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MODEL PROTOCOL FOR THE MANAGEMENT OF EXTREME ACCUMULATIONS OF *SARGASSUM* ON THE COASTS OF CRFM MEMBER STATES

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Model Protocol for the Management of Extreme Accumulations of *Sargassum* on the Coasts of CRFM Member States

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ACRONYMS AND ABBREVIATIONS

CARICOM	Caribbean Community
CCCCC	Caribbean Community Climate Change Centre
CFO	Chief Fisheries Officer
COTED	Council on Trade and Economic Development (of CARICOM)
CRFM	Caribbean Regional Fisheries Mechanism
CRPLC	Centre de Recherche sur les Pouvoirs Locaux dans la Caraïbe
DoF	Director of Fisheries
EAF	Ecosystems Approach to Fisheries
OECS	Organisation of Eastern Caribbean States

FOREWORD

The 26th Meeting of the CRFM Executive Committee noted the protocol developed for the management of extreme accumulations of *Sargassum* in Puerto Rico and considered the efficacy of such a protocol being considered for adoption and implementation by the CRFM. The Executive Committee noted that the protocol developed by Puerto Rico closely meets the current needs of the CRFM, based on geographical as well as social and economic realities; and, mindful of the concerns already expressed by the CRFM Ministerial Council, the Organisation of Eastern Caribbean States (OECS) Council of Ministers, CARICOM's Council on Trade and Economic Development (COTED) and CARICOM Heads of Government, endorsed the development a protocol for the management of extreme accumulations of *Sargassum* by the CRFM. The 14th Meeting of the Caribbean Fisheries Forum agreed that the Puerto Rico *Sargassum* protocol be used as a point of departure and modified where necessary to meet the needs of the region in respect to the establishment of a regional *Sargassum* protocol. The 10th Meeting of the CRFM Ministerial Council, held on 15 June 2016 in Montego Bay, Jamaica, supported the initiative to develop a regional (CRFM) protocol on the management of extreme accumulations of *Sargassum* seaweed in waters of Member States.

The present model protocol is an adaptation, pursuant to the above direction, of that developed for Puerto Rico and is prepared in the form of a template that can be utilised by Member States; recognising, that there is significant variability in the institutional frameworks that obtain in and among the different States. Some measure of urgency was seen as driving this adaptation, not only consequent upon the abovementioned concerns, but also given predictions[1] suggesting that the last week of July and the first week of August 2016 might have seen large *Sargassum* influxes into the islands of the Lesser Antilles.

The model protocol has been developed as a template, which Member States will customize.

[1] Maréchal, J-P, J. Franks, D. Johnson and C. Hu. 2016. PSB-CARIB project: Predicting *Sargassum* Blooms in the Caribbean. Université des Antilles, CRPLC; Observatoire du Milieu Marin Martiniquais; The University of Southern Mississippi; and, University of South Florida. 8p.

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1. INTRODUCTION

Since 2011, from March to August, there has been a significant increase of *Sargassum* arriving on the coasts of CRFM Member States and the rest of the Caribbean which has provoked an excessive accumulation of this marine alga on some of the beaches frequented by citizens and visitors alike.

The pelagic *Sargassum* that arrives on the coasts of Member States are composed of two species of brown algae, *Sargassum natans* and *Sargassum fluitan.* These brown algae have structures that enable them to float and be transported by the marine currents, in contrast to those that live adhering to the marine floor, which leaves them moving at the whim of oceanic currents.

In the North Atlantic large masses of these algae are found concentrated in the Sargasso Sea. The Sargasso Sea is a region of the North Atlantic Ocean between 28°20'08"N and 66°10'30". Its area has been estimated at around 2 million square miles and although the depth of the species does not exceed 50 cm, its biomass has been calculated to be between 4 and 11 million tons of wet weight. The reason why such a large mass of algae remains in this specific region of the Atlantic Ocean is the ripple produced by the rising oceanic currents of the Gulf and the North Atlantic which run toward the east north of 40°north latitude and the descending ones of the Canary Islands and the North Equatorial drift which runs to the west below 20° north latitude.

