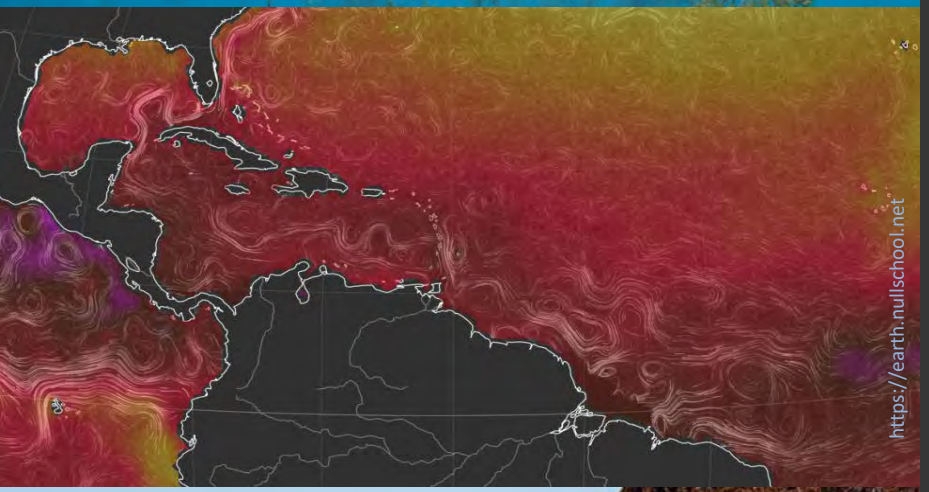





# Communicating complex climate change impacts and adaption to regional stakeholders:

## the case of

# Sargassum

Hazel A. Oxenford, Patrick McConney
Shelly-Ann Cox

University of the West Indies
Centre for Resource Management and Environmental Studies,
Cave Hill Campus, BARBADOS


Acknowledging support from:
- Conference organizers
- Commonwealth Marine Economies (CME) programme, UK Government


https://theoceancleaner.wordpress.com/sargassum-problem/

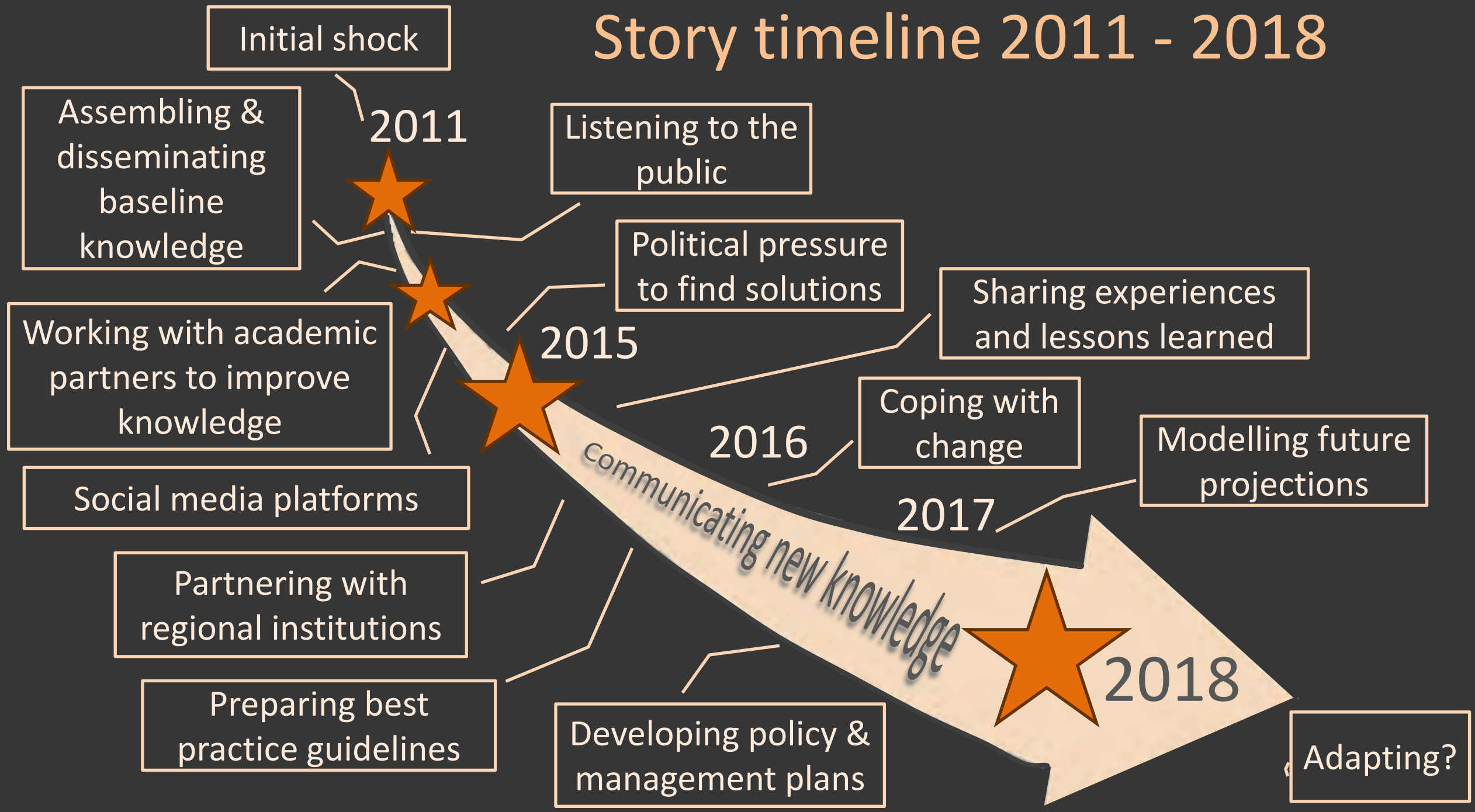

Above Barbados

# Sargassum

**The story facts:**

- 2011 mass influxes into the Caribbean a new phenomenon
- Immense challenges for fishing and tourism sectors
- Lack of prior relevant policy (no one to take responsibility)
- Lack of knowledge led to fear, misinformation and mistakes
- Lack of funding a huge constraint

# Story timeline 2011 - 2018



# Baseline knowledge

## Dispelling myths

- Unique free-floating non-toxic brown seaweed
- Only found in the Atlantic
- Propagate asexually and capable of fast growth
- Can form large floating mats or long windrows of weed
- Can accumulate over huge areas of open ocean (Sargasso Sea)
- Has variable biomass over space and time (seasonal and annual)



Amy Cox


Ned Deloach


Hazel Oxenford

# Sargassum is good

## Open Ocean

- High ecological significance
- Supports ocean food webs
- Supports high biodiversity including endemic species
- Nursery for endangered sea turtles
- Spawning substrate
- Increases ocean productivity




# Sargassum is good

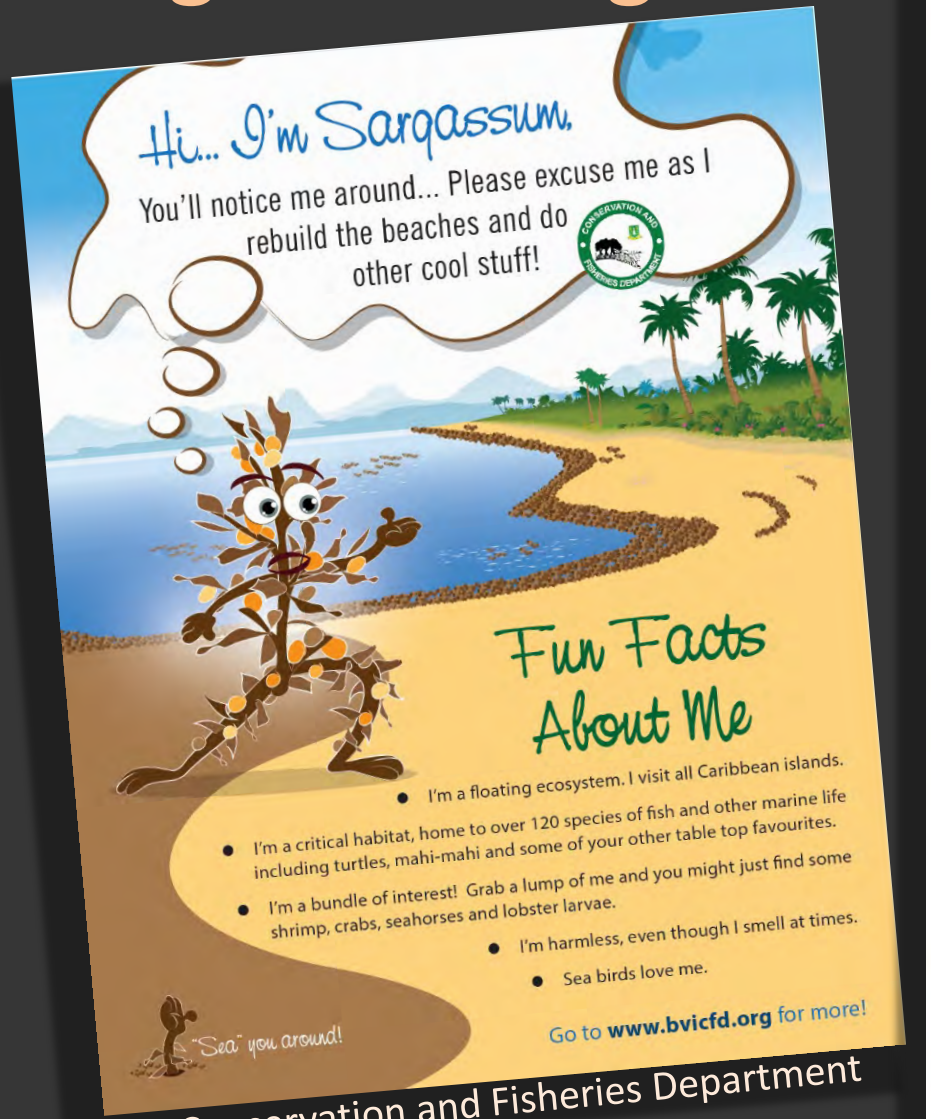
## Nearshore / onshore

- Shelter and camouflage
- Provides extra forage
- Forage for shore birds
- Shelter and extra forage
- Binds sand and dunes
- Fertilizes shore plants



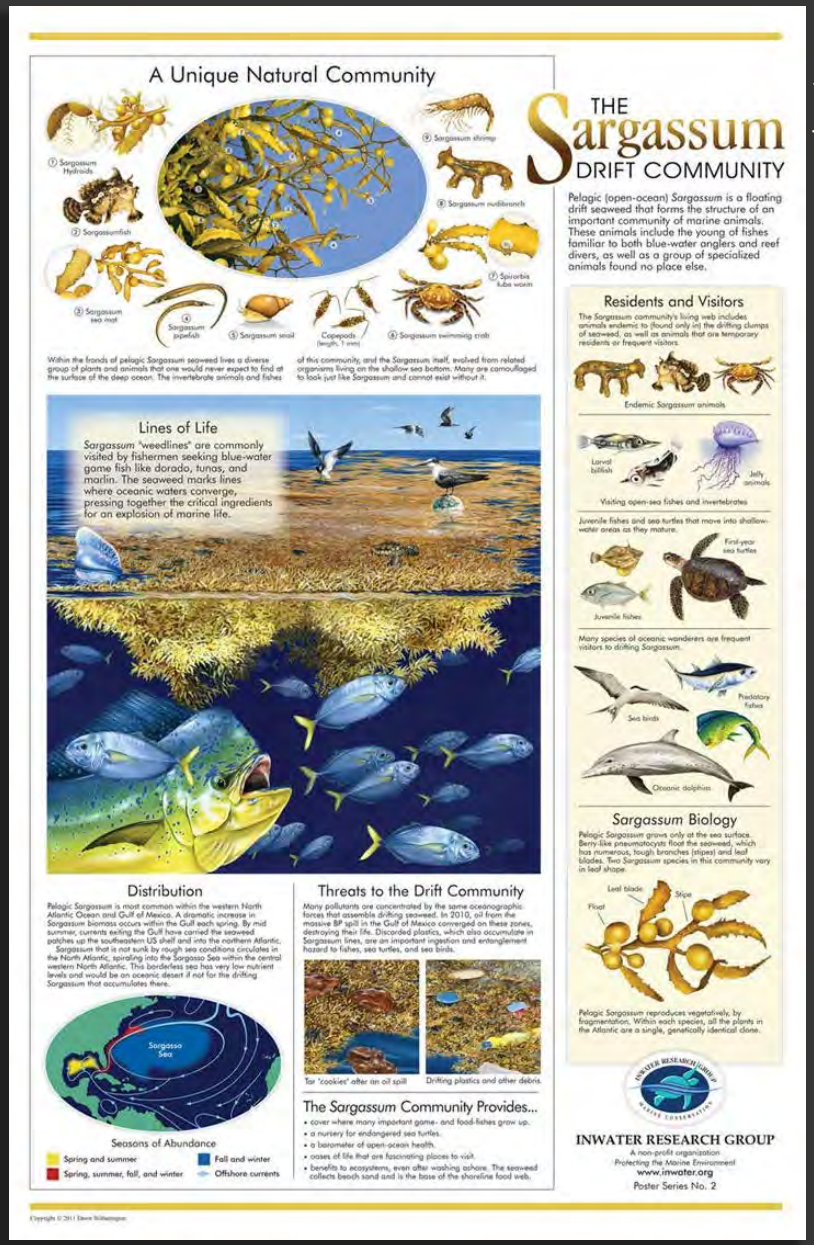
# Assembling & disseminating baseline knowledge

