



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

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Mexican Caribbean



(FRINGING) REEF SYSTEMS



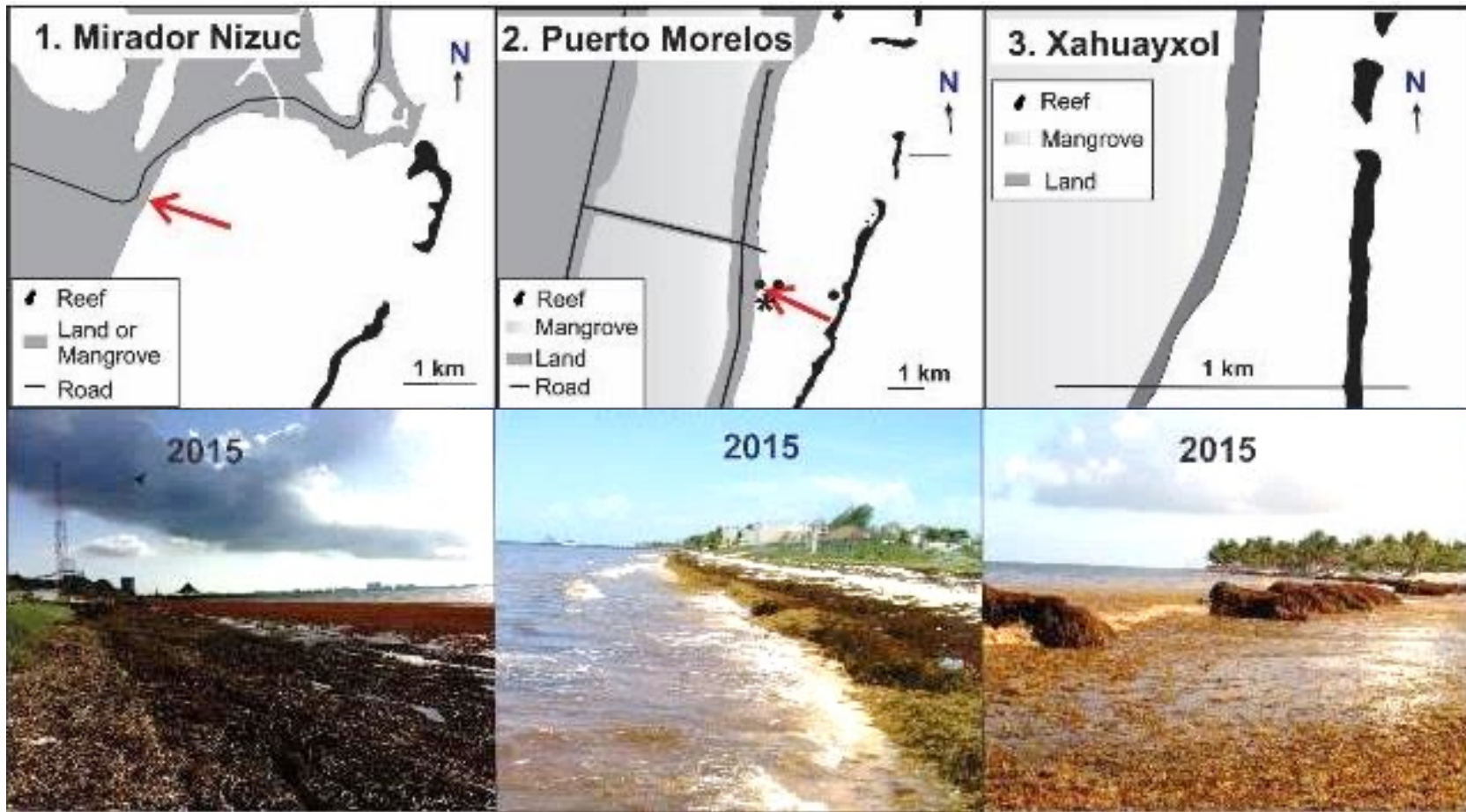
