Nourishing the ocean deserts

Rhiannon Mather, Sarah Reynolds and colleagues criss-crossed the Atlantic Ocean armed with pumps and plastic bottles in search of the nutrients that feed open-ocean productivity.

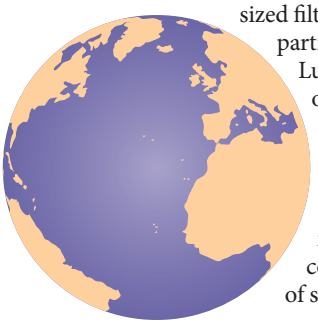
What was the objective of the work?
Inorganic nutrients, such as nitrate and phosphate, are important for plankton growth in the sunlit surface oceans. But even in the extensive regions over the globe where concentrations of inorganic nutrients are very low — often referred to as ocean deserts — there is still phytoplankton growth. We wanted to test the idea that organic nutrients might provide an alternative nutrient source for phytoplankton in these regions, so we set up research cruises in the Atlantic Ocean along 24° N, 36° N, and 20° W to measure and survey the organic nutrient concentrations in a systematic manner.

TIMOTHY LESWORTH

One of the many spectacular sunsets seen by the team.

Why did you choose this particular location for the fieldwork?
In the Atlantic Ocean there are two ocean deserts situated within the basin-wide gyres of ocean circulation that sit north and south of the equator. The two regions differ in the ways they are affected by the atmosphere, as Saharan dust preferentially falls over the North Atlantic gyre. This difference between the otherwise similar ocean gyres effectively sets up an excellent natural study site to compare how different ocean deserts operate.

What sort of samples were you after and was it straight forward to get them back to shore?
We collected samples of sea water to analyse inorganic and organic nutrients using a CTD. The CTD is mounted with sensors that enable us to measure basic oceanographic parameters such as conductivity, temperature and depth, and up to 24 water bottles that can collect water from different depths. We also pumped sea water from the surface layer of the ocean, which was then passed through a pancake-sized filter to collect particulate materials. Luckily, many of the samples could be analysed straight away on ship, which reduced the complications of storage or transportation: samples have to be kept frozen for the length of the cruise and on their way back to the lab. The ship has many freezers, but for transport back to the lab we have to rely on dry ice. The filters and other samples were frozen and analysed back in the lab.



Did you encounter any difficulties?
Not unusually for a research cruise, we experienced some bad weather, which forced us to abandon some of the sample locations. The rain was too heavy and the waves too large for us to sample safely from the deck. In these conditions you are only allowed on deck in exceptional circumstances as waves can often break over the side of the ship, and it becomes very difficult for the officers and crew of the ship to safely deploy the equipment and keep us on station throughout the sampling. We also had to make a few detours to the Azores for some ship maintenance. These were only brief stops but were often happily received, as it was an excuse to walk on solid ground again!

Did you have any encounters with dangerous animals?
We encountered some fantastic animals during the cruises: there were regular sightings of dolphins, whales, turtles, flying fish, sunfish and albatross. The officers of the ship would often announce these sightings so we all could observe. We also saw the occasional shark, but always from the safety of the deck!

Any low points, close misses? What was the highlight of the cruise?
These cruises are expensive to run and logistically challenging. There is really only one shot to get the samples, so hard work is essential. The scientific personnel work shifts of eight hours to enable around the clock sampling, even through the night. There were occasional low points, such as seasickness, but we managed to get great data. The cruises themselves have also allowed us to see some amazing places, such as Bermuda, the Bahamas, South Africa and the Falklands.

Did the trip give you any ideas for future research projects?
We now have more specific questions about how these ocean deserts operate, and their role in drawing down carbon dioxide from the atmosphere. In particular it is unclear how the iron and phosphorus are cycled in these ocean deserts. We hope future cruises may enable us to answer these questions.

This is the Backstory to the work by Rhiannon Mather and colleagues, published on page 439 of this issue.