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A Question of Development
Synthesis of AFD studies and research
DECEMBER 2025
N° 101

# *Sargassum* strandings in the Caribbean

## How can we integrate knowledge, innovation, and governance to find a sustainable management solution?

In the last decade, *Sargassum* strandings in the Tropical Atlantic have caused serious environmental and socioeconomic problems. Although the topic has attracted the attention of numerous scientists, the research landscape remains fragmented and impact studies point to an increasing need for government action (Julia *et al.* 2025). This article presents an overview of current knowledge and discusses the major challenges facing decision-makers in the Caribbean region.

### What do we know about *Sargassum*?

*Sargassum* is a genus of brown seaweed found in many of the world's seas. Although most *Sargassum* species are sedentary and attached to the seafloor, two species are "holopelagic"—in other words, they float on the surface of the ocean throughout their life cycle: *Sargassum fluitans*[1] and *Sargassum natans*.[2] Both these species are currently found in the Antilles. *Sargassum* has been concentrated in the Sargasso Sea for hundreds of years. Christopher Colombus himself encountered it when he reached the Americas. In 2009–2010, the Great Atlantic Sargassum Belt (GASB) formed as a result of prolonged and abnormal westerly winds (see Figure 1). Since 2011, it has been carried by currents and winds from the Gulf of Guinea to the Gulf of Mexico, covering thousands of kilometers in the form of large rafts. The GASB is growing bigger every year thanks to nutrients from various sources: warming waters, upwellings of cold water from the deep sea to the surface, Sahara dust inputs from aeolian events, and nutrients from watersheds and transported by the region's major coastal rivers (Amazon, Congo, Orinoco, etc.). As it drifts past on its journey, some of the Sargassum washes up on the Caribbean, Central African, and West African coasts.

[1] Scientific classification: *Sargassum fluitans* (Børgesen) Børgesen 1914.

[2] Scientific classification: *Sargassum natans* (Linneaeus) Gaillon 1828.

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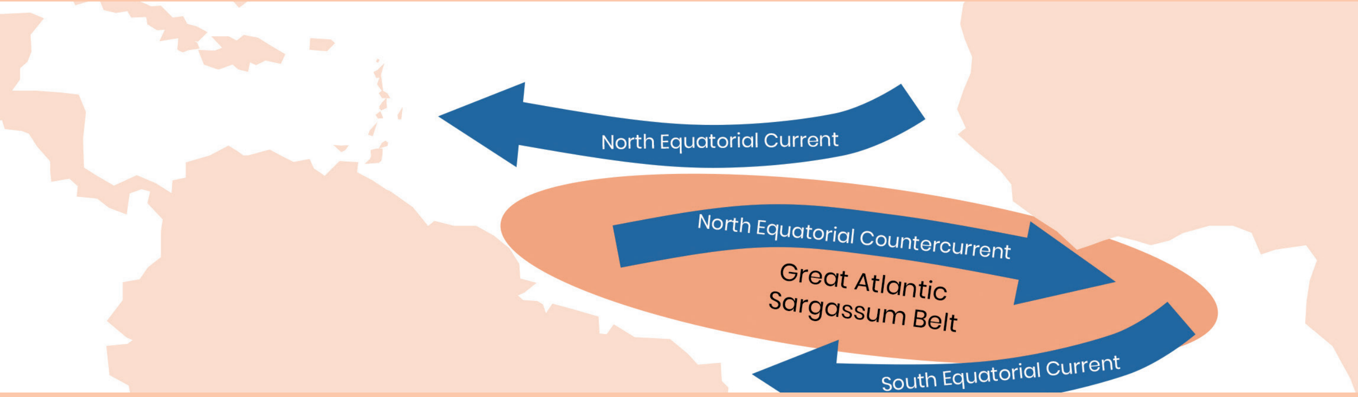
Figure 1 - The Great Atlantic Sargassum Belt: The Sargasso Sea and the principal North Atlantic currents




The new Sargassum zone: the great Sargassum belt is located in the Atlantic Ocean, south of the Caribbean.

Source: Cristèle Chevalier.

## Detection and prevention of *Sargassum* strandings

*Sargassum* in the ocean is generally spotted using satellite images, on which the rafts are detectable by their spectral signature. This data, coupled with oceanographic and meteorological models, can be used to predict their trajectory at the regional level with precision varying from a few days to a few months. At the local level, alert systems can give advance warning of strandings. These short and long-term predictions are crucial because they allow prevention measures to be put in place beforehand as well as informing plans to manage strandings and potentially exploit them as a resource. Nevertheless, the variability of *Sargassum* routes, growth, and mortality can make predictions uncertain and requires further investigation. Moreover, short-term predictions (which are essential for precise management and at-sea collection) are hampered by the fact that most studies take a large-scale approach, with few studying *Sargassum* dynamics at higher resolutions. Satellite images are also subject to numerous distortions (such as "glint": reflections of sunlight on water, cloud edges, etc.), which should be reduced. Approaches such as combined analysis using a variety of sensors would help to refine observations.

