

Event log and CTD/Niskin bottle data collected from R/V Endeavor cruise EN734 in the North Atlantic and Chesapeake Bay from Jul to Aug 2025

Website: <https://www.bco-dmo.org/dataset/1005482>

Data Type: Cruise Results

Version: 1

Version Date: 2026-09-09

Project

» [Nitrous Oxide Consumption in Surface Waters](#) (N2O Surface Ocean)

Contributors	Affiliation	Role
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Abstract

This event log was recorded during R/V Endeavor cruise EN734 in the central North Atlantic Ocean, during July and August 2025. The cruise track included six process stations, four of which comprise an offshore transect (PS1, PS2, PS3, PS4) and two of which were inside the lower reaches of Chesapeake Bay (PS5, PS6). Experimental manipulations to measure nitrogen (N) cycle processes were carried out at these stations. The sampling strategy was tailored to the process under investigation, e.g., photosynthesis and photochemical processes in surface waters, and depth profiles for most standard rates. Complete depth profiles were measured for nitrification, while CO₂ and nitrogen nutrient (nitrate, ammonium, urea) uptake rates focused on the euphotic zone. One additional short station (PS6) was sampled only for nitrification and nitrate uptake. Nitrous oxide consumption and photochemical production of nitrous oxide were measured in surface waters at PS1-PS5. Zooplankton net tows were carried out at PS1 – PS5. This dataset includes an event log documenting over-the-side sampling activities (date, time, station, position, and observer notes) combined with CTD and Niskin bottle data (depth, temperature, salinity, sigma-theta, dissolved oxygen, beam attenuation, transmission, chlorophyll fluorescence, and PAR) collected at each process station during the cruise.

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Coverage

Location: North Atlantic (transect along 36 N from 66 W to 74 W) and Chesapeake Bay

Spatial Extent: N:37.84353 E:-66.58026 S:36.23684 W:-76.14046

Temporal Extent: 2025-07-23 - 2025-08-24

Methods & Sampling

Event Log

The cruise track included six process stations, four of which comprised a transect along 36 N from the mid Sargasso Sea inshore towards Chesapeake Bay, including one in the Gulf Stream (PS1 - PS4). The other two

stations (PS5, PS6) were inside Chesapeake Bay. Experimental manipulations to measure nitrogen (N) cycle processes were carried out at these stations. The sampling strategy was tailored to the process under investigation, e.g., photosynthesis and photochemical processes in surface waters, and depth profiles for most standard rates. Complete depth profiles were measured for nitrification, while CO₂ and nitrogen nutrient (nitrate, ammonium, urea) uptake rates focused on the euphotic zone. One additional short station (PS6) was sampled only for nitrification and nitrate uptake. Nitrous oxide consumption and photochemical production of nitrous oxide were measured in surface waters at PS1-PS5.

CTD/Niskin bottle

A Seabird SBE-911+ was used with 12 30-L Niskin bottles.

Sensors:

1. Temperature Sensor, SensorID="55"; serial number: 4695
2. Conductivity Sensor, SensorID="3"; serial number: 0618
3. Pressure, Digiquartz with TC, SensorID="45"; serial number: 0444
4. Temperature Sensor, SensorID="55"; serial number: 4130
5. Conductivity Sensor, SensorID="3"; serial number: 2822
6. Transmissometer, WET Labs C-Star, SensorID="71"; serial number: 969DR
7. Fluorometer, WET Labs ECO-AFL/FL, SensorID="20"; serial number: 4028
8. Altimeter Sensor, SensorID="0"; serial number: 49898
9. PAR/Irradiance, Biospherical/Licor, SensorID="42"; serial number: 70709
10. Oxygen, SBE 43, SensorID="38"; serial number: 1230
11. Oxygen, SBE 43, 2; SensorID="38"; serial number: 1648
12. User Polynomial Sensor, SensorID="61"; serial number: 783
13. SPAR, Biospherical/Licor, SensorID="51"; serial number: 20121

Data Processing Description

Software Version Seasave V 7.27.0.46

The data have been preliminarily processed by the ship's technician using Sea-Bird recommended default parameters. Raw CTD data were processed using SBEDataProcessing-Win32 software. These files should not be taken as the final processed product for analysis. Reference the Seasoft Data Processing manual for more information. We did not perform additional processing of the data in the bottle files.

