An investigation of submarine groundwater–borne nutrient fluxes to the west Florida shelf and recurrent harmful algal blooms

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Limnol. Oceanogr., 57(2), 2012, 471-485 | DOI: 10.4319/lo.2012.57.2.0471

ABSTRACT: A cross-shelf, water-column mass balance of radon-222 (^{222}Rn) provided estimates of submarine groundwater discharge (SGD), which were then used to quantify benthic nutrient fluxes. Surface water and groundwater were collected along a shore-normal transect that extended from Tampa Bay, Florida, across the Pinellas County peninsula, to the 10-m isobath in the Gulf of Mexico. Samples were analyzed for ^{222}Rn and radium-223,224,226 (^{223,224,226}Ra) activities as well as inorganic and organic nutrients. Cross-shore gradients of ^{222}Rn and ^{223,224,226}Ra activities indicate a nearshore source for these isotopes, which mixes with water characterized by low activities offshore. Radon-based SGD rates vary between 2.5 and 15 cm d^{-1} proximal to the shoreline and decrease offshore. The source of SGD is largely shallow exchange between surface and pore waters, although deeper groundwater cycling may also be important. Enrichment of total dissolved nitrogen and soluble reactive phosphorus in pore water combined with SGD rates results in specific nutrient fluxes comparable to or greater than estuarine fluxes from Tampa Bay. The significance of these fluxes to nearshore blooms of *Karenia brevis* is highlighted by comparison with prescribed nutrient demands for bloom maintenance and growth. Whereas our flux estimates do not indicate SGD and benthic fluxes as the dominant nutrient source to the harmful algal blooms, SGD-derived loads do narrow the deficit between documented nutrient supplies and bloom demands.