Particulate bulk and amino acid d15N values from EXPORTS cruises on RRS Discovery (DY131) and RRS James Cook (JC214) in May 2021

Website: https://www.bco-dmo.org/dataset/986932
Data Type: Cruise Results
Version: 1
Version Date: 2026-01-28

Project
» Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation under High Productivity and High Carbon Flux Conditions (EXPORTS) (EXPORTS OM Degradation Indicators)

Program
» EXport Processes in the Ocean from Remote Sensing (EXPORTS)

Contributors	Affiliation	Role
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Abstract
This dataset presents bulk and compound-specific nitrogen stable isotope ratios of amino acids in size-fractionated and sinking particles from the Northeast Atlantic during the spring bloom decline as part of the second EXPORTS campaign. Size-fractionated particles were collected via in situ filtration and sinking particles were collected via sediment traps in May 2021. Size-fractionated particles were collected from 20 meters (m) to 500 m at various depths, depending on particle type. At 30 and 340 m, five size fractions were collected for both bulk and amino acids isotopic analysis: 0.3-1 micrometers (µm), 1-6 µm, 6-51 µm, 51-335 µm, and >335 µm. At 20, 50, 75 or 95, 125 or 145, 175 or 195, 330, and 500 m, two size fractions were collected for amino acid isotopic analysis: 0.8-51 µm particles and >51 µm particles. Particle data were used to determine major processes altering particulate organic matter. The collection of these data was supported by NSF.

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Coverage

Location: Northeast Atlantic

Spatial Extent: **N**:49.1384 **E**:-14.6 **S**:48.7885 **W**:-14.9
Temporal Extent: 2021-05-12 - 2021-05-27

Methods & Sampling

Particle sampling was conducted onboard RRS Discovery (size-fractionated particles) and James Cook (sinking particles) in the Northeast Atlantic (around 49°N, 15°W) during a declining spring phytoplankton bloom in May 2021 as part of the EXPORTS campaign. Particles were collected by in situ pump filtration using large volume pumps (WTS-LV; McLane Research Laboratories, Inc) outfitted with mini-MULVFS (Multiple Unit Large Volume in situ Filtration System) filter holders (Bishop et al., 2012). At 30 meters (m) and 340 m, sequentially stacked filters were loaded on pumps of 5 filter pore sizes: 0.3-1 micrometers (µm) particles (combusted GF75 glass fiber filters), 1-6 µm particles (combusted quartz fiber filters), 6-51 µm particles, 51-335 µm particles, and >335 µm particles (acid-washed Nitex mesh). At 20, 50, 75 or 95, 125 or 145, 175 or 195, 330, and 500 m, filter stacks of two filter pore sizes were loaded onto pumps: 0.8-51 µm particles (Supor polyethersulfone filters) and >51 µm particles (acid-washed polyester mesh). Filters containing particles were stored in combusted foil and kept frozen at -80 degrees Celsius (°C) until further processing on land. Large particles were resuspended off Nitex mesh filters using low-nutrient, 0.2 µm- filtered seawater, and subsequently collected onto 47-mm diameter combusted glass fiber filters, which were then re-frozen, and lyophilized. Lyophilized, large particles (≥6 µm) were examined under a dissecting microscope, and materials that should be excluded from the passively sinking POM pool were removed. Sinking particles were collected using sediment traps, either surface tethered sediment traps (STT) or neutrally buoyant sediment traps (NBST). Sinking particles were collected in polycarbonate tubes with a collection area of 0.0113 square meters (m^2). Sinking particles were kept frozen at -80°C until further processing on land, then particles were lyophilized. Lyophilized particles were quantitatively split by weight for bulk isotope analysis and compound-specific isotope analysis of amino acids (CSIA-AA).

Bulk nitrogen concentrations and $\delta^{15}N$ values were determined using standard methods in the Close Laboratory (University of Miami). Subsamples from filters for bulk nitrogen analysis were quantitatively split by weight and packed directly into tin capsules for elemental and isotopic composition.

