Red Tide

New Mexico Adventures in SuperComputing Challenge

Final Report

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Team 105

Shiprock High School

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Executive Summary:

You may look at an ocean and just admire the impressive exquisiteness of it, but its beauty can be deceiving. If you look closely you will see that deep within the waters there are many toxins that not only affect the animals that live in the water, but it can also affect us humans. One of many toxins that pollute the oceans we are focusing on is called Red Tide. Red Tide is basically a natural occurring marine algal bloom that is caused by species of dinoflagellates. Red tides also occur in places where there are no associated human activities. These toxins kill fish and are accumulated by filter feeders. This bioaccumulation of toxins causes bivalves – like oysters and clams – collected in areas affected by algal blooms to be potentially dangerous for human consumption. Since Red Tide has different toxins, we decided to look at one toxin which is classified under Red Tide; it is Paralytic Shellfish Poisoning (PSP). It is predominantly found in the Pacific Northwest and Alaska. PSP can also be life threatening. Symptoms develop fairly rapidly, within 30 minutes to two hours, and are purely neurological. Duration of effects is a few days in non-lethal cases. Symptoms include tingling, numbness, loss of muscle control, giddiness, drowsiness, fever, rash, and staggering. The most severe cases result in respiratory arrest within 24 hours of consumption of the toxic shellfish.

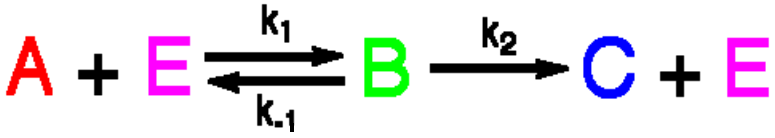
Introduction:

Hypothesis:

Red tide as we know can be very harmful to marine life and to one's health. We think the effects it has on the marine animals and human health are a very important issue and should be taken seriously. Many people don't know what Red Tide is and believe it isn't that big of a deal. We as a team are striving it important information about Red Tide out to the public. They need to know where it occurs and what to do when in contact with the harmful algae.

Model:

Michaelis Menten Equation



$$\frac{d[C]}{dt} = \frac{k_2[A]}{K_M + [A]}[E]_0$$

$$K_M = \frac{k_2 + k_{-1}}{k_1}$$

$$\frac{d[B]}{dt} = k_1[A][E] - (k_{-1} + k_2)[B] \qquad \frac{d[C]}{dt} = k_2[B]$$

$$\frac{d[C]}{dt} = \frac{k_2([A]_0 - [C])}{K_M + [A]_0 - [C]}[E]_0$$

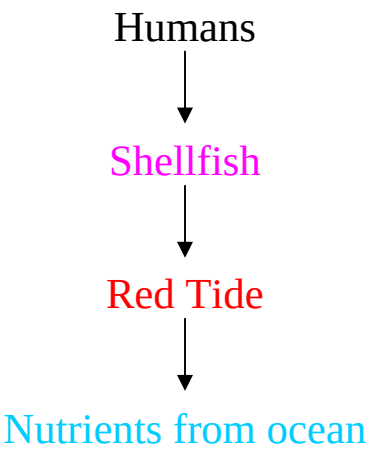
Project Description:

Hypothesis:

One of our main goals is to try and inform the public about the how harmful Red Tide can be. Through our research we have found that these Harmful Algae Blooms are responsible for numerous deaths of at least three endangered marine mammals: Humpback whales, bottle-nosed dolphins, and Florida manatees. In 1996, red tide was also responsible for the deaths of almost 10% of the Florida manatee population and 162 dolphins in Mexico.

Model:

Food Chain



Results:

We have found that Red Tide is a toxic growing problem in the oceans of the world and needs to be known to publicly. This toxin is known to effect bivalves such as mussels, mollusks, shellfish, etc.

As a result we are trying to the public inform about how it may affect them physically and how it could destroy marine life in the oceans. There are so many ways to help out this cause it’s just that the public don’t know about any of them. Which is where we come in; we are wiling to help them learn about Red Tide.

Conclusion:

In our research we learned that Red Tide is harmful to marine life and human health. We as a team will do what we can to inform the public of the effects it has. This is why we are trying to join an organization called S.T.A.R.T to help protect marine life and human health.

In conclusion we have learned a great deal of very interesting information about Red Tide and we are happy to have found some ways we could help out.

Recommendations:

We recommend that you watch what kind of seafood such as shellfish, mussels, clams, lobsters, crabs, etc; you eat because you really don't know if they contain the toxin. We also found in our research that studies have recommended that the bivalves should be eaten within the months that end with an "r."

Acknowledgements:

We would like to thank Mrs. Noble and Mrs. Hermann for their guidance and knowledge while we were working on this project. We also would like to thank Jason Lennes for giving us the information we needed. We like to thank the judges for their advice on our project. Thank-you!

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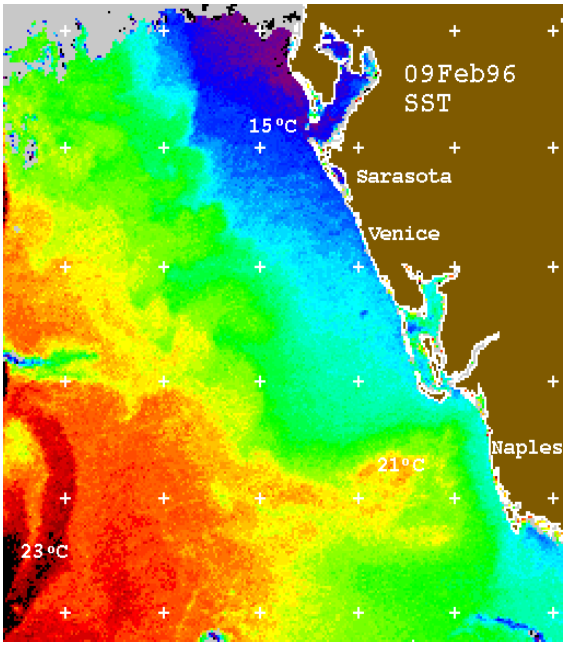
Appendix A:



Red Tide from a satellite picture


Florida Red Tide (dead fish)

Red Tide somewhere in South America

Appendix B:

Off the coast of Prince Edward Island

Red Tide off the coast of La Jolla, California

Red Tide in New Zealand

Red Tide in Tokyo where clams were infected