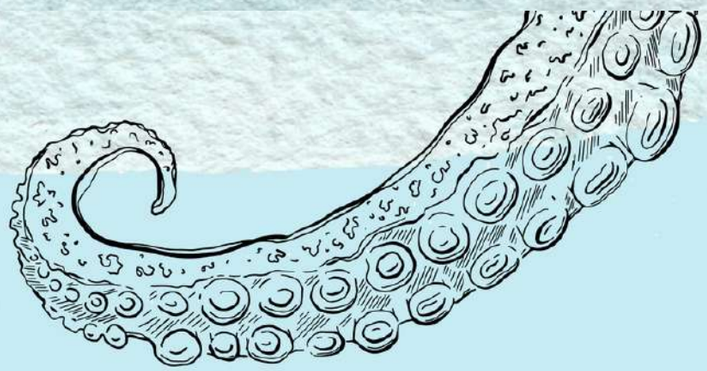
November 2023



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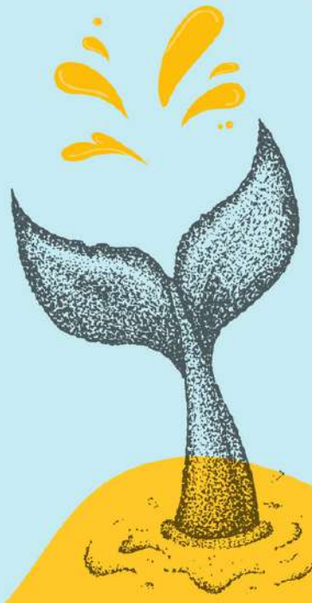
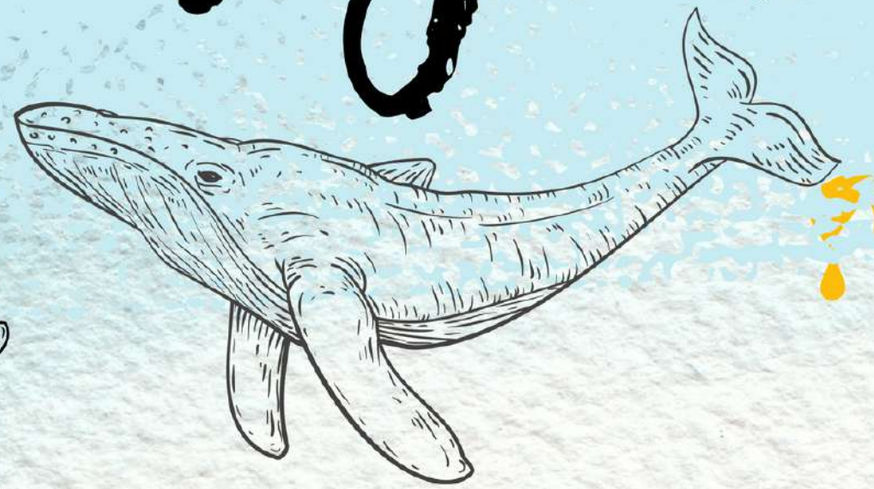
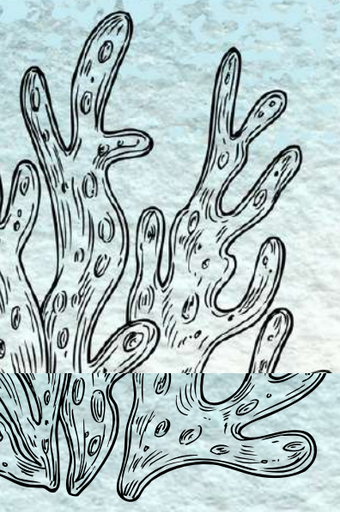






shark stories,
turtle tales
& more...

Issue 4

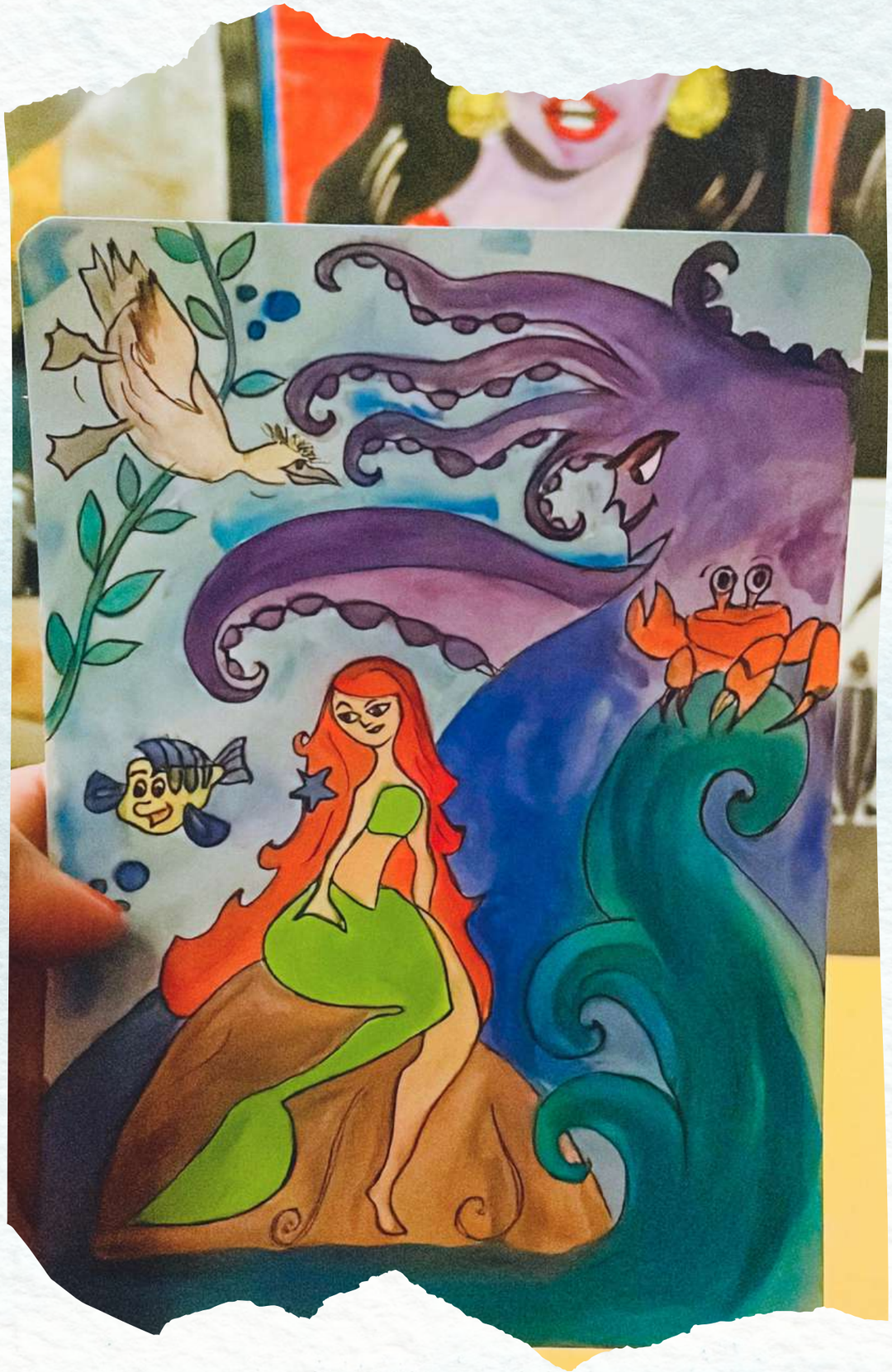
Dear Reader,

I recently took this online quiz by the Natural History Museum called '*What fantastic real-life beast are you?*' and discovered that I am in fact, a manatee. If not for my very human organs, I wouldn't have hesitated for a second to dive deep into seagrass meadows and spend the rest of my life frolicking happily, occasionally surfacing to make a controversial appearance to baffle sailors, leading them to make up tales of mermaids as they return to the shores....oh wait, we're way past the 1st century...Too bad, Pliny, the Elder.

