

CRUISE REPORT – U.S. GO-SHIP

Project Name:	GO-SHIP DOM	Measurements:	DOC & TDN (Level I)
Cruise ID:	P02 LEG2/RR2205	PI:	Craig Carlson, UCSB
Dates:	13 JUN-16 JULY 2022	Total Stations(Samples):	46 STN(1,585 samples)
Ports of call:	Honolulu – San Diego	Analysts (UCSB):	Keri Opalk, Elisa Halewood
Chief Sci:	Andreas Thurnherr	Support:	NSF
Technician (at sea):	Michelle Michelsen	Date submitted:	10 APR 2024

SUMMARY

Project Goals:	<p>The goal of the DOM project is to provide high resolution, long term monitoring of DOC/TDN distribution throughout the water column, in order to help better understand biogeochemical cycling in global oceans. For 2022 the Carlson Lab at UCSB will evaluate dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) concentrations along the US GO-SHIP P02 transect.</p>
Sampling Plan:	<p>Over the course of the P02 cruise, DOC/TDN was sampled at every other station in conjunction with DIC, Alkalinity, and pH. For these, DOM was sampled from 36 unique Niskins ranging the full depth of the water column, with two duplicates randomly selected for a total of 38 samples collected per cast.</p>
Sampling details:	<p>DOM samples were passed through an inline filter holding a combusted GF/F filter attached directly to the Niskin for samples above 500 m of each cast. This was done to eliminate particles larger than 0.7 μm from the sample. Samples from deeper depths were not filtered. Previous work has demonstrated that there is no resolvable difference between filtered and unfiltered samples in waters below the upper 500 m at the $\mu\text{mol kg}^{-1}$ resolution.</p> <p>Collection of TDN samples was restricted to the surface 300 m and sampled from the same DOC sample Niskin.</p> <p>To avoid contamination, nitrile gloves were used when handling all sampling equipment and clean lab surfaces were used for processing samples. After each station, all equipment used for sampling was rinsed with 5-10% hydrochloric acid and MilliQ water in preparation for the following station. All samples were rinsed 3 times with ~ 5 mL of seawater and collected into 40 mL glass EPA vials.</p> <p>Sample vials were prepared in advance for this cruise by combusting at 450°C for 4 hours to remove any organic matter. Vial caps were cleaned by soaking in 10% hydrochloric acid, followed by a soak in Nanopure water overnight, followed by a 3 times rinse with Nanopure water and left out to dry. Samples were fixed with 50 μL of 4N hydrochloric acid and stored upright in well-</p>

	<p>sealed pelican coolers at room temperature on board (for I05 this was the forward hold). Samples were never frozen. Samples will be shipped back to UCSB for analysis via high temperature combustion on Shimadzu TOC-V or TOC L analyzers.</p>
<p>Standard Operating Procedure for DOM analyses (Carlson Lab, UCSB):</p>	<p>DOC samples were analyzed via high temperature combustion using a Shimadzu TOC-V or Shimadzu TOC-L in a shore based laboratory at the University of California, Santa Barbara. The operating conditions of the Shimadzu TOC-V have been slightly modified from the manufacturer’s model system. These methods have been added to the GO SHIP Practices collection and are fully detailed in Halewood et. al, 2022, and previously [Carlson 2010, Hansell 2005, Hansell 1998].</p> <p>TDN samples were analyzed via high temperature combustion using a Shimadzu TOC-V with attached Shimadzu TNM1 unit at an in-shore based laboratory at the University of California, Santa Barbara. The operating conditions of the Shimadzu TOC-V were slightly modified from the manufacturer’s model system as detailed in Halewood et. al, 2022 and previously [Walsh 1989].</p> <p>Final results are reported in units of $\mu\text{mol kg}^{-1}$. Where possible direct measures of sample salinity and analytical temperature are used to calculate average seawater density. In practice we have found that applying an average seawater density of 1.028 kg m^{-3} to open ocean water column DOM samples, compared to direct measure of sample density results in a difference of less than $0.01 \mu\text{mol kg}^{-1}$ (i.e., less than analytical resolution). However, when salinity and an average analytical lab temperature are available or in regions where salinity varies strongly, a more accurate density correction is determined and applied for each sample. Each parameter includes a field for quality control flags.</p>
<p>References:</p>	<p>Halewood E, Opalk K, Custals L, Carey M, Hansell D.A. and Carlson, C.A. (2022) Determination of dissolved organic carbon and total dissolved nitrogen in seawater using High Temperature Combustion Analysis. <i>Front. Mar. Sci.</i> 9:1061646. doi: 10.3389/fmars.2022.1061646.</p> <p>Carlson, C. A., D. A. Hansell, N. B. Nelson, D. A. Siegel, W. M. Smethie, S. Khatiwala, M. M. Meyers and E. Halewood 2010. Dissolved organic carbon export and subsequent remineralization in the mesopelagic and bathypelagic realms of the North Atlantic basin. <i>Deep Sea Research II</i>, 57: 1433-1445.</p> <p>Hansell, D.A. and C.A. Carlson 1998. Deep ocean gradients in the concentration of dissolved organic carbon. <i>Nature</i>, 395: 263-266.</p> <p>Hansell, D.A. 2005 Dissolved Organic Carbon Reference Material Program. <i>EOS</i>, 35:318-319.</p>

	<p>Walsh, T.W., 1989. Total dissolved nitrogen in seawater: a new high-temperature combustion method and a comparison with photo-oxidation. <i>Mar. Chem.</i>, 26:295-311.</p>
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