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# current conservation

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Current Conservation carries the latest in research news from natural and social science facets of conservation, such as conservation biology, environmental history, anthropology, sociology, ecological economics and landscape ecology.

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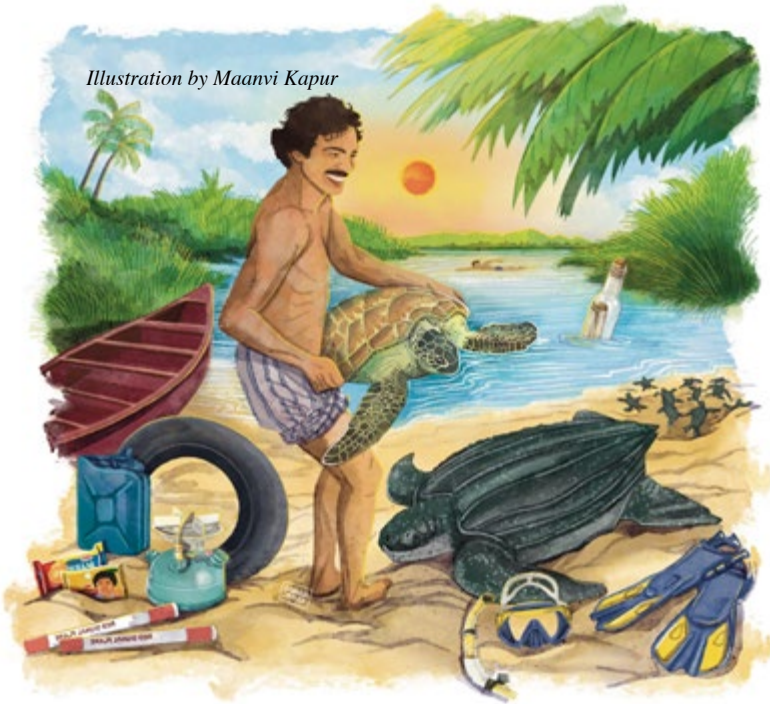
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## editor's note

Cover art **Sayan Mukherjee**

Welcome to the latest edition of Current Conservation.

In the featured story of this issue, Trisha Gupta offers a glimpse into the enigmatic lives of rhino rays—strange-looking ancient relatives of sharks—and the researchers studying these endangered cartilaginous fish. Nupur Kale and Andrea Phillott expound the importance of evidence-based practices in sea turtle conservation with a focus on hatcheries. Abel Job Abraham and Diya Deepak introduce us to Kalumangothi, a fisherman from the Lakshadweep archipelago whose knowledge and wisdom extend beyond individual species to the ocean as a whole.

Women, while being disproportionately impacted by environmental degradation and climate change, are underrepresented in conservation efforts. Wanjiku Kinuthia spotlights a few trailblazing women who are leading the way in East Africa's marine space, and Gathoni Mwai showcases how an eco-credit scheme is improving the lives of countless women in coastal Kenya—where the poverty rate is many times the national average—while also incentivising conservation.

This year has seen the tragic passing of two cherished colleagues and friends: Anne Heloise Theo and Satish Bhaskar. Both left their mark on marine biology and conservation, Anne with her groundbreaking research on mixed species groups of reef fish and Satish with his extensive work on sea turtles across India as well as West Papua, Indonesia. We dedicate this marine-themed issue to them.

— **Devathi Parashuram**

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# Tried and tested:

## The role of evidence-based practices in sea turtle conservation

Authors **Nupur Kale & Andrea D. Phillott**

Illustrator **Harshavardhan Behura**

*Drive along the Ratnagiri coast in western India in the early months of any year, and you are sure to come across a fenced-off enclosure on many of its beaches. The inside of the enclosure is usually dotted with small, evenly-spaced placards, while outside a fluttering banner or a wooden board declares it to be a sea turtle hatchery. Hatcheries, in general, are synonymous with sea turtle conservation the world over. But the efficacy of these structures in protecting sea turtle eggs and hatchlings (baby turtles) depends on whether the hatcheries follow best practices. As a conservation technique, freshly laid nests that are moved from their original locations on exposed beaches to protected hatcheries should—in theory—produce more hatchlings than nests that are left unprotected. With fewer resources available and an increasing urgency for conservation actions to succeed, how do we know if this conservation strategy works?*



## Evidence-based conservation

For those of us familiar with the crime genre, evidence is a term used mainly in legal proceedings that eventually leads to a person being implicated (or not!) in some wrongdoing. Similarly, evidence plays a crucial role in many other action-based disciplines, including medicine, education, social work, and biodiversity conservation. The concept of evidence-based practice originated back in 1981 when a group of epidemiologists, led by Dr. David Sackett, suggested using evidence in medical sciences to choose the best treatment for their patients. They recommended that physician decisions needed to be informed by a well-rounded, systematic evaluation of available medical literature. Later, it came to be known as evidence-based medicine, a phrase coined by Dr. Gordon Guyatt and his team, and the practice served as a tool for physicians to determine the best course of action to reduce patient ailments. In the past few years, there has been an expansion in the use of evidence-based practices to aid in decisions for biodiversity protection and management.

**Like medicine, conservation can be considered a ‘crisis discipline’ in which decisions must be made in a short time period and, sometimes, with limited information.**

In 2001, Pullin and Knight first suggested the use of evidence to inform conservation actions, backed by scientific studies and not merely based on prior experience or instinct. The following years saw a rise in the number of reviews that were conducted to evaluate conservation strategies and determine their efficacy. Just like for medicine, it was called evidence-based conservation or EBC, and was adopted by prominent research groups, giving rise to online repositories like *Conservation Evidence* that compile evidence summaries from scientific studies to determine the success of conservation strategies for different taxa or ecosystems. Such repositories provide a source of validated information for quick access by conservationists and managers. The main intention is to identify the factors that lead to conservation success, which can then be used to promote its effective usage and target funding towards it. Examples for evidence-based practices in conserva-

tion include the evaluation of spatial strategies like the creation of protected areas, celebrity endorsement in marketing conservation, and the success of techniques used in sea turtle hatchery management!

## Sea turtle life: On land and in the sea

As marine reptiles, sea turtles spend the better part of their lives feeding and resting in the sea. Their experience on land is short—limited to the time after they emerge from their sandy, underground nests as hatchlings and scramble across the beach to enter the water. Male turtles rarely ever return to land once they have left as hatchlings, but adult female turtles make the journey back to the natal region where they hatched, to lay eggs of their own. Despite the limited amount of time sea turtles spend on land, it is easier for us to protect the eggs laid on our beaches than to reduce threats to turtles at sea.

## Sea turtle hatcheries: A conservation tool

Hatcheries are a popular *ex-situ* (i.e., away from the natural location) conservation strategy widely used across the world. A hatchery is usually a secure enclosure on or close to the nesting beach where at-risk sea turtle nests are relocated (i.e., moved from one location to another). Mainly used to combat threats to sea turtle eggs, including depredation by animals, poaching, and beach erosion, hatcheries are also a great resource to raise awareness about sea turtles and generate tourism, thus boosting the local economy by providing a source of income for many coastal communities. Based on its purpose, local materials, and the number of clutches of eggs that need to be protected, the enclosures come in all shapes and sizes.

**A hatchery used only for conservation purposes is most likely to be a simply designed temporary arena constructed from wooden poles and mesh, with space to incubate relocated turtle eggs. Hatcheries that operate with additional objectives of ecotourism or to create awareness may expand their enclosures to include small information centres,**

**tanks to retain hatchlings or hold injured or disabled turtles for viewing, and tend to be permanent structures.**

Hatcheries operate on the core principle of protecting relocated eggs. But while moving these eggs from point A to point B may sound easy, it is a long process involving multiple steps that starts with locating a natural nest, removing the eggs, carrying them to the hatchery, constructing an artificial nest, and monitoring the number of hatchlings produced. Even the construction of a hatchery requires several considerations, the first and foremost being whether it is even required in the first place! After that, most of the steps in relocating eggs require decisions on when and how to conduct and/or complete a particular activity. These decisions are driven by the various biological processes behind the

development of turtle embryos in the eggs, which have been studied extensively and have helped experts in determining the basic dos and don'ts when employing hatcheries. Guided by these practices, practitioners and managers have used hatcheries to protect and improve their local sea turtle populations.

However, simply employing a hatchery does not guarantee a victory for conservation. The real measure of success lies in the number of eggs that hatch and the number of hatchlings that then enter the sea—all of which are influenced by the decisions made and the precision with which the best hatchery practices are followed. So, where does India stand when it comes to sea turtle hatcheries and their success?







## Assessment of hatcheries in India

Three years ago, we began a study on hatchery practices in India. Considering India's 7,500-km long coastline, we knew there would be a lot of hatchery managers and workers to reach out to for information. The main objective was to compare the best practices described in guidelines for hatcheries with real-life practices in collection, transportation, and incubation of eggs as well as the holding and release of hatchlings. With a few misses but mostly hits, representatives from 36 hatcheries agreed to participate in our survey and provided considerable information that improved our understanding of hatchery practices in India.

Responses revealed that some of the techniques used by the hatcheries did not align with practices recommended by experts and supported by scientific evidence. We found that most hatcheries were temporary structures, set up to mainly protect sea turtle eggs from predators, and which were moved annually so that relocated eggs were buried in clean sand. Other than protecting the eggs, some hatcheries were also used for

ecotourism and to spread awareness about sea turtles and their conservation among local communities. The hatchery nests were spaced as recommended (no more than one nest per square metre) to ensure that the heat and respiratory gases generated by one clutch of eggs did not affect another. However, a lot of nests were moved to the hatcheries just within or outside the accepted time limit for moving eggs (six hours), which potentially affected their chances of survival.

The depth of nests in some of the hatcheries was also different from the average nest depth for that particular species. Depths can influence the temperatures within the nest, and shallower or deeper relocated nests will affect the percentage of eggs that survive and the sex of hatchlings during the development stage. The most concerning finding, however, was that the percentage of eggs that successfully hatched out of the relocated clutches was no different from those left unprotected on the beach. This was observed to be true not only for hatcheries in India, but also for those in other countries in the northern Indian Ocean region. Further, our results also highlighted a lack of regular

training in hatchery techniques for managers and workers, including an explanation of the scientific logic behind every practice, and limited resources that restricted the capabilities of the hatcheries to always follow best practices, thus minimising the conservation outcomes.

Based on our findings, we recommend that hatcheries must alter their practices depending on the requirement to protect nests in that particular region. This includes reducing the time between when eggs are laid and reburied in a hatchery, decreasing nest density within the hatchery, and ensuring suitable nest depths. There is also a need to periodically train hatchery workers to refresh their knowledge and to emphasise proper record-keeping of details such as hatching success and hatchling emergence. Finally but most importantly, conservationists and hatchery managers must consider *in-situ* protection of eggs, i.e., leaving eggs in their original location and/or using additional strategies like building small fences around individual nests. The material of the fences can be modified depending on the type of prevalent threats, thereby reducing the need for extra manpower and resources in moving eggs to a large hatchery.

## Conclusion

In response to global biodiversity loss and the climate crisis, conservation activities around the world have increased to reduce threats, improve wild populations of plants and animals, and preserve our natural resources.

