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Title: Individual-Based Model (Ibm) Predicting Impacts Of Climate Change On Diversity In A Representative Submerged Aquatic Vegetation (Sav) Community Of The Chesapeake Bay

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ABSTRACT

The Intergovernmental Panel on Climate Change (IPCC) released their fourth report using the six Special Report Emission Scenarios (SRES), predicting a *likely* increase in air temperature ranging from 1.1^{o}C to 6.4^{o}C, over the next century. Projected acceleration of temperature increase due to climate change raises concerns about the community-level impacts that could be seen in the various ecosystems. Temperature changes impact process and production rates of species that make up a community, possibly changing population densities or vulnerability to predation (Vannote and Sweeney, 1980). In the Chesapeake Bay submerged aquatic vegetation (SAV) provides many ecosystem functions, including being a source of food and refuge for various species. In the Bay, over the past few decades, SAV populations have declined markedly in local diversity and acreage (Orth et al, 2006a; Moore, 2009). The individual-based model Aquatic Biodiversity Climate Change (ABC2) was created to investigate if climate change will have a negative impact on eelgrass (*Zostera marina*) in the Chesapeake Bay and if the predator-prey relationships in this community might be altered based on changes to the *Z. marina* population. In the ABC2 model, observed life-cycles and behaviors of the three species

(eelgrass, caprellids and spot) were utilized to design the individual agent types. These observations were gathered through scientific literature review. Seasonal temperatures play a large role in eelgrass growth. In the Bay, eelgrass are slow-growing in the winter when temperatures are low and experience defoliation in August-September due to temperatures >25^{o}C (Nejrup and Pedersen, 2008; Orth and Moore, 1986). In the model, the eelgrass population followed these seasonal fluctuations, except with slight changes that emerge over time in the runs. In model runs with a high *likely* increase (+0.064^{o}C per year) the eelgrass populations were depressed for more days following high temperatures in the summer compared to the eelgrass populations in the runs with a low *likely* increase (+0.011^{o}C per year). The eelgrass biomass was slower to rebound in the warmer model runs; this impacted the predator-prey relationship. The predator in the model, spot (*Leiostomus xanthurus*) has a higher success of consuming prey, caprellid amphipods (*Caprella sp.*) when eelgrass density levels are < 516 m^{-2}. This lower eelgrass density occurs for a longer timeframe in the model runs with the high *likely* temperature increase (+0.064^{o}C per year), leaving the caprellids vulnerable to predation for a longer time each year, leading to a reduction in the population.