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**Nature-based reef solution for coastal protection and marine biodiversity enhancement**

**Restoration of oyster and sabellaria reefs to protect the beach and  
increase biodiversity at the Bevano River mouth (Ravenna)**



ALMA MATER STUDIORUM  
UNIVERSITÀ DI BOLOGNA



Comune di Ravenna



Parco Delta del Po  
Emilia-Romagna



PROAMBIENTE  
innovation & environment



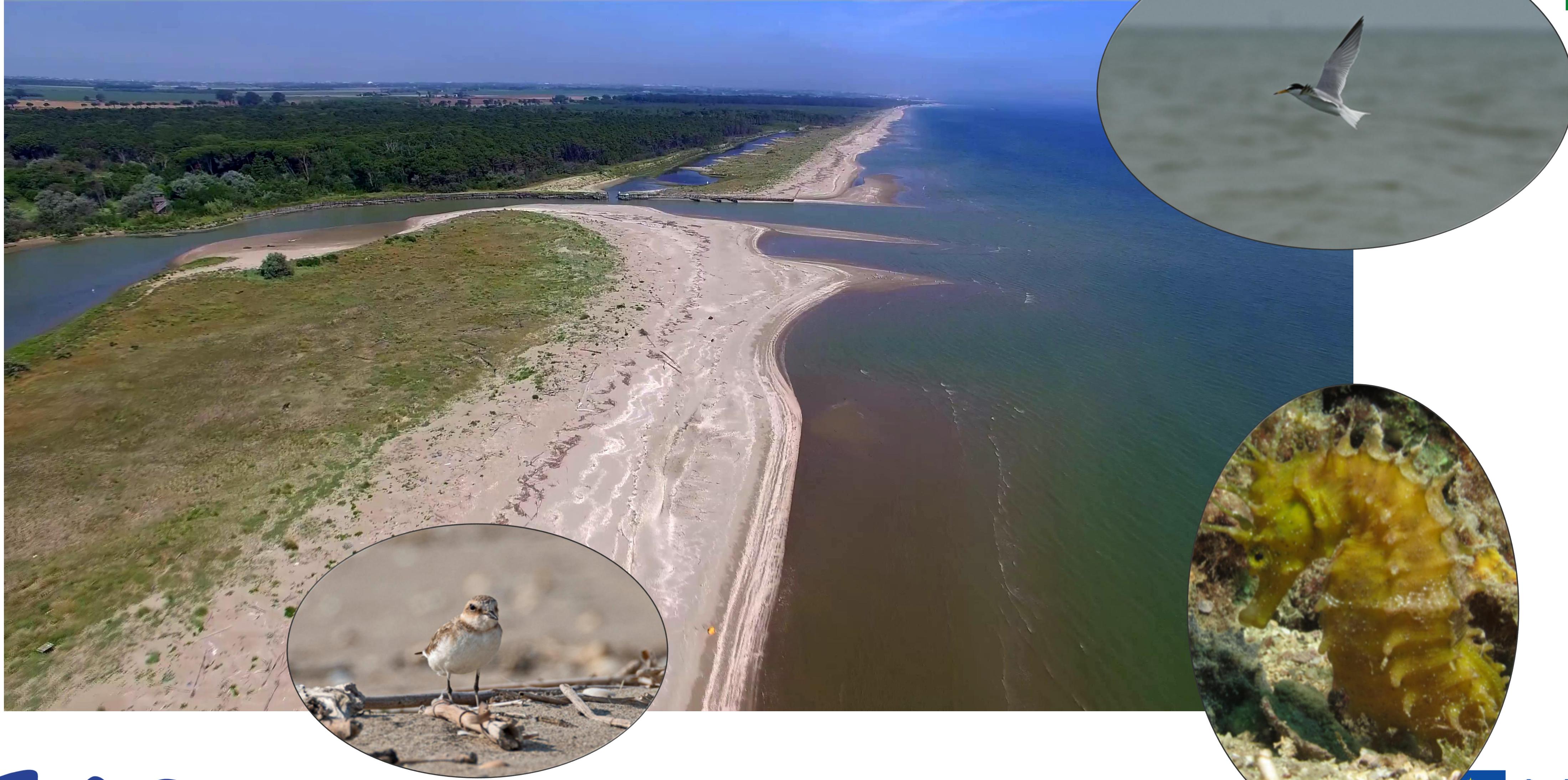
FONDAZIONE FLAMINIA  
RAVENNA



# High biodiversity still present in some marine and coastal habitats of Emilia–Romagna region



PARCO DELTA DEL PO  
EMILIA-ROMAGNA



## Threats

- natural and anthropogenic subsidence
- sea level rise
- increase in frequency and intensity of extreme events
- coastal urbanization
- overexploitation of resources



## The consequences:

- biodiversity loss
- habitat loss
- floods
- ecosystem goods and services loss



## The "engineering" solutions...

- groynes
- coastal walls
- breakwaters emerge
- breakwaters submerged
- beach nourishment



...short-term protection of tourism investments

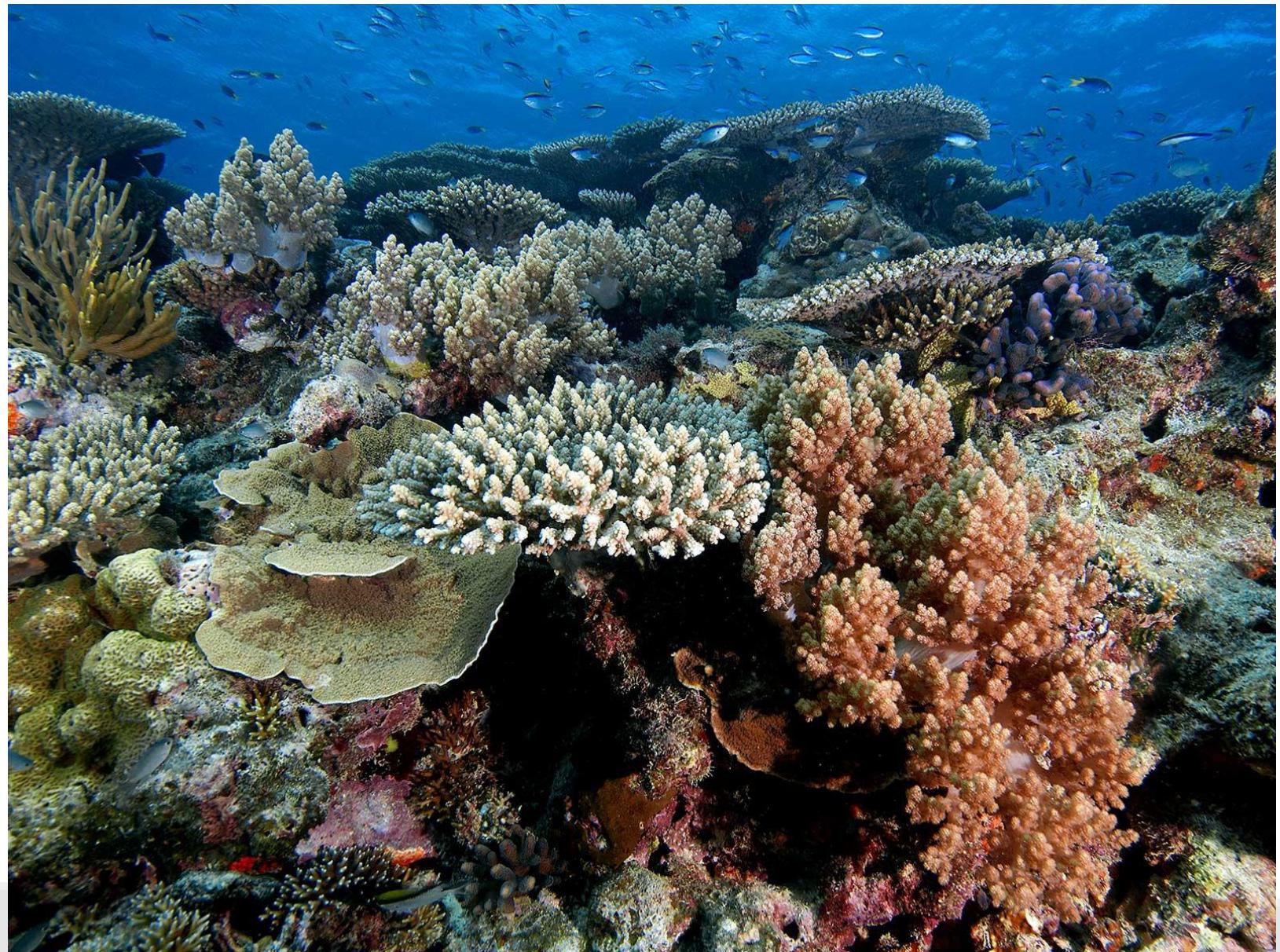
## How do natural systems work?



