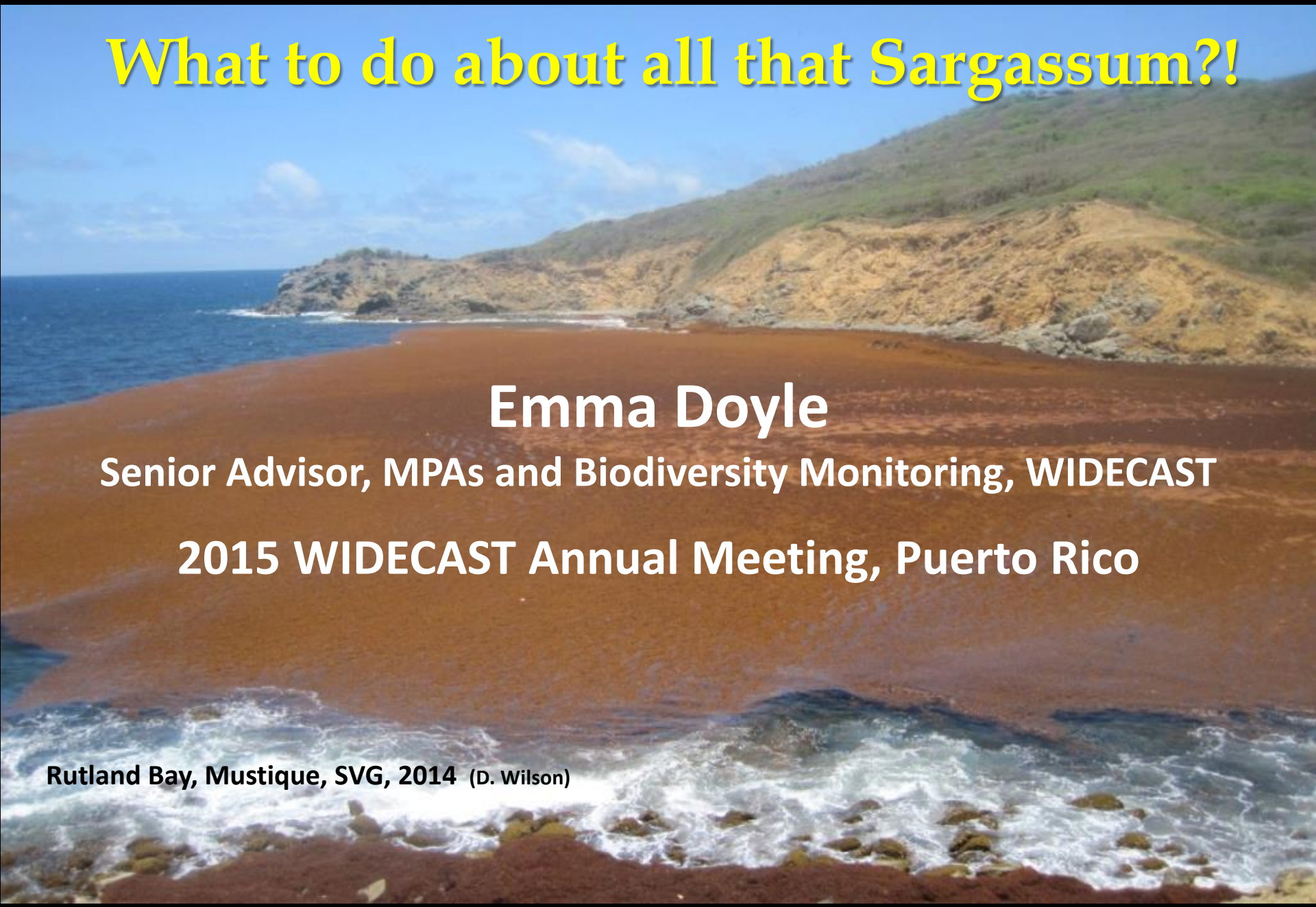
What to do about all that Sargassum?!



Emma Doyle

Senior Advisor, MPAs and Biodiversity Monitoring, WIDECAST

2015 WIDECAST Annual Meeting, Puerto Rico

Rutland Bay, Mustique, SVG, 2014 (D. Wilson)

Warm-up questions

1. Have you noticed an occurrence of greater than normal amounts of sargassum on your beaches in recent years?
2. Has it caused any problems for your turtles or their habitats?
3. Are other people in your country/territory talking about sargassum?

Would you like to know more?

An emerging topic….

“Retention and growth of pelagic sargassum in the North Equatorial Recirculation Region of the Atlantic Ocean: Hypothesis for examining recent mass strandings of sargassum along Caribbean and West Africa coastlines”

James Franks, Donald Johnson, Dong-Shan Ko[1]

Center for Fisheries Research & Development
Gulf Coast Research Laboratory
The University of Southern Mississippi
Ocean Springs, MS

[1]Naval Research Laboratory
Stennis Space Center, Mississippi

What is sargassum?