CSIA-AA preparation was guided by methods of Hannides et al. (2013), Hannides et al. (2020), and Popp et al. (2007) and were identical to those of Wojtal et al. (2023). Samples were hydrolyzed using 6N HCl at 110°C for 20 hours, filtered using disc filters, purified using cation exchange resin (50W-X8, 100-200 mesh, 1 milliliter (mL) bed volume), eluting in 2N ammonium hydroxide, followed by reprotonation using 0.2N HCl at 110°C for 5 minutes, and derivatized to trifluoroacetyl/isopropyl esters in a two-step process (isopropyl esterification and trifluoroacetylation; Popp et al., 2007). Excess salts were removed after derivatization using liquid-liquid extraction (phosphate buffer/chloroform), and samples were put through a second acetylation before storage at -20°C prior to analysis. Immediately before analysis, sample aliquots were dried under N_2 gas and reconstituted in ethyl acetate. All glassware was acid washed (10% HCl) and combusted at 500°C overnight before use.

Bulk nitrogen concentrations and $\delta^{15}N$ values were determined using a Costech Elemental Analyzer (EA) interfaced with a MAT 253 Plus Isotope Ratio Mass Spectrometer (IRMS) via a Conflo IV open split interface. The EA oxidation reactor was held at 980°C, the reduction reactor held at 650°C, and the oven housing the gas chromatography column was held at 65°C. CSIA-AA samples were analyzed using a Thermo Fisher Scientific Trace 1310 Gas Chromatograph (GC) coupled to a MAT 253 Plus IRMS via a Thermo Fisher GC Isolink II system with a combined oxidation/reduction reactor held at 1000 °C, a liquid nitrogen trap, and a Conflo IV open split interface.

$\delta^{15}N$ values (‰ vs. AIR) were calculated by the Thermo Isodat 3.0 software, using reference nitrogen gas peaks. Instrument accuracy was determined by analyzing a mixture of amino acids of known $\delta^{15}N$ values that was prepared alongside samples. Individual amino acid $\delta^{15}N$ values were calculated as the average across replicates, if applicable. The 1σ uncertainty was calculated as the standard deviation across samples replicates, if no replicates were possible (low sample concentration) a 1‰ error was applied. Amino acid concentrations were determined from the IRMS peak area response of individual amino acid standards and the amount of sample injected.

Data Processing Description

Data were processed through Thermo Fisher Isodat 3.0 and Microsoft Excel.

BCO-DMO Curation Notes

- Imported original file "particulate_bulk_AA_d15N.csv" into the BCO-DMO system.
- Flagged "nd" as a missing data value (missing data are empty/blank in the final CSV file).
- Created separate columns for the standard deviation values.
- Converted all date fields to ISO 8601 format or YYYY-MM-DD.
- Saved the final file as "986932_v1_exports_particulate_bulk_aa_d15n.csv".

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Data Files

File
986932_v1_exports_particulate_bulk_aa_d15n.csv (Comma Separated Values (.csv), 14.05 KB) MD5:2e5d9f9349e03947df06d71ce8858cb1 Primary data file for dataset ID 986932, version 1

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Related Publications

Bishop, J. K. B., Lam, P. J., & Wood, T. J. (2012). Getting good particles: Accurate sampling of particles by large volume in-situ filtration. Limnology and Oceanography: Methods, 10(9), 681–710. doi:10.4319/lom.2012.10.681
Methods

Hannides, C. C. S., Popp, B. N., Choy, C. A., & Drazen, J. C. (2013). Midwater zooplankton and suspended particle dynamics in the North Pacific Subtropical Gyre: A stable isotope perspective. Limnology and Oceanography, 58(6), 1931–1946. doi:10.4319/lo.2013.58.6.1931
Methods

