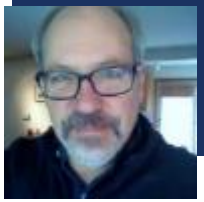
C1 BSAI CRAB STOCKS

MARTIN DORN, CPT CO-CHAIR

OCTOBER 2ND, 2020



BSAI CRAB STOCKS MANAGEMENT TIMING

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

Biennial cycle, next assessment in 2021

Triennial cycle, assessment in 2020

Assessed in May/June

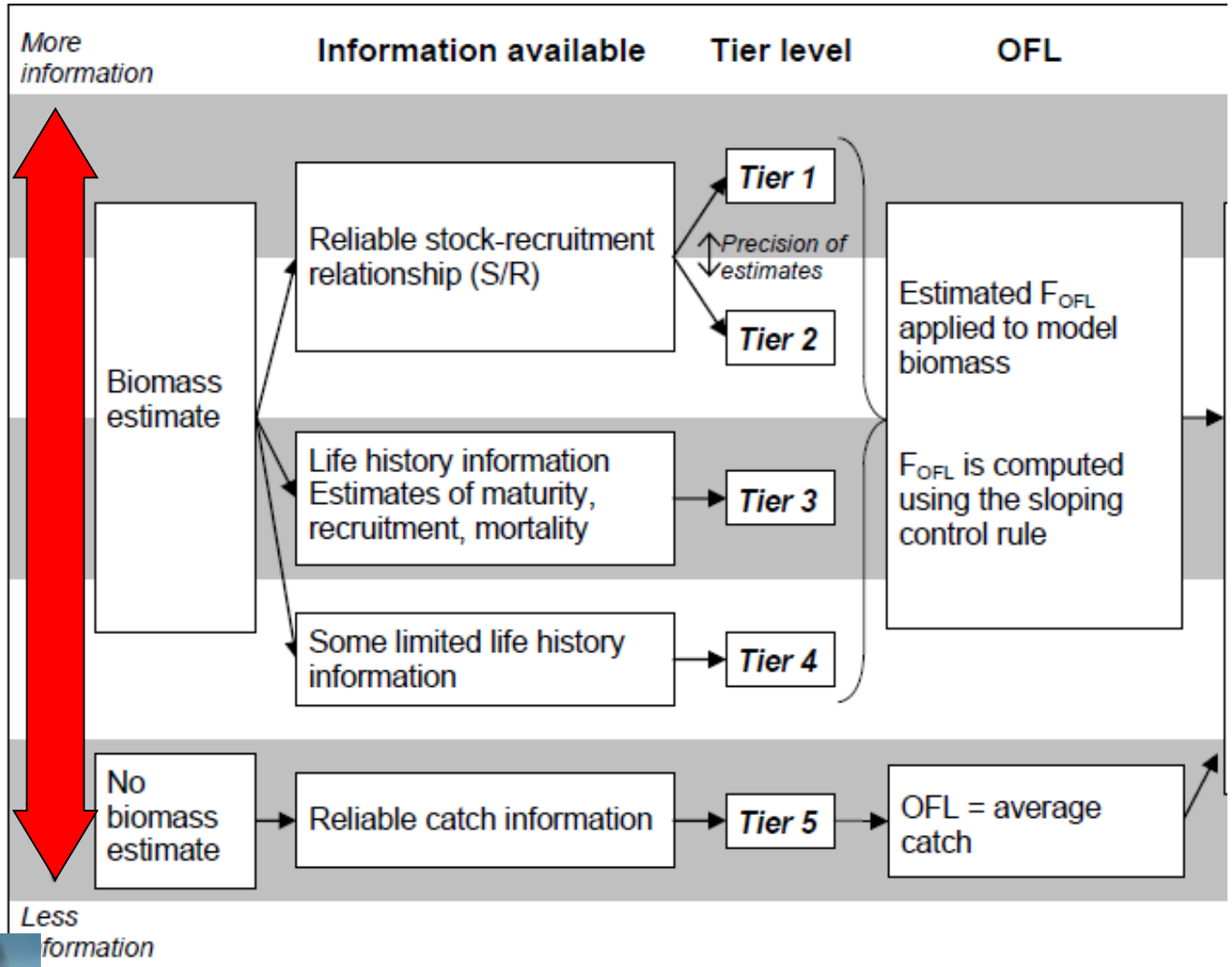
EBS snow crab
Bristol Bay red king crab
EBS Tanner crab
Pribilof Islands red king crab *
St. Matthew blue king crab

