

Management Recommendations to Cope with *Sargassum* Landings in the Caribbean

Recomendaciones para el Manejo de la Afluencia del *Sargazo* Pelágico en la Caribe

Recommandations pour la Gestion des Arrivées Massives de *Sargasses* dans la Caraïbe

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EXTENDED ABSTRACT

Since 2011, massive strandings of pelagic *Sargassum* have occurred along many coastlines across the Caribbean. In response to the associated socio-economic impacts (e.g. disruption of the tourism and fishing sectors, a reduction in the quality of life of coastal communities, and concern about health issues) and environmental impacts (e.g. coastal erosion, disturbance of critical nearshore habitats, disruption of turtle nesting) (see Doyle and Franks 2016), a variety of mitigation actions have been implemented to cope with this new phenomenon in the region. Although there has been considerable diversity in the *Sargassum*-related experiences across the Caribbean, the observed management responses have generally been reactive, uncoordinated and not always sustainable. This has highlighted the need for better coordination and sharing of information and experiences to develop best management practices to deal with this new, and likely reoccurring phenomenon within the region. Here, as a compliment to existing publications by Doyle and Franks (2015) and Hinds et al. (2016), we share sustainable management recommendations for coping with mass strandings of *Sargassum* seaweed, based on lessons learnt to date from around the region.

Customize the Solution

An important lesson learnt is that every situation is different and therefore solutions need to be customized to suit the type of beach use, beach accessibility, the ecological sensitivity of the beach and nearshore area (e.g. presence of coral reef, seagrass, sea turtle nesting, vulnerability to erosion), any protected status, the available workforce and budget, as well as the local legislation.

Inform the Public

Another important lesson is to keep the public and the media well-informed about *Sargassum* seaweed and about a stranding event and any clean-up efforts to prevent them developing misconceptions and to avoid the spread of misinformation. A well-informed public will be much more understanding and can be of great assistance in coping with massive *Sargassum* strandings.

Recognize When to Clear

It is important to recognize whether or not a beach really needs clearing of stranded *Sargassum*. Small to moderate strandings of *Sargassum* can be highly beneficial to a beach: improving sand stability, helping to build dunes and preventing shoreline erosion; providing nourishment to beach vegetation; and providing valuable forage for shorebirds and crabs. The stranded *Sargassum* at the back of the beach dries quickly, becoming brittle and is easily incorporated into the sand, whilst the weed along the wet shoreline may become buried or taken back offshore by wave action. Leaving the *Sargassum* on the shore is often the best and least expensive option.

When massive strandings of *Sargassum* overwhelm a beach and become trapped in the water along the shoreline this can lead to undesirable socio-economic and environmental impacts. These may include seriously disrupting beach tourism, bathing and watersports activities; preventing fishing vessel access; diminishing turtle nesting success and hatchling survival and even entrapping and causing suffocation of turtles foraging nearshore. Furthermore, piles of wet *Sargassum* decompose to release foul smelling, corrosive hydrogen sulphide gas that is toxic to marine life and can be harmful to humans at high concentrations. The decomposing *Sargassum* can also damage sensitive nearshore ecosystems (e.g. coral reefs, seagrass meadows) through release of high levels of nutrients (nitrates and phosphates), removal of oxygen from the water, and through sinking and smothering the substrate. Under these conditions active removal of *Sargassum* is justified and should be done before the *Sargassum* begins to decompose.

Manual Removal from Shore

The least damaging method of *Sargassum* removal on shore is via manual methods such as hand raking and removal by wheelbarrows to burying or collection areas. This minimizes loss of sand and damage to beach vegetation in the clearing process, and allows retrieval of trapped turtle hatchlings. This requires a large work force but can be done with supervised volunteers. Effort can be focused on sections of the beach important to users such as clearing access pathways to the sea, slipways for boat access, or sections of beach in front of hotels or local recreation areas. Likewise, areas with sensitive

nearshore ecosystems should be cleared to prevent the *Sargassum* being trapped in the water along the shoreline. Manual removal by hand raking is also appropriate for pocket beaches with no vehicular access, or rocky and engineered shorelines.

Mechanical Removal from Shore

Mechanized removal maybe justified when clearing *Sargassum* is deemed absolutely necessary but there is an insufficient manual workforce to clear a very large stranding event or one that continues over an extended period. However, this can only be done effectively where there is vehicle access and where the beaches are sandy, wide, and relatively flat. To minimize removal of sand and beach erosion, help prevent compaction of the beach sand, and minimize removal of beach vegetation and associated fauna, vehicles should use only controlled access routes, have large soft tyres, and mechanized rakes (e.g. purpose built beach rakes) or grabs (e.g. those used to load sugar cane). Tracked vehicles should not be used, and vehicles with buckets should be avoided, or the bucket must be set above the level of the beach sand to scrape only the top layers of weed. Turtle nesting areas should be avoided and only cleared manually. Mechanized removal is most effective when restricted to the wet, inter-tidal beach area. The mechanized removal of *Sargassum* may require legislation to control unauthorized use of unsuitable equipment.

Removal from Nearshore

In some situations where removal is deemed necessary, it may be more appropriate to remove the *Sargassum* directly from the water nearshore, such as in harbors or anchorages that become inundated with *Sargassum*, or engineered shorelines without beaches where the *Sargassum* cannot come ashore, or simply to avoid removal of any sand. However, *Sargassum* should never be removed from offshore locations where it serves as a valuable and unique open ocean ecosystem supporting commercial fisheries, endangered species, and high marine species biodiversity.

So far, the most successful in-water equipment appears to be specialized purpose-built barges fitted with conveyor belts to pick up the floating *Sargassum*, or amphibious vehicles with rakes. The major constraints with these specialized vessels are their high cost, small carrying capacity and the fact that they are only effective in calm conditions. In some circumstances, it is also possible to remove in-water *Sargassum* with grab buckets operated by a shore-based vehicle, but again the efficiency and scope are low.

There have been a number of attempts to use purpose-built barriers to deflect or trap *Sargassum* before it reaches the beach or sensitive habitat or enters a semi-enclosed bay or harbor. However, to date these have proven very costly, extremely difficult to anchor securely and must be cleared frequently to prevent them becoming overwhelmed with *Sargassum*. Likewise, pumps designed to remove *Sargassum* directly from the water have so far proven largely unsuccessful. There have also been trials with hand-operated or towed fishing nets and with horse-drawn baskets. However, the nets become very heavy to handle

and are easily damaged, and the latter method requires trained horses and further development of suitable towed baskets.

Communication and sharing information and lessons learnt regarding the many experiences with *Sargassum* across the Caribbean will be critical to the region's ongoing efforts to sustainably manage the massive *Sargassum* stranding events and support the continued development and up-dating of best practice guidelines.

KEYWORDS: *Sargassum*, management, best practices

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