Particulate lipids from RIPPLE cruises

Website: https://www.bco-dmo.org/dataset/997821
Version: 1
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Project
» Production and Fate of Fats in the Upper Ocean (RIPPLE)

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Coverage

Spatial Extent: **Lat**:0 **Lon**:0

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Parameters

Parameters for this dataset have not yet been identified

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Deployments

AE2320

Website	https://www.bco-dmo.org/deployment/963695
Platform	R/V Atlantic Explorer
Start Date	2023-09-04
End Date	2023-09-11
Description	See additional information from R2R: https://www.rvdata.us/search/cruise/AE2320

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Project Information

Production and Fate of Fats in the Upper Ocean (RIPPLE)

Coverage: Gulf of Maine, Oregon coast, Sargasso Sea

The Production and Fate of Fats in the Upper Ocean Phytoplankton, microscopic photosynthetic organisms in the ocean, produce a type of fat called triaclyglycerols (TAGs). A recent discovery in the North Pacific Ocean showed that a significant percentage of primary production from phytoplankton is devoted to producing TAGs. This suggests that TAGs may serve as a source of energy for phytoplankton at night, when they are unable to generate energy from photosynthesis. Phytoplankton are the base of the food web in the ocean. Therefore, it is important to understand how they create and store energy. This project will investigate the role of fats in the ocean. Specifically, this research will look at: 1) factors that affect the production and use of TAGs by phytoplankton and 2) how TAGs contribute to the global carbon cycle. This project will support the training and education of graduate students. This project will also provide resources for mentoring high school students, support summer research experiences for high school and undergraduate students, and offer field trips for 7th grade students.

Triacylglycerols (TAGs) are one of the most abundant classes of lipids in the ocean. A new discovery suggests that TAGs are also a very dynamic class of biochemicals. A recent study in the surface waters of the North Pacific subtropical gyre (NPSG) showed that TAGs doubled in concentration between sunrise and sunset daily, accounting for 16 to 42% of net primary production by eukaryotic nanophytoplankton (Becker et al., 2018). These results show that TAGs are an vital component of the physiology of eukaryotic phytoplankton and that TAGs contribute significantly to the carbon cycle of the NPSG. Based on estimates from this study, daytime production of TAGs in the subtropical gyres accounted for 4 to 6 percent of total global primary production. Outside of subtropical gyres, the production rates of TAGs are entirely unknown, particularly in regions where primary production rates are higher and eukaryotic phytoplankton are more dominant. Thus, the contribution of TAGs to the global ocean carbon cycle is almost certainly underestimated. There are major outstanding questions about TAGs. What environmental factors affect rates of net TAG production? What fraction of net TAG production is exported in sinking particles? Do TAGs play a role in the food web of the euphotic zone? How much of the TAGs produced during the day do phytoplankton themselves consume at night? These questions will be answered using state-of-the-art lipidomics, in situ observations, isotope-tracing techniques, incubations, and on-deck experiments. This study will provide significant advances in our understanding of TAG metabolism in phytoplankton, elucidate the roles that TAGs play in the marine carbon cycle, constrain their global importance by studying TAGs in multiple disparate environments, and set the groundwork for future research on these fascinating and vital molecules.

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.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2022597

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