

SARGCOOP

WORK PACKAGE : CARIBBEAN SARGASSUM FORUM

13 JANUARY 2023 WEBINAR :
 « ANTICIPATING AND MEASURING THE IMPACT »

**Impact of sargassum brown tides on the Mexican Caribbean coast:
 seagrass meadow and beach**

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Sargassum Brown Tide



Inadequate management during the events of massive influx of pelagic *Sargassum* species..
(either algal masses are not prevented to reach the shores, or -when beached- they are not removed timely)
.. results in coastal seas (10->100 m wide zones) suffering from **Sargassum brown tides (Sbt)**:



Puerto Morelos; Mexican Caribbean

Seagrass Meadows



Many coastal zones impacted by Sbt used to typically colonized by seagrasses

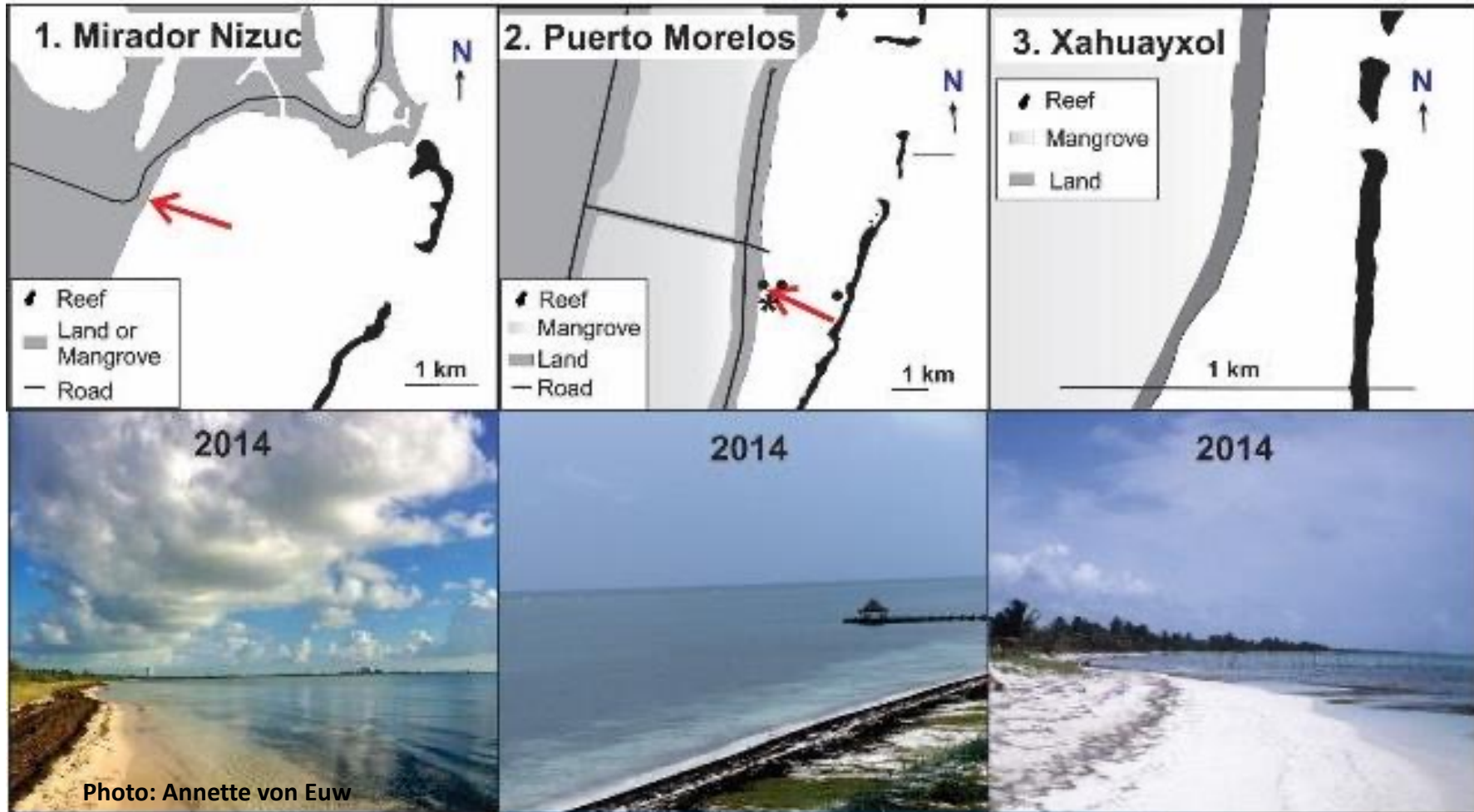
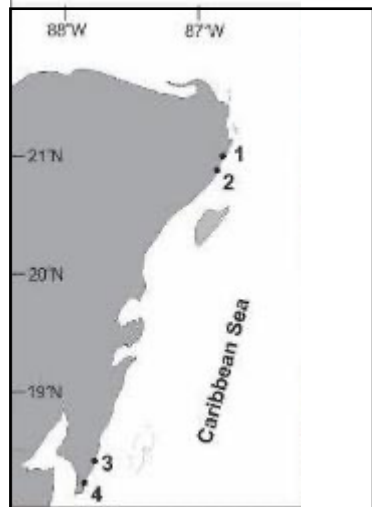