- Pelagic brown alga
- Class Phaeophyceae
- Family Sargassaceae
- Occurs only in Atlantic
- Buoyancy from gas-filled pods
- Reproduces by fragmentation
- Two species

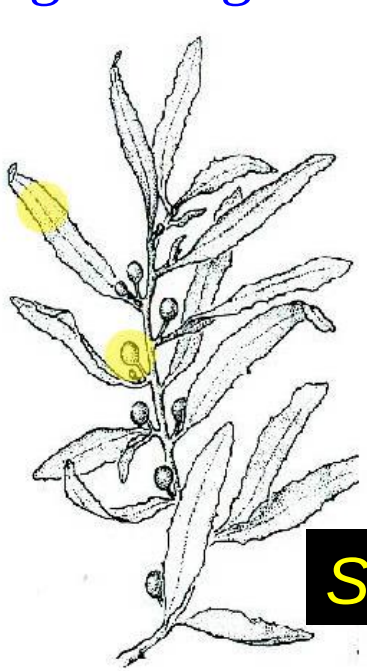
Sargassum natans
Common Gulfweed
photo by Phillipe Rouja

Sargassum fluitans
Broad-toothed Gulfweed
photo by GCRL

The characteristics described below are useful in differentiating between the two species. However, characteristics vary and identification of a particular sample may not be straightforward.

http://www.usm.edu/gcrl/sargassum

Sargassum natans



Sargassum fluitans

Sargassum natans

- Pods - usually tipped with spikes or small leaves
- Leaves - long-stalked, narrow

Sargassum fluitans

- Pods - usually *not* tipped with spikes or small leaves
- Leaves - short-stalked, broad

Illustrations by Julia S. Child (Schneider and Searles, 1991)

Sargassum natans *Sargassum fluitans*

Importance of sargassum

- Entirely natural in our region
- Pelagic ecosystem harbors diverse fauna eg. small fish, crustaceans, worms, mollusks, tunicates, and coelenterates
- Refuge for migratory species
- Important nursery habitat for sea turtles - shelter and food for young turtles
- Nursery and cover habitat for fish of commercial and recreational value eg. marlin
- Role in beach nourishment
- Important element in shoreline stability

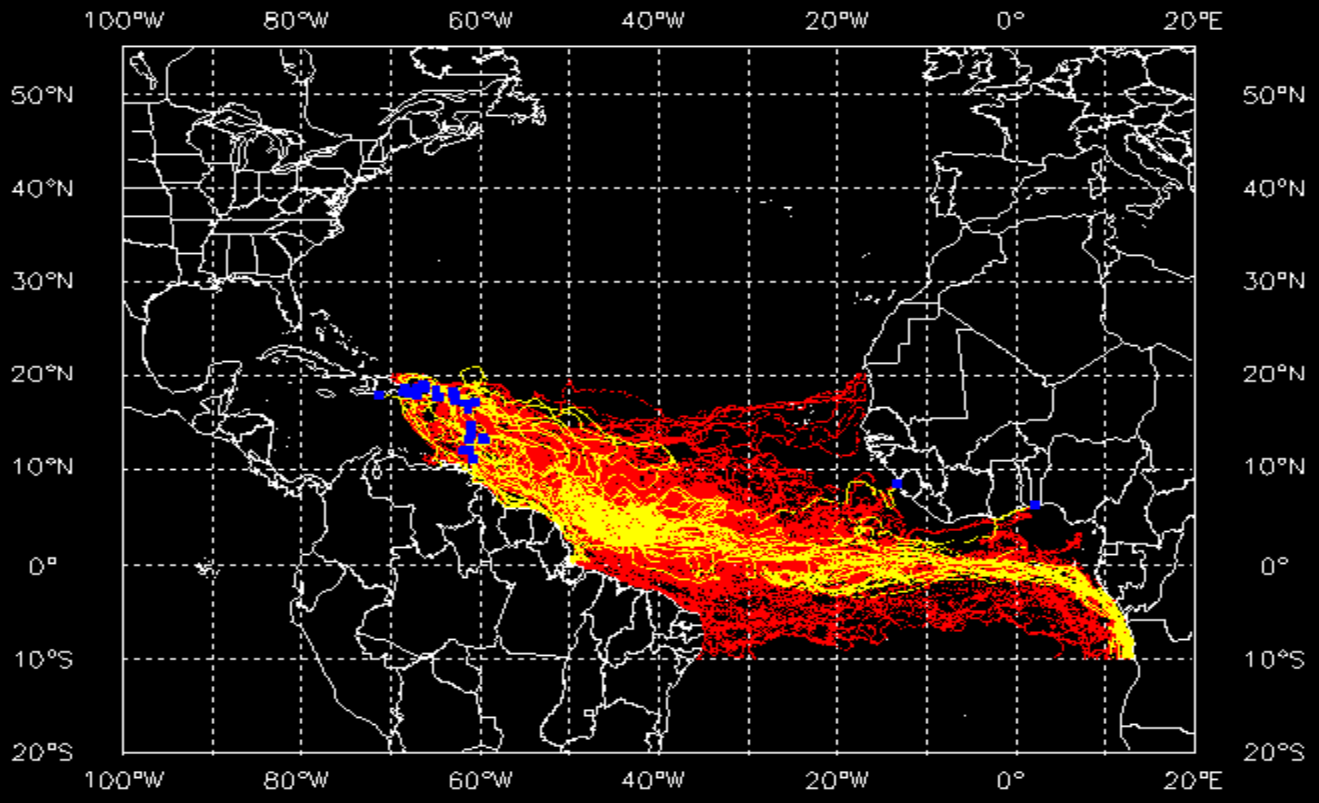
‘Behaving like an invasive’

