

# Knobbed Whelk – *Busycon carica*

Overall Vulnerability Rank = Very High ■

Biological Sensitivity = High ■

Climate Exposure = Very High ■

Data Quality = 79% of scores  $\geq 2$

<i>Busycon carica</i>		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)	
Sensitivity attributes	Stock Status	2.4	0.2		
	Other Stressors	2.3	1.5		
	Population Growth Rate	2.2	1.6		
	Spawning Cycle	2.2	2.9		
	Complexity in Reproduction	1.9	2.3		
	Early Life History Requirements	1.5	2.8		
	Sensitivity to Ocean Acidification	3.9	2.6		
	Prey Specialization	2.4	2.7		
	Habitat Specialization	1.9	2.5		
	Sensitivity to Temperature	1.7	2.8		
	Adult Mobility	3.0	2.8		
	Dispersal & Early Life History	3.6	3.0		
	<b>Sensitivity Score</b>		<b>High</b>		
	Exposure variables	Sea Surface Temperature	3.9	3.0	
Variability in Sea Surface Temperature		1.0	3.0		
Salinity		1.6	3.0		
Variability Salinity		1.2	3.0		
Air Temperature		3.5	3.0		
Variability Air Temperature		1.0	3.0		
Precipitation		1.3	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		1.6	1.5		
<b>Exposure Score</b>		<b>Very High</b>			
<b>Overall Vulnerability Rank</b>		<b>Very High</b>			

### **Knobbed Whelk (*Busycon carica*)**

Overall Climate Vulnerability Rank: **Very High** (58% certainty from bootstrap analysis).

Climate Exposure: **Very High**. Three exposure factors contributed to this score: Ocean Surface Temperature (3.9), Air Temperature (3.5) and Ocean Acidification (4.0). Knobbed Whelk are found in inner shelf and nearshore waters.

Biological Sensitivity: **High**. Three sensitivity attributes scored above 3.0: Sensitivity to Ocean Acidification (3.9), Adult Mobility (3.0), and Dispersal and Early Life History (3.6). Adults have a calcium carbonate shell and low mobility. Eggs are attached to the bottom in a gelatinous egg sack and dispersal of larvae is believed to be limited.

Distributional Vulnerability Rank: **High** (100% certainty from bootstrap analysis).

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Knobbed Whelk 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 Knobbed Whelk. Although there is relatively little information, warming has the potential to cause northward distribution shifts and may reduce productivity in the southern part of the ecosystem.

Data Quality: 79% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: There is relatively little information regarding the population dynamics and climate effects on productivity and distribution of Knobbed Whelk. Ries et al. (2009) found that calcification rate of other gastropods decreased with decreasing aragonite saturation state. Thus ocean acidification may reduce population productivity, but specific experiments on knobbed whelk are needed.

Life History Synopsis: Knobbed Whelk is a slow-growing, estuarine and marine shellfish that occurs from Cape Cod, Massachusetts, to Cape Canaveral, Florida (Eversole et al., 2008). The species was once believed to be hermaphroditic, but recent work and genetics have confirmed that Knobbed Whelks are dioecious with larger and later maturing females (6 years) and smaller, earlier maturing males (4 years) (Avisé et al., 2004; Power et al., 2009). Maturity may occur later in northern parts of their range (Castagna and Kraeuter, 1994; Power et al., 2009). Spawning occurs in spring and fall, but it is uncertain whether an individual female can spawn twice a year, and fall is the dominant spawning season (Magalhaes, 1948). Knobbed Whelk form small spawning aggregations and fertilization occurs internally (Magalhaes, 1948). A female produces thousands of eggs that are encased in capsules and laid in a long string with one end buried in the mud or sand as an anchor (Magalhaes, 1948). Eggs usually incubate over the winter and hatch in the spring, but incubation can be as short as 6 weeks (Power et al., 2009) or as long as 13 months (Anderson, 2005). Young Knobbed Whelks emerge from the eggs as small juveniles (Magalhaes, 1948). Knobbed Whelk are an abundant species of whelk throughout most of their range, particularly in inshore and shelf mud and sand bottom habitat (Magalhaes, 1948). During late fall and winter, Knobbed Whelks partially submerge themselves in the sand in deeper waters (Magalhaes, 1948; Power et al., 2009). Adults prey primarily on bivalves, but annelids are also consumed and Knobbed Whelk may scavenge on recently dead fish (Magalhaes, 1948). Crabs and gulls are common predators (Magalhaes, 1948). Knobbed Whelks are long-lived, late maturing, and slow growing (Eversole et al.,

2008). Commercial fisheries exist throughout their range and are managed on a state-by-state basis. Knobbed Whelks can be hand-picked, dredged, or occasionally caught in traps (Magalhaes, 1948).

Literature Cited:

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