Hannides, C. C. S., Popp, B. N., Close, H. G., Benitez-Nelson, C. R., Ka'apu-Lyons, C. A., Gloeckler, K., … Drazen, J. C. (2020). Seasonal dynamics of midwater zooplankton and relation to particle cycling in the North Pacific Subtropical Gyre. Progress in Oceanography, 182, 102266. doi:10.1016/j.pocean.2020.102266
Methods

Popp, B. N., Graham, B. S., Olson, R. J., Hannides, C. C. S., Lott, M. J., López-Ibarra, G. A., … Fry, B. (2007). Insight into the Trophic Ecology of Yellowfin Tuna, Thunnus albacares, from Compound-Specific Nitrogen Isotope Analysis of Proteinaceous Amino Acids. Terrestrial Ecology, 173–190. doi:10.1016/s1936-7961(07)01012-3
Methods

Wojtal, P. K., Doherty, S. C., Shea, C. H., Popp, B. N., Benitez-Nelson, C. R., Buesseler, K. O., Estapa, M. L., Roca-Martí, M., & Close, H. G. (2023). Deconvolving mechanisms of particle flux attenuation using nitrogen isotope analyses of amino acids. Limnology and Oceanography. Portico. https://doi.org/10.1002/lno.12398
Methods

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Parameters

Parameter	Description	Units
Cruise_sample_number	Sample number given to each filter	unitless

Trap_ID	Sample number given to each filter from sediment traps	unitless
Latitude	Latitude in decimal degrees (postive values = North)	decimal degrees
Longitude	Longitude in decimal degrees (negative values = West)	decimal degrees
Start_latitude	latitude at the time of sediment trap deployment in decimal degrees (postive values = North)	decimal degrees
End_latitude	latitude at the time of sediment trap recovery in decimal degrees (postive values = North)	decimal degrees
Start_longitude	longitude at the time of sediment trap deployment in decimal degrees (negative values = West)	decimal degrees
End_longitude	longitude at the time of sediment trap recovery in decimal degrees (negative values = West)	decimal degrees
MidPumping_DateTime_UTC	date and time (UTC) of the mid point of sampling for particles collected via in situ filtration in ISO 8601 format	unitless
Start_time_UTC	date and time (UTC) at the sediment trap deployment in ISO 8601 format	unitless
End_time_UTC	date and time (UTC) at the sediment trap recovery in ISO 8601 format	unitless
Date_local	local date of in situ filtration (Cape Verde Time, -01:00 from UTC)	unitless
Time_local	local time of mid-point in situ filtration (Cape Verde Time, -01:00 from UTC)	unitless
Start_date_local	local date of sediment trap deployment (Cape Verde Time, -01:00 from UTC)	unitless
End_date_local	local date of sediment trap recovery (Cape Verde Time, -01:00 from UTC)	unitless
Start_time_local	local time of sediment trap deployment (Cape Verde Time, -01:00 from UTC)	unitless

End_time_local	local time of sediment trap recovery (Cape Verde Time, -01:00 from UTC)	unitless
Depth	depth at which pump filter or sediment trap collected particles	meters (m)
Size_Fraction_Min	minimum size fraction captured on filter	micrometers (µm)
Size_Fraction_Max	maximum size fraction captured on filter	micrometers (µm)
Volume_Filtered	volume of water filtered through filters	liters (L)
d15N_Bulk	isotopic composition of particulate nitrogen in the sample	permil relative to AIR (‰)
d15N_Bulk_sd	standard deviation of the isotopic composition of particulate nitrogen in the sample	permil relative to AIR (‰)
d15N_Ala	nitrogen isotopic composition of alanine	permil relative to AIR (‰)
d15N_Ala_sd	standard deviation of alanine	permil relative to AIR (‰)
d15N_Gly	nitrogen isotopic composition of glycine	permil relative to AIR (‰)
d15N_Gly_sd	standard deviation of glycine	permil relative to AIR (‰)
d15N_Thr	nitrogen isotopic composition of threonine	permil relative to AIR (‰)
d15N_Thr_sd	standard deviation of threonine	permil relative to AIR (‰)
d15N_Ser	nitrogen isotopic composition of serine	permil relative to AIR (‰)
d15N_Ser_sd	standard deviation of serine	permil relative to AIR (‰)
d15N_Val	nitrogen isotopic composition of valine	permil relative to AIR (‰)
d15N_Val_sd	standard deviation of valine	permil relative to AIR (‰)