On land, *Sargassum* is detected by various *in situ* methods: monitoring, regular beach inspections, systematic analysis of information from social networks, and so on. Other *in situ* methods, such as fixed cameras in coastal locations (generally linked to automatic image processing algorithms) or aerial imagery (from drones, UAVs,[3] or helicopters) are also used to map the extent of *Sargassum* strandings along the shoreline. Strandings can also be detected indirectly by gas sensors that measure hydrogen sulfide ($H_2S$) and ammonia ($NH_3$) emissions produced by the decomposition of biomass. This method is rarely used, however, with only two studies conducted to date, largely due to the limited deployment of such systems.

[3] Unmanned aerial vehicle.

## What is the impact of strandings?

An oasis in the middle of the ocean, floating *Sargassum* provides a refuge for an abundant flora and fauna. On land, although it can also shelter a rich biodiversity, massive strandings affect both the coastal environment and the populations that live there.

From an environmental perspective, for example, strandings can stop sea turtles from digging their nests, or can cover their nests and prevent the hatchlings from emerging. Crabs, fish communities, mollusks, sea urchins, and worms can all be disturbed by the arrival of large amounts of *Sargassum*.

Decomposing *Sargassum* also affects water quality, making water turbid, often hypoxic,[4] or contaminated. In the worst cases, it can have irreversible consequences for coral reefs, seagrass meadows, and mangroves. As it rots, the *Sargassum* releases the heavy metals it picks up during its time at sea, as well as emitting toxic gases (hydrogen sulfide and ammonia).

Strandings also cause unpleasant effects to which human communities must adapt (foul smells, toxicity, degradation of the landscape, corrosion of electronic equipment, etc.). They are associated with numerous health problems: headaches, dizziness and nausea, and irritation of the eyes, nose, throat, and lungs. These effects can be severe enough to increase hospitalization rates. Because massive *Sargassum* strandings are a recent phenomenon, there is little data about the effect of long-term exposure, with only one hospital in Martinique currently studying the potential health impacts. Moreover, *Sargassum* composition has been shown to vary in different places and at different times. Does its impact depend on its composition? More detailed studies are needed to gain a better understanding of this question.

Finally, strandings negatively impact the economies of affected areas. Studies have revealed changes in tourist activity, including a reduction in reservations (-35 % in Mexico in the first half of 2018), a reduction in beach tourism, and an increase in visitor numbers at inland sites. Fisheries can also be impacted by damage to equipment and changes in fish species.

[4] Water is described as turbid when it becomes murky due to the presence of numerous suspended particles. Turbidity increases the density of water and can, in some cases, create currents. Hypoxia, meanwhile, is a reduction in the quantity of oxygen that can affect marine life.

## *Sargassum* as a resource: Progress and limitations

Stranded *Sargassum* represents a substantial biomass, averaging several million tons per year in recent times. There are numerous ways that collected *Sargassum* can be used: It can be transformed into compost or animal feed, or be used for energy production, as a pharmaceutical and cosmetic product, as a biomaterial, or for bioremediation.[5] Other than bioremediation, which has been studied since the 1990s, these ideas mostly emerged after 2011 thanks to the efforts of Mexican and Caribbean researchers in response to large-scale strandings (see Figure 2).

Nevertheless, several challenges remain, including:

- the extraction and management of toxic substances in order to exploit the raw material and ensure the non-toxicity of resulting products. *Sargassum* composition varies: As well as organic matter, it also contains heavy metals (including arsenic) and sometimes pollutants, such as chlordecone, with content often exceeding regulated limits;
- seasonality (strandings are essentially confined to six months of the year in these areas), which makes it more difficult to develop a reliable plan of action; and
- the fact that at-sea *Sargassum* collection requires precise knowledge of its location at a given time.

