Summary report on the development of a sub-regional sargassum outlook bulletin for the Eastern Caribbean

S-A. Cox and H. A. Oxenford

Submitted to

Food and Agriculture Organization of the United Nations (FAO)

by

Centre for Resource Management and Environmental Studies (CERMES),
University of the West Indies Cave Hill Campus, Barbados

March 2019

Disclaimer and copyright

Acknowledgements

The development of this information product has benefited from the generous support of the Climate Change Adaption in the Eastern Caribbean Fisheries Sector (CC4FISH) project of the Food and Agriculture Organization (FAO) and the Global Environment Facility (GEF).The authors would also like to express their gratitude to the stakeholders who provided valuable feedback on the prototype.

Cover photograph: Aerial photograph of Skeete's Bay, Barbados. Courtesy of BlueGreen Initiative.

Abstract

Since 2011 thousands of tons of pelagic sargassum seaweed have piled up on beaches and in nearshore waters of many countries across the Caribbean region (Franks et al. 2016). These periodic influx events, now considered to represent a 'new normal' in this region (Maréchal et al. 2017), have significant negative implications across multiple sectors including fisheries, tourism, health and environment (Oxenford et al. 2017). They also present new potential opportunities for development of industry using sargassum as a raw material (Hinds et al. 2016, Louime et al. 2017). Adapting to this new normal by learning to cope with, and even profit from, these influx events is a critical next step for the region, and would benefit greatly from the development and communication of reliable long and medium-term forecasts of sargassum arrivals. A recently launched monthly sargassum outlook bulletin for the Wider Caribbean by USF/NASA is providing timely updates on sargassum presence in the entire region relative to previous years and comments on future bloom probability for the next three months (Wang and Hu 2017). This provides an excellent opportunity to develop a complimentary outlook bulletin at a finer sub-regional scale that would better serve the interests of individual countries. This report presents a summary of the development process of a Quarterly Sub-regional Sargassum Outlook Bulletin tailored for the Eastern Caribbean. This prototype was developed with key stakeholders in an effort to add sector-specific value to the bulletin in the form of advice on appropriate responses. We anticipate that this bulletin will facilitate wider access to specifically tailored early warning information allowing better decision-making processes by key socio-economic sectors in the region.

Citation: Cox, S. and H.A. Oxenford**.** 2019. *Summary report on the development of the Sub-regional sargassum outlook bulletin for the Eastern Caribbean*. CC4FISH Project Report D24 to the FAO. Centre for Resource Management and Environmental Studies, University of the West Indies, Cave Hill Campus. Bridgetown: Barbados. 11 pp

Contents

Introduction

Communicating long-term implications of climate-related impacts such as sargassum influx events is dependent on the provision of reliable early warning information tailored to the Caribbean context. At present, the University of South Florida in collaboration with NASA disseminates a monthly bulletin entitled 'Outlook of Sargassum blooms in the Caribbean Sea'. This bulletin provides a general outlook of current bloom condition and future bloom probability for the Caribbean Sea. However, the resolution of the images presented is too coarse to accurately determine the specific islands forecasted to be affected and the implications to sectors of interest. This presents the opportunity to improve on this existing bulletin and integrate the outputs of the new pelagic sargassum transport prediction model developed under the CC4FISH project. Here we present a zero-order draft of a quarterly (Oct-Jan) Sub-regional Sargassum Outlook Bulletin for the Eastern Caribbean (see appendix) developed in collaboration with key sectoral partners.

Sargassum outlook bulletin prototype

Design criteria

The Outlook Bulletin is intended to serve two of the most heavily impacted sectors of the Eastern Caribbean, i.e. fisheries and tourism, with the target audiences being tourism businesses and policy makers, fisheries managers and fisherfolk. Our design criteria included the following essential elements: short and attractive publication for print or electronic delivery; simplified scientific jargon to translate the latest science into easy-to-understand language; provision of best available information on the current sargassum intensity-level and a 3-month outlook of likely sargassum abundance; summary of possible implications customized for each of the two sectors; and provision of links to useful resources.

