



NOAA
FISHERIES

Ecosystem & Socioeconomic Profile

Bristol Bay Red King Crab Report Card

Erin Fedewa and Kalei Shotwell

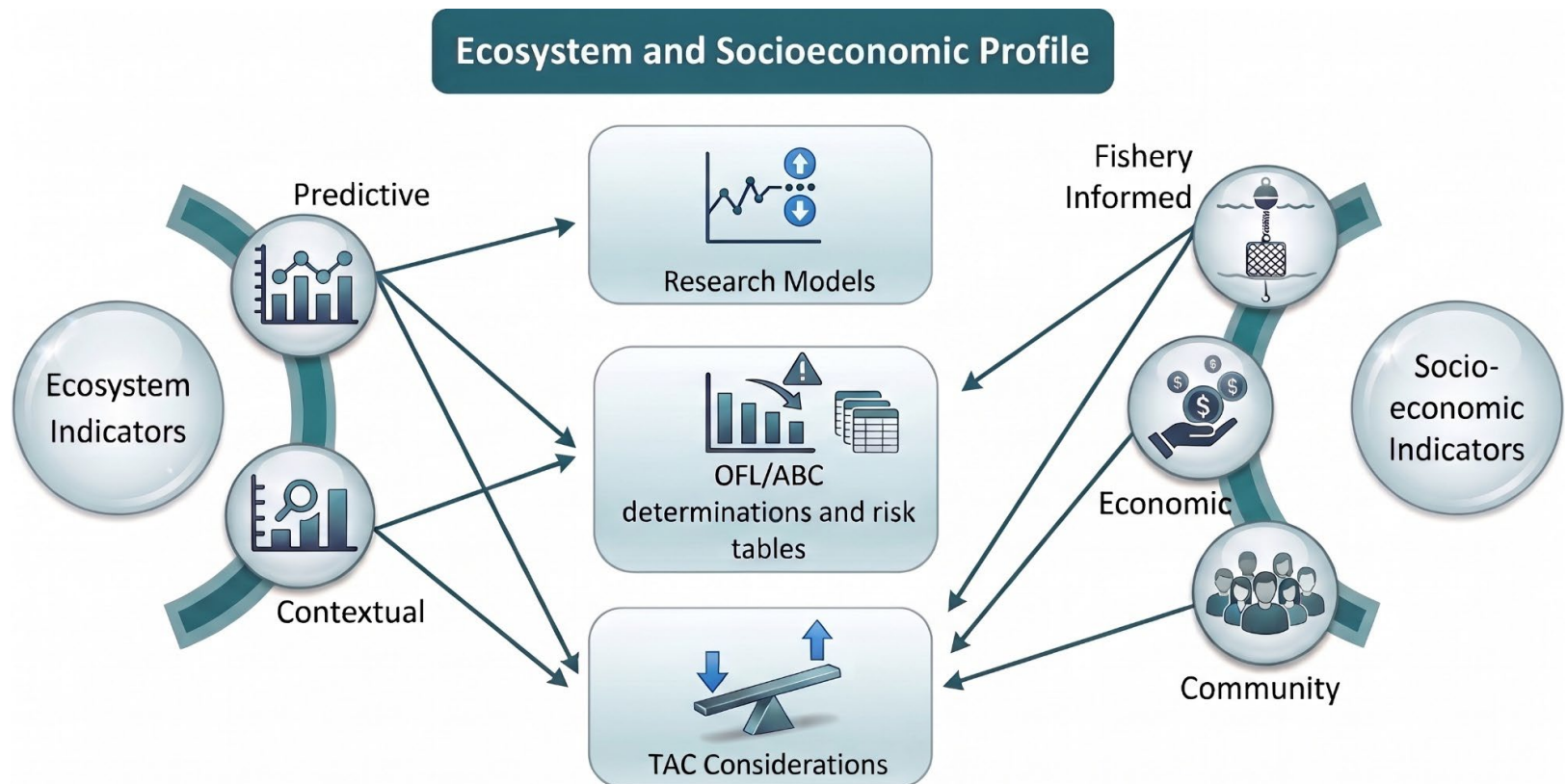
September 2026

Matt Callahan, Curry Cunningham, Brian Garber-Yonts, Tyler Jackson, Jean Lee, Cory Lescher, Ethan Nichols, Darren Pilcher, Dale Robinson, and Leah Zacher

ESP General Updates

2025 proposed ESP workflow adopted by CPT and GPT

- Ecosystem indicators categorized according to the results of indicator analysis
- Monitoring indicators downweighted in ESP products



ESP General Updates

2026 draft risk tables co-produced with ESR author, meetings with assessment authors

2026 Risk Table Summary for Eastern Bering Sea Snow Crab

The following is a synthesis and interpretation of the most recent ecosystem and socioeconomic information available for eastern Bering Sea (EBS) snow crab from the Ecosystem and Socioeconomic Profile (ESP, Fedewa et al., 2026), the AFSC Spring Preview of Ecosystem and Economic Conditions Workshop (AFSC Spring PEEC 2026), and the Eastern Bering Sea Ecosystem Status Report (ESR, Siddon, 2026, in press). This information may be helpful for evaluating risk table score levels and is organized below by the proposed risk table categories.

