

Ecosystem & Socioeconomic Profile

Bristol Bay Red King Crab Report Card

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
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Overview

BBRKC ESP in SAFE Appendix

- Initial full ESP in 2020
- 2021 – 2023 Report Cards

2023 BBRKC Report Card

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

Appendix C. Ecosystem and Socioeconomic Profile of the Bristol Bay Red King Crab Stock - Report Card

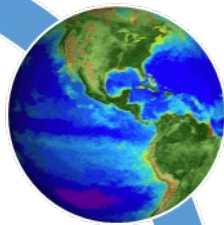
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BBRKC Ecosystem Indicators

Ecosystem Indicators



Physical



Lower Trophic



Upper Trophic

- + 1. Arctic Oscillation (climate model)
- + 2. Cold pool extent (BT survey)
- + 3. Summer bottom temperature (BT survey)
- + 4. pH index (ocean model)
- 5. Wind stress (satellite)

- + 6. Chl-*a* Biomass (satellite)

- + 7. Benthic invertebrate density (BT survey)
- 8. Juvenile sockeye salmon abundance (BASIS survey)
- 9. Pacific cod density (BT survey)
- 10. Area Occupied (BT survey)
- + 11. Catch distance from shore (BBRKC fishery)

Ecosystem Traffic Light Table

Indicator	2019 Status	2020 Status	2021 Status	2022 Status	2023 Status
Winter Spring Arctic Oscillation Index Model	neutral	high	neutral	neutral	neutral
Summer Cold Pool SEBS BBRKC Survey	low	NA	low	neutral	neutral
Summer Temperature Bottom BBRKC Survey	high	NA	neutral	neutral	neutral
Spring pH BBRKC Model	low	low	low	low	low
Summer Wind Stress BBRKC Satellite	high	neutral	high	neutral	neutral
Spring Chlorophylla Biomass SEBS Inner Shelf Satellite	neutral	neutral	neutral	low	low
Summer Sockeye Salmon Abundance EBS Survey	NA	NA	NA	high	NA
Summer Pacific Cod Density BBRKC Survey	low	NA	neutral	neutral	NA
Summer Benthic Invertebrate Density BBRKC Survey	neutral	NA	neutral	neutral	NA
Summer Red King Crab Male Area Occupied BBRKC Model	high	NA	neutral	high	neutral
Summer Red King Crab Female Area Occupied BBRKC Model	high	NA	high	neutral	neutral
Annual Red King Crab Catch Distance Shore BBRKC Fishery	high	neutral	neutral	neutral	NA

2023 Ecosystem Considerations

- Bottom temperatures and the spatial extent of the cold pool remained near-average in Bristol Bay. Summer bottom temperatures were well-within the thermal range of juvenile and adult red king crab.
- Red king crab have experienced a steady decline in bottom water pH in the past two decades, reaching 7.91 in 2023. Threshold pH levels of 7.8 could negatively affect juvenile red king crab growth, shell hardening and survival
- Sockeye salmon abundance in the eastern Bering Sea continues to remain well above average, and may represent increased predation on larval BBRKC. Anomalously low levels of chlorophyll-a in 2023 indicate a less pronounced spring bloom and poor feeding conditions for larval BBRKC
- Mature female spatial extent has remained above-average since 2019. The relatively large spatial footprint of mature females in recent years can be attributed to an increased use of habitats in central Bristol Bay that have historically been avoided in years when $<1^{\circ}\text{C}$ waters extended into Bristol Bay

Socioeconomic Indicators

Socio-economic Indicators



Fishery Performance

1. Catch-per-unit-effort (BBRKC fishery)
2. Total potlifts (BBRKC fishery)
3. Number active vessels (BBRKC fishery)
4. Incidental catch (Groundfish fisheries)



Economic

5. TAC Utilization (BBRKC fishery)
6. Ex-vessel value (BBRKC fishery)
7. Ex-vessel price/lb (BBRKC fishery)
8. Ex-vessel revenue share (BBRKC fishery)



