Sustainable solutions for Sargassum Inundations in Turks & Caicos

Dr Debbie Bartlett CMLI FCIEEM SFHEA
Professor of Environmental Conservation

Location & Aim of project

Large quantities of holopelagic *Sargassum spp.* has been washing ashore since 2011.

This project aimed to

- review historical information
- determine current distribution and
- composition of beached sargassum
- how this is affecting businesses
- what the implications might be for removal

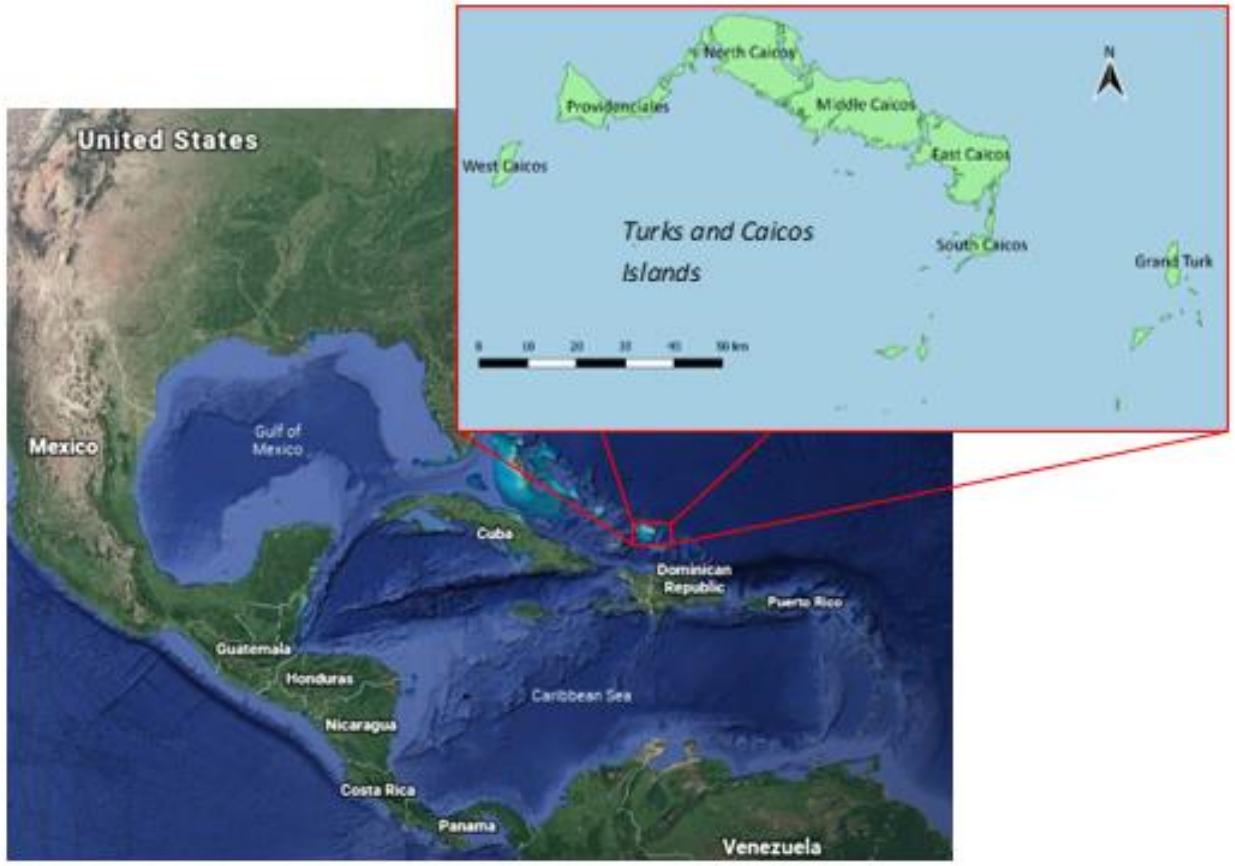


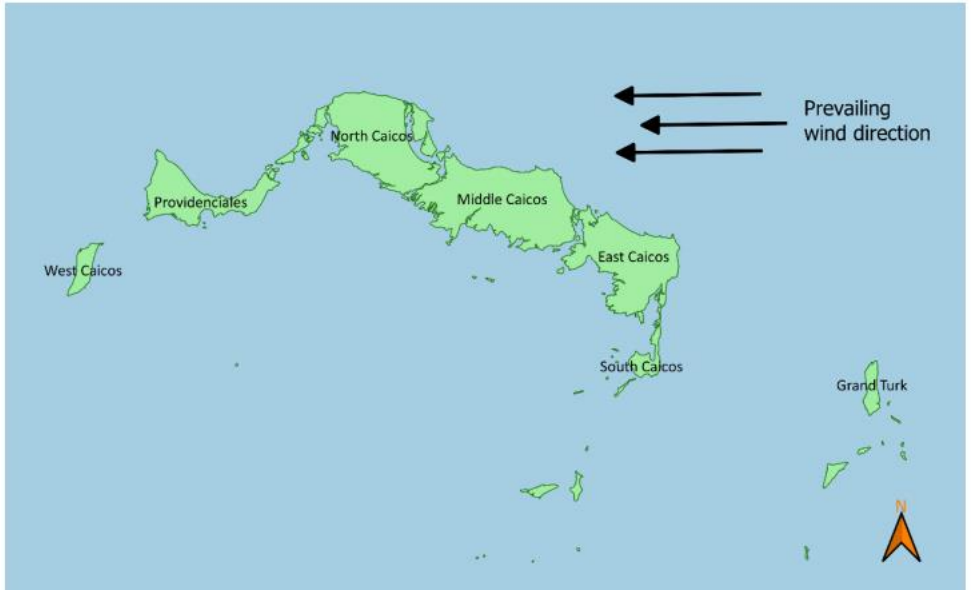
Figure 1: Location of TCI (Google, 2019)

