

C1 BSAI CRAB STOCKS

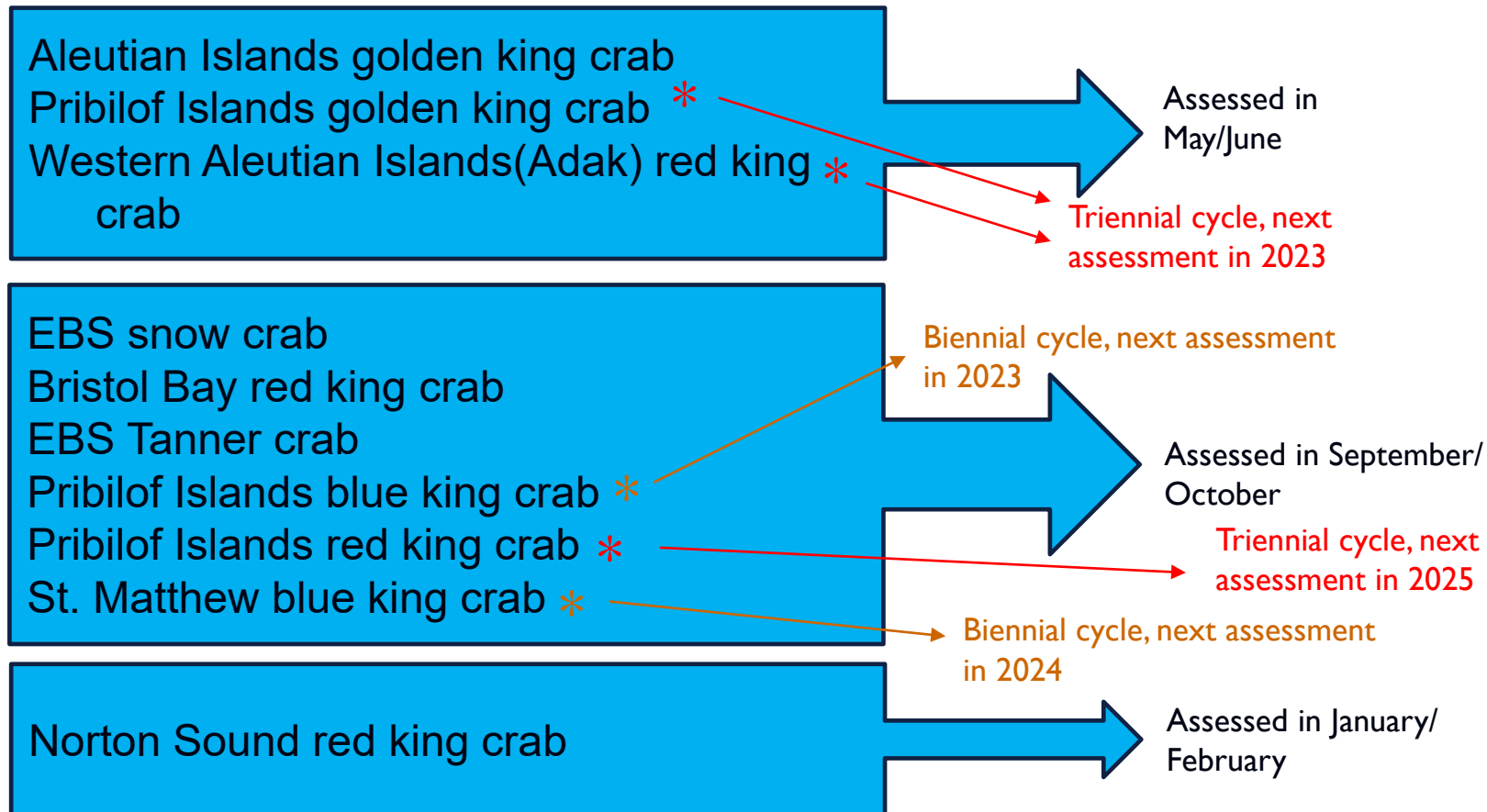
KATIE PALOF & MIKE LITZOW (CPT CO-CHAIRS)