Prototype design

The bulletin prototype took the format of a two-page letter-size newsletter design with 6 main sections (see Appendix). The pdf format chosen allowed readers to view clickable links which directed them to media articles and useful resources. The header of the first page displays the name of the bulletin, date of issue and the logos of collaborating organisations involved in the production process. At present, no sectoral organisations are illustrated but we intend to include these organisations before the trial issue is released.

The first feature of the bulletin is the summary statement which gives a snapshot of the key messages in the bulletin. It outlines the current situation and the outlook for the next 3 months.

The statement is followed by a processed 7-day composite satellite image (Figure 1) to show current sargassum presence for mid-October (in this case). Short descriptive text is placed below the image to describe the current situation with regard to sargassum presence, where warm colours (red and orange) indicate higher sargassum abundance.

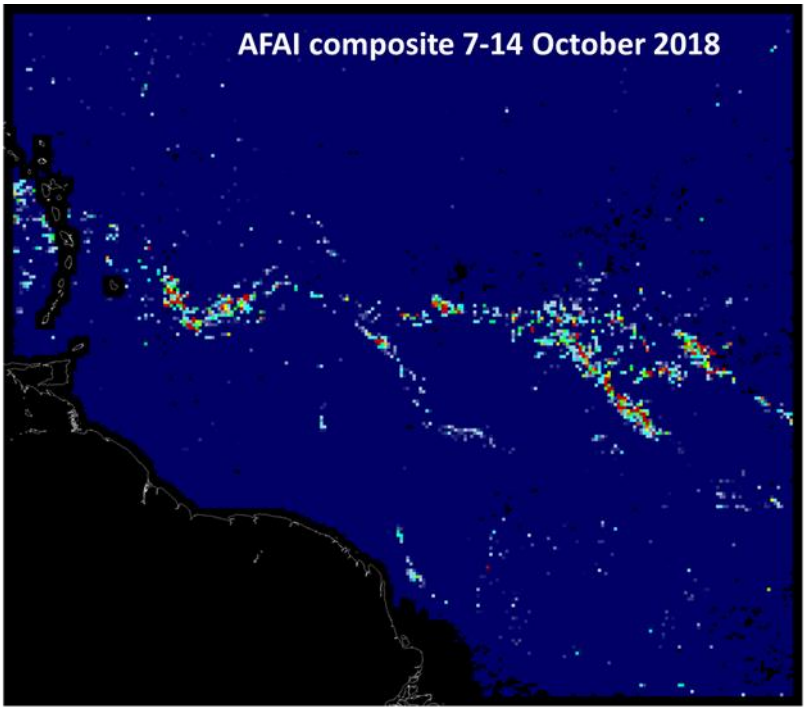


Figure 1: Processed satellite image courtesy of the USF Optical Oceanography Laboratory

Developing sargassum intensity levels

Information on the current sargassum intensity-level is displayed on the front cover of the bulletin. For this zero-draft we used a current AFAI (alternative floating algae index) 7-day composite satellite image of the Central Atlantic from the University of South Florida (USF) Optical Oceanography Laboratory (https://optics.marine.usf.edu/cgi-bin/optics_data?roi=C_ATLANTIC&current=1), covering the period 7-14 October 2018 for a visual reference, together with a current intensity-level gauge to help 'translate' the current satellite image into something that the audience can relate to (Figure 2 top left).

