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Spatial trends in community richness, diversity, and evenness across rocky intertidal environmental stress gradients in eastern Canada

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ABSTRACT: An environmental stress model (ESM) developed by B. A. Merrett and colleagues predicts how local-scale richness and diversity (terms often used interchangeably) should vary with environmental stress. We tested model predictions by sampling rocky intertidal communities across vertical (elevation) and horizontal (wave/ice exposure) stress gradients on the Gulf of St. Lawrence (which freezes in winter) and open Atlantic (which does not freeze in winter) coasts. Winter conditions are harsher than on most temperate shores studied previously. We found a wide to-high range of stress: richness and diversity would be lowest in high stress (high elevation) and highest in low stress (low elevation). Results matched predictions across vertical gradients (richness and diversity negatively related to elevation) and across horizontal gradients on the Gulf coast (richness and diversity related to wave/ice exposure) but not entirely on the Atlantic coast (richness and diversity showed an opposite trend). The spatial changes in evenness were also related to stress. Richness and diversity were higher on the Atlantic than on the Gulf coast, despite stronger physical stress (winter ice scour) on the Gulf coast. Our study indicates that differences in richness and diversity to local-scale environmental stress, contrary to common assumptions, are not necessarily such differences might occur, future ESM studies should investigate both vertical and horizontal gradients. Richness determines diversity.

KEY WORDS: Diversity · Elevation · Environmental stress gradient · Evenness · Intertidal · Ice exposure

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