RHATC's coastal chronicles: a journey through 8 unique habitats!

We had eight days field visit to the Gulf of Mannar Biosphere Reserve (GoM), Rameswaram and Point Calimere to practically understand and observe the flora and fauna in their natural habitat. Mr. Raveendran Natarajan, the founder of the Iragukal Amritha Nature Trust, organized the trip. Even though he is an engineer by qualification, his passion for wildlife put him on a journey to becoming a phenomenal birder, working in the field of conservation and outreach programs since 2005.

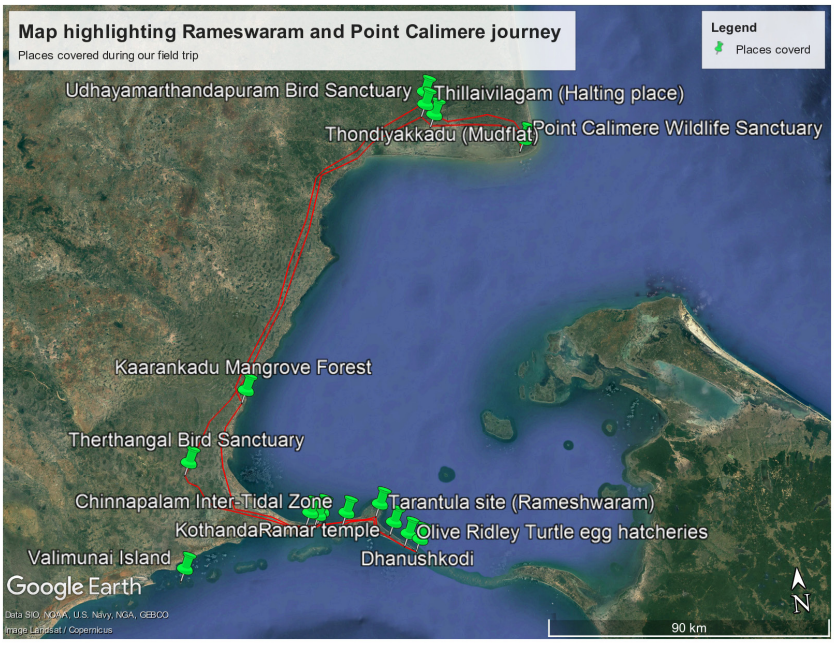
Moreover, this phenomenal exposure to diverse ecosystems wouldn't have been possible without another resource person, H. Byju, a bird expert. He is an executive board member of the Wildlife Information Liaison Development (WILD) Society and is also the author of wonderful books like 'Valley of Hope - Moyar and Vultures' and 'The Matriarch: The Autobiography of an Elephant'. He has also been working with Raveendran since 2015, and together they have published several scientific papers from the southeastern coast of peninsular India.

This article covers our day-wise experience during the field visits to eight different landscapes and meeting inspiring people during the entire trip.

DAY 1 - KARANKADU MANGROVE ECOSYSTEM

On 26 December 2023, we visited Karankadu community-based ecotourism, established by the forest department and managed by the eco development committee (EDC) that is part of Palk Bay, which is located in Tamil Nadu's Ramanathapuram District.

Diverse resident and migratory species of birds congregate there in large flocks to feast on the mangrove inhabitants, like fish, crabs, and bivalves. We saw a spectacular sight of a Greater Crested Tern *Thalasseus bergii* diving into the water to catch fish. The other species of water birds we saw include Great Cormorant *Phalacrocorax carbo*, Intermediate Egret *Ardea intermedia*, Whiskered Tern *Chlidonias hybrida*, Little Tern *Sternula albifrons*, Common Sandpiper



The locations visited by RHATC fellows in Rameswaram and Point Calimere


Mangrove ecosystems. © Amrin Ansari.

Actitis hypoleucos, and Black-winged Stilt *Himantopus himantopus*. We also saw wetland-associated species like Pied Kingfisher *Ceryle rudis* and a passage migrant Rosy Starling Pastor roseus.

Byju and Raveendran mentioned that mangroves have evolved to withstand the fluctuating salinity of the environment, and their specialised root system called pneumatophores protects the shorelines from erosion and tsunamis. Factors like pollution and siltation are the major threats to the degradation of mangrove ecosystems, resulting in the loss of biodiversity. As a result, the conservation of mangroves is critical. In mangrove areas, biodiversity protection and ecological restoration should be prioritised. The most crucial part of the conservation of mangroves in Karankadu is raising public awareness.

All of us walked for the first time on the sandy sea grass bed in the middle of an estuary. For most of us, walking among the sea grasses and observing the molluscs, crabs, and other benthic flora and fauna was a fantastic practical and experiential learning experience.

Priyanka, Tandrali, and Usha, from the '1OCEAN' (Ocean Conservation Educator Action Network) initiative of the Zoo Outreach Organisation, informed that mangrove ecosystem and estuaries are nurseries for some shark species and support unique species dependent on mangroves. Raveendran explained his work on shore birds from the region. This mangrove ecosystem, which is part of the Gulf of Mannar Marine National Park, is situated in the Palk Bay area of the southeastern coast of India. The most common mangrove tree species in the


Fellows interacting with N. Raveendran. © H. Byju.

Karankadu forest is *Avicennia marina,* followed by *Rhizophora apiculata*, and *Rhizophora mucronata* (Byju et al. 2023).

Interesting observation on marine flora and fauna in Chinnapalam beach. © H. Byju.

DAY 2 - INTERTIDAL ECOSYSTEM, CMFRI MUSEUM, AND BYCATCH

Shore walk:

On 27 December 2023, we went to Chinnapalam village in Pamban panchayat, Rameshwaram Island. We met Lakshmi Moorthy, a visionary and former seaweed collector who was then elected as a councillor for eight wards in the Pamban area. We learned about her inspiring journey through a visionary idea of sustainable seaweed collection, which she has been successfully implementing with local communities for several decades. She is also the recipient of the Seacology Prize 2015 from Berkely, California, for her exceptional effort in preserving marine environments and fisherfolk culture. She received a sum of Rs. two lakhs along with the prize. She utilized the amount to purchase a piece of land for the construction of a school and also helped in the renovation of an existing school. The government then followed her lead to build two more schools in the area. She also shared her story of how she inspired other women from the community and grew to a 150-member group from merely 18 women over the last decade.

Lakshmi- a true inspiration. © Sanjay Molur.

