UWI Cave Hill Campus Sargassum Research Coordination Workshop Summary

Date: 28 June, 2021

Workshop Agenda

SESSION	TOPIC	PRESENTER/FACILITATOR
WELCOME	Welcome	Patrick McConney
CERMES SARGASSUM ACTIVITIES	SargAdapt Project Overview	Karima Degia
	Research informing Management - SAMS and beyond	Patrick McConney
	Brief Q & A	Janice Cumberbatch
SARGASSUM RESEARCH PART 1	The UWI Rum and *Sargassum* Project: Saving tourism and transportation in a 100% Fossil Fuel Free Barbados	Legena Henry
	Utilization of *Sargassum* and its Extractions	Srinivasa Popuri
	Potential of using sargassum seaweed in agriculture, as fertilizer and mulch	Francis Lopez
	Novel microbial biocatalysts for valorization of *Sargassum* seaweed wastes	Bidyut Mohapatra
BREAK	Comfort Break	-
SARGASSUM RESEARCH PART 2	An Investigation of the Bio-processing of Pelagic *Sargassum* sp.	Nikolai Holder / Shontelle Sealy
	Sargassum associated biodiversity	Makeda Corbin/ Kristie Alleyne
COLLABORATION & COORDINATION	Sargassum communications	Shelly-Ann Cox
	Plenary: Collaboration opportunties, next steps	Janice Cumberbatch
	Summarise Next Steps, Action Items	Janice Cumberbatch
CONCLUSION	Closing Remarks	Patrick McConney

The UWI Rum and *Sargassum* Project: Saving tourism and transportation in a 100% Fossil Fuel Free Barbados

Dr. Legena Henry

- Solution for transportation as it transitions to 100% RE
- Solution for tourism – less sargassum in the ocean is less on the beach
- Biomethane can cheaply and easily power CNG (compressed natural gas) – converted ICE (internal combustion engine) vehicles
- Anaerobic digestion needs water; since Barbados is water scarce, wastewater can be used. Rum distilleries produce water as a waste product which can be used in anaerobic digestion.
- Sugar cane can be used as a potential biofuel crop; however, the sugar cane industry is declining in Barbados.
- Sargassum is here to stay and produces more biomass than we can produce which makes a good biofuel crop.
- Future plans to use sargassum biogas to fuel vehicle by year end and aiming to commercialise – test 100 CNG converted cars
- Project aligns with the UN Sustainable Development Goals.

Utilization of Sargassum and its Extractions

Dr. Srinivasa Popuri

- Sargassum seaweed is a nutritious food and is mainly composed of carbohydrates
- Sargassum has some antibacterial/antioxidant properties
- A key interest is in carbohydrates (alginates) to prepare alginate membranes
- Alginate is found in brown algae cell walls – other commercial species have more alginate than sargassum but are not readily available here.
- Alginate or Algin or Alginic acid is a hydrophilic polysaccharide with over 100 applications (textiles, cosmetics, water, treatment, food, welding, pharmaceutical, dentistry)
- Research has looked at different methods to increase extraction efficiency of alginate. So far have improved from 6% to 17% yield
- Alginate can be used as a wastewater treatment where heavy metals like copper are removed
- **Present research**:
    - Sargassum as a feed stock for microbial fuel cells (energy production with simultaneous water treatment)
    - Ecofriendly bioethanol production from sargassum biomass
    - Use hydrogen sulphide gas produced by sargassum to produce sulphuric acid and sulphur and a variety of inorganic sulphides for pesticide use, leather dyes and pharmaceuticals. Membrane technology can be used to extract/purify H2S. Main research interest is in this membrane technology

Potential of using Sargassum Seaweed in Agriculture, as Fertilizer and Mulch

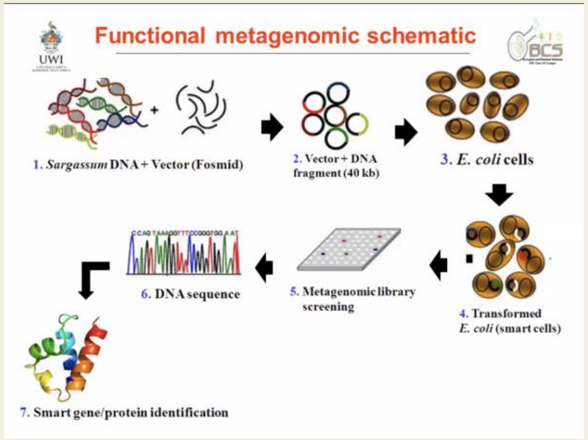
Dr. Francis Lopez

- **Application of sargassum to soil**:
    - Mulches
    - Soil mixes and composts
    - Extracts
    - Other soil additives:
        - Digestate
        - Biochar
- **Results of applying sargassum to soil**
    - Fresh sargassum used as mulch (washed and unwashed) can cause soil salinization and salinization of ground water over time.
    - Works like a mulch (improved soil moisture, microbial activity and plant)
    - Sargassum 3 months old works better than mulch material at 8 months old
    - It increased plant tissue moisture more than an inert mulch
    - Reduces need for inorganic fertilizers
    - Scaling up with use of mulch on larger field plots of sweet potato in follow-up work
- **Further work**
    - Optimizing quality and storage of sargassum product for use as mulch/biofertilizer
    - Quality assurance for biostimulants and organic residues produced from sargassum
    - Biochar from sargassum feedstock with energy capture from the production process
    - Optimizing biofertilizers from digestate after biogas production from sargassum