## Sargassum is good



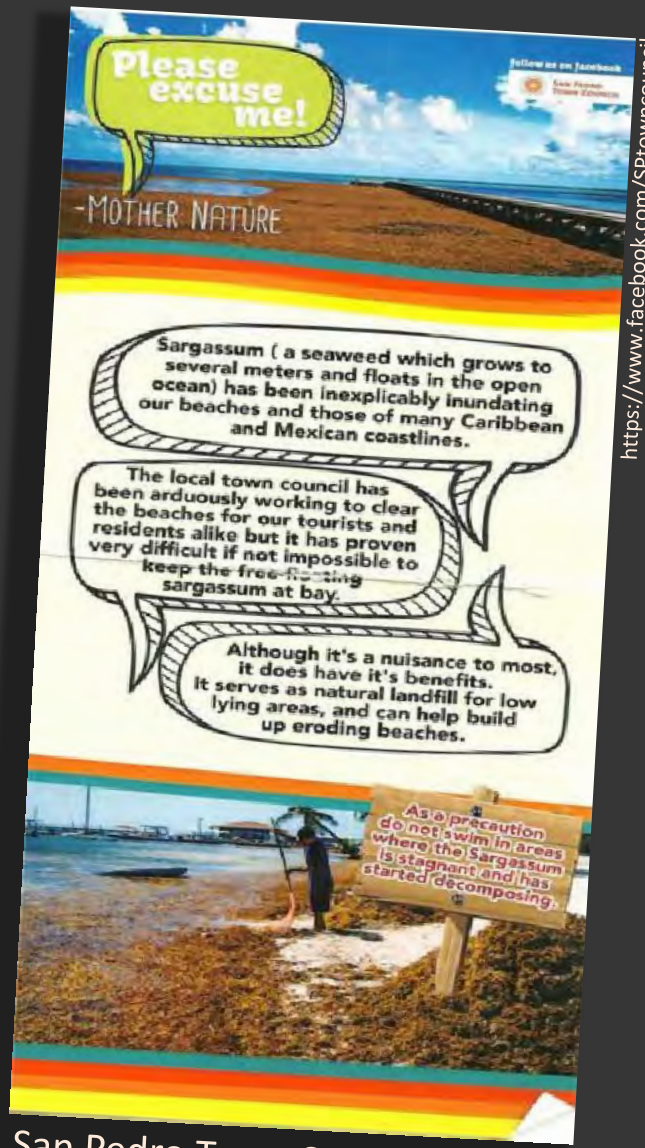

BVI Conservation and Fisheries Department

2011




www.inwater.org

Inwater Research Group




https://www.facebook.com/SPtowncouncil

San Pedro Town Council, Belize

2015

# Sargassum is good


NationNews

'Make use of seaweed'

rhondathompson, rhondathompson@nationnews.com
Added 03 September 2011

BARBADIANS are being urged to make use of the sargass
seaweed currently washing up around the island rather th
simply dismissing it out of hand.


NationNews

Mulch to gain from sargassum

Carlos Atwell,
Added 17 September 2011

Ocean surf local organic mulch is on its way to becoming a household name, at least to those in agriculture. The mulch, made from the sargassum seaweed washing up on Barbados' shores, is the creation of 82-year-old Cavendish Atwell

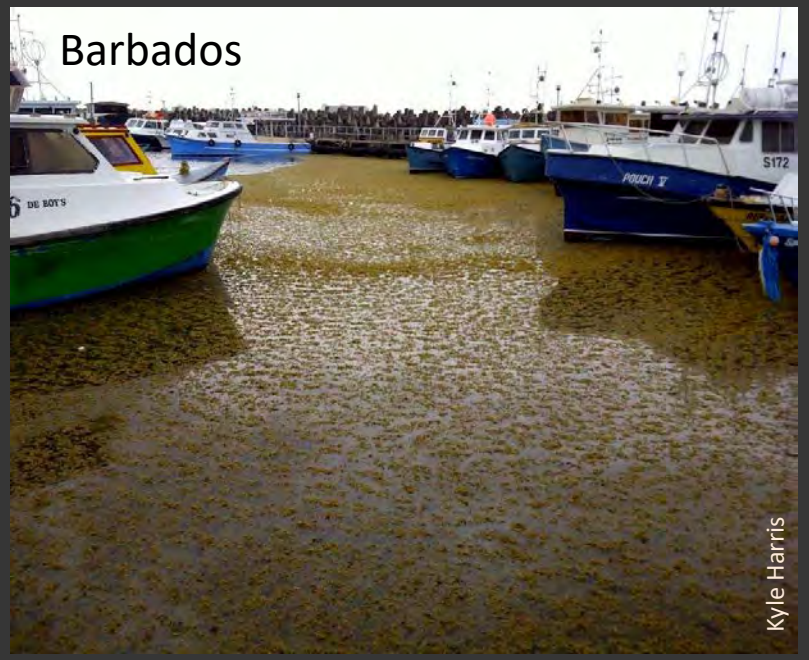
2011

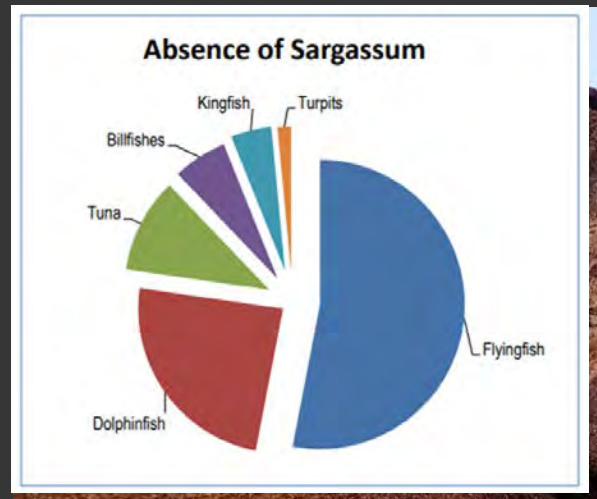
## Product development

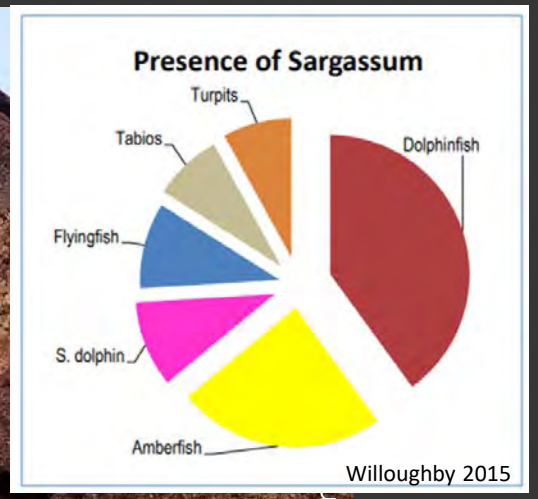
- Early interest in agricultural use
- Extracts for use in personal care products
- Sustainable fuel (biogas)
- Major constraint was uncertain supply

# Listening to the public and gathering data

## .....but new evidence said otherwise!





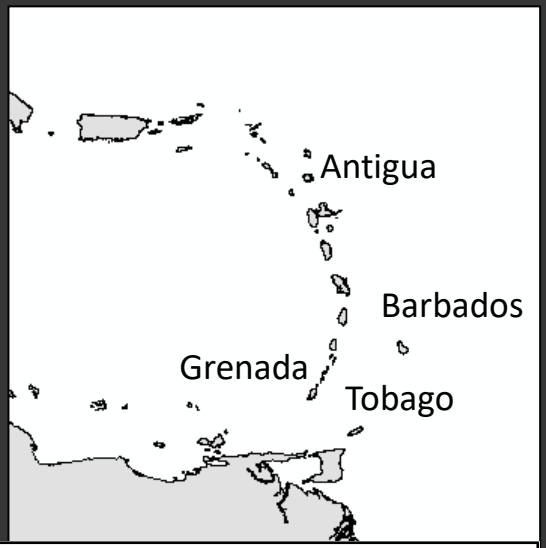
## Huge challenge for fishers and managers



# .....but new evidence said otherwise!


High-end resorts took the brunt of the sargassum influxes

**Hoteliers suffering**




# .....but new evidence said otherwise!



## Hoteliers suffering

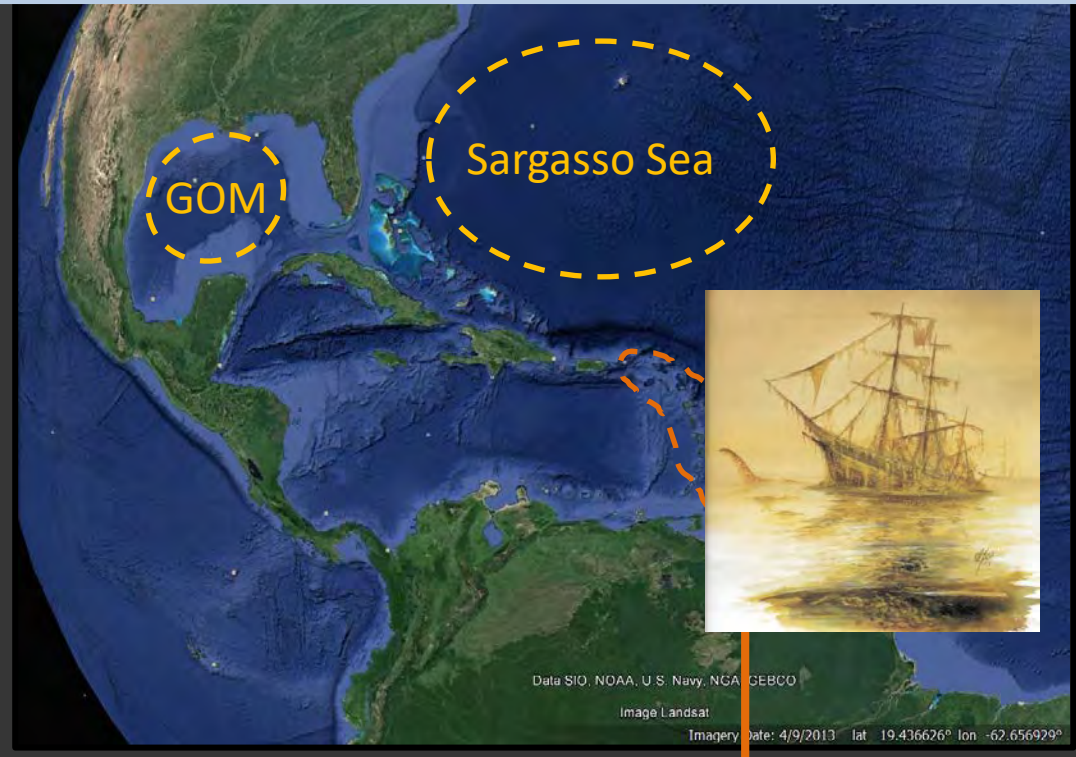
Many mistakes with heavy equipment

tripadvisor

# …. and the questions changed

- **Where is it coming from?**
- **Why?**
- Best known in Sargasso Sea
- Also in the Gulf of Mexico (GOM)
- Now mass influxes in the Caribbean
- Then a reprieve ……

