SARGASSUM IMPACTS IN WEST AFRICA: SENEGAL TO NIGERIA

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INTRODUCTION

- Marine systems are prone to biological invasions with impact documented in fewer than 30% of globally recognized non-indigenous marine species (NIMS) and even fewer impacts quantitatively assessed.

- Marine macroalgae are a significant component of NIMS with current global estimates of introduced macroalgae ranging from 163 to >300 species (Davidson et al. 2015).

- Globally, there is a dramatic increase in " seaweed tides" has caused economic disruption to local economy and environment.

- Majority of beach inundations are caused by green seaweeds-*Ulva* casuing green tides and brown/ golden brown pelagic seaweed, *Sargassum* responsible for the golden tides.

- Prior to 2011, deposits of *Sargassum* occured naturally and regularly on beaches, albeit in smaller quantities.

INTRODUCTION (CONTD.)

- In a balanced environment, *Sargassum* are important :
  - as unique nursery habitat and food especially for endangered species such as sea turtles.
  - for shoreline stability and nutrients for beach and dune plants.
  - as source of biochemicals, feed, food, fertiliser and fuel.

- Since 2011, the West Africa has been adversely affected by the pelagic seaweeds, *Sargassum*.

- Unprecedented impact in geographical scale and quantities consistent with global rise in seaweed tides in recent years.

- Concerted efforts have been initiated at local, regional and international organizations levels.

INTRODUCTIO(CONTD.)

First Regional Expert Meeting on *Sargassum* invasion held in Sierra Leone, November 2015 on the request of nine West African countries.

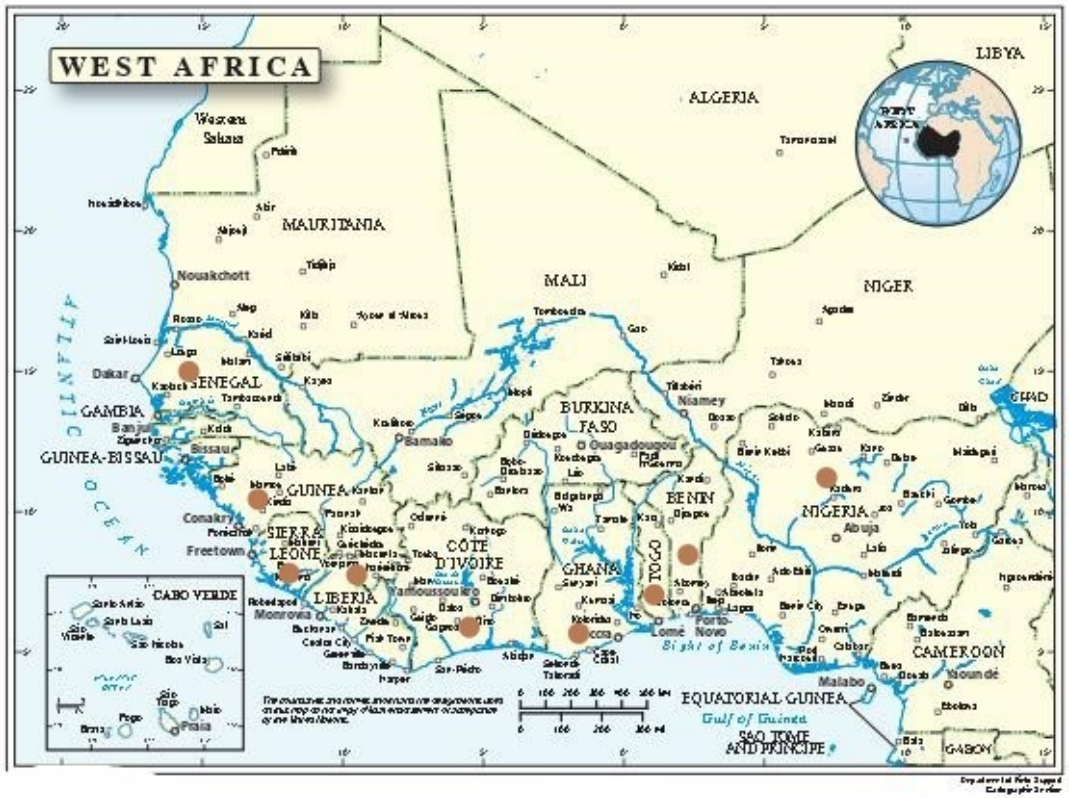

Figure 1. Locations of nine countries in West Africa (Senegal to Nigeria) affected by *Sargassum* influxes (brown circles)

INTRODUCTION (CONTD.)

- Studies of *Sargassum* impacts in West Africa are relatively few and just emerging; considerable knowledge gaps exist.

- Any study of the *Sargasssum* phenomenon should include Greater Caribbean region to the Gulf of Mexico, West African coastal waters, Coastal waters off northern Brazil, North Equatorial Recirculation Region (NERR) (Kershaw et al., 2017).

