STOCK ENHANCEMENT AND ECOSYSTEM CARRYING CAPACITY IN BLUE CRAB NURSERY HABITATS OF CHESAPEAKE BAY

Rochelle Seitz*, Rom Lipcius, Katie Knick, Mike Seebo, and W. Chris Long
Virginia Institute of Marine Science, The College of William and Mary
P.O. Box 1346, Gloucester Point, Virginia 23062, USA
seitz@vims.edu

Over the past 10 years, the blue crab, *Callinectes sapidus*, has experienced an 84% decline in spawning stock biomass in Chesapeake Bay. One method to restore blue crab populations in is enhancement of the natural population with juvenile hatchery-reared crabs. For the last 3 years, we have conducted field experiments on the effects of enhancement in small-scale ecosystems to determine if the shallow, marsh-fringed nursery habitats in lower Chesapeake Bay are below carrying capacity. Juvenile blue crabs were either collected in seagrass beds or obtained from hatcheries and released in shallow mud coves in the York River. Blue crabs showed an increase in the enhanced coves, whereas no increase was observed in control coves. Benthic resources were examined through time in enhanced and control coves.

In 2003, densities of *Macoma balthica*, a clam that makes up ~50% of the blue crab diet, were initially high in enhanced coves, and decreased to a level equivalent to control coves by the end of the experiment. The population trajectory of all clams remained well above a low-density threshold, suggesting that the system is above carrying capacity and could handle further enhancement.

In 2004, we examined juvenile crab survival in the presence and absence of high densities of infaunal clams that may serve as alternative prey for cannibalistic adult crabs. Survival of juvenile crabs was highest where clam densities were lowest, suggesting that alternative prey did not afford extra protection, but may have led to higher densities of adult crabs due to bottom-up control.

In 2005, in early spring, the benthic community in control and enhanced sites included a large percentage of amphipods and isopods, with many clams and polychaetes. In addition, benthic prey analyses showed that clam densities in all experimental coves were high (200-500 individuals/m^2) throughout the summer and paralleled crab densities. Crab densities were significantly correlated with densities of major benthic prey including clams, polychaetes, and small crustaceans (e.g., amphipods and isopods). Moreover, gut contents of juvenile crabs showed an ontogenetic shift from a majority of small crustaceans (amphipods and isopods), plant material, and polychaetes in guts of crabs < 20 mm carapace width, to more bivalves in larger juveniles 20-40 mm carapace width. There was no evidence of cannibalism in individuals < 20 mm carapace width.

We conclude that the blue crab population in the experimental coves was increased by enhancement, and that enhancement using hatchery-reared crabs caused no detrimental changes to the ecosystem. This suggests that the ecosystem is below carrying capacity, that the blue crab is recruitment and not resource limited, and that enhancement may be a viable method of restoring the Chesapeake Bay blue crab population.