CTD data and particulate organic carbon, particulate organic nitrogen, and adenosine triphosphate from Niskin bottle samples collected along the coastal ocean off Virginia Beach into the Chesapeake Bay aboard RV Fay Slover on April 1, 2024

Website: https://www.bco-dmo.org/dataset/994268
Data Type: Cruise Results
Version: 1
Version Date: 2026-02-26

Project
» Adenosine triphosphate as a master variable for biomass in the oceanographic context (ATP biomass indicator)

Contributors	Affiliation	Role
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Abstract
CTD data and Niskin bottle samples were collected and analyzed for particulate organic carbon (POC), particulate organic nitrogen (PON), and adenosine triphosphate. Samples were taken at five stations and six depths during a one-day transect from the coastal ocean off Virginia Beach into the Chesapeake Bay on April 1, 2024 conducted on R/V Fay Slover.

Table of Contents

Coverage

Location: Costal North Atlantic and Chesapeake Bay entrance
Spatial Extent: **N**:36.97415 **E**:-75.59008333 **S**:36.96506667 **W**:-76.12536667
Temporal Extent: 2024-04-01

BCO-DMO Processing Description

Data have been submitted and are awaiting processing.

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Project Information

Adenosine triphosphate as a master variable for biomass in the oceanographic context (ATP biomass indicator)

Coverage: Global

NSF Award Abstract:
In the ocean, most living organisms are microbes that are too small to be seen by the naked eye. Despite their small size, microbes play an important role in processes that govern marine ecosystems and food webs. For example, microbes affect the concentrations of nutrients and gases in the water and the atmosphere, thereby exerting a significant impact on the climate globally. Consequently, it is important to know how many microbes there are in any given environment because there is a direct causal connection between living mass and overall biological activity. Determining how "alive" any volume of water is, however, is a difficult task. The gold standard is to count microbial cells under the microscope. This method is extremely time consuming when done well and needs to be performed separately on many different types of microbial cells. In addition, standard microscopic techniques do not reveal whether the cells were alive when they were collected. In contrast, a chemical method based on the amount of adenosine triphosphate (ATP) offers distinct advantages. Notably, ATP is relatively easy to measure, and the method can be widely used because all living cells contain ATP in similar concentrations. This study tests and applies an improved method of ATP analysis to generate data at very high resolution in space and time. One PhD student and six undergraduate students will receive research training and the project fosters international research collaborations with European scientists. This research provides deeper insights into the distribution of live matter in different regions and depths of the world's oceans.

Decades ago, adenosine triphosphate (ATP) was proposed as a universal biomass indicator. However, its application in the field of oceanography has been limited due to misconceptions regarding cellular ATP concentration. Recent evidence suggests that ATP functions as a hydrotrope requiring homeostatically controlled ATP levels much higher than those solely needed for energy metabolism. ATP occurs in surprisingly stable concentrations in cytoplasm across a wide range of microbes thus representing live cytoplasm volume. This project examines in detail the usefulness of particulate ATP (PATP) as a biomass marker over a large section of the North Atlantic Ocean with special emphasis on mesopelagic and deep-sea environments where chlorophyll is a poor indicator of biomass or associated biological processes. The project uses field collections of marine snow and ambient water in combination with particle cameras to examine the microscale heterogeny of biomass in the water column. Laboratory studies determine factors that may influence the recovery of PATP through filtration and extraction protocols and determine to what extent ATP concentrations potentially deviate from the typical cytoplasm concentration during phosphorus limitation. The improved PATP-biomass method offers numerous operational advantages, especially the fact that it can be employed at high spatial and temporal resolution. Once validated, the PATP biomass method could be widely adopted as a key variable for biomass in routine oceanographic surveys. This project supports graduate and undergraduate students from diverse backgrounds to contribute to laboratory and field research. Public outreach efforts include tours and presentations for middle and high-school students, as well as the general public.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2319114