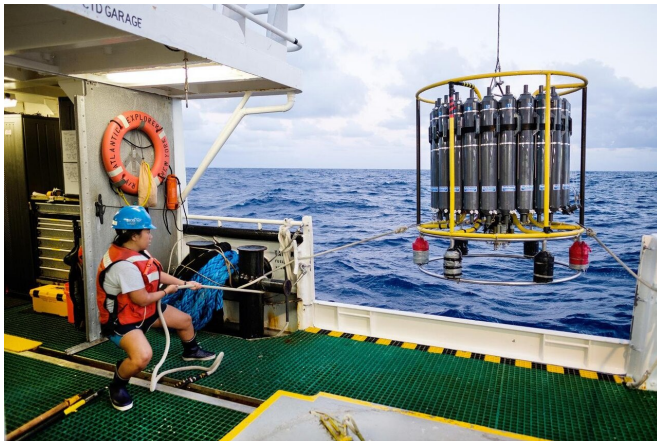


# The ocean responds to a warming planet

6 April 2020



Maya Thompson, marine technician intern, hauls in the CTD (conductivity, temperature and depth) rosette aboard the R/V Atlantic Explorer on a recent research cruise in the Sargasso Sea. The CTD rosette collects water samples and physical oceanographic measurements from discrete depths. Credit: Bermuda Institute of Ocean Sciences

We're familiar with how climate change is impacting the ocean's biology, from bleaching events that cause coral die-offs to algae blooms that choke coastal marine ecosystems, but it's becoming clear that a warming planet is also impacting the physics of ocean circulation.

A team of scientists from the University of British Columbia, the Bermuda Institute of Ocean Sciences (BIOS), the French Institute for Ocean Science at the University of Brest, and the University of Southampton recently published the results of an analysis of North Atlantic Ocean water masses in the journal *Nature Climate Change*.

"The oceans play a vital role in buffering the Earth from climate change by absorbing [carbon dioxide](#) and heat at the surface and transporting it in the [deep ocean](#), where it is trapped for long periods," said Sam Stevens, doctoral candidate at the University of British Columbia and lead author on

the study. "Studying changes in the structure of the world's oceans can provide us with vital insight into this process and how the [ocean](#) is responding to climate change."

One particular layer in the North Atlantic Ocean, a water mass called the North Atlantic Subtropical Mode Water (or STMW), is very efficient at drawing carbon dioxide out of the atmosphere. It represents around 20% of the entire carbon dioxide uptake in the mid-latitude North Atlantic and is an important reservoir of nutrients for phytoplankton—the base of the marine food chain—at the surface of the ocean.



Scientists undertake work collecting water samples each month at the same site in the open ocean nearly 50 miles (80 kilometers) off Bermuda, as part of the Bermuda Atlantic Time-series Study (BATS) to analyzing hydrographic, chemical, and biological parameters throughout the water column. Scientific colleagues and students from around the world also join BATS cruises to undertake associated research, and many use BATS data to investigate a variety of topics, including ocean physics and biogeochemistry, the global carbon cycle, and the ocean's response to climate change. Credit: Tiffany Wardman, Bermuda Institute of Ocean Sciences

Using data from two of the world's longest-running open-ocean research programs—the Bermuda Atlantic Time-series Study (BATS) Program and

Hydrostation 'S'—the team found that as much as 93% of STMW has been lost in the past decade. This loss is coupled with a significant warming of the STMW (0.5 to 0.71 degrees Celsius or 0.9 to 1.3 degrees Fahrenheit), culminating in the weakest, warmest STMW layer ever recorded.

"Although some STMW loss is expected due to the prevailing atmospheric conditions of the past decade, these conditions do not explain the magnitude of loss that we have recorded," said Professor Nick Bates, BIOS senior scientist and principal investigator of the BATS Program. "We find that the loss is correlated with different [climate change](#) indicators, such as increased surface ocean heat content, suggesting that ocean warming may have played a role in the reduced STMW formation of the past decade."

carbon dioxide.

"This is a good example of how human activities are impacting natural cycles in the ocean," said Stevens, who was previously a BATS research technician from 2014 through 2017 before beginning his doctoral work, which leverages the work he did with BATS/BIOS.

**More information:** Samuel W. Stevens et al, A recent decline in North Atlantic subtropical mode water formation, *Nature Climate Change* (2020). [DOI: 10.1038/s41558-020-0722-3](https://doi.org/10.1038/s41558-020-0722-3)

Provided by Bermuda Institute of Ocean Sciences



The CTD (conductivity, temperature, and depth) instrument is the backbone of the Bermuda Atlantic Time-series Study (BATS) program, collecting a variety of physical, chemical, and biological oceanographic data from the North Atlantic Ocean on a monthly basis. Over time, these data points form a time-series, which allow scientists to examine trends in a variety of research areas, including the global carbon cycle and climate change. Credit: Annaliese Meyer, Bermuda Institute of Ocean Sciences

These findings outline a worrying relationship where ocean warming is restricting STMW formation and changing the anatomy of the North Atlantic, making it a less efficient sink for heat and

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