Kamchatka flounder − *Atheresthes evermanni*

Overall Vulnerability Rank = Moderate

Biological Sensitivity = Moderate

Climate Exposure = Moderate

Sensitivity Data Quality = 50% of scores ≥ 2

Exposure Data Quality = 56% of scores ≥ 2

	Atheresthes evermanni	Expert Scores	Data Quality	Expert Scores Plots (Portion by Category)
Sensitivity attributes	Habitat Specificity	1.3	2.8	
	Prey Specificity	1.6	2.8	
	Adult Mobility	1.5	1.6	
	Dispersal of Early Life Stages	1.4	1.6	
	Early Life History Survival and Settlement Requirements	2.2	1.8	
	Complexity in Reproductive Strategy	2.0	0.6	
	Spawning Cycle	2.8	1.4	
	Sensitivity to Temperature	2.2	2.0	
	Sensitivity to Ocean Acidification	1.7	2.8	
	Population Growth Rate	3.4	2.4	
	Stock Size/Status	1.6	2.6	
	Other Stressors	1.2	1.6	
	Sensitivity Score	Moderate		
Exposure factors	Sea Surface Temperature	2.0	2.5	
	Sea Surface Temperature (variance)	1.9	2.5	
	Bottom Temperature	2.1	3.0	
	Bottom Temperature (variance)	2.5	3.0	
	Salinity	1.1	2.0	
	Salinity (variance)	2.1	2.0	
	Ocean Acidification	4.0	3.0	
	Ocean Acidification (variance)	1.3	3.0	
	Phytoplankton Biomass	1.2	1.2	
	Phytoplankton Biomass (variance)	1.2	1.2	
	Plankton Bloom Timing	1.6	1.0	
	Plankton Bloom Timing (variance)	2.2	1.0	
	Large Zooplankton Biomass	1.2	1.0	
	Large Zooplanton Biomass (variance)	1.5	1.0	
	Mixed Layer Depth	1.6	1.0	
	Mixed Layer Depth (variance)	2.1	1.0	
	Currents	1.4	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	Moderate		
Overall Vulnerability Rank		Moderate		

Low
Moderate
High
Very High

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Kamchatka flounder (*Atheresthes evermanni*)

Overall Climate Vulnerability Rank: **Moderate**. (62% certainty from bootstrap analysis).

Climate Exposure: **Moderate**. Exposure to ocean acidification was ranked as "very high", and exposure to variability in bottom temperature (2.5) was ranked as "moderate".

Biological Sensitivity: **Moderate**. Population growth rate (3.4) was ranked as "high" sensitivity, and spawning cycle was ranked as "moderate" sensitivity.

Potential for distribution change: **High** (67% certainty from bootstrap analysis). Dispersal of early life stages and habitat specificity indicated very high potential for distribution change, whereas adult mobility indicated a 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 Kamchatka flounder, with 95% certainty in expert scores.

Data Quality: 50% 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:

It is not known what effect climate has or will have on the distribution and abundance of Bering Sea and Aleutian Islands Kamchatka flounder. Estimates of recruitment variability have not yet been linked to any particular environmental variable. Distributions from surveys conducted in the BSAI since 1991 (when they were first identified in survey catches) indicate a stable spatial population. Any future changes in the advective properties of the Bering Slope current with a changing climate that reduces the flow from deep slope waters to the outer continental shelf could hamper larval advection.

Life History Synopsis:

Kamchatka flounder (*Atheresthes evermanni*) is a relatively large flatfish which is distributed from northern Japan through the Sea of Okhotsk to the western Bering Sea north to Anadyr Gulf (Wilimovsky et al. 1967) and east to the eastern Bering Sea shelf and south of the Alaska Peninsula (there is also a catch record from California). In U.S. waters they are found in commercial concentrations in the Aleutian Islands and the Bering Sea slope where they generally decrease in abundance from west to east (Zimmerman and Goddard 1996). They are also present in Bering Sea slope waters but are absent in survey catches east of Chirikof Island. They are managed as a single stock throughout their U.S. distribution.

Adults are found in deep waters of the continental slope from the Gulf of Alaska to the western Bering Sea (225-800m). This habitat is abundant and may be classified as both a physical and biological habitat (Lauth and Conners 2013, Wilderbuer et al. 2014, Zimmerman and Goddard 1996). The habitat is marginally disturbed and they are most likely a generalist within this habitat. Juveniles occupy shallower water than adults, settling on the continental shelf. This habitat is also abundant and marginally disturbed.

Adult and juvenile diet is also similar to arrowtooth flounder and includes pollock, other small fish, shrimp, polychaetes and euphausids. The amount of fish in the diet and the size of the prey increases with length of the fish (Yang and Livingston 1986). The diverse diet indicates a trophic generalist.

Kamchatka flounder are believed to spawn in deep water during the winter. Large migrations have not been documented for this species. Age at 50% maturity is estimated at 10.1 years and fish have been aged as old as 35 years (Stark 2012, Wilderbuer et. al 2014). Diffusion requirements are unknown for eggs and larvae of this species but their presence on the continental shelf indicates that they require favorable advection through currents and tides to reach favorable nursery areas. Some larvae have been captured on the outer limits of the shelf. In general, larvae are thought to disperse such that larvae will not metamorphose in the same location as spawning, but instead in shallow nursery areas (DeForest et al. 2014). Food availability is unknown but larvae can be advected to undesirable locations where a mismatch can occur. The extent of larval predation is unknown, however, the survival of larvae is thought to be more strongly dependent upon the availability of suitable prey than on predation pressure.

Literature Cited:

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