



Endorsed

This is an updated endorsement document that refers to the more recent publication. There are minor differences in the Frontiers published version and the report, and some wording was updated to emphasize that these methods are not only applicable to GO-SHIP but are useful to the wider marine science community.

DETERMINATION OF DISSOLVED ORGANIC CARBON AND TOTAL DISSOLVED NITROGEN IN SEAWATER USING HIGH TEMPERATURE COMBUSTION ANALYSIS

Author(s): Elisa Halewood, Keri Opalk, Lillian Custals, Maverick Carey, Dennis A. Hansell and Craig A. Carlson

Essential Ocean, Climate, Biodiversity Variable(s): Dissolved organic carbon

Supporting or other variables: N/A

Network(s): GO-SHIP program

Sensors: N/A

Endorsed by (GOOS PANEL, eg OCG, BIOECO): GO-SHIP, GOOS OCG

Endorsement date: 10th May 2022

DOI Identifier: <https://doi.org/10.3389/fmars.2022.1061646>

Brief description of community review process:

Manuscript was submitted to the GO-SHIP Science Committee for review (Rik Wanninkhof), and GO-SHIP SC then found additional international experts in the measurement to perform review (Boris Koch, Germany and Youhei Yamashita, Japan). This was endorsed as a report. It was then submitted to Frontiers, with minor changes and peer reviewed.

Links to previous versions or full manuals if this is a summary paper:

<https://repository.oceanbestpractices.org/handle/11329/1921>

This publication is the same as the manual that has been endorsed by the GOOS Observation Coordination Group - GO-SHIP panel of Experts as a globally accepted best practice for determination of dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) in seawater samples.

The GOOS best practice endorsement process has been developed by the GOOS and the Observation Coordination Group (OCG) in conjunction with the Ocean Best Practices System (OBPS).

The aim is for global networks (eg the International Argo programme through GOOS OCG) or groups of experts (eg. the GOOS Biogeochemical Panel) to endorse and share methods which have reproduced superior results for confidence in and uptake by the broader ocean community.

The endorsed methods can range from standard operating procedures to field manuals and have been adopted by community review as 'globally' accepted methods. Following best practices improves the reproducibility of science research, and interoperability across disciplines and datasets by standardizing methods and data collection. It allows for research to be more efficient, leads to quality datasets, and supports future proofing data.

Endorsed GOOS best practices have been through a strong identifying process. They have been adopted and used by established ocean observers and therefore represent a strong basis for the ocean science community.

The document will be updated and re-endorsed as appropriate.

ANNEXE I – CERTIFICATE OF THE GOOS ENDORSED BEST PRACTICE

BELOW IS THE CERTIFICATE FOR THE BEST PRACTICE AND/OR ACKNOWLEDGEMENT TEXT TO INSERT IN DOCUMENT TO BE PUBLISHED. WHEN FILLING IT IN, PLEASE FOLLOW THE SAME FORMAT AS THE ONE USED TO COMPLETE THE METADATA SHEET.

IF BEST PRACTICE IS ALREADY PUBLISHED THIS PAGE WILL BE USED TO PROVIDE METADATA TO THE OBPS TAGGING SYSTEM AND IT WILL BE LINKED TO THE BEST PRACTICE IN THE OBPS

The following acknowledgement has been added to the manuscript as of 3/29/22:

This manual was written by technical teams at the University of California Santa Barbara (Craig Carlson Microbial Oceanography Lab) and University of Miami (Dennis Hansell Organic Biogeochemistry Lab). Support for this work was provided by the U.S. National Science Foundation (NSF OCE 1436748 to DAH, OCE 2023500 to CAC) and Simons Foundation International BIOS-SCOPE program to CAC.

The authors thank the technical staff, students and field teams in the Carlson and Hansell labs over the years who contributed to the development of these methods. Thank you also to Juliet Hermes of the Global Ocean Observing System (GOOS Task Team on Best Practices lead) and the Ocean Best Practices System (OBPS) for guidance on developing and sharing best practices for the ocean community.

The authors would also like to acknowledge and thank the following scientific colleagues for extensive review of the manuscript and constructive comments and suggestions for improvement:

Boris Koch, Rik Wanninkhof, 山下 洋平 (Youhei Yamashita)



Endorsed

GO-SHIP REPEAT HYDROGRAPHY: DETERMINATION OF DISSOLVED ORGANIC CARBON (DOC) AND TOTAL DISSOLVED NITROGEN (TDN) IN SEAWATER USING HIGH TEMPERATURE COMBUSTION ANALYSIS

Author(s): Elisa Halewood, Keri Opalk, Lillian Custals, Maverick Carey, Dennis A. Hansell and Craig A. Carlson

Essential Ocean, Climate, Biodiversity Variable(s): Dissolved organic carbon

Supporting or other variables: N/A

Network(s): GO-SHIP program

Sensors: N/A

Endorsed by (GOOS PANEL, eg OCG, BIOECO): GO-SHIP, GOOS OCG

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Endorsed GOOS best practices have been through a strong identifying process. They have been adopted and used by established ocean observers and therefore represent a strong basis for the ocean science community. The document will be updated and re-endorsed as appropriate.