d15N_Leu	nitrogen isotopic composition of leucine	permil relative to AIR (‰)
d15N_Leu_sd	standard deviation of leucine	permil relative to AIR (‰)
d15N_Iso	nitrogen isotopic composition of isoleucine	permil relative to AIR (‰)
d15N_Iso_sd	standard deviation of isoleucine	permil relative to AIR (‰)
d15N_Pro	nitrogen isotopic composition of proline	permil relative to AIR (‰)
d15N_Pro_sd	standard deviation of proline	permil relative to AIR (‰)
d15N_Asx	nitrogen isotopic composition of aspartic acid	permil relative to AIR (‰)
d15N_Asx_sd	standard deviation of aspartic acid	permil relative to AIR (‰)
d15N_Met	nitrogen isotopic composition of methionine	permil relative to AIR (‰)
d15N_Met_sd	standard deviation of methionine	permil relative to AIR (‰)
d15N_Glx	nitrogen isotopic composition of glutamic acid	permil relative to AIR (‰)
d15N_Glx_sd	standard deviation of glutamic acid	permil relative to AIR (‰)
d15N_Phe	nitrogen isotopic composition of phenylalanine	permil relative to AIR (‰)
d15N_Phe_sd	standard deviation of phenylalanine	permil relative to AIR (‰)
d15N_Tyr	nitrogen isotopic composition of tyrosine	permil relative to AIR (‰)
d15N_Tyr_sd	standard deviation of tyrosine	permil relative to AIR (‰)
d15N_Lys	nitrogen isotopic composition of lysine	permil relative to AIR (‰)
d15N_Lys_sd	standard deviation of lysine	permil relative to AIR (‰)
d15N_THAA	isotopic composition of the molar weighted sum of measured amino acids	permil relative to AIR (‰)

d15N_THAA_sd	standard deviation of the molar weighted sum of measured amino acids	permil relative to AIR (‰)
Bulk_N_concentration	the concentration of particulate nitrogen in the sample	micromoles per liter (µmol/L)
Total_AA_N_concentration	the sum of all amino acids measured in a sample collected by in situ filtration	nanomoles per liter (nM)
Flux_AA	the sum of all amino acids in sinking particle samples collected with sediment traps	micromoles per square meter per day (µmol/m2/d)

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Instruments

Dataset-specific Instrument Name	Conflo IV open split interface
Generic Instrument Name	Continuous Flow Interface for Mass Spectrometers
Dataset-specific Description	Bulk nitrogen concentrations and δ15N values were determined using a Costech Elemental Analyzer (EA) interfaced with a MAT 253 Plus Isotope Ratio Mass Spectrometer (IRMS) via a Conflo IV open split interface. CSIA-AA samples were analyzed using a Thermo Fisher Scientific Trace 1310 Gas Chromatograph (GC) coupled to a MAT 253 Plus IRMS via a Thermo Fisher GC Isolink II system with a combined oxidation/reduction reactor held at 1000 °C, a liquid nitrogen trap, and a Conflo IV open split interface.
Generic Instrument Description	A Continuous Flow Interface connects solid and liquid sample preparation devices to instruments that measure isotopic composition. It allows the introduction of the sample and also reference and carrier gases. Examples: Finnigan MATConFlo II, ThermoScientific ConFlo IV, and Picarro Caddy. Note: This is NOT an analyzer

Dataset-specific Instrument Name	Costech Elemental Analyzer
Generic Instrument Name	Elemental Analyzer
Dataset-specific Description	Bulk nitrogen concentrations and δ15N values were determined using a Costech Elemental Analyzer (EA) interfaced with a MAT 253 Plus Isotope Ratio Mass Spectrometer (IRMS) via a Conflo IV open split interface.
Generic Instrument Description	Instruments that quantify carbon, nitrogen and sometimes other elements by combusting the sample at very high temperature and assaying the resulting gaseous oxides. Usually used for samples including organic material.

