AQUATIC ECOSYSTEMS ARE THE MOST UNCERTAIN BUT POTENTIALLY LARGEST SOURCE OF METHANE ON EARTH

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Atmospheric methane is a potent greenhouse gas that has tripled in concentration since pre-industrial times. The causes of rising methane concentrations are poorly understood given its multiple sources and complex biogeochemistry. Natural and human-made aquatic ecosystems, including wetlands, are potentially the largest single source of methane, but their total emissions relative to other sources have not been assessed. Based on a new synthesis of inventory, remote sensing and modeling efforts, we present a bottom-up estimate of methane emissions from streams and rivers, freshwater lakes and reservoirs, estuaries, coastal wetlands (mangroves, seagrasses, salt-marshes), intertidal flats, aquaculture ponds, continental shelves, along with recently published estimates of global methane emissions from freshwater wetlands, rice paddies, the continental slope and open ocean. Our findings emphasize the high variability of aquatic methane fluxes and a possibly skewed distribution of currently available data, making global estimates sensitive to statistical assumptions. Mean emissions make aquatic ecosystems the largest source of methane globally (53% of total global methane emissions). Median emissions are 42% of the total global methane emissions. We argue that these emissions will likely increase due to urbanization, eutrophication and climate change.