Biennial cycle, next assessment in 2021

Assessed in September/ October

Norton Sound red king crab

Assessed in January/ February



ABC buffer

10-20%

10-25%

25-40%

SEPT 2020 AGENDA

- Uncertainty due to 2020 survey cancellation
- **BBRKC final assessment, OFL and ABC,** fishery overview, ESP
- **Snow crab final assessment, OFL and ABC,** fishery overview
- **SMBKC final assessment, OFL and ABC,** ESP update
- **Tanner crab final assessment, OFL and ABC,** fishery overview
- WAIRKC, AIGKC, PIBKC, PIRKC, PIGKC overfishing updates
- Stock projections subgroup
- NSRKC model runs for Jan/Stock boundaries
- Trawl survey updates
- ESR
- Crab PSC (Analyses for BBRKR, snow and Tanner crab subject to caveats but regarded as useful for Council staff to analyze proposed action)
- PIBKC NPRB final project report

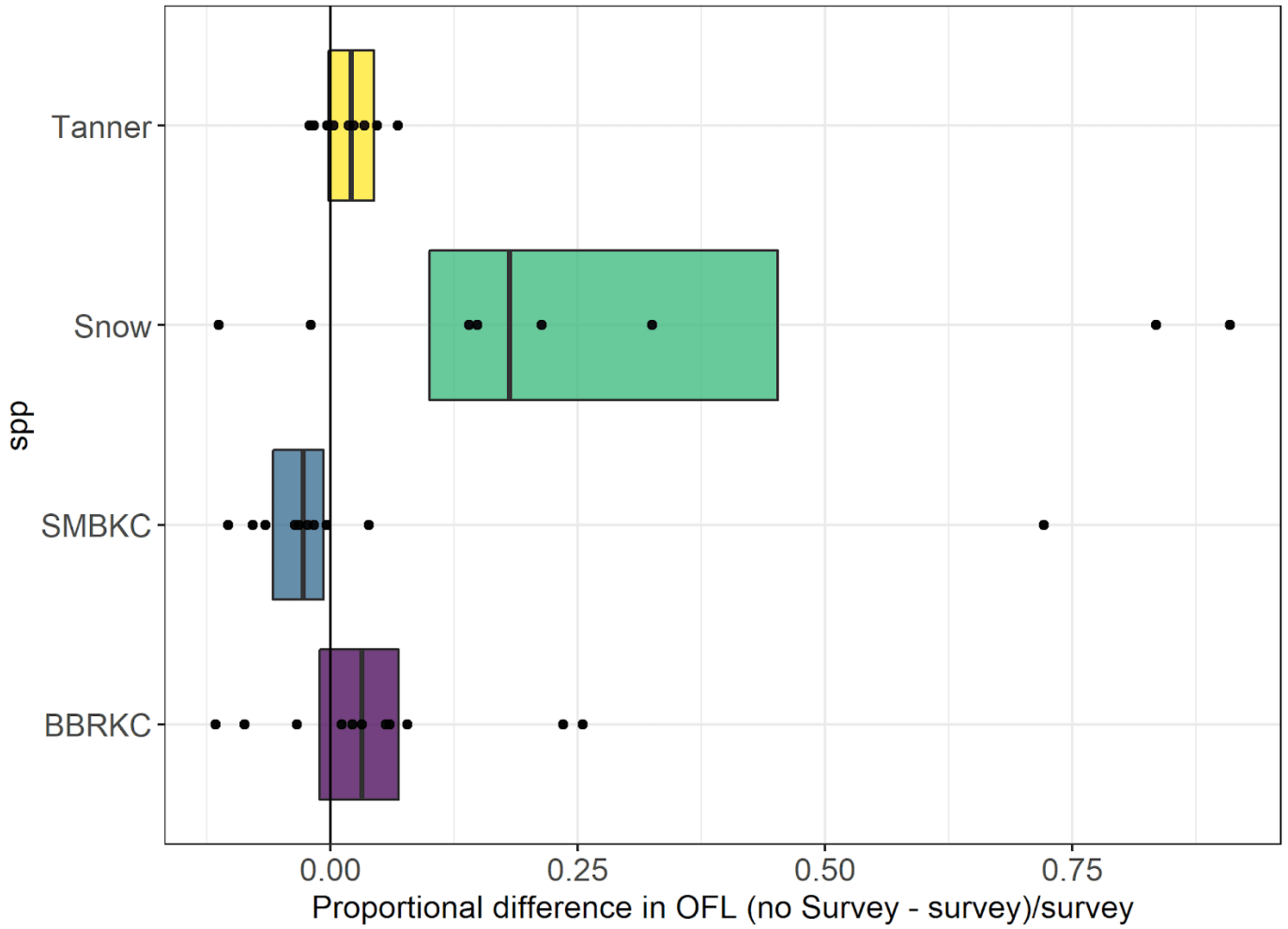
CPT APPROACH TO EVALUATING IMPACTS OF THE CANCELLATION OF THE 2020 SURVEY

- CPT and SSC agreed on two analyses that would done for each affected assessment.
- **Approach 1: Retrospective analysis with two sets of runs.** The first set is the standard retrospective analysis. The second set of retrospective runs is like the first except that the survey data in the final year are also removed.
