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ECOSINK
Trajectories of change of *Posidonia oceanica* seagrass meadow and related Carbon sink

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Universitat de Barcelona

Università degli Studi di Palermo

DISTAV Università degli Studi di Genova

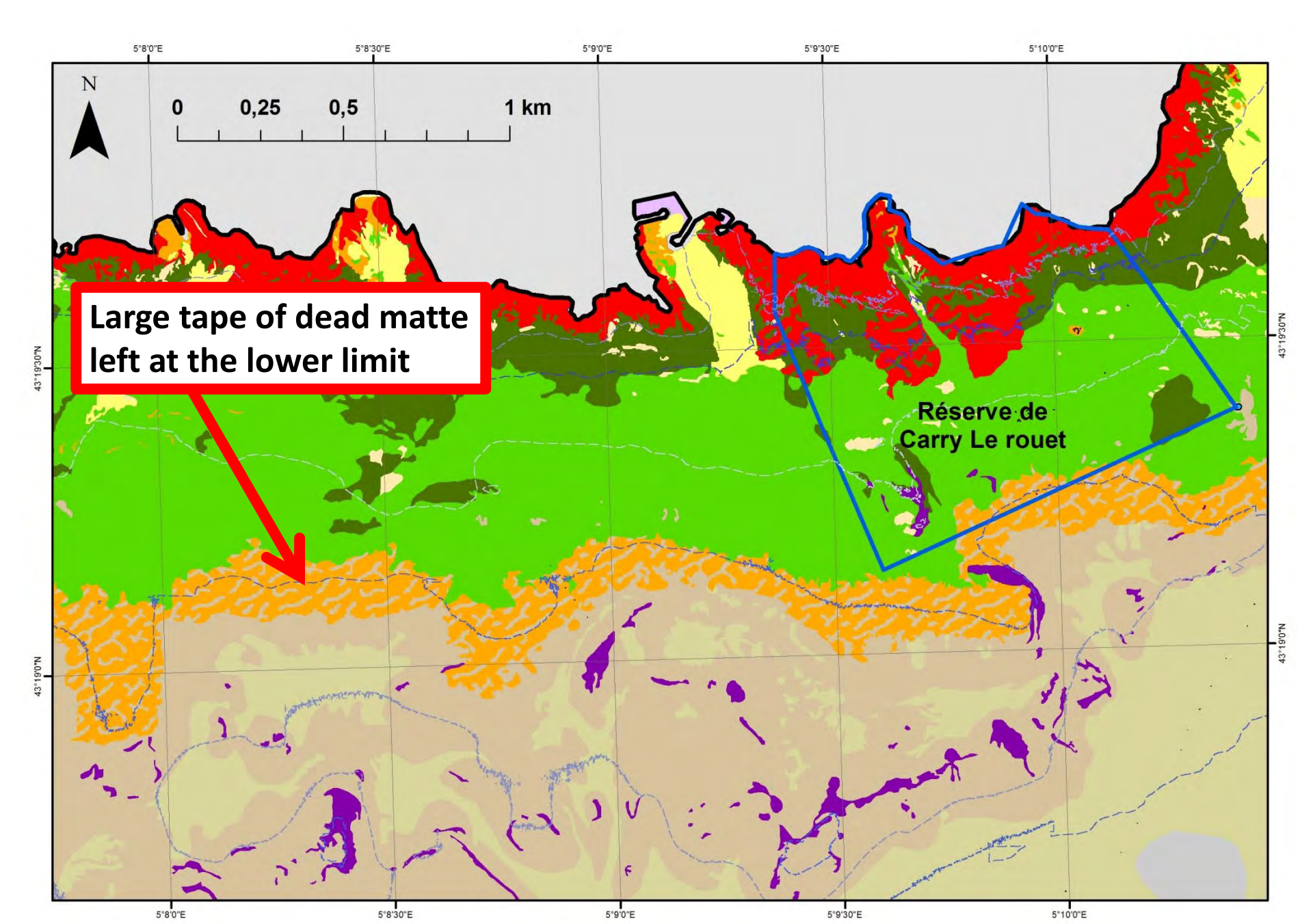
CEFREM

SEMANTIC TS

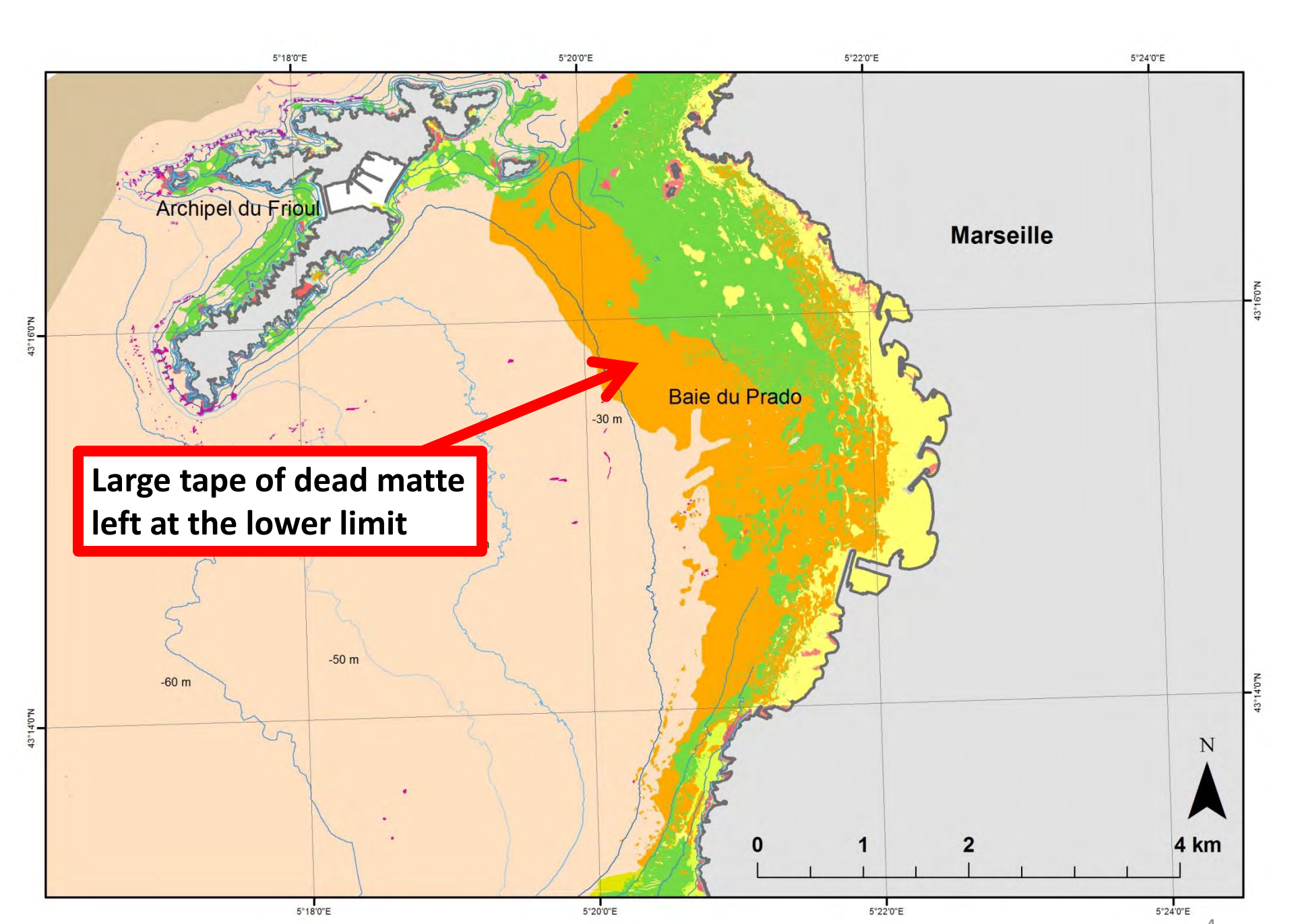
National Oceanography Centre Natural Environment Research Council

