

Policy Brief



The potential economic impacts of sargassum events in the Caribbean: Recommendations for assessing economic impacts

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Introduction

Measuring the potential scope, magnitude, and distribution of economic consequences caused by sargassum influx events (large floating rafts of seaweed in the open sea and inundating shorelines) is an important prerequisite for appropriate planning and mitigation efforts. Despite a wide array of research on sargassum impacts, our understanding of the economic costs of sargassum events remains limited. The purpose of this brief is to provide a set of recommendations for improved data collection and analysis to fill numerous information gaps related to understanding the economic consequences of sargassum events in the Caribbean.

Economic impacts from sargassum are best measured as **lost economic surplus** (i.e., forgone net gains). This includes:

- **Economic benefits** that would have been realized were it not for a harmful sargassum event.
- **Opportunity cost** of resources dedicated to mitigation and clean-up.

These values include market values (e.g., lost incomes and profits due to reductions in transactions; expenditure on cleanup equipment and labour), and non-market values (e.g., lost benefits from ecosystem services) due to adverse impacts on coastal and marine ecosystems.

Economic Impacts of sargassum events are best measured as:

Lost Economic Surplus = Lost Economic Benefits + Opportunity Costs

Credit: H.A. Oxenford





Complications and constraints to estimating lost economic value from sargassum events

Estimating lost economic surplus from sargassum events is complicated by several factors. First, we must estimate the value of transactions and activities that did not take place. This requires detailed information on baseline (i.e., pre-sargassum) transactions and activities against which to measure change. Generally, such baseline data are not available. Further, in terms of lost market values, we must account for suppliers' ability to substitute to other forms of employment and income, and buyers' ability to substitute toward other goods and services that provide economic value. For example, it can be expected that some fishers and tourism operators will turn to other sources of income during sargassum events, offsetting losses in earnings induced by the presence of sargassum. Likewise, when sargassum reduces access to coastal businesses or diminishes the appeal of visiting coastal locations, consumers and recreationists can be expected to substitute toward other locations or activities. As is the case with baseline data pertaining to market activity, data on the nature and extent of these substitution effects are largely unavailable.

Defining the spatial and temporal extent of analysis is another complication. Given the possibility of resource substitution, the adverse economic impacts in one area may be partially or wholly offset by economic gains in other areas and markets. It is therefore essential that attempts to measure the economic impacts of sargassum events carefully define the temporal, geographic and demographic scopes of analysis prior to attempting to assign a value to impacts. Economic losses associated with a particular sargassum event may be considerably lower if the impact is defined on a broad scale (e.g., long-term, economy-wide impacts) rather than on a narrow scale (e.g., short-term impacts in a particular area or to a particular business).

Estimation of lost non-market values from detrimental impacts on ecosystems is similarly constrained. Estimating these losses requires an understanding of how ecosystems are impacted by sargassum events and how those impacts translate into losses of ecosystem goods and services. There are significant gaps in the literature regarding how sargassum affects provisioning, regulating, and supporting services provided by coastal and marine ecosystems. Further, to provide estimates of costs that are useful for informing policy, these lost ecosystem goods and services must then be valued in monetary terms. While there is a deep body of literature providing estimates of the economic value of the goods and services provided by coastal and marine ecosystems, these values vary significantly by location, ecosystem scale and socioeconomic conditions, limiting the transferability of value estimates across sites.

Estimating the costs of ecosystem service losses is further complicated by the fact that most ecosystem service valuations focus on the value of improvements in resource quantity, which tend to be significantly lower than estimates of the value of equivalent losses. Using welfare estimates derived in the context of environmental improvements is therefore likely to underestimate economic losses from sargassum.



Credit: H.A. Oxenford

Recommendations for data collection and future research

Filling these information gaps will require a range of data collection and research activities and a coordinated effort between those who measure and catalogue physical damages and those who assess market and non-market values associated with damages. Below we outline recommendations for data collection and analysis to further inform the economic consequences of sargassum events.

1 Collection of detailed (pre-sargassum) baseline data

To provide a baseline against which to measure economic losses, data pertaining to market and non-market economic activity in the absence of sargassum should be collected at relevant temporal and spatially explicit scales. These data should include measures of market transactions such as number and type of businesses in sargassum-prone coastal areas, associated sales revenue, employment, consumers, and visitation rates.

