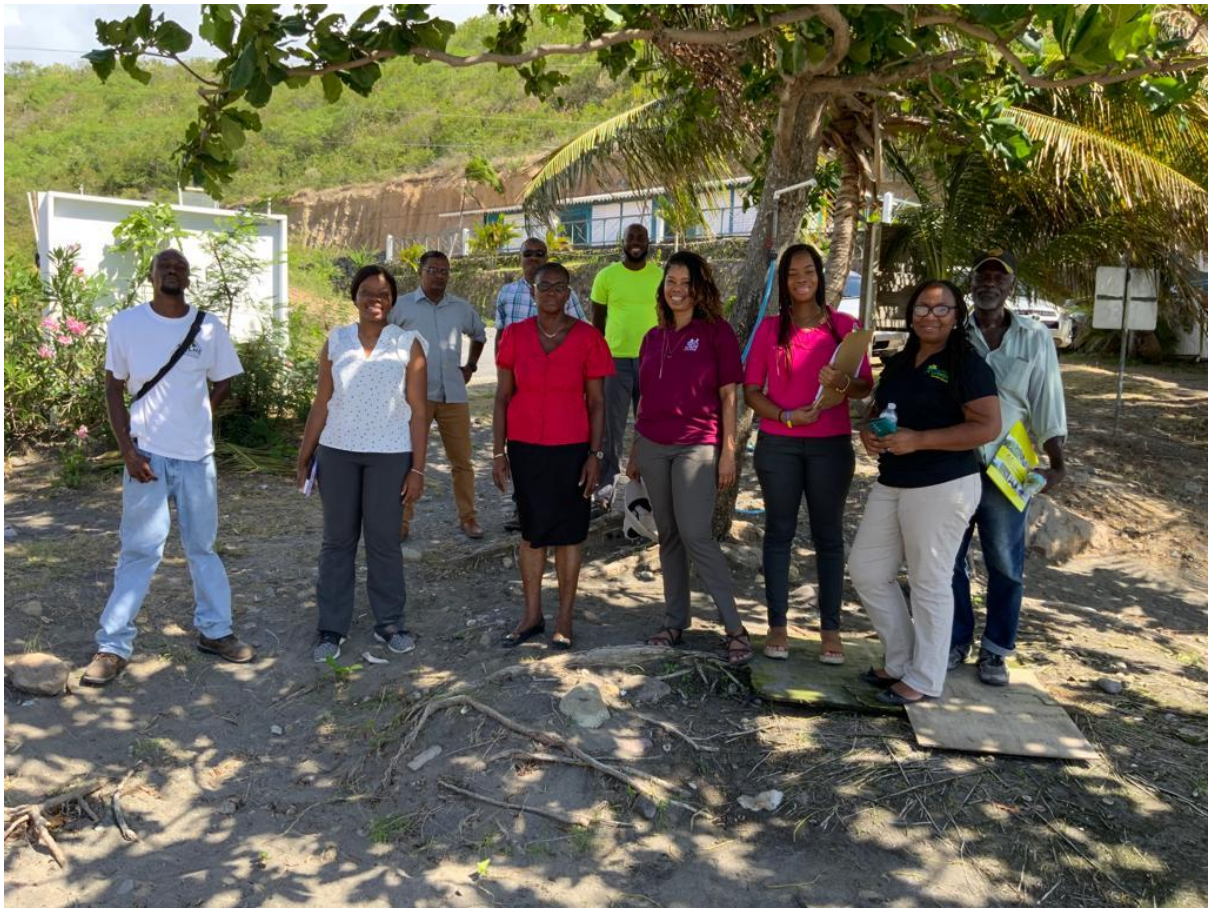
Report of Training Workshop on
Improving management of sargassum influxes in Montserrat



The Cultural Centre, Montserrat

May 23-24, 2023

Contents

Project Background

Since 2011, sargassum influxes have been affecting the Caribbean region, becoming a recurring threat over recent years in the Eastern Caribbean, including in Anguilla, Montserrat and the Virgin Islands, UK. These influxes have resulted in increasingly negative ecological and socio-economic impacts including biodiversity loss in coastal and marine ecosystems; health impacts associated with emissions of hydrogen sulphide and ammonia; and socio-economic and livelihood impacts in the tourism, fisheries and marine transport sectors.