BCO-DMO Curation Notes

This section documents curation actions performed prior to publication review with the submitter, and additional information relevant to understanding and reusing this dataset. It distinguishes changes made to the submitted (meta)data from unresolved issues and/or enhancements that improve future reuse and interoperability.

CURATION ACTIONS PERFORMED ON DATA

- Loaded EN734_2025_EventLog.xlsx (sheet 1, header row 1) with strings cast strategy, empty string and "nd" set as missing values
- Loaded EN734_BottleFilesCombined.xlsx (sheet 1, header row 1), preserving displayed cell formatting, with "", "nd", "N/A" set as missing values, named en734_bottle_files_combined
- Created Event column in en734_bottle_files_combined by formatting Cast number as "CTD" plus zero-padded 2-digit cast number
- Converted Month/Day/Year/Time columns into CTD_Collection_Datetime_UTC (UTC, ISO 8601 format)
- In event log table, combined Lat Deg (N) and Lat Min (N) into temporary lat_dms_temp string, skipping rows where lat was "N/A"
- Combined Long Deg (W) and Long Mins (W) into temporary lon_dms_temp string, skipping rows where lon was "N/A"
- Converted lat_dms_temp from degrees-decimal_minutes to decimal degrees as Latitude_Event_Log, forcing N directional, skipping missing rows

- Converted lon_dms_temp from degrees-decimal_minutes to decimal degrees as Longitude_Event_Log, forcing W directional (negative), skipping missing rows
- Fixed two Date typos in event log: "7/224/2025" to "7/24/2025" and "7/27/2-25" to "7/27/2025"
- Converted Date + Local Time (in water) into Deploy_Datetime_Local (datetime, "%Y-%m-%dT%H:%M")
- Converted Date + UTC time column into Deploy_Datetime_UTC (datetime, UTC, "%Y-%m-%dT%H:%MZ")
- Deleted temporary/intermediate columns: Date, Local Time (in water), UTC, Lat Deg (N), Lat Min (N), Long Deg (W), Long Mins (W), lat_dms_temp, lon_dms_temp from event log table
- Rounded Latitude_Event_Log and Longitude_Event_Log to 5 decimal places, no trailing zeros
- Deleted original Date, Month, Day, Year, Time columns from en734_bottle_files_combined
- Renamed Latitude to Latitude_CTD_Collection and Longitude to Longitude_CTD_Collection in bottle files table
- Joined event log table (source, keyed on Event, deleted after join) into en734_bottle_files_combined (target, keyed on Event) as full-outer join, pulling in Air Temp (°C), Deploy_Datetime_Local, Deploy_Datetime_UTC, Event, Latitude_Event_Log, Longitude_Event_Log, Notes, Observer, Rosette, Station, Surface Temp (°C) using first-value aggregation
- Renamed fields with spaces/special characters for BCO-DMO naming compliance: "Potential T" to Potential_T, "Beam Attenuation" to Beam_Attenuation, "Surface Temp (°C)" to Surface_Temp, "Air Temp (°C)" to Air_Temp
- Reordered columns into final logical sequence (Event, CTD_Collection_Datetime_UTC, coordinates, deploy times/coordinates, cast/bottle/CTD parameters, station/environmental/metadata columns)
- Renamed Latitude_CTD_Collection to CTD_Collection_Latitude, Longitude_CTD_Collection to CTD_Collection_Longitude, Latitude_Event_Log to Deploy_Latitude, Longitude_Event_Log to Deploy_Longitude
- Replaced μ (micro sign) character with "u" in Notes column
- Output file as 1005482_v1_en734_event_log_ctd.csv

CURATION ACTIONS PERFORMED ON METADATA

- BCO-DMO's standard metadata entry and text formatting steps were performed. See: <https://www.bco-dmo.org/how-to/standard-curation-edits>

ISSUES POTENTIALLY IMPACTING REUSE

- An unexpected date is used for CTD05.