- Resistance
- Resilience
- Adaptation



# What are natural coastal bioconstructions?



Coral reefs

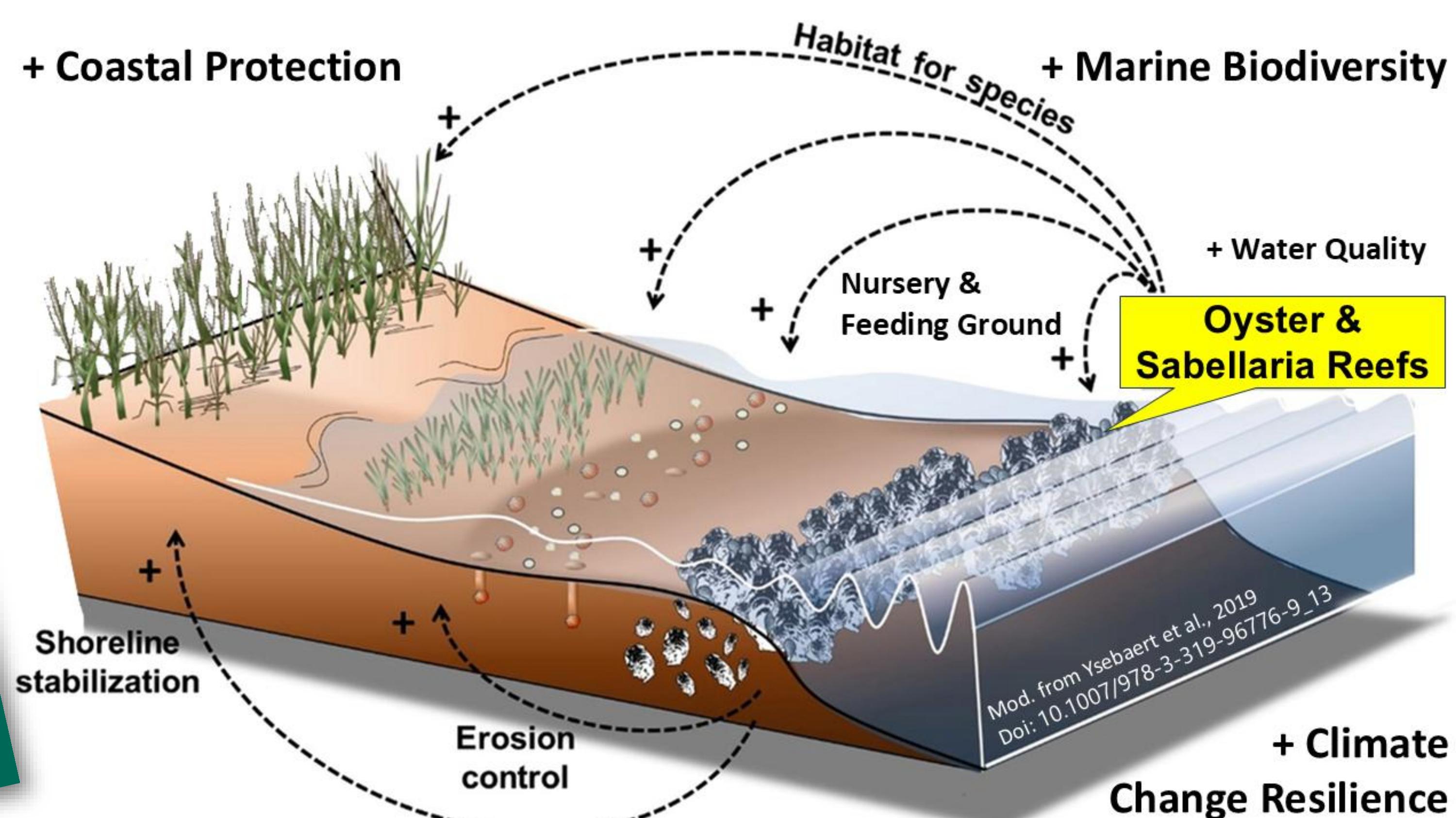
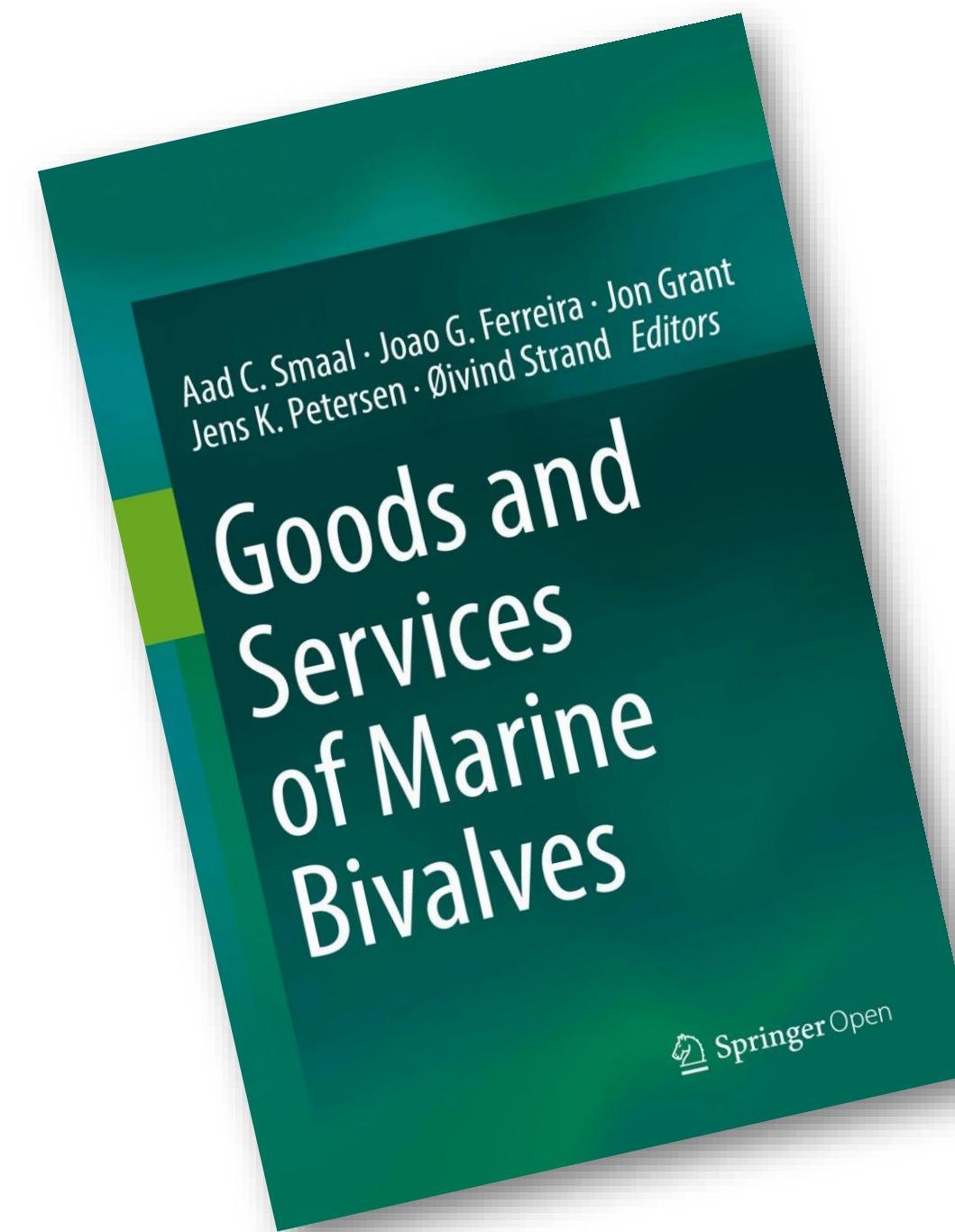