Context

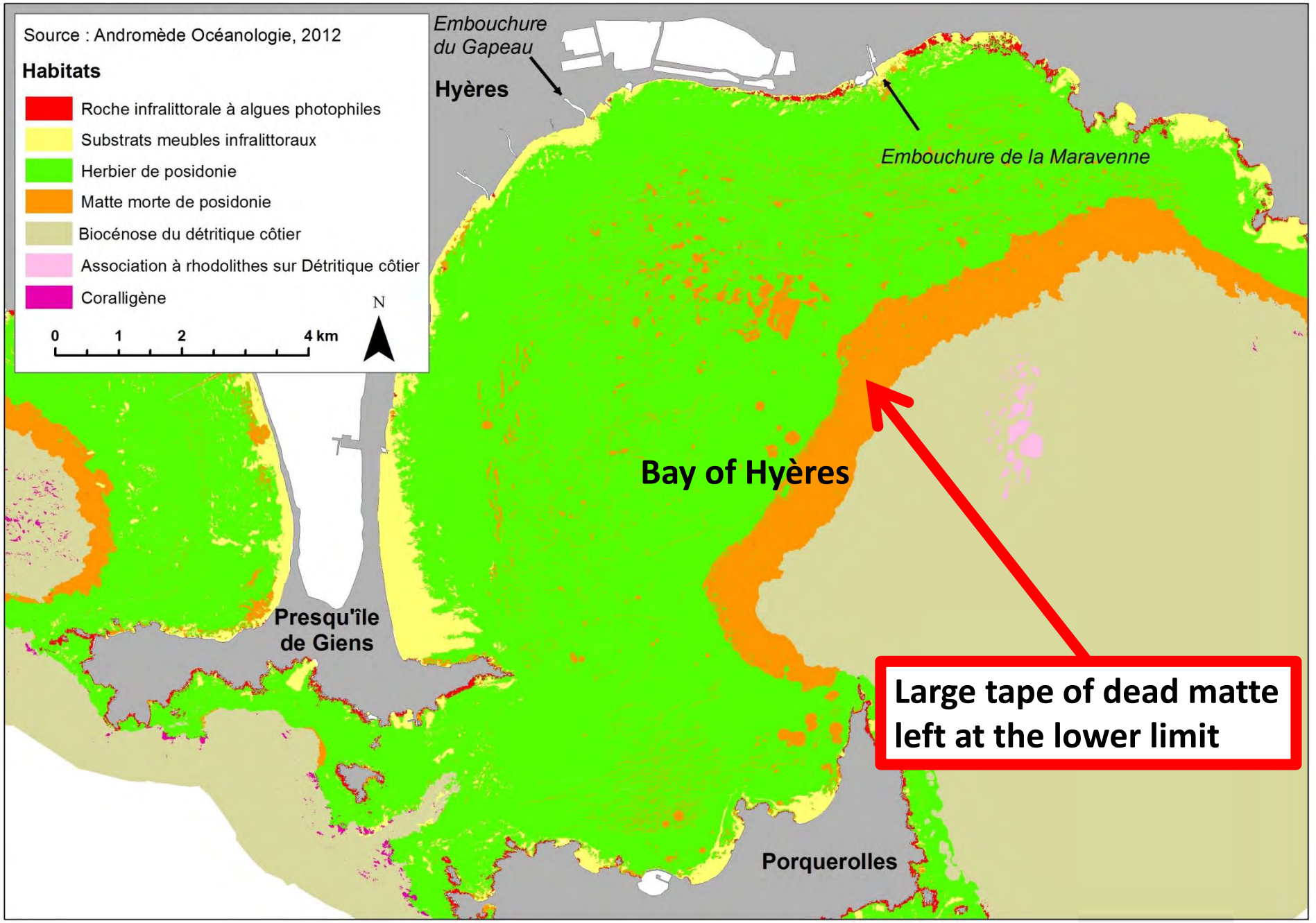
- ***P. oceanica* meadow lower limit withdrawal** (Mayot *et al*., 2006 ; Meinesz *et al*., 2008 ; Boudouresque *et al*., 2009 ; Astruch *et al*., 2014 ; Pergent *et al*., 2014), also in low impacted areas
- **Various causes explain this decrease**, several temporal scales (Gravez *et al*., 1992 ; Boudouresque *et al*., 2006, 2009 ; Vacchi *et al*., 2012 ; Astruch *et al*., 2014)



