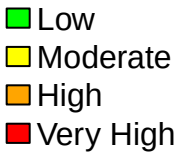
Weakfish − *Cynoscion regalis*

Overall Vulnerability Rank = Moderate

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

	Cynoscion regalis	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Stock Status	2.4	1.4	
	Other Stressors	2.5	2.6	
	Population Growth Rate	1.8	2.6	
	Spawning Cycle	2.2	3.0	
	Complexity in Reproduction	2.1	2.6	
	Early Life History Requirements	2.4	2.5	
	Sensitivity to Ocean Acidification	1.7	3.0	
	Prey Specialization	1.2	3.0	
	Habitat Specialization	1.6	3.0	
	Sensitivity to Temperature	1.9	2.6	
	Adult Mobility	1.5	2.7	
	Dispersal & Early Life History	2.6	3.0	
	Sensitivity Score	Low		
Exposure variables	Sea Surface Temperature	4.0	3.0	
	Variability in Sea Surface Temperature	1.0	3.0	
	Salinity	2.8	3.0	
	Variability Salinity	1.2	3.0	
	Air Temperature	4.0	3.0	
	Variability Air Temperature	1.0	3.0	
	Precipitation	1.2	3.0	
	Variability in Precipitation	1.3	3.0	
	Ocean Acidification	4.0	2.0	
	Variability in Ocean Acidification	1.0	2.2	
	Currents	2.0	1.0	
	Sea Level Rise	2.5	1.5	
	Exposure Score	Very High		
	Overall Vulnerability Rank	Moderate		



Weakfish (*Cynoscion regalis*)

Overall Climate Vulnerability Rank: **Moderate** (96% certainty from bootstrap analysis).

Climate Exposure: **Very High**. Three exposure factors contributed to this score: Ocean Surface Temperature (4.0), Ocean Acidification (4.0) and Air Temperature (4.0). Exposure to all three factors occur during the life stages. Weakfish occur in estuarine and coastal waters and make seasonal north-south migrations.

Biological Sensitivity: **Low**. Two sensitivity attributes scored above 2.5: Other Stressors (2.5) and Dispersal & Early Life History (2.6). Deterioration of coastal waters due to urbanization, dredging, and other human activities has contributed to a decline in Weakfish abundance in some areas. In addition, Weakfish are facultative estuarine dependent and use estuarine and coastal areas as feeding and nursery grounds (Able, 2005).

Distributional Vulnerability Rank: **High** (100% certainty from bootstrap analysis). Two attributes indicated vulnerability to distribution shift: Adult Mobility and Habitat Sensitivity. Weakfish are mobile and make seasonal north-south migrations. Adults use a variety of nearshore and coastal habitats during warmer months and inner shelf habitats in colder months.

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Weakfish on the Northeast U.S. Shelf is estimated to be neutral, but with a moderate degree of uncertainty (<66% certainty in expert scores). Adult distribution may extend northwards as warming continues, but losses of habitat due to sea-level rise may negatively impact productivity. The effect of ocean acidification over the next 30 years is likely to be minimal. Despite high data quality, there are a number of information gaps in the region, which contribute to the uncertainty as to the directional effect of climate change.

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

Climate Effects on Abundance and Distribution: Relatively little work has been done on the effect of climate on distribution and productivity of Weakfish. Lankford and Targett (1994) found an interactive effect of salinity and temperature on juvenile Weakfish growth suggesting changes in temperature, precipitation, and sea level could affect productivity. In terms of distribution, the abundance of Weakfish at the northern end of their range has increased, potentially suggesting a northward shift (Howell and Auster, 2012).

Life History Synopsis**:** Weakfish is an estuarine and coastal fish species that can be found from Nova Scotia to Cape Canaveral, Florida, but is most abundant between New York and North Carolina (Able and Fahay, 2010). Maturity is reached around age 1, but older fish arrive at the spawning grounds first, produce more eggs per batch, and more batches per season, so the contribution of age-1 spawners is believed to be proportionally low (Klein-MacPhee, 2002; NEFSC, 2009). Spawning occurs May – August, beginning in the south, and in near-shore marine areas, particularly near larger inlets, and in bays and estuaries (Klein-MacPhee, 2002; Able and Fahay, 2010). Weakfish return to the same spawning grounds each year (Able and Fahay, 2010). Eggs are pelagic, occur in warm water, but a range of salinities, and hatch after 2-3 days (Klein-MacPhee, 2002; Able and Fahay 2010). Eggs and larvae occur in both marine-coastal and estuarine habitats, but it is not fully known whether both are equally suitable nursery habitats (Able and Fahay, 2010). Larvae are pelagic, but become demersal early, and may use bottom currents to move into low-salinity nursery habitats (Klein-MacPhee, 2002). Larvae consume copepods,

tintinnids, and polychaete larvae (Klein-MacPhee, 2002). Larvae settle to a variety of substrates in the intertidal and subtidal marshes, as well as shallow and deep bay areas (Able and Fahay, 2010). Larger juveniles and adults prefer the deep bay areas in summer (Able and Fahay, 2010). Juveniles leave the estuaries in fall, and migrate to the outer-shelf south of Cape Hatteras, North Carolina (Able and Fahay, 2010). The diet of juveniles shifts from primarily invertebrates, especially mysid and decapod shrimp, to primarily fish, especially clupeids and engraulids (Klein-MacPhee, 2002; Able and Fahay, 2010). Adult Weakfish occur in shallow coastal waters, bays, and estuaries over sand or mud substrates, and occasionally move into freshwater (Able and Fahay, 2010). In the southern portion of their range, Weakfish are resident and do not make offshore migrations (Klein-MacPhee, 2002). In fall, the northern portion of the population moves in schools to overwintering grounds on the outer-shelf (Klein-MacPhee, 2002). Larger Weakfish do not migrate as far south as younger fish and overwinter offshore of Southern New England and the Mid-Atlantic states (Klein-MacPhee, 2002; Able and Fahay, 2010). By spring, adults begin returning to coastal spawning habitats, starting with the larger fish (Klein-MacPhee, 2002). Weakfish adults are generally piscivorous, but include a variety of invertebrate prey in their diet, and while their diet is largely opportunistic, clupeids, anchovies, and small crustaceans are the dominant prey (Klein-MacPhee, 2002; Able and Fahay, 2010). The major predators of Weakfish include: Striped Bass, Bluefish, and older Weakfish, but dogfish, skates, Angel Shark, Monkfish (Goosefish), and Summer Flounder are also known predators of the species (Klein-MacPhee, 2002; Able and Fahay, 2010). The Atlantic States Marine Fisheries Commission manages Weakfish through the Interstate Fishery Management Plan for Weakfish, but a stock-wide assessment is conducted by the Northeast Fisheries Science Center (NEFSC, 2009). Weakfish are deemed depleted, but not experiencing overfishing (ASMFC, 2009). Total mortality is increasing despite steady fishing mortality, so recovery is not expected through management of the fishery alone (NEFSC, 2009; ASMFC, 2009).

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