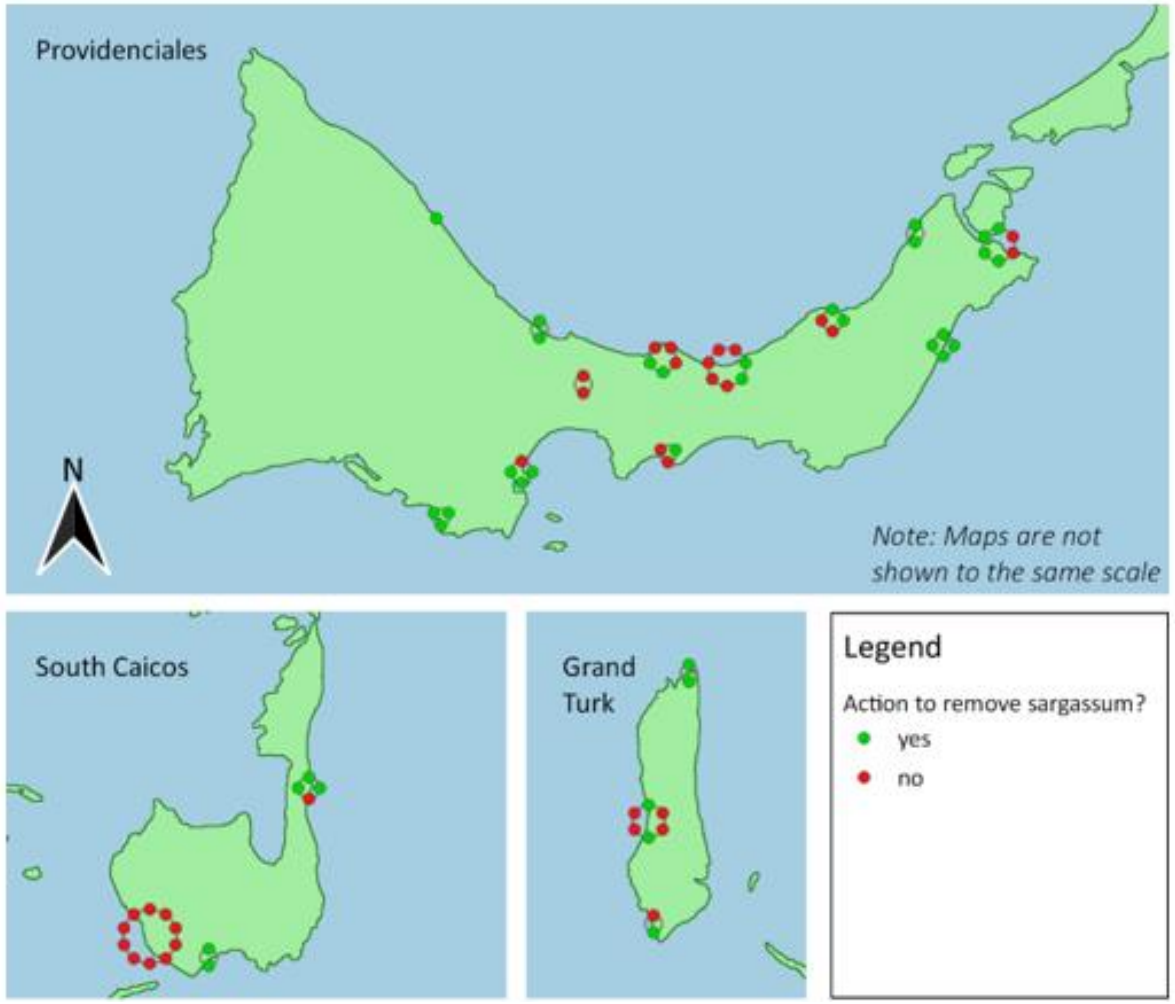
This research was funded DEFRA Darwin Plus DPLUS100: in partnership with the Department of Environment and Coastal Resources (DECR), Turks and Caicos Islands (TCI) Government; the University of Greenwich (UofG); the School for Field Studies (SFS), South Caicos, and the Chartered Institute of Ecologists and Environment Managers (CIEEM) Overseas Territory Special Interest Group.

What do we need known to consider solutions?