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Parameters

Parameter	Description	Units
Event	Event number of event deployment	unitless
CTD_Collection_Datetime_UTC	Datetime UTC of the cast/event (source: Ship)	unitless
CTD_Collection_Latitude	Latitude of CTD collection, N is positive (source: Ship)	decimal degrees
CTD_Collection_Longitude	Longitude of CTD Collection, W is negative (source: Ship)	decimal degrees
Deploy_Datetime_UTC	UTC time of event deployment	unitless
Deploy_Datetime_Local	Local time (UTC-4:00) of event deployment	unitless

Deploy_Latitude	Latitude of deployment, N is positive (source: Ship)	decimal degrees
Deploy_Longitude	Longitude of deployment, W is negative (source: Ship)	decimal degrees
Cast	CTD cast number	unitless
Bottle	Niskin bottle number	unitless
Depth	Depth (source: CTD)	meters (m)
Sigmatheata	Sigma theta (source: CTD)	kilograms per cubic meter (kg/m3)
Salinity	Salinity (source: CTD)	PSU
Temperature	Temperature (source: CTD)	degrees Celsius
Potential_T	Potential temperature (source: CTD)	degrees Celsius
Pressure	Pressure (source: CTD)	decibars (dbar)
Oxygen	SBE O2 sensor (source: CTD)	micromoles per liter ($\mu\text{mol/L}$)
Beam_Attenuation	Beam Attenuation (source: CTD)	inverse meters (1/m)
Transmission	Transmission (source: CTD)	percent (%)
ChlFluor	Fluorescence (source: CTD)	milligrams per cubic meter (mg/m3)
Par	Photosynthetically active radiation Biospherical /Licor sensor	$\mu\text{mol photon per meter squared per second}$ ($\mu\text{mol photons/m}^2\text{/sec}$)
Station	Station designation	unitless
Air_Temp	Air temperature at time of deployment (source: Ship)	degrees Celsius
Surface_Temp	Surface temperature at time of deployment (source: Ship)	degrees Celsius

Rosette	Rosette configuration; 12 indicates a rosette equipped with 12 30-L Niskin bottles.	unitless
Observer	Person in charge of the log for that event	unitless
Notes	Event type, brief description of event	unitless

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Instruments

Dataset-specific Instrument Name	Altimeter
Generic Instrument Name	Altimeter
Dataset-specific Description	Altimeter Sensor, SensorID="0"; serial number: 49898
Generic Instrument Description	An instrument that measures height above a fixed surface. The data can be used to map ocean-surface topography and generate gridded surface height fields.

Dataset-specific Instrument Name	Conductivity Sensor
Generic Instrument Name	CTD - profiler
Dataset-specific Description	Conductivity Sensor, SensorID="3"; serial number: 0618 Conductivity Sensor, SensorID="3"; serial number: 2822
Generic Instrument Description	The Conductivity, Temperature, Depth (CTD) unit is an integrated instrument package designed to measure the conductivity, temperature, and pressure (depth) of the water column. The instrument is lowered via cable through the water column. It permits scientists to observe the physical properties in real-time via a conducting cable, which is typically connected to a CTD to a deck unit and computer on a ship. The CTD is often configured with additional optional sensors including fluorometers, transmissometers and/or radiometers. It is often combined with a Rosette of water sampling bottles (e.g. Niskin, GO-FLO) for collecting discrete water samples during the cast. This term applies to profiling CTDs. For fixed CTDs, see https://www.bco-dmo.org/instrument/869934 .