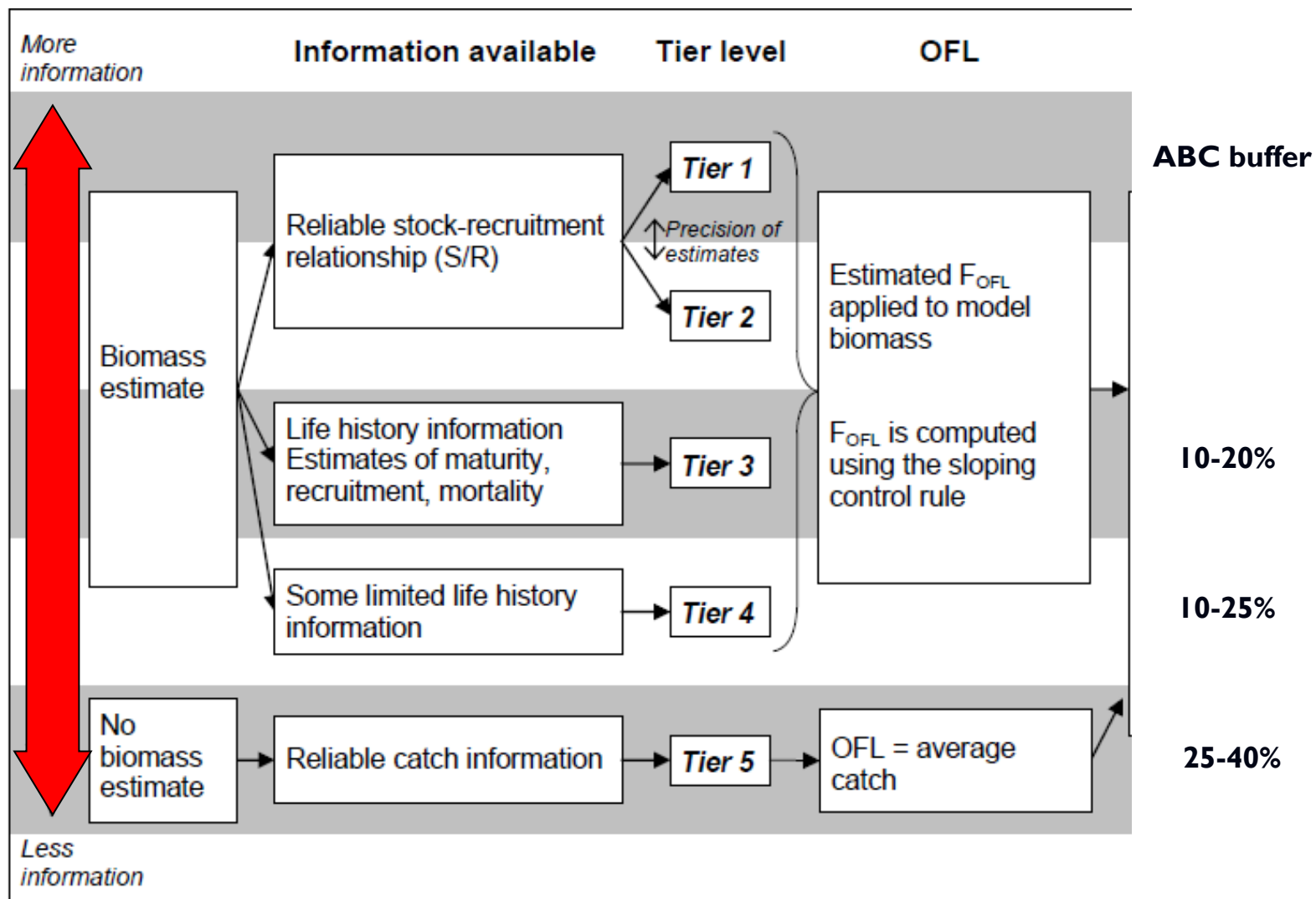
JUNE 2023 NPFMC MEETING

CPT MEETING MINUTES – MAY 16TH – 18TH, JUNEAU, AK



BSAI CRAB STOCKS MANAGEMENT TIMING





MAY 2023 AGENDA

- ✓ **AIGKC final assessment, OFL and ABC**
- ✓ **PIGKC final assessment, OFL and ABC**
- ✓ **WAIRKC final assessment, OFL and ABC**
- ✓ Proposed model runs:
 - ✓ PIBKC
 - ✓ Tanner
 - ✓ Snow
 - ✓ BBRKC
- ✓ Unobserved mortality workshop scoping
- ✓ BSFRF research updates and spring BBRKC sampling
- ✓ Simpler models workshop report
- ✓ Bering Sea red king crab stock structure template
- ✓ Catch accounting and EM (informational)
- ✓ ABSC /NOAA collaboration on climate resilient fisheries (informational)
- ✓ ESP updates, GMACS updates



ALEUTIAN ISLAND GOLDEN KING CRAB (AIGKC)

