

## SARGASSUM

### What is threatening biodiversity of the Guadeloupe islands?

#### OBJECTIVE OF INDICATOR

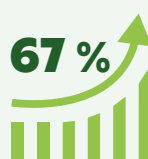
This Sargassum threat indicator aims to gather relevant data on the quantity, spatial and temporal distribution, as well as characteristics of the massive Sargassum seaweed strandings<sup>1</sup> that have been affecting the Guadeloupe archipelago. It is intended to provide objective data and information to local authorities, environmental managers and political decision-makers for a better understanding of a phenomenon that now occurs on a regular basis. By providing up-to-date data and relevant analyses, this indicator will help strengthen strategies to prevent, manage and mitigate the impacts of these strandings on the environment, public health and the local economy.



► Port of Sainte-Marie, Capesterre-Belle-Eau

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#### SUMMARY RESULTS



**67 %**  
more Sargassum  
present in  
Guadeloupean waters  
from 2011 to 2020



**4 %**  
average annual  
increase in  
Sargassum  
season length



record year for  
sargassum in  
Guadeloupe waters



**1/3** of coastal  
businesses in  
Guadeloupe were  
affected by Sargassum  
in the first half of 2015



2015 season  
record length



**\$5.7 million**

Estimated financial  
losses for the first  
half of 2015

<sup>1</sup> Sargassum pile-up on beaches and shores.



## CONTEXT

Located in the heart of the Lesser Antilles, Guadeloupe is an archipelago known for its rich biodiversity –as it is home to unique species—but also for the diversity of its marine and terrestrial ecosystems (beach, coral reefs, lush mountains, etc.). However, beyond this natural wealth, Guadeloupe faces major environmental challenges, including massive Sargassum strandings.

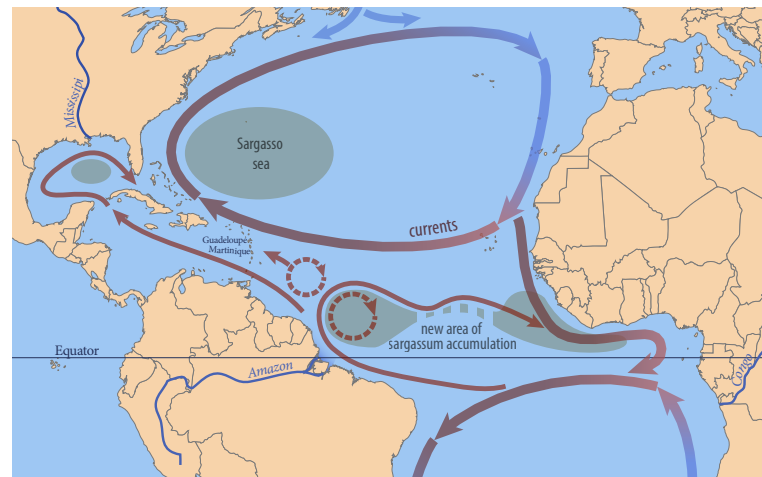
Sargassum are floating pelagic brown seaweed<sup>2</sup> from the *Sargassaceae* family, mainly species of the *Sargassum* genus, which grow naturally in the Atlantic Ocean. Historically, these algae have been an integral part of marine ecosystems, drifting on the water surface and serving as a refuge and nursery for many marine species. However, over the last decade, their proliferation has become excessive. Sargassum now regularly wash up in large quantities on Caribbean shores – including Guadeloupe's. These massive strandings seriously disrupt the local environment, the tourist economy and public health.

<sup>2</sup> Relative to marine environments far from shore, on the high seas.

