Workshop Report: Assessing *Sargassum* Knowledge Gaps for Effective Management
May 19-21, 2025

A beach on Saint Martin covered in *Sargassum*. Photo courtesy of NOAA's Atlantic and Oceanographic Meteorological Laboratory.

Organizing Committee

Maximillian Brown[1], Katharine Egan[2], Josie Galloway[1], Frank Hernandez[3], Felix Martinez[1]

1) NOAA National Centers for Coastal Ocean Science, 2) NOAA Southeast and Caribbean Regional Collaboration Team, 3) NOAA Southeast Fisheries Science Center

Workshop Participants

Felipe Arzayus[1],Brian Barnes[2], Arielle Benjamin[3], Brigitte Berry[4], Andrés Bisono[5], Rachel Brewton[6], Andy Bruckner[7], Lisamarie Carrubba[8], Ricardo Colón[9], Dani Cox, Nelson Crespo[10], David Dale[8], Amy Dempsey[11], Mya Garrison[12], William Hernandez[13], Chuanmin Hu[14], Lisa Krimsky[15], Brian Lapointe[16], Mariana C. León-Pérez[17], Clifford Louime[18], Loraine Martell[13], José Martínez-Ortiz[19], Dennis McGillicuddy[20], Julio Morell[13,21], Peter Morton[21], Josefina Olascoaga[12], Jannette Ramos Garcia[22], Wilson Santiago Soler[9], Brent Stoffle[8], Joaquin Trinanes[23,24], Karen Urelius[25], Brigitta van Tussenbroek[26]

1) NOAA National Centers for Coastal Ocean Science, 2) University of South Florida, 3) Environmental Protection Agency, 4) USVI Department of Planning and Natural Resources, 5) SOS Carbon, 6) Florida Atlantic University, 7) NOAA Florida Keys National Marine Sanctuary, 8) NOAA National Marine Fisheries Service (retired), 9) Puerto Rico Department of Natural & Environmental Resources, 10) Puerto Rico Commercial Fisherman and Caribbean Council, 11) BioImpact, 12 University of Miami, 13) University of Puerto Rico Mayaguez, 14) University of South Florida, 15) Florida Sea Grant, 16) FAU Harbor Branch Oceanographic Institute, 17) Mar Caribe Consulting, 18) University of Puerto Rico Rio Piedras, 19) Sea Grant Knauss Fellowship, 20) Woods Hole Oceanographic Institution, 21) Caribbean Coastal Ocean Observing System, 22) Texas A&M University, 23) Puerto Rico Sea Grant, 24) NOAA Office of Oceanic and Atmospheric Research, 25) Universidad Santiago Compostela, 26) U.S. Army Corps of Engineers, 27) National Autonomous University of Mexico

Acknowledgments

NOAA's National Centers for Coastal Ocean Science (NCCOS) and the Southeast and Caribbean Regional Collaboration Team (SECART) would like to thank all workshop participants for their involvement. Their combined efforts will be invaluable in determining informed research pathways to inform future *Sargassum* management.

Suggested Citation

Brown M, Martinez F, Arzayus F, Carrubba L, Egan K, Galloway J, Hernandez F, Lapointe B, León-Pérez MC, Stoffle B, Trinanes J (2025) *Workshop Report: Assessing* Sargassum *Knowledge Gaps for Effective Management*, May 19-21, 2025 [virtual workshop report]. U.S. Department of Commerce. National Oceanic and Atmospheric Administration. https://doi.org/10.25923/rk3r-wd43

Contents

Executive Summary

This year the Caribbean Coastal Ocean Observing System (CARICOOS) reported that *Sargassum* reached historically high densities in several regions. A record breaking 37.5 million metric tons of the macroalgae were detected throughout the Caribbean in May 2025. From disrupting fisheries and overwhelming beach resorts to impacting ecosystems and human health, *Sargassum* accumulation in the Caribbean, Southeast Atlantic, and Gulf of America is increasingly causing harmful impacts across the region. As *Sargassum* Inundation Events (SIEs) become increasingly recurrent phenomena, the National Oceanic and Atmospheric Administration (NOAA) is accelerating its efforts to promote timely and pertinent research that can improve management of *Sargassum* in affected areas of the United States.