Photo: Annette von Euw

Before Sargassum brown tide



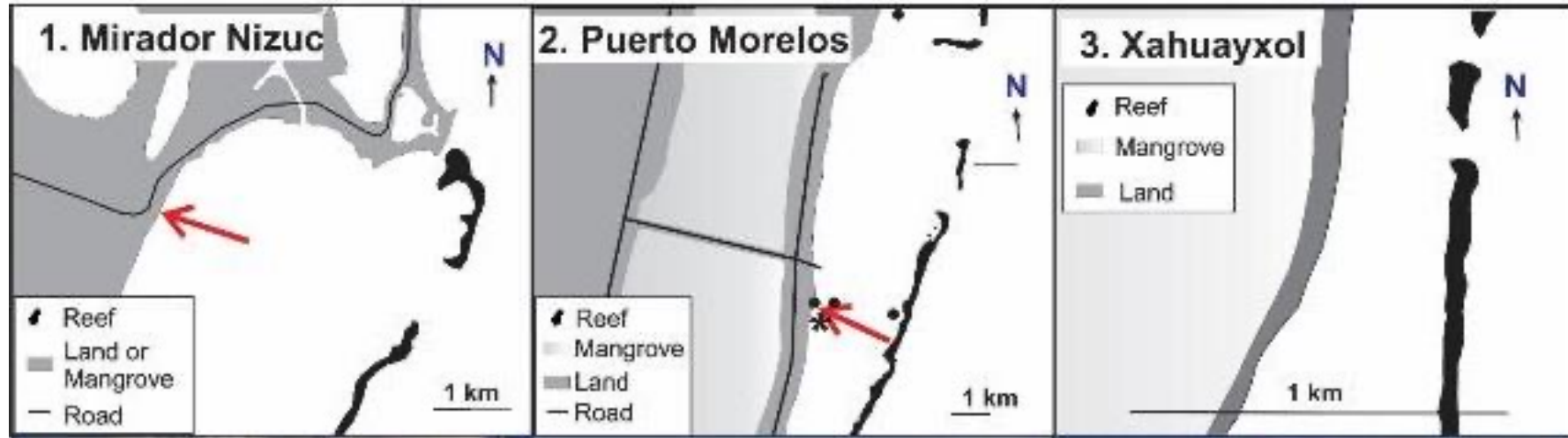
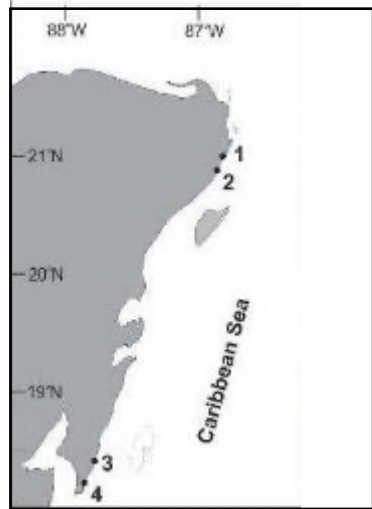
These coastal zones used to look like this:



2015 Sargassum Brown Tide



Massive accumulation of algal biomass on shores, and near-shore seas, releasing OM and leachates