## Further Reading

Phillott, A. D., N. Kale and A. Unhale. 2021. Are sea turtle hatcheries in India following best practices? *Herpetological conservation and biology* 16(3): 652–670.

Downey, H., T. Amano, M. Cadotte, C. N. Cook, S. J. Cooke, N. R. Haddaway, J. P. G. Jones et al. 2021. Training future generations to deliver evidence-based conservation and ecosystem management. *Ecological solutions and evidence* 2(1): e12032.

However, despite this urgency, there are limited resources for conservationists and managers, who struggle to achieve the double aim of conserving biodiversity and safeguarding the welfare and livelihoods of people living in the area. In this context, there is very little margin of error and resources have to be smartly used on strategies that will ensure a high likelihood of success. And this is where evidence-based practices in conservation or simply evidence-based conservation come in handy.

Knowledge of evidence-based conservation, combined with experiential learning, will help us make informed decisions and assure maximum success in our work. Practitioners are already advocating for the inclusion of evidence-based practices in curricula, to train future generations of conservationists and natural resource managers in critical analysis early on. Many conservation funders now include 'Monitoring and Evaluation' as a reporting requirement for projects that receive their funding. As the call for further conservation actions gathers momentum, it is important that conservationists and managers not only assess the effectiveness of their own activities, but also examine the best use of their efforts and resources to ensure that every action contributes to protecting biodiversity.

**Nupur Kale** is a Project Coordinator at WCS-India. She has predominantly worked on sea turtles and keeps going back to them despite the allure of corals and reef fishes.

**Andrea D. Phillott** conducts research on sea turtle biology and conservation and teaches conservation biology, ecology, and environmental studies at FLAME University in Pune, India.

**Harshavardhan Behura** is freelance illustrator and Application Developer. He works as a developer for SAP labs. He has his own world of mesmerizing creations.





# Trailblazing women in East Africa's marine conservation space



Author **Wanjiku Kinuthia** | Illustrator **Kruttika Susarla**

The role of women in marine conservation in East Africa is critical, as they are disproportionately affected by the impacts of environmental degradation, and their contributions to marine conservation efforts are often overlooked. Female leadership is especially important in this context because women bring unique perspectives, experiences, and skills that are essential for the success of marine conservation initiatives. Women often have a deep knowledge of the natural resources in their local areas, which can be used to develop effective conservation strategies. They are also often skilled communicators and negotiators, which can be valuable in engaging local communities in conservation efforts and in advocating for policy change.

Here, we profile women who play various roles in marine conservation across East Africa, paving the way for impactful, transformative leadership.

## **Dr Fiona Wanjiku Moejes, CEO, Mawazo Institute, Kenya**

*The Mawazo Institute is a women-led African organisation based in Nairobi, Kenya supporting early career African women researchers as they work to find solutions to local and global development challenges. Member of the African Marine Conservation Leadership Programme, is a Women for the Environment Africa Fellow and sits on the Executive Committee of the International Society of Applied Phycology.*

Prior to joining Mawazo, I served as both a senior marine research scientist (with a focus on applied microalgae and seaweed research) and a marine programme manager. During my time as programme manager at Dahari, I had the opportunity to lead community-led, research-based marine conservation efforts in the Comoros, where environmental degradation has had negative impacts on both the ecosystem and the communities that depend on it. Despite the limited resources available in the small East African island nation, our team at Dahari worked with the local fisher communities to support them in the management of their marine resources. One of my highlights was working with a fisherwomen's association who were so passionate about

protecting their natural resources and quickly became changemakers and leaders in their communities, helping them to live more sustainably with their marine ecosystem.

I see my role at Mawazo being complementary and a continuation to my previous work in the marine research and conservation space. I am building on my own experience and supporting the growth of the next generation of African women researchers, including those working in conservation.

African women researchers lack access to funding, mentorship and networks, and have to contend with gender-insensitive university policies, unequal domestic responsibilities and outright discrimination; all impacting their mental, emotional and physical wellbeing. This has led to the exclusion of African women and their authentic perspectives and voice in academia, research and development spaces—places where key decisions affecting Africa's development are made. As a leader in this space, I am supporting the inclusion of the ideas and perspectives of African women in conservation and beyond, leading to the implementation of innovative, holistic and homegrown solutions for Africa.

## **Julitha Mwangamilo, Programme Manager at Sea Sense, Tanzania**

*Sea Sense works closely with coastal communities in Tanzania to safeguard and preserve threatened marine wildlife, such as sea turtles, dugongs, whales, dolphins, and whale sharks. Member of the African Marine Conservation Leadership Programme.*

Two decades ago, I began my career in marine conservation as a researcher with a focus on fish species. However, my current role as a Programme Manager at Sea Sense is particularly rewarding as it enables me to develop the skills and capacities of my team and community leaders, including women in fishing communities.



My work with communities is centred on improving their ability to manage their marine resources, as well as developing alternative livelihoods and enterprise opportunities. One project involved collaborating with mothers in a local community to create alternative income streams, which helped support their children's secondary education. I see myself as a bridge between conservation and community needs, with a particular emphasis on the female perspective.

In addition, I have worked to strengthen community capacity for fisheries co-management, particularly in terms of governance, leadership skills, and securing alternative livelihoods to reduce fishing pressure on marine resources. Through mentoring and guiding my team, women leaders in small-scale fishing, and fishers involved in managing fisheries resources, I have helped to build their leadership skills, resulting in empowered community leaders who are now implementing and running their own programs.

I am a firm believer that good leaders never stop learning, which is why I joined the African Marine Conservation Leadership Programme to enhance my skills. This leadership training has equipped me with valuable insights that have influenced my leadership style, enabling me to continue to mentor and guide my team effectively and work alongside the community to achieve our conservation goals.

### **Lorna Slade, Technical Advisor and co-founder, Mwambao, Tanzania**

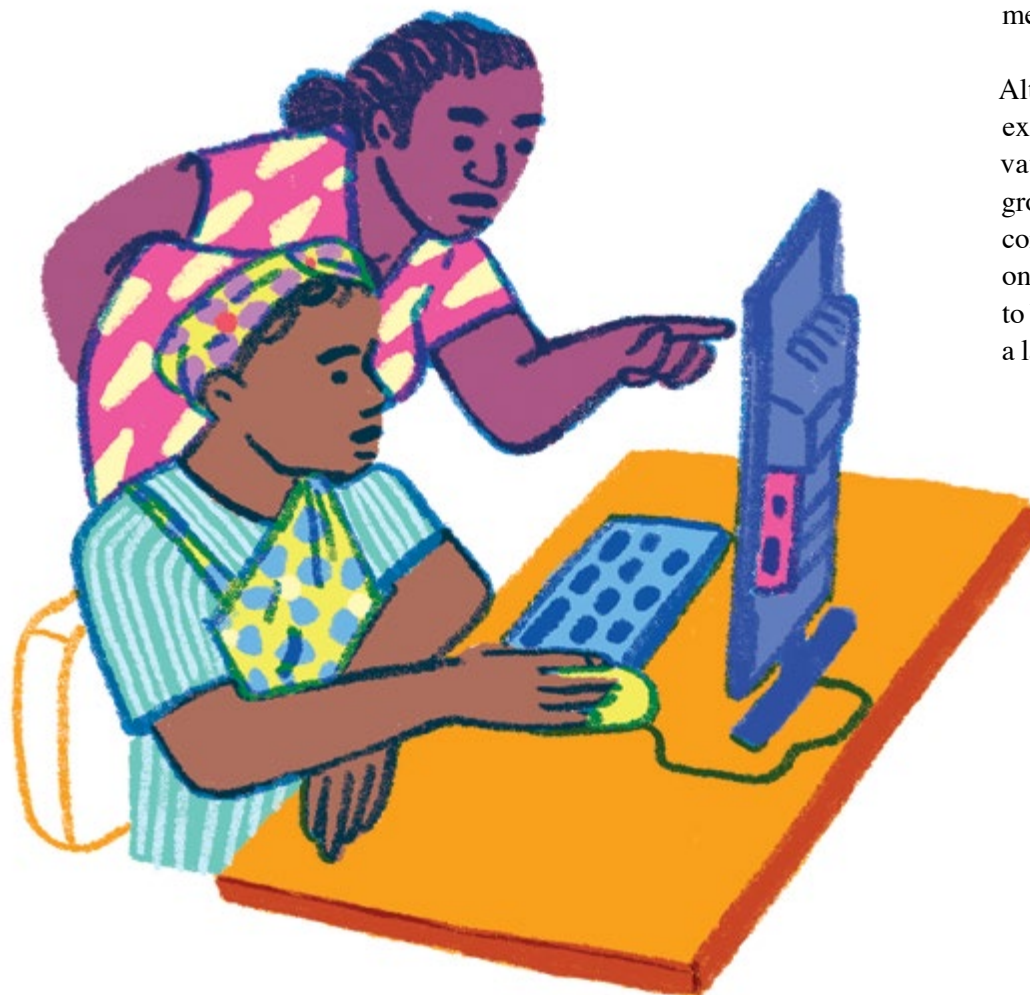
*Mwambao facilitates a learning network linking coastal communities and other partner stakeholders that builds community resilience, and implements improved sustainable coastal resource management and livelihoods. Member of the African Marine Conservation Leadership Programme.*

My colleague Ali Thani and I founded Mwambao in 2010 after we realised that there was a need for a coordinated effort to address important issues affecting the coastal communities of Tanzania and the ocean on which they depend. Mwambao is today a network of more than 50 communities working together to support

the sustainable management of natural resources in coastal areas. The network's approach is based on the principles of community-based natural resource management (CBNRM), which emphasises the importance of centering communities in the decision-making process, and empowering them to be wise stewards of their natural resources.

Since Mwambao's launch, we have been able to bring together a diverse range of stakeholders, including fishermen, women's groups, youth organisations, and local government officials to work towards shared goals.

*The network has helped to build the capacity of these groups through training and mentoring, and has supported the development of community-led initiatives such as local marine protected areas, eco-compliance loans, and sustainable fishing practices. Being part of this movement is a source of pride for me, and I aspire to inspire other women to assume leadership positions in conservation, particularly in the marine sector.*



### **Jane Muteti, Programme Coordinator, COMRED, Kenya**

*Coastal and Marine Resource Development (COMRED) focuses on building resilient coastal communities and environments in the Western Indian Ocean region, supporting livelihoods and marine conservation.*

I am a Program Coordinator at COMRED. I hold an MSc in Marine and Lacustrine Science and Management from Vrije Universiteit Brussel and a BSc degree in Coastal and Marine Resource Management from Kenyatta University.

I'm passionate about my role, and I'm lucky to have had the opportunity to use my knowledge and skills to provide valuable contributions to marine conservation early on in my career. As a coordinator, I'm involved in the implementation of projects and partnerships, and I'm dedicated to ensuring that these projects are successful. I work closely with stakeholders to identify and address the challenges facing marine life and environment, and identify solutions.

Although it can be intimidating, I am passionate and excited to be a young female leader in marine conservation. Every day my strength and experience is growing, and I strive to make a positive and meaningful contribution to the environment and the people that rely on it. I am learning how to use my unique perspective to bring value to the sector, and am determined to make a lasting impact.

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**Wanjiku Kinuthia** is a Communications Manager at Maliasili and has close to a decade's experience executing conservation communications strategies in Kenya.