**Figure 2:** Morphological differences between species and/or morphotype of pelagic Sargassum.

Source: Govindarajan *et al.*, 2019

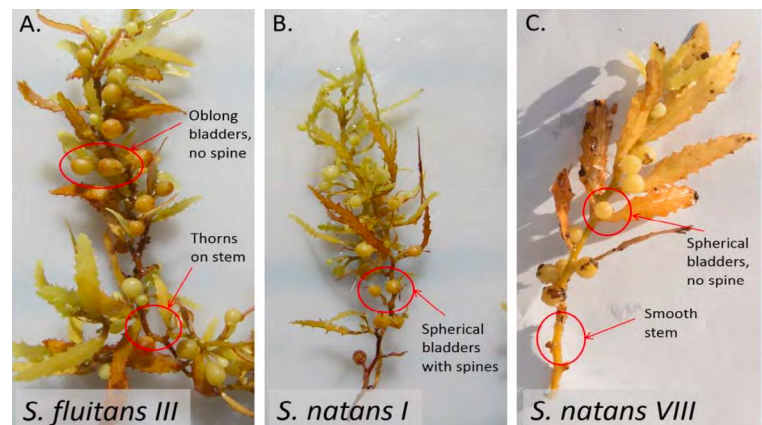
*The Sargasso Sea, located to the north near Florida, has always existed but is not believed to be involved in the current massive strandings.*



**Figure 1:** Map of the Atlantic Ocean's currents.

The *hot* and *cold* currents illustrate how Sargassum, produced in the new accumulation zone off the coast of French Guiana, can reach the Caribbean.

Source: Marc Gayot, based on PSB-CARIB data



## History of the phenomenon

First signs of **increased strandings**. Changes in ocean currents and climate conditions favoring the **proliferation of sargassum**.

**2000**

**Sporadic and insignificant** Sargassum strandings. Beaches can be cluttered at times, but the natural phenomenon is **managed locally** without major difficulties.

**Intensification** of the phenomenon with **massive and cyclical strandings** across various parts of the archipelago, especially between April and June. But may occur **all year** round depending on weather and ocean conditions.

**2011**

**First massive strandings** affecting Caribbean coastlines, including Guadeloupe's. Authorities and residents recognise **the growing scale** of the phenomenon.

