Cancer Crabs − *Cancer borealis/C. irroratus*

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate
Climate Exposure = High
Data Quality = 75% of scores ≥ 2

	Cancer borealis/C. irroratus	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Stock Status	2.0	0.8	
	Other Stressors	2.0	1.6	
	Population Growth Rate	1.3	1.6	
	Spawning Cycle	2.6	2.0	
	Complexity in Reproduction	1.2	2.0	
	Early Life History Requirements	2.0	2.2	
	Sensitivity to Ocean Acidification	2.2	2.6	
	Prey Specialization	1.1	2.4	
	Habitat Specialization	1.2	2.2	
	Sensitivity to Temperature	1.8	3.0	
	Adult Mobility	2.7	1.9	
	Dispersal & Early Life History	1.7	3.0	
	Sensitivity Score	Moderate		
Exposure variables	Sea Surface Temperature	4.0	3.0	
	Variability in Sea Surface Temperature	1.0	3.0	
	Salinity	1.9	3.0	
	Variability Salinity	1.2	3.0	
	Air Temperature	2.8	3.0	
	Variability Air Temperature	1.0	3.0	
	Precipitation	1.1	3.0	
	Variability in Precipitation	1.1	3.0	
	Ocean Acidification	4.0	2.0	
	Variability in Ocean Acidification	1.0	2.2	
	Currents	2.1	1.0	
	Sea Level Rise	1.8	1.5	
	Exposure Score	High		
	Overall Vulnerability Rank	Moderate		

Low
Moderate
High
Very High

Cancer Crabs (*Cancer borealis / Cancer irroratus*)

Overall Climate Vulnerability Rank: **Moderate** (75% certainty from bootstrap analysis).

Climate Exposure: **High**. Two exposure factors contributed to this score: Ocean Surface Temperature (3.9) and Ocean Acidification (4.0). All life stages of Cancer Crabs use marine habitats.

Biological Sensitivity: **Moderate**. Two sensitivity attributes scored above 2.5: Spawning Cycle (2.6) and Adult Mobility (2.7). Spawning occurs in warmer months after molting and adults have low mobility.

Distributional Vulnerability Rank: **High** (100% certainty from bootstrap analysis).

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Cancer Crabs on the Northeast U.S. Shelf is estimated to be neutral, but with a moderate degree of uncertainty (66-90% certainty in expert scores). Research suggests that crustaceans are not negatively impacted by ocean acidification. Cancer Crabs are temperate and cold-water species, so warming may reduce the availabile habitat in the region, but specific studies have not yet been completed.

Data Quality: 75% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: Relatively little is known regarding the dynamics of Cancer Crabs in the Northeast U.S. Shelf. Abundance of Cancer Crabs have been increasing in Narragansett Bay, but multiple causes have been proposed (Collie et al., 2008). Larval growth and metamorphosis of *C. irroratus* is temperature dependent with maximum rates observed at 15-18^{o}C (Johns, 1981). *C. irroratus* is more common in temperate waters, whereas *C. borealis* is more common in boreal waters suggesting the response to climate change may differ between species (Jeffries, 1966).

Life History Synopsis**:** Cancer Crabs are benthic marine species found in intertidal to shelf slope habitats from Nova Scotia, Canada, to Florida (Robichaud and Frail, 2006). In the region, two species are harvesterd as Cancer Crab: Rock Crab (*Cancer irroratus*) and Jonah Crab (*Cancer borealis*). Rock Crabs reach maturity between 1 and 2 years (DFA, 1999). Females spawn while their shell is still soft after molting between April and October, producing one brood per year (Bigford, 1979; DFA, 1999; ISFMP, 2013). Eggs and the first 6 stages of post-hatch development occur in the neuston and are transported via wind and tide toward shore (DFA, 1999). These early life history stages are omnivorous planktivores and preyed upon by larger zooplankton and ichthyoplankton (DFA, 1999). Cancer Crabs settle to the benthos when megalopae molt to the first crab instar (Bigford, 1979). Cancer Crabs occur in shallow waters in the northern part of their range, and are more likely to be offshore in the southern part (Bigford, 1979; DFA, 1999; ISFMP, 2013). Jonah Crabs are generally more abundant in deeper, more thermally stable, habitat with rocky, silt, or clay substrates than Rock Crab which can tolerate a larger temperature range and prefer sandy substrates (Bigford, 1979; ISFMP, 2013). Rock Crab appear to migrate between inshore and offshore habitat seasonally (Bigford, 1979). Adult Cancer Crabs are generalist predators on benthic organisms such as mussels, polychaetes and sea urchins, as well as scavenging on crab and fish remains (DFA, 1999). Small, inshore crabs are common prey for Cunner, sculpins, and American Lobster, while Atlantic Cod and other large fish are common predators of offshore populations (ISFMP, 2013). Cancer Crabs will be managed by the Atlantic States Marine Fisheries Commission starting in 2016 (ASMFC 2015), owing to a growing targeted fishery and high bycatch levels in the American Lobster fishery (ISFMP, 2013).

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