**Kruttika Susarla** is an illustrator and cartoonist. Her practice ranges from making comics about animals side hustling in the gig economy to working with community-based orgs.





# Samundar ka guru<sup>1</sup>: An account of Kalumangothi's life and wisdom on the ocean

Authors **Abel Job Abraham & Diya Deepak** | Illustrator **Deepika Nandan**

On a late sunny afternoon back in April 2019, I was talking to Shamsudheen, or Shamsu *bhai* as we call him. We were standing outside the Dak Bungalow on Minicoy, an island in the Lakshadweep archipelago off the coast of Kerala, India. Shamsu bhai is the President of *Maliku Masveringe Jamaath*—a traditional body that decides the rules and practices for managing Minicoy's pole and line tuna fishery. Being the island from where the pole and line tuna fishery was transferred to other Lakshadweep Islands, I was seeking to document Minicoy's traditional fisheries management systems.

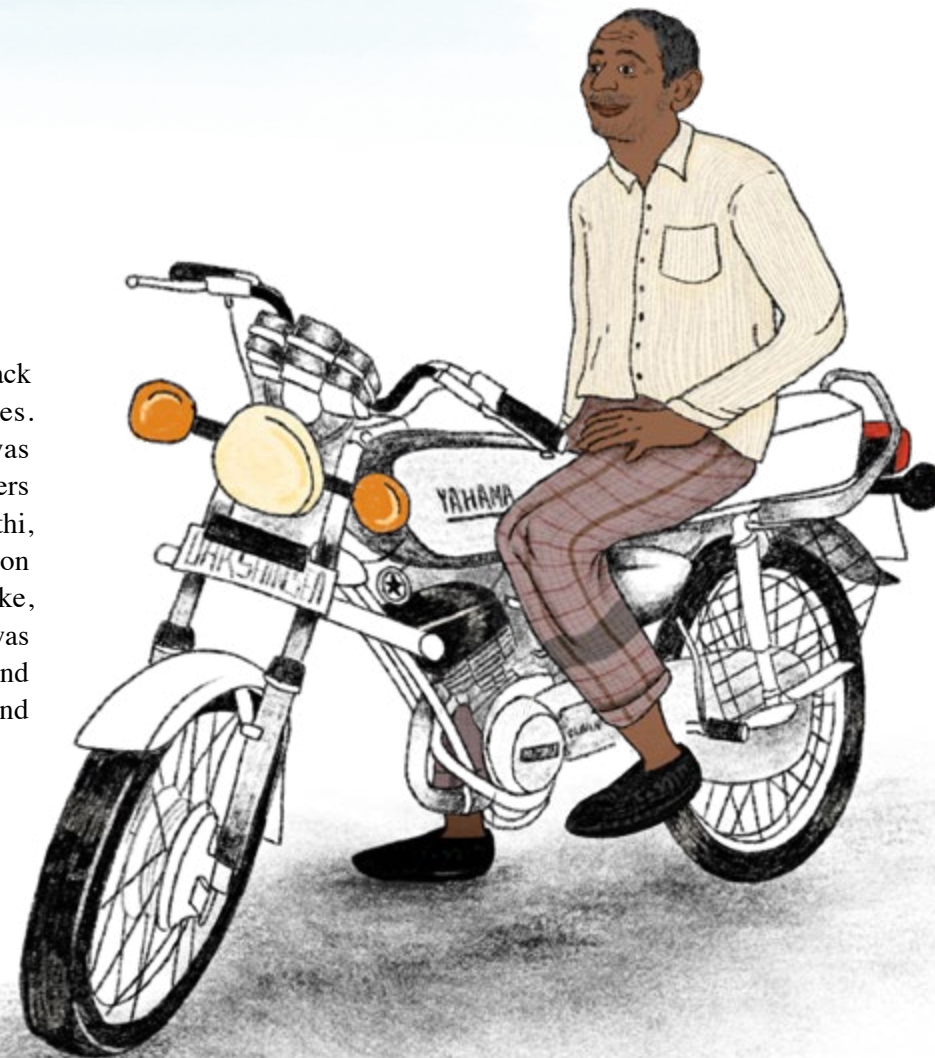
After a not-so-successful field trip in March, I was back on the island looking for potential interviewees. Shamsudheen, being busy with official duties, was suggesting the names of other knowledgeable fishers on the island. That's when Mohammed Kalumangothi, fondly known on the island as Kalumaan, appeared on his black Yamaha RX100. Sitting on his motorbike, wearing a broad smile, he asked Shamsu *bhai* what was happening. In response, Shamsu *bhai* looked at me and said, "Here's the answer to all your questions." And that was the first time that I, Abel, met Kalumaan.

Kalumaan, a knowledgeable fisherman and the lone communist on the island, has an interesting personality. He started fishing when he was 14, and now in his early 50s, he already has decades of fishing experience. Being the skilful and likeable person that he is, he has been one of the most popular *kelus* (boat captains) in Minicoy. Padmini, Agartala, Bahrain, Kamyab are just some of the many boats that Kalumaan has captained across the 11 villages on the island.

Each year during the month of Ramadan, after the *Eshah* prayer in the evening, the island that is still and calm during the day comes to life. People go shopping, and are seen conversing over tea by the beach or taking walks, while some women are busy preparing special Ramadan delicacies. And this is when our work begins as well.

Post dinner at Hotel Aboo & Sons each night, I take an auto rickshaw and head to Kalumaan's place. As I near Falessery village, in the distance, I always see Kalumaan eagerly waiting for me. He then takes me to his wife's house where he resides at night as per Minicoy's matrilineal system. "*Baa aadyam chaaya kudikkaam*," he says and serves me *kattan chaaya* (black tea) along with *bodu appam* and *riha appam*, Minicoy's favourite evening snacks.

On our way to the seashore, where Kalumaan loves to spend his evenings, he opens his *chellam* (a tiny box) and takes out a few *karambus* (cloves) to chew on. At the sandy beach, under the starry sky, he spreads a cloth for us to sit on. Boats with blinking red lights on top are anchored close to shore. Crabs are milling around, and the cool sea breeze carries a fishy, salty scent.



"*Enthoru haramaanu?*" He asks if this much fun can be experienced anywhere on the mainland. Only once the above routine is completed is Kalumaan ready to answer questions about *Chaala* and *Choora*. Baitfish, locally known as *Chaala*, is one of the critical factors for Lakshadweep's pole and line tuna fishing. Pole and line is a sustainable fishing method owing to its selective, non-invasive, and small-scale approach. This technique has its origin in the Maldives from where it spread to Minicoy. A comprehensive system of traditional fisheries management that covers the spatial and temporal aspects of resource management has evolved in Minicoy over time. However, while transferring pole and line from Minicoy to the other Lakshadweep islands in the 1960s, these systems were left behind.

<sup>1</sup>*Samundar ka guru* means the guru of the sea in Hindi. We came across some Hindi-speaking seamen in Minicoy referring to Kalumaan as such during our fieldwork on the island earlier this year.



Kalumaan's in-depth knowledge about every species he interacts with during his fishing ventures is remarkable. Whether it's baitfish or coral ecology, or the behaviour of turtles, sting rays and octopuses or the catching techniques of *vembolu*, *metti* or *chammelli*, Kalumaan knows it all. From the 2019 field season alone, we have over 8.5 hours of recorded interviews with him. And this was excluding the countless informal monologues of his that were packed with useful information. It was Kalumaan, with his enthusiasm and cheerfulness, who made the strenuous documentation exercise engaging for us. Our ongoing work attempts to document this knowledge so that other similar coastal systems can also learn from Minicoy's traditional resource management systems. Having said that, this knowledge is also key to Minicoy's existence, as the island is heavily dependent on natural resources and its systems are vulnerable to unsustainable transitions.

Kalumaan's wisdom is not restricted to individual species or their ecosystems, but extends to the ocean at large. Sea salinity, current patterns, fishing grounds, underwater terrain, navigation based on the *Nakai* calendar (an indigenous Maldivian calendar system) and astronomical knowledge—these are some of the many aspects he is well-versed in. All of this is knowledge he has gathered through observation over the years. "Suppose we already caught a thousand tuna, and another boat is trying to catch from the same school the easy way, without using a single baitfish, which is against the *Jamaath's* norm, then, dip a steel glass in

the water and all the tuna will flee, leaving nothing for anyone to fish."

It isn't only his technical know-how or skills that make Kalumaan unique. He motivated two men with disabilities to join his fishing crew when nobody else was keen on taking them on. An old colleague of ours, having merely transcribed the recorded interviews of Kalumaan, was intrigued by his compassionate tales and engaging conversations. Keen on meeting him, she made it to Minicoy in the next field season, and made friends with Kalumaan. He is also a local celebrity. Young boys on motorbikes, men lounging in beach shacks and women carrying headloads of filleted tuna to village kitchens all greet him as "*sakhave*" (comrade) or "*Kalumaan kaaka*" as they pass. "Allah! What can I say, it's full of acquaintances here, that's the problem," Kalumaan turns to us and says with a grin on his face.

Fast forward to March 2023, I am still in awe of the hospitality, warmth and trust that he extends to us. Even Diya, who was carrying out fieldwork on the island for the first time and a total stranger to Kalumaan, was received with a tour of his entire village and an invitation to attend a family wedding. Always welcoming, never averse to being asked questions—what more can a researcher ask from someone in the community that they work with? It is people like Kalumaan who make our work possible on the island. And that comes with the responsibility to not feel entitled to all the support we have been given.

Although he always appears jovial, Kalumaan has faced his fair share of hardships. Over the past two decades, he has lost three boats—two to cyclones and one during peak monsoon in 2004, while rescuing the crew onboard MT Indira after their engine failed. To date, he

hasn't received any compensation for the boats he lost, even after filing several applications. But that never stopped him from lending a hand to those in need. A migrant worker we met recently at the Minicoy jetty, was telling us how Kalumaan helped all of them who were stranded on the island during the COVID-19 lockdown by giving them fish for free and making sure they all had a decent meal every day. At times, Kalumaan also gives money to a person with a mental illness so that he doesn't have to go hungry. And in his unique fashion, Kalumaan invited the entire island, including non-islanders, to his daughter's wedding by posting an invitation on the local television channel!

Kalumaan hasn't changed in the few years that we have known him, but things have changed for him. The man who spent most of his life at sea is now seen only on the shore, having become paralysed along his right side at the beginning of 2022. He was airlifted to the mainland, where he underwent surgery and prolonged treatment. He is now back on the islands almost a year later but

#### Further Reading

Abraham, A. J. and A. Sridhar. 2021. Plural islands of Lakshadweep: Insider-outsider narratives of Minicoy. Le thinnai Revi. <https://medium.com/thinnairevi/plural-islands-of-lakshadweep-insider-outsider-narratives-of-minicoy-by-abel-job-abraham-and-de8b03715fd>. Accessed on April 20, 2023.

Khot, I., M. Khan, P. Gawde, A. J. Abraham, A. Raj, R. Sen and N. Namboothri. 2023. *Fish for the Future: Creating participatory and sustainable fisheries governance pathways in the Lakshadweep Islands* — A 10-year report. Bengaluru: Dakshin Foundation.

