

Sveučilište u Zadru
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Praćenje širenja invazivne alge *Caulerpa cylindracea* u uvali Sakarun (Dugi otok, Hrvatska)

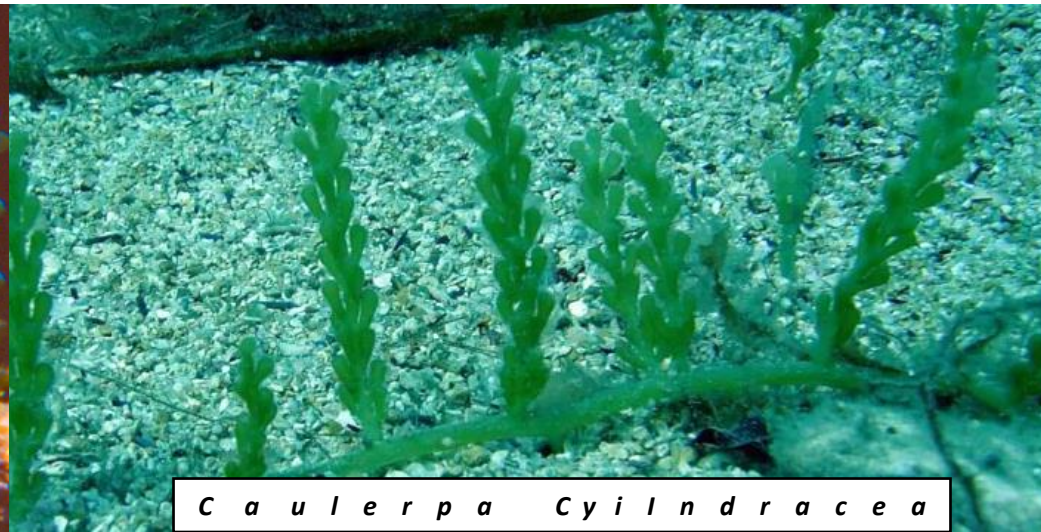
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Climate change and preservation
of marine ecosystems in the
Adriatic Sea

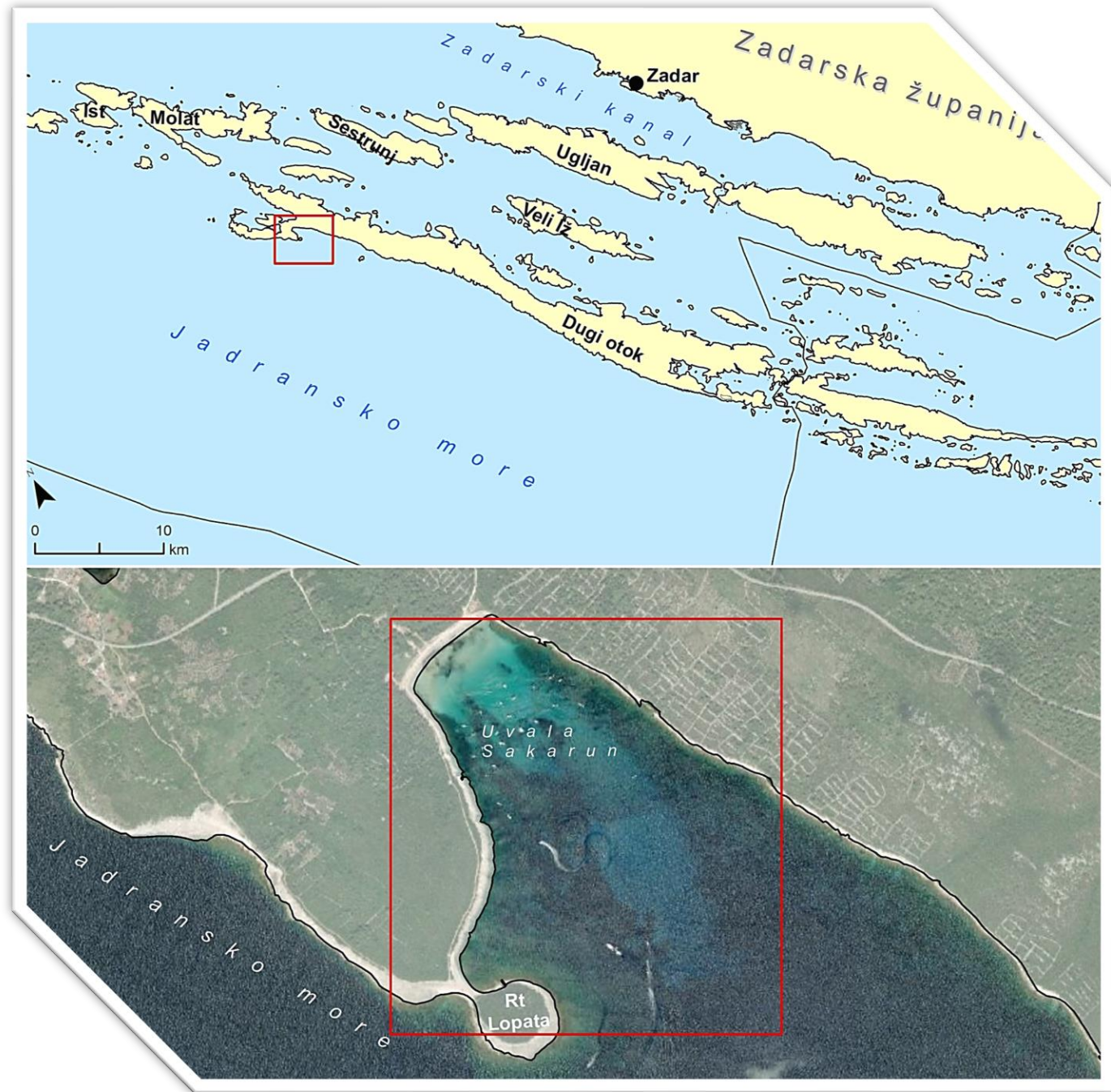
1. Introduction

- **Invasive species** are among the major threats to marine ecosystems
- One such species is *Caulerpa cylindracea*, a tropical green macroalga from Australia that has rapidly spread throughout the Mediterranean Sea.
- It has ability to cause **ecological changes** and **reduce biodiversity**. It aggressively colonizes rocky substrates and areas near seagrass meadows of *Posidonia oceanica*, disrupting the balance of benthic communities.
- Caulerpa in Croatia is first time detected in 2000 around Pakleni islands . To 2005 is found at additional 40 locations and in 2012 at 100 locations.
- It is also found in NP Kornati, Mljet and Nature Park Lastovsko otočje.



