NOAA FISHERIES

Ecosystem & Socioeconomic Profile

Eastern Bering Sea Snow Crab Report Card

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September 2025

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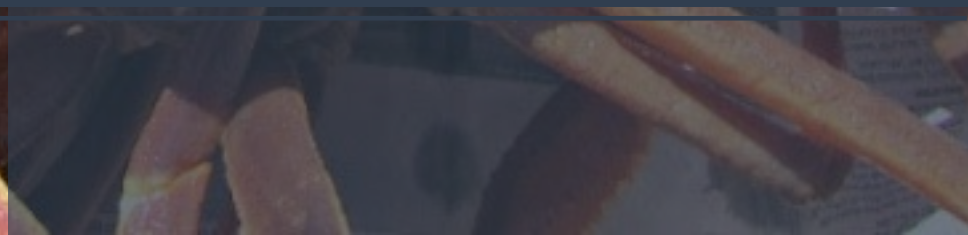
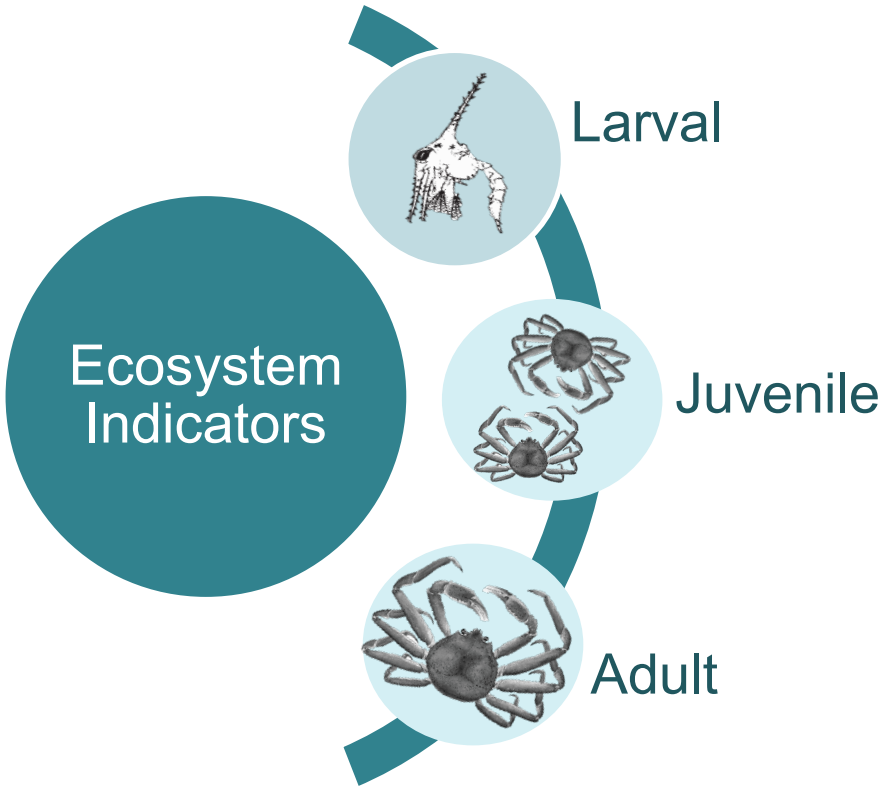