The project, "Sustainable sargassum management in Anguilla, British Virgin Islands and Montserrat" aims to implement a participatory and multi-level approach to managing the social-ecological system responses to sargassum influxes in order to protect and enhance coastal and marine biodiversity and associated livelihoods. It is being implemented from 2021-2024 by the Caribbean Natural Resources Institute (CANARI) in collaboration with Department of Natural Resources–Anguilla, Ministry of Natural Resources, Labour and Immigration–Virgin Islands, Department of Environment–Montserrat, Centre for Resource Management and Environmental Studies (CERMES) of the University of the West Indies, and the Organisation of Eastern Caribbean States (OECS) Commission. It is funded by a grant from the Darwin Initiative.

One of the key activities under this project is building the capacity of coastal and marine managers and users for sargassum use removal and rehabilitation of affected areas. To this end, training workshops were held in each of the participating territories as follows:

Territory	**Workshop dates**	**Facilitators**
Anguilla	May 4-5, 2023	Dr. Ainka Granderson, Senior Technical Officer, CANARI Dr. Hazel Oxenford, Professor, CERMES
Montserrat	May 23-24, 2023	Ms. Yasa Belmar, Senior Technical Officer, CANARI Ms. Richeda Speede, Research Assistant, CERMES
Virgin Islands, UK	May 30-31, 2023	

Workshop Objectives

The workshop was designed to enable participants to share experiences and to gain a better understanding of the sargassum and best practices related to its management. The original agenda is attached at **Appendix 1** although minor modifications were made during the course of the workshop.

The specific objectives of the workshop were for participants to:

- have an increased and clearer understanding of sargassum, including its origins, ecological value, uses, bloom prediction, and remaining scientific uncertainties;
- be familiar with the principles of sargassum adaptive management within application to coastal and marine resources;
- be able to select the most suitable tools and approaches for monitoring, collection and removal of sargassum and the rehabilitation of affected areas;

- be able to access and utilize data and information on sargassum, including local knowledge, to improve their management decisions; and
- be equipped to effectively engage stakeholders in participatory sargassum management and to communicate about appropriate responses and adaptation approaches.

Participants

Participants in these workshops included coastal and marine managers and users who are affected by sargassum influxes, such as government agencies responsible for natural resources management, fisheries, planning, and disaster management, fisherfolk organizations, civil society organizations, and private sector representatives. The full list of participants for Montserrat is attached as **Appendix 2**.

Structure of the Workshop

On day 1, participants were introduced to the science of sargassum, including the high level of uncertainty associated with that phenomenon and the importance of participatory monitoring and research in supporting decision-making for effective sargassum management. On day 2, the focus was on sargassum adaptive management, including practical approaches to sargassum clean-up and management, selection of tools and approaches for sargassum removal and rehabilitation of affected areas, and effective stakeholder engagement and communication.

Methods

The workshop used an interactive and participatory format which built on participants' experiences and enabled them to apply the learning to their own context. A variety of facilitation methods were used including plenaries, brainstorming, collaborative small-group tasks and round-robin discussions.

The facilitators were Ms. Yasa Belmar, Senior Technical Officer at the CANARI and Ms. Richeda Speede, Research Assistant at CERMES.

The presentations made by the facilitators are summarised in this report and are attached as **Appendix 3**. Photos of the workshop can be found in **Appendix 4**.

Session 1 – Workshop opening

Ms. Yasa Belmar opened the workshop by providing a brief overview of supporting project and the workshop's objectives. She noted that while it was branded as a 'trainer of trainers workshop,' it could equally be referred to as an 'asker of askers workshop' since, as we will come to understand, sargassum management raises far more questions than it provides answers.

Following Ms. Belmar's introduction, Ms. Earnestine Corbette, Director of Environment at the Ministry of Agriculture, Trade, Lands, Housing, and Environment, and the project focal point, delivered brief welcoming remarks. During her address, Ms. Corbette emphasized the significant threat posed by sargassum to the Caribbean region and stressed the importance of enhancing the capacity for an effective response. She acknowledged that while Montserrat has not experienced the same level of impact as some other territories, it remains essential for them to be prepared for any future developments and to be ready to capitalize on potential opportunities.

Session 2– Introduction to sargassum science and participatory coastal and marine resource management

The session began with an ice-breaker where provided with sticky notes to write down a burning question(s) they had about sargassum. Then, in round robin fashion, they stated their names, the agency they represented, shared their question(s) with the group. After everyone had their turn, the

sticky notes were collected and placed on a flip chart or wall at the front of the room. The questions asked by participants across the 3 territories covered a broad of topics ranging from its ecological impact and uses to questions about its effects on human health, who/which agencies are/should be responsible and appropriate measures taken to manage and control it. (See Box 1)

The rest of the session aimed to provide answers to these questions using a variety of formats. This included showing the video documentary Drowning in Seaweed, followed by a presentation by Ms. Ajhermae White of the Department of Environment on Sargassum Management in Montserrat.

