

**Interreg**  
**Caraïbes**



Fonds européen de développement régional

**SARG'COOP**  
Programme caraïbéen de coopération de  
lutte contre les algues sargasses



# Impact of pelagic *Sargassum* on coastal ecosystems in the Mexican Caribbean

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# Mexican Caribbean



## (FRINGING) REEF SYSTEMS



# Golden tide vs Sargasso brown tide

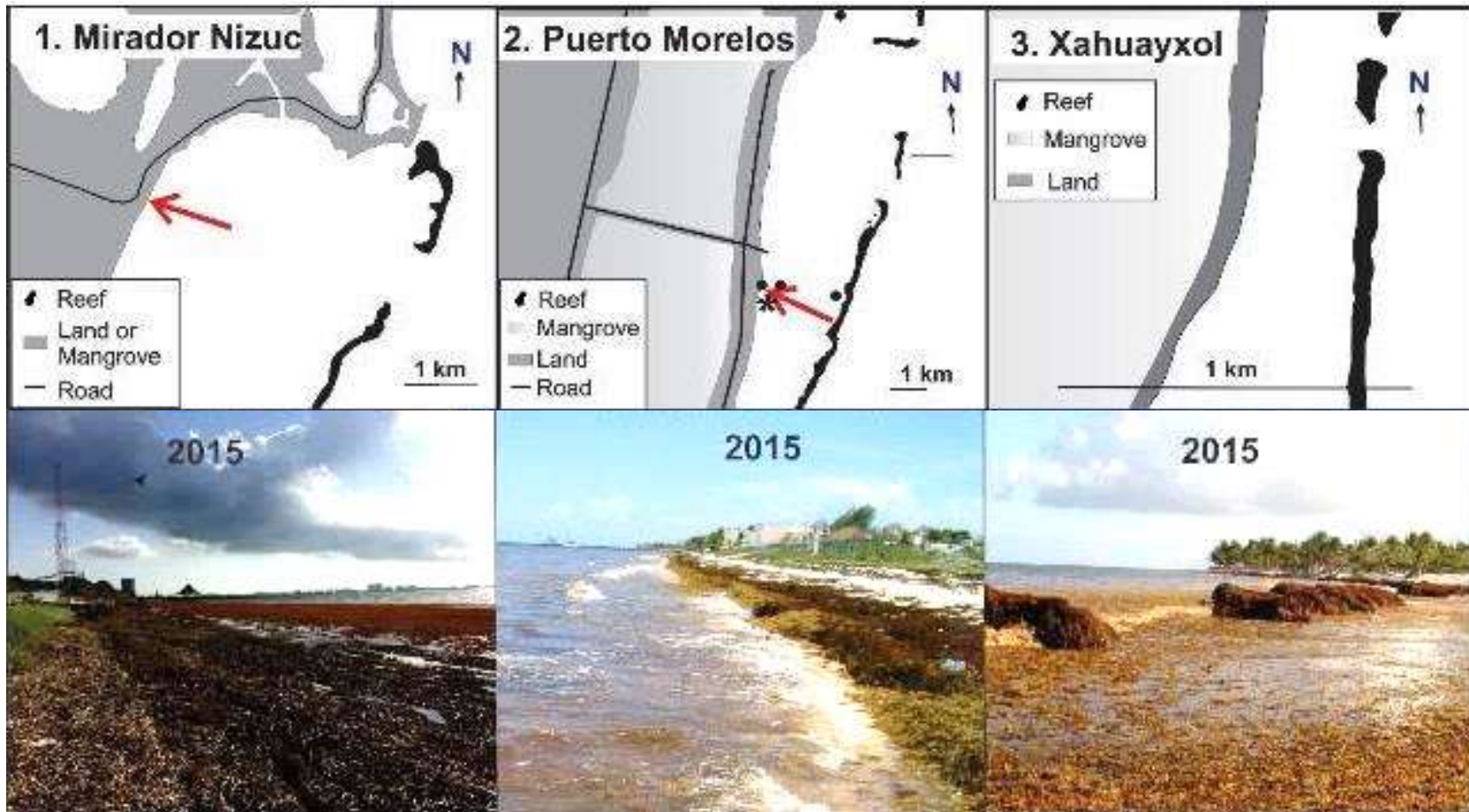
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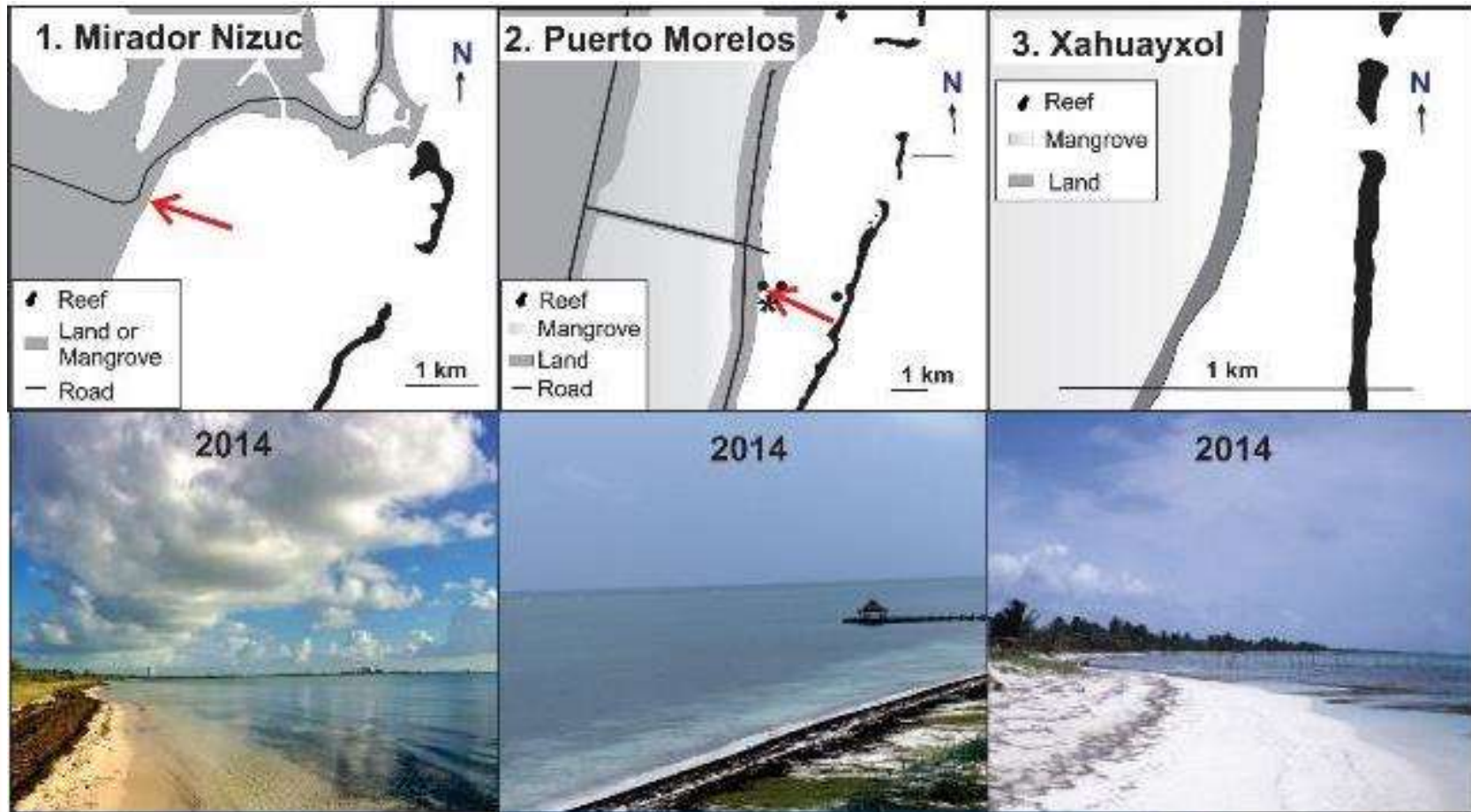
[searchoflife.com](http://searchoflife.com)



