Spatial and temporal distribution of *Hemigrapsus sanguineus* in Narragansett Bay, RI: Implications for invasive species management

Nicole E. Rohr[1], Kenneth Raposa[2], and Carol S. Thornber[1]

[1] Department of Biological Sciences, University of Rhode Island, [2] Narragansett Bay National Estuarine Research Reserve

INTRODUCTION

Biodiversity is an important indicator of healthy and resilient marine ecosystems, and maintenance of this ecological indicator has been highlighted as a management goal for ecosystems around the world. The Asian shore crab, *Hemigrapsus sanguineus* (Fig. 1), was first discovered off the coast of New Jersey in 1988 and has Since become common in Narragansett Bay, RI (NB). *H. sanguineus* frequently outcompetes established green crabs, *Carcinus maenas*[1], which has led to the displacement of *C. maenas* from the intertidal zone of cobble beaches in NB[2]. This invasional replacement could have significant changes to current community interactions.

The purpose of this research was to determine the spatial and temporal distribution of *H. sanguineus* on cobble beaches in the intertidal zone of NB. This was the first Bay-wide, long-term survey conducted for *H. sanguineus.*

Fig. 1: *H. sanguineus* is common in NB.
Photo: MIT Sea Grant

Fig. 2: Surveys were conducted in NB.

Fig. 3: The carapace width of all crabs was recorded.

METHODS

We randomly selected 15 cobble beach sites throughout NB. Beginning in June 2008, three 1-m^2 quadrats were randomly sampled each month along a 30-m transect parallel to the low tide line of the cobble beach at each site (Fig. 2). We identified, sexed, and measured the carapace width of all crabs present (Fig. 3). We continued the surveys through October 2008 for all sites except the four sites on Prudence Island, which are an on going part of the NBNERR long-term invasive species monitoring program.

LITERATURE CITED

[1] G. C. Jensen, P. S. McDonald, D. A. Armstrong, *Marine Ecology Progress Series* **225**, 251 (2002).
[2] A. M. Lohrer, R. B. Whitlatch, *Ecology* **83**, 719 (2002).

ACKNOWLEDGEMENTS

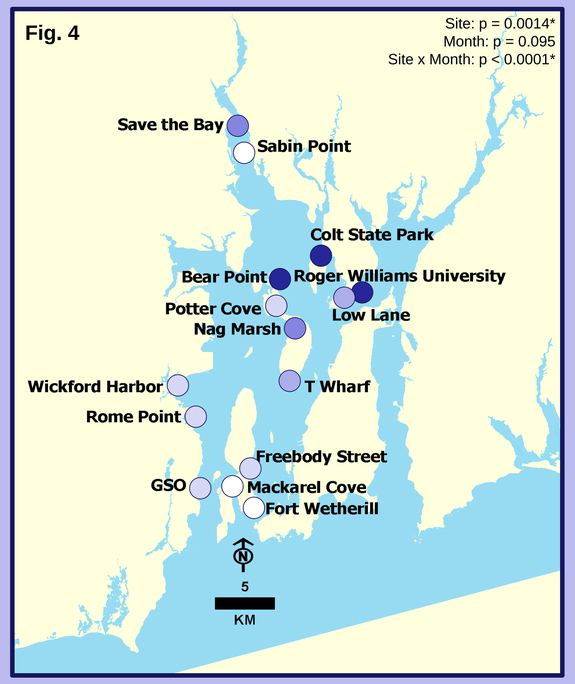
We would like to thank E. Blair, R. Dapp, C. Donahue, F. Olmeta, and A. Viveiros for assistance in the field. Funding was provided to N. Rohr by an NSF IGERT Fellowship and URI.

RESULTS

In the Bay-wide surveys, the density of *H. sanguineus* varied significantly among sites but not among months ($p = 0.0014$ and $p = 0.095$, respectively) with a significant interaction ($p < 0.0001$; Fig. 4). Carapace width varied significantly among sites and among months ($p = 0.0012$ and $p < 0.0001$, respectively) with a significant Interaction ($p < 0.0001$; Fig. 5).