The intensity-level gauge was developed using a one degree square just to the east of Barbados (59.5 - 58.5° W, 12.5 - 13.5° N; Figure 2 top right) in which to quantify sargassum intensity from monthly composite AFAI satellite images going back to 2010 (provided by C. Hu and M. Wang, USF Optical Oceanography Lab). Intensity was calculated each month (using the monthly composite image) as the total % cover of the one-degree square by the coloured pixels representing sargassum presence, and plotted as a time series (Figure 2 bottom panel). The time series plot was then used to devise a simple, but somewhat arbitrary, 4-level gauge (clear, mild, moderate, severe) based on our collective experience and anecdotal reports (see Ramologan et al. 2017) of the impacts of sargassum suffered in Eastern Caribbean islands (especially Barbados) over the same 8-year period. We determined that the level that most accurately described the current situation was mild. This outcome was illustrated using the gauge graphic feature in Figure 2.

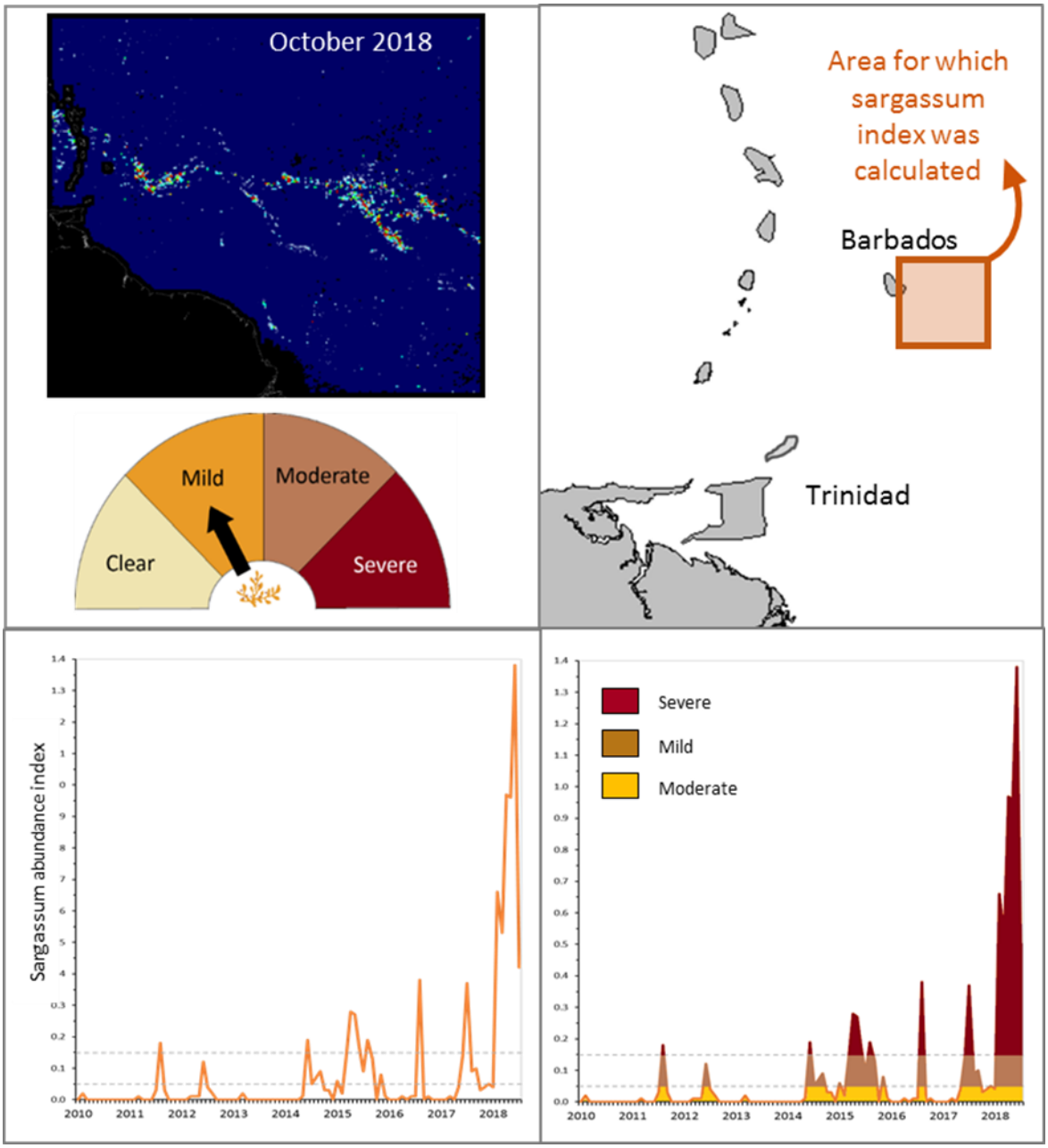


Figure 2: Interpretation of current abundance of sargassum. Top left: shows the satellite image and sargassum intensity-level gauge displayed on the front cover of the zero-draft Sargassum Outlook Bulletin. The image is an AFAI processed 7-day (07/10/2018-14/10/2018) composite satellite image showing sargassum presence (as white through red pixels) in the Central Atlantic in early October (source: USF Optical Oceanography Laboratory, Hu and Wang 2017). Top right: shows the one-degree square to the east of Barbados in which a time-series of sargassum abundance was calculated. Bottom panels show the time-series plot of sargassum abundance (as monthly % cover of the square) up to July 2018, and the assignment of intensity-level based on the abundance index and the impacts experienced (clear = 0, mild = 0.01-0.05, moderate = 0.06-0.15, intense > 0.15).

Headline impacts

