MARCONS
COST Action CA 15121

ADVANCING MARINE CONSERVATION IN THE EUROPEAN AND CONTIGUOUS SEAS

Differences in morphological, physiological and genetic traits between native and invasive populations of *Halophila stipulacea*

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INTRODUCTION

Halophila stipulacea (Forsskål) Ascherson is a tropical seagrass species, native to the Red Sea, Persian Gulf and Indian Ocean[1]. One of the earliest Lessepsian migrants it became established in many parts of the Mediterranean Sea[2,3]. Recently, this species has made it to the Caribbean where it also displayed invasiveness[4] causing declines of native seagrasses. This may be attributed to the fact that *H. stipulacea* is highly adaptive to a wide range of physiological conditions[2].

OBJECTIVE

Setup identical permanent monitoring systems in the northern Gulf of Aqaba and in the eastern Mediterranean (Fig. 1). Collect samples for morphological, physiological, genetic and associated bacteriome comparisons between native and invasive *H. stipulacea* populations.

METHODS

Transects (50 m long) were set up at 3 and 9 m depths at Eilat and Limassol. Photo-quadrats (50x50 cm, n=10) were taken along transects to estimate percent of seagrass cover. Plant matter within quadrats (25x25 cm, n=3) was collected to record morphometric parameters. Samples were also taken for 2bRAD genotyping (genetic diversity) of plants and their associated microbiome (16SrRNA gene using the universal primers COM1 and COM2)[5].

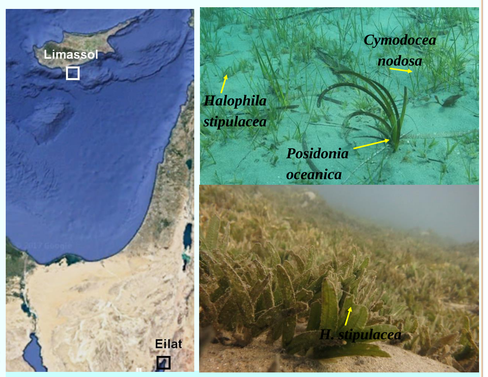
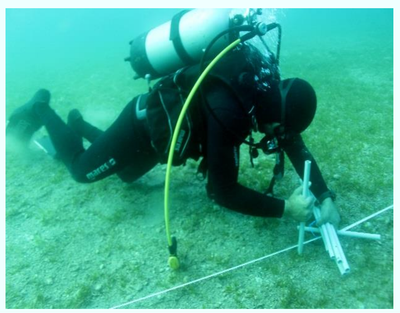


Figure 1. *Left* - Study sites, *Top right* - typical *H. stipulacea* meadows in Limassol (Cyprus), *Bottom right* - typical meadow in Eilat (Israel).

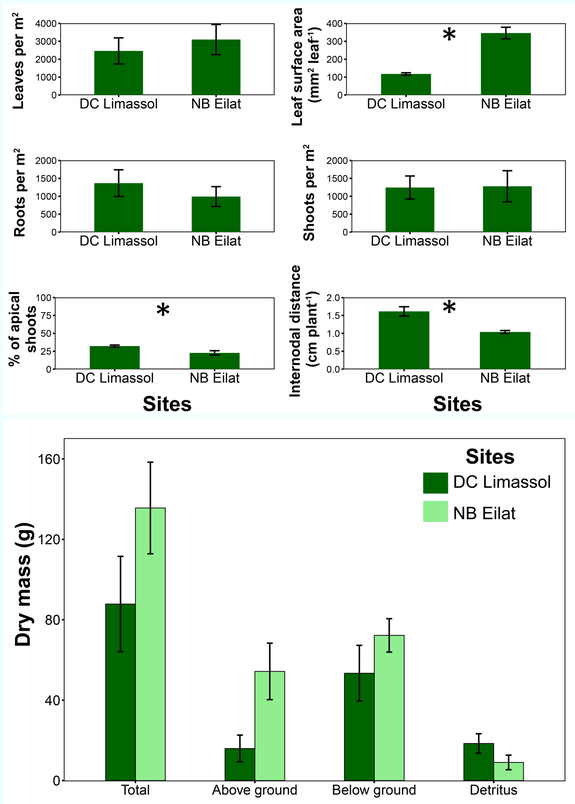
Sediment and seawater samples were collected to determine nutrient and sediment composition. Morphometric differences between the two sites were tested using R software (two-sample t-test). Data collection will be repeated seasonally for one year. *H. stipulacea* specimens from both basins were collected and planted in a microcosm system, composed of 15 controlled aquaria (ADSSC, Israel). Common garden stress experiments with both native and invasive populations are underway.