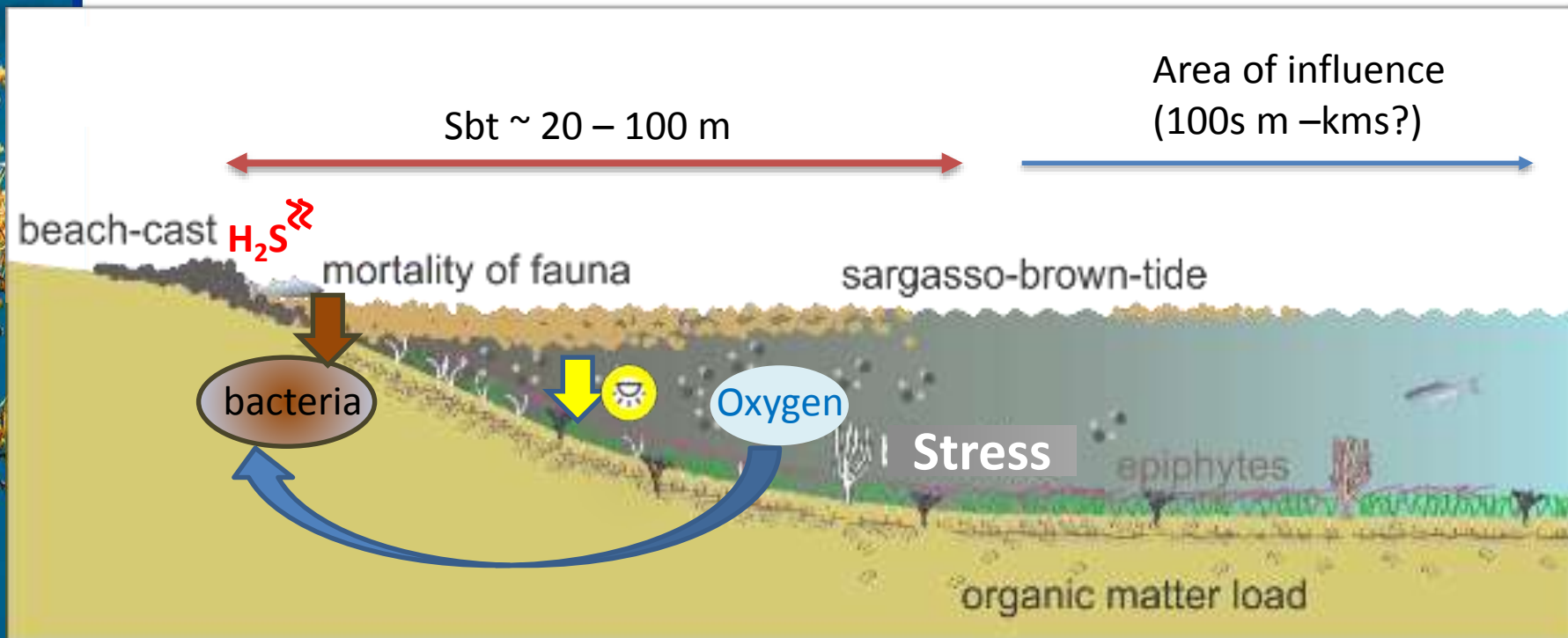
# Sargasso brown tide (2015)



