

In mighty Atlantic Ocean, ecosystem wonders and threats lie below the surface

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Scientists from numerous countries are joining forces to tackle risks to life in the world's second-largest ocean.

During his first offshore expedition in 1997, [marine-biology](#) expert Murray Roberts was shocked to see the state of cold-water corals located west of Scotland's Shetland Islands.

A century earlier, Victorian-era naturalists had described seeing stony thickets of vibrant coral covering many kilometers. But all that Roberts noticed was coral rubble left by an environmentally destructive form of fishing: bottom trawling, which drags weighted nets along the seabed.

Eye-opening moment

"I saw with my own eyes what the deep-sea trawlers had done," said Roberts, a professor of applied marine biology and ecology at the University of Edinburgh in Scotland.

Originally a student of general biology, he switched his focus to marine biology in 1992 after a research stint in the Egyptian Red Sea looking into tropical corals and fish.

Decades of experience in the field landed Roberts the role in 2019 of leading a research project to assess the health of ecosystems in the Atlantic Ocean. The Atlantic is the second-largest ocean in the world, covering more than 106 million square km.

Called iAtlantic, the project is due to end in March 2024 and has focused on deep-sea and open-ocean ecosystems.

The initiative brings together 44 organizations from 16 countries that border the Atlantic. The nations range from Argentina and France to South Africa and the US.

"Without a functioning and healthy ocean, we don't have a functional planet," said Roberts.

Give seas a chance

The iAtlantic researchers have focused on 12 locations of international conservation significance and economic interest.

One is the Sargasso Sea, a subtropical open-ocean system that is bounded by four currents east of North America. Named after the brown Sargassum seaweed found there, it serves as a haven for biodiversity and is the world's only sea without land boundaries.

Another location is a major deep-sea gap in the Mid-Atlantic Ridge. Called the Romanche Fracture Zone, it is an east-west trench that reaches a depth of more than 7,000 meters and has a significant impact on the deep-water circulation of the Atlantic.

A third is a chain of sea mountains off Brazil that extends for approximately 1,200 km and is home to various reef ecosystems and fish communities. The project team has conducted geological and biological surveys of the seamounts.

Looking at the ocean as an interconnected system, the researchers have tried to identify the points at which steady environmental changes cause bigger, irreversible ones—so-called tipping points.

The ocean is a vast, interrelated whole. Changes in one area can affect other parts of it, highlighting the need for close international cooperation to predict and prevent major damage.

Enlightening experiments

In one experiment, the project sent a rig known as a lander to the sea floor in the Cape Verde Basin. There, the researchers enclosed a section

of the seabed, injected algae into it and tracked how the algae moved through all the food chains.

Results from the experiment suggested that rising global temperatures would decrease the carbon-storage potential of the deep sea floor.

The project has also harnessed local and indigenous knowledge. An amateur scientist in Bermuda, for example, had spent 15 years collecting data on humpback whales by looking at their unique tail patterns.

The iAtlantic researchers took that information and used it to reconstruct how the population of the humpback whales had recovered following a 1986 moratorium on commercial whaling.

Results showed that humpback whales began to increase steadily as of 2012.

"If we give ocean species and ecosystems a chance, we see tremendous recovery," said Roberts. "But we have to keep on top of that."

After his experience off the Shetland Islands almost 30 years ago, the United Nations in 2006 passed a resolution that banned trawling in vulnerable ecosystems, including corals.

Roberts called this a defining moment for him by showing that basic environmental improvements were possible when the political will exists at global level.

Circulating currents

The stakes are high on numerous fronts.

For example, Roberts said "relatively strong agreement" exists in the

[scientific community](#) that a key component of ocean circulation is declining.

Known as the Atlantic Meridional Overturning Circulation, or AMOC, it is like a conveyor belt transporting water from north to south and back again and—in the process—warms different parts of the planet while circulating nutrients crucial to sustaining ocean life.

The AMOC makes northern Europe habitable by preventing the weather there from being near-Arctic, and as a result, the collapse of this circulation component would be a disaster, according to Roberts.

Here, iAtlantic joined forces with another research project—TRIATLAS, which ended in November 2023 after more than four years.

TRIATLAS and iAtlantic helped fund the installation in the South Atlantic of scientific moorings to measure variations in the AMOC.

TRIATLAS focused on marine ecosystems in the southern and tropical Atlantic and produced missing pieces of the puzzle when it comes to understanding currents and ecosystems.

"There's a lot less data compared to the North Atlantic," said Noel Keenlyside, a professor of tropical meteorology at the University of Bergen in Norway and the coordinator of TRIATLAS.

Both projects also trained researchers in Brazil and South Africa to use the moorings, which consist of a long wire with an anchor at one end, a buoy at the other and instruments in between.

The moorings allow better understanding of changes in currents—and the oxygen they supply—and the resulting cascading effects on

ecosystems.

Economic element

TRIATLAS included 38 organizations from 15 countries that range from Angola and Brazil to Norway and Spain, forging partnerships with nations and communities for whom the Atlantic has environmental and economic importance.

"Our main intention was to predict marine ecosystems shifts and their societal impacts based on climate predictions," said Keenlyside, who was born in Guyana, a South American nation that borders the South Atlantic.

Across the ocean in countries such as Senegal and Morocco, he said that fish stocks have declined by 80% as a result of overfishing and a changing climate, affecting the ability of local communities to feed themselves.

Here TRIATLAS too recognized the value of local and indigenous knowledge. Because monitoring fisheries is costly, the project developed an inexpensive and easy-to-use [app](#) for fishermen to report data.

The device shows how basic and affordable technologies can help fill knowledge gaps in the management of fisheries in developing nations.

Collaboration to come

Because the amounts of data on the open sea collected by TRIATLAS and iAtlantic were unprecedented, the projects will continue to feed scientific work in the area for years to come.

Both projects are part of an initiative to improve international collaboration known as the All-Atlantic Ocean Research and Innovation Alliance.

The EU itself has made marine protection a policy priority, pledging in a special mission that features research initiatives to restore oceans and seas by 2030.

As it draws to a close, iAtlantic will recommend more environmental impact assessments of deep-sea mining and the usefulness of local and indigenous knowledge in related research.

Future research priorities include monitoring the moorings that were installed and using satellite data to expand knowledge about the Atlantic.

For its part, the TRIATLAS team is urging policymakers to pursue an Atlantic scientific network at regional, national and local levels.

Keenlyside stressed the urgency of protecting ocean ecosystems while addressing the headline threat to Earth as a whole of global warming.

"We talk a lot about the climate emergency, but the ecosystem emergency is just as important," he said.

More information:

- [iAtlantic](#)
- [TRIATLAS](#)

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