This section highlights impacts of recent influx events and provides links to online media sources. We also included a link to a reporting site for mass strandings maintained by our collaborators at the University of Southern Mississippi (USF). It is anticipated that the inclusion of this site will encourage citizen scientists to participate in reporting impacts. Our collaborators have communicated their plans for simplifying the reporting form and including a map feature to illustrate location of impacts. This output is anticipated for inclusion into the bulletin to display more credible sources of impacts. It is our intention to work with our collaborators to develop this feature in upcoming issues. We also intend to explore the use of the hashtag #sargassum on social media in highlighting geo-referenced photos of sargassum influxes. If these images can be easily validated then this may serve as a useful data source for possible inclusion on the reporting site.

Latest news

The final section on Page 1 provides a spotlight on the most recent innovative uses of sargassum and important upcoming events. This section also has the potential for providing a space to announce the latest sargassum related reports and scientific journal articles. Perhaps over time this section can feature new technology and equipment used to remove sargassum from beaches.

Current outlook

The 3-month outlook, shown on the second page of the bulletin, is based on the best-fit model developed so far, of predicted sargassum transport to this sub-region. The details of this model are given in Johnson et al. 2019. In brief, we used the mean current field of three archived data sets, namely: satellite tracked mixed-layer drifters; and two climatological hydrographic models, HYCOM (HYbrid COordinate Model) and OSCAR (Ocean Surface Current Analysis Real-time). Starting points for the model were derived from areas of high concentration of sargassum detected in the processed AFAI satellite images from the USF Optical Oceanography Laboratory (Figure 3 top panel). We then used a simple forward tracking algorithm with our mean current field to track the transport of sargassum and predict its arrival at the 60° W meridian fronting the Eastern Caribbean island chain. The number of tracking points crossing the 60° W meridian serves as a simple sargassum prediction index. To provide better resolution of predictions, we also separated the island chain into northern and southern islands using 15.4° N as the dividing line on the meridian (Figure 3).