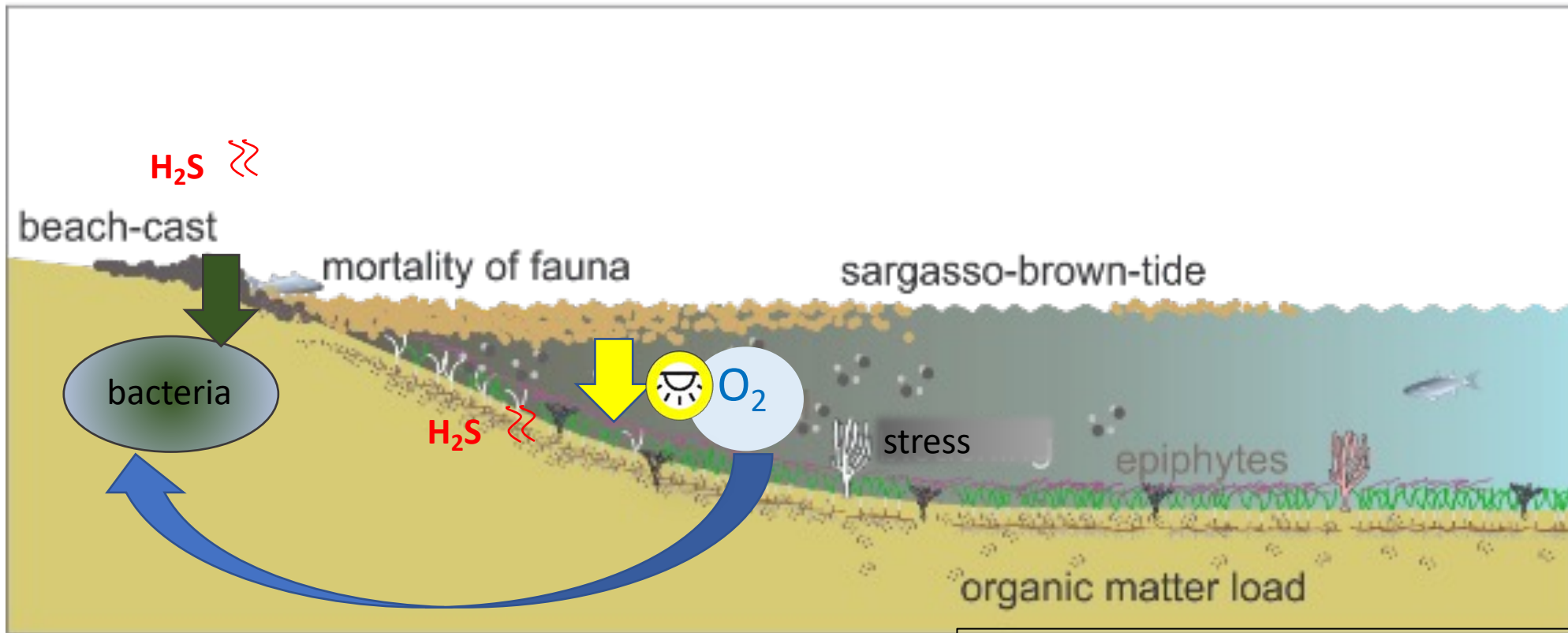


Sargassum brown tide



Sargassum itself is not bad or harmful

What is harmful to the environment are the huge decaying algal masses



Adapted from Van Tussenbroek et al. 2017. MPB

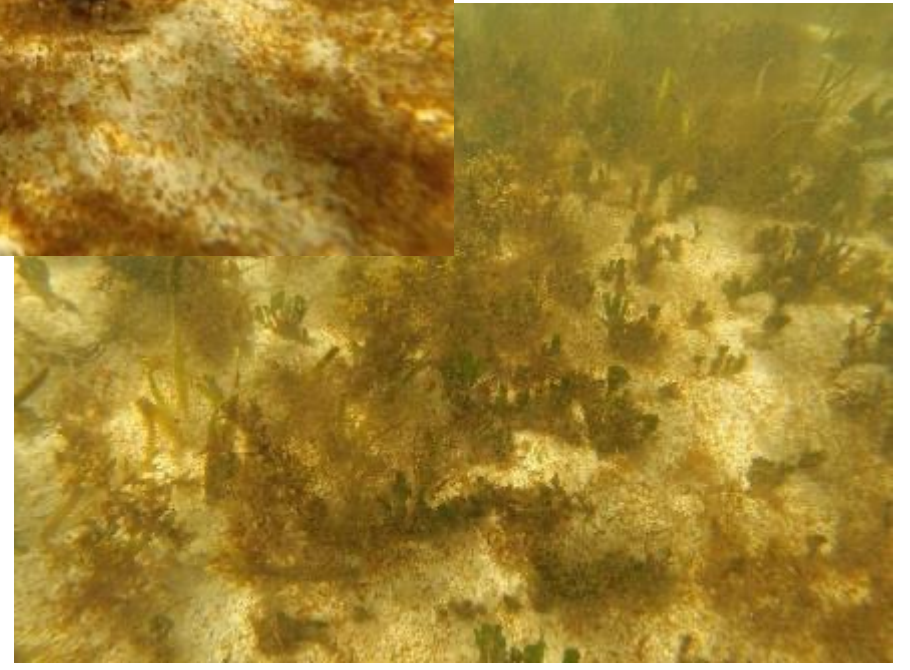
Mortality of seagrasses



Before Sbt



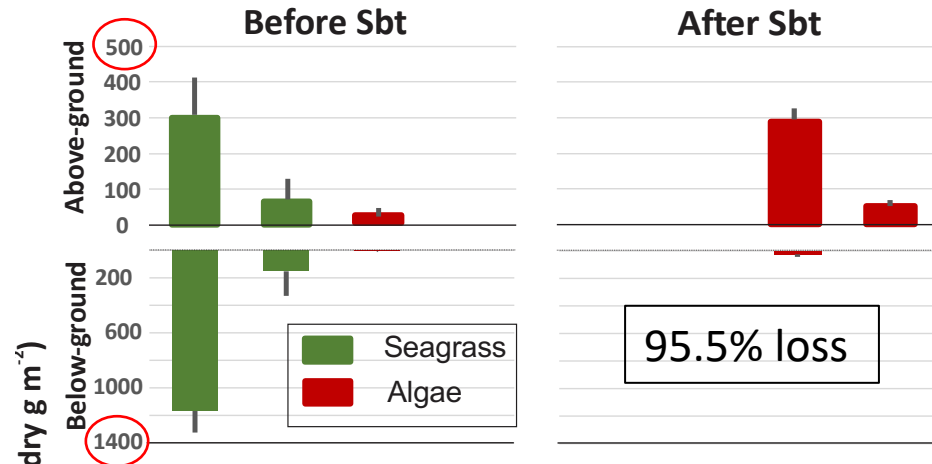