This interaction provided us with a better understanding of the fishing communities. Following that, Lakshmi took us to the Chinnapalam intertidal muddy shore to learn more about the biodiversity during the morning low tide. We walked in the intertidal zone for the first time, and the diverse marine organisms in such a small area made us very excited. Chinnapalam is located on the Gulf of Mannar side

but is very close to the Pamban bridge. This region is referred as the Pamban channel which connects the GoM and Palk Bay. We observed the sunrise as we drove on the Pamban bridge at 6:26 AM and the first neap tide was at 08:22 AM (Tides4fishing 2023), and the tidal height at 09:16 AM was 0.24 m (Survey of India 2024). This ensured that we were able to see many fantastic intertidal marine biodiversity on the exposed sea floor.

Like any other beach, the shore was busy with the presence of fishermen engaged in their daily routines since dawn, showcasing the vibrant livelihoods of those who depended on the sea for their sustenance. We strolled along the muddy shore and had the following observations:

Sea grasses and Sea weeds:

As the name suggests, seagrasses are aquatic plants found in the marine ecosystem. Seagrass species are primary producers and support substantial proportion of marine biodiversity in this ecosystem (Kaldy & Dunton 2000; Mateo et al. 2006). They are excellent at carbon sequestration in the oceans (Duarte et al. 2005; Macreadie et al. 2014) and exist as meadows covering the sea bed, acting as a source of food for a wide range of marine fauna like Sea Cow *Dugong dugon*, sea turtles, scarids (parrotfish), etc. (Lanyon et al. 1989; den Hartog & Kuo 2006; Unsworth et al. 2007). Apart from that, seagrass beds also serve as excellent breeding grounds and nurseries for fish as they protect them from predators (Jackson et al. 2001).

Sea weeds inhabit marine or brackish water in the intertidal region of seas and oceans. We saw both sea grass and sea weeds and were intrigued by the differences. Sea weeds are non-vascular plants and we saw them to be free floating, whereas the sea grasses are flowering, vascular plants that has roots, and some species were flowering and fruiting as well. Both sea grasses and seaweeds are extremely unique aquatic flora that play a significant role in coastal and marine ecosystems. Some of the sea weeds we observed are Caulerpa spp., *Sargassum* spp., *Halimeda* spp., and Ulva spp.

Not your average cucumber

Sea cucumbers are echinoderms and are closely related to starfish and sea urchins. They are benthic filter feeders and are found in most marine ecosystems. They use tube feet for feeding and locomotion, which are retractable tubular skin projections (Slater & Chen 2015). We came across three species, namely *Holothuria atra*, H. *scabra*, and *Stichopus* sp. We observed *Stichopus* sp. excreting, and the excreta contains nitrogen and phosphorus that enhance the productivity of benthic biota. They also host more than 200 species of parasitic symbionts

Sea Cucumber along with sea grasses. © C.K. Arjun.

Peacock-tailed Shrimp on Haddon's Carpet Sea Anemone. © Sanjay Molur.

and thus play an important role in maintaining benthic biodiversity (Purcell et al. 2016).

Even though all the sea cucumber species are protected under Schedule I of the Wildlife (Protection) Act, these species are considered delicacies and get overexploited for human consumption. In India, illegal sea cucumber catches (both live and dead) have been caught by forest department officials in regular intervals. But as is the case with most illegal wildlife trade, many sea cucumber catches slip through the underground market and get exported every year (Fernandes et al. 2022).

Under the tentacles

Sea anemones are cnidarians that bear specialized stinging cells called nematocysts on their tentacles that are used as defense mechanism (Bruce & Svoboda 1983). We spotted some Haddon's Carpet sea anemones *Stichodactyla haddonion* in the muddy substratum, with Peacock-tailed Shrimps *Periclimenes brevicarpalis* moving along the tentacles. The female shrimps most often hide under the sea anemone's tentacles, whereas males most frequently are found on top of the sea anemone's dorsal surface (Bruce & Svoboda 1983). The symbiotic interrelationship between *P. brevicarpalis* and sea anemones seems to be parasitic because these shrimps feed upon the tentacles of the host (Suzuki & Hayashi 1977; Bruce & Svoboda 1983). When *P. brevicarpalis* is associated with sea anemones, its growth rate, molting interval, and larval production all increase (Fautin et al. 1995). The ornamental fish industries collect and trade this shrimp species along with sea anemones (Prakash et al. 2017).

Barnacles everywhere

Barnacles are arthropods and are closely related to crabs, prawns, and lobsters. The origin of the term 'barnacle' is intriguing, as its abrupt emergence parallels the sudden appearance of maggots on decaying meat (Anil et al. 2012). They have a wide range of occurrences, from intertidal zones to the deepest oceans (Chan & Høeg 2015). They are epibiotic organisms that attach to any substratum or host organism but do not feed on the host as they are filter feeders (Fertl & Newman 2018). We came across a lot of barnacles attached to boats, anchors, wood logs, and even on some mollusc shells.

Hermits in shells

Hermit Crabs are arthropods that have evolved to use empty gastropod shells as homes. The tough shells provide protection against their predators (Resse 1962). The crabs select the shells based on two criteria: (i) they should be

easy to carry and (ii) they should be spacious for accommodation (Resse 1963; Volker 1967). We observed quite a few of these shy crabs goofing around the mud flats.

Egg cases on molluscs

We observed the egg cases of the Dog Conch *Laevistrombus canarium* on some twigs as a substrate. Also, we observed that some of the bivalves, like Pinna sp. happen to serve as a substratum for marine invertebrates to lay their eggs.

See Sea Shells

We observed various mollusc species during our shore walk, and later Dr. R. Ravinesh, University of Kerala, helped us identify the gastropod species.

Pipe fishes

Pipefish belong to the same family as seahorses — Syngnathidae. They are sit-and-wait predators, which have a tubular, toothless mouth that they use to slurp up their prey. They have been actively traded for both medicinal and ornamental purposes. The distinctive body structure and captivating behaviours of these creatures make live pipefish a high demand group for marine aquaria. Unfortunately, these pipefishes are frequently captured unintentionally as 'by-catch' during fishing operations, worldwide. Some most economically disadvantaged fishers deliberately target pipefish as a means of sustaining their livelihoods. This dual pressure from trade and unintentional capture poses significant challenges for the well-being of pipefish populations (Murugan et al. 2008). We observed a shy pipefish swimming and hiding among the sea grasses. It is quite uncommon to see a live pipefish in its habitat, and we were lucky enough to see one. https://youtu.be/nwZd3xRUY80?si=sNEgQDRqKuFAEFdr

Checklist of gastropods observed at Chinnapalam sea grass bed.