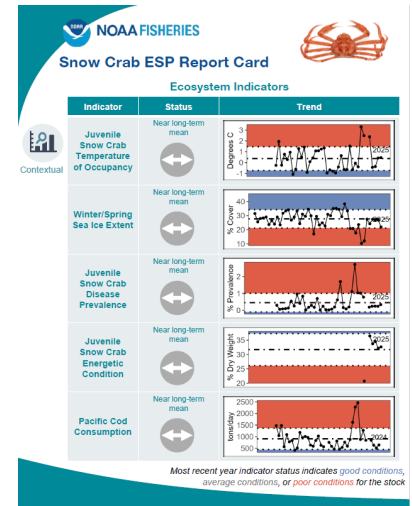
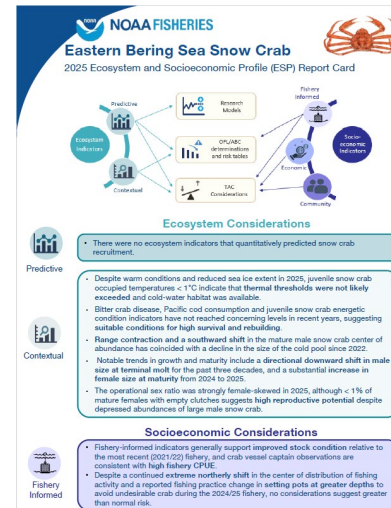
Using Dynamic Structural Equation Modeling (DSEM), we identified **spring sea ice extent**, **juvenile snow crab energetic condition**, **cold-water habitat availability**, and **juvenile snow crab temperature of occupancy** as ESP indicators with statistically supported causal relationships with snow crab recruitment. Specifically, declines in temperatures occupied by juvenile snow crab, and elevated sea ice extent, energetic condition and cold-water habitat availability are expected to drive increases in snow crab recruitment. These indicators are emphasized in **BOLD** below.

Current Year Population Dynamics Considerations:

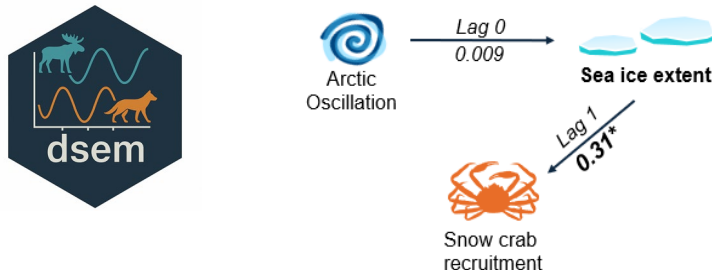
Risk Level 1: Normal

- **Juvenile snow crab energetic condition** rebounded following the population collapse and remains elevated in 2026, well above lab-derived starvation thresholds (ESP).

Rapid communication ESP report card and supporting document updated with 2026 indicators



Snow Crab ESP indicator analysis transitioned to Dynamic Structural Equation Modeling



Responses to CPT/SSC recommendations:

Oct 2025 SSC Recommendation:

“The SSC recommends that research be conducted to evaluate whether clutch fullness is a reliable indicator of female reproductive output, using histology or lab rearing experiments.”

Laboratory studies noting extrusion of unfertilized clutches:

- Saine Marie and Carriere, 1995
- Sainte Marie et al., 2010
- Rondeau and Sainte-Marie, 2001

Findings:

Primiparous females with very low sperm reserves extruded unfertilized egg clutches in the laboratory

Caveats:

Likely a laboratory artifact, driven by non-competitive mating and mating trials limited in duration and frequency

Kodiak Laboratory Insight:

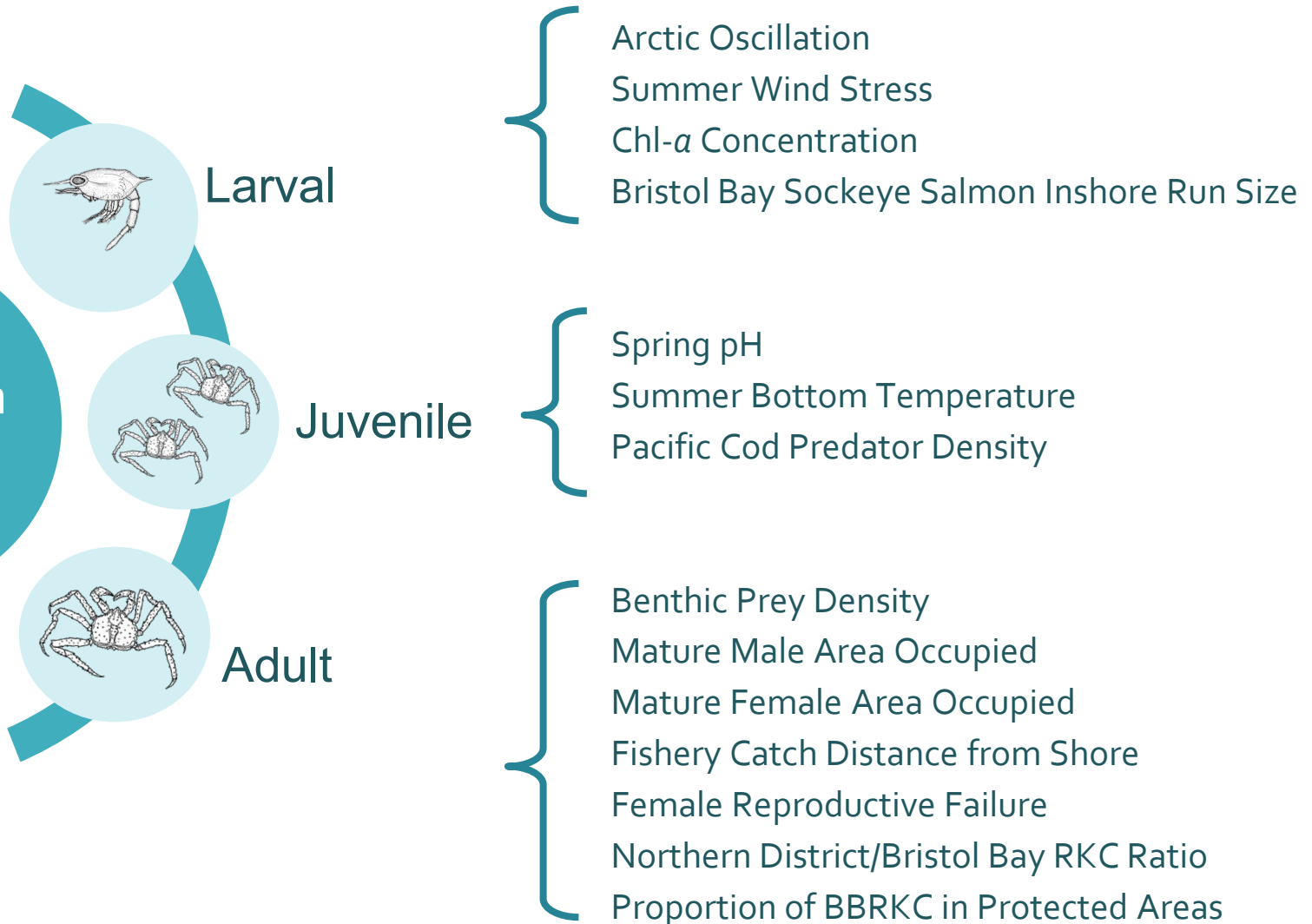
In recent years, no evidence of unfertilized clutches in ovigerous female Tanner and snow crab that were mated in the field and brought to the lab for OA experiments

Extrusion of unfertilized clutches is unlikely to be a major concern for females mated outside of laboratory settings