Golden tide vs Sargasso brown tide



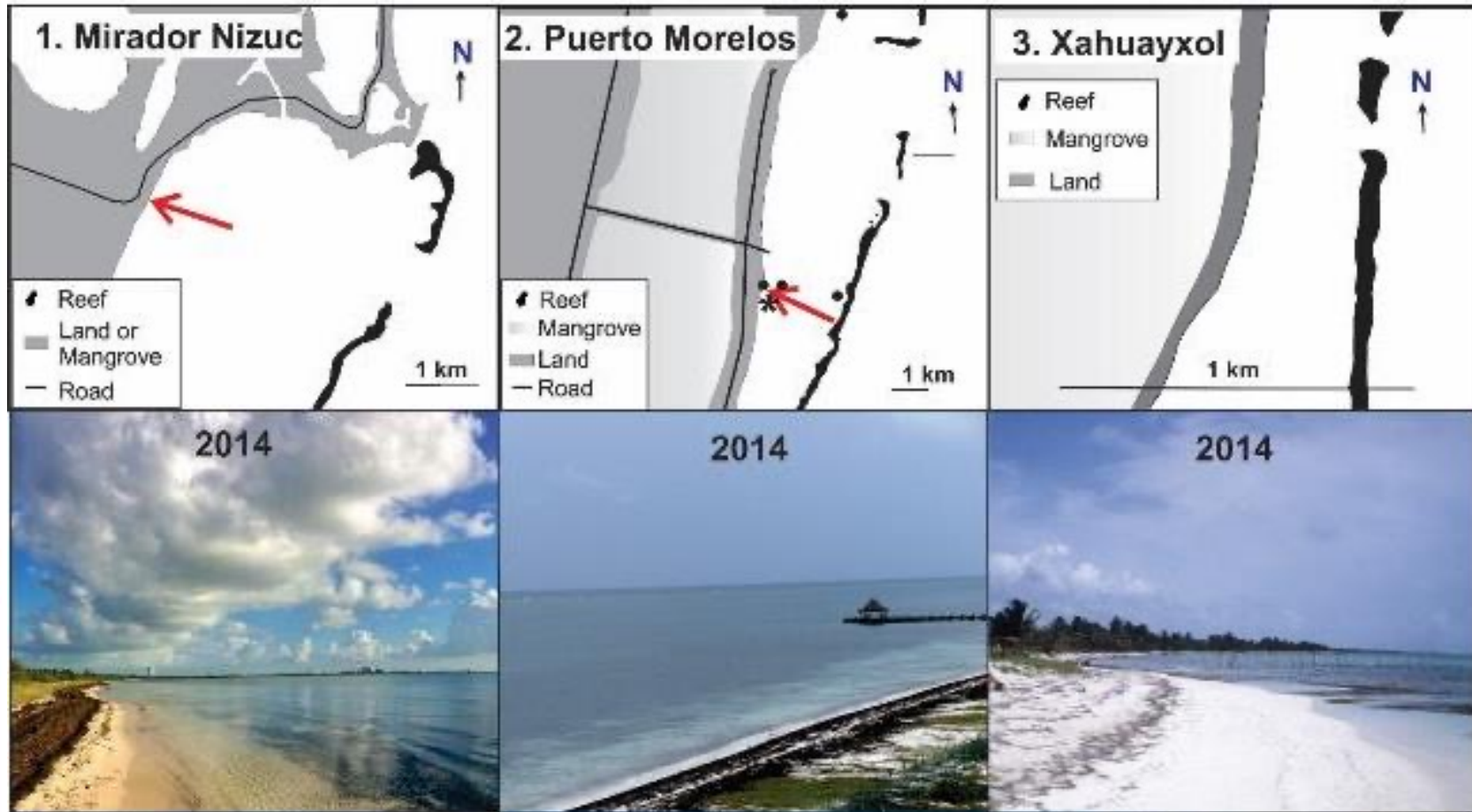
searchoflife.com



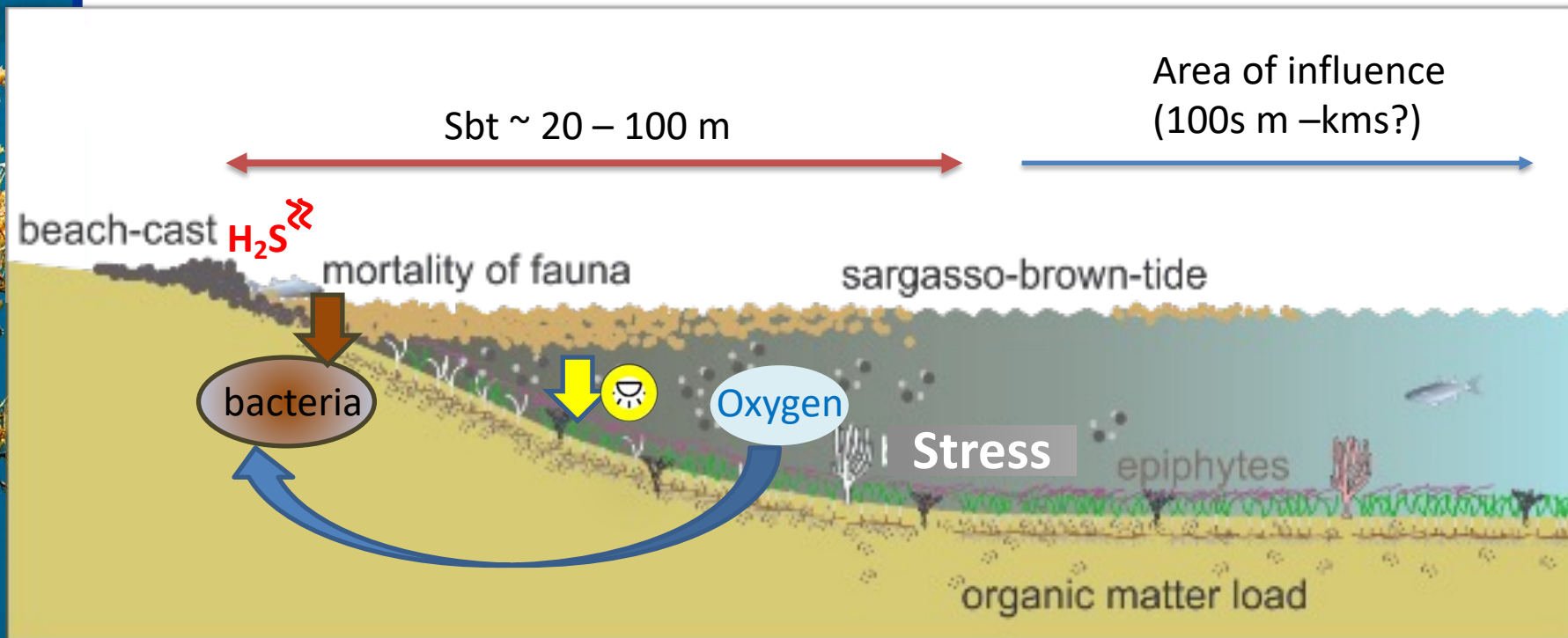
Sargasso brown tide (2015)