Port Honduras Marine Reserve, Belize

Not a regular event, not local event, not one-off event

Unprecedented quantities of pelagic sargassum occurred throughout the Caribbean in 2011, 2014 = influx

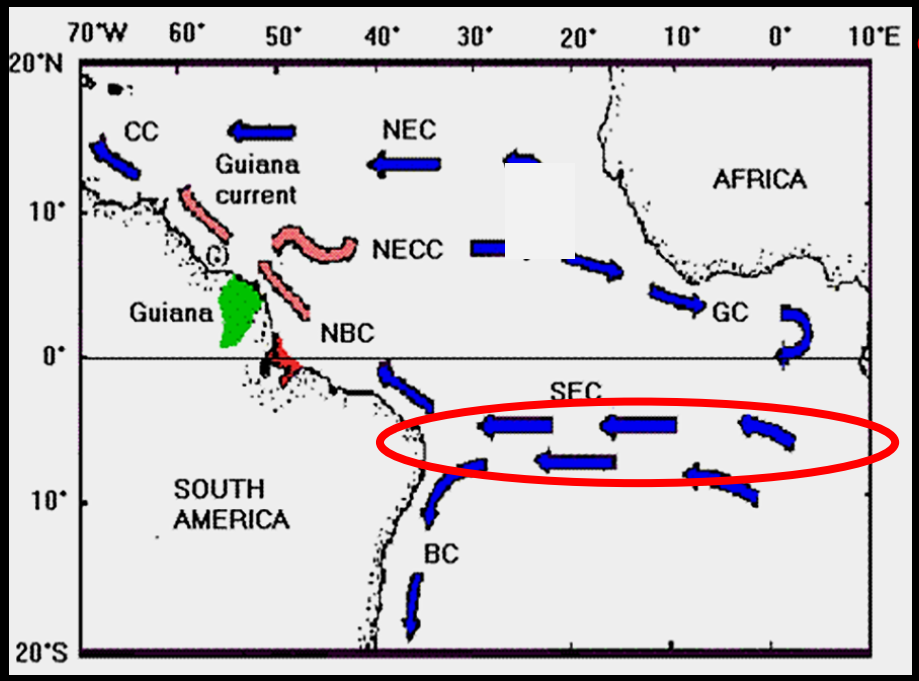
Where is the sargassum coming from?



Hypothesis:

an <u>equatorial</u> event

Hypothesis about influx

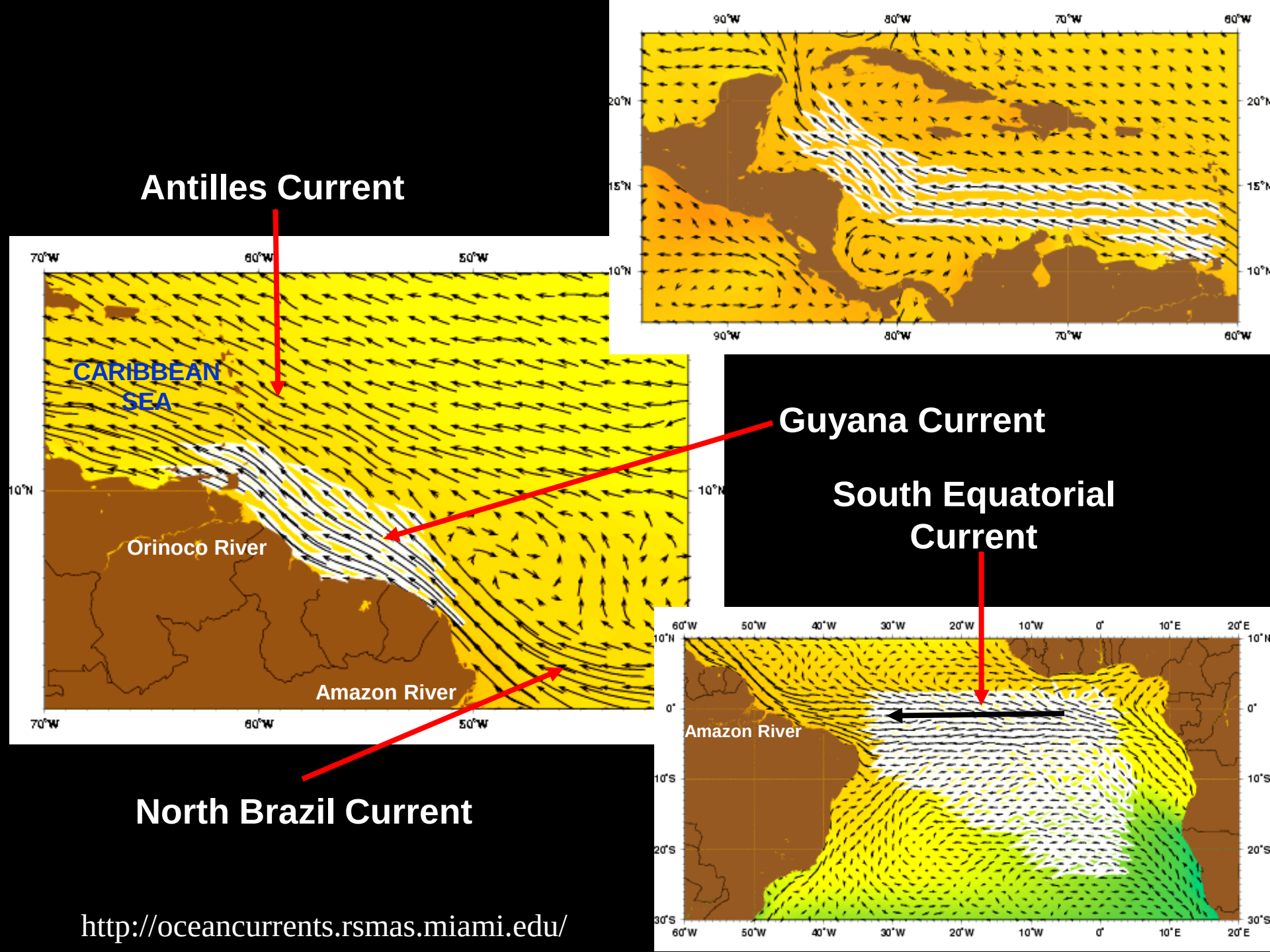


- NERR

NEC – North Equatorial Current
NECC – North Equatorial Counter Current
GC – Guinea Current
SEC – South Equatorial Current
NBC – North Brazil Current
CC – Caribbean Current

nb. takes one year to go from one end of NERR to other

Sargassum proliferation (bloom) occurred in the North Equatorial Recirculation Region (NERR) of the North Atlantic between the North Equatorial Counter Current and the equator


Antilles Current
CARIBBEAN SEA
Orinoco River
Amazon River
Guyana Current
South Equatorial Current
North Brazil Current
Amazon River
http://oceancurrents.rsmas.miami.edu/

Method for research into source and pathways

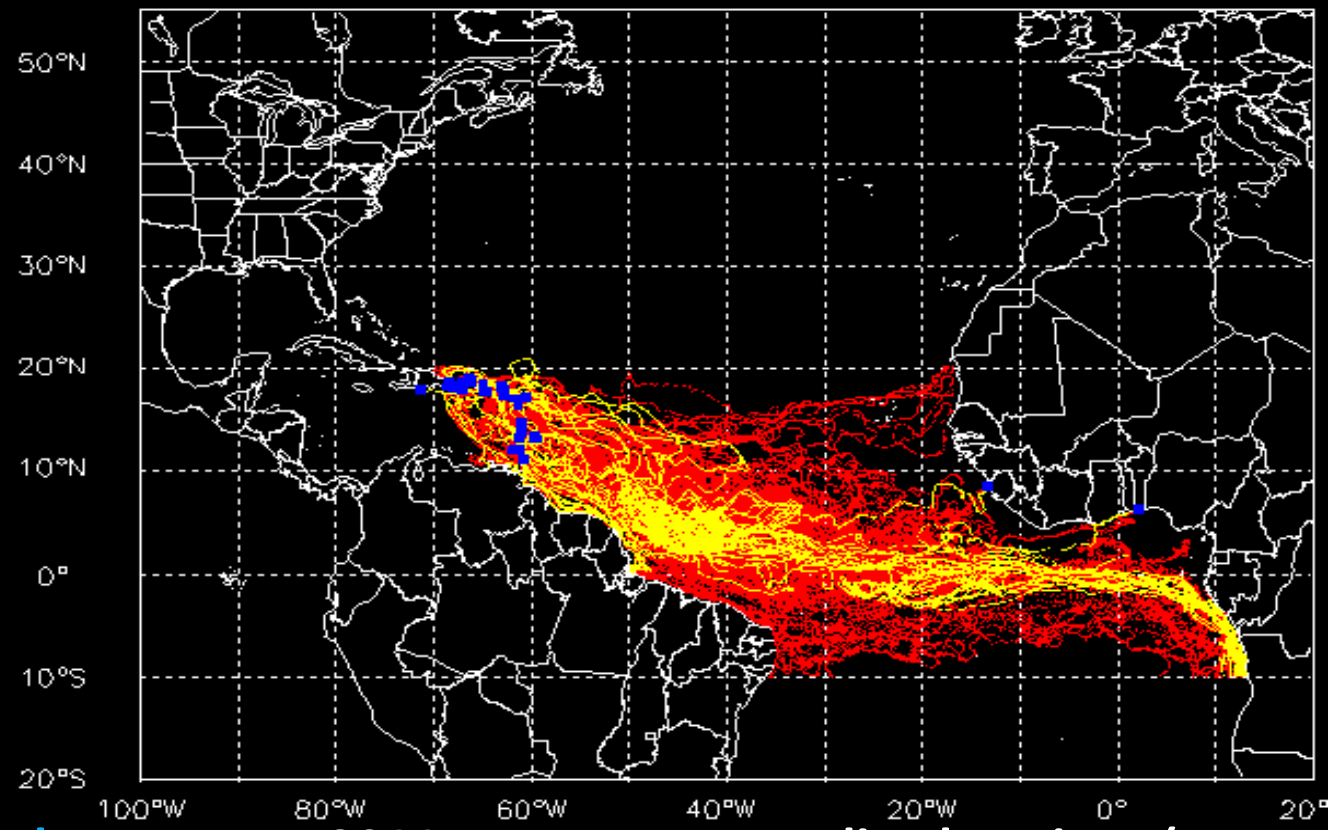
- Use oceanographic modelling and satellite-tracked drifters:
  1. Back-tracking of sargassum transport patterns from sargassum landing sites using modelled currents
  2. Forward-tracking of sargassum transport patterns from possible source regions using the same modelled currents
  3. Validation of sargassum transport patterns using data from satellite-tracked ocean surface drifters previously deployed in the Atlantic
  4. Examination of interannual changes in NERR ocean dynamics between 2009-2013

