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Effect of fluid shear and irradiance on population growth and cellular toxin content of the dinoflagellate Alexandrium fundyense

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ABSTRACT: The potential for in situ turbulence to inhibit dinoflagellate population growth has been demonstrated by experimentally exposing dinoflagellate cultures to quantified shear flow. However, despite interest in understanding environmental factors that affect the growth of toxic dinoflagellates, little is known of the effect of shear on the growth of toxin-producing dinoflagellate species. Cultures of the dinoflagellate, *Alexandrium fundyense*, a producer of toxins responsible for paralytic shellfish poisoning, were exposed to quantified laminar shear generated in Couette flow for 1-24 h d^{-1} over 6-8 d. Shear stress in all experiments was 0.003 N m^{-2}, similar to levels expected in near-surface waters on a windy day. Net population growth decreased with shear exposures >1 h d^{-1} and became negative with exposures >12 h d^{-1}. Cellular toxin content at the end of each experiment was measured by a receptor-binding assay that used [3H]saxitoxin. Toxin $cell^{-1}$ of cultures sheared for >1 h d^{-1} increased up to three times that of control cultures. Cellular toxin content increased significantly as growth rate of sheared cultures decreased. However, varying culture growth rate using irradiance had no significant effect on toxin $cell^{-1}$. Because shear stress levels used in this study were plausible for near-surface turbulent flows, oceanic turbulence may inhibit population growth and increase cellular toxin content of *A. fundyense*. However, in natural populations it would be difficult to distinguish the effect of turbulence on toxin content from other influences on toxin variability, particularly if volume-or mass-specific, rather than cell-specific, measures of toxin are used.

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