5. DOCUMENT DATA SHEET (for submissions to www.oceanbestpractices.org)

For Report or Monograph

<p>Document Type: Document Type: * Select the document format of the item being deposited</p> <p> <input type="radio"/> Book/Monograph: A book or a conference volume or complete serial issue. <input type="radio"/> Book Section: A chapter or section in a book, monograph or conference volume. <input type="radio"/> Journal Contribution: A contribution to a journal <input checked="" type="radio"/> Report: This may be a technical report, project report, documentation, manual or guideline, working paper, discussion paper. <input type="radio"/> Report Section: A chapter or section in a report. <input type="radio"/> Software: Computer programs and applications. <input type="radio"/> Video/Image : A static image or recording of moving visual images made digitally. <input type="radio"/> Web Based Content: Usually a website/webpage. If a document is hosted on a website, use the appropriate document type for the item and include the website URL in the Resource URL metadata field. <input type="radio"/> Other: Something within the scope of the repository, but not covered by the other categories. </p>	<p>Report (manual)</p>
<p>Language: Enter the language of the full text deposit, If the language does not appear in the list below, please enter 'Other'. If the content does not really have a language (for example, if it is software, a dataset or an image) please enter 'N/A'.</p> <p>English Chinese French German Italian Japanese Spanish Other N/A </p>	<p>English</p>
<p>Methodology type: Select the type of methodological document you are submitting. Please select all that apply. Separate entries with a semicolon (;)</p> <p>Guidelines & Policies Guidelines & Policies: A set of conventions and options to advise action; an indication or outline of conduct. Policies are generally high-level guidelines on expected or acceptable behaviour, especially of a governmental body</p> <p>Method Method: A documented procedure, a step-by-step set of instructions for accomplishing a task. Examples include manuals, scientific/medical protocols, standard test methods and standard practices (e.g. standard operation procedures)</p> <p>Methodological commentary/perspect Methodological commentary/perspective: Narrative reflections on or discussion of a methodological document</p> <p>Description of a metrology standard description of a metrology standard: Documentation of a physical standard used for metrology (e.g. a manufactured object used to calibrate sensors)</p> <p>Specification of criteria Specification of criteria: a description of requirements (e.g. a technical, quality assurance and inclusivity requirements) that a methodology should comply with in order to fulfill the expectations of a community or organisation</p> <p>Reports with methodological relevance Reports with methodological relevance: a report of any activity which has relevance to methodology (e.g. a set of existing methods were compared, a report on a field expedition where new technology was tested, or a report on a computational benchmarking experiment)</p> <p>Training/Educational material</p>	<p>Method</p>
<p>Maturity Level If applicable, enter the maturity level of the methodology in the document N/A: where maturity level not applicable Mature: Methodologies are well demonstrated for a given objective, documented and peer reviewed; methods are commonly used by more than one organization (TRL 7-9) Pilot or Demonstrated: Methodologies are being demonstrated and validated; limited consensus exists on widespread use or in any given situation (TRL 4-6) Concept: A methodology is being developed at one institution(s) but has not been agreed to by the community; requirements and form for a methodology are understood (TRL 1-3)</p>	<p>Mature</p>

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<p>Endorsement (external): Please indicate whether this submission (in its entirety) has been endorsed by an organisation or community. Please name the organisation or community that performed the endorsement above</p>	<p><u>YES/NO</u> GO-SHIP, GOOS</p>
<p>Refereed Status** Has this document been peer reviewed/refereed? Please enter YES, NO or UNKNOWN</p>	<p>YES</p>
<p>Author Last, First Name(s) ** Separate multiple entries with a semicolon (;) e.g.: Smith, Joseph; Jones, H.; (enter the name/s as it appears in the document in the correct order)</p>	<p>Halewood,Elisa; Opalk, Keri; Custals, Lillian; Carey, Maverick; Hansell, Dennis A.; Carlson, Craig A.</p>
<p>Editor Last, First Name(s) Where there is no personal author list the editor/s. Separate multiple entries with a semicolon (;) (enter the name/s as it appears in the document in the correct order) eg: Buttigieg, Pier Luigi; Simpson, Pauline;</p>	<p>n/a</p>
<p>Corporate Author Where there is no personal author or editor enter the organization, project or team name responsible for creating the best practice, eg. CleanSea Project</p>	<p>n/a</p>
<p>Date of Issue (yyyy-mm-dd) ** e.g. 2018-05-21</p>	<p>2022-03-28</p>
<p>Recommended Next Content Review Date (yyyy-mm-dd) Please indicate the date which you believe the document should be revised and updated</p>	<p>2027-03-28</p>