After Sbt



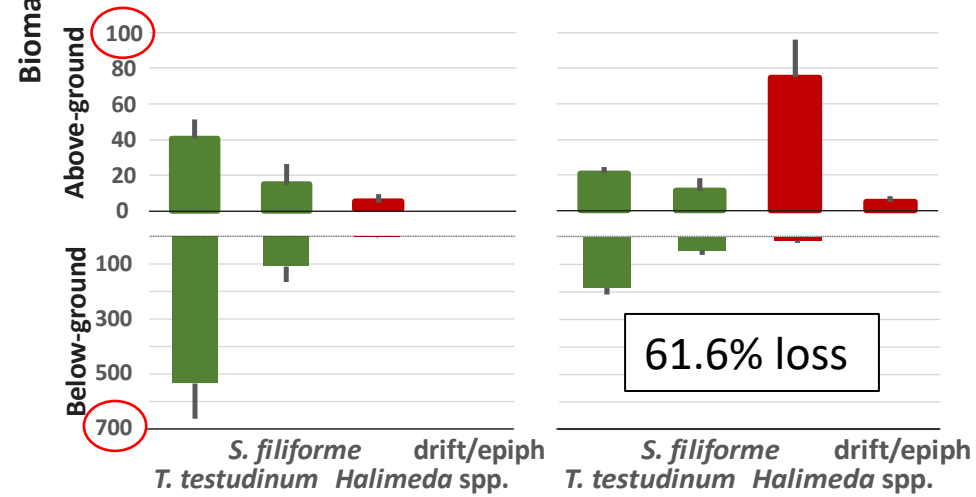
Site-specific mortality



Site 1
Mirador Nizuc



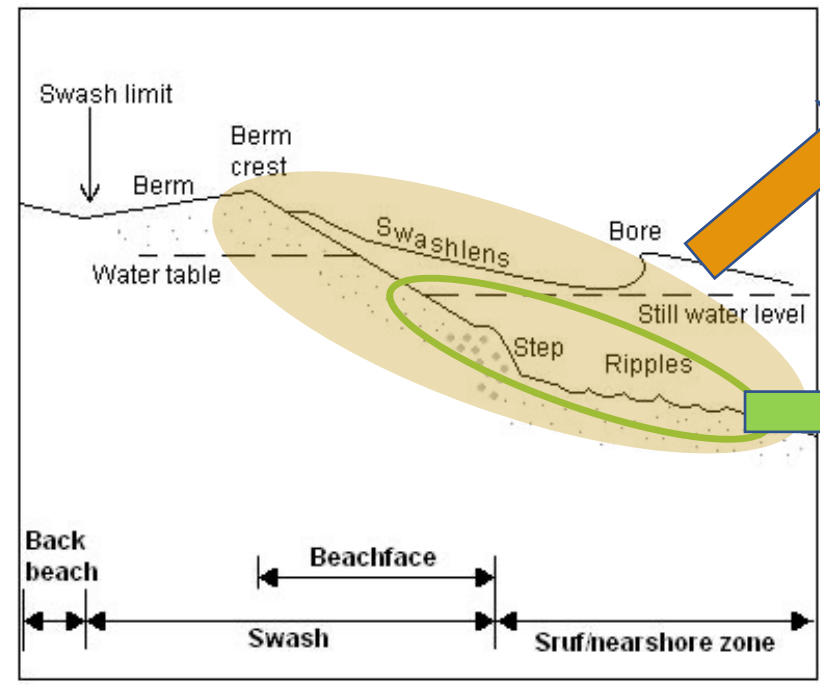
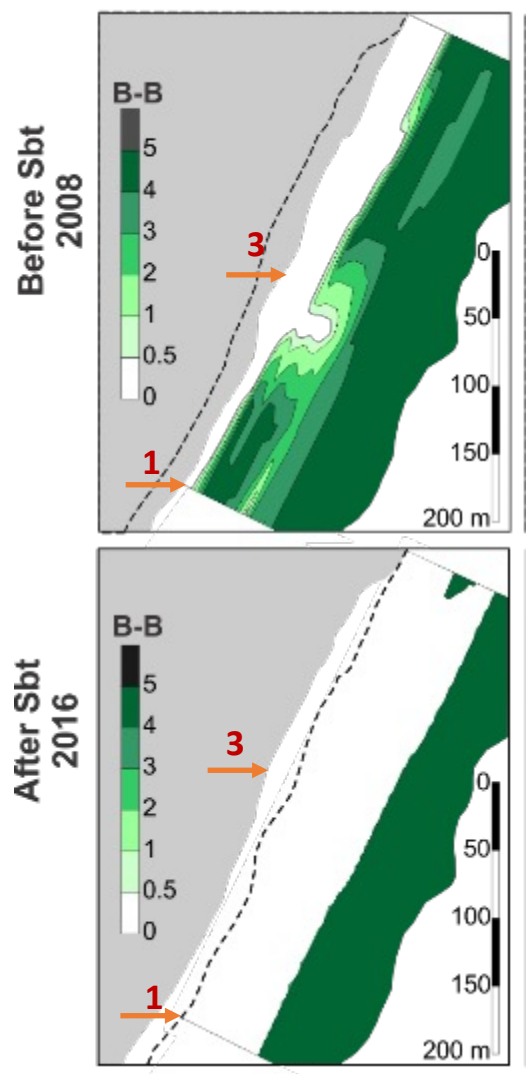
Site 2
Pto. Morelos



Importance of near-shore meadows



T. testudinum



Area affected directly by Sbt

iSeagrass territory!



