SARGASSUM EARLY ADVISORY SYSTEM (SEAS): A comparison of Sargassum landing amounts vs cold fronts on the Gulf Coast

A Whitepaper from the SEAS Team

By

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The summer of 2014 was a historic and outlying landing of Sargassum with Galveston Island receiving a minimum 49,445.83 tons of Sargassum. The amount of Sargassum that lands each season is determined by an accumulation of variables. These variables are defined as the Sargassum loop system including the Azores high pressure system, North Atlantic Gyre, Langmuir Circulation, Gulf Stream, and available nutrients (Webster, 2013). One variable that must be further investigated is the interplay between the weather patterns within the Gulf of Mexico and Sargassum's seasonal arrival. Weather patterns that are thought to hold special significance are the cold fronts that move through the Gulf Coast. For the purpose of this research a cold front will be described as a weather pattern that shifts from the southerly winds to a northerly based wind. This pushes cold air masses towards the Gulf of Mexico and the resulting winds drive the Sargassum that is circulating in gyres into the southern region of the Gulf. This area known as the Bay of Campeche, has been attributed to incredible capacity for Sargassum growth in past research (Gower and King, 2012). This research seeks to examine whether or not the amounts of Sargassum that makes landing per season is

affected by the cold fronts that pass through Texas from December 1st through April 30th.

Data from 2010-2015 was collected from Weather Underground and Landsat imagery as described by Development and Implementation of Sargassum Early Advisory System (SEAS), Captain Robert Webster and Dr. Tom Linton. In 2014, there were 26 cold fronts that came through Houston before May 1st. It is hypothesized that it was these cold fronts that pushed the Sargassum into the southern Gulf of Mexico. It was this occurrence that kept the Sargassum mats in nutrient rich Bay of Campeche. The vegetative growth of the algae make well mixed nutrient rich waters the optimal conditions for maximum Sargassum growth (Lapointe, 1993). The Bay of Campeche's environment meets these conditions and allowed the Sargassum to experience a significant bloom in growth before it made landfall.

The Sargassum Season of 2015 has been a lighter than average year for the Gulf Coast, appearing to be an outlier on the opposite end of the spectrum from the 2014 season. Landings have occurred in the Caribbean Islands, the Yucatan Peninsula and the Atlantic Coast of Florida. The lack of Sargassum landings of the Gulf Coast can be attributed to the other deciding factors in the Sargassum Loop. The Sargassum that has made it into the Gulf of Mexico has been pushed out into the Atlantic Ocean.

The 2009 – 2014 Sargassum seasons can be compared to the cold fronts utilizing a method developed by Robert Webster. As a means of quantifying the Sargassum landings, Webster established a data bank of newspaper complaints lodged with cities that were major hubs along the Texas coastline. This serves as a proxy variable for the excessive Sargassum wracks that were making landing at the time. Until recently,

accurate reports of the true volume of Sargassum landing were not recorded. We will use this proxy variable in the comparison.

Sargassum Season	2010	2011	2012	2013	2014
# Complaints Lodged	0	4	4	1	30
# Cold Fronts	22	18	20	20	26

Table 1. Comparison of Complaints of Sargassum landings vs cold fronts

With the data shown in Table 1, it is impossible to draw a scientifically sound conclusion. Intuitively the concept that being held in an area of high nutrients for a long period of time causes exceptional growth makes sense. Taking into account previous work on Sargassums life cycle, some preliminary conclusions can be assumed. Gower and King pointed to the Bay of Campeche as a location fit for rapid vegetative growth (Gower and King, 2012). Lapointe's work also hinges on the availability of Nitrate, Phosphate, Ammonia, and Iron (Lapointe, 1993). With the collimation of these works, there does seem to be strong evidence to suggest that time spent in neritic waters such as the Bay of Campeche will result in a significant increase in biomass. As systems of collecting Sargassum volumetric data are developed exploring this correlation will become more feasible. Moving forward, the need for continued study in this arena is clear, and in depth research into the unexplored minutia of Sargassum's life cycle is highly encouraged.