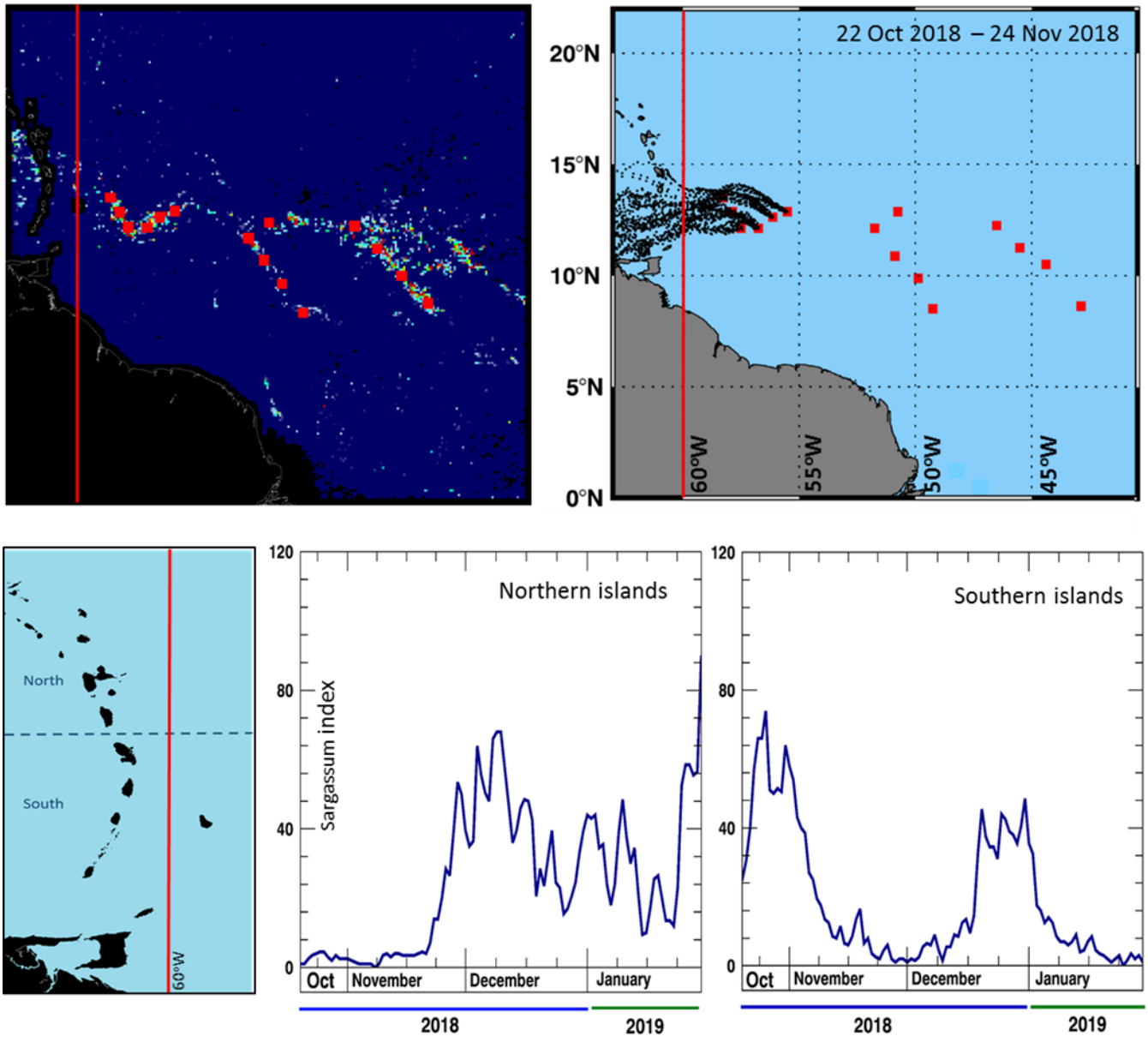


Figure 3: Development of 3-month sargassum abundance outlook. Red lines mark the 60oW meridian used to measure an index of sargassum arriving in the Eastern Caribbean. Top left: shows selection of starting points (as red squares) for sargassum transport predictions superimposed on AFAI satellite image (from USF Optical Oceanography Laboratory, Hu and Wang 2017). Top right: shows model run for one month on nearest starting points. Bottom left: shows higher resolution map of division used between northern and southern eastern Caribbean islands. Bottom middle: shows expected sargassum abundance levels arriving in the northern Eastern Caribbean islands, and Bottom right: shows expected levels for the southern islands, based on model runs of the starting points shown in top panel.