Dataset-specific Instrument Name	Thermo Fisher Scientific Trace 1310 Gas Chromatograph (GC)
Generic Instrument Name	Gas Chromatograph
Dataset-specific Description	CSIA-AA samples were analyzed using a Thermo Fisher Scientific Trace 1310 Gas Chromatograph (GC) coupled to a MAT 253 Plus IRMS via a Thermo Fisher GC Isolink II system with a combined oxidation/reduction reactor held at 1000 °C, a liquid nitrogen trap, and a Conflo IV open split interface.
Generic Instrument Description	Instrument separating gases, volatile substances, or substances dissolved in a volatile solvent by transporting an inert gas through a column packed with a sorbent to a detector for assay. (from SeaDataNet, BODC)

Dataset-specific Instrument Name	MAT 253 Plus Isotope Ratio Mass Spectrometer (IRMS)
Generic Instrument Name	Isotope-ratio Mass Spectrometer
Dataset-specific Description	Bulk nitrogen concentrations and δ15N values were determined using a Costech Elemental Analyzer (EA) interfaced with a MAT 253 Plus Isotope Ratio Mass Spectrometer (IRMS) via a Conflo IV open split interface. CSIA-AA samples were analyzed using a Thermo Fisher Scientific Trace 1310 Gas Chromatograph (GC) coupled to a MAT 253 Plus IRMS via a Thermo Fisher GC Isolink II system with a combined oxidation/reduction reactor held at 1000 °C, a liquid nitrogen trap, and a Conflo IV open split interface.
Generic Instrument Description	The Isotope-ratio Mass Spectrometer is a particular type of mass spectrometer used to measure the relative abundance of isotopes in a given sample (e.g. VG Prism II Isotope Ratio Mass-Spectrometer).

Dataset-specific Instrument Name	large volume pumps (WTS-LV)
Generic Instrument Name	McLane Large Volume Pumping System WTS-LV
Dataset-specific Description	Particles were collected by in situ pump filtration using large volume pumps (WTS-LV; McLane Research Laboratories, Inc) outfitted with mini-MULVFS (Multiple Unit Large Volume in situ Filtration System) filter holders.
Generic Instrument Description	The WTS-LV is a Water Transfer System (WTS) Large Volume (LV) pumping instrument designed and manufactured by McLane Research Labs (Falmouth, MA, USA). It is a large-volume, single-event sampler that collects suspended and dissolved particulate samples in situ. Ambient water is drawn through a modular filter holder onto a 142-millimeter (mm) membrane without passing through the pump. The standard two-tier filter holder provides prefiltering and size fractioning. Collection targets include chlorophyll maximum, particulate trace metals, and phytoplankton. It features different flow rates and filter porosity to support a range of specimen collection. Sampling can be programmed to start at a scheduled time or begin with a countdown delay. It also features a dynamic pump speed algorithm that adjusts flow to protect the sample as material accumulates on the filter. Several pump options range from 0.5 to 30 liters per minute, with a max volume of 2,500 to 36,000 liters depending on the pump and battery pack used. The standard model is depth rated to 5,500 meters, with a deeper 7,000-meter option available. The operating temperature is -4 to 35 degrees Celsius. The WTS-LV is available in four different configurations: Standard, Upright, Bore Hole, and Dual Filter Sampler. The high-capacity upright WTS-LV model provides three times the battery life of the standard model. The Bore-Hole WTS-LV is designed to fit through a narrow opening such as a 30-centimeter borehole. The dual filter WTS-LV features two vertical intake 142 mm filter holders to allow simultaneous filtering using two different porosities.

