Dynamics of seagrasses in a heterogeneous tropical reef ecosystem

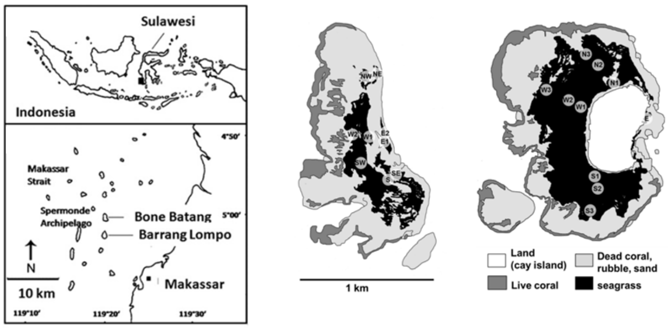
Dominik Kneer

Alfred-Wegener-Institute for Polar and Marine Research,
Wadden Sea Station Sylt, Germany

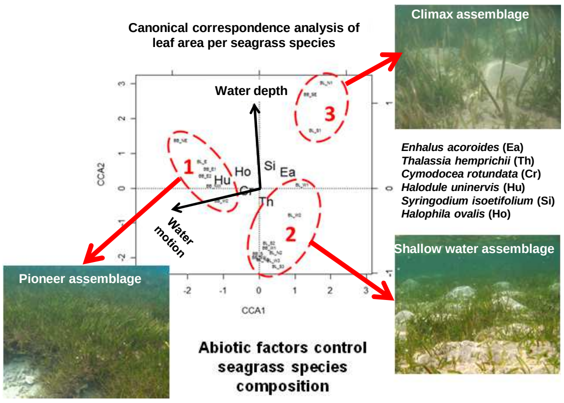
Introduction

Seagrasses form extensive meadows in coastal areas. They rank globally among the most valuable, but also among the most threatened coastal ecosystems. In spite of this, seagrasses have received little research attention, especially when compared to coral reefs.

The tropical Indo-Pacific is characterized by high seagrass species diversity where several species often grow together in mixed stands. The main objective of the research presented here was to improve our understanding of the physical and biotic processes which influence seagrass distribution and abundance in the Spermonde Archipelago, a barrier reef and lagoon ecosystem off the west coast of Southwest Sulawesi, Indonesia.



Location of the two studied islands in the Indonesian Archipelago, and position of the 19 research sites on the islands



Enhalus acoroides (Ea)
Thalassia hemprichii (Th)
Cymodocea rotundata (Cr)
Halodule uninervis (Hu)
Syringodium isoetifolium (Si)
Halophila ovalis (Ho)

The species composition of seagrass assemblages is controlled by water motion and water depth

At 19 research sites distributed over two patch reefs, the distribution and abundance of six seagrass species were related to water motion and water depth.

Thalassia hemprichii can tolerate high irradiance and air exposure better than other species, it dominates intertidal sites.

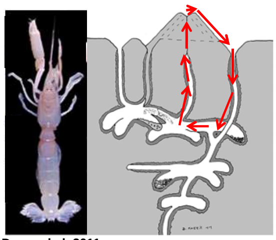
Halodule uninervis and *Cymodocea rotundata* are able to dominate exposed settings with frequent erosion by colonizing unvegetated areas from surviving plant patches.

Enhalus acoroides dominates areas with low water motion, its large size is of advantage in heavily bioturbated settings and where diffusion boundary layer exchange is limited.

Burrowing callianassid shrimp control the lower boundary of seagrass distribution

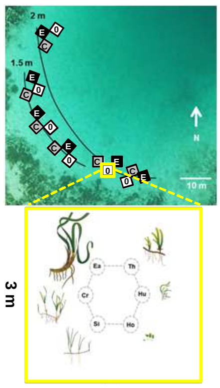
Seagrasses stabilize sediments with their roots and rhizomes, while burrowing callianassid shrimp use a feeding strategy called „conveyor-belt deposit feeding“ which involves the processing of large quantities of sediments. The distribution of seagrasses and shrimp is therefore usually mutually exclusive. Excluding shrimp from sheltered unvegetated areas in the subtidal allowed the permanent establishment of seagrass vegetation.