Ecosystem Indicator Suite



Arctic Oscillation
Chl-*a* Concentration**

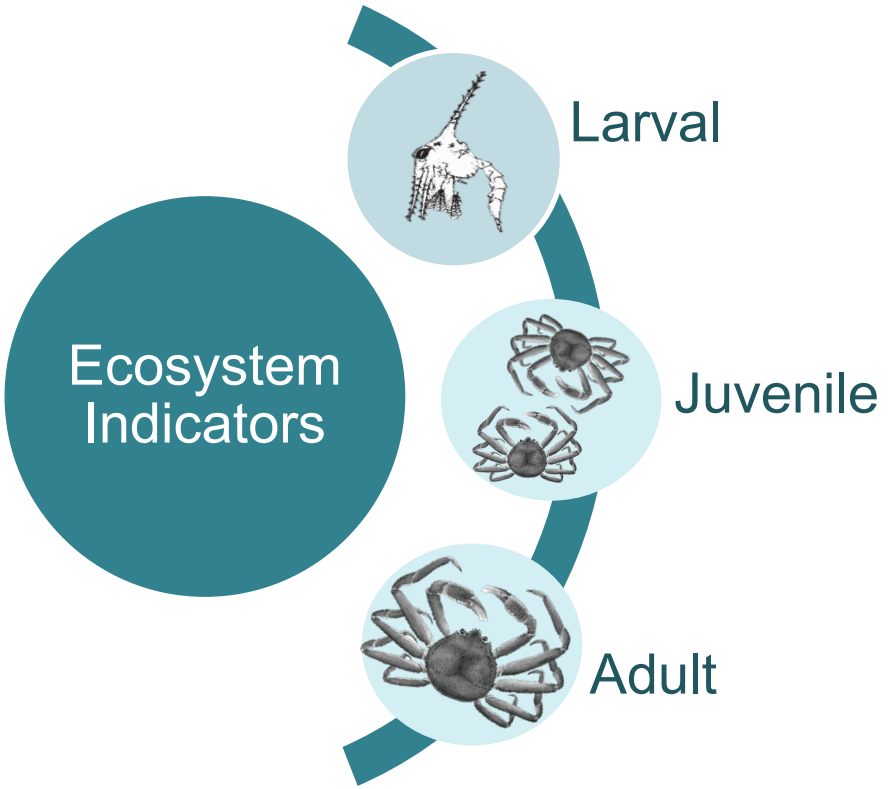
Spatial Extent of Bottom Waters < 0°C**
Juvenile Temperature of Occupancy
Winter Sea Ice Extent**
Juvenile Disease Prevalence
Juvenile Energetic Condition
Pacific Cod Consumption**

Benthic Prey Density
Male Size at Maturity
Female Size at Maturity
Mature Male Area Occupied
Mature Male Center of Abundance
Female Reproductive Failure**
Operational Sex Ratio

** Modified indicators for 2025

New Indicators proposed for 2025

Ecosystem indicator subsetting for importance analysis



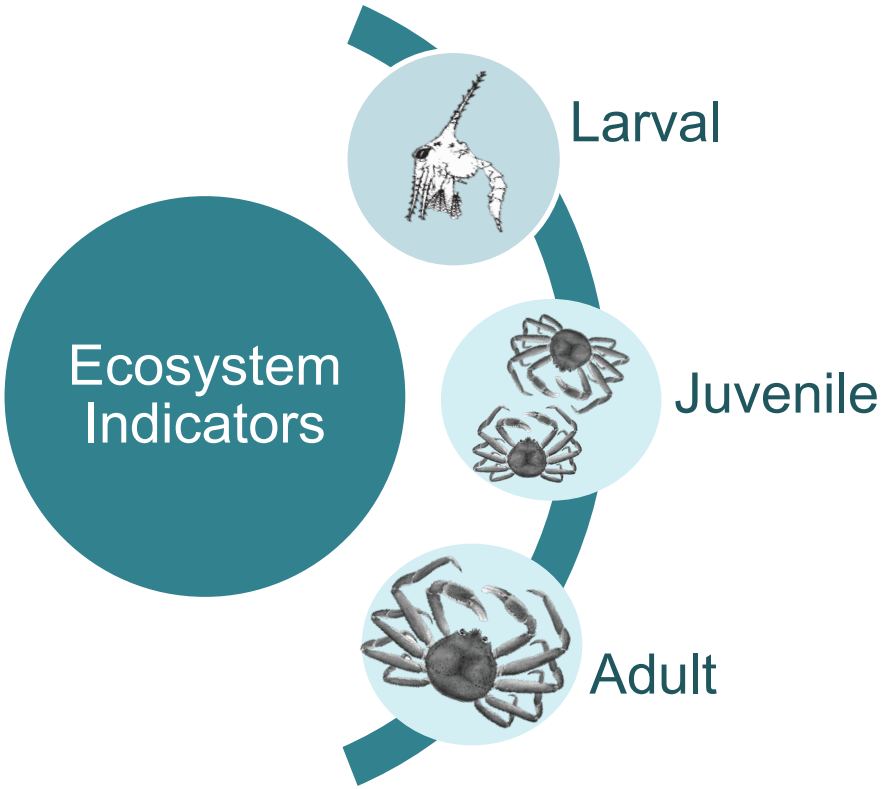
- Arctic Oscillation
- Chl-*a* Concentration