(Astruch *et al.*, 2011)



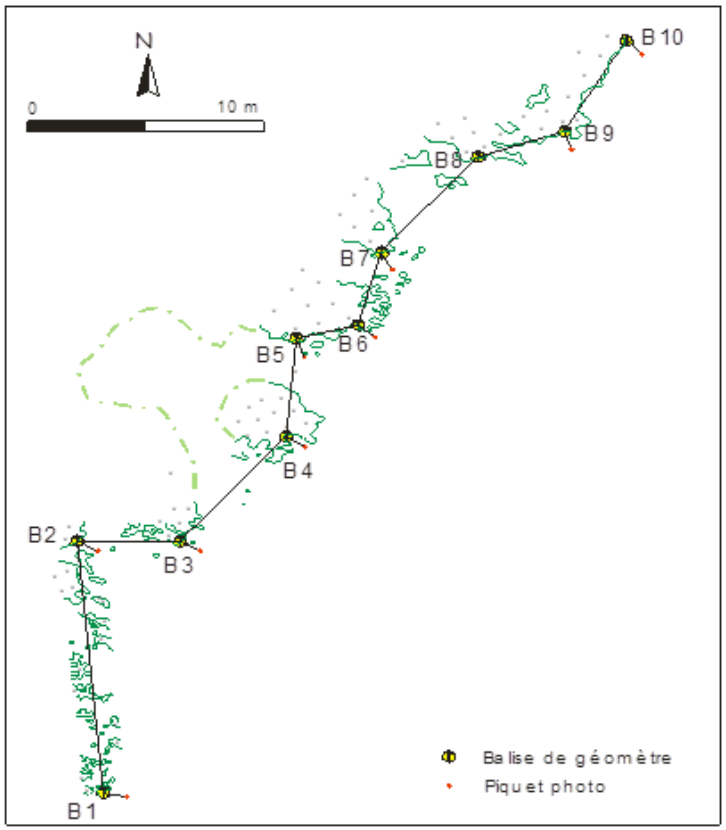
(Œil d'Andromède, 2008)

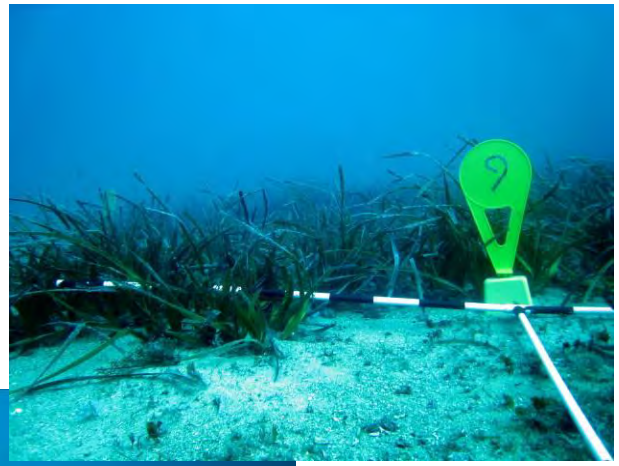

Source : Andromède Océanologie, 2012
Habitats
Roche infralittorale à algues photophiles
Substrats meubles infralittoraux
Herbier de posidonie
Matte morte de posidonie
Biocénose du détritique côtier
Association à rhodolithes sur Détritique côtier
Coralligène
0 1 2 4 km
N
Embouchure du Gapeau
Hyères
Embouchure de la Maravenne
Bay of Hyères
Presqu'île de Giens
Porquerolles
Large tape of dead matte left at the lower limit