Novel Microbial Biocatalysts for Valorisation of Sargassum Seaweed Wastes

Dr. Bidyut Mohapatra

- Research focus: Assessing microbes in sargassum waste as biocatalysts (alginate lyase and cellulases)
- A microbial biocatalyst is defined as the whole cell or enzyme of a microbe for catalysis of a chemical reaction
- Biocatalysts are very important for many applications e.g. fixing nitrogen. Microbial biocatalyst production is a huge global industry worth billions of dollars. Market is growing because their use is eco-friendly.
- Particular interest is in alginate lyase which breaks down alginate into very valuable derivative with diverse biotechnological applications
- Also interest in cellulases which breakdown cellulose into glucose and has biotechnological applications.
- Pharmacology – alginate lyase is being used in acute cystic fibrosis treatment
- Functional metagenomics:
    - DNA is extracted from the sargassum samples and cloned into a fosmid vector to construct a metagenome library
    - This library assists in the identification of novel alignate lyase and cellulase genes from both the cultivable and uncultivable microorganisms.
- Sea Turtle project provides sargassum samples
- Methods have been developed at UWI's Biological and Chemical Sciences Department for high-throughput cultivation and rapid screening of potent microorganisms from sargassum waste to be used as biocatalysts



An Investigation of the Bio-processing of Pelagic *Sargassum* spp.

Shontelle Sealy / Dr. Nikolai Holder

- Alginate is available in the cell walls of brown seaweeds, and it helps to prevent the breakdown of the seaweed
- Alginate comprises D-mannuronic acid molecules linked by bonds
- Through research, developed a very efficient method of alginate extraction in 3 steps:
  - Acidification (with HCl)
  - Neutralization (with Na_2CO_3)
  - Precipitation (with alcohol)

An Assessment of Sargassum Associated Biodiversity

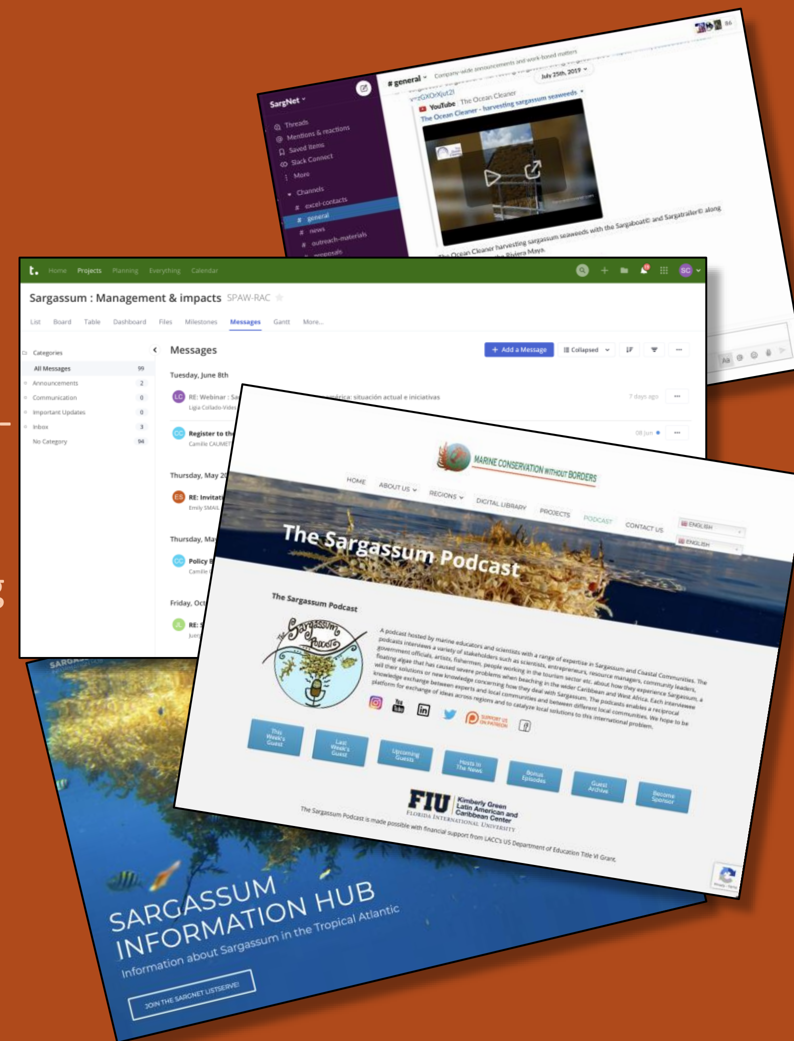
Makeda Corbin / Kristie Alleyne

- Under SargAdapt this research sets out to address current gaps in biodiversity knowledge that are essential to the design of mitigation strategies.
- It is important to address current gaps in biodiversity knowledge in order to assess trade offs associated with in-water and onshore harvesting.
- Using a combination of net sampling and underwater video footage, biodiversity assessments will be conducted inshore (<50 m), mid-shore (50-500 m) and offshore (500-1000 m).
- Results of this study will be used to better understand the biodiversity threat of in-water harvesting as a management strategy.