<p>English-language document title ** Entries should be in English. If applicable, include a sub-title after a colon (:) and version number after the title text (e.g. Version 3.2).</p>	<p>GO-SHIP Repeat Hydrography: Determination of dissolved organic carbon (DOC) and total dissolved nitrogen (TDN) in seawater using High Temperature Combustion Analysis. (Version 1.0).</p>
<p>Alternative or Non-English document title If the title was not originally in English, please include it in its original form here. If applicable, include a sub-title after a colon (:) and version number after the title text (e.g. Version 3.2).</p>	<p>n/a</p>
<p>Publisher Name(s) ** e.g.: Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) Please state the Institute's (Issuing Organization) name as it is specified in official communications. Separate multiple publisher entries with a</p>	<p>University of California Santa Barbara (UCSB)</p>
<p>Place of Publication e.g.: Plouzane, France This should correspond to the publisher name(s) provided below.</p>	<p>Santa Barbara, CA, USA</p>
<p>Pages or Extent e.g.: 57pp. Use straight through pagination of document e.g. 39pp. & Annexes Use pagination of the document body text e. g. 12 mins (for video)</p>	<p>25pp. & Annexes</p>
<p>Series and/or Document Number(s) If applicable, list creator document identifiers, e.g.: SIP Protocol Series 6; JERICO-NEXT-W2-D2.1.-24112016-V2.0 Separate multiple entries with a semicolon (;).</p>	<p>n/a</p>
<p>External identifiers e.g. DOI:xxxxxx ; ISBN: xxxxxx Separate multiple entries with a semicolon (;).</p>	<p>DOI TBD-submitting to OBPS</p>
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<p>Contact person - Last, First names e.g. Smith, Joseph</p>	<p>Halewood, Elisa</p>
<p>Contact person - Email **</p>	<p>wallner@ucsb.edu</p>
<p>Abstract/Summary ** Free text, Please provide a brief summary of your best practice including, as appropriate, a brief descriptions of what techniques your best practice is about, which ocean environments or regions it targets, the primary sensors covered, what type of data/measurements/observing platform it covers, limits to its applicability and note the community of practice that developed the best practice.</p>	<p>This paper describes procedures for collection and measurement of DOC and TDN in discrete seawater samples and is suitable for the assay</p>

	of oceanic levels of DOC (<80 $\mu\text{mol C kg}^{-1}$) and total dissolved nitrogen (<40 $\mu\text{mol N kg}^{-1}$). It presents best practices using the high temperature combustion (HTC) method which has been used on U.S. GO-SHIP cruises since 2003.
Spatial Coverage If applicable, please specify the region where the best practice is applied. For regional term guidance use the following link: https://www.nodc.noaa.gov/worlddatacenter/regions.html . e.g. SW Pacific Ocean	Global Ocean basins
Sustainable Development Goals, Targets, and Indicators ** If applicable, please specify if the best practice has application for a sustainable development goal. Target number is required and should be entered e.g 14.1 Add Indicator if applicable eg. 14.1.1 Refer to this page for more information: https://sustainabledevelopment.un.org/ Separate multiple entries with a semicolon (;)	14.a
Essential Ocean Variables (EOV)** Copy and paste standard variable names from the list on this link . Separate multiple entries with a semicolon(;) Enter N/A if not applicable	Dissolved organic carbon
Essential Biodiversity Variables (EBV) Copy and paste names from this link Separate multiple entries with a semicolon(;) 	n/a
Essential Climate Variables (ECV) Copy and paste standard variable names from the list on this link (e.g for atmospheric variables not already under EOVs) Separate multiple entries with a semicolon(;) 	n/a
Supporting variables Please list here any supporting variables, this refers to variables observed or known from instrumentation or identified in the text and used to calculate the desired EO, ECV or EBV. Separate multiple entries with a semicolon(;) 	n/a
Other Variables Please list here any other variable relevant to your document that are not included as EO, ECVs , EBVs or supporting variables above, (e.g. ice accretion, anthropogenic carbon) Separate multiple entries with a semicolon(;) 	Dissolved inorganic nutrients (DIN) used to calculate DON (DON=TDN-DIN)
Sensors If applicable, please list here the type of sensor/s and manufacturers that are mentioned in the best practice, e.g. Water sampler General Oceanics. Separate multiple entries with a semicolon (;).	Shimadzu Total Organic Carbon Analyzers with Shimadzu Non-Dispersive Infrared detectors (NDIR)

<p>Other Keywords Add any other key words, e.g. Melt pond; Diatoms; Absorption coefficient; Separate multiple entries with a semicolon (;).</p>	
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Version history metadata

Please order your revisions such that the earliest is at the bottom of the table.

Revision	Date	Note on modifications	Lead Author
Version 1.0	(2022-03-28)	Initial submission	Halewood, Elisa