There are different suggestions about the origin of the masses of algae that are presently arriving in the Caribbean[2], which are not associated with the Sargasso Sea. Scientists have identified zones of large masses of *Sargassum* to the west of Africa which are expanding because of the high water temperatures and the high quantities of nutrients. These masses are transported by currents toward the east of the Atlantic Ocean, rise along the coast of Brazil until they arrive in the Caribbean region. To determine the origin of the *Sargassum* that arrives to the coasts of Caribbean Countries the currents of the Atlantic should be studied and analyze how the avalanches of *Sargassum* are moved by the currents and arrive at the locations and in which locations they are deposited.

In the open sea, the floating masses of *Sargassum* represent a rich habitat of over 120 species of fish and over 120 species of invertebrates. Below the *Sargassum*, turtle hatchlings, sea horses, and other small species can be found. It also serves as an area for the reproduction of species of singular importance such as the flyingfish (*Exocoietidae sp.*) and a great quantity of fish that in turn serve as food for larger fish such as dolphinfish (*Coryphaena hippurus*).

The floating masses of *Sargassum* also have an important role as areas of nutrition and nurseries for juveniles of more than 100 species of important commercial and recreational fish such as saw fish, jacks, tuna, barracuda, wahoo, dolphinfish and bill-fish. Various species of marine turtles in

[2] See, for example: Fortune, J., C. Louime and G, Gervais, 2016. Commentary: Brown invasive algae in the Caribbean: Origin, concern and opportunities. Caribbean News Now! http://caribbeannewsnow.com/headline-Commentary%3A-Brown-invasive-algae-in-the-Caribbean%3A-Origin%2C-concern-and-opportunities-31591.html [accessed 30 August 2106]

danger of extinction utilise the *Sargassum* for food and protection during their first years of life. Once they arrive on the coast, many of the species that have utilised *Sargassum* as a habitat move towards mangroves, bays, estuaries and coral reefs to protect themselves from predators and continue their circle of life. The concentrations of *Sargassum* in the open sea represent a perfect nursery and area of nutrition for multiple species, particularly in their juvenile stages.

The *Sargassum* can be considered a problem when it affects the use of the public beaches, the recreational activities on the coasts and the bathing areas in front of the hotels, tourist areas, and public spas[3]. One of the principal effects of *Sargassum* upon decomposition is that it produces objectionable odours and it alters the appearance and aesthetics of areas used for tourism, recreation and marketing.

The accumulations of *Sargassum* on the edge of the sea, where portions of these accumulations of algae are found floating and some over the sand in the intertidal area, can produce negative effects on natural systems which can be covered by *Sargassum*, because:

1) It interrupts the penetration of light affecting marine resources,
2) It raises the temperature below the algal mass, and
3) It increases friction and the possible mechanical damage associated with *Sargassum* which is displaced at the mercy of the tides and surf.

On the other hand, the accumulations of *Sargassum* on the high beaches and the dunes contribute to stabilize areas undergoing erosion. Similarly, the scientific literature on *Sargassum* concludes that the deposition on the dunes contributes to stabilizing and that upon decomposition it provides nutrients that accelerate colonization of these formations by costal vegetation which stabilizes it.

In terms of navigation, these accumulations of *Sargassum* can affect boating. In the case of jet skis the algae can enter the propulsion system and cause the cooling system to collapse leaving the unit inoperable. This can be resolved by immediately diving and removing the algal cover and continuing on the journey avoiding the *Sargassum* masses. Boats with outboard motors can also be affected by when they cross masses of *Sargassum* and these become entangled in the propellers, thus stopping their rotation and impeding the operation of the boat. The principal recommendation, by whatever means, the concentrations and masses of *Sargassum* should be avoided during the journey.

With regards to public health, it has been documented that coming into contact with masses of *Sargassum* can cause allergic reactions on the skin of some individuals. Consequently, it is recommended that direct contact with the *Sargassum* should be avoided.

[3] c.f.: Hinds, C., H. Oxenford, J. Cumberbatch, F. Fardin, E. Doyle and A. Cashman, 2016. Golden Tides: Management Best Practices for Influxes of Sargassum in the Caribbean with a focus on clean-up. CERMES, CAR/SPAR-RAC, GCFI Sargassum Management Brief. 17p. http://www.cavehill.uwi.edu/cermes/getdoc/123bf91c-1565-414d-8e21-e59fb6f7ca2d/cermes_sargassum_management_brief_2016_08_24.aspx[accessed 25 August 2016]

2. ADOPTION

Because of the possible impact of the extreme accumulation of *Sargassum* on the coasts of [***country***], this Protocol is adopted through [***cite appropriate national legislation***] [, where the procedures are established to address these events, as well as where the preventative measures are described, which result in the protection of the natural resources and the maintenance of optimal conditions of coasts for the enjoyment of present and future generations.]