As I was watching the live-action Disney movie The Little Mermaid, I hooted for these tiny sea creatures which had such main character energy. Sebastian the tropical ghost crab, Flounder the regal angelfish (*or was it a Hawaiian sergeant*?), Flotsam and Jetsam the moray eels, Ursula the giant squid, Scuttle the gannet and Ariel the mermaid (*or as many of us marine folks would like to re-imagine- a manatee or a dugong*)! It led me to think of those very real marine animals on which the characters were based. Their role in the marine ecosystems certainly is one of the major reasons flagship marine animals survive today.

Fish like Flounder and crabs like Sebastian may be predated by moray eels like Flotsam and Jetsam or fill some jelly bellies. Our good old flagship species like sharks and sea turtles, in turn, feed on them! Look at nudibranchs- bright, animated-looking organisms straight out of a Disney movie- they are bioindicators for reef ecosystems, the rainforests of the sea. Even seabirds like Scuttle the gannet (*expert sea divers*) have become important indicators of prey availability closer to ocean water surfaces, which researchers think may have important implications to earmark some ocean habitats as Marine Conservation Zones.

So, I remembered to never fail to pause and admire small sea dwellers who make our oceans the aqua kingdoms they are. We hope in this issue we've splashed enough squid ink to colour our monochromatic lives with tales of these 'inkredible' creatures from Under Sea. Don't forget to drift a letter across and tell us how you want the next issue to look.



“Through the tides, with the help of her little friends,

Ariel soared

And as realisation dawned on his face, Titan roared...

Uncertain, angry, afraid of a certain death

While the bold squid queen waited with bated breath

In her eyes, a devious gleam,

For she could see turning into reality, her dream”

~Debangini

Meet the Meadow Folks

Dugong (*Dugong dugon*)

Image: Dr Vardhan Patankar

Gentle, giant, rotund and whiskery, the dugong (*dugong dugon*) is the closest to merfolks we'll ever encounter. One of the only four surviving species of the order Sirenia (*a once diverse group of marine mammals that include manatees*), the dugong is a herbivorous sea mammal growing up to 10 feet and weighing 510 to 1,100 pounds. Some believe that dugongs were the inspiration for ancient seafaring tales of mermaids and sirens.

Called sea cow for a reason, the dugong exclusively feeds on seagrass day and night, grazing in the meadows and chomping grass with its rough lips. Seagrass, therefore, is essential to the survival of the dugong, which has a particularly slow reproduction rate, compared to other sea creatures. The female dugong breeds every 2.5 to 7 years and has one calf after a year-long pregnancy.

The dugong was long sought for its meat, oil, skin, bones, and teeth. Though legally protected

throughout its range and listed as Vulnerable in the IUCN Red List of Threatened Species, some studies show its conservation status is highly variable. It is extinct in China but can be found in warm coastal waters from East Africa to Australia, including the Red Sea, Indian Ocean, and Pacific. Nearer home, Tamil Nadu notified the first-ever dugong conservation reserve in India in the Gulf of Mannar and the adjacent Palk Bay on the southeast coast. There are an estimated 200-250 dugongs left in the oceans, and this reserve has now become the most significant surviving natural habitat for dugongs globally. There are also reports of dugongs found near the Andaman and Nicobar Islands and the Gulf of Kutch in Gujarat.

Trivia:
An interesting fact about these meadow folks is that they can stay underwater for six minutes before surfacing and sometimes breathe by "standing" on their tail with their heads above water, giving an impression of sea yogis!

To learn more about these fascinating real-life mermaids, read this interview with Dr Elrika D'Souza from Nature Conservation Foundation who works extensively on seagrass meadows and dugongs in the Andamans.

Sources:
1. *Anon. 2011. "Dugong." National Geographic. Retrieved November 22, 2023 (https://www.nationalgeographic.com/animals/mammals/facts/dugong).*
2. *D'Souza, Elrika. 2022. "Dwindling Dugongs: Meandering Trails in Seagrass Meadows." RoundGlass | Sustain. Retrieved December 11, 2023 (https://roundglasssustain.com/species/dugongs).*

Researcher's Isle

Meet Bharat Ahuja

Tell us about your current work.

I am currently a PhD student at the Centre for Ecological Sciences, IISc Bangalore. My work here focuses on mixed-species fish flocks. I try to understand why different species of surgeonfish and parrotfish come together to form ephemeral groups in the fringing reefs of the Andaman Sea. The formation of such groups allows fishes to forage more efficiently, while also ensuring safety in numbers. I explore the costs and benefits associated with partaking in these groups as well as the consequences that such shoaling herbivorous fish groups have on the reef ecosystem.

What has your journey been like till this point?