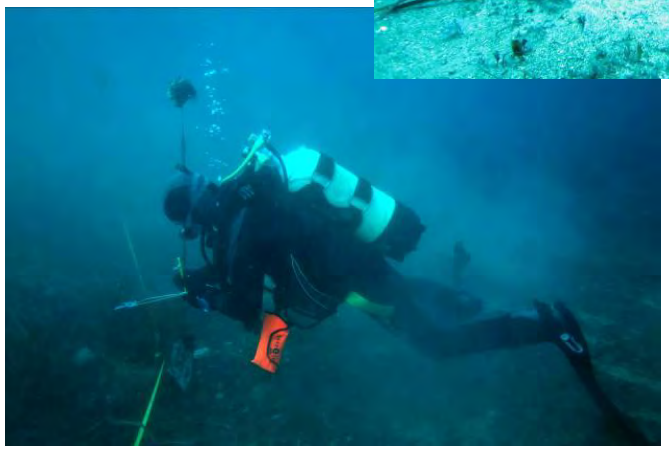
Context

- **Permanent markers positioned on the lower limit** 10-40 year-old (Charbonnel *et al*., 2000) **(Posidonia Survey Network in Provence, French riviera and Corsica, other devices in Spain and Italy)**

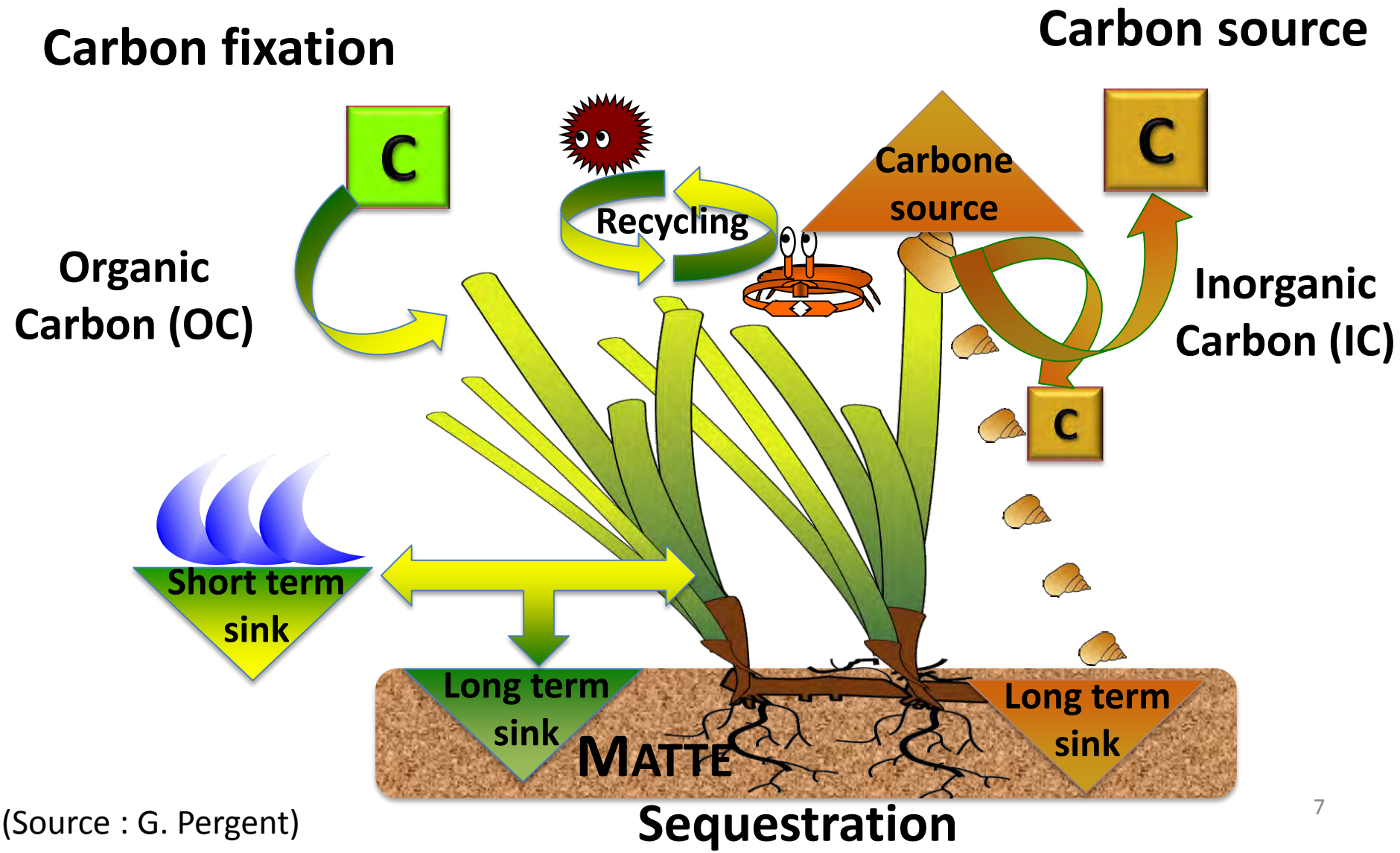
➔ meadow recent evolution **key witnesses**







