The article, *Modeling harmful algal blooms in a changing climate,* was written by David Ralston and Stephanie Moore from the Woods Hole Oceanographic Institution and NOAA's division of Environmental of Fisheries Sciences Division, respectively. Ralston and Moore first review previous studies that have be done that model harmful algal blooms (HABs) with regards to future climate changes, and then provide their recommendations for future studies to address these issues. HABs could potentially respond to a changing climate in many different ways, depending on the changes of different environmental factors: increased temperatures, increased stratification of waterbodies, changes in nutrient loadings and nutrient composition, light intensity, and ocean acidification. Regarding the present climate, two different types of models are used to simulate HABs: statistical models and process-based or mechanistic models. Statistical models use observations that relate important forcing variables (e.g., nutrient concentrations, temperature, or wind speeds) with measures of HABs (time of HAB growths, abundance and spatial characteristics, and toxicity). Statistical models are typically used for short-term time scales. Process-based models use equations to simulate HAB processes; these models require known transport pathways, relationships and large amounts of data to represent these processes.

Few articles have modeled HABs with regard to climate change implications. After reviewing the few studies (fewer than 10) that have been done, the authors laid effective modeling infrastructure and recommendations for HABs regarding climate change. First, future models should use process-based models because they have advantages over statistical models due to their long-term time scales and greater complexity that allows different climate change aspects to be analyzed. Second, Ralston and Moore recommend using an ensemble approach to address the uncertainty from long-term projections and different parameterizations and variability. This approach considers many different inputs factors and effects on the uncertainty in an effort to double-check the model. The last two recommendations are for the use of downscaled climate models and to verify the models with long-term observations. Modeling HABs with climate change is an important and emerging field that is important for future ecosystem and human health implications. Modeling future effects could allow key mitigation and policy efforts to me enacted to combat increased effects of HABs with climate change.