> Confirmed by observations of fishers at sea, fisheries officers etc

- Remote sensing incomplete and difficult - confused with oil, phytoplankton

2011 Influx

- Back-tracked sargassum movements from landing sites across the Atlantic equatorial region to W. Africa
- The equatorial region recirculated and consolidated sargassum prior to the 2011 release into the Caribbean

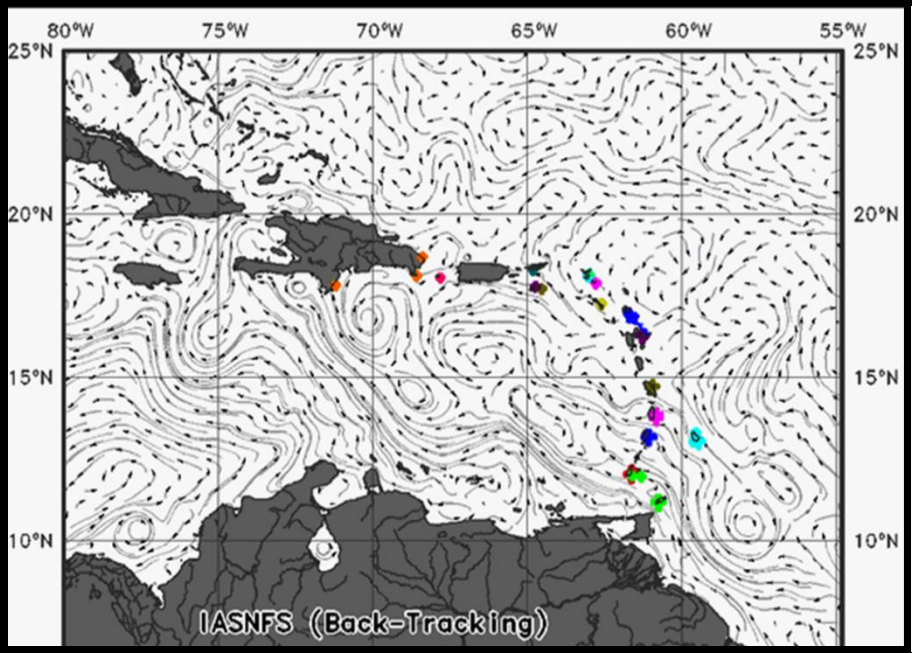


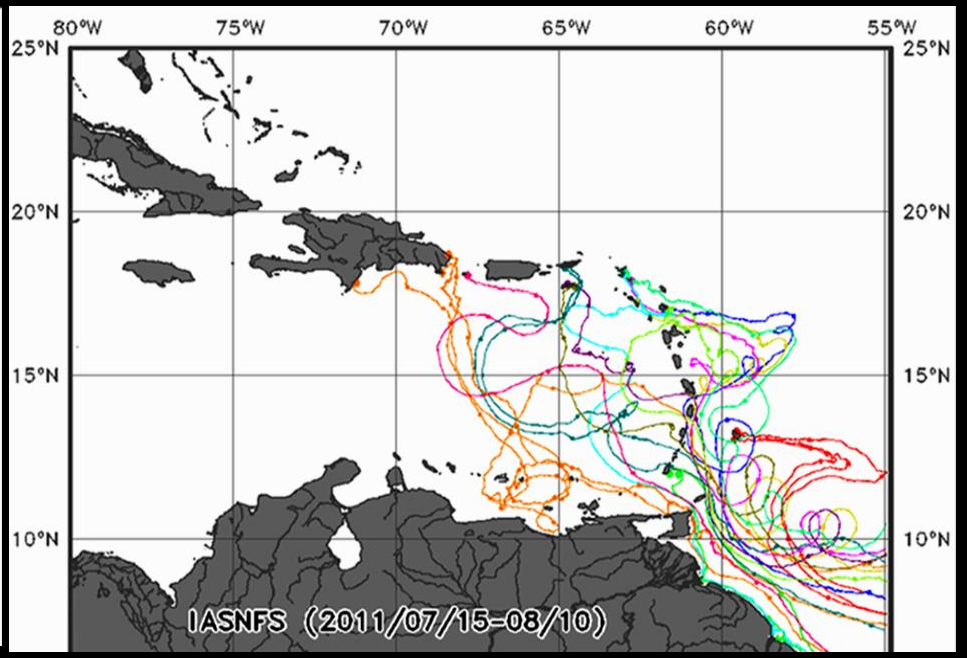
Blue squares: 2011 sargassum stranding locations (note west Africa)
Yellow lines: back-tracked sargassum movements to January 2010
Red lines: model uncertanties (Lagrangian stochastic model, LSM)

