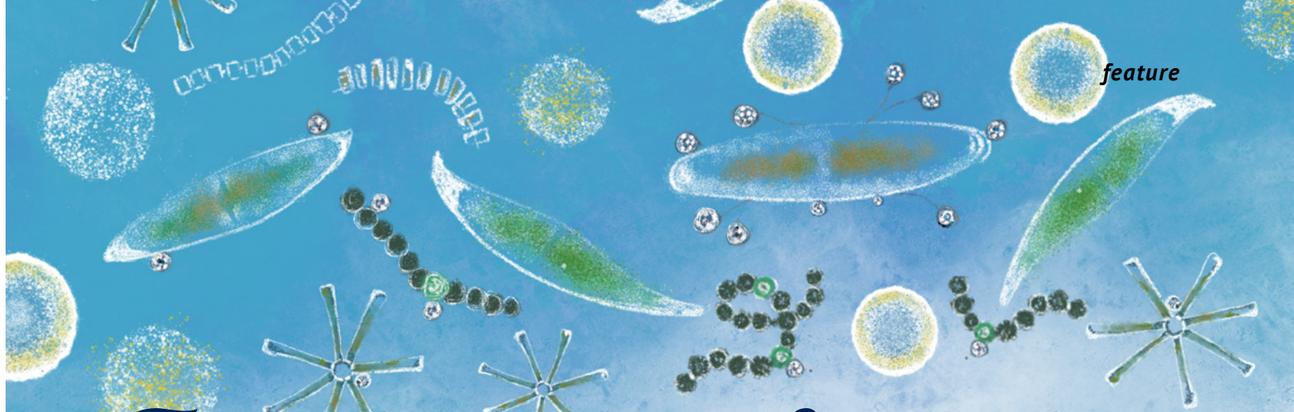
Naturally, climate change significantly affects rivers. Our role is to convince people that humans also have an impact on these changes. However, current climate and energy policies make speaking to laypersons challenging. Even if we succeed in convincing a large number of people, the majority remain skeptical about this issue.

We should ask the question whether humans are allowed to change nature entirely, and just like certain animal species, can they freely and consciously, or maybe even unintentionally, modify its current state? The beaver is a species that changes and adapts its environment to its needs. Humans are also a part of nature, and evolution gave us the abilities and skills to completely dominate other species and landscape elements. However, in the process of evolution, we also developed reasoning and questioning minds that have the ability to innovate for non-survival purposes. In the light of the current anthropic changes in the environment, the command to 'subdue the Earth' is no longer valid for at least a 100 years, or maybe even abused. It would seem that the Earth will not subdue any more.

It is necessary to conduct thorough studies to analyse environmental conditions, prior to the construction of hydroelectric power stations and the deepening of riverbeds to develop inland navigation. This would allow us to provide solutions that minimize human impact on the natural environment. It would seem that this clean, pro-ecological river energy would reduce greenhouse gas emissions, but without doubt, it would also decrease the environmental value of river ecosystems. It is crucial that scientists, administrative staff, business representatives, and ecologists agree that humans have a negative impact on rivers. Even though reaching a compromise poses a challenge, there is little doubt that we have no option but to achieve this. If making up for the damage we've caused is too cumbersome, well, cry me a river.

Robert Czerniawski *is a river ecologist working in the Department of Hydrobiology at the University of Szczecin, Poland.*

Keya Lall *is an illustrator who finds her inspiration in creatures both real and imagined. She likes to experiment with mediums, from digital to traditional.*



The bright side of chytrid algal parasites in pelagic food webs

Special Section Freshwater Conservation

Author **Andras Abonyi, Serena Rasconi, Martin Kainz, Robert Ptacnik**
Illustrator **Megha Vishwanath**

We are pretty sure that your first thought on hearing the word 'parasite' is not something you associate with being pleasant.t. But that's no reason to dismiss parasites, and particularly not their usefulness. Sure, they are small and hideous and do bad things to other lifeforms. But like most creations of nature, parasites can be beneficial too.