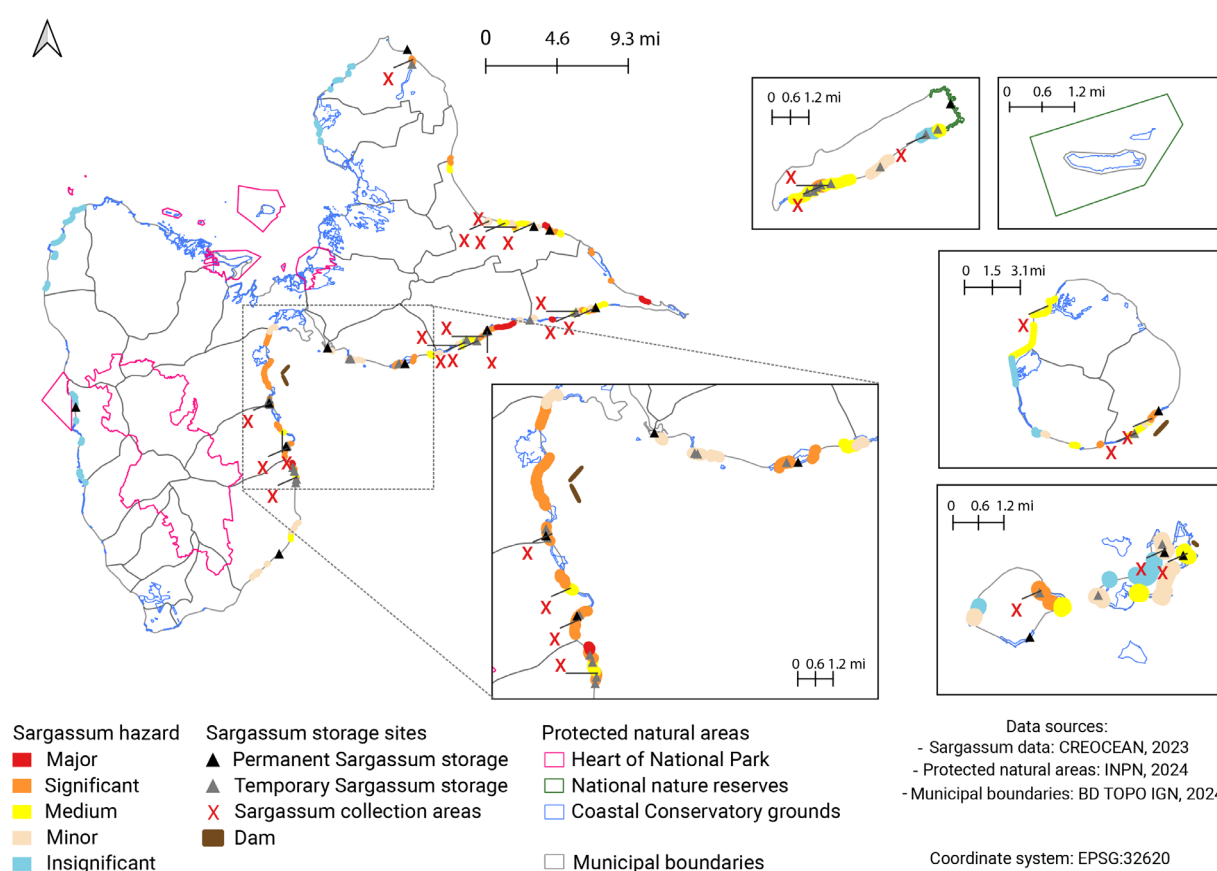
## 1. Magnitude of Sargassum strandings

Between 2018 and 2022, the volumes of stranded Sargassum were estimated to set up an adequate management strategy. This estimate, called “Sargassum hazard,” provides a visual representation of the affected areas. **The windward coast of Guadeloupe is severely impacted by the phenomenon. The southern islands (La Désirade, Marie-Galante,**

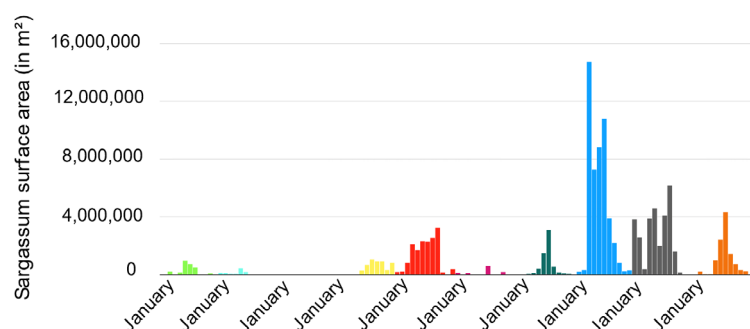
**and Les Saintes) are not spared and are in fact the first areas to be hit.** Most of the impacted municipalities, with a **high risk** (13 mi of coastline, i.e., **18%** of the affected coastline) to **major risk** (2.4 mi of coastline, i.e., **3%** of the affected coastline), have established permanent or temporary storage areas (▲) near the collection sites (X).

▼ **Figure 3:** Map of Sargassum distribution across the territory from 2018 to 2022.

*The Sargassum hazard corresponds to the estimated amount of Sargassum on the coastline within a 984 ft strip along the coastline over a total linear length of 77 mi. Collection areas were updated in 2024 and offset to enhance readability.*



From 2011 to 2020, **the presence of Sargassum in Guadeloupe's waters increased by 67%**, showing a worrying trend towards ever more frequent and voluminous strandings. The year 2018 was particularly notable, with record amounts of sargassum reaching Guadeloupe's shores. No less than 53,340,000 m<sup>2</sup> (20.4 mi<sup>2</sup>) of Sargassum washed ashore over the year, which is more than twice the size of La Désirade.