- Where is the sargassum arriving?
- When – seasonal variations?
- What does the beached material consist of
- How much?
- What is the impact?
- (what is thee potential for commercial exploitation?)
- What is the impact of harvesting?

Where?





1) Reports from those removing it

2) Citizen science photographic project


A: GDT


B: GDT

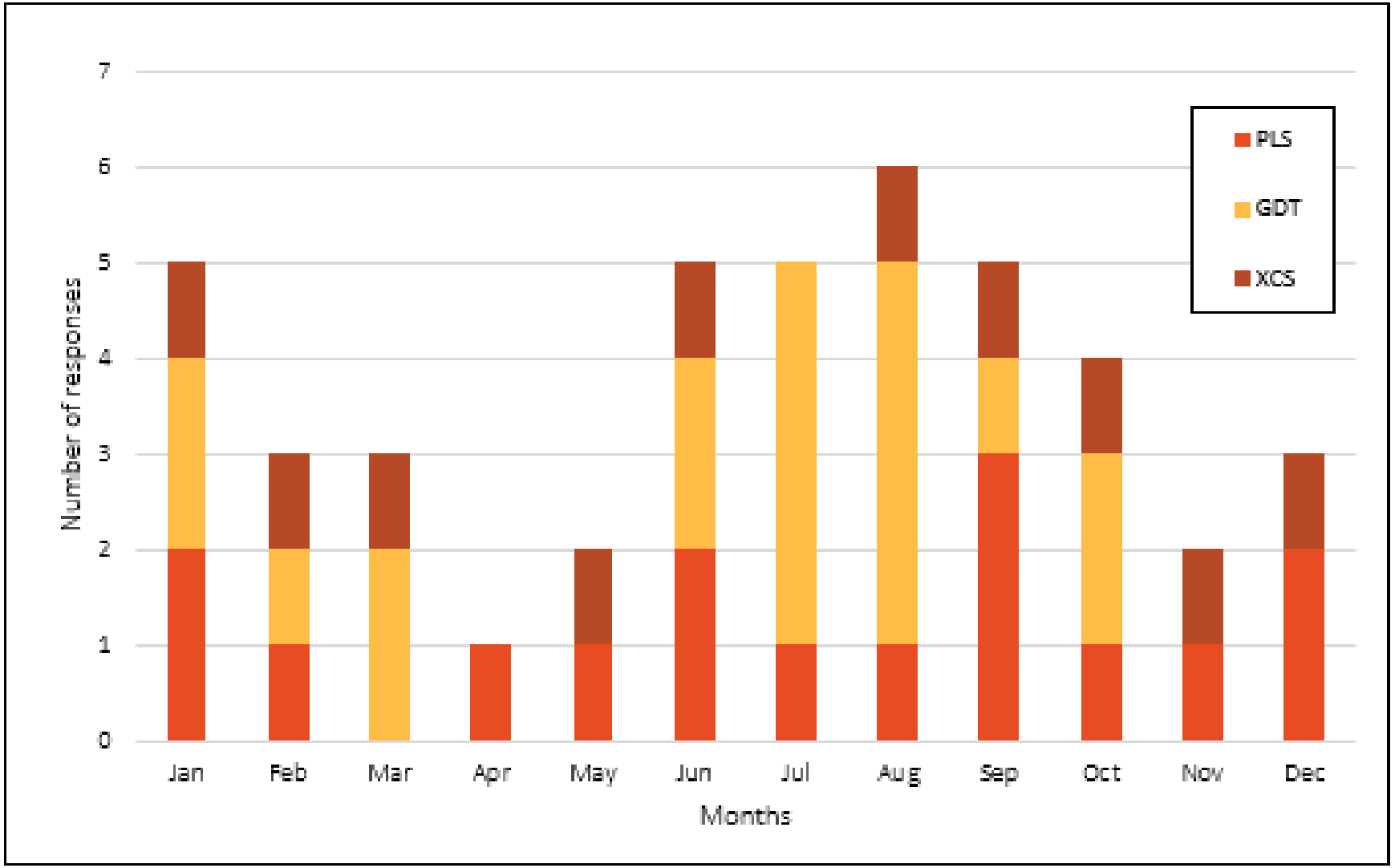

C: PLS


D: PLS


E: XSC


F: XSC

When?


Number of responses
0
1
2
3
4
5
6
7
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Months
PLS
GDT
XCS

What is the composition of the beached *Sargassum*?

