Deep−sea Red Crab − *Chaceon quinquedens*

Overall Vulnerability Rank = Low

Biological Sensitivity = Low
Climate Exposure = High
Data Quality = 79% of scores ≥ 2

	Chaceon quinquedens	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Stock Status	2.3	0.8	
	Other Stressors	1.5	2.0	
	Population Growth Rate	2.1	1.4	
	Spawning Cycle	2.1	2.4	
	Complexity in Reproduction	1.4	2.5	
	Early Life History Requirements	1.8	1.2	
	Sensitivity to Ocean Acidification	2.1	2.6	
	Prey Specialization	1.2	2.8	
	Habitat Specialization	1.3	3.0	
	Sensitivity to Temperature	2.2	2.4	
	Adult Mobility	2.1	2.6	
	Dispersal & Early Life History	1.5	2.4	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature	3.9	3.0	
	Variability in Sea Surface Temperature	1.0	3.0	
	Salinity	1.8	3.0	
	Variability Salinity	1.2	3.0	
	Air Temperature	1.0	3.0	
	Variability Air Temperature	1.0	3.0	
	Precipitation	1.0	3.0	
	Variability in Precipitation	1.0	3.0	
	Ocean Acidification	4.0	2.0	
	Variability in Ocean Acidification	1.0	2.2	
	Currents	2.1	1.0	
	Sea Level Rise	1.1	1.5	
	Exposure Score	High		
	Overall Vulnerability Rank	Low		

Low
Moderate
High
Very High

Deep-Sea Red Crab (*Chaceon quinquedens*)

Overall Climate Vulnerability Rank: **Low** (98% 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 Deep-Sea Red Crab use marine habitats.

Biological Sensitivity: **Low**. No sensitivity attributes scored above 2.5.

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

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Deep-sea Red Crab 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. Warming may negatively impact Deep-sea Red Crab and reduce habitat availability, but there is a lot of uncertainty.

Data Quality: 79% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: There is very little information on the effect of climate forcing on Deep-Sea Red Crabs. Most studies indicate that acidification has neutral or positive effects on crustacean in general (Kroeker et al., 2013), but no specific studies have been done. Temperature effects on Deep-Sea Red Crab are also little known, but their continental slope habitat is warming (Forsyth et al., 2015).

Life History Synopsis**:** Deep-sea Red Crab is a long-lived crustacean that occurs along the outer continental shelf and slope from the Gulf of Saint Lawrence to possibly the western South Atlantic including the Gulf of Maine and Gulf of Mexico (Steimle et al., 2001). Males mature at about 75 mm carapace width; females likely mature at smaller sizes (NMFS, 2006). Females occur in shallower waters of the upper slope than males, so males may migrate from deeper, mid-slope waters for spawning (Steimle et al., 2001). Males form a protective cage around females, carrying them for up to three weeks, before the female molts and copulation occurs (Steimle et al., 2001). Males may need to be larger than females for mating to occur (NMFS, 2006). Females are believed to go 5-7 years between molts, meaning spawning may not occur annually for each individual, but females may be able to store sperm to fertilize eggs between molts (Steimle et al., 2001; NMFS, 2006). Eggs are attached to the underside of females for up to 9 months before hatching (Steimle et al., 2001). Hatching occurs between January and June (NMFS, 2006). Larvae are released into the water column and may actively swim to the surface where they exist for 23-125 days (based on lab-reared larvae) and transition through four zoeal and one megalops stages before settling to the bottom (Steimle et al., 2001). Larvae are rarely collected, but are likely zooplanktivorous (Steimle et al., 2001). Settlement to the middle or base of the slope occurs at 4 mm carapace width, which is fairly large for brachyuran crabs (Steimle et al., 2001). Juveniles prefer smooth or dimpled silt-clay sediments and occur deeper than the adult population (Steimle et al., 2001). Young red crabs move upslope to shallower waters as they grow and become available to the fishery at about 100 mm carapace width and age 4-6 years (Steimle et al., 2001). Juvenile red crabs are opportunistic foragers on infaunal and epifaunal benthic inverts and small fish including: sponges, hydroids, gastropods, scaphopods, small polychaetes, crustaceans, tunicates, and bivalves (Steimle et al., 2001). Adult Deep-sea Red Crabs occur on the slope and outer continental shelf and travel short distances except for a possible spawning migration up and down the slope (Steimle et

al., 2001). The diet of adults includes similar benthic fauna to juvenile red crab and larger prey such as demersal and mid-water fish, squid, Quill Worm and scavenging deadfalls of fish and squid (Steimle et al., 2001). Red crab is not a major prey species for any predator, but has been found in Longfin Hake, Atlantic Cod, and Red Hake stomachs (Steimle et al., 2001). Deep-sea Red Crab is managed under the New England Fishery Management Council's Deep-Sea Red Crab Fishery Management Plan and is probably not being overfished, but poor estimates of biomass and productivity prevent a designation (NMFS, 2006).

Literature Cited:

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