From May 19-21, 2025, the National Centers for Coastal Ocean Science (NCCOS) and NOAA's Southeast and Caribbean Regional Collaboration Team (SECART) hosted a virtual workshop to 1) outline the current state of science related to *Sargassum* management, and 2) identify gaps in our understanding of *Sargassum* that may inform more effective management. Prior to this workshop, leaders in several areas of *Sargassum* research were asked to meet in small groups to summarize the state of science in their field, and prepare that information for presentation. This document is a summary of the initial findings from that workshop, including copies of all presented materials made available on SECART's *Sargassum* landing page. Findings and discussion points from this workshop will be synthesized into a Research Strategy document. The Research Strategy will establish research priorities to guide *Sargassum* research and inform management decisions.

Background

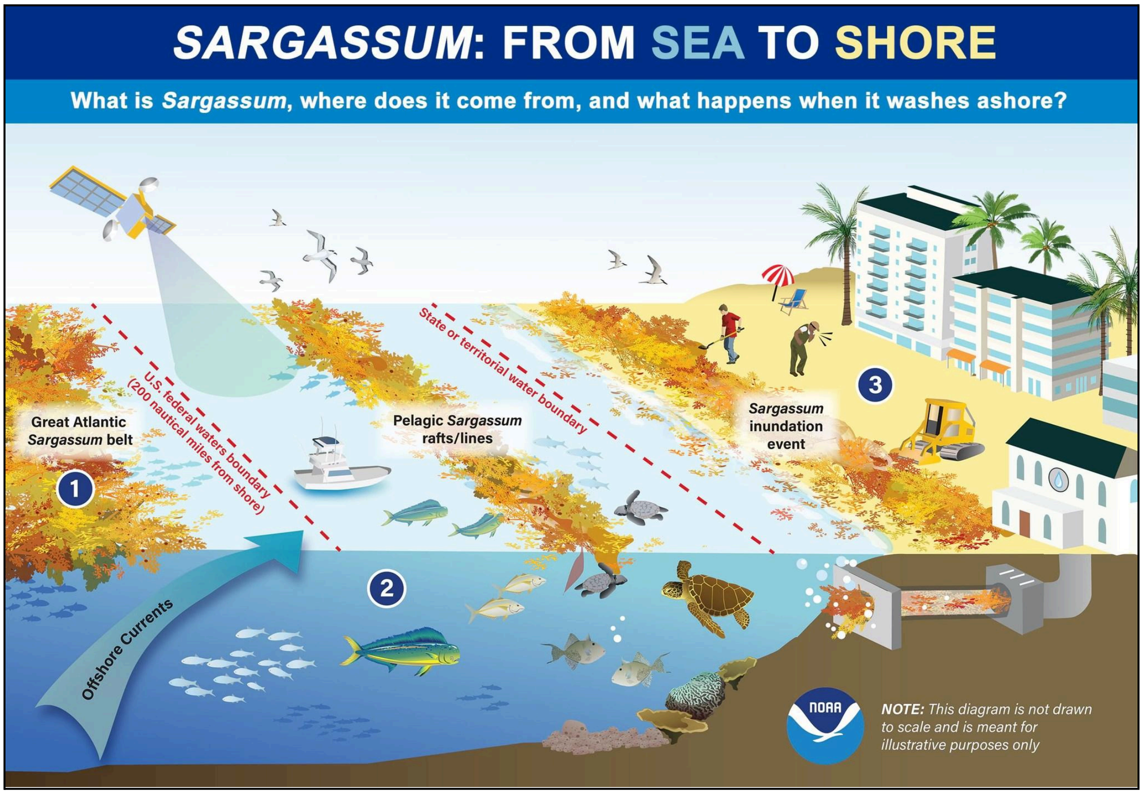

Figure 1: This infographic illustrates the movement of *Sargassum* from sea to shore. Out at sea, *Sargassum* provides important fish and wildlife habitat. However, this free-floating algae often washes ashore in great quantities due to strong wind and water currents. Masses of this algae beaching on shore can harm coastal ecosystems, drive away tourists, and pose public health threats. NOAA is working to help coastal communities address the growing problem of what experts call "*Sargassum* inundation events." Graphic courtesy of NOAA's National Ocean Service.