Seagrass canopy attenuates the waves, and rhizomes and roots fix sediments

Wikipedia

Importance of near-shore meadows



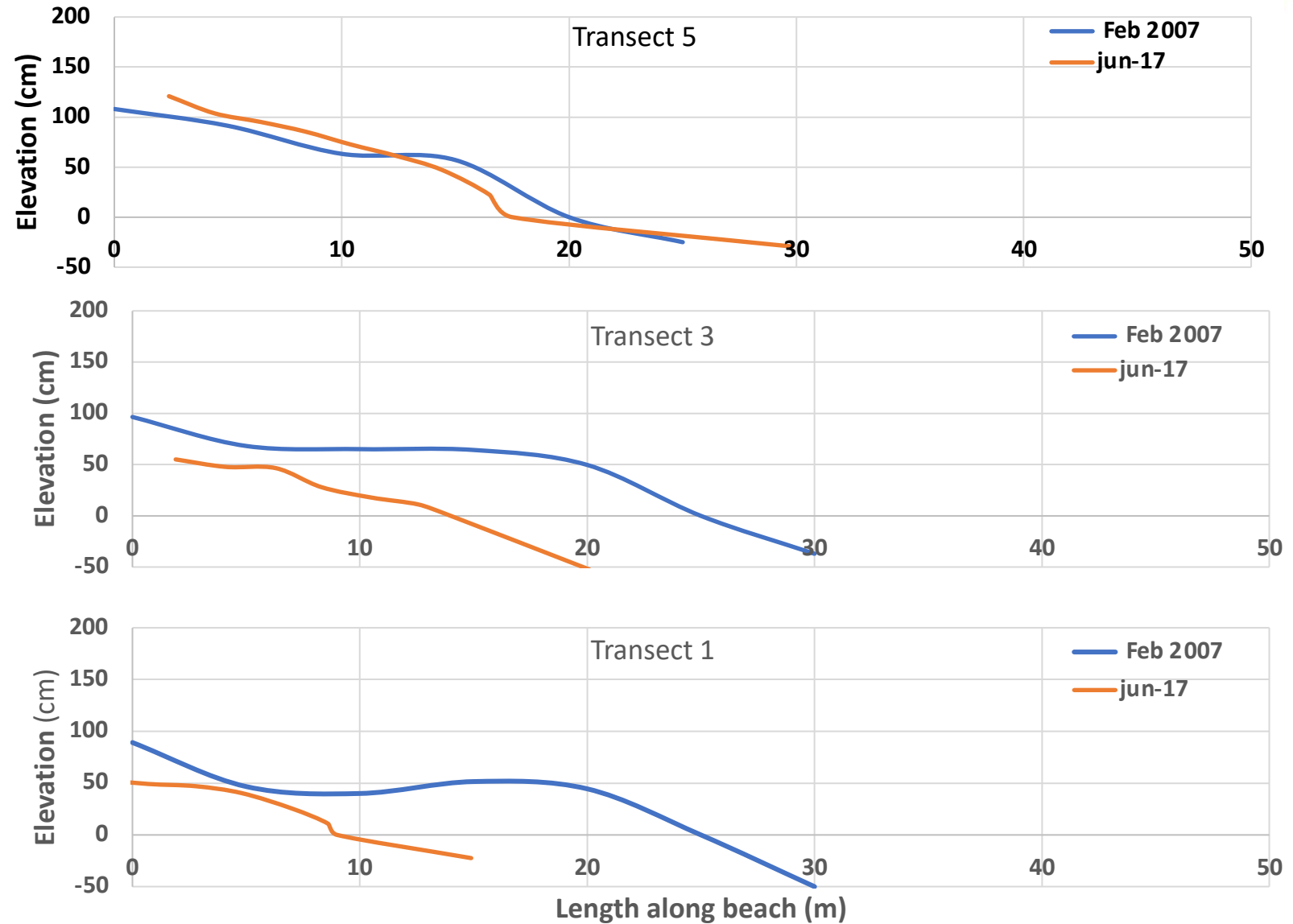
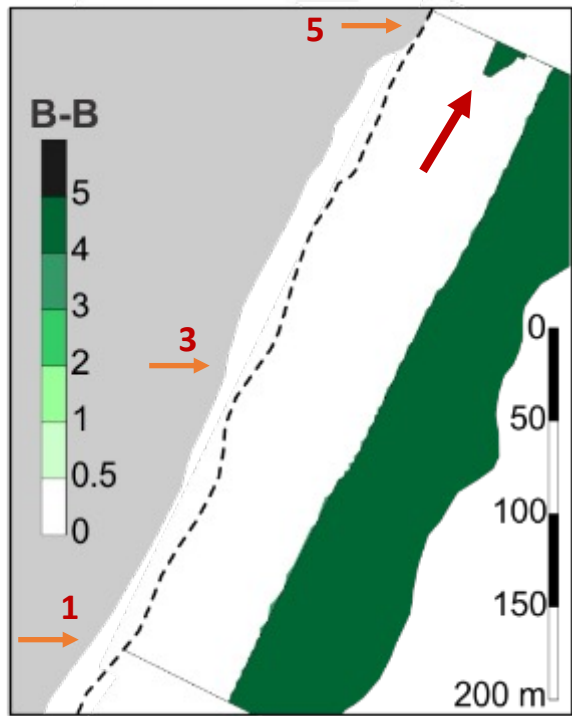
James et al. 2019

