Rosette Skate – *Leucoraja garmani*

Overall Vulnerability Rank = Moderate 🟨

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

Leucoraja garmani		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
				🟩 Low 🟨 Moderate 🟧 High 🟥 Very High
Sensitivity attributes	Stock Status	3.0	2.8	
	Other Stressors	1.4	1.0	
	Population Growth Rate	2.9	0.6	
	Spawning Cycle	1.3	2.2	
	Complexity in Reproduction	1.5	1.6	
	Early Life History Requirements	1.0	2.8	
	Sensitivity to Ocean Acidification	1.4	2.2	
	Prey Specialization	1.1	2.8	
	Habitat Specialization	1.2	2.8	
	Sensitivity to Temperature	1.2	2.8	
	Adult Mobility	2.4	1.4	
	Dispersal & Early Life History	1.9	3.0	
	Sensitivity Score	**Moderate**		
Exposure variables	Sea Surface Temperature	3.9	3.0	
	Variability in Sea Surface Temperature	1.0	3.0	
	Salinity	2.7	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	**Moderate**		

Rosette Skate (*Leucoraja garmani*)

Overall Climate Vulnerability Rank: **Moderate** (78% certainty from bootstrap analysis).

Climate Exposure: **High**. Two exposure factors contributed to this score: Ocean Surface Temperature (4.0) and Ocean Acidification. Rosette Skate are demersal and complete their life cycle in marine habitats.

Biological Sensitivity: **Moderate**. Two sensitivity attributes scored above 2.5: Stock Status (3.0) and Population Growth Rate (2.9). In 2013, based on trawl survey indices Rosette Skate was above the biomass threshold but below the biomass target. Further, the index has been declining since the early 2000s (NEFSC, 2013). There is a high degree of uncertainty in Population Growth, but skates in general have a low population growth rate (Frisk, 2010).

Distributional Vulnerability Rank: **High** (83% certainty from bootstrap analysis). Rosette Skate are habitat generalists and moderately mobile as adults, making seasonal movements. In addition, skate egg cases are subject to movement by currents and juveniles may move on scales of 1-10 km.

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Rosette Skate is estimated to be neutral, but this estimate has high uncertainty (<66% certainty in expert scores). Rosette Skate inhabits temperate waters and may benefit from warming on the Northeast U.S. Shelf. But ocean acidification may reduce productivity and no changes in distribution have been observed over the past 30 years despite significant warming.

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

Climate Effects on Abundance and Distribution: Little specific information exists on the effect of climate on Rosette Skate. Di Santo (2015) found that increased warming and acidification reduce body condition of newly hatched Little Skate – a congener. These reductions in size could result in reduced juvenile survival and thus recruitment. In regional studies of distribution, Rosette Skate was not included (Murawski, 1993; Nye et al., 2009) but examination of NEFSC trawl survey data suggests no change in the center of the distribution over the last 30 years (http://oceanadapt.rutgers.edu/, website last checked 13 June 2015).

Life History Synopsis**:** Rosette skate is a benthic, marine elasmobranch found from Nantucket Shoals to the Dry Tortugas, Florida, but the population south of Cape Hatteras, North Carolina, may be a separate species (Packer et al., 2003). North of Cape Hatteras, Rosette Skates mature between 33-43 cm total length, which is estimated to be about 4 years of age and mate using internal fertilization (Packer et al., 2003; Sosebee, 2005). Like most skates, single eggs are encased in a horned capsule; females produce egg capsules year-round, but peak production occurs during summer (Packer et al., 2003). There is no larval stage. Juvenile Rosette Skates inhabit the outer continental shelf and mostly occur in the mid-Atlantic region, but are occasionally recorded in the Gulf of Maine (Packer et al., 2003). Adults are found on soft-bottom habitat on the outer shelf and upper slope and prefer moderate water temperatures (Packer et al., 2003). Rosette Skates prey upon Crangon Shrimp, Cancer and galatheoid crabs, amphipods, polychaetes, copepods, cumaceans, squids, octopods, and small fishes (Packer et al., 2003). The New England Fishery Management Council manages the species as part of a Northeast Skate Complex. Rosette Skates are not overfished and overfishing is not occurring (NEFSC, 2007).

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