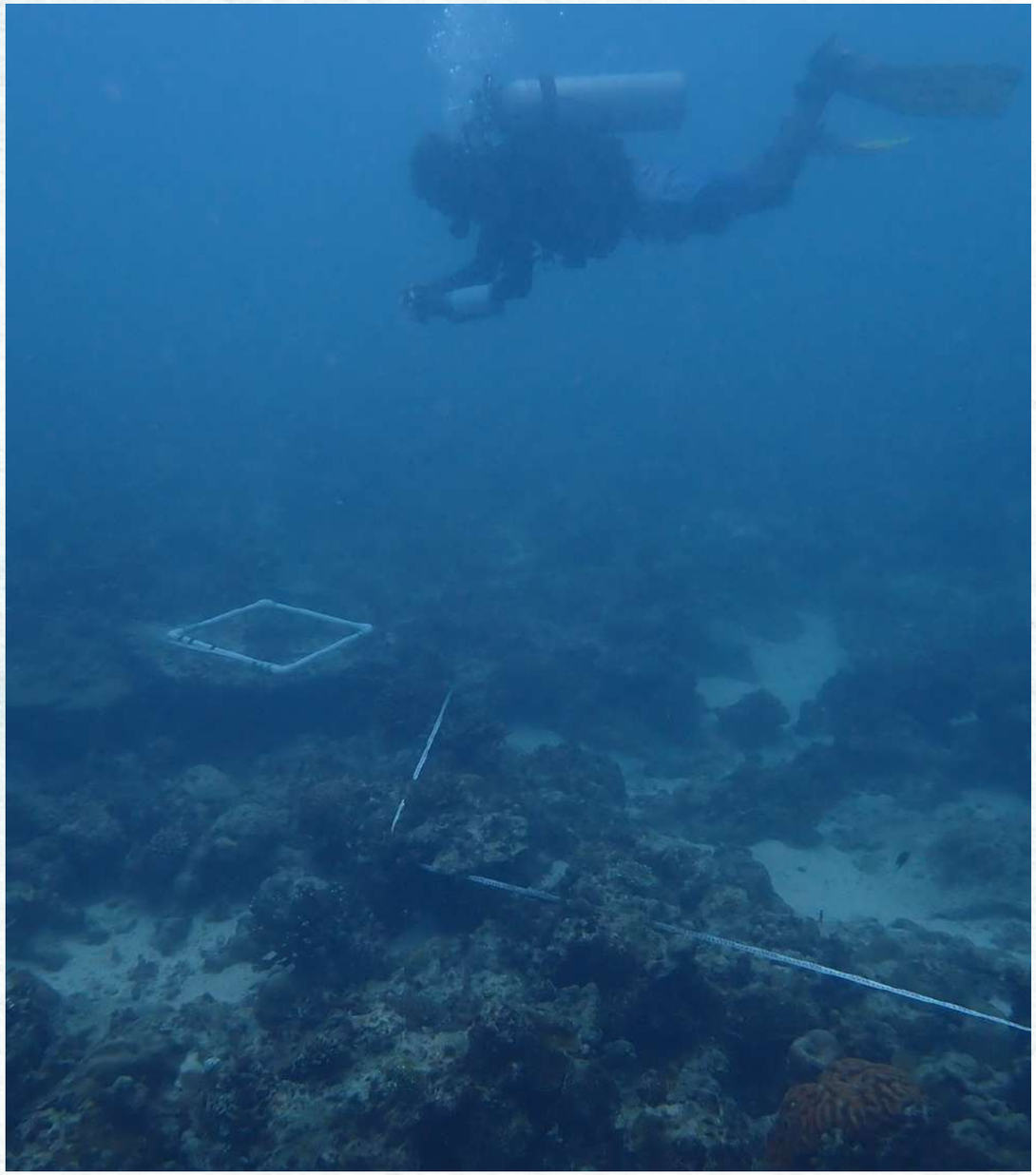
Much like the tide (*though not as predictable*), there have been periods of ebb and flow. I'm grateful for some incredible people I've met who have helped me through periods of uncertainty. I consider myself fortunate to have ended up in the institutions I have worked in and privileged to witness animals living their lives in an attempt to understand them better.

What are some of the challenges you have faced along the way or continue to face?

The early stages of a career in academia can be quite lonely and I often find myself trapped in my head. This is never a good place to be, especially when your work is dependent on several factors that you have almost no control over such as permits, boat registrations and bad weather. It is therefore immensely important to surround yourself with people who will support you through testing times and keep you on track when you're floundering.

Advice you would want to give to those who want a career in marine research and conservation...

Dip your toes into the sea before you go SCUBA diving – start small and stay true to your skill set. Don't let hurdles you encounter discourage you and celebrate even the smallest of victories. Most importantly, stay curious and don't ever hesitate to ask a question.



You can email Bharat at bt.ahuja@gmail.com or find him on Instagram @the_pathseeker.

SEAmbiosis

Nudibranchs: Slaying it with colours!

~*Debangini Ray & Tanmay Wagh*

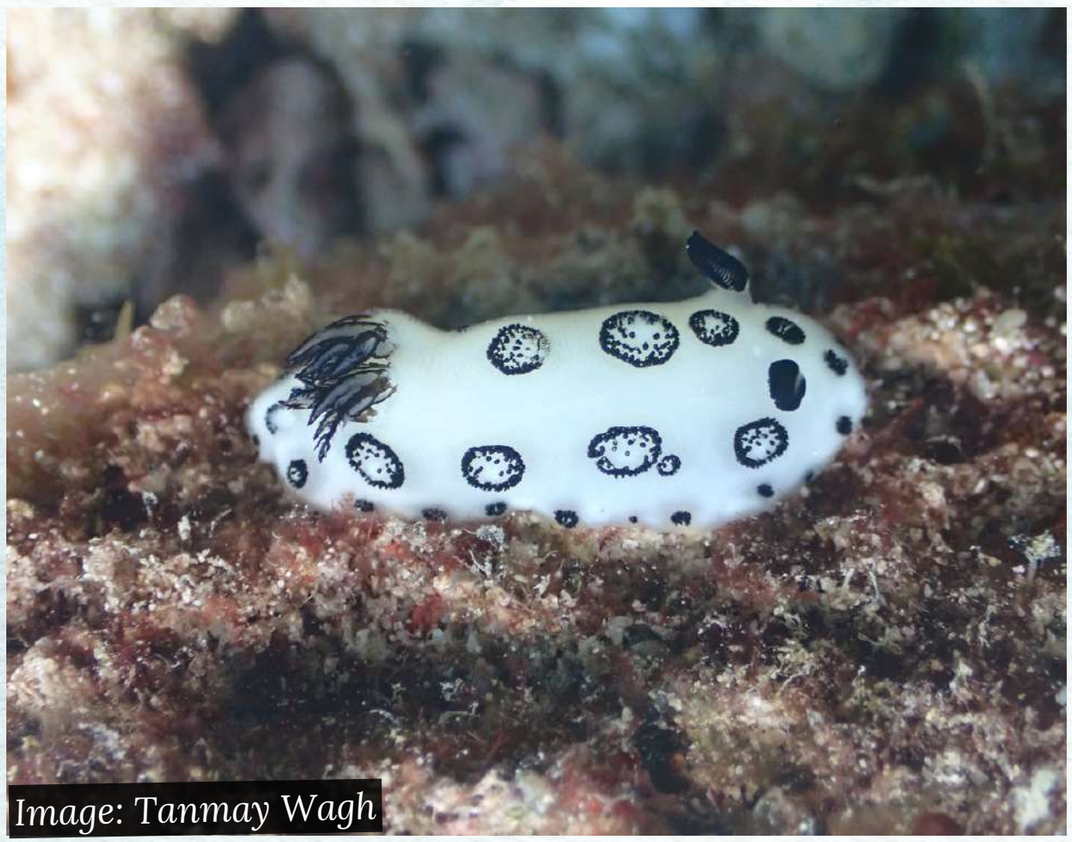


Image: Tanmay Wagh

Among the dazzling, unique and enchanting marine creatures that live in and around coral reefs, nudibranchs perhaps are the most popular because of their adorably quirky shapes and colours that remind us of Pokémon!

Nudibranchs (*pronounced as nudee- branks*) are shell-less marine gastropod molluscs with more than 2000 species in the world's oceans! They belong to the snail trail...we mean the family of opisthobranchs (*snails without shells*), characterised by their *nudus* (Latin for naked) *bránkhia* (Ancient Greek for gills).

The vivid and breathtakingly beautiful patterns on these organisms (*which will likely give fashion designers a run for their money*) are there for a specific reason (*nope, not for Ocean Fashion Week or a Tim Burton musical, though good thinking there*). The two main purposes of these intricate patterns and bright colours are defence and camouflage. Nudibranchs obtain their chemical defences from their food sources.

For example, after preying on sponges (*a popular food source for nudis which contain poisonous chemicals*), they recycle and use the chemicals to decrease their palatability and deter predators from eating them.

Because of their dependence on coral reefs, life history traits and ability to rapidly adapt, they are considered key bioindicator species for reef health. Though typically found in coral reefs, you may also find them among seagrasses and inter-tidal regions. Most of them crawl on the bottom of the sea floor but some are also known to hit the dance floor to swim gallantly (*like the Spanish dancer*)!