Since 2011, the increased frequency and severity of *Sargassum* Inundation Events (SIEs) in the South Atlantic, Caribbean, and Gulf of America regions of the United States have created a variety of challenges for coastal communities, wildlife managers, and commercial fisheries. SIEs may be considered harmful algal blooms (HAB) in nearshore and coastal areas. SIEs often have considerable socioeconomic impacts: they deter tourism leading to financial losses, and have damaged critical infrastructure including water treatment facilities and power plants. SIEs are documented to impact wildlife by deteriorating coastal habitats, inducing low light and hypoxic or anoxic conditions. As onshore *Sargassum* decomposes, it additionally poses hazards to human health. However, while large nearshore mats of *Sargassum* are recognized as costly and hazardous, the free floating algae is an important habitat for many marine organisms in the open ocean, including several endangered and protected species. *Sargassum* management falls under the jurisdiction of several federal and state agencies due to its ecological role and wide-spread distribution. It is designated as Essential Fish Habitat (EFH) in different jurisdictions and is a key feature of designated and proposed critical habitat units for loggerhead and green sea turtles.

NOAA's Southeast and Caribbean Regional Collaboration Team (SECART) and the National Centers for Coastal Ocean Science (NCCOS) created a Policy Analysis to provide an overview of regulatory jurisdictions surrounding *Sargassum* and a useful reference in the event of a disaster caused by SIEs. Through this effort, SECART and NCCOS determined that the complicated regulatory and legal framework surrounding *Sargassum* makes it difficult for coastal managers to respond to SIEs.

Purpose

SECART and NCCOS convened a workshop to identify research gaps that could inform *Sargassum* research and management strategies, particularly given the complexities of the existing regulatory framework. The purpose of the workshop was to develop information that will assist NOAA and other federal, state, and local agencies in their strategic planning and research prioritization for addressing *Sargassum*. Key objectives were to:

1. Evaluate current prediction and observing capabilities that determine when, where, and to what degree of severity a mass of *Sargassum* will impact a specific location;
2. Assess the state of the knowledge regarding the socioeconomic and ecological impacts of *Sargassum* inundation events; and
3. Identify strategies and underlying policy mechanisms for effective prevention, mitigation, and clean-up of *Sargassum* inundation events.

Workshop Format

The workshop was structured around the three themes noted above that define crucial information for *Sargassum* management: improving observation and monitoring; understanding potential socioeconomic or ecological impacts; and determining best management practices to safeguard coastal environments. Five teams composed of experts across sectors were established to summarize available information and research gaps for subthemes within each theme.

1. Observation and prediction of SIEs
    1.1. Ocean and nearshore transport (e.g., seasonality, micro-currents)
    1.2. Bloom drivers (e.g., nutrients, intensity)

2. Socioeconomic and ecological impacts of SIEs
    2.1. Physical, chemical, and biological (e.g., essential fish habitat, shading, choking, eutrophication, toxicity)
    2.2. Social, cultural, economic, and human health (e.g., tourism, costs, beach access)

3. Prevention, mitigation, and clean-up of SIEs
    3.1. Offshore interdiction (e.g., harvesting, redirection, ecological impacts, permitting/regulatory requirements) and onshore processing (e.g., removal, erosion, ecological impacts, safety and protection of workers, permitting/regulatory requirements)

Prior to the workshop, the teams met to complete an assessment of their assigned subthemes. During the workshop, the teams gave an overview of the result of their assessments. In the next section, we present initial summaries of each group's findings, highlight their condensed summaries of each knowledge area, and provide an overview of the key gaps discussed.

