
C1 BSAI CRAB STOCKS

KATIE PALOF & MARTIN DORN,

CPT MEETING MINUTES – SEPT 13-16, 2021



SNOW CRAB

FINAL ASSESSMENT, OFL/ABC SPECS



SNOW CRAB BUFFER & RECOMMENDATIONS

2019/20 ABC buffer	2020/21 ABC buffer	2021/22 Proposed ABC buffer	Rationale	Status/ Trend in MMB
20%	25%	25%	<ul style="list-style-type: none"> - Retrospective patterns - Model structure uncertainties (trade off between selectivity and mortality) - Uncertainty around M and mortality event, assuming M returns to reference level - Unexpected results from 2021 survey - Additional model uncertainty in functional maturity, is F35% appropriate? - Definition of reproductive outputs - Last minute adjustments for model convergence, review ability is smaller 	0.33/down

- GMACS version of snow crab model (May 2022)
- Continued work on selectivity/mortality



REBUILDING REQUIREMENTS REVIEW

DIANA STRAM NPFMC



NOTIFICATION AND IMPLICATIONS

- Council will receive a notification in October [TBD] from the Agency that EBS Snow crab is overfished.
- MSA requires that a rebuilding plan be prepared and implemented within 2 years
 - Must specify a time frame to rebuild
 - Time frame not to exceed ten years (unless this cannot be accomplished in the absence of all fishing mortality)



First steps for rebuilding plan = T_{\min} and T_{\max}



- Need to specify T_{\min}
 - T_{\min} = time the stock or stock complex to rebuild to its MSY biomass level in the absence of any fishing mortality ($\geq 50\%$ probability)
- Need to specify T_{\max} (maximum time for rebuilding)
- If T_{\min} for the stock or stock complex is 10 years or less, then T_{\max} is 10 years.
- If T_{\min} for the stock or stock complex exceeds 10 years, then one of the following methods can be used to determine T_{\max} :
 1. T_{\min} + one generation time. “Generation time” = average length of time between when an individual is born and the birth of its offspring,
 2. Time to rebuild to B_{msy} if fished at 75 percent of MFMT, or
 3. T_{\min} multiplied by two.
- In situations where T_{\min} exceeds 10 years, T_{\max} establishes a maximum time for rebuilding that is linked to the biology of the stock.

PLANNING FOR CPT MEETING (JANUARY)

- **Consideration 1:** projections of T_{\min} and T_{\max}
 - If T_{\min} or the stock or stock complex is 10 years or less, then T_{\max} is 10 years.
- **Consideration 2:** Continued discussions of what factors appear to be causing observed decline
- Report back to SSC, AP, Council in February the results of both considerations
- Council to begin to draft alternatives in February for analysis in a rebuilding plan



SEPT 2021 AGENDA

- Snow crab final assessment, OFL and ABC, ESP indicator draft
- **Tanner crab final assessment, OFL and ABC**
- **BBRKC final assessment, OFL and ABC**, ESP report card update
- Proposed model runs:
 - NSRKC
- 2021 bottom trawl survey results
- Fishery summary 2020/21
- Overfishing updates: WAIRKC, PIGKC, PIBKC, AIGKC
- Overfishing update and rollover specifications: **PIRKC, SMBKC**
- Risk table: comment on SSC report
- [Ecosystem status report](#)
- [ABSC industry survey updates](#)
- [BSFRF research updates](#)
- [AFSC climate science regional action plan for EBS and Artic](#)
- [GMACS updates](#)
- [New business/ co-chair elections](#)





BBRKC

FINAL ASSESSMENT 2021



BBRKC FISHERY UPDATE

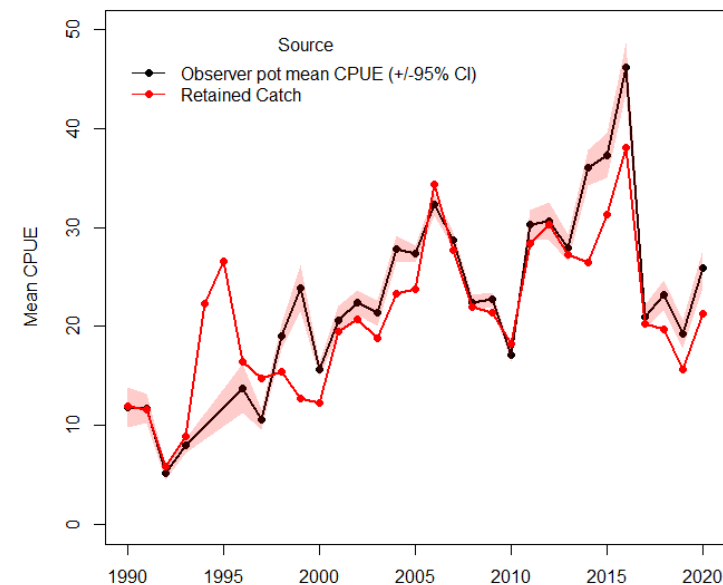
- Total catch for 2020/21 2771 t, lowest catch in recent history
- Legal male CPUE showed a slight uptick in 2020/21
- Captains reported high CPUE fishing with nearly all new shell crab.
- Majority of captains reported that they saw more recruits in the pots than in the two previous seasons.
- Most captains reported seeing “some” females.



BBRKC retained catch

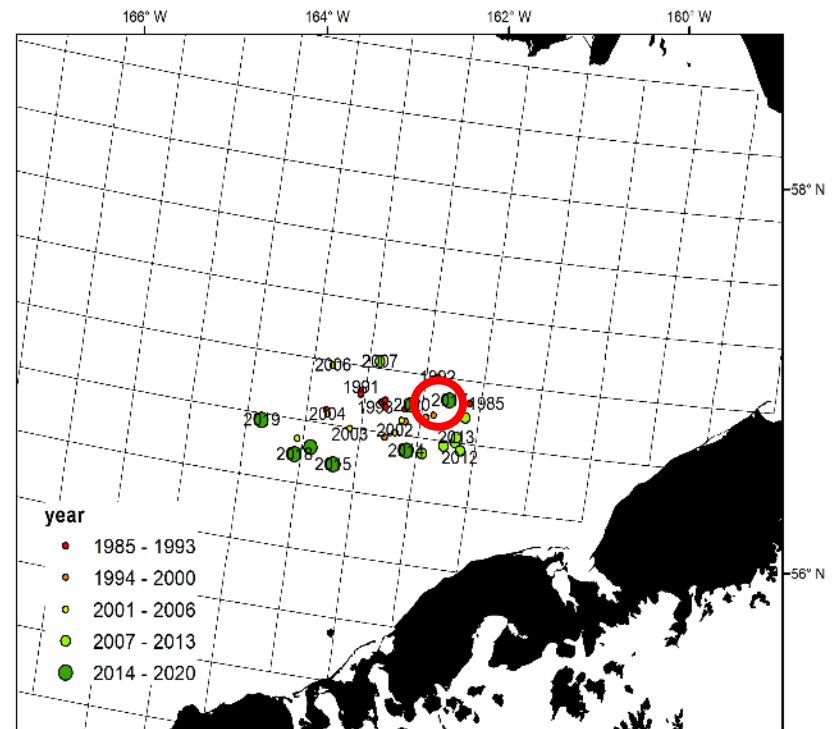
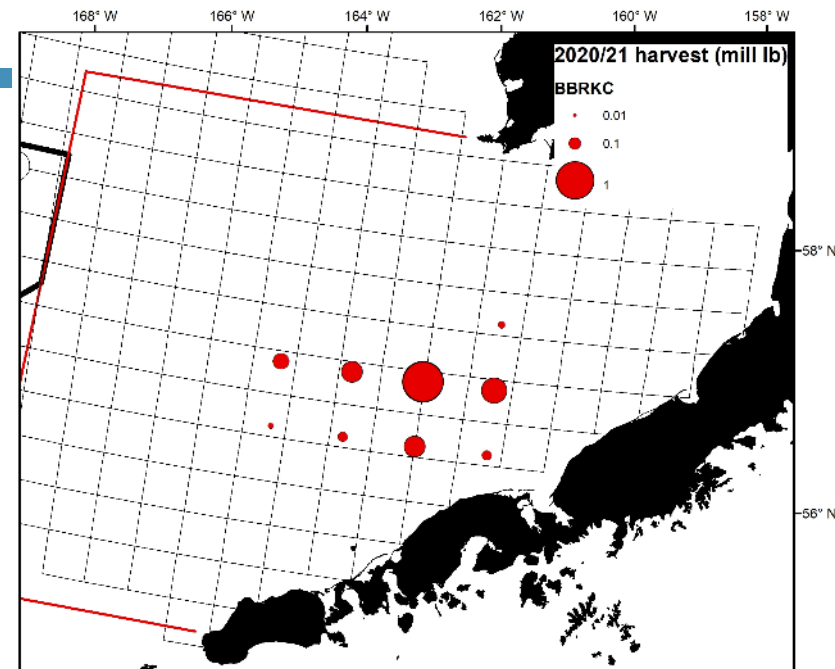


BBRKC legal male CPUE



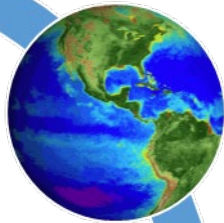
BBRKC FISHERY UPDATE

- Effort was well distributed across the fishing grounds, with vessels fishing more of the “traditional” areas to the east.
- Most of harvest in first two weeks of fishery
- Bycatch occurred primarily in yellowfin sole (stable) and pot cod fisheries (much reduced)



BBRKC REPORT CARD: ECOSYSTEM INDICATORS

Ecosystem Indicators



Physical



Lower Trophic

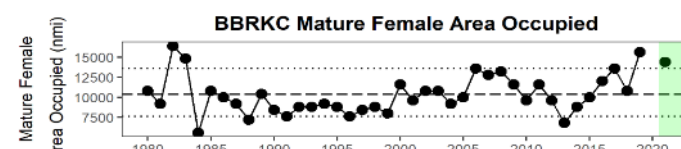
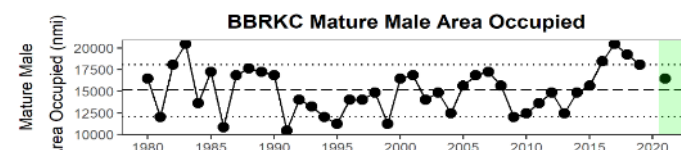
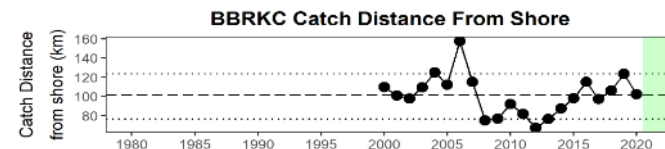
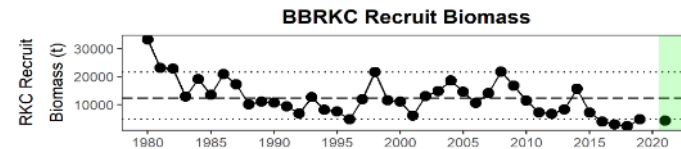
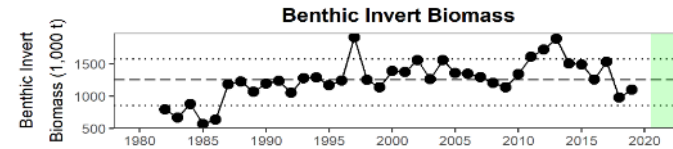
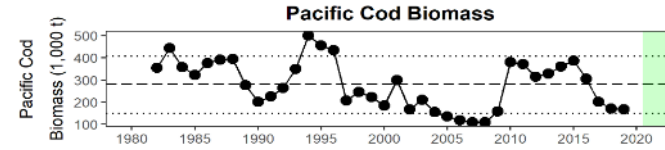
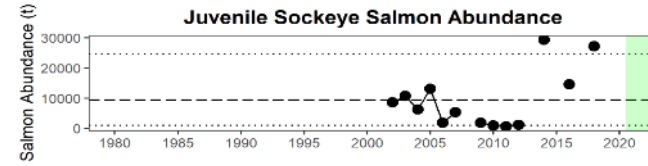
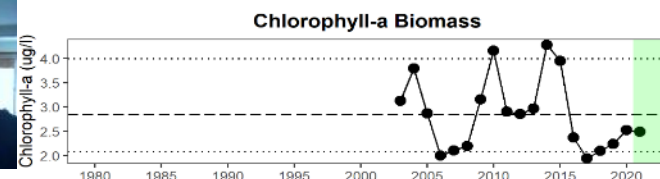
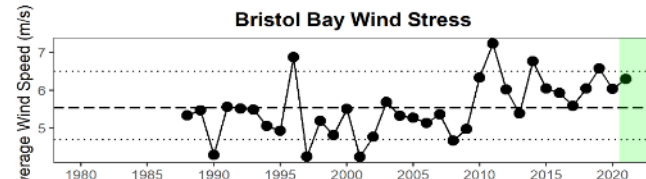
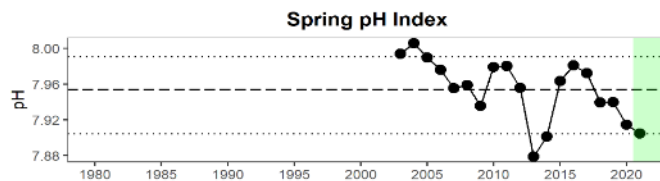
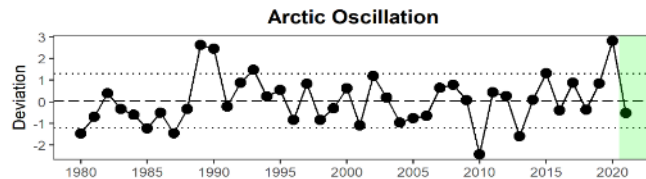
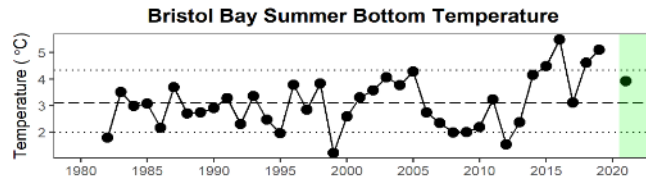
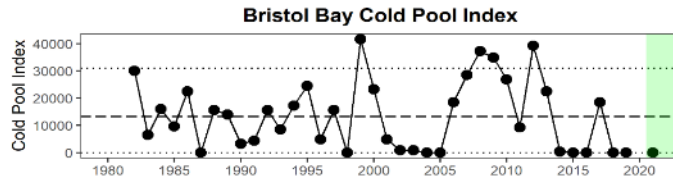


Upper Trophic

- + 1. Arctic Oscillation (climate model)
- + 2. Cold pool extent (BTS)
- + 3. Summer bottom temperature (BTS)
- + 4. pH index (ocean model)
- + 5. Production (chlorophyll *a*, satellite)
- 6. Wind stress (satellite)
- + 7. Benthic invertebrate biomass (BTS)
- 8. Juvenile sockeye salmon abundance (BAS)
- 9. Pacific cod biomass (BTS)
- + 10. Male recruit biomass (BTS)
- 11. Area Occupied (BTS)
- + 12. Catch distance from shore (BBRKC fishery)



ECOSYSTEM INDICATOR TIME SERIES



ECOSYSTEM TRAFFIC LIGHT TABLE

Indicator	2017 Status	2018 Status	2019 Status	2020 Status	2021 Status
Summer Cold Pool BBRKC Survey	neutral	low	low	missing	low
Summer Temperature Bottom BBRKC Survey	neutral	high	high	missing	neutral
Winter Spring Arctic Oscillation Index Model	neutral	neutral	neutral	high	neutral
Spring pH Index BBRKC Model	neutral	neutral	neutral	low	low
Summer Wind Stress BBRKC Satellite	neutral	neutral	high	neutral	high
Spring Chlorophylla Biomass SEBS Inner Shelf Satellite	low	neutral	neutral	neutral	neutral
Summer Sockeye Salmon Abundance EBS Survey	missing	high	missing	missing	missing
Summer Pacific Cod Biomass BBRKC Survey	neutral	low	low	missing	missing
Summer Benthic Invertebrate Biomass BBRKC Survey	neutral	neutral	neutral	missing	missing
Annual Red King Crab Recruit Biomass BBRKC Model	low	low	low	missing	low
Summer Red King Crab Area Occupied Male BBRKC Survey	high	high	high	missing	neutral
Summer Red King Crab Area Occupied Female BBRKC Survey	high	neutral	high	missing	high
Annual Red King Crab Catch Distance Shore BBRKC Fishery	neutral	neutral	high	neutral	missing



ECOSYSTEM CONSIDERATIONS

- Above-average wind stress and persistently low levels of chlorophyll-*a* in Bristol Bay could indicate **poor larval feeding conditions** and **increased predation** on BBRKC early life stages
- Delayed spring BBRKC hatching relative to mid-May peak bloom timing may have resulted in a **spatiotemporal mismatch** between first-feeding larvae and preferred diatom prey.
- The cold pool did not extend into Bristol Bay in summer 2021, suggesting **optimal conditions for embryo development** and potentially **greater larval retention** within Bristol Bay
- Red king crab have experienced a **steady decline in bottom water pH** in the past 5 years.
- Spatial extent of mature female red king crab in Bristol Bay was above average in 2021 despite declines in abundance. **Northwest shifts in stock distribution** may limit the effectiveness of central Bristol Bay trawl closure areas designated to protect red king crab.