Community

No community indicators proposed

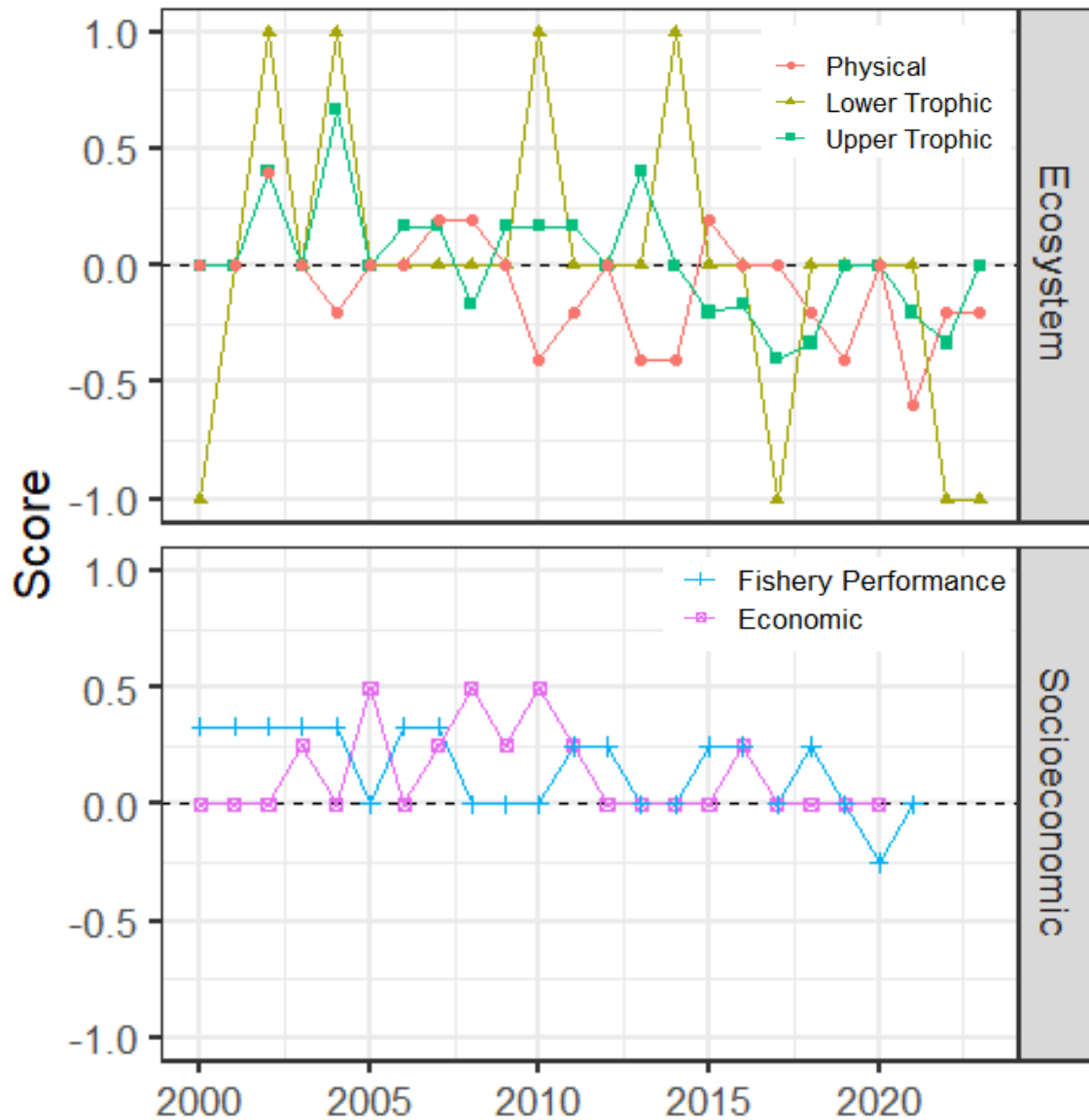
Socioeconomic Traffic Light Table

Indicator category	Indicator	2018 Status	2019 Status	2020 Status	2021 Status	2022 Status
Fishery Performance	Annual Red King Crab CPUE BBRKC Fishery	neutral	neutral	neutral	NA	NA
	Annual Red King Crab Total Potlift BBRKC Fishery	neutral	neutral	low	NA	NA
	Annual Red King Crab Active Vessels BBRKC Fishery	neutral	neutral	neutral	NA	NA
	Annual Red King Crab Incidental Catch EBS Fishery	neutral	neutral	neutral	neutral	NA
Economic	Annual Red King Crab TAC Utilization BBRKC Fishery	neutral	neutral	neutral	NA	NA
	Annual Red King Crab Exvessel Value BBRKC Fishery	low	low	low	NA	NA
	Annual Red King Crab Exvessel Price BBRKC Fishery	high	high	high	NA	NA
	Annual Red King Crab Exvessel Revenue Share BBRKC Fishery	neutral	neutral	neutral	NA	NA