3. IMPLEMENTATION

For the effective implementation of this Protocol, a committee shall be established for the management of issues related to deposited *Sargassum*, with the [***appropriate national agency***] as the lead agency. This is a problem that has affected coasts in the past and although the phenomenon has occurred, the quantity of deposited material has increased considerably in the last few years. This has brought problems to the tourist beaches in CRFM Member States, as well as in Europe, in other parts of the Wider Caribbean including, on the east coast of the United States, Cuba, the Dominican Republic, and Puerto Rico. Tons of extreme accumulations of deposited *Sargassum* have been recorded, in some cases on only one beach.

It is recommended that the members of the Committee should include the following agencies, groups or entities:

- [***appropriate national agency***] as lead agency on behalf of the State, utilizing funds allocated by Government in the annual [estimates of expenditure][budget]
- Department of Agriculture (DA)
- Solid Waste Management Authority (*named corresponding national agency*)
- Environmental Agency (*named corresponding national agency*)
- Affected municipalities
- Hotel and Tourism Association (*named corresponding national agency*)
- [Relevant] Environmental entities or organizations, community groups and/or volunteers

One aspect to be explored with regard to the management of the extreme accumulation of *Sargassum* is its possible commercial use, be it at the industrial or craft level. Available literature suggests possible uses of this extreme accumulation of *Sargassum*, such as its preparation as organic compost and possible extraction of prime material for commercial products. This extreme accumulation of *Sargassum* is characterized by a high content of trace elements, minerals and nutrients that besides its possible use for compost is also viable to produce feed for cattle and poultry. Mindful of this, the established committee should also be encouraged/responsible for promoting public education and awareness initiates to help sensitize the public.

In addition, it is recommended that national public-sector agencies promote collaborative agreements, in the event assistance is required be it from private enterprises, nongovernmental organizations or municipal entities to deal with the extreme accumulation of *Sargassum*.

4. LEGAL BASE

As stipulated in [***appropriate article(s)***], [***appropriate section(s)***] of the [***relevant legal instrument***], the [***appropriate national agency***], has the duty to guarantee the conservation, protection, management and appropriate use of the natural resources and environment of [***country***].

Pursuant to the provisions of [***relevant legal instrument***], the ***appropriate national agency***] administers a series of laws and regulations which encourages compliance with the duty previously mentioned, such as [***list relevant legislation***]

5. STEPS TO FOLLOW TO CONFRONT AN EXTREME ACCUMULATION OF *SARGASSUM*

1) **Identification of zones or beaches prone to the impact of extreme accumulations of *Sargassum* –** Since the principal problem presented by the extreme accumulation of *Sargassum* is on sandy beaches and since this is a cyclical or seasonal event, the following are essential:
   a. Identify ahead of time the beaches prone to the impact of extreme accumulations of *Sargassum* and the severity of the event.
      i. Type of accumulation of *Sargassum* (floating in the water near the coast, accumulated on the coast and floating in the water, accumulated only on the coast.)
      ii. Approximate quantity of accumulation (mild, moderate, large, extraordinary)
   b. Identify the coincidence of these events with beaches with nesting marine turtles.
      i. Have a registry identifying the nests in the areas that could potentially be affected.
      ii. Before an event of extreme accumulation of *Sargassum* in an area already identified with nesting, the technical personnel along with support groups will manually clean the area identified as a nest, using only manual rakes to clear around the area and the possible path toward the shore in the event the eggs hatch. This is until the final plan for the removal of accumulated debris is developed.
2) **Preparation of a Work Plan –** Since there is a tendency for this to be a recurring event, after identifying the areas, a site work plan will be developed for the accumulation of *Sargassum* events.
   a. The plan should include a diagram or map that identifies the following:
      i. Zones prone to the extreme accumulation of *Sargassum*;
      ii. Sensitive ecosystems or marine turtle nesting areas near the coast;
      iii. Access streets, roads or highways;
      iv. Possible areas of accumulation of material for disposal;
      v. Possible disposal areas; and

vi. Identification of dunes in the area (if applicable).