Let's take the example of chytrid algal parasites. To understand them, we need to understand how pelagic food webs work.

First, the open water of lakes and oceans is called the pelagic region, which contains highly diverse microscopic organisms living in suspension, called plankton. Planktic organisms able to photosynthesize are functionally similar to plants and are called phytoplankton. Phytoplankton produces as much as half of the oxygen on the planet. They are at the very base and foundation of the food web in lakes and oceans, while they themselves get eaten by microscopic consumers called zooplankton. The phytoplankton-zooplankton interface has a direct bearing on the entire pelagic food web. An efficient dietary energy transfer from phytoplankton to zooplankton is central for organisms at higher trophic levels such as fish.

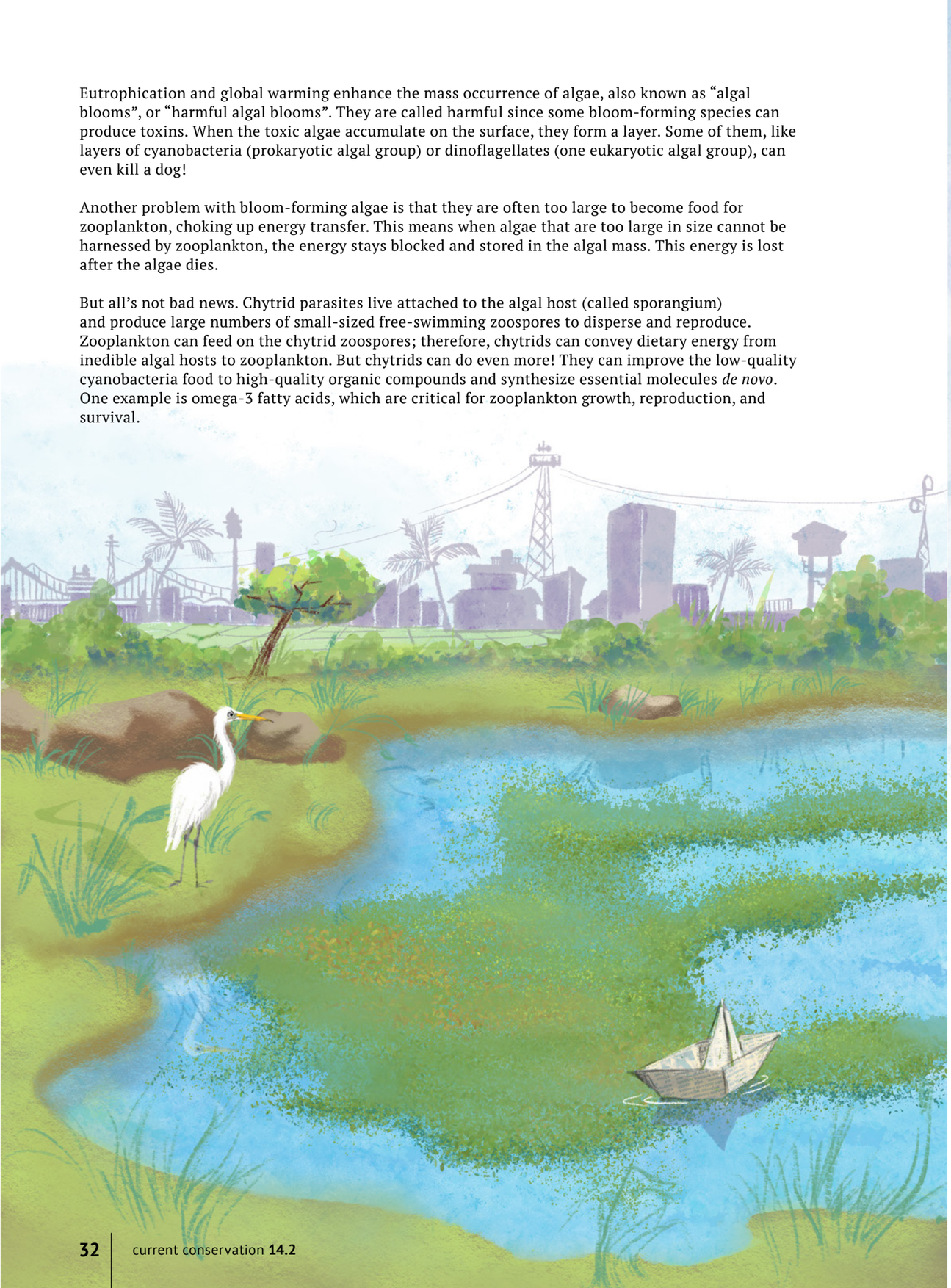
The high diversity of so far poorly characterised pelagic microscopic organisms also includes aquatic fungi. Recent progress highlighted the importance of alternative trophic pathways in pelagic food webs with chytrid algal parasites as key elements. But what are chytrids, really? Chytrids are fungi, and most of them act as parasites infecting a wide variety of phytoplankton species. One peculiar thing about them is that they are rather host-specific. This means, one chytrid species infects one or a few phytoplankton species.