FINAL ASSESSMENT 2023



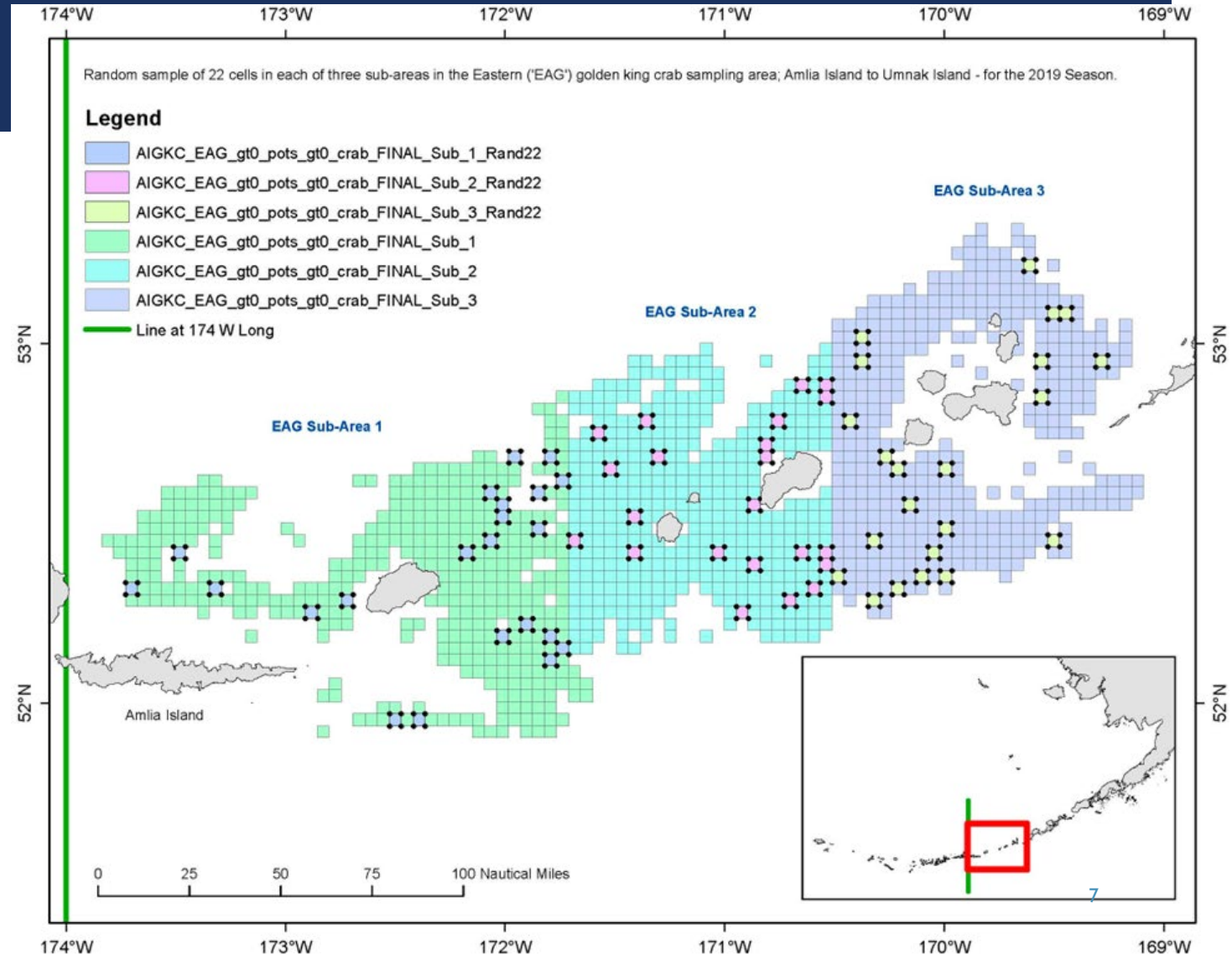
AIGKC OVERVIEW

- **GMACS assessment** framework approved in Jan/Feb 2023
- **Changes in authorship** – welcome Tyler Jackson (ADF&G) as primary author after Siddeek Sharif’s retirement this spring
- **Tier 3 annual stock assessment based completely on fishery-dependent data**
- OFL/ABC set for AIGKC stock but modeled as two separate stocks – EAG and WAG
- Updates to **input data**
 - 2022/23 retained catch (not completed at time of assessment)
 - CPUE standardization updates – year effect (model 21.1e2) or year:block effect (model 22.1f)
 - Industry- cooperative survey results for EAG
- **Model presented:**
 - **Model 22.9c** - 2022 accepted model (22_1e2) with modifications for GMACS transition
 - **Model 21.1e2** - Model 22.9c in GMACS (w/o Yr:Block)
 - **Model 22.1f** - Model 22.1e2 (w/ Yr:Block)
 - **Models 22.1g and 22.1h** – only for EAG with co-op survey 2015-2022