BBRKC Ecosystem Indicator Suite

No changes to ecosystem indicators in 2026

Ecosystem Indicators



Ecosystem indicator subsetting for importance analysis

Ecosystem Indicators

Larval



Juvenile



Adult



Arctic Oscillation

Summer Wind Stress

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

Bristol Bay Sockeye Salmon Inshore Run Size

Spring pH

Summer Bottom Temperature

Pacific Cod Predator Density

Benthic Prey Density

Mature Male Area Occupied

Mature Female Area Occupied

Fishery Catch Distance from Shore

Female Reproductive Failure

Northern District/Bristol Bay Ratio

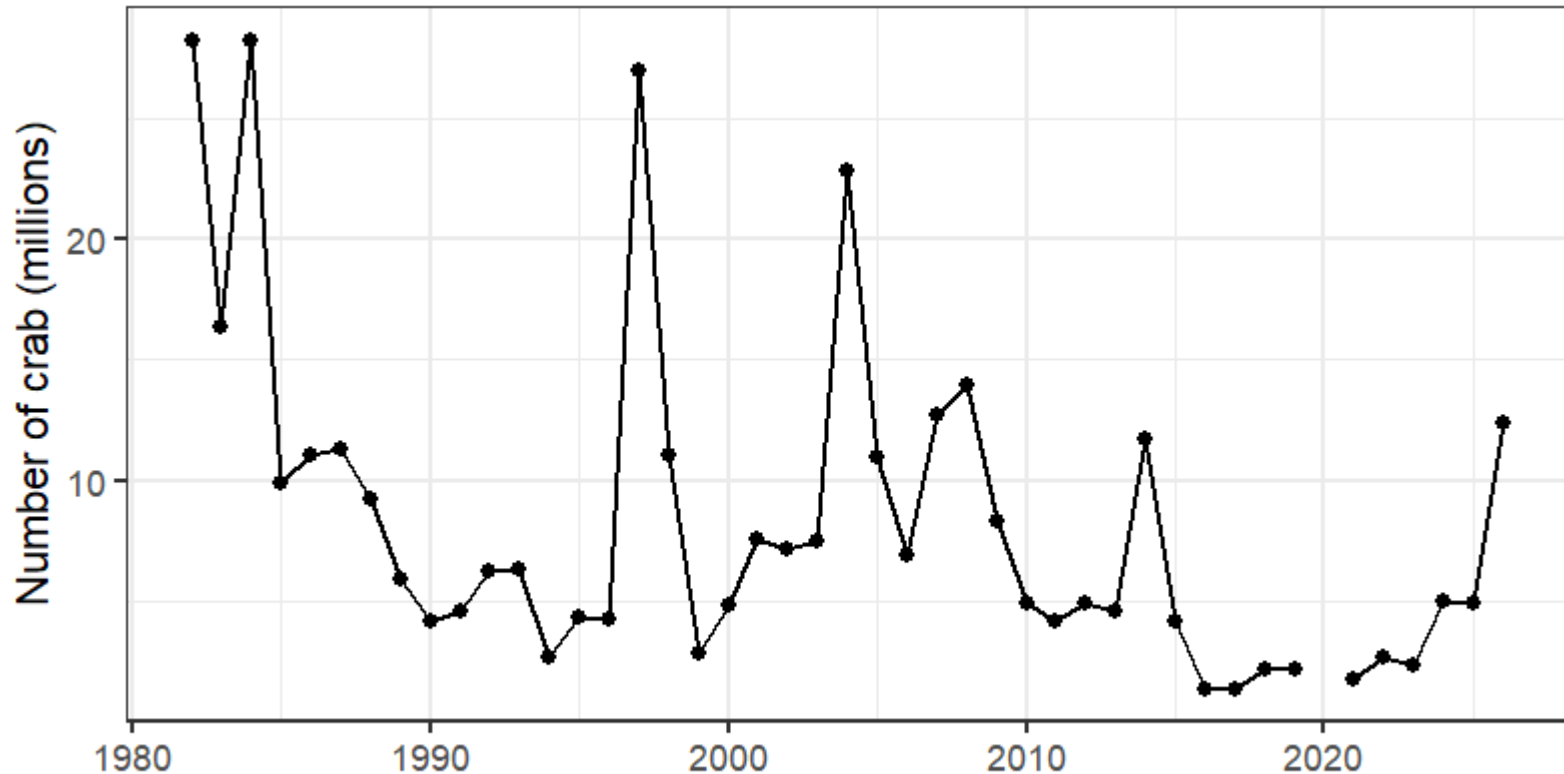
Protected Area Proportion

*Not drivers
of
recruitment*

Indicator Importance Testing: *Bayesian Adaptive Sampling*

Response Variable: Survey abundance of male BBRKC (95 – 120 mm CL)

Represents males ~ 6 - 7.9 years post-settlement, and 1 molt away from recruitment to the fishery



Indicator Importance Testing:

Bayesian Adaptive Sampling

Indicator tested in BAS analysis	Lag Applied (years)	Rationale
 Arctic Oscillation	6	Hypothesized to affect larval stages
 Wind Stress	6	Hypothesized to affect feeding success of larval stages
 Bristol Bay Sockeye Run Size	6	Predators of RKC larval stages
 pH	4	Strongest effects on YOY RKC juveniles
 Pacific Cod Density	1	Prior year most informative for survival
 Bottom Temperature	2	Effects on survival of juvenile RKC
 Benthic Prey Density	1	Prior year most informative for survival
 % Empty Clutches	7	6 year larval lag + 12 months for embryo incubation