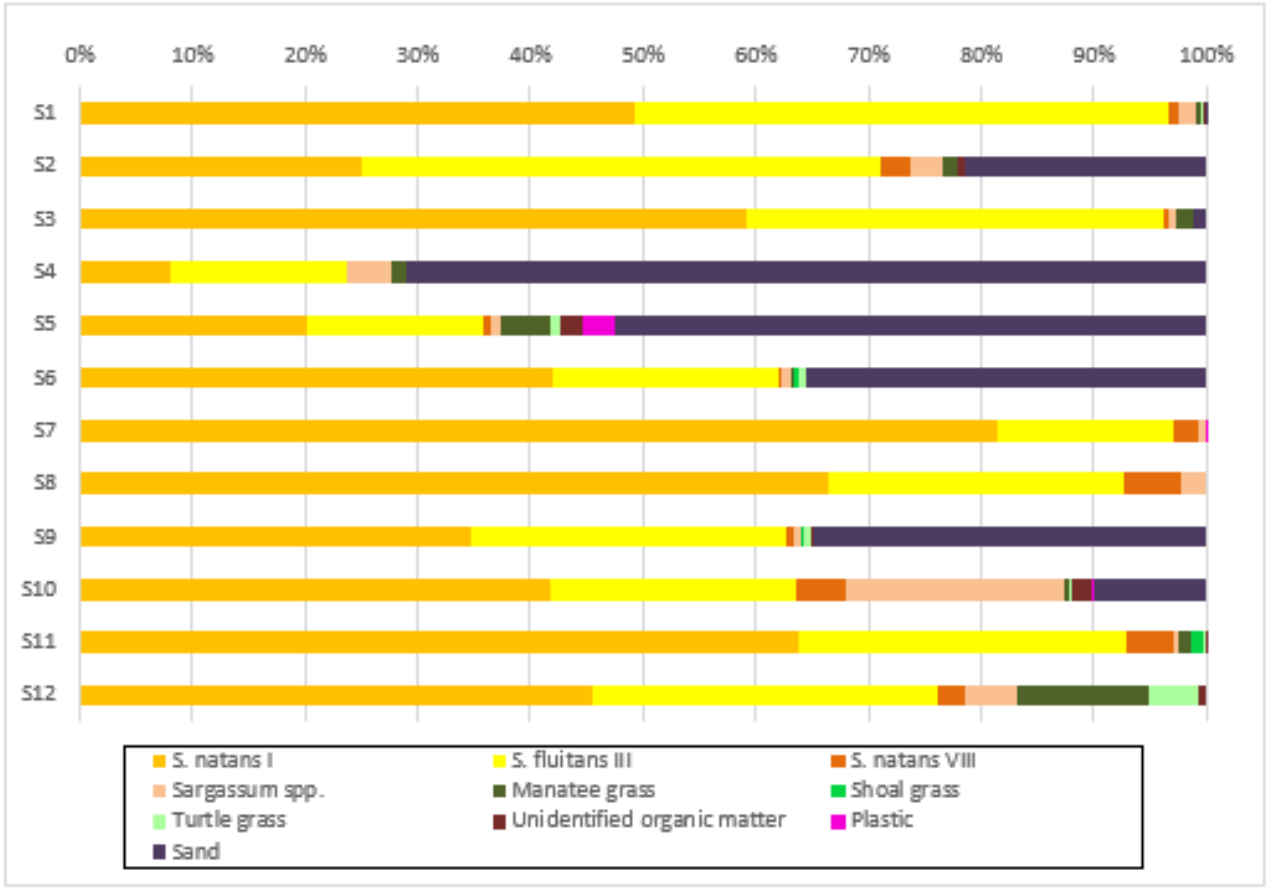
Schell *et al* (2015) reported three morphotypes

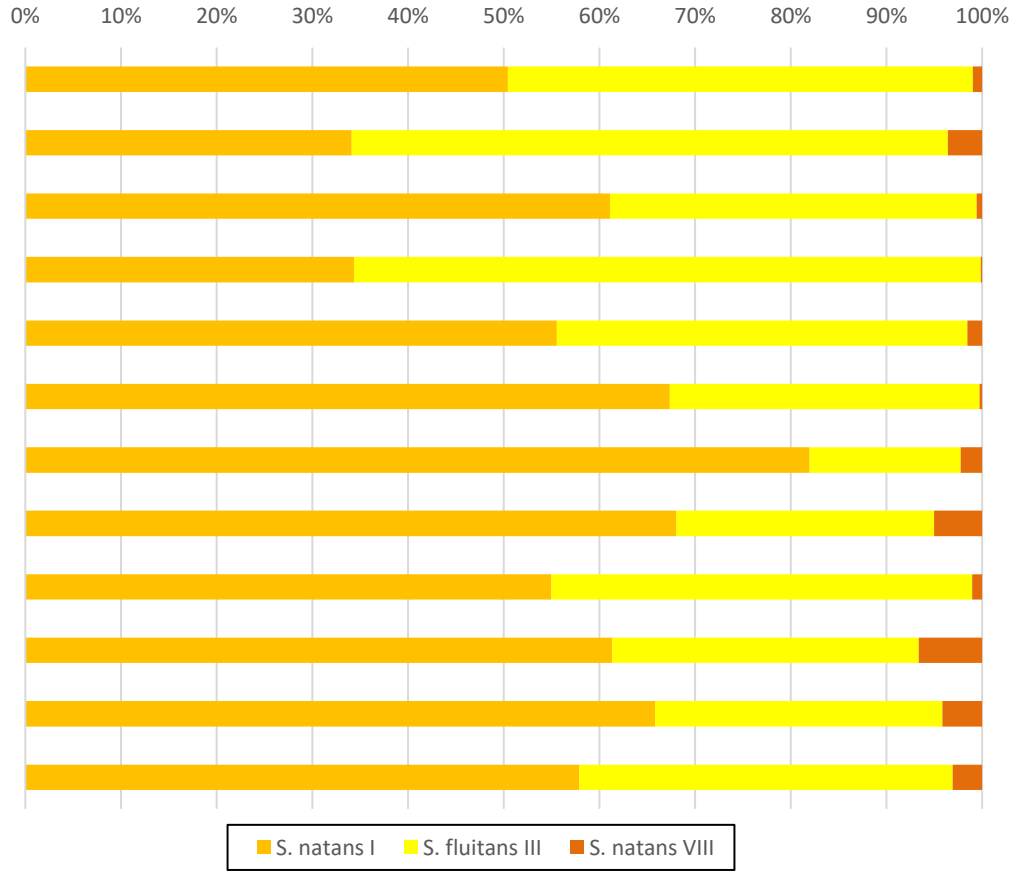
S. natans VIII made up 92% of samples in the 'Antilles Current' region, which includes TCI