Namboothri N., I. Khot and A. J. Abraham. 2022. Small islands, big lessons: Critical insights into sustainable fisheries from India's coral atolls. In: *Conservation through sustainable use: Lessons from India*. (eds. Varghese A., M. A. Oommen, M. M. Paul and S. Nath). 1st edition. Pp. 27–40. London: Routledge India. <https://doi.org/10.4324/9781003343493>

continues to be on medication and physiotherapy. Still, just yesterday before writing this account, we were there once again—sitting on the shore with Kalumaan, laughing at his hilarious accounts of crabs having tussles with rats, and listening to his revolutionary ideas about replacing diesel power generators with wave energy projects so that the daylong power cuts on the island due to diesel shortages can be a thing of the past.



**Abel Job Abraham** is a researcher with the Sustainable Fisheries programme of Dakshin Foundation, Bangalore. His work looks at the traditional systems of resource management on Minicoy Island.

**Diya Deepak** is excited about all things nature. After completing her bachelors in Environmental Studies, she is currently exploring community-based conservation working at the Dakshin Foundation.

**Deepika Nandan** is an illustrator, animator, and tattoo artist. Using location and context specific media, she investigates the biosphere and the detrimental human impacts on it.





# Rhinos of the sea

Author **Trisha Gupta** | Illustrator **Sayan Mukherjee**

We have all heard of sharks. When you imagine one, the typical picture that might come to your mind is a large, grey-white fish with pointed fins and sharp, deadly teeth. Now imagine something like a shark, but with a flattened head and torso, pointed snout and brown body, and you get a rhino ray, the strange-looking and ancient relatives of sharks. Named because their pointed snouts apparently resemble rhino horns, these species are cartilaginous fish that evolved from sharks and form a link between sharks and rays. Rhino rays are made up of different families, including guitarfish

(*Glaucostegidae*), wedgefish (*Rhinidae*) and sawfish (*Pristidae*). Their flattened bodies are an adaptation for life on the seafloor—they are often found swimming close to the bottom, or resting in the seabed, concealed and camouflaged in sediment.

## On the edge of extinction

Rhino rays have been increasingly in the spotlight in recent years, and not for good reasons. Sadly, research has found they are currently one of the most threatened

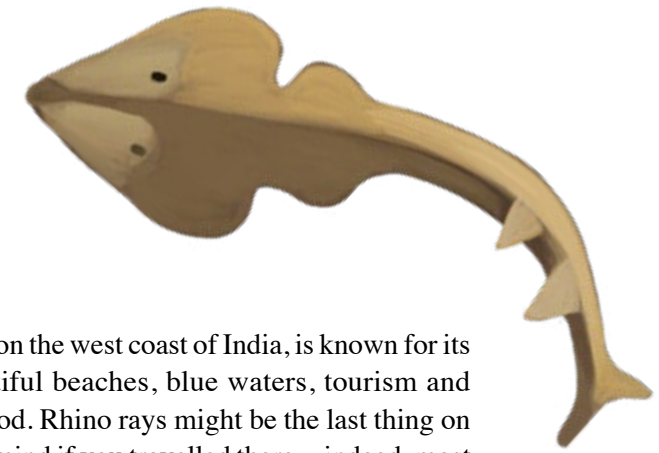
groups of species in the world. All but one species of guitarfish, wedgefish and sawfish are Endangered or Critically Endangered. These species are found in shallow coastal waters, overlapping with some of the most intense coastal fisheries in the world. Their fins are highly valuable, fetching at least twice the price of shark fins, which drives fishers to target and catch them. In other cases, they are caught accidentally as ‘bycatch’ and then retained by fishers to sell or consume. These factors have pushed rhino rays to the edge of extinction, even more so than other rays and sharks. Rhino rays are ‘bioturbators’, excavating and modifying the ocean sediments and habitats. As meso-predators, they also form important links between species at the top and bottom of the food web. These essential ecological functions could be lost if rhino rays disappear.

**Despite the risks they face, rhino rays remain a data-limited species, which means we know very little about them, especially in countries such as Indonesia and India where they are the most fished. Studying any marine species is challenging, but rhino rays can be particularly elusive despite being found in shallow waters. They were also overlooked for a long time, with their more charismatic cousins—sharks—receiving most of the attention from research and conservation.**

Sawfish have been hit the hardest. These rays have a characteristic elongated rostrum (nose extension) with sharp teeth on either side, resembling a saw. Once abundant in tropical waters, sawfish populations have faced catastrophic declines globally and have all but disappeared from many parts of their range. Reaching up to 7m in length, these gentle giants are unable to withstand high levels of exploitation by fisheries. The big concern now is that other rhino ray species, such as guitarfish and wedgefish, may share a similar fate if no action is taken.

## The guitarfish of Goa

“It’s a super rare fish, but you can see it on the shore. If you see it on the shore, it means your stars are aligned and you are very lucky,” says a gillnet fisher in Goa.



Goa, on the west coast of India, is known for its beautiful beaches, blue waters, tourism and seafood. Rhino rays might be the last thing on your mind if you travelled there—indeed, most tourists who visit have probably never heard of them. But species such as the widenose guitarfish (*Glaucostegus obtusus*) and sharpnose guitarfish (*Glaucostegus granulatus*) are found along Goa’s coastline, sometimes inhabiting waters that are only ankle-deep!

I have been working in the field of fisheries and shark research since 2018 and have surveyed hundreds of dead rhino rays captured in fishing vessels. It was in Goa that I had my first live sighting of one species—the widenose guitarfish. I was on a quiet beach at sunset, when a number of them came into the shallow waters, moving in and out with the waves. Seeing these Critically Endangered species swimming at my feet was an experience I’ll never forget. These encounters led me to study rhino rays, especially guitarfish, in Goa for part of my PhD research.

Given that scientists know almost nothing about these species in this region, fishing communities can be the best source of information. The lives of fisherfolk are intertwined with the sea, and they hold a wealth of knowledge accumulated over generations. Our study has documented the local ecological knowledge (LEK) that fishers in Goa hold about rhino rays, to better understand their habitat use and seasonality, the kind of threats they face and how people can conserve them. We also looked into their interaction with fisheries—how they were fished, how they were used, and what kind of value they have for fishing communities. We plan to use these insights and knowledge on rhino rays to understand how to conserve them.



“It's a super rare fish, but you can see it on the shore. If you see it on the shore, it means your stars are aligned and you are very lucky”

– A gillnet fisher in Goa







## A day in the research life

With my degree in marine biology, people often assume that I spend most of my time underwater exploring the frontiers of the ocean. The reality is very different; most of my fieldwork involves spending time in fishing centres, monitoring catch, and engaging with local communities. For this research on guitarfish, a typical day in the field involved visiting one or multiple fishing sites and interviewing local fishers about guitarfish, sharks, and issues about marine sustainability. In total, we visited and sampled 20 different fishing villages and harbours in Goa. Some of these were tourist beaches, others were more isolated and sometimes quite challenging to get to.

**Some fishers were enthusiastic to speak to us about ‘Ellaro’ or ‘Kharra’, as guitarfish are called in Konkani (the local language) and had numerous stories to share. Others couldn’t understand why we were interested in this *ajeeb machli* (strange-looking fish), as one fisher put it.**

Conducting interviews and working with communities is not always easy; people can be suspicious and unwilling to speak, sometimes interviewees may lie (with good intentions) to give you the responses they think you want, and conversations can often take unexpected turns. But it can be a very rewarding process overall. The knowledge and experiences that some fishers have are unlike

anything you could read in a textbook or scientific paper, and it can be a pleasure to document them.

## Feeding time

Why do guitarfish come to such shallow waters? We suspect that many of these beaches, especially around river mouths, form nursery grounds for guitarfish, where females come to give birth to their young. Guitarfish, like many sharks and rays, are ‘viviparous’ or live-birthing, which means they give birth to a small number of young (called pups) and don’t lay eggs. Shallow, sheltered beaches near estuaries and rivers can form ideal habitats (nursery grounds) for the pups, because of the abundance of food and protection from predators. Given their importance in the life cycle of guitarfish and other rhino rays, these habitats should be protected. However, in many parts of the world, these shallow estuarine habitats are facing severe disturbance from development, fishing, and other human activities.

In Goa, fisher knowledge has helped us identify the types of habitats and regions that guitarfish are found in (sandy seafloors near river mouths), and their seasonality (found most often during and right after the rains). Fishers also confirmed that they had seen small guitarfish feeding on crabs and molluscs in the shallow beach waters. We have broadly mapped the potential nursery sites and other essential habitats for guitarfish, and through further research, we can identify the areas that need to be prioritised and protected.

## Communities and conservation

Alarmingly, fishers reported that not only sawfish but also wedgefish appear to be severely declining or even vanishing from this region. “We call this fish *Anshi*,” an older fisher remarked when I showed him a picture of a sawfish. His younger crewmates had not seen this species before and didn’t recognise it. “I haven’t seen this fish in at least 20 years. It’s gone from our waters”.

This isn’t the case for guitarfish, which continue to be fished in Goan seas. Fishers catch them as bycatch in all types of fishing gear, most often small-sized individuals (juveniles), which are considered to have low economic values and are used only for local consumption. In fact, more than half of interviewed fishers would discard the fish back into the water, dead or alive, if they were too small or they had caught too many. When we spoke to them about the protection of guitarfish and other rhino rays, fishers’ attitudes seemed to support conservation.

**“We don’t get them much, and don’t really sell them much, so if catching this fish is banned, it won’t make a difference to us,” a gillnet fisher told us.**

All the fishers we interviewed stated that they may be willing to participate in conservation measures for rhino rays, which is a very positive finding. One young fisher explained, “If catching the guitarfish is banned, we can just release them back into the water and they will swim back to wherever they like to live. They stay alive for a long time even after we catch them, so they will be fine.”

At the time of this study, all species of guitarfish were legally permitted to be fished and were not protected. However, with recent changes in legislation, the wide-nose guitarfish has been listed as protected, along with a few other rhino ray species. Our findings suggest a pathway for this legislation to be implemented in regions like Goa — where the rhino rays form low-value bycatch, live release measures through community participation would likely be more effective than top-down sanctions. Local knowledge of fishers will be essential to designing effective and fair conservation plans.

If guitarfish can be protected locally or regionally in places like Goa, then these sites could become sanctuaries for these highly threatened species. These small-scale successes could spell hope for the future and help save the guitarfish from becoming the next sawfish.

## Further Reading

Kyne, P. M., R. W. Jabado, C. L. Rigby, Dharmadi, M. A. Gore, C. M. Pollock, K. B. Herman et al. 2020. The thin edge of the wedge: Extremely high extinction risk in wedgefishes and giant guitarfishes. *Aquatic conservation: Marine and freshwater ecosystems* 30(7): 1052–7613. doi.org/10.1002/aqc.3331.

Gupta, T., E. J. Milner-Gulland, A. Dias and D. Karnad. 2023. Drawing on local knowledge and attitudes for the conservation of critically endangered rhino rays in Goa, India. *People and nature* 5(2): 645–659. doi.org/10.1002/pan3.10429.

**Trisha Gupta** is a marine conservation scientist doing her PhD at the University of Oxford. She works on the conservation and sustainable fishing of sharks and rays in India.

**Sayan Mukherjee** is a Bangalore-based artist and illustrator. Her unique style draws inspiration from human experiences, nature, and imagination, creating a beautiful world through art.