	Family	Scientific name	Depicted by
1	Babyloniidae	*Babylonia spirata*	Linnaeus, 1758
2	Cardiidae	*Vepricardium asiaticum*	Bruguière, 1789
3	Carditidae	*Cardites bicolor*	Lamarck, 1819
4	Cypraeidae	*Naria erosa*	Linnaeus, 1758
5		*Erronea* sp.	
6	Fasciolariidae	*Pleuroploca ponderosa*	Jonas, 1850
7	Glycymerididae	*Glycymeris* sp.	
8		*Glycymeris taylori*	Angas, 1879
9	Melongenidae	*Volegalea cochlidium*	Linnaeus, 1758
10	Muricidae	*Chicoreus virgineus*	Röding, 1798
11		*Murex carbonnieri*	Jousseaume, 1881
12	Mytilidae	*Modiolus philippinarum*	Hanley, 1843
13	Nassariidae	*Nassarius canaliculatum*	Lamarck, 1822
14	Naticidae	*Notocochlis gualteriana*	Récluz, 1844
15	Neritidae	*Clithon oualaniense*	Lesson, 1831
16	Olividae	*Agaronia gibbosa*	Born, 1778
17	Pinnidae	*Pinna bicolor*	Gmelin, 1791
18	Potamididae	*Pirenella cingulata*	Gmelin, 1791
19		*Terebralia palustris*	Linnaeus, 1767
20	Strombidae	*Laevistrombus canarium*	Linnaeus, 1758
21		*Lambis lambis*	Linnaeus, 1758
22	Synaptidae	*Synaptula reticulata*	Semper, 1867
23	Tonnidae	*Tonna dolium*	Linnaeus, 1758
24	Turbinellidae	*Turbinella pyrum*	Linnaeus, 1767
25	Veneridae	*Circe scripta*	Linnaeus, 1758
26		*Gafrarium pectinatum*	Linnaeus, 1758
27		*Sunetta* sp.	
28		*Sunetta solanderii*	Gray, 1825
29		*Sunetta effossa*	Hanley, 1843
30		*Antigona chemnitzii*	Hanley, 1845

CMFRI Museum:

To gain more insights from the field visit in the morning, we paid a visit to the National Marine Biodiversity Museum at the Central Marine Fisheries Research Institute (CMFRI),

Hermit crab using an abandoned gastropod shell. © Amrin Ansari.

Collection of commonly available molluscs of Mandapam coast at CMFRI museum. © C.K. Arjun.

Commonly available molluscs at Chinnapalam (a) *Circe scripta* (b) *Babylonia spirata* (left) and *Gafrarium pectinatum* (right) (c) *Chicoreus virgineus.* © Amrin Ansari.

situated in Mandapam, near Rameswaram. It was established in February 1947 under the Ministry of Agriculture and Farmers Welfare; later in the year 1967, it was shifted under the Indian Council for Agricultural Research (ICAR).

CMFRI primarily focuses on the estimation of marine fishery catch and landings, research related to the taxonomy of marine organisms, coastal mariculture, and the bio-economic values of fish and other marine organisms. The establishment of the marine biodiversity museum at CMFRI is focused on the collection, preservation, cataloguing and display of marine organisms for educational purposes, research activities, and public information. We were amazed to see the specimens displayed at the museum. For most of us, it was our first exposure to innumerable marine organisms. Mr. Ramamurthy, an experienced curator who has profound knowledge of marine organisms, explained about the specimens displayed in the museum. Following are categories under which we have classified some species that caught our attention.

Species having commercial value

- Blue-swimmer Crab *Portunus pelagicus* is used as food and has huge demand.
- Oyster species and the process involved in pearl culture.
- Lobsters that are exported to Singapore for food, especially live ones, have high demand.
- Various species of seaweeds that are commercially important, such as Cobia *Rachycentron canadum*, are cultured and generate good revenue.
- Indian Mackerel *Rastrelliger kanagurta* is one of the most consumed fish.

Species that are endangered and protected under the Wildlife (Protection) Act

- The shells of Leather-back Turtle *Dermochelys coriacea*
- Olive Ridley Turtle *Lepidochelys olivacea* and Seahorse *Hippocampus kuda*
- Various species of corals
- Shovelnose Ray *Glaucostegus typus*, one of the endangered species

Other species

Molluscs, especially gastropods, crustaceans such as shrimps, small crabs, prawns, Tuna *Thunnus thynnus*, various species of starfish, various species of coelenterates, Giant Guitarfish *Rhynchobatus australiae*, jellyfish, stingrays, *Stonefish Synanceia* verrucosa which is a highly venomous species, False Killer Whale *Pseudorca crassidens*, species of eels, Porcupine Fish *Diodon hystrix* and sawfish.

We saw an enormous skull of a Sperm Whale *Physeter microcephalus*. We came to know some interesting facts about the organism, such as ambergris produced in the digestive system of the Sperm Whale, which has a huge demand as it is used in the synthesis of perfumes, flavoring agents in alcoholic beverages, etc. The skeleton of Sea Cow was also on display.

Stuffed specimens of Guitar fishes *Rhynchobatus* sp in CMFRI museum. © C.K. Arjun.

Preservation:

Preservation is the art of making sure the specimens retain their original structure and pigments for longer periods of time. Formalin is most commonly used for preserving most of the specimens except for the phylum Echinodermata (which comprises starfish, sea urchins, sea anemones, sea cucumbers, etc.), for which rectified spirit is used. We were also fascinated to learn about taxidermy, the art of preparing, stuffing, and mounting the skins of animals.

We visited the CMFRI aquarium and witnessed various species of crustaceans, Hawksbill Sea Turtles, and ornamental fish.

The way the curator explained it focused more on the commercial use and economic value of marine biodiversity than the conservation aspects of the species. We felt disappointed that such a distinguished institution prioritizes human interests while contributing very little to conservation.

Bycatch

In the evening, we visited Munakkad Beach in the Pillaimadam region. It is a site for fishing and seaweed culture. We witnessed enormous piles of bycatch (an unintentional capture of non-targeted species), which comprised various species of gastropods, bivalves, cephalopods, and echinoderms, along with several species of fish. Priyanka Iyer explained about eight to ten groups of organisms that were present in the pile, which were difficult to identify, and highlighted the bycatch issue and how a lot of marine organisms are affected due to the bycatch, which includes several endangered and unidentified species. It is unfortunate to lose out

Priyanka explains bycatch and its effect on marine ecosystems. © H. Byju.

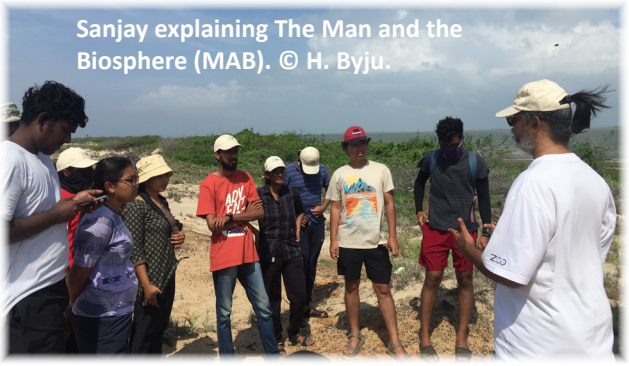
on species even before knowing them. All of us were disheartened to look at this gloomy and darker side of human use of marine life. This pile is formed every day, and millions of animals are eliminated from their precious ecosystems.

