General Information
F2022-096 - GO-SHIP A16N 2023

Sponsoring institution(s): NOAA, Office of Oceanic and Atmospheric Research, Global Ocean Monitoring and Observing (GOMO) Program.
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Scientist in charge of the project: Name: Leticia Barbero
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Description of Project (Nature and objectives of the project):
This cruise is part of the decadal re-occupation of select NOAA hydrographic transects to determine natural and man-made changes in chemical and physical properties in the ocean under auspices of the international program Global Ocean Ship-based Hydrographic Investigations Program GO-SHIP (www.go-ship.org). The focus of this particular cruise is to determine the changes in anthropogenic CO2, distributions, and fluxes in the Atlantic Ocean since the last occupation in 2013 as part of the GO-SHIP program. Decadal variations of CO2 tracer, oxygen, and temperature distributions are strongly influenced by climate change and natural processes. The repeat hydrography cruises are the only means to obtain climate quality data to study changes and impacts in the ocean. This research is co-sponsored by the USA agencies NOAA and NSF. Clearance to conduct research in Iceland, Portugal and Spain EEZ waters on the NOAA Ship Ronald H. Brown is requested. Water samples will be collected at the stations indicated on the map from the 24-bottle rosette at each station, from surface to bottom and analyzed for salinity, oxygen, nutrients, dissolved inorganic carbon, total alkalinity, pCO2, pH, and other parameters.

Relevant previous or future research projects:
GO-SHIP is the leading international program responsible for monitoring decadal changes in the world's oceans. Examples of publications
stemming from this program are available here:
https://www.go-ship.org/Documents.html#CWPs

Previous publications relating to the project:
More than 400 peer-reviewed publications have used data from this decade's long program. A bibliography is available here: https://www.goship.org/Bib.html
All data from previous occupations of this line can be downloaded here:
https://cchdo.ucsd.edu/search?q=A16N

Geographical Areas:
The cruise will depart from Recife/Natal, Brazil, and head east to about 6S, 25W. It will then head north-northeast, ending approximately at 63.3N, 20W, in Icelandic coastal waters. The ship will do a port call halfway through the cruise either in Portugal or in Spain.

Methods and means to be Used
Name: RONALD H. BROWN
Type/Class: Ship: NOAA
Nationality (Flag state): United States
Identification Number (IMO/Lloyds No.): IMO 9105786
Owner: Department of Commerce, National Oceanic and Atmospheric Administration
Operator: Office of Marine and Aviation Operations
Overall length: 83.50 m
Maximum draught: 5.20 m
Displacement/Gross tonnage: 3,180.0
Propulsion: Two Fully Rotating Stern Z-Drives, 3000 HP each.
Cruising: 23.00 km/h
Maximum speed: 28.00 km/h
Call sign: WTEC
INMARSAT number and method and capability of communication (including emergency frequencies): GMDSS Equipped; VHF Channel 16; SSB; Inmarsat C & Inmarsat Mini-M (Sat M); MF/HF frequencies 156.525 MHz, 2187.5 kHz, 8414.5 kHz. Voice Over Internet Protocol (VOIP) 541.867.8913/8914. Satellite phone 011-870- 773-131-320.
Name of master: Marc Moser
Number of crew: 30
Number of scientists on board: 30

Particulars of methods and scientific instruments
Types of samples and measurements:
CTD/O2 profiles. Stations will be completed to full water depth of maximum 6000 m. Water samples will be collected in rosette bottles for chemical measurements. Water transport. Surface seawater partial pressure of CO2 (pCO2), oxygen, salinity, and temperature. Bathymetry data.

Methods to be used:
Temperature, conductivity, and oxygen will be collected with a CTD. Water samples from rosette bottle will be analyzed on board by spectrophotometry (nutrients, pH), coulometry (inorganic carbon), infrared analysis and gas chromatography (dissolved gases and tracers), and titration (alkalinity and oxygen). Acoustic doppler current

profiling. Automated instruments connected to the scientific seawater intake line on the ship. Multibeam echosounder.

Instruments to be used:
CTD (conductivity, temperature, depth) profiler, chemical analyzers on board. RDI Acoustic Doppler Current Profiler (ADCP). pCO2 - underway pCO2 system; oxygen - SeaBird optode; salinity and temperature - thermosalinograph. Kongsberg EM122 Deep water Multibeam. Echosounder.

Estimated overall project start and end dates:
Project Start Date: 2/27/2023
Project End Date: 5/22/2023

Coastal State-specific details:
Coastal Area: Portugal
Estimated Entry Date: 3/30/2023
Estimated Departure Date: 4/28/2023
Estimated Research Start Date: 3/30/2023
Estimated Research End Date: 4/28/2023
Explanation of multiple entries: Ship may transit through territorial waters surrounding Madeira and mainland Portugal. Only underway sampling will be conducted.
Research will be performed: within 12 nm, between 12-200 nm.
Extent to which Portugal will be enabled to participate or to be represented in the research project:
All data will be shared with the coastal State

Coastal Area: Spain
Estimated Entry Date: 3/30/2023
Estimated Departure Date: 4/28/2023
Estimated Research Start Date: 3/30/2023
Estimated Research End Date: 4/28/2023
Explanation of multiple entries: Ship may transit through territorial waters of the Canary Islands and mainland Spain.
Research will be performed: within 12 nm, between 12-200 nm.
Extent to which Spain will be enabled to participate or to be represented in the research project: All data will be shared with coastal state. Chief scientist is a Spanish citizen.
Name, affiliation and contact information for all participants from Spain: Leticia

Barbero Muñoz, University of Miami, lbarbero@miami.edu / 305-361-4453

Coastal Area: Iceland
Estimated Entry Date: 4/24/2023
Estimated Departure Date: 5/22/2023
Estimated Research Start Date: 4/24/2023
Estimated Research End Date: 5/22/2023
Research will be performed: within 12 nm
Extent to which Iceland will be enabled to participate or to be represented in the research project: All data will be shared with the coastal State.

Access to Data, Samples and Research Results
Anticipated dates of submission to the coastal State of the final report:
No more than 2 years from the end date of the research. Data will be provided through official channels at no cost to the coastal State(s). Samples will be provided upon request. Full cruise report and complete dataset will be made publicly available at https://cchdo.ucsd.edu/

Proposed Cruise Track
R/V Ronald H. Brown
April 24 – May 22, 2023