- Spatial Extent of < 0°C
- Juvenile Temperature of Occupancy
- Winter Sea Ice Extent
- Juvenile Disease Prevalence
- Juvenile Energetic Condition
- Pacific Cod Consumption

- Benthic Prey Density
- Male Size at Maturity
- Female Size at Maturity
- Mature Male Area Occupied
- Mature Male Center of Abundance
- Female Reproductive Failure
- Operational Sex Ratio

Not drivers of recruitment

Ecosystem indicator subsetting for importance analysis



Arctic Oscillation

Chl-*a* Concentration — *Limits model run start date*

Spatial Extent of < 0°C

Juvenile Temperature of Occupancy

Winter Sea Ice Extent

Juvenile Disease Prevalence

Juvenile Energetic Condition — *Time series length*

Pacific Cod Consumption

Benthic Prey Density

Male Size at Maturity

Female Size at Maturity

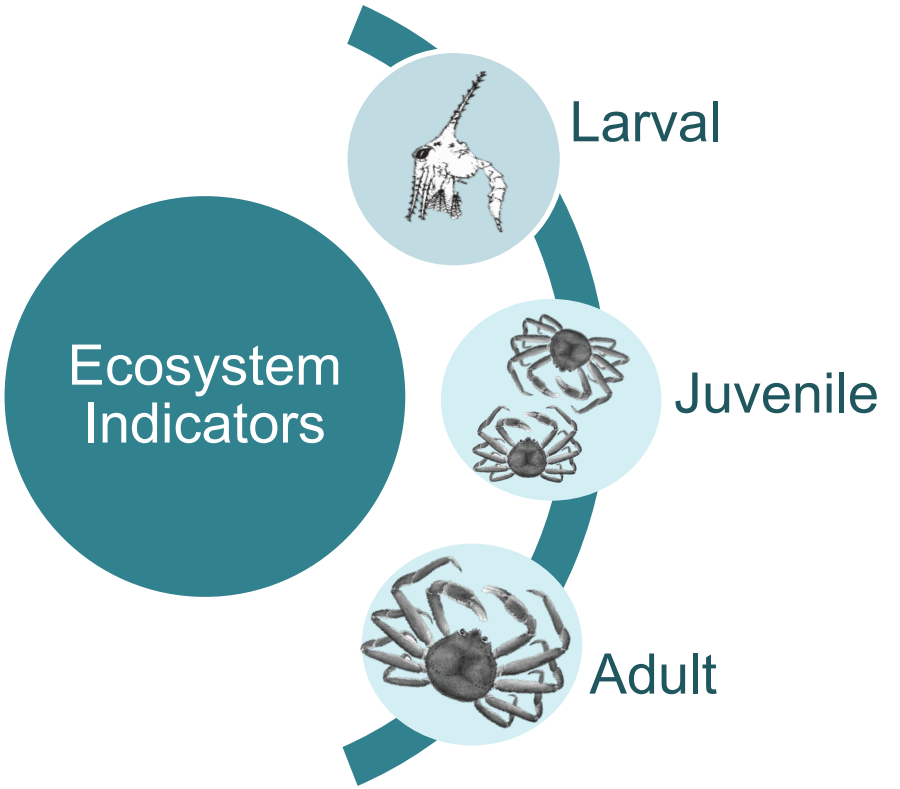
Mature Male Area Occupied

Mature Male Center of Abundance

Female Reproductive Failure — *Limits model run start date*

Operational Sex Ratio

Ecosystem indicator subsetting for importance analysis