DAY 3 - DHANUSHKODI, TURTLE HATCHERY, MAN AND BIOSPHERE, THREATS & HANUMAN PLOVER

After witnessing the diverse marine life in their natural ecosystem, we visited Dhanushkodi, at the southeastern tip of India, on 28 December 2023. It is a ghost town that is a part of Rameswaram island in the Gulf of Mannar located between peninsular India and Sri Lanka.

The Gulf of Mannar extends from Rameswaram Island in the north to Kanyakumari in the south with 21 other islands, from Mandapam to Tuticorin (Kumaraguru et al. 2006).

We stopped near the Kothandaramar temple to understand the geographic features like the lagoon, bay, gulf, and isthmus which harbour different ecosystems. We were standing on the isthmus, and on one side we saw Kothandaramar lagoon, and on the other side there was a Gulf of Mannar. H. Byju and Dr. Sanjay Molur, course



Sanjay explaining The Man and the Biosphere (MAB). © H. Byju.

Sunset Selfie at Pillaimadam. © Sanjay Molur.

director of RHATC and executive director of the Zoo Outreach Organisation were explaining to us about the landscape in our surroundings.

On 28 December, on the way to Dhanushkodi we stopped by a hatchery station along the beach, which is a part of the GoM. Mr. Ravindran explained about the sea turtles coming ashore to lay their eggs on specific nesting sites along the coast of the GoM. He also added that a total of 1,600–1,800 turtle eggs were collected from the nesting sites to protect them from threats like street dogs and local people. Once collected, the eggs are reburied on the same beach at a different location with fencing and regular monitoring by the anti-poaching watchers of the forest department. The incubation process is crucial for the success of turtle hatcheries where it takes 45 days on average for the eggs to hatch. The Olive Ridley Turtles lay their eggs from January to March. After the eggs hatch, the hatchlings are released into the sea and he mentioned that the GoM region has 42 hatcheries managed by the forest department essential for the conservation of Olive Ridley Turtles *Lepidochelys olivacea*. He also mentioned the important role of the turtle hatcheries in raising in the GoM about the importance of sea turtle conservation.

Along the way we came across the memorial stone on a project initiated by the United Nations Educational, Scientific and Cultural

Is it a lagoon? A gulf? A bay?

A gulf is a large body of water that is completely surrounded by land and has a narrow mouth. The Gulf of Mannar is an example from the field. An isthmus is a narrow strip of land that connects two larger land masses. The strip of land that connected the main road to the Konthadaramar temple was an example we saw in the field. A bay is a larger, curved inlet of the sea or a coastline surrounded by land. In the field, we saw Palk Bay as an example. A lagoon is a shallow body of water that may have an opening to a larger body of water but is also protected from it by a sandbar or coral reef. The best example we saw was at the Pillaimadam lagoon. The visit provided us with practical exposure to and understanding of different marine ecosystems, such as gulf, lagoon, and bay.

Organization (UNESCO), The Man and the Biosphere (MAB). Sanjay explained about the program, where it aims to establish a scientific basis for the improvement of relationships between people and the environment. One of the key components of the MAB Programme is the designation of Gulf of Mannar as a Biosphere Reserve. It was established in 1989 and covers a diverse range of ecosystems, including coral reefs, seagrass meadows, mangroves, and other coastal habitats.

Byju shared a brief overview of the newly proposed upcoming project for the construction of a railway track by the Government of India along the coastline of Dhanushkodi with us.

This regios is one of the most visited tourist places in Tamil Nadu, particularly for the famous Rameswaram temple, but the railway line exists until Rameswaram and Dhanushkodi is well connected by road, hence there is no need for the railway line. Also mentioned the proposal to declare this area of Dhanushkodi as a bird sanctuary. It is a crucially diverse habitat that is an attractive destination for a variety of migratory bird species, including Curlew Sandpiper *Calidris ferruginea*, Black-tailed Godwit *Limosa limosa*, Broad-billed Sandpiper *Calidris falcinellus*, Sanderling *Calidris alba*, Common Redshank *Tringa totanus*, Common Greenshank *Tringa nebularia*, and Terek Sandpiper *Xenus cinereus*.

What is left now of the natural ecosystem will be completely lost with the development project the government is planning. On the other hand, declaring the area a bird sanctuary will help save the existing ecosystem.

Breeding site of Hanuman Plover Charadrius seebohmi at Pillai madam

We walked in the shallow pool of freshwater at the Pillai madam abutting Palk Bay, adjacent to Rameswaram Island, which is a saltwater lagoon and is bridged by a bar mouth to Palk Bay in the north. On the landward side, the lagoon is surrounded by grass patches. Shorebirds, large wading birds, gulls, and terns are seen regularly in this region (Byju et al. 2023). The site is characteristically a lagoon that holds seawater on one side and the other side becomes inundated during rains. This site is one of the six breeding sites of Hanuman Plover in India.

Byju led us to the breeding site where the Hanuman Plover was discovered. We walked in the shallow water, collected due to heavy downpours that happened in the previous week of the visit, and thus there were very few birds. The presence of water meant that the breeding site couldn't be closely examined by us, but Byju did his best to provide an accurate account of the discovery and his experiences.

According to Byju, the species was suspected to be seen here by his mentor, Dr. Balachandran of the Bombay Natural History Society (BNHS), who used to work in that region, and he also shared old stories while working in the field. Byju also pointed out the challenges in identifying these small birds, even though they chose an open, vast environment for breeding; their colour makes it extremely difficult to spot them in the landscape, and these birds are also very timid, which makes it strenuous to observe them for a long period of time. He then talks about the interaction and relationship he has been maintaining with the local community

there. We understood the importance of involving the local people in assisting with research and the conservation of animals.

Unfortunately, this place comes under the proposed site for the Rameswaram airstrip. These changes to this fragile and crucial habitat will be highly detrimental for the native species ranging from the tiniest fungus to the largest animal.

DAY 4 - VISIT TO THE HOME OF CORALS AND TARANTULAS

Snorkeling all the way

On 29 December 2023 we started an exciting and thrilling journey from Ervadi beach to reach Valimunai, a stunning coral island which is a part of Keelakarai group of Islands and one among the 21 Islands of GoM. The area range of the island is less than 2 km square, and the coastline is around 1.43 km (DWIEP 2018).

The land part of the island is completely dominated by invasive trees like the Mesquite Tree, *Prosopis juliflora* and Indian Tulip *Thespesia populnea* (DWIEP 2018).

