

Climate Change and Atlantic Surfclams: A Coupled System Study

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The Atlantic surfclam fishery lands 22,000 metric tons annually, (worth \$39 million), making it one of the most valuable single species commercial fisheries in the US. Since 1997, populations from southern inshore regions of the clam's range have experienced significant mortality co-incident with warm bottom water temperatures (reaching 21-24°C in September). Resulting changes in population distribution have major implications for the clam fishery. The processes underlying this ongoing range shift are being investigated using a multi-disciplinary approach that includes an individual-based population model that simulates the growth of post-settlement surfclams. The individual-based biological model includes phenotypic variability and individual adaptation to environmental conditions. Hindcast simulations using this model reproduced observed mortality events from southern inshore regions of Virginia through New Jersey, consistent with the northward range shift. In simulations, higher temperatures decreased ingestion, caused stunted growth, reproductive failure, and eventual starvation and death. Additional simulations examining changes in population range and demographics resulting from climate warming will be discussed. Integrating predictions from the biological model with those of other disciplines (physical oceanography, economics and anthropology) provides comprehensive guidance for a proactive approach to Atlantic surfclam management in the face of climate-driven shifts in resource distribution.