Ms. White's presentation highlighted the main areas impacted by sargassum in Montserrat and its impact on fishers. She also raised concerns about a possible relationship between the spread of Stony Coral Tissue Loss Disease due to the movement of Sargassum throughout the region. In terms of its benefits, she pointed out that sargassum has benefitted Montserrat's migratory shorebird population and has brought red mangrove propagules to the island for the first time since the volcanic eruptions. She explained that regular monitoring of sargassum is not currently done on the island. However, capacity for drone monitoring was built under this Darwin Plus project.

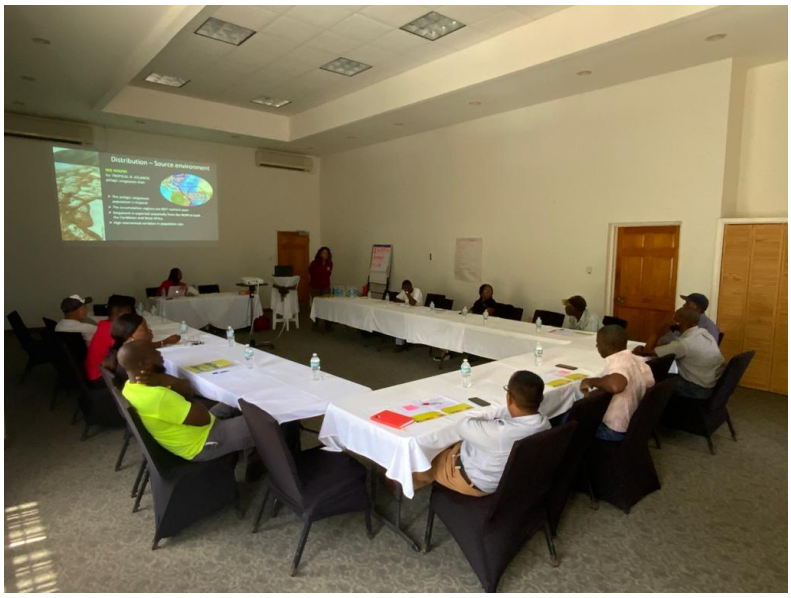


Figure 1 Participants sharing their burning questions

Ms. Richeda Speede then gave a short presentation on the basic science surrounding sargassum. After this, the facilitators reviewed the burning questions shared at the beginning of the session, answering the simple ones, but highlighting overall, that there is much uncertainty regarding sargassum, highlighting the need for ongoing participatory research and monitoring as part of an adaptive management approach.

Box 1- Burning Questions

Human Health and Safety:

- Is it safe to swim in sargassum-infested waters?
- Are the gases produced by sargassum harmful?
- Does the level of heavy metals affect safety of its use in agriculture?
- Does it affect people living near sargassum?

Uses and Applications:

- Can it be used as a fertilizer/ compost in agriculture?
- What are some alternative uses of sargassum (if it shouldn't be used in agriculture)?
- What is the NPK ratio of sargassum for fertilizer?
- Is the heavy metal content and absorption a problem?
- How can sargassum be beneficial?

Management and Control:

- Are there any strategies for controlling sargassum?
- Can we harvest and control sargassum at sea?
- Are there any measures that can be taken to reduce sargassum production?
- How can we control the smell?
- How can we protect beaches for tourism?

Science of Sargassum:

- The sargassum was not always there. What changed? Where did it come from?
- What is the geographic spread of sargassum?
- What factors are contributing to sargassum influxes?
- What is the role of eutrophication? Why do we hear more about the role of climate change?
- Can we predict future influxes?
- What happens when sargassum breaks down?
- How many species of sargassum exist and which one/s are washing up on our shores?
- What is the growth rate and life span of sargassum?
- Will it ever disappear?
- How does and where does the weed absorb heavy metals from? Is all the weed contaminated or only from certain areas? Are there better strains or weaker strains?

Responsibility and Financial Aspects:

- Who is really responsibility for addressing the sargassum issue?
- Is there any international financial assistance available for clean-up?