Captivating Corals

We went for an intertidal reef walk to the ecological sensitive areas (ESAs) of Valimunai island's coral reefs, seagrass, and seaweed beds and encountered mesmerizing coral reefs featuring Lesser Star Coral *Goniastrea ratiformis*, Hump or Finger coral Porites sp., Table coral Acropora sp., Pore coral *Montipora spumosa*, Brain coral *Favia* sp., Lesser Valley coral *Platygyra lamellina*, and Larger Star coral *Favites abdita*. Every step during our walk unveiled the wonders of the underwater world, leaving us fascinated by the intricate tapestry of life flourishing in the coral patch.

The diversity extended beyond coral formations, captivating us with the intricate beauty of seagrasses such as Serrated Ribbon Seagrass *Cymodocea serulata*, Halophila sp., and Turtle Grass *Thalassia hemprichii*. Engaging in snorkeling was the best way to observe the diverse and vibrant schools of fish associated with the seagrass beds, swimming in rhythmic harmony, the elusive crabs running on the sandy substrate, and sea cucumbers looking like shiny blobs. We observed shy mantis shrimp camouflaging within the vibrant corals.

Here, There, Everywhere – The Sea Hare

We saw a lot of sea hares on the coral beds. They are sluggish, soft-bodied molluscs that lack an external shell. We accidentally stepped on one and noticed a blood-like fluid diffusing

Fellows on a boat ride to coral island. © C.K. Arjun.

Coral reef ecosystem in Valimunai Island.
© Praveen Rozario.

Sea hare sliding along the Sea grapes.
© Praveen Rozario.

An adult female Tarantula *Poecilotheria hanumavilasumica* at Hanumavilasum Sacred grove.
© C.K. Arjun.

A coral exhibiting nature's intricate patterns.
© C.K. Arjun.

Pee-ka-boo, I see you (Fish peeking out of its burrow). © Praveen Rozario.

The master of camouflage- a Crab concealed among the Sea Grapes. © Praveen Rozario.

in the water between the coral beds, and we got worried for the poor creature. Later, we came to know that the slug was very much alive and that the fluid was in fact ink, which is part of their defense mechanism to escape from predatory sea anemones, crabs, gastropods, lobsters, starfish, sea turtles, and wrasses. They secrete the dark pinkish-purple ink from a specialized gland called the 'Purple gland' on the roof of their mantle cavity (Jhonson & Willows 1999).

We also spotted a vibrant greenish-black and yellow sea slug crawling its way through the corals. Looking at its morphology, we came to know that it was a nudibranch *Elysia grandifolia* (Kumar et al. 2011). Nudibranchs are shell-less gastropods that feed on algae and are commonly referred to as sea slugs.

A familiar sight from the Chinnapalam intertidal mudflats, we saw the same association between Haddon's Carpet Sea Anemone *Stichodactyla haddonion* and Peacock-tailed Shrimp *Periclimenes brevicarpalis* moving along its tentacles.

Sacred grove

After our exhilarating journey in the morning to the island, we visited the Hanumavilasum sacred grove in the night. This place is the last refuge for the endemic arboreal tarantula. It was a patch of old tamarind trees *Tamarindus indica* inhabited predominantly by *Poecilotheria hanumavilasumica*. While walking in the dark towards the tree where a female tarantula was waiting for us, we were warned to watch out for the snakes. Sanjay and Priyanka enriched our knowledge about tarantulas.

The genus Poecilotheria is the only arboreal tarantula found in India and Sri Lanka. *Poecilotheria hanumavilasumica* is endemic to Rameswaram. Sanjay explained that the species has a high demand in the pet trade because they are very aggressive and this brings up the macho factor. Hence, conservation, national, and international legislation for the species is required. He and his team are planning to do a IUCN Red List conservation assessment of the species belonging to the family Theraphosidae.

He also mentioned that, due to construction activities at a nearby tarantula site, the entire tamarind grove was cut down. His team collected 90 individuals of *P. hanumavilasumica* and then translocated them to the present Hanumavilasum sacred grove. For decades, he and his team have been observing the adaptation of the species, and they came to know that *P. hanumavilasumica* is tolerant of changes in habitat quality and adapts to secondary habitats like casuarina plantations.

Pelicans and Painted stork families in their nests on *Acacia* trees. © Amrin Ansari.

We were amazed to know the behaviour and morphology of the tarantula. These spiders live in the tree crevices. Females are bigger than males. The breeding season is from July to September. They lay eggs in October; by December, juveniles are observed. Females mature around 5 to 7 years, and their lifespan is about 12 to 18 years. The male matures at 10 to 18 months, and their lifespan is about one breeding season since the female may eat the male when they attempt to mate. If males are strong enough while mating, they push female front legs up and mate, then they will flee before the females chase and eat the males. If the male survives he will attempt to mate with another female but since the males are constantly on the move in search of females that reside in burrows, chances of mortality by predation or roadkill are high. Females are constantly looking to eat, not to mate. Some males are successful, and most of them die. This is one of the rarest breeding behaviours observed in tarantulas. They are ambush predators and feed on invertebrates and geckos. They line their crevices with webs. They have a very unique way of residing in the crevices. They have poor vision but are very susceptible to touch; through tactile receptors, they sense their surroundings. We were then split into five groups of two each to look out for tarantulas in the sacred grove.

DAY 5 - WETLANDS and MUDFLATS

Therthangal Bird Sanctuary

On 30 December 2023 morning a visit to the Therthangal bird sanctuary evoked curiosity when the expert birder Byju asked us to recognise the noise that was emerging from far behind. We all looked around and were trying to find out which bird species it was. Immediately in the sky, appeared a big bird! Our mentors, Byju, Raveendran, and Priyanka, all said it was an Asian Openbill. Our curiosity did not end there; instead, we became more enthusiastic and reached the watch tower for a better view. The view was phenomenal, as it entirely covered the landscape. Witnessing and observing birds on trees in their respective nests and new hatchlings associated with their mother; a few birds majestically flying, foraging, feeding, and gathering materials for building their nests was beautiful.

Therthangal Bird Sanctuary is a wetland habitat situated in Therthangal Village in Paramakudi Taluk, Ramanathapuram District, Tamil Nadu, India. The bird sanctuary spans an area of approximately 29 ha. The migratory season, from October to March, is the favourite time for birdwatchers and nature enthusiasts to visit this place. It is surrounded by villages, each with its own set of kanmois (irrigation tanks) and ooranis (village ponds) (Mohan et al. 2020). These provide feeding grounds for the birds.

There were mostly *Acacia nilotica* trees, which seemed to be favourable nesting sites for most of the bird species. The checklists for the birds we observed are provided on the next page.

When we were keenly looking for the birds, we were excited to spot hundreds of fruit bats *Pteropus medius* roosting on a tamarind tree.

