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

Aleutian Islands golden king crab
Pribilof Islands golden king crab *
Western Aleutian Islands(Adak) red king crab *

→ Assessed in May/June

→ Triennial cycle, next assessment in 2023

EBS snow crab
Bristol Bay red king crab
EBS Tanner crab
Pribilof Islands blue king crab *
Pribilof Islands red king crab *
St. Matthew blue king crab *

→ Biennial cycle, next assessment in 2023

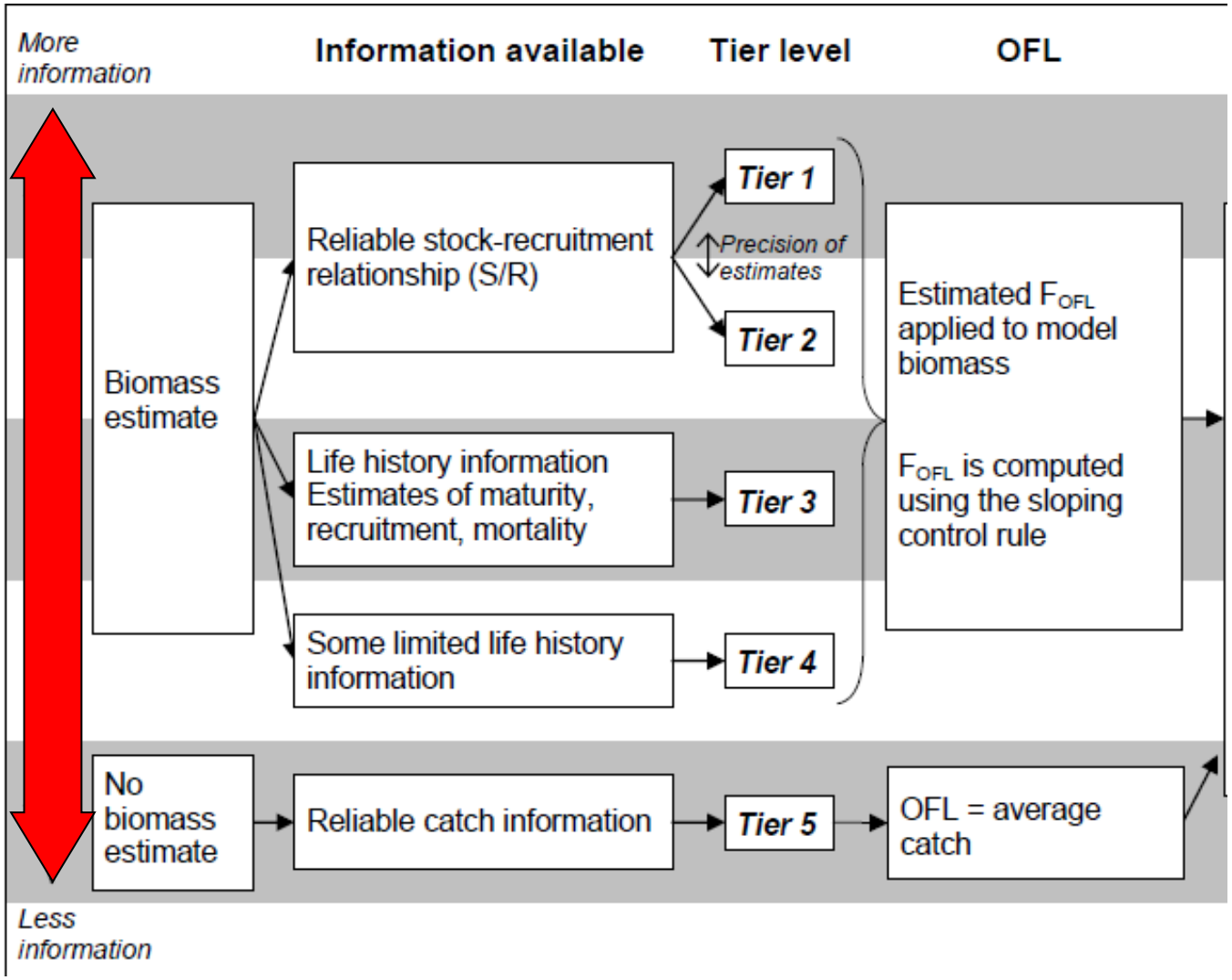
→ Assessed in September/ October

→ Triennial cycle, next assessment in 2025

→ Biennial cycle, next assessment in 2024

Norton Sound red king crab

→ Assessed in January/ February



ABC buffer

10-20%

10-25%

25-40%

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)