# Before Sargasso brown tide



# Sargasso brown tide (Sbt)

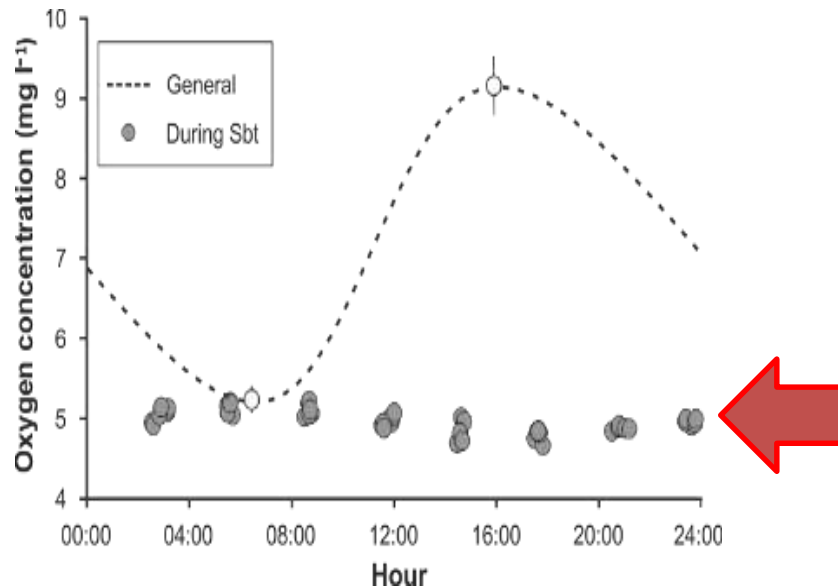


# Sbt – Oxygen deficit

- Light reduction results in failure of oxygen production through photosynthesis by primary producers
- Increased bacterial activity due to decomposition of organic material depletes Oxygen

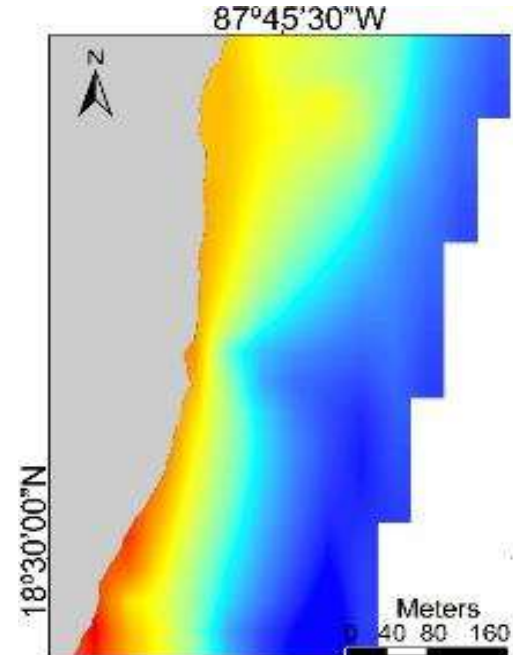
## HYPOXIA

Puerto Morelos  
(daily O<sub>2</sub> cycle)



## ANOXIA

Xahuayxol  
(anoxic coastal fringe)