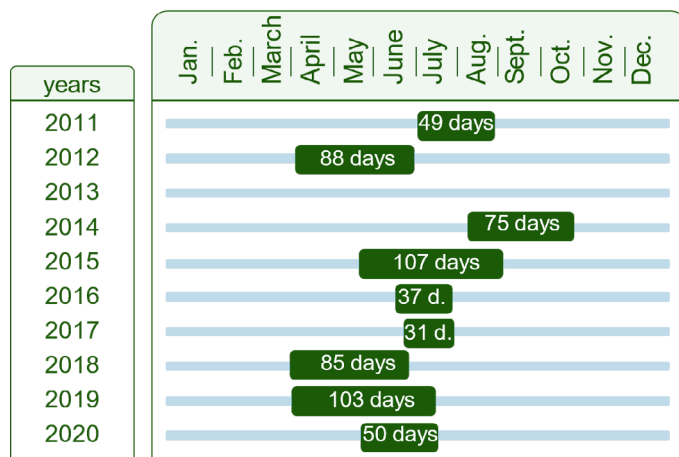


▲ **Figure 4:** Changes in the presence of Sargassum per month in m<sup>2</sup> over a period from 2011 to 2020. This is the surface area (in m<sup>2</sup>) of Sargassum detected at sea by satellite image, for each month, near the Guadeloupe archipelago. Each stick represents a month; only January is shown to indicate the beginning of each new year. Source: Météo France, DIRAG



Sargassum seasons, that is, the periods during which Sargassum are present on beaches, **extend each year by about 4% on average**. In 2011, the Sargassum season lasted 49 days, while in 2015, it reached **107 days, the highest peak recorded so far**. To date, although there is no fixed season, Sargassum season generally fluctuates between March and October.

**These data highlight the growing severity of massive Sargassum strandings and the necessity of effective management to mitigate their impacts, which are far from insignificant.**

