

US EPA ARCHIVE DOCUMENT



Trophic Interactions of Two Invasive Crab Species, *Carcinus maenus* and *Hemigrapsus sanguineus*, and Their Effects on Indigenous Mollusc Populations

Environmental Issue

Invasions: Introduction of non-indigenous species to coastal systems is a major and growing environmental problem that impacts biological and evolutionary processes as well as local and regional economies.

The green crab, *Carcinus maenus*, well-established throughout the Gulf of Maine, arrived on the northeast Atlantic coast over 100 years ago. This highly invasive species established quickly, decimated the soft shell clam industry in many areas, competed for resources with lobster and other crustacea, and caused morphological changes in indigenous molluscan prey. The recent arrival on the Atlantic coast of the shore crab, *Hemigrapsus sanguineus* has brought further complexity to areas previously impacted by *C. maenus*. Its range currently extends only as far north as the southern Gulf of Maine. However, with continued rise in ocean water temperatures, this secondary invader could extend its range widely. It is not clear what the cumulative impact of these two invasive crab species will be on molluscan prey over their entire latitudinal range. Crabs are capable of modifying their morphology adaptively in response to prey shell defenses. These modifications in claw size and strength depend on growth rates, which, in turn, are affected by temperature. Temperatures vary substantially in the Gulf of Maine, increasing from Massachusetts northward. Because temperature affects each species' foraging and growth rates differently, their respective impacts on mollusc populations may vary over both the current and projected geographical range. It is important for both environmental and economic reasons to understand and predict impacts on prey populations.

Scientific Approach

Hypothesis: Ecological factors such as temperature affect claw morphology and foraging and growth rates of invasive crab predators. Latitudinal differences in temperature alter trophic interactions between these species and ultimately their impact on indigenous molluscan populations.

Research Plan:

Research will be done over a latitudinal range to compare effects of temperature on phenotypic plasticity of both invasive species and their prey and its impacts on trophic interactions.

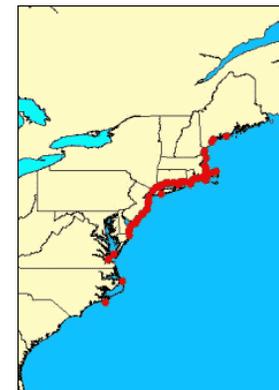
Measure and compare effects of temperature on foraging and growth rates of *C. maenus* and *H. sanguineus* between northern and southern sites.



C. maenus.



H. sanguineus



Current range of *H. sanguineus*

Impact

Gulf of Maine/Atlantic Coast

The results of the study will:

- help predict the eventual range and impact of *H. sanguineus* as it spreads north;
- increase understanding of trophic interactions between invasive species and the role of phenotypic plasticity in marine invasions.

Other ecosystems

This study will:

- help invasion biologists understand ecological factors mediating individuals' fitness that may, in turn, promote or limit range expansion by introduced species;
- enable prediction of ecological and economic consequences and the extent of their spread.