Implications to sectors

Summary information on likely implications for fisheries and for tourism over the next 3-months was developed with key stakeholders in an effort to add sector-specific value to the bulletin in a form that

allows for development of appropriate responses. Photographs were added to this section to illustrate the key messages communicated.

Links and useful resources

Links to media articles and other useful information were also embedded in the pdf document. This was our attempt to highlight existing information sources tailored to the Caribbean context.

Feedback on bulletin

Two feedback sessions on the bulletin were chaired by CERMES representatives at the Gulf Caribbean Fisheries Institute (GCFI) Conference on 9 November 2018 and the Regional Sargassum Symposium on the 21st November 2018. The bulletin was well received at the conference and the feedback was very positive. Participants from Colombia and Mexico expressed their interest in having a bulletin developed for their region.

At the Regional Sargassum Symposium, a 15-minute presentation was delivered before facilitating a feedback session using targeted questions (see Appendix II). Thirty-five stakeholders from Tourism, Fisheries and Agriculture sectors gave feedback in a plenary session and on printed copies of the bulletin. Their responses are summarized below:

- Feedback was consistent and positive. Most respondents agreed on the importance of a forecasting service that is collaboratively developed, user friendly, trusted and accurate.
- The layout in general is adequate, simple and easy to read. Language is simple but definitions of terms like 'bloom intensity' need clarity;
- Headlines and news features were good but there were some concerns about inaccurate and embellished news inadvertently being spread;
- Participants agreed that an option for both pdf and interactive media should be pursued, with options to download, zoom in on maps and citizen reporting considered;
- Email delivery of the bulletin in the morning was the preferred timing, noting that quarterly distribution is likely; and
- Subscriptions, advertising, private partnerships, government subvention were all mentioned as potential financing options. Some participants expressed willingness to pay for subscriptions: $2-3 per bulletin or $40-100 per year.

Possible improvements to the bulletin include:

- Sharing management solutions from different islands;
- Superimpose CTO tourist arrival projections on graph;
- Geographical context on maps, axis labels on graphs;
- Links to other climate/ocean-related bulletins in resources sections;
- Include indication of whether volumes have increased or decreased since the last bulletin; and
- Reorganise sections of the bulletin so that the outlook is on the first page and 'Headline Impacts' and 'Latest News' are placed on the second page.

Next steps

The 2-sided, zero-draft Outlook Bulletin document presented here provides a much needed, easy to understand and fresh approach to assisting stakeholders in key sectors within the Eastern Caribbean to prepare for expected sargassum influxes over the coming months. Next steps before roll out of the trial version will include efforts to: continue working on improving the prediction model for this area; use feed-back from the GCFI and FAO-UWI meetings to improve elements of the design of the bulletin; engage sectoral stakeholders in the co-development process; and seek a viable method to sustain production. This will include forming partnerships with processed satellite image providers (USF), seeking long-term funding, and automating the oceanic model for forward-tracking predictions. There is also the opportunity to integrate graphics from the bulletin into the existing Fisheries Early Warning and Emergency Response (FEWER) mobile app.

We anticipate that this bulletin will facilitate the wider availability and access to specifically tailored early warning information. This is a basic pre-condition for the integration of early warning information into the decision-making processes of key socio-economic sectors in the region.

References

Franks, J. S., D. R. Johnson and D. S. Ko. 2015. 2016. *Pelagic sargassum in the tropical North Atlantic*. Gulf and Caribbean Research 27: SC6-SC11.

Hinds, C., H. Oxenford, F. Fardin, E. Doyle, J. Cumberbatch and A. Cashman. 2016. Sargassum management brief. Golden tides: management best practices for influxes of sargassum in the Caribbean with a focus on clean-up. Centre for Resource Management and Environmental Studies (CERMES), University of the West Indies, Cave Hill Campus, Barbados, 17pp.