Session 3 – Dealing with Uncertainty: Participatory Research and Monitoring

This session began with Ms. Richeda Speed giving a presentation introducing the Participatory Research and Monitoring (PRAM) Framework developed under the project which, if implemented, would help to fill knowledge gaps and lead to more evidence-based decision-making regarding sargassum. See **Appendix 5** for a copy of the PRAM. Participants were then divided into groups to conduct an exercise where they were required to make a list of all the current or potential research and monitoring tools that could be utilized to fill knowledge gaps highlighted in the previous session, using coloured paper to differentiate between those they thought would be most feasible (green paper), potentially feasible if relevant capacity building or material resources were provided (yellow), or not feasible at all for their context (red). They also listed the information or data that the tool would be used to collect.

<table>
<tr><th>Highly feasible</th><th>Potentially feasible</th></tr>
<tr><td>Size of influxes
Current
Distribution
Impacts on marine habitats
Coral reef
Marine ecology
Bathymetry
Current trajectory
Forecasting
Awareness raising
Training
Tracking of fish stock by fisheries
Citizen science approaches</td><td>Barrier netting
Skimmers
Satellites
Remote sensing
Some level of monitoring the marine habitat</td></tr>
<tr><th colspan="2">Not Feasible</th></tr>
<tr><td colspan="2">Offshore
Impacts on fishing equipment
Removal from sea bed
Invasive species breaches
Eradication</td></tr>
</table>

Session 4: Field trip

The afternoon session consisted of a field trip to the following sargassum monitoring sites in Montserrat: Little Bay, Woodlands Bay and Margarita Bay. The primary objectives were to evaluate the influence of sargassum in these areas, examine the data collection methods currently in use, and identify any additional information requirements.

Demonstration drone flights took place in Anguilla and Montserrat; however, adverse weather conditions prevented a flight in the Virgin Islands. The drone team provided insights into the process of setting up a site for drone monitoring and discussed various challenges associated with this approach. These challenges encompassed factors like weather-related flight scheduling constraints, limited drone availability (with some teams sharing access to a single drone provided under the Darwin project), and flight restrictions near certain locations, such as airports. In cases where drone usage was restricted, alternative manual methods were required.

Furthermore, it was emphasized that drone-generated data must be complemented with socio-economic information collected through diverse means, such as surveys, key-informant interviews, and focus groups. Data regarding health impacts on surrounding communities could be gathered through collaboration with public health authorities. Similarly, information on the effects on education, electricity, and water supply could also be acquired from relevant authorities, tailored to local needs and priorities.

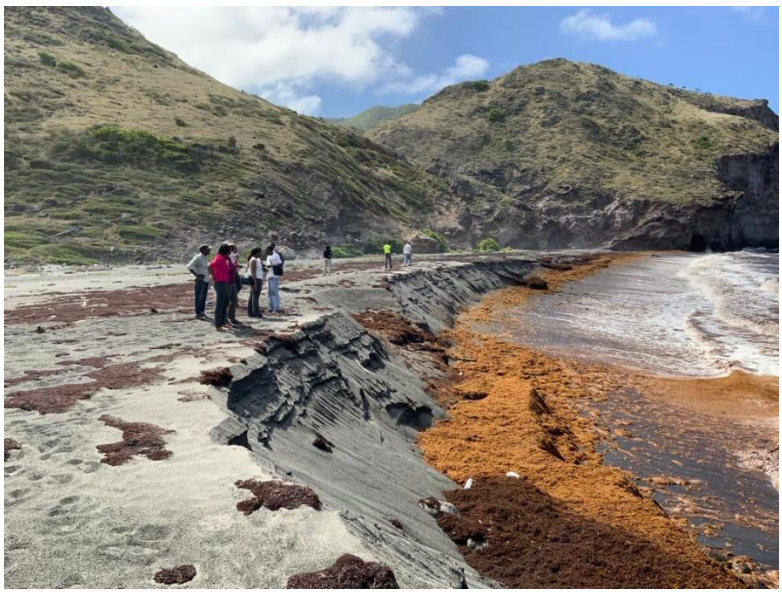


Figure 2 Participants observing sargassum accumulations at Margarita Nay

During the site visits, participants reviewed the site profiles produced for each site and reflected on the following questions:

- how they could be improved?
- what other aspects needed to be recorded?
- Who has the required expertise?
- Which organisations have the capacity to do this monitoring on a regular basis? and
- What should the frequency of monitoring be for these different data sets

They also learnt how to identify different species of sargassum.