Primary Findings

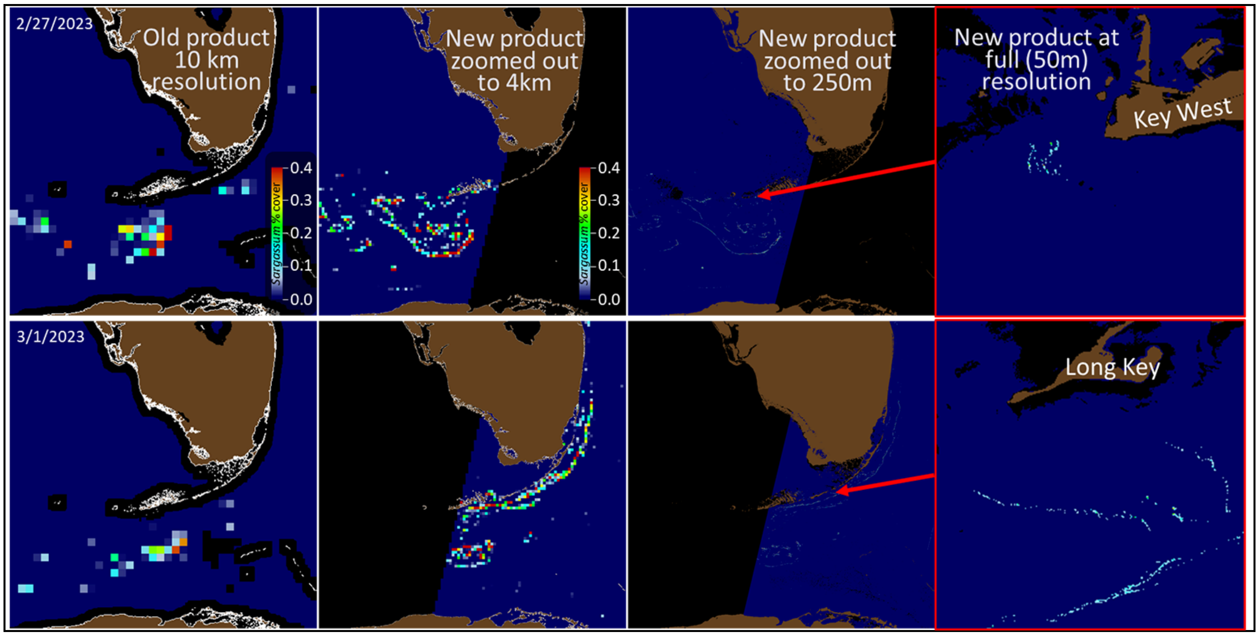

Figure 2: The figure above depicts the improved resolution of the *Sargassum* watch system. Photo courtesy of Brian Barnes (University of South Florida’s College of Marine Science’s Optical Oceanography Lab).

Observation and Prediction of SIEs: ocean and nearshore transport

State of the Science

It is known that large scale ocean (North Equatorial, Caribbean current) and mesoscale (eddies, fronts) circulation patterns as well as winds play a dominant role in long-range transport. SIEs are also modulated by nearshore dynamics including tidal currents, waves, wind-driven drift, and coastal bathymetry. Satellite-based products (e.g. MODIS, VIIRS, OLCI, MSI) and ocean current models (e.g. HYCOM, Mercator global ocean analysis and forecast) are increasingly used for monitoring and trajectory estimation to track *Sargassum* distribution and movement. There are new missions (PACE OCIE, PlanetScope cubesats) that can provide higher spectral and temporal resolution.

Questions and Gaps

Key questions identified by this group that guide research in this area are: What are the dominant transport mechanisms from the open ocean to the nearshore environment? How can data best be integrated from multiple satellite sensors into a common assimilation framework?

What are the best practices for estimating biomass using satellite data? How do small scale circulation and wind wave effects (local) impact SIE variability? What environmental parameters impact *Sargassum* aggregation and buoyancy? What are the roles of interannual variability and extreme events?

The gaps in current modeling efforts that were identified include:

1. Insufficient real-time, high resolution data on nearshore currents and wind patterns affecting SIEs. Poor satellite coverage in cloudy areas and presence of sun glint adds to this. A resolution of 5-10 meters every five days is not sufficient
    - There is also limited computational capacity to process high resolution multi-sensor data and complex models in real time.
2. Limited understanding of *Sargassum* transport dynamics. Most drift models are simplified and miss key physical and biological interactions; sub-mesocale currents, eddy retention, and inertial particle behavior are poorly resolved.
    - There is also a lack of understanding for how long an SIE will last.
3. There is a lack of integration between biological and physical processes. Models do not simulate the biology (growth, fragmentation, decay, or morphotype composition) of *Sargassum* rafts.
    - There is one global conversion factor for satellite imagery to biomass, despite known spatiotemporal variability.
    - There is uncertainty in the linkages of climate predictions to SIEs and the Greater Atlantic Sargassum Belt (GASB).
4. There is inconsistency in forecast model validation with groundtruth datasets.
5. Combining observations from multiple sensors continues to be a challenge due to different spatial and spectral resolutions, revisit times, and viewing conditions. Additionally, data combination is difficult due to a lack of standardized protocols for integrating satellite, *in situ*, modeling, and other sensor data across regions.