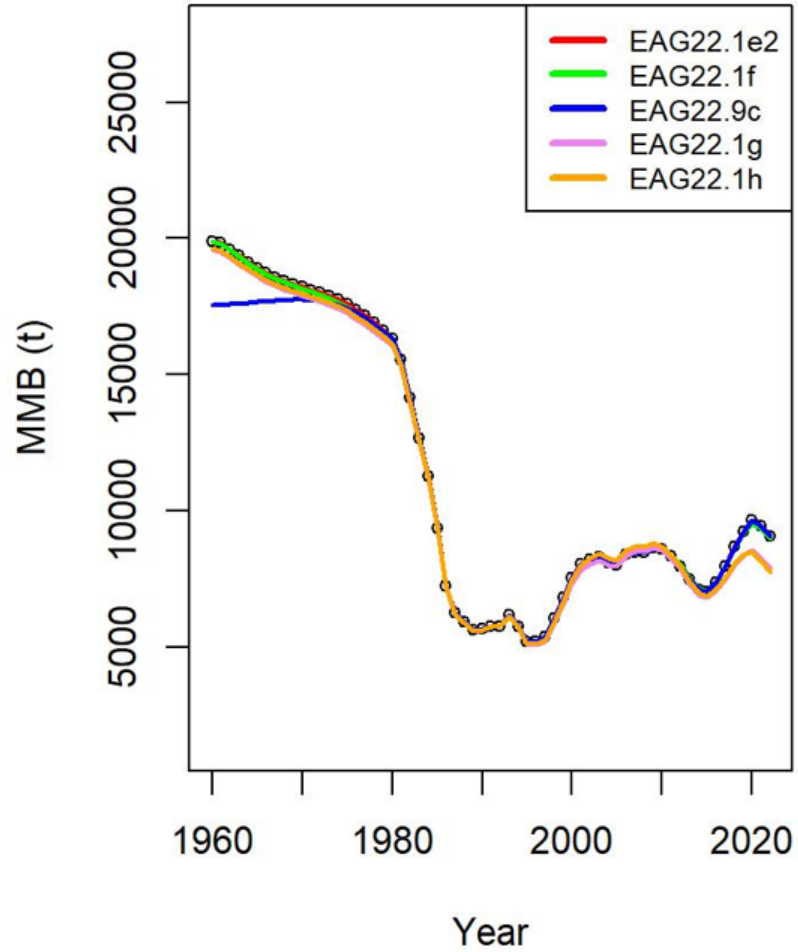


COOPERATIVE SURVEY (APPENDIX C)

- EAG cooperative survey from 2015 to 2022
- Current runs replace observer CPUE with this time series
- CPT discussed more appropriate way would be for this survey to be its own “fleet” in the model.
- More work expected in the future on these models, they are not ready for specifications.



EAG



WAG

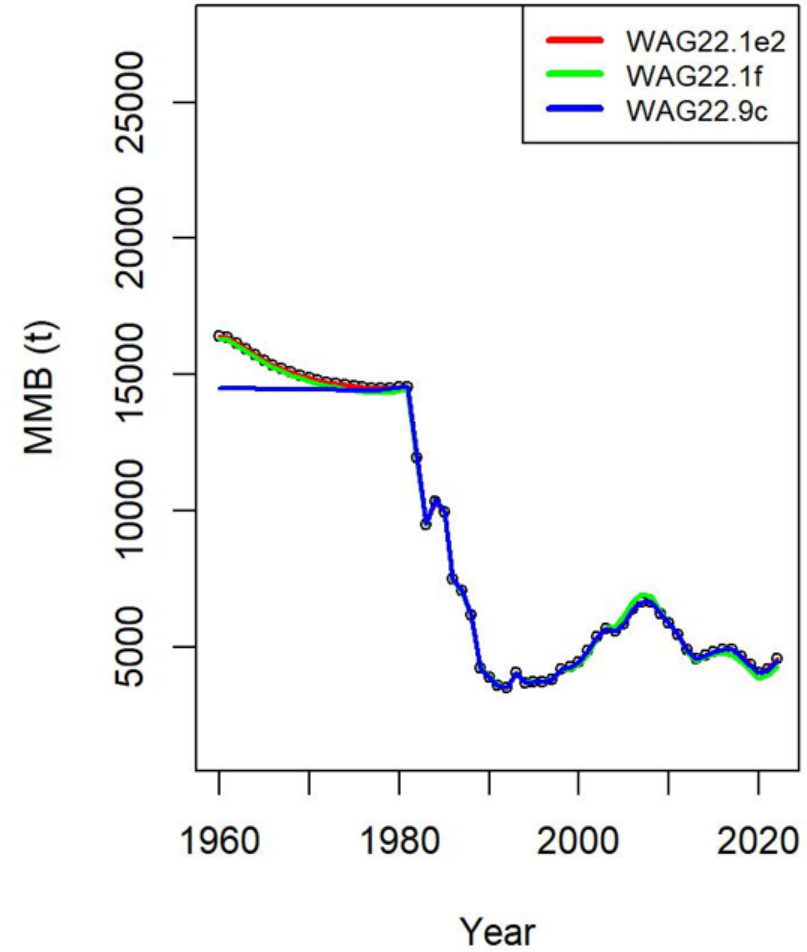


Figure 22a, pg 82

CPT RECOMMENDATIONS

| 22.1e2 | | | | | | | 1,000 tons | |
|---------|--------------------|---------------------|-------|----------------|--------------------------|--------------------|--------------------|--|
| Year | MSST | Biomass (MMB) | TAC | Retained Catch | Total Catch ^a | OFL | ABC ^b | |
| 2019/20 | 5.915 | 16.386 | 3.257 | 3.319 | 3.729 | 5.249 | 3.937 | |
| 2020/21 | 6.014 | 15.442 | 2.999 | 3.000 | 3.520 | 4.798 | 3.599 | |
| 2021/22 | 5.715 | 13.581 | 2.690 | 2.699 | 3.056 | 4.817 | 3.372 | |
| 2022/23 | 5.832 ^d | 13.600 ^d | 2.291 | 2.369* | 2.612* | 3.761 ^c | 2.821 ^c | |
| 2023/24 | | 12.069 ^d | | | | 4.182 ^d | 3.137 ^d | |

- CPT recommended using **model 22.1e2** for both areas
 - Year: block standardization still under development
 - Tier 3 stock with stock status determined as a combined stock – Tier 3a
- **Buffer – 25%** (same as 2022/23)
 - Only assessment using only fishery CPUE as an index
 - Small number of vessels in fishery and limited spatial coverage compared to the stock
 - Retrospective patterns



PRIBILOF ISLANDS GOLDEN KING CRAB (PIGKC)