Before Sargasso brown tide



Sargasso brown tide (Sbt)

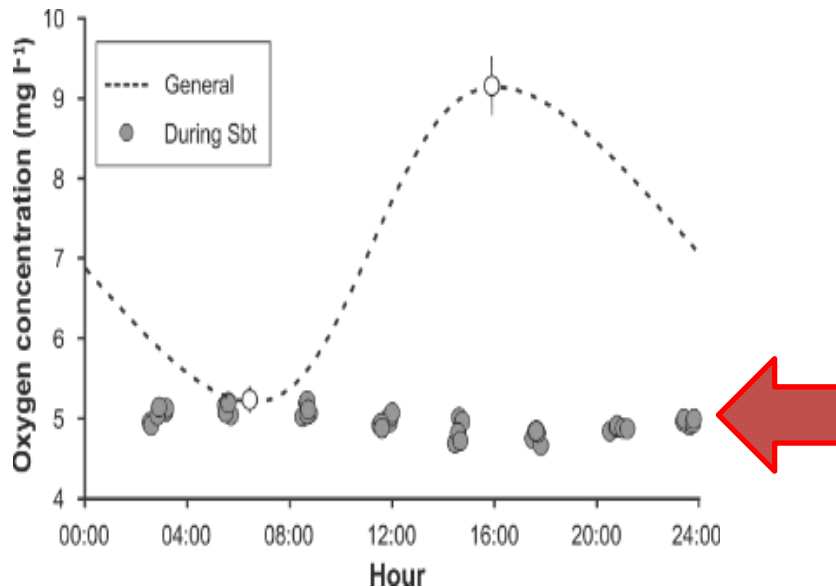


Sbt – Oxygen deficit

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

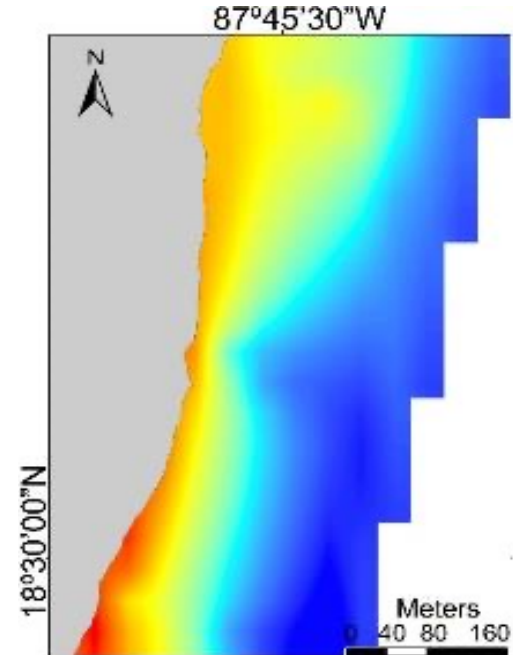
HYPOXIA

Puerto Morelos
(daily O₂ cycle)



ANOXIA

Xahuayxol
(anoxic coastal fringe)