Oyster reefs



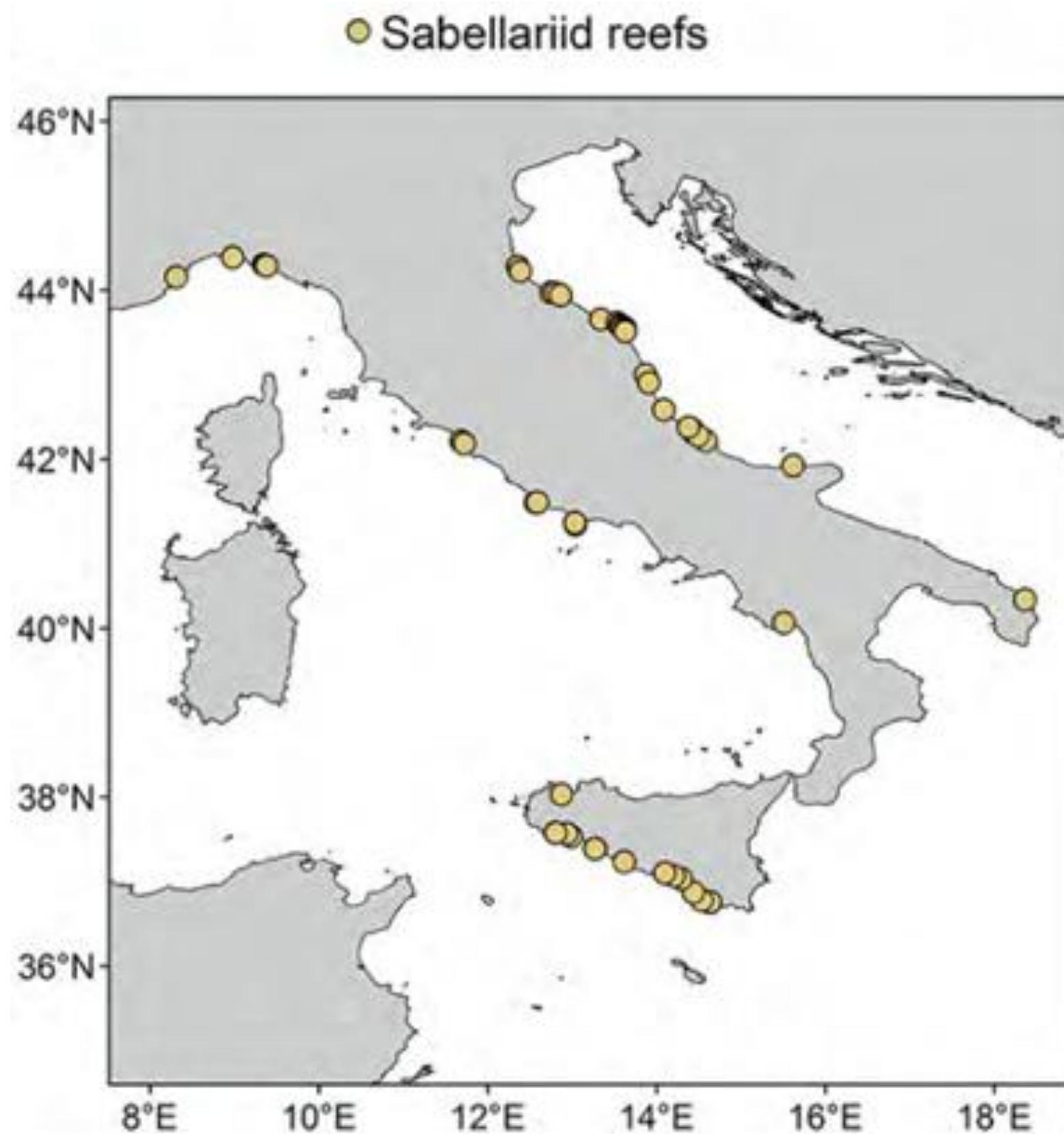
Sabellaria reefs

# An oyster reef... it's much more than just a pile of shells!



Ysebaert T, Walles B, Haner J, Hancock B (2019) Habitat modification and coastal protection by ecosystem-engineering reef-building bivalves. In: Smaal AC, Ferreira JG, Grant J, Petersen JK, Strand Ø (eds) Goods and Services of Marine Bivalves. Springer International Publishing, Cham, p 253–273.

# We have the opportunity to restore our ancient natural reefs!



Current distribution of sabellaria reefs  
(Ingrosso et al. 2018)



Sabellaria reef in Marina di Vasto (Abruzzo, Italy)

Ingrosso G, Abbiati M, Badalamenti F, Bavestrello G, Belmonte G, Cannas R, Benedetti-Cecchi L, Bertolino M, Bevilacqua S, Bianchi CN, Bo M, Boscarini E, Cardone F, Cattaneo-Vietti R, Cau A, Cerrano C, Chemello R, Chimienti G, Congiu L, Corriero G, Costantini F, De Leo F, Donnarumma L, Falace A, Fraschetti S, Giangrande A, Gravina MF, Guarneri G, Mastrototaro F, Milazzo M, Morri C, Musco L, Pezzolesi L, Piraino S, Prada F, Ponti M, Rindi F, Russo GF, Sandulli R, Villamor A, Zane L, Boero F (2018) Mediterranean bioconstructions along the Italian coast. *Adv Mar Biol* 79:61-136 <https://doi.org/10.1016/bs.amb.2018.05.001>