- **Carbon sink** (Pergent *et al.*, 2014), sequestration by living meadow and storage within the matte = **ecosystemic service**



(Source : G. Pergent)

Problematic

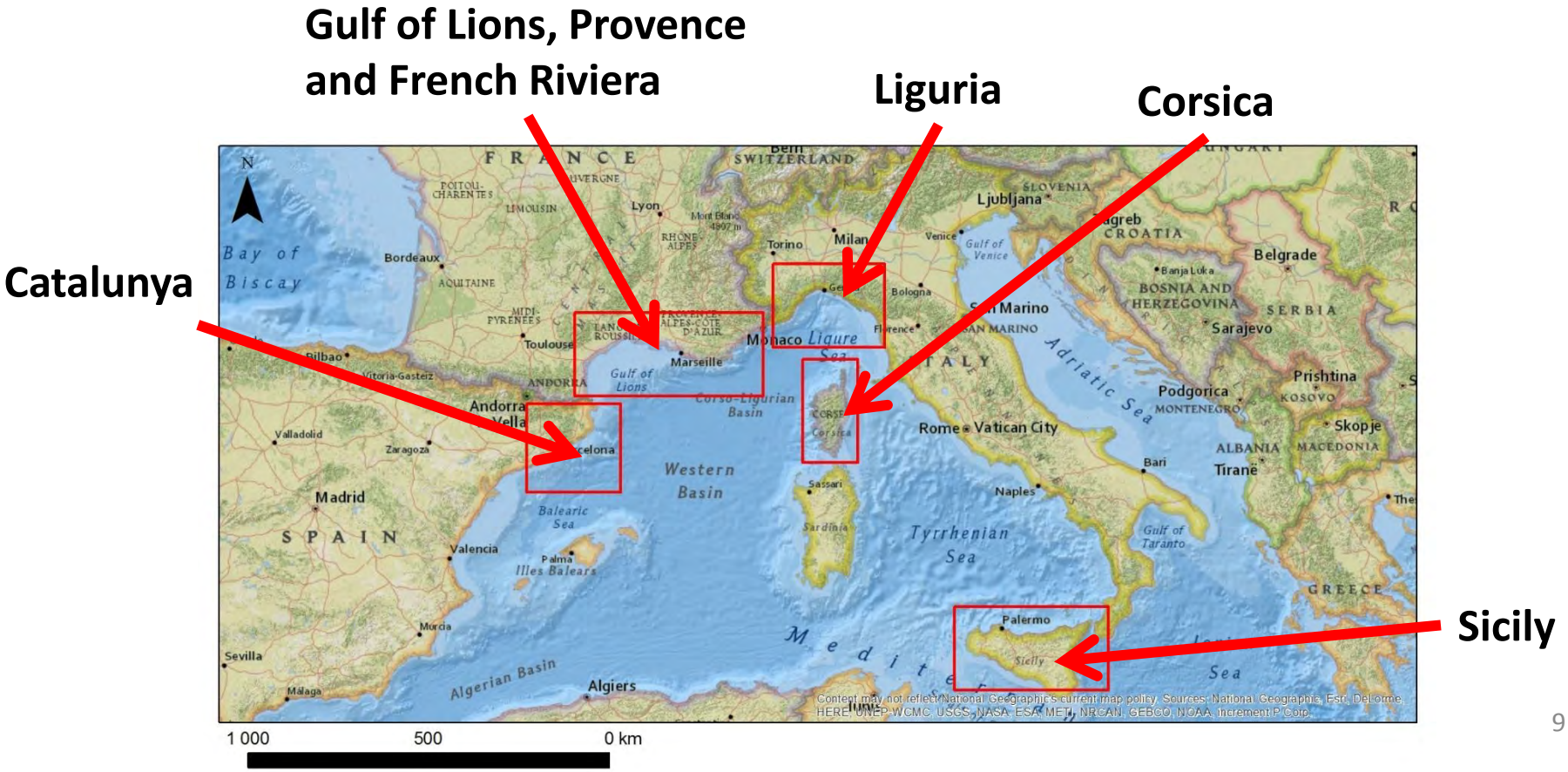
- What are the **distinct factors behind this withdrawal**?

- **When** has it occurred ?

- What influence has **Global Change** on this withdrawal?

Project frame

- **WP1** : Past evolution
- **WP2** : Present evolution
- **WP3** : Future, global change issues



WP1. Long term (centuries-millennia) evolution of *P. oceanica* lower limit linked to past climate changes

Methods : sampling dead matte (roots and rhizomes) near and beyond the lower limit to **date the meadow death using ^{14}C analysis** following a depth gradient from the actual limit (n ≈ 100 samples)

➔ **understand its kinetic and causes**, highlighting hypotheses like human induced impact (recent or ancient), past climate change, erosion, rise of the sea level, compaction of the matte overtime)

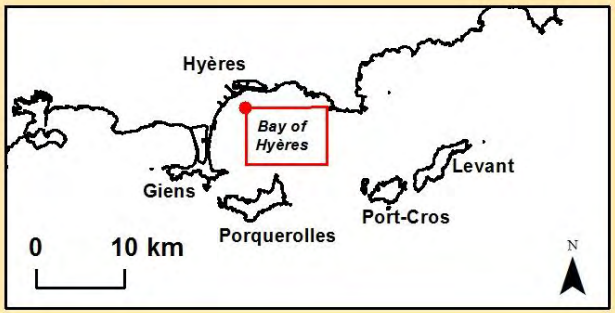
Bay of Hyères (Provence)