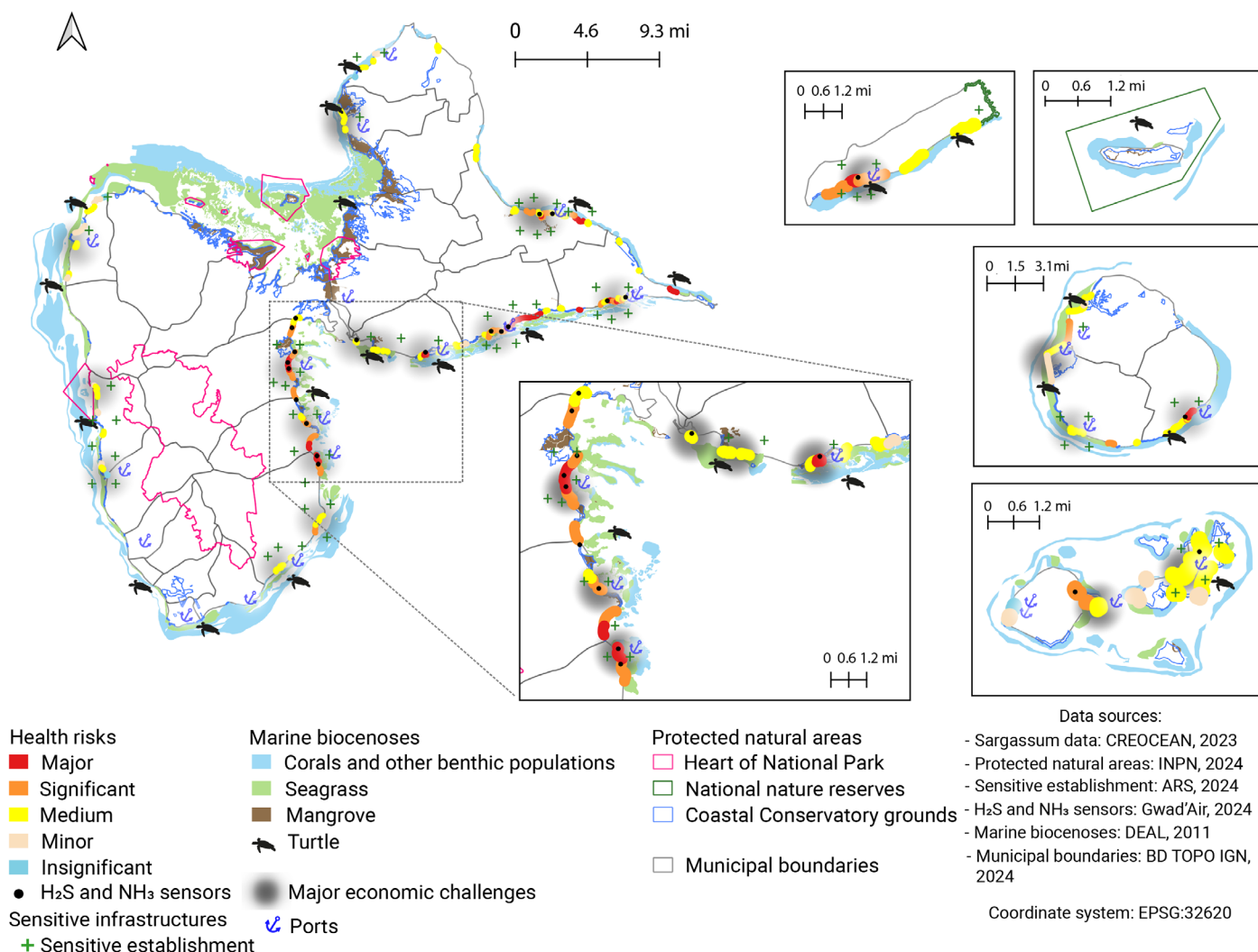


▲ Figure 5: Changes in the distribution and duration of Sargassum stranding seasons between 2011 and 2020.

Source: Météo France, DIRAG

## 2. Environmental, health and socio-economic impacts due to Sargassum

These strandings do have impacts on the population's health, the environment, and the archipelago's economy. These impacts were evaluated on a 984ft strip on either side of the coastline in the areas affected by strandings.



▲ Figure 6: Map showing the impacts of Sargassum across the territory. For better readability, the "+" and "port" symbols have been offset.





## HEALTH IMPACT

The decomposition of Sargassum at stranding sites releases potentially toxic gases, such as hydrogen sulphide (H<sub>2</sub>S)<sup>3</sup> and ammonia (NH<sub>3</sub>)<sup>4</sup>.

The effects reported for short-term exposure to H<sub>2</sub>S are mainly local irritation of the eyes and throat, watery eyes, and headaches. These symptoms can be reversed by moving away from areas of decomposition, given the concentrations measured across our territory.

Sensors have been installed at moderate to high risk sites, especially near homes and public facilities. These measurements alert the authorities and initiate procedures to protect populations, including the most vulnerable. **In 2022, the 1ppm H<sub>2</sub>S threshold was exceeded 164 times, with a maximum daily average concentration for the year of 0.70 ppm H<sub>2</sub>S** (Source: Gwad'Air).



## BIODIVERSITY IMPACT

Sargassum invasion of beaches **disrupts turtle nesting sites, compromising egg laying and the survival of hatchlings**. This could have detrimental consequences for already vulnerable sea turtle populations.

The decomposition of Sargassum alters water quality, affecting mangroves and coral reefs. As for seagrass beds, the pile-up of algae blocks the light that is essential for their survival. These ecosystems, which protect coastlines from erosion and serve as refuge and nursery for marine biodiversity, experience degradation that disrupts marine food chains in a cascading effect, **reducing their resilience to climate change**.

**Beaches and storage sites can be contaminated by metals (arsenic, cadmium, lead and mercury) and pesticides (chlordecone) contained in Sargassum**, potentially polluting bathing waters, soils, and surrounding biodiversity.

<sup>3</sup> Colorless, flammable and toxic gas that smells like rotten eggs, formed naturally in swamps, sewers, volcanoes and by the decomposition of sulphur-containing organic matter.

<sup>4</sup> Colorless and irritant gas with a pungent smell, that results from organic decomposition. It is widely used in chemical and agricultural industries.