- **Approach 3: High/Low survey sensitivity.** Obtain a predicted value for the 2020 survey. Multiply the predicted survey value by the 25th and 75th percentiles of the multiplicative residual to obtain a high and a low survey observation for 2020. Fit these values in two model runs to evaluate sensitivity to variation in the ending year survey in 2020.
  - Large changes in management quantities such as OFL and MMB indicate high sensitivity.
  - This sensitivity analysis evaluates the behavior of the assessment model in the current year, while the first analysis evaluates the historical performance of the assessment.

CPT APPROACH TO EVALUATING IMPACTS OF THE CANCELLATION OF THE 2020 SURVEY

- At the start of the meeting the CPT discussed three possible approaches for dealing three possible approaches for dealing with the cancellation of the 2020 survey:
  - No additional ABC buffers for any stock assessment to account for the cancellation of the 2020 survey.
  - Add the same additional ABC buffer for all assessments affected by the cancellation of the survey (for example a 10% additional buffer).
  - Take a species-by-species approach to decide on a buffer. An additional buffer should be considered only for stocks where assessment uncertainty increases appreciably.
- The CPT concluded that the third option was the best course of action.

SUMMARIZING APPROACH 1: RETROSPECTIVE WITH AND WITHOUT TERMINAL YEAR SURVEY



Approach 3 – Summarizing sensitivity of the OFL estimate to potential high and low 2020 survey data point