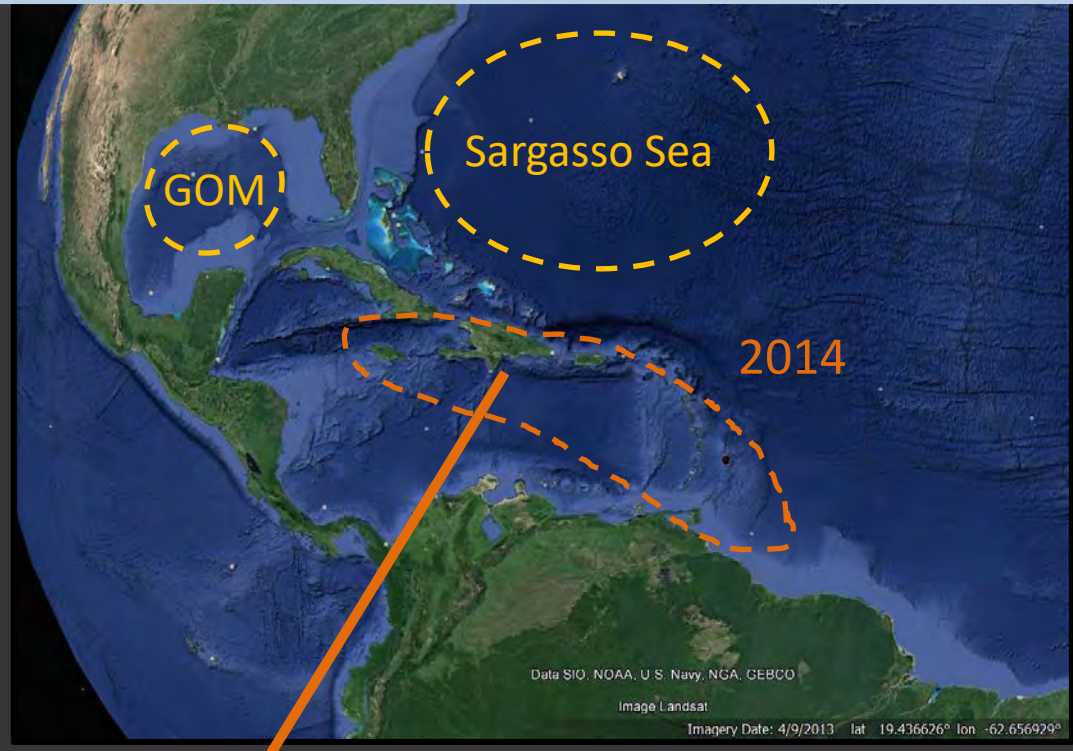
- **Will it happen again?**




Lesser Antilles

# …. and the answers changed

- **Yes it did happen again!**
- Reprieve lasted until 2014

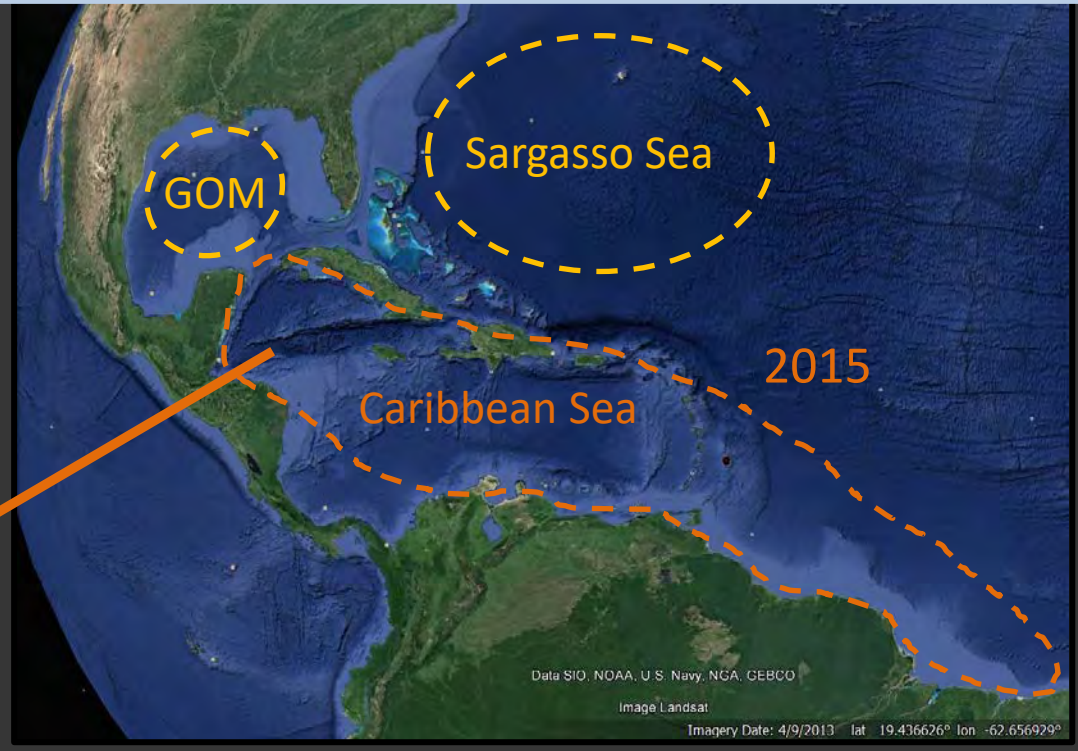



Greater Antilles


Lesser Antilles

# …. and sargassum kept coming!

- Increasing geographic scope increased the communication challenge




Central & South America



Greater Antilles


Lesser Antilles

# …. spreading far and wide

- Affecting West Africa from Senegal to Nigeria
- Almost no communication

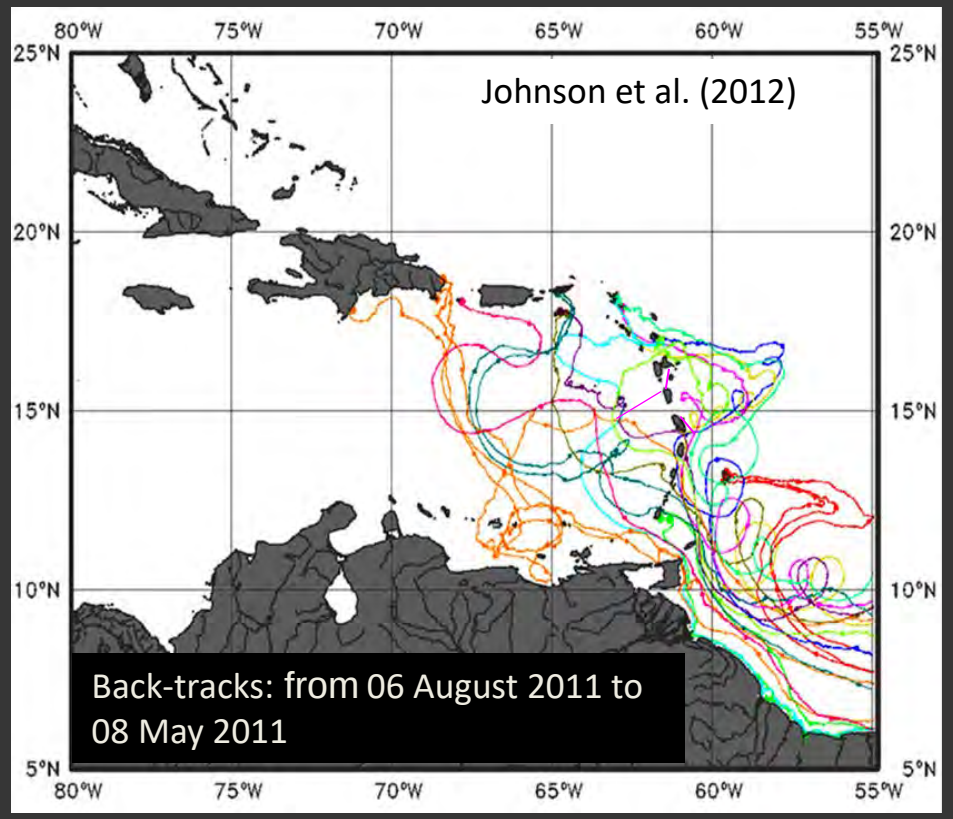




# Where was it coming from?

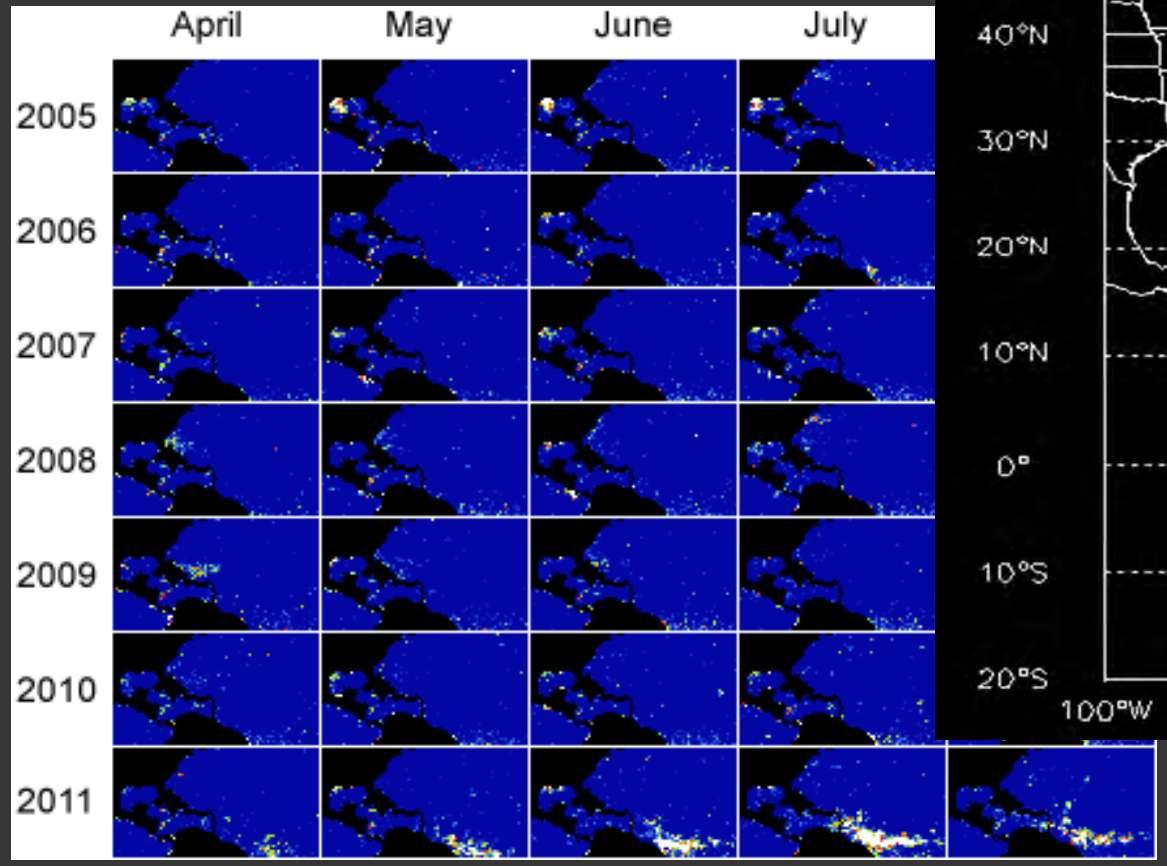
- Landing dates
- Archived surface currents
- Backtrack to source


- Coming into region from SE
- Not from Sargasso Sea or the GOM



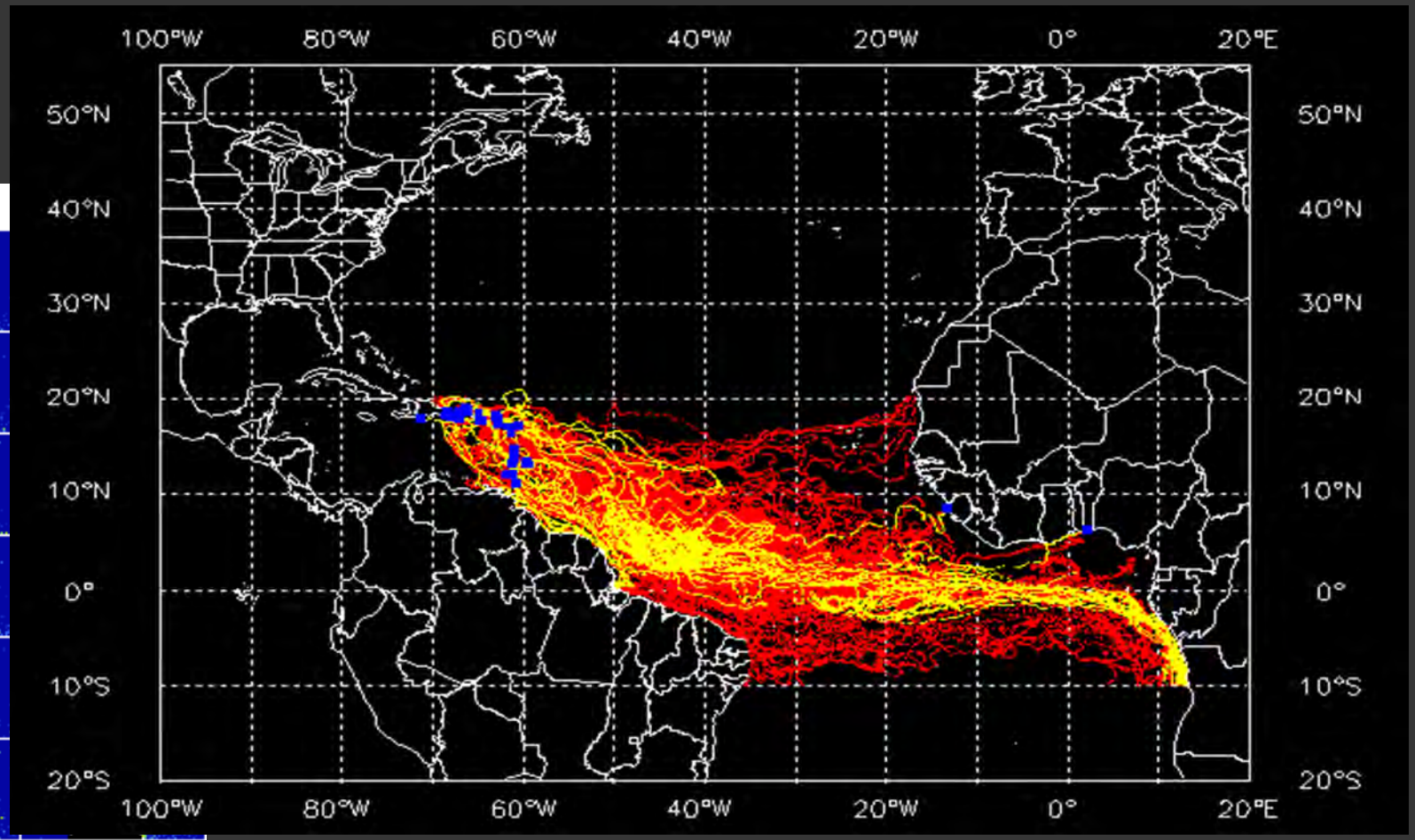
# Where was it coming from?

## Archived satellite imagery




Gower et al (2013)

## 1 yr back-traces from 2011 landing dates




Franks et al. (2014)

## Equatorial region

# Where was it coming from?

Alternative hypotheses were also being released

- Suggesting a Sargasso Sea source and a series of cold fronts
- Conflicting stories complicated communication


Hill et al. 2016

# Meanwhile the problem got worse!

2015

**Socio-economic disaster**

- Disruption of livelihoods
- Impacts to human health
- Damage to property


Trinidad & Tobago Guardian Online


http://observers.france24.com/


Brian LaPointe


http://theoceancleaner.org/sargassum-problem/


http://www.outremersbeyou.com/sargasse-photos-instagram/

# … and worse!

## 2015 National and International media reports

NationNews

Added 25 April 2015

**Sargassum seaweed no threat to humans**

THE C
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poses

ST. LUCIA NEWS ONLINE

**By Caribbean 360** October 19, 2015

CARIBBEAN: Sargassum now affecting tourism, fishing, marine life on both sides of the Atlantic

Sierra Leone's white sand beaches may not be as famous as those of the Caribbean, but their hitherto unspoilt beauty had until quite recently exerted a magnetic attraction on locals and tourists alike.

Newsweek U.S.

Sar

Page 4 BARBADOS TODAY Wednesday, August 12, 2015



Hazel Oxenford, a professor of Marine Ecology and Fisheries.

**Bad press**

INTERNATIONAL MEDIA CHASTISED OVER SARGUSSUM COVERAGE

A leading professor attached to the Centre for Resource Management and Environmental Studies at the University of the West Indies (UWI) Cave Hill Campus has said that Barbados has not been left out to sea as the island grapples with the barrage of Sargassum seaweed on beaches lining the north, south-east and east coasts.

Hazel Oxenford, a professor of Marine Ecology and Fisheries, has chastised international media for what she called "unfair" coverage of the phenomenon, which she stressed, was not new or exclusive to Barbados or its Caribbean neighbours.

"It's very unfair press, it's unfortunate, but we have got better things to focus on like how we are going to tackle it," she told **Barbados TODAY** in an interview.