b. The plan will establish the type of management of extreme accumulation of *Sargassum* according to the quantity deposited.
   i. Mild to moderate quantity – the plan will consider if removal or relocation is required, and removal and disposal methods.
   ii. Moderate to large quantity – the plan will identify the procedure for removal, and relocation and removal and relocation methods.
   iii. Great to extraordinary quantity – the plan will establish the coordination in the areas regarding type of equipment and personnel required and the impact on the system will be determined using a preliminary environmental evaluation.

c. In the event of an extreme accumulation of pelagic *Sargassum* that impacts the pelagic zone of the marine environment, the plan will evaluate the following:
   i. Magnitude of the extreme accumulation of *Sargassum*;
   ii. Possible impact on the benthic/pelagic flora and fauna;
   iii. Need for removal; and
   iv. Management, movement and disposal of the material.

6. NOTIFICATION AND ACTIONS TO BE TAKEN TO ADDRESS THE EXTREME ACCUMULATION OF *SARGASSUM* ON COASTS OR BEACHES

a. All entities affected by the extreme accumulation of *Sargassum* (municipalities, hotels, businesses, civic/environmental groups, among others), should notify the [***appropriate national agency***] about the situation, especially in the following areas:
   i. [Regional] Officers of the [***appropriate national agency***]
      - [list area] – [contact number(s)]
      -
      -
      -
      -
   ii. [***appropriate enforcement agency***] Command – [telephone number]
   iii. Natural Protected Area ([list ***appropriate national agencies***]) (*Offices of Management and/or Biological Officials*)

b. Administrative notification procedure:
   i. The Region, detachment or area (*use appropriate national designations*) of the [***appropriate enforcement agency***] that receives the notice should take the following information:
      - Name , telephone, e-mail of complainant
      - Town, neighbourhood, location specifying the beach or coast affected and name of the beach with access routes or roads.
   ii. The Region, detachment or area (*use appropriate national designations*) of the [***appropriate enforcement agency***] that receives the notice will notify or activate

the technical personnel of the impacted region and the [***appropriate enforcement agency***].

7. EVALUATION OF THE EXTREME ACCUMULATION OF *SARGASSUM* EVENT

1) Evaluation of the impacted area

a. The technical personnel with the assistance of the [***appropriate enforcement agency***], will evaluate the impacted zone (*conditions in the bay, inlet, estuary, coral reef area, sea grass or beach*)

b. The evaluation should include approximate length of the impacted area.

c. The following should be determined:

i. Area impacted, be it the zone of the coast affected above high tide or the coastal pelagic zone.

ii. A biological sampling of the area to determine water quality, the presence of turtle nests, marine or terrestrial organisms that require rescuing and releasing.

iii. Whether to remove, not remove or relocate the material.

iv. Specific places where removal of the material will occur, if applicable.

v. Approximate quantity to be removed, if applicable – This evaluation will determine the method of removal and if the process will be done manually by raking (with minimal impact to the system) or if machinery is necessary. Removal method, if applicable.

d. The technical evaluation should be finalized within two (2) days of knowledge of the event. The evaluation report should be submitted during this period to the Office of the Secretary for authorization. The [***title of agency head***] of the [***appropriate national agency***] may delegate the approval of the technical evaluation to the [***appropriate national designee***].

e. The technical evaluation should take the following into consideration:

i. The removal of moderate quantities of *Sargassum* will be undertaken with the use of rakes or other manual equipment which does not remove sand from the beach system.

ii. For the removal of greater quantities requiring non-manual equipment, special attention should be taken that only a minimal amount of sand is removed from the beach during the process.

iii. Once authorized, removal should be undertaken at low tide.

iv. In areas where erosion of the beach is evident, the displacement of the *Sargassum* will be undertaken in the most exposed areas and efforts will be undertaken to confine it to this space, where it will contribute to the retention of sediments and reduce erosion.

v. In areas with dunes, the accumulations of *Sargassum* may be removed and placed at the base of the dunes where the decomposition provides nutrients that contributes to the colonization by coastal vegetation that contributes to the stabilization of these formations.

f. In the process of evaluation for the disposal, the disposal of excess *Sargassum* may be authorized in trenches in sites outside of beaches and dune areas. In addition to the use for stabilization of beaches and dunes, its use should be contemplated for compost, nutrition, bio-fuel (generation of energy), and among others.