These sectors have reached varying levels of development depending on the challenges to be addressed. Most are still exploratory, while some have reached the pilot phase. Processing costs and legal aspects mean only a few are currently operational, however. Some governments are launching pilot projects and hope to create new economic sectors based on *Sargassum* exploitation.[6]

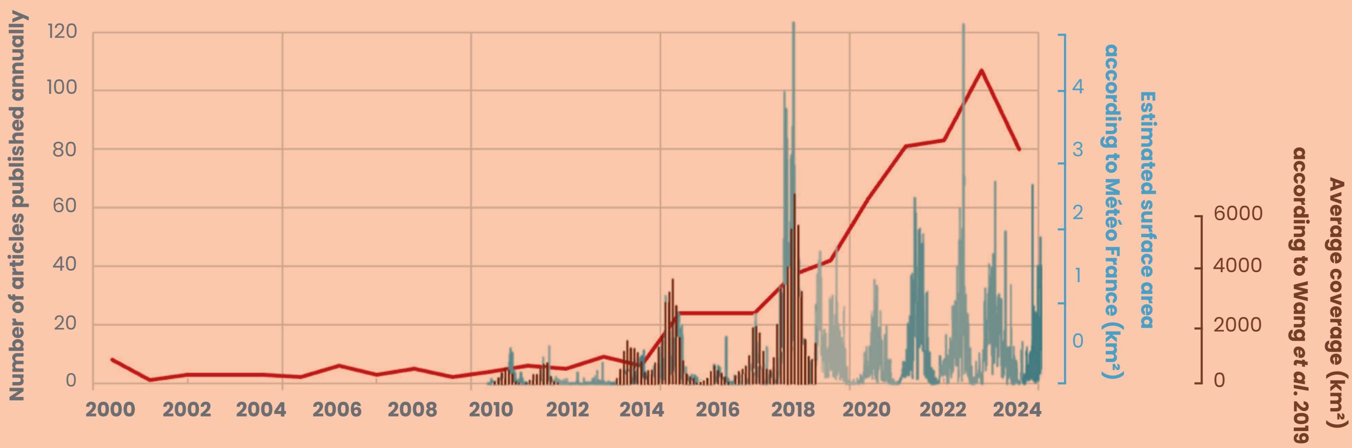
## From science to action: Toward regional *Sargassum* governance?

Faced with the scale of the phenomenon and the lack of clear scientific recommendations, governments have taken various steps to address this new issue. Mexico is the most active country when it comes to management, followed by the French Antilles and the United States. In 2018, for example, the French government invested six million euros in the collection and storage of stranded seaweed (Joseph *et al.* 2025). These strategies remain fragmented and are mostly confined to a local or regional scale, however. They are often implemented at the level of a single island or even community: manual or mechanical collection on beaches, installation of floating barriers, at-sea collection, or, conversely, a ban on removal to preserve coastal dunes, as in Texas. The diversity of these approaches reflects the lack of a framework for regional coordination.

At the international level, several institutions—the United Nations (UN), the UN Environment Programme (UNEP), and the Caribbean Regional Fisheries Mechanism (CRFM)—have drawn up recommendations and regional management plans, particularly as part of the UN Decade of Ocean Science for Sustainable Development. To date, however, there are no binding policies or comprehensive legal instruments concerning *Sargassum*. The regulatory landscape remains fragmented, giving rise to disparate responses depending on national capacities and priorities. While France and its overseas territories have developed measures to reduce the impact and exploit *Sargassum* as a resource, many other countries still do not have the necessary infrastructure to respond effectively.

The legal status of *Sargassum* remains vague and also varies by country: classed as a biological resource when offshore, a waste product when stranded on the coast, a potential raw material, and so on. This ambiguity hampers the establishment of sustainable industries and complicates regional cooperation.

Figure 2 - Annual number of scientific publications in relation to *Sargassum* quantity




Source: adapted from Julia *et al.* 2025 (data: for Sargassum quantities in the Atlantic Ocean, Wang *et al.* 2019; for the Antilles, Météo France).

[5] A process of biological depollution that uses specific microorganisms to eliminate waste.

[6] For example, the *Deutsche Gesellschaft für Internationale Zusammenarbeit* (GIZ) (German Agency for International Cooperation) has developed a project to produce biogas from Sargassum and use it to power a hotel in Mexico.

This situation calls for reflection on new modes of governance. A coordinated, cross-border, and adaptive approach would make it possible to harmonize regulatory frameworks, pool knowledge, and support long-term strategies.

Beyond crisis management, it is essential to build a shared vision: to transform a "negative commons" into an opportunity for regional cooperation and sustainable innovation.

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**Agence française de développement (AFD)**
5, rue Roland Barthes | 75012 Paris | France
**Publishing director** Rémy Rioux
**Editor-in-chief** Thomas Mélonio
**Graphic design** MeMo, Juliegilles, D. Cazeils
**Layout** PUB
**Translation** Cadenza Academic Translations

**Legal deposit** 4th quarter 2025 | **ISSN** 2428-8926





Printed by the AFD reprographics department





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