American, British and Canadian media have been cautioning travellers not to expect the usual pristine, white beaches in the Caribbean, which they reported were being overtaken by foul banks of the decaying Sargassum.

Professor Oxenford suggested that Barbados counter the negative publicity by simply turning the spotlight to the unaffected west coast.

"We need to focus more on the west coast where much of the primary tourist plant is. The west coast is fine. It's only a portion of the island that's affected and the most heavily affected part of the



Seaweed blankets the beach in Cancun, Mexico. The huge influx of sargassum has hit most of the Caribbean this year and prompted cancellations from tourists. Photograph: Israel Leal/AP

Mail Online

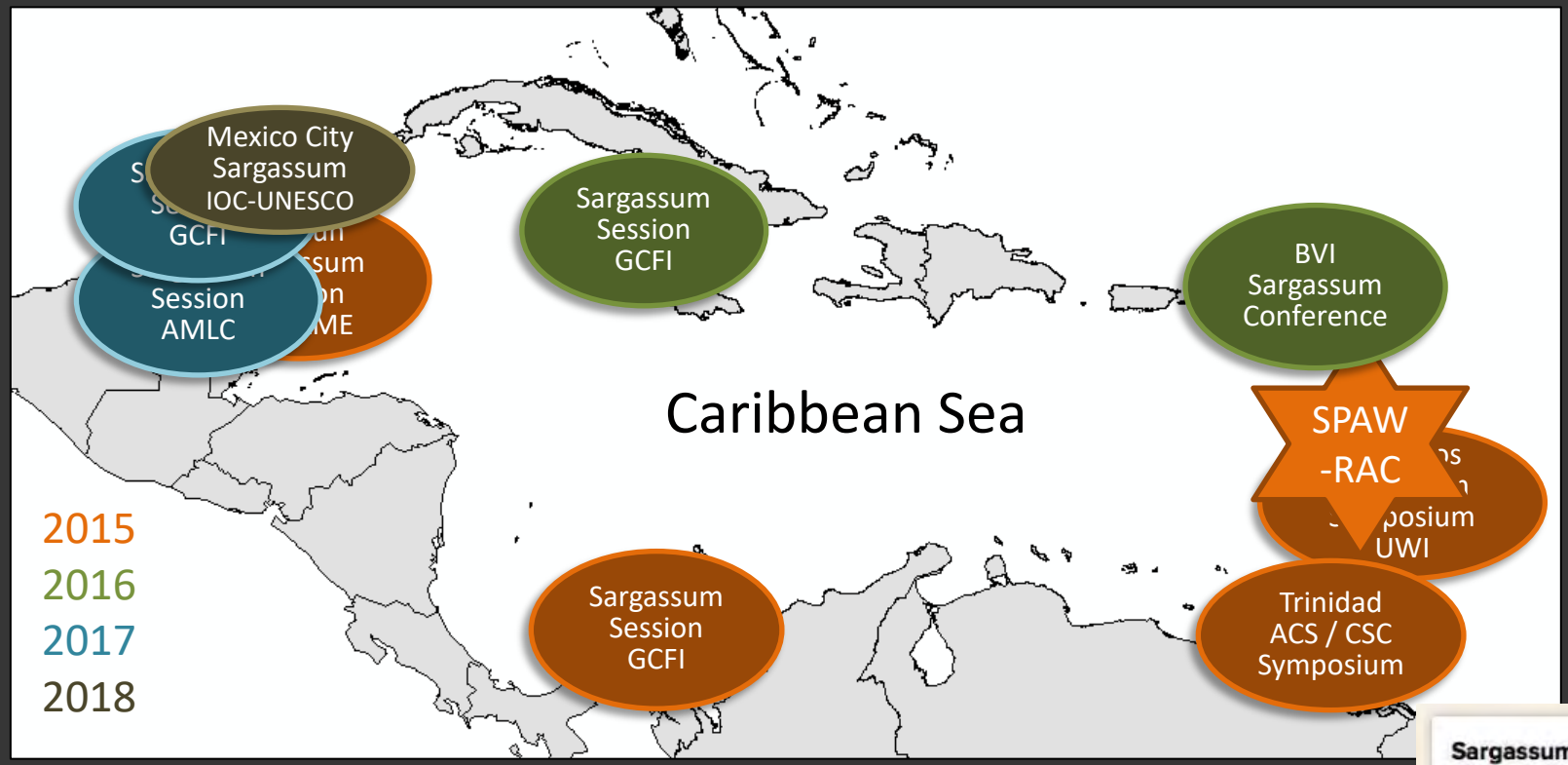
By Dailymail.com and Associated Press

**PUBLISHED:** 05:30 BST, 18 October 2015

that
gs
beaches

- Threatening tourism
- Huge economic implications

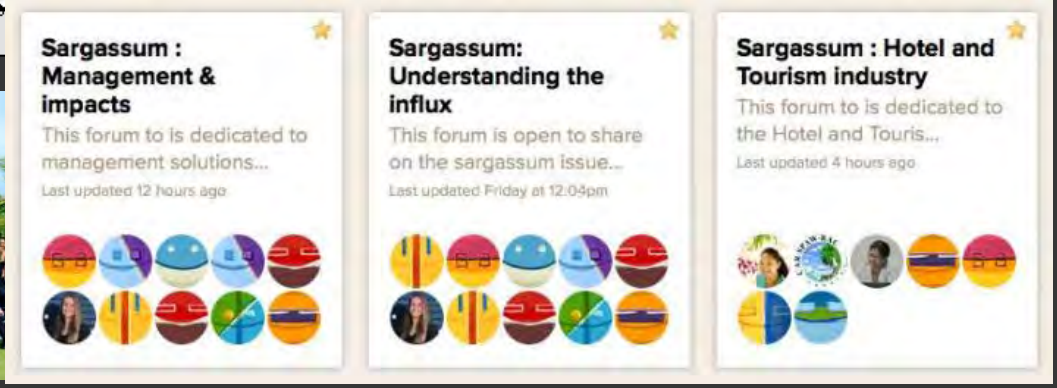
# 2015 Regional partnerships and networks




## Coordinating Responses

- Regional symposia
- Regional network
- Partnering with regional institutions
  - UWI, USM, USF, French IRD
  - GCFI, CRFM, UNEP-CEP, ACS-CSC, FAO
  - CTO, CAST, CHTA



# …. and the ecological damage unfolded



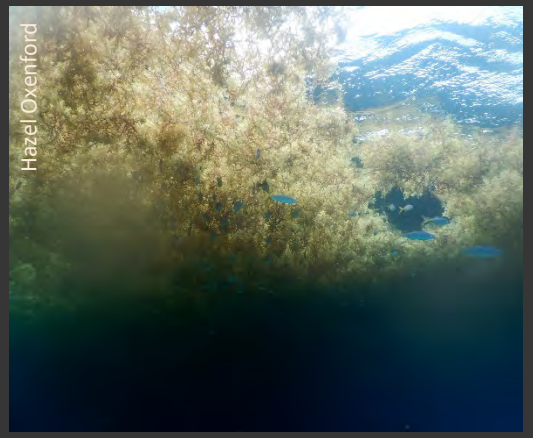

## Ecological disaster

- Inundating shorelines
- Smothering seagrass beds
- Choking mangroves
- Drowning sea turtles

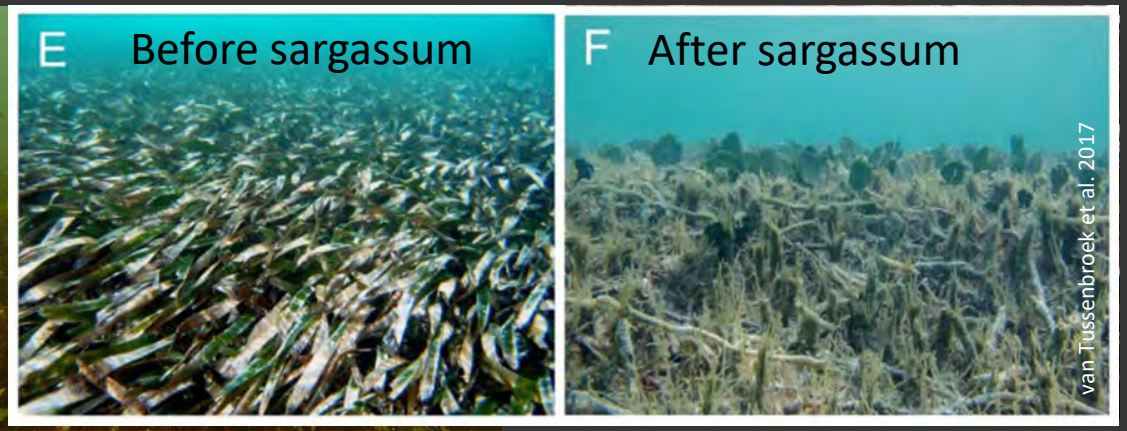

# …. and the ecological damage unfolded


## Ecological disaster

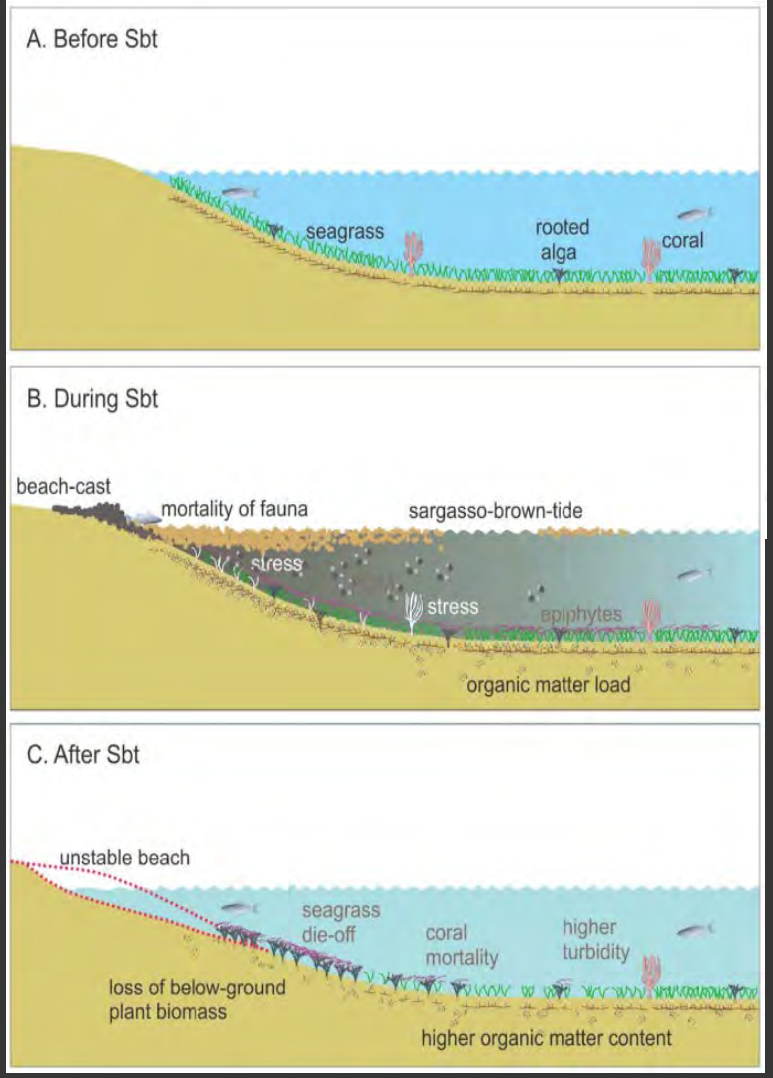
- Shading, low $O_2$
- High nutrient loads
- $H_2S$ gas, $O_2$ depletion
- Fish kills
- Long-term damage to critical ecosystems








## Mexican Caribbean coastline




van Tussenbroek et al. 2017

# Key messages needed to change – a focus on coping


**2014 - 2015**

## Fact Sheets

- Acknowledging the problem
- New source of sargassum
- Causes and consequences
- First tips on how to cope
  - CRFM, GCFI, DEAL, CAST, UNEP-CEP
  - Focused on different stakeholders (Fishers, natural resource managers, hoteliers)

# Key messages needed to change - sector specific

## Best practice guides

- Focused on coping

CERMES UWI · SPAW-RAC · GCFI

**Sargassum Management Brief**

Golden Tides: Management Best Practices for Influxes of Sargassum in the Caribbean with a focus on clean-up

**Catrina Hinds[1], Hazel Oxenford[1], Janice Cumberbatch[1], Frédérique Fardin[2], Emma Doyle[3], Adrian Cashman[1]**

2016

[1] Centre for Resource Management and Environmental Management (CERMES), University of the West Indies, Cave Hill Campus, Barbados
[2] Regional Activity Centre for Specially Protected Area and Wildlife (SPAW-RAC), Parc National de la Guadeloupe, 97120 Saint Claude, Guadeloupe
[3] Gulf and Caribbean Fisheries Institute, PO Box 21655 Charleston SC 29413, USA

The purpose of this management brief is to enable government officials, coastal managers, beach caretakers and coastal residents to get ahead of the "*golden tides*" by providing up-to-date information on the recent 'sargassum influxes' (arrival of unprecedented mass quantities of sargassum seaweed) in the Caribbean region; and, importantly, by offering guidance on how best to *sustainably* manage the seaweed, based on lessons learnt to date. This first brief focuses on the immediate problem of clean-up, after mass strandings of the weed. Others will be developed that focus on potential commercial uses of the weed and on adaptation measures suitable for fishers and other vessel operators. This is all part of the on-going efforts by The University of the West Indies and a number of other institutions in the Wider Caribbean to actively research and understand this new phenomenon and develop solutions.



