Magistrate armhook squid − *Berryteuthis magister*

Overall Vulnerability Rank = Low

Biological Sensitivity = Low

Climate Exposure = Low

Sensitivity Data Quality = 42% of scores ≥ 2

Exposure Data Quality = 56% of scores ≥ 2

	Berryteuthis magister	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Habitat Specificity	1.3	1.7	
	Prey Specificity	1.7	2.7	
	Adult Mobility	1.3	2.3	
	Dispersal of Early Life Stages	1.3	1.3	
	Early Life History Survival and Settlement Requirements	1.9	1.0	
	Complexity in Reproductive Strategy	2.5	1.3	
	Spawning Cycle	2.1	2.0	
	Sensitivity to Temperature	1.2	3.0	
	Sensitivity to Ocean Acidification	1.7	3.0	
	Population Growth Rate	1.2	1.7	
	Stock Size/Status	1.5	1.3	
	Other Stressors	1.7	0.8	
	Sensitivity Score	Low		
Exposure factors	Sea Surface Temperature	2.0	2.0	
	Sea Surface Temperature (variance)	1.5	2.0	
	Bottom Temperature	2.1	2.0	
	Bottom Temperature (variance)	2.1	2.0	
	Salinity	1.2	2.0	
	Salinity (variance)	2.3	2.0	
	Ocean Acidification	4.0	2.0	
	Ocean Acidification (variance)	1.3	2.0	
	Phytoplankton Biomass	1.4	1.2	
	Phytoplankton Biomass (variance)	1.5	1.2	
	Plankton Bloom Timing	1.5	1.0	
	Plankton Bloom Timing (variance)	2.1	1.0	
	Large Zooplankton Biomass	1.3	1.0	
	Large Zooplanton Biomass (variance)	1.5	1.0	
	Mixed Layer Depth	1.5	1.0	
	Mixed Layer Depth (variance)	2.2	1.0	
	Currents	1.3	2.0	
	Currents (variance)	1.7	2.0	
	Air Temperature	NA	NA	
	Air Temperature (variance)	NA	NA	
	Precipitation	NA	NA	
	Precipitation (variance)	NA	NA	
	Sea Surface Height	NA	NA	
	Sea Surface Height (variance)	NA	NA	
	Exposure Score	Low		
	Overall Vulnerability Rank	Low		

Low
Moderate
High
Very High

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Magistrate armhook squid (*Berryteuthis magister*)

Overall Climate Vulnerability Rank: **Low**. (100% certainty from bootstrap analysis).

Climate Exposure: **Low**. With the exception of ocean acidification (4.0), all exposure factors had scores less than 2.5.

Biological Sensitivity: **Low**. Complexity in reproductive strategy (2.5) was ranked as "moderate" sensitivity, and all other sensitivity attributes were ranked as "low" sensitivity.

Potential for distribution change: **Very High** (85% certainty from bootstrap analysis). Three attributes (adult mobility, dispersal of early life stages, and habitat specificity) indicated high potential for distribution change.

Directional Effect in the Eastern Bering Sea: Projected climate change in the eastern Bering Sea is expected to have a neutral effect on magistrate armhook squid, with 84% certainty in expert scores.

Data Quality: 42% of the sensitivity attributes, and 56% of the exposure factors, had average data quality scores of 2 or greater (indicating at least "moderate" data quality).

Climate Effects on Abundance and Distribution: Although climate effects on *B. magister* have not been studied, there is substantial evidence that squid species are strongly influenced by environmental changes. The timing of veined squid *Loligo forbesi* migrations in the Atlantic Ocean was related to temperature changes connected to the North Atlantic Oscillation (Sims et al. 2001), and range expansion of Humboldt squid *Dosidicus gigas* off California was related to changes in ocean conditions (Zeidberg and Robison 2007). Squids have generally very high, temperature-dependent growth rates, and warmer ocean temperatures are likely to have complex effects on squid physiology and population structure (Pecl and Jackson 2008). These effects include the interaction of increased growth with higher prey consumption and oxygen requirements. In addition faster-growing squids appear to mature at a smaller size and have smaller offspring, suggesting that warmer temperatures may affect the size structure of populations.

Life History Synopsis: *Berryteuthis magister* is distributed from southern Japan throughout the Bering Sea, Aleutian Islands, and Gulf of Alaska to the U.S. west coast as far south as Oregon (Roper et al. 1984). In the EBS they occur mainly along the edge of the continental shelf, particularly at the heads of large submarine canyons at depths below 200 m (Ormseth 2016). The maximum size reported for *B. magister* is 28 cm mantle length. In the eastern Bering Sea, *B. magister* appear to have an approximately 1-year life cycle (Drobny 2008), and appear to grow and mature more quickly than their conspecifics in Russian and Japanese waters. Squid growth appears to be heavily influenced by ocean temperature (Forsythe 2004), which may account for some of the regional variability in mean size. Populations of *B. magister* and other squids are complex, being made up of multiple cohorts spawned throughout the year. Adult *B. Magister* are predated by sperm whales. Juveniles, distributed close to the surface, serve as prey for fishes, seabirds, and northern fur seals.

There are no directed fisheries for squid in the Bering Sea and Aleutian Islands region but they are captured incidentally in commercial fisheries, particularly those targeting walleye pollock (Ormseth 2016). Until 2018, *B. magister* was a part of a squid stock complex that was managed as a target fishery with annual catch limits. With the other squid species it is now considered an Ecosystem Component. Annual catch limits are not required but directed harvesting is prohibited and bycatch is limited by a maximum retention allowance.

Literature Cited:

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