Johnson, D.R., H.A. Oxenford, S-Ann Cox and J.S. Franks. 2019. Holopelagic sargassum and the complexities of predicting influxes and impacts on pelagic fisheries of the Lesser Antilles. Proceedings of the Gulf and Caribbean Fisheries Institute 71: in press.

Louime, C., J. Fortune and G. Gervais. 2017. *Sargassum invasion of coastal environments: a growing concern*. American Journal of Environmental Sciences 13: 58-64.

Maréchal, J-P., C. Hellio and C. Hu. 2017. *A simple, fast, and reliable method to predict Sargassum washing ashore in the Lesser Antilles*. Remote Sensing Applications: Society and Environment 5: 54-63.

Oxenford, H.A., F. Fardin, E. Doyle and J. Cumberbatch. 2017. *Management recommendations to cope with sargassum landings in the Caribbean*. Extended Abstract, Proceedings of the Gulf and Caribbean Fisheries Institute 69: 215-216

Ramlogan, N.R., P. McConney and H.A. Oxenford. 2017. *Socio-economic impacts of Sargassum influx events on the fishery sector of Barbados*. Centre for Research Management and Environmental Studies (CERMES) Technical Report No. 81. 86 pp.

Wang, M., and C. Hu. 2017. *Predicting sargassum blooms in the Caribbean Sea from MODIS observations*. Geophysical Research Letters 44: 3265–3273.

Appendices

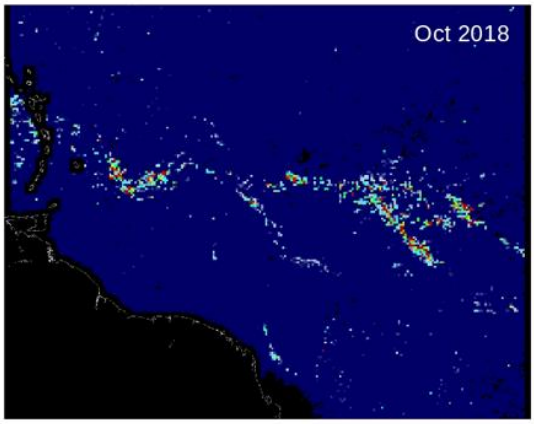
Appendix 1: Sargassum outlook bulletin prototype

SARGASSUM

SUB-REGIONAL OUTLOOK BULLETIN

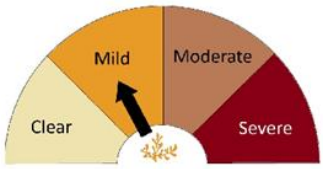
CERMES UWI CC4FISH NOVEMBER 2018 | ISSUE 1 | VOL I

SARGASSUM INFLUX EVENTS ARE LIKELY TO CONTINUE IN THE COMING WEEKS



Sargassum image courtesy of M. Wang and C. Hu, USF Optical Oceanography Laboratory

- The map above shows sargassum presence over a 7-day period, with warm colours representing high sargassum abundance.
- The islands of the Eastern Caribbean have been experiencing a record high Sargassum influxes since January 2018.



Sargassum abundance intensity level (October)

Intensity level gauge illustrating index of sargassum abundance based on % cover of sargassum pixels in satellite Images

HEADLINE IMPACTS

Sargassum seaweed invades Caribbean. Read more....

Sargassum seaweed invasion across the Caribbean is killing wildlife. Read more...

Masses of seaweed threaten fisheries And Foul Beaches. Read more...

Loads of seaweed are threatening the Caribbean's sea life and tourism. Read more...