Arctic Oscillation

Chl-*a* Concentration

Spatial Extent of < 0°C — *Highly correlated*

Juvenile Temperature of Occupancy

Winter Sea Ice Extent

Juvenile Disease Prevalence — *Highly correlated*

Juvenile Energetic Condition

Pacific Cod Consumption

Benthic Prey Density

Male Size at Maturity

Female Size at Maturity

Mature Male Area Occupied

Mature Male Center of Abundance

Female Reproductive Failure

Operational Sex Ratio

Indicator Importance Testing:
Bayesian Adaptive Sampling

Indicator tested in BAS analysis	Lag Applied (years)	Rationale
Arctic Oscillation	6	Hypothesized to affect larval stages
Pacific Cod Consumption	3	Predation highest on 10-20 mm juvenile snow crab
Sea Ice Extent	3	Early benthic juvenile stages highly stenothermic and dependent on ice-associated spring blooms
Juvenile Temperature of Occupancy	1	Prior year most informative for survival
Benthic Prey Density	1	Prior year most informative for survival

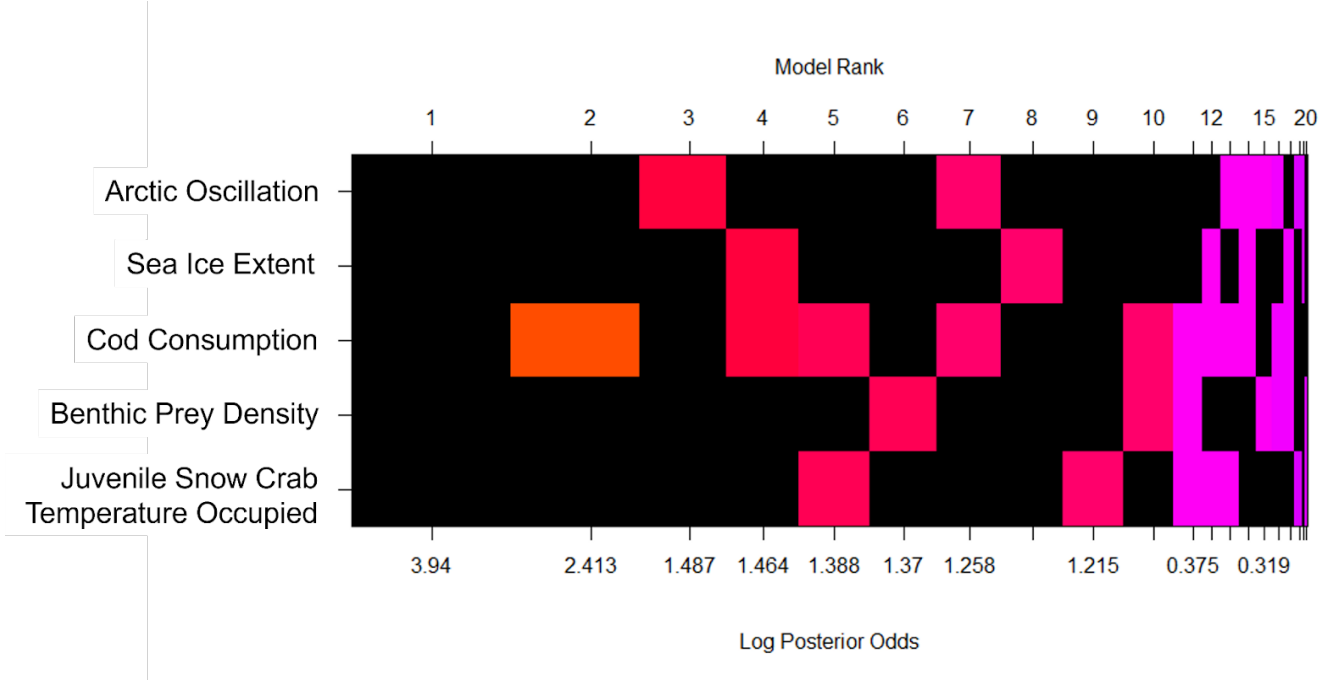
Larval indicator *Juvenile indicator* *Adult indicator*

