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INVASIVE SEAWEED IMPACT AND MANAGEMENT IN INDIA

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ABSTRACT

Exotic creatures can cause ecological and economic losses in marine habitats when they are introduced. With 407 introduced algal species, seaweeds worldwide make up a sizable portion of these non-indigenous species. The taxonomically varied group of marine plants known as seaweeds is where land plants separated more than 50 billion years ago. Modern molecular systematic data suggests that these plants are enormously diversified, contrary to the traditional classification of these plants. Seaweeds are helpful to humans in various ways, such as a source of pharmaceuticals, dietary supplements, and industrial chemicals, as well as a possible biofuel and CCS candidate (carbon capture and sequestration).

INTRODUCTION

The term "seaweed" is inaccurate; it is a plant with many purposes. The word's etymology indicates that it has been in use since the 1570s when people were less aware of its uses. The names "sea-plant" or "sea-vegetable" would be a better substitute; however, they are not as well known. Seaweeds are watery, non-vascular marine macroalgae (Bast, 2014). The term "algae" in this article refers to aquatic photosynthetic organisms known as microalgae and seaweeds (also known as marine macroalgae). Algae play a crucial role in the aquatic ecosystem by providing the energy foundation of the food web for all aquatic organisms. They also offer a number of environmental advantages and ecosystem services, including reducing eutrophication, capturing carbon dioxide or sequestering it, reducing ocean acidification, providing habitat, and protecting shorelines (Cai *et al.*, 2021). The majority of foreign seaweeds were introduced accidentally. Due to distinguishing characteristics (such as the ability to spread successfully), some species appear to be more likely to become invasive. However, it is not necessarily certain that they would successfully establish in the new area or become detrimental once introduced. Because of this, it is impossible to categorise a particular species of seaweed as invasive in an absolute sense.

Moreover, when an organism becomes invasive, it may exhibit various behaviours and impact many scales and locations (Petrocelli and Cecere, 2015). The scientific community has recognised the ecological

importance of seaweeds by evaluating their ecosystem services, including regulating, provisioning, and cultural services, which directly or indirectly promote human well-being. Algae are important regulators of the aquatic environment because they serve as a source of primary and secondary production, safeguard coastal areas, and serve as modifying grounds. Moreover, various aquatic creatures use seaweed as a food source, supporting provisioning services for a diverse spectrum of invertebrates. Moreover, seaweeds have economic importance for society and are an important component of each region's cultural legacy and identity (Pacheco *et al.*, 2020).

SEAWEED FLORA OF INDIA

The Indian subcontinent, which has a coastline of over 7,500 km, has some of the longest uninterrupted coastal ecosystems in the world and is home to a wide variety of seaweed. The most significant seaweeds in India in terms of their pervasive nature are Sargassum and Turbinaria among brown seaweeds, Hypnea and Kappaphycus among red seaweeds, and Ulva and Caulerpa among green seaweeds. Most seaweeds in India are found around the beaches of Gujarat, Kerala, and Tamil Nadu. I believe Mandapam in Tamil Nadu has India's greatest variety of seaweed species. While there are hints that the reefs surrounding the Andaman and Nicobar islands sustain greater seaweed diversity, the area nears the Pamban Bridge that connects the island of Rameswaram to the mainland. An increase in nutrients for the opulent growth of seaweed is considered to result from the mixing of the eastern Bay of Bengal with the southern Indian Ocean at Mandapam (Palk Strait). For those who enjoy seaweed, a trip to this location, which we will call "Botanical Beach," might be a memorable one that is simple to combine with a trip to Rameswaram or Dhanushkodi. One can rent a local manual or motorised dinghy to travel beneath the Pamban Bridge and the nearby locations. One can even go snorkelling because, in good weather, the sea is remarkably tranquil (Bast, 2014).

ENVIRONMENTAL BENEFITS AND ECOSYSTEM SERVICES

Seaweeds and microalgae provide important ecological functions and environmental advantages. It is unnecessary to directly employ freshwater, feed, fertiliser, or terrestrial soil to cultivate seaweed. Microalgae can be raised on marginal land in arid and desert climates and in freshwater or marine habitats. The photosynthetic process of seaweeds and microalgae can lessen eutrophication, treat wastewater, lessen ocean acidification, and capture/sequester carbon by removing nutrients (nitrogen and phosphorus) from surrounding waters and absorbing carbon dioxide. The cultivation of seaweed and microalgae can help with the to combat climate change through a variety of mechanisms, such as producing low-carbon footprint human foods, animal feeds, and fertilisers, (ii) capturing or sequestering carbon, and (iii) lowering methane emissions from cattle farming that uses specific seaweeds as feed supplements.

IMPACTS OF SEAWEED FARMING ON NATIVE SEAWEED POPULATIONS

Imported non-native seaweeds risk outcompeting native flora and animals, changing the ecology in their new habitat, and becoming invasive. On various scales within the recipient system, further possible effects can take the form of altered ecosystem functions, such as changes in community productivity, habitat complexity, and biodiversity. As a result of the invasion of non-native seaweeds, the species richness of native seaweed communities has been observed to have decreased. Although there is evidence that seaweed farming can lower native seaweed biomass in seagrass environments, comparable research has not been carried out in the WIO region, and investigations on consequences on recipient macrophyte systems have primarily focused on seagrasses.

In general, there is limited scientific knowledge about the ecological processes and natural habitats of seaweed in this region. Given that *Eucheuma denticulatum* and *Kappaphycus alvarezii* are native to the Western Indian Ocean (WIO) region, it is difficult to distinguish the various strains visually, making it difficult to detect a potential invasion of farmed SEA haplotypes (we will refer to these as "haplotypes" of SEA or EA types" in this review). However, growth rate assays have shown that Sea *E. denticulatum* often exhibits a greater growth rate than native *E. denticulatum (Halling, unpubl.),* indicating this could be a possible problem. It is still uncertain if the introduced eucheumatoids are competing with native populations. Parallel to this, newly introduced eucheumatoids might also face competition from other seaweed species, such as significant habitat-forming species like Sargassum spp (Eggertsen and Halling, 2021).

CONCLUSION

There may not be much influence on the environment from seaweed farming; a major worry is the introduction of non-native seaweeds. Due to their capability for rapid growth rates, efficient asexual reproduction by fragmentation, and simple substrate attachment, seaweeds like eucheumatoids must note this. Conclusion: Precautionary measures are always advised because any seaweed, tropical or temperate, that possesses those traits and is introduced in an environment with favourable conditions such as temperature, salinity, presence of settling substrate, etc., could potentially be at risk of spreading into its new habitat.

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