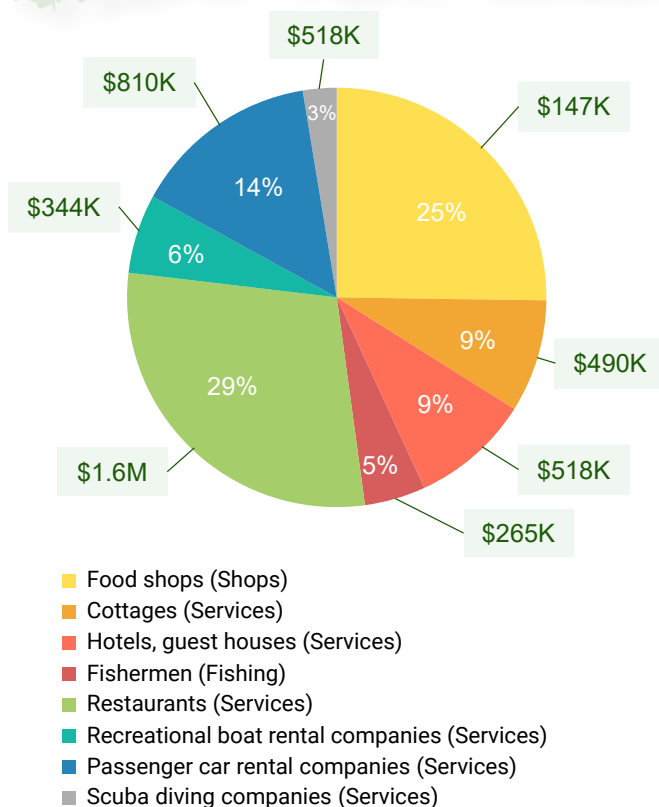
## SOCIO-ECONOMIC IMPACT

A survey conducted in 2015 by the Guadeloupe Chamber of Commerce (CCI) revealed that out of 424 coastal businesses interviewed in Guadeloupe, **one third** were affected by Sargassum. Financial losses for the first half of 2015 were estimated at **\$5.7 million**.

**Tourism is extremely impacted.** The Sargassum invasion makes beaches unwelcoming for tourists and the local population. The unpleasant odors and the appearance of decomposing algae deter visitors, leading to a decreased attendance at hotels, restaurants and tourist attractions –sometimes resulting in closures– while the population shifts towards previously less-visited sites.

**Sargassum also disrupts fishing activities** by entangling equipment and causing damage that increase maintenance costs.

**Local businesses close to the coast also suffer the consequences of Sargassum strandings.** The machines and tools used in coastal industrial activities wear out prematurely due to exposure to Sargassum and the conditions they create.

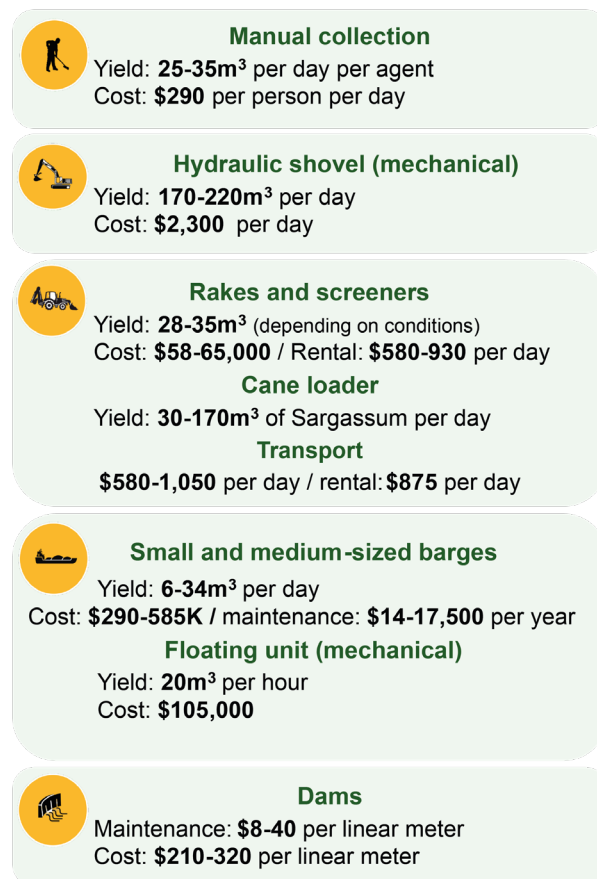


▲ **Figure 7:** Distribution of companies affected by Sargassum per sector of activity (in percentage) with their average loss in turnover. Source : CCI survey, 2015

### 3. Managing Sargassum strandings

Météo France's assessment of the quantity of Sargassum at sea makes it possible to anticipate and adapt collection and storage methods on permanent or temporary sites. **The quality and efficiency of collection can vary significantly depending on the severity of strandings, the configuration of beaches, and the local authorities' response capacity.** In addition, coastal erosion is a major issue that can be exacerbated by inadequate collection of Sargassum. The use of poorly adapted mechanical equipment can lead to excessive sand removal, thus disturbing the natural balance of beaches. For instance, at Anse Maurice, mechanical harvesting has contributed to a significant coastline retreat, sometimes exposing bedrock and making beaches more vulnerable to erosion.

