

# First record of vertical rhizome growth in *Zostera marina*

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## INTRODUCTION

Increased sediment loads in marine environments are caused by many different anthropogenic activities and more frequent storms due to climate change. Increases in sedimentation leads to increases in turbidity, which reduces penetration of light in the water. Deposited sediment buries the lower parts of the plant including photosynthetic tissues. Various seagrass species tolerate sediment burial differently (Cabaço et al., 2008). A plant can respond to burial with vertical or horizontal rhizome elongation. Vertical rhizome growth is interpreted as a mechanism selected to counteract the effects of burial. Vertical rhizome growth has been described in many seagrass species, but no published records exist of vertical rhizome growth in *Zostera marina*. Here we present the first record of vertical rhizome in *Zostera marina*.

### VERTICAL RHIZOME

- Vertical rhizome is appearing in a vertical plane
- Shoot with green tissue growing from the tip, along the same axis as the rhizome
- Rhizome with roots and shoot coming out of it



Figure 1 a) and b). Vertical rhizome of *Zostera marina*

## MATERIALS AND METHODS

As a part of the research on effect of sediment relocation processes on the seagrass community in the Novigrad Sea, central Croatian Adriatic, seagrass samples were taken in summer, 2011. Novigrad sea is known to be an area with high sediment movement with 3 seagrass species occurring in that area: *Zostera noltii*, *Zostera marina* and *Cymodocea nodosa*. Three replicates of seagrass samples were collected by SCUBA divers at each of 8 different locations on 3 and 4,5 meter depth. Seagrass analysis included measurement of morphological characteristics (internode length and width).

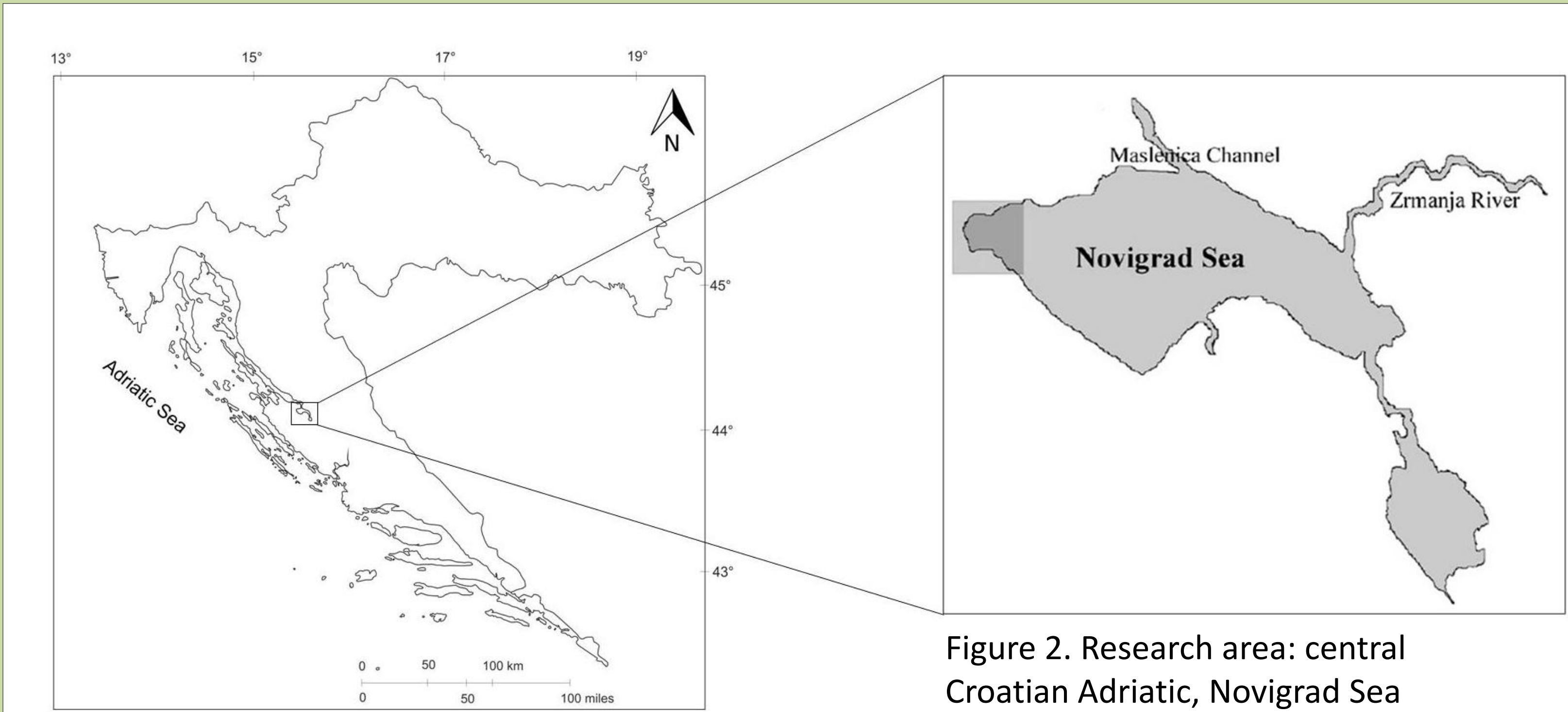


Figure 2. Research area: central Croatian Adriatic, Novigrad Sea

## RESULTS and DISCUSSION

- First record of vertical rhizome in *Zostera marina*
- Vertical rhizome bearing shoots as well as horizontal rhizome
- Mean vertical internode length=3.27±1.35 mm, maximum internode length=9 mm, mean vertical internode width=1.92±0.32 mm, maximum internode width=2.5mm
- Mean horizontal internode length=8.99±3.4 mm, maximum horizontal internode length=26 mm, mean horizontal internode width=2.88±0.4 mm, maximum horizontal internode width=4 mm
- Significant effect of rhizome type on the internode length and width (p<0.001)
- Vertical rhizome consisted of several short vertical internodes
- Vertical growth of *Zostera marina* might be triggered by sediment accumulation which is present in Novigrad sea
- Sediment accumulation in these natural processes is presumed to be more gradual than in laboratory experimental conditions which then gives enough time to the plant to adopt to new conditions by producing vertical rhizome
- Vertical internodes found in *Z. marina* show shorter length as well as vertical internodes of *Z. noltii* described by Brun et al. (2005) which is different from most seagrass that have vertical growth and have longer vertical internodes
- Vertical rhizome might increase survival rate of *Zostera marina* in areas with high sediment dynamics