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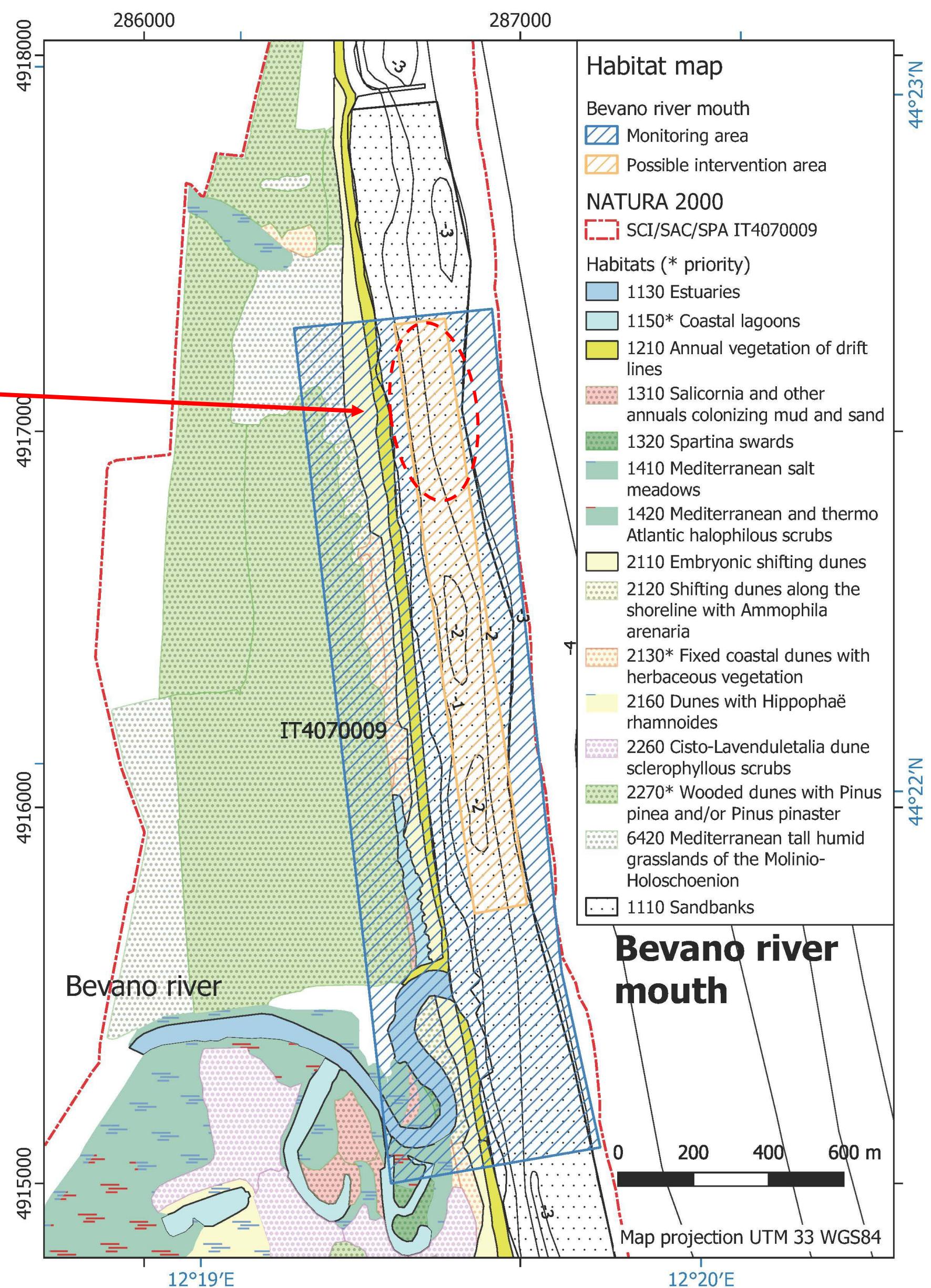
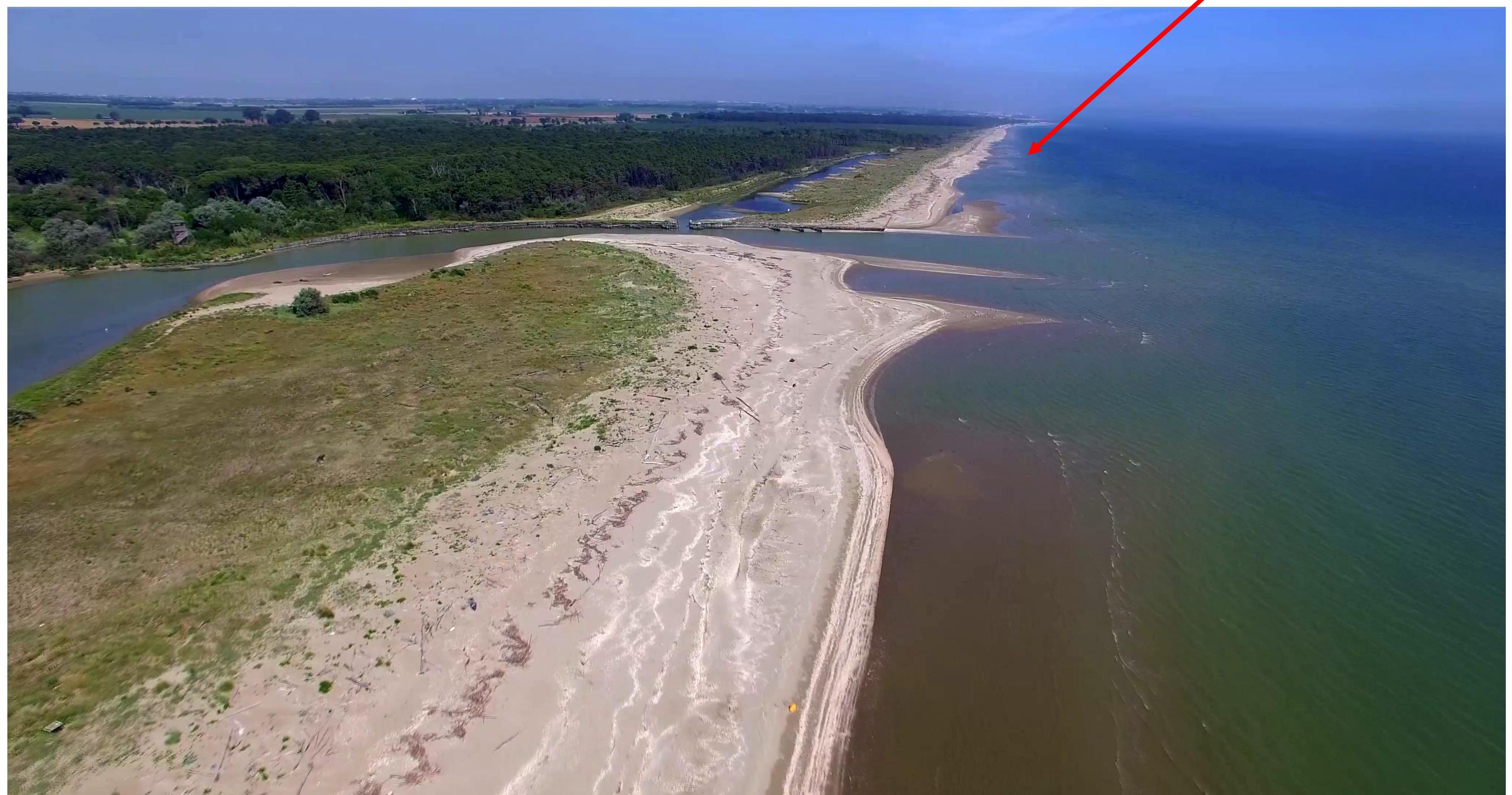


Sandy tubes made by *Sabellaria spinulosa*  
(3D X-Ray CT scan by Eva Turicchia)

# The project idea...

Demonstrate:

- the possibility of rebuilding oyster and sandbar reefs
- their effectiveness in protecting the coast
- and increasing biodiversity



# Project activities



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**WP1** Project management and coordination (1-48 m)

