Sequential resuspension of protists by accelerating tidal flow: Implications for community structure in the benthic boundary layer

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ABSTRACT: We measured resuspension thresholds of protists and bacteria at a subtidal coastal site with in situ flumes and by sampling the benthic boundary layer during tidal accelerations. Heterotrophic nanoflagellates, oligotrich ciliates, the diatom *Navicula distans*, and bacteria resuspended in weak flow (friction velocity u_{*crit} = 0.25-0.80 cm s^{-1}), likely associated with a surficial fluff layer of sediment. Hypotrich ciliates, scuticociliates, and the diatoms *N. transitans* and *Pleurosigma* sp. resuspended in moderate flow (u_{*crit} = 0.82-1.3 cm s^{-1}), followed by pigmented nanoflagellates and diatoms of two *Nitzschia* spp. in strong flow (u_{*crit} >= 1.5 cm s^{-1}). Hypotrichs and scuticociliates resuspended independent of sediment erosion thresholds, whereas most diatoms resuspended with bulk sediment. Differing thresholds may be due to cell size, specific gravity, behavior, or association with particles. As tidal currents accelerated to u_* = 1.3 cm s^{-1}, resuspension caused cell concentrations at 5 cm above bottom to increase by 2-16 times, varying among taxa. Community structure shifted accordingly, with total oligotrichs, hypotrichs, and scuticociliates changing from 75% to 96% of the ciliate community and the total diatom taxa listed above changing from 37% to 63% of the pennate cells. Sequential resuspension suggests that the species assemblage entering the water column during a resuspension event depends on the maximal bed shear stress, thus varying with the springneap cycle as well as atmospheric forcing and local hydrography. Flow-induced fluctuations of community structure may influence microbial food-web dynamics in the benthic boundary layer and sediment.