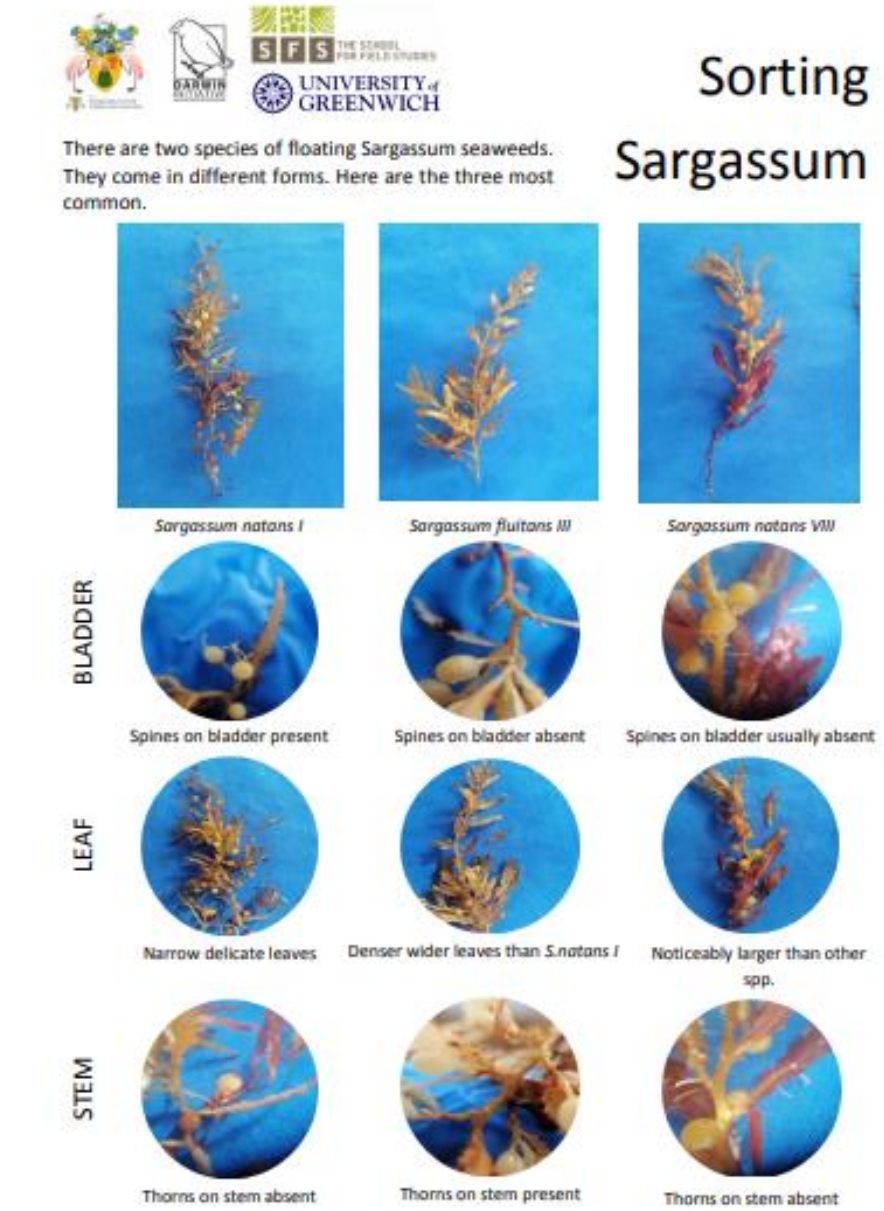
S. natans I dominated at 87.5% in the 'South Sargasso Sea' region just north of TCI

García-Sánchez et al (2020) found a shift in species and morphotypes in the Mexican Caribbean region occurred from 2016 to 2020.