Observation and Prediction of SIEs: bloom drivers (e.g. nutrients, intensity)

State of the Science

Sargassum research during the late 1980s found approximately two-fold higher photosynthetic and growth rates in neritic waters compared to oceanic. This correlates with higher tissue nitrogen (N) and phosphorous (P) values in neritic waters. Long-term sampling of *Sargassum* in the western North Atlantic from 1983-2022 revealed an increase in tissue N%, with a 55% overall increase and a 95% in the Sargasso sea. Tissue P decreased slightly in this period, suggesting N enriched growth and a shift towards P-limitation. *Sargassum* has been shown to compensate for increasing P-limitation through increased alkaline phosphatase activity that allows *Sargassum* to access dissolved organic P pools.

Tissue N% and the stable isotope ^{15}N have been used to identify N source. The highest N% values are in the Gulf of America, coastal Florida waters, northern Sargasso Sea, and the western tropical Atlantic/Amazon plume region. ^{15}N values in the North Atlantic vary but enriched ^{15}N values correlate with tissue N% in other regions. Depleted ^{15}N values are found in the central and southern Sargasso Sea, the Caribbean Sea, and the Straits of Florida.

Nutrient cycling and metabolism may be mediated and/or impacted by microorganisms, although this topic is largely understudied. Members of the *Sargassum* microbiome have been defined as *Psuedomonadota*, *Bacteriodota*, *Actionmycetota*, *Cyanobacteriota*, *Planctomycetota*, *Chloroflexota*, and *Verrumicrobiota.* Active heterotrophs, diazotrophs, and phosphate degraders cycling local macronutrients (C, N, and P, respectively) are associated with *Sargassum*.

Questions and Gaps

In general, there are many unknowns about concentrations, composition, and fluxes of nutrients. Nutrient data and photosynthesis/growth rate data are not available for the eastern and central tropical regions of the GASB, which makes it difficult to draw conclusions about N-related growth in the western regions. It is unclear to what degree atmospheric deposition of nutrients impacts *Sargassum* growth including impacts from Saharan dust and burning biomass (agricultural burning, wildfires). Wet versus dry deposition may also play a role. The role of trace nutrients (Fe and Zn) in neritic waters needs to be assessed. It is also unclear if changes in vertical mixing (e.g., wind forcing, upwelling, thermal stratification) are driving shifts in nutrient availability as a result of ocean warming.

Elucidating microbial dynamics may help answer mechanistic questions regarding the role of nutrient enrichment in SIEs. Crucially, microbially- facilitated nutrient acquisition by *Sargassum* has not yet been shown, and the role of microbes in other host functions have not yet been explored. Microeukaryotic, archaeal, and endophytic members of the microbiome remain understudied. Interstudy comparison of the *Sargassum* microbiome is hindered by differences in microbial isolation techniques, and there are few studies that record microbial activity rates.

Figure 3: *Sargassum* Inundation in Puerto Rico. Photo courtesy of Mariana León-Pérez (Mar Caribe Consulting).

Socioeconomic and ecological impacts of SIEs: Physical, Chemical, and Biological

State of the Science

Biomass and residency time of an SIE drive ecosystem level changes. The dynamics of the impacts appear to be specific for different ecosystem types (e.g., mangroves, corals, seagrasses). The ecological impacts of SIEs have not been thoroughly characterized across ecosystem types, and at present, most of our understanding is about the short term impacts of large scale *Sargassum* events.

1. Physically, SIEs smother, or cover, the benthic ecosystem for a variable period of time. The short term impacts of light attenuation are well understood, as well as impacts on sand quality and aeration.
2. Chemically, we understand the transient nearshore impacts on water quality such as increase in nutrient levels, reduction in O_2, and impacts on pH.
3. Documented biological impacts of brown tides include “direct and short term” impacts on sea turtle nesting, impacts on benthic communities, impacts on mangrove communities, and impacts on fish and larger fauna including incidental mortality of adult sea turtles.