RESULTS

Morphometric variables are compared for the two shallow study sites setup in the Gulf of Aqaba and eastern Mediterranean. Most parameters were not significantly different ($p > 0.05$) between the two sites. However, in the northern Gulf of Aqaba a significantly higher leaf surface area was measured (346 vs 118 mm^2 $leaf^{-1}$) while in the eastern Mediterranean site a significantly higher % of apical shoots (32 vs 23%) and internodal distance (1.61 vs 1.04 cm) were recorded (Fig. 2). Higher plant biomass was recorded at the native seagrass meadows in the northern Gulf of Aqaba (135.60 vs 87.83 g m^{-2}) (Fig. 2).



Both native (Eilat) and invasive (Limassol) populations of *H. stipulacea* are successfully acclimatizing in microcosms. Soon, common thermal stress experiments will initiate (Fig. 3). The microbial 16SrRNA gene was successfully amplified with PCR (Fig. 4). Fingerprinting of the microbial community genetic profile and sequencing is in progress. 2bRAD analysis in underway.



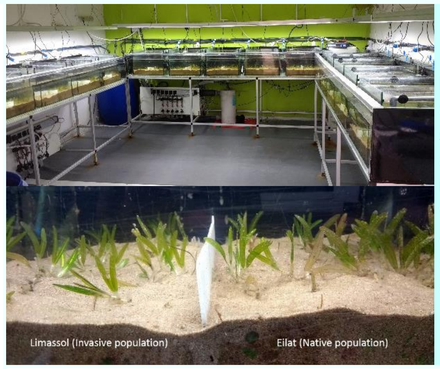


Figure 3. Native (Israel) and invasive (Cyprus) *H. stipulacea* are currently acclimatizing alongside in a microcosm system within 65 L aquaria at ADSSC (n=15). Common stress experiments will soon initiate.

Figure 4. 16SrRNA gene amplifications with PCR of bacterial DNA collected from water, sediment, *H. stipulacea, C. nodosa* and *P. oceanica* run in an agarose gel.

Figure 2. Comparisons in plant morphological parameters between the study sites in the eastern Mediterranean (DC Limassol) and the northern tip of the Gulf of Aqaba (NB Eilat). n=3 quadrats sampled from each site, +/- SE. * within a panel denotes significant differences (two-sample t-test, $p < 0.05$) between the two sites.

CONCLUSIONS

Although results are obviously preliminary, the first morphological analyses suggest that invasive (Cyprus) and native (Israel) plants are different. Invasive plants were generally smaller and had more apical shoots and larger internode distances than their native counterparts. We need to further investigate the environmental conditions that may lead to these differences. Seasonal data will continue to be collected from the permanent transects installed and analysis will help increase our knowledge of the seasonal dynamics in native and invasive *H. stipulacea* populations in the two basins. Common stress garden experiments are underway and the physiological responses to thermal stress will be compared in native and invasive populations, under projected climate change conditions. The microbial analyses will help to our further understanding of the functionality of seagrasses and their associated microbiomes and will be interesting to find out whether the microbiomes are species-specific or more related to the environmental microbial background[5]. 2bRAD will help compare the genetic diversity between invasive and native populations.

References

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