DRAFT 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)



Economic

4. Ex-vessel value (BBRKC fishery)
5. Ex-vessel price/lb (BBRKC fishery)
6. Ex-vessel revenue share (BBRKC fishery)



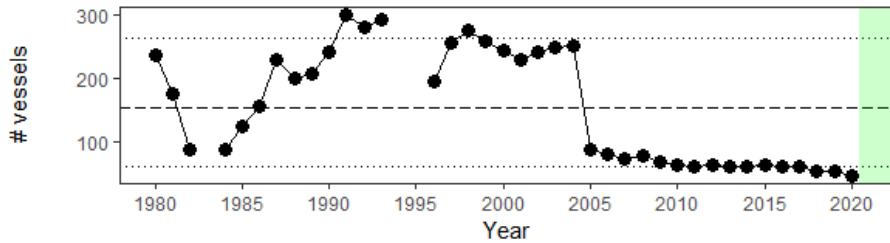
Community

No community indicators proposed

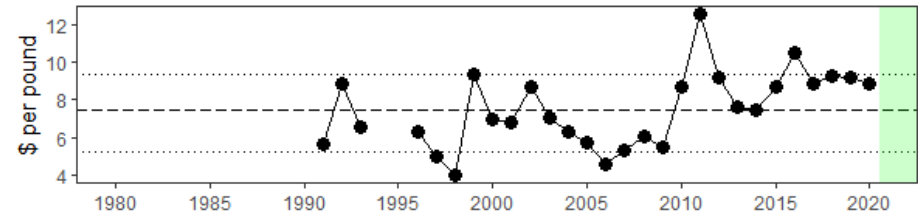


SOCIOECONOMIC INDICATOR TIME SERIES

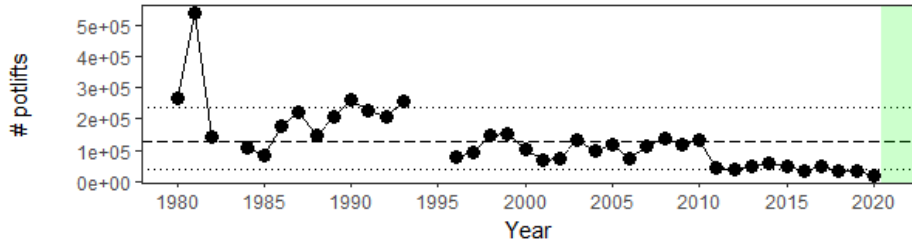
Vessels Active in Fishery



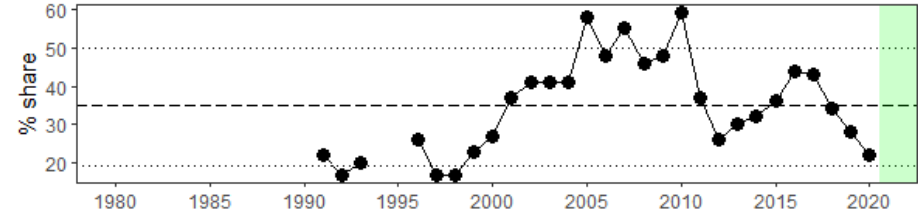
Ex-vessel Price per Pound



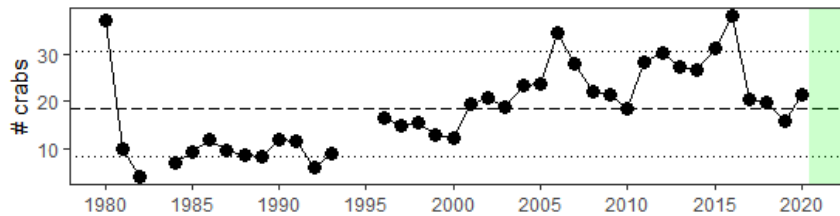
Total Potlifts



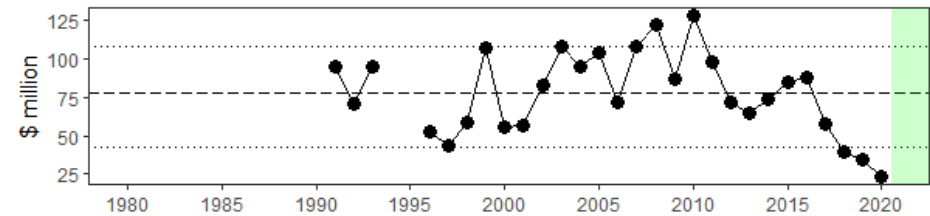
BBRKC Ex-vessel Revenue Share



CPUE



Ex-vessel value of BBRKC landings



Indicator	2016 Status	2017 Status	2018 Status	2019 Status	2020 Status
Annual Red King Crab Active Vessels BBRKC Fishery	low	low	low	low	low
Annual Red King Crab Total Potlift BBRKC Fishery	neutral	neutral	neutral	neutral	low
Annual Red King Crab Potlift CPUE BBRKC Fishery	high	neutral	neutral	neutral	neutral
Annual Red King Crab Exvessel Price BBRKC Fishery	high	neutral	neutral	neutral	neutral
Annual Red King Crab Exvessel Revenue Share BBRKC Fishery	neutral	neutral	neutral	neutral	low
Annual Red King Crab Exvessel Value BBRKC Fishery	neutral	neutral	low	low	low

MARCH 2021 CIE REVIEW OF BBRKC

Three independent experts: Drs. Yong Chen, Nick Caputi, and Billy Ernst

Many good recommendations:

1. Address large retrospective patterns: identifying temporal trends and/or time blocks of parameters, such as natural mortality and survey catchability.

Response: Model 21.2 is a small step. Further future work needed.

2. Evaluate survey performance/efficacy and selectivity curve in term of changes in distributions over time, and the stock area evaluation.

Response: Potential ADF&G tagging study; examination of RKC north of Bristol Bay.

3. Evaluate commercial catch, effort, and CPUE for crab distributions, fishery performance relative to the trawl survey results and on impacts on survey timing and survey availability.

Response: Commercial CPUE and catch spatial distributions are always examined. CPUE standardization will be developed for potential use in the model.



MARCH 2021 CIE REVIEW OF BBRKC

4. Extend estimates of sizes-at-50% maturity for females and examine the impacts of changes on mature female biomass estimates.

Response: This will be done.

5. Develop a model just using data from 1985 to avoid high natural mortality during the early 1980s.

Response: This has been done before and will be done again for May 2022.

6. Conducting new tagging study to update the outdated tagging/return data used in the assessments.

Response: We agree with this recommendation. Hopefully, tagging study will be conducted for BBRKC in the future.



BBRKC FINAL ASSESSMENT 2021

- Survey results: males slight increase, drop in females, overall abundance remains low
- New data: 2021 survey data, directed fishery data, groundfish bycatch (abundance and size comps)
- Explored alternative configurations of for sex-specific catchability and selectivity
- Evaluated the use of the VAST model
- Whether to model a mortality event in 2018 and 2019



BBRKC FINAL ASSESSMENT 2021

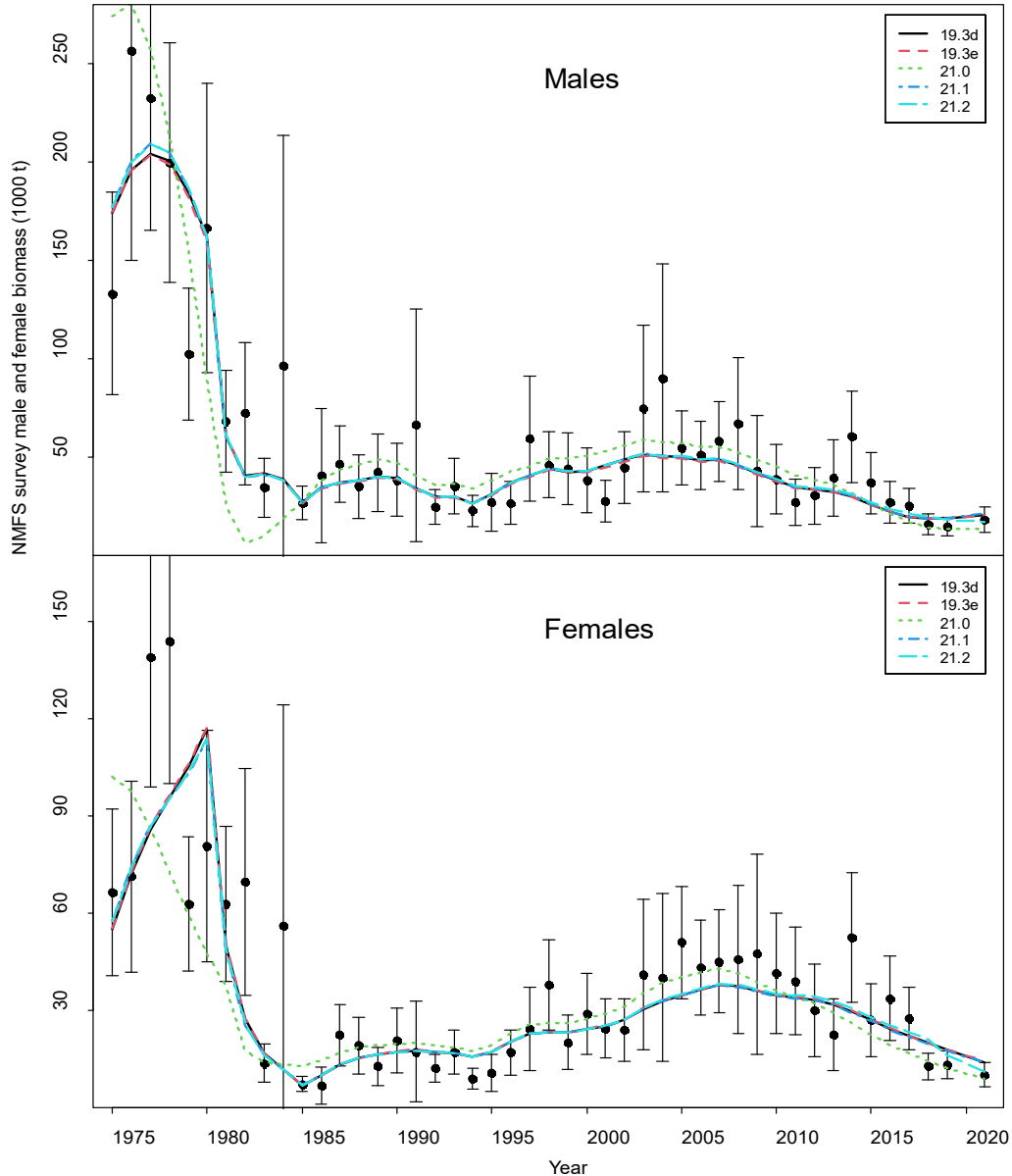
- **19.3d:** the same as the base model 19.3 in September 2020 except for updating/standardizing the observer data in the directed pot and Tanner crab fisheries, changing the maximum cap of effective sample size from 100 to 150 for the retained catch and total males in the directed pot fishery, fishing effort data used to estimate red king crab bycatch in years before the observer data in the Tanner crab fishery are changed from east of 1630 W to east of 1660 W, five more years of length composition data with relatively small observed sample sizes from the Tanner crab fishery are also included.
- **19.3e:** the same as model 19.3d except for males and females to have different NMFS trawl survey catchabilities.
- **19.3g:** the same as model 19.3d except that VAST-estimated NMFS survey trawl biomass and CV are used.
- **21.0** (suggested by the SSC): the same as model 19.3d except for estimating one natural mortality parameter across sex and time, and one shared catchability and selectivity curve for the NMFS trawl survey.
- **21.1:** the same as model 19.3d except for one shared catchability and selectivity curve for the NMFS trawl survey and one selectivity curve for the BSFRF trawl survey.
- **21.2:** the same as model 21.1 except for estimating an additional time block (2018-2019) of natural mortality parameter.



BBRKC FINAL ASSESSMENT 2021

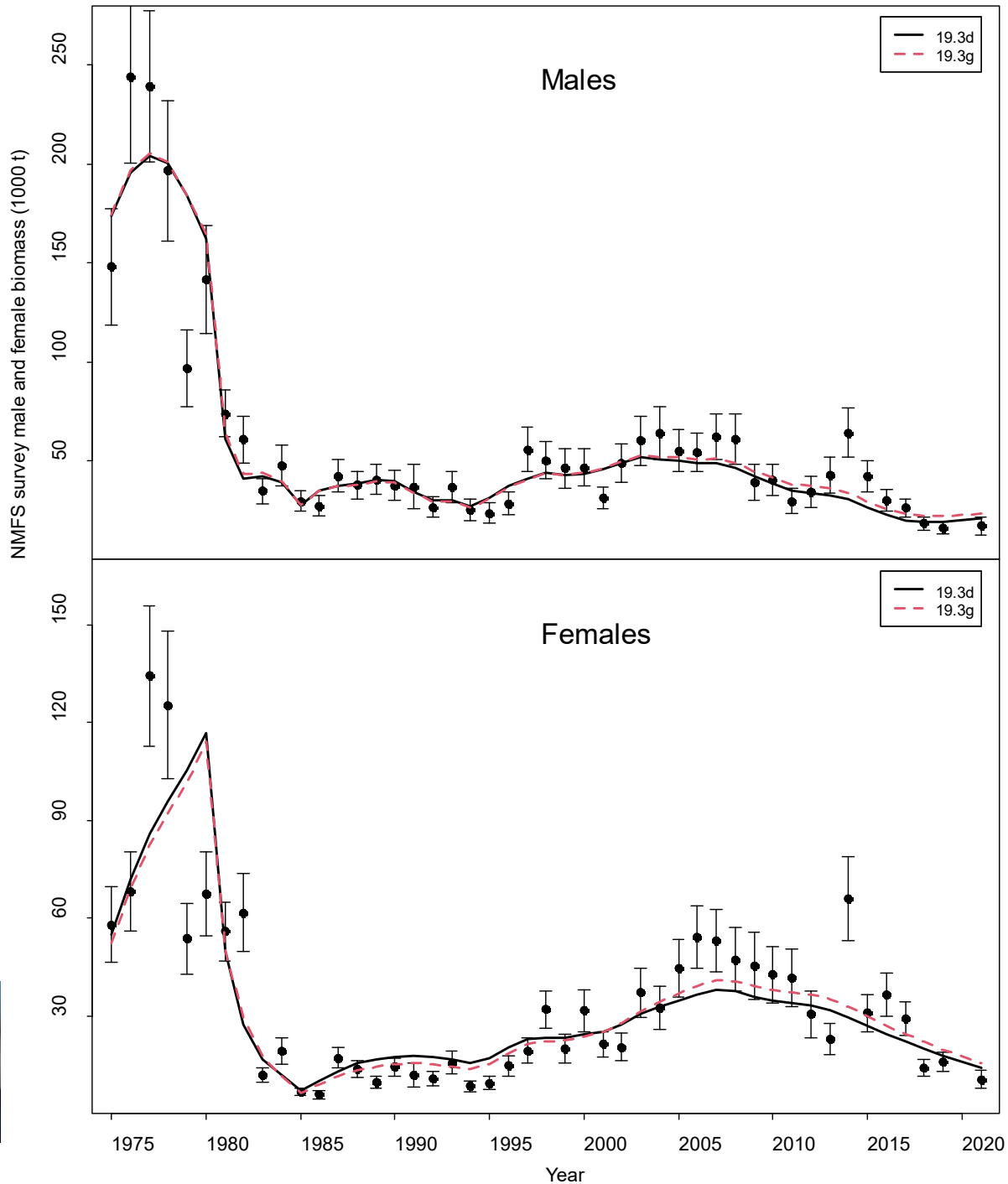
Model	Male M	Female M	Updated obs. estimates	Max cap of ret. & total male ESS	VAST	Diff. sele. By sex	Diff. Q by sex
19.3d	80-84: MI , others: 0.18	c*male M	Y	150	N	Y	N
19.3e	80-84: MI , others: 0.18	c*male M	Y	150	N	Y	Y
19.3g	80-84: MI , others: 0.18	c*male M	Y	150	Y	Y	N
21.0	Constant M	= male M	Y	150	N	N	N
21.1	80-84: MI , others: 0.18	c*male M	Y	150	N	N	N
21.2	80-84: MI , 2018-19: M2 , others: 0.18	c*male M	Y	150	N	N	N





Comparisons of area-swept estimates of male and female NMFS survey biomass and model prediction for model estimates in 2021 under five models. The error bars are plus and minus 2 standard deviations of model 19.3d.



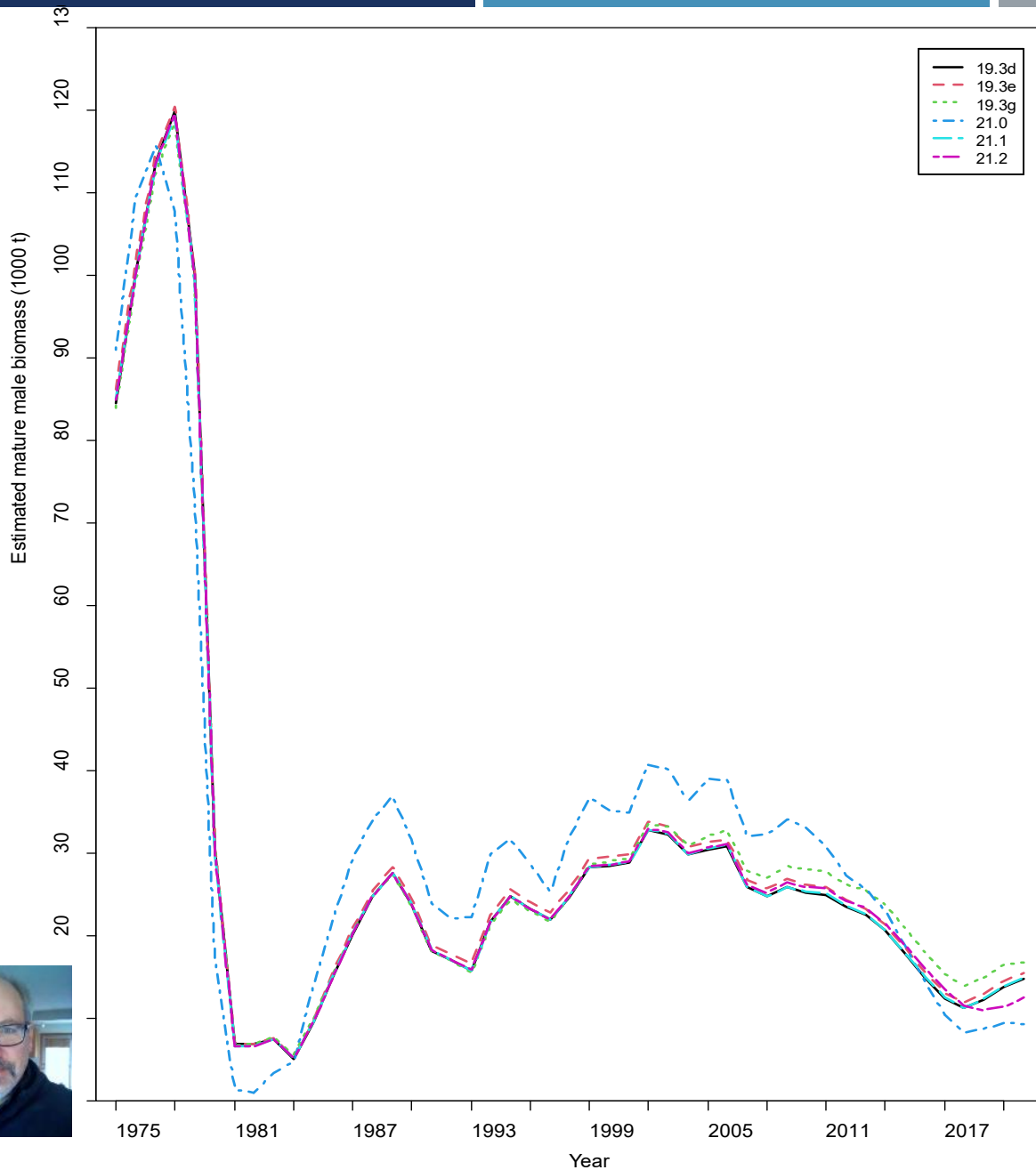


Comparisons of area-swept estimates of male and female NMFS survey biomass and model prediction for model estimates in 2021 under two models. The error bars are plus and minus 2 standard deviations of model 19.3g.