Larval indicator



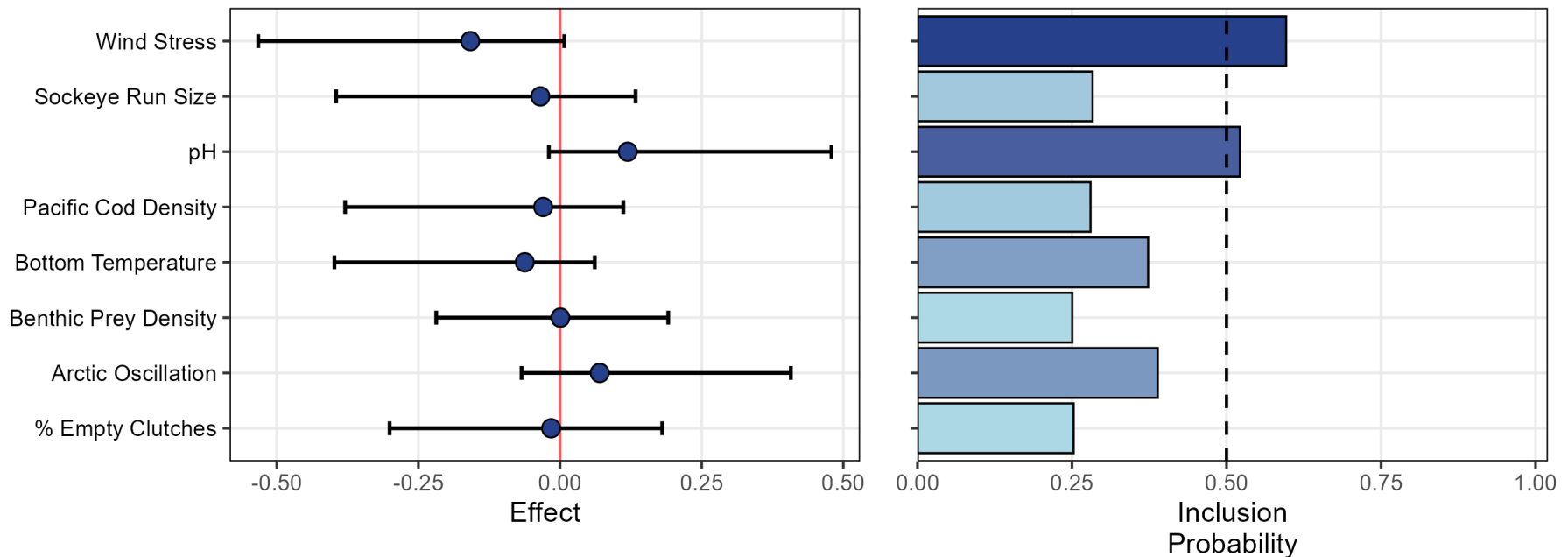
Juvenile indicator



Adult indicator

Indicator Importance Testing:

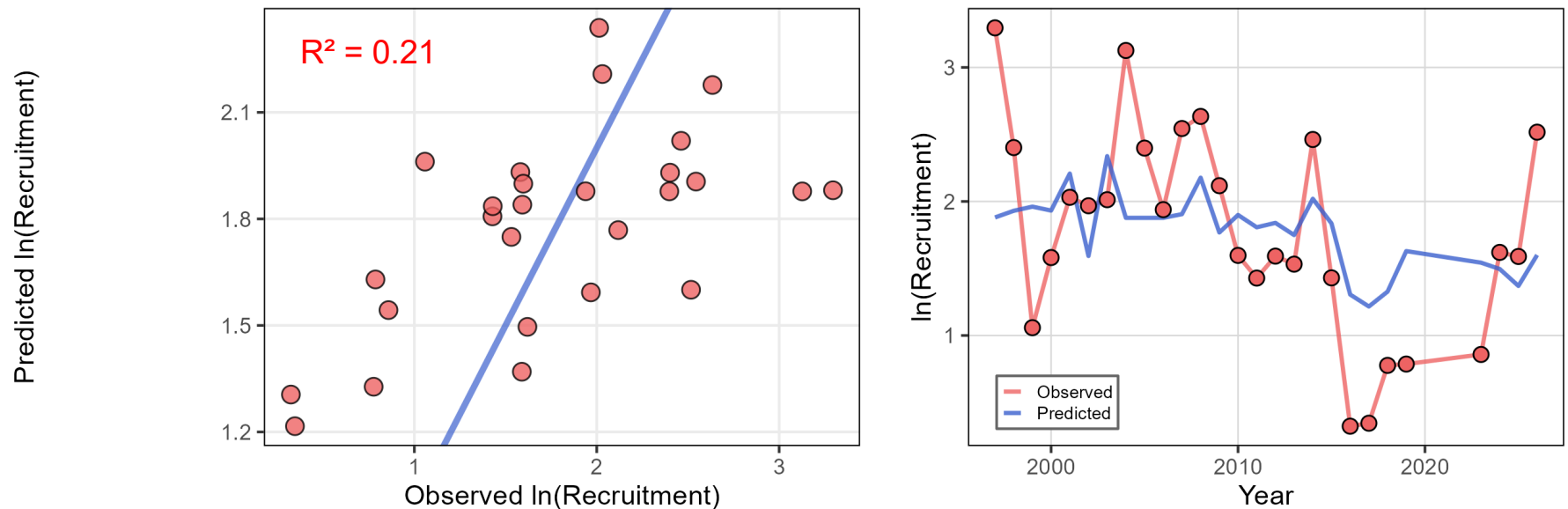
Bayesian Adaptive Sampling



No support for any predictive indicators identified from BAS

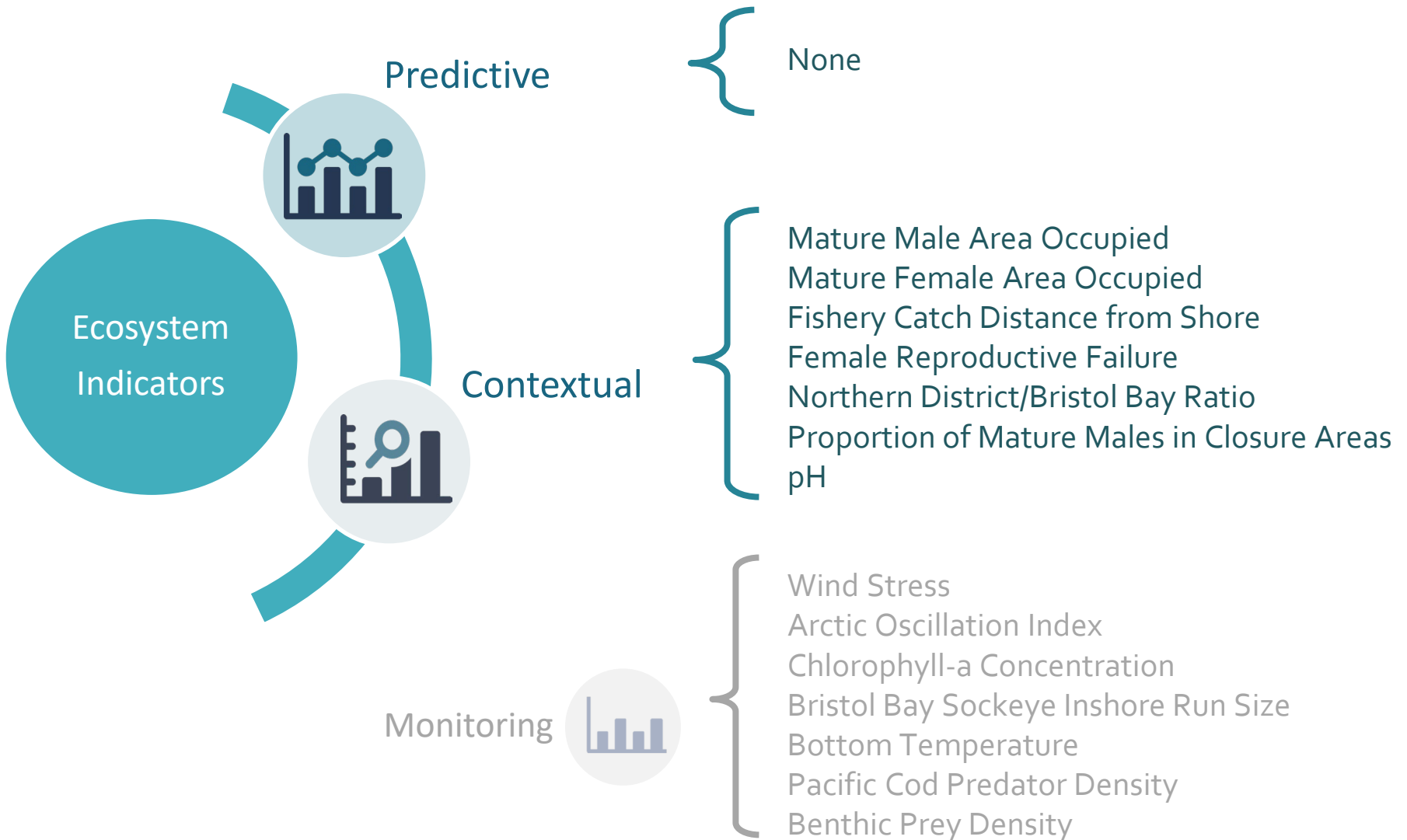
Wind stress and pH had inclusion probabilities > 0.5 , but credible intervals couldn't be distinguished from zero

Indicator Importance Testing: *Bayesian Adaptive Sampling*



The final BAS model selected explained very little variation in BBRKC recruitment