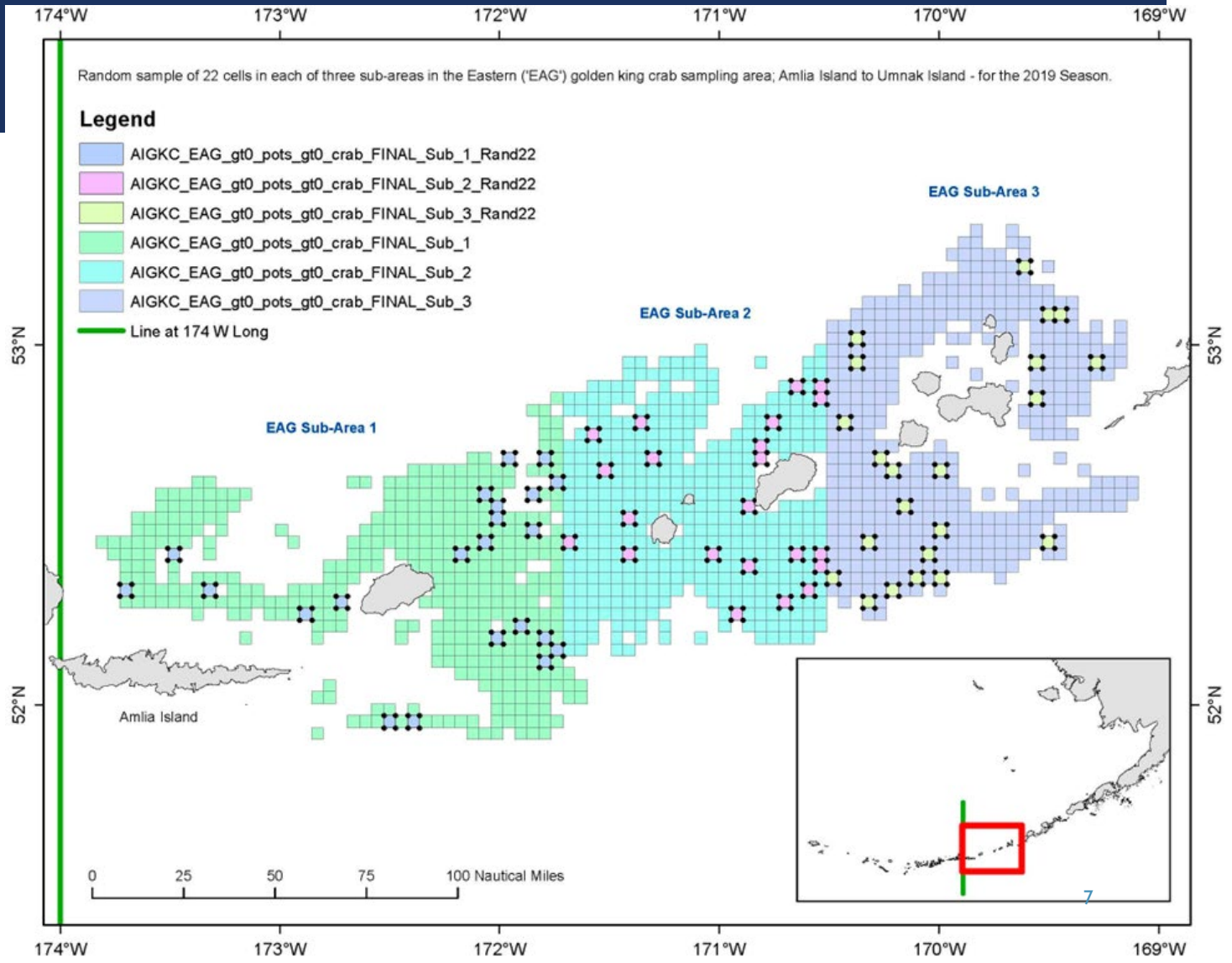
FINAL ASSESSMENT 2023

AIGKC OVERVIEW

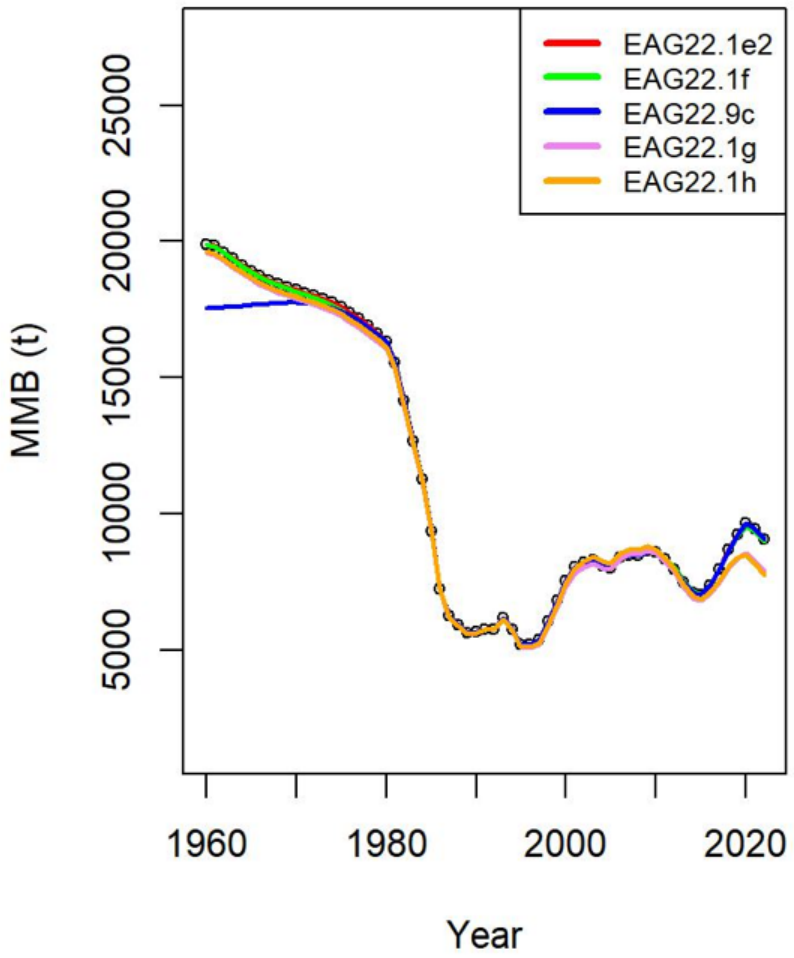
- **GMACS assessment** framework approved in Jan/Feb 2023
- **Changes in authorship –** welcome Tyler Jackson (ADF&G) as primary author after Siddeek Sharif's retirement this spring
- **Tier 3 annual stock assessment based completely on fishery-dependent data**
- OFL/ABC set for AIGKC stock but modeled 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