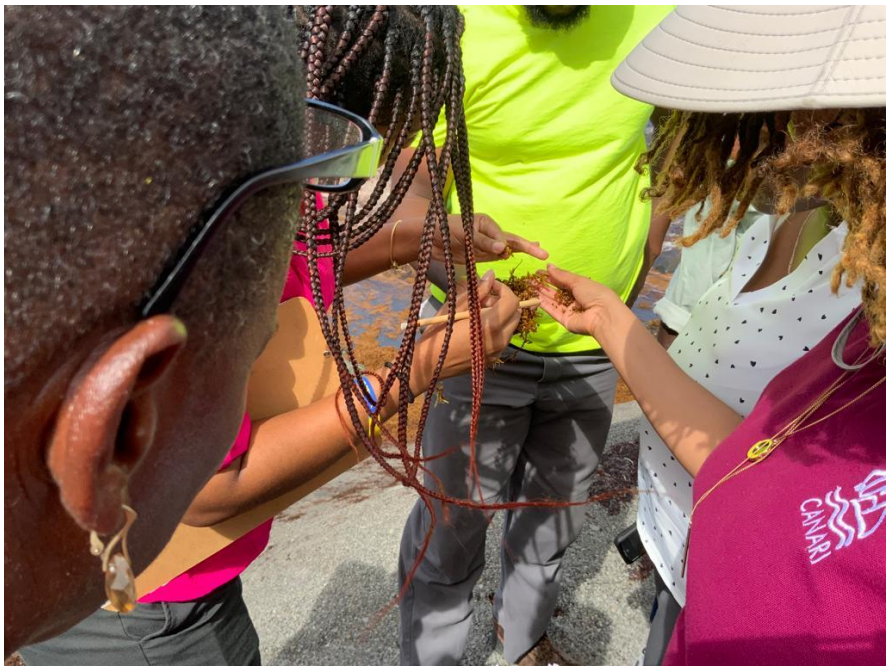


Figure 3 Ms. Richeda Speede explains sargassum species identification during site visit to Margarita Bay

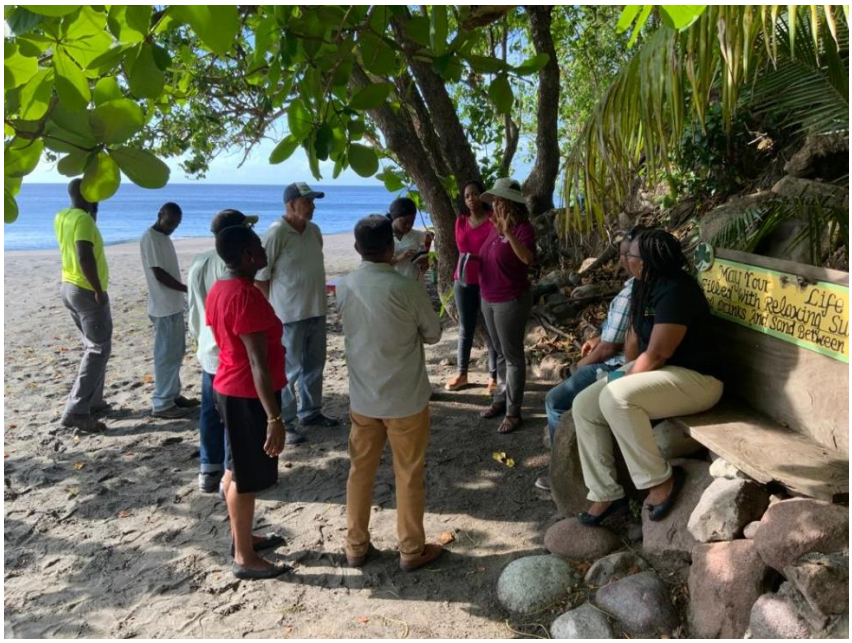


Figure 4 Participants reviewing the site profile for Woodlands Bay

Fieldtrips across the 3 territories highlighted the following issues in common:

- Many stakeholders are unaware of the types of data being collected by done monitoring teams and how this data was useful.
- While continuous monitoring is important, this data needs to be analysed, communicated and used in informing decision making regarding sargassum management.
- Iti is important to clarify roles and responsibilities so people know what to do when there is an influx of sargassum.

- It is not always necessary to clean beaches. It is important to monitor the impacts of management actions and to adjust as appropriate. Attitudes and perceptions may need to change.
- Vulnerability assessments should play a central role in prioritizing the allocation of limited resources. The facilitators emphasized that *exposure* to sargassum influxes is just one component of vulnerability. For instance, a site might have a high exposure to sargassum influxes, but if it is a self-cleaning beach and the sargassum will quickly be taken away by currents, or there are few assets or livelihoods affected in that area, the overall vulnerability of the site is low. Consequently, it would not be a priority for management efforts.
- Local/traditional knowledge of a site is important information that should be considered.
- It is important to leverage existing capacities across government, the private sector, and civil society. Establishing mechanisms that facilitate regular communication among stakeholders and encourage collaborative problem-solving is crucial.