Initial Results (research is ongoing)







The aim is to sort samples into:

- *Sargassum natans* I
- *Sargassum natans* VIII
- *Sargassum Fluitans* III
- *Sargassum* spp. (too small to ID or with unclear characteristics)
- Manatee Grass (*Syringodium filiforme*)
- Turtle Grass (*Thalassia testudinum*)
- Shoal Grass (*Halodule wrightii*)
- Plastic
- Other organic matter
- Sand

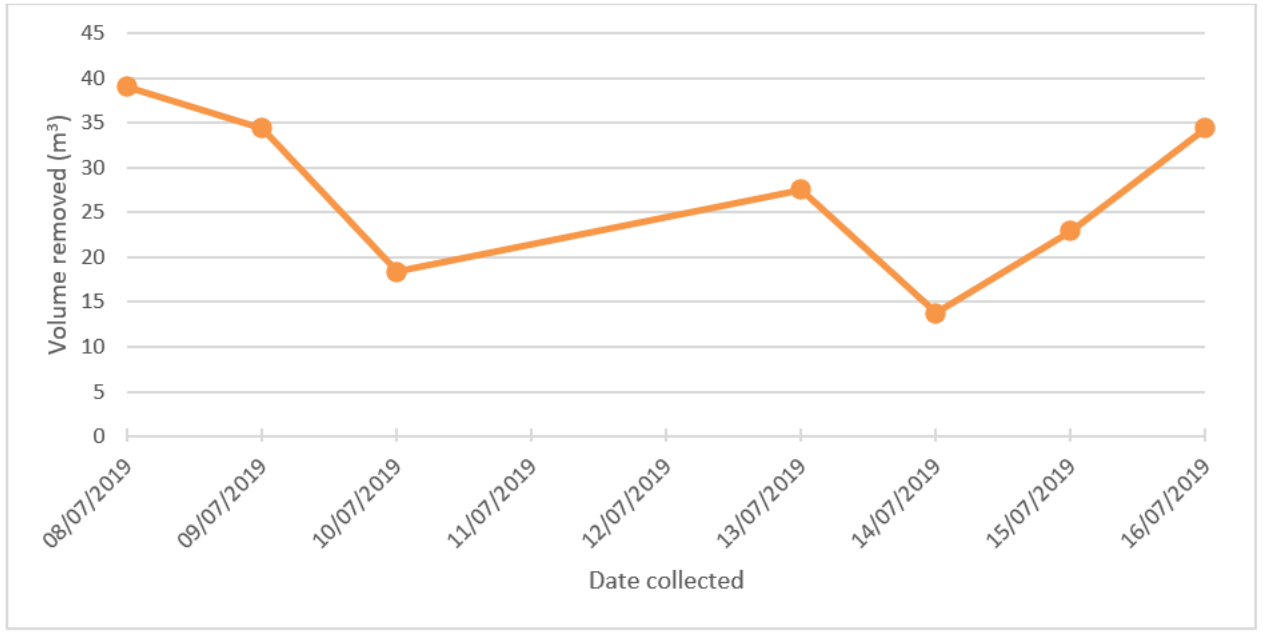
How much?

SHARK BAY monitoring

- Area cleared
- Arisings weighed & recorded
- Repeated weekly

School for Field Studies staff & students

Estimating quantity



Depth of deposit x area = volume m^3

Quantity removed by an individual resort

Impact ?

- We know sargassum is affecting coral reefs and sea grass meadows by shading and chemical composition of the water
- Impact on mangroves is less clear but likely to be significant
- Businesses?

We ask 100 involved in tourism on TCI

The Impact of Sargassum on Tourism Related Businesses:

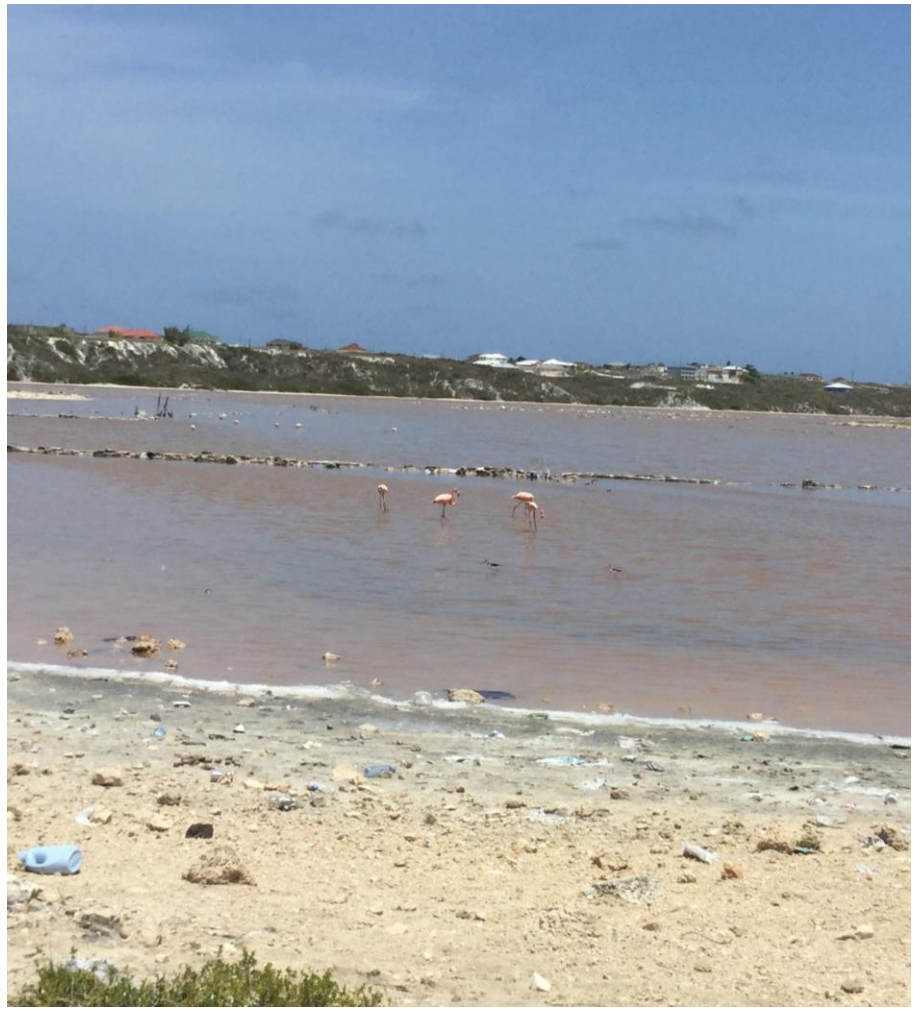
Initial Assessment Report

Business category	Total responses				Number reporting impact (responding 'Yes' to Q1)				Percentages impacted per business			
	All	PLS	GDT	XCS	All	PLS	GDT	XCS	All	PLS	GDT	XCS
Restaurant/bar	11	8	1	2	6	5	0	1	55	63	0	50
Fishing	7	1	1	5	6	1	1	4	86	100	100	80
Sports fishing	6	4	1	1	6	4	1	1	100	100	100	100
Resort	9	4	0	5	7	3	0	4	78	75	N/A	80
Accommodation	4	3	1	0	3	3	0	0	75	100	0	N/A
Real estate/developer	4	4	0	0	3	3	0	0	75	75	N/A	N/A
Wildlife charity	1	1	0	0	0	0	0	0	0	0	N/A	N/A
Snorkelling / Diving	11	7	3	1	5	2	3	0	45	29	100	0
Surface water sports	9	7	2	0	6	4	2	0	67	57	100	N/A
Shore leisure	5	2	3	0	3	1	2	0	60	50	67	N/A
Market Trader	12	8	2	2	2	2	0	0	17	25	0	0
Travel/ boat trips	12	6	3	3	7	2	2	3	58	33	67	100
Farmer	1	1	0	0	1	1	0	0	100	100	N/A	N/A
Independent tourism consultant	2	2	0	0	1	1	0	0	50	50	N/A	N/A
Tourist board	2	1	1	0	2	1	1	0	100	100	100	N/A
Entrepreneur	1	1	0	0	0	0	0	0	0	0	N/A	N/A
Utilities/services	1	0	0	1	0	0	0	0	0	N/A	N/A	0
Government dep.	1	0	1	0	0	0	0	0	0	N/A	0	N/A
Museum	1	0	1	0	0	0	0	0	0	N/A	0	N/A
Totals	**100**	**60**	**20**	**20**	**58**	**33**	**12**	**13**	**58**	**55**	**60**	**65**

Removal Methods

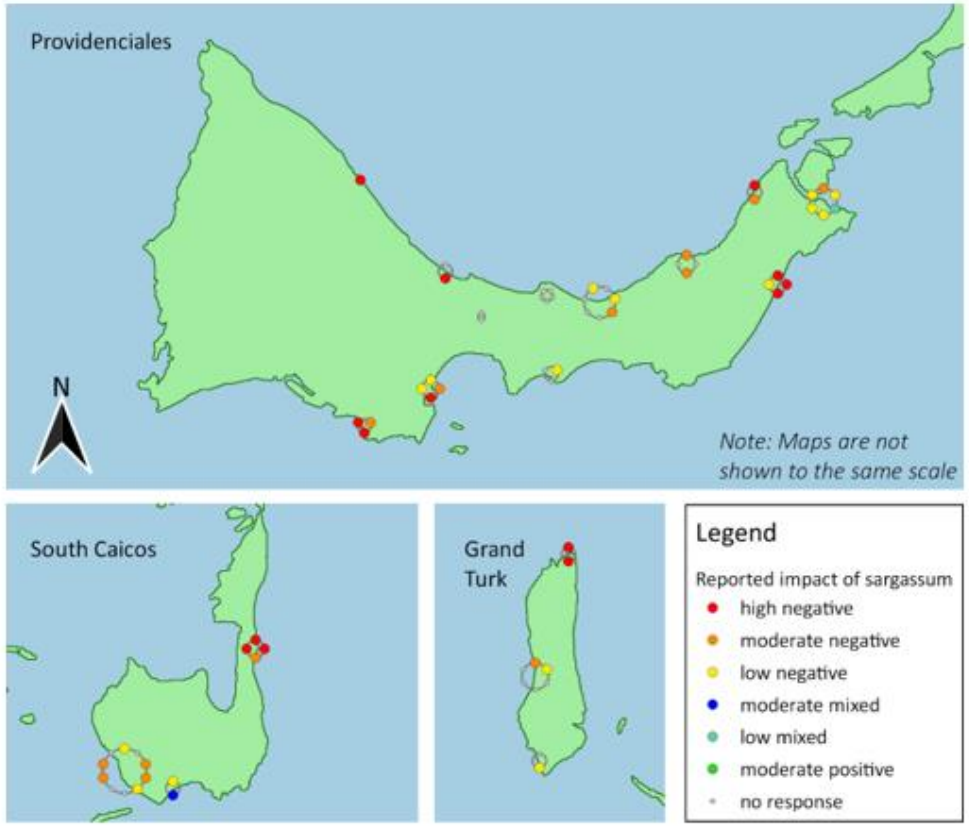
Removal method	All	PLS	GDT	XCS
Raking and shovels	30	23	5	2
Machines	11	4	2	5
Hand cleaning of equipment	8	5	2	1
From water using hand tools	2	2	0	0
Boom	1	1	0	0