Questions and Gaps

Understanding the ecological impacts of SIEs requires monitoring at longer temporal and spatial scales. This approach will allow for the cascading effects of ecological shifts to be mechanistically demonstrated (e.g. how do brown tides cause landscape fragmentation from the shore to reefs). There are a number of gaps/questions related to the physical, chemical, and biological impacts of SIEs.

The physical impacts of scoring/scrubbing on benthic ecosystems and coastal vegetation needs to be documented over time. The long term effects of direct and indirect light attenuation over time remain understudied. In addition, impacts of residency time on shoreline topography, bathymetry, and sediment transport (erosion) are unknown. It is clear that the physical impacts of SIEs listed here may vary based on ecosystem type (e.g. tidal flushing will play out differently in mangroves than in seagrasses), but these impacts remain understudied.

Chemical processes during the deterioration/decay of *Sargassum* mats are understudied. The impact of H_2S, Methane, and O_3 emissions locally are not characterized. What are the long term ecological effects in toxicity pathways and mitigation strategies?

There are a plethora of biological impacts that remain understudied, due to the cascading impacts an SIE can have. General avenues of research include understanding the residence time of nutrients and contaminants released by *Sargassum*, understanding the impact on microbial communities, understanding changes in trophic networks, understanding the impacts of introduced non-native species, and determining ecosystem shifts related to cascading effects from an SIE. More specifically:

- Changes in reef and seagrass communities (more algae/pioneer species)
- Complications related to the erosion of beach-dune systems
- Increasing vulnerability of stony corals to stony coral tissue loss disease (SCTLD)
- Impacts to/of more generalist detritivores
- The impacts of raft associated non-native fauna

- The increase of *Vibrio spp*. associated with decay
- Offshore changes in fish populations (e.g., jacks vs flying fish)
- Changes in the feeding behavior of whale sharks
- Changes in organic matter influx to deep-sea systems

Socioeconomic and ecological impacts of SIEs: Socioeconomic impacts on communities

State of the Science

Drawing from key informants and affected coastal community members in the U.S. Southeast region (including South Atlantic, Gulf of America, and the U.S. Caribbean) *Sargassum*'s impacts on fisheries, coastal industry, and human well-being were documented. The impact varied by subregion, having differential socioeconomic impacts on coastal communities and local fisheries. An overarching theme was that on any given coastline, some areas are more heavily impacted than others. Understanding these regional and localized impacts provides an opportunity to plan future management strategies based on coastal resource use.

Regarding fisheries, *Sargassum* at sea can play a positive and negative role depending on the fishery. For hire and commercial fisheries that target pelagic species utilize *Sargassum* mats as a means of locating highly valued and desired species. Commercial, for hire, and recreational fishermen actively use satellite tools (e.g., SARGUS, CARICOOS) to determine where and when to go fishing. However, it is reported that too much *Sarassum* can create navigational hazards, causing mechanical damage to boats, closing access to marinas, damaging fishing gear, and making it difficult for net and pot fishing (e.g., fish, lobster, and crab traps). Fishermen also report instances where inundation in nursery areas and mangroves are perceived to have caused the death of many juvenile fish species.

Economic impacts are well documented, as SIEs cause a reduction in tourism and localized closures of small businesses (restaurants, bars, small vendors, and boat rentals). In Puerto Rico and St.Thomas, U.S. Virgin Islands, marinas facing eastward tend to consistently be first inundated because of prevailing currents and wind. However at the time of writing (2025), this year the inundation is larger than ever and impacting locations that previously saw little to no *Sargassum*.

Regionally, *Sargassum* has had differential economic impacts. In previous years, tourists have moved to other mainland areas, bringing their business with them. However, on smaller islands this is not possible. This observed adaptability in behavior suggests the negative impacts of long lasting SIEs are regionally limited. Beach closures and the lack of established infrastructure and management surrounding SIEs limit the utilization of green space for social activities, reducing the overall social and mental wellness of the community.