Neocallichirus vigilax, a „conveyor-belt deposit feeder“

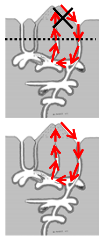


Dworschak 2011

811 g sediment per shrimp daily
- equals to a complete turnover of the upper 35 cm every six months



Exclusion experiment



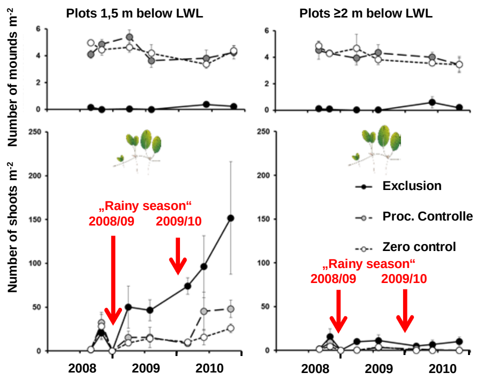
E Exclusion: 10 cm sand were removed, 1 mm mesh was inserted sand was filled back

C Procedural control: 10 cm sand were removed and filled back

0 Zero Control: No treatment

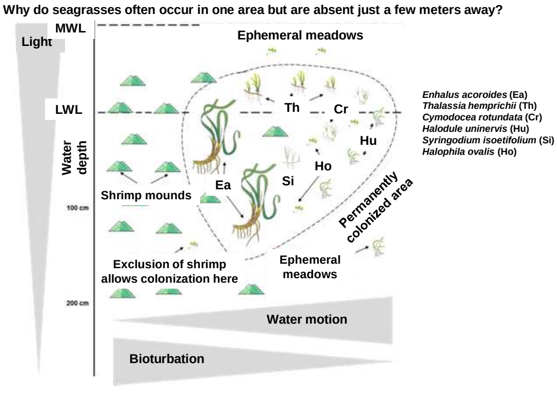
Seagrass was transplanted into all 18 plots:

Species codes: *Enhalus acoroides* (Ea), *Thalassia hemprichii* (Th), *Cymodocea rotundata* (Cr), *Halodule uninervis* (Hu), *Syringodium isoetifolium* (Si), *Halophila ovalis* (Ho)



Differences significant for *Halophila*

Kneer et al. (2013) *JEMBE* 446, 262-272



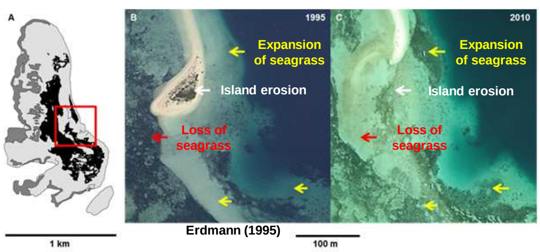
Enhalus acoroides (Ea)
Thalassia hemprichii (Th)
Cymodocea rotundata (Cr)
Halodule uninervis (Hu)
Syringodium isoetifolium (Si)
Halophila ovalis (Ho)

Conceptual diagram showing the pattern of the distribution of the six seagrass species, and the probable causes for this pattern

Conclusion

It was confirmed that hydrodynamics are at least as important as water depth in determining the species composition of mixed meadows. Bioturbation by burrowing callianassid shrimp limits seagrasses at the lower limit of their distribution in calm settings.

Sea level rise might already have caused a shift in habitat distribution. The expansion of seagrasses could potentially promote the instability of reef islands by reducing the potential mobility of sand on the reef flats.



15 years of sea level rise concide with island loss and net seagrass expansion on the Bone Batang reef flat.
However reef destruction, eutrophication and sand mining are also potential explanations