Beach erosion after the 2015 Sbt

Site 1 - Mirador Nizuc



After Sbt
2016



Beach erosion after the 2015 Sbt

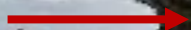


Due to combined effects of removal practices and loss of near-shore seagrasses

2008



2016



Recovery

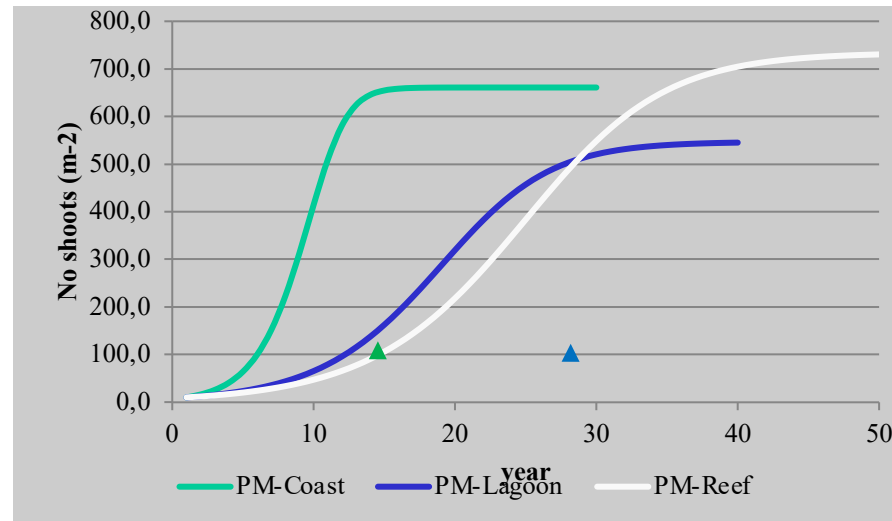


The recovery rate depends on population growth rate of the dominant robust seagrass

Thalassia testudinum



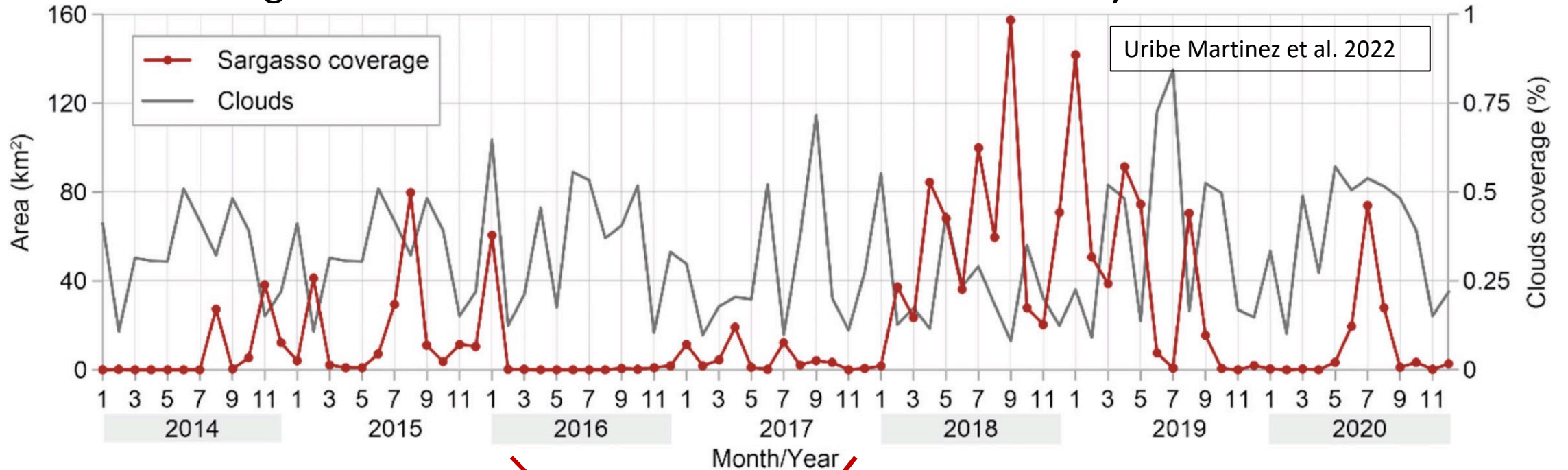
- Logistic population growth based on clonal expansion rates
- Simulation starting with 10 shoots m⁻²
- **Recovery of coastal meadow > 10 years**