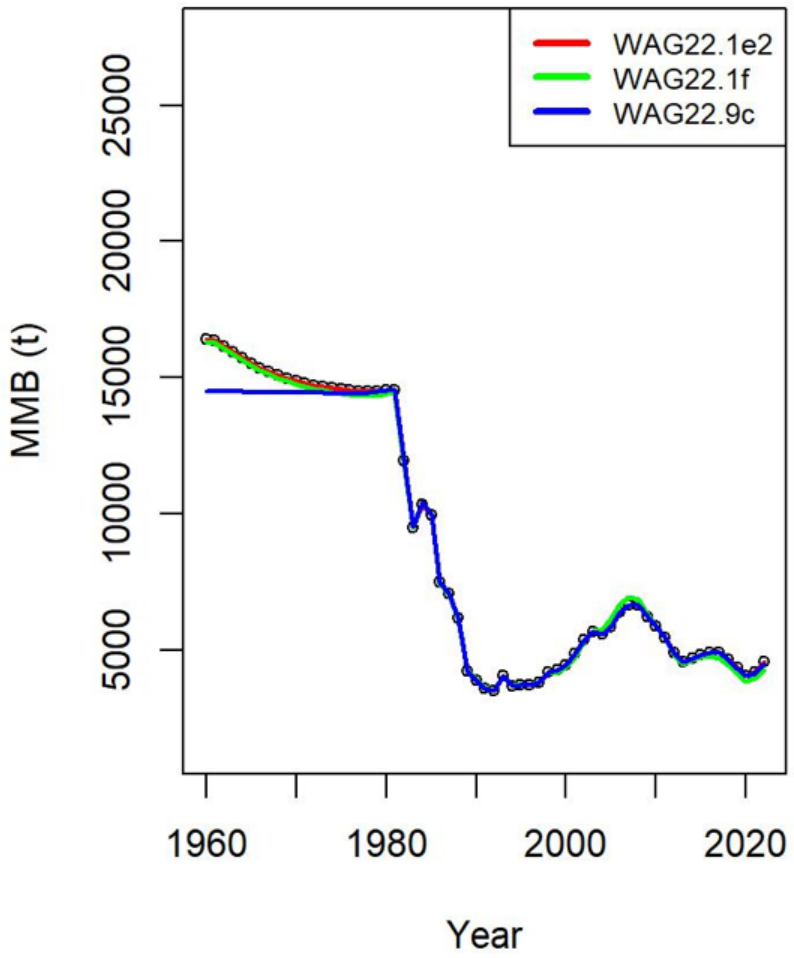


Figure 22a, pg 82

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 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 × M
  - Fit with M = 0.18 yr^{-1} and 0.22 yr^{-1}

CPT RECOMMENDATIONS

- **Tier 4 and Tier 4/5 approaches not justified at this time**
  - Tier 4 does appropriately increase uncertainty as most recent fishery-independent data ages
  - But without any new survey data since 2016 uncertainty will continue to increase monotonically
  - 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
- **25% buffer**
  - Consistent with other Tier 5 stocks
  - In place since 2014, no new information to motivate change
  - Tier 5 OFL = 95t, ABC = 71t
- **SSC recommends Tier 4/5 approach**
  - Tier 5 status with *B* calculated from survey biomass (mean 2002-2016 survey MMB)
  - Retains 25% ABC
  - Tier 4/5 OFL = 113.7t, ABC = 85.3t
- **Total catch below OFL in 2020-2021 (2022 not yet summarized); overfishing did not occur**

WESTERN ALEUTIAN ISLANDS RED KING CRAB (WAIRKC)

