Chapman University
Chapman University Digital Commons

Student Research Day Abstracts and Posters

Office of Undergraduate Research and Creative Activity

Spring 5-14-2015

Puffs and Tufts: A Comparison of Trichodesmium Colony Formations and Nutrient Availability Across the North Atlantic Ocean Using Remote Sensing Methods

Marc Rosenfield
Chapman University, rosen181@mail.chapman.edu

Follow this and additional works at: http://digitalcommons.chapman.edu/cusrd_abstracts

 Part of the Bacteria Commons, and the Terrestrial and Aquatic Ecology Commons

Recommended Citation

Rosenfield, Marc, "Puffs and Tufts: A Comparison of Trichodesmium Colony Formations and Nutrient Availability Across the North Atlantic Ocean Using Remote Sensing Methods" (2015). *Student Research Day Abstracts and Posters.* Paper 155.
http://digitalcommons.chapman.edu/cusrd_abstracts/155

This Poster is brought to you for free and open access by the Office of Undergraduate Research and Creative Activity at Chapman University Digital Commons. It has been accepted for inclusion in Student Research Day Abstracts and Posters by an authorized administrator of Chapman University Digital Commons. For more information, please contact laughtin@chapman.edu.

Puffs and Tufts: A Comparison of *Trichodesmium* Colony Formations and Nutrient Availability Across the North Atlantic Ocean Using Remote Sensing Methods

Marc Rosenfield
Chapman University
rosen181@mail.chapman.edu

Introduction

Trichodesmium, a genus of diazotrophic bacteria, has the capability and the population to produce a large percentage of the total oceanic N_2-fixation. Though their population is known to be heavily dependent on two of the ocean's largest limiting factors, phosphorus and iron concentrations, it is unknown what affect these factors have on the population. In this study two of the largest colony formations of *Trichodesmium* in the North Atlantic, tufts and puffs, are compared nutrient quality with respect to time and geographical location. Though very little nutrient *in situ* data was collected from the cruise, remote sensing data collected from the MODIS satellite was used to bolster information dealing with nutrient quality. High tuft concentration was observed within the center of the North Atlantic Gyre, where puff concentrations were not collected until below the 26^0 N latitude line (in the South Sargasso Sea).
In turn, puff concentrations were recorded to spike when iron concentrations along the cruise track were higher. Tuft concentrations were observed at low and high iron concentrations. By comparing *Trichodesmium* colony orientation and concentration to general remote sensing of nutrient quality, correlations and suggestions could be reached.

Research Questions

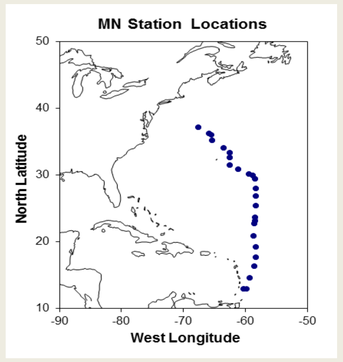
Can Remote Sensing aid the analysis of ocean quality across latitudes in terms of *Trichodesmium* colony differentiation?

What are the factors that make one colony orientation more advantageous than another?

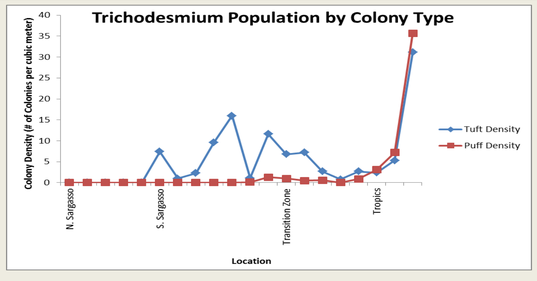
Study Site and Methods

In situ data was collected across various latitudes of the North Atlantic Ocean, for a total of 20 meter net stations. Collections were done aboard the scientific vessel *SSV Corwith Cramer.* The study spanned large distances of Latitude, between 31°30.7' N and 22°46.4' N latitudes.

