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Dispersion of seagrasses via vegetative fragments

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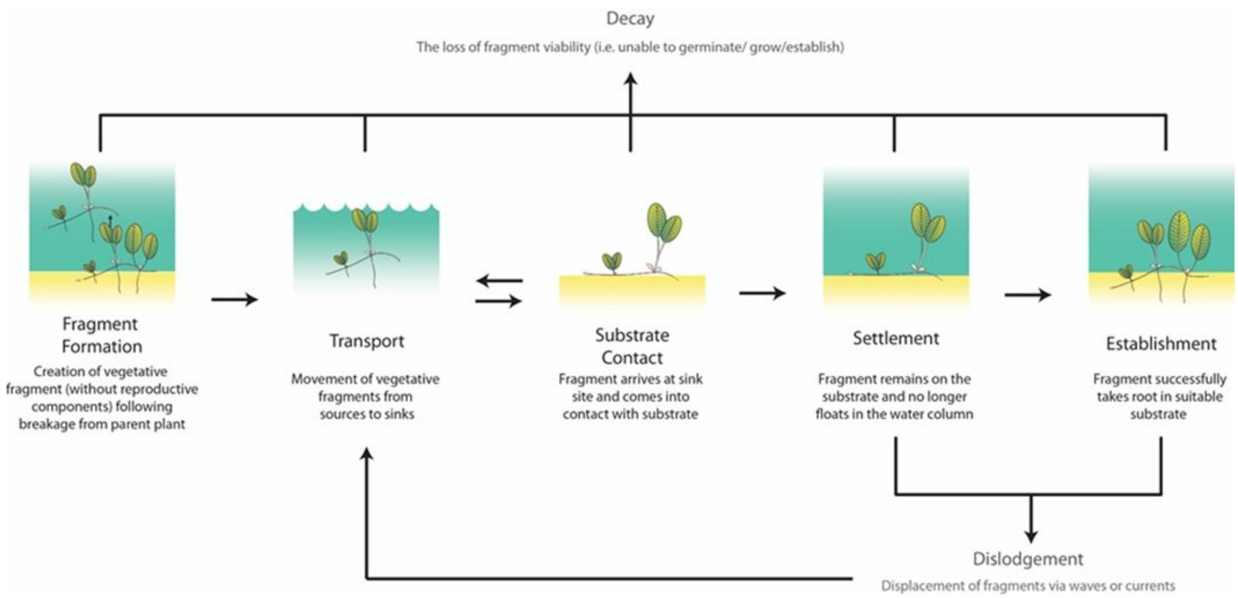

Figure shows the seagrass fragment transport conceptual model with seven distinct steps: (i) fragment formation, (ii) transport, (iii) decay, (iv) substrate contact, (v) settlement, (vi) establishment and (vii) dislodgement. Credit: Seagrass images adapted from Catherine Collier, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

NUS marine biologists have developed a model describing the dispersal of seagrass via vegetative fragments for the ecological engineering of coastlines.

Seagrasses form vast meadows that are home to a great diversity of marine species. They are also one of the most valuable coastal habitats in the world, and provide a multitude of ecosystem services including coastal protection, nutrient cycling, carbon sequestration, and providing nurseries for fish and shellfish. Seagrass dispersal (i.e. how seagrasses spread to new areas) is critical to their long-term survival. However, knowledge on long-distance dispersal mechanisms is mostly related to sexual propagules, i.e. fruits. Dispersal via vegetative fragments has mostly been overlooked. Vegetative fragments are pieces of the seagrass plant that include rhizomes, roots and shoots. Following detachment from the parent plant, these can re-establish elsewhere to create a new independent plant. While there is evidence that such a process might be important for dispersal, little is known about the mechanisms involved. A better understanding of these dispersal mechanisms can eventually help researchers model how seagrass meadows remain connected, which is crucial for prioritising areas for conservation.

A research team led by Prof Peter TODD from the Department of Biological Sciences, NUS, partnered with scientists from DHI Singapore and the Royal Netherlands Institute for Sea Research to develop a conceptual model for seagrass dispersal via vegetative fragments which involves several distinct fundamental steps. Researchers are able to piece them together in a model to predict where seagrasses are able to disperse and take root.

The research team found that both settlement (the fragment remains on the substrate) and establishment (the fragment takes root in the substrate) rates increased with fragment age before these rates decrease due to decay. This suggests there may be a window of opportunity during which settlement and establishment are optimal, i.e. when the fragment has enough time to float away from the parent meadow, but not too long that it decays, loses viability and is no longer able to establish. Different species were also found to have different settlement and establishment rates. Out of the four seagrass species tested, the species Halophila ovalis was found to settle and establish quicker and more successfully than others. While the mechanisms that enable it to settle and establish more quickly are not apparent, this trait could contribute to its success as a pioneering species, especially in areas of newly accumulated sediment.

Prof Todd said, "The findings help determine the dispersal potential of different seagrass species and the kind of conditions needed for successful dispersal. This research represents significant progress in our understanding of how seagrasses can disperse without sexual propagules and has important implications for their conservation and management."

More information: Samantha Lai et al. Unlikely Nomads: Settlement, Establishment, and Dislodgement Processes of Vegetative Seagrass Fragments, *Frontiers in Plant Science* (2018). DOI: 10.3389/fpls.2018.00160

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