2. Study area

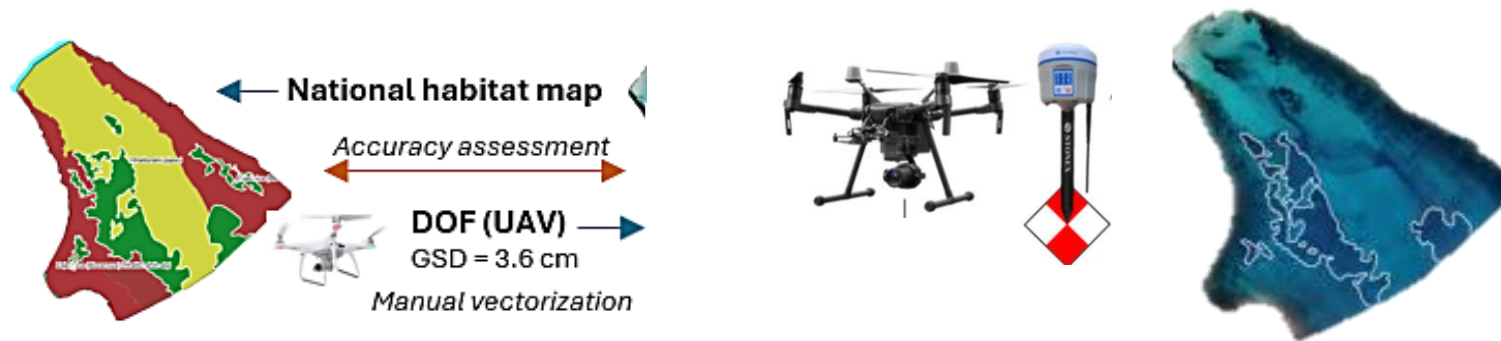
- Sakarun Bay (60 ha) is located in the SW part of Dugi Otok (**Natura 2000**)
- Geomorphological characteristics: alignment of orographic structure with underlying geological formations and a **karst landscape**
- The bay is susceptible to intensive abrasion due to winds from the open sea
- Sakarun **Beach** is a gravel beach formed in tectonically weakened and fragmented carbonate rocks. Despite this, **sand** predominates in the bay.



3. Materials and methods

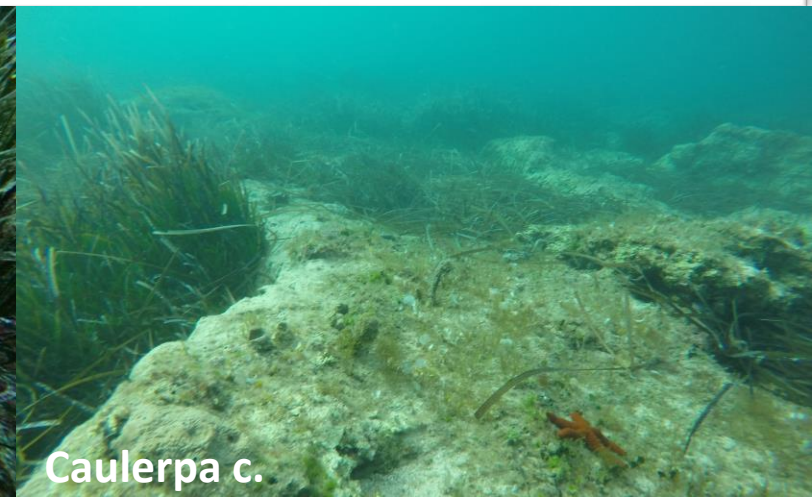
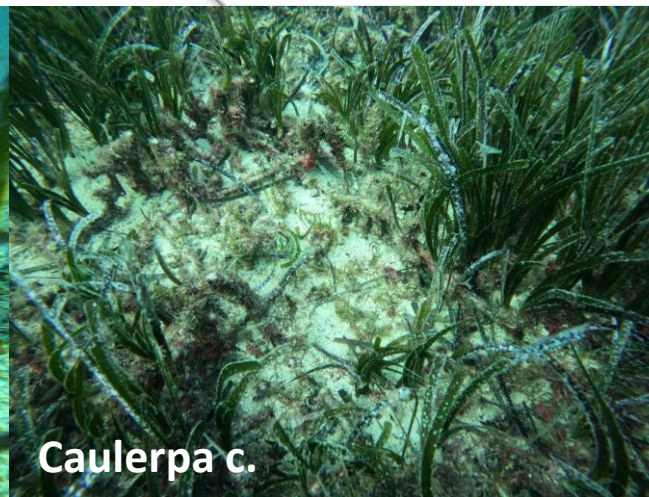
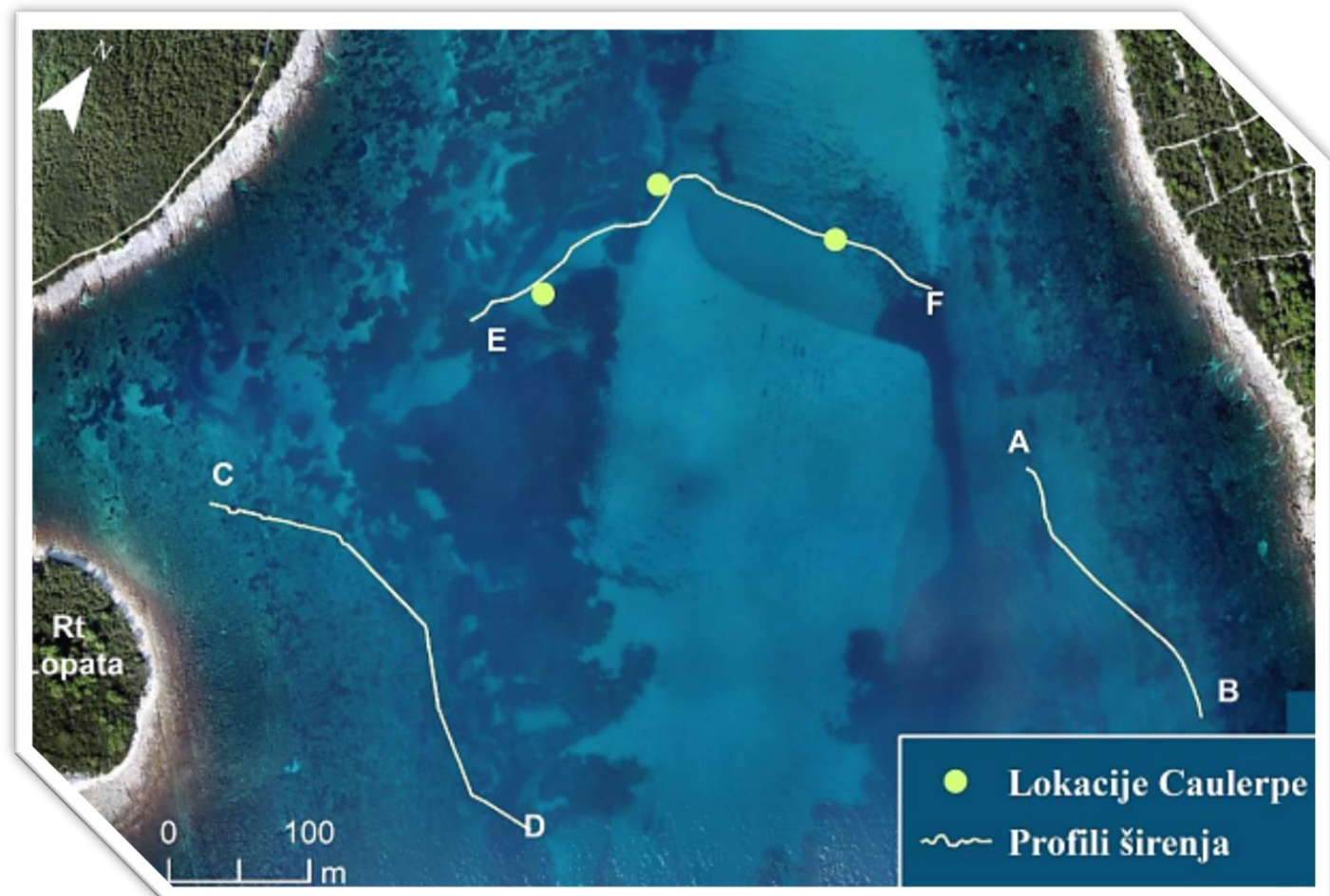
This study, focuses on monitoring the spread of *C. cylindracea* and dynamics and distribution of *P. oceanica* in Sakarun Bay

- 1. **Monitoring the spread of Caulerpa in Sakarun Bay (2021–2023)**
 - Conducted a **diving survey** and collected **coordinates** of *C. cylindracea* locations
 - 12 profiles were recorded using digital cameras (*Canon G16 and GoPro Hero 5*).
 - Transect** with dimensions: **5 m wide** and **200 m long**
- 2. **Posidonia state from 2016 to 2023**
 - Is assessed based on open-source satellite **multispectral imagery** from the *PlanetScope* with a **spatial resolution of 3 m**
 - Additionally, a **DOF (Digital Orthophoto)** was created, the supervised classification techniques were applied to **classify the seabed**, and the **bathymetric model** was created (from *Navionics*)

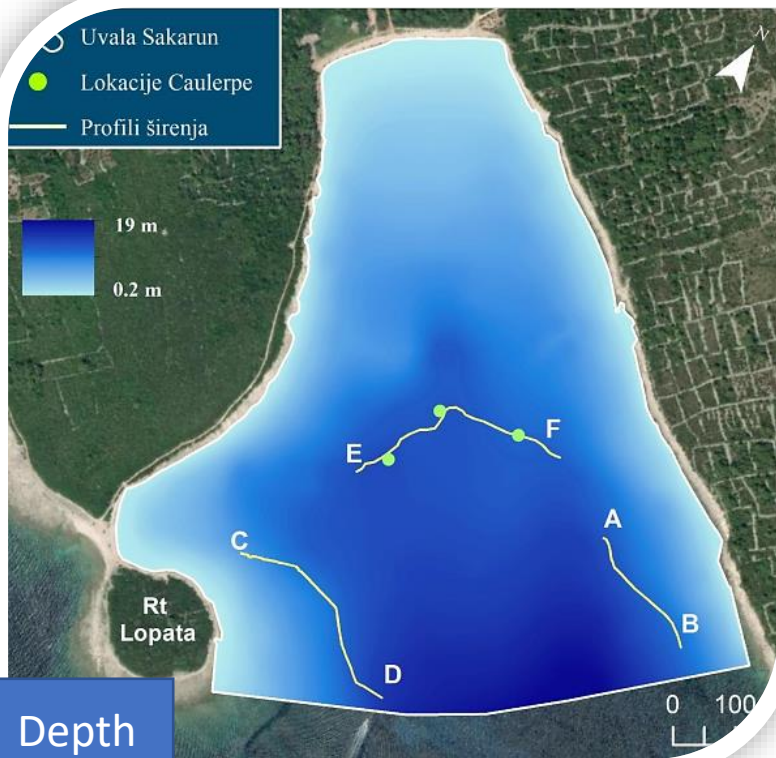


4. a) Results: *Caulerpa* monitoring

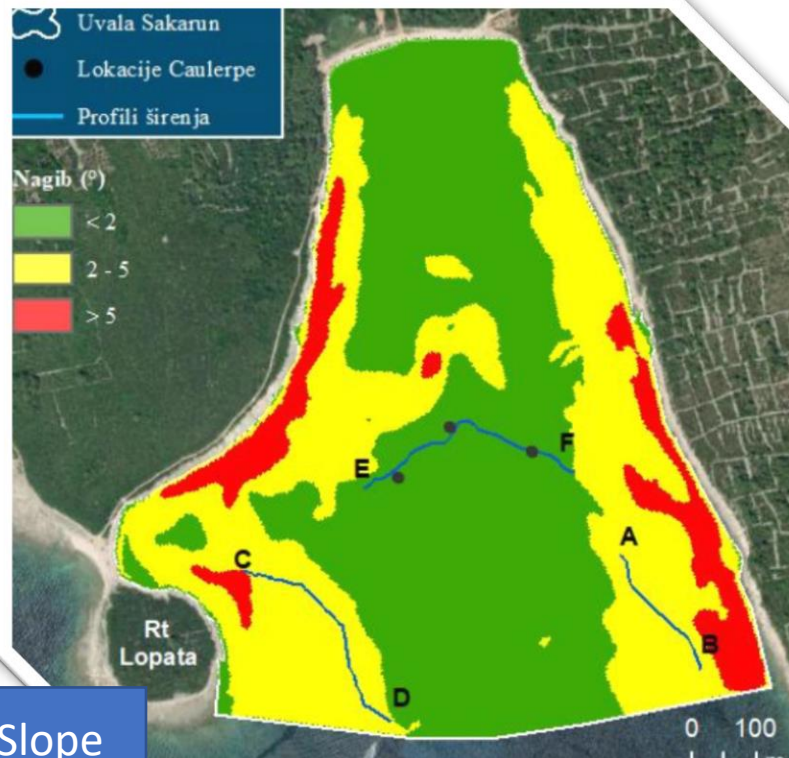
- *Caulerpa* spread is detected along **three dominant lines (1050 m)**
- In Sakarun bay *Caulerpa c.* grows on **rocky substrates** along the edge of *P. oceanica* meadows
- It also grows on the mats of intertwined rhizomes of dead *P. oceanica*.



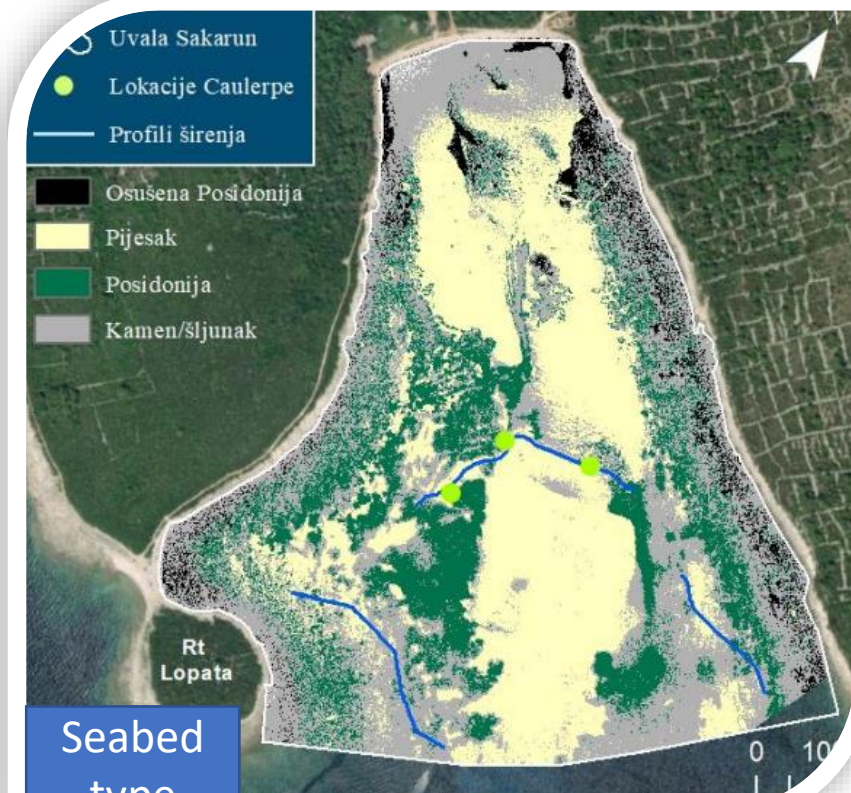




Depth



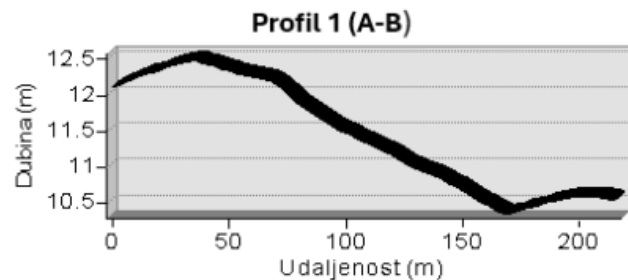
Slope



Seabed type

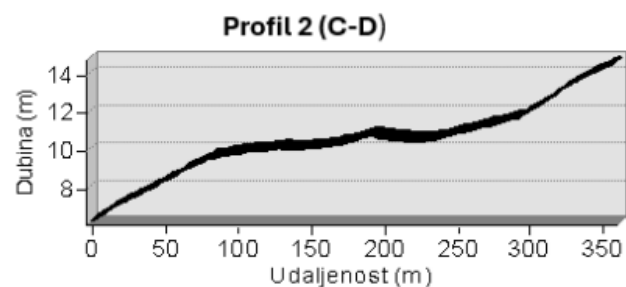
• Profile A-B (2021)

- Length 200 m
- Depth 0.2 to 14 m
- Slope (2° - 5°)



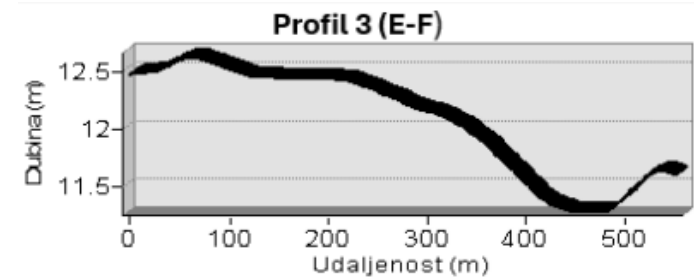
• Profile C-D (2022)

- Length 350 m
- Depth 0.1 to 13 m
- Slope (2° - 5°)

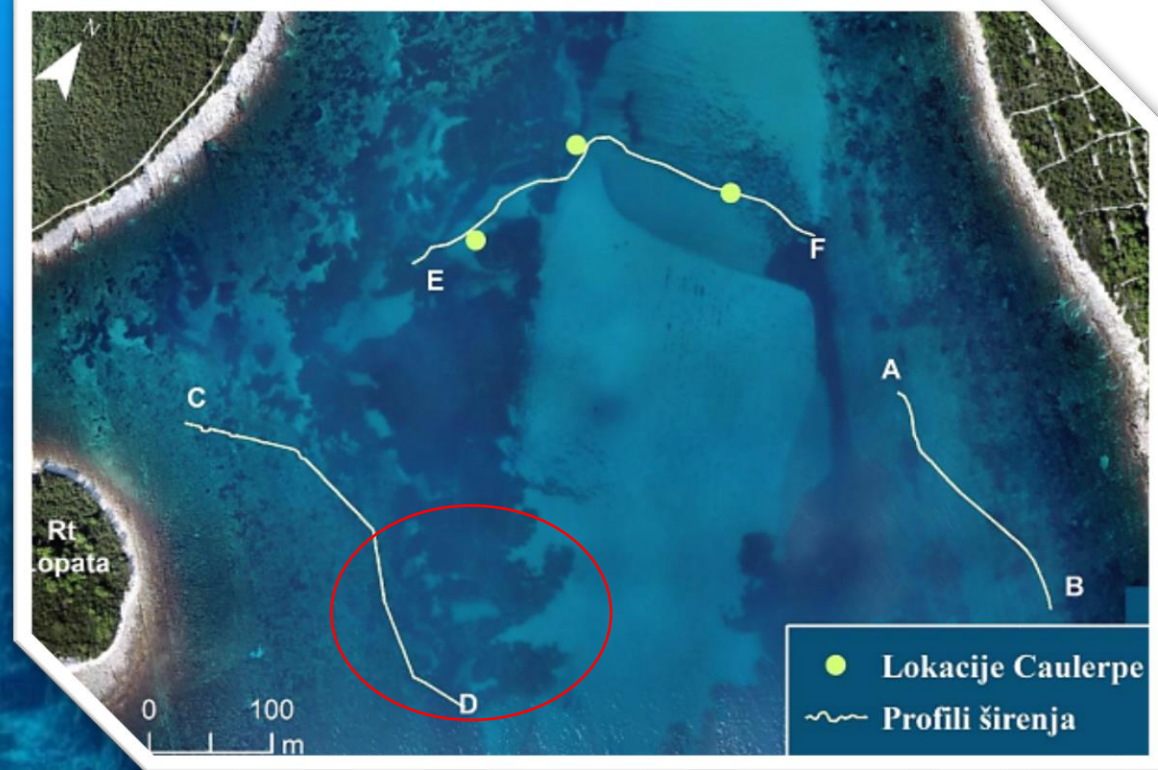
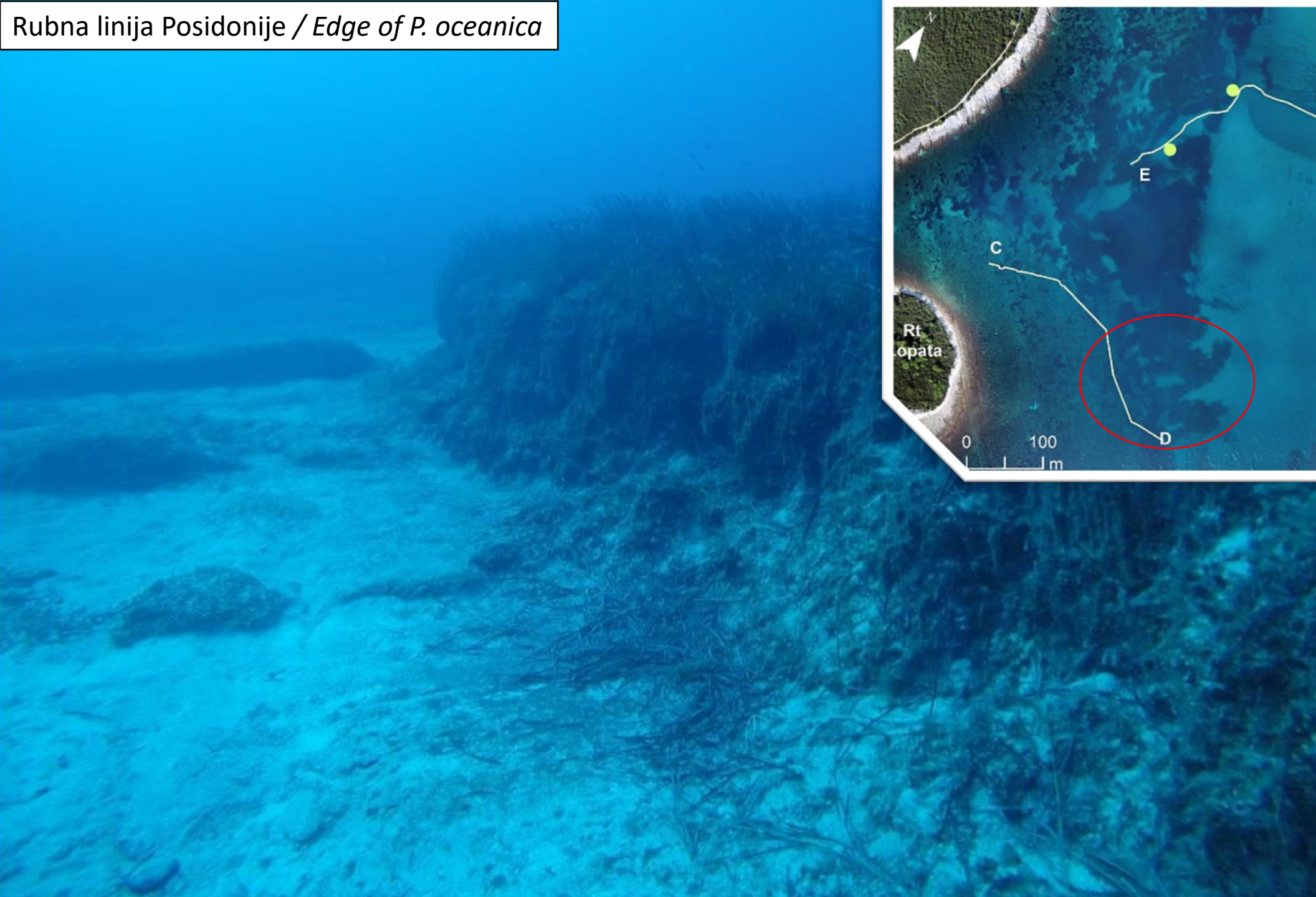


• Profile (E-F) (2023)

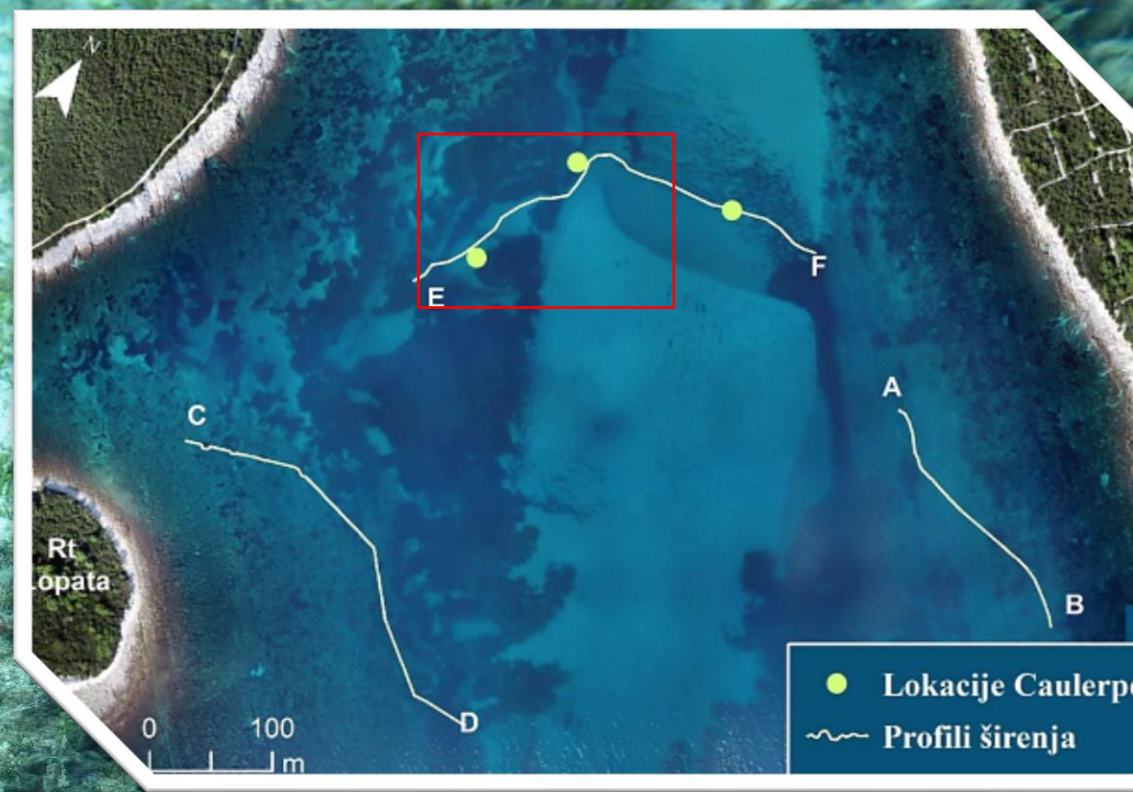
- Length 500 m
- Depth 0.2 to 13 m
- Slope (<2°)

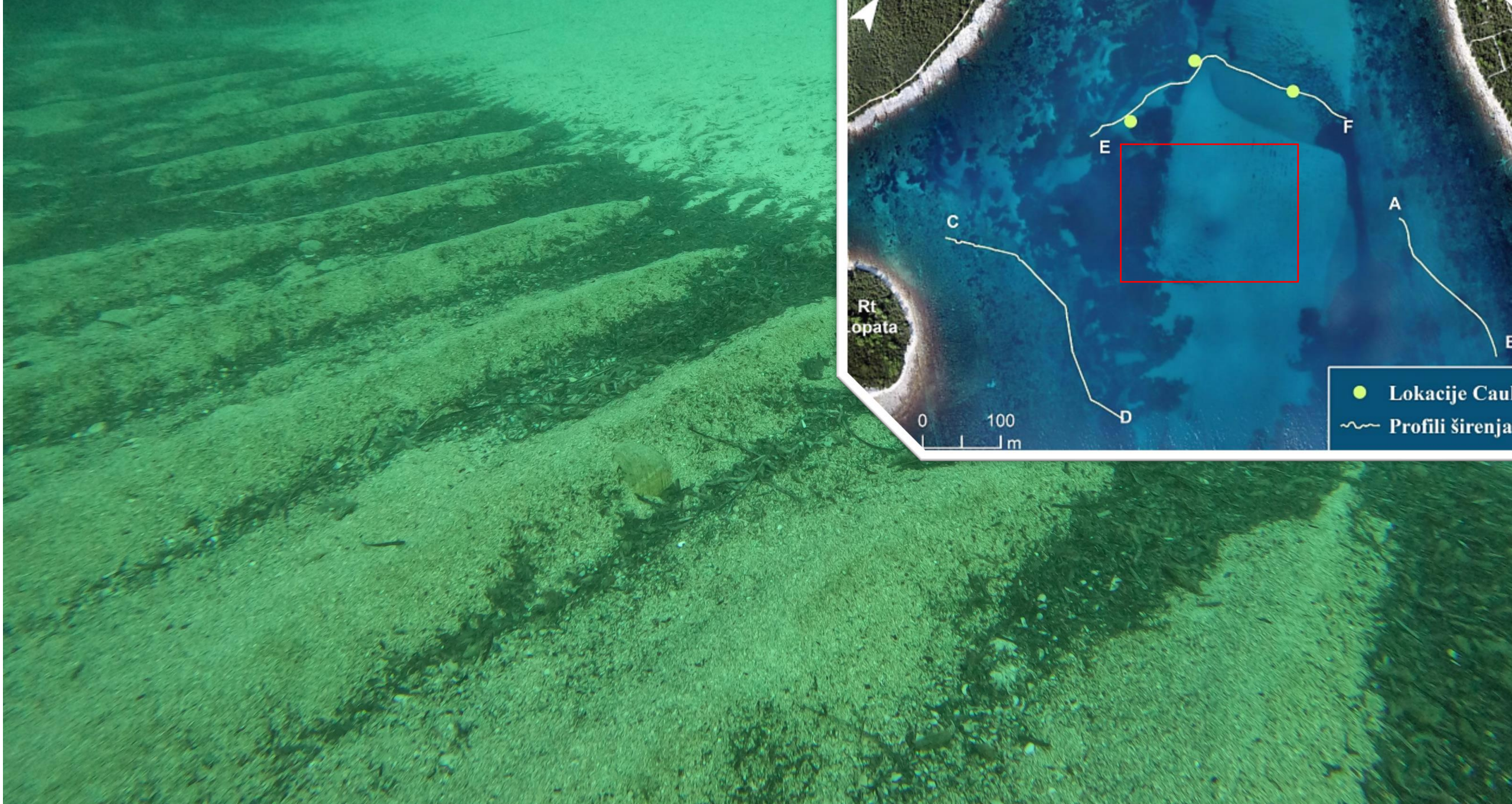


Rubna linija Posidonije / Edge of *P. oceanica*



Caulerpa c. na naslagama rizoma Posidonije /
Caulerpa c. on deposits of rhizomes (mattes) of Posidonia

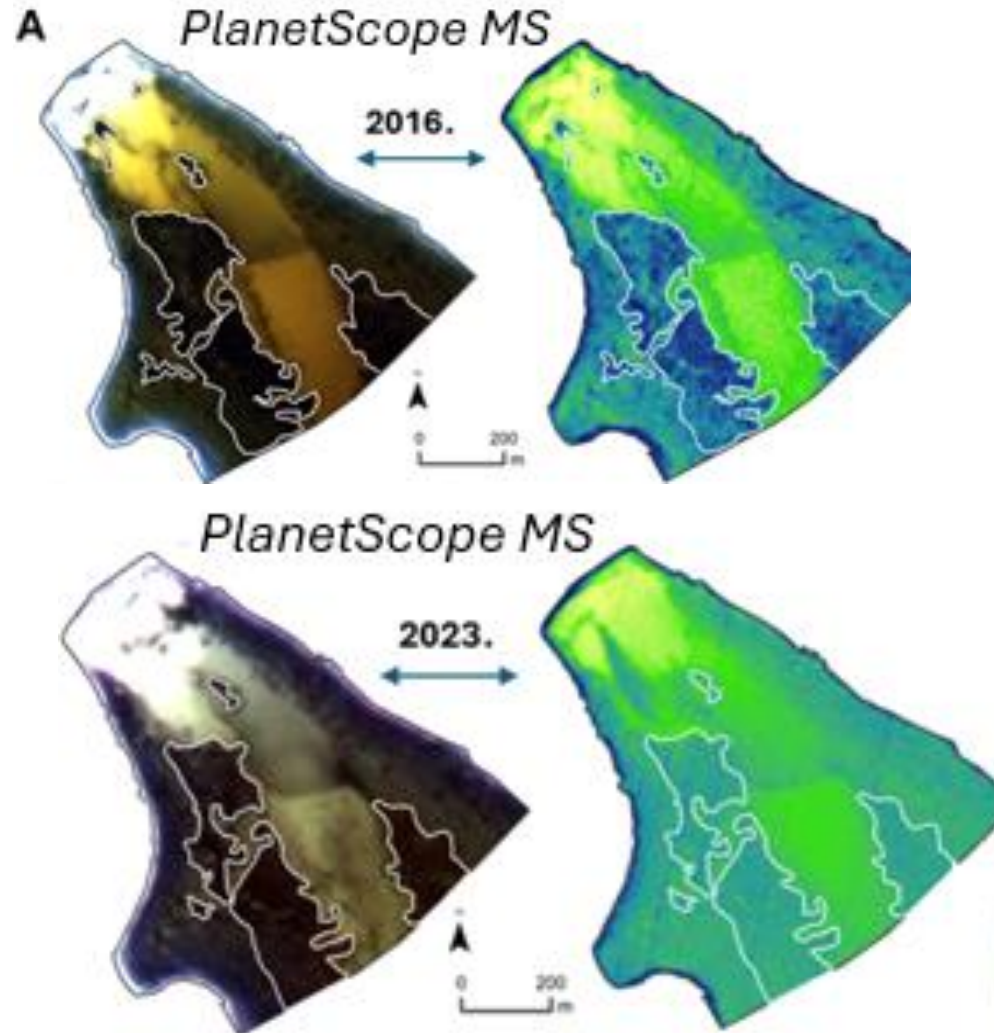




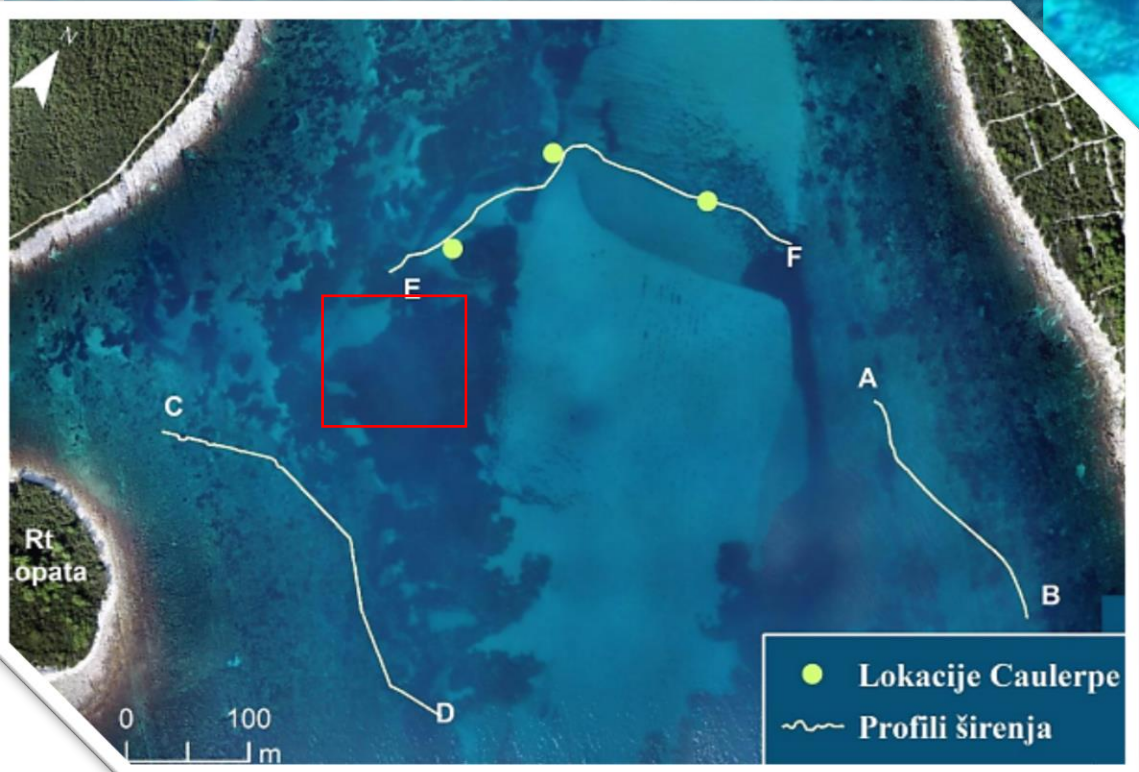
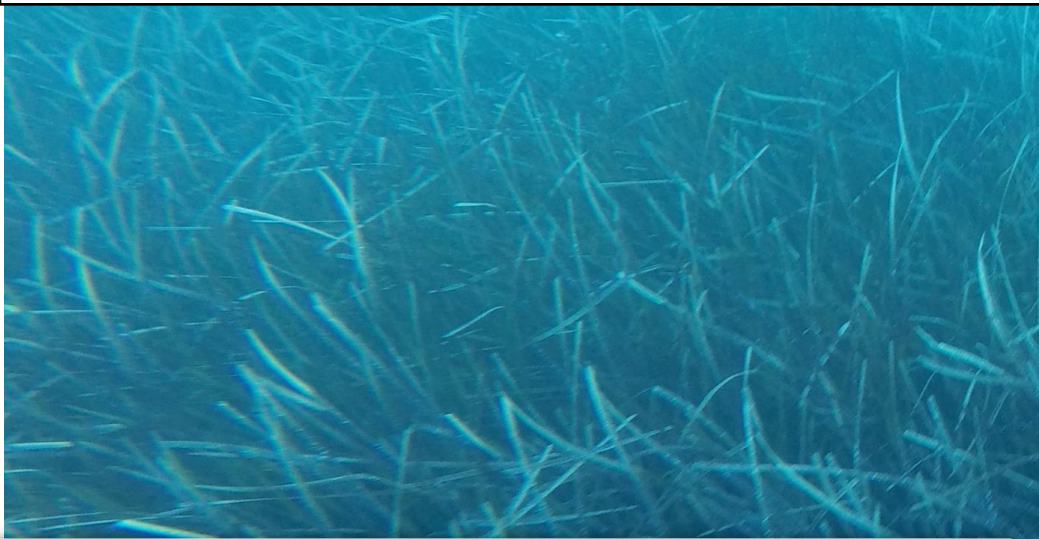
Pješčani dio uvale pod utjecajem valova / Sandy part of the Bay under the influence of waves

4. b) Results: *Posidonia status 2016 - 2023*

- *P. oceanica* cover an area of **131,460 m²**, primarily at depths ranging from 6 to 16 meters on gentle slopes



Infralitoralna zona s kombinacijom stijena i biocenoze morske cvjetnice Posidonia /
The infralittoral zone with a combination of rocks and biocenosis of Posidonia marine flowering plants





Conclusion

- It is visible that *Caulerpa* is moving towards the interior part of the bay
- The density is not yet so high that it crosses over *P. oceanica*
- Early removal strategies could be applied in the bay to mitigate the potential environmental disruptions caused by algae proliferation.



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Thanks for your attention!

