North Sea efficient sink for carbon dioxide

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A relatively large number of algae grow in the North Sea. These form the basis for a much richer food chain than that found in the Atlantic Ocean. Dutch-sponsored researcher Yann Bozec calculated that coastal seas such as the North Sea remove about three times as much carbon dioxide from the atmosphere than would be expected on the basis of their small surface area.

The measured annual increase in the concentration of carbon dioxide (CO_2) in the atmosphere is only 60 percent of the annual emissions from fossil fuels. The other 40 percent is absorbed by the seas and oceans. Yann Bozec investigated how the North Sea fulfils this task.

Up until now, little was known about the concentrations and transport cycle of CO2 in the North Sea. This lack of data was rectified with four expeditions, each of one-month duration, with the oceanographic research vessel 'Pelagia' from the Royal Netherlands Institute for Sea Research (NIOZ). Per expedition the researchers made a vertical water profile at 97 locations. Travelling between locations they also measured the levels of CO_2, nutrients (phosphate, nitrogen and silicate), and the amount of algal growth. This resulted in the most extensive and accurate data set ever for a coastal sea.

Bozec used these data to calculate how much carbon dioxide the North Sea absorbs from the atmosphere each year and then stores in the deep North Atlantic Ocean. This storage capacity was found to be almost three times as high as the average for all of the world's seas. When the data over the entire North Sea were pooled, this gave an annual net

uptake of carbon dioxide of no less than 8.5 million tonnes of carbon per year. If this performance is theoretically extrapolated to all of the world's coastal seas - of which the North Sea constitutes just 2 percent - then these would together account for about 20 percent of the carbon dioxide uptake for all of world's seas, even though they only account for 7 percent of the sea surface. Therefore coastal seas absorb CO_2 far more efficiently than open oceans.

Seawater can absorb carbon dioxide in two different ways. The 'physical pump' works as a result of the CO_2 concentration in the atmosphere being higher than that in the seawater. As nature always tries to restore the balance, carbon dioxide flows from the atmosphere into the surface of the seawater. In the winter, the surface water in the cold polar seas cools down and becomes slightly heavier. As a result of this it sinks under its own weight into the deep sea.

The second way is by algae fixing carbon dioxide under the influence of sunlight (photosynthesis). This mechanism is important in the North Sea. Algae grow in the surface water and form their cell material by assimilating carbon dioxide from the seawater. This reduces the carbon dioxide concentration in the seawater thereby allowing more carbon dioxide to be absorbed from the atmosphere. The algae are further assimilated in the entire food web. As a result of this water that flows out of the North Sea is much richer in organisms (and carbon-containing waste products from these) than the inflowing, blue oceanic water.

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