$$\frac{OFL_{Hi} - OFL_{Lo}}{OFL_{Base}}$$

BBRKC 10.6%

Snow 26.5%

Tanner 4.4%

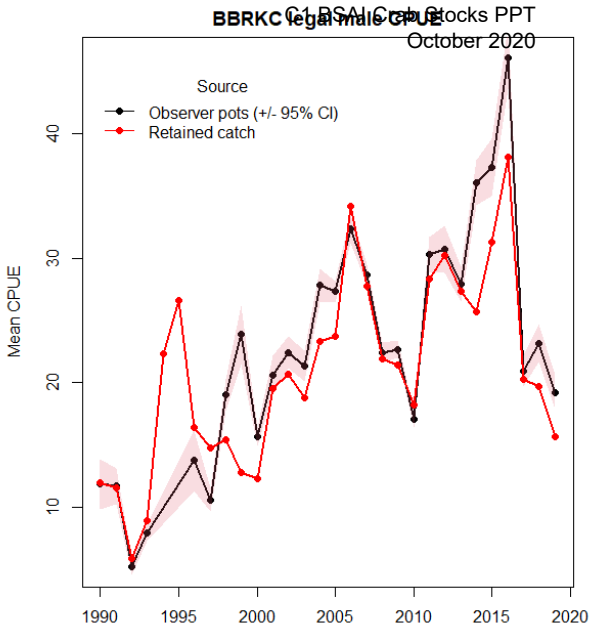
SMBKC 13.6%

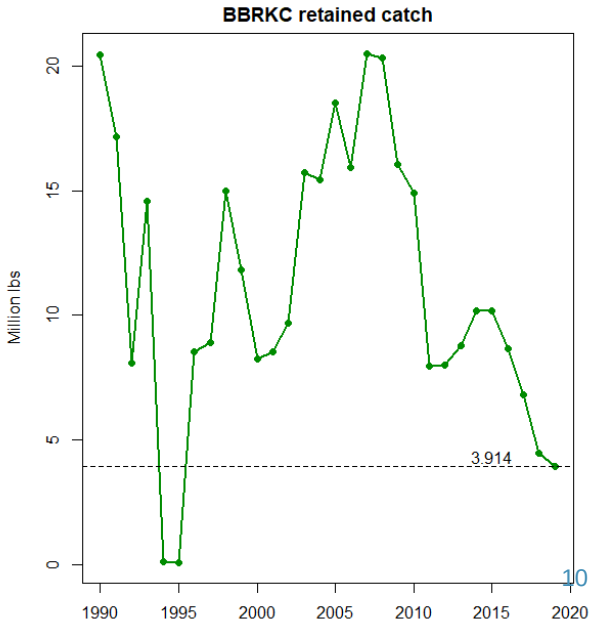
BBRKC

FINAL ASSESSMENT 2020

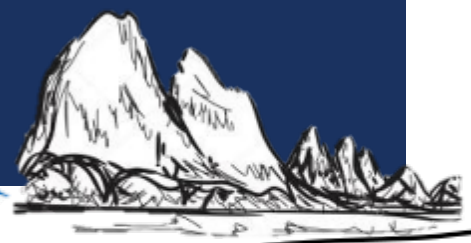
BBRKC FISHERY UPDATE

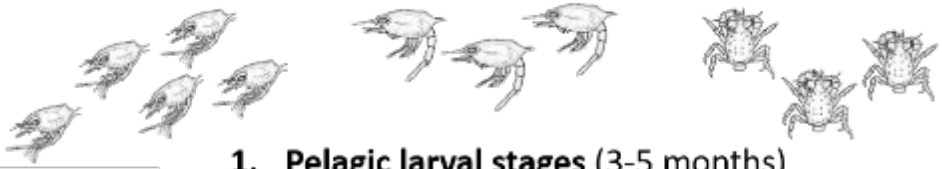
- Total catch for 2019/20 3.914, lowest catch in recen history
- Legal male CPUE declined over past 5 seasons
- Most of harvest in first two weeks of fishery
- Further west in Bristol Bay than past fisheries
- Higher discard mortality (likely sublegal & old shell crab)
- Increase in average weight of retained catch
- Groundfish bycatch – under 60-ft Pacific cod pot an yellowfin sole trawl





BBRKC METRICS ASSESSMENT AND ECOSYSTEM PROCESSES





5 – 10 °C

1. **Pelagic larval stages** (3-5 months)
   Peak hatch: February
   Larval stages: March-June