Sbt – Mortality of motile fauna



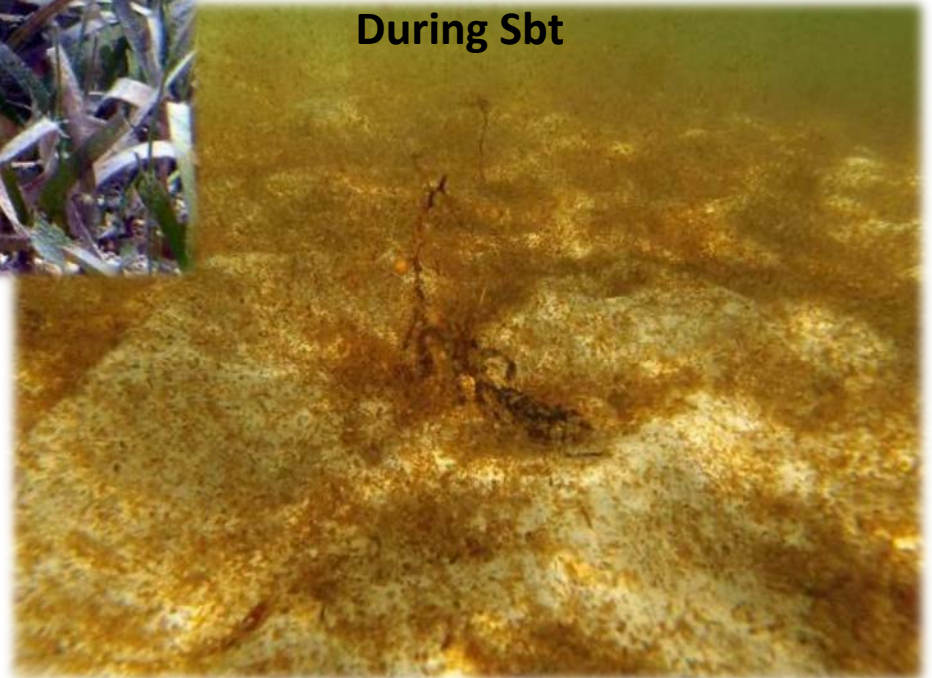
Fotos:
ECOSUR

Sbt – Mortality of benthos

Before Sbt

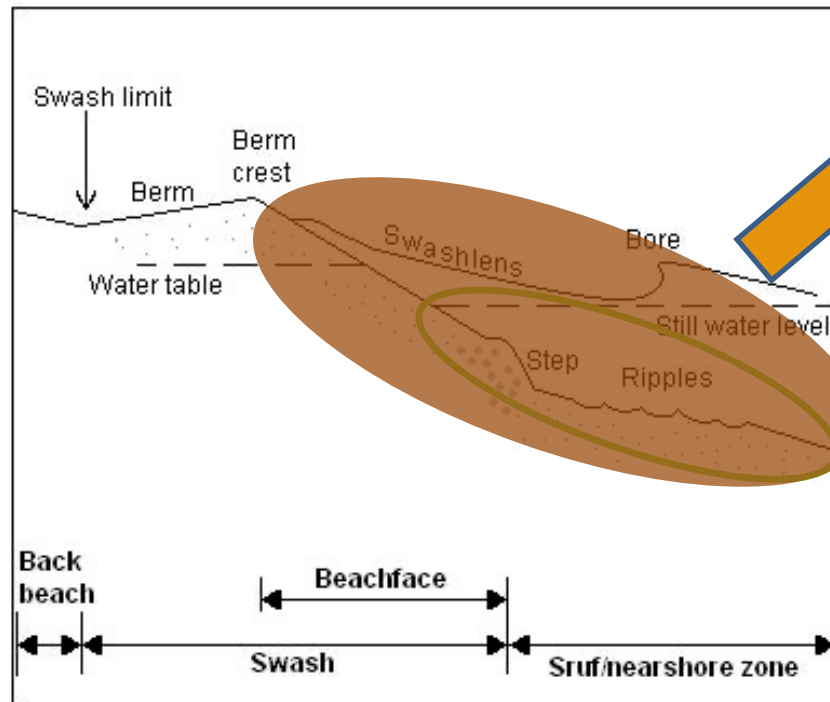


During Sbt

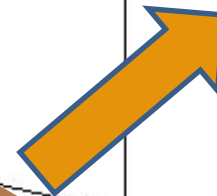


Benthic seagrasses fix sediments

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



Area affected by Sbt!

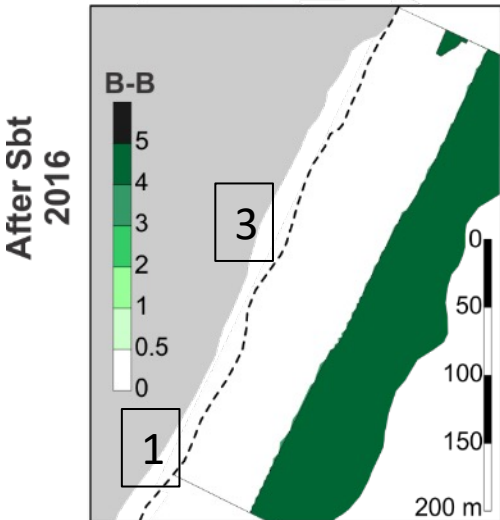
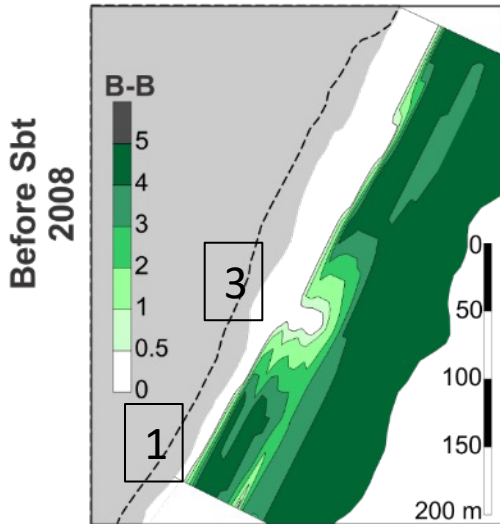


Seagrass territory!