- Goal is to summarize current knowledge of the golden tides impacts and management interventions in West Africa.
- Objectives :
  - review information on the causes of *Sargassum* inundations;
  - identified and potential impacts, and measures taken to mitigate golden tides in West Africa.

Ecology: Distribution and Biodiversity

- Generally, seaweeds are known to flourish in temperate regions (Fakoya et al., 2011).
- Variability in distribution and diversity is almost identical with phytoplankton productivity in areas close to nutrient-rich upwellings(King 2007).
- Tropical West Africa has a distinctive but depauperate flora except Ghana(John and Lawson, 1991).
- Genus *Sargassum* (> 350) is found throughout tropical and subtropical areas of the world (Milledge and Harvey, 2016).
- Five species : *Sargassum acinarium*, *S. cyniaun S. filipendula, S. ramifolum* and *S. vulgare* were reportedly found in some West African countries (John et al., 2003). While only *S. vulgare* and its variety (var. *foliosissimum*) distributed in 12 West African countries (Oyesiku and Egunyomi, 2014). .

Causes of *Sargassum* invasion

- Pelagic *Sargassum* (*S. fluitans* and *S. natans*), blossom naturally in the Sargasso Sea and Gulf of Mexico (Grass-Sessay, 2015).
- Floating jungle or golden floating rainforest of the Atlantic Ocean (Milledge and Harvey, 2016).
- Observations of pelagic *Sargassum* date to the time of Christopher Columbus and more recently by satellite imagery- changes in biomass and range expansion (Brooks et al., 2018).

Figure 2. Examples of *S. natans* (left) and *S. fluitans* (right). Source : Kershaw et al., (2017).

Causes of *Sargassum* invasion

- *S. natans* and *S. fluitans* predominated in golden tides off West Africa in 2011 except Ghana where it was first recorded in 2009 (Addico and deGraft-Johnson, 2015).
- *Sargassum* influx in 2011 traced to a new source – NERR (Grass-Sessay, Kershaw et al., 2017).
- Flushing-out of *Sargassum* in the spring of 2011 from breakdown of the North Equatorial Counter Current (Grass-Sessay, 2015).
- Severity of inundations were less in **Benin, Guinea and Togo** than in **Nigeria, Sierra Leone, Ghana** and **Cote d'Ivoire.**
- Post - 2011, *Sargassum* influxes of lesser magnitude events were experienced and reached a critical maximum in 2015

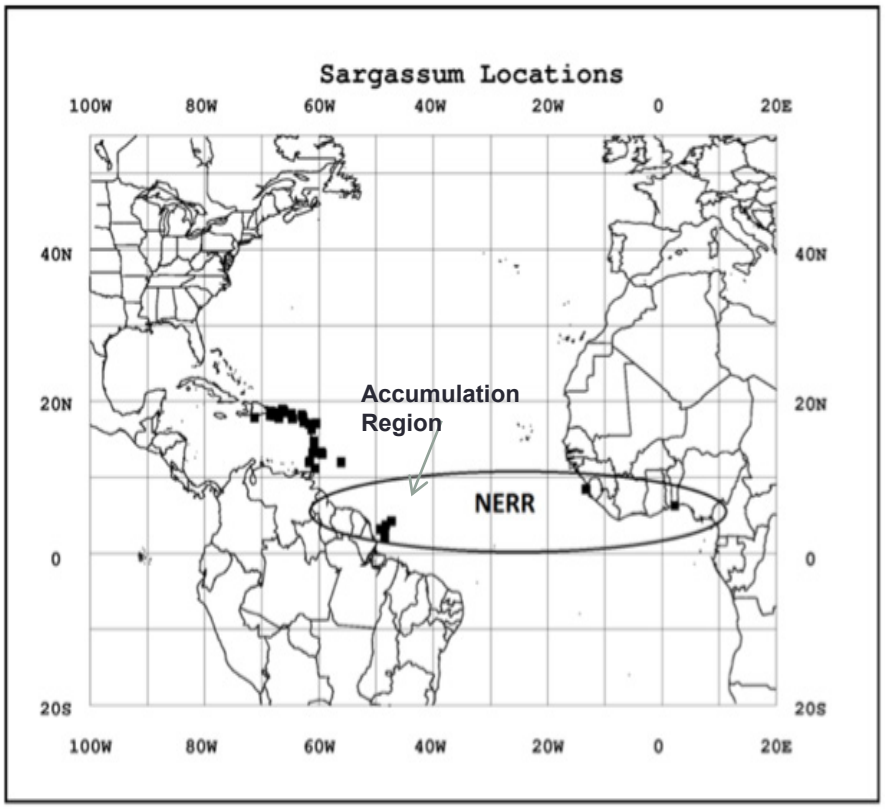

Figure 3. Origin of *Sargassum* influxes and inundations on the shorelines in the Caribbean and West Africa (black squares) (Source : Grass-Sessay, 2015, Kershaw et al., 2017)

Causes of *Sargassum* invasion

Figure 4. Invasion of *Sargassum* in Côte d'Ivoire (left) and in Sierra Leone (right). Source : Grass-Sessay (2015).