Mass stranding of sargassum on beach at Bathsheba, Barbados.
***Source:*** H. Oxenford, 2015

Clean-up


| SECTORS IMPACTED |
|---|
| Fisheries |
| Tourism |
| Coastal zone management |
| Biodiversity / habitats |
| Vessel transit |
| Public health ($H_2S$) |
| Livability of human settlements |
| Urban stormwater / drainage |
| Emergency response |
| Energy production |
| Desalination |
| Property values |

Doyle & Franks 2016

**2016 - 2018**

# Why is it happening?

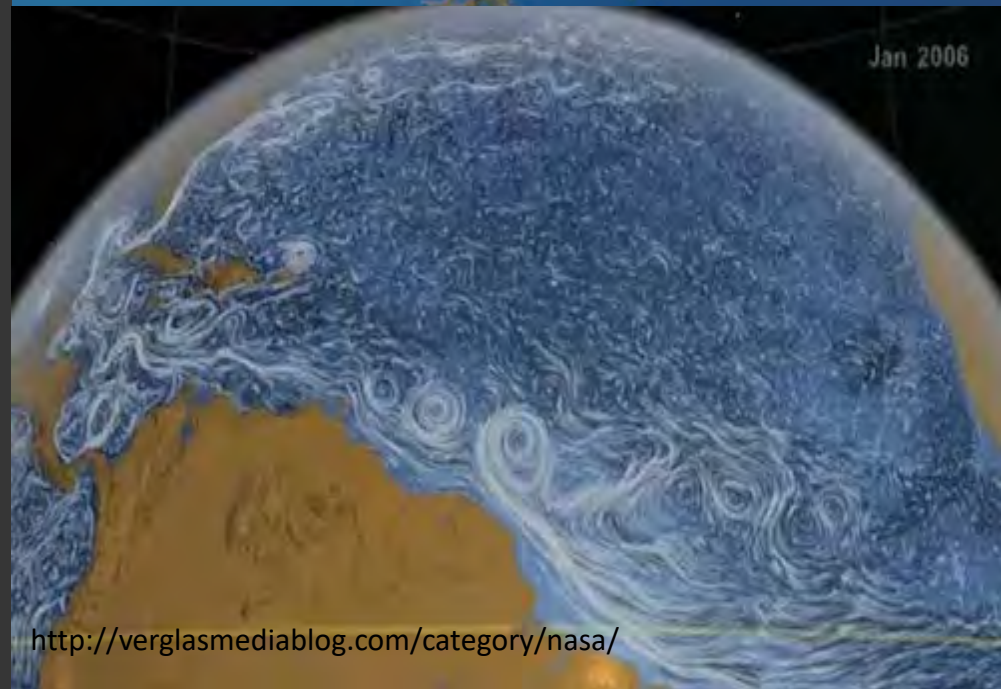
## Drivers and their long-term trends

### Nutrients
- Where are they coming from?

### Warm water
- Are water temperatures changing?

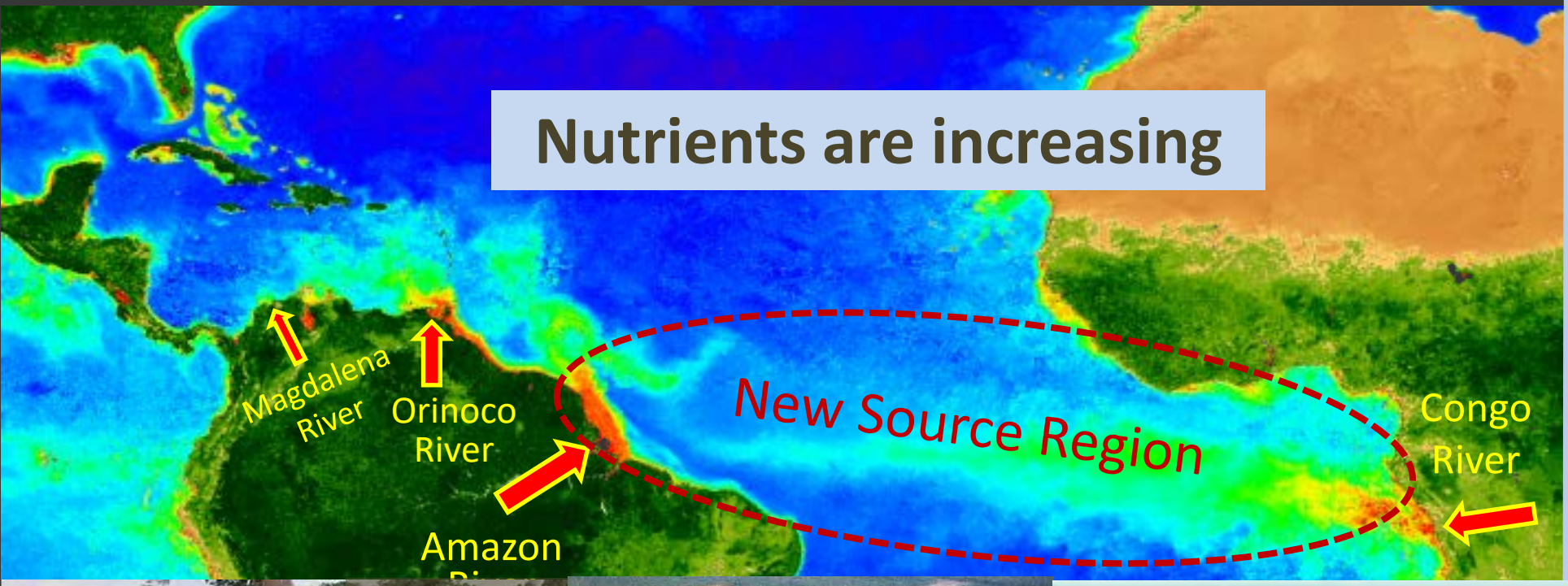
### Consolidation region
- Are recirculating currents changing?

### Release & transport
- How & when do currents ‘break away’?


http://verglasmediablog.com/category/nasa/

# Why is it happening?




## Sources of nutrients

- Some of the world's largest rivers drain into this equatorial region

**Ocean Eutrophication**




# Why is it happening?

## African dust plume

- Possible source of key nutrients
- Brings terrestrial nutrients, particularly iron

**Dust storms increasing?**

**Changing transport**

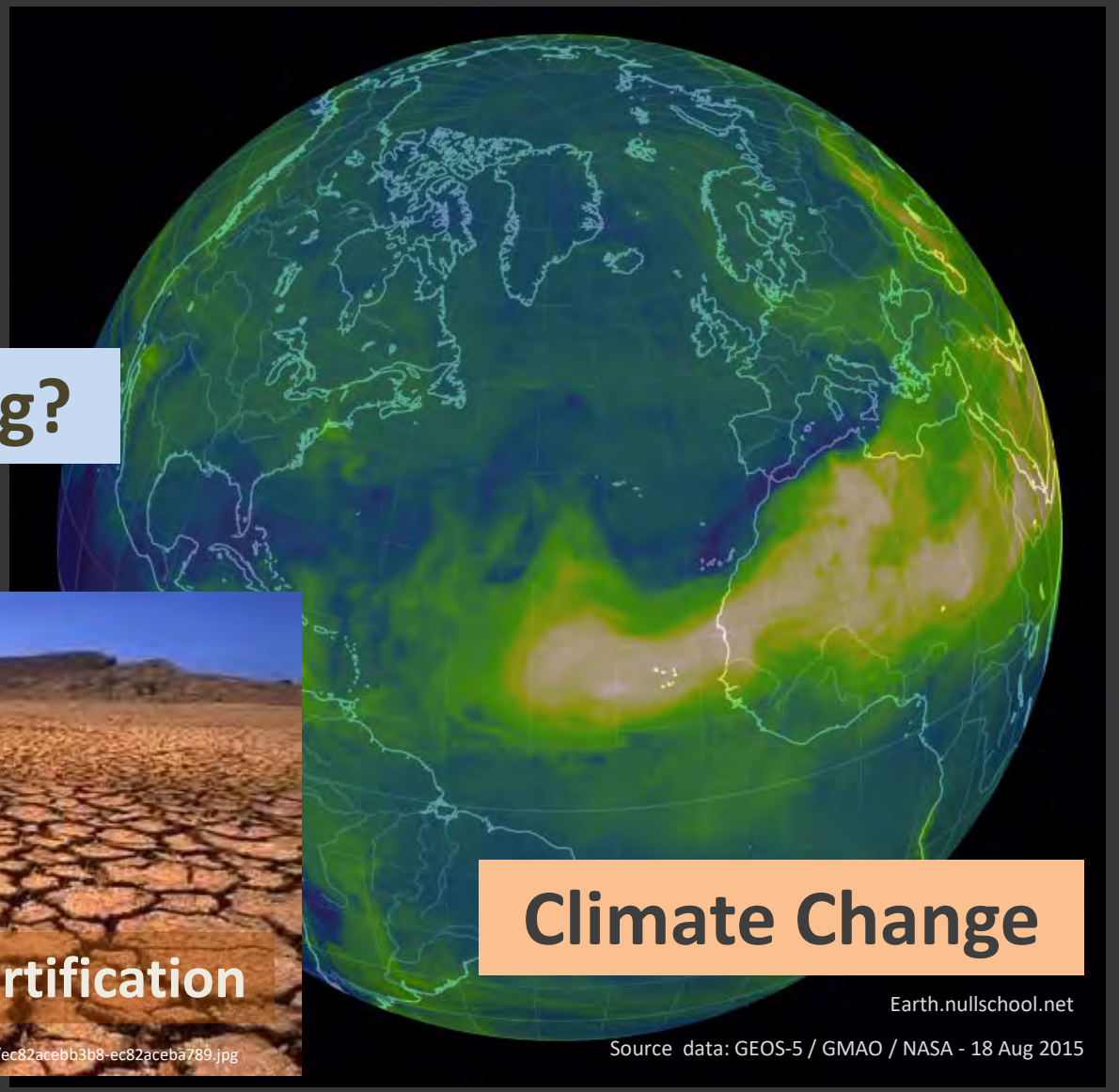
http://america.pink/camel-train_835468.html

http://www.desertegyptsafari.com/

**Desertification**

https://richardlstansfield.files.wordpress.com/2011/11/ec82acebb3b8-ec82aceba789.jpg

# Sources of nutrients



**Climate Change**

Earth.nullschool.net

Source data: GEOS-5 / GMAO / NASA - 18 Aug 2015

less more

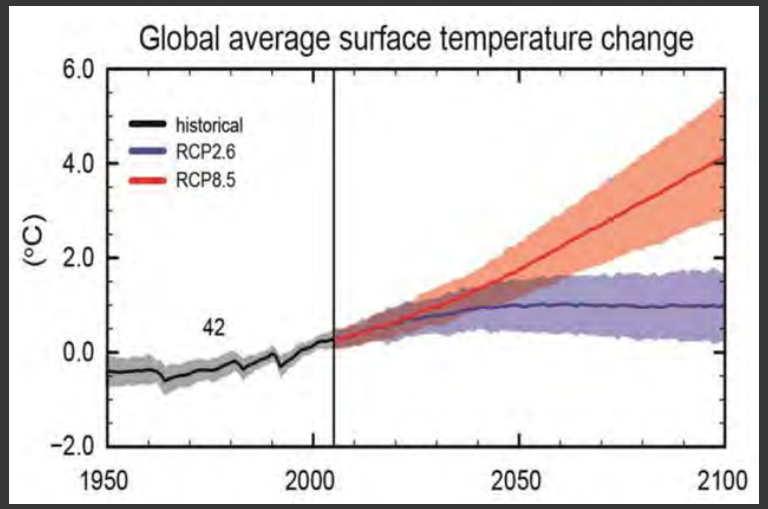
# Why is it happening?