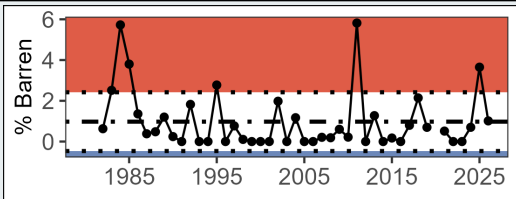
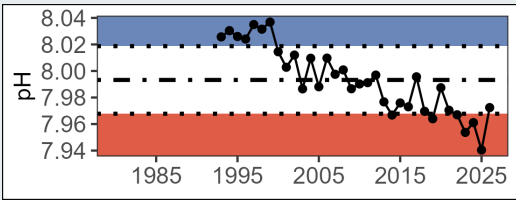
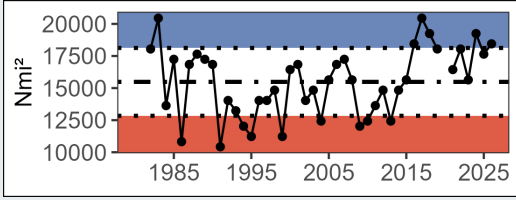
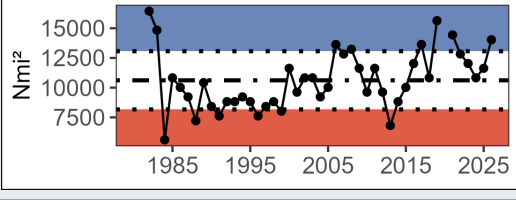
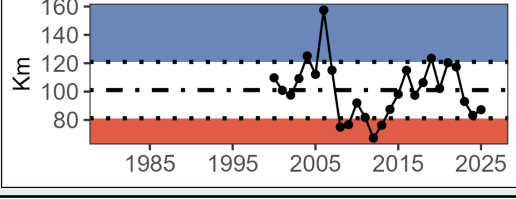
Ecosystem Indicator Categorization



Bristol Bay Red King Crab ESP Report Card

Ecosystem Indicators



Indicator	Status	Trend
Female BBRKC Reproductive Failure	Near long-term mean 	
Spring pH	Near long-term mean 	
BBRKC Mature Male Area Occupied	Above long-term mean 	
BBRKC Mature Female Area Occupied	Above long-term mean 	
Fishery Catch Distance from Shore	Near long-term mean 	

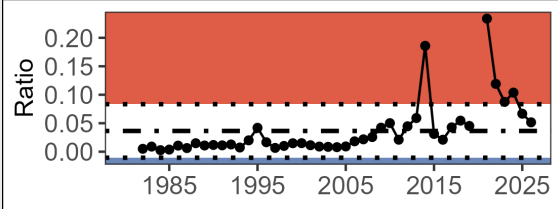
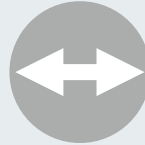
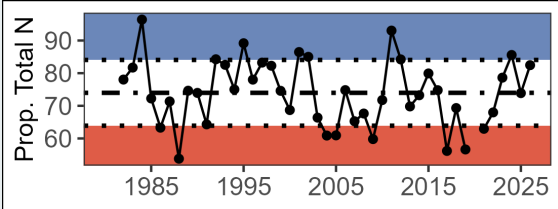


Most recent year indicator status indicates *good conditions*, *average conditions*, or *poor conditions* for the stock

Bristol Bay Red King Crab ESP Report Card

Ecosystem Indicators



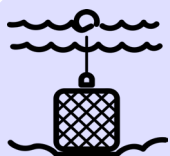
Indicator	Status	Trend
Northern District: Bristol Bay RKC Ratio	Near long-term mean 	
Proportion of Mature Males in Closure Areas	Near long-term mean 	



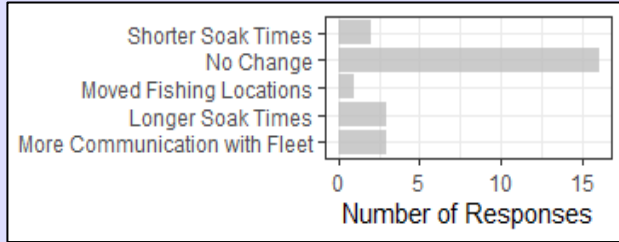
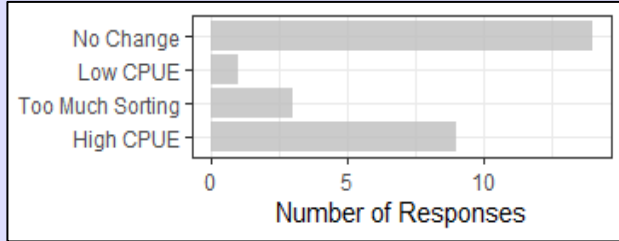
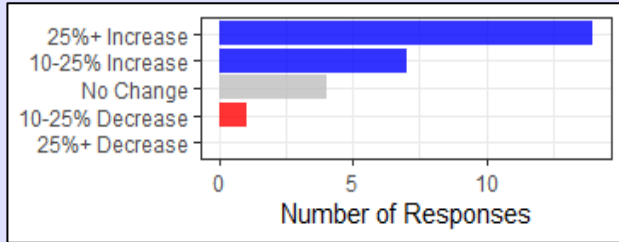
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Bristol Bay Red King Crab ESP Report Card