**Figure 8:** Yield and cost of the various Sargassum management methods. Source : ADEME- 12/2022 report with PULSAR Unit update







































#### Strategic approaches to collection

With the evolution of collection methods, a more strategic approach has been adopted. Rather than collecting systematically in all affected areas, selective interventions are carried out to minimize environmental impact and reduce management costs.

**Figure 9:** Management methods adapted to the beach profile and stranding severity. Source : ADEME (adapted)

→ **Adopting environmentally friendly collection practices and implementing coastal management measures are essential to protect beaches and preserve coastal ecosystems. Joint efforts to manage Sargassum strandings sustainably are crucial to limit health risks and maintain the richness and beauty of Guadeloupe's coastlines.**

	CONFIGURATION	Minor Strandings	Moderate Strandings	Major Strandings	Massive Strandings
WITH LAND ACCESS TO THE COASTLINE	wide beach with access road				
	coastline without traffic areas with punctual access roads				
	coastline that can be developed for access to land vehicles		 	 	 
WITHOUT LAND ACCESS TO THE COASTLINE	coastline with nearby land access	 	  	 	 
	coastline with no nearby land access but a navigable one				
	coastline with no nearby land access, not navigable	 	 	 	 

# Threats

## HEALTH IMPACT

- Respiratory diseases among sensitive populations due to toxic gases ( $H_2S$  and  $NH_3$ ).
- Heavy metal pollution in bathing waters and soils.

## BIODIVERSITY IMPACT

Degradation of coastal ecosystems and storage sites, pollution and salinization of soils in storage sites.  
Degradation of the quality of spawning sites, difficult access for turtles and hatchlings.

## ECONOMIC IMPACT

- Management and storage costs for communities.
- Impact on tourism, food trade, fishing and other sectors...
- Material damage due to corrosion (machines, tools, air conditioning,...).



# Solutions

## Financial aid

- **Management funding:**
  - State grant via an emergency fund (Plan Sargasse I et II)
  - Regional Council grant
  - Departmental Council grant
  - European Funds (ERDF)
- **Funding of innovation research and development (valorization, collection, etc.):**
  - European funding (INTERREG Caribbean)
  - State funding (ADEME, Plan Sargasses, ANR)
  - Local funding (Regional Council of Guadeloupe)

## Prevention and surveillance

- Anticipation of strandings via satellite monitoring.
- Measurement of  $H_2S$  and  $NH_3$  levels at sites posing health risks in order to initiate procedures to protect vulnerable populations.

## Knowledge acquisition and monitoring effort

- Improving knowledge of the phenomenon's impact on our ecosystems and storage sites.
- Monitoring the impact on these ecosystems in the long run.

## Management and cleaning Restoration

- Article L2212-2 of the French General Code for Local Authorities.
- Safeguards public health and mitigates pollution by coordinating seaweed collection.
- Adapted to the sites' profiles, Sargassum quantities and public health.
- Restoration of storage sites.

## Valorization

- Bio-materials
- Composting
- Extraction of molecules of interest
- Combustion
- Agricultural spreading
- Animal or human nutrition

## Raising awareness among the general public and school children

- Awareness-raising campaign for the population, tourists and economic actors.
- Educational program in schools on the preservation of marine environments.

▲ **Figure 10:** Threats from massive Sargassum strandings and solutions to address them. The red arrows signal the threats and the green arrows, solutions to be provided.



## ABOUT THE INDICATOR

### ► Calculation method

Design of the Sargassum surface presence graph

- Monthly and annual aggregation of daily data over ten years.

Analysis of Sargassum season length

- Logarithmic method for monthly percentage distribution.
- Identification of the start and end days of Sargassum seasons. Comparison of the months impacted by the presence of Sargassum, centered on the average of the observation period.

