



Linking the physiologic and phylogenetic successions in free-living bacterial communities along an estuarine salinity gradient

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ABSTRACT: In this paper we assess whether the bacterial compositional succession that occurs along an estuarine salinity gradient is accompanied by changes in both community and single-cell metabolic activity in the free-living bacterioplankton. In addition, we explore whether up- and downstream estuarine communities, which are dominated by different phylogenetic groups, show distinct patterns in single-cell activity and characteristics. We have characterized the physiological succession of the bacterioplankton along the salinity gradient in the Choptank River Estuary (Maryland), using a combination of indices of single-cell activity, which include respiratory activity, membrane polarization and integrity, and DNA and RNA contents, combined with flow cytometry. We have also measured bacterioplankton community production, respiration, and growth efficiency along the estuary. Our data suggest that the sharp phylogenetic succession that occurs within the fresh to saltwater transition region is accompanied by profound metabolic changes both at the single-cell and community levels and that the phylogenetic succession occurs together with measurable physiological stress. The different indices of single-cell characteristics that we have used converge to suggest that within the fresh to saltwater transition zone, there is generalized decline in growth and possibly a loss of activity and even significant cell mortality. At the community level, these changes in singlecell physiology at the site of the phylogenetic succession appear to translate into a generalized decline in bacterial growth efficiency with a decrease in bacterial growth and production but an actual increase in bacterial carbon consumption. Our data also suggest that different phylogenetic groups may have intrinsically different levels of single-cell activity or at least respond differently to the activity assays that we currently use.

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