Smooth Skate – *Malacoraja senta*

Overall Vulnerability Rank = Moderate ▢

Biological Sensitivity = Moderate ▢
Climate Exposure = High ▢
Data Quality = 83% of scores $\geq$ 2

Malacoraja senta	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)	
				▢ Low
				▢ Moderate
				▢ High
				▢ Very High
Sensitivity attributes				
Stock Status	2.6	2.5		
Other Stressors	1.2	1.4		
Population Growth Rate	3.0	2.0		
Spawning Cycle	1.2	3.0		
Complexity in Reproduction	1.3	1.8		
Early Life History Requirements	1.1	3.0		
Sensitivity to Ocean Acidification	1.6	2.1		
Prey Specialization	1.2	3.0		
Habitat Specialization	1.2	3.0		
Sensitivity to Temperature	2.1	2.8		
Adult Mobility	2.0	2.1		
Dispersal & Early Life History	2.5	3.0		
Sensitivity Score	**Moderate**			
Exposure variables				
Sea Surface Temperature	3.9	3.0		
Variability in Sea Surface Temperature	1.0	3.0		
Salinity	1.4	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**			

Smooth Skate (*Malacoraja senta*)

Overall Climate Vulnerability Rank: **Moderate** (93% certainty from bootstrap analysis).

Climate Exposure: **High**. Two exposure factors contributed to this score: Ocean Surface Temperature (3.9) and Ocean Acidification (4.0). Smooth Skate are demersal and complete their life cycle in marine habitats.

Biological Sensitivity: **Moderate**. Two sensitivity attributes scored above 2.5: Stock Status (2.6) and Population Growth Rate (3.0). In 2013, based on trawl survey indices Smooth Skate was above the biomass threshold but below the biomass target. Further, the index has been low in the 1980s, 1990s and 2000s relative to higher indices in the 1960s and 1970s. In general, skates have a low population growth rate (higher sensitivity to climate change) (Frisk, 2010).

Distributional Vulnerability Rank: **Moderate** (44% certainty from bootstrap analysis). Smooth Skate are habitat generalists and moderately mobile as adults, making seasonal migrations.

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Smooth Skate is very likely to be negative (>95% certainty in expert scores). Smooth Skate is a cold-water species and warming and acidification may reduce productivity. In addition, abundance indices are low relative to the 1960s and 1970s.

Data Quality: 83% 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 Smooth Skate. Di Santo (2015) found that increased warming and acidification reduce body condition of newly hatched Little Skate. If similar effects occur on Smooth Skate, reductions in size could result in reduced juvenile survival and thus recruitment. In regional studies of distribution, Smooth Skate was not included (Murawski, 1993; Nye et al., 2009) but examination of NEFSC trawl survey data suggests a northward then southward shift in distribution over the last 30 years (http://oceanadapt.rutgers.edu/, website last checked 13 June 2015).

Life History Synopsis**:** Smooth Skate is a boreal, marine elasmobranch species found from the Gulf of St. Lawrence and Labrador Shelf to South Carolina, with the center of abundance in the Gulf of Maine (Packer et al., 2003). Smooth Skate reach maturity at 5 years, mate using internal fertilization, and females likely spawn in summer and winter, based on the occurrence of females with fully formed egg capsules (Packer et al., 2003), or year round based on hormone levels (Kneebone et al., 2007). Horned egg cases each contain a single egg and house the embryo throughout early development (Packer et al., 2003). Juveniles hatch out of the egg case as small immature adults (Packer et al., 2003). Juveniles and adults range from 31-874 m depths, but are most common at depths 110-500 m, in cold water, primarily over mud or silt, but also use broken shell, sand, or gravel bottom (McEachran, 2002). Smooth Skate specialize on epifaunal crustaceans, but their diet includes: cephalopods, polychaetes, copepods, larval stomatopods, isopods, amphipods, mysids, euphausiids, decapod shrimps and crabs, and fishes (McEachran, 2002). Decapods and euphausiids are the primary prey throughout the life of the Smooth Skate, but an ontogenetic shift from amphipods, mysids, and euphausiids to crustaceans occurs at about 30cm (McEachran, 2002). Not much is known about predators of the species, but other skates likely prey on Smooth Skates, especially as embryos (Packer et al., 2003). The New England Fishery Management Council manages Smooth Skate as part of a seven species skate complex under the Skate

Fishery Management Plan. Based on the most recent assessment, Smooth Skate are not overfished nor is overfishing occurring (NEFSC, 2007).

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