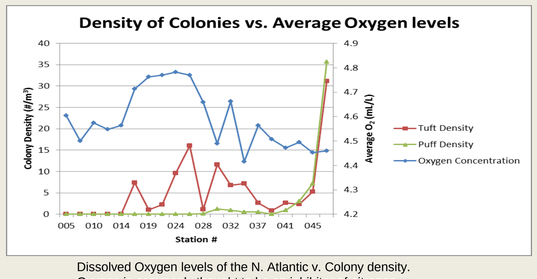
Remote sensing information was taken from GIOVANNI between the dates of Oct. 9th through November 18th (*in situ* data was collected from Oct 17th – Nov. 7th. MODIS-AQUA data was collected for Sea Surface Temperature, Colored Dissolved Organic Matter (CDOM), Optical Aerosol Thickness (869nm), attenuation, and Chlorophyll a concentration. RS data was collected in a time series, on a 1x1 degree basis. For 8-day data, a monthly average was presented per sample location to avoid large gaps of data.



In situ Data

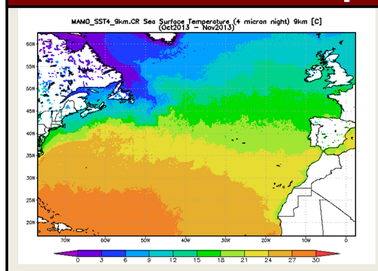


Trichodesmium populations were collected and a population density was calculated. Puffs were counted separately from tufts with the use of a dissecting microscope.

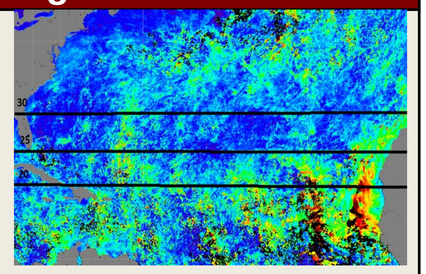


Dissolved Oxygen levels of the N. Atlantic v. Colony density. Oxygen is commonly thought to be an inhibitor of nitrogen fixation.

Graphs/figures

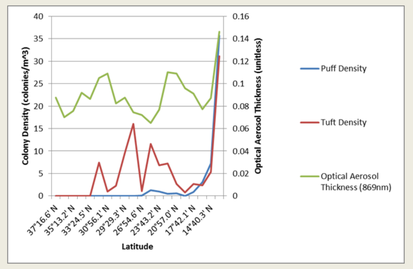


Sea Surface Temperature. Data was collected at night, during which *Trichodesmium* are known to fix nitrogen.

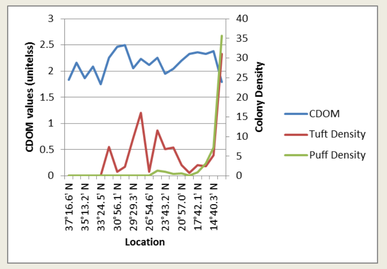


Optical Aerosol Thickness (869 nm). Wind patterns move in an anti-cyclonic (clockwise) fashion from the coast of Western Africa and around the North Atlantic.

Optical Aerosol Thickness and CDOM



Puff and Tuft densities and Optical Aerosol Thickness graphed against geographical location along the *Cramer's* Cruise track. The R squared comparison of puff density and Optical Aerosol Thickness was 0.75 (p= 0.01), where for tufts it was only 0.46 (p= 0.08).



In terms of Colored Diffuse Organic Matter (CDOM), both colonies (puffs and tufts) had a negative R-squared value of -0.67 and -0.61 respectively. *Trichodesmium* are known to inhabit highly stratified, low nutrient waters.

Conclusions

Many classes of RS proved to be helpful in the assessment of oceanic variables along the *SVV Corwith Cramer's* 2013 voyage. RS data was successful in producing results that could not have been collected *in situ* due to limited time and rough seas. Of the data assessed, Aerosol and sea temperature have the highest correlations with *Trichodesmium* population data. High concentrations of aerosols along the voyage were suggested to be the differentiating factor between tuft and puff dominated areas of the North Atlantic.

This study has left variables for future assessment. The study neglected the measurement of dissolved phosphorus levels along the cruise track, which has been suggested to be a strong limiting factor of *Trichodesmium* populations. An annual and inter-annual assessment of *Trichodesmium* population would also be helpful for a more comprehensive understanding of colony orientation in comparison with oceanic parameters.

Acknowledgements: A special thanks to Dr. El-Askary and Sea Education Association (SEA) for the acquisition of the data presented in this project.