FROM THE POLLS TO DEATH TOLLS

Analyzing anthropogenic and environmental effects on *K. brevis* algal blooms from 2000-2018 in Florida

**K. BREVIS IN FLORIDA**

Harmful algal blooms have devastating effects on human health, environmental health, animal health as well as the economic environment. Algal blooms occur when diatoms or dinoflagellates like *K. brevis* and *P. brevis* release neurotoxins like phosphates and nitrogen, sunlight, and slow moving water to cause oxygen sources. Some, like *K. brevis* can produce potent neurotoxins called brevetoxins that can be lethal to wild animals, and cause severe symptoms in humans through inhalation, and the consumption of shellfish and fish. Economically, the loss is evident in the fisheries industry, public health impacts are through treating illnesses, and covering sick days, to finances spent on leading, rehabilitating and medically treating wild animals. Tourism declines dramatically during what is typically the peak season on the west coast of Florida due to the unsightly pile of carcasses, and pungent odor. NOAA estimates a total of 862 million a year in economic loss is contributed to the toxic algal blooms in the United States. There are many factors that contribute to the increasing spread of the algal blooms over the years, factors such as rainfall which can cause run off, temperature increases which make a hospitable environment for the growth of algal blooms, and fertilizer use. Minimal effort has been put forth by policy makers, and the death toll of the wildlife is increasing, as are the human impacts. In this paper I will attempt to find a correlation of factors that can contribute to the increasing duration of the algal blooms and propose a solution to increase the health of our environment and community.

**ELECTIONS AND THE ENVIRONMENT**

From 2000 to 2018 the state of Florida has had three different governors. Jeb Bush’s term was from 1999-2007, Charlie Crist’s term was from 2007-2011, and Rick Scott’s term has been from 2013 to present day. All three candidates pledged to make a difference if elected with no results, and the issue was deemed impossible to fix when the opportunity came to honor their pledges. Throughout the ten years of preservation towards the issue it has become increasingly severe every year. It was only until recently that Rick Scott declared a state of emergency during the tail end of this year blooms and promised $3 million to aid in relief and clean up. Amages of dying marshes have been promised, as there is some belief that dying marshes could aid in mitigating the effects of harmful algal blooms. Maritime Lab will begin research later this week in an attempt to prove this theory. Florida does have a clean water act, which by permit only can discharge of dredged or fill materials be dumped into waters, including wetlands.

**WHAT TO ANALYZE**

- Census tract data was taken from the 2010 and 2016 U.S. census to determine the population density per square mile. The difference was calculated using the field calculator and subtracting the 2010 census per square mile from the 2016 census per square mile. Change over time was done using inter-quartile range. Increase in the population occurred in the majority of the state, predominantly on the coast in the ten year span. It can be assumed that with an increase in human population there is an increase of septic waste. This funding

**CLIMATE**

Climate is an issue of concern globally and through the data collected in from the Southern Regional Climate Center this average temperature time line graph is able to show a slight but still significant increase in overall temperature in the state of Florida over the last 10 years. Data was collected during the months of June, July, August and September to show a range during the peak time of the algal blooms. Warner climate are ideal living conditions for this microorganism. If this trend continues it’s likely the severity of the blooms will follow suit.

Rains close to a daily occurrence in Florida, this can aid in the ideal environment for the harmful algal blooms even if the rains are predominantly inland. The average precipitation data was taken from the Southern Regional Climate Center in their long term trend reports. Using their data, average precipitation from 2000-2016 was collected for the months of June, July, August and September to show a change in the amount of precipitation over the last ten years. This line graph was created and shows a slight increase in average precipitation during the peak of the harmful algal blooms season. This can increase the occurrence of potential run off of fertilizers and contaminants to enter the sewer and waste water system that eventually lead to the oceans and provides nitrogen and phosphorus in plentiful amounts to *K. brevis*.

**FERTILIZER USE**

Fertilizer use in the state of Florida exceeds more than 90% of the United States ( EPA, 2017). This can be because of your round crops due to favorable rain and temperature conditions, but the soil quality is predominantly sand in Florida and humans intervene to supplement the soil with fertilizers to hope to improve the nutrient quality. Fertilizer sales are regulated in part by the Florida Department of Agriculture and Consumer services, and the University of Florida Extension program collected data for the consumers between July 2011 and June 2012, and categorized them in Table 1. This table shows the majority of the fertilizers being used in Farms, Non-farms, Lawn and Athletic fields the most.

**HARMFUL ALGAL BLOOMS OVER TIME**

Data was collected from the Florida Fish and Wildlife conservation commission, this organization tests the water surrounding the peninsulas of Florida weekly and creates maps in order to educate the general public of the current state of the harmful algal blooms. From their downloaded data, samples were separated into five small year interval maps and one four year span map. Kernel density was used to evaluate the magnitudes per unit area from the points obtained. This was done in order to see the severity of the algal blooms over time. Through the series of maps it is visibly clear that the harmful algal blooms have tremendously been able to engulf the state of Florida over the 10-year time frame.

**CONCLUSIONS AND HOW TO IMPROVE THE FUTURE**

In order for policy makers and the citizens to make informed decisions about the fate of our environment they should be well informed of the opportunity to create better outcomes.

When comparing the faciulization distance map to the population change map and the algal blooms over time, there is a 100 mile gap on the coast line where there are no water treatment facilities, minimal change in population and steady growth of algal blooms/concentrations. Furthermore, the *K. brevis* algal blooms have increased dramatically in the last 10 years, as has the population, temperature and average precipitation. All of these factors aid the algal blooms in thriving and extend this natural occurrence well past its natural duration. Policy makers have the opportunity to be more proactive about creating a solution to this issue. This can be done through creating more water treatment facilities and regulating the amount of fertilizer sold to decrease the amount of potential run off. Creating cleaner water and a rigorous filtration system, and limiting the amount of dumping permits even so could show change as early as next year bloom. Implementing these changes will increase tourism, limit the amount of spending on rehabilitation sick and decoupled animals, treating human illnesses and improve the quality of the oceans.