Bay Scallop − *Argopecten irradians*

Overall Vulnerability Rank = Very High

Biological Sensitivity = Very High
Climate Exposure = Very High
Data Quality = 88% of scores ≥ 2

	Argopecten irradians	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Stock Status	2.6	1.6	
	Other Stressors	3.6	3.0	
	Population Growth Rate	1.5	2.0	
	Spawning Cycle	2.8	3.0	
	Complexity in Reproduction	2.4	2.8	
	Early Life History Requirements	3.7	3.0	
	Sensitivity to Ocean Acidification	3.9	2.2	
	Prey Specialization	1.3	2.6	
	Habitat Specialization	3.4	3.0	
	Sensitivity to Temperature	2.4	3.0	
	Adult Mobility	3.9	2.8	
	Dispersal & Early Life History	2.6	2.8	
	Sensitivity Score	Very High		
Exposure variables	Sea Surface Temperature	3.9	3.0	
	Variability in Sea Surface Temperature	1.0	3.0	
	Salinity	2.0	3.0	
	Variability Salinity	1.2	3.0	
	Air Temperature	3.9	3.0	
	Variability Air Temperature	1.0	3.0	
	Precipitation	1.3	3.0	
	Variability in Precipitation	1.4	3.0	
	Ocean Acidification	4.0	2.0	
	Variability in Ocean Acidification	1.0	2.2	
	Currents	2.0	1.0	
	Sea Level Rise	3.9	1.5	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Very High		

Low
Moderate
High
Very High

Bay Scallop (*Argopecten irradians*)

Overall Climate Vulnerability Rank: **Very High** (100% certainty from bootstrap analysis).

Climate Exposure: **Very High**. Three exposure factors contributed to this score: Ocean Surface Temperature (3.9), Air Temperature (3.9), Sea-Level Rise, and Ocean Acidification (4.0). Bay Scallops used both marine and estuarine habitats through their life cycle.

Biological Sensitivity: **Very High**. Four sensitivity attributes scored above 3.5: Other Stressors (3.6), Early Life History Requirements (3.7), Sensitivity to Ocean Acidification (3.9), and Adult Mobility (3.9). Bay are found in estuarine waters and are exposed other stressors including habitat loss and contaminants. Spawning occurs in the winter and larvae settle to eel grass and other biological structure. Adults have a calcium carbonate shell and very limited mobility.

Distributional Vulnerability Rank: **Low** (97% certainty from bootstrap analysis).

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Bay Scallop on the Northeast U.S. Shelf is very likely to be negative (>95% certainty in expert scores). Ocean acidification will likely negatively impact molluscs, including Bay Scallop. Warming may reduce habitat and increase vulnerability to predation which will reduce productivity. Sea-level rise also has the potential to negatively impact coastal habitats where Bay Scallop live.

Data Quality: 88% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: Shell growth in larval and juvenile Bay Scallops is reduced under ocean acidification (Ries et al., 2009; White et al., 2013; Talmage and Gobler, 2010). Increases in temperature and CO_2 resulted in decreased survival, development, growth, and lipid synthesis (Talmage and Gobler, 2011). These studies indicate that population productivity will likely decrease under climate change. Bay Scallop fisheries are already at very low levels as a result of fishing and harmful algal blooms (MacKenzie, 2008); climate change will add to these negative pressures.

Life History Synopsis**:** Bay Scallop is a short-lived, estuarine bivalve species that occurs from the north shore of Cape Cod, Massachusetts to Laguna Madre, Texas, as three subspecies: *Argopecten irradians irradians* (Lamark 1819) ranging from Cape Cod, Massachusetts, to New Jersey; *A. irradians concentricus* (Say 1882) ranging from New Jersey to Chandeleur Islands in the Gulf of Mexico, and *A. irradians amplicostatus* (Dall 1898) ranging from Galveston, Texas, to Laguna Madre, Texas (NCDMF, 2015). Bay Scallop mature during their first year, but because they only live 1-2 years and most die during their second winter, generally only spawn once (NCDMF, 2015). Spawning season varies with latitude, but ranges from spring to fall (Fay et al., 1983). Spawning occurs later in the south, where spawning is cued to falling temperatures, and earlier in the north, where spawning is cued to rising temperatures (Fay et al., 1983). These broadcast spawning hermaphrodites release only the male or female gametes into the water column at a time to prevent self-fertilization (NCDMF, 2015). Bay Scallop develop through several larval stages before transforming into juveniles. The short-lived trocophore larvae stage quickly develops into the veliger stage within ~2 days post fertilization (NCDMF, 2015). Over the next 10 days, the organs, gills, foot, and first shell develop, and this pediveliger larvae then alternates between swimming and resting on the bottom (NCDMF, 2015). Larval Bay Scallop settle after 2-3 weeks, attaching to submerged aquatic vegetation and other suspended substrate (e.g., rope, oyster shell, filamentous algae) with byssal threads secreted from the foot (Fay et al., 1983; NCDMF, 2015). Survival

is adversely affected by settlement directly to soft sediments, but once the early juveniles reach 20-30 mm they drop to the sediment, preferably in an area of slow currents (NCDMF, 2015). Once settled, juveniles and adults do not travel far, but while still able to make byssal threads, rarely attach to substrate, and often swim away from unfavorable conditions by pulsing water through the mantle cavity (Fay et al., 1983; NCDMF, 2015). Adults are almost exclusively estuarine in shallow flats of mud, hard sand, and submerged aquatic vegetation with slow currents (Fay et al., 1983; NCDMF, 2015). Bay Scallops can tolerate low salinity water for short time periods and cool water during winter, but prefer higher salinities and require warm water for growth (Fay et al., 1983; NCDMF, 2015). Bay Scallops are filter feeders, consuming benthic diatoms as well as planktonic algae and bacteria (Fay et al., 1983; NCDMF, 2015). Pea crabs are a common parasite, and gulls, Blue and Green Crabs, Knobbed Whelks, starfish, and Cownose Rays are common predators (Fay et al., 1983; NCDMF, 2015). Bay Scallop are managed state-by-state. Red tides, high fishing pressure, and increased rates of predation have led to massive population declines and slow recovery (NCDMF, 2015).

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