FINAL ASSESSMENT 2023



PIGKC OVERVIEW

- Tier 5 stock
- Managed on calendar year basis (January 1 – December 31)
- Triennial assessment
- Guideline Harvest Level (GHL) of 59 t since 2015
- Participation is sporadic; CPUE data difficult to compare across vessels
- Updates to **input data**
 - Directed fishery retained and discarded catch through 2022
 - Bycatch estimates through 2022



PIGKC OVERVIEW

Models presented:

- **Tier 5** – approach used since 2012
 - OFL = mean estimated total catch for 1993-1998
- **Tier 4** incorporating slope survey data
 - Random-effects approach using R package *rema*
 - Models fit with $M = 0.18 \text{ yr}^{-1}$ and 0.22 yr^{-1}
- **Tier 5 using Tier 4 approach for calculating OFL** – based on spiny dogfish example
 - OFL = average slope survey MMB 2002-2016 $\times M$
 - Fit with $M = 0.18 \text{ yr}^{-1}$ and 0.22 yr^{-1}



CPT RECOMMENDATIONS

- **Tier 4 and Tier 4/5 approaches not justified at this time**
 - No new survey data since 2016
 - Revisit these approaches when new data become available
- **Continue with Tier 5 approach**
 - Provides management consistency
 - Appropriate for stock without good fisheries-dependent or fisheries-independent data



CPT RECOMMENDATIONS

- **25% buffer**
 - Consistent with other Tier 5 stocks
 - In place since 2014, no new information to motivate change

Values in t

| Year | MSST | Biomass (MMB) | GHL | Retained Catch | Total Catch | OFL | ABC |
|------|------|---------------|-----|----------------|-------------|-----|-----|
| 2019 | | | 59 | Conf. | Conf. | 93 | 70 |
| 2020 | | | 59 | 49 | 52 | 93 | 70 |
| 2021 | | | 59 | 16 | 21 | 93 | 70 |
| 2022 | | | 59 | Conf. | Conf. | 93 | 70 |
| 2023 | | | 59 | | | 93 | 70 |
| 2024 | | | | | | 95 | 71 |
| 2025 | | | | | | 95 | 71 |
| 2026 | | | | | | 95 | 71 |

- Updated bycatch time series resulted in slight change to OFL/ABC
- Total catch below OFL in 2020-2021; overfishing did not occur



WESTERN ALEUTIAN ISLANDS RED KING CRAB (WAIRKC)