# Sbt – Mortality of motile fauna

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Fotos:  
ECOSUR



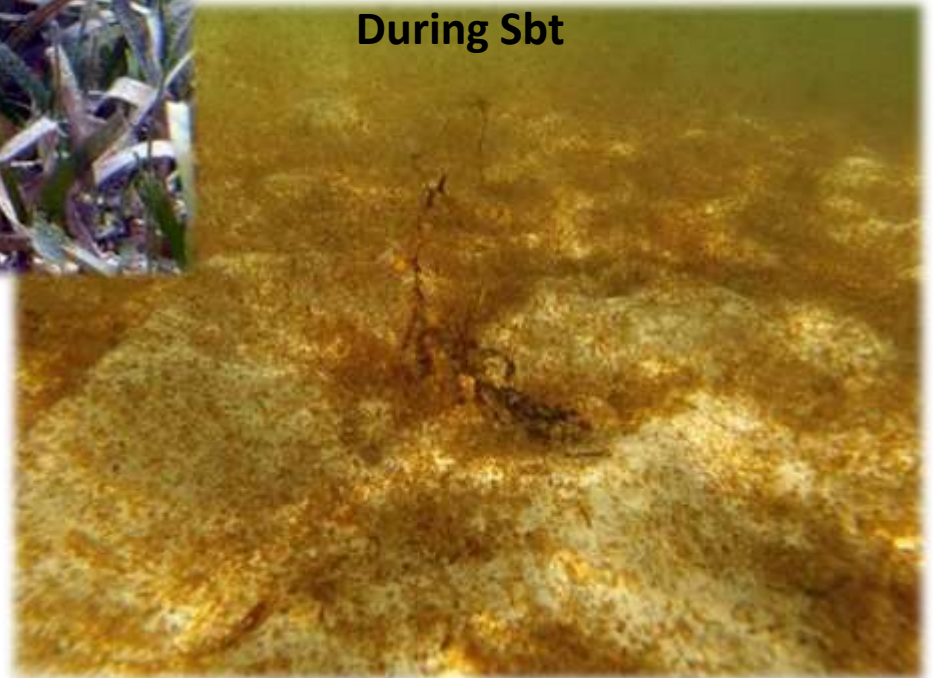
# Sbt – Mortality of benthos

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Before Sbt

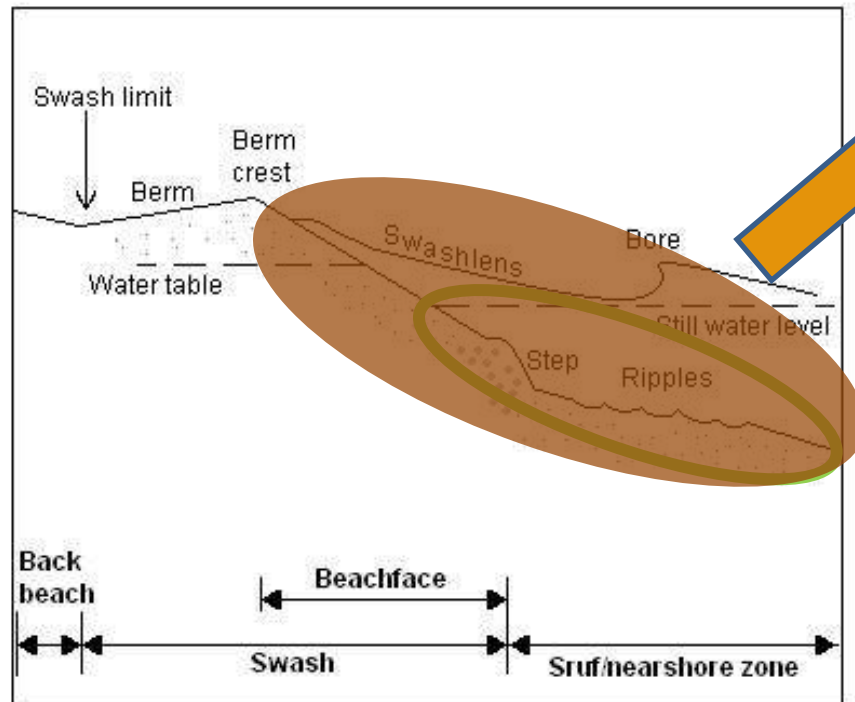


During Sbt



# Benthic seagrasses fix sediments

Waves can move tremendous amounts of sand in the surf and swash zones



**Area affected by Sbt!**

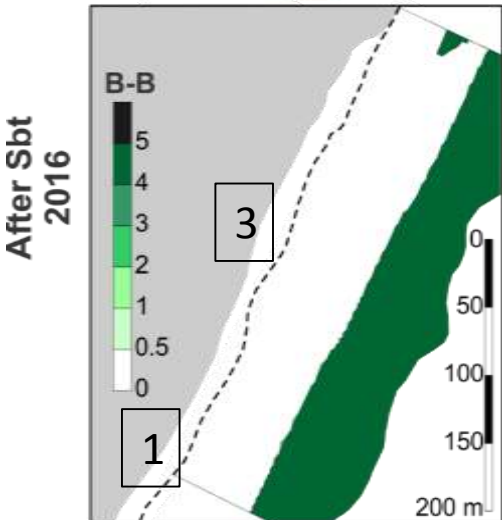
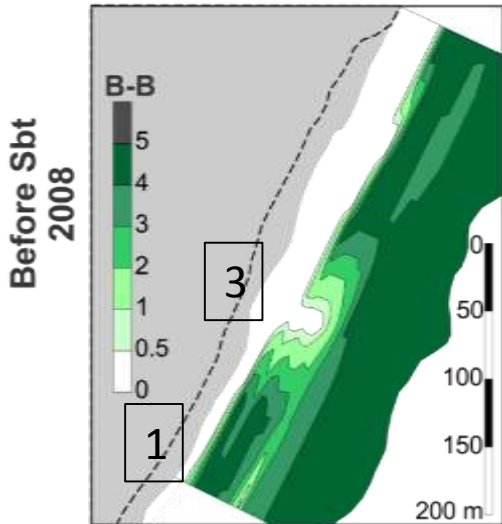