Session 4: Debriefing of field trip and day 1

During the first session on Day 2, participants reflected on their key takeaways from Day 1 and the field trip. These were as follows:

- Heavy metal content and its implications on agriculture
- Undercutting of beach due to waves and sargassum influxes
- Safety issues for beach goers (Altered beach profile)
- Need for more data sharing, also good practice and innovation
- Beach accessibility for heavy equipment is a key consideration when planning responses to heavy influxes
- The need for routine monitoring and consistent data collection
- Many interrelated issues affecting the coastal environment to be considered, e.g. sargassum is bringing red mangrove seeds that is enabling the Environmental Department to undertake restoration of mangroves in Montserrat
- Needs to explore opportunities for commercialisation of sargassum and this may require skimming collection offshore
- The importance of monitoring the impacts of our management interventions on the environment
- Key sectors need to be actively involved to ensure inclusive and comprehensive approaches are taken
- Multisectoral collaboration is needed for sargassum management
- So much to be learned on sargassum. The potential impacts on pregnant women were surprising
- The workshop can encourage policy makers to take action and stimulate political will
- Where is the baseline data to enable monitoring of changes?
- How can we ensure that we integrate traditional knowledge?

The purpose of this debriefing exercise was to get participants to begin thinking about what data, indicators, research topics and key learning questions surrounding sargassum need to be answered going forward.

Session 5: Assessing tools and approaches for collection and removal of sargassum

This session opened with Ms. Richeda Speede presenting on tools and approaches for collection and removal of sargassum. This presentation provided an overview of the different approaches and tools

for managing sargassum inundations both on- and off-shore, the pros and cons of different approaches, and outlined the recommended selection criteria, as outlined in the SAMS. In Anguilla and the Virgin Islands, facilitators engaged participants in a plenary discussion on their previous experiences with some of the tools and approaches mentioned, lessons learnt and their relative advantages and limitations. In Montserrat, where there has not been any active management of sargassum, participants had the opportunity to ask questions about tools and approaches which may be applicable in the future.

Territory	**Tools used, experiences and lessons learnt**
Anguilla	Key lessons: 1. Use forecast (2.5 month in advance) to inform procurement process before influx of sargassum 2. Better communication protocol for clearing beaches to hotel operators, contractors and local communities to encourage 'good practices.' 3. Activate Sargassum taskforce/ coordination mechanism for effective and efficient clean-up and removal and proper oversight by government agencies. 4. Use forecast with link to EWS to identify who should lead with what type of response needed based on size of influx 5. Review prioritization of Anguilla beaches for action based on exposure with impacts on people/ livelihoods
Virgin Islands	Tools and experiences: *Lake harvesters* • Two of these machines were purchased by a private company • They worked but required a conveyor belt • Couldn't work during rough weather • Fell into disrepair due to lack of use out of season/maintenance issues *Ocean harvesting/ skimming, shredding, sinking* • Government received a proposal from a private company • Would require a $10k per day contract • Uncertain about the potential environmental impacts? *Small scale harvesting experiments* • BVI Kelp – running trials on different approaches to removal, drying for export. • Successful experiments but questions remain regarding scaling - what's appropriate for small islands when it comes to commodification *Pumps/ Ice Bubblers* • Resorts/ Marinas have utilized pumps and outboard engines to" keep it moving" and away from the desalination plant inlets • Spent up to $1000/year on fuel • Expense make it infeasible for long-term operation *Deflection/ Booms*

	• Using natural wind/ wave dynamics to deflect or keep it moving is preferable • Not clear how this impacts on marine biodiversity/ fisheries • Question: Are we creating “feeding stations” for sharks with nets/booms close to shore? Key lesson: We need to monitor the impacts of these different tools/approaches

Session 6: Rehabilitation of affected areas and sargassum uses

Ms. Yasa Belmar opened this session by discussing site rehabilitation. Her presentation highlighted the potential damage which can be caused to critical habitats/ ecosystems when inappropriate actions are taken to facilitate access and clean-up sargassum. She also covered key considerations for different approaches to ecosystem rehabilitation and restoration. essential factors to consider when approaching ecosystem rehabilitation and restoration. Ms. Belmar stressed the importance of having a thorough understanding of the socio-cultural and economic context, existing hazards, vulnerabilities, and technical requirements before embarking on site rehabilitation. Interventions should prioritize the needs of the most vulnerable and aim to alleviate poverty and promote livelihood development.

