

When accounting for the global nitrogen budget, don't forget fish

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Like bank accounts, the nutrient cycles that influence the natural world are regulated by inputs and outputs. If a routine withdrawal is overlooked, balance sheets become inaccurate. Over time, overlooked deductions can undermine our ability to understand and manage ecological systems.

Recent research by the Université de Montréal (Canada) and the Cary Institute of Ecosystem Studies (Millbrook, New York) has revealed an important, but seldom accounted for, withdrawal in the global nitrogen cycle: commercial fisheries. Results, published as the cover story in the February issue of *Nature Geoscience*, highlight the role that fisheries play in removing nitrogen from coastal oceans.

Nitrogen is essential to plant and animal life; however, it is possible to have too much of a good thing. During the past century, a range of human activities have increased nitrogen inputs to coastal waters. Fertilizer run-off is the best documented and most significant source of terrestrial nitrogen pollution. Nitrogen-rich fertilizer applied to farmland eventually makes its way into coastal waters via a network of streams and rivers.

Research spearheaded by Roxane Maranger (Université de Montréal) and Nina Caraco (Cary Institute) demonstrates that commercial fisheries play an important but declining role in removing terrestrial nitrogen from coastal waters. Accounting for this withdrawal is crucial; terrestrial-derived nitrogen can stimulate coastal phytoplankton growth, leading to

eutrophication. Eutrophic waters are characterized by reduced dissolved oxygen, decreased biodiversity, and species composition shifts.

Because fish accumulate nitrogen as biomass, and humans move fish from the ocean to the table, commercial fisheries return part of this terrestrial-generated nitrogen back to the land. In the 1960s, nitrogen removal in fish harvest was equivalent to 60% of the nitrogen fertilizer delivered to coastal ecosystems throughout the world. Today, this figure has dropped to 20%; fish harvest has not (and cannot) keep pace with escalating nitrogen runoff.

A continued decline in the proportion of nitrogen withdrawn by fishery harvests will contribute to an increase in the balance of nitrogen in coastal waters. From a historical perspective, this is bad news. Throughout the world, these ecosystems are becoming richer in nitrogen, resulting in increased phytoplankton blooms, anoxic bottom waters, and coastal dead zones.

Source: Institute of Ecosystem Studies

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