

Cusk – *Brosme brosme*

Overall Vulnerability Rank = High ■

Biological Sensitivity = High ■

Climate Exposure = High ■

Data Quality = 67% of scores ≥ 2

<i>Brosme brosme</i>		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)	
Sensitivity attributes	Stock Status	3.0	0.4		
	Other Stressors	1.5	0.8		
	Population Growth Rate	3.1	1.6		
	Spawning Cycle	3.0	2.4		
	Complexity in Reproduction	1.3	1.5		
	Early Life History Requirements	2.6	0.2		
	Sensitivity to Ocean Acidification	1.2	1.6		
	Prey Specialization	1.1	2.4		
	Habitat Specialization	2.7	2.4		
	Sensitivity to Temperature	2.0	2.4		
	Adult Mobility	2.7	2.4		
	Dispersal & Early Life History	1.8	2.2		
	Sensitivity Score		High		
	Exposure variables	Sea Surface Temperature	3.9	3.0	
Variability in Sea Surface Temperature		1.0	3.0		
Salinity		1.1	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		High			

Cusk (*Brosme brosme*)

Overall Climate Vulnerability Rank: **High** (69% 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 Cusk use marine habitats.

Biological Sensitivity: **High**. Three sensitivity attributes scored above 3.0: Stock Status (3.0), Population Growth Rate (3.1), and Spawning Cycle (3.0). Cusk is a NMFS Species of Concern owing to apparent low population sizes (Hare et al., 2012). Peak spawning occurs during summer and adults are late maturing and slow growing (Klein-MacPhee, 2002).

Distributional Vulnerability Rank: **Low** (96% certainty from bootstrap analysis).

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Cusk on the Northeast U.S. Shelf is very likely to be negative (>95% certainty in expert scores). Cusk is a cold-temperate species and warming will likely reduce habitat and increase population fragmentation.

Data Quality: 67% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: Relatively little is known regarding the dynamics of Cusk. Hare et al. (2012) projected that the amount of habitat for Cusk in the Gulf of Maine will decrease with climate change and that the available habitat will become more fragmented. Both could potentially result in lower population productivity. Nye et al. (2009) reported that Cusk have shifted deeper in recent years consistent. Thus both productivity and distribution will likely be impacted.

Life History Synopsis: Cusk is a marine, sedentary, solitary, benthic species found on both sides of the Atlantic, ranging from the Straits of Belle Isle and the Grand Banks of Newfoundland to New Jersey in the western Atlantic Ocean (Klein-MacPhee, 2002). Males begin to mature at age 5, females at age 6, and complete maturity for both genders occurs by age 10 (Klein-MacPhee, 2002). Spawning occurs between March and November with peak spawning in spring and summer (Klein-MacPhee, 2002). Cusk are highly fecund and produce pelagic eggs (Klein-MacPhee, 2002). Larval Cusk are pelagic, float near the surface, and are often associated with jellyfish (Klein-MacPhee, 2002). Little is known about the juvenile stage, but settlement to benthic habitats occurs around 50 mm, at which time they are believed to adopt the solitary and sedentary habits of the adults (Klein-MacPhee, 2002). Cusk <51 cm consume a diet of polychaetes, Crangon shrimp, and hermit crabs (Klein-MacPhee, 2002). Adult Cusk prefer hard bottom in moderately deep areas of the shelf and slope and also associate with deepwater coral (Klein-MacPhee, 2002). Cusk is a cool-water species that is entirely benthic and rarely moves (Klein-MacPhee, 2002). The diet of adult Cusk includes: crustaceans, fish, and echinoderms (Klein-MacPhee, 2002). The primary predator of Cusk is Spiny Dogfish, but Cusk have also been found in the stomachs of Winter Skate, Atlantic Cod, Atlantic Halibut, White Hake, Monkfish (Goosefish), Fawn Cusk-eel, Sea Raven, Summer Flounder and Windowpane, hooded seal, and gray seal (Klein-MacPhee, 2002; Harris and Hanke, 2010). Cusk are not managed in United States waters, but are being considered for listing as endangered or threatened after drastic reductions in abundance due to fishing pressure and climate-change induced habitat loss (Hare et al., 2012).

Literature Cited:

Hare JA, Manderson JP, Nye JA, Alexander MA, Auster PJ, Borggaard DL, et al. Cusk (*Brosme brosme*) and climate change: assessing the threat to a candidate marine fish species under the US Endangered Species Act. ICES J Mar Sci. 2012; 69: 1753–1768. DOI: 10.1093/icesjms/fss160

Harris LE, Hanke AR. Assessment of the Status, Threats and Recovery Potential of Cusk (*Brosme brosme*). DFO Can. Sci. Advis. Sec. Res. Doc. 2010/004. vi + 23 p. Accessed online (August 2015): http://www.dfo-mpo.gc.ca/CSAS/Csas/publications/resdocs-docrech/2010/2010_004_e.pdf

Klein-MacPhee G. Cusk/ *Brosme brosme* (Ascanius 1772). Pages 223-225. In: BB Collette, G Klein-MacPhee (editors), Fishes of the Gulf of Maine, 3rd edition. Smithsonian Institution Press, Washington D.C. 2002; 882 p.