Socioeconomic Indicators



**Fishery
Informed**

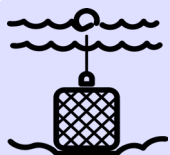
Indicator	Status	Trend												
Skipper Survey: Changes in Fishing Behavior	Minor changes in behavior 	 <table><tr><th>Category</th><th>Number of Responses</th></tr><tr><td>Shorter Soak Times</td><td>2</td></tr><tr><td>No Change</td><td>15</td></tr><tr><td>Moved Fishing Locations</td><td>1</td></tr><tr><td>Longer Soak Times</td><td>3</td></tr><tr><td>More Communication with Fleet</td><td>3</td></tr></table>	Category	Number of Responses	Shorter Soak Times	2	No Change	15	Moved Fishing Locations	1	Longer Soak Times	3	More Communication with Fleet	3
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More Communication with Fleet	3													
Skipper Survey: Motivation for Changes in Fishing Behavior	Minor changes in behavior 	 <table><tr><th>Category</th><th>Number of Responses</th></tr><tr><td>No Change</td><td>15</td></tr><tr><td>Low CPUE</td><td>1</td></tr><tr><td>Too Much Sorting</td><td>3</td></tr><tr><td>High CPUE</td><td>8</td></tr></table>	Category	Number of Responses	No Change	15	Low CPUE	1	Too Much Sorting	3	High CPUE	8		
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No Change	15													
Low CPUE	1													
Too Much Sorting	3													
High CPUE	8													
Skipper Survey: Perceived Abundance of Legal Males	Increase in perceived abundance 	 <table><tr><th>Category</th><th>Number of Responses</th></tr><tr><td>25%+ Increase</td><td>15</td></tr><tr><td>10-25% Increase</td><td>7</td></tr><tr><td>No Change</td><td>4</td></tr><tr><td>10-25% Decrease</td><td>1</td></tr><tr><td>25%+ Decrease</td><td>0</td></tr></table>	Category	Number of Responses	25%+ Increase	15	10-25% Increase	7	No Change	4	10-25% Decrease	1	25%+ Decrease	0
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Bristol Bay Red King Crab ESP Report Card

Socioeconomic Indicators



Indicator	Status	Trend
Fishery CPUE	Above long-term mean ↑	
Fishery Total Potlifts	Below long-term mean ↓	
Annual Incidental Catch	Below long-term mean ↓	
Number of Active Vessels	Below long-term mean ↓	



**Fishery
Informed**

Bristol Bay Red King Crab ESP Report Card



Ecosystem Considerations for ABC and TAC

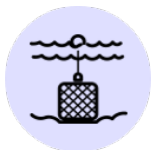


Contextual

- Bristol Bay average bottom temperature in summer 2026 was the 4th coldest in the 47-year survey time series, resulting in 56% of mature females that had not yet completed the molt-mate cycle by June. Of the females that had successfully molted and mated at the time of survey sampling, **<1% had empty clutches**.
- **Area occupied** by mature males and females in Bristol Bay was **above average** in summer 2026. Contextual indicators that highlight potential spatial distribution shifts across management boundaries and closure areas remain near-average, suggesting that **the population continues to occupy core habitats in Bristol Bay** despite below average summer bottom temperatures that have historically aggregated crab closer to the Alaska Peninsula.
- Spring bottom water **pH increased** from 2025 to 2026 to a near-average value. However, this indicator has been declining for the past three decades and continued declines to pH levels of 7.8 could negatively affect Bristol Bay red king crab survival.



Socioeconomic Considerations for ABC and TAC



Fishery
Informed

- **Total effort** (# of vessels and total potlifts) in the 2025/26 BBRKC fishery increased relative to the past season but remains **below the post-rationalization average**.
- **Fishery CPUE declined slightly** this season but remains above the 30-year average of legal crab per potlift.
- Results from the ABSC Skipper Survey are consistent with **high fishery CPUE**, an **increase in perceived abundance**, and **no notable changes in fleet behavior**. 81% of captains reported a >10% increase in perceived abundance of legal males relative to the previous season.

Questions?