VAST estimated biomass.

Note that model 19.3d fits area-swept biomasses, not these VAST biomasses.





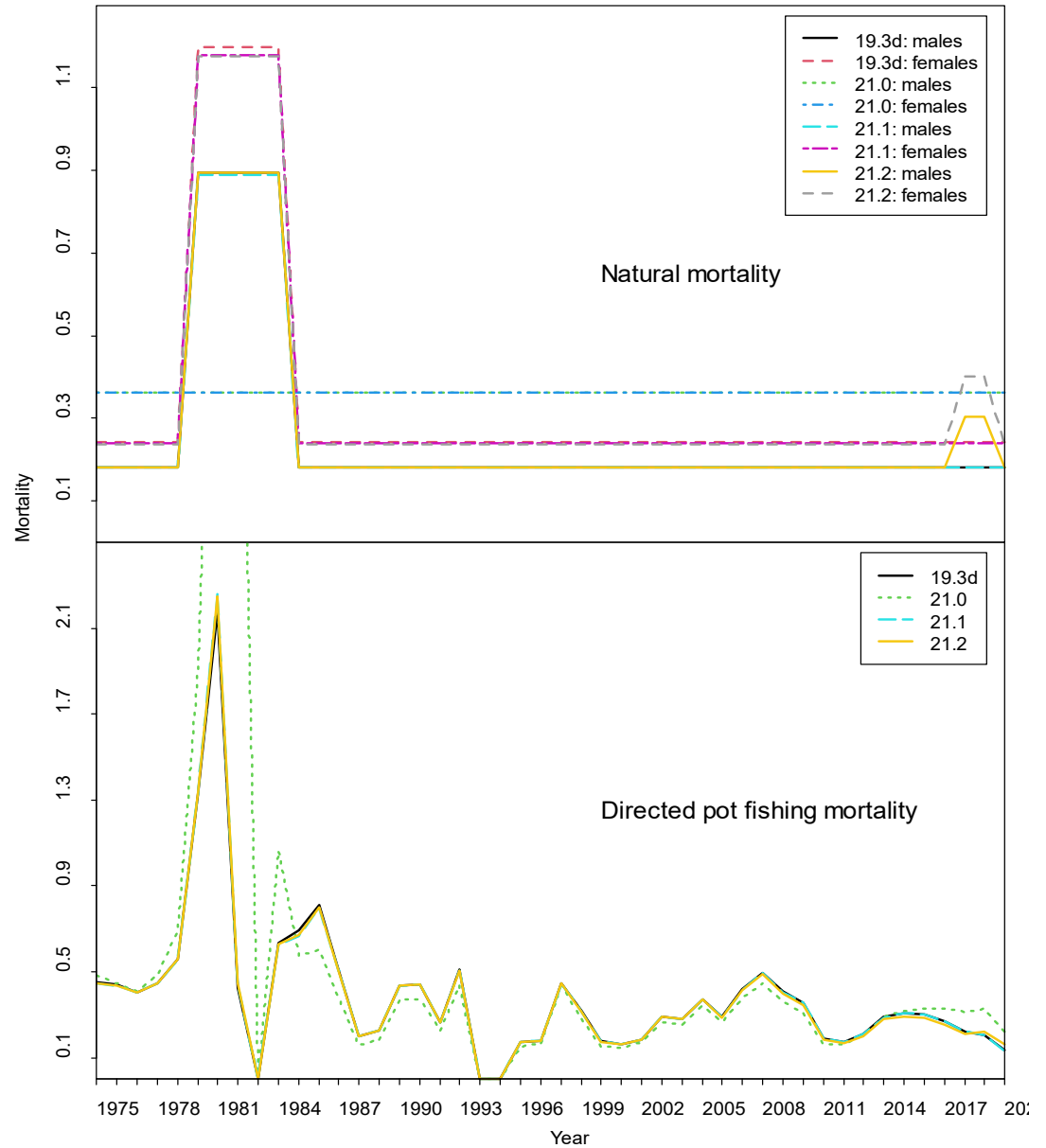
Comparisons of mature male biomass on Feb. 15 under eight models.

Estimated trawl survey catchabilities:

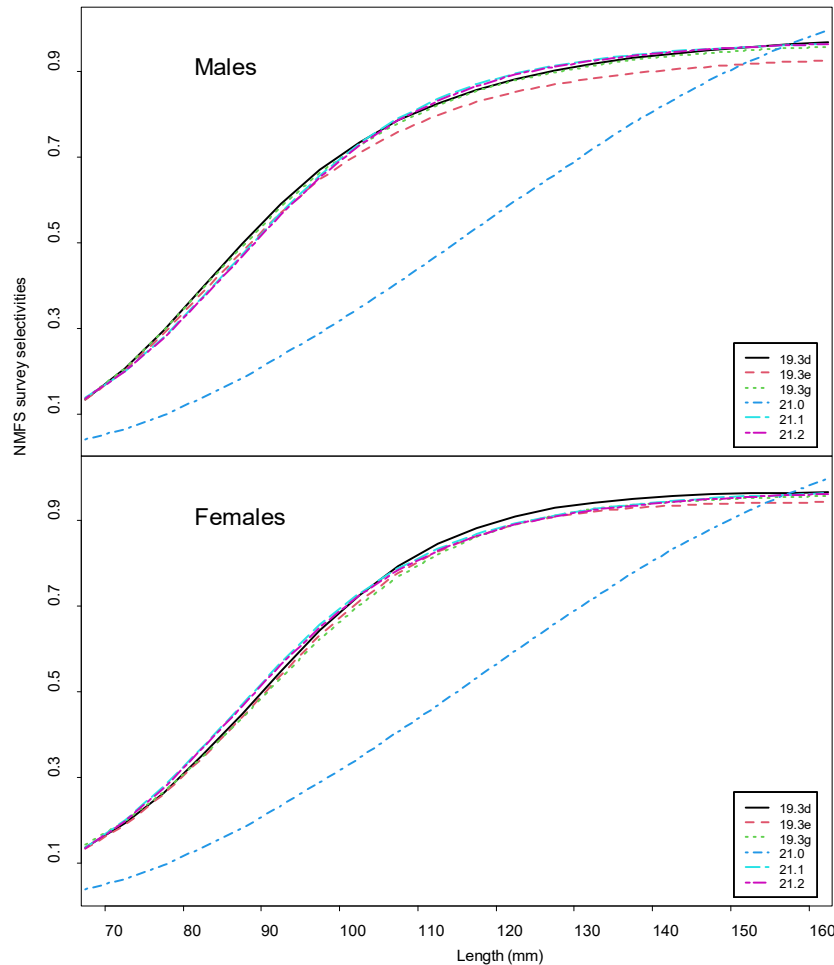
Model	Q
19.3d	0.967
19.3e	0.925/0.944
19.3g	0.957
21.0	0.998
21.1	0.964
21.2	0.963



Comparison of estimated M and directed pot fishing mortality over time



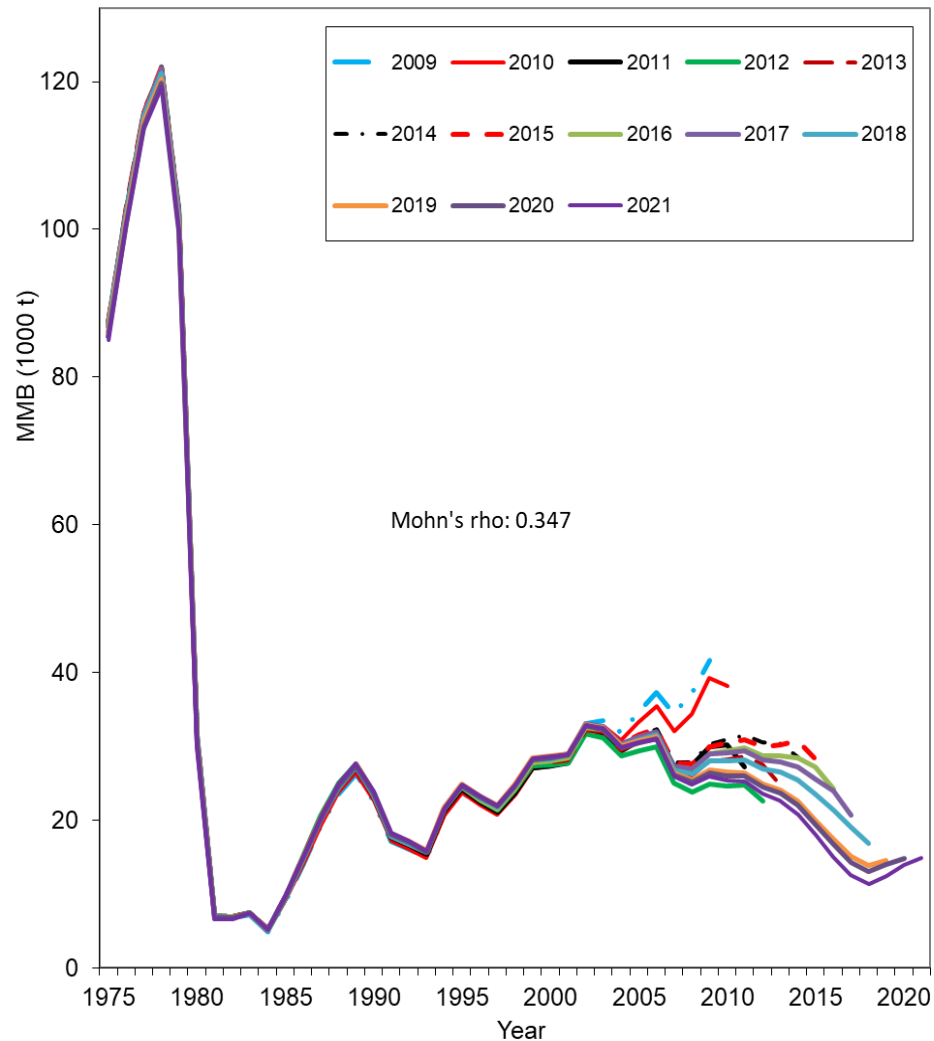
NMFS SURVEY SELECTIVITIES (INCLUDING CATCHABILITY)



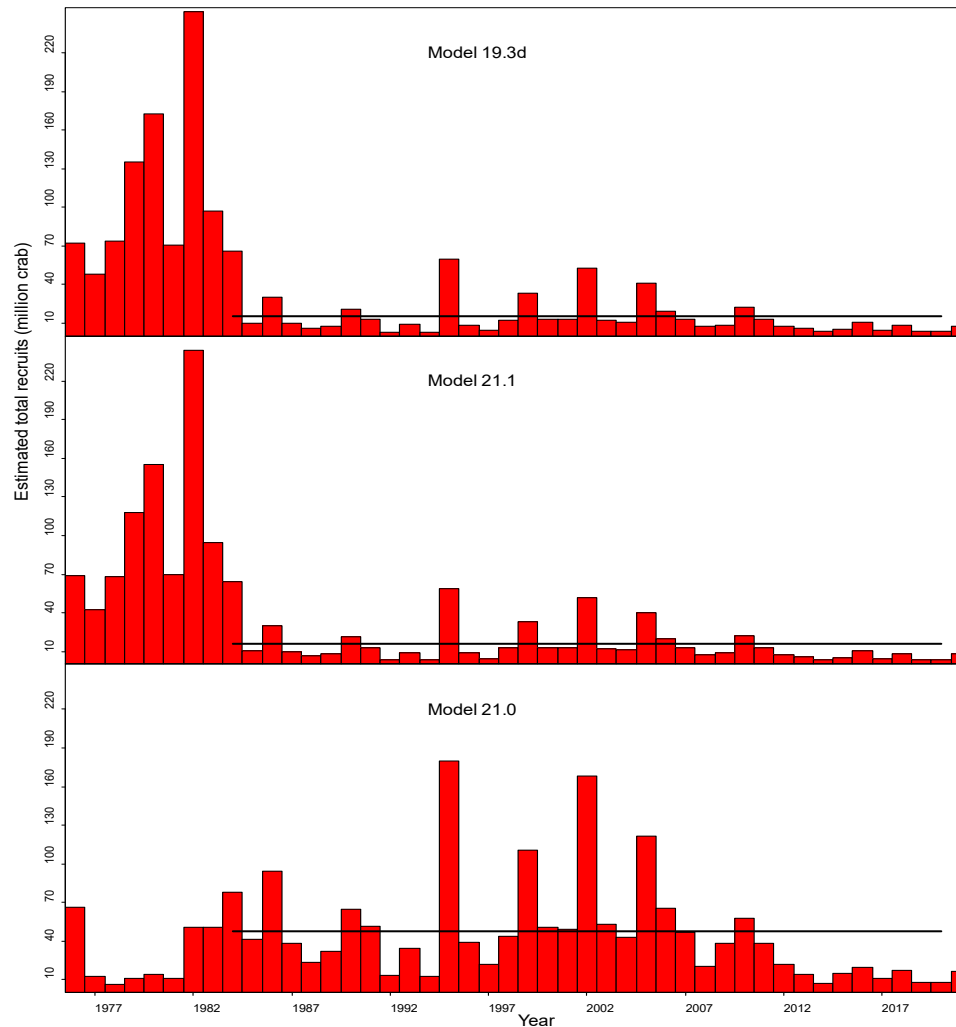
Estimated selectivities (including catchability) of NMFS trawl survey during 1982-2021 with six models



Comparison of hindcast estimates of MMB for model 21.1 from 1975 to 2021 made with terminal years 2009-2021.



Estimated recruitment time series during 1976-2021 with models 19.3d, 21.1, and 21.0.



Status and catch specifications (1,000 t) (model 21.1):

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2017/18	12.74 ^A	24.86 ^A	2.99	3.09	3.60	5.60	5.04
2018/19	10.62 ^B	16.92 ^B	1.95	2.03	2.65	5.34	4.27
2019/20	12.72 ^C	14.24 ^C	1.72	1.78	2.22	3.40	2.72
2020/21	12.12 ^D	13.96 ^D	1.20	1.26	1.57	2.14	1.61
2021/22		14.95 ^D				2.23	1.78

Basis for the OFL: Values are in 1,000 t (model 21.1):

Year	Tier	B _{MSY}	Current MMB	B/B _{MSY} (MMB)	F _{OFL}	Years to define B _{MSY}	Natural Mortality
2017/18	3b	25.1	21.3	0.85	0.24	1984-2017	0.18
2018/19	3b	25.5	20.8	0.82	0.25	1984-2017	0.18
2019/20	3b	21.2	16.0	0.75	0.22	1984-2018	0.18
2020/21	3b	25.4	14.9	0.59	0.16	1984-2019	0.18
2021/22	3b	24.2	14.9	0.62	0.17	1984-2020	0.18



Model 21.1, base ABC buffer 20%



CPT DISCUSSION ON ABC BUFFERS FOR BBKRC

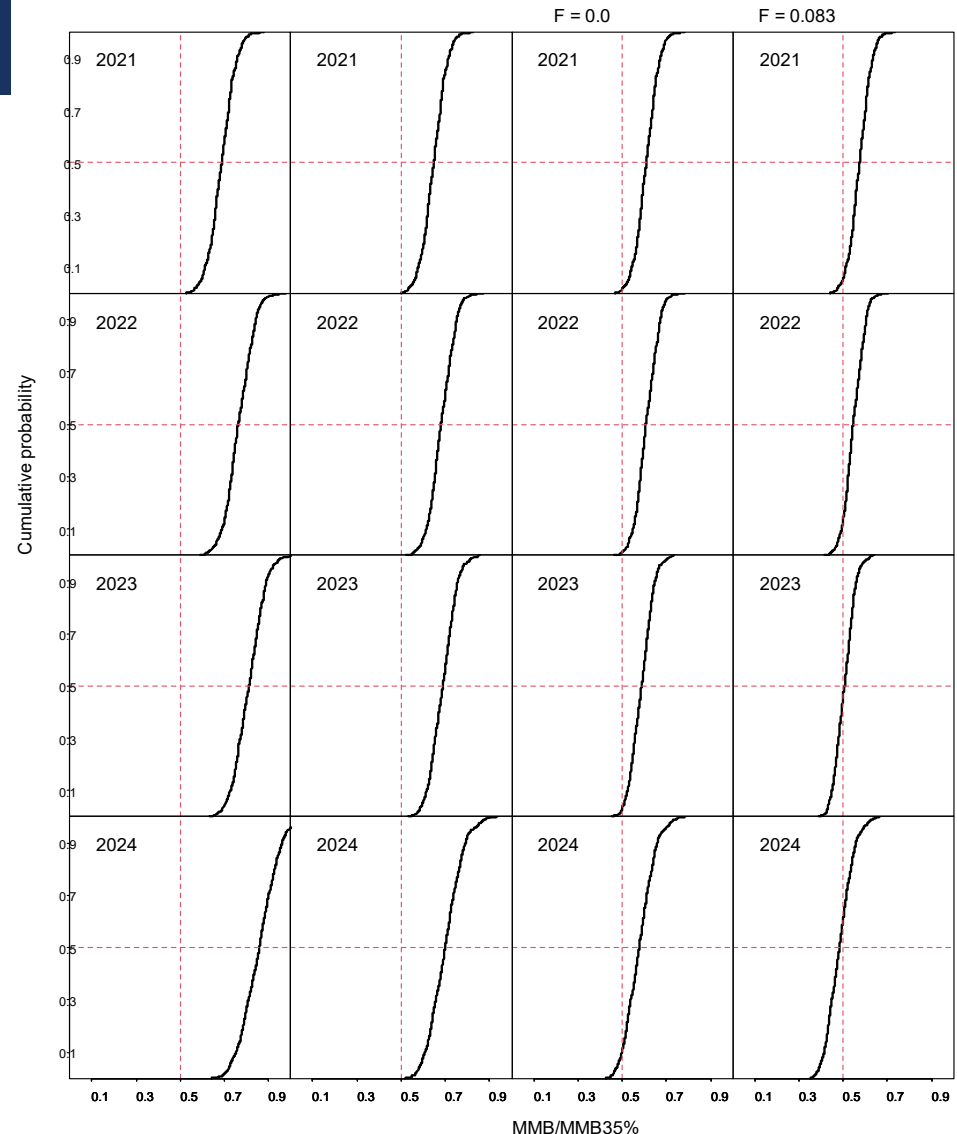
- ABC base buffer 20%
- In 2020, the CPT recommended a larger buffer of 25% to account for the lack of a 2020 bottom trawl survey
- Uncertainty due to a cancelled survey is not relevant this year (no follow-on effects)
- Similar uncertainties exist as previously for this assessment:
 - Cold pool distributional shifts
 - Declining trends in mature biomass
 - Lack of recruitment,
 - Retrospective patterns
 - Poor recent environmental conditions
- CPT recommends reverting to a buffer of 20%



IS BBRKC APPROACHING OVERFISHED CONDITION?