Sources:

- *Formel, Nathan. 2013. "A Colorful Defense." Living Oceans Foundation. Retrieved November 20, 2023 (https://www.livingoceansfoundation.org/a-colorful-defense/).*
- *Garner, L., and C. J. Oosthuizen. 2023. "Send Nudis: An Assessment of Nudibranch Diversity in Sodwana Bay, South Africa." Ecology and Evolution 13(11):e10676. doi: 10.1002/ece3.10676.*
- *Purushotham, Chetana. 2022. "The Fabulous, Functional World of Sea Slugs." RoundGlass | Sustain. Retrieved November 20, 2023 (https://roundglasssustain.com/species/sea-slugs).*

Further reading: Are reef-building corals actively feeding on sea slugs for additional energy? Read the paper to know more.

Source: Rohan Chakravarty, *www.greenhumour.com, from the book 'Pugmarks and Carbon Footprints' published by Penguin India.*

Brain Surf

True or False?

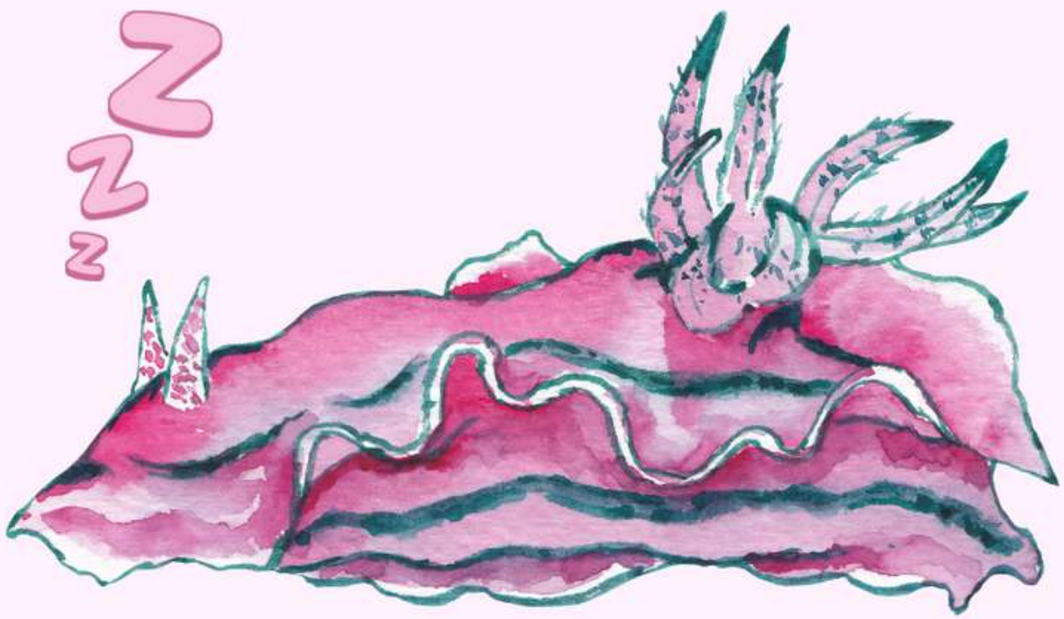
Look for answers at the end

1. Dugongs are related to elephants.

2. There is a species of nudibranch, called the Spanish dancer.

Some puns have washed ashore

Guess who's feeling 'sluggish' after drinking too much cucumber-flavoured jelly mojito at the slumber party in Unicorn Reef last night?



HOW MANY TICKLES DOES IT TAKE TO MAKE A SQUID LAUGH?

Straight from the field

Jellyfish Jamboree & A Fisherman's Woe

~Garima Bora

During pilot boat sampling trips with a seasoned gillnet fisherman off the coast of Malvan, we found ourselves face to face with an unexpected challenge – jellyfish trouble that has been brewing in the region's fisheries for a while now. As we ventured into the waters, what caught our attention was not the usual sight of vibrant schools of fish but rather a mesmerising Jellyfish Ballet! The ocean seemed to be teeming with them. However, our awe was not shared by the local fishermen.

You see, the increasing prevalence of jellyfish is more than just a spectacle; it is a troubling sign of rising ocean temperatures. A surge in jellyfish populations often indicates a decline in the fish populations, a concerning trend for those whose livelihoods depend on successful fishing expeditions.

The jellyfish not only compete with fish for resources but also inflict damage on the fishing nets, adding an extra layer of frustration for the fishermen.

This issue is not a recent phenomenon. Since the 1980s, documented evidence suggests a gradual increase in both abundance and sightings of jellyfish swarms in Malvan waters (*read the paper here*). As we continued our explorations, it became evident that the delicate balance between marine life and environmental changes is undergoing a significant shift, leaving marine scientists and local fishermen grappling with the challenges these gelatinous invaders pose.

Reference: *Siddique, A., Purushothaman, J., Madhusoodhanan, R., Raghunathan, C. 2022. The rising swarms of jellyfish in Indian waters: The environmental drivers, ecological, and socio-economic impacts. Journal of Water and Climate Change; 13:10: 3747. https://doi.org/10.2166/wcc.2022.245*

Images: Garima Bora, Malvan.