Baseline ecosystem data are also required. Data pertaining to ecosystem extent and condition and the provision of ecosystem services (e.g., coral / mangrove / seagrass health, beach width, recreation visits) should also be collected when sargassum is not present or affecting these ecosystems.



Credit: H.A. Oxenford

2 Collection of detailed cost and impact data during and after sargassum events

Data pertaining to costs of clean-up (spending on labour and equipment, volume of sargassum removed) are available for some locations (Chávez et al. 2020), but such data are generally collected in an *ad hoc* manner, limiting efforts to aggregate costs across sites and sargassum events. More systematic and granular data pertaining to cleanup efforts would improve our understanding of these costs.

To estimate economic impacts to business and recreation activity relative to baseline, pre-sargassum data collection efforts related to market and non-market economic activity should be repeated periodically over the duration of sargassum events. Data on market and non-market economic activity should also be collected for a period after sargassum events to estimate the extent of intertemporal impacts.

As noted above, economic losses from sargassum events will be lower if recreationists can temporarily shift visitation to unaffected beaches or other recreation activities, if fishers and tourism operators can reallocate their labour toward other sources of employment, and if tourism and fishery-dependent businesses can substitute toward other inputs when market conditions are interrupted by sargassum events. Hence it is critical to assess patterns of resource substitution by stakeholders affected by sargassum events. Such an assessment will likely require carefully crafted stakeholder surveys.



Recommendations for data collection and future research

3 Assessment of the impact of sargassum events on tourists' willingness to travel to Caribbean destinations

It is unknown whether sargassum events in the region have tempered the overall growth in tourist arrivals. Understanding the magnitude and duration of sargassum impacts on tourism arrivals is confounded by impacts of the global COVID-19 pandemic.

Future research should be directed at assessing the relationship between media coverage of sargassum and tourists' decisions to visit particular destinations, the scope and magnitude of negative "halo effects" (i.e., visitors choosing not to visit locations that may not be affected by sargassum due to news of sargassum at proximate or similar locations), and the cumulative impacts on visitation that may occur if visitors who are initially deterred by sargassum, persist in their decisions to not return.

4 Assessment of tourists' encounters with sargassum and perceptions of disamenities

Understanding the impact of sargassum on tourism would be improved with information on the degree of visitor encounters with sargassum (e.g., location, amount of sargassum viewed), perceptions/ratings of coastal quality during sargassum events, which aspects of sargassum are most important in terms of satisfaction from traditional "sun, sea and sand" recreation and leisure, and how sargassum affects recreation decisions.

Future research should address these questions with survey efforts directed at tourists. Surveys should be designed to measure the amount and location of sargassum encountered by visitors, visitors' perceptions of sargassum, how their willingness to return to destinations is related to the presence of sargassum, and the relative impacts of sargassum on beaches, discoloured seawater, odour from decomposing sargassum and the presence of clean-up equipment on the enjoyment of coastal recreation, visitation decisions, and willingness to pay.

Recommendations for data collection and future research

5 Assessment of impacts on coastal and marine ecosystems and ecosystem services

To understand non-market economic losses associated with sargassum impacts on coastal and marine ecosystems, future research should be directed at improving our understanding of how ecosystem structure and function are affected by sargassum, how alternative policy actions (e.g., various forms of sargassum clean-up or prevention) mitigate losses and/or create other adverse impacts on ecosystems, how these effects on ecosystems translate into changes in ecosystem services, and how those changes in ecosystem services translate into measurable indicators of benefits to people.

Such inquiries will require interdisciplinary collaboration and should include the construction of ecological or bio-physical models that estimate how sargassum events affect ecosystem health, function, and service provision. Examples of measurable benefits indicators include changes in fisheries output, incidence of health effects, beach width, likelihood of storm damage, and encounters with species.

6 Prediction of sargassum events

One of the largest obstacles in understanding the economic consequences of sargassum events is a lack of information on the timing, scope, and magnitude of sargassum inundation events. This information gap is primarily due to limited systematic shoreline monitoring to measure magnitudes of inundations and the limitations of modelling efforts to understand the distribution of events across the region and predict how sargassum events are expected to change in the future.

Bibliography

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Chávez et al. 2020. Massive Influx of pelagic sargassum species on the coasts of the Mexican Caribbean 2014–2020: Challenges and opportunities. *Water* 12: 2908



Amberfish have replaced flyingfish catches in the Barbados fishery during sargassum influxes

Credit: H.A. Oxenford