## Acknowledgement:

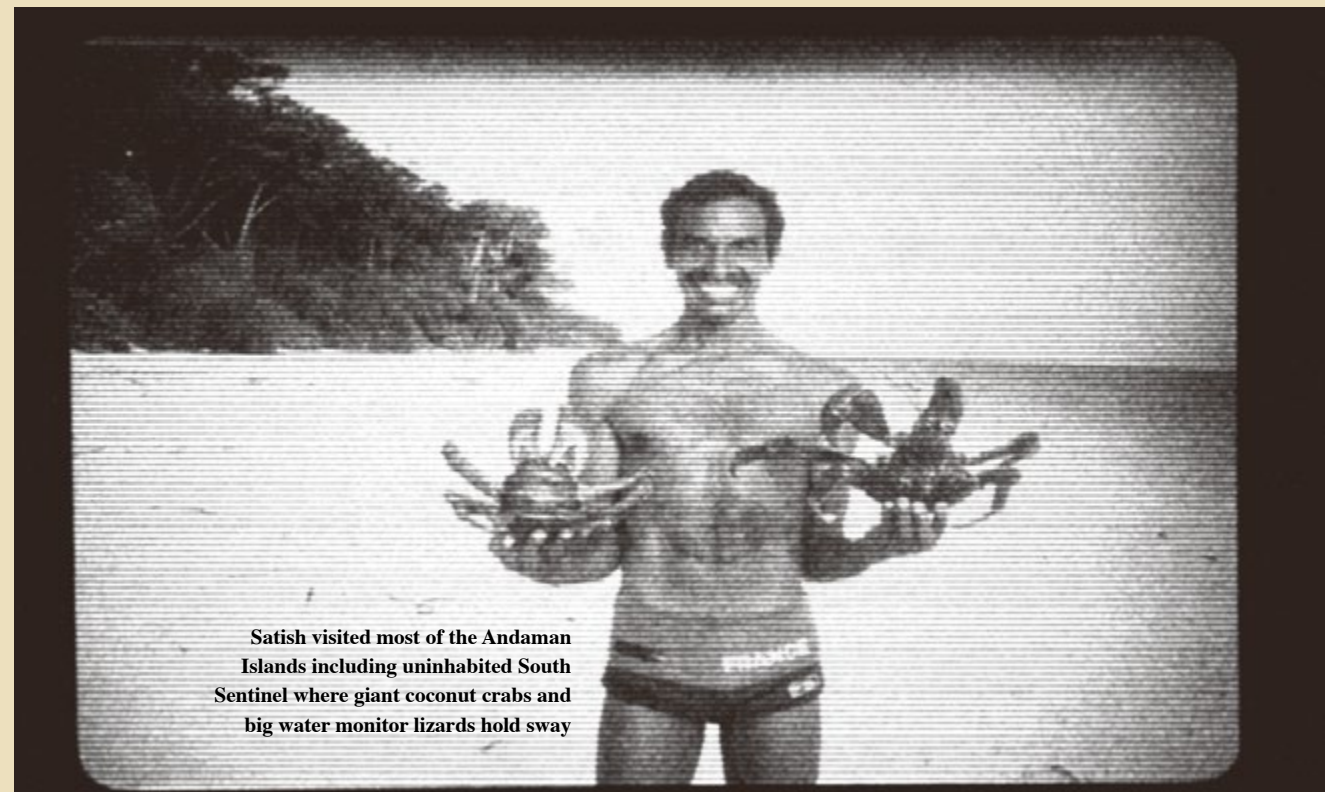
This research was conducted by Trisha Gupta, EJ Milner Gulland, Andrew Dias, and Divya Karnad, and was supported by the Prince Bernhard Nature Fund and the Levine Family Foundation.





# SATISH BHASKAR

September 11, 1946  
to March 22, 2023



Satish visited most of the Andaman Islands including uninhabited South Sentinel where giant coconut crabs and big water monitor lizards hold sway

## Turtle walker extraordinaire

-Rom Whitaker,

In the early 1970s, the Madras Snake Park, located very close to the Indian Institute of Technology, was a magnet for a certain breed of student who just couldn't bear the drudgery

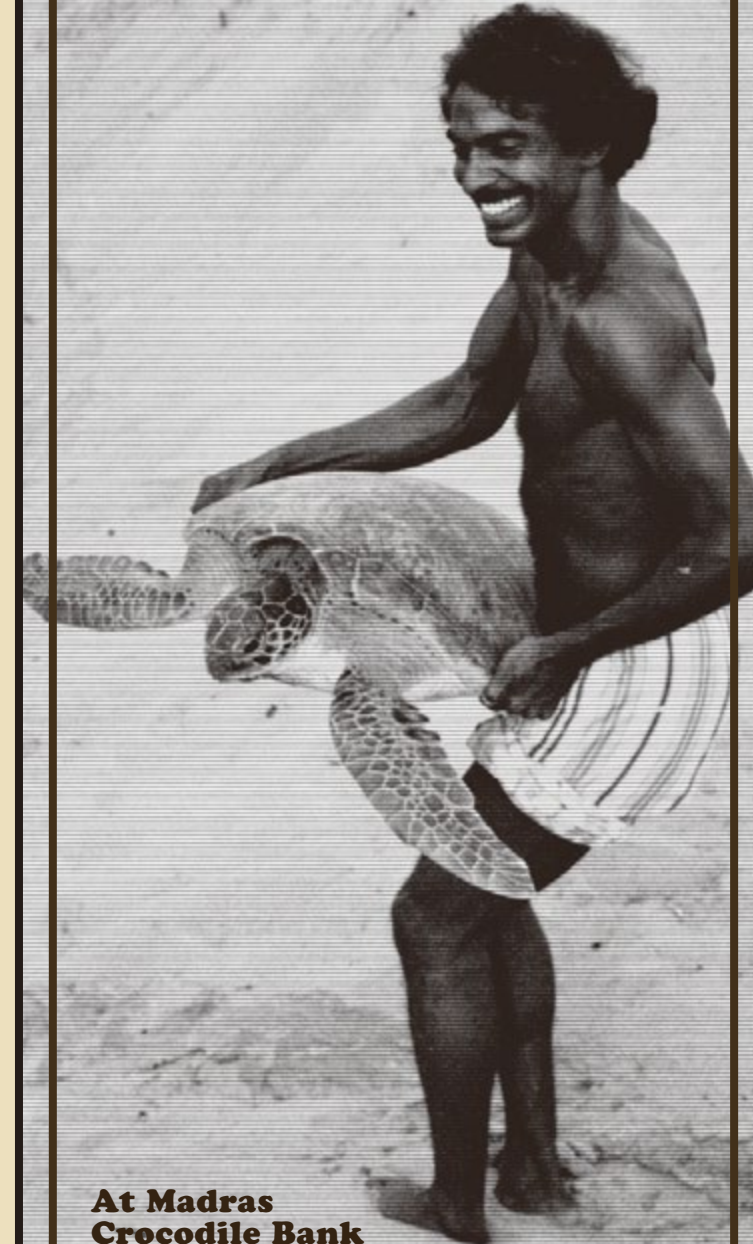
of a college education. Since I was of the same non-academic ilk, I encouraged them to hang out with us and help develop the Snake Park's field activities of conservation and research. One of these stalwarts was Satish Bhaskar,

a quietly intense young man from IIT, whose passion was jogging several kilometres each morning to Elliot's Beach to have a swim in the ocean.

We had recently started nocturnal beach walks to find olive ridley sea turtle nests before the poachers got them and rebury them in a safe hatchery we had set up at the Cholamandal Artists Colony. Satish got into this routine with zest and his strength was a welcome addition when we had to carry heavy bags of eggs back to the hatchery. The rest of us at the Snake Park were hung up on snakes and crocodiles and it was Satish's dedicated single-mindedness that made me suggest to him that India needs a Mr. Sea Turtle and he would be the ideal man for the job.

He obviously took this idea to heart and, starting with the meagre resources the Snake Park provided him, he began his sea turtle surveys. His intrepid trips covering both the beaches of mainland India and eventually the Lakshadweep, Andaman and Nicobar Islands were made possible by the World Wildlife Fund and other donors, and resulted in close to 50 reports, notes and papers. But it was his entertaining letters that grabbed us the most. Writing from the Nicobar Islands, he described the torture of sand flies during the day and by mosquitoes at night. One night on a remote Nicobar beach, he bedded down on the mat with mosquito net stitched to it (an invention we made). Very early next morning, he was awakened by a shuffling sound and he opened one eye to watch a saltwater crocodile walk past him and slide into the surf ten metres away. Surveying those beaches, he had to swim across frequent small estuaries, always keeping an eye out

## Mr. Sea Turtle



At Madras Crocodile Bank Satish got us started rearing sea turtles, like this green turtle rescued from a fishing net.





Satish with Dhruvajyoti Basu, Rom Whitaker and Allen Vaughan and their haul of lobsters, caught while snorkelling off the coast at Mahabalipuram

for crocodiles. In a remarkable nine-month trip in 1979, he covered almost all the islands in the archipelago and then returned several times in the 1980s to visit the others.