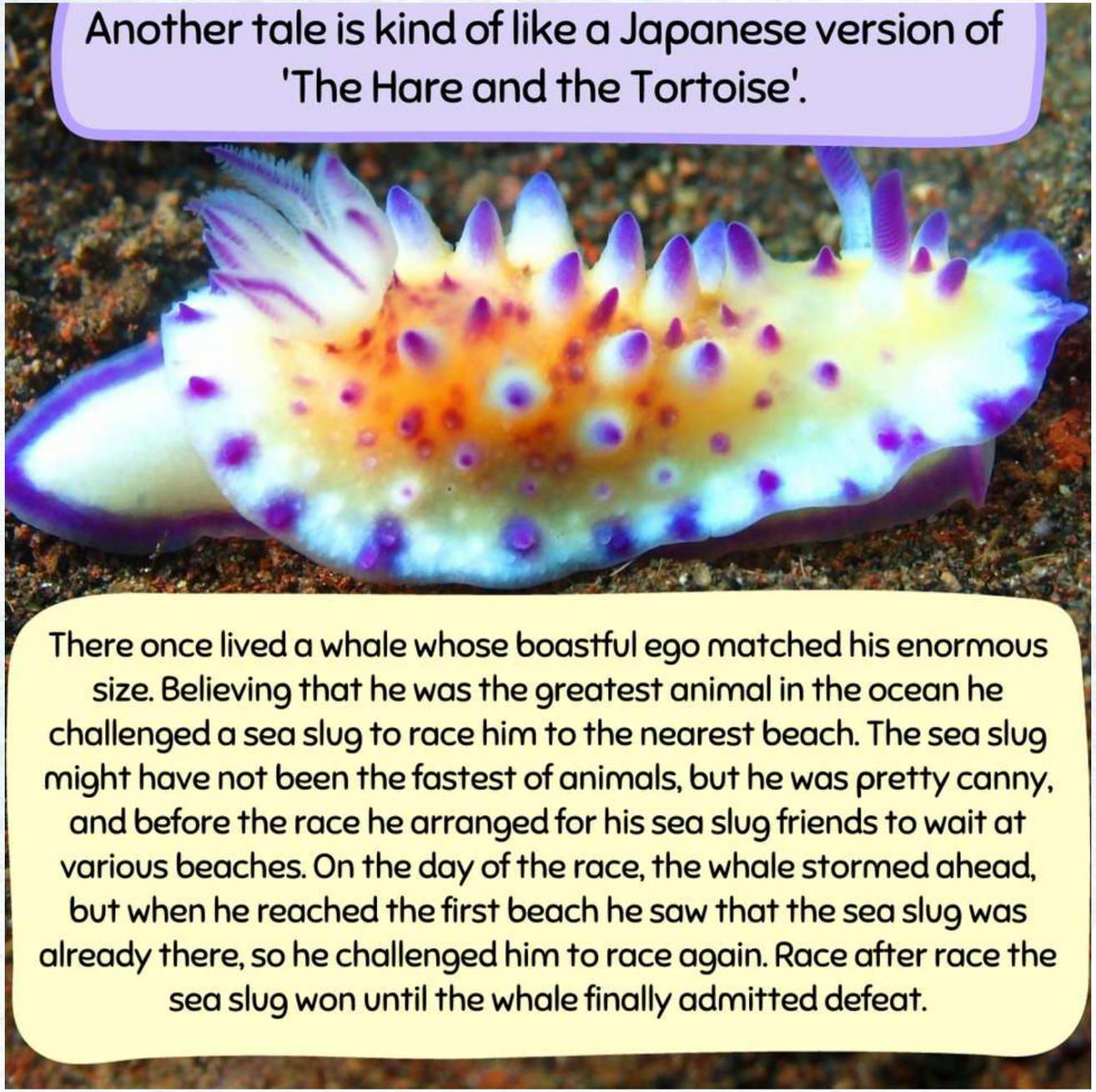
Pearls of Fishdom

Secrets of the Sea Slugs

In Japanese mythology, it is said that when the gods were asking all the sea creatures how they would serve mankind, only the sea slug remained silent. So angry was one of the goddesses (amanozume-no-mikoto) that she cursed the sea slug to always remain as indecisive and wishy-washy forever more. Some versions of the tale say that she also took a dagger and cut the creature's mouth into the strange orifice that it now has.

Sea slugs have been a popular subject of mythology and folklore for centuries. In many cultures, they are seen as a symbol of transformation and rebirth. In Native American traditions, sea slugs are often seen as a bridge between the physical and spiritual realms as well as associated with healing and protection. In some cultures, they are believed to be able to cure diseases and ward off evil spirits.

Sea slugs can photosynthesise, using sunlight to create energy for themselves. This ability has led some to see them as a symbol of Christ, who is often referred to as the “Light of the World.” In Africa, they are often associated with the goddess Aphrodite, who is said to have been born from the sea. These colourful marine animals are also said to represent the cycle of life, death, and rebirth. This is probably because they can regenerate their bodies after being consumed by predators. In China, it is said that consuming sea slugs can help to cure numerous diseases. In Hawaii, it is believed that eating sea slugs can help to increase strength and stamina.



Sources:

1. *Anon. 2022. “Sea Slug Spiritual Meaning, Symbolism and Totem.” Spirit & Symbolism. Retrieved November 28, 2023 (https://spiritandsymbolism.com/sea-slug-spiritual-meaning-symbolism-and-totem/).*

2. *Anon. n.d. “Folklore and Legends (Marine Mammals).” What-When-How. Retrieved November 28, 2023 (http://what-when-how.com/marine-mammals/folklore-and-legends-marine-mammals/).*

From the Galley

Whale Sashimi

The following is a traditional Japanese recipe for whale sashimi, locally known as *Onomi no sashimi*, which is popular in Taiji Town in Wakayama.

"The meat of the rokku whale landed in Taiji was a commodity, and most of it was shipped to the city in barrels, sprinkled with salt. However, it is thought that some of the meat was also distributed to the local people for consumption under various names. The meat of small toothed whales such as the Gondoh whale, which is not included in the six-whale category, must have been distributed locally for private consumption, so to speak, and is still very popular today."

How to eat

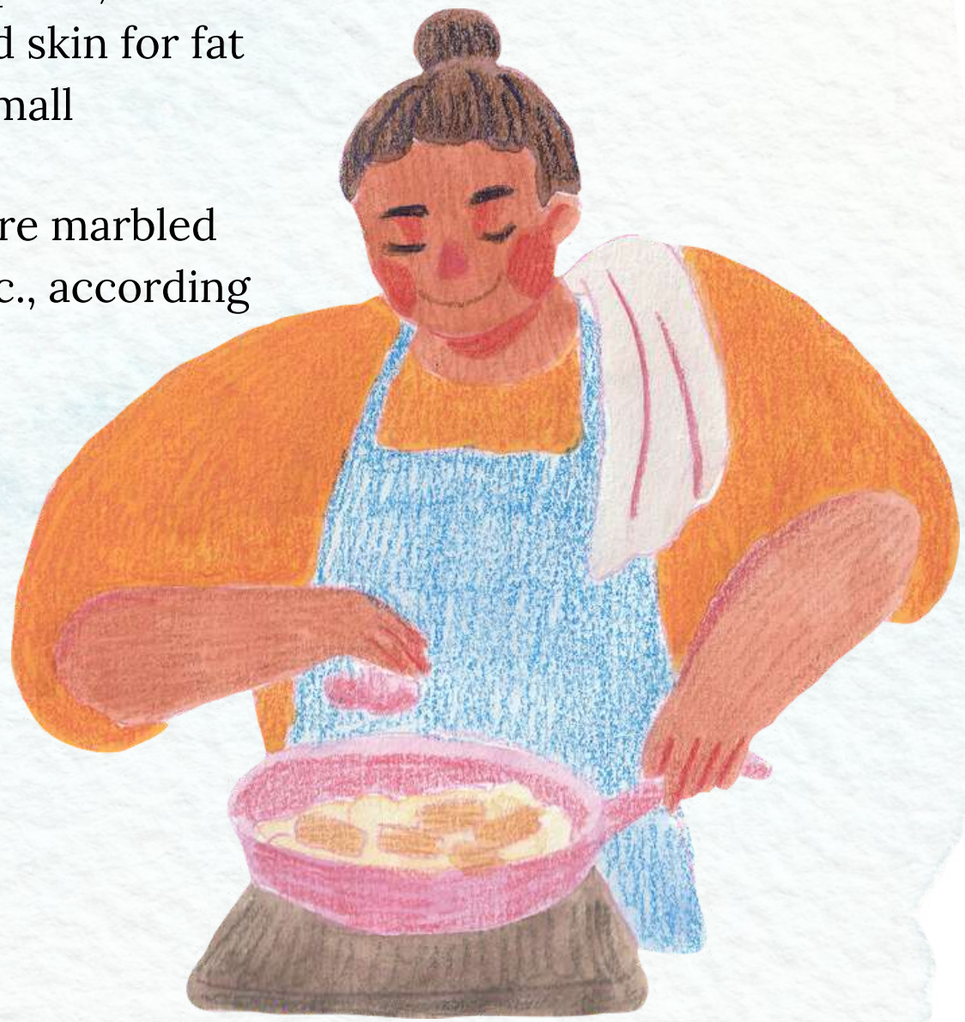
“Tail meat is also called oniku. It is the meat at the base of the tail fin, and only a small amount is harvested. It is a finely marbled meat with fine tannins and is usually sliced into thin slices and eaten as sashimi. Whale meat is classified into various parts, such as back meat, belly meat, and breast meat for red meat, *unesu*, *kawasu*, and skin for fat meat, and heart, tongue, oesophagus, *hyakujo* (stomach), and *hyakuhiro* (small intestine) for viscera. Various cooking methods that take advantage of the characteristics of each part have been handed down throughout Japan. Rare marbled meat is subdivided into tail meat, *aburasunoko*, *kanoko*, *shiofuki kanoko*, etc., according to texture, taste, and amount of fat, and is treated as a luxury item.”

