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Comparison of natural and anthropogenic nutrient sources in the Southern California Bight

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ABSTRACT

Eutrophication of coastal waters has greatly increased in the last several decades throughout the world, with demonstrated linkages to anthropogenic nutrient loads. Anthropogenic inputs been shown to provide significant sources of nitrogen that have been linked to increased primary production and are considered the most significant factor contributing to the global increase in harmful algal blooms (HABs). While a growing number of studies have suggested a linkage between anthropogenic nitrogen sources and HABs in California, there is a general perception that in upwelling regions, such as California, the flux of anthropogenic nutrient inputs are small relative to upwelling flux, and therefore they have relatively little effect on the productivity of coastal waters. However, no studies to date have quantified the natural and anthropogenic inputs on regional and local scales in the SCB to verify the accuracy of this perception. In order to test the hypothesis that natural sources (e.g., upwelling) greatly exceed anthropogenic nutrient sources to the SCB, this study compared the contributions of nitrogen (N) from four major nutrient sources: 1) upwelling, 2) treated wastewater effluent discharged to ocean outfalls, 3) riverine runoff, and 4) atmospheric deposition. This comparison was made using large regional datasets combined with modeling on both regional (SCBwide) and sub-regional scales. The results from this study show that at the regional bight-wide spatial scale, upwelling is the largest source of nitrogen by an order of magnitude to effluent and two to riverine runoff. However, at smaller spatial scales, natural and anthropogenic contributions were equivalent. In particular, wastewater effluent and upwelling contributed the same quantity of nitrogen in several regions of the SCB. These findings contradict the currently held perception that in upwellingdominated marine ecosystems, anthropogenic nutrient inputs are negligible and are consistent with the growing number of studies that have suggested a linkage between anthropogenic nitrogen sources and HABs in California nearshore waters. These results of this study suggest that anthropogenic nutrients cannot be dismissed as a significant source of nutrients for algal blooms in the SCB.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2012AnnualReport/ar12_029_048.pdf