**Seagrass territory!**

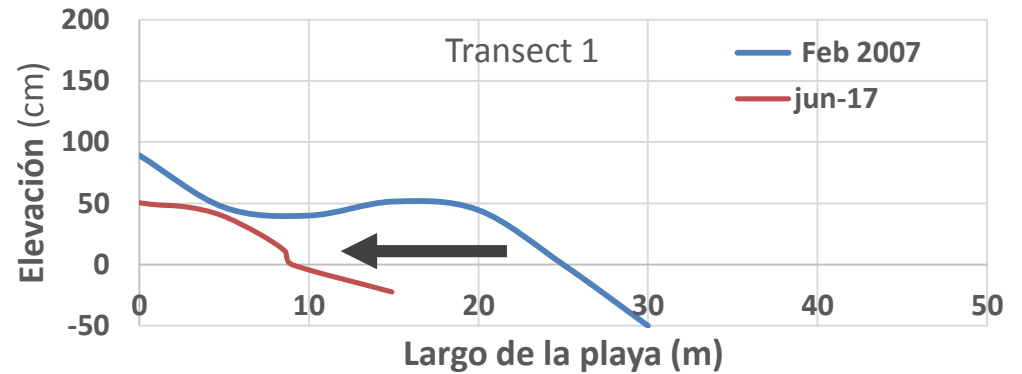
Wikipedia

# Benthic seagrasses fix sediments

*T. testudinum*



Cancún- Mirador Nizuc



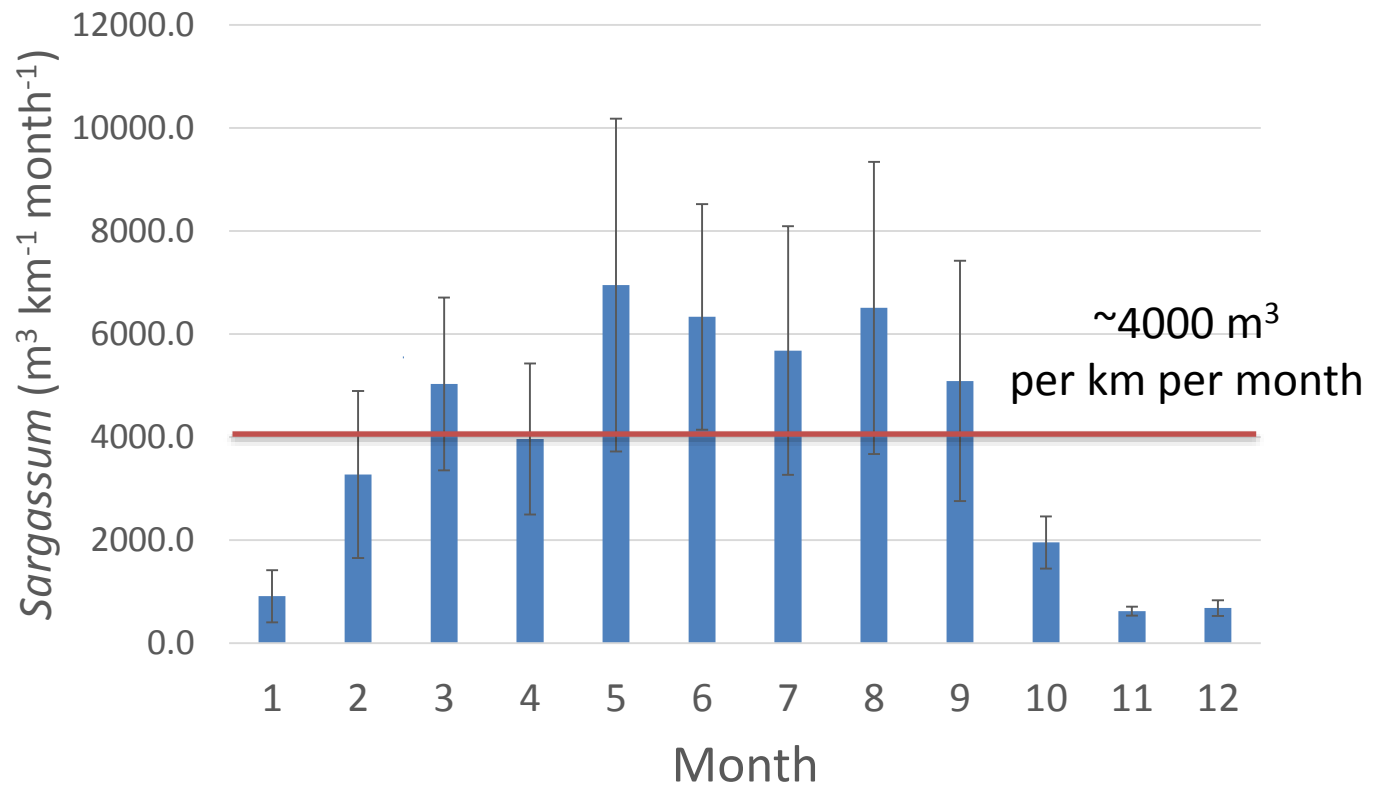
# Beach erosion

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# How much Sargassum arrived?

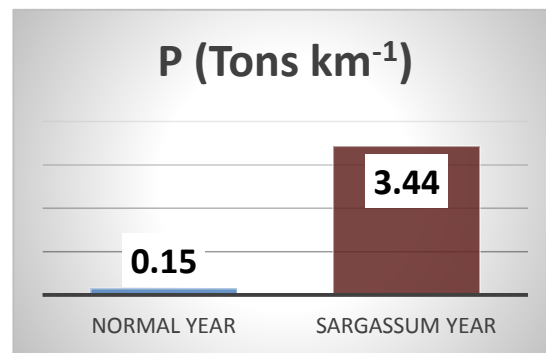
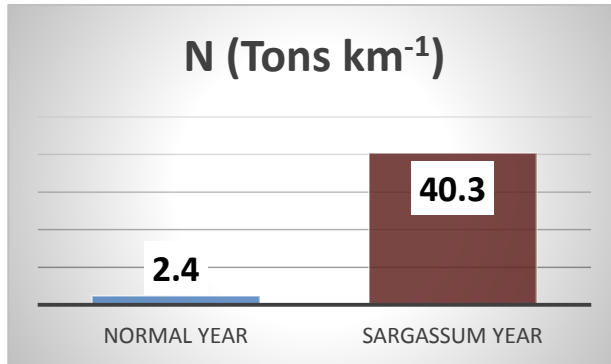
Sargassum collected from beach sections of hotels and the public beach at Puerto Morelos 2018



Data collected by ICML, UNAM  
See also Protocolo Puerto Morelos

# How much is 4000 m<sup>3</sup> /month / km?

## Input of N & P



1 dry g  $\equiv$  7.53 mg N & 0.075 mg P  
(van Tussenbroek et al. 2017)

Normal year:  
Hernández-Terrones et al. 2011

## Input of Organic C

- $\approx 48000$  m<sup>3</sup> Sargassum / km / year
  - 84 dry kg por m<sup>3</sup>
  - 1 dry g  $\equiv$  25 mg C<sub>org</sub>

**1008 Tons C<sub>org</sub> / km / year**

**¿How much is this in C credits?**

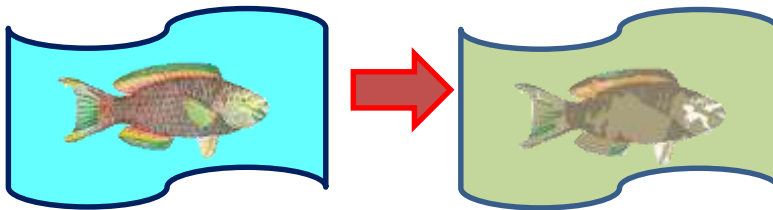
- 1008 ton C<sub>org</sub> = 3696 ton CO<sub>2</sub>
  - C trade US\$28 por ton of captured CO<sub>2</sub>