Dataset-specific Instrument Name	dissecting microscope
Generic Instrument Name	Microscope - Optical
Dataset-specific Description	Lyophilized, large particles (≥6 µm) were examined under a dissecting microscope, and materials that should be excluded from the passively sinking POM pool were removed.
Generic Instrument Description	Instruments that generate enlarged images of samples using the phenomena of reflection and absorption of visible light. Includes conventional and inverted instruments. Also called a "light microscope".

Dataset-specific Instrument Name	neutrally buoyant sediment traps (NBST)
Generic Instrument Name	Neutrally Buoyant Sediment Trap
Dataset-specific Description	Sinking particles were collected using sediment traps, either surface tethered sediment traps (STT) or neutrally buoyant sediment traps (NBST).
Generic Instrument Description	In general, sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. The Neutrally Buoyant Sediment Trap (NBST) was designed by researchers at Woods Hole Oceanographic Institution. The central cylinder of the NBST controls buoyancy and houses a satellite transmitter. The other tubes collect sediment as the trap drifts in currents at a predetermined depth. The samples are collected when the tubes snap shut before the trap returns to the surface. (more: http://www.whoi.edu/instruments/viewInstrument.do?id=10286)

Dataset-specific Instrument Name	surface tethered sediment traps (STT)
Generic Instrument Name	Sediment Trap
Dataset-specific Description	Sinking particles were collected using sediment traps, either surface tethered sediment traps (STT) or neutrally buoyant sediment traps (NBST).
Generic Instrument Description	Sediment traps are specially designed containers deployed in the water column for periods of time to collect particles from the water column falling toward the sea floor. In general a sediment trap has a jar at the bottom to collect the sample and a broad funnel-shaped opening at the top with baffles to keep out very large objects and help prevent the funnel from clogging. This designation is used when the specific type of sediment trap was not specified by the contributing investigator.

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Deployments

JC214

Website	https://www.bco-dmo.org/deployment/880457
Platform	RRS James Cook
Start Date	2021-05-01
End Date	2021-06-01
Description	Objective: The aim of the EXPORTS 2021 North Atlantic deployment is to sample the demise of the annual spring bloom. Hence our requested May 1 start of sampling somewhere near the PAP site (49N 16.5W). The exact location will be dependent upon the oceanographic features observed from remote sensing and autonomous vehicles beforehand. We will attempt to measure all aspects of the biological carbon pump – vertical fluxes, food web processes, physics, geochemistry, etc. Hence, there are officially 54 PIs collaborating on EXPORTS, although many will not sail. See more information at: https://www.bodc.ac.uk/resources/inventories/cruise_inventory/report/17792/ https://seabass.gsfc.nasa.gov/experiment/EXPORTS

DY131

Website	https://www.bco-dmo.org/deployment/893299
Platform	RRS Discovery
Report	https://www.bodc.ac.uk/resources/inventories/cruise_inventory/reports/dy131.pdf
Start Date	2021-05-01
End Date	2021-06-01
Description	See additional information at: https://www.bodc.ac.uk/resources/inventories/cruise_inventory/report/17779/ https://seabass.gsfc.nasa.gov/cruise/EXPORTSNA

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Project Information

Collaborative Research: Isotopic Indicators for Mechanisms of Organic Matter Degradation under High Productivity and High Carbon Flux Conditions (EXPORTS) (EXPORTS OM Degradation Indicators)

