An Analysis of Nitrate Levels and Movement in the Raritan River

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Purpose:
The Raritan River is a highly urbanized and understudied river. Throughout the past century, NOAA and the USGS have monitored the river and collected data on it. This data has never been significantly analyzed. This study is an attempt to acquire and analyze nitrate data on the river. Using the historical data as well as new equipment to examine the river, we hope to learn how nitrate is flowing through the river and its surrounding basin. Three particular characteristics that we are focused on examining are:

\begin{itemize}
  \item The concentration of nitrate throughout the river.
  \item The effects of rainfall on nitrate levels.
  \item How the nitrate reacts to mixing with the salty waters coming in from the Raritan Bay.
\end{itemize}

Methods:
This study is centered on the use of a CTD outfitted with an optical nitrate sensor (SUNA), as well as on the use of historical data. The CTD/SUNA unit was used to take profiles of salinity, temperature, optical backscatter, depth, and nitrate on the Raritan River. Historical data was obtained from the websites of the USGS, NOAA, and the UCC (Utah Climate Center). All analysis was performed in MATLAB.

Discussion:
In our analysis we found that the river appears to be discharging nitrate at extremely high levels, with the concentration of nitrate in River's fresh water being over 100\textmu m. This value is well above what we anticipated and reveals the significance of the River as a source of pollution to the bay. We also discovered that this high value does not change in response to rainfall events. This means that nitrate offloading increases with increasing flow because more water is mixing into the bay at a constant nitrate concentration.

While looking at Figures 4 and 5, it also appears as if nitrate concentration is inversely proportional to salinity. This suggests that biological uptake of nitrate is overwhelmed by mixing such that the relationship appears conservative. The apparent conservative mixing of nitrate is suggestive of the existence of some other limiting nutrient or of low light levels limiting biological nitrate uptake.

Future Work:
Future studies will be geared at both increasing the size of the available data set on the Raritan, and investigating anomalies in the data such as the nitrate anomaly at river mile 8.5, and the depth anomaly at river mile 6.

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