Dataset-specific Instrument Name	CTD: Seabird SBE-911+
Generic Instrument Name	CTD Sea-Bird SBE 911plus
Dataset-specific Description	CTD Data: A Seabird SBE-911+ was used with 12 30-L Niskin bottles.. Sensors: Temperature Sensor SensorID="55"; serial number: 4695 Conductivity Sensor SensorID="3"; serial number: 0618 Pressure, Digiquartz with TC SensorID="45"; serial number: 0444 Temperature Sensor SensorID="55"; serial number: 4130 Conductivity Sensor SensorID="3"; serial number: 2822 Transmissometer, WET Labs C-Star WET_LabsCStar SensorID="71"; serial number: 969DR Fluorometer, WET Labs ECO-AFL/FL FluoroWetlabECO_AFL_FL_Sensor SensorID="20"; serial number: 4028 Altimeter Sensor SensorID="0"; serial number: 49898 PAR/Irradiance, Biospherical/Licor; PAR_BiosphericalLicorChelseaSensor SensorID="42"; serial number: 70709 Oxygen, SBE 43; SensorID="38"; serial number: 1230 Oxygen, SBE 43, 2; SensorID="38"; serial number: 1648 User Polynomial Sensor SensorID="61"; serial number: 783 SPAR, Biospherical/Licor SPAR_Sensor SensorID="51"; serial number: 20121
Generic Instrument Description	The Sea-Bird SBE 911 plus is a type of CTD instrument package for continuous measurement of conductivity, temperature and pressure. The SBE 911 plus includes the SBE 9plus Underwater Unit and the SBE 11plus Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 plus and SBE 11 plus is called a SBE 911 plus. The SBE 9 plus uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 plus and SBE 4). The SBE 9 plus CTD can be configured with up to eight auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). more information from Sea-Bird Electronics

Dataset-specific Instrument Name	SPAR, Biospherical/Licor
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Dataset-specific Description	SPAR, Biospherical/Licor, SensorID="51"; serial number: 20121
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	PAR/Irradiance, Biospherical/Licor
Generic Instrument Name	LI-COR Biospherical PAR Sensor
Dataset-specific Description	PAR/Irradiance, Biospherical/Licor, SensorID="42"; serial number: 70709
Generic Instrument Description	The LI-COR Biospherical PAR Sensor is used to measure Photosynthetically Available Radiation (PAR) in the water column. This instrument designation is used when specific make and model are not known.

Dataset-specific Instrument Name	30-L Niskin bottles
Generic Instrument Name	Niskin bottle
Dataset-specific Description	A Seabird SBE-911+ was used with 12 30-L Niskin bottles.
Generic Instrument Description	A Niskin bottle (a next generation water sampler based on the Nansen bottle) is a cylindrical, non-metallic water collection device with stoppers at both ends. The bottles can be attached individually on a hydrowire or deployed in 12, 24, or 36 bottle Rosette systems mounted on a frame and combined with a CTD. Niskin bottles are used to collect discrete water samples for a range of measurements including pigments, nutrients, plankton, etc.

Dataset-specific Instrument Name	Digiquartz with TC
Generic Instrument Name	Pressure Sensor
Dataset-specific Description	Pressure, Digiquartz with TC, SensorID="45"; serial number: 0444
Generic Instrument Description	A pressure sensor is a device used to measure absolute, differential, or gauge pressures. It is used only when detailed instrument documentation is not available.

Dataset-specific Instrument Name	SBE 43
Generic Instrument Name	Sea-Bird SBE 43 Dissolved Oxygen Sensor
Dataset-specific Description	Oxygen, SBE 43, SensorID="38"; serial number: 1230 Oxygen, SBE 43, 2; SensorID="38"; serial number: 1648
Generic Instrument Description	The Sea-Bird SBE 43 dissolved oxygen sensor is a redesign of the Clark polarographic membrane type of dissolved oxygen sensors. More information from the manufacturer: https://www.seabird.com/products/sbe-43-dissolved-oxygen-sensor

Dataset-specific Instrument Name	WET Labs C-Star
Generic Instrument Name	Transmissometer
Dataset-specific Description	Transmissometer, WET Labs C-Star, SensorID="71"; serial number: 969DR
Generic Instrument Description	A transmissometer measures the beam attenuation coefficient of the lightsource over the instrument's path-length. This instrument designation is used when specific manufacturer, make and model are not known.