Synchrony with spring bloom

Offshore advection

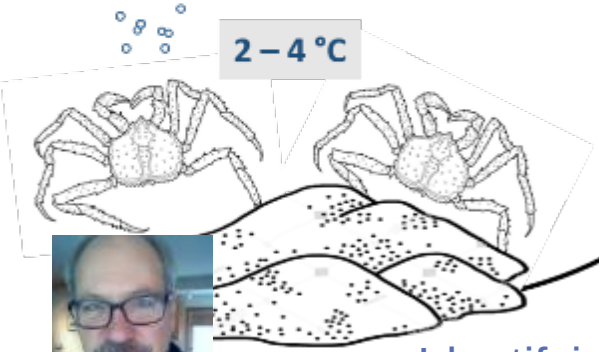
2 – 12 °C

2. **Early benthic juvenile stage**
   Settlement: July-Aug

Habitat

Predation

Depth



2 – 4 °C

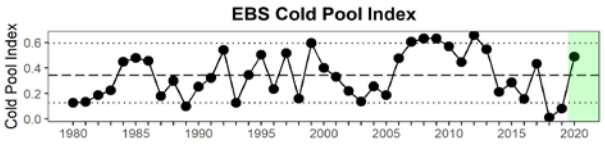
3. **Benthic adult stage**
   Annual molt, mate and extrude: Jan-June

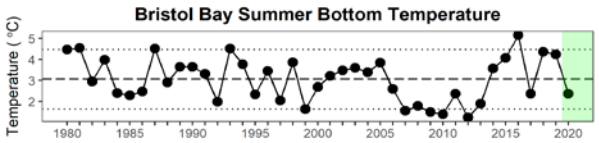
Predation

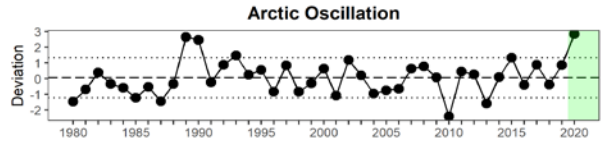
Temperature

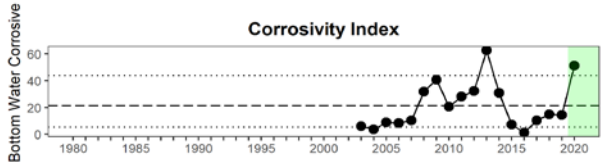
Identifying **vulnerability** or **resilience** of the stock to ecosystem or socioeconomic pressures