- NS I guidelines: “A stock or stock complex is approaching an overfished condition when it is projected that there is more than a 50 percent chance that the biomass of the stock or stock complex will decline below the MSST within two years.”

Model 21.1
Approaching
overfished
condition during
2021-2024



TANNER CRAB

FINAL ASSESSMENT, OFL/ABC SPECS



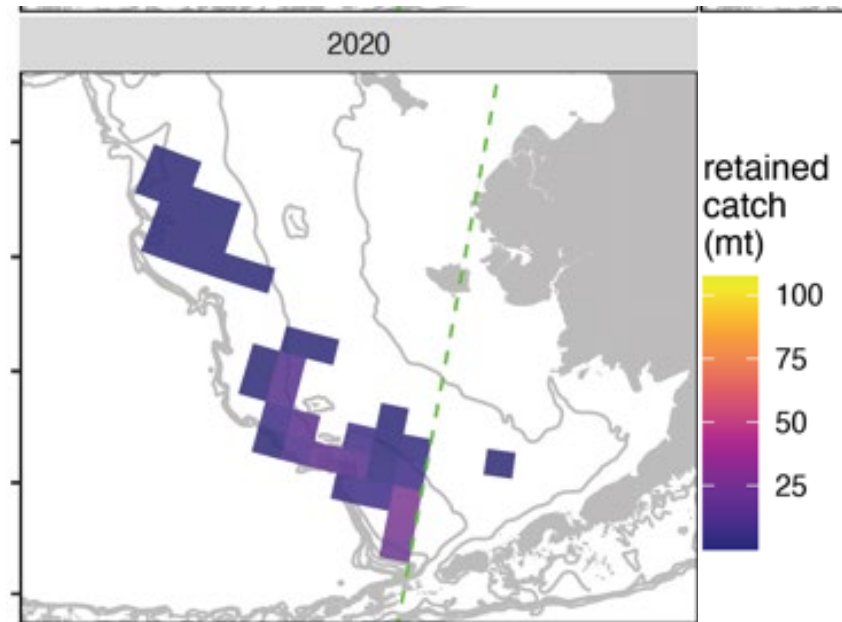
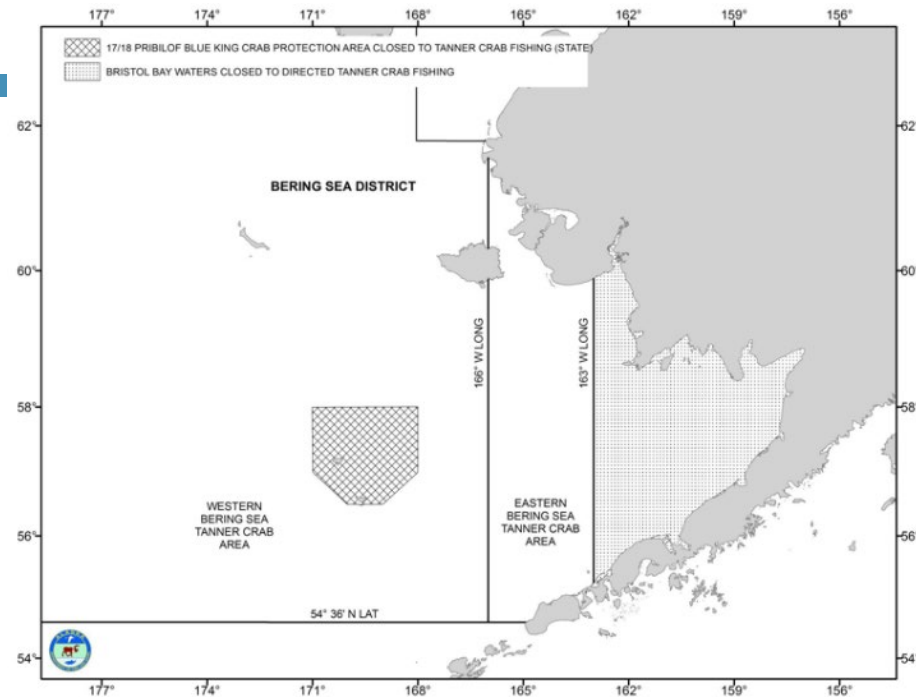
TANNER CRAB OVERVIEW

- SSC/CPT comments
 - Addressed many of the modeling specifics comments in May and they are reflected in models here (reducing selectivity parameters, parameter distribution changes, convergence issues under jittering, etc.)
 - Continued work on VAST and BSFRF/NMFS side-by-side trawl survey selectivity and availability in the future
- Recent fishery and survey trends
- Model description and scenarios
- Model evaluations
- Status determination & OFL
- Recommendations

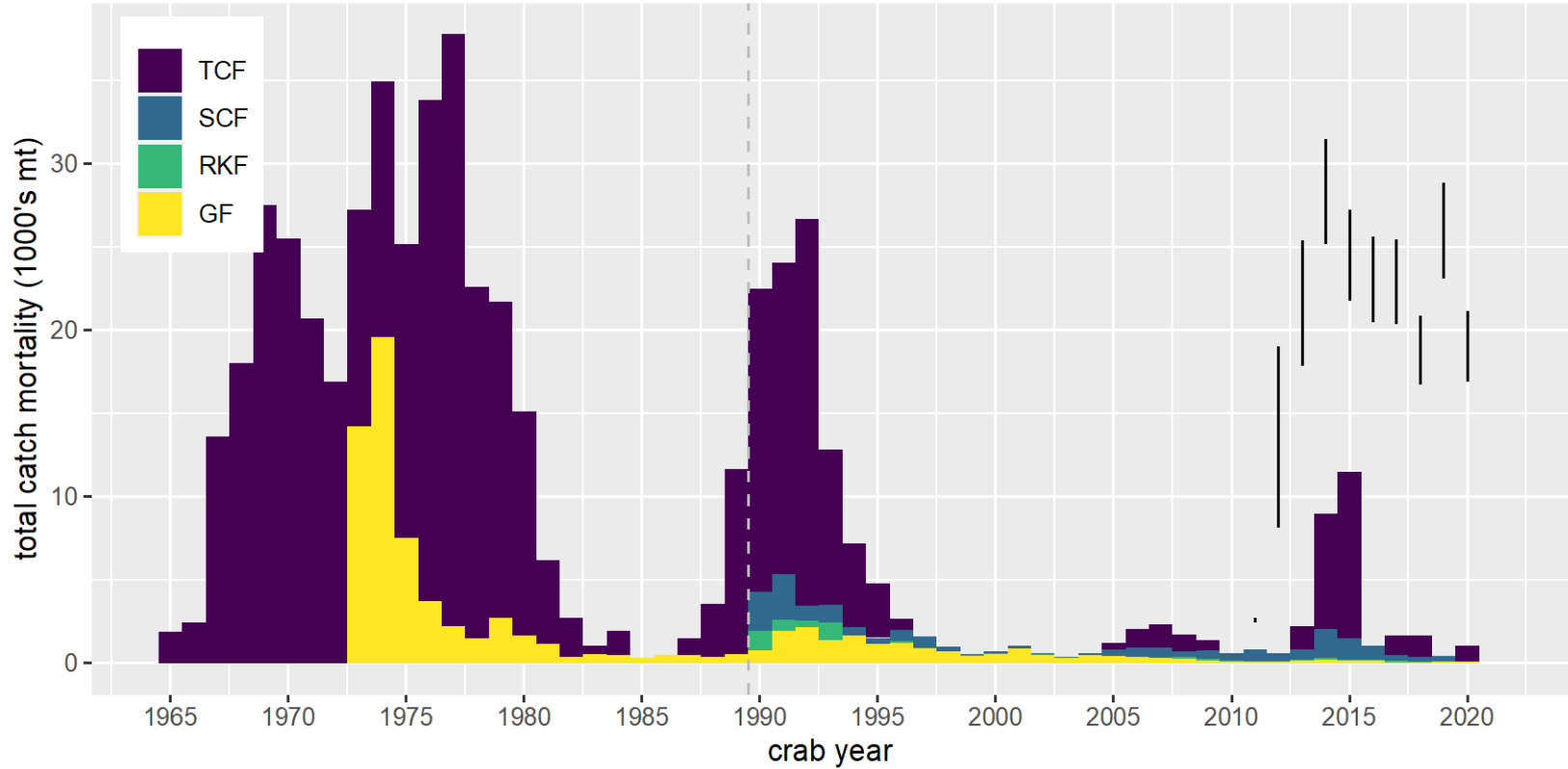


OVERVIEW

- 2020/21 Federal management
 - OFL: 21,130 t
 - ABC: 16,900 t
 - Total catch mortality: 960 t
 - mostly taken in directed fishery
- ADFG management
 - Eastern Area closed
 - MMB failed to meet threshold
 - Western Area
 - TAC: 1,070 t
 - Retained catch: 660 t
 - 41 vessels participated
 - CPUE: 21



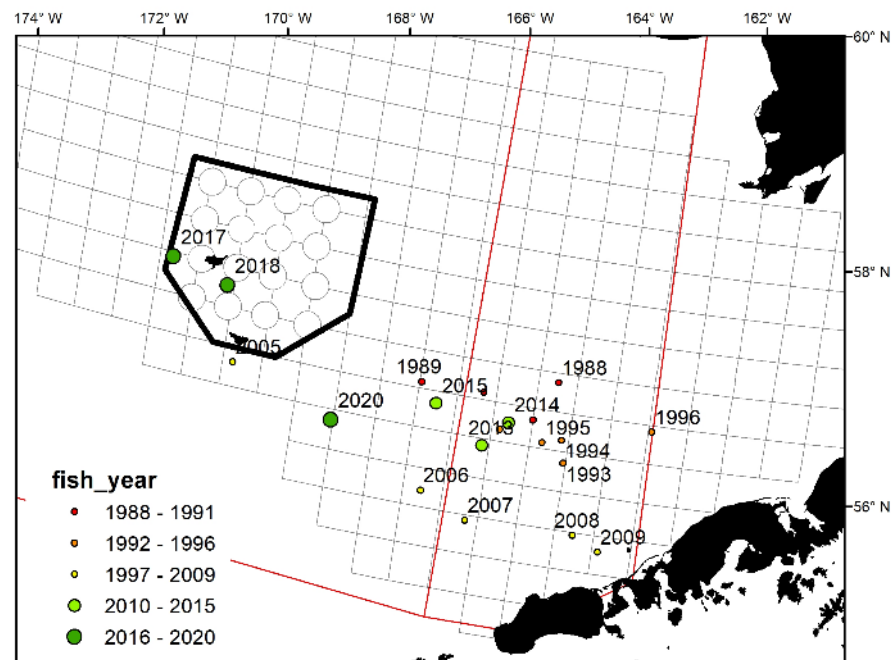
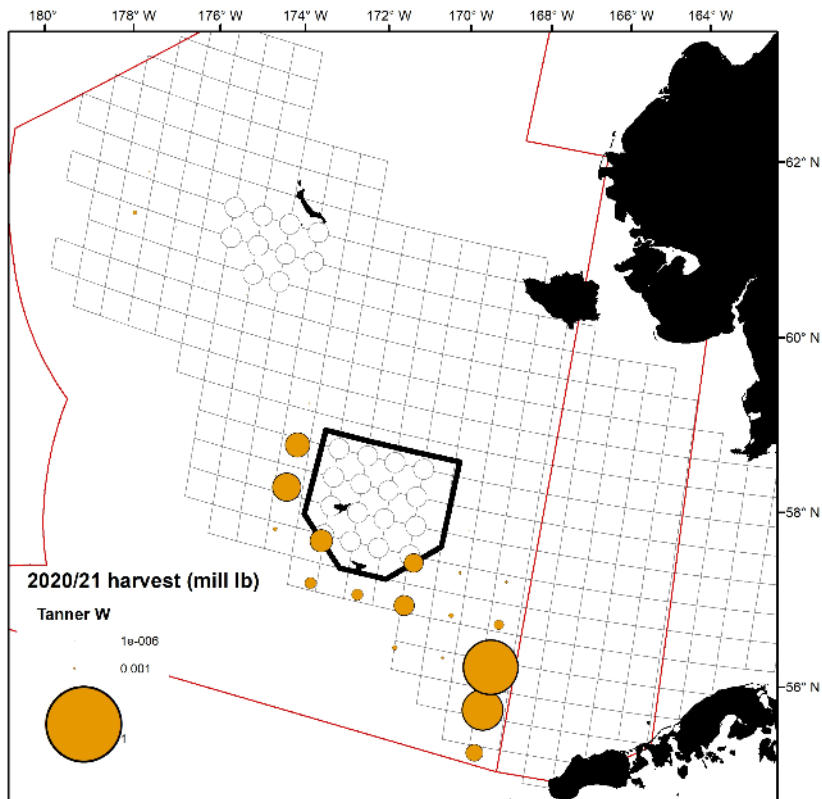
Total catch mortality



2020/21 TANNER CRAB RETAINED CATCH

Fleet observations:

- Low cpue across WBT in fall after BBRKC
- Many vessels quit after one trip
- Good pots of legal crab here and there, but hard to find.



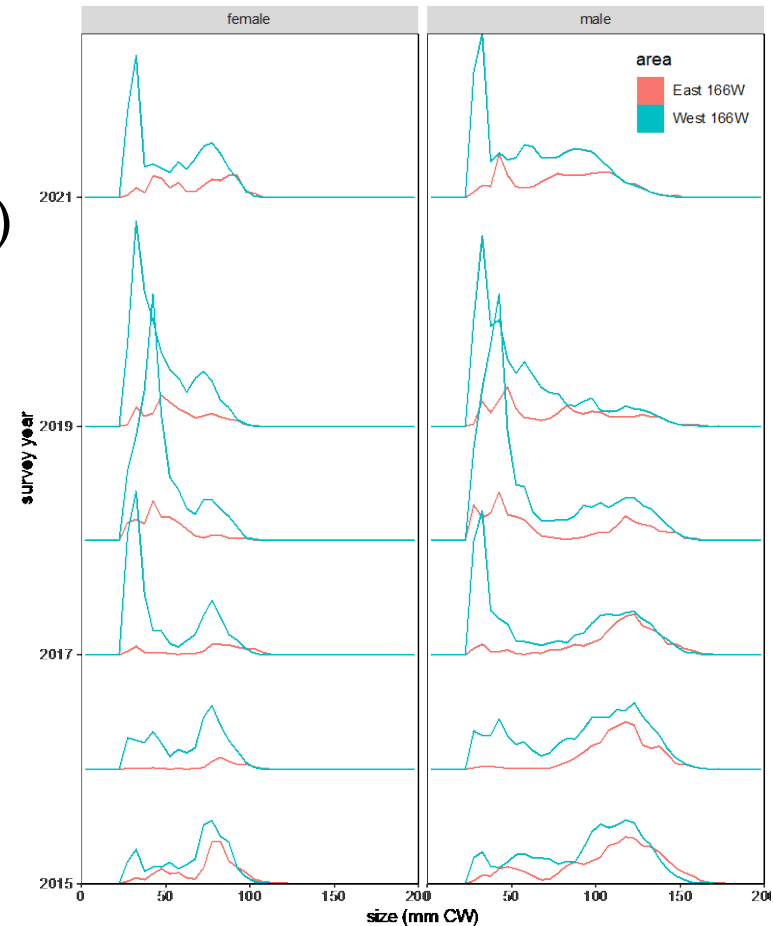
OVERVIEW:

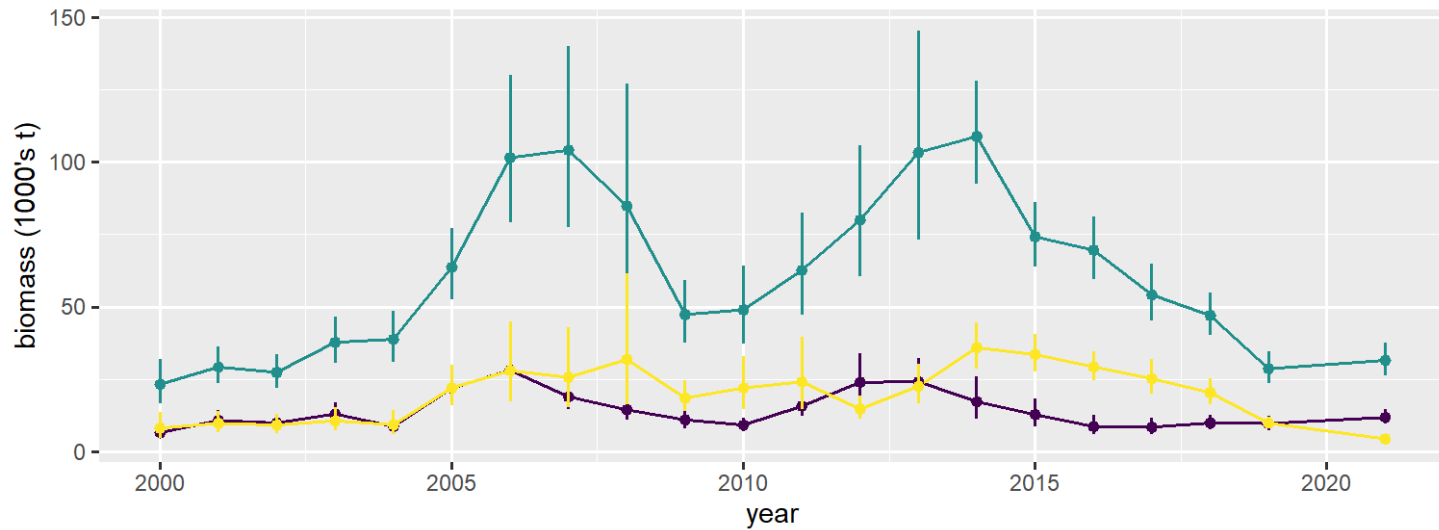
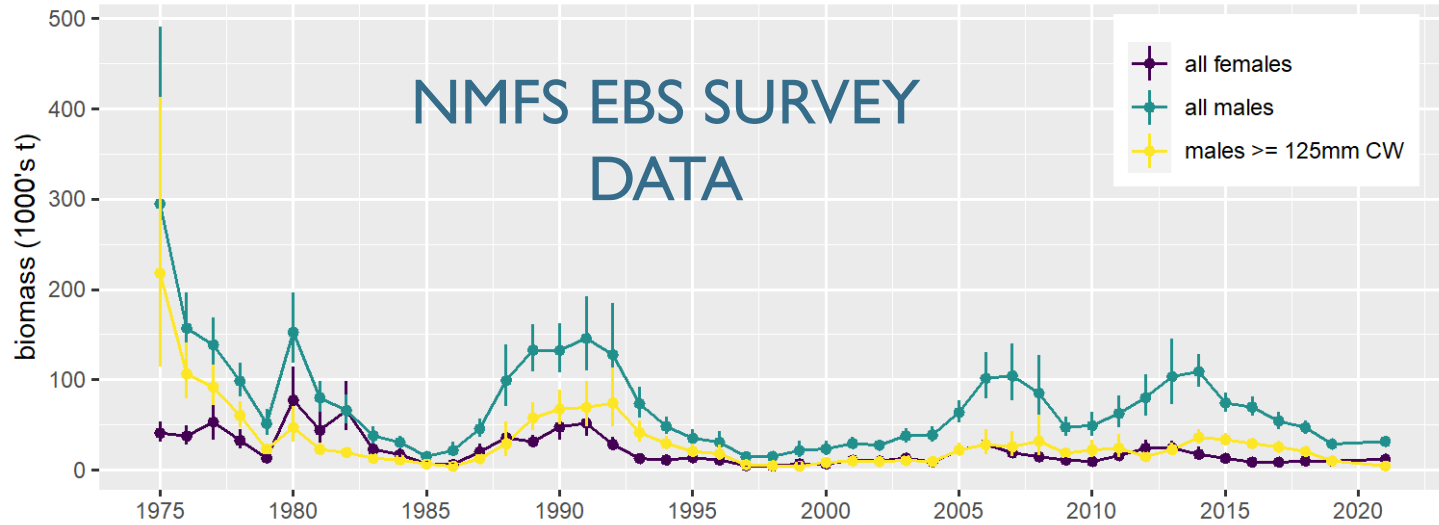
Surveys

- 2021 NMFS EBS Shelf Survey Biomass
 - 31,138 t male biomass (+10%)
 - 4,409 t industry-preferred males (-55%)
 - 8,420 t mature female biomass (+77%)
- Concern:
 - lots of recent recruitment but it is not moving into larger size classes

2021/22 Management

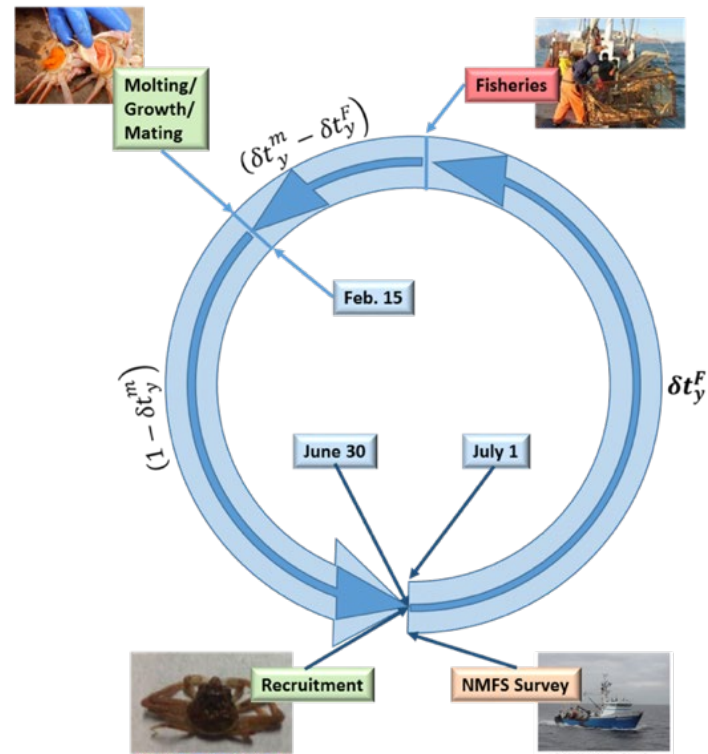
- Based on preferred model (21.22a)
 - Tier 3a ($B > B_{MSY}$; not overfished)
 - OFL: 27,170 t, ABC: 21,740 t





ASSESSMENT

- Tier 3 size-structured model
 - Survey data
 - NMFS EBS shelf survey: 1975-present
 - BSFRF side-by-side haul studies
 - Fishery data
 - directed fishery (areas combined)
 - retained catch
 - total catch
 - bycatch in
 - snow crab fishery
 - BBRKC fishery
 - groundfish fisheries
 - Estimates:
 - Annual recruitment
 - Annual numbers-at-size (M,F)
 - mature biomass (MMB, MFB)
 - Determines:
 - F_{msy} , B_{msy} , F_{OFL} , OFL , ABC



MODEL SCENARIOS

- 20.07u: 2020 assessment model, with updated data for 2020/21
- 21.22: CPT/SSC recommended scenario from May Meeting
 - no parameters at bounds in May
 - 5 parameters at bounds with 2020/21 data
- 21.24: CPT/SSC recommended scenario from May Meeting
 - 21.22 + mean growth determined outside model
- 21.22a: Author's preferred model
 - 21.22 + changes necessary to obtain model with no parameters at bounds



MODEL 21.22A: 21.22 ADJUSTED SO NO PARAMETERS AT BOUNDS

1. Increased prior on ln-scale rec devs

2. Fixed the following 7 parameters:

- the ln-scale parameter determining the recruitment variance
- BBRKC fishery female bycatch selectivity size-at-full selection in the half-normal function (pre-1997 time block, set to the same value, 140 mm CW, as other time blocks)
- Parameters for snow crab fishery male bycatch double-normal selectivity function (pre-1997 time block):
 - the plateau parameter to 0 (no plateau; same as the other time blocks)
 - the parameter controlling the width of the descending limb (to 1 mm CW)
- NMFS female survey selectivity size-at-full selection to 130 mm CW in both selectivity time periods (1975-1981, 1982+),
- NMFS male survey selectivity size-at-full selection to 180 mm CW (1982+)



MODEL EVALUATION

model scenario	number of parameters	objective function value	max gradient	Jitter runs	# runs converged to MLE	scenario description	Number of parameters at bounds
20.07	349	3,429.39	0.0003	400	47	2020 assessment model	11
20.07u	355	3,619.43	0.0001	139	51	2020 assessment model with updated 2020/21 data	12
21.22	353	2,939.77	0.0011	347	313	CPT/SSC recommended alternative	5
21.22a	346	3,132.07	0.0001	400	360	21.22 updated to eliminate parameters at bounds	0
21.24	349	3,014.12	0.0006	360	8	CPT/SSC recommended alternative: 21.22 with growth estimated outside model	10

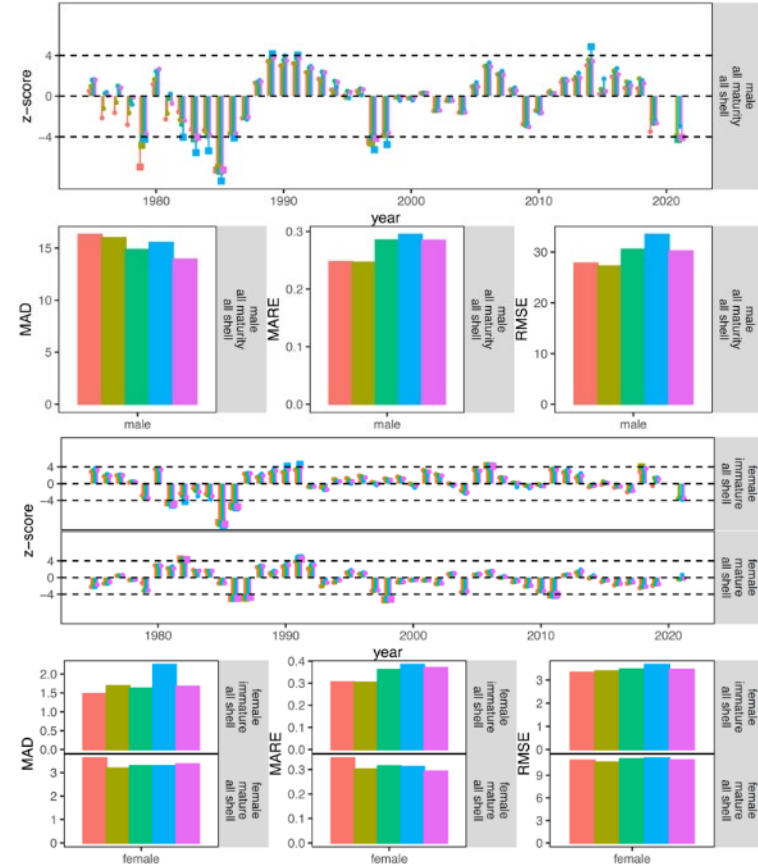
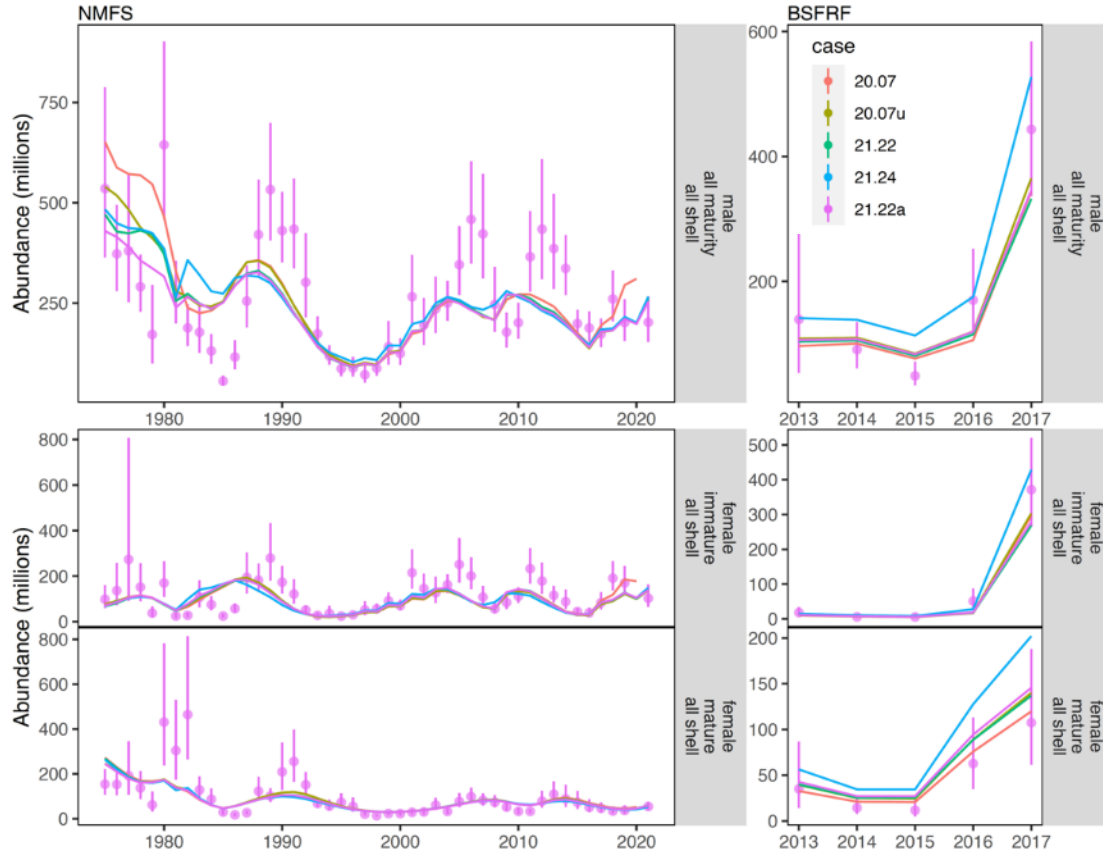


Model Evaluation: Missing Survey

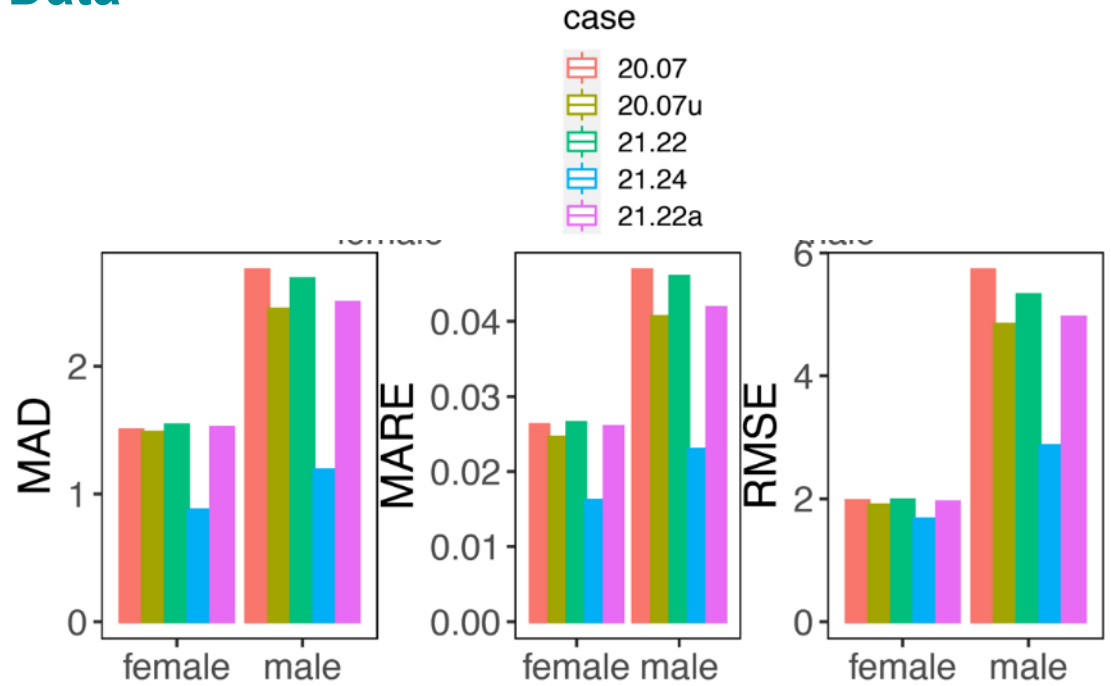
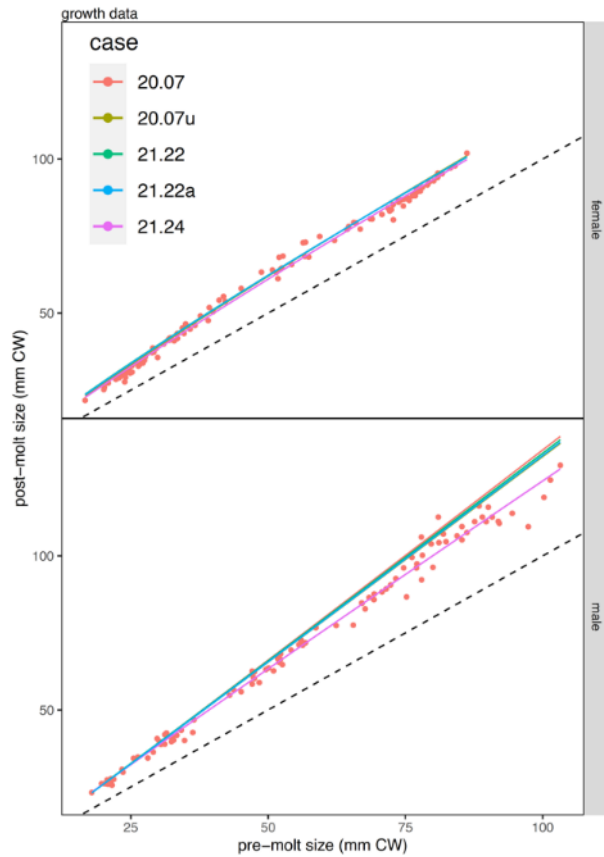
- Faked the 2020 survey
- Ran 21.22a with “all” data
- Dropped single survey year sequentially going back to 2016
- “1” represents the true dataset (no 2020 survey)