**103,488 US\$ per km per year**

# Sbt - Impact on ecosystems

## Water Transparency

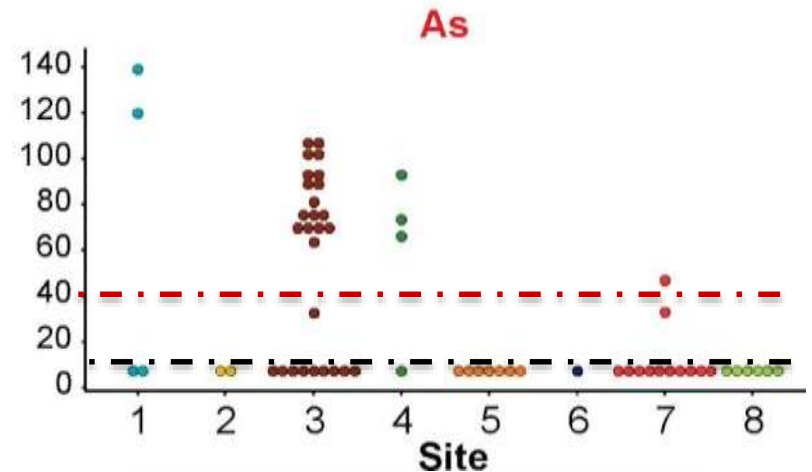
Puerto Morelos Reef Lagoon  
1 year after Sbt of 2015



Van Tussenbroek et al. 2017

## Heavy metal contamination?

Concentration in Sargassum tissues



--- Potentially Toxic

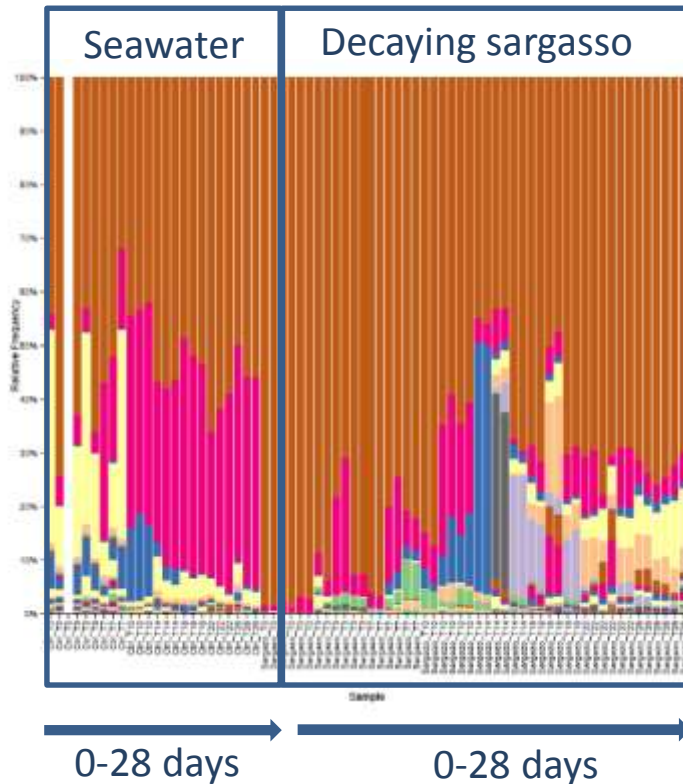
--- LOD

Torrescano-Valle et al. in prep.

# Sbt - Impact on communities

Microbial community ?

