Commander skate – *Bathyraja lindbergi*

Overall Vulnerability Rank = Low

Biological Sensitivity = Moderate

Climate Exposure = Low

Sensitivity Data Quality = 42% of scores ≥ 2

Exposure Data Quality = 33% of scores ≥ 2

| | *Bathyraja lindbergi* | Expert Scores | Data Quality | Expert Scores Plots (Portion by Category) |
|---|---|---|---|---|
| Sensitivity attributes | Habitat Specificity | 1.6 | 1.7 | |
| | Prey Specificity | 1.2 | 2.0 | |
| | Adult Mobility | 2.2 | 1.3 | |
| | Dispersal of Early Life Stages | 2.9 | 1.3 | |
| | Early Life History Survival and Settlement Requirements | 1.0 | 2.0 | |
| | Complexity in Reproductive Strategy | 2.9 | 1.3 | |
| | Spawning Cycle | 1.7 | 1.0 | |
| | Sensitivity to Temperature | 1.7 | 2.7 | |
| | Sensitivity to Ocean Acidification | 1.5 | 2.0 | |
| | Population Growth Rate | 3.7 | 2.0 | |
| | Stock Size/Status | 1.7 | 1.0 | |
| | Other Stressors | 1.2 | 1.3 | |
| | Sensitivity Score | Moderate | | |
| Exposure factors | Sea Surface Temperature | NA | NA | |
| | Sea Surface Temperature (variance) | NA | NA | |
| | Bottom Temperature | 2.1 | 2.0 | |
| | Bottom Temperature (variance) | 1.9 | 2.0 | |
| | Salinity | NA | NA | |
| | Salinity (variance) | NA | NA | |
| | Ocean Acidification | 3.9 | 2.0 | |
| | Ocean Acidification (variance) | 1.3 | 2.0 | |
| | Phytoplankton Biomass | 1.5 | 1.2 | |
| | Phytoplankton Biomass (variance) | 1.4 | 1.2 | |
| | Plankton Bloom Timing | 1.5 | 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 | 1.5 | 1.0 | |
| | Mixed Layer Depth (variance) | 2.0 | 1.0 | |
| | Currents | NA | NA | |
| | Currents (variance) | NA | NA | |
| | 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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**Commander skate (*Bathyraja lindbergi*)**

Overall Climate Vulnerability Rank: **Low**. (95% certainty from bootstrap analysis).

Climate Exposure: **Low**. With the exception of ocean acidification (3.9), all exposure factors had scores less than 2.5.

Biological Sensitivity: **Moderate**. Population growth rate (3.7) was ranked as "very high" sensitivity, and complexity in reproductive strategy (2.9) and dispersal of early life stages (2.9) were ranked as "moderate" sensitivity.

Potential for distribution change: **Moderate** (79% certainty from bootstrap analysis). Habitat specificity indicated high potential for distribution change, and adult mobility indicated moderate 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 commander skate, with 91% certainty in expert scores.

Data Quality: 42% of the sensitivity attributes, and 33% 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: Few data exist to make predictions regarding climate effects on commander skate. This species is distributed in deep water (> 400 m depth; Ormseth 2016) on the eastern Bering Sea continental slope, where temperatures are less variable than in shallower water and increases in ocean temperature may be less apparent. The abundance of commander skate remained stable during 2002-2012, a period that included warm and cold temperatures.

Life History Synopsis: Commander skate has received little research attention beyond one study that estimated basic life history parameters (Ebert 2005). The maximum observed total length is 97 cm for both sexes. Length at 50% maturity ($L_{50\%}$) was 78 cm for males and 85 cm for females. Although age and growth rate have not been determined for commander skate, the observation that $L_{50\%}$ is close to the maximum length suggests that they are achieve sexual maturity late in their life (similar to other skate species) and have a vulnerable life history strategy.

Commander skate is managed as part of the Bering Sea and Aleutian Islands (BSAI) skate complex. There are no directed fisheries for skates in the BSAI but skates are captured incidentally in commercial fisheries and they are managed with annual catch limits. Limits are determined by multiplying an estimate of biomass by a natural mortality rate of 0.1. Data regarding catches of individual skate species are uncertain, but due to its distribution in deep water catches of commander skate are probably uncommon.

Literature Cited:

Ebert, D.A. 2005. Reproductive biology of skates, *Bathyraja* (Ishiyama), along the eastern Bering Sea continental slope. J. Fish. Biol. 66: 618-649.

Ormseth, O.A. 2016. Assessment of the skate stock complex in the eastern Bering Sea and Aleutian Islands. In: Stock assessment and fishery evaluation report for the groundfish resources of the Bering Sea/Aleutian Islands regions, pp. 1769-1868. North Pacific Fishery Management Council, 605 W. 4th Ave, suite 306. Anchorage, AK 99501.