Ingredients

- Whale Meat (50-100gm)
- Grated ginger
- Soy sauce
- *Ken* (radish and carrot)
- *Sudachi* (Japanese citrus fruit)

Recipe

- Cut the meat from the tail of the whale into thin slices.
- Garnish with radish, carrot *ken*, *sudachi* and *hojiso* to taste, and serve with ginger soy sauce, etc.



Source: *Wakayama Culinary Association. n.d. “Onomi No Sashimi.” Our Regional Cuisines. Retrieved November 28, 2023 (https://local-cuisine.maff.go.jp/en/recipe/1757/).*

Remembering Anne Wright

(10 June 1929–4 October 2023)

The following is an excerpt from the book section 'The Wright Way' from Chapter 3, 'From the Ports of Odisha to the Pans of Kolkata', from the book 'From Soup to Superstar' by Kartik Shanker:

Art by Kavya Gupta

Anne Wright was one of the founding trustees of WWF India in the 1960s, and a member of the Tiger Task Force commissioned by Prime Minister Indira Gandhi to select tiger reserves for the launch of Project Tiger in 1973. She served on the national board for wildlife for nineteen years and was on the wildlife board for several states including much of north-east India, West Bengal, Bihar, Odisha and the Andaman and Nicobar Islands (...). Wright played a little-known but crucial role in the drafting of the Indian Wildlife (Protection) Act, 1972. She obtained, through the good offices of the Kenyan polo team, which was visiting India at the time, a copy of the Kenyan Wildlife Act, retyped it and passed it on to the bureaucrats in New Delhi who were framing the Indian Act.

(...)

Subsequently, she visited Gahirmatha on a few occasions with the forest department and coast guard. Anne remembered one of her first visits to the rookery: '*I was camping on the beaches by myself, in a tent. There was a marvellous young man who was doing some research there. Suddenly, on a moonlit night, he came tearing across the sand. He had nothing on, except for a little lungi, and was shouting, "C'mon, c'mon, c'mon, the turtles have arrived!*" So we both ran and there we were, amongst a sea of turtles, all coming out of the water.'

(...)

Needless to say, Anne was a great influence on her daughter Belinda, who would become very much part of the turtle conservation melting pot in Odisha a couple of decades later. In the 1980s, Anne Wright was awarded the Order of the Golden Ark and the Member of the Most Excellent Order of the British Empire, or MBE, for her conservation efforts in India.

———

Source: *Shanker, Kartik. 2015. "Chapter 3: From the Ports of Odisha to the Pans of Kolkata." Pp. 98–99 in From Soup to Superstar. India: Harper Litmus.*

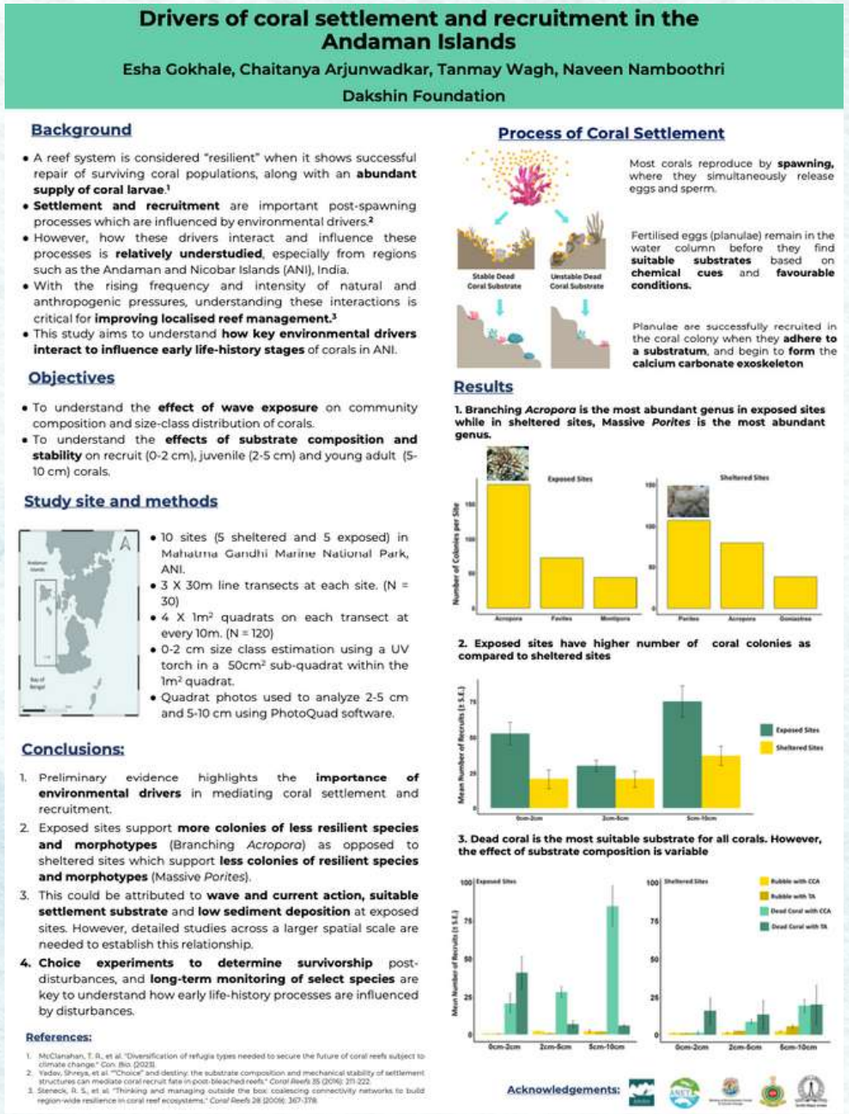
You can read her interview with Dr Kartik Shanker, published in Sea Turtles of India.

Sea Board

Curing conservation: one blog at a time

Kartik Shanker was invited as a speaker to the webinar '*Saving The World One Joke At A Time: humour in a biodiversity crisis*', along with Daniel Brockington and Sofia Castello y Tickell, hosted by the Society for Conservation Biology (SCB) and Current Conservation on the 24th of October this year.

The Student Conference on Conservation Science (SCCS), Bengaluru (9th-12th October 2023) took place offline at the JN Tata Auditorium after a long gap. The Marine Flagships team had a great time displaying outreach work and materials, as well as networking with young students and researchers in the Who's Who sessions.



Drivers of coral settlement and recruitment in the Andaman Islands

Esha Gokhale, Chaitanya Arjunwadkar, Tanmay Wagh, Naveen Namboothri

Dakshin Foundation

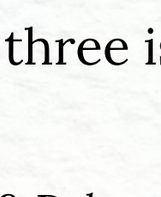
Background

- A reef system is considered "resilient" when it shows successful repair of surviving coral populations, along with an **abundant supply of coral larvae**.[1]
- **Settlement and recruitment** are important post-spawning processes which are influenced by environmental drivers.[2]
- However, how these drivers interact and influence these processes is **relatively understudied**, especially from regions such as the Andaman and Nicobar Islands (ANI), India.
- With the rising frequency and intensity of natural and anthropogenic pressures, understanding these interactions is critical for **improving localised reef management.**[3]
- This study aims to understand **how key environmental drivers interact to influence early life-history stages** of corals in ANI.

