

# South China Sea found to have heightened levels of anthropogenic surface nitrogen

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Credit: Tiago Fioreze / Wikipedia

(Phys.org)—A team of researchers from Taiwan and the U.S. has found evidence of higher levels of anthropogenic surface nitrogen in the South China Sea, likely due to an increase in atmospheric nitrogen levels. In their paper published in the journal *Science*, the group describes their study of nitrogen deposition on coral reefs over the past half-century. Edward Boyle with MIT offers a Perspective [piece](#) on the work done by

the team in the same issue along with an outline of nitrogen ocean processes.

Prior to the arrival of humans, nitrogen levels at or near the [ocean surface](#) were stable due to upward mixing of nitrate ions dissolving in deep [water](#). That nitrogen was then consumed by phytoplankton and returned to the depths when they died. But humans have changed things by pumping nitrogen into the atmosphere by burning gasoline or coal and dropping it onto the ground to fertilize crops. Nitrogen makes its way to streams and rivers and eventually into the ocean. Computer models suggest the likelihood that human endeavors have led to doubling of ocean surface nitrogen levels, but because ocean water samples were not collected until recently, there has been no way to prove the models correct. In this new effort, the researchers sought to do so by measuring nitrogen isotopes in proteins captured in aragonite skeletons of banded coral collected from Dongsha Atoll in the South China Sea.

The coral samples were dated and found to be on average 45 years old, and were also found to harbor the isotope  $^{15}\text{N}$  over time, which allowed for measuring the amount of nitrogen in the ocean over the years of their life. The researchers report that they found a decrease of  $^{15}\text{N}$  that allowed them to calculate the amount of nitrogen in the water—they found that nitrogen due to human impact now makes up approximately 20 percent of the nitrogen found in ocean surface water. The team then noted that by measuring the levels over time, it was clear that the increase was due more to atmospheric nitrogen sources (burning of fossil fuels) than fertilizer use. They report also that their measurements were sensitive enough to observe seasonal changes in [nitrogen](#) levels due to the inflow of fresh water during monsoon seasons.

**More information:** Haojia Ren et al. 21st-century rise in anthropogenic nitrogen deposition on a remote coral reef, *Science* (2017). [DOI: 10.1126/science.aal3869](https://doi.org/10.1126/science.aal3869)

**Abstract**

With the rapid rise in pollution-associated nitrogen inputs to the western Pacific, it has been suggested that even the open ocean has been affected. In a coral core from Dongsha Atoll, a remote coral reef ecosystem, we observe a decline in the  $^{15}\text{N}/^{14}\text{N}$  of coral skeleton-bound organic matter, which signals increased deposition of anthropogenic atmospheric N on the open ocean and its incorporation into plankton and, in turn, the atoll corals. The first clear change occurred just before 2000 CE, decades later than predicted by other work. The amplitude of change suggests that, by 2010, anthropogenic atmospheric N deposition represented  $20 \pm 5\%$  of the annual N input to the surface ocean in this region, which appears to be at the lower end of other estimates.

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