Socioeconomic Considerations

- The BBRKC fishery was closed to targeted fishing for the second consecutive season, representing severe economic hardships for industry.
- Incidental catch of BBRKC in EBS groundfish fisheries has remained near-average for the most recent 2018 – 2021 period.

Indicator Monitoring Analysis: Traffic Light Score

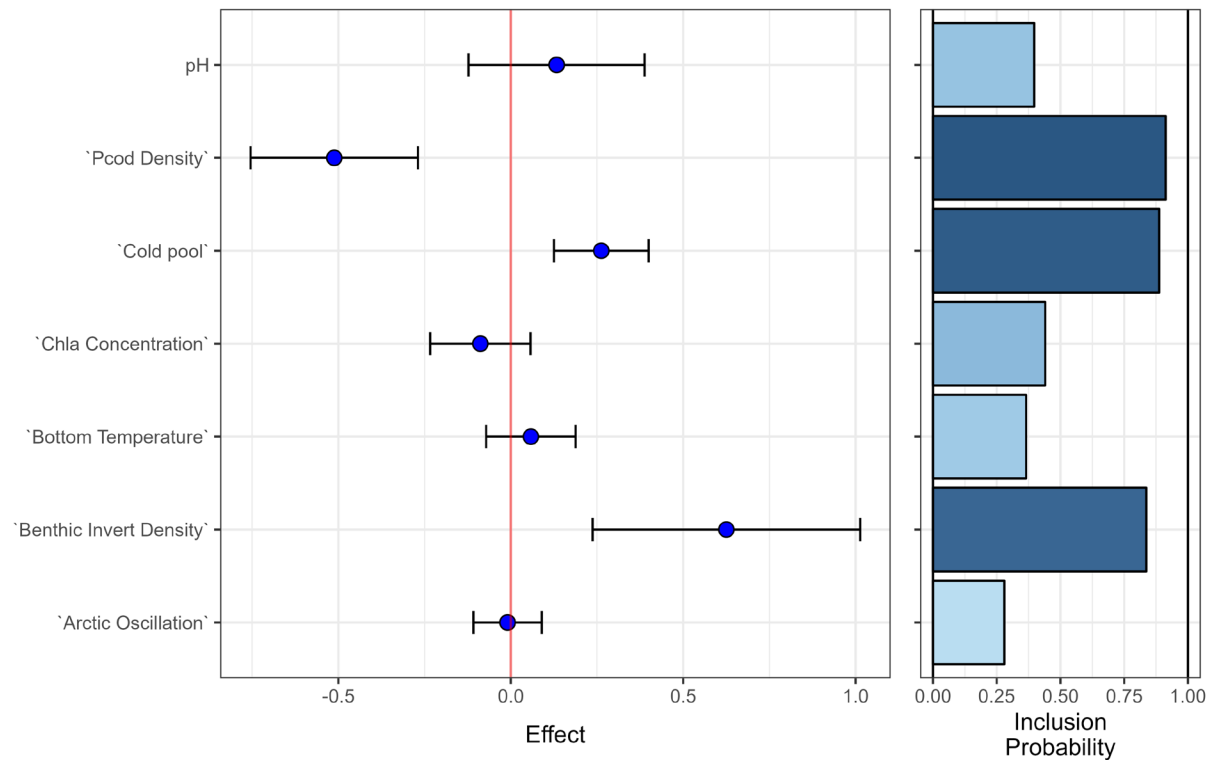


- Physical and lower trophic indicators scored below average for 2023
- Upper trophic indicators were average

Indicator Monitoring Analysis: Importance Test

Highest ranked predictor variables (> 0.50 inclusion probability) in Bayesian adaptive sampling analysis:

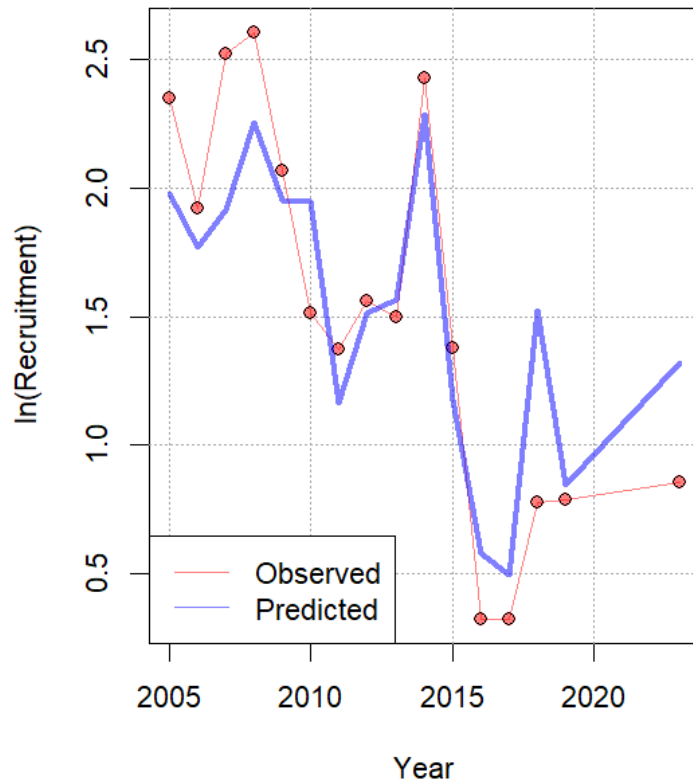
- Pacific cod density
- Cold pool extent
- Benthic invertebrate density



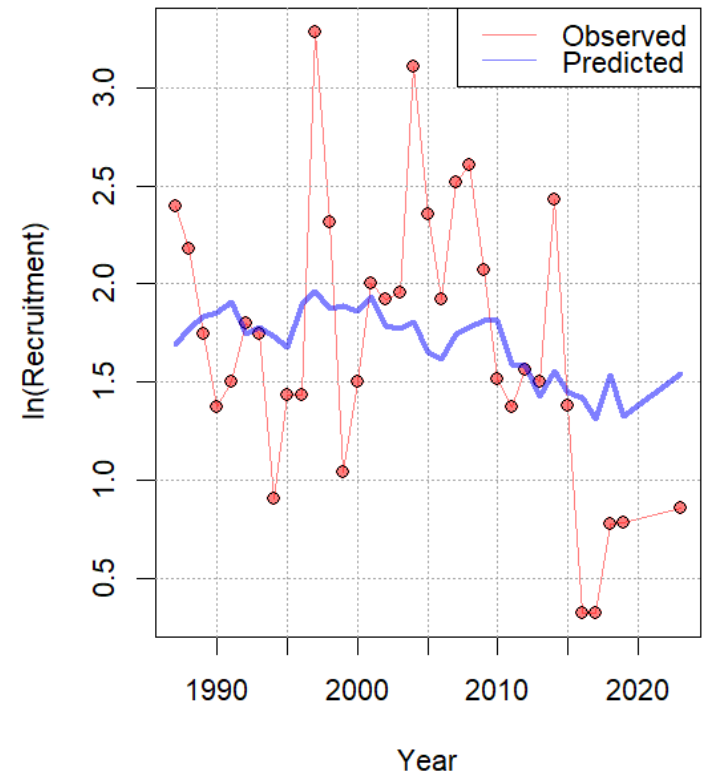
Indicator Monitoring Analysis: Importance Test

Bayesian adaptive sampling model runs incorporating the longest time series (1988 – 2022) resulted in very poor fits to observed BBRKC recruitment. Evidence for non-stationarity?

2005 – 2022 recruitment model run



1988 – 2022 recruitment model run



Planned ESP Developments

- Explore additional statistical techniques for indicator importance tests that are more robust to non-stationarity
- Producing a Request for Indicators in February 2024 to highlight data gaps and propose new indicator contributions
- Development of new indicators:
 - Stakeholder outreach for input on community indicators (Friday!)
 - Average clutch fullness (currently in SAFE)
 - Northern District RKC: BBRKC abundances (currently in SAFE)
 - RKC/fishing gear spatial overlap metric
 - Habitat disturbance metric



Questions?