**WP2** Habitat and biodiversity baseline, monitoring, evaluation and KPI (1-48 m)

**WP3** Design and construction of the basal limestone reef (1-36 m)

**WP4** Design and implementation of the biogenic reefs (1-46 m)

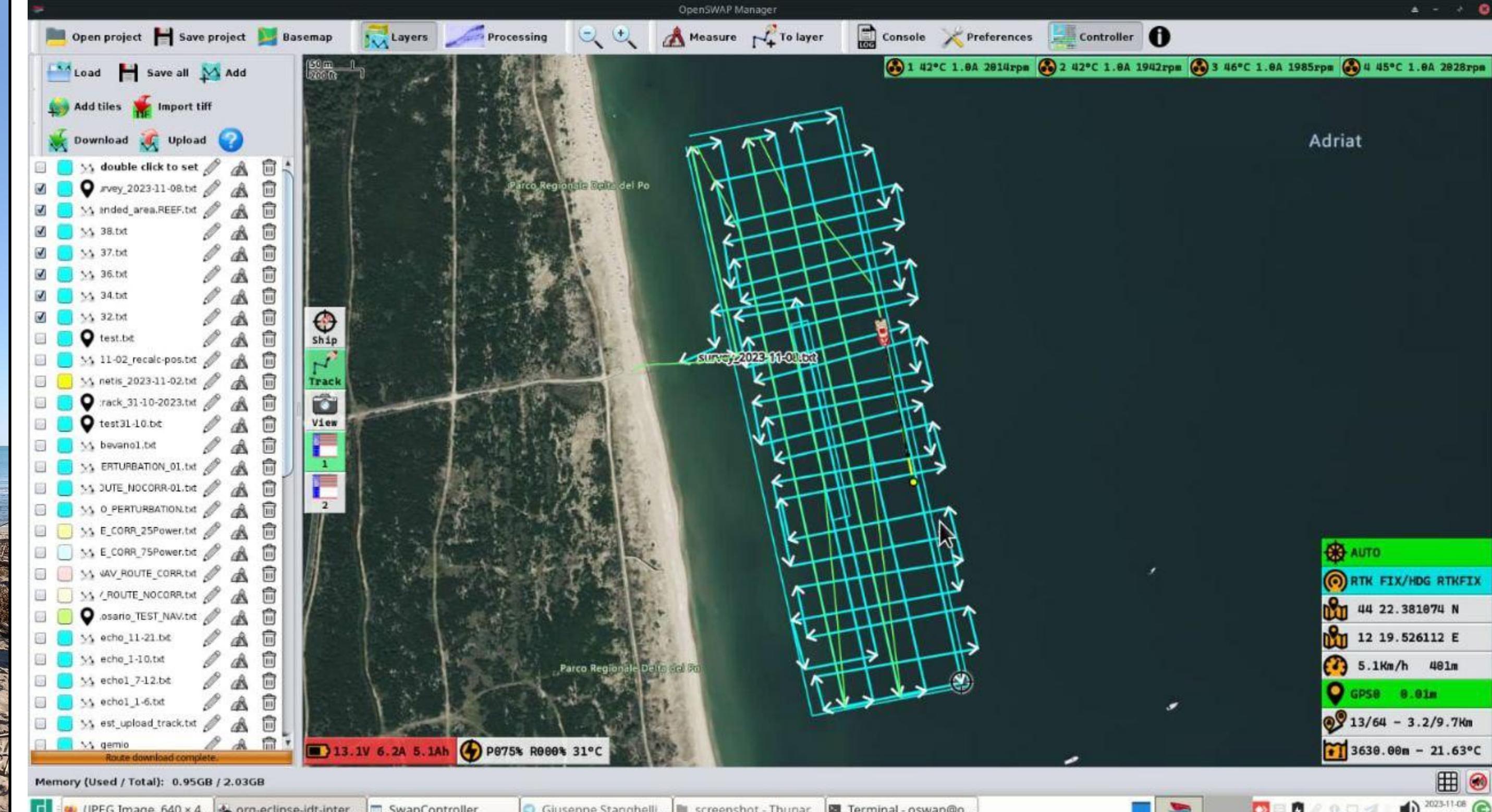
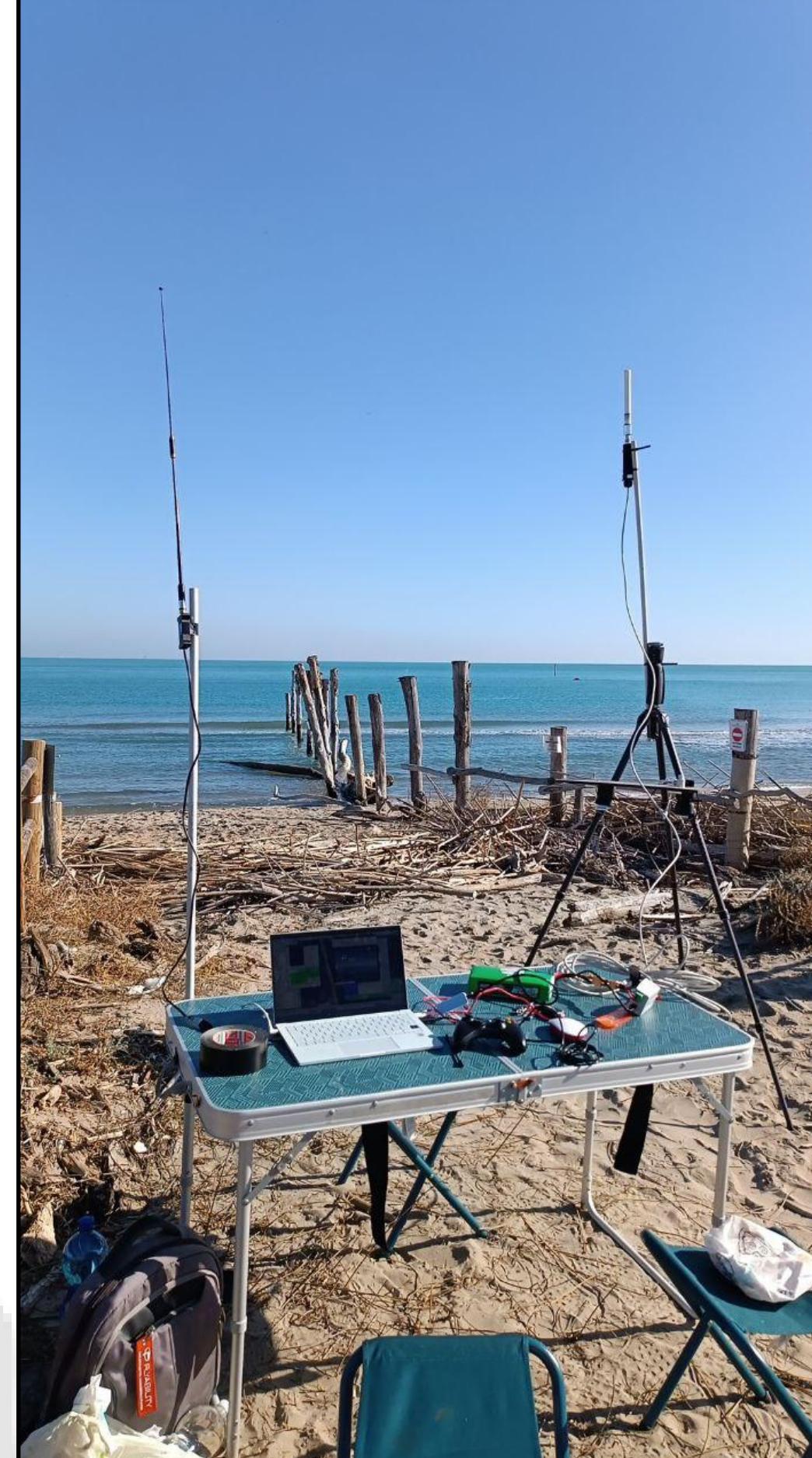
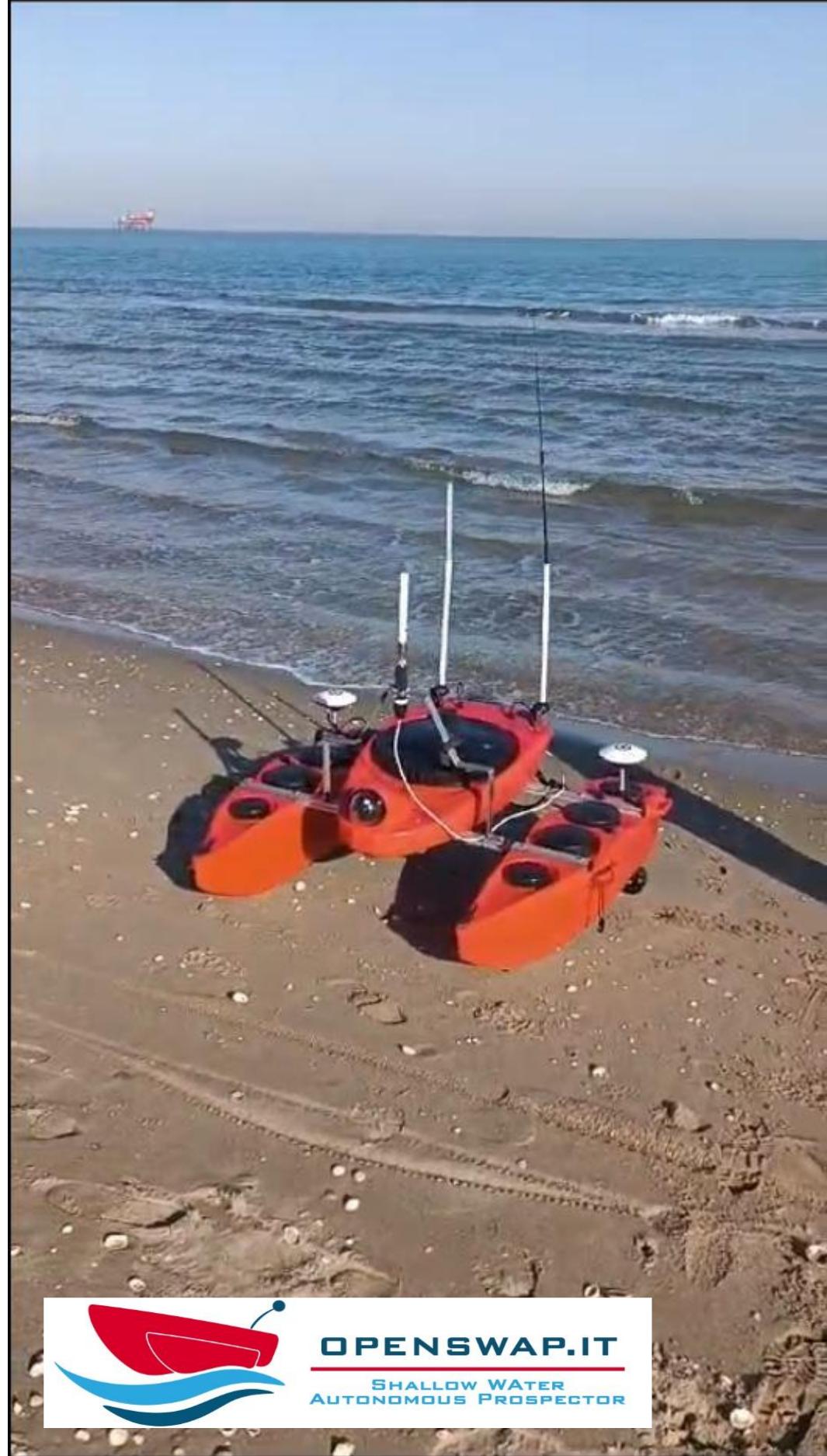
**WP5** Dissemination, communication and public engagement (1-48 m)