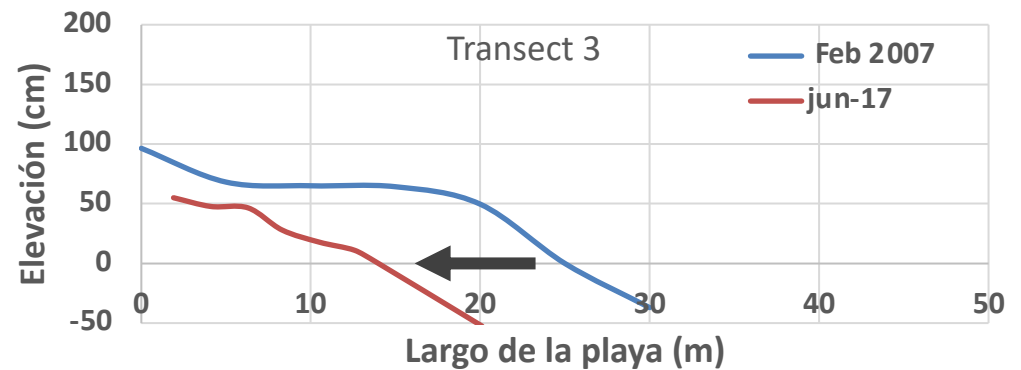
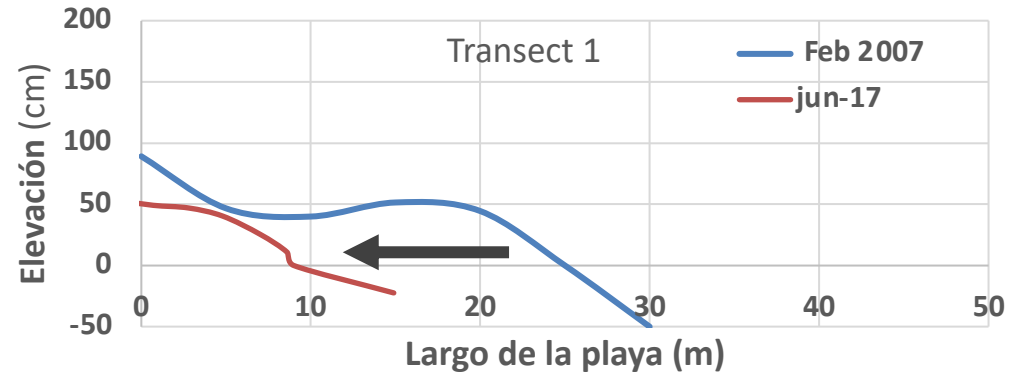
Wikipedia

