

Harmful Algal Blooms and Toxicity in the Sea: A Global Increase?

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Some remarkable, unusual parallel events relative to the historical record, and suggestive of a major change in microalgal (= phytoplankton) dynamics and associated foodweb processes, may be occurring in the sea: increased regional harmful algal bloom (HAB) outbreaks of indigenous species; novel HAB events in regions previously free from such events and sometimes becoming persistent; geographical range expansion of toxic species; toxic outbreaks of species previously considered to be benign, and even nutritionally advantageous; occurrence of new types of human toxicity accompanying shellfish consumption; increased aquacultural losses due to HAB; novel dieoffs of foodweb components, such as whales, attributed to toxic bloom events. Collectively, these phenomena have been declared by some to indicate a global epidemic of harmful algal blooms is currently in progress in the sea. Others disagree, contending that this conclusion is merely the result of increased scientific awareness because of improved surveillance or increased aquacultural activities. Among those favoring the global epidemic paradigm, two divergent causation theories have been proposed. The anthropogenic theory holds that long-term trends in increased frequency and dynamics of "red tide" outbreaks of indigenous species, both benign and harmful, have accompanied cultural nutrient enrichment of coastal waters and inland seas on a global scale, including alterations in nutrient ratios which influence species selection. In the case of non-indigenous species, ballast water vectoring of introduced toxic species leading to their subsequent blooms has been proposed. Adherents of the "natural" causes theory have sought linkages to climatological factors. The global evidence for the HAB epidemic paradigm is evaluated. Events and conditions in the Baltic Sea, Dutch Wadden Sea, North Sea, Black Sea and Seto Inland Sea, among other regions, will be considered in this analysis.