P01 (-26 m): 470 BP
P02 (-29 m): 230 BP
P03 (-33 m): 415 BP
P04 (-37 m): 990 BP
P05 (-28 m): 160 BP
P06 (-30 m): 200 BP
P07 (-31 m): 480 BP
P08 (-34 m): 980 BP
P09 (-29 m): 740 BP
P10 (-31 m): 430 BP
P11 (-32 m): 580 BP
P12 (-32 m): 500 BP
P13 (-37 m): 1050 BP

-20 m
-30 m

N
0 1 2 km

Sample sites
Marine habitats
Posidonia oceanica meadow
Dead *matte* of *Posidonia oceanica*
Soft bottom



WP2. Short term (decades) evolution of the *P. oceanica* lower limit linked to human activities

Methods : visit ±50 sites (≈ 500 **permanent markers**) with at least 10 years old markers of the meadows lower limit:

- Markers distance to the actual limit,
- depth and type of limit,
- health descriptors (meadow cover, shoot density, plagiotropic rhizome rate, etc.)
- Alien species covering (*i.e. Caulerpa cylindracea*, etc.)

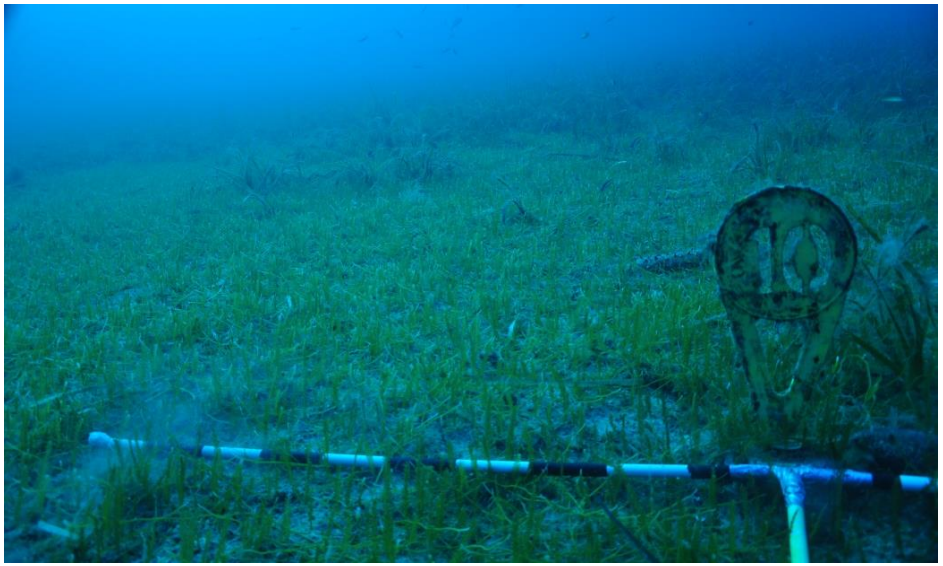
➔ Incidence of human activities per study site

➔ Eventual incidence of global change, potential catalyst effects of human induced impacts and environmental conditions.

e.g. Withdrawal of the lower limit of Port-Cros island

➔ **Meadow lower limit: 31-34 m**, >1 m large withdrawal in 10 years despite well-preserved conditions (no anchoring, no trawling, far from continental influences)

2002



2012

Bonhomme *et al.* (2012)