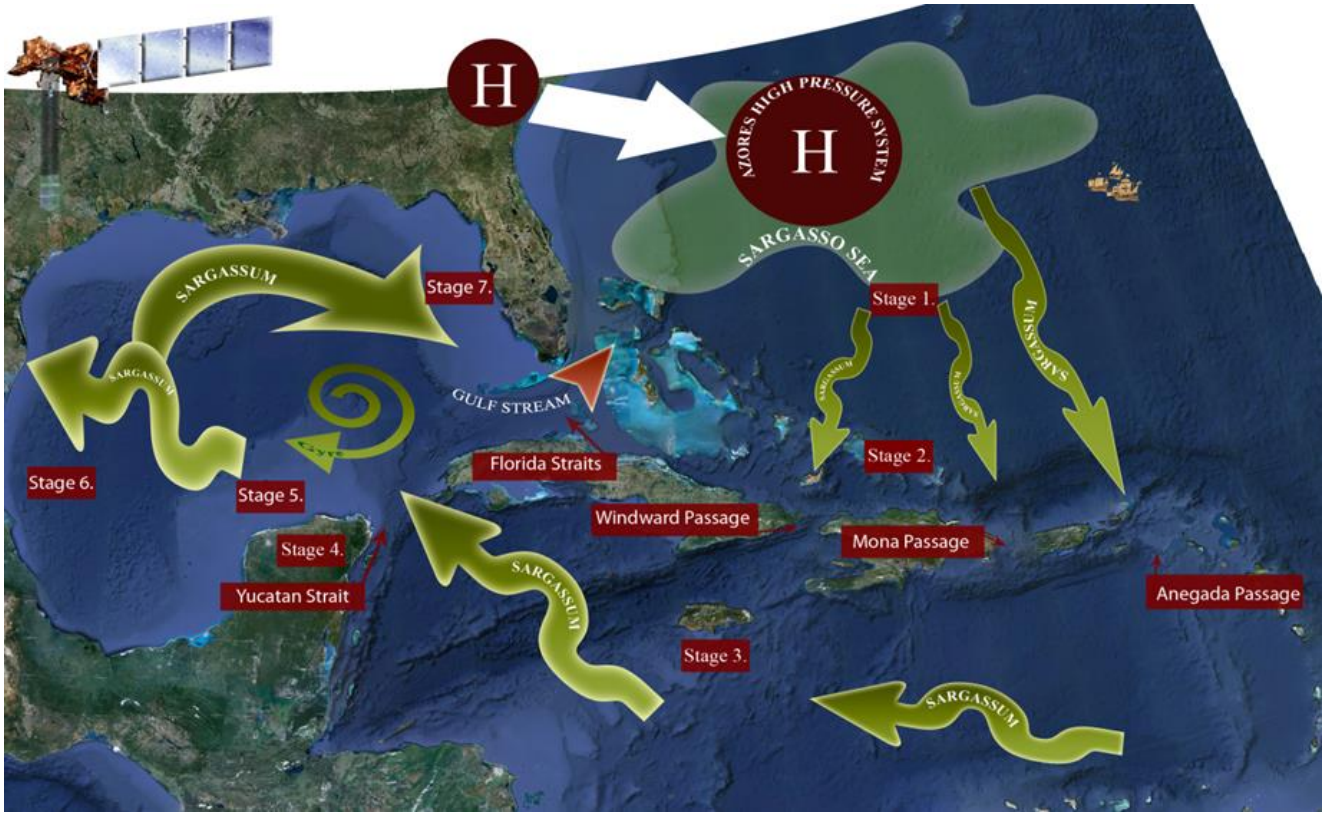

Figure 1. Sargassum Loop System

1. The loop system begins with the wind circulation of the Azores High Pressure System pushing large slicks of Sargassum from the Sargasso Sea, located near Bermuda.

2. The Sargassum is transported through the passes of the North Caribbean.

3. The swift currents of the Caribbean Sea sweep the Sargassum towards the Gulf of Mexico.

4. Sargassum enters in the Gulf of Mexico through the Yucatan Strait,

5. A gyre periodically will break off from the Gulf Stream with the potential of taking with it Sargassum slicks.

6. The gyre can drift towards the west and if steering currents are favorable can reach the North Mexico and South Texas coastline.

7. Sargassum that doesn't make landfall eventually returns to the Gulf Stream terminating its voyage at the Sargasso Sea.

Works Cited

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