## Growth rate affected by temperature

- Warmer water stimulates faster growth

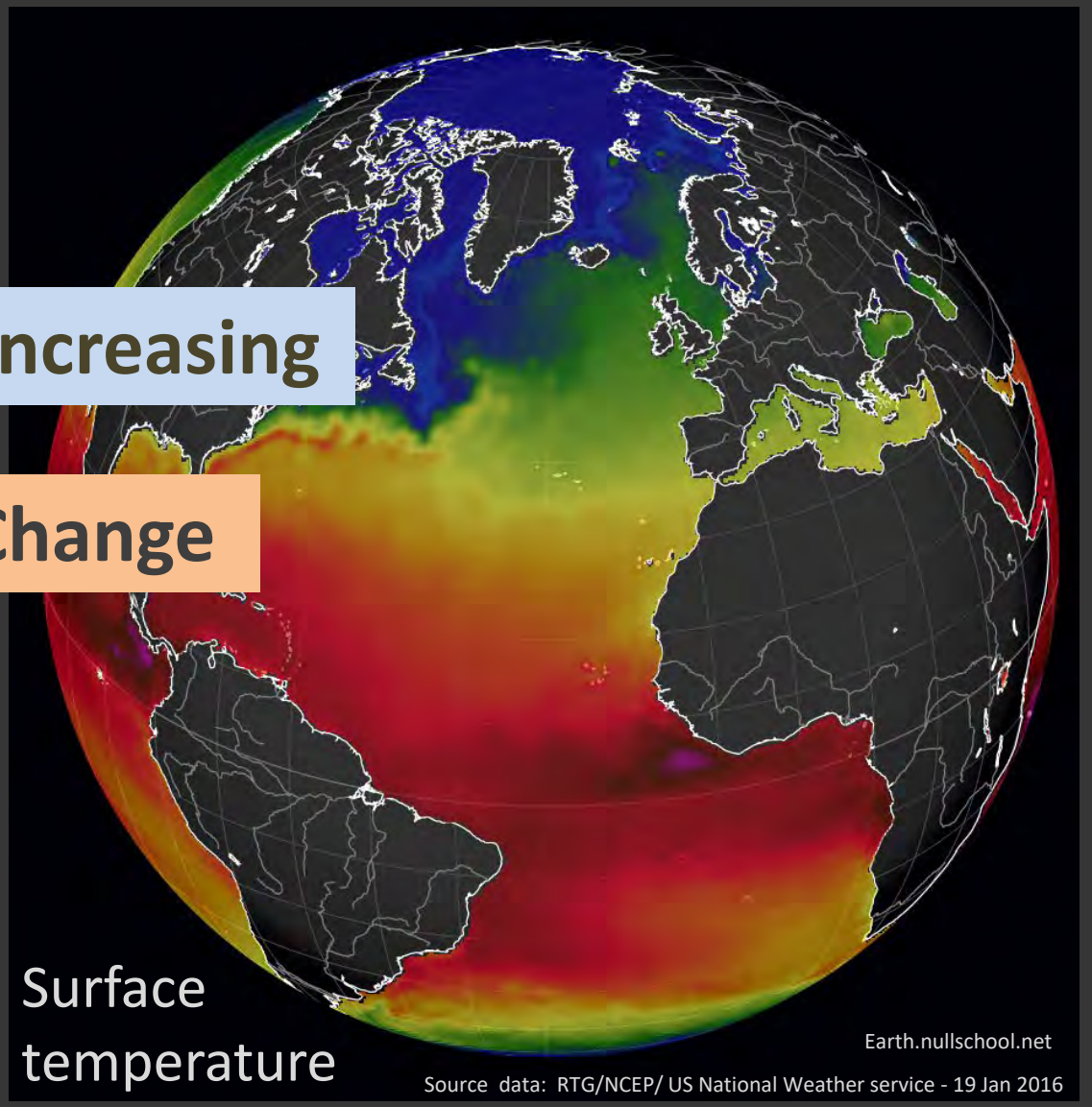
**Temperatures are increasing**

**Climate Change**




Latest IPCC predictions

## Surface temperature



# Why is it happening?

## Consolidation, release and transport affected by ocean currents

- Changes determine whether sargassum accumulates or is released

**Are these patterns changing?**

## Equator is an area of complex circulating currents

- Current patterns highly variable with season and from year to year

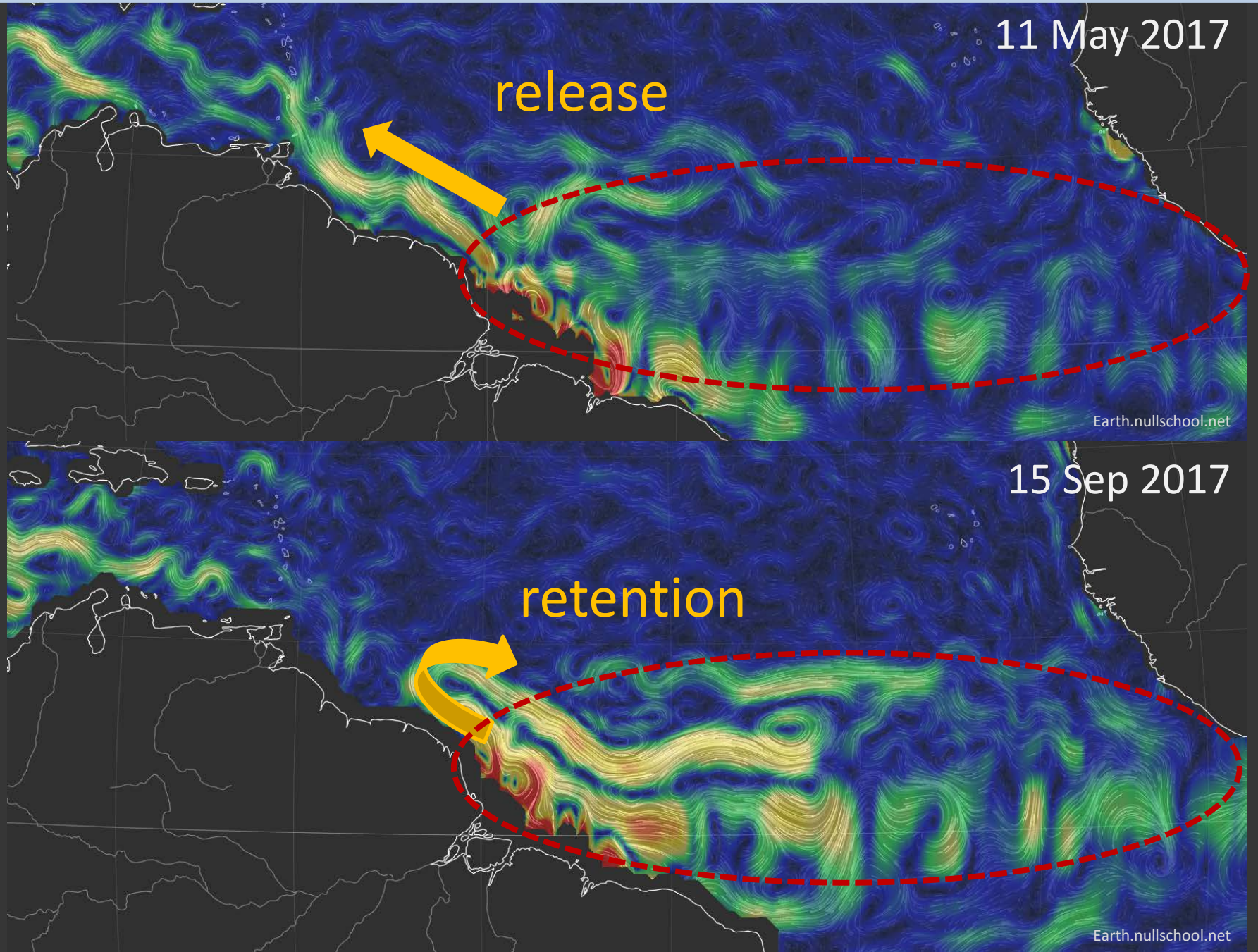
**Climate Change?**

## Ocean currents


http://www.bio.gc.ca/science/research-recherche/ocean/variability-variabilite/labrador/amoc-acmr-en.php

# Ocean currents

## Seasonal variation



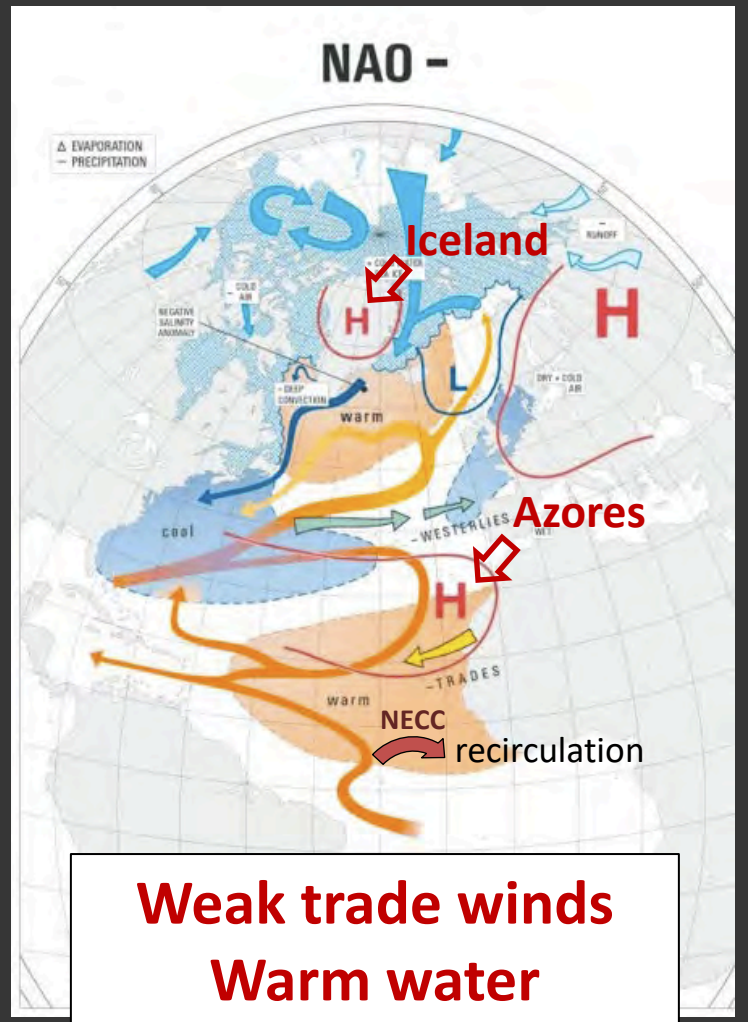

**Climate Change?**

# What drives annual changes?

## Ocean currents

Annual variation

**North Atlantic Oscillation Index (NAO)**




Open Source Systems, Science, solutions http://ossfoundation.us/

**Weak trade winds**
**Warm water**
**Strong recirculation**

# What drives annual changes?

## Ocean currents

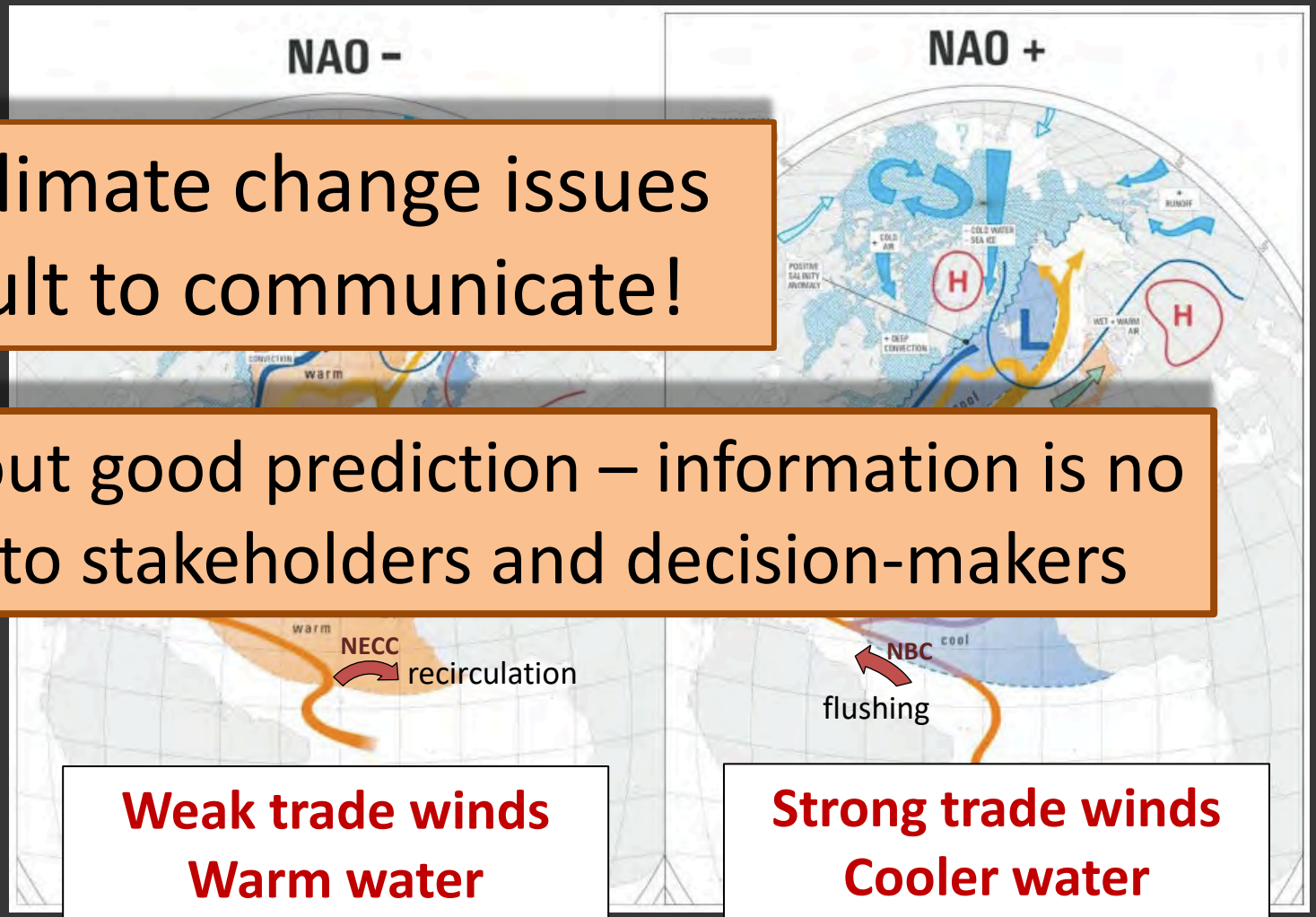
## Annual variation

**North Atlantic Oscillation Index (NAO)**

**Climate Change?**

Complex climate change issues very difficult to communicate!