Questions and Gaps

There is a lack of communication materials and strategies available to inform tourists, the public, and small businesses about SIEs in a manner that does not negatively affect the coastal economy. There is a need for policy solutions at multiple levels of government to disseminate information and coordinate response in a manner that will minimize loss to the local economy. Certain locations, like Galveston, TX, have allocated funds anticipating the need to reduce

Sargassum's impact on coastal resource use, especially tourism. There may be opportunities to utilize known localization of negative impacts as a planning tool.

From an economic standpoint, locals are concerned about the loss of revenue and overall impact on industries (fisheries and tourism) as it relates to *Sargassum*. Fishing days lost, cost of gear repair or replacement, reduction in tourism, and closures of restaurants and other service related businesses are just a few examples of how coastal communities (formal and informal economies) are impacted by increases in *Sargassum*.

Main questions from impacted communities centered around clean-up and disposal of *Sargassum*. This ranged from financial support to labor needs and technical assistance. Removing *Sargassum* from beaches does not remove the problem: there must be locations where the collected *Sargassum* can be disposed of and treated. In addition, the clean-up, disposal, and treatment also carries with it health concerns for those involved with these tasks. A primary concern among locals was the necessity for appropriate information regarding safety equipment to mitigate skin or respiratory illnesses.

Figure 4: *Sargassum* booms deployed in the U.S. Virgin Islands. Photo courtesy of Bioimpact, Inc.

Availability, feasibility, and effectiveness of SIE prevention, control, and mitigation strategies

State of the Science

Florida, Puerto Rico, and the U.S. Virgin Islands are all at different stages in coordinating and managing SIEs and have differing regulatory requirements for in-water and onshore *Sargassum* management.

Current in-water management strategies for SIEs include deflection, harvesting, and ocean disposal. Deflection with equipment containing anchoring systems (booms) may impact benthic ecosystems. Build-up of *Sargassum* and other materials along these structures requires regular maintenance and monitoring. Placement of booms requires permits from the U.S. Army Corps of Engineers (USACE) and may require state/territorial or local authorization. Harvesting of *Sargassum* can be done with mechanized equipment (conveyor belts) or a fixed system (e.g., a mesh that passively collects the macroalgae as a vessel navigates). Harvesting normally does not require a USACE permit (unless it alters bathymetry), but may require an Endangered Species Act (ESA) incidental take permit from NOAA National Marine Fisheries Service (NMFS). The South Atlantic Fishery Management Council (SAFMC) fishery management plan recognizes *Sargassum* harvesting as a fishery in federal waters and prohibits harvesting south of the North/South Carolina border (offshore of South Carolina, Georgia, and Florida's East Coast). There are also restrictions for harvesting offshore of North Carolina. Ocean disposal methods have been considered as a potential management strategy, but have not been widely utilized. Because of the lack of information regarding the potential impacts of ocean disposal on deep-sea ecosystems, the Environmental Protection Agency (EPA) considers research permits for ocean disposal projects, which may also require USACE authorization. The Seaweed Ocean Sequestration of Carbon (SOS Carbon) system is a patented technology that has been used to test ocean disposal in deep water.

Onshore clean up strategies involve keeping *Sargassum* in the same coastal habitat that it washes up on. These include: natural degradation, utilization in restoration, or manual/mechanized removal and integration. Natural degradation is practiced in state and county parks in Florida, as well as some natural reserves in Puerto Rico because of their inaccessibility. *Sargassum* can also be used for coastal restoration where it is used in areas impacted by erosion or used to form dunes or mounds. Manual removal is labor intensive but low impact, where mechanized removal requires a tractor, frond-end loaders, or beach rakes and can have permanent impacts on the beach. Manual removal does not require a permit unless the activity is part of a federal action, however, an ESA incidental intake permit is necessary if ESA resources may be affected. Mechanized removal that may remove sediments from the wet part of the beach (seaward of the Mean High Water Line [MHWL]) and seabed requires a USACE permit; the presence of listed species would require an ESA consultation with the U.S. Fish and Wildlife Service (USFWS) or NMFS and impacts to Essential Fish Habitat (EFH) would require consultation with NMFS. Mechanized burial involves filling a pit with *Sargassum* and covering it with sand, whereas integration involves mechanically mixing *Sargassum* into the sand using tractors. As with mechanized removal methods, these require a USACE permit if conducted seaward of the MHWL and may require consultations. Onshore burial and removal activities must also meet state/territorial and local requirements.