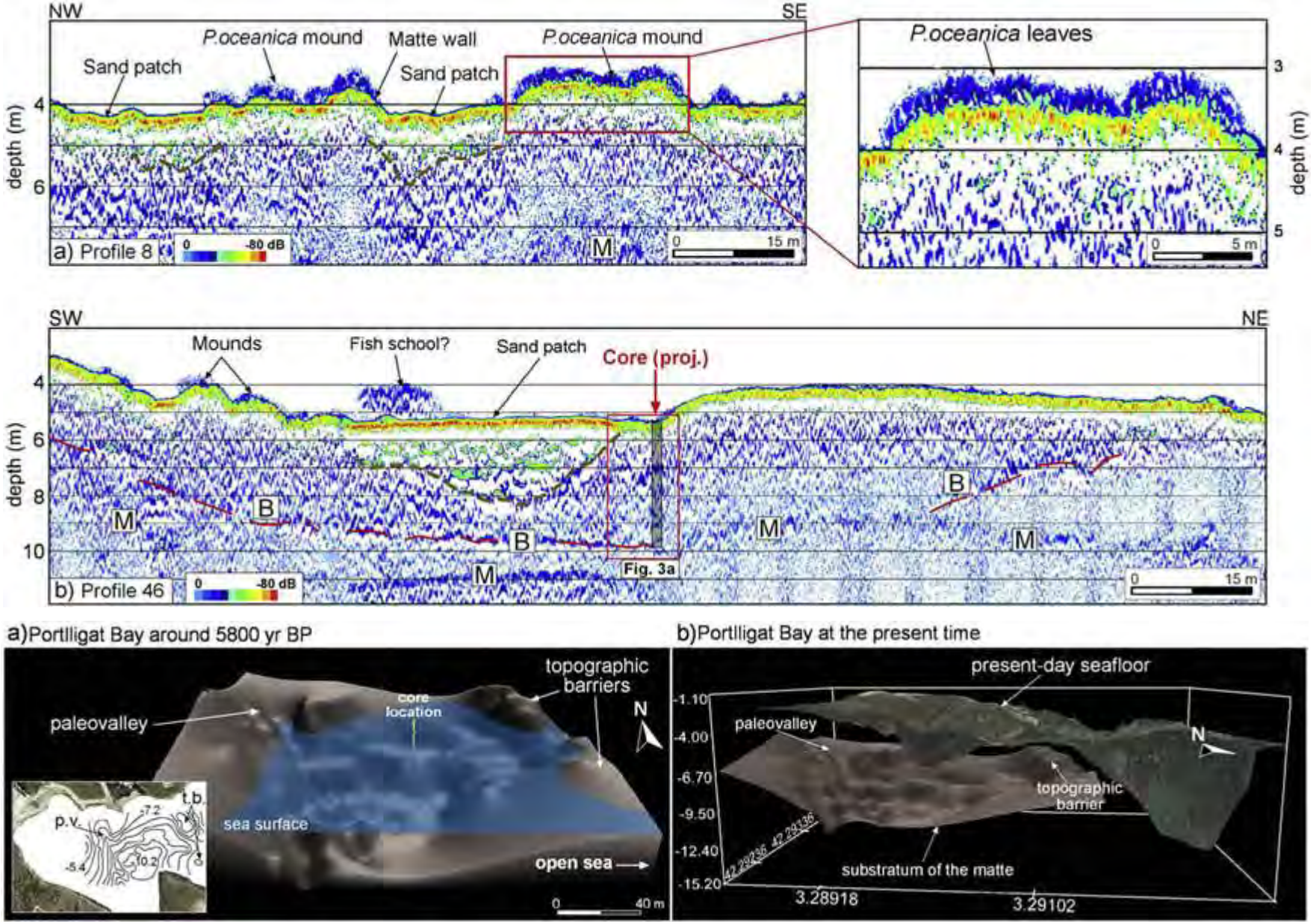
WP3. Trajectories of change of *P. oceanica* Carbon stocks linked to future climate change

Methods : testing new remote sensing methods based on **seismo-acoustic devices** to evaluate matte thickness and stored carbon volume.

Matte serves as a huge carbon sink that plays a significant role to limit greenhouse effect (Pergent *et al.*, 2014)

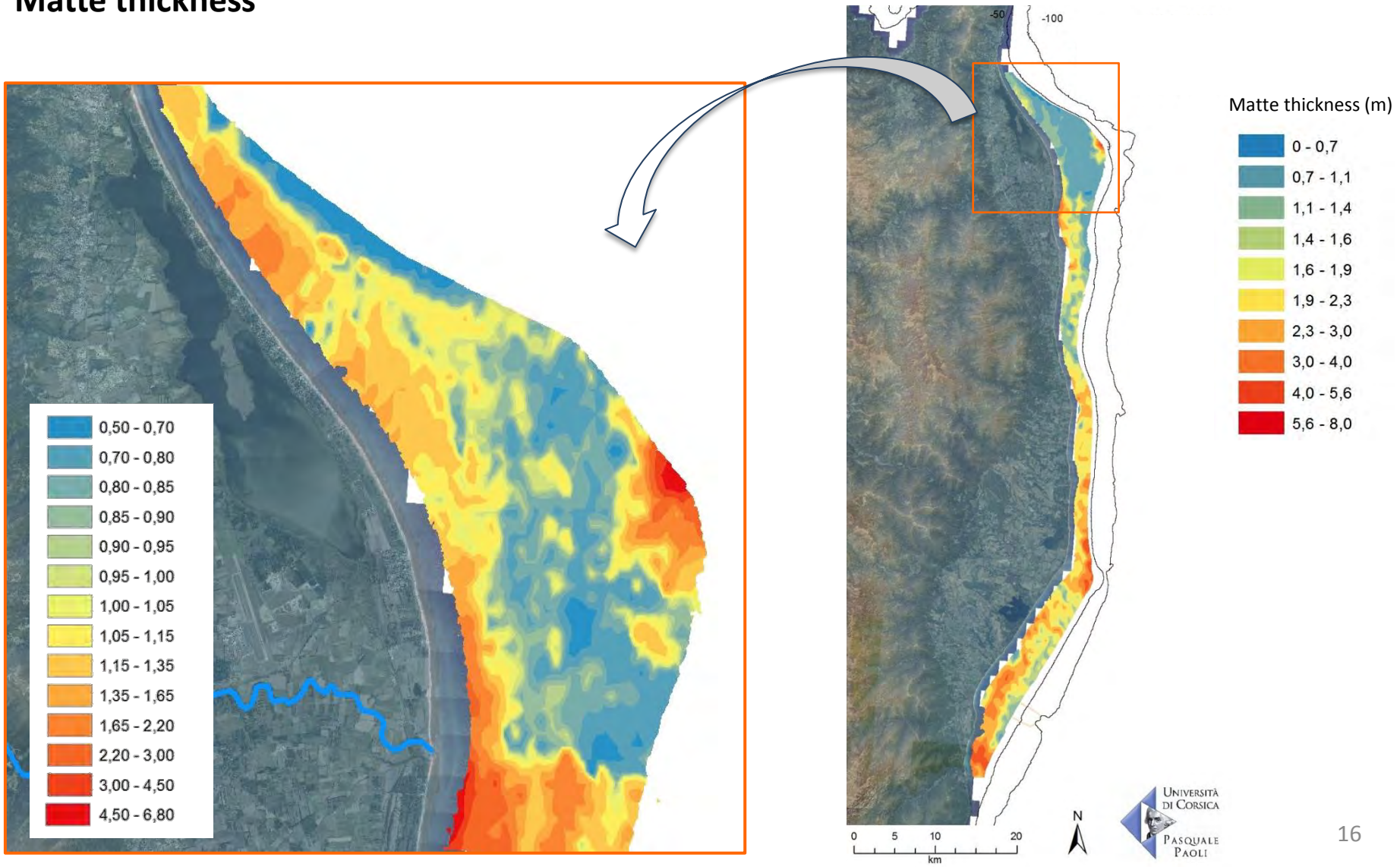
The reduction of *P. oceanica* surfaces induces **a decrease of new sequestration and concomitant mitigation** of climate change. Furthermore, vast extents of dead matte could be exposed to erosion, consequently releasing a large amount of organic carbon (*i.e.* similar to fossil fuel)

