

Atlantic Hagfish – *Myxine glutinosa*

Overall Vulnerability Rank = Moderate ■

Biological Sensitivity = Moderate ■

Climate Exposure = High ■

Data Quality = 67% of scores  $\geq 2$

<i>Myxine glutinosa</i>		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)	
Sensitivity attributes	Stock Status	2.4	0.2		
	Other Stressors	1.6	1.1		
	Population Growth Rate	2.6	0.6		
	Spawning Cycle	1.1	2.6		
	Complexity in Reproduction	1.9	1.0		
	Early Life History Requirements	1.1	2.1		
	Sensitivity to Ocean Acidification	1.5	1.9		
	Prey Specialization	1.0	2.6		
	Habitat Specialization	1.2	3.0		
	Sensitivity to Temperature	1.6	2.7		
	Adult Mobility	3.0	2.2		
	Dispersal & Early Life History	2.7	1.4		
	<b>Sensitivity Score</b>		<b>Moderate</b>		
	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		
<b>Exposure Score</b>		<b>High</b>			
<b>Overall Vulnerability Rank</b>		<b>Moderate</b>			

## **Atlantic Hagfish (*Myxine glutinosa*)**

Overall Climate Vulnerability Rank: **Moderate** (92% 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 Atlantic Hagfish use marine habitats.

Biological Sensitivity: **Moderate**. Two sensitivity attributes scored above 2.5: Adult Mobility (3.0) and Dispersal and Early Life History (2.7). The life cycle is uncertain, but it is likely that there is no larval stage and adults hatch from eggs (Martini and Flescher, 2002). Hagfish burrow in soft sediment and likely have limited mobility (Martini and Flescher, 2002).

Distributional Vulnerability Rank: **Low** (82% certainty from bootstrap analysis). Adults are relatively immobile and there is likely no dispersive larval stage limiting the potential of a change in distribution.

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Atlantic Hagfish on the Northeast U.S. Shelf is estimated to be neutral, but with a moderate degree of uncertainty (66-90% certainty in expert scores). There is very little information available for hagfish making the estimate of the directional effect of climate change difficult.

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

Climate Effects on Abundance and Distribution: There is very little information regarding the dynamics of Atlantic Hagfish as well as little information regarding environmental effects on abundance and distribution.

Life History Synopsis: Atlantic Hagfish are an ancient, benthic, marine species found throughout the Atlantic Ocean from Kola Peninsula, Russia, to the Shetland Islands off the Antarctic Peninsula (Martini and Flescher, 2002). Very little is known about the spawning and early development of Atlantic Hagfish. Individuals >400 mm are sexually mature and can have both male and female reproductive organs, but only one is developed at a time (Martini and Flescher, 2002). Most individuals are female, with developed ovary and rudimentary testis, and about a quarter of the population are sterile (Martini and Flescher, 2002). Spawning can occur year round and is believed to occur in deep water (Martini and Flescher, 2002). Eggs are rare in samples and few are fertilized, leading to the assumption of low fecundity among Atlantic Hagfish (Martini and Flescher, 2002). There is likely no larval stage; small immature adults hatch out of eggs (Martini and Flescher, 2002). Hagfish live within horizontal burrows in soft muddy sediment on the sea floor (Martini and Flescher, 2002). Hagfish need high salinity water; sharp changes in salinity or temperature can have severe effects on survival (Martini and Flescher, 2002). Hagfish are opportunistic feeders on Northern Shrimp, dead or dying fish, and benthic and burrowing invertebrates, often interfering with commercial trap, gillnet, and longline catches (Martini and Flescher, 2002). Atlantic Cod, Spiny Dogfish, harbor seal, and harbor porpoise eat Atlantic Hagfish, and groundfish may prey on their eggs (Martini and Flescher, 2002). There is a small fishery for Atlantic Hagfish in the United States to sell to the Asian leather industry, but the species is not actively managed (Martini and Flescher, 2002).

Literature Cited:

Martini FH, Flescher D. Atlantic Hagfish/ *Myxine glutinosa* Linnaeus 1758. Pages 10-16 In: BB Collette, G Klein-MacPhee (editors), *Fishes of the Gulf of Maine*, 3rd edition. Smithsonian Institution Press, Washington D.C. 2002; 882 p.