Dataset-specific Instrument Name	Temperature Sensor
Generic Instrument Name	Water Temperature Sensor
Dataset-specific Description	Temperature Sensor, SensorID="55"; serial number: 4695 Temperature Sensor, SensorID="55"; serial number: 4130
Generic Instrument Description	General term for an instrument that measures the temperature of the water with which it is in contact (thermometer).

Dataset-specific Instrument Name	WET Labs ECO-AFL/FL
Generic Instrument Name	Wet Labs ECO-AFL/FL Fluorometer
Dataset-specific Description	Fluorometer, WET Labs ECO-AFL/FL, SensorID="20"; serial number: 4028
Generic Instrument Description	The Environmental Characterization Optics (ECO) series of single channel fluorometers delivers both high resolution and wide ranges across the entire line of parameters using 14 bit digital processing. The ECO series excels in biological monitoring and dye trace studies. The potted optics block results in long term stability of the instrument and the optional anti-biofouling technology delivers truly long term field measurements. more information from Wet Labs

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Deployments

EN734

Website	https://www.bco-dmo.org/deployment/1007278
Platform	R/V Endeavor
Start Date	2025-07-22
End Date	2025-08-14
Description	Project: Nitrous Oxide Consumption in Surface Waters

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Project Information

Nitrous Oxide Consumption in Surface Waters (N2O Surface Ocean)

Coverage: North Atlantic Ocean

NSF Award Abstract:

Nitrous oxide (N2O) is a trace component of Earth's atmosphere. It is a strong greenhouse gas, whose concentration has been increasing since the industrial revolution, and contributes about 6% to the total greenhouse effect. N2O is also implicated in ozone depletion in the stratosphere. The ocean is a net source of N2O to the atmosphere. N2O is produced and consumed in the ocean by microbes as part of the nitrogen cycle. The conversion of N2O to N2 (dinitrogen gas) is the only known biological sink for N2O and is catalyzed by an enzyme that is strongly inhibited by oxygen, so N2O consumption has been thought to be confined to

oxygen-free environments. Thus, it was surprising to find that the genetic capability for N₂O consumption was both present and active in the surface ocean, where oxygen is abundant. Experiments showed that surface ocean microbes rapidly consume N₂O when oxygen is removed. It appears that the microbes can use N₂O as an alternative to oxygen for respiration. Why would it be advantageous to retain this capacity in fully oxygenated surface water? Does this potential N₂O consumption constitute an actual sink for N₂O, which might reduce the net transfer of N₂O from the ocean to the atmosphere?

The reduction of nitrous oxide (N₂O) to N₂ is considered to be an obligately anaerobic process, usually restricted to anoxic environments in water and sediments. Previous work showed that the genes (*nosZ*) encoding the N₂O reductase enzyme were both present and expressed in the surface ocean, and that surface ocean samples rapidly reduce N₂O to N₂ when oxygen is removed. The *nosZ* genes in surface waters appear to belong almost exclusively to microbes that do not perform the upstream steps in denitrification – they are facultative N₂O respirers. The research proposed here will investigate the factors that might control or stimulate N₂O reduction in surface waters and characterize the microbes responsible for the process. Experiments will test the hypothesis that N₂O respirers are versatile heterotrophs whose activity is related to organic matter supply and possibly associated with particulate material or linked to in situ primary production. Researchers will perform ¹⁵N tracer incubations to measure the rate of N₂O reduction and its response to various kinds of organic substrates, including in situ particulate material and fresh phytoplankton exudates. The quantity and community composition of *nosZ*-containing microbes will be determined using a suite of molecular biological methods – necessary because the *nosZ* gene is so diverse that previous methods have likely underestimated both its abundance and diversity and may not have identified the main microbes responsible for the process. Draft genomes of *nosZ*-containing microbes will be characterized to investigate their carbon metabolism and link their lifestyles to organic matter supply or phytoplankton. One field expedition is planned to investigate the significance of N₂O reduction in the North Atlantic subtropical gyre. If N₂O consumption occurs even at low rates over vast regions of the surface ocean, its impact on the overall N₂O budget of the ocean and atmosphere could be large.

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-2342493

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