Benthic seagrasses fix sediments

T. testudinum



Cancún- Mirador Nizuc

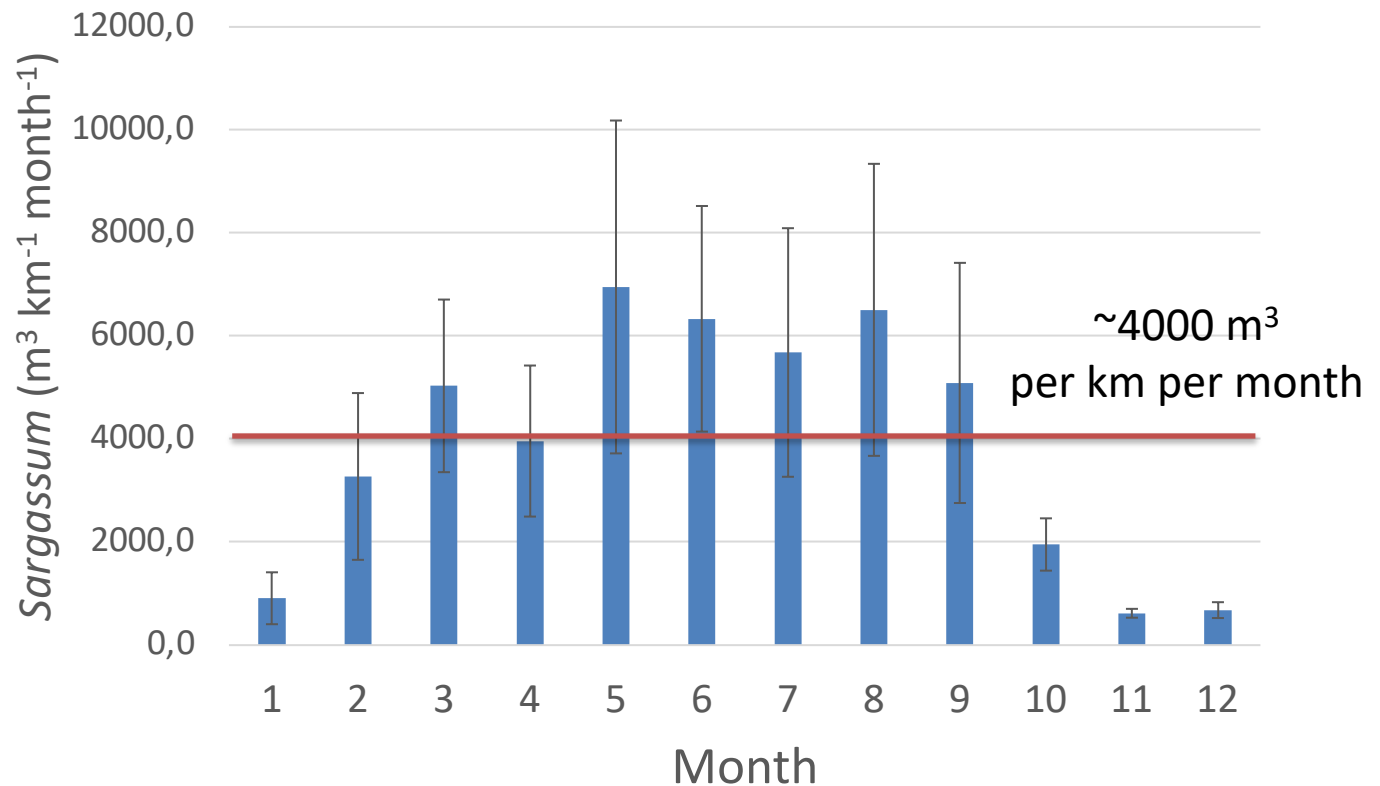


Beach erosion



How much Sargassum arrived?

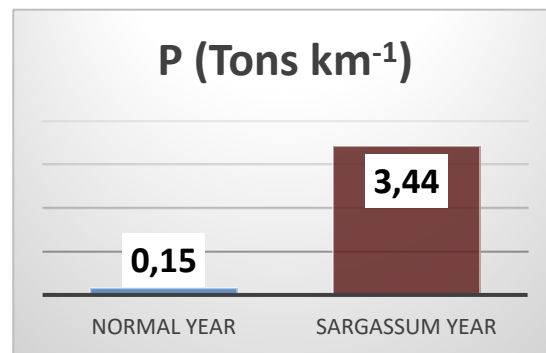
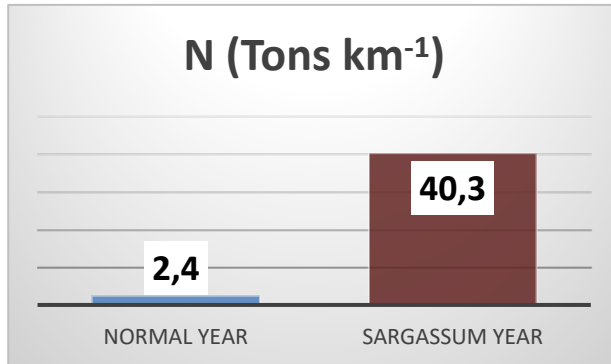
Sargassum collected from beach sections of hotels and the public beach at Puerto Morelos 2018



Data collected by ICML, UNAM
See also Protocolo Puerto Morelos

How much is 4000 m³ /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

- ≈ 48000 m³ Sargassum / km / year
 - 84 dry kg por m³
 - 1 dry g \equiv 25 mg C_{org}

1008 Tons C_{org} / km / year

¿How much is this in C credits?

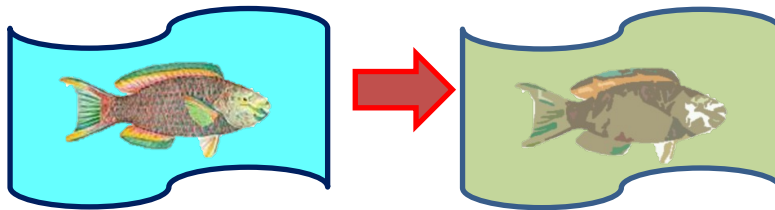
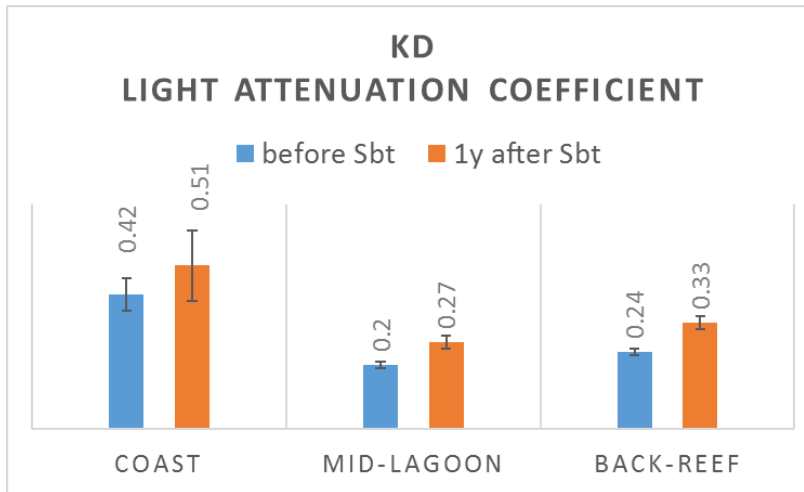
- 1008 ton C_{org} = 3696 ton CO₂
 - C trade US\$28 por ton of captured CO₂