Thondiyakaadu (mudflat)

On 30 December, we visited the southern delta of Kaveri in Tamil Nadu at Thondiyakaadu, witnessing a shift from marine ecosystems to a vast and continuous mudflat. We reached

Checklist of birds observed at Therthangal Bird Sanctuary.

	Common name	Scientific name	IUCN Red List	Migratory status
1	Asian Openbill	*Anastomus oscitans*	LC	R
2	Spot-billed Pelican	*Pelecanus philippensis*	NT	R
3	Painted Stork	*Mycteria leucocephala*	LC	R
4	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R
5	Great Cormorant	*Phalacrocorax carbo*	LC	R
6	Indian Cormorant	*Phalacrocorax fuscicollis*	LC	R
7	Grey Heron	*Ardea cinerea*	LC	R
8	Little Egret	*Egretta garzetta*	LC	R
9	Intermediate Egret	*Ardea intermedia*	LC	R
10	Indian Pond Heron	*Ardeola grayii*	LC	R
11	Black-crowned Night Heron	*Nycticorax nycticorax*	LC	R
12	Eurasian Spoonbill	*Platalea leucorodia*	LC	R
13	Glossy Ibis	*Plegadis falcinellus*	LC	R
14	White-throated Kingfisher	*Halcyon smyrnensis*	LC	R
15	Grey-headed Swamphen	*Porphyrio poliocephalus*	LC	R
16	Brahminy Kite	*Haliastur indus*	LC	R
17	Oriental Darter	*Anhinga melanogaster*	NT	R
Migratory status: Resident (R), Winter visitor (WV), Passage migrant (PM); IUCN status: Least Concern (LC), Near Threatened (NT).				

Checklist of birds observed at Kodiyakarai Wildlife Sanctuary.

	Common name	Scientific name	IUCN Red List status	Migratory status
1	Northern Shoveler	*Anas clypeata*	LC	WV
2	Northern Pintail	*Anas acuta*	LC	WV
3	Garganey	*Anas querquedula*	LC	WV
4	Painted Stork	*Mycteria leucocephala*	LC	R
5	Great Egret	*Ardea alba*	LC	R
6	Intermediate Egret	*Ardea intermedia*	LC	R
7	Little Egret	*Egretta garzetta*	LC	R
8	Spot-billed Pelican	*Pelecanus phillippensis*	NT	R
9	Black-winged Stilt	*Himantopus struthersii*	LC	WV
10	Black-tailed Godwit	*Limosa limosa*	NT	WV
11	Eurasian Curlew	*Numenius arqata*	NT	WV
12	Common Redshank	*Tringa totanus*	LC	WV
13	Common Greenshank	*Tringa nebularia*	LC	WV
14	Marsh Sandpiper	*Tringa stagnatillis*	LC	WV
15	Wood Sandpiper	*Tringa giareola*	LC	WV
16	Common Sandpiper	*Actitis hypoleucos*	LC	WV
17	Little Stint	*Calidris minuta*	LC	WV
18	Brown-headed Gull	*Choricocephalus brunnicephalus*	LC	WV
19	Gull-billed Tern	*Gelochelidon nilotica*	LC	WV
20	Caspian Tern	*Hydroprogne caspla*	LC	WV
21	Little Tern	*Sternula albifrons*	LC	WV
22	Whiskered Tern	*Childonias hybrida*	LC	WV
23	Little Ringed Plover	*Charadrius dubius*	LC	R
24	Greater Sand Plover	*Charadrius leschenaultii*	LC	WV
25	Lesser Sand Plover	*Charadrius mongolus*	LC	WV
26	Common Snipe	*Gallinago gallinago*	LC	WV
27	Eurasian Spoonbill	*Platalea leucorodia*	LC	R
28	Whimbrel	*Numenius Phaeopus*	LC	WV
29	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R
Migratory status: Resident (R); IUCN status: Least Concern (LC), Near Threatened (NT).				

and settled in our new field station at Thillaivilagam and we were taken to the delta region at Thondiyakaadu where, Mother Nature's grand spectacle of the magnificent sunset above the Kaveri Delta was welcoming us with her warm embrace.


The vast view of Thondiyakadu mudflat. © Amrin Ansari.

Sanjay gave us a brief explanation about this wide delta that is formed when the Kaveri River breaks into multiple tributaries before emptying into the Bay of Bengal. Byju, Priyanka, and Senthil were along with the fellows, explaining the ecosystem and the names of various rivers that form the delta of the mighty Kaveri. The Kaveri River originates in the Western Ghats in Karnataka and flows through the Deccan Plateau. It is one of the major rivers in southern India, originating at Talakaveri in Kodagu flowing through Mysuru. After flowing through Karnataka, the river enters the state of Tamil Nadu, where it further branches out and forms the Kaveri Delta. Here we also spotted a colony of flamingos and few other birds like, Spot-billed Pelican *Pelecanus phillippensis* and Marsh Sandpiper *Tringa stagnatilis*.

DAY 6 - MAN MADE NATURAL ECOSYSTEM

Fabulous flocks: Kodiakkarai Wildlife Sanctuary

On 31 December 2023 we went to the Point Calimere Wildlife Sanctuary (PCWS), which is also known as Kodiakarai Wildlife Sanctuary, to gain a deeper understanding of shore birds and their habitat. Located in Nagapattinam District, Tamil Nadu, PCWS is one of the most important wetlands in southern India and was declared a Ramsar site on 19 August 2002. It is part of the Central Asian Flyway, hence harbouring a lot of migratory birds with feeding and wintering grounds (Jagadeeshan et al. 2016). The shoreline habitat varies seasonally, from a shallow sheet of saline water during the monsoon to continuous stretches of mudflats in the drier seasons. These mudflats provide excellent feeding and breeding habitats for a lot of fauna, including birds. During our visit, mentors Byjus and Raveendran assisted in identifying the following waterbirds we encountered.

During our visit, we also came across two native fisherfolk who were actively fishing throughout the time. Upon an informal interaction, we came to know that they were collecting shrimp for personal consumption, which is a practice they do almost three times a week. The fisherfolk used the traditional method of splashing the seawater with bare hands to loosen the balance of the shrimp on the flat surface of the mud and then collecting them in their waist bags. The PCWS is an area of utmost importance, but the area is getting degraded as a result of human interference, and a decline of over 70% has been noted in the wader's populations (Balachandran


Fellows observing wetland birds using Spotting scope. © C.K. Arjun.


Feeding party of Painted Storks. © Amrin Ansari.


Local fisherfolks catching shrimps (b) Fellows interacting with them. © Amrin Ansari.


Eurasian Spoonbill showing its breeding plumage. © Amrin Ansari.