FINAL ASSESSMENT 2023



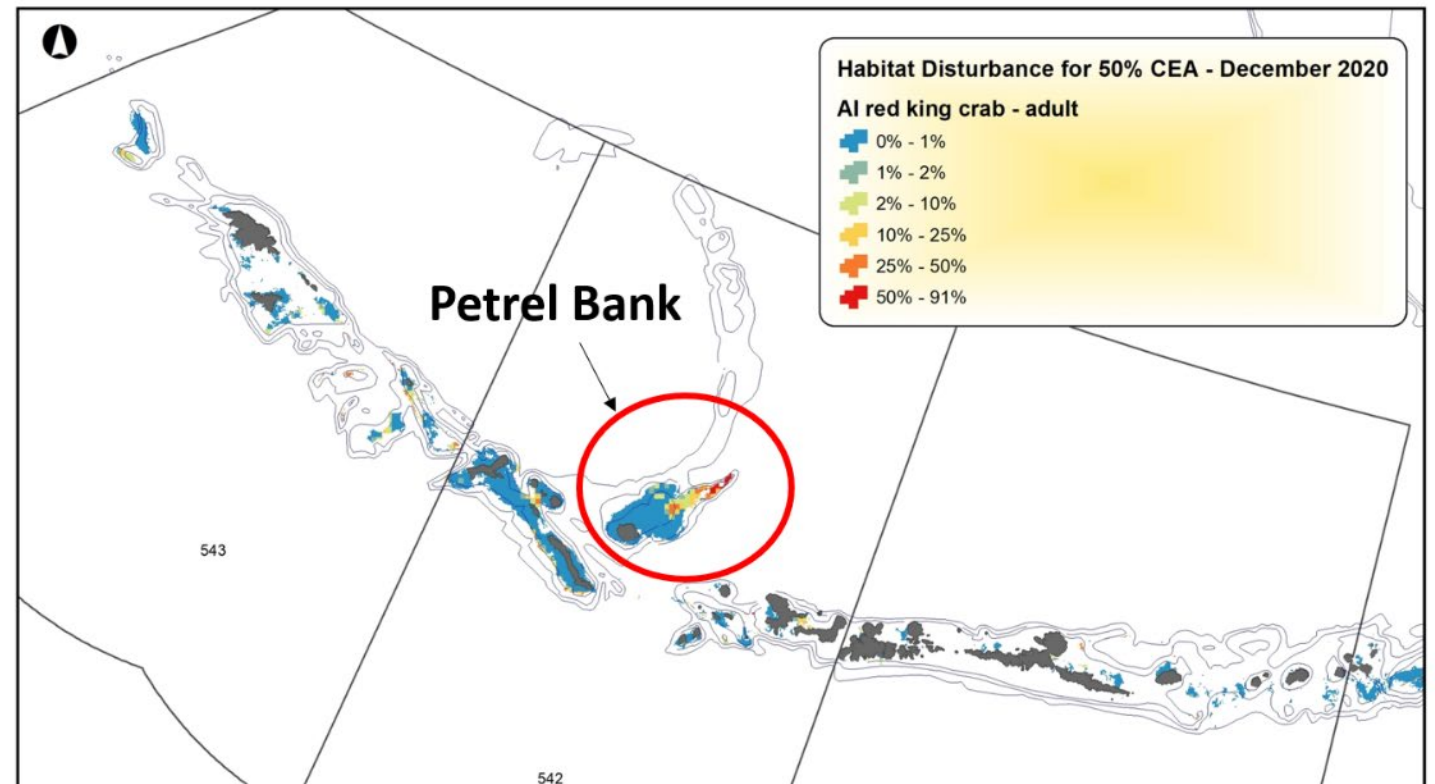
WAIRKC OVERVIEW

- Fishery closed since 2003/04
- Triennial assessment
- Survey data for Petrel Bank (2006, 2009, 2016) and Adak (2002, 2015) indicate stock is severely depressed
- Tier 5 stock
- OFL based on estimated total catch during 1995/96 – 2007/08



STOCK STATUS DISCUSSION

- Extremely low fishery and survey CPUE since 2002 indicate the stock is severely depressed
- Formal overfished declaration not possible for Tier 5 stock
- Conservation measures such as habitat protection could be evaluated
 - Author notes habitat disturbance in areas of Petrel Bank with historical RKC occurrence



CPT RECOMMENDATIONS

- **75% buffer**
 - In place since 2017
 - No new information
 - Stock severely depressed

Values in t

| Fishing Year | MSST | Biomass (MMB) | TAC | Retained Catch | Total Catch | OFL | ABC |
|--------------|------|---------------|--------|----------------|-------------|-----|-----|
| 2018/19 | | | Closed | 0 | <1 | 56 | 14 |
| 2019/20 | | | Closed | 0 | <1 | 56 | 14 |
| 2020/21 | | | Closed | 0 | <1 | 56 | 14 |
| 2021/22 | | | Closed | 0 | <1 | 56 | 14 |
| 2022/23 | | | Closed | 0 | <1 | 56 | 14 |
| 2023/24 | | | | | | 56 | 14 |
| 2024/25 | | | | | | 56 | 14 |
| 2025/26 | | | | | | 56 | 14 |



- Total catch below OFL in 2020/21, 2021/22, 2022/23; overfishing did not occur

PRIBILOF ISLANDS BLUE KING CRAB (PIBKC): PROPOSED MODEL RUNS 2023

- Tier 4 stock, biennial assessment
- Author proposed moving current model to R package *rema*
- Change to modeling platform, not model structure
- Fits to survey data very similar for *rema* version
- CPT supports bringing forward *rema* version in September



TANNER CRAB: PROPOSED MODEL RUNS 2023

- Model exploration on growth, selectivity, VAST vs design based survey estimates, time-varying mortality
- Extensive work by the author on these explorations
- Recommended models:
 - Base model
 - Model with VAST survey estimates
- Future work includes continuation of work on a number of subjects including time varying natural mortality and work on selectivity



BBRKC: PROPOSED MODEL RUNS 2023

- Stable model in GMACS since 2018
- Directed fishery was closed in 2021/22 and 2022/23 season due to low mature female abundance.
- Low recruitment in recent years (last 8-12 years), projected decline in biomass without a large recruitment event
- Model explorations around a few themes:
 - GMACS updates, start year for model (1975 vs 1985), natural mortality, Q for NMFS trawl survey, sensitivity to female resample data
- Recommended models:
 - Base model
 - Base model with estimated M
 - Model with data start in 1985 (vs. 1975)



SNOW CRAB: PROPOSED MODEL RUNS 2023

- Past problems:
 - Convergence issues and bimodality in management quantities
 - Multiple plausible modeled population trajectories for stock collapse
 - Inability to fit survey index and size compositions
 - Retrospective patterns
 - Unrealistic biology (e.g. probability of terminal molt)
 - Unrealistic catch advice
- Response:
 - Let the biology lead modeling decisions
 - Think outside historical decisions



SNOW CRAB: PROPOSED MODEL RUNS 2023

Five models presented:

- Status quo
- Research model
- Two bridging models
 - Combine aspects of research model with status quo
- Tier 4 fallback approach
 - B_{MSY} proxy = mean survey biomass of >95mm carapace width males 1982-2021
 - F_{MSY} proxy = M of 0.27 yr⁻¹ based on assumed maximum age of 20 years



CPT RECOMMENDED MODELS 2023

- Status quo
- Focused bridging model
 - M time-invariant except for 2018-2019
 - Only to be brought forward in September if convergence issues can be addressed
- Tier 4 fallback