103,488 US\$ per km per year

Sbt - Impact on ecosystems

Water Transparency

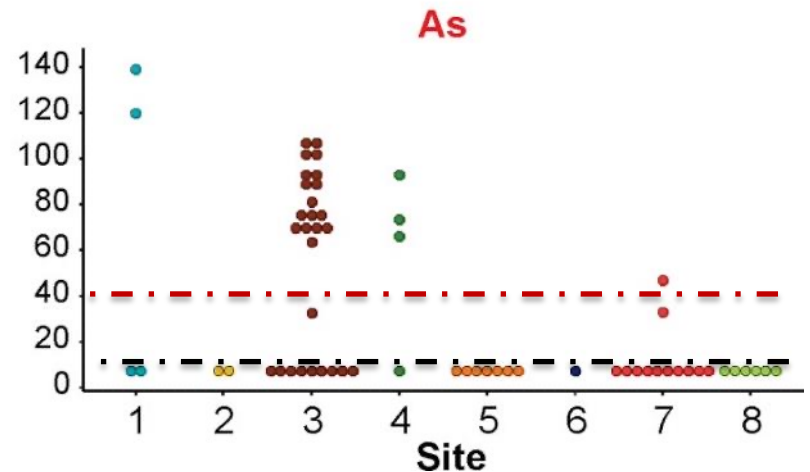
Puerto Morelos Reef Lagoon
1 year after Sbt of 2015



Van Tussenbroek et al. 2017

Heavy metal contamination?

Concentration in Sargassum tissues



--- Potentially Toxic

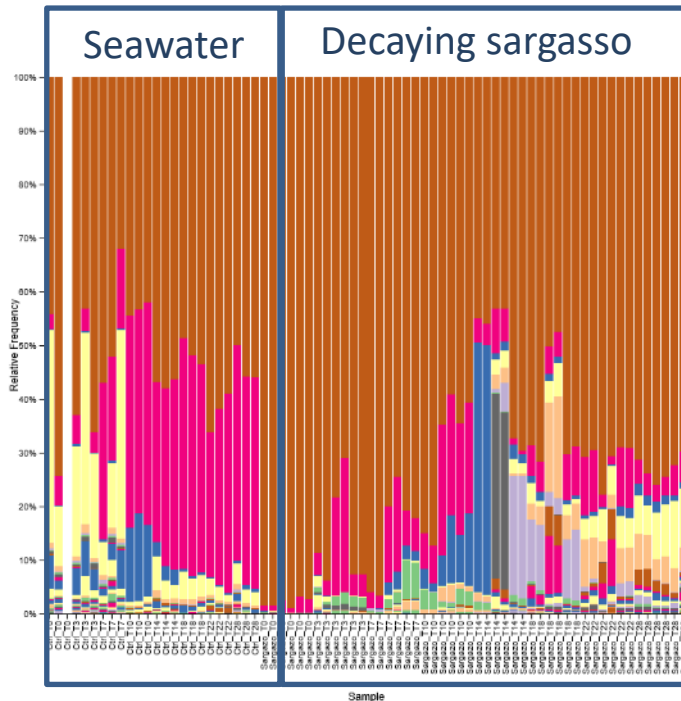
--- LOD

Torrescano-Valle et al. in prep.

Sbt - Impact on communities

Microbial community ?