Some clean-up strategies involve moving *Sargassum* to another location. This is usually done to process *Sargassum* for a commercial end-use or to dispose of it. Transportation involves using lifting equipment (e.g. cranes or ATVs with sleds) to load the onshore *Sargassum* into a truck. Offshore booms are sometimes used to divert biomass from the water to onshore collection points, and there are similarly some pump systems that suction *Sargassum* from the water for transfer to land. For transporting *Sargassum* on land, state/territorial, or local laws must be consulted. For example, a waste handling permit may be required in certain jurisdictions. Pre-processing and processing *Sargassum* involves preparing the raw material for conversion into an end product, and this can involve washing, drying, or removing heavy metals. The discharge of liquids during this process are subject to federal, state/territorial, and local regulations. Depending on the end use (e.g. biofuels, compost), different permits may be required depending on the state or territory. An EPA permit may be required for large-scale incineration as a biofuel, or when *Sargassum* containing arsenic is being processed for use as compost in agriculture. Staging of *Sargassum* is used to accumulate the material for transport and dry it out before loading and transport. Final disposal of *Sargassum* in landfills is regulated at the local level.

Questions and Gaps

Currently, not all impacted U.S. states and territories have clear, direct, and accessible *Sargassum* management plans, which hinders the ability of coastal managers to respond to SIEs. The process of developing a more comprehensive management plan has begun in Puerto Rico with a 2022 *Sargassum* management workshop (León-Pérez et al. 2024) and in The Virgin Islands with the Foundational Blueprint for the Development of a Comprehensive Pelagic Sargassum Management Plan. However, given the resource limitations in the U.S. and wider Caribbean in particular, there is a need for management of SIEs at a broader scale, which requires standardization of best management practices and protocols for responding to SIEs in order to establish response networks.

In order to facilitate SIE response, coastal managers must identify and communicate with relevant stakeholders and the federal regulatory requirements that apply regardless of the state or territory where *Sargassum* management strategies have occurred. At the same time, state/territorial and local regulatory frameworks must be made clear. To do this effectively, key stakeholders in areas where SIEs occur in each U.S. jurisdiction must be identified. Once that is done, informed recommendations for the use of different removal strategies can be made to ensure public safety and compliance with existing regulations. It is critical to carve out a role for the federal government in *Sargassum* management: providing states and territories with information, tools, and resources to address issues related to *Sargassum* influx in each jurisdiction that prioritize management approaches.

In order to broadly inform management plans, there are some critical research questions to address regarding *Sargassum* interventions. Specifically, it is necessary to quantify and understand the extent of in-water protected and managed species bycatch/entrainment during deflection, harvesting, and removal. It is also important to understand the broader ecological consequences of ocean disposal, as well as on-land removal/management strategies. Characterizing these impacts can help decide where and when to deploy different management strategies. Studies should collect data over ecologically relevant timescales and appropriate geographic scales.

Acronyms

CARICOOS: The Caribbean Coastal Ocean Observing System
EFH: Essential Fish Habitat
EPA: Environmental Protection Agency
ESA: Endangered Species Act
GASB: Great Atlantic *Sargassum* Belt
HAB: Harmful Algal Bloom
HYCOM: The Hybrid Coordinate Ocean Model
MODIS: Moderate Resolution Imaging Spectroradiometer
MHWL: Mean High Water Line
MSI: Multispectral Imager
NCCOS: National Centers for Coastal Ocean Science
NMFS: National Marine Fisheries Service
NOAA: National Oceanic and Atmospheric Administration
OLCI: Ocean and Land Colour Instrument
PACE OCI: Plankton, Aerosol, Cloud, and ocean Ecosystem Ocean Color Instrument
SARGUS: Synthetic Aperture Radar Satellite Payload Simulation
SAFMC: South Atlantic Fisheries Management Council
SECART: Southeast and Caribbean Regional Collaboration Team
SCTLD: Stony Coral Tissue Loss Disease
SIE: Sargassum Inundation Event
U.S. United States
USACE: United States Army Corps of Engineers
USFWS: United States Fish and Wildlife Service
USVI: United States Virgin Islands
VIIRS: Visible Infrared Imaging Radiometer Suite