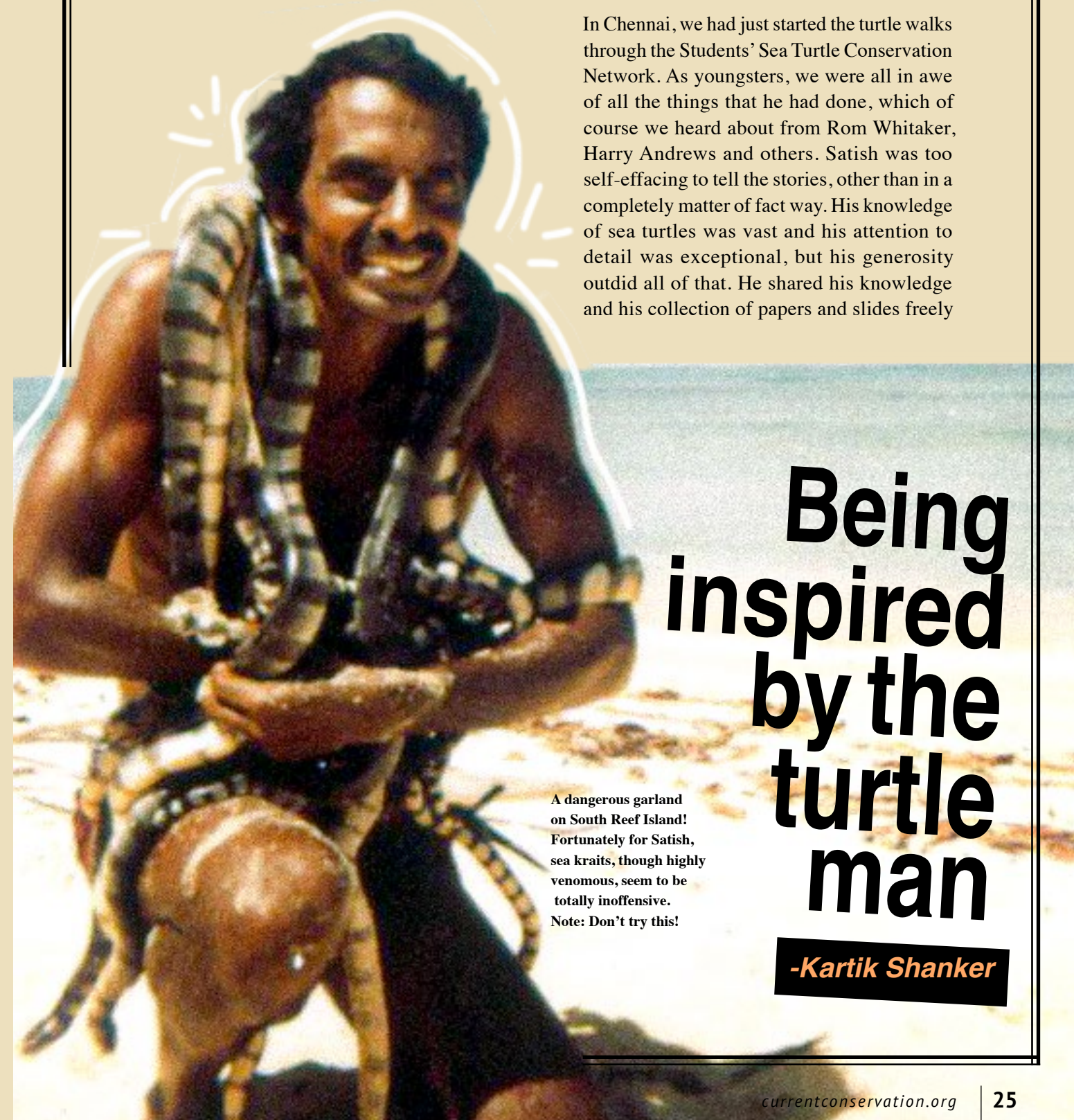
After his first trip to the Lakshadweep in 1977, he told us that he would love to stay and study the green sea turtle nesting beach on Suhelipara, one of the uninhabited islands. He said the only problem was that they nested during the monsoon and there was no boat traffic then as the seas were too rough. "I'll have to maroon myself on the island for the whole monsoon," he said with a smile. We started going over all the things that could go wrong, anything from a bad toothache to malaria or an upset tummy could put a real damper on this idea, but he was adamant and did maroon himself on the island between June and September 1982. Famously, his letter in a bottle floated to Sri Lanka and reached his wife just 24 days after he had thrown it into the surf at the edge of the lagoon. The boat that was due to pick him was just one month late!! But not much fazed Satish in the field.

Satish really kick-started interest in sea turtle conservation in India and I'm proud that I had a role in it.

When I met Satish in the late 1980s, he had just returned from his surveys in West Papua, Indonesia, that WWF had supported. The beaches were remote and accessible only by a boat that passed once in a few weeks. He was the first outsider that the Papuans in Wermon had ever met, and he communicated with the world by swimming out to said boat and giving them

letters to post. He counted over 13,000 leatherback nests and tagged 700 turtles almost single-handedly. Over the next decade, the leatherback populations declined and the locals decided that Satish was the cause—that he had tagged the turtles with metal tags so he could steal them later with a giant magnet.

In Chennai, we had just started the turtle walks through the Students' Sea Turtle Conservation Network. As youngsters, we were all in awe of all the things that he had done, which of course we heard about from Rom Whitaker, Harry Andrews and others. Satish was too self-effacing to tell the stories, other than in a completely matter of fact way. His knowledge of sea turtles was vast and his attention to detail was exceptional, but his generosity outdid all of that. He shared his knowledge and his collection of papers and slides freely



# Being inspired by the turtle man

A dangerous garland on South Reef Island! Fortunately for Satish, sea kraits, though highly venomous, seem to be totally inoffensive. Note: Don't try this!

**-Kartik Shanker**

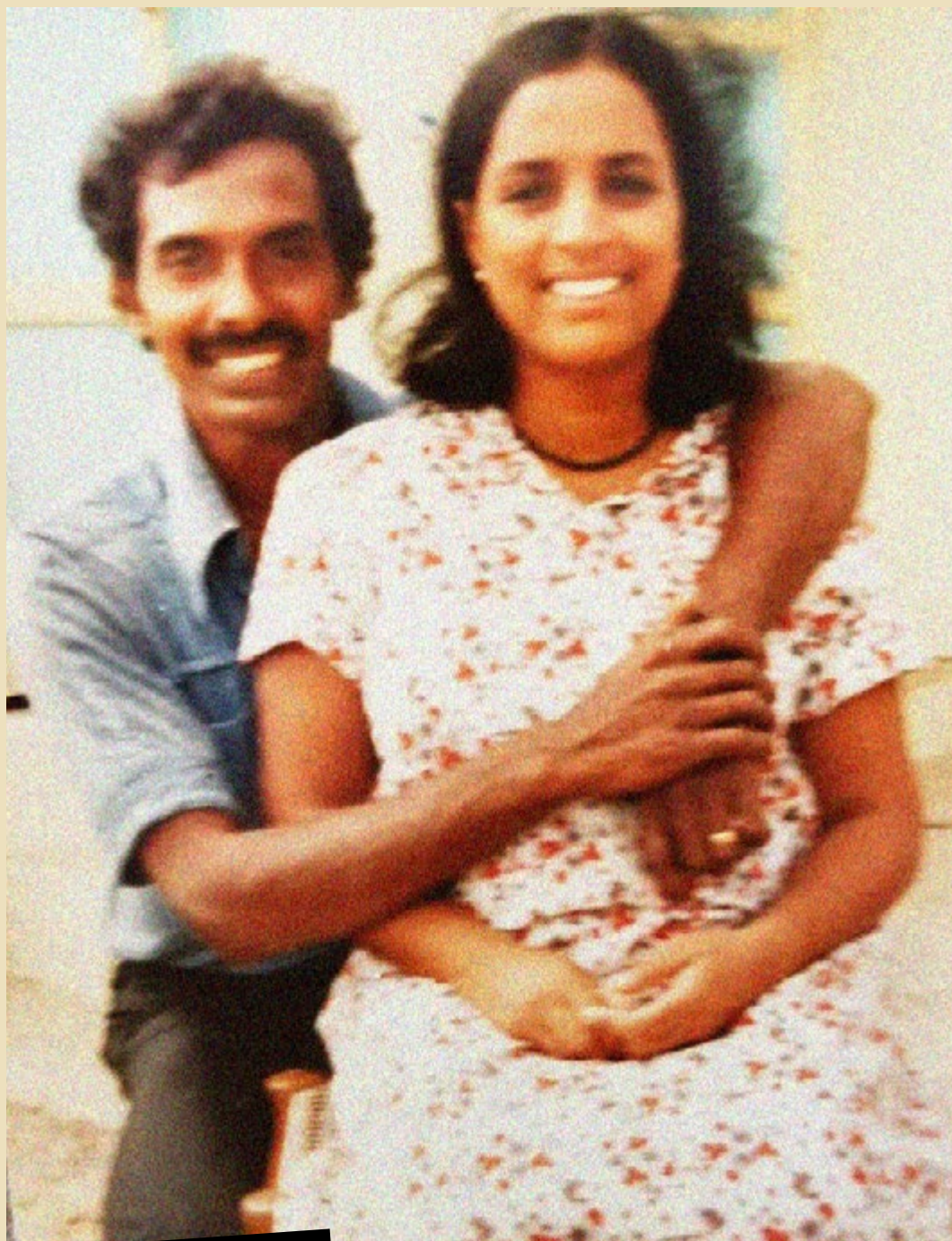


with us, including the first edition of *Biology and Conservation of Sea Turtles*, a collection of articles that emerged from the first ever global conference on sea turtles that was a bible for many years for the community. Satish's article in the collection is the first comprehensive account of sea turtle nesting across India.

A few years later, Satish returned to the islands to survey Great Nicobar Island along with Manjula Tiwari, and then decided to initiate a monitoring programme for hawksbill turtles on South Reef Island. He would camp out on this tiny island (just 700m long and a little over 100m wide) with his assistant Saw Emway and swim to Interview Island to get water. On one of those trips, they were chased by one of Interview's feral elephants, and Satish threw his shirt off to distract it. He later retrieved the shredded shirt and posted it to his wife, Brenda.

In the early 1990s, Satish and Brenda, on a whim, decided to move to Goa, and he had little contact with his colleagues for several years afterwards. Aaron Lobo, an eager 12-year-old naturalist, happened to meet Satish in Benaullim, Goa, by complete chance. Satish's children studied French with Aaron's aunt, whom he would visit. From then on, he started visiting Satish regularly and they wandered about on the beaches and the scrub around Satish's house, looking for snakes and other critters.

After completing his Masters at the Wildlife Institute of India, Aaron



**Brenda and Satish, circa '77**

Two integral people in the early Croc Bank days – Satish our Field Officer and his wife Brenda our Secretary

Image source: Madras Crocodile Bank Trust/Centre for Herpetology, Facebook, October 2022

talked to Satish about an upcoming trip to the Gulf of Mannar to document sea snakes in the region. Since Satish had conducted his first field survey there, he decided to accompany Aaron and spend a few months with him. There were many interesting experiences and sightings, but most eventfully, they were at sea on a trawler on 24 December 2004, when the tsunami struck. Fortunately, the wave passed safely under their boat while they were sleeping. During this time, they travelled together to several parts of the Gulf of Mannar coast, snorkelling in the shallows. Over two decades earlier, Satish had seen giant spider conches numbering in their hundreds, but they had dwindled to just a few. During the night, they combed the beaches for sea kraits—sea snakes that came ashore to lay their eggs and digest their prey. Satish had encountered these frequently in the Andaman islands, but Aaron never found any in the Gulf of Mannar.

The rest of us had little contact with Satish in the intervening years. In 2010, we conducted the International Sea Turtle Society's Annual Symposium in Goa. We honoured Satish with the Sea Turtle Champion's Award. Though the who's who of the global community were present, Satish declined to collect the award and I had to deliver it to him at home. But he did sneak into town to meet his old Karen friends who were attending the conference.

In 2018, filmmaker Taira Malaney and her team decided to make a film on Satish's life. When we heard that they had convinced him to return to ANET and South Reef Island, the turtle fanatics Muralidharan, Adhith Swaminathan and I decided that we would just have to go along. We landed in Mayabunder and Satish had a touching reunion with Saw Uncle Paung, who had accompanied him on many of his early surveys.

A friendly forest officer offered to take Satish back to South Reef once he heard about Satish's seminal surveys there. After a long boat ride, we reached Interview Island, where to our considerable surprise, we found Saw Emway, who had been Satish's field assistant in the 1990s. We proceeded to South Reef Island, but

the boat could no longer land there due to changes in topography after the tsunami. Satish, who until then had looked like the 72-year old he was, threw off his clothes, donned his fins, slipped into the water and started swimming to the island. Emway, the film crew and I quickly followed suit. On the island, Satish was rejuvenated as he walked around the island remembering where hawksbills had nested when he was there two decades earlier.

I've spent the last 25 years studying sea turtles across India. Everywhere I've been, from the Andaman and Nicobar Islands to Lakshadweep to Papua, Satish has been there before and left his mark. It's easy to get obsessed with sea turtles, but even easier when you've had Satish Bhaskar as your mentor and inspiration. After recurring bouts of ill health, Brenda passed away in October 2022 and Satish a few months later in March 2023. He is survived by his children, Nyla, Kyle and Sandhya.

