Seasonal disturbance to mussel beds: Field test of a mechanistic model predicting wave dislodgment

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ABSTRACT: We report the first field confirmation of a mechanistic model predicting fine-scale temporal dynamics of wave dislodgment, an important disturbance process structuring many temperate rocky intertidal communities. A biomechanical approach is used to predict the frequency and severity of mussel dislodgment from wave-swept shores in Rhode Island over a 3-yr period. Using inputs of wave height and mussel attachment, the model correctly predicts strong dislodgment events during hurricane season (August to October, ~10% monthly loss), a period when large waves coincide with relatively weak mussel attachment. Such a mechanistic approach, incorporating temporal variation in both environmental challenges and physiological tolerances, is necessary to predict patterns of environmental stress; such predictions cannot be made from environmental forecasts alone. In addition to wave dislodgment, we report substantial mussel mortality due to temperature stress (up to 50% monthly loss). These two physical agents, which caused equivalent mussel mortality in our 3-yr study, are likely to be influenced by future global climate shifts.

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