2011 Influx

- Back-tracked sargassum from reported sighting locations & dates to determine transport pathways (Franks et al. 2011)
- Examination of connectivity across the tropical Atlantic, particularly the NERR (Johnson et al. 2012)

Intra-Americas Sea Nowcast-Forecast System (IASNFS) model

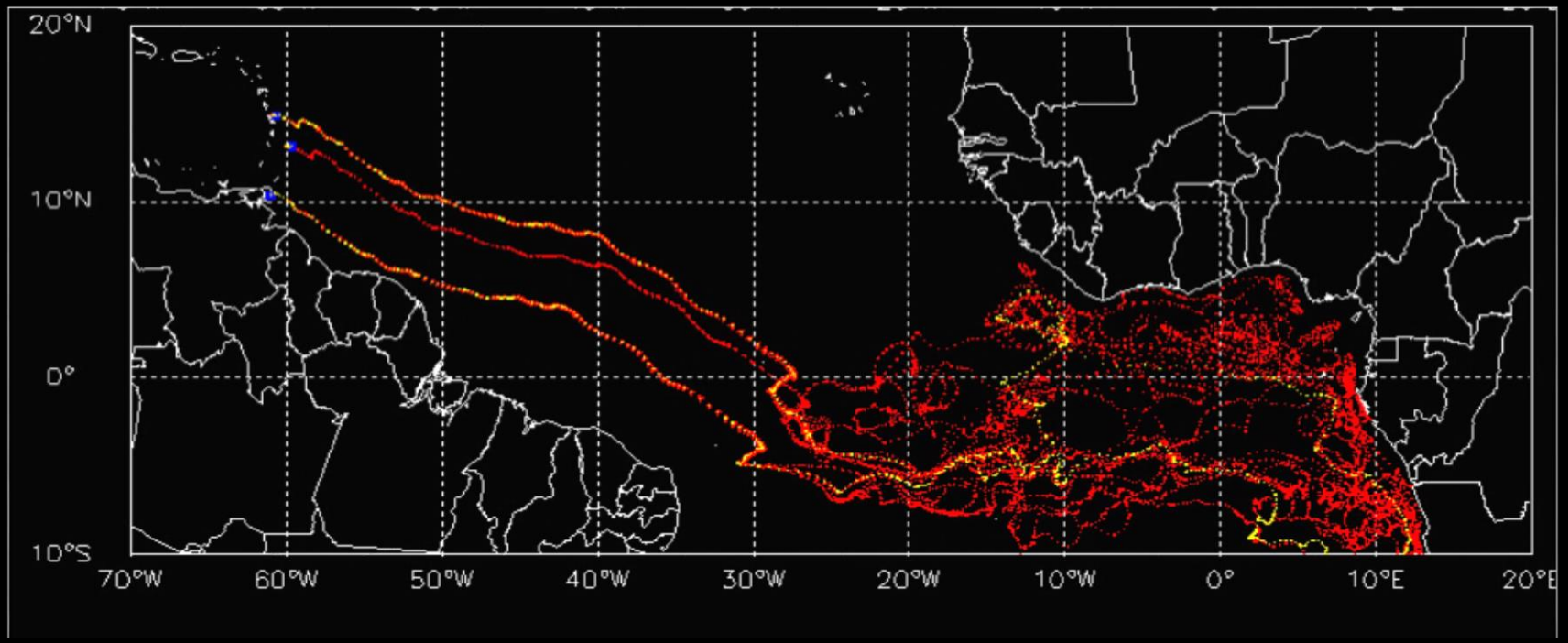




May – September 2011

2014 Influx

- Back-tracked sargassum movements from landing sites across the Atlantic equatorial region to W. Africa
- No western recirculation zone off Brazil, but a direct pathway to the equatorial consolidation region and Gulf of Guinea



Blue squares: 2014 sargassum stranding locations (examples)
Yellow lines: back-tracked sargassum movements to January 2013
Red lines: back-tracked sargassum movements with LSM

What is causing the sargassum influx?