There are many, many more Satish stories. Read about his adventures here:

<https://www.seaturtlesofindia.org/talking-turtles/satish-bhaskar/>

<https://www.iotn.org/iotn12-07-special-profile-satish-bhaskar/>

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**Kartik Shanker** is Faculty at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore and Founding Trustee of Dakshin Foundation, Bangalore.

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

**Shivangi Pant** is a visual communicator working at the intersection of art and environment. She works as an Art Editor at Current Conservation.



# Unfettered and undeterred:

## Anne Theo's tryst with marine biology

Author **Kartik Shanker**  
Illustrator **Joanna Davala**



Unfettered and undeterred. Those words best describe the young woman who came into my lab and life in 2009. Anne Theo would get into the PhD programme at the Indian Institute of Science the following year, but she spent her first months tinkering with some secondary data and helping me organize an international sea turtle conference in Goa. It was very clear from the beginning that she was fearless, both in her ideas and the things she did.

But one story captures her spirit and personality best. On our very first dive together in the Lakshadweep Islands, Anne got separated from us. Her fellow researchers and I surfaced after the mandatory search and became increasingly worried as there was no sign of her. The sea was getting choppy and we were running out of options. Anne surfaced seconds later, about 10 metres away, looked at us and said “Where were *you* guys?”

Anne was never lost, the rest of the world was!

Anne had not considered in-water research when she began her PhD. In fact, she was not even a particularly good swimmer at the time. But we chanced upon mixed-species groups of reef fish based on a remark by Umesh Srinivasan, who was doing similar research for his PhD on birds. Anne latched on to the idea, and trained herself rapidly in the Institute's swimming pool and got her dive certification as well. However, a larger problem loomed. Many marine biologists she consulted were not enthusiastic about her plan to study mixed species groups (MSGs) in reefs—they thought that reef fish MSGs were too ephemeral and might not be interesting.

Anne was undeterred. She spent her first field season in the Lakshadweep Islands gathering evidence that MSGs were common, could be video-graphed and that there were a host of interesting ecological questions

that one could address about them. She gathered a massive dataset across four years, and made significant contributions to our understanding of fish MSG group types. Her work, which emphasised the fundamental ecological and behavioural differences between shoaling and attendant fish groups, would inform theoretical frameworks that were developed for a global review.

Bina, one of her closest friends from childhood, remembers how much she loved the ocean and how keen she was to share the joy with others through her encouragement and swimming lessons, that she imparted with 'gentle and obsessive persistence'. Even in the field, Anne had a long history of friendships and partnerships. Over a period of several years, her buddies—on land and in the water—included researchers from multiple different institutions. She started her field work in 2011 with Rucha Karkarey from the Nature Conservation Foundation. Diving during the day, playing the guitar and writing songs in the evening (including classics such as Harami Gourami), the two livened up the Kadmat field station. She was also paired with her fellow student, Bharti, who was scoping a project on green sea turtles. She then worked for several seasons with Mahima Jaini of Dakshin Foundation; Mahima helped Anne with her dives, Anne helped Mahima with Malayalam.

Anne, Mahima and I made a memorable trip to Suheli Island in Lakshadweep in 2015. Uninhabited other than a police camp, fishers visit periodically during the fair season. Suheli is legendary because the late Satish Bhaskar, doyen of sea turtle surveys in India, spent five



solitary months there during the monsoons in the 1970s to count and monitor green turtle nesting. We left before dawn, walking down narrow lanes to the beach; while the rest of us had perfunctory field backpacks, Anne had her large pink stroller suitcase that she took everywhere. We had hired two tuna boats to ferry us there, and caught tuna and other fish along the way. The diving was spectacular; at one point, Anne and I turned to see two eagle rays gliding effortlessly through the water. They swum languidly in an arc towards us, realized we were there and veered away with barely a wobble in their trajectory. A moment of surreal beauty that we remembered many times after. And then, later on the dive, work completed, she did a goofy dance underwater and we took some memorable comic photographs with Mahima.

On that trip, I met Jafer, who took our team out on his boat for their dive surveys in Agati and Bangaram. Jafer's daughter, Nihla Fatima, then three years old was very fond of Anne and Mahima, and endeared herself greatly to all of us. The people I met and the spectacular diving there led to Moonlight in the Sea, an illustrated story about a little girl from the Lakshadweep who learns to snorkel and falls in love with

marine life. One day, her boat gets swept away in a storm and she ends up stranded in Suheli, where she learns to fend for herself. When my illustrator was working on the book, she commented that the little girl was far too nonchalant for a 10-year-old stuck on a remote island. It struck me later that Anne had wormed her way into the young protagonist's personality.

Later that year, when we got advanced dive training at Havelock Island in the Andamans, Anne was on hand to try and convince Priti Bangal, a new student and novice diver, to work on reef fish. Priti ended up working on birds, but Anne would get another opportunity to impart her vast knowledge of reef fish when she helped Bharat Ahuja with his field work in 2021. We joked that Bharat had the most qualified field assistant that any student had ever had. From getting lost to leading dives, Anne had come a long way.

Despite significant struggles with her health during her PhD, she never gave up her passion for science and fieldwork. She mentored a host of junior students doing marine ecology in both analysis and fieldwork, including identifying surgeonfish and parrotfish species that only she could tell apart. She escorted Meenakshi Poti to Lakshadweep and helped her get started on her project on green turtles. She worked with Ajay Venkaraman on an analysis of her data during the COVID-19 lockdown, when Ajay was stuck in India waiting for the Australian borders to open so he could start his PhD.

She loved the ocean and fieldwork, but she was a whizz at R, and taught courses and workshops in statistics. In the summer of 2022, she was my (vastly overqualified

again) teaching assistant for a quantitative ecology course at the department, one that I was teaching for the first time. Having Anne to talk to about my struggle to relearn equations was a relief in no small measure. In the last year, she also played a key role in developing and proposing a special issue on mixed species groups in the prestigious journal, Philosophical Transactions of the Royal Society B, working closely with her co-editors Todd Freeberg, Nora Carlson and Eben Goodale. The last paper she worked on is included in the theme issue, which is dedicated to her.

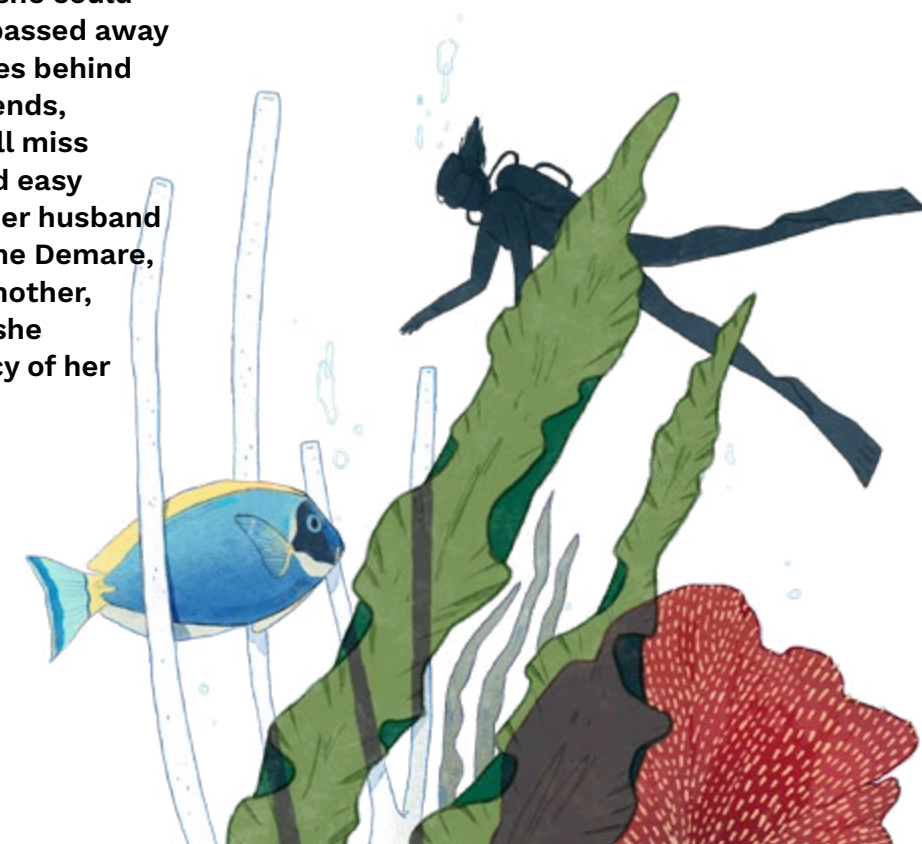
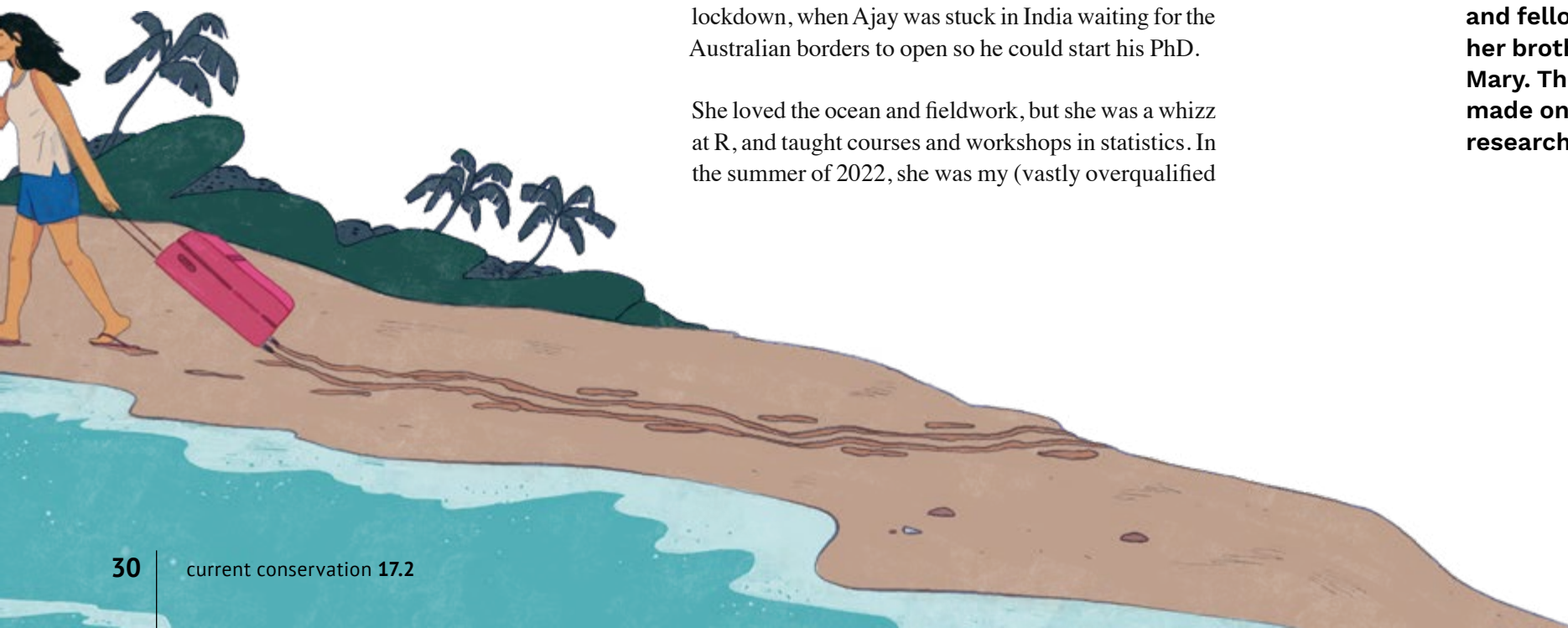
**Anne's plans for the world were unfettered. She was innately caring and carefree, but she also wanted to stomp on things that she found unfair, illogical or senseless. She wanted to create a science cooperative that transcended the politics and pitfalls of academia. She wanted to end patriarchy and capitalism. Tragically, before she could do any of those things, Anne passed away on February 6, 2023. She leaves behind a vast community of close friends, colleagues and family who will miss both her fierce arguments and easy affection. She is survived by her husband and fellow ecologist, Guillaume Demare, her brother, Dennis, and her mother, Mary. The lasting impression she made on people and the legacy of her research will live on.**

Anne, so long and thanks for all the fish stories!