2) Proposed work plan following approval of the report:

a. The Office of the [***title of agency head***] of the [***appropriate national agency***] will designate a coordinator for the affected area to ensure that the work is carried out according to the authorization.

b. The technical personnel together with personnel or volunteers, whether beach cleaners or others, will undertake a final inspection of the area to verify the proposed work plan to address the specific situation.

c. Upon completion of the site visit, the coastal area to be to be cleaned will be determined, be it partial or total.

d. A zone on the beach will be identified where the material can be relocated, if viable, or a location away from the coast or beach where it can be transferred, and where efforts can be made to re-access the location for the sand to be retrieved once the *Sargassum* had decomposed.

e. In the event that there are dunes, the material will be dispersed on the dune in accordance with recommendations from the technical personnel in order to assist in consolidating the system.

f. Before commencing the removal work, the personnel or volunteers will be provided with a briefing on health and security issues associated with handling *Sargassum* in addition to providing them with personal protection equipment (overalls, respirators, etc.) and a briefing shall be provided on their use.

g. The plan should clearly enunciate the role of the private sector in making contributions towards maintenance, for long term effective control/management of such extreme accumulations

8. MECHANISMS FOR THE DISPOSAL OF THE MATERIAL AND THE USE OF HEAVY EQUIPMENT

1) Quantity to be handled

a. The handling of the material deposited will determine the procedure regarding the type of equipment to be used and the final disposal of the material

i. For events with little or moderate quantities of material, it will determined:

- Removal or not of the material
- Relocating the material without burying
- Burying in trenches or drains
- Consolidating material on dunes

ii. For events with moderate to great quantities of material:
- Determine if removal of the material can be carried out manually with rakes
- Determine of disposal will be inside or outside the area
- Consolidate the material in dunes
- Coordinate with the different areas the method of removal and haulage.
- Identify place where the trench will be located in the event the material is to be buried (a depth of 5-6 feet (1.5240 – 1.8288 m) is recommended).

iii. For events of great to extraordinary quantities of material:
- Tractor with shovel to be utilized for cost effectiveness
- This method to be used when the accumulated quantity exceeds 10 inches
- Instructions shall be given to the operator that the shovel should not be buried in the sand.

2) Heavy equipment according to the needs:
   a. (list available equipment and summarise appropriateness for possible tasks)
   b.
   c.

   In the event of extreme accumulations of *Sargassum* of great extent, an environmental evaluation will be undertaken to determine the possible impact in the zone. For these cases the following procedures will be followed:

   i. Technical personnel will send a report indicating the need to use machinery or mechanical equipment for removing the material. The report will indicate the possible impact on the system, if any.
   ii. The report will be sent to the corresponding supervisors or directors for their approval.
   iii. The final report will be sent tom the Office of the Secretary for approval.

All use of heavy equipment must be coordinated with the [***state appropriate officials and agencies***].

9. ACTIONS IN COASTAL ZONES (PELAGIC) IMPACTED

Depositions have occurred on coastal zones (pelagic) in the past with or without impacts on the coast. In that case, the technical personnel will proceed to evaluate the area and determine the plan of action to be undertaken. The possible scenarios could be that the area could be affected considerably by the presence of sea grass or coral, in which case, and depending on the evaluation, a mechanism for the possible removal of the deposition will be prepared.

The possible courses of action include:

1. Upon evaluating the area and determining that there will be no significant impact on the environment, a recommendation for no intervention is made.
2. In the event that removal is undertaken, a determination will be made if it should be undertaken in the following way:
   a. Manual removal with rakes to the shoreline
   b. If viable, a "long reach" will be used to pick up the material
   c. The use of nets will be considered for moving it seaward or toward the coast with subsequent removal from easily accessible zones or with boats.

10. SECURITY PLAN

All material of anthropogenic origin such as the products from marine currents, winds, discarded trash deposited on the coasts, should be treated with great care by personnel working on the removal of deposits. For those effects, a security plan shall be prepared for these situations providing the necessary security equipment to avoid possible allergic reactions to the skin, lesions, cuts, or puncture wounds. This material should be disposed in the appropriate manner once the deposits have been separated. This will include any plastic material or other solid waste.

11. FINAL REPORT

Once the work of removal is completed a final report on the work implemented will be prepared which shall be submitted to the Office of the [***title of agency head***] of the [***appropriate national agency***]