

Ecosystem & Socioeconomic Profile

Eastern Bering Sea
Snow Crab

Erin Fedewa and Kalei Shotwell

September 2023

ESP Contributors: Matt Callahan, Curry Cunningham, Ben Daly, Jean Lee, Jens Nielsen, Katie Palof, Darren Pilcher, Dale Robinson, Abigail Tyrell, Ellen Yasumiishi and Leah Zacher



NOAA
FISHERIES

Overview

Snow Crab ESP in SAFE Appendix

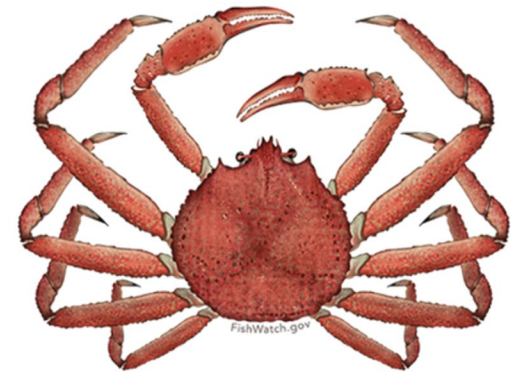
- Initial full ESP in 2022
- 2023 Report Card

2023 Snow Crab Report Card

- Ecosystem Indicator Assessment and Analysis
- Socioeconomic Indicator Assessment and Analysis
- Recommendations and Considerations
- Proposed Developments for 2024

Appendix A. Ecosystem and Socioeconomic Profile of the Snow Crab Stock in the Eastern Bering Sea - Report Card

Erin Fedewa and Kalei Shotwell
September 2023



Ecosystem Indicators

Ecosystem Indicators

Physical

- 1. Arctic Oscillation (climate model)
- +
- 2. Cold pool extent (BT survey)
- +
- 3. Sea ice concentration (satellite)

Lower Trophic

- +
- 4. Chl-*a* concentration (satellite)
- +
- 5. Benthic invert density (BT survey)

Upper Trophic

- +
- 6. Snow crab area occupied (BT survey)
- 7. Temperature of occupancy (BT survey)
- +
- 8. Snow crab center of abundance (BT survey)
- 9. Pcod consumption of snow crab (BT survey)
- +
- 10. Male snow crab 50% size at maturity (BT survey)
- 11. Snow crab disease prevalence (BT survey)
- +
- 12. Juvenile snow crab condition (lab)**

**New Indicator Inclusion Pending CPT Review

Ecosystem Traffic Light Table

Indicator category	Indicator	2019 Status	2020 Status	2021 Status	2022 Status	2023 Status
Physical	Winter Spring Arctic Oscillation Index Model	neutral	high	neutral	neutral	neutral
	Summer Cold Pool SEBS Survey	low	NA	low	neutral	neutral
	Winter Sea Ice Advance BS Satellite	low	neutral	neutral	neutral	neutral
Lower Trophic	AMJ Chlorophylla Biomass SEBS Satellite	neutral	neutral	neutral	neutral	low
	Summer Benthic Invertebrate Density SEBS Survey	neutral	NA	neutral	neutral	NA
Upper Trophic	Summer Snow Crab Juvenile Temperature Occupancy	high	NA	high	neutral	neutral
	Summer Snow Crab Juvenile Disease Prevalence	neutral	NA	neutral	neutral	neutral
	Annual Snow Crab Male Size Maturity Model	neutral	NA	low	neutral	neutral
	Summer Snow Crab Male Area Occupied SEBS Survey	low	NA	neutral	neutral	neutral
	Summer Snow Crab Male Center Distribution SEBS Survey	neutral	NA	high	high	high
	Summer Snow Crab Consumption Pacific cod Model	neutral	NA	neutral	neutral	NA
	Summer Snow Crab Juvenile Condition SEBS Survey	low	NA	neutral	neutral	neutral

2023 Ecosystem Considerations

- Summer bottom temperatures and the spatial extent of the cold pool remained near-average in the eastern Bering. The Arctic Oscillation was slightly positive this past winter
- Juvenile snow crab occupied -0.3°C bottom waters on average, suggesting optimal cold-water habitat availability for predator refuge
- Anomalously low levels of chlorophyll-a in 2023 indicate a less pronounced spring bloom and poor feeding conditions for larval snow crab
- Following a dramatic increase in the prevalence of bitter crab syndrome and Pacific cod predation in 2016 coinciding with a large snow crab recruitment event, disease prevalence remains near-average. Pacific cod consumption on snow crab has also remained near-average in 2021 and 2022
- The center of mature male abundance remains more northerly than average, indicative of a large-scale distribution shift from historic mid-shelf habitats
- Juvenile snow crab were in very poor body condition prior to the 2021 population collapse, although 2021-2023 condition estimates have returned to near-average.

