Seagrass: a 'natural sieve' for marine plastic

The ever-increasing polluting footprint of plastics from human activity is a major environmental issue that affects coastal and oceanic ecosystems around the world. Since the massive production of plastics in the mid-20th century, most of these materials have been abandoned after use and have found their way to the oceans, directly and indirectly. They cause tremendous damage to aquatic animals that either consume the plastic fragments (microplastics) or become trapped in plastic bags or abandoned fishing gear. Plastic was found even in the deepest depths of the Mariana Trench (the deepest part of the ocean) and has even made its way into the human food chain through seafood, mainly shellfish. Microplastics have been found in both deep and shallow waters, and such plastic waste poses a threat to the aquatic species and to human health. According to a recent finding of the Commonwealth Scientific and Industrial Research Organisation (CSIRO)[1], around 14 million tonnes of microplastics are littering the sea floor of our planet. The plastics we find floating in the sea represent just 1% of the total load; the rest being distributed in deeper oceans. Removing the microplastics from marine environment remains a challenge. The seagrass has now emerged as a potent sieve to check the issue caused by microplastics.

Seagrass meadows are one of the most important global coastal ecosystems, providing nursery habitats, shelter, and food for a large number of aquatic species. They also act as a natural barrier to the shoreline helping to prevent coastal erosion; filter water pollutants and sequester carbon dioxide (CO_2) at a rate 35% greater than the terrestrial forests, making them also our planet's lungs. Seagrasses play a major role in sustaining a wide variety of ecological resources that interact with more illustrious and well-known habitats, such as mangrove forests and coral reefs. However, the worth of the seagrass is frequently underestimated owing to its relatively mundane appearance. A recent study[2] has revealed the potential advantage offered by seagrass in naturally trapping marine microplastics.

Posidonia oceanica, an underwater phanerogam, or seed-bearing seagrass in the Mediterranean coastal areas has long, ribbon-like leaves, with a specific differentiation in the blade of the leaf and the base of the leaf, which connects the leaf to the stem, called rhizome. The blades that detach from these get interlaced and form a mass of entangled balls called 'Neptune balls'. At first glimpse, these balls look like a bunch of useless plant dirt that serve absolutely no purpose. However, it was found that their stiff fibres can trap and collect even small pieces of plastic waste in the water, and eventually carry them to the nearest shoreline, when they are swept ashore. The researchers have estimated that these seagrasses naturally collect nearly 900 million plastic pieces annually in the Mediterranean alone. However, they were unable to pinpoint where the Neptune balls would ultimately end up.

The project itself is new, launched in 2018; yet the team has collected critical evidences required to support their claims. An analysis on the Neptune balls washed off the coast of Mallorca, Spain has revealed that a kilogram of grass contains around 600 bits of plastic. In the case of denser Neptune balls, only 17% of the samples obtained were found to contain plastic. Even then, the balls had a higher plastic density, with almost 1,500 bits of plastic per kilogram. The scale of the plastic bits varied from just over 1 mm to 59 mm in length, with an average length of around 9.5 mm. These numbers are assumed to be 'significantly greater' than the plastics captured by leaves or sand. According to the study, stuck microplastics in the *Posidonia oceanica* seagrass are mostly filaments, fabrics and polymer particles as polyethylene terephthalate (PET) that are denser than seawater. Though this particular seagrass is found only in the Mediterranean Sea, similar species are found in the shallow waters off the coast of Australia. However, their efficacy in sieving the microplastics remains to be quantified.

Seagrass meadows are in decline, with as much as 30% destroyed in the world over the last 100 years. Around the UK, a 92% decrease in seagrass scale has led to a joint seagrass restoration campaign, part of which has enabled the development of a 'Seagrass Spotter' app. The key global hurdles to seagrass survival are: unawareness of what seagrasses are and insufficient social understanding of the importance of seagrasses in coastal environments; inadequate knowledge of many seagrass meadows and absence of up-to-date data on status and condition; lack of self-awareness of threatening traits at local scales. These point to the need to broaden our view of the connection between the socio-economic and environmental properties of seagrass habitats; need to expanding seagrass studies to develop scientific research that promote conservation measures; and increased awareness of the interconnections between seagrass and climate change to adopt effective conservation strategies. The hope that seagrass meadows will continue to support food security, climate change mitigation and biodiversity promotion will only be achieved if we respond to these challenges without delay.

The new ecosystem service of the *Posidonia oceanica* has a significant value in a marine area that has high quantities of floating plastic and in the seafloors with the seagrass that can occupy vast areas up to 40 m deep. They also deter beach erosion and cushion shorelines from storm surges, reducing the damage they inflict. It is also remarkable to see how much this idle plant life provides without even moving. While multi-million ventures are ongoing to physically eliminate microplastics from the water bodies, the seagrass, along with its many benefits to the environment, has been cleansing the oceans of plastics naturally.

1. Barrett, J., In *Frontiers in Marine Science*, October 2020; doi:10.3389/fmars.2020.576170.
2. Sànchez-Vidal, A., Canals, M., de Haan, W. P., Romero, J. and Veny, M., *Sci. Reports*, January 2021; doi:10.1038/s41598-020-79370-3.

Arjun R. Krishnan, Science Writing Fellow, *Current Science*.
e-mail: arjunkriz92@gmail.com