**WP6** Sustainability, replication and exploitation of project results (13-48)



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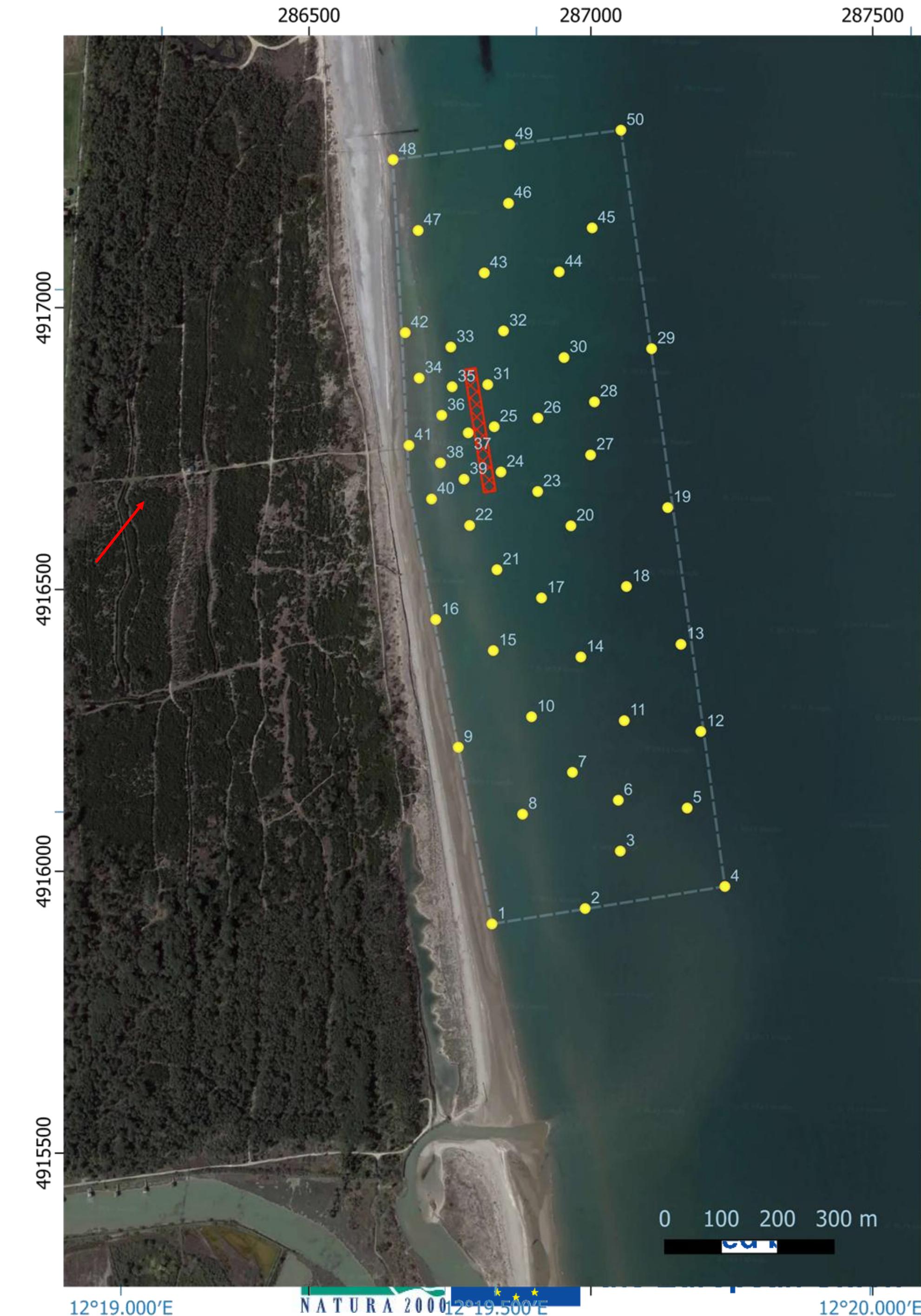


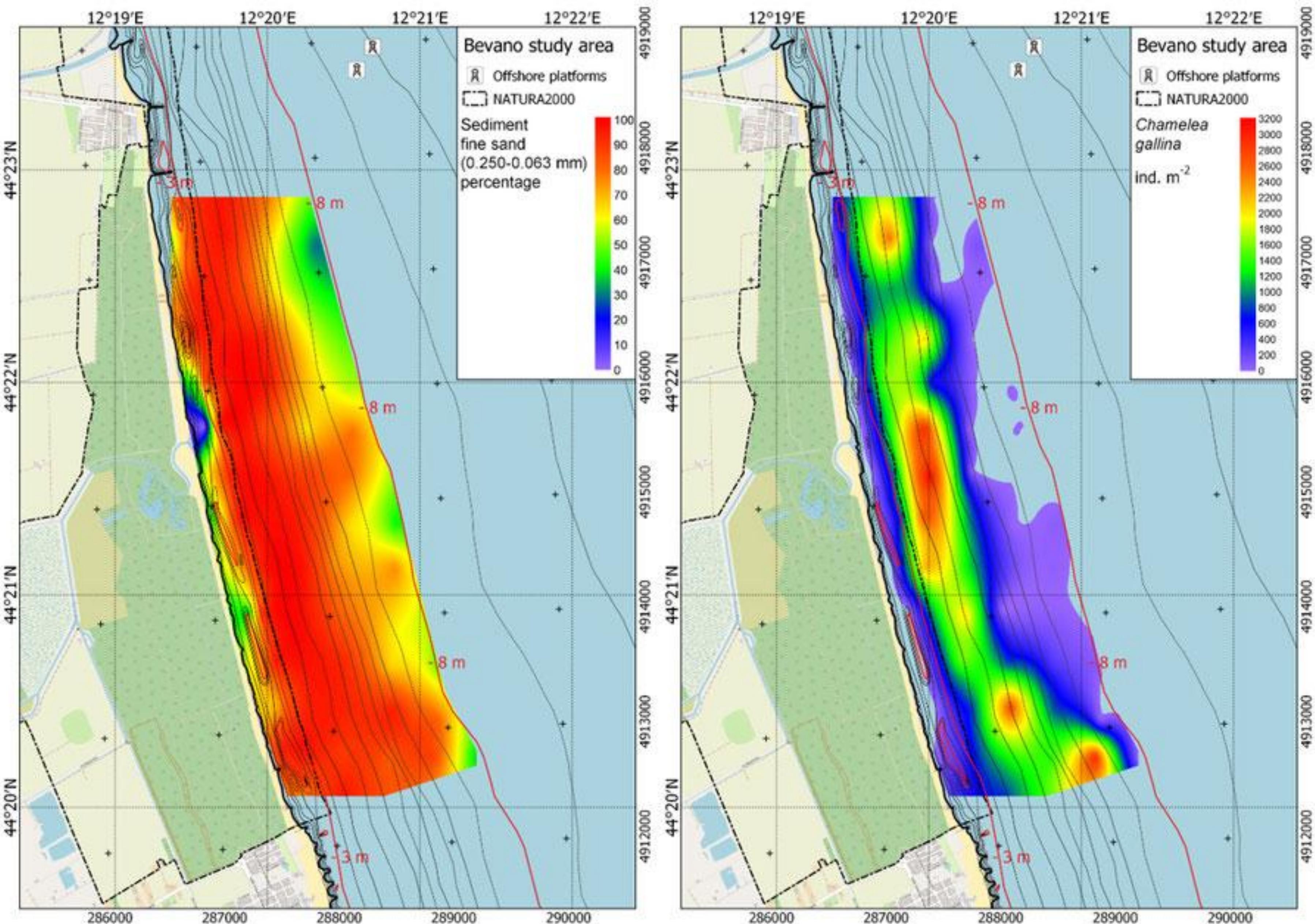
Digital bathymetry survey  
(by PROAMBIENTE)