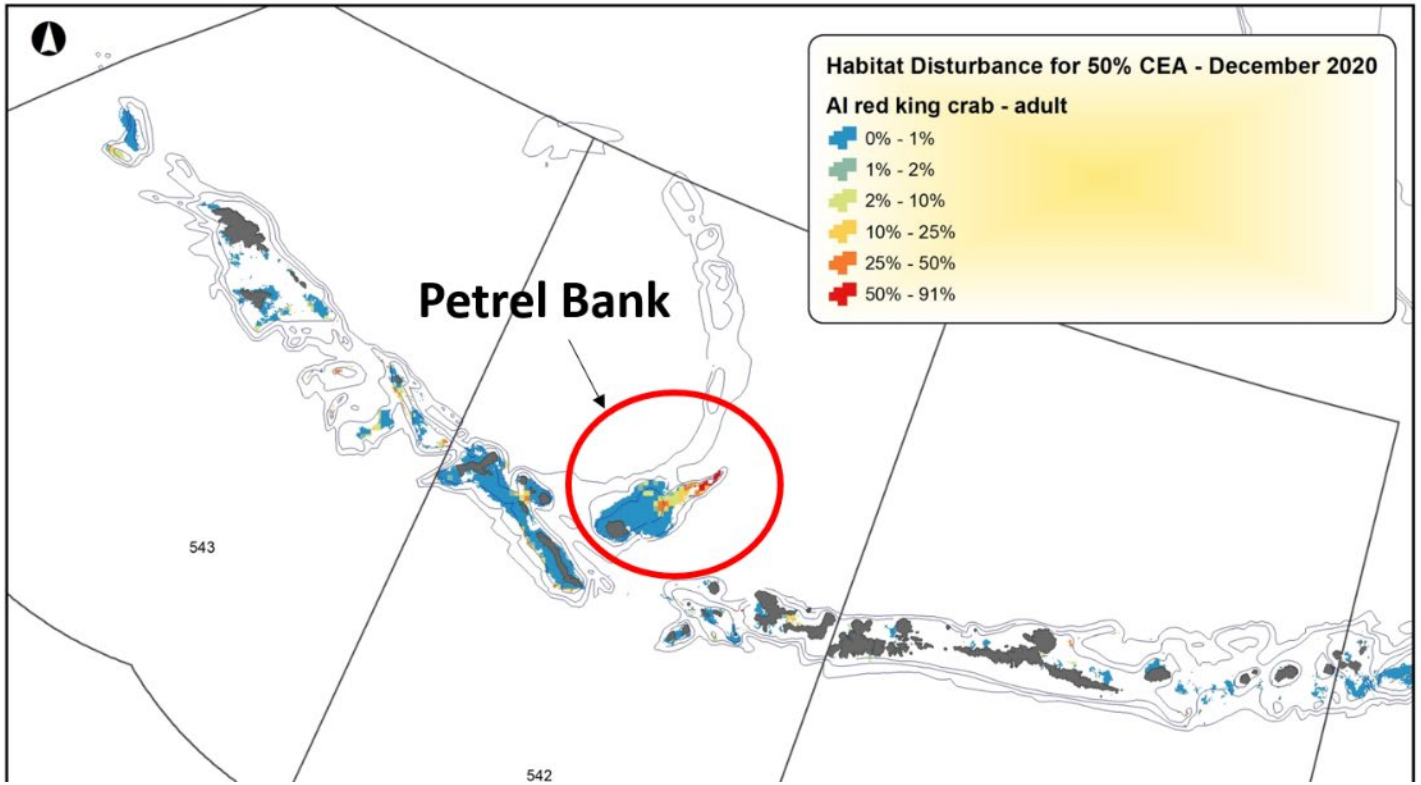
FINAL ASSESSMENT 2023

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

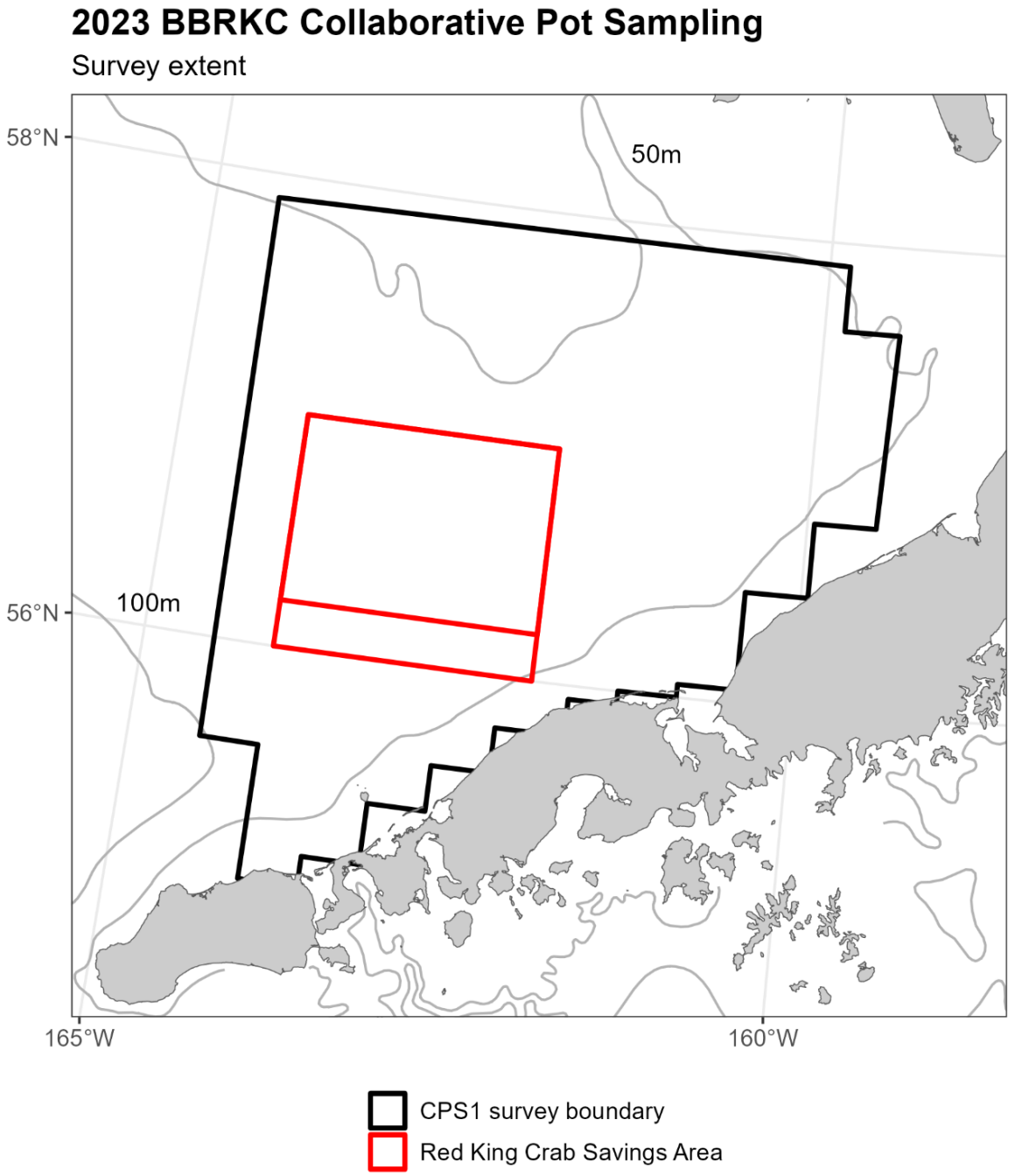
BALANCE OF CPT REPORT