Following Ms. Belmar's presentation, Ms. Richeda Speede discussed the uses of sargassum and the feasibility of various options. These uses ranged from small to medium-scale regional initiatives, including the production of biostimulants, weed suppressants, paper products, to larger industrial endeavors such as manufacturing construction blocks (Sargablock), plant tonics, and biofuels.

Participants gave examples of the current uses of sargassum in the OTs. In Anguilla, it is being used in small scale dune restoration experiments. In Anguilla, it is being used in small-scale dune restoration experiments. In the VI, it is being incorporated into road construction on Mosquito Island, and a local company BVI Kelp is conducting trials on different collection and drying methods for export using mobile micro-processing units. In Montserrat, sargassum has been promoted as a valuable composting material for gardening, although there is a need to raise awareness about the risks associated with its high heavy metal content to discourage such usage. Across all territories, scalability of different usage options was a concern due to their small size and limited resources, highlighting the need for increased collaboration among OTs.

Participants emphasized the importance of identifying suitable locations for drying and storing sargassum before use, with a focus on areas where heavy metal leaching into the water table is unlikely. The Virgin Islands participants acknowledged that this could be challenging due to limited public land availability.

Some participants suggested the creation of an accessible database of methods and extraction techniques to facilitate usage, citing intellectual property restrictions as a hindrance for countries with limited research and development capabilities to commercialize sargassum.

There was a proposal to encourage youth innovation through science fairs and by sharing success stories of entrepreneurs in the region. Participants from the BVI workshop highlighted the need for government incentives to stimulate private sector investment in research and development by both local and foreign entrepreneurs. They mentioned the possibility of the Virgin Islands Climate Change Trust Fund providing seed funding grants to innovators. Additionally, there is a need for business

incubation support for small and microenterprises in this sector, with a potential role for the Ministry of Finance and Commerce in promoting corporate social responsibility initiatives that support innovation. As sargassum businesses develop, there will be a need for legal clarity regarding ownership and potential regulation. Tax-related implications should also be considered, necessitating the Ministry of Finance and Commerce's involvement in tracking the economic contributions of these businesses.

On the topic of rehabilitation, it was pointed out that in Montserrat, near-shore ecosystems had been severely affected by the volcanic activity, therefore protection and restoration of ecosystems is of importance. For instance, the red mangrove population has been severely depleted. However, sargassum rafts have played a crucial role in the government's ongoing mangrove restoration program by bringing red mangrove seedlings from neighbouring islands. Additionally, sargassum has proven beneficial to sea bird colonies, providing them with a rich source of food from the organisms that wash up in the mats. However, not enough is known about the impact of sargassum influxes on coral reefs and sea grass beds, and whether any rehabilitation is required. Collection of baseline data and continuous monitoring is therefore required.

In the Virgin Islands, participants emphasized the importance of strengthening and enhancing the enforcement of legislation to address issues related to critical ecosystem damage. They called for stricter penalties for activities that harm mangroves, highlighting the need for improved education and awareness regarding more appropriate management responses.

Session 7: Introduction to SAMS- Adaptive management of sargassum influx threats and opportunities

In her presentation on adaptive management of sargassum influx threats and opportunities, Ms. Richeda Speede provided a conceptual overview of the Sargassum Adaptive Management Strategy. See **Appendix 6** for copies the Montserrat SAMS Volumes 1 and 2.

She emphasized that Sargassum presents both challenges and opportunities, stressing the importance of a balanced and integrated approach that draws from the best practices of both disaster risk management and adaptive management. Additionally, designing appropriate *institutional arrangements* that are inclusive, participatory, efficient, effective, transparent, and responsive was essential. *Financial aspects*, including funding for monitoring, evaluation, clean-up, and research and development, were also discussed.

It is crucial to establish clarity regarding appropriate actions and responsibilities for each stage in the sargassum influx cycle. To facilitate this, the presentation was followed by an exercise in which groups of participants were tasked with mapping out relevant stakeholders (government, civil society, and the private sector), their roles and responsibilities, capacities, and needs during the pre-influx, influx, and post-influx phases. Groups had the freedom to choose how they presented this information.

In Montserrat, participants began identifying stakeholders who should be involved in different phases of the influx cycle, their roles and capacity needs, as outlined in the table below. Given that sargassum does not currently have a major impact on settlements in Montserrat, the focus of the discussion was on ensuring that there was clarity in roles and that appropriate data was being collected on impacts to justify requests for any additional resources that might be required.

