Drought and the Decline of South Carolina Blue Crabs

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Introduction

Blue crabs make up one of the most important commercial fisheries in the U.S. but there has been concern over the large declines in landings seen in recent years.

3 Hypotheses : Why Crabs Are Declining

(1) Ecological Trap hypothesis: higher salinity forces crabs further upriver where they experience lower growth and/or higher mortality (Posey et al. 2005)

(2) Hematodinium hypothesis: higher salinity increases infection by this lethal dinoflagellate parasite (Messick & Shields 2000)

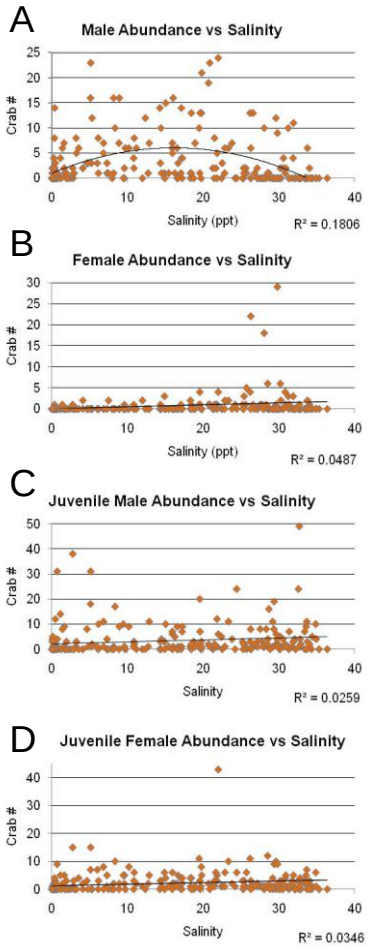
(3) Ecological Refuge hypothesis: higher salinity forces crabs further upriver where they escape fishing mortality until freshwater flows are restored

Methods

Crabs were collected quarterly from the South Carolina coast in the ACE Basin National Estuarine Research Reserve. Three rivers were sampled with nine sites on each river for a total of 27 sampling sites. The lowest sites sit at the mouth of each river in St. Helena Sound and each remaining site is located 4-6 miles upriver from the previous site. Crabs were collected by commercial crab pots wrapped in ¼" Vexar mesh to retain juvenile crabs. Four pots were deployed at each location and allowed to soak for 4-6 hours. Water quality parameters including temperature, salinity, conductivity, pH and dissolved oxygen were measured at each sampling site. All crabs were measured, weighed, sexed, and photographed. A hemolymph sample was drawn and preserved for molecular analysis.

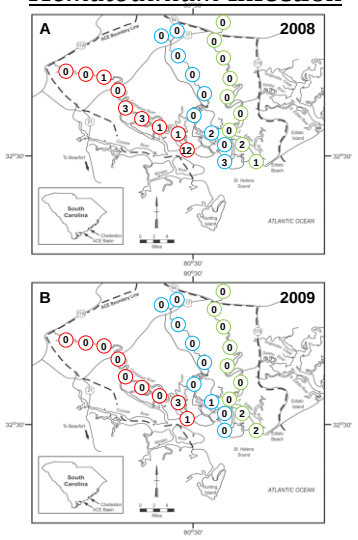
Results

Crab Abundance



Crab abundance verses salinity A) Adult males B) Adult Females C) Juvenile Males D) Juvenile Females

Hematodinium Infection



Maps of ACE Basin NERR sampling sites with the number of infected crabs located in 2008 (A) and 2009 (B). Ashepoo River are blue circles, Combahee River are red circles, and Edisto River are green circles. Sites are numbered 1-9 in increasing order as you move further upriver (e.g. Edisto 1 is off of Edisto Beach and Edisto 9 is north of US 17).

Factor	r^2	df	c^2	p
Sex (male / female)	0.0112	1	2.230	0.1354
Stage (adult / juvenile)	0.0069	1	0.242	0.2423

Log likelihood ratio tests of the ratio of infected to uninfected crabs for those sites with infected crabs only. Sample size N = 211.

Factor	Estimate	r^2	df	c^2	p
Temp.	-0.301	0.3193	1, 143	34.726	0.0001
Salinity	0.083	0.1022	1, 143	11.119	0.0009
D.O.	0.26	0.1355	1, 143	14.739	0.0001
pH	1.94	0.0983	1, 143	10.689	0.0011

Logistic regression of presence / absence of infected crabs by site for a selection of environmental factors. Negative estimates indicate a negative relationship to infection.

Conclusions

- Salinity is the most important environmental factor affecting blue crab abundance
- Adult male crabs show a unimodal relationship with salinity
- Adult females, juvenile males, and juvenile females all showed a positive relationship with salinity
- Hematodinium infection rates are highest in December at the mouth of the Combahee River
- No differences in infection rate were seen between males and females and adults and juveniles
- Multiple environmental factors are correlated with *Hematodinium* infection

Future Work

1) Continue monitoring crab distribution, abundance and *Hematoinium* infection
2) Examine larval dispersal within the ACE Basin
3) Conduct a tethering study to examine survival for juvenile crabs
4) Perform a growth study to examine the effects of different salinity regimes on growth and survival

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