Without good prediction – information is no value to stakeholders and decision-makers

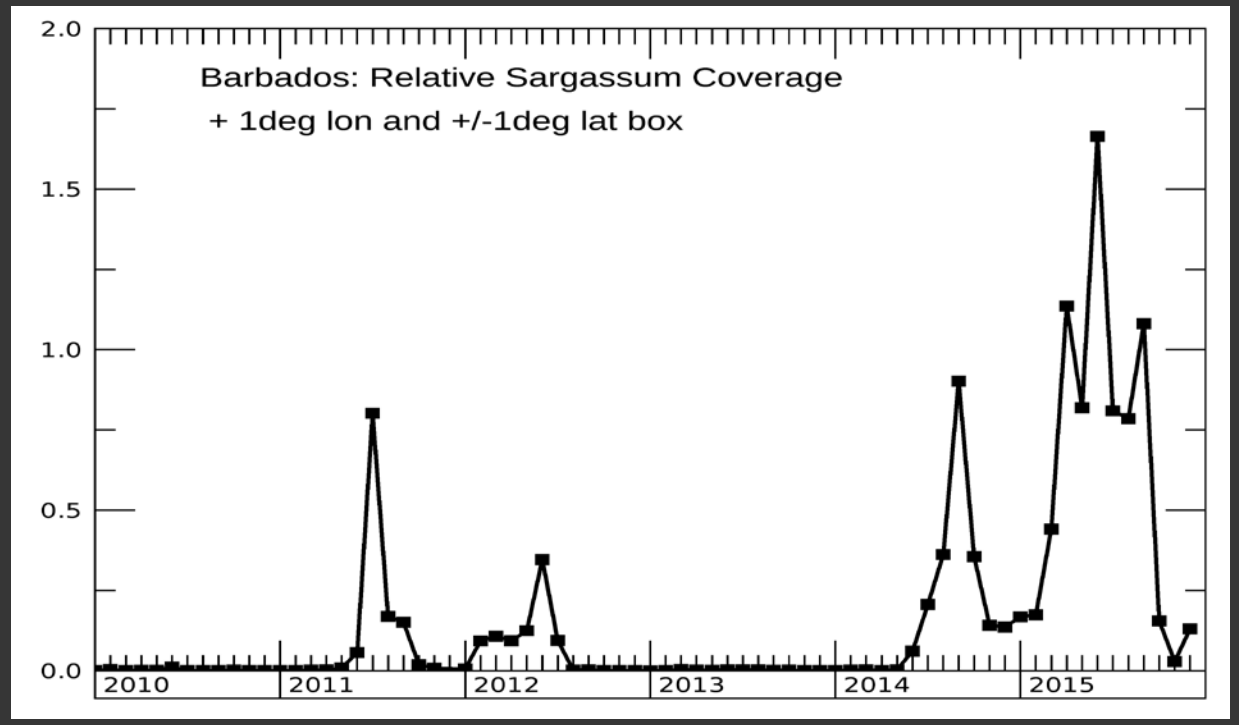



**Weak trade winds**
**Warm water**
**Strong recirculation**

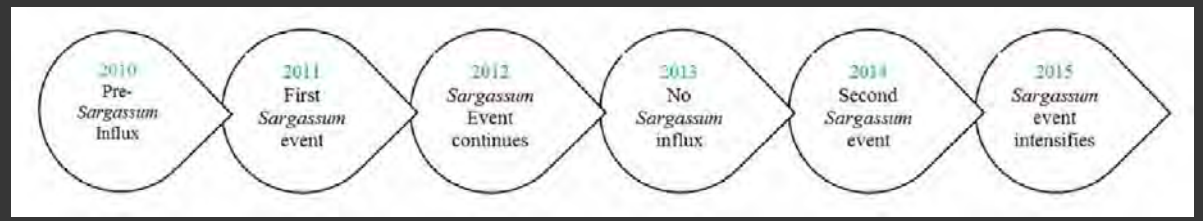
**Strong trade winds**
**Cooler water**
**Flushing of NERR**

# Prediction research

## Quantifying sargassum influxes

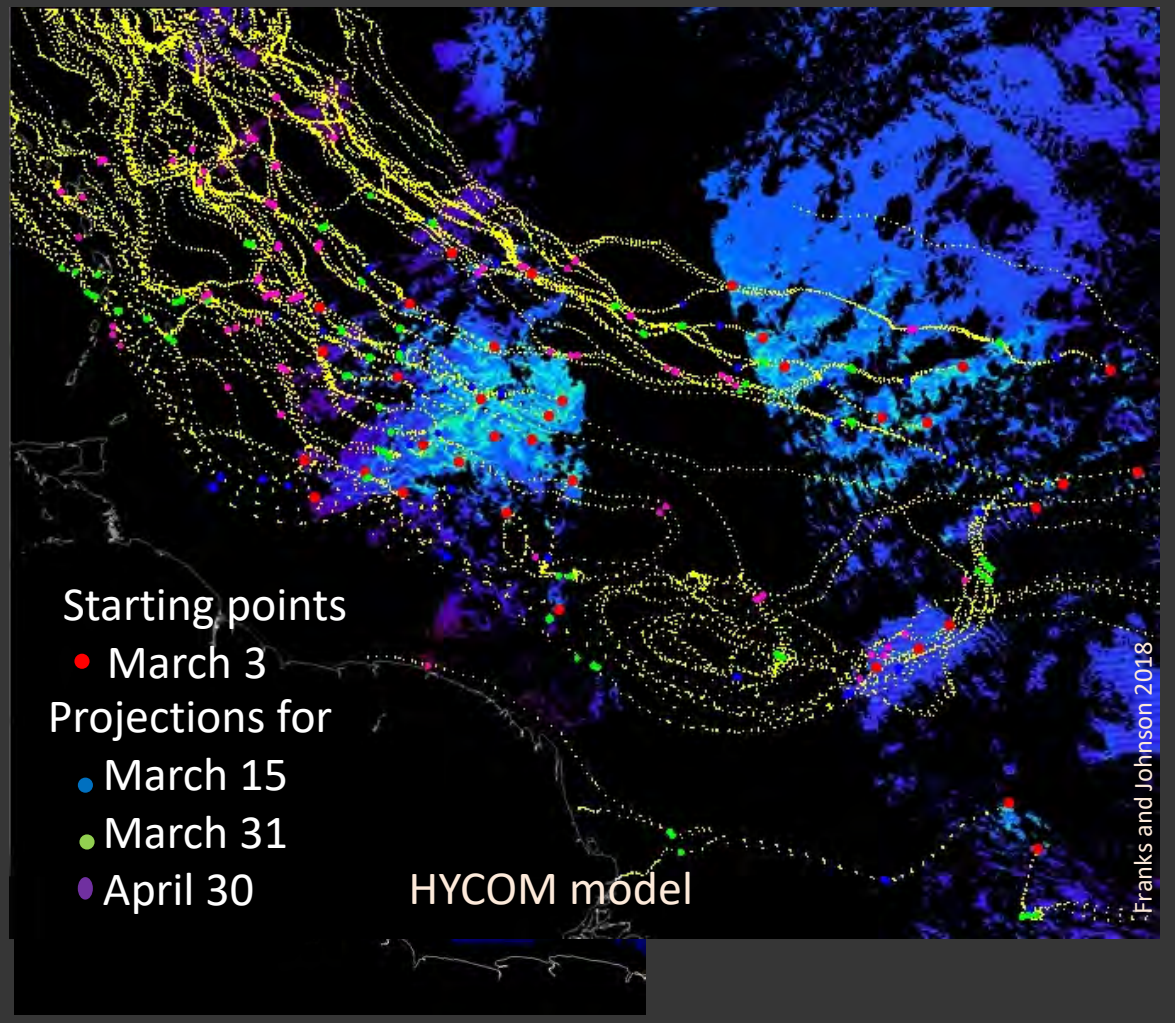



Timeline of sargassum events reported by fishers in Barbados




Ramlogan et al. (2017)

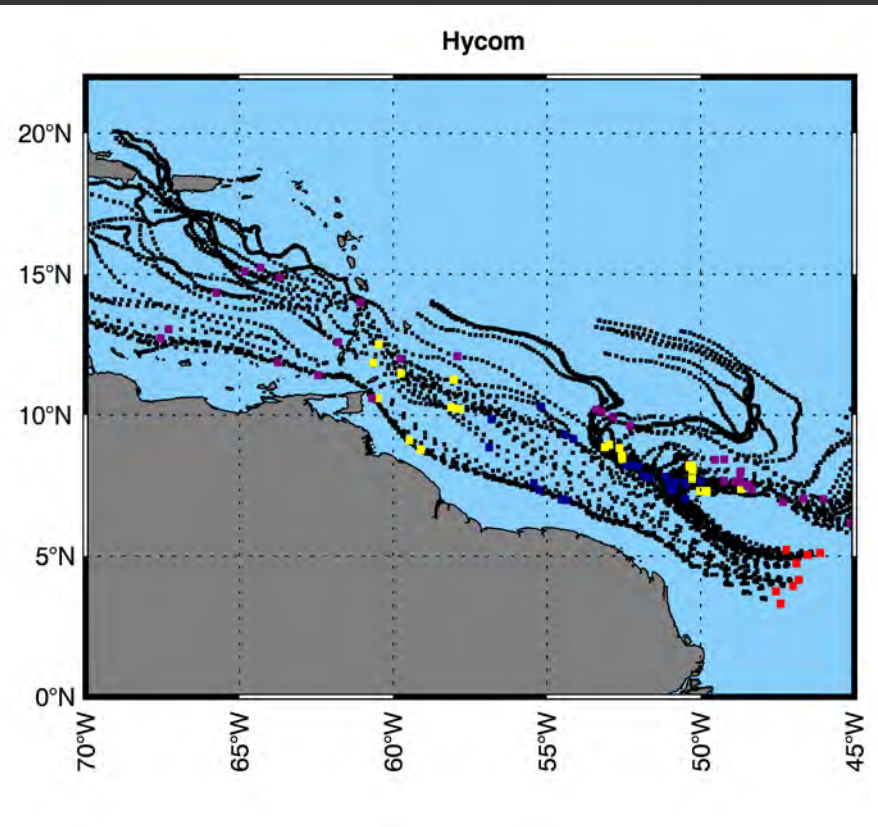
- Competition and collaboration
- Short-term and long-term

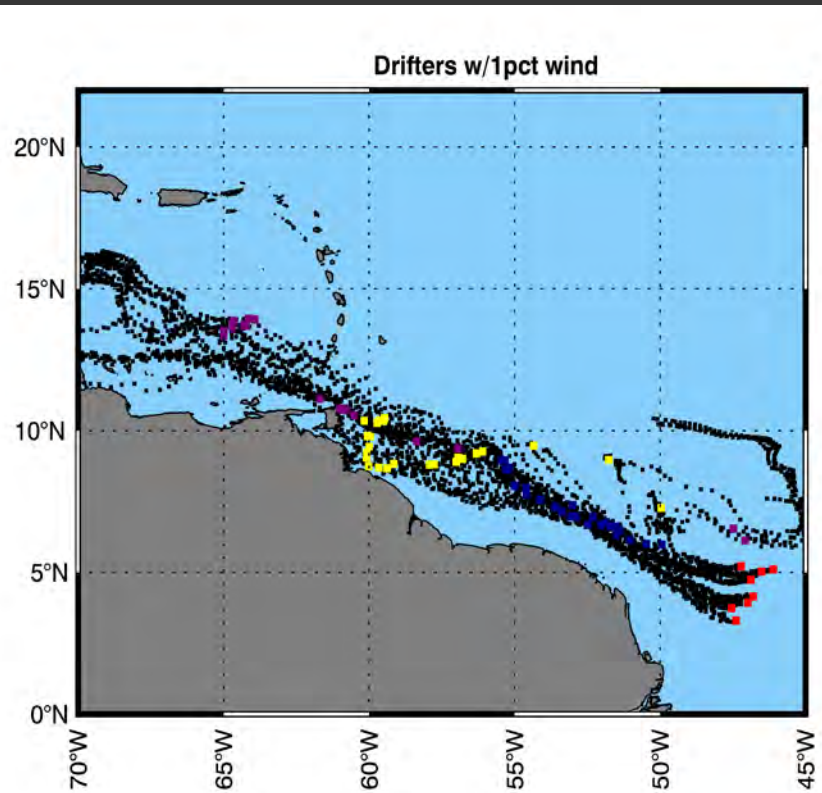


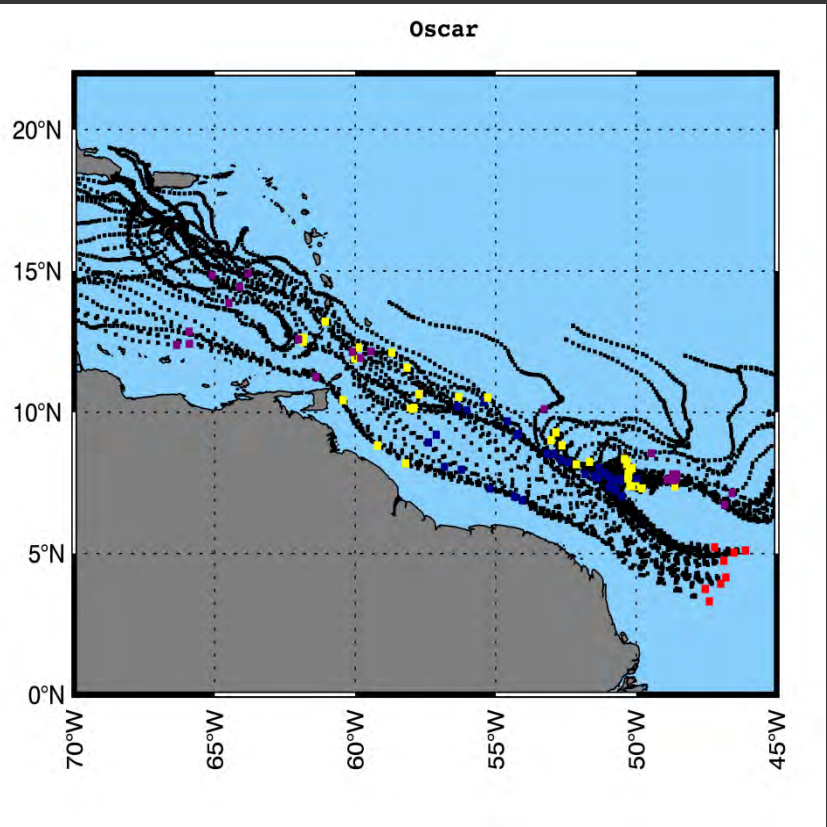
- Starting locations 25 April
- 31 May
- 30 June
- 30 July

# Monitoring and prediction research

## 3-month trials with climatology from different ocean current models



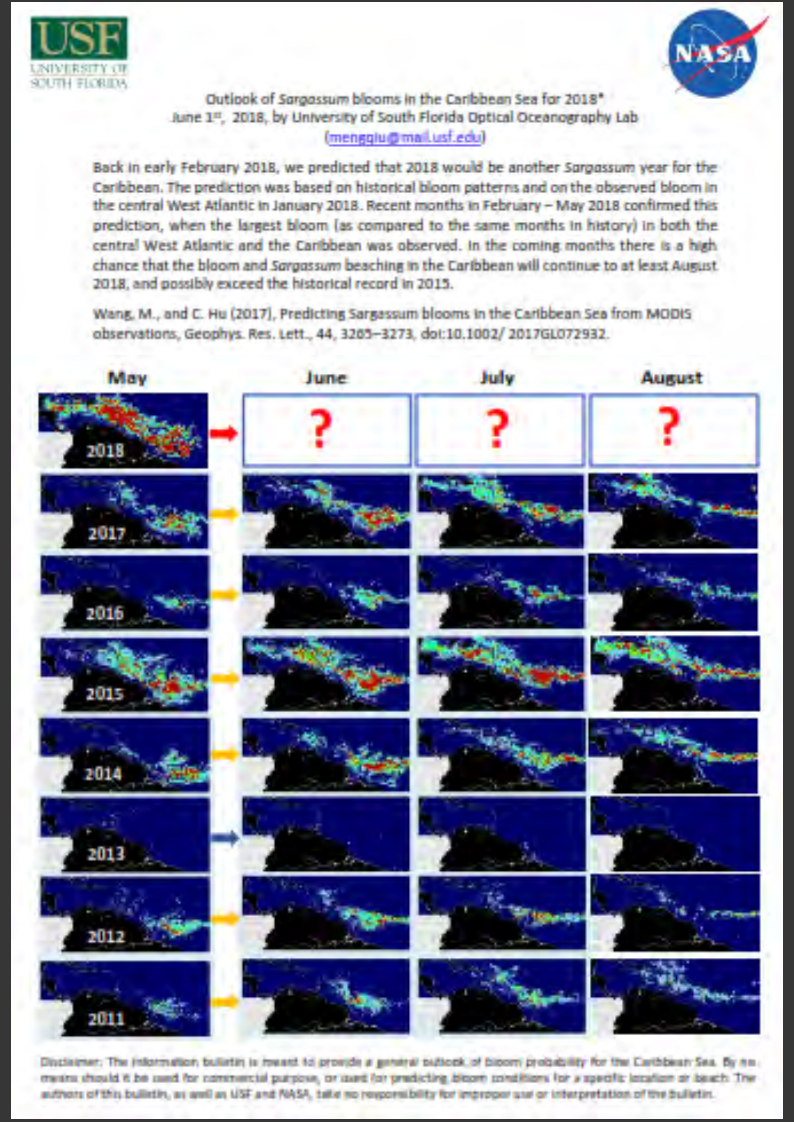




HYCOM DRIFTERS OSCAR

# Communicating monitoring and prediction research

## Preliminary Sargassum Outlook Bulletin

- How best to share this information?



