

16 y 17  
de Mayo

Instituto de Estudios Portuarios  
Málaga

Jornadas abiertas  
“Las praderas marinas en el litoral español:  
Conservación, uso y gestión”

# Carbon storage by *Posidonia oceanica*

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Beneficiarios

JUNTA DE ANDALUCÍA  
DEPARTAMENTO DE AGRICULTURA, PESCA  
Y MEDIO AMBIENTE Y AGUA  
CONSEJO REGULADOR DE LA PRODUCCIÓN  
AGROPECUARIA DE CALIDAD AGUJA Y PASADURA  
CONSEJO REGULADOR DE LA PRODUCCIÓN AGROPECUARIA DE CALIDAD AGUJA Y PASADURA



Asociación Andaluza  
de Científicos de Pesca



Colaborador





Current best estimate of  
anthropogenic CO<sub>2</sub> emissions:

Fossil fuels: 8.5 PgC  
Land changes: 1.6 PgC

TOTAL: 10.1 PgC y<sup>-1</sup>



Forests  
0.8 PgC y<sup>-1</sup>

Atmosphere  
3.3 PgC y<sup>-1</sup>

Oceans  
2.2 PgC y<sup>-1</sup>

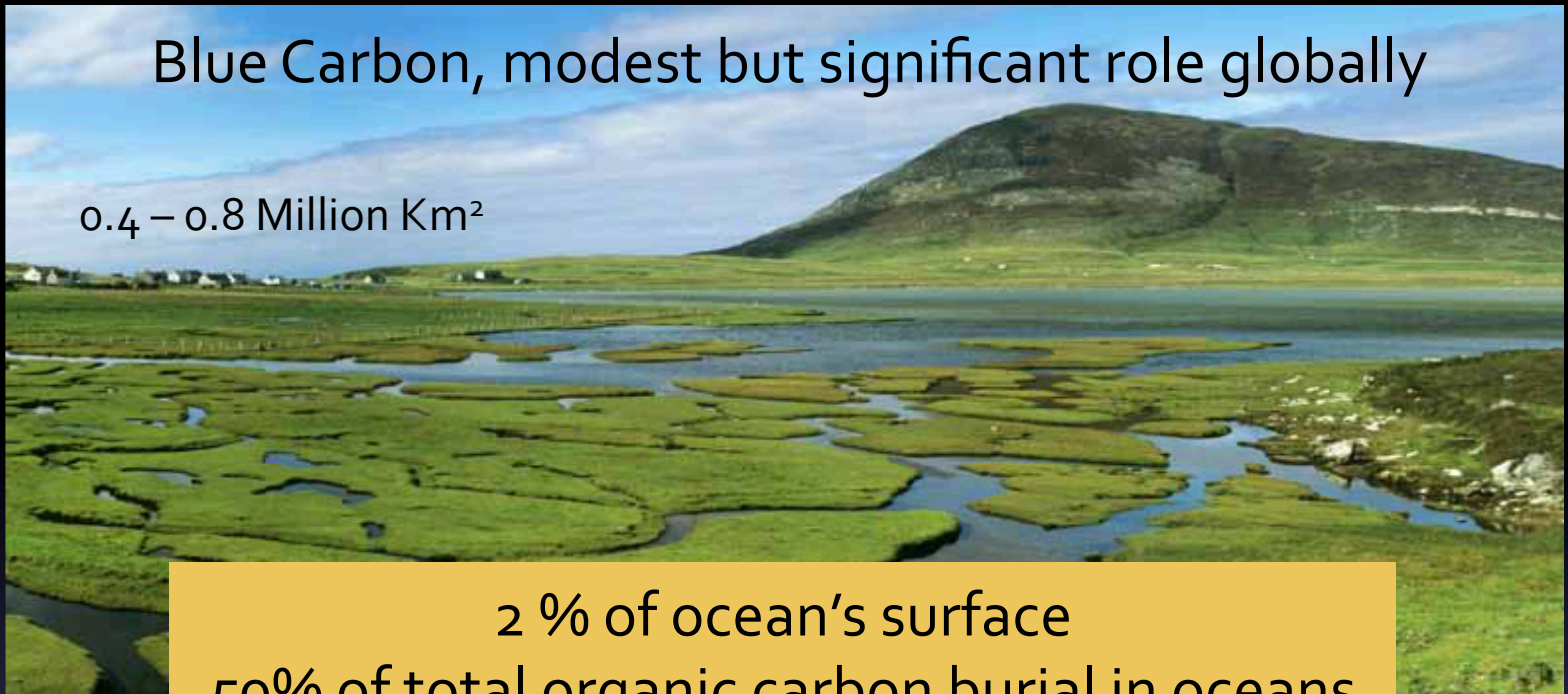
Residual terrestrial sink  
≈ 4 PgC y<sup>-1</sup>