Socioeconomic Indicators

Socio-economic Indicators

Fishery Performance

1. Center of gravity (snow crab fishery)
2. Catch-per-unit-effort (snow crab fishery)
3. Total potlifts (snow crab fishery)
4. Number active vessels (snow crab fishery)
5. Incidental catch of snow crab

Economic

6. Ex-vessel value (snow crab fishery)
7. Ex-vessel price/lb (snow crab fishery)
8. Ex-vessel revenue share (snow crab fishery)
9. TAC Utilization (snow crab fishery)

Community

ABSC Skipper Survey Results (no 2023 update)

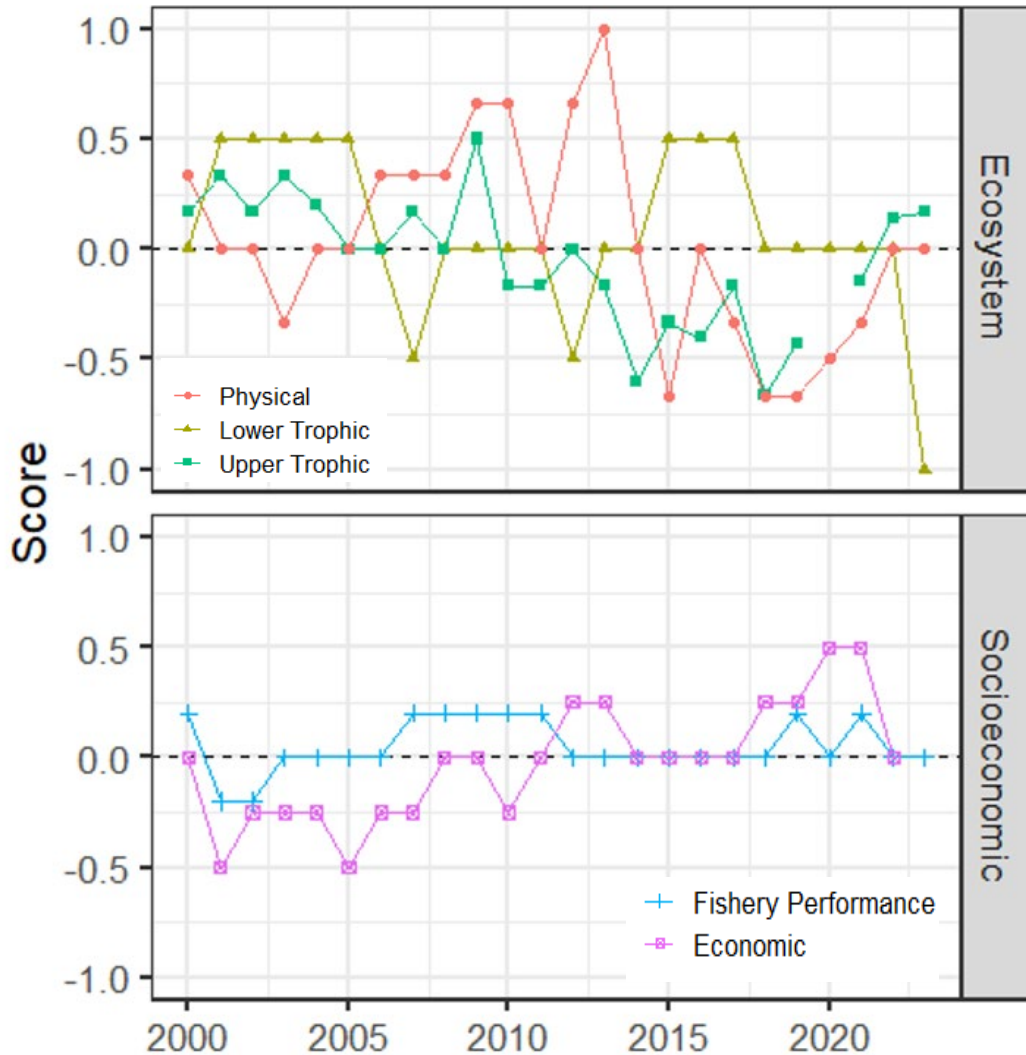
Socioeconomic Traffic Light Table

Indicator category	Indicator	2019 Status	2020 Status	2021 Status	2022 Status	2023 Status
Fishery Performance	Annual Snow Crab Active Vessels EBS Fishery	neutral	neutral	neutral	low	NA
	Annual Snow Crab CPUE Fishery	neutral	neutral	neutral	neutral	NA
	Annual Snow Crab Potlift Fishery	neutral	neutral	neutral	neutral	NA
	Annual Snow Crab Center Distribution EBS Fishery	high	neutral	high	high	NA
	Annual Snow Crab Incidental Catch EBS Fishery	neutral	neutral	neutral	neutral	neutral
Economic	Annual Snow Crab TAC Utilization EBS Fishery	neutral	neutral	neutral	neutral	NA
	Annual Snow Crab Exvessel Value EBS Fishery	neutral	neutral	neutral	low	NA
	Annual Snow Crab Exvessel Price EBS Fishery	high	high	high	high	NA
	Annual Snow Crab Exvessel Revenue Share EBS Fishery	neutral	high	high	neutral	NA