Coverage: North Atlantic approximately 49N, 16.5W

NSF Award Abstract:
The downward settling of organic material transports carbon out of the ocean surface, as part of a process called the biological pump. However, only a small fraction of organic material produced by organisms in surface waters makes it to the deep ocean. The rest can be fragmented or consumed (respired) by bacteria or larger organisms; the role of each process remains in question. Guided by recent results from the Pacific Ocean, the investigators will use the stable isotopes of carbon and nitrogen in amino acids to identify the input of fresh algal material, zooplankton feces, and bacteria to the biological pump in the North Atlantic spring bloom. With data from contrasting locations, the investigators will test and develop their isotopic models so they can be used to help predict global patterns in carbon transport. The work will be part of a large oceanographic field program (NASA EXPORTS). The tremendous amount of data collected in this program will aid the development and interpretation of the isotopic models. To share results broadly, the investigators will produce and distribute several episodes of Voice of the Sea, a local television program that will air in Hawaii and the Pacific islands. Episodes will be posted online and publicized through social media to the south Florida community. The project will support a Ph.D. student and an undergraduate student at University of Miami, which serves a 25% Hispanic population, and a Ph.D. student and an undergraduate student at University of Hawaii, a designated minority-serving institution.

The proposed work will assess the relative importance of packaging organic matter in fecal material, particle disaggregation, microbial reworking, and zooplankton dietary usage on vertical patterns of particle flux across contrasting oceanic provinces, using empirical methods independent of incubation techniques or metabolic rate measurements. From their existing work in relatively low-flux environments of the Pacific Ocean, the investigators have developed two nascent models: (1) a mixing model that uses the compound-specific isotope analysis of amino acids (AA-CSIA) to estimate the phytodetritus, fecal pellet, and microbially degraded composition of particles, such that the vertical alteration mechanisms and size distribution of these materials can be detected; and (2) an inverse relationship between carbon flux into the deep ocean and the reliance of mesopelagic food webs on small, degraded particles. In this project, the investigators will test these two models by applying the same methods to the recent NASA EXPORTS field study in a high productivity, high flux regime, the North Atlantic spring bloom. The first EXPORTS field study in the subarctic Pacific provided some of the materials from which the models were developed. Application and refinement of the investigators' newly developed isotopic indicators will enable development of a globally generalized isotopic framework for assessing the degradative history of particulate organic matter and its relationship to mesopelagic dietary resources, including small, microbially degraded particles that are often not accounted for as a metazoan dietary resource. This work capitalizes on existing, comprehensive field programs specifically focused on building a predictive framework relating surface ocean properties to the vertical flux of organic carbon. The proposed work directly addresses EXPORTS Science Question 2: What controls the efficiency of vertical

transfer of organic matter below the well-lit surface ocean? The results of this work additionally will provide observational comparisons to global models of carbon flux composition and pelagic food web resources.

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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Program Information

EXport Processes in the Ocean from Remote Sensing (EXPORTS)

Website: http://oceanexports.org/

EXport Processes in the Ocean from Remote Sensing (EXPORTS) is a large-scale NASA-led field campaign that will provide critical information for quantifying the export and fate of upper ocean net primary production (NPP) using satellite observations and state of the art ocean technologies.

Ocean ecosystems play a critical role in the Earth’s carbon cycle and the quantification of their impacts for both present conditions and for predictions into the future remains one of the greatest challenges in oceanography. The goal of the EXport Processes in the Ocean from Remote Sensing (EXPORTS) Science Plan is to develop a predictive understanding of the export and fate of global ocean net primary production (NPP) and its implications for present and future climates. The achievement of this goal requires a quantification of the mechanisms that control the export of carbon from the euphotic zone as well as its fate in the underlying "twilight zone" where some fraction of exported carbon will be sequestered in the ocean’s interior on time scales of months to millennia. In particular, EXPORTS will advance satellite diagnostic and numerical prognostic models by comparing relationships among the ecological, biogeochemical and physical oceanographic processes that control carbon cycling across a range of ecosystem and carbon cycling states. EXPORTS will achieve this through a combination of ship and robotic field sampling, satellite remote sensing and numerical modeling. Through a coordinated, process-oriented approach, EXPORTS will foster new insights on ocean carbon cycling that maximizes its societal relevance through the achievement of U.S. and International research agency goals and will be a key step towards our understanding of the Earth as an integrated system.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124416
NSF Division of Ocean Sciences (NSF OCE)	OCE-2124415

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