



The Ocean's Biological Deserts Are Expanding

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ScienceNOW Daily News
25 January 2008

High and dry.

The least biologically productive regions of the ocean--the subtropical gyres (darkest blue)--are getting bigger.

Credit: NASA/GSFC/SeaWiFS

warming models predict.

The Sahara, the Gobi, the Chihuahuan--all are great deserts. But what about the South Pacific's subtropical gyre? This "biological desert" within a swirling expanse of nutrient-starved saltwater is the largest, and least productive, ecosystem of the South Pacific. Together with the subtropical gyres in other oceans, biological deserts cover 40% of Earth's surface. But their relative obscurity may be about to change. Researchers are reporting that the ocean's biological deserts have been expanding, and they are growing much faster than global

The evidence comes from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) onboard the orbiting SeaStar spacecraft. Launched in 1997, SeaWiFS maps ocean color around the globe. The green of the photosynthetic pigment chlorophyll a is a measure of the abundance of plant life, which supports the base of the food chain. In an upcoming *Geophysical Research Letters* paper, biological oceanographer Jeffrey Polovina of the U.S. National Marine Fisheries Service in Honolulu, Hawaii, and his colleagues describe how they charted the changing size of the central region of faintest green in the subtropical gyres of the North and South Pacific, North and South Atlantic, and South Indian oceans from SeaWiFS's launch through 2006.

All of the biological deserts had grown, except the South Indian Ocean's. The total expansion was 6.6 million square kilometers or 15%, and it happened as the shallow waters of the gyres were warming. "We're seeing this pattern in each of the four ocean basins," says Polovina. That suggests to him that global warming could be the ultimate cause of the observed desert expansion.

Gyre waters are already strongly layered, so stirring by the wind brings little of the nutrients stored in deep waters to the surface to fuel plant and ultimately animal growth. Warming further strengthens this stratification, making such nourishing mixing all the more difficult. Climate-ecosystem models predict that global warming will exacerbate ocean desert expansion, but not this quickly, Polovina notes. During the past 9 years, gyre deserts expanded 10 to 25 times faster than modeled.

The trend feels solid to other scientists. "Everything seems to hold together," says SeaWiFS project scientist Charles McClain of NASA's Goddard Space Flight Center in Greenbelt, Maryland, who was not affiliated with the study. A variety of oceanographic observations and modeling is consistent with warming driving the expansion of the gyres and their low-productivity waters, he says. A lingering question, he adds, is whether part or even all of the expansion might be just a natural variation that could reverse itself in a decade or two. "We can't rule that out," says Polovina. One thing's for sure: Given the limited lifetimes of orbiting spacecraft, SeaWiFS won't be around long enough to find out.