Distribution of businesses affected by Sargassum

- Percentage of the number of businesses affected per sector, out of the 424 companies that responded to the survey.

### ► Limitations

- Analyses rely significantly on data access and data quality. Satellite data for calculating Sargassum areas and the Sargassum hazard were preferred over collected Sargassum volume data, which are not reliable enough to be used.
- Satellite data does not allow for a direct, quantified link to be established between Sargassum hazards and health impacts, given the intermediate stages between detection at sea and the release of H<sub>2</sub>S and NH<sub>3</sub> gases.
- The time periods for which the data were most robust were selected.
- For biodiversity data, the most recent data was used.
- In turn, the analysis of the economic impact is based on a 2015 study with a sample of 424 companies representative of those affected.

### ► Theoretical update frequency

5 to 10 years depending on the phenomenon's evolution.

### ► Data sources

Sargassum hazard 2018-2022/ health hazard/H<sub>2</sub>S sensor:

Cartographic atlas of Sargassum stranding sites and vulnerabilities across the territory of Guadeloupe and the Northern Islands/(Agence CReOCEAN Antilles-Guyane/PREFECTURE OF THE GUADELOUPE REGION).

[Estimated surface area data for Sargassum at sea - Météo France DIRAG.](#)

• [Descloîtres, J., et al. \(2021\).](#)

• [Podlejski, W., et al. \(2022\).](#)

**Turtle nesting site:** study conducted by Marc Girondot, based on the interpretation of trace monitoring data collected from 2000 to 2022.

**Air quality:** Gwad'Air

**Economic impact:** Étude d'impact sargasse 2015 CCI Guadeloupe.

**Management method:** Description of table « Recommandations d'utilisation du matériel de collecte selon la configuration du site d'échouage et l'intensité des échouages » from ADEME.

**Cost & yield:** Sargasses : panorama des dispositifs de collecte et barrage. Rapport 12/2022, ADEME.

### ► Bibliographic references

Franks, J.S, et al. (2011). Unprecedented Influx of pelagic Sargassum along Caribbean island coastlines during summer 2011. Proc. Gulf Caribb. Fish. Inst., 64:6-8. <http://hdl.handle.net/1834/36124>.

Dierssen, H. M., et al. (2015). Hyperspectral discrimination of floating mats of seagrass wrack and the macroalgae Sargassum in coastal waters of Greater Florida Bay using airborne remote sensing. Remote Sens. Environ., 167:247-258. <https://doi.org/10.1016/j.rse.2015.01.027>.

Wang, M., & Hu, C. (2017). Mapping and quantifying Sargassum distribution and coverage in the Central West Atlantic using MODIS observations. Remote Sensing of Environment, 189, 56-68. <https://doi.org/10.1016/j.rse.2016.04.019>.

Govindarajan A. F., et al. (2019). The distribution and mitochondrial genotype of the hydroid Aglaophenia latecarinata is correlated with its pelagic Sargassum substrate type in the tropical and subtropical western Atlantic Ocean. PeerJ 7:e7814. [doi : 10.7717/peerj.7814](https://doi.org/10.7717/peerj.7814).

### Editors

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### USEFUL LINKS

Météo-France : <https://meteofrance.gp/fr/sargasses>

Gwad'Air : <https://www.gwadair.fr/surveiller/mesures-sargasses>

ARS : <https://www.guadeloupe.ars.sante.fr/informations-sargasses>

University of the French Antilles : <https://hal.univ-antilles.fr/COVACHIM-M2E/browse/latest-publications>

French Ministry of Ecological Transition : <https://www.ecologie.gouv.fr/politiques-publiques/algues-sargasses>

DEAL : <https://www.guadeloupe.gouv.fr/Actions-de-l-Etat/Securite/Risques-naturels-et-technologiques/Dossier-sargasses>

ADEME : [https://librairie.ademe.fr/dechets-economie-circulaire/6347-evaluation-de-la-dangerosite-des-algues-sargasses.html#/44-type\\_de\\_produit-format\\_electronique](https://librairie.ademe.fr/dechets-economie-circulaire/6347-evaluation-de-la-dangerosite-des-algues-sargasses.html#/44-type_de_produit-format_electronique)

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