Objectives

- To understand the **effect of wave exposure** on community composition and size-class distribution of corals.
- To understand the **effects of substrate composition and stability** on recruit (0-2 cm), juvenile (2-5 cm) and young adult (5-10 cm) corals.

Study site and methods



- 10 sites (5 sheltered and 5 exposed) in Mahatma Gandhi Marine National Park, ANI.
- 3 X 30m line transects at each site. (N = 30)
- 4 X 1m² quadrats on each transect at every 10m. (N = 120)
- 0-2 cm size class estimation using a UV torch in a 50cm² sub-quadrat within the 1m² quadrat.
- Quadrat photos used to analyze 2-5 cm and 5-10 cm using PhotoQuad software.

Conclusions:

1. Preliminary evidence highlights the **importance of environmental drivers** in mediating coral settlement and recruitment.
2. Exposed sites support **more colonies of less resilient species and morphotypes** (Branching *Acropora*) as opposed to sheltered sites which support **less colonies of resilient species and morphotypes** (Massive *Porites*).
3. This could be attributed to **wave and current action, suitable settlement substrate** and **low sediment deposition** at exposed sites. However, detailed studies across a larger spatial scale are needed to establish this relationship.
4. **Choice experiments to determine survivorship** post-disturbances, and **long-term monitoring of select species** are key to understand how early life-history processes are influenced by disturbances.

References:

1. McClanahan, T. R., et al. "Diversification of refugia types needed to secure the future of coral reefs subject to climate change." *Con. Bio.* (2023).
2. Yadav, Shreya, et al. "'Choice' and destiny: the substrate composition and mechanical stability of settlement structures can mediate coral recruit fate in post-bleached reefs." *Coral Reefs* 35 (2016): 211-222.
3. Steneck, R. S., et al. "Thinking and managing outside the box: coalescing connectivity networks to build region-wide resilience in coral reef ecosystems." *Coral Reefs* 28 (2009): 367-378.

Process of Coral Settlement

Most corals reproduce by **spawning,** where they simultaneously release eggs and sperm.

Fertilised eggs (planulae) remain in the water column before they find **suitable substrates** based on **chemical cues** and **favourable conditions.**

Planulae are successfully recruited in the coral colony when they **adhere to a substratum**, and begin to **form** the **calcium carbonate exoskeleton**

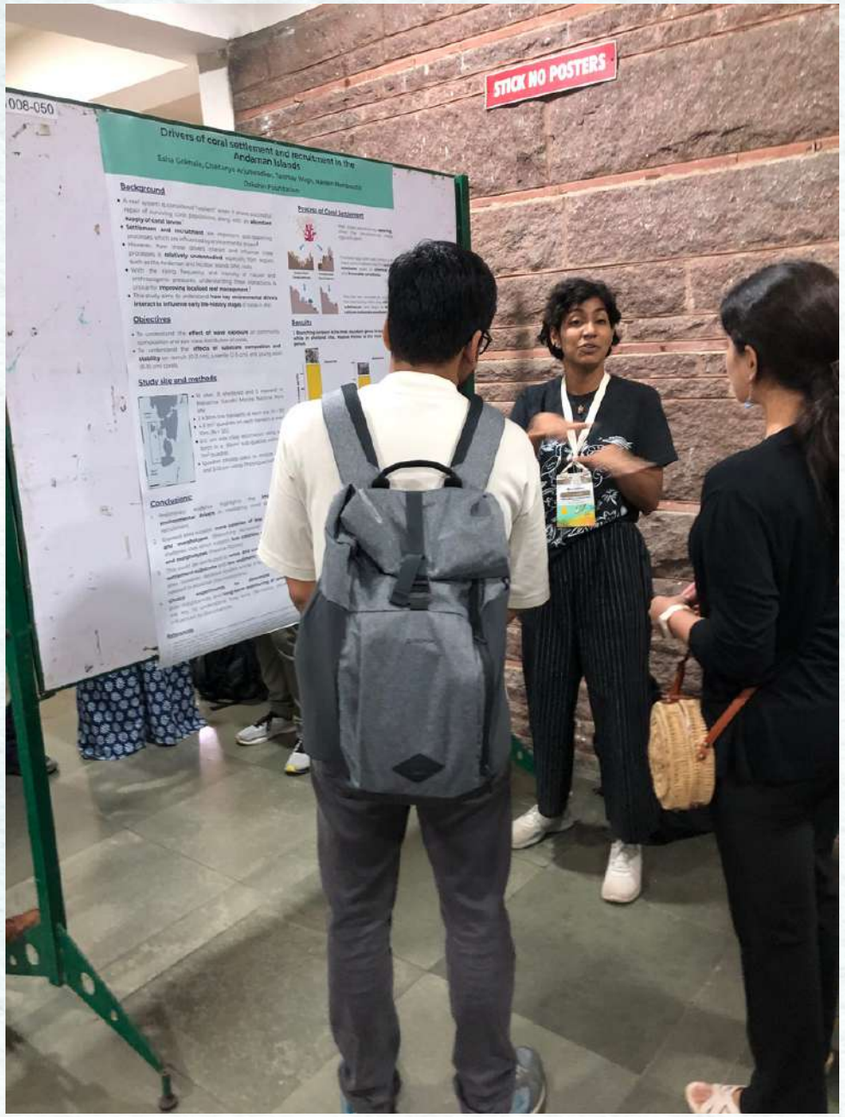
Results

1. Branching *Acropora* is the most abundant genus in exposed sites while in sheltered sites, Massive *Porites* is the most abundant genus.

2. Exposed sites have higher number of coral colonies as compared to sheltered sites

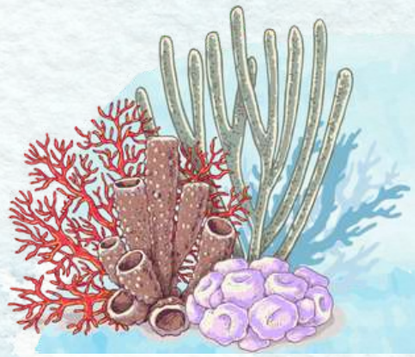
3. Dead coral is the most suitable substrate for all corals. However, the effect of substrate composition is variable

Acknowledgements:



Esha Gokhale, Program Assistant at Dakshin Foundation with the LTEO program, presented a poster highlighting the preliminary findings of an independent study she conducted as a larger part of the LTEO fieldwork. The poster visually conveys the post-spawning processes of coral settlement and recruitment (*mass release of eggs and sperm by coral colonies*) at ten sites covering three islands in Mahatma Gandhi Marine National Park, Andaman Islands. You can download the poster here.

Images: Tanuj Mark & Debangini Ray



Reef Logbook

Cool as a Cucumber!

Sea cucumbers (Holothuroidea) are echinoderms that grow up to 6.5 feet. There are some 1,250 known species, and many of these animals are indeed shaped like soft-bodied cucumbers.