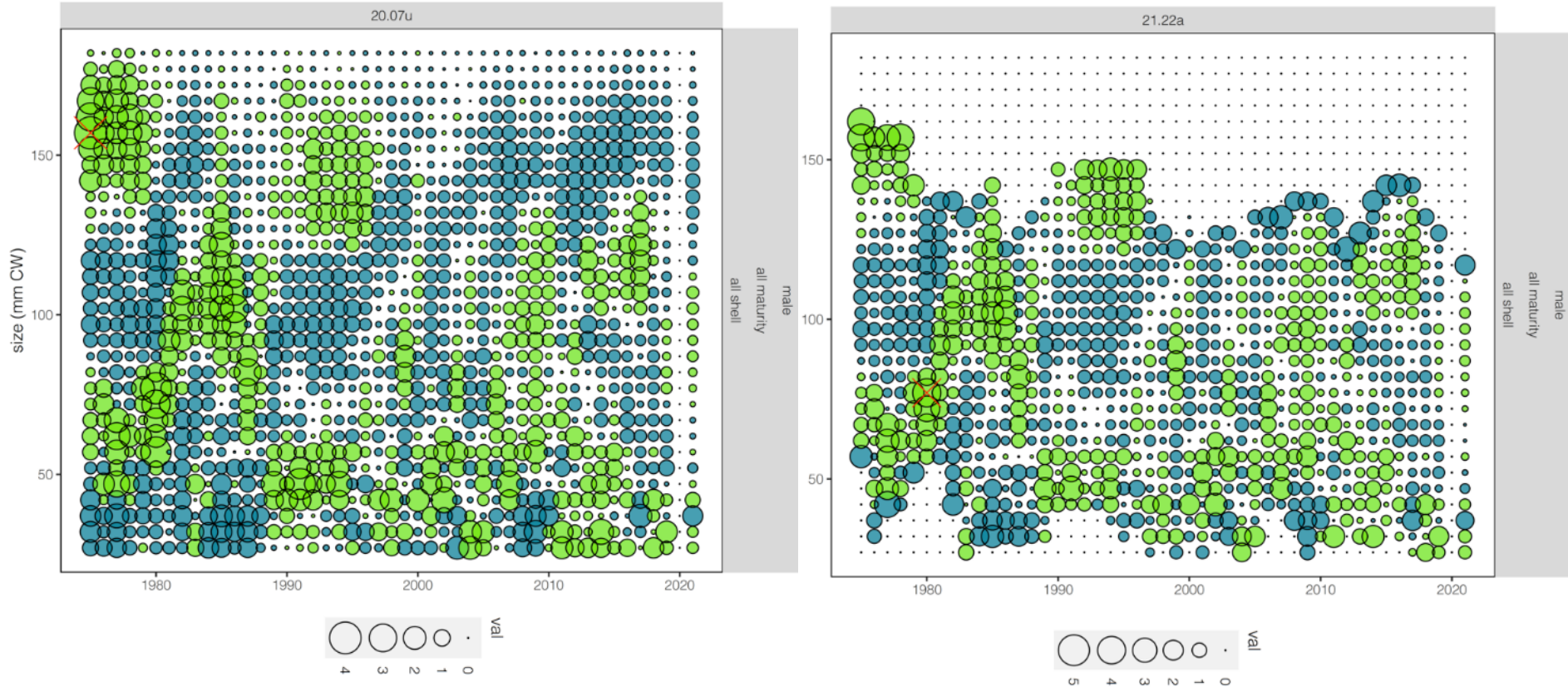
Diagnostic fits to NMFS Survey Abundance



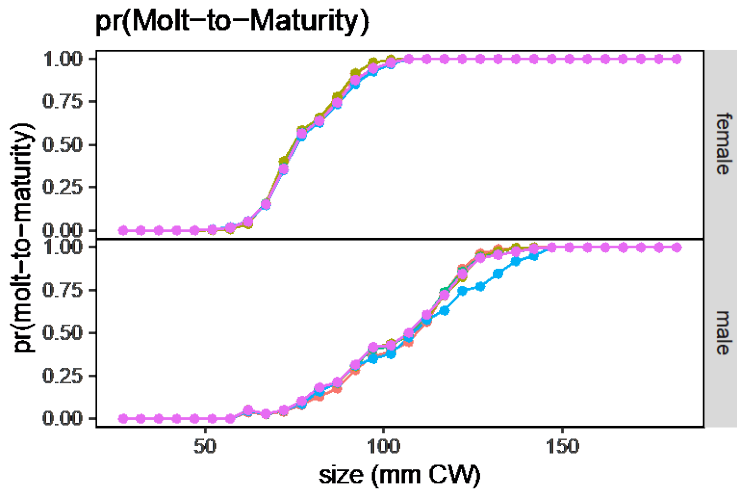
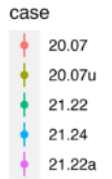
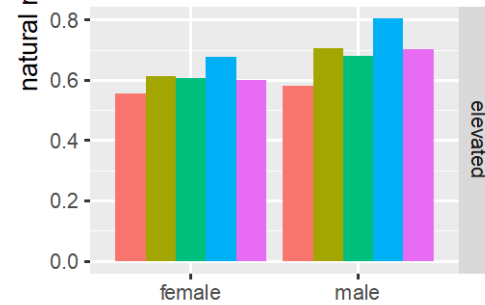
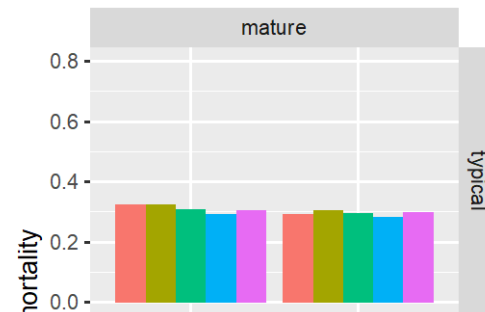
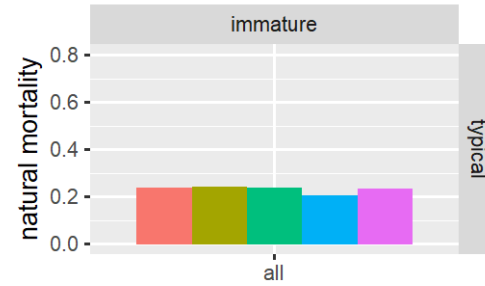
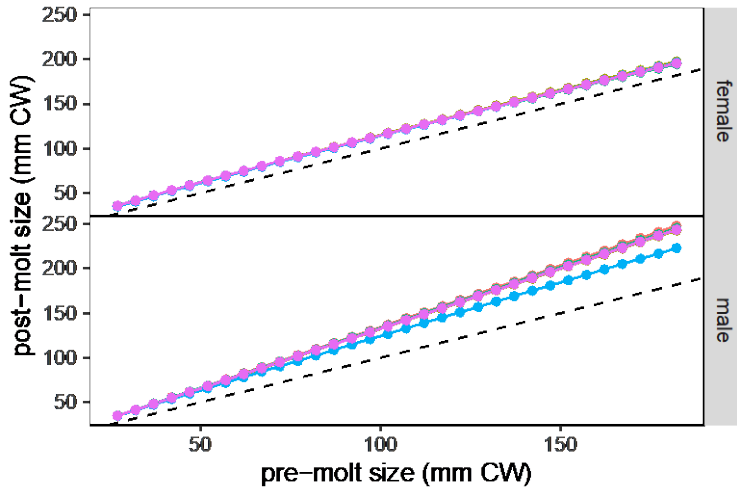
Fits to Data: Molt Increment Data



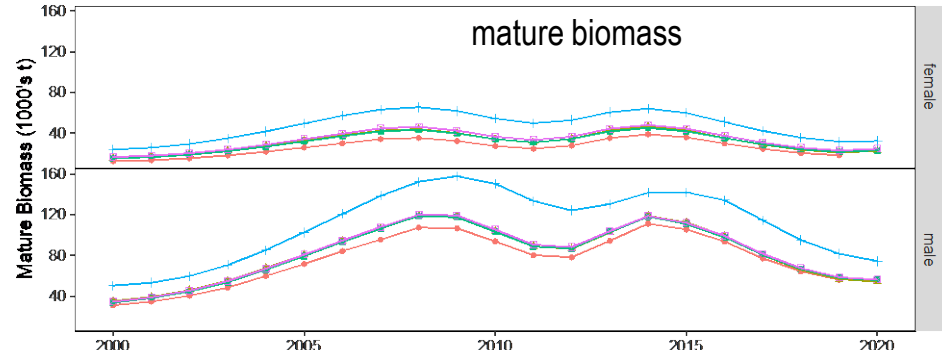
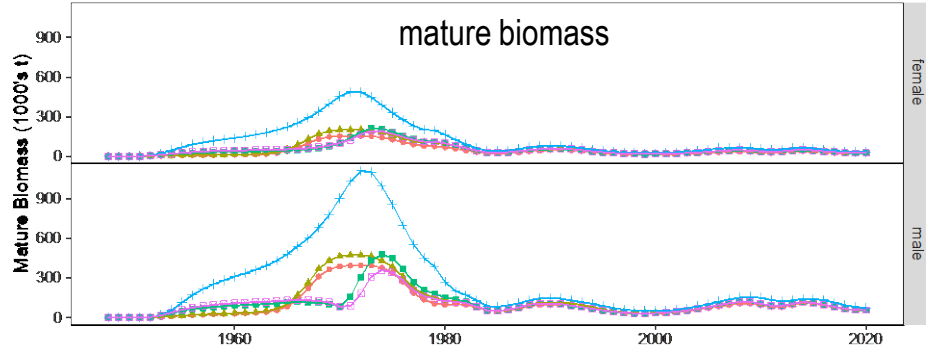
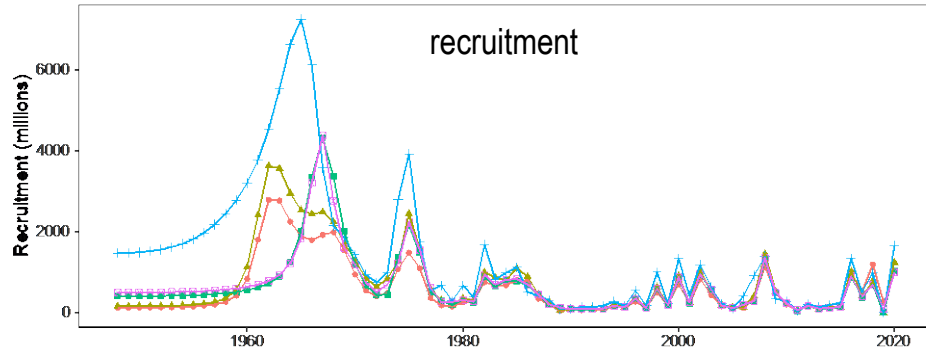
Fits to Data: NMFS Survey Male Size Comps



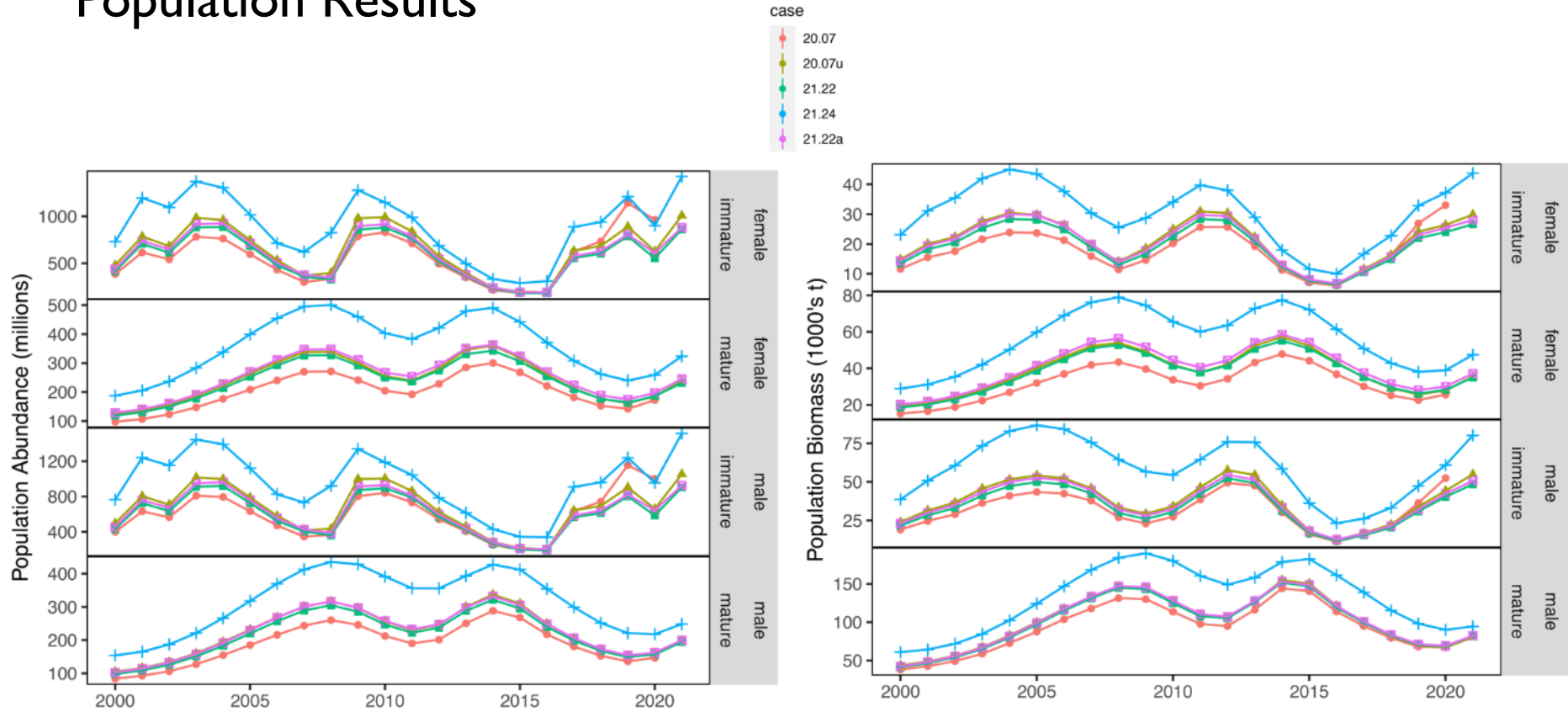
Population Results



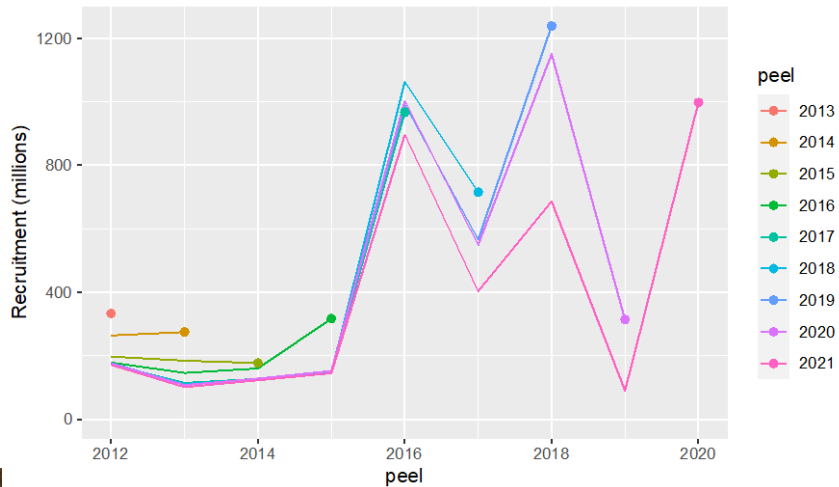
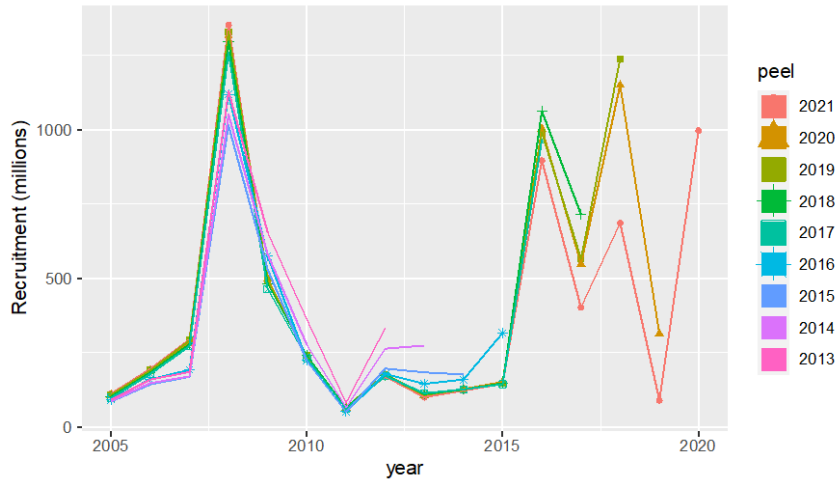
Population Results



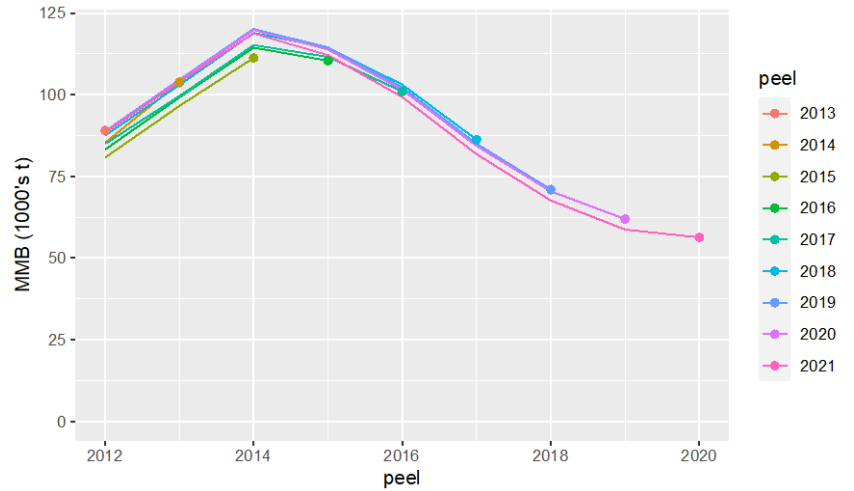
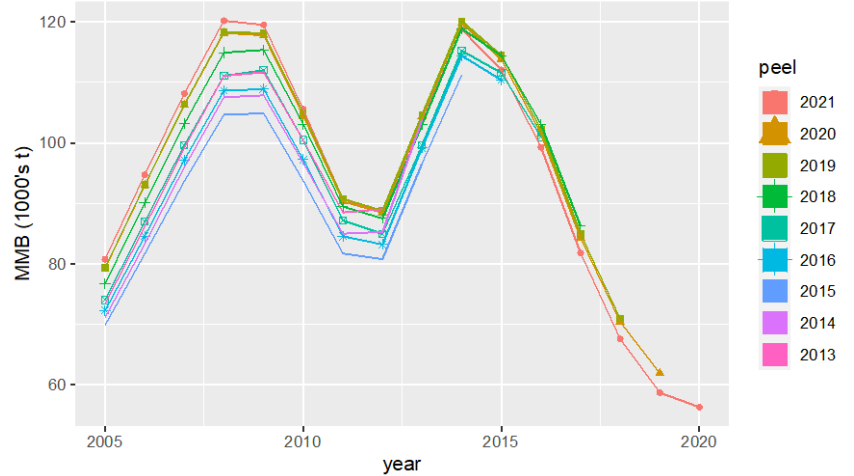
Population Results