Response Variable:

Survey abundance of newshell male snow crab (65 – 80 mm CW)

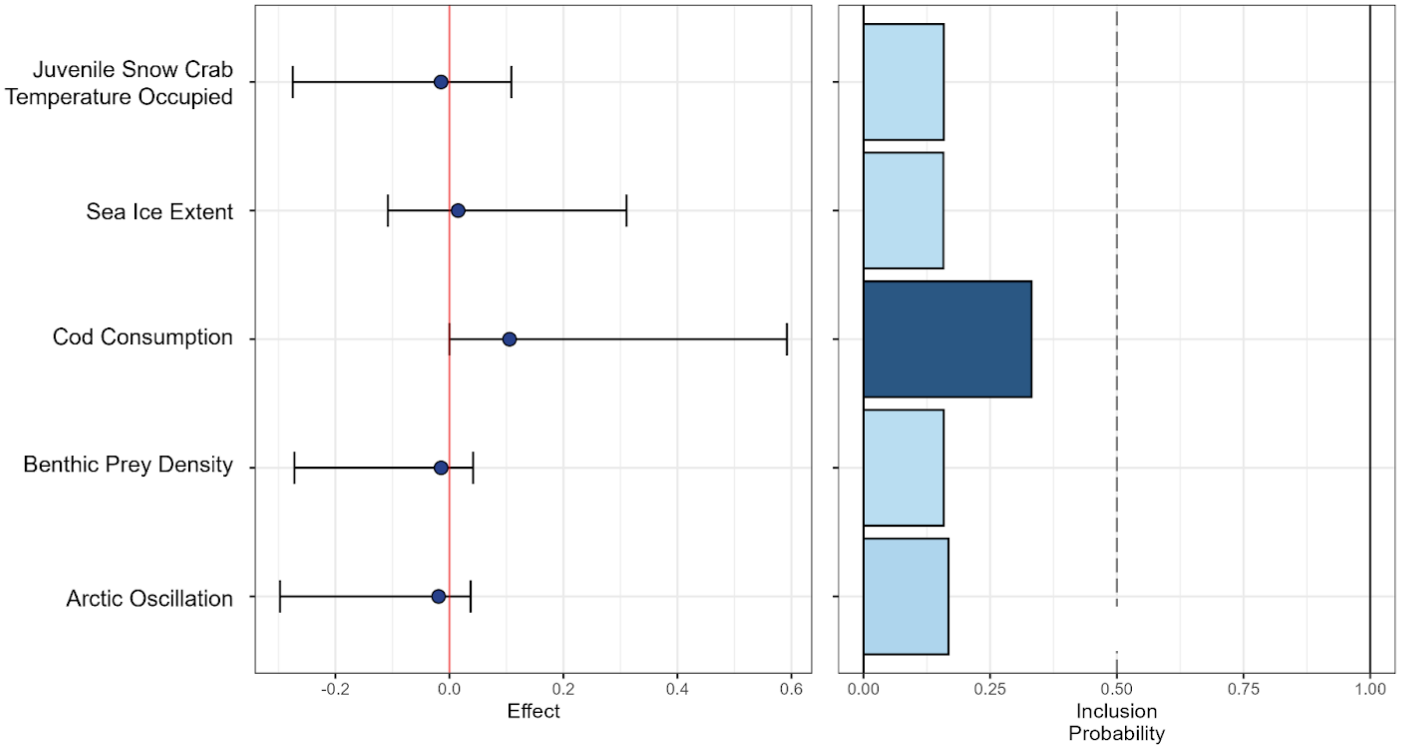
Represents males ~ 6.7 - 7.7 years post-settlement, and 1 -2 molts away from terminal molt and recruitment to the fishery