Sargassum Communications Overview

Dr. Shelly-Ann Cox

- Sargassum Communication Tools and Platforms
  - **Sargassum Hub** (https://sargassumhub.org)
  - **SARGNET listserv and Slack Workspace** (https://listserv.fiu.edu/cgi-bin/wa?SUBED1=SARGNET&A=1)
  - **SPAW-RAC/UNEP-CEP Sargassum Online Forum** (https://www.car-spaw-rac.org/?Sargassum-on-line-forum)
  - **Bulletins (USF, UWI-CERMES, MeteoFrance, NOAA SIR)** (https://sargassumhub.org/monitoring/; https://www.cavehill.uwi.edu/cermes/projects/sargassum/home.aspx)
  - **Sargassum Podcast** (https://marinefrontiers.org/sargassum)
  - **Webinars, Symposia, Conferences, Workshops**
  - **Social media hashtags: #sargassum #sargassumseaweed #sargazo**



Questions and Answers

1. Is there is way to prepare for sargassum influx?
    - Sargassum approaches from the windward side of Barbados where the seas are rough which makes it difficult to collect Sargassum. Barbados has a small sargassum harvester which is not designed to operate in rough open water; it works best in harbours and on sheltered coastlines. In countries like Mexico where sargassum comes ashore in calm waters, collection of sargassum is much easier and they have made significant advances in ways to collect it, including the use of very large sargassum harvester barges.
2. Can you use old ‘crispy’ SG or is there a specific time period it must be collected after being washed up for usability for mulch / fertilizer? Can you only use sargassum harvested in sea? Or can it be collected on the beach? If so, are there time or condition requirements?
    - Quality/effectiveness is apparently unaffected if seaweed is freshly collected or sun-dried and washed ashore; the only problem is that when sargassum is collected from the beach, sand is also collected (potentially beneficial to plants due to island’s clayey soil), but damaging for the beach.

Questions and Answers

3. People often ask about changes in sargassum chemical and physical properties: [1] fragmenting nearshore in the sea and [2] drying out ashore in the sun. Then, how could information on properties assist in determining best product development uses based on the condition of the sargassum, e.g. especially if it is stockpiled to dry in times of plenty?
   - Biochemical compounds and micronutrients within sargassum have been studied by SARTRAC and shows variations with the different ages of sargassum.
   - Appropriate storage of sargassum varies depending on intended end use.

4. For some uses, sargassum is a feedstock for some kind of process. One of the key challenges must be the variability in supply of this raw material. Can these processes use multiple feedstock streams, e.g. sargassum + wild cane + "river tamarind" for redundancy in periods when there is less or no sargassum?
   - Greater consideration of river tamarind as a feedstock is recommended, since it is easy to grow. River tamarind can be used with sargassum.
   - Sargassum + river tamarind mix is being used for mulch in the Dominican Republic

Sharing Information

- **LinkedIn:**
  - https://www.linkedin.com/in/shontelle-sealy-61a43b14b/
  - https://www.linkedin.com/in/amina-desai-b778b2100/
  - https://www.linkedin.com/in/patrick-mcconney-a27b2643/
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  - https://www.linkedin.com/in/shelly-ann-cox-57602726/
  - https://www.linkedin.com/in/akarimadegia/
- **Twitter**
- **IDB** can be used to publish articles
- Life of a scientist IG page by Shontelle Sealy (https://www.instagram.com/life_ofascientist/)
- Kudos (https://info.growkudos.com/research-stories-communication-impact)
- Share an edited version of this symposium's recording on UWITV or on some online platform.
- Send your manuscripts to the Special issue on Sargassum in Phycology: “Sargassum Golden Tides, a Global Problem”: https://www.mdpi.com/journal/phycology/special_issues/Sargassum_Golden_Tides
- Campus Research Day, usually in November, can be used to disseminate information
- UWI scientists special issue of Journal of Caribbean Environmental Sciences and Renewable Energy (CESaRE)
- Sargassum symposium in 2022 which can be a collaborative effort

Intellectual Property

- The Office of the Deputy Principal
  - The Office of Research, Innovation & Community at Cave Hill (RICCH – link) - area responsible for moving research to profit
  - Prof. Winston Moore
  - https://www.cavehill.uwi.edu/gradstudies/resources/forms-faculty/intellectual-property-policy.aspx
- UWI Mona has an office for Projects which looks at intellectual property (IP)
- CORPORATE AFFAIRS AND INTELLECTUAL PROPERTY OFFICE (https://caipo.gov.bb/home/index.php/intellectual-property)
- It was suggested that an IP seminar be held - where we can even be advised by experts on local laws and protections, as well as how to share and present work while still protecting