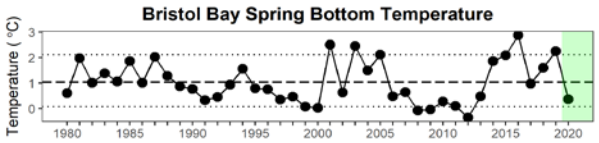
BBRKC ECOSYSTEM INDICATOR TIME SERIES

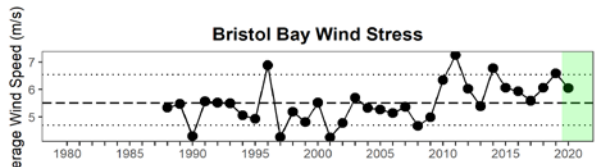


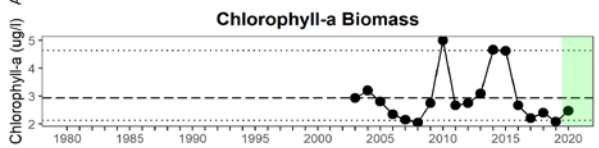


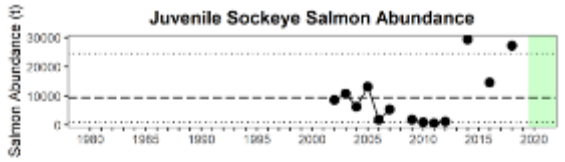


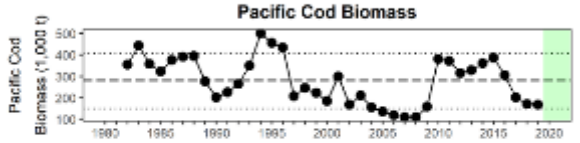


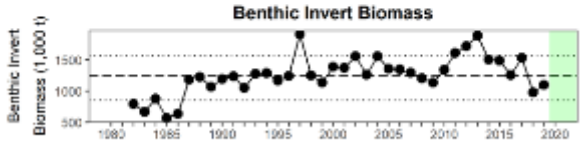


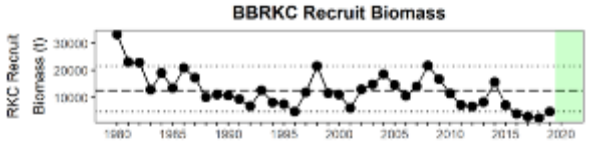


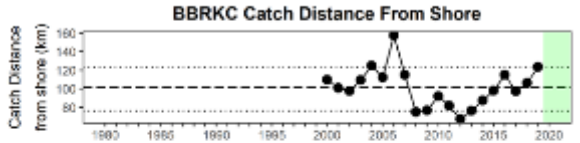


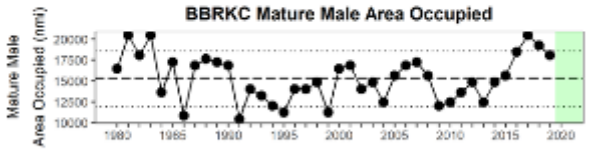


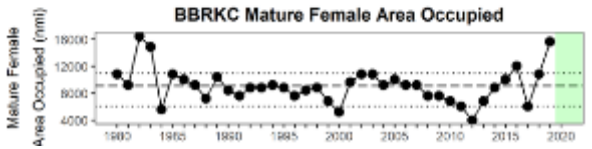












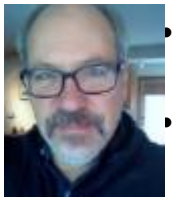
STAGE 1 INDICATOR ANALYSIS:
TRAFFIC LIGHT TEST FOR ECOSYSTEM INDICATORS

Title	Description	Recent
Cold Pool Index	Fraction of the EBS BT survey area with bottom water less than 2°C on 1 July of each year from Bering10K ROMS model output hindcasts	●
Summer Bottom Temperature	Average of June-July bottom temperatures (° C) within the BBRKC management boundary from the Bering 10K ROMS model output hindcasts	●
Arctic Oscillation	Average of Jan-March Arctic Oscillation Index estimates; constructed by projecting daily 1000mb height anomalies poleward of 20°N onto the loading pattern of the Arctic Oscillation	+
Corrosivity Index	Percent of the BBRKC management area containing an average bottom aragonite saturation state of < 1 from Feb-April	+
Spring Bottom Temperature	Average of Feb-March bottom temperatures (° C) within the BBRKC management boundary from the Bering 10K ROMS model output hindcasts	●
Wind Stress	June ocean surface wind stress within the BBRKC management boundary. Product of NOAA blended winds and MetOp ASCAP sensors from multiple satellites	●
Chlorophyll-a Biomass	April-June average chlorophyll-a biomass within the Southern Inner Shelf of the Bering Sea; calculated with 8-day composite data from MODIS satellites	●