Sargasso has a different microbioma than seawater



0-28 days

0-28 days

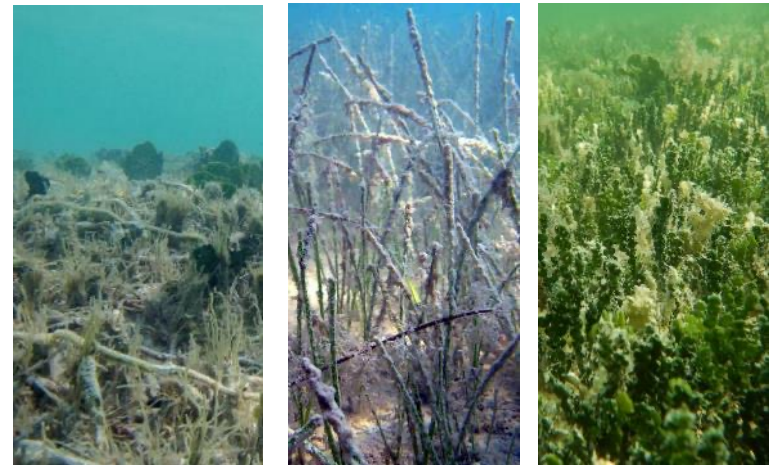
Beltrán et al. in process

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*



*Syngnatus
pelagicus*

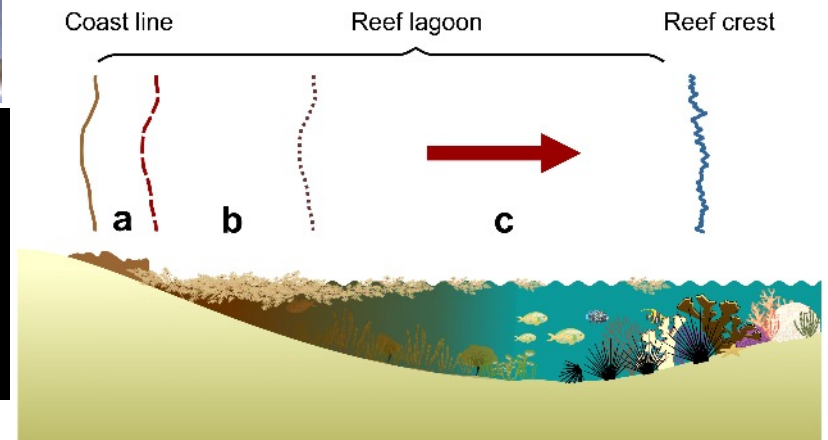
*Stephanolepis
hispidus*

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

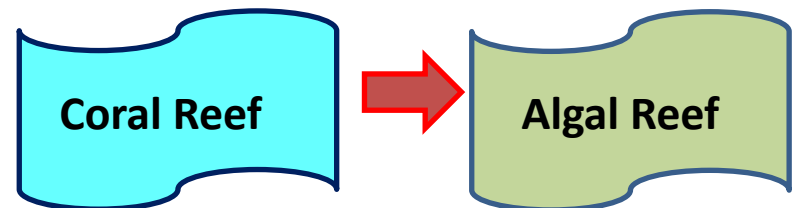
Increasing coral death & disease?



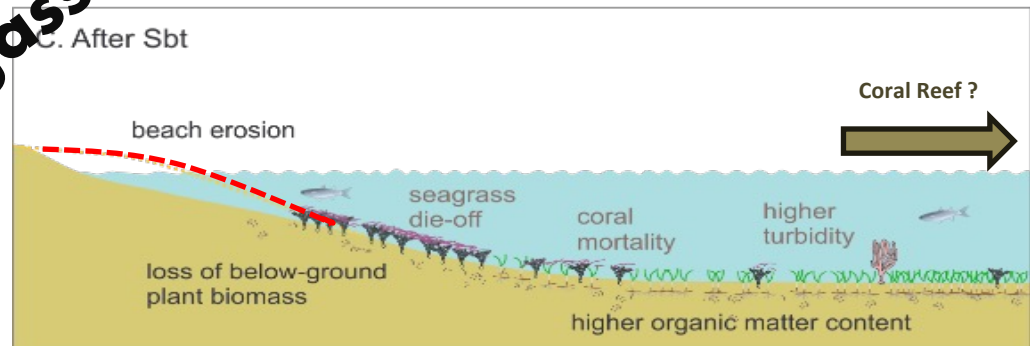
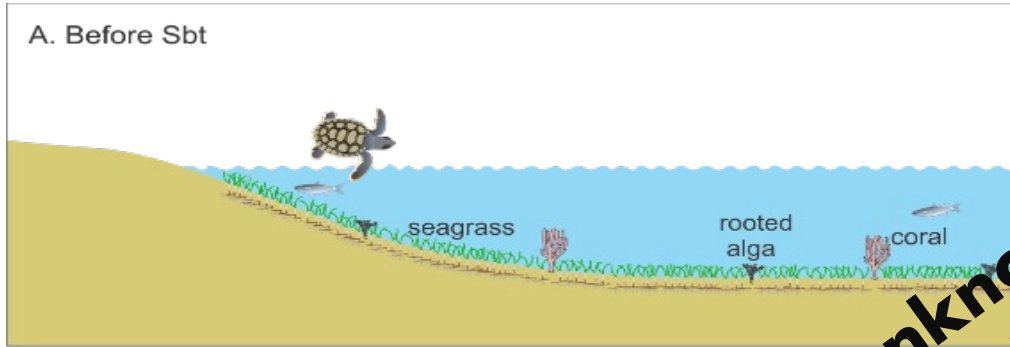
Likely due to decrease in water quality, but no direct relationship with Sbt has been established

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

Shift in reef community?



After a Sbt – The system has changed!



Conclusion

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



ButRestoration of the damaged ecosystems after we have properly attended this massive influx will be an equally large challenge!



Thank you



In collaboration with:

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