	Df	Sum Sq	Mean Sq	F value	p
Width	1	183.20	183.201	1266.9	<0.001
Residuals	1025	148.22	0.145		

Table 1. Analysis of variance (ANOVA) of the effect of rhizome type on internode width

	Df	Sum Sq	Mean Sq	F value	p
Length	1	6595.2	6595.2	735.66	<0.001
Residuals	1028	9216.1	9.0		

Table 2. Analysis of variance (ANOVA) of the effect of rhizome type on internode length

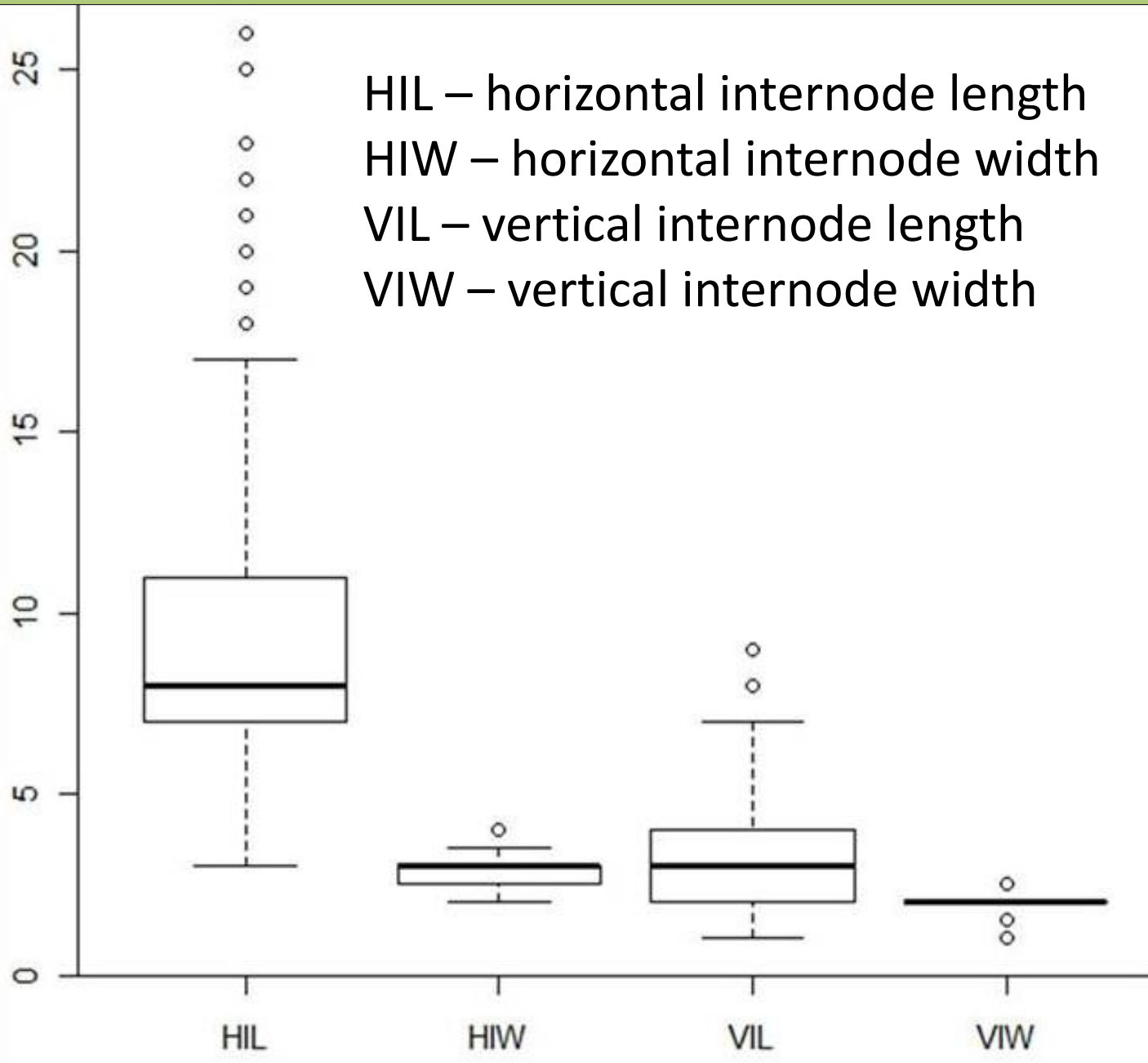


Figure 3. Horizontal and vertical internode length and width (mm)

## CONCLUSION

According to existing literature this is the first record of vertical rhizome in *Zostera marina*. Substantial annual sediment movement in this area, due to natural processes, could have stimulated this developmental response in *Z. marina* growth. Vertical growth may enable *Z. marina* to withstand negative effects of burial more than it would be possible with only a horizontal rhizome growth, and may contribute to the adaptability of *Z. marina* to increased storm activity and sediment movement as a result of global climate change.

### Aknowledgments

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### References

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