If Sbt recur within 10 y, then the changes will be permanent

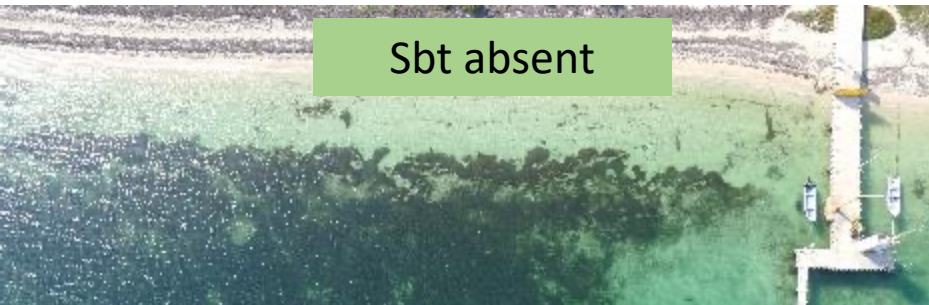


Sargassum detected in the sea in front of Mexico by satellites



From 2016 until the beginning of 2018, we registered good recovery of the nearshore seagrass meadows
But massive influxes of sargassum recurred in Mexico in 2018, 2019, and 2022

Consequences of Recurrence



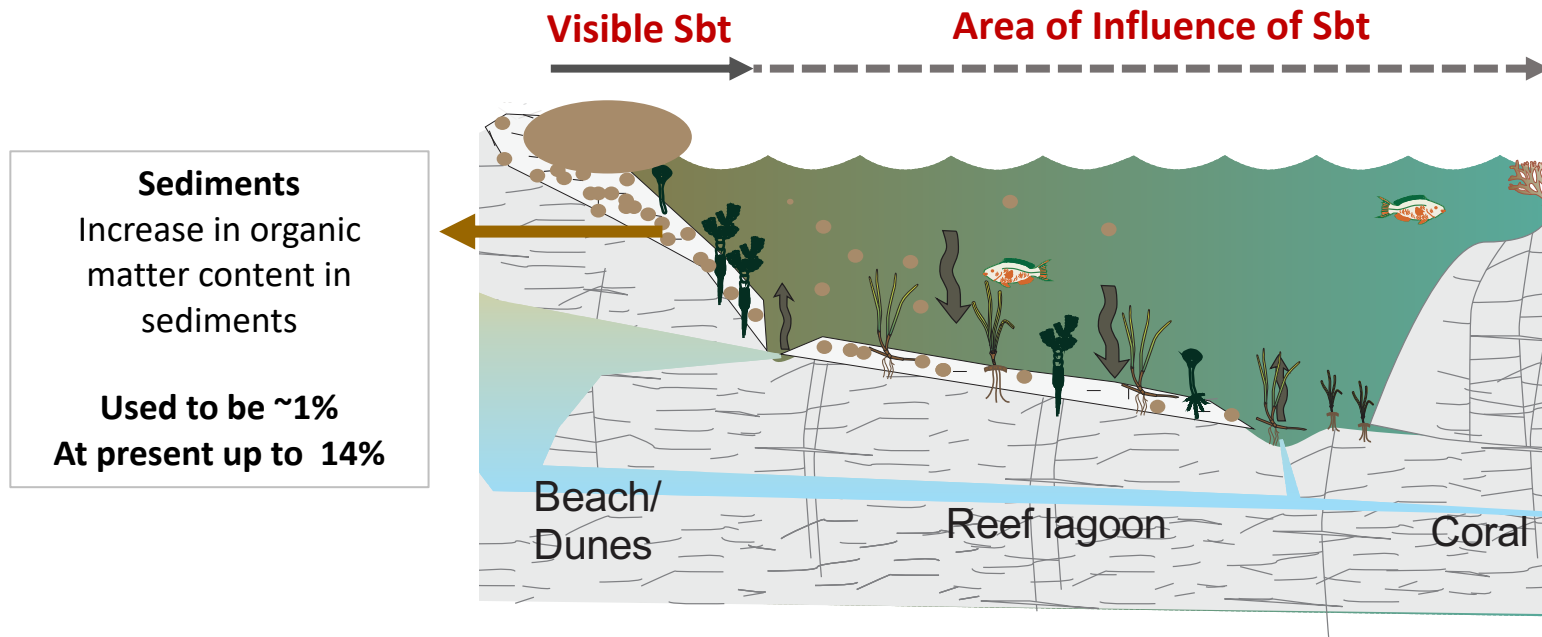
The buildup of organic material in the sediments of recurrent massive influxes of sargassum has long-lasting consequences

- Likely cumulative input of nutrients, potentially toxic elements and organic matter into the systems (if they are not removed naturally from the system at intervals $<$ recurrence intervals)
- High organic matter loads in near coastal waters cause brown tides even in absence of dead beach cast algal masses
- For seagrasses, any restoration efforts in sediments with high organic matter is more difficult
- The coastal ecosystem will suffer a phase shift

Sbt and impact beyond the coastal fringe



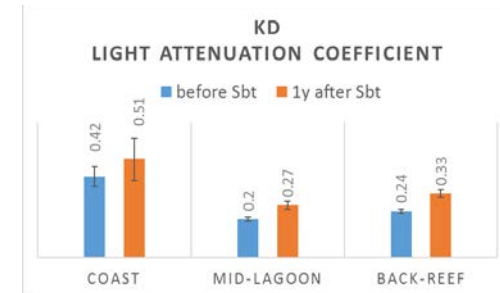
The leachates and organic matter of beach decaying sargassum masses are distributed throughout the system