Disposal methods



Disposal method	All	PLS	GDT	XCS
Pile on beach	8	2	1	5
Skip/dump	7	4	1	2
Burying it	5	4	1	0
Composting	1	1	0	0

Impact of *Sargassum* on TCI



Frequency	All	PLS	GDT	XCS
Daily	23	15	4	4
Weekly	5	4	0	1
Monthly	4	4	0	0
When necessary	3	3	0	0
Other	7	4	2	1

Sargassum rafts support a diverse array of life described as ‘golden rainforests’ (Laffoley *et al*, 2011)

- 100 species of fish
- 4 turtles,
- 145 invertebrates
- numerous sponges, fungi, bacteria, diatoms, and protists
- 10 endemic species
- spawning grounds for economically important and iconic species
  - such as American and European eels (*Anguilla rostrata* and *A. anguilla*),
  - flying fish (*Exocoetidae*),
  - white marlin (*Tetrapturus albidus*), and blue marlin (*Makaira nigricans*).
- floating nurseries for
  - swordfish (*Xiphius gladius*),
  - Green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricate*), loggerhead (*Caretta caretta*), and Kemp’s Ridley turtles (*Lepidochelys kempii*).
  - Tuna (*Thunnus spp.*),
- Hunting grounds
  - Various sharks (*Selachimorpha*)
  - whales (*Cetacea*)

(Huffard *et al*, 2014; Laffoley *et al*, 2011).

FLOATING RAFTS	
Positive impact	Negative Impacts
• **feeding, nesting and spawning grounds for diverse fish and sea turtle species** • **10 endemic species** • **foraging for endangered humpback whales**	• Change water chemistry • reduce water oxygen levels • mortality to near-shore corals • change in ecology of seagrass meadows

BEACHED SARGASSUM	
Positive impact	Negative Impacts
• **high beach and sand dune stabilisation** • **provides nutrients that can increase coastal vegetation growth** • **foraging for birds**	• objectionable odours • aesthetically unpleasant views of beaches • potential health effects of odours • barrier for hatchling turtles • mortality to corals & seagrass meadows.

Sustainable Solution?

What is the environmental impact of harvesting?

At sea? From the beach?

What is the impact of not removing it?

Only with a full cost – benefit assessment can this be determined

REFERENCES

García-Sánchez M, Graham C , Vera E , Escalante-Mancera E, Álvarez-Filip L & van Tussenbroek B I (2020) Temporal changes in the composition and biomass of beached pelagic *Sargassum* species in the Mexican Caribbean. Aquatic Botany 167, 103275

Huffard C L, Von Thun S, Sherman A D, Sealey K and Smith K L (2014) Pelagic Sargassum community change over a 40-year period: temporal and spatial variability. Marine biology 161(12) pp.2735-2751

Laffoley D d'A, Roe, H S J, Angel, M V, Ardron J, Bates N R, Boyd I L, Brooke S, Buck K N, Carlson C A, Causey B, Conte M H, Christiansen S, Cleary J, Donnelly J, Earle S A, Edwards R, Gjerde K M, Giovannoni S J, Gulick S, Gollock M, Hallett J, Halpin P, Hanel R, Hemphill A, Johnson R J, Knap A H, Lomas M W, McKenna S A, Miller M J, Miller P I, Ming F W, Moffitt R, Nelson N B, Parson L, Peters A J, Pitt J, Rouja P, Roberts J, Roberts J, Seigel D A, Siuda A N S, Steinberg D K, Stevenson A, Sumaila V R, Swartz W, Thorrold S, Trott T M, and V Vats (2011) The protection and management of the Sargasso Sea: The golden floating rainforest of the Atlantic Ocean. Summary Science and Supporting Evidence Case. Sargasso Sea Alliance, 44 pp.

Schell J M, Goodwin D S and Siuda A N (2015) Recent Sargassum inundation events in the Caribbean: Shipboard observations reveal dominance of a previously rare form. Oceanography, 28 (3) pp.8-11

Thank you for listening

d.bartlett@gre.ac.uk