

# Barndoor Skate – *Dipturus laevis*

Overall Vulnerability Rank = Moderate ■

Biological Sensitivity = Moderate ■

Climate Exposure = High ■

Data Quality = 83% of scores  $\geq 2$

<i>Dipturus laevis</i>		Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)	
Sensitivity attributes	Stock Status	2.8	2.4		
	Other Stressors	1.4	1.4		
	Population Growth Rate	3.0	2.8		
	Spawning Cycle	2.2	0.4		
	Complexity in Reproduction	1.3	2.2		
	Early Life History Requirements	1.0	3.0		
	Sensitivity to Ocean Acidification	1.4	2.8		
	Prey Specialization	1.2	3.0		
	Habitat Specialization	1.2	3.0		
	Sensitivity to Temperature	2.2	3.0		
	Adult Mobility	1.9	2.4		
	Dispersal & Early Life History	1.7	2.8		
	<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		1.6	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>			

## **Barndoor Skate (*Dipturus laevis*)**

Overall Climate Vulnerability Rank: **Moderate** (94% certainty from bootstrap analysis).

Climate Exposure: **High**. Two exposure factors contributed to this score: Ocean Surface Temperature (3.9) and Ocean Acidification (4.0). Barndoor Skate are demersal and complete their life cycle in marine habitats.

Biological Sensitivity: **Moderate**. Two attributes scored above 2.5: Population Growth Rate (3.0) and Stock Status (2.8). In general, skates have a low population growth rate (higher sensitivity to climate change) (Frisk, 2010). Barndoor Skate is below the biomass target, but above the biomass threshold and abundances have increased since 2000 (NEFSC, 2013).

Distributional Vulnerability Rank: **High** (100% certainty from bootstrap analysis). Barndoor Skates are habitat generalists and mobile as adults, making seasonal movements. In addition, skate egg cases are subject to movement by currents and juveniles may move on scales of 1-10 km.

Directional Effect in the Northeast U.S. Shelf: The effect of climate change on Barndoor Skate is estimated to be negative, but this estimate has a high degree of uncertainty (<66% certainty in expert scores). Barndoor Skate are a cold water species and reductions in productivity may occur because of warming and ocean acidification. However, distributions have not shifted in recent years, contrary to the expectation of a northward shift with warming.

Data Quality: 83% of the data quality scores were 2 or greater indicate that data quality is moderate.

Climate Effects on Abundance and Distribution: Little specific information exists on the effect of climate on Barndoor Skate. Di Santo (2015) found that increased warming and acidification reduce body condition of newly hatched Little Skate. These reductions in size could result in reduced juvenile survival and thus recruitment if similar affects occur in Barndoor Skate. In regional studies of distribution, Barndoor Skate was not included (Murawski, 1993; Nye et al., 2009) but examination of NEFSC trawl survey suggests no change in the center of the distribution over the last 30 years (<http://oceanadapt.rutgers.edu/>, website last checked 13 June 2015). Working in the Northeast Atlantic, Jones et al. (2013) found that the habitat distribution of *Dipturus batis* may change substantially and an important question identified was the ability of *D. batis* to disperse to the new habitat areas.

Life History Synopsis: Barndoor Skate is a large marine skate species found from Newfoundland to North Carolina (Packer et al., 2003). Individuals of the species reach maturity after 8-11 years and are estimated to produce approximately 47 eggs per year (McEachran, 2002; Packer et al., 2003). Spawning is believed to occur in winter, but the actual spawning season may be longer (McEachran, 2002; Packer et al., 2003). Eggs are encapsulated in a horned pouch known as a mermaid's purse and likely hatch in spring or early summer (Packer et al., 2003). Young Barndoor Skate are rarely collected, but are thought to be 180-190 mm total length at hatching (Packer et al., 2003). Adults and juveniles migrate in along- and cross-shelf directions, and are generally farther offshore during winter and are occasionally in high abundances around Georges Bank and the Gulf of Maine (Packer et al., 2003). Barndoor Skate are often associated with Little Skate and Winter Skate in soft muddy, sandy, and gravelly substrate in a range of temperatures and depths (McEachran, 2002; Packer et al., 2003). Barndoor Skate may occur in very deep offshore waters and in estuaries, but are most often collected at depths <150 m in high salinity water (McEachran, 2002). Smaller individuals consume benthic invertebrates such as polychaetes,

copepods, amphipods, isopods, Crangon shrimp, and euphausiids (McEachran, 2002). As the Barndoor Skates increase in size, they include more active prey in the diet, including polychaetes, gastropods, bivalve molluscs, squids, crustaceans, hydroids, and fishes (Spiny Dogfish, Alewife, Atlantic Herring, Atlantic Menhaden, hakes, sculpins, Cunner, Tautog, Sand Lance, Butterfish, and various flounders; McEachran, 2002; Packer et al., 2003). Little is known about predators of the species, but Barndoor Skate are likely consumed by large sharks and maybe whales (McEachran, 2003). Barndoor Skate is managed within a complex with six other species of skate, by the New England Fishery Management Council and are neither overfished nor is overfishing occurring (NEFSC, 2007).

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