Retrospective Analysis: 21.22a



Mohn's rho = 0.37



Mohn's rho = -0.00191



Evaluation

consideration			20.07u	21.22	21.24	21.22a
convergence			+	+	~	+
parameters			---	---	---	+
model fits	biomass	retained catch	++	++	++	++
		total catch	++	+	+	+
		surveys	-	-	--	-
	size comps	retained catch	+	+	+	+
		total catch	-	-	-	-
		surveys	-	-	-	-
	growth data		--	--	+	--
	maturity data		-	+	--	+
	retrospective patterns	recruitment				---
MMB					+	



OFL CALCS

MCMC Results (Model 21.22a)

- $MMB_{2021/22.}$ = 42.57 kt
- $B_{MSY.}$ = 35.94 kt
- F_{MSY} = 1.17
- OFL = 27.17 kt
- p-star ABC = 27.14 kt
- buffer ABC = 21.74 kt (20%)

- Average recruitment time frame: 1982-2019 (terminal year-1)
- 2019 recruitment very low, but consistent with 2021 survey size compositions



Recommended 20% buffer

- Same as last year
- Positive:
 - no parameters at bounds
- Negative:
 - Missing 2020 survey, decline in 2019 recruitment
 - Issues with overestimating large crab
 - Overestimating terminal survey biomass
 - Lack of full recruitment potential



STOCK STATUS

- Tier 3a
- Not overfished
- No overfishing

Year	MSST	Biomass (MMB)	TAC (East + West)	Retained Catch	Total Catch Mortality	OFL	ABC
2017/18	15.15	64.09	1.13	1.13	2.37	25.42	20.33
2018/19	20.54	82.61	1.11	1.11	1.90	20.87	16.70
2019/20	18.31	56.15	0.00	0.00	0.54	28.86	23.09
2020/21	17.97	56.34	1.07	0.66	0.96	21.13	16.90
2021/22		42.57				27.17	21.74

Year	Tier	B _{M_{SY}}	Current MMB	B/B _{M_{SY}}	F _{OFL} (yr ⁻¹)	Years to define B _{M_{SY}}	Natural Mortality (yr ⁻¹)
2017/18	3a	29.17	47.04	1.49	0.75	1982-2017	0.23
2018/19	3a	21.87	23.53	1.08	0.93	1982-2018	0.23
2019/20	3b	41.07	39.55	0.96	1.08	1982-2019	0.23
2020/21	3b	36.62	35.31	0.96	0.93	1982-2019	0.23
2021/22	3a	35.94	42.57	1.18	1.17	1982-2020	0.23

*immature: 0.23, females: 0.31, males: 0.30
(Table 40, p. 108)



FUTURE RECOMMENDATIONS

- BSFRF/NMFS SBS selectivity analysis
- Model simplification:
 - Start in 1982, drop fits to small bycatch data sets
- Further examination of weighting schemes
- VAST estimates
- Develop a model that incorporates aspects of state management for Tanner – east and west fleets “as areas”
- Projection and delta approximation capabilities for model
- EBS tanner implementation into GMACs



BALANCE OF CPT REPORT



ROLL-OVER STOCKS: SMBKC

- Moved to a biennial assessment (next full assessment in 2022)
- Overfished, rebuilding plan put into place in 2020
- Total catch (all bycatch mortality) <<< ABC – no overfishing
- Recommendation is to rollover specs from 2020, similar bycatch mortality and no indication of increased risk or morality for this stock

Table 1: Status and catch specifications (1000 t) for the base model.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2017/18	1.85	2.05	0.00	0.00	0.003	0.12	0.10
2018/19	1.74	1.15	0.00	0.00	0.001	0.04	0.03
2019/20	1.67	1.06	0.00	0.00	0.001	0.04	0.03
2020/21		1.12	0.00	0.00	0.001	0.05	0.04
2021/22		1.12				0.05	0.04

Table 3: Basis for the OFL (1000 t) from the base model.

Year	Tier	B_{MSY}	Biomass (MMB_{mating})	B/B_{MSY}	F_{OFL}	γ	Basis for B_{MSY}	Natural mortality
2017/18	4b	3.86	2.05	0.53	0.08	1	1978-2017	0.18
2018/19	4b	3.7	1.15	0.35	0.043	1	1978-2017	0.18
2019/20	4b	3.48	1.06	0.31	0.042	1	1978-2018	0.18
2020/21	4b	3.34	1.12	0.34	0.047	1	1978-2019	0.18
2021/22	4b	3.34	1.12	0.34	0.047	1	1978-2019	0.18



ROLL-OVER STOCKS: PIRKC

- Moved to a triennial assessment (next full assessment in 2022)
- Total catch (all bycatch mortality) <<< ABC – no overfishing
- Recommendation is to rollover specs from 2019 assessment
 - Similar bycatch mortality
 - No directed fishing due to overfished PIBKC that would be likely bycatch
 - No increased risk for rolling over the specifications this year

Year	MSST (t)	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2015/16	2,756	9,062	0	0	4.32	2,119	1,467
2016/17	2,751	4,788	0	0	0.94	1,492	1,096
2017/18	2,751	3,439	0	0	1.41	404	303
2018/19	866	5,368	0	0	7.22	404	303
2019/20	866	6,431	0	0	3.84	864	648
2020/21		6,431			5.09	864	648



OVERFISHING UPDATES

- No overfishing is occurring in any of these stocks, all total catch < ABC
- PIBKC & AIGKC: assessed in May when crab year had not ended yet.
 - PIBKC: total catch = 0 (no directed fishing)
 - AIGKC: total catch of 3.44 < 3.599 ABC
- WAIRKC, PIGKC
 - Roll over specifications, just update total catch
 - PIGKC: total catch 0.12 < 0.15 ABC
 - WAIRKC: total catch 0.00073 < 0.031 ABC (no directed fishing)





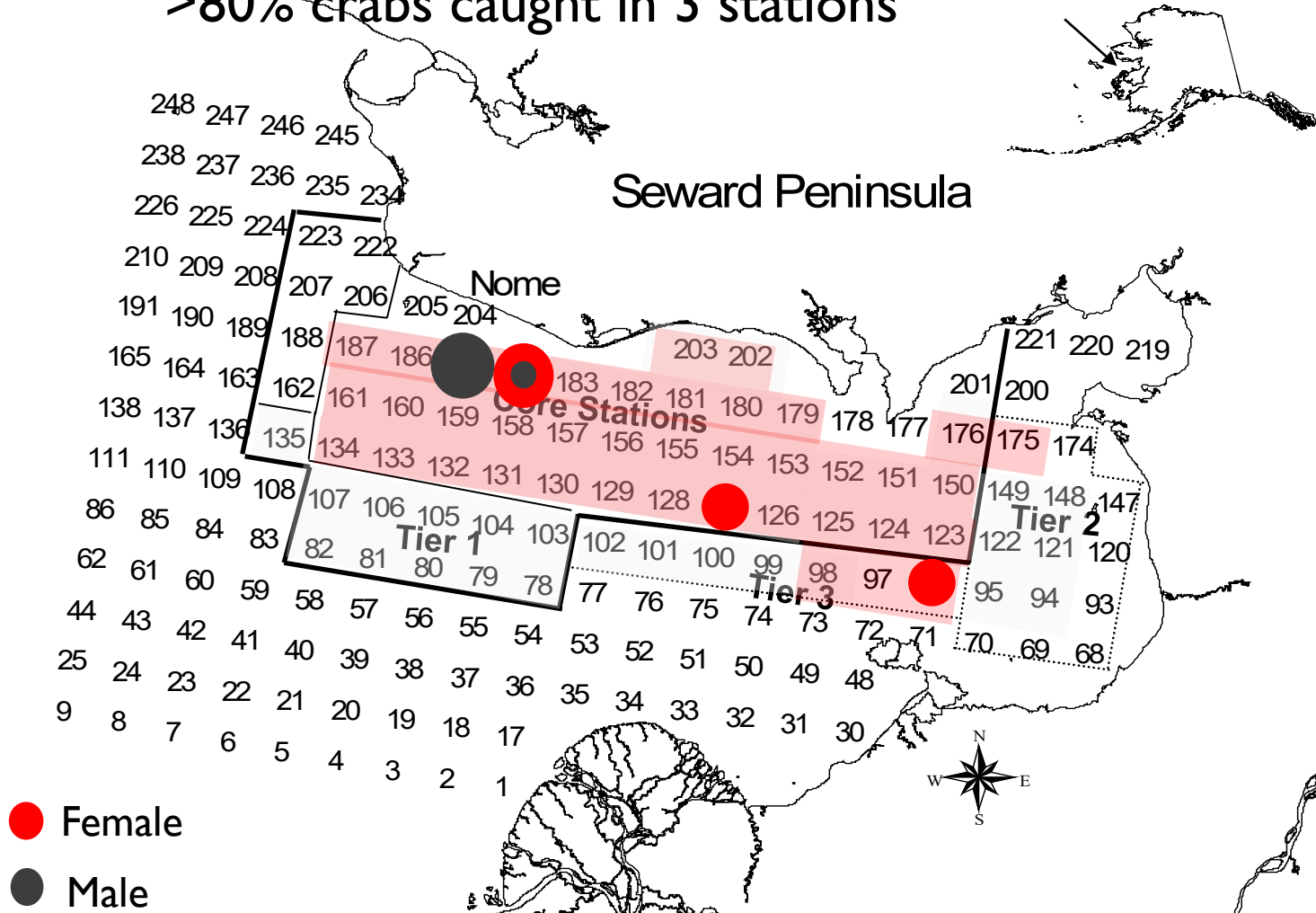
NSRKC

PROPOSED MODEL RUNS FOR JANUARY



2021 ADF&G trawl survey abundance by Station

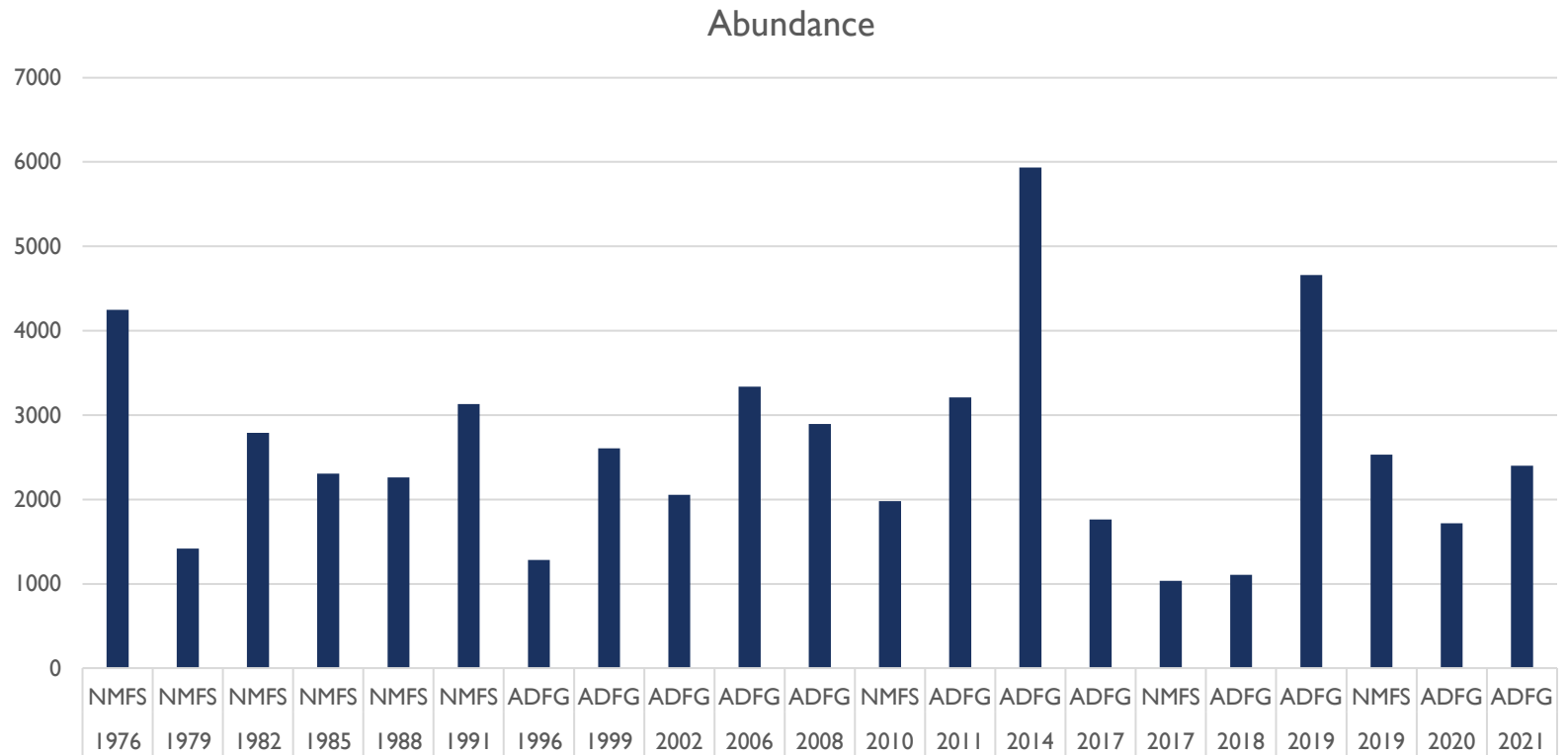
>80% crabs caught in 3 stations



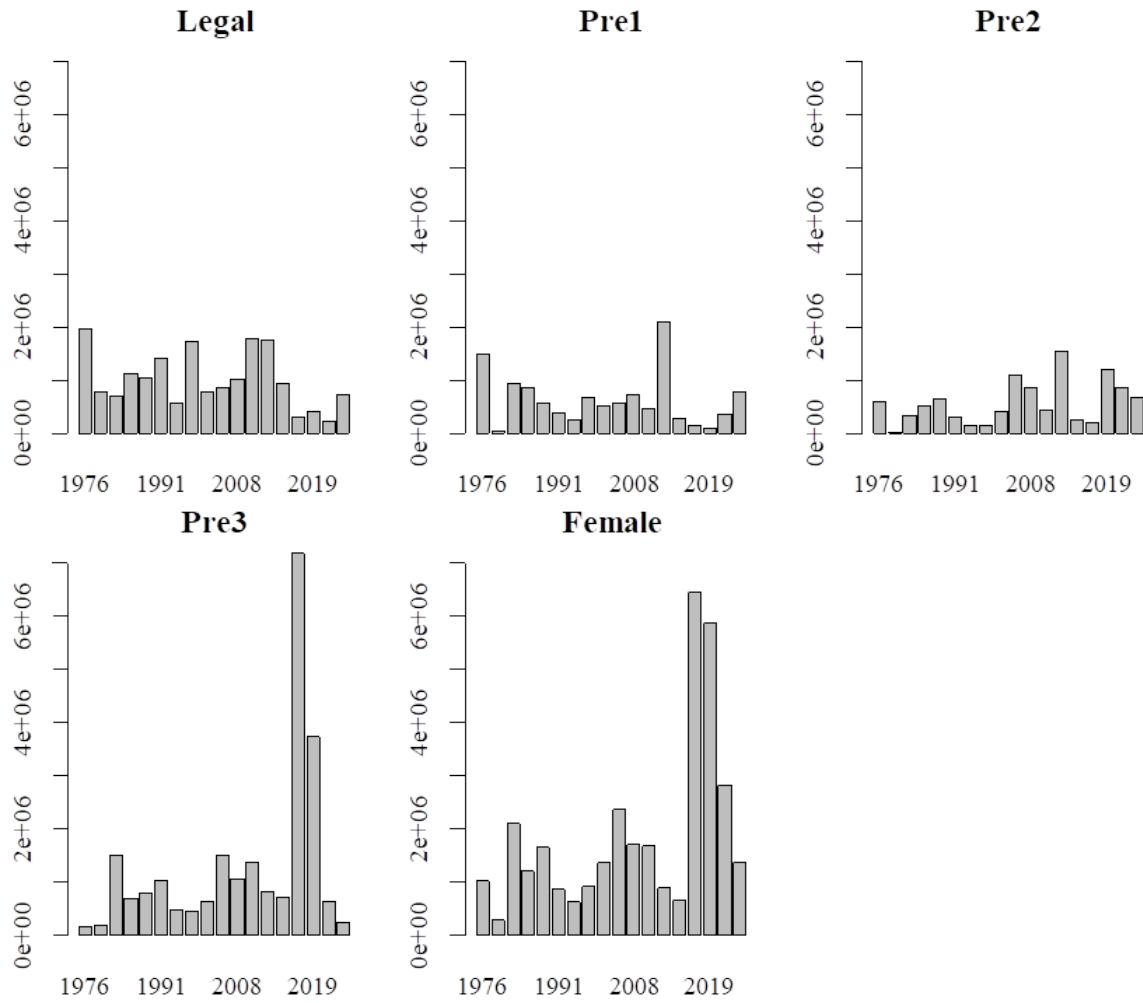
- Female
- Male



MALE ABUNDANCE (>64MM) NO UNSAMPLED AREA EXPANSION



TRAWL SURVEY ABUNDANCE BY SIZE SEX



NSRKC RESEARCH 2021

Tackling Assessment Model NSRKC biology assumptions, especially the fate of large crab.

- Size dependent mortality
 - Is mortality higher for large crab than small crab
- Size at maturity
 - What is the functional size at maturity of NSRKC?
- Large crabs movement
 - Do large crabs move out of Norton Sound?



2021 Norton Sound red king crab research

Mortality study

Hold small and large crab long term to see if there is differential mortality rates between the sizes.

Sent 26 NS Crab to Kodiak:

8 large (>113 mm CL) and 16 small (<90 mm CL)

(Hope to send more crab later in September),

Functional maturity

Determine smallest CL male crab can successfully mate.