**Anne Heloise Theo**  
(August 28, 1985 – February 6, 2023)

**Kartik Shanker** is Faculty at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore and Founding Trustee of Dakshin Foundation, Bangalore.

**Joanna Davala** is a freelance illustrator & graphic designer specializing in branding, website design and editorials.





# Linking eco-credits and livelihoods with marine conservation in coastal East Africa

Author **Gathoni Mwai** Illustrator **Ritika Nair**



Mwandazi Kassim Shee runs a small successful retail shop, selling items such as soap, tea, bread, milk, flour and vegetables. But things were not always like this; very much like other people in her area, cassava and coconut were her only source of subsistence, and every day was a struggle to survive. Mwandazi is a resident of Majoreni, a small town in Kwale county, along Kenya's southern coast. In coastal Kenya, many women cultivate coconut trees and cassava plants and sell the surplus. But with excess supply from all the farmers, the demand has not increased, which means the profits barely help make ends meet. Kwale county is one of the poorest in Kenya, with a poverty rate of nearly 42 percent compared to a national average of 12.2 percent.

But things are changing for the better for Mwandazi. She is a member of the Shangani self-help group and one of the beneficiaries of an eco-credit scheme spearheaded by the NGO Coastal and Marine Resource Development (COMRED). COMRED works with communities to preserve marine resources in coastal Kenya for the benefit of nature and people, and the eco-credit scheme, through 'grants', is giving the community groups an incentive for conservation as they boost members' livelihoods.

Majoreni and similar eco-credit groups are under no obligation to reimburse COMRED, but there is a condition attached: members must actively engage in conservation initiatives to be eligible for the 'grant'. In this way, the grant transforms into a self-sustaining fund, with group members providing loans to one another while maintaining their involvement in conservation efforts. The range of environmental conservation activities is extensive and typically involves activities such as cleaning up beaches to remove plastic waste, planting mangroves, conducting patrols of fisheries and mangrove forests, as well as educating other community members on environmental issues.

**"I'm now able to pay school fees for my kids, compared to before when it was a struggle. And in Majoreni, we now understand better why it's important to protect the environment. For example, fish get a place to breed in the mangroves, and they also get food. So we must help to stop mangrove degradation. Our economy as a people is based on the ocean," Mwandazi says.**

## How it started

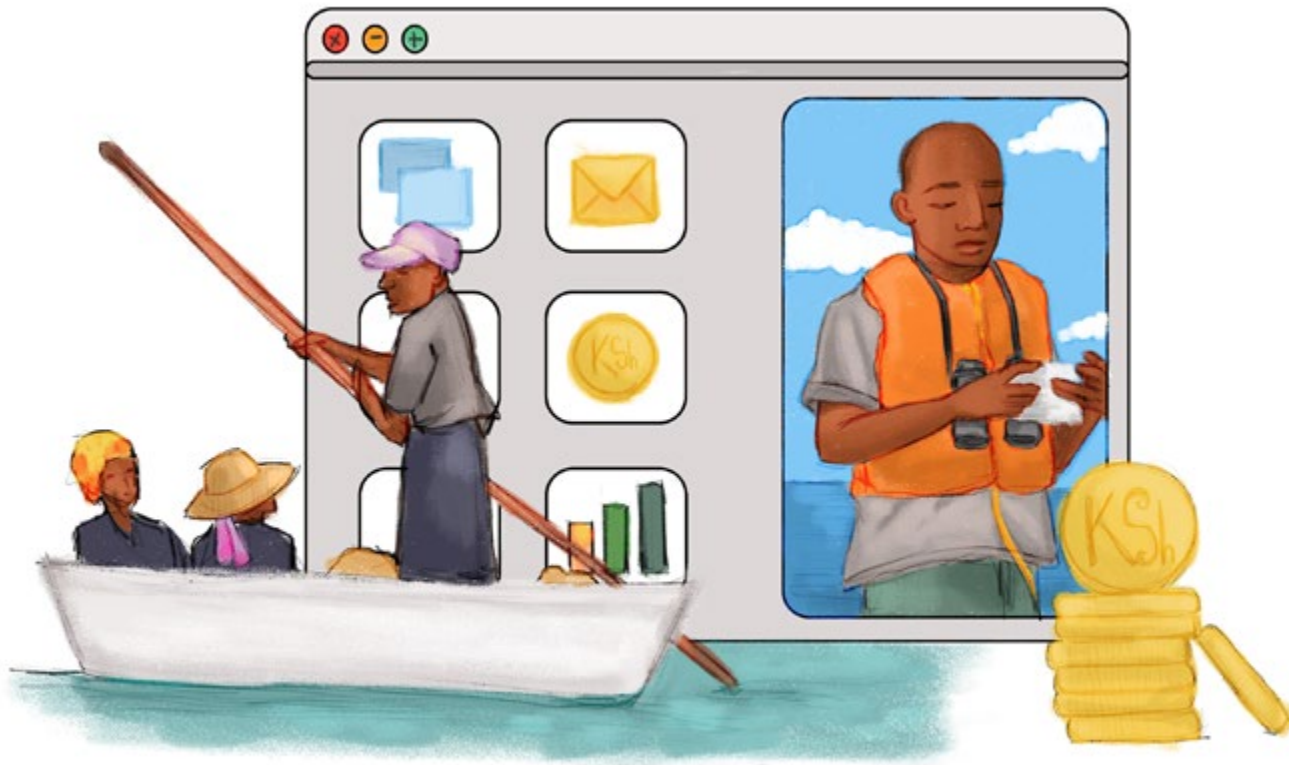
Kwale's coast stretches approximately 250km and is divided into 22 local fisheries management associations known as Beach Management Units (BMUs). These BMUs are responsible for looking after fishers and fisheries activities. Many coastal community members are low-income fishers, small-scale fish processors (98% women) or traders who don't have access to formal and reliable financial services and struggle to save and get loans. To try to help people and solve the ocean's challenges simultaneously, COMRED introduced this eco-credit system that provides people in coastal communities with loans tied to carrying out marine conservation activities.

COMRED launched the Kwale Community Eco-Credit Fund in April 2022 with seed money of Ksh 800,000/USD 6,400 and gave the first 10 savings groups Ksh 80,000 (around USD 700) each. Each group then develops a marine conservation action plan, such as planting and protecting mangrove forests, providing community services, and doing beach cleanups. The conservation action plans address issues that are part of a wider problem in a national context.

Coastal communities in Kwale, like in all other coastal Kenyan communities, face various challenges affecting their livelihoods and environments, such as marine and coastal degradation, population pressure and climate change. This has led to the overuse of marine resources and a subsequent decrease in productivity, forcing these dependent communities into poverty. This becomes a vicious cycle, where poverty increases dependence on limited natural resources and exacerbates competition between nature and human survival, especially in the face of climate change. Therefore, communities often have to face the trade-off between pursuing livelihoods for subsistence and conserving marine resources by dedicating time and setting aside some habitats for conservation purposes. This is where the eco-credit scheme incentivises communities to participate in conservation while providing financial support to improve their livelihoods.

Members can access credit, grow the fund, and make it sustainable. Savings grow the seed capital, making more credit available to new and existing members. Community data monitors are trained to record conservation activities, such as the number of beach clean-ups conducted and mangrove planting carried out, as well as recording financial transactions, tracking each group's progress, and sharing the data with the project team through a mobile application called ODK Collect. This means the community members can monitor their progress per the goals they set, not just for their conservation





work but for their finances, giving them greater ownership and sustainability for the conservation work.

#### Getting inspired by others in the marine space: The Mwambao story

The eco-credit system, designed in consultation with the community and conservation micro-credit company GreenFi, has also seen strong community engagement in neighbouring Tanzania. The project was initiated by one of Maliasili's partners, a marine conservation organisation, Mwambao. The eco-credit system known as 'Mkuba – the fund to care for the sea' has been running since July 2018.

**The model's effectiveness is apparent from its impressive results; not only is it delivering financial but environmental benefits as well. It has facilitated almost 370 community-managed loans to 213 beneficiaries across five groups. Over 50 percent of these beneficiaries are women, with the total value of loans exceeding USD 27,000, and the community has ensured that legal fishing gears have been adhered to, over 20,000 mangrove seedlings have been planted, and patrols**

**and security of octopus closures have significantly increased, leading to increases in octopus landings and improved fisher incomes.**

While on a field visit with our East Africa portfolio team, I had the opportunity to personally meet with one of the groups on Tumbatu Island, located off the coast of Zanzibar. The island is home to a vibrant and close-knit community, with around 13,000 residents who primarily rely on fishing and seaweed farming as their main economic activities. The rich marine environment around Tumbatu Island and along the northeast coast of Zanzibar is a traditional fishing ground for people from the entire region. The newly established marine conservation area also contains Zanzibar's third largest mangrove stand.

Fishing has long been a traditional way of life for the people of Tumbatu Island, but much like other East African coastal communities, they have been facing challenges from overfishing by illegal fishers from other areas, which has led to the depletion of fish stocks as well as damage to the marine ecosystem through the illegal harvesting of mangrove forests. The island's residents also have limited access to healthcare, education, and basic infrastructure. During

this meeting, I heard directly from the group members about the impact of the eco-credit scheme and how it's improving their quality of life as well as the marine environment by giving the communities support to improve their livelihoods and an obligation to protect their environment.

#### Paving the way for innovative financing in marine conservation

These innovative blue loans projects provide coastal communities with much-needed access to credit to help them improve their lives and the environment around them. Communities have greater ownership and responsibility for the management of their environments.

The appetite and growing community interest in these eco-credit schemes open the door for the potential of broader implementation, not only in Kenya and Tanzania but around the world. With the 'Ocean Decade' and

30 by 30 all set to actualise in 2030, eco-credit schemes and blue loans provide an opportunity for coastal communities to gain some direct economic benefit from marine conservation. This motivates them to protect biodiversity, and the additional income also improves their financial well-being.

**Gathoni Mwai** is one of the East Africa Portfolio Managers at Maliasili. Based in Nairobi, she is passionate about community-led conservation and innovation, and has a decade's experience in social development, and a focus on sustainable resource management.

**Ritika Nair** is a visual designer and artist. She enjoys creating illustrations that symbolizes a deeper connection with nature and from that, ourselves.





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