So chytrids infect phytoplankton, while zooplankton can feed on both phytoplankton and their chytrid algal parasites. Therefore, chytrids make the pelagic food web a bit more complex, and we should be very much pleased about that. Primarily, when zooplankton can only feed on a few phytoplankton species due to the massive dominance of few species caused by human impacts like anthropogenic eutrophication (that is, the release of large amounts of nutrients to the water due to agriculture or inefficient wastewater treatments).

Eutrophication and global warming enhance the mass occurrence of algae, also known as “algal blooms”, or “harmful algal blooms”. They are called harmful since some bloom-forming species can produce toxins. When the toxic algae accumulate on the surface, they form a layer. Some of them, like layers of cyanobacteria (prokaryotic algal group) or dinoflagellates (one eukaryotic algal group), can even kill a dog!

Another problem with bloom-forming algae is that they are often too large to become food for zooplankton, choking up energy transfer. This means when algae that are too large in size cannot be harnessed by zooplankton, the energy stays blocked and stored in the algal mass. This energy is lost after the algae dies.

But all’s not bad news. Chytrid parasites live attached to the algal host (called sporangium) and produce large numbers of small-sized free-swimming zoospores to disperse and reproduce. Zooplankton can feed on the chytrid zoospores; therefore, chytrids can convey dietary energy from inedible algal hosts to zooplankton. But chytrids can do even more! They can improve the low-quality cyanobacteria food to high-quality organic compounds and synthesize essential molecules *de novo*. One example is omega-3 fatty acids, which are critical for zooplankton growth, reproduction, and survival.



So, chytrid algal parasites are out there to help nature function. They support pelagic food webs by recycling algal biomass and making essential dietary molecules available for other consumers. They can constitute a fundamental resource in case of harmful algal blooms. Humans, hopefully, are now much more aware of the negative impacts of eutrophication and global warming on aquatic ecosystems than before. As for the chytrids, there might be much more to do, especially to realise and understand their quantitative importance in pelagic food webs.

While in the past we asked: “why chytrid algal parasites are there”, “what do they do?”, we are now after a new question: “are there enough chytrid algal parasites to support pelagic food webs?”.

Andras Abonyi *is working to quantify the importance of chytrids in aquatic food webs at WasserCluster Lunz, Lunz am See, Austria, in collaboration with* **Martin Kainz** *and* **Robert Ptacnik**, *leaders of the LipTox and AquaScale groups (FWF, “FungUp”, P 30419-B29).* **Serena Rasconi** *works on carbon cycling and species interactions at UMR CARRTEL, INRAE, France.*

Megha Vishwanath *is an illustrator and bit-of-a-chatterbox, she loves writing rhyming verses and drawing animals, people and trees. (Self/)Published for Children’s content, Magazines and Comics, her toughest client is her toddler for whom she draws at the drop of a hat.*

The Planthood of Persons

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

Reading conservation papers these days is like exploring a new galaxy. We are not just discovering new worlds, we are being forced completely to re-imagine what life constitutes, and what self and identity actually mean.