Indicator Importance Testing:
Bayesian Adaptive Sampling



The final model selected using BAS was the intercept-only model, indicating that the suite of ecosystem indicators tested had no predictive skill for estimating snow crab recruitment over the years evaluated (1989-2025)

Indicator Importance Testing:
Bayesian Adaptive Sampling



Credible intervals for all effect sizes overlapped zero, and marginal inclusion probabilities were < 0.5

Ecosystem Indicator Categorization

Predictive

None

Contextual

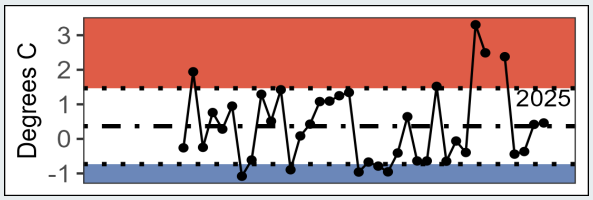
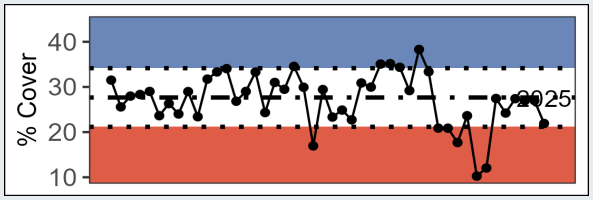
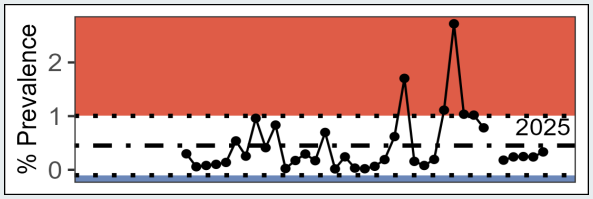
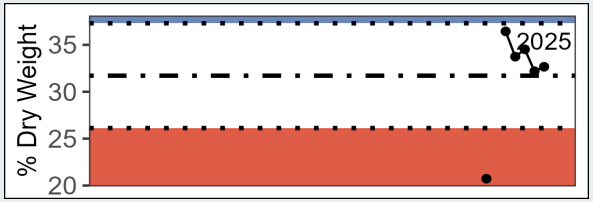
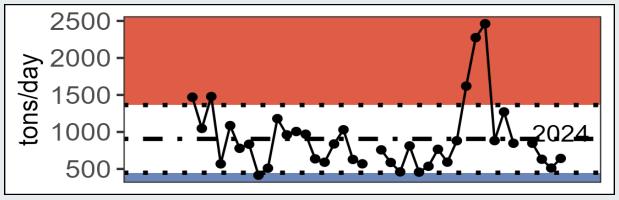
- Juvenile Temperature of Occupancy
- Winter Sea Ice Extent
- Juvenile Disease Prevalence
- Juvenile Energetic Condition
- Pacific Cod Consumption
- Male Size at Maturity
- Mature Male Area Occupied
- Mature Male Center of Abundance
- Female Reproductive Failure
- Operational Sex Ratio

Monitoring

- Arctic Oscillation
- Benthic Prey Density
- Chl-*a* Concentration
- Spatial Extent of Bottom Waters < 0°C
- Female Size at Maturity