Combining IPCC 2007 and Houghton 2007



# Blue Carbon, modest but significant role globally

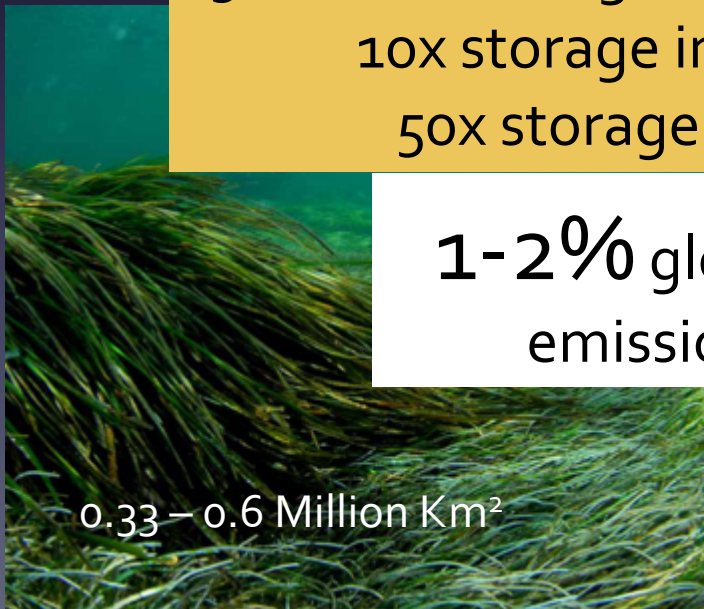
0.4 – 0.8 Million Km<sup>2</sup>



2 % of ocean's surface  
50% of total organic carbon burial in oceans  
10x storage in temperate forests  
50x storage in tropical forests

**1-2%** global annual CO<sub>2</sub>  
emissions (3% RTS)

0.33 – 0.6 Million Km<sup>2</sup>

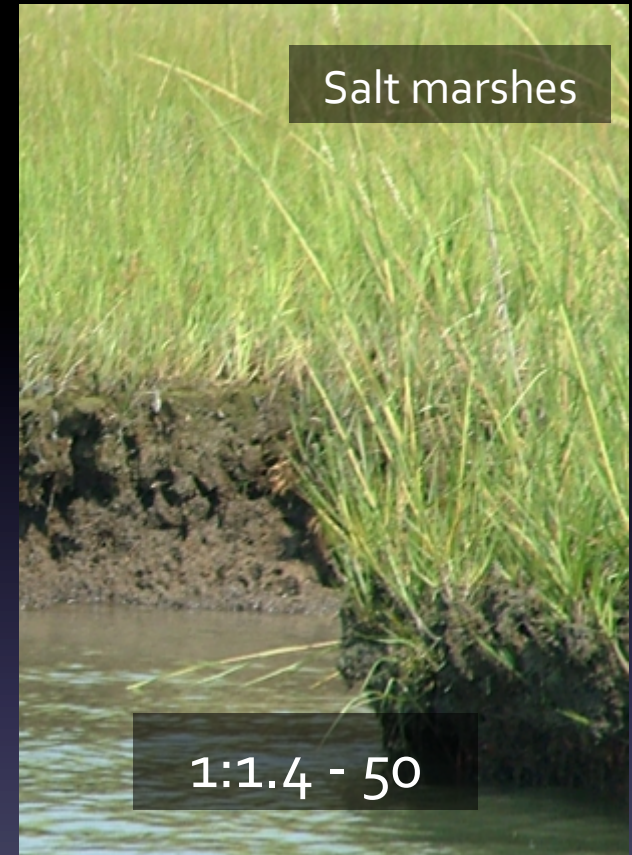
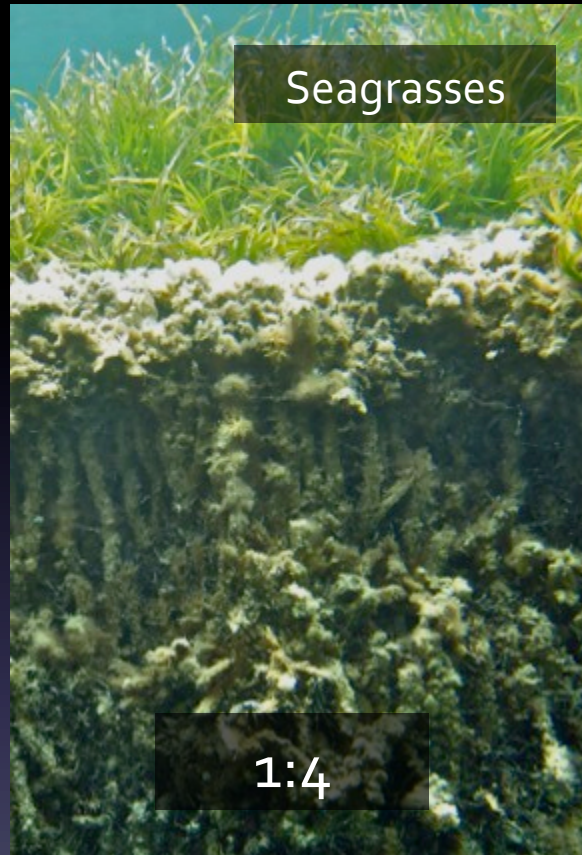


0.17 – 0.3 Million Km<sup>2</sup>





# Special features of the coastal vegetation results in long-term accumulation

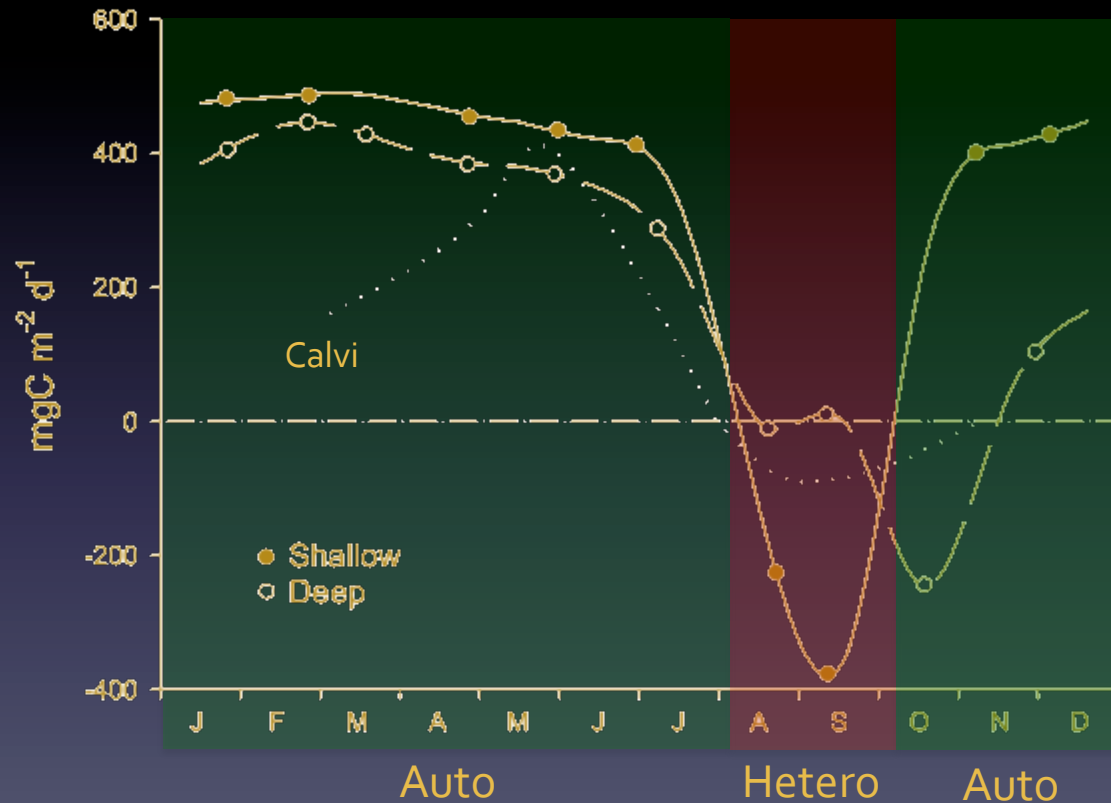


1. Developement of massive belowground compartments
2. Refractory nature of detritus
3. Sediment anoxia

# *P. oceanica* is autotrophic annually. Saving is possible!

Annual ecosystem balance (Production / Respiration)

(Mateo et al 2006)



P/R Above:  
(*P. oceanica*)

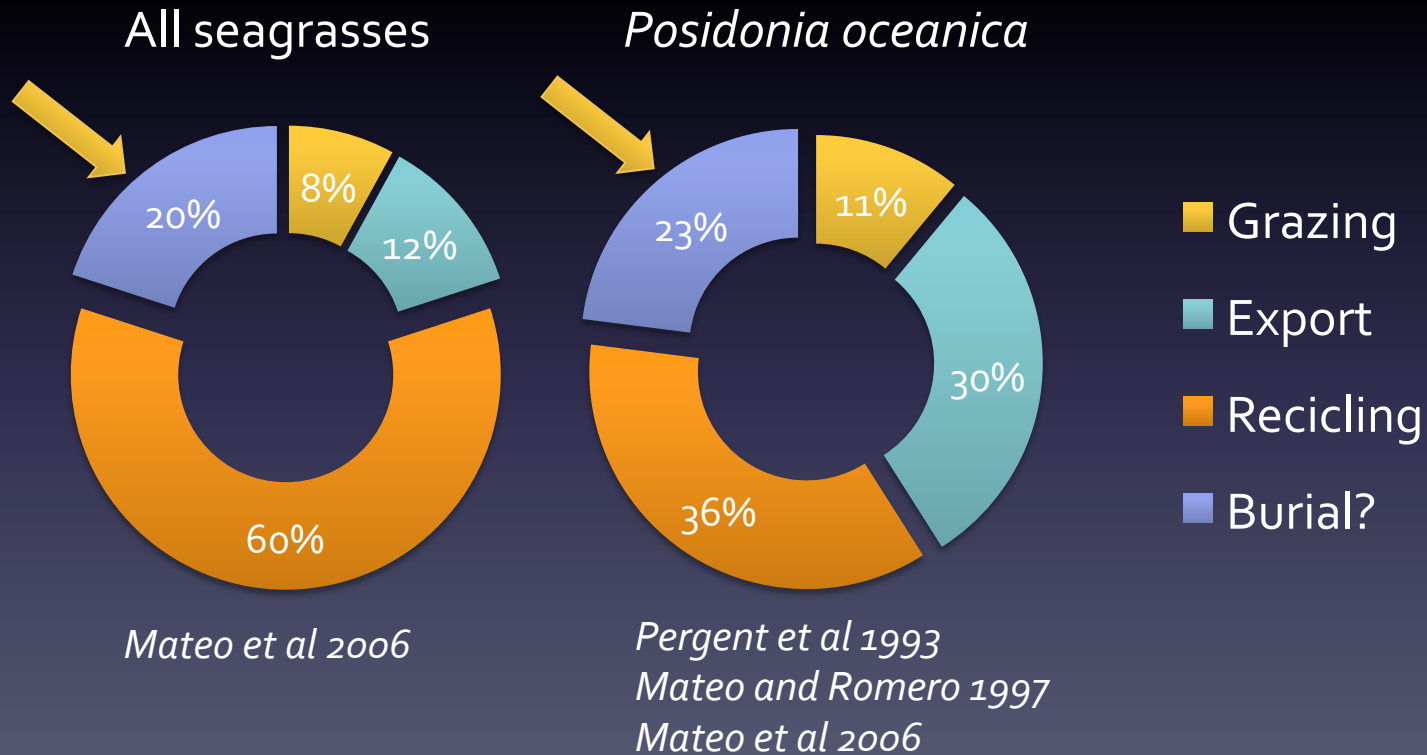
**$3.0 \pm 0.7$**   
(Mateo et al 2006)

P/R Plant:  
(All seagrasses)

**$1.5 \pm 0.1$**   
(Duarte et al 2010)

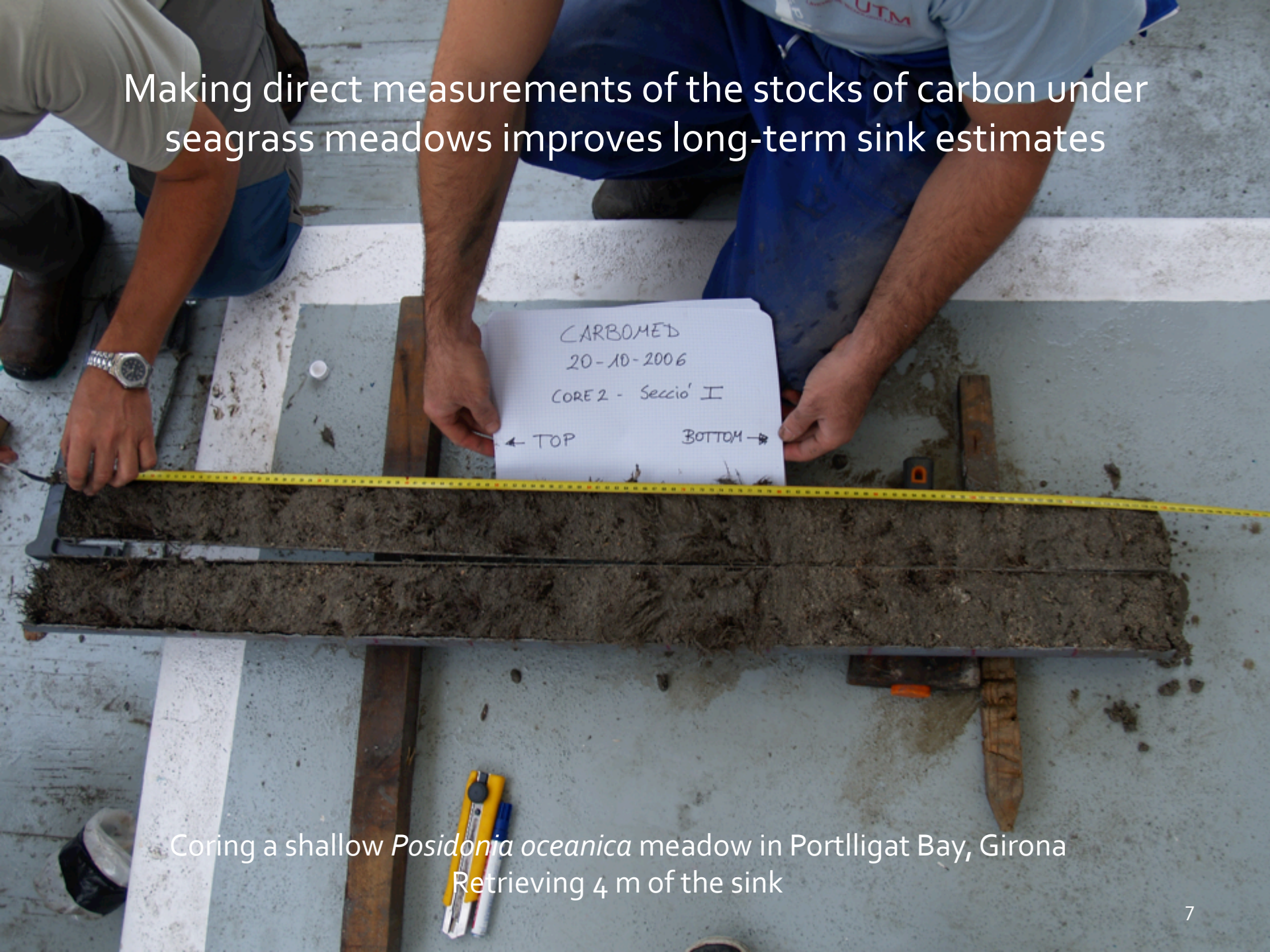
Most of the estimates of the carbon sink to date are indirect

## The fate of seagrass production





Making direct measurements of the stocks of carbon under seagrass meadows improves long-term sink estimates



Coring a shallow *Posidonia oceanica* meadow in Portlligat Bay, Girona  
Retrieving 4 m of the sink



Dating the sink ...

*Posidonia oceanica* is a net carbon kidnaper, but carbonates deposition might reduce this capacity

## RATES

	Specific $\text{gC m}^{-2} \text{y}^{-1}$	Mediterranean $\text{TgC y}^{-1}$
( $\text{Tg} = 10^{12} \text{ g}$ )		
<b>Organic sink</b>	6 to 175	0.15 to 8.75
<b>Inorganic source</b>	28 to 83	0.7 to 4.2
<b>Balance</b>	-147 to +77	-7.4 to +3.9

Mateo and Serrano 2012. IUCN



# *P. oceanica* in the Blue Carbon context

## RATES

Nelleman et al. 2009

Component	Area	Organic Carbon burial	
Blue carbon	Million km <sup>2</sup>	Ton C ha <sup>-1</sup> y <sup>-1</sup>	Tg C y <sup>-1</sup>
Mangroves	0.17 (0.3)	1.39, 0.20 – 6.54 (1.89)	17 – 23.6 (57)
Salt Marsh	0.4 (0.8)	1.51, 0.18 – 17.3 (2.37)	60.4 – 70 (190)
Seagrass	0.33 (0.6)	0.83, 0.56 – 1.82 (1.37)	27.4 – 44 (82)
<i>Posidonia oceanica</i>	0.035 (0.050)	0.06 – 1.75	0.15 – 8.75

Seagrass Global Sequestration Rate: 0.2 % of global emissions  
(0.5 % of RTS)

Considering 670 km<sup>2</sup> round the Balearic Islands, *P. oceanica*  
sequesters 8.66 % of global emissions of the islands

# Seagrass ecosystems as a globally significant carbon stock

James W. Fourqurean<sup>1\*</sup>, Carlos M. Duarte<sup>2,3</sup>, Hilary Kennedy<sup>4</sup>, Núria Marbà<sup>2</sup>, Marianne Holmer<sup>5</sup>, Miguel Angel Mateo<sup>6</sup>, Eugenia T. Apostolaki<sup>7</sup>, Gary A. Kendrick<sup>3</sup>, Dorte Krause-Jensen<sup>8</sup>, Karen J. McGlathery<sup>9</sup> and Oscar Serrano<sup>6</sup>

Measurements of organic carbon content of living seagrass biomass and underlying soils in 946 distinct seagrass meadows across the globe

All seagrasses

9.8 - 19.8 Pg Carbon  
(top meter)

*Posidonia oceanica*

2.5 - 20.5 Pg Carbon  
(1 – 4 top meters)

Seagrass loss = release of up to 299 Tg carbon / yr (if top meter remineralized)  
(15-25 % of that released due to deforestation)



*P. oceanica* organic global **stock: 2.5-20.5 PgC**

In a **Global** context:

**1/4-2** times the annual fossil fuel CO<sub>2</sub> emitted by the globe

In a **Mediterranean** context:

**11-89 %** of the fossil fuel CO<sub>2</sub> emitted by Mediterranean countries between 1802 and 2006 (23 PgC)

**In the Carbon stock market (CO<sub>2</sub> offset)**

138 – 1128 bilion € (*miles de millones*)

6 – 23 € m<sup>-2</sup>

9 - 35 x 1 m<sup>2</sup> of tropical forest soil

60,000 – 230,000 € / ha





Results presented here at our best, but may change...

¡Gracias!

*Es Pujols*  
*Formentera*  
*2.7 m*  
*1,200 yBP*