Lo Iacono *et al.*, (2008)



Assessment of Carbon sequestrated (source : G. Pergent)

Matte thickness



Expected results

(i) **try to quantify the last decades loss** of *P. oceanica* meadows area in the W Mediterranean at lower limit

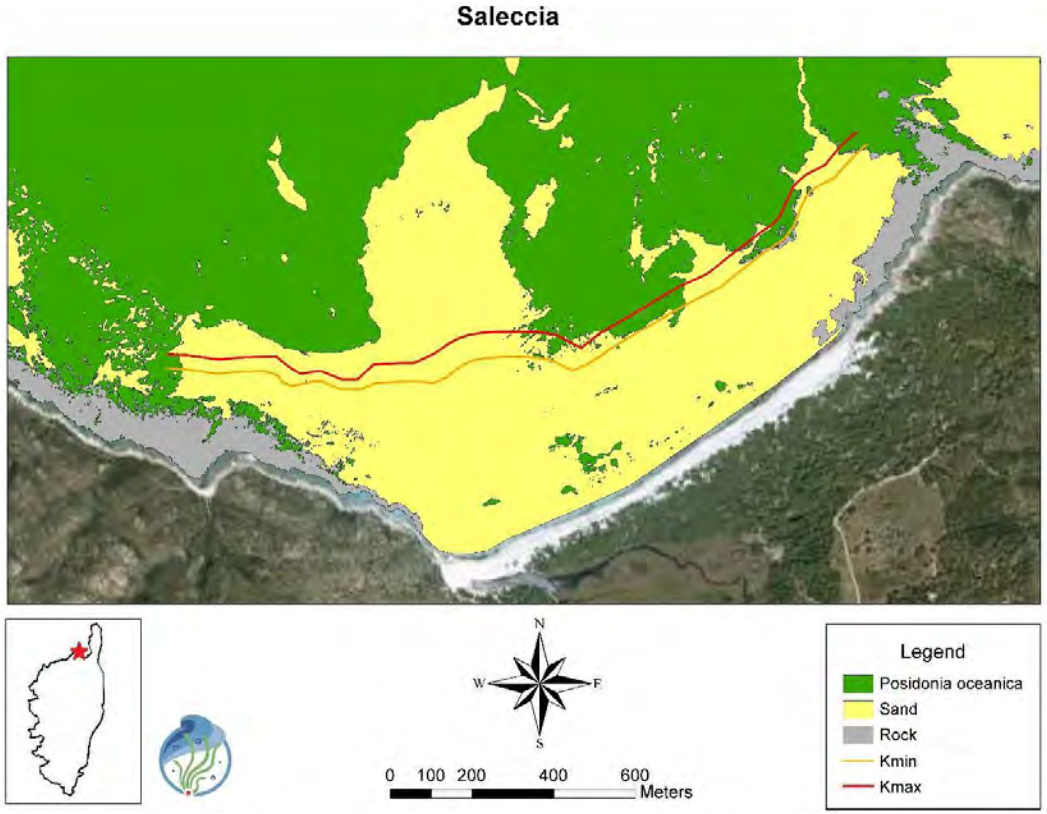
(ii) **understand short and long-term dynamics** of *P. oceanica* meadows at lower limit related to actual and past climate changes.

(iii) **understand main consequences** of **carbon loss** of living seagrass and matte (sequestration and storage issues?)

(iv) **provide useful advice** for environmental managers and stakeholders

Project evolution?

- Focus on WP1 and WP2 (WP3 topics already considered in other projects)
- Vacchi et al. (2012, 2014) model, applied in Liguria, can be used in other areas to compensate the lack of reference meadows maps (without human-induced impact)



(Misson *et al.*, 2014)

- Use index to evaluate ecosystem quality and changes? (EBQI, Phase-shift index, etc.) (Montefalcone, 2009; Personnic *et al.*, 2014)


Thank you for your attention!!