BALANCE OF CPT REPORT



BERING SEA FISHERIES RESEARCH FOUNDATION (BSFRF) UPDATE

Collaborative Pot Sampling (CPS) of Bristol Bay red king crab

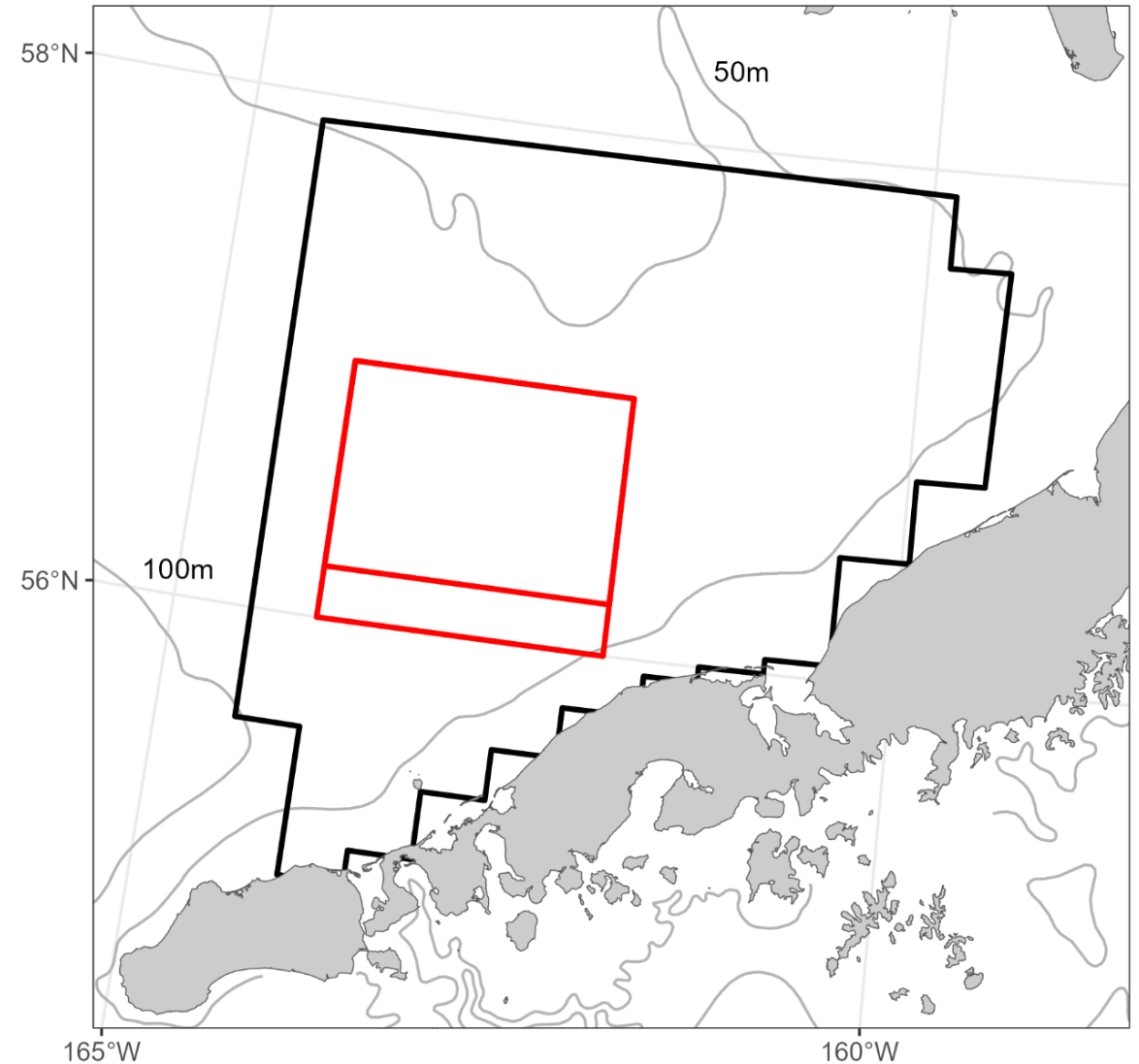
- Cooperative ADF&G, NOAA, BSFRF effort
- 2 vessels, ~ 25 days each, March-early April
- Goals:
 - Winter distribution data
 - Tagging data to connect winter and summer distribution
- 636 potlifts
- 10,191 RKC captured
- 100 satellite tags deployed
- Distribution data publicly available:

<https://github.com/AFSC-Shellfish-Assessment-Program/CPS1>



2023 BBRKC Collaborative Pot Sampling

Survey extent

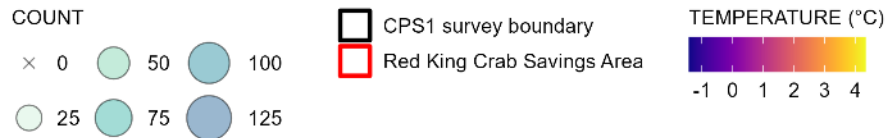
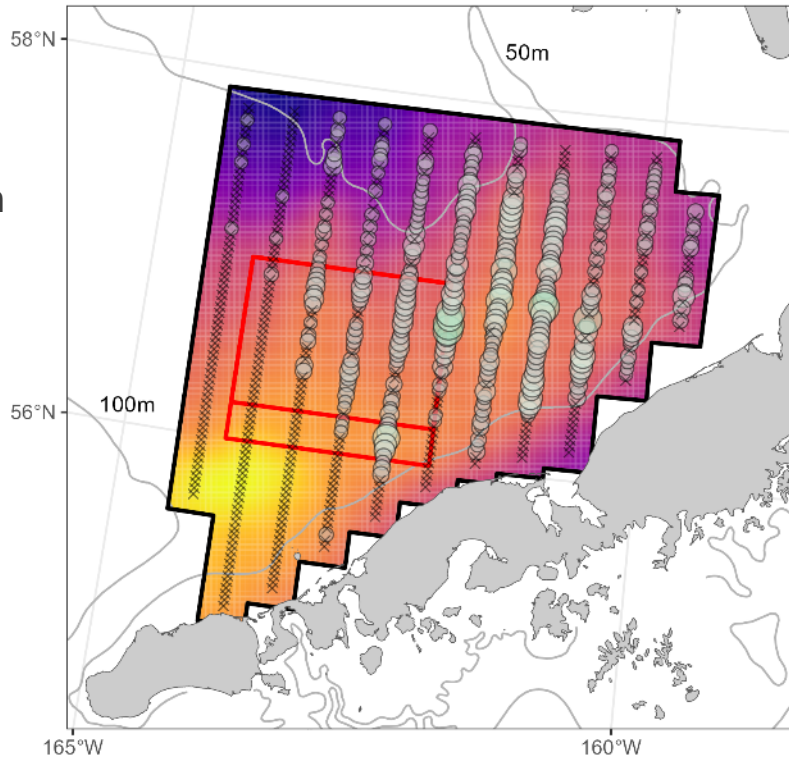


- CPS1 survey boundary
- Red King Crab Savings Area

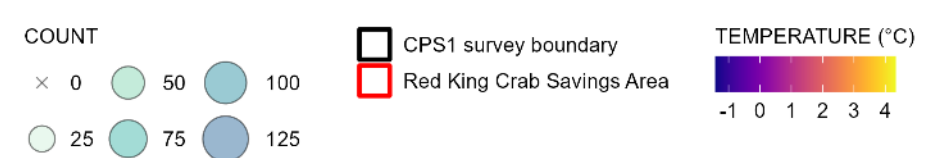
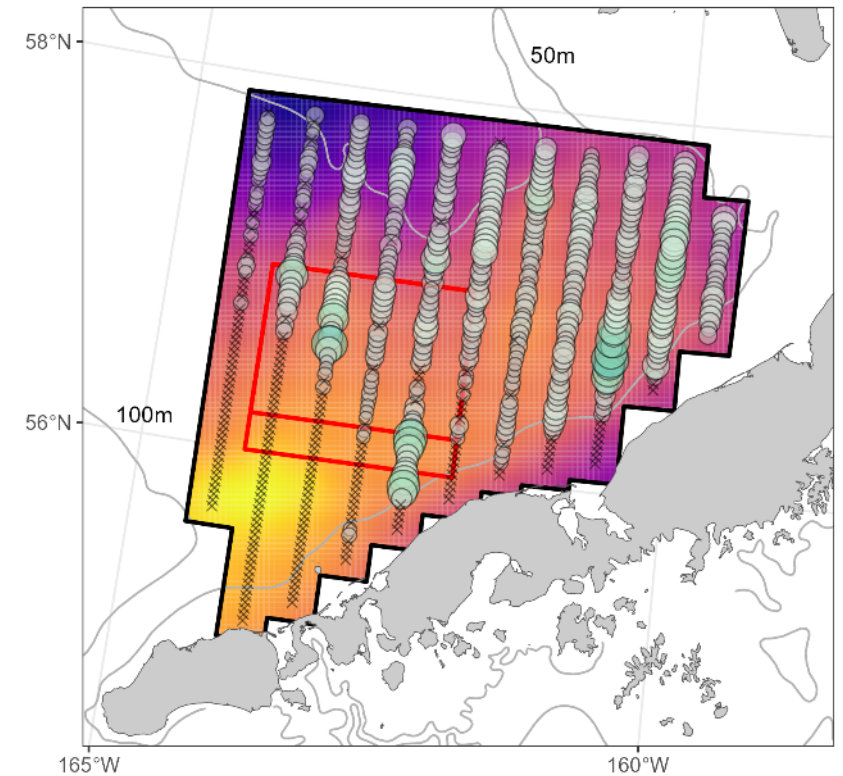
COLLABORATIVE POT SAMPLING

- Catch 23% female, 77% male
 - Molt timing or distribution difference?
- Tags currently popping up (coinciding with summer survey)
- Tentative plans for two more years

2023 BBRKC Collaborative Pot Sampling
Mature female



2023 BBRKC Collaborative Pot Sampling
Mature male (>= 120mm)



UNOBSERVED CRAB MORTALITY: NEXT STEPS

- SSC recommends working group (October 2022): “to develop a framework for how to estimate the magnitude of unobserved mortality for crab stocks and how these estimates may be utilized in BSAI crab assessments”
- Supported by Council (December 2022)
- CPT discussion:
 - Possible use of unobserved mortality estimates inside and outside assessments (e.g. for conservation)
 - Could review available data and guide future research
 - Could guide planned research on fishing interactions with specific life history stages (Erin Fedewa, AFSC)
 - Suggested initial interagency working group with subsequent public workshop
 - Possible expertise / personnel / groups to include were discussed
 - Tentative start date: early 2024



QUESTIONS?

- Thanks to all CPT members and crab authors.