BERING SEA FISHERIES RESEARCH FOUNDATION (BSFRF) UPDATE

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

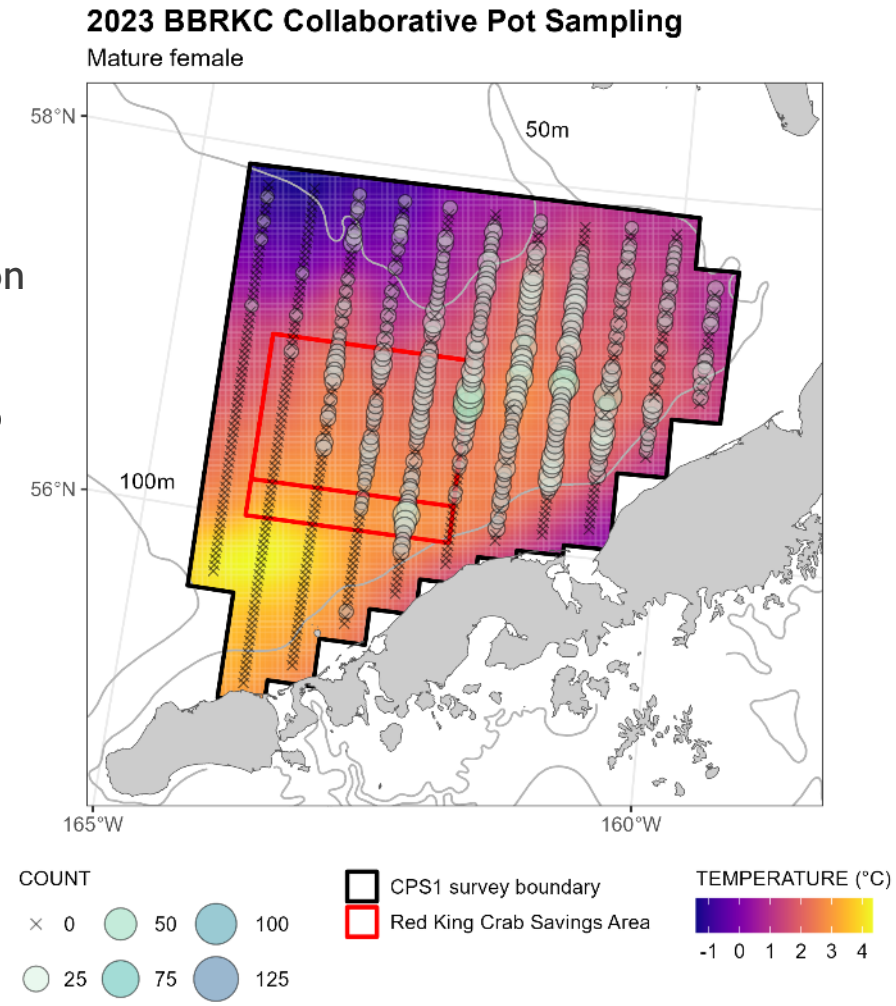
- Cooperative ADF&G, NOAA, BSFRF effort
- 2 vessels, ~ 25 days each, March-early April
- Goals:
  - Winter distribution data
  - Tagging data to connect winter and summer distribution
- 636 potlifts
- 10,191 RKC captured
- 100 satellite tags deployed
- Distribution data publicly available:

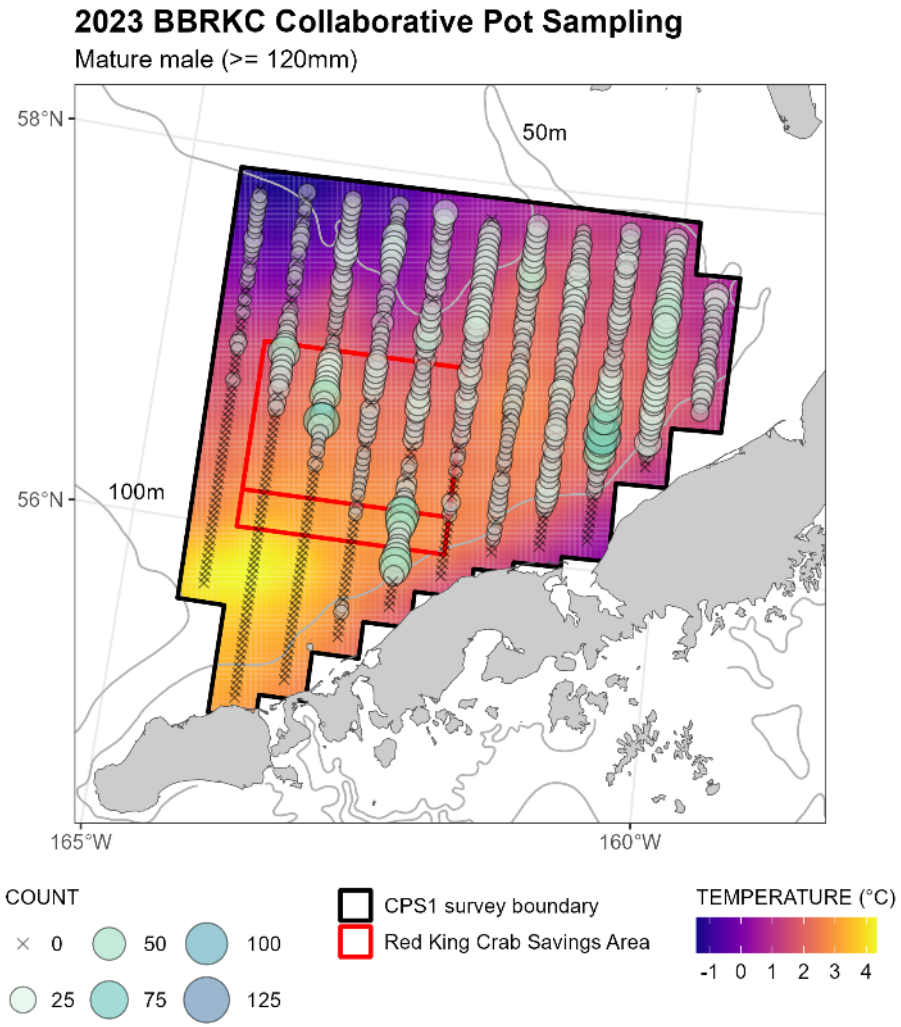
https://github.com/AFSC-Shellfish-Assessment-Program/CPS1



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





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.