Life beneath the canopy: How mangroves, seagrass beds, and reefs form a vital marine web

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Imagine walking along the coast, where dense clusters of mangrove trees extend from land to the sea. These remarkable trees, with their roots propping and rising like stilts above the water, may seem like mere scenery, but they are far more than that. Mangrove roots, specifically *Avicennia* sp. and *Sonneratia* sp., exhibit pneumatophores, which are structures that grow vertically above water from their main root system that are submerged. They are specialised aerial roots that allow these trees to breathe. In the case of *Rhizophora* sp., they grow a prop root system which appears like stilts that extend from their lower trunk and loops back into the ground buttressing the tree structure. The exposed portion of their prop roots aerate the tree. Growing in dense, waterlogged soil, mangroves need breathing structures such as pneumatophores and prop roots to exchange gases with the air, making it possible for them to survive in such challenging environments.

But the role of mangroves in the ecosystem extends far beyond their roots. Each mangrove tree supports a diverse array of life, both above and below the waterline. On the branches and canopy, you will find snails, ants, spiders, bees, birds, snakes, and even monkeys like the long-tailed macaques. Beneath the water, the tree's roots offer shelter to crustaceans, crabs, and fishes. Tiny plants called epiphytes attach to the pneumatophores, creating a miniature forest beneath the water's surface that provides food for young fish.

Below ground, mangroves support a variety of organisms such as annelids, nematodes, clams, and other invertebrates. This intricate web of life makes each mangrove tree a vital hub, sustaining aquatic and terrestrial animals while contributing to the overall health and biodiversity of the marine environment.

The importance of mangroves becomes even clearer when we look at their role in the larger coastal ecosystem. Seagrass beds, which often grow near mangroves, are significantly more vibrant when they are close to these trees. Studies show that fish abundance and the variety of species in seagrass beds are at least twice as high when these habitats are near mangroves. This is because the proximity to mangroves provides more available food and better shelter, making the seagrass beds more attractive to fish. This connection remains strong regardless of whether it is day or night—the number of fish in seagrass beds near mangroves is consistently double that of those farther away.

Moreover, when seagrass beds are located near both mangroves and reef habitats, they support a much higher number of juvenile fish compared to those that are only near one type of habitat. The combination of these three habitats—seagrass beds, mangroves, and reefs—creates an ideal environment that greatly increases fish populations. The diverse and interconnected ecosystem offers abundant food sources and shelter for both juvenile and adult fish, illustrating the combined value of these habitats. When they are conserved together, the benefits for marine life are far greater than when each habitat stands alone.

Horn-eyed ghost crab (*Ocypode ceratophthalmus*)
Budak

This ecological connectivity is also vital for predatory fish, which are a dominant presence in seagrass beds both during the day and at night. These predators feed on a variety of prey, including fish and invertebrates, and thrive in environments where food is abundant. In areas where seagrass beds, mangroves, and reef habitats are located close to one another, there are significantly higher densities of fish species, which serve as a crucial food source for larger predators. By ensuring that these habitats are all nearby, we create an environment where there are more fish, and consequently more food available for predators. This then helps to maintain a balanced and healthy food web.

Long-tailed macaque (*Macaca fascicularis*)
Ranong Biosphere Reserve, Thailand
Sheila Dee

The time of day also significantly impacts these interconnected habitats, particularly because of plankton—those tiny organisms that drift with the water currents. Plankton have diel variation, meaning their activity and position in the water column change depending on the time of the day. Some plankton rise to the surface at night to feed, while others descend to deeper waters during the day to avoid predators. This daily movement affects the availability of food for fish and other marine organisms, influencing the entire food web. In ecosystems where seagrass beds, mangroves, and reefs are close together, the changing abundance and distribution of plankton throughout the day further shape the interactions between species and the overall structure of the ecosystem.

Conserving ecological connectivity through ASEAN ENMAPS

This is where initiatives like the ASEAN ENMAPS (*Effectively Managing Networks of Marine Protected Areas in Large Marine Ecosystems in the ASEAN Region*) Project play a crucial role. ASEAN ENMAPS is a regional initiative that aims to expand the conservation coverage of its 11 pilot marine protected areas (MPAs) sites in the Large Marine Ecosystems of Bay of Bengal (Thailand), Indonesian Seas (Indonesia), South China Sea, and Sulu–Celebes Sea (Philippines) in the ASEAN region to form a network of MPAs that will enable the conservation of the interconnected marine habitats. By focusing on the importance of ecological connectivity, ASEAN ENMAPS aims to ensure that mangroves, seagrass beds, and reefs continue to thrive together, supporting rich biodiversity and healthy marine ecosystems.

Conserving all three habitats—seagrass beds, mangroves, and reefs—together, a more complex and robust marine ecosystem will then be supported. There is higher fish abundance and diversity, richer food webs, and better environments for juvenile fish to grow and thrive. The work of ASEAN ENMAPS highlights the importance of these connections, advocating for policies and actions that protect these vital ecosystems. In doing so, the project helps to ensure a healthier future for our oceans and all the creatures that depend on them.

Mangroves are more than just trees—they are life-giving giants of the sea. Their roots are the foundation of an interconnected world that stretches from the seabed to the canopy, supporting a web of life that thrives on their presence. By understanding and preserving this ecological connectivity, we can safeguard the health and diversity of our marine environments for generations to come.

REFERENCE:

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ASEAN ENMAPS is a regional initiative designed to enhance the management of networks of marine protected areas and marine corridors within selected Large Marine Ecosystems in Indonesia, the Philippines, and Thailand. It has 11 pilot sites within the four Large Marine Ecosystems of Bay of Bengal, Indonesian Sea, South China Sea, and Sulu-Celebes Sea. The project is implemented by the UNDP through the funding of the GEF, and with the ACB as the executing agency.

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