They feed on algae, minute aquatic animals, or waste materials, which they gather in 8 to 30 tube feet that look like tentacles surrounding their mouths. Sea cucumbers are super cool because they break down these particles into even smaller pieces, which become fodder for bacteria, thus recycling them back into the ocean ecosystem!

Masters of self-defence, some sea cucumbers discharge sticky threads to ensnare their enemies when threatened. Others can mutilate their bodies as a defence mechanism (*don't worry, the missing body parts are quickly regenerated*).

Sources:

1. *Anon. 2010. "Sea Cucumbers." National Geographic. Retrieved November 20, 2023 (https://www.nationalgeographic.com/animals/invertebrates/facts/sea-cucumbers).*
2. *Ghai, Rajat. 2022. "Sea Cucumbers Most Frequently Trafficked Marine Species in India between 2015 and 2021: Analysis." Down To Earth.*

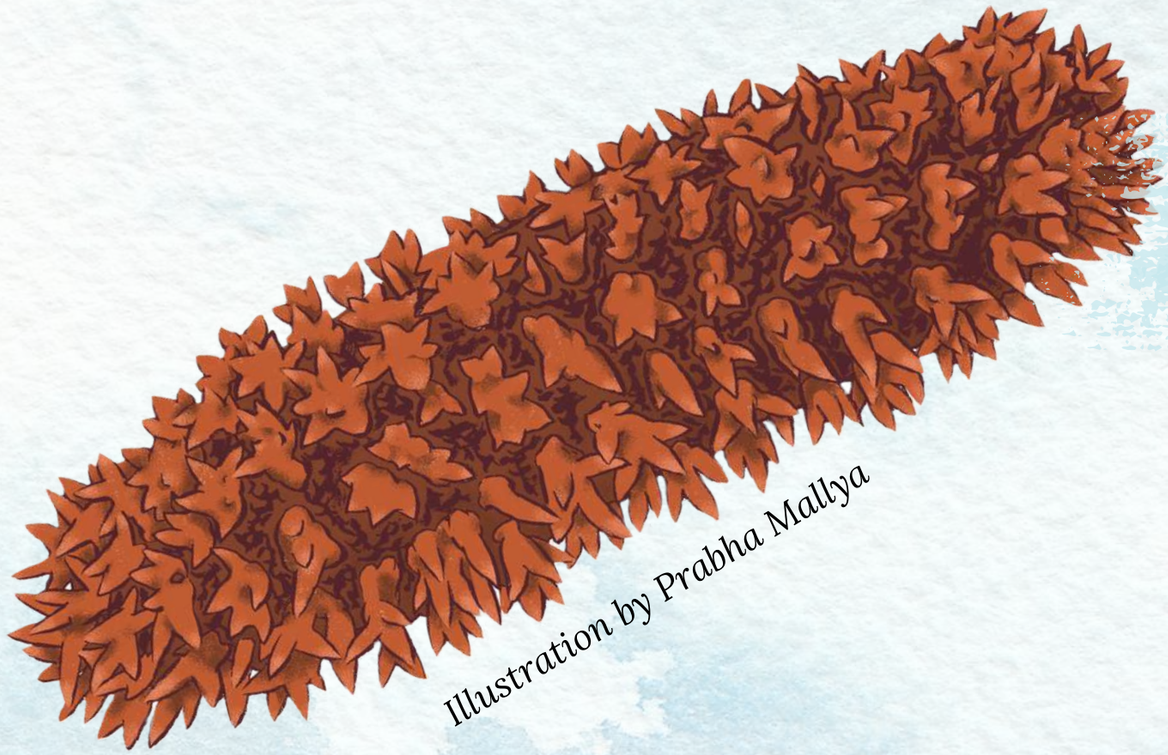


Illustration by Prabha Mallya

If you wish to become part of India's first underwater citizen science program, join us!

Did You Know?

Sea cucumbers are also enjoyed by humans, especially in Asia, and some species are farmed as delicacies. To learn more about sea cucumbers, watch this video.

Answers to Brain Surf:

1. True. Manatees and dugongs are members of the order Sirenia and are considered to be the closest living relatives of the proboscideans (animals with trunks). Dugongs have incisors that become tusks that display signs of their semi-aquatic past.

2. True. The Spanish dancer gets its name from its ability to swim in an undulating motion, using its red "skirt" which waves about and unfurls as it propels itself through the water. The motion looks very similar to an exotic flamboyant flamenco dancer, twirling in a hypnotic fashion that few can take their eyes off.

Making Waves

News from the coasts

1. A dead Bryde's whale had washed ashore at Pathameghavaram village in the Srikakulam district of Andhra Pradesh; it met an unfortunate end most probably by starvation due to entanglement. It was the first-ever sighting of this species in the region. Read more.

2. Forty fishermen in Muthalappozhi Harbour, Trivandrum, successfully worked together and released a massive 20-foot whale shark from a fishing net, in a heartwarming rescue story which you can read about and watch here.

3. The recent discovery of fossils in Morocco reveals the astounding diversity of marine life 66 million years ago, just before the asteroid hit. Read all about it here.

4. A geologist has discovered a collection of marine fossils at an altitude of 16,000 feet above sea level in Ladakh, augmenting the idea that the Himalayas were born as continental plates thrust out of the Tethys Sea about 40 million years ago. Read more about this amazing discovery here.

5. Not only land-based life forms but even marine animals from whales and fishes to corals and plankton are impacted by light pollution, as a recent study by Miller and Rice has concluded.

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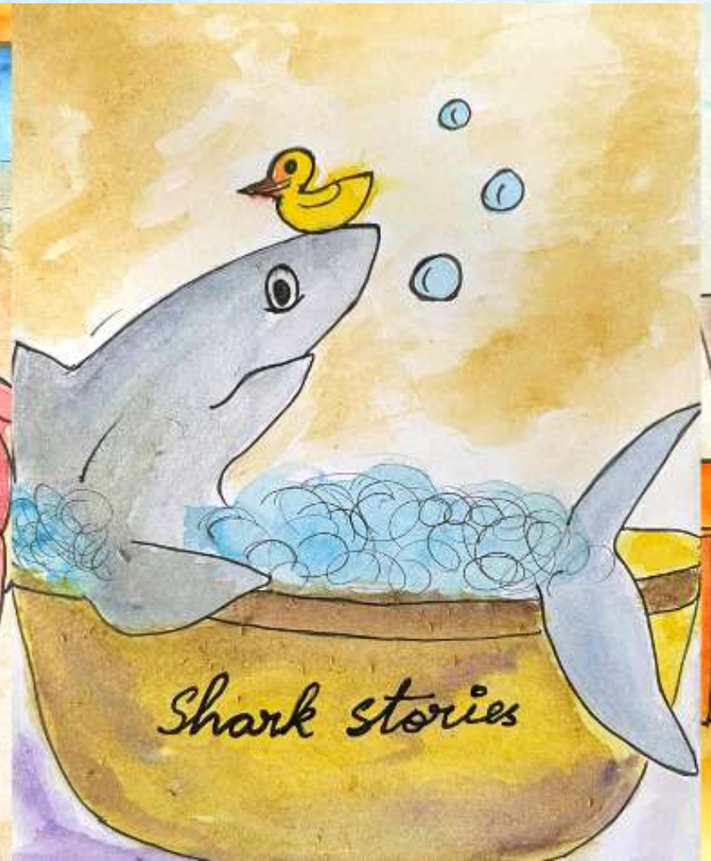

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