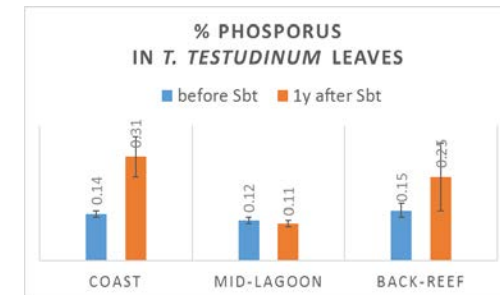
Sediments
 Increase in organic matter content in sediments

 Used to be ~1%
 At present up to 14%

Water transparency



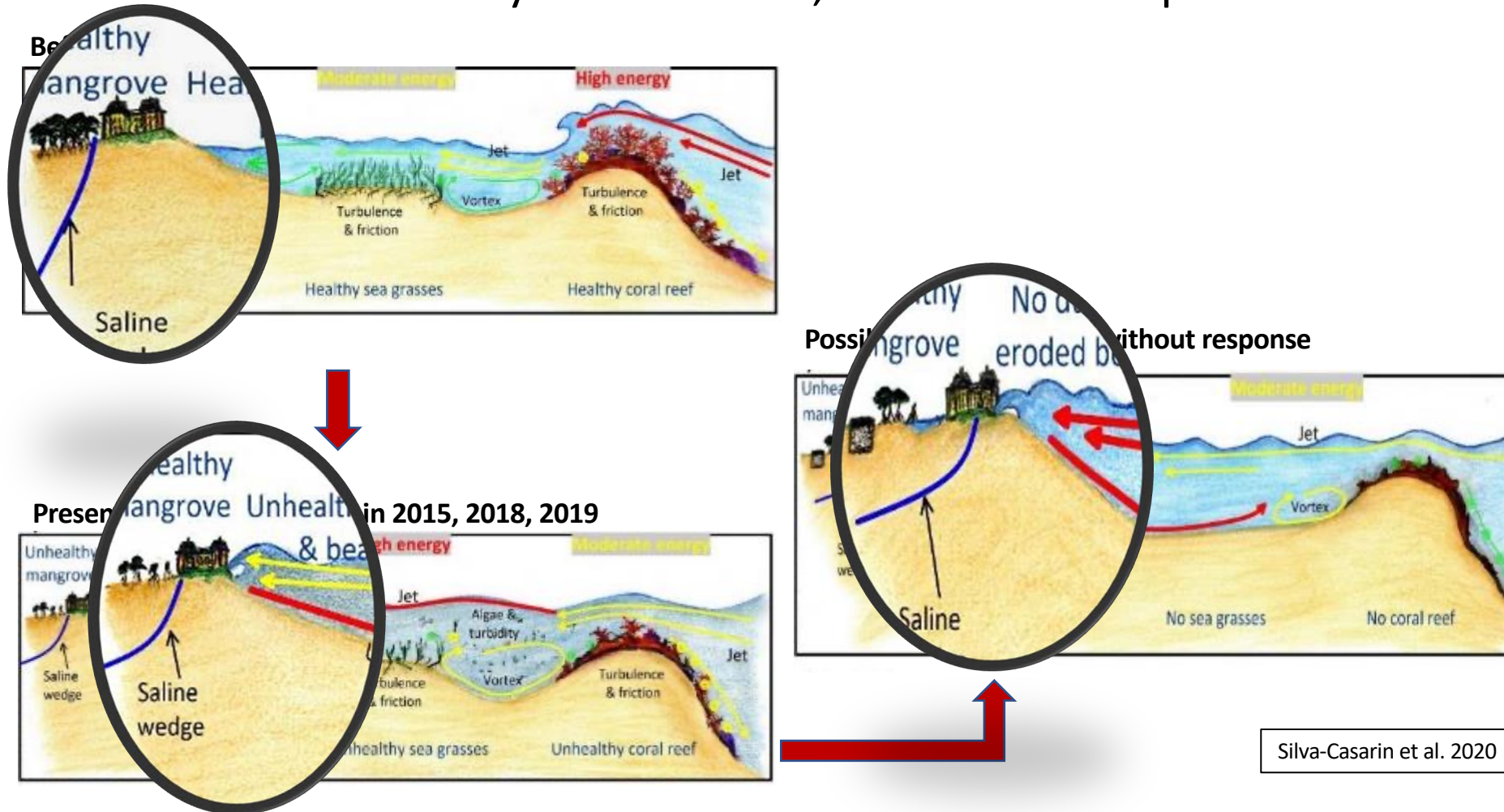
Nutrient availability



Future scenario (without adequate management)



Loss of ecosystem services, such as coastal protection



Thank you



**Actual state of
Site 1 -
Mirador Nizuc
(10 de Nov 2022)**

Ongoing beach
erosion, despite
beach
replenishment
efforts

Artificially filled