Causes of *Sargassum* invasion

- Presently, exact conditions responsible for the unusual bloom of pelagic *Sargassum* are unclear.
- Evidence of maritime traffic or aquaculture as most likely potential introduction vector is substantially weak or missing.
- According to Grass-Sessay (2015) and Kershaw et al., (2017), tentative chemical, physical and biological factors influencing proliferation of pelagic *Sargassum* include:
- **Availability of nutrients, from local or long-distance sources.**
  - Variability of riverine nutrients inputs from the Congo River and the Amazon River;
  - Variability in the supply of iron due the atmospheric deposition of Saharan dust. Likely source in the occurrence of red tides in the Gulf of Mexico.
  - Increased land based nutrients and pollutants (which include nitrogen-heavy fertilizers and sewage waters) washing into the ocean water;

Causes of *Sargassum* invasion

- **Variability in ocean climate and ocean circulation**

  - *Sargassum* cycles are closely linked to seasonal change affecting production at Sea Surface Temperature;

  - Maps of the Sea Surface Temperature indicate that NERR and the Accumulation Region are the warmest regions in the Atlantic Ocean;

  - Variability in the position and intensity the Canary and Guinea Eastern Boundary Currents; associated equatorial upwelling and coastal upwelling off West Africa.

- **Enhanced capabilities to disperse and colonize new habitats outside its natural range** :
  - Asexual reproduction by fragmentation for new growth;
  - Free-floating; not requiring hold-fast mechanism or attachment.

Identified and potential impacts of *Sargassum* invasion

- Clogging of fishing nets (Adet et al., 2017)
- Entanglement of engine propellers.
- Limit access to beach for launching, recovering boats and cause boats to capsize

- Reduced fish catch
- Reduced fishing period and income

- Decrease in daily household earnings of women in processing, distribution and marketing of fisheries products.
- Affects daily earnings and livelihoods of other actors in small-scale fisheries value chain.
- Negative impact on community well-being viz-a-viz quality of life, children's education, availability of social amenities e.g. healthcare etc.

Identified and potential impacts of *Sargassum* invasion

Tourism, Aesthetics and Health Aspects

- Beach fouling reduces access to the sea and shoreline for swimming and other activities.
- Irritation of skin, eyes and respiratory system from inhaling highly toxic hydrogen sulphide (Oyesiku and Egunyomi, 2014).
- Risks of fatality from inhaling low concentrations of highly toxic gas (Kershaw et al., 2017).

Ecological Effects

- Perturbation and relocation of marine species.
- Undocumented reports of fish kills
- Beach erosion: sand may be inadvertently removed leading to depletion and possible shoreline instability.
- Restrict access of sea turtles to nesting sites; forming barrier to the sea for the hatchlings (Kershaw et al., 2017)

Initiatives related to the occurrence of massive accumulations of *Sargassum*

- A Regional Strategy Document coupled with an Implementation Plan and a GEF/PIF Form on *Sargassum* and invasive species for consideration by the Parties to the Convention in March 2017.
- Collaboration between Abidjan Convention and SPAW-RAC under coordination of UN.
- Key follow-up action to promote South-South Corporation with Caribbean states to enhance information sharing on “best management practices” of seaweed.
- Alignment of proposed National Action Plans with Regional Strategy Document inclusive of :
- Establishing an early warning mechanism through an effective use of satellite images.
- Setting-up an information management, monitoring and surveillance mechanism for tracking purposes.
- Setting-up seaweeds farms in affected coastal communities which will serve as storage facilities and value-addition hubs.

Initiatives related to the occurrence of massive accumulations of *Sargassum.*

- Sierra Leone, Ghana and Ivory Coast have demonstrated actions on the management and utilization.
- UN Environment GPA: Coordinates efforts within UN Environment, including Regional Seas (Cartega and Abidjan Conventions).
- FAO (FAO CC4FISH) : Modelling growth and transport of pelagic *Sargassum* invasions from West Africa into the Eastern Caribbean and implications for pelagic fisheries
- *Sargassum* subcommittee established by SCOR-IOC-UNESCO (GlobalHAB).
- WMO- Atmospheric nutrients inputs
- UN Environment The Convention for Cooperation in the Protection, Management and Development of the Marine and Coastal Environment of the Atlantic Coast of the West, Central and Southern Africa : Focus on West African Fisheries ans other economic factors.

CONCLUSIONS

- Causes of recent blooms and mass strandings of *Sargassum* are not yet well understood.
- Fact is *Sargassum* proliferation is a consequence of warming and changing of ocean temperature due to global climate change.
- Critical knowledge gaps exist on the ecological impacts of invasive *Sargassum* on the ecosystem in general.
- Understanding what environmental factors are controlling recent variability is difficult, however, without understanding drivers of variability in *Sargassum* distribution on seasonal time scales.
- Discontinuous and unreliable supply coupled with presence of pollutants present a challenge to utilization.
- Expedient for South-South Collaboration and Cooperation between West Africa and the Caribbean + Gulf of Mexico on *Sargassum* phenomenon.

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THANKING YOU FOR LISTENING!