Table 1 Proposed stakeholder roles and capacity needs during different influx phases in Montserrat

Agency	Role	Capacity Needs
Pre-influx phase		
AGs Office	Policy, reg	MAHLE must provide advice to AGs regarding required policies (e.g. establishment of the ocean governance committee)
Environment	Environmental monitoring (Baseline creation); identification of suitable storage sites	Data, skills, capacity building, establish storage sites, coordinate with regional bodies for provision or resources and equipment Training/capacity building in data collection, Stock/ ecosystem assessments to generate data; HR; monitoring equipment
Met Office	Receive and disseminate forecasts to media	N/A systems are in place
DMCA	Disseminate advisories and warnings (Bulletins)/ Advisories	
Health	Provide advice	Awareness building, gas monitors, collab with MVO for gas monitoring
Fisheries and Ocean Governance	Coordination	
Tourism	Budget for cleaning	Data to support request for increased beach cleaning budget
Schools/institutions	Citizen science	Training in the use of citizen science tools
Ministry of Communication and works (MCWL)	Procurement of equipment with MAHLE	Rakes, wheelbarrows, shovels, buckets, etc.
Influx Stage		
Agency	**Role**	**Capacity Needs**

DMCA	Coordinating response depending on amount of influx (emergency situation)	
Ministry of Agriculture, lands, housing, environment	Lead coordination, inform key stakeholders	Staff, SOPs, MOUs,
Fishermen and boat operators	Assist in cleanup. Reporting influxes,	Equipment, manpower
Ministry of Communications and works	Equipment provision or leasing during large influxes	
Ministry of Tourism	Equipment tourism during moderate influxes	
Post-influx phase		
DMCA	Evaluating, learning lessons, making changes for future events	
Ministry of Agriculture, lands, housing, environment		
Fishermen and boat operators		

Key learnings from this session across the three territories included:

- The need to clarify institutional responsibilities and to identify a lead agency who will be responsible for coordination. (The public should be aware of these responsibilities);
- The importance of leveraging existing resources and capacities;
- The need to develop standard operating procedures (SOPs) and triggers for different levels of response; and
- The importance of reflecting on what worked and what didn't during the post-influx phase and adapting institutions and SOPs as necessary.

Session 8: Delivering participatory process: stakeholder engagement and communications for management

This session underscored the significance of effective stakeholder engagement and communications in promoting participatory sargassum management. In her framing presentation, Ms. Belmar emphasized that communication could serve various purposes, including raising awareness, mobilizing action, and advocating for policy or process changes. Therefore, it is essential to have a clear goal or objective for communication and identify the target audience.

In Montserrat participants began identifying target audiences, the subject of their key messages and pathways for dissemination as outlined in the table below.

Table 2 Proposed communications priorities for Montserrat

Target audiences	Key messages	Pathways
Ministry of Health • Chief Medical Officer • Principal Environmental Health Officer • Outreach Officer	Potential health risks associated with sargassum • Do not use as a fertilizer • Pay attention to potential impacts of the gases on pregnant women	• Write a report on sargassum to the Ministry of Health to educate them about the risks • Face-to-face meetings
Public Works • Permanent Secretary • Director • Heavy Plant Supervisor • Charge Hand	• Role they should play in the clean-up • Require man-power and equipment • Sort out storage and collection	• Write a letter to the PS • On-on-one meetings • Explain the action plans and priority areas
Fishers	• Safety precautions/ best practices for fishers	•
Beach users and residents of affected communities	• Potential health risks • Precautions regarding uses	• Citizen Science

Key learnings from this session across the 3 territories included:

- The importance of communicating the relevance of sargassum to interests of stakeholders across sectors;
- The role of citizen science in both monitoring and awareness-raising;
- The importance of face-to-face meetings with key stakeholders to get their buy-in; and
- The opportunity to leverage free resources such as radio interviews and government information services to disseminate messages.

Session 9: Workshop evaluation and next steps

To close the workshop, Ms. Belmar thanked the Department of Environment, Mr. Norman Cassell, local mobiliser and participants for their cooperation in delivering a successful workshop. She explained that explained that over the next year the project will be provide technical support for implementation of the SAMS and PRAM and engaging in practical awareness raising exercises.

The workshop evaluation report is attached as **Appendix 5**.

Appendices

Appendix 1	Original agenda
Appendix 2	Participants list
Appendix 3	Presentations
Appendix 4	Photos
Appendix 5	Participatory Research and Monitoring (PRAM) Framework
Appendix 6	Sargassum Adaptive Management Strategy (SAMS)
Appendix 7	Evaluation Report