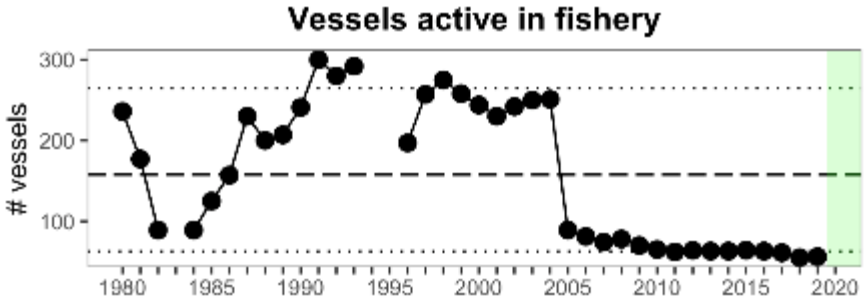
Title	Description	Recent
Juvenile sockeye salmon abundance	Estimated September juvenile sockeye salmon biomass from the Bering Arctic Subarctic Integrated Surveys in the EBS	+
Pacific cod biomass	Biomass (1,000t) of Pacific cod within the BBRKC management boundary on the EBS bottom trawl survey	-
Benthic invertebrate biomass	Combined biomass (1,000t) of benthic invertebrates within the BBRKC management boundary on the EBS bottom trawl survey	●
BBRKC recruit biomass	Biomass of male red king crab (110-134 mm CL) from the EBS bottom trawl survey that will likely enter the fishery the following year.	-
BBRKC Catch Distance from Shore	Mean distance (km) legal male Bristol Bay red king crab were caught from shore in the autumn fishery (starting Oct. 15th) using observer data.	+
BBRKC mature male area occupied	The minimum area containing 95% of the cumulative CPUE for BBRKC mature males from the EBS bottom trawl survey	+
BBRKC mature female area occupied	The minimum area containing 95% of the cumulative CPUE for BBRKC mature females from the EBS bottom trawl survey	+

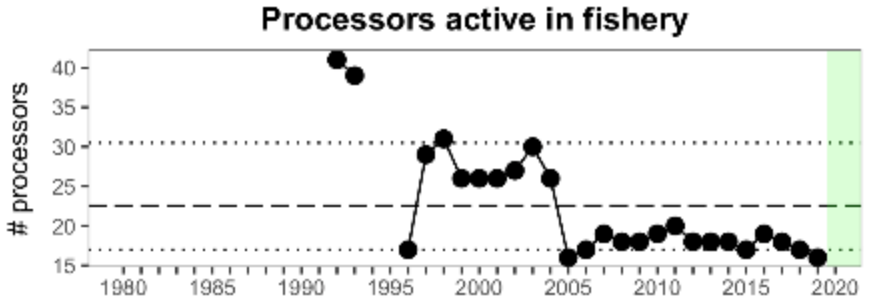
Ecosystem Considerations:

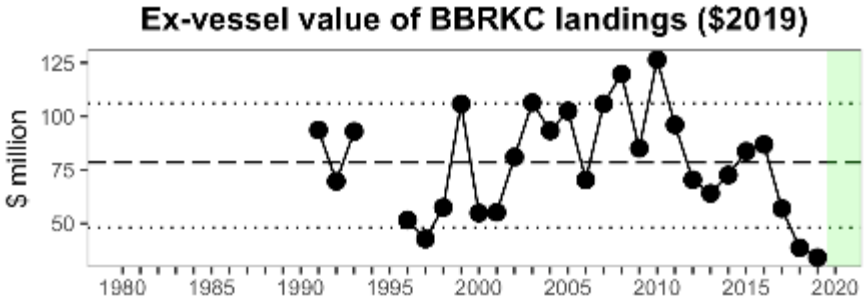
- Available physical indicators for 2020 show a return to near-average conditions in Bristol Bay
- A relatively high positive Arctic Oscillation index in winter 2020 may suggest favorable conditions for BBRKC productivity
- Current-year increases in corrosive bottom waters in Bristol Bay have the potential to impact shell formation, growth and survival of BBRKC

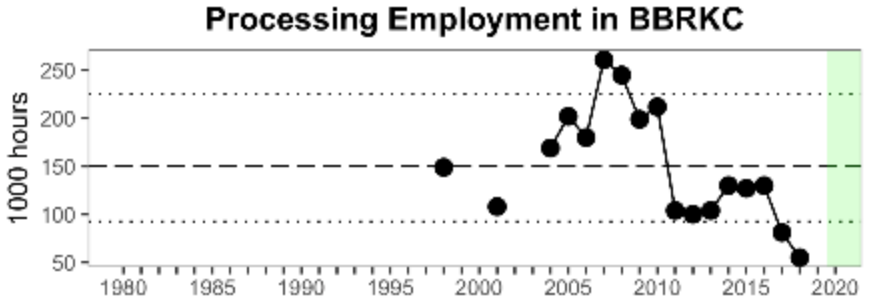