And nowhere is this truer than with plants. Lively ontologies rumbunctiously jostle the fertile imaginaries of more-than-plant personhood. They playfully imbricate otherness into rhyzomatic structures, joining cosmologies within and through connection. Variegated subjectivities intersperse across and within species boundaries, defying traditional taxonomies. These are networks, if you will, that are not just *animate*, but *plantimate*.

These interests have a distinguished pedigree. Jagdish Chandra Bose, a doyen of early 20th century science, strapped vegetables to machines to measure their electrical impulses, demonstrating that carrots winced as they were sliced and convulsing cabbages gasped in boiling water. He even showed that they grew better when they listened to good music. Bose argued that plants felt both pleasure and pain.

Nearly a century later, it turns out he was onto something. Plants do emit ultrasonic sounds when cut[1]. They respond to the buzzing of bees. They might well ask:

> *'How are we not like you?,*
> *If you cut us, do we not scream[2]?,*
> *If you tickle us, do we not giggle?,*
> *If you introduce us to sport pitches,*
> *do we not scream with joy when trodden on by famous cricketers?'*

Thus has emerged the campaign to confer personhood upon plants. Now this creates a conundrum for a certain section of society. Currently at the top of Mount Morality are those who believe that no animal shall serve any human purpose whatsoever. Every animal is a person, has a right, and must not be used or abused in any way.

But, if adoration of animals comes, can passion for plants be far behind? After all, if plants have personhood too, then we must go the whole hog (or potato). We must democratise trophic webs and introduce participatory decision making into food chains down to the last blade of grass.

But before we embrace our new brethren, before we dare to welcome them to our domain, we need to take a long hard look at ourselves in the mirror. There is an ugly shadow of patriarchal and imperial domination looming over this beautiful garden of exploration. Our quest is for others be like ourselves, be recognisable to us, controlled by us. We are the original, they the facsimile. But who are we to say that plants should share our exalted status?

[1]Khait, O. et al. (2020) Plants emit informative airborne sounds under stress bioRxiv 507590; doi: https://doi.org/10.1101/507590
[2]For incontrovertible evidence, see The Very Things (1984) The bushes scream while my daddy prunes. Reflex Records.

The personhood of plants? Indeed not! Why would any right thinking plant want to become a person? Do plants want to share our history of despoilation? Are we trying to make the trees responsible for Amazonian deforestation? Petunias for the conquest of the Americas? Should grasses and flowers take the blame for feudalism, patriarchy and the horrors of modernity?

We must reverse this thinking. It is time we dignified the adventurous transgressive multi-species project by recognising the planthood of persons. At one time, it was choice abuse to accuse a person of having the IQ of a plant. Now it should appear to be an honour. And let us be generous with this distinction. Let us seek to confer planthood upon every person. Perhaps we all, if we try hard, deserve to be recognised as plants. We can share their rootedness, their longevity, their fecundity, their seasonality. Their ability to stay in one place all the time and wave around in the wind.

In fact, we would go further. It is only be recognising the innate vegetal state of particularly visible sections of human society that we can characterise its true condition. The corporate elite is plainly a strangling fig. Old cabbages, fungal growth and mould dominate our political leadership. You are fortunate indeed if you can look at your President without instantly reaching for the salad dressing.

But, my friends, these are more-than-metaphors. These are actual physical conditions. Real chlorophyll surges through our politicians' veins. It is only when we see our leaders as needing a gentle watering twice a day, and a very thorough dose of manure, that we can properly appreciate our place in the cosmos.

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