EBS Snow Crab ESP Report Card

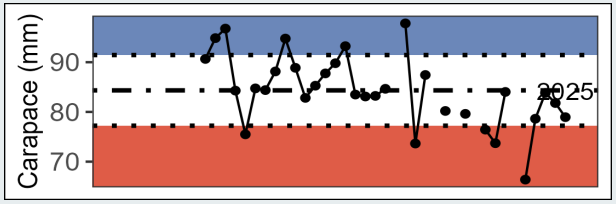
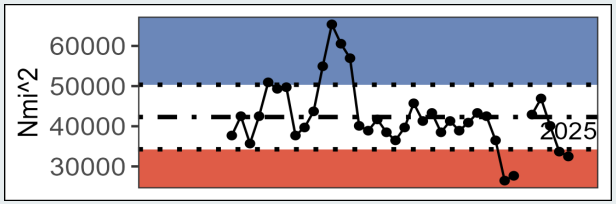
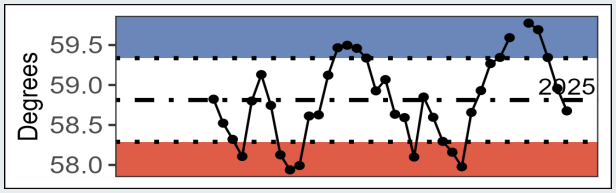
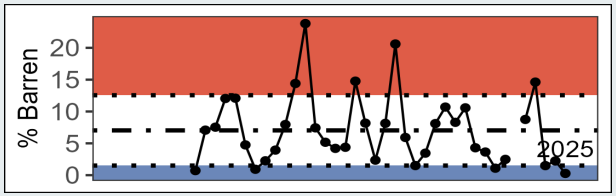
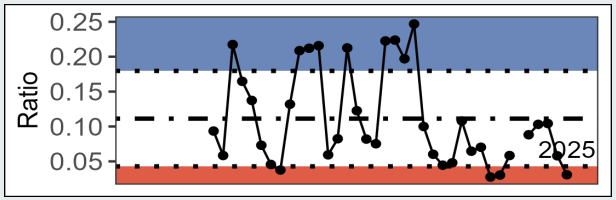
Contextual

Indicator	Status	Trend
Juvenile Temperature of Occupancy	Near long-term mean	
Winter/Spring Sea Ice Extent	Near long-term mean	
Juvenile Snow Crab Disease Prevalence	Near long-term mean	
Juvenile Snow Crab Energetic Condition	Near long-term mean	
Pacific Cod Consumption	Near long-term mean	

Most recent year indicator status indicates good conditions, average conditions, or poor conditions for the stock

EBS Snow Crab ESP Report Card

Contextual

Indicator	Status	Trend
Male Snow Crab Size at Maturity	Near long-term mean	
Male Snow Crab Area Occupied	Below long-term mean	
Male Snow Crab Center of Abundance	Near long-term mean	
Female Snow Crab Reproductive Failure	Below long-term mean	
Snow Crab Operational Sex Ratio	Below long-term mean	

Most recent year indicator status indicates good conditions, average conditions, or poor conditions for the stock

Ecosystem Considerations to Inform ABC and TAC Decisions

Predictive

- There were no ecosystem indicators that quantitatively predicted snow crab recruitment.

Contextual

- Despite warm conditions and reduced sea ice extent in 2025, juvenile snow crab occupied temperatures < 1°C indicate that **thermal thresholds were not likely exceeded** and cold-water habitat was available.
- Bitter crab disease, Pacific cod consumption and juvenile snow crab energetic condition indicators have not reached concerning levels in recent years, suggesting **suitable conditions for high survival and rebuilding**.
- **Range contraction and a southward shift** in the mature male snow crab center of abundance has coincided with a decline in the size of the cold pool since 2022.
- Notable trends in growth and maturity include a **directional downward shift in male size at terminal molt** for the past three decades, and a substantial **increase in female size at maturity** from 2024 to 2025.
- The operational sex ratio was strongly female-skewed in 2025, although < 1% of mature females with empty clutches suggests **high reproductive potential** despite depressed abundances of large male snow crab.

Next Steps

New Indicators in Development:

- Tanner/snow crab spatial overlap
- Spring bloom type (open water vs. ice-associated; Jens Nielsen)
- Refined cod consumption indicator (Jon Reum/Kerim Aydin)
- Refined benthic invert prey indicator (Jon Reum)

Continuing to refine ESP report card documents, intermediate stage analysis and report card graphics. Any and all feedback welcome on new templates!


Questions?