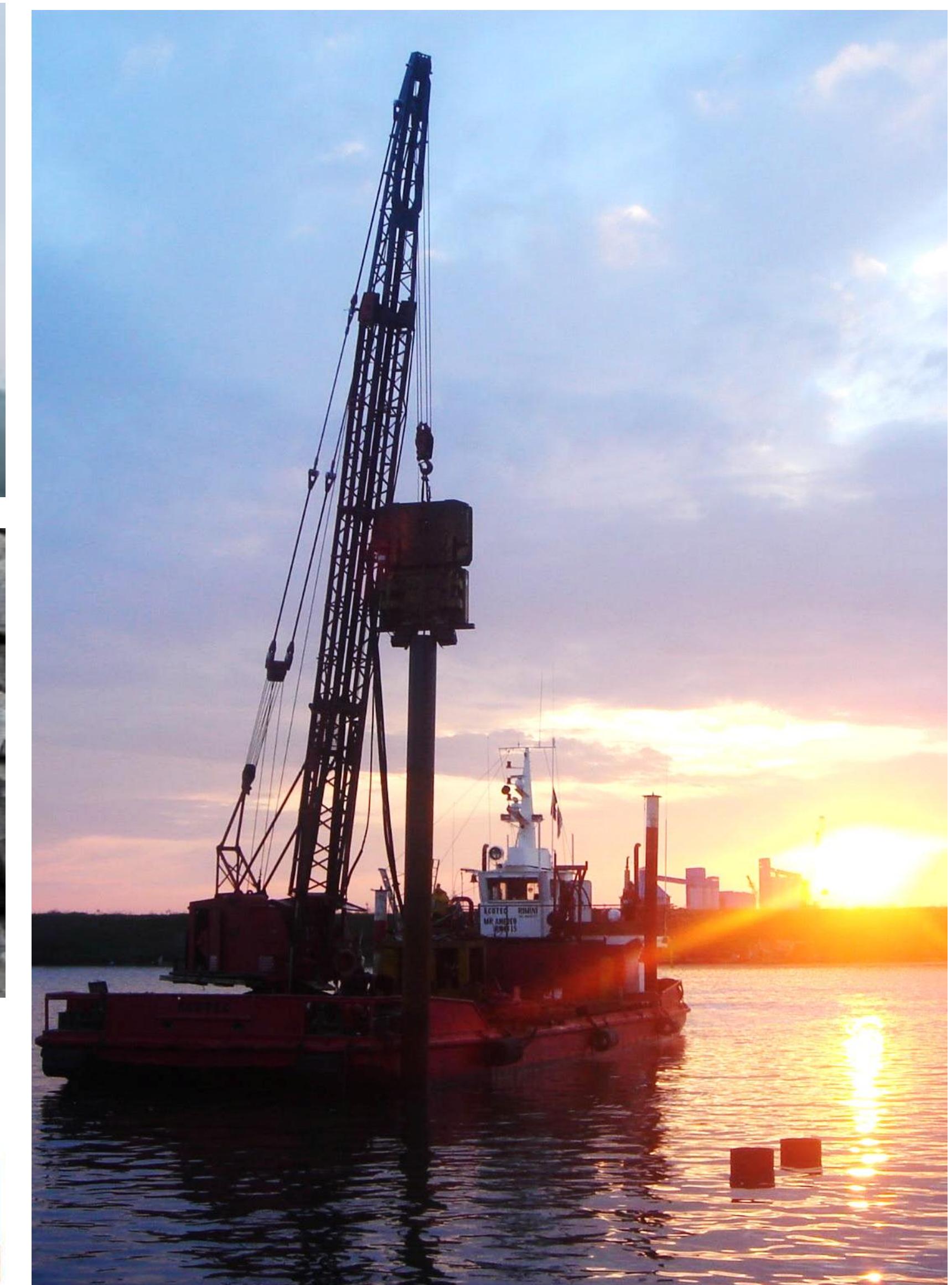
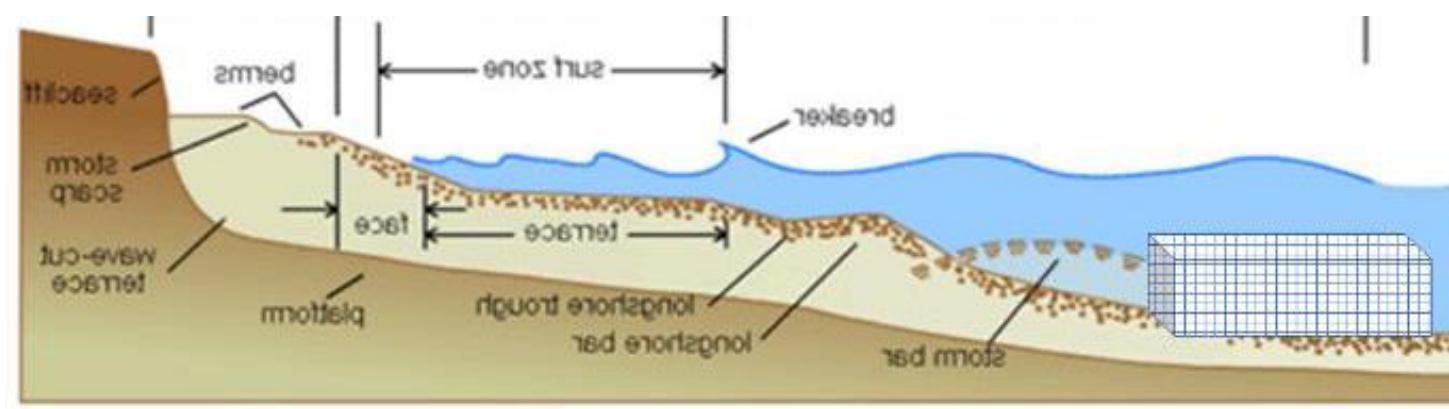
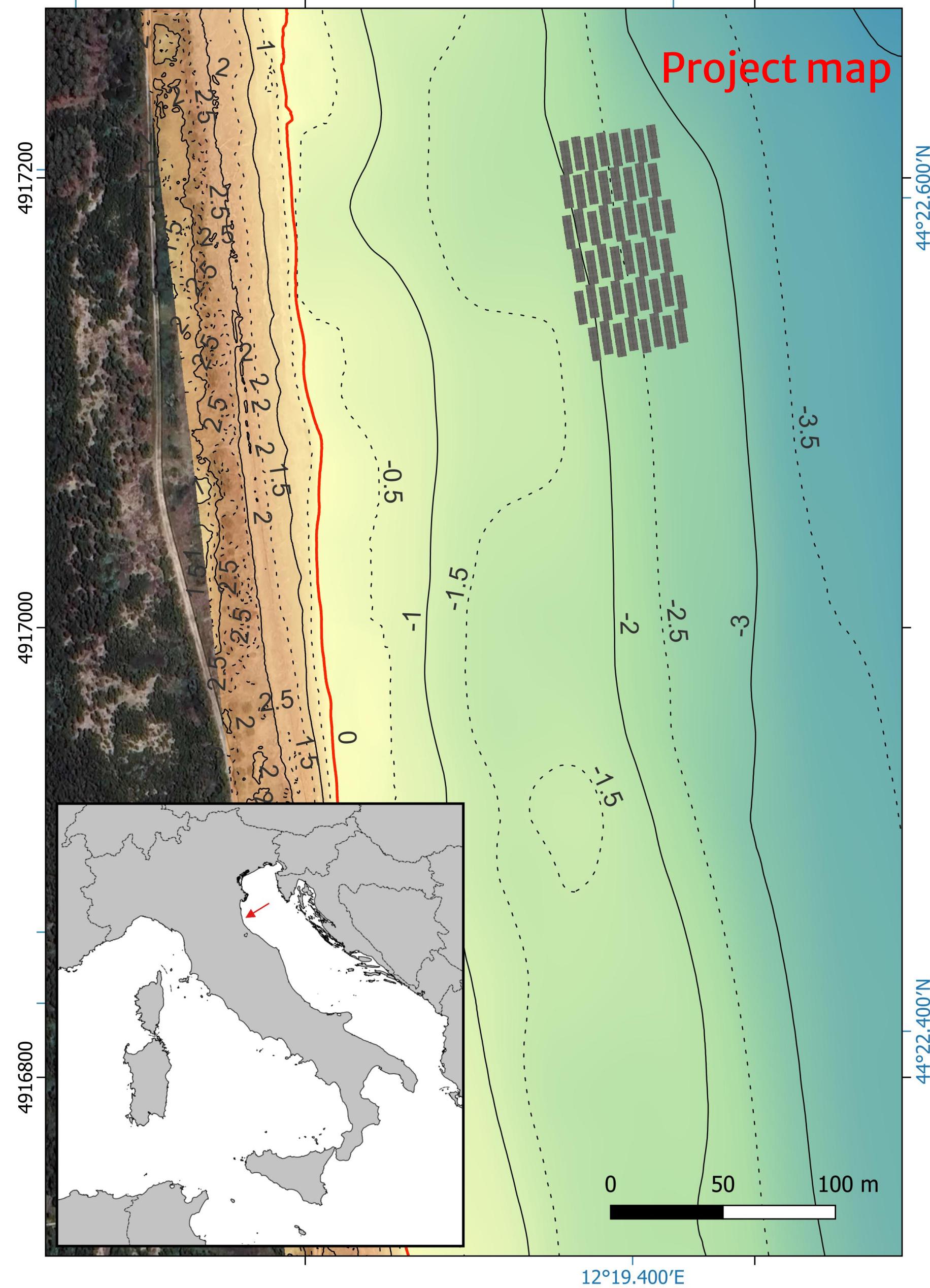