Source + Growth + Consolidation + Transport

- Smaller quantities of sargassum found in the NERR recirculation region bloomed through high nutrient input (eg. equatorial upwelling, river inflow, African dust)
- Exceptional alignment of peaks (+ and -) in climate indices during 2009-10 in the North Atlantic (high temps, low wind, reduced currents) created conditions in the NERR that allowed sargassum accumulation and consolidation pre-Caribbean influx in 2011
- Transport pathways via currents

Meanwhile in West Africa….

Sierra Leone

Per: Andrew Huckbody
Huckbody Environmental Ltd.

West African coastlines also impacted by sargassum

In Summary…

- The sargassum ‘bloom’ that impacted the tropical Atlantic in 2011 – 2014 (& ongoing) did not originate in the Sargasso Sea or the Gulf of Mexico
- The North Equatorial Recirculation Region (NERR) between Brazil & Africa was favorable for accumulation & consolidation of pelagic sargassum… growth from nutrient input
- Atlantic climate indices reached historical maxima/minima in the period 2009-2011. It is suggested that conditions during this period favored recirculation, consolidation & massive growth of sargassum in the equatorial Atlantic

What's the message for coastal managers?

- Sargassum influx could be an indicator of climate change
- Sargassum might have become 'established' in the NERR
- Future influxes of sargassum might periodically occur – eg. in next 2-3 months?
- Adaptation strategies are needed

Crane Beach

Photo credit: Hazel Oxenford

What's the impact on sea turtles?

- **Direct impacts:**
  - Stranding of sea turtles (eg. SVG, Martinique)
  - Entanglement of hatchlings (eg. Saint Lucia)
  - Obstruction of hatching?
  - Marine debris and invasive species
  - Reduced light levels on reefs, benthic communities and submerged sea grass
  - Decomposition of sargassum with water quality impacts

What's the impact on sea turtles?

- **Indirect impacts:**
  - **Trampling of stranded turtles in beach cleaning**
  - **Compaction of nests by heavy beach cleaning machinery**
  - **Destruction of nesting habitat**
  - **Erosion due to removal of sand and loss of nourishment**
  - **Local conflict**


Antigua


Martinique, E. Dumont-Dayot

Other impacts and concerns

- **Fishing: entangled lines and nets, difficulties accessing resource, loss of locally important species**
- **Vessels: motor intakes (over-heating), launching issues**
- **Tourism: incessant incursion onto shorelines and into bays, decomposition and smell**

"I have lived in the Bay Islands of Honduras for 10 years. I have never seen anything like this. It is a disaster."