© Praveen rozario

Salt and pepper: Glossy Ibis with Intermediate Egret. © Praveen Rozario.

2006). Climate change and changing rainfall patterns in the area is also a potential threat to shorebirds.

DAY 7 - Mosaic Landscapes

Point Calimere Wildlife Sanctuary

A new year, a new landscape, and a fresh start. After reaching Point Calimere Wildlife Sanctuary on 1 January 2024, we were the first to go on the safari. Point Calimere Wildlife Sanctuary is in the Vedaranyam block of Nagapattinam District of Tamil Nadu. The Point Calimere region was first identified as an area of high significance in bird conservation by late Dr. Salim Ali in 1962. The sanctuary covers an area of 1,728.81 ha along the Palk Strait, where it meets the Bay of Bengal. It was declared in 1967 for the conservation of Blackbucks *Antilope cervicapra* and also for birds. Point Calimere Wildlife Sanctuary, along with the Great Vedaranyam Swamp, was declared a Ramsar Wetland Site (No. 1210) on 19 August 2002, and it is also one of the 554 Important Bird Areas of India (Ramsar Sites Information Service 2002; Tamil Nadu Forest Department 2007; National Wetland Atlas 2010).

The sanctuary has a unique landscape, covered by the Bay of Bengal in the east, the Palk Strait in the south, swampy backwaters, and salt pans to the west and north, respectively. Low sand dunes are located along the coast; the western periphery has coastal plains, tidal mud flats, and shallow seasonal ponds.

The sanctuary hosts a combination of history and a rich diversity of flora and fauna. There are remnants of a brick-and-mortar lighthouse that dates back more than 1,000 years built by the great Chola empires. The Chola lighthouse was severely destroyed by the 2004 Indian Ocean earthquake and tsunami (Sivasubramaniam et al. 2005). There is also a British-period lighthouse which was built in 1890 (DGLL 2023).

The landscape of the sanctuary is a mix of salt pans, mangroves, backwaters, grasslands, and dry evergreen forests. PCWS boasts of 14 mammal species, 18 reptile species, and nine amphibian species. Similarly, it has about 154 species of medicinal plants (Point Calimere Wildlife Sanctuary 2023) in the dry evergreen forests.

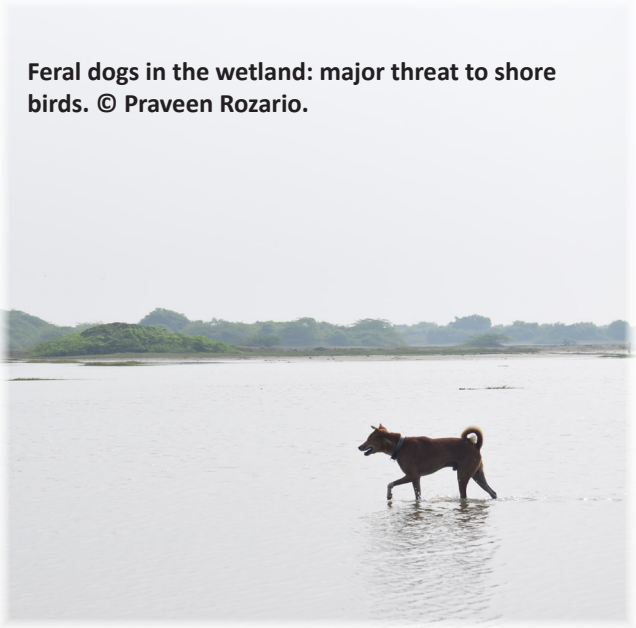
Of this unique biodiversity we were fortunate to see Blackbucks *Antilope cervicapra*, one of the six antelope species of India and the flagship species of the sanctuary. Apart from that, we saw animals such as Bonnet Macaque *Macaca radiata*, Wild Boar *Sus scrofa cristatus*, Monitor Lizard *Varanus bengalensis*, Spotted Deer Axis axis, Indian Grey Mongoose *Urva edwardsii*, and Indian Star Tortoise *Geochelone elegans*. But we didn't encounter the apex predator, Golden Jackals *Canis aureus*.

The sanctuary is home to an enormous number of bird species, both resident and migratory birds. The checklists for the birds we observed are provided on the next page. This rich biodiversity is threatened by an antagonist growing stronger every year which is the abundance of invasive species such as *Prosopis juliflora*, *Senna auriculata, Suaeda maritima, Opuntia dilleni, Chloris virgata, Lantana camara, Vitex*

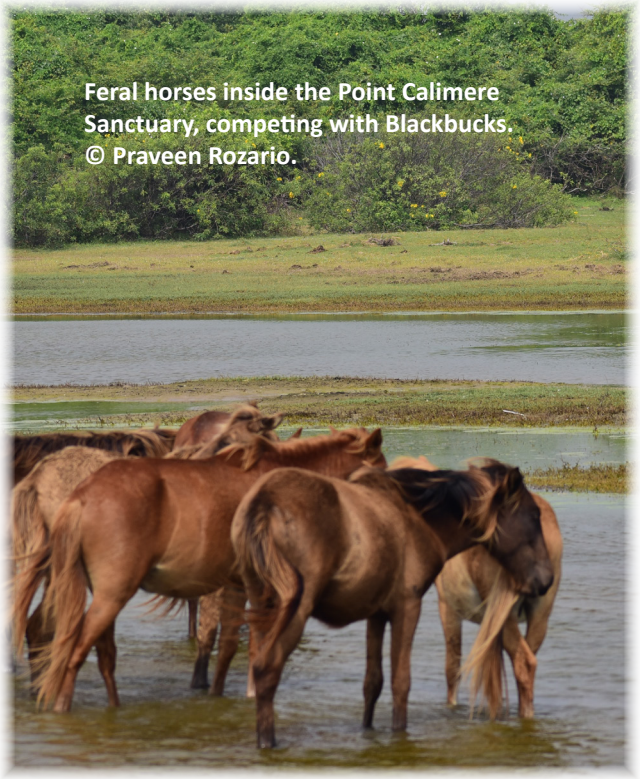
Blackbuck- the star of Point Calimere Wildlife Sanctuary. © Praveen Rozario.

Territorial fight of mudskippers at Point Calimere wildlife sanctuary. © Amrin Ansari.

The wild boar family. © Praveen Rozario.



Feral dogs in the wetland: major threat to shore birds. © Praveen Rozario.



Feral horses inside the Point Calimere Sanctuary, competing with Blackbucks. © Praveen Rozario.

Checklist of birds observed at Point Calimere Wildlife Sanctuary.