To report mass strandings click here

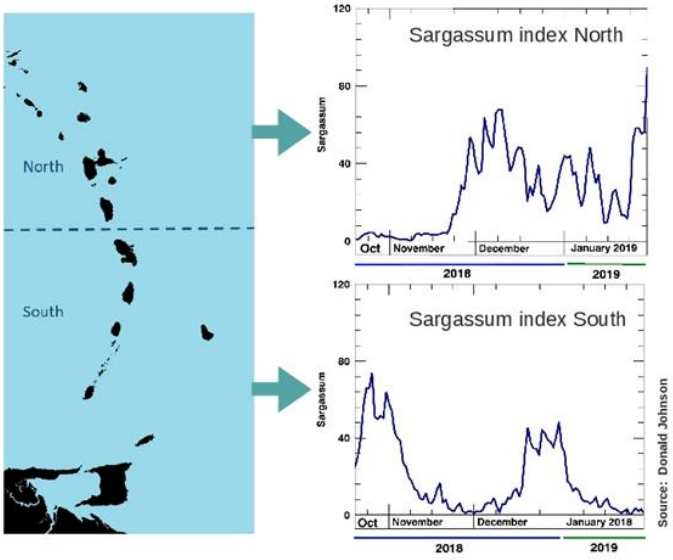
LATEST NEWS

First house entirely made of Sargassum built by Mexican inventor in Quintana Roo.

2nd Regional Sargassum Symposium to be convened by the FAO in association with The UWI on 21-22 November 2018

CURRENT OUTLOOK (OCT - JAN 2018/19)

- Bloom intensity in the Eastern Caribbean Sea is predicted to decrease slightly from current levels in the coming months.
- Southern islands will be most impacted until the end of November,
- Influxes are expected to shift slightly north by the beginning of 2019.



USEFUL RESOURCES

UWI Sargassum Management Brief 2015
CHTA/CAST: Sargassum A Resource Guide for the Caribbean
CRFM Model Protocol for Management of Sargassum Seaweed
GCFI Timely Guidance for Hotels and Resorts on the Sargassum Influx

FOR MORE INFORMATION CONTACT:

Hazel Oxenford, Ph.D. (CERMES, UWI)
Shelly-Ann Cox, Ph.D. (CERMES, UWI)
James Franks, Ph.D. (GCRL, USM)
Donald Johnson, Ph.D. (GCRL, USM)

IMPLICATIONS FOR THE TOURISM SECTOR

- The decrease in bloom intensity is welcomed at the start of the tourism high season (December - April).
- Beaches and bathing areas should remain relatively clear of sargassum.
- Hotels and other tourism businesses should stay tuned to forecasts.

IMPLICATIONS FOR THE FISHERIES SECTOR

- The decrease in bloom intensity coincides with the start of the fishing season (November - June).
- It will be good news for flyingfish fishers and consumers but expect fewer Almaco jacks.
- Windward landing sites should remain clear of inundation.


Photo credit: Hazel Oxenford

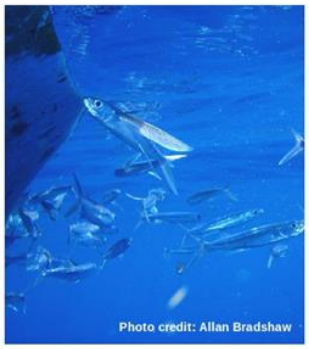


Photo credit: Allan Bradshaw

Appendix 2: Sargassum outlook bulletin testing exercise

Purpose of Exercise: To continue the co-design of the sargassum outlook bulletin with stakeholders acting on the operational level in the fisheries and tourism sectors.

Guidelines:

Set ground rules: For example- one person talks at a time, speak clearly.

Instructions:

Step 1: Give participants 10 minutes to read the bulletin.

Step 2: Give participants the opportunity to answer the following questions.

1. What do you like about the bulletin (design, layout, content, language figures, relevance, length)? What don't you like (design, layout, content, figures, relevance, length)? How can it be improved?

2. How do you think you can use the information in the bulletins?

3. Do you prefer a pdf (static) vs an online format (interactive)?

4. What is the optimal time to send the bulletin to your inbox? Early morning, midday, around 2pm or evening.

5. Would you share this with your stakeholders/colleagues?

6. Do you have ideas for sustainable funding of the bulletin?