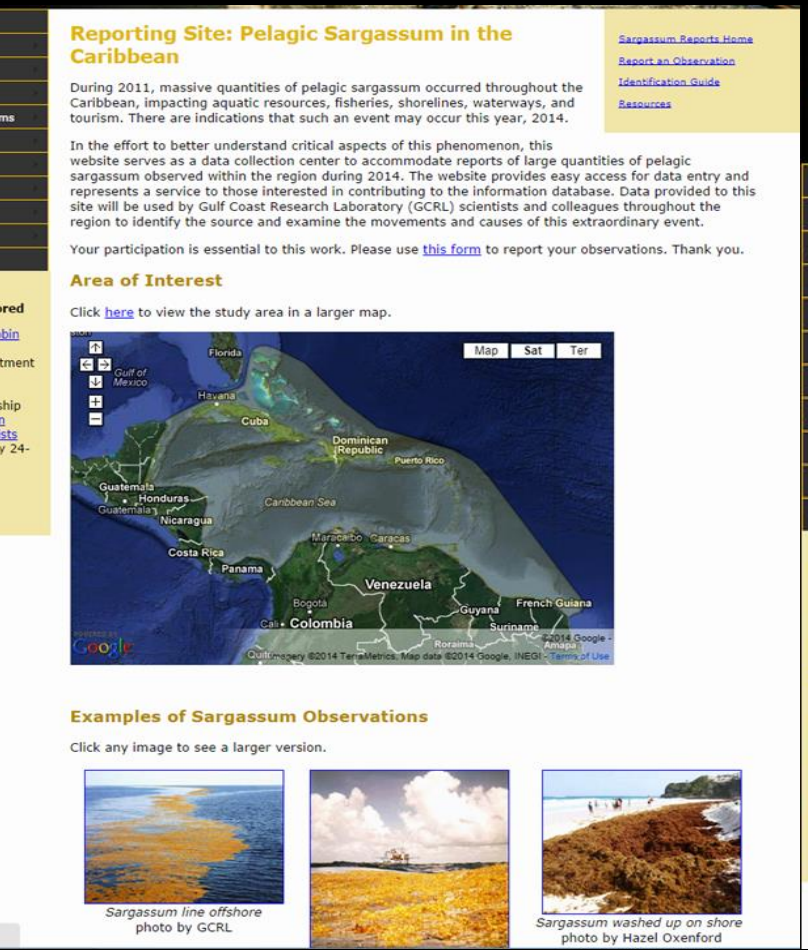
Antigua

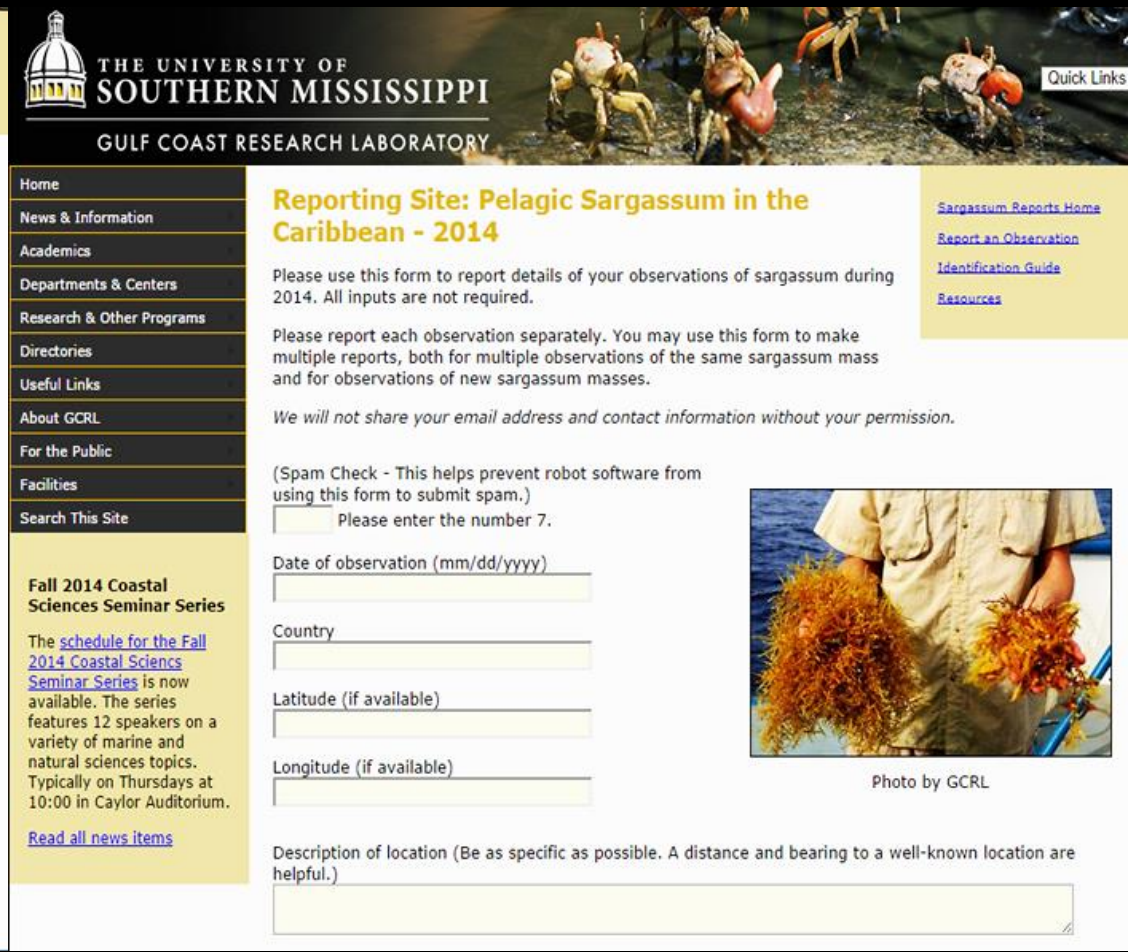
Eli Fuller – Adventure Antigua
Photo credit: Max Freeling; Bugpilot

What can we do?

- **Report influxes:**
  - ➢ **Confirm species of sargassum you see**

http://www.usm.edu/gcrl/sargassum/sargassum.observation.form.php





What can we do?

- **Stay informed:**
  - **Watch developing alert systems eg. Texas A&M**
- **Communicate with stakeholders:**
  - **It's natural and important - leave it on the beach! ...Marc?**
  - **eg. tourism industry (Martinique)**
- **Educate about turtle friendly practices:**
  - **Avoid heavy machinery, only essential cleaning, not on dunes**
- **Enforce existing CZM regulations:**
  - **Work with agencies and law enforcement partners**

What can we do?

- Monitor impacts on sea turtles:
  - Nesting and hatching success on index beaches
  - Beach profile monitoring (WWF protocol)
  - Record and share about strandings (eg. SVG)
- Monitor effectiveness of adaptation strategies:
  - eg. value of clearing path for hatchlings?
- Assist with data gathering:
  - Random surveys by dip net, sort free organisms, photograph and freeze sample (with attached organisms), note water quality indicators

Possible opportunities?

- Encourage local livelihoods:
  - Beach raking for supplemental income?
  - Use as fertilizer
  - Novel approaches eg. via small grants (Martinique)

Possible opportunities?

- Leverage opportunity for support:
  - Build on general interest to communicate about marine biodiversity and CZM
  - Resource managers and tourism industries may need to develop action plans for risk management
  - Assist SPAW with response plan
  - Seek climate change adaptation funding?

Please join the working group at 4pm

ACKNOWLEDGMENTS

James Franks, Donald Johnson, Dong-Shan Ko

- gcfinet@listserv.gcfi.org
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