	Common name	Scientific name	IUCN Red List status	Migration status
1	Oriental Pratincole	*Glareola maldivarum*	LC	WV
2	Wood Sandpiper	*Tringa glareola*	LC	WV
3	Common Sandpiper	*Actitis hypoleucos*	LC	WV
4	Common Ringed Plover	*Charadrius hiaticula*	LC	R
5	Little Ringed Plover	*Charadrius dubius*	LC	WV
6	Spot-billed Pelican	*Pelecanus philippensis*	NT	R
7	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R
8	Painted Stork	*Mycteria leucocephala*	NT	R
9	Western Reef Egret	*Egretta gularis*	LC	R
10	Brown-headed Gull	*Chroicocephalus brunnicephalus*	LC	WV
11	Paddyfield Pipit	*Anthus rufulus*	LC	R
12	Indian Bush-Lark	*Mirafra erythroptera*	LC	R
13	Glossy Ibis	*Plegadis falcinellus*	LC	R
14	Little Egret	*Egretta garzetta*	LC	R
15	Green Bee-eater	*Merops orientalis*	LC	R
16	Blue-tailed Bee-eater	*Merops philippinus*	LC	WV
17	Barn Swallow	*Hirundo rustica*	LC	WV
18	Brahminy Kite	*Haliastur indus*	LC	R
19	Booted Eagle	*Hieraaetus pennatus*	LC	WV
20	Black Kite	*Milvus migrans*	LC	R
21	Eurasian Curlew	*Numenius arquata*	NT	WV
22	Yellow Wagtail	*Motacilla flava*	LC	WV
23	Red-wattled Lapwing	*Vanellus indicus*	LC	R
24	Rosy Starling	*Pastor roseus*	LC	PM
25	Marsh Sandpiper	*Tringa stagnatilis*	LC	WV

Migratory status: Resident (R), Winter Visitor (WV), Passage Migrant (PM); IUCN status: Least Concern (LC), Near Threatened (NT).

negundo, and *Gloriosa superba* that impact the native species populations. Apart from this, the presence of cattle, feral dogs, and feral horses is a threat to the native species thriving there.

The mudflats of the sanctuary are inhabited by Boddart's Goggle-eyed Goby *Boleophthalmus boddarti,* which was a sight to observe. Watching the territorial behavior of mudskippers was something great and unique. The forest department is planting mangroves in mudflats that would gradually restore the habitat of these conspicuous fishes.

Udayamarthandapuram Bird Sanctuary

On 1 January 2024, we visited the Udayamarthandapuram Bird Sanctuary (UBS) located in Tiruvarur District, Tamil Nadu, India. We loved that evening, walking among the lush green vegetation, looking at birds everywhere.

This sanctuary, spanning an area of around 43 ha, was declared as a protected area in 1999.

It has been designated as a Ramsar site since 2022. UBS has a diverse habitat including large and deep water body with a number of inlets

Checklist of birds observed at Udayamarthandapuram Bird Sanctuary.

	Common name	Scientific name	IUCN Red List status	Migration status
1	Indian Roller	*Coracias benghalensis*	LC	R
2	Common Kingfisher	*Alcedo atthis*	LC	R
3	Green Bee-eater	*Merops orientalis*	LC	R
4	Greater Coucal	*Centropus sinensis*	LC	R
5	Blue-faced Malkoha	*Phaenicophaeus viridirostris*	LC	R
6	Rose-ringed Parakeet	*Psittacula krameri*	LC	R
7	Eurasian Collared Dove	*Streptopelia decaocto*	LC	R
8	Indian Paradise Flycatcher	*Terpsiphone paradisi*	LC	R
9	Rufous Treepie	*Dendrocitta vagabunda*	LC	R
10	Red-wattled Lapwing	*Vanellus indicus*	LC	R
11	Grey Heron	*Ardea cinerea*	LC	R
12	Oriental Darter	*Anhinga melanogaster*	NT	R
13	Common Coot	*Fulica atra*	LC	R
14	Grey-headed Swamphen	*Porphyrio Poliocephalus*	LC	R
15	Eurasian Moorhen	*Gallinula chloropus*	LC	R
16	Glossy Ibis	*Plegadis falcinellus*	LC	R
17	Asian Openbill Stork	*Anastomus oscitans*	LC	R
18	Indian Spotted Eagle	*Clanga hastata*	VU	R
19	Shikra	*Accipiter badius*	LC	R
20	Western Marsh Harrier	*Circus aeruginosus*	LC	WV
21	Brahminy Kite	*Haliastur indus*	LC	R
22	Brahminy Starling	*Sturnia pagodarum*	LC	R
23	Rosy Starling	*Pastor roseus*	LC	PM
24	Black Drongo	*Dicrurus macrocercus*	LC	R
25	Tricolored Munia	*Lonchura malacca*	LC	R
26	White-browed Bulbul	*Pycnonotus luteolus*	LC	R
27	Blyth's Reed Warbler	*Acrocephalus dumetorum*	LC	WV
28	Red Collared Dove	*Streptopelia tranquebarica*	LC	R
29	Black-crowned Night Heron	*Nycticorax nycticorax*	LC	R
30	Black-headed Ibis	*Threskiornis melanocephalus*	NT	R
31	Painted Stork	*Mycteria leucocephala*	NT	R
32	White-browed Wagtail	*Motacilla maderaspatensis*	LC	R
33	Little Egret	*Egretta grazetta*	LC	R
34	Intermediate Egret	*Egretta intermedia*	LC	R
35	Large Egret	*Ardea alba*	LC	R
36	Barn Swallow	*Hirundo rustica*	LC	WV

Migratory status: Resident (R), Winter Visitor (WV), Passage Migrant (PM); Red List status: Least Concern (LC), Near Threatened (NT).

and surrounding irrigated agricultural fields. This site is a part of the Central Asian Flyway (Tamil Nadu State Wetlands Mission 2023).

A little more research about the place gave us the real picture of the threats this beautiful bird sanctuary faces. The wetland receive the runoff of chemicals fertilizers and pesticides used in the paddy fields. The birds are dependent on the

water body and surrounding paddy fields for food and are prone to poaching (Mohan et al. 2020).

CONCLUSION:

Our journey through eight different landscapes enriched our knowledge, understanding and gave us deeper insights in the field of conservation and role of communities in conservation.

The wetlands and grasslands near marine ecosystems are different from those we had visited previously. We were able to recognise and differentiate the adaptations of species in different landscapes from our earlier field visits adding to our understanding of concepts taught in the class. Observing biodiversity and at the same time comprehending anthropogenic pressure was an eye opener for all of us at the mangrove ecosystem, intertidal mudflat zone, mudflats near Point Calimere, island, and coral ecosystem.

This introduction to the marine ecosystem helped us establish links between classroom sessions and on-field learning. This raised our curiosity to keep exploring and observing biodiversity, landscapes, ecosystems and build conservation interventions based on scientific evidence to mitigate threats to wildlife.

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