USF UNIVERSITY OF SOUTH FLORIDA

NASA

Outlook of *Sargassum* blooms in the Caribbean Sea for 2018*
June 1st, 2018, by University of South Florida Optical Oceanography Lab
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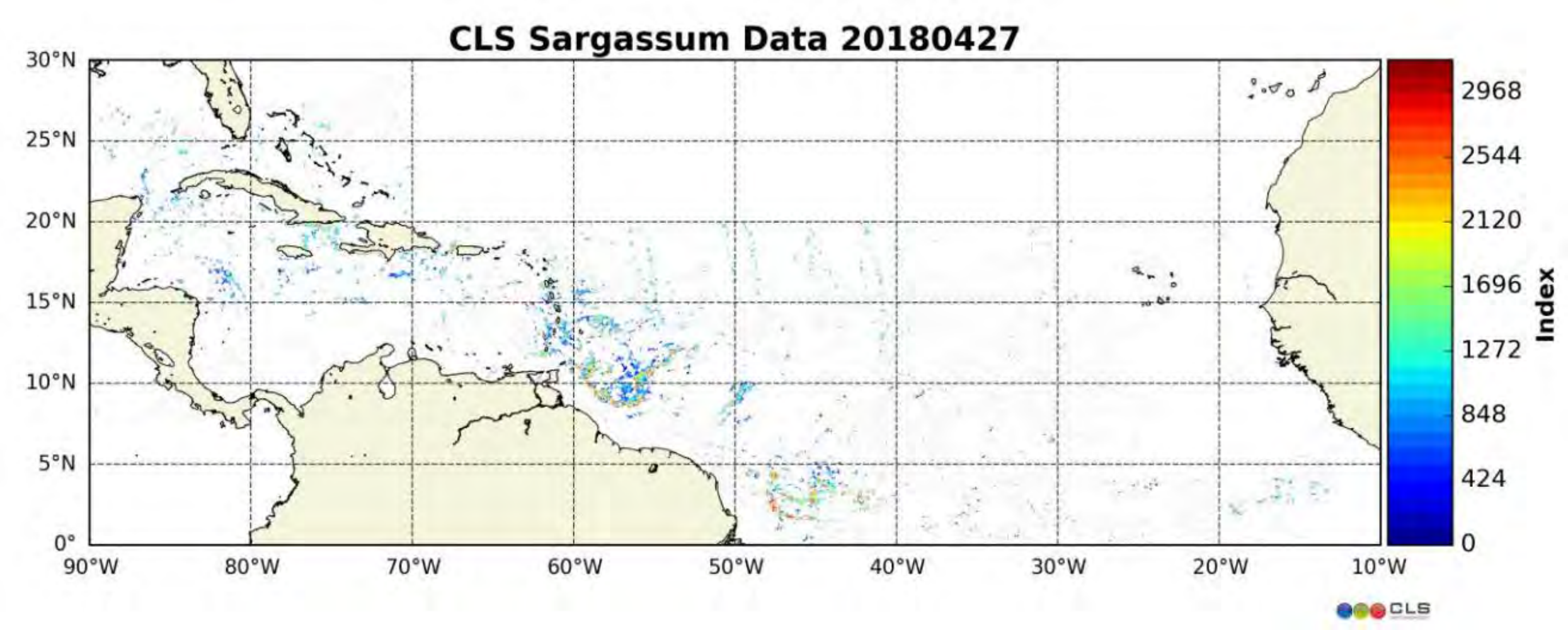
Back in early February 2018, we predicted that 2018 would be another *Sargassum* year for the Caribbean. The prediction was based on historical bloom patterns and on the observed bloom in the central West Atlantic in January 2018. Recent months in February – May 2018 confirmed this prediction, when the largest bloom (as compared to the same months in history) in both the central West Atlantic and the Caribbean was observed. In the coming months there is a high chance that the bloom and *Sargassum* beaching in the Caribbean will continue to at least August 2018, and possibly exceed the historical record in 2015.

Wang, M., and C. Hu (2017), Predicting Sargassum blooms in the Caribbean Sea from MODIS observations, Geophys. Res. Lett., 44, 3265–3273, doi:10.1002/ 2017GL072932.



Disclaimer: The information bulletin is meant to provide a general outlook of bloom probability for the Caribbean Sea. By no means should it be used for commercial purpose, or used for predicting bloom conditions for a specific location or beach. The authors of this bulletin, as well as USF and NASA, take no responsibility for improper use or interpretation of the bulletin.

# Monitoring and prediction research




Detecting sargassum with algorithm using synergy of  multiple satellite sensors

# Accepting a ‘new normal’

## Governance framework

- Developing policy

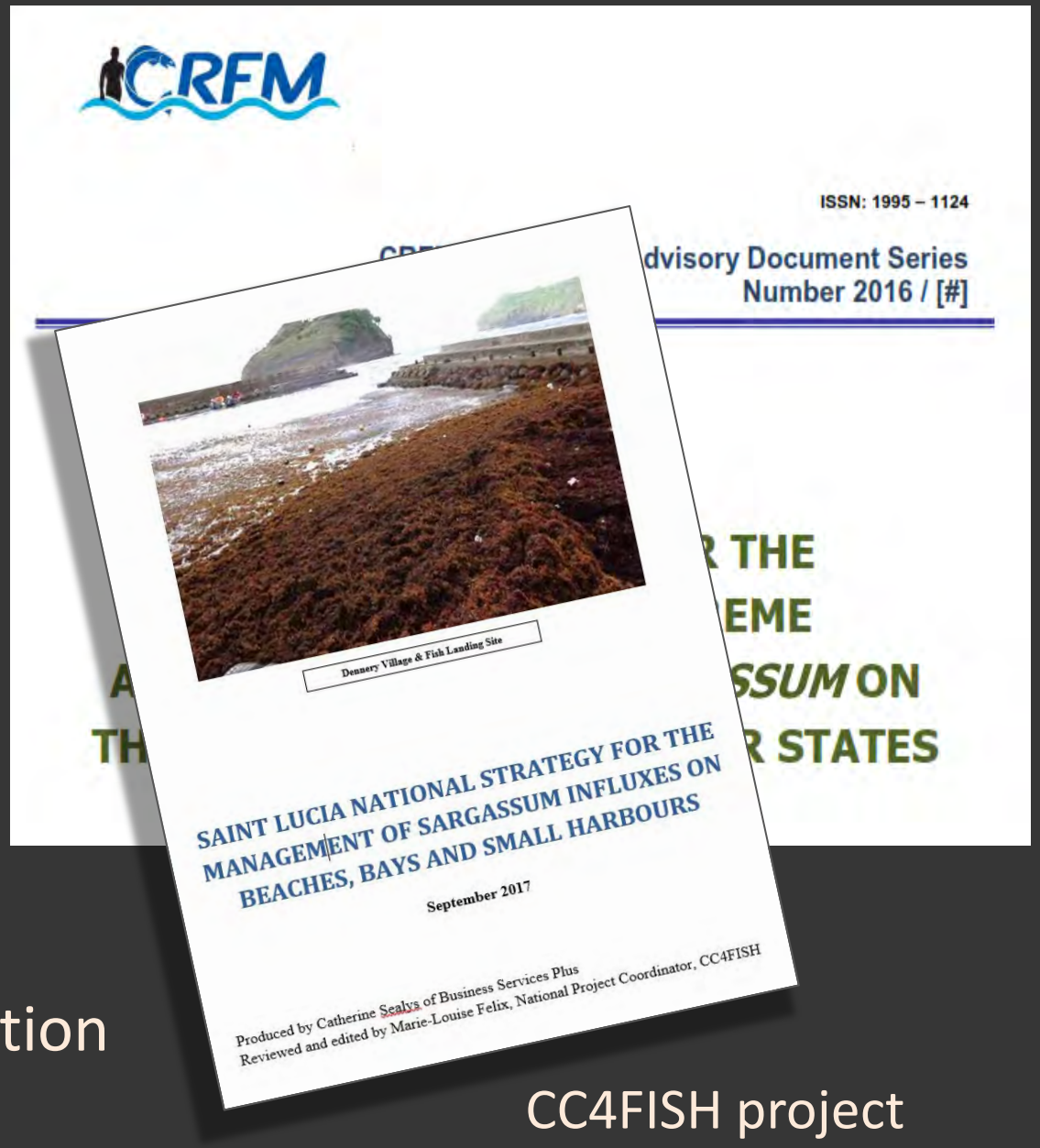
  High level attention:

  - CARICOM / OECS 2012
  - CARICOM Heads of Gov 2015
  - Council for trade and Economic Development (COTED)
  - Ministers of Fisheries, tourism, environment
  - UN General Assembly Resolution Dec 2015

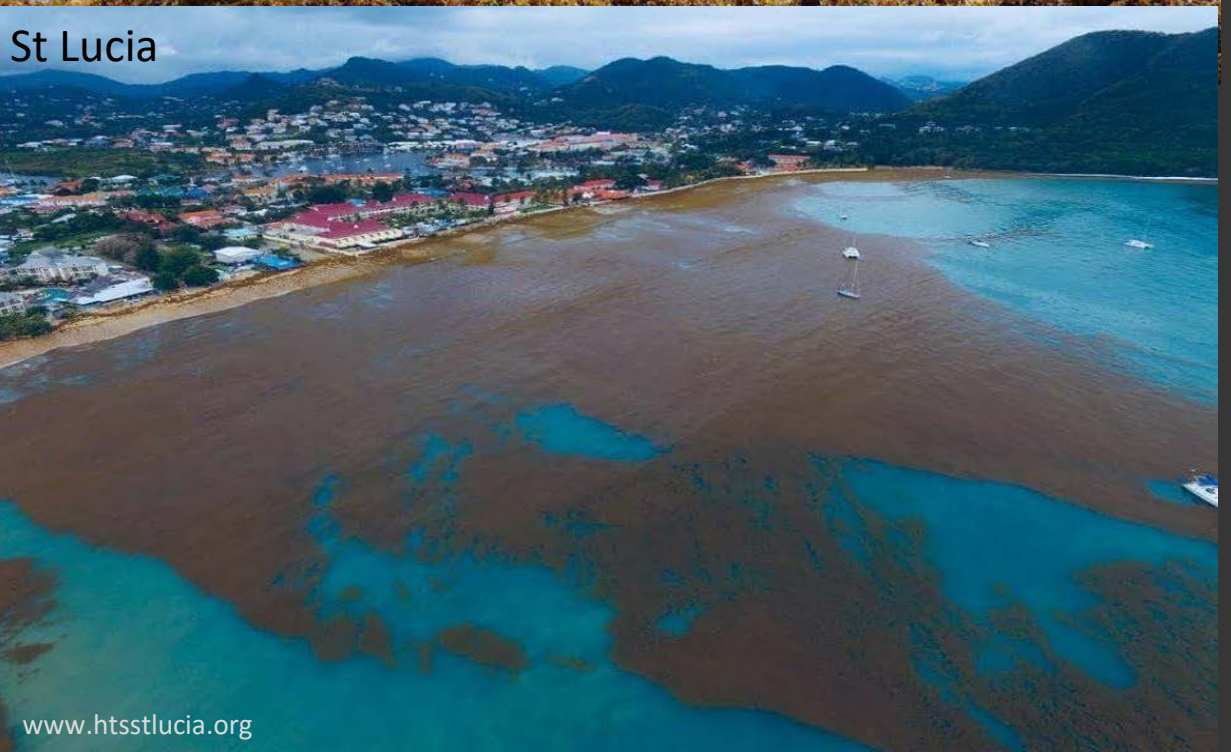
- Drafting management plans

## Main-streaming

- Vulnerability, Capacity building & Adaptation
- Disaster risk management




CC4FISH project


# Sargassum

## A wicked problem!

- Incomplete and contradictory knowledge
- Large number of stakeholders and opinions involved
- Huge economic burden
- Interconnected nature of the problems (both the causes and consequences)

Communication & adaptation remain challenging


**Questions?**

Thank you!