In the Prudence Island surveys, the density of *H. sanguineus* varied significantly among sites and among months with a significant interaction ($p < 0.0001$ for each; Fig. 6). Carapace width varied significantly among sites and among months ($p < 0.0001$ and $p = 0.042$, respectively) with a significant interaction ($p = 0.0039$, Fig. 7).

Fig. 4 (right): Mean density of *H. sanguineus* in August 2008, chosen as a representative month, from the Bay-wide surveys.



0-15 crabs m^{-2} · 16-30 crabs m^{-2} · 31- 45 crabs m^{-2} · 46-60 crabs m^{-2} · 61-75 crabs m^{-2}

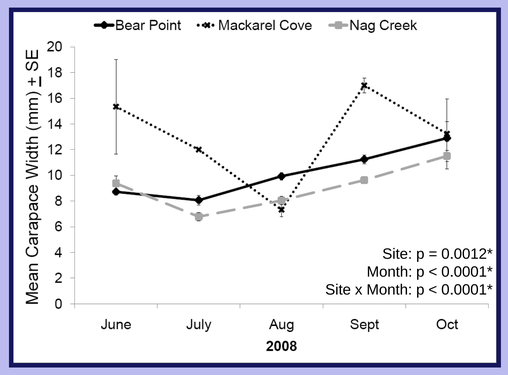


Fig. 5: Mean carapace width of *H. sanguineus* in Bay-wide surveys. Mackarel Cove had the largest crabs, Nag Creek the smallest, and Bear Point is representative of all other sites.

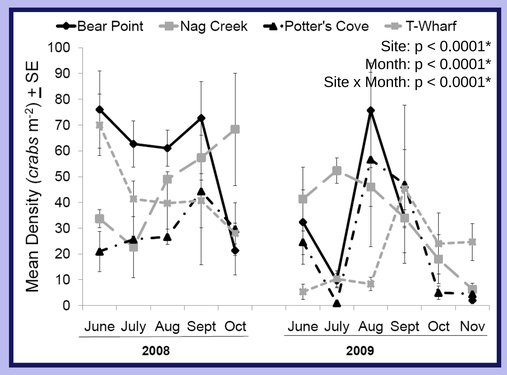


Fig. 6: Mean density of *H. sanguineus* (crabs m^{-2}) on Prudence Island. Densities peak from June through November and are less than 10 crabs m^{-2} during the winter and spring months.

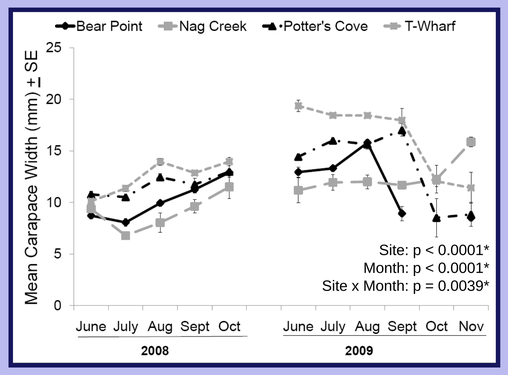


Fig. 7: Mean carapace width of *H. sanguineus* on Prudence Island. Crabs with CW < 10 mm were classified as juveniles, CW >10 mm were classified as adults and sexed.

CONCLUSIONS

H. sanguineus is present throughout the intertidal zone of Narraganett Bay year-round. While their density and carapace width vary temporally and spatially, they likely exclude other crabs from cobble beaches during low tide. It is crucial to understand the distribution of *H. sanguineus* in order to best manage for subsequent invasions and range expansion. As coastal invasion rates continue to increase due to human-mediated dispersal and global climate change, invasive species research and mitigation techniques will be a key component of developing future ecosystem-based management plans.