Send males (70-75 mm CL) and females to Kodiak prior to mating (January—March 2022)

Collaboration with NOAA and ADF&G



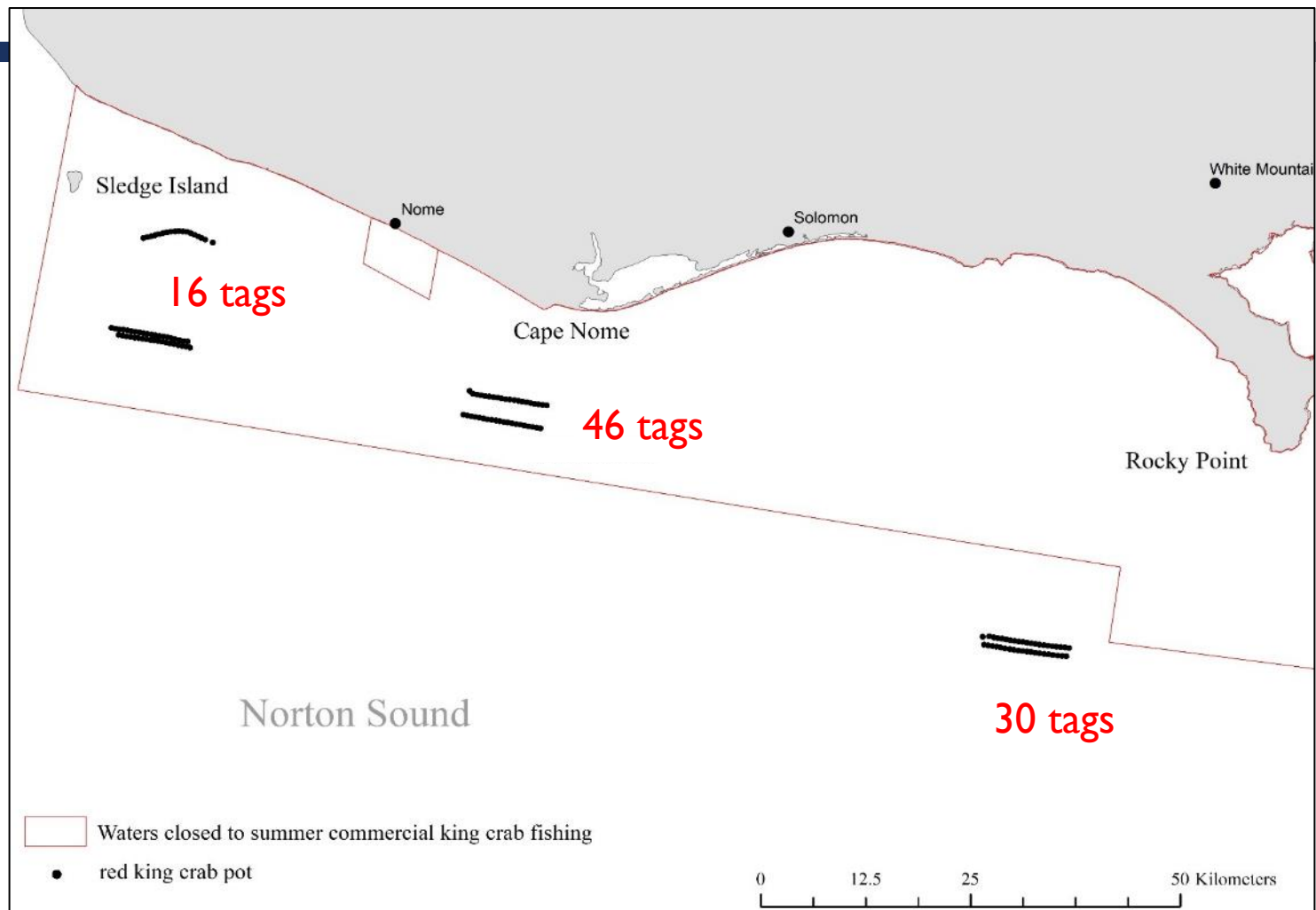
Satellite tagging: Track large crabs

Funded by Bering Sea Crab Research- Led by ADF&G- Kodiak



Thanks to: Ben Daly, Vicki Vanek, Andrew Nault, William Gaeuman, Kevin Clark, Luke Henslee, Ethan Kelso, Justin Leon, Dawn Wehde (NSEDC), and Gabe Blanco





92 tags deployed in 3 areas in Norton Sound- June 12-22

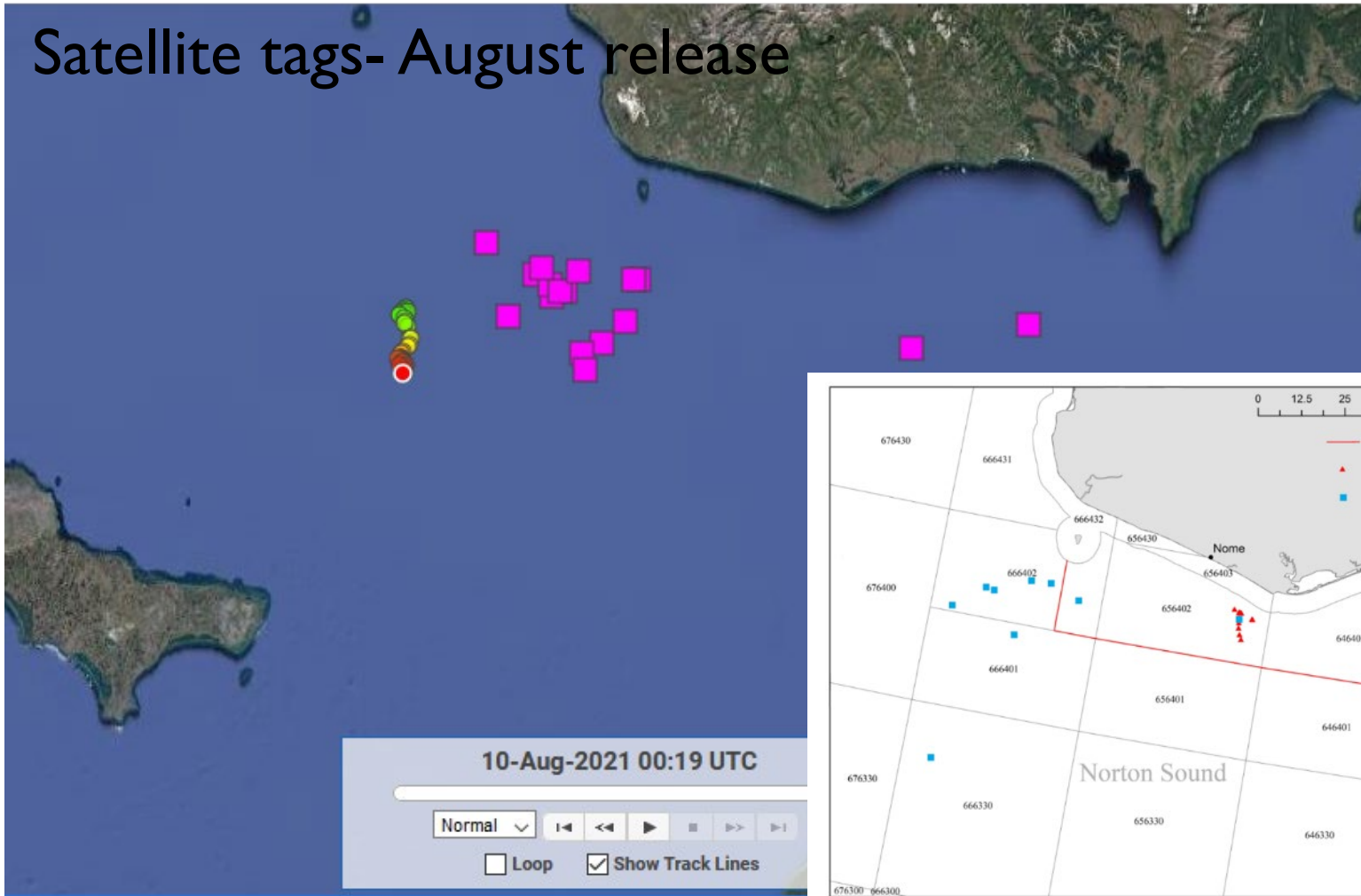
Length : 117-152 mm CL (avg=126 mm CL)

64 New shell, 24 Old shell, 4 Very old shell

31 August release, 61 October release



Satellite tags- August release



25 out of 31 tags popped up- still examining locations/movements

No unexpected locations...

Large crabs are neither staying inshore, nor moving out of Norton Sound.

Move out in fall?



NSRKC PROPOSED MODEL RUNS FOR JAN

- Male only assessment
- Seven size bins
- Fit to NMFS bottom trawl survey and ADF&G trawl survey in Norton Sound
- $M = 0.18$ for length class 1-6, higher mortality for length classes 7 and 8
- Discard mortality = 0.2
- Fishery harvests occur instantaneously:
 - Winter fishery: Feb 01: Nov – May
 - Summer fisher: July 01: Jun – Sept



NSRKC PROPOSED MODEL RUNS FOR JAN

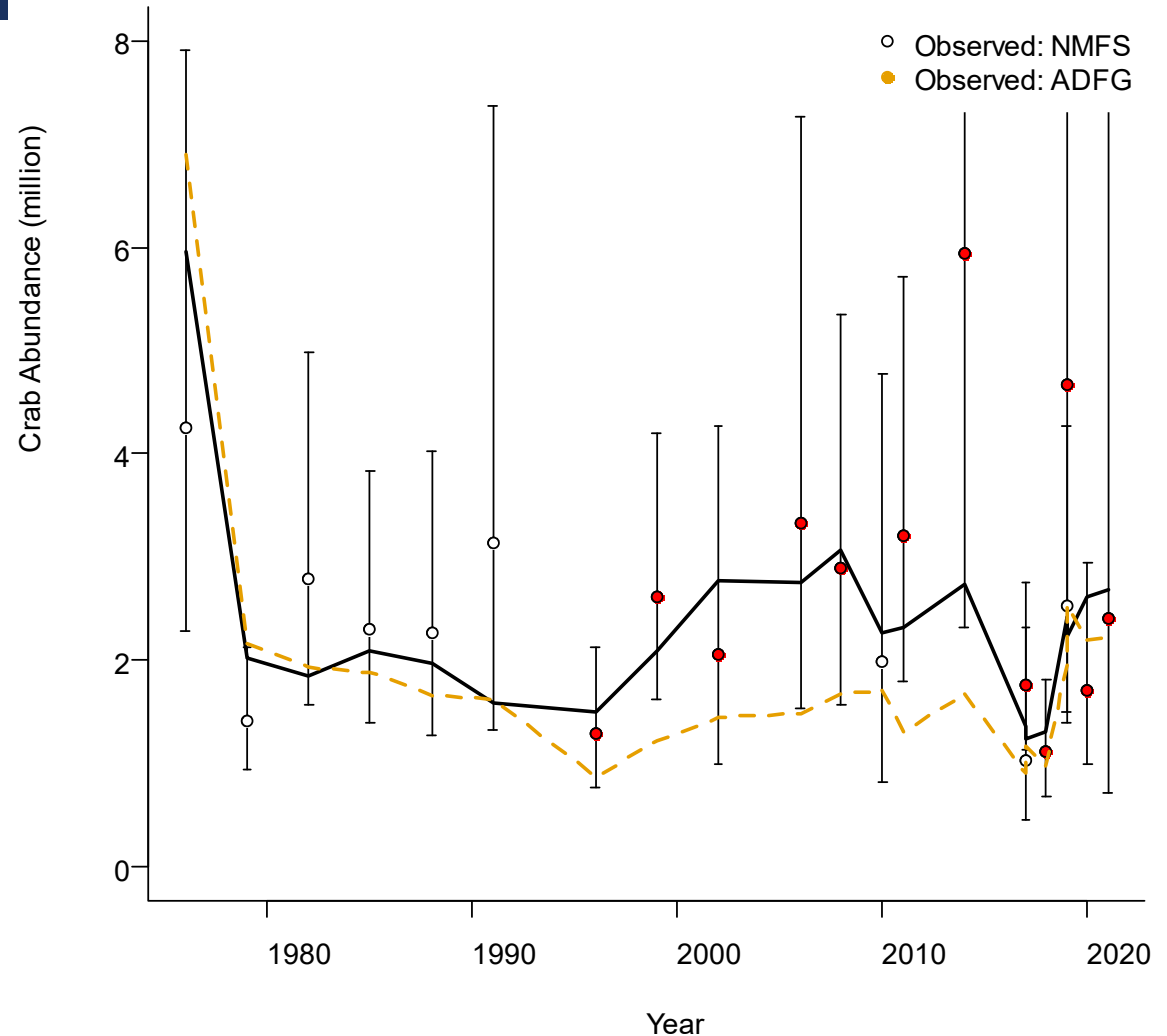
- Assessment author proposed two models proposed Models 21.0 and 21.1.
- Model 21.0 is Model 19.0 (last year's model) with discards estimated using the proportion method, a revised methodology for standardizing CPUE, and two retention probabilities estimated for both the summer and winter commercial fisheries.
- Model 21.1 is Model 21.0 plus $M = 0.18\text{yr}^{-1}$ for all size classes.



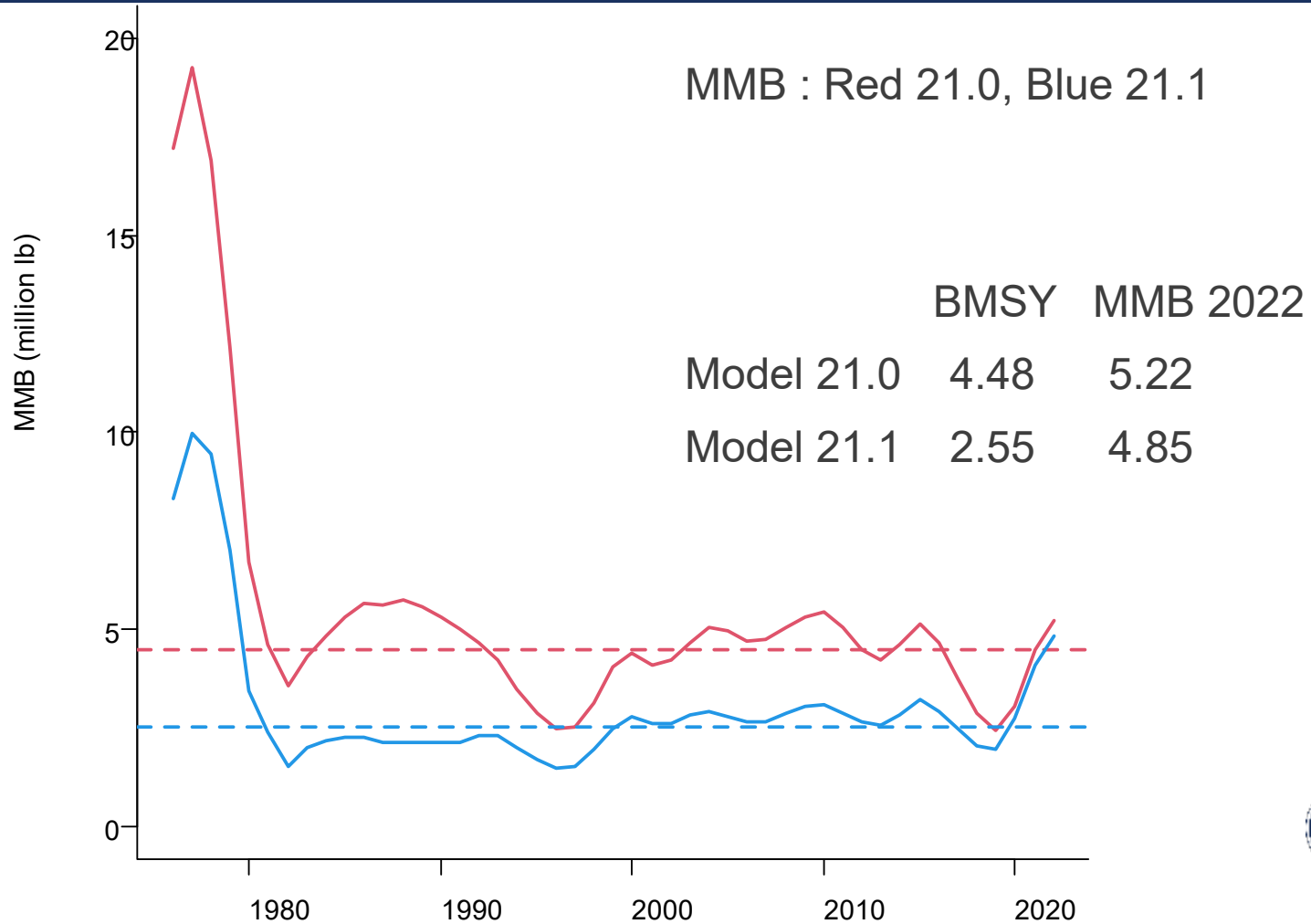
NSRKC PROPOSED MODEL RUNS FOR JAN

Trawl survey crab abundance

Fit to Trawl Survey:
Observed (open circle) (White: NMFS, Red ADF&G) and model (Model 21.0 solid black, Model 21.1 dash red) trawl survey male abundances



NSRKC PROPOSED MODEL RUNS FOR JAN



NSRKC PROPOSED MODEL RUNS FOR JAN

- Model 21.0 seems reasonable, though appropriate documentation to evaluate the changes is lacking
- The CPT requests that 'bridging' analyses be conducted to demonstrate the successive changes made between models, starting with (and present) last year's accepted model.
- CPT (and SSC) have been clear in their intent to set ABCs and OFLs on the basis of total catch
- The cessation of the observer program for NSRKC is not a positive development since it ends the collection of discard data.
- CPT requests that methods be developed to use historical data to estimate discard rates.
- Finally, the CPT continues to prioritize development of a GMACS model for NSRKC.



RISK TABLE CPT COMMENTS ON SSC REPORT

- Current discussions about risks to the stock and the recommended buffer include many of the risk table components.
- Risk tables would better organize our current process, allow us to account for environmental or socioeconomic considerations, and provide better transparency and clarity for the public and SSC/Council
- Risk tables would assist the state management decisions by identifying concerns that should be taking into account in the TAC setting process.
- CPT would like to start exploring draft risk tables in the upcoming assessment cycle (May 2022). Looking for SSC recommendations.
- Eventually CPT supports developing a risk table – even if no environmental information is available about the stock – for all stocks to inform CPT and state management decisions.