Socioeconomic Considerations

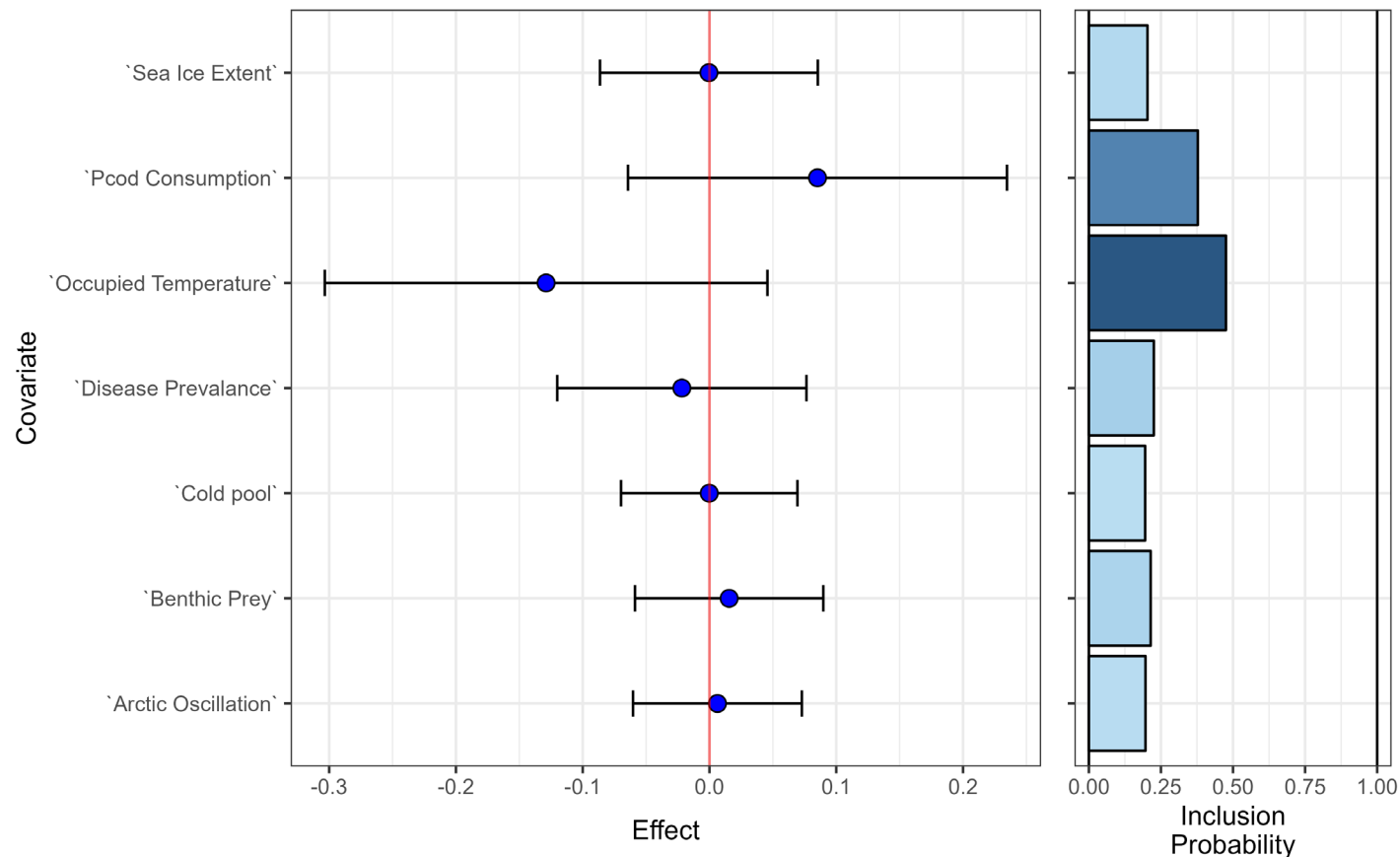
- The Bering Sea snow crab fishery was closed to targeted fishing for the first time in history, representing severe economic hardships for industry alongside BBRKC fishery closures
- Incidental catch of snow crab in EBS groundfish fisheries has remained near-average for the past 5-year period

Indicator Monitoring Analysis: Traffic Light Score



- Physical and lower trophic indicators scored below average for 2023
- Upper trophic indicators were average

Indicator Analysis Stage 2: BAS Indicator Importance



The highest ranked predictor variables were 1) juvenile snow crab temperature of occupancy and 2) Pacific cod consumption, although effect sizes were relatively small and marginal inclusion probabilities were < 0.5 for all predictors

Planned ESP Developments

- Producing a Request for Indicators in February 2024 to highlight data gaps and propose new indicator contributions
- Refinement to existing indicators:
 - Using observed size at maturity data for immature/mature indicator cutlines
 - Standardizing cod consumption rates by snow crab abundance
 - NBS disease prevalence
- Development of new indicators:
 - Stakeholder outreach for input on community indicators (Friday!)
 - Average clutch fullness (currently in SAFE)
 - Bloom timing/type indicators
 - Snow crab/fishing gear spatial overlap metric
 - Habitat disturbance metric



Questions?