Tidal dynamics of dissolved and particulate matter and bacteria in a tidal flat ecosystem in spring and fall

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ABSTRACT: Tidal flat ecosystems are highly dynamic environments with tremendous short-term and long-term changes in physical, chemical, and biological properties. We measured salinity, temperature, oxygen, dry weight (dry wt), inorganic (PIC) and organic carbon (POC) fractions of suspended particulate matter (SPM), and chlorophyll *a* (Chl *a*); counted numbers of free-living and particle-associated bacteria; and measured dissolved amino acids and carbohydrates, and ectoenzymatic activities throughout tidal cycles in the Spiekeroog tidal flat system of the German Wadden Sea in November 1999 and May 2000. Bacterial production was measured only in May 2000. In November, high sediment resuspension, as indicated by increased amounts of SPM, PIC, and POC, mainly controlled bacterial dynamics and led to enhanced numbers of aggregate-associated bacteria. In contrast, in May, phytoplankton-related processes mainly influenced bacterial dynamics. Increased concentrations of oxygen, Chl *a*, and dissolved combined neutral monosaccharides resulted in high numbers of free-living bacteria, elevated ß-glucosidase activities, and high bacterial production rates. The introduction of foreign water masses, either from the open North Sea or adjacent tidal basins, as reflected by different signatures of SPM and the mole percent composition of particulate combined amino acids, appeared to be a regular event in this highly dynamic system and rapidly changed physical, chemical, and biological processes.