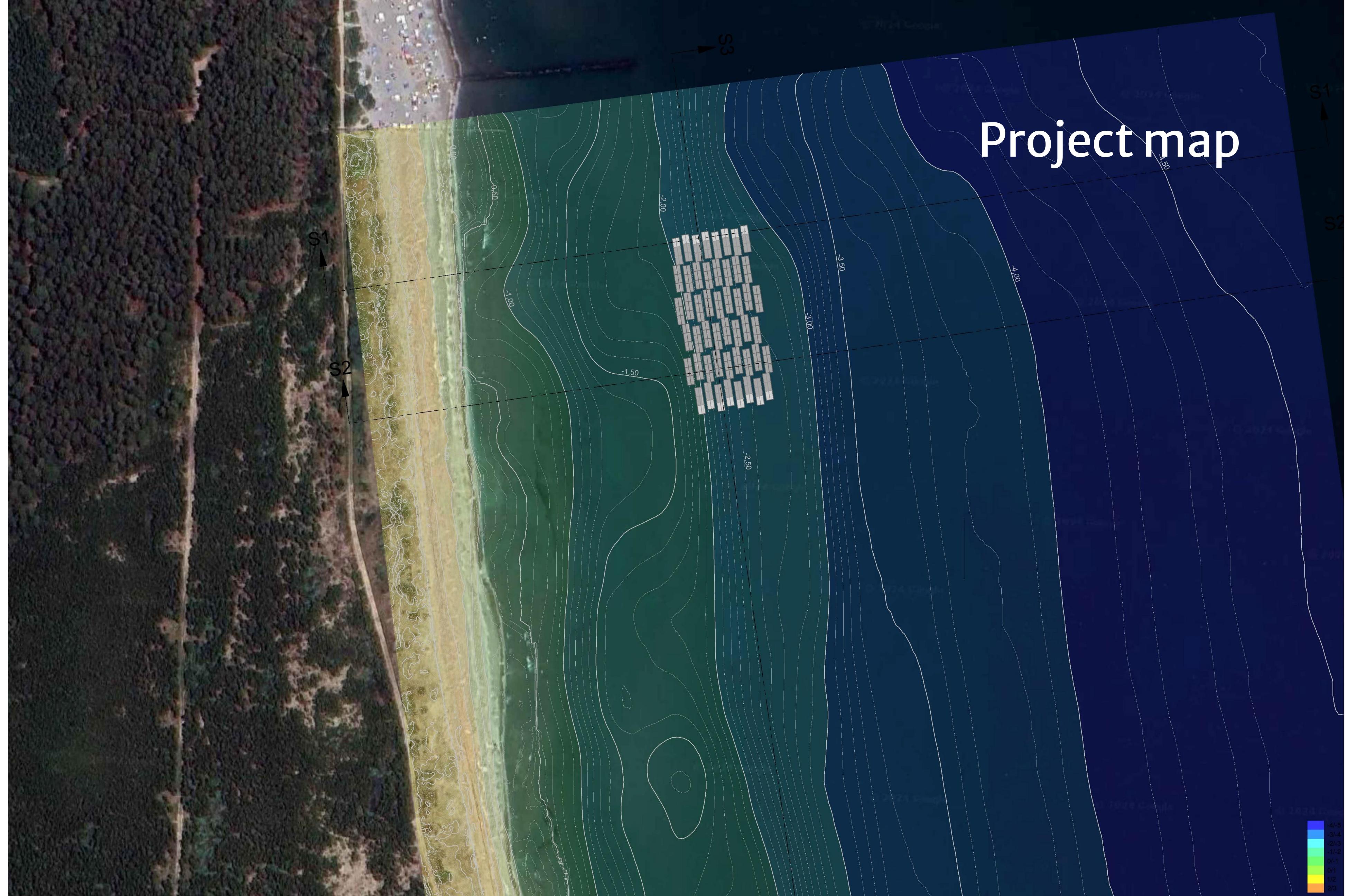
Underwater sampling  
(by scientific divers at UNIBO)

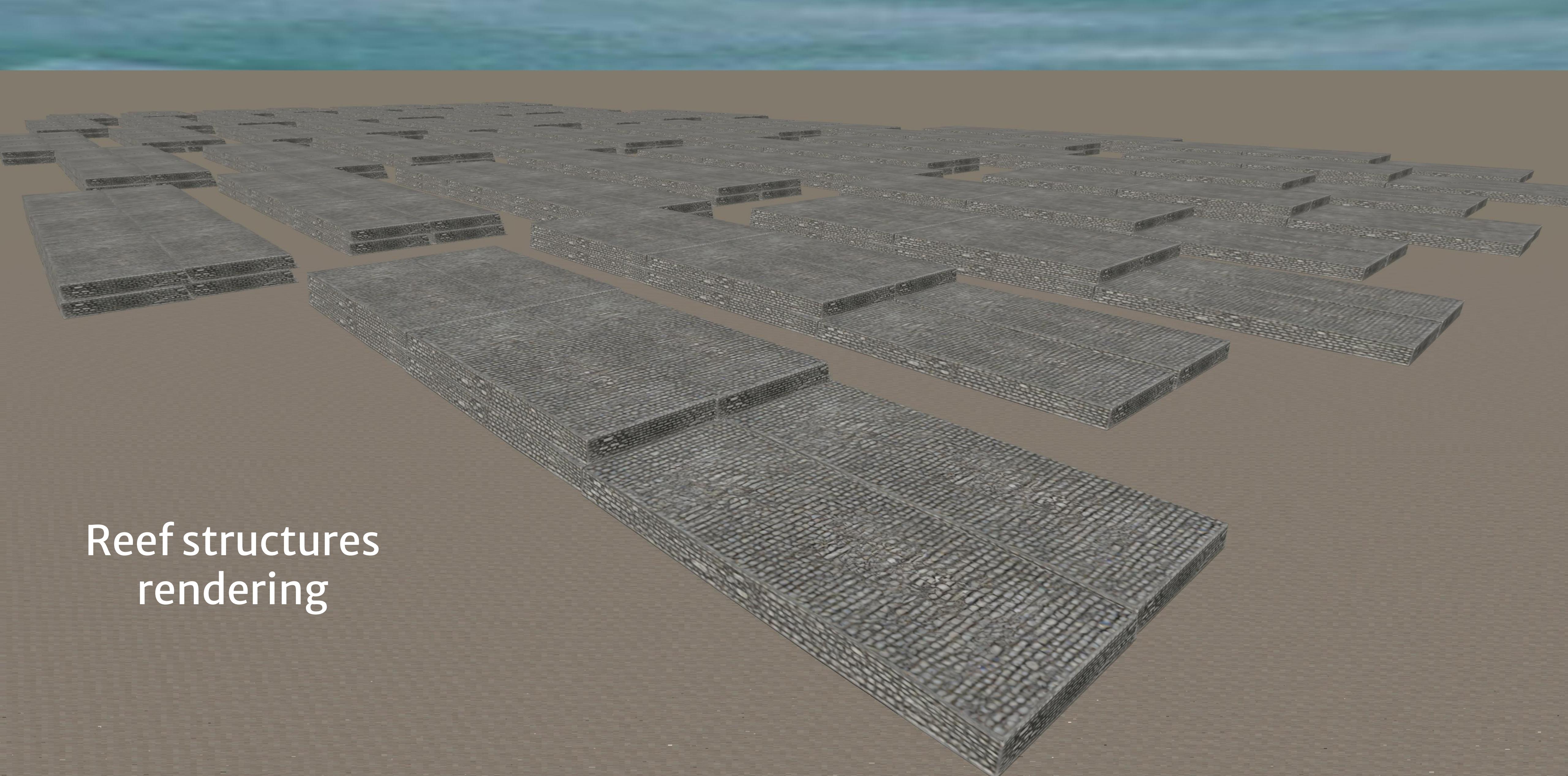




# Location and construction of the reef







# Reef structures rendering



## LIFE NatuReef

### Nature-based reef solution for coastal protection and marine biodiversity enhancement



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Programme UE: LIFE

LIFE-2022-SAP-NAT - Nature & Biodiversity - Standard Action

Reference: LIFE22-NAT-IT-LIFE-NatuReef/101113742

Period: 1/07/2023 - 30/06/2027



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