Sargasso has a different microbioma than seawater



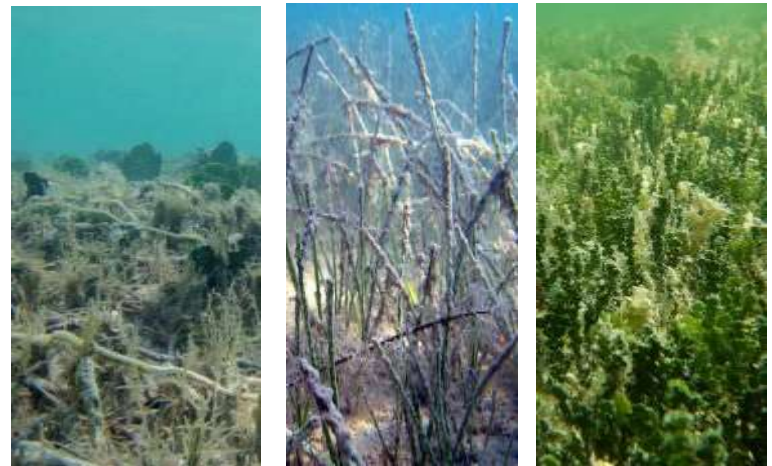
Beltrán et al. in process

Shift in seagrass community

Before Sbt



After Sbt



Lab. Pastos-UNAM - et al. in process



# Sbt - Impact on communities

## New Introductions ?

Sargasso - Associated fauna

*Idotea  
metalica*

*Litopia  
melanostroma*



*Sygnatus  
pelagicus*

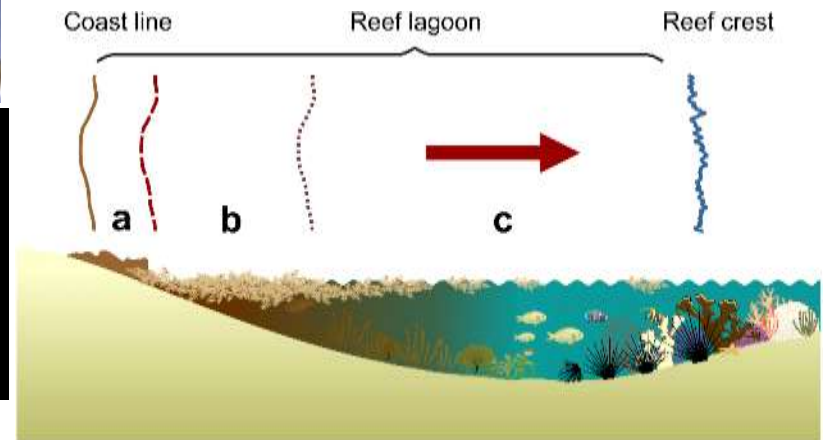
*Stephanolepis  
hispidus*

Monroy-Velázquez et al. 2019

## Trophic relationships ?

Sargassum blooms alter the trophic structure of the sea urchin

*Diadema antillarum*



Cabanillas-Terán et al. 2019

# Sbt - Impact on communities

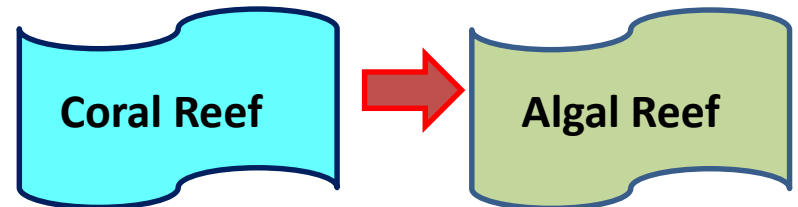
Increasing coral death & disease?



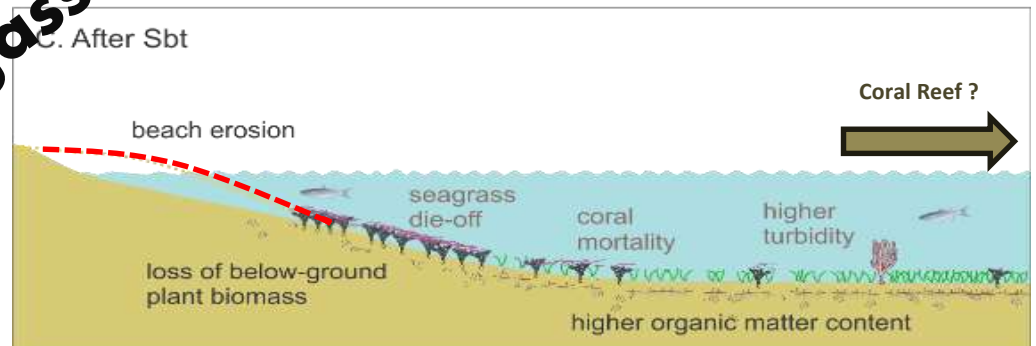
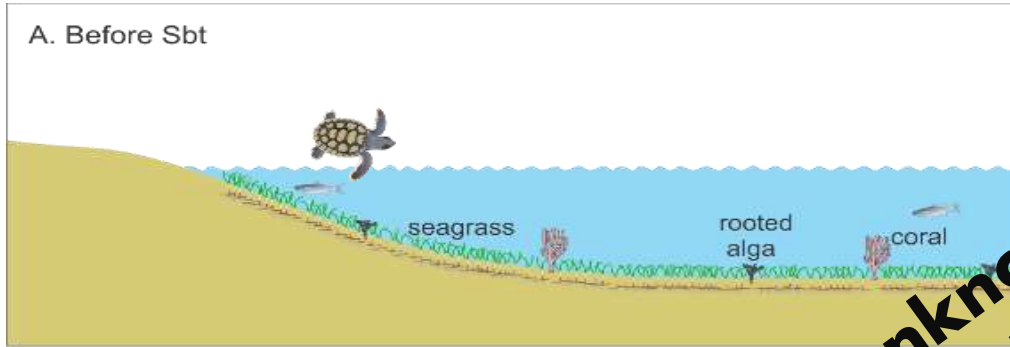
Likely due to decrease in water quality, but no direct relationship with Sbt has been established

Various Reef Labs – UNAM  
Reef Park Pto. Morelos - CONANP

Shift in reef community?



# After a Sbt – The system has changed!



**Time for recovery is unknown  
but likely covers decades,  
if the Sargassum influx does not recur**

# Conclusion

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**Management of the massive Sargassum influx is urgently needed and poses a major challenge**



**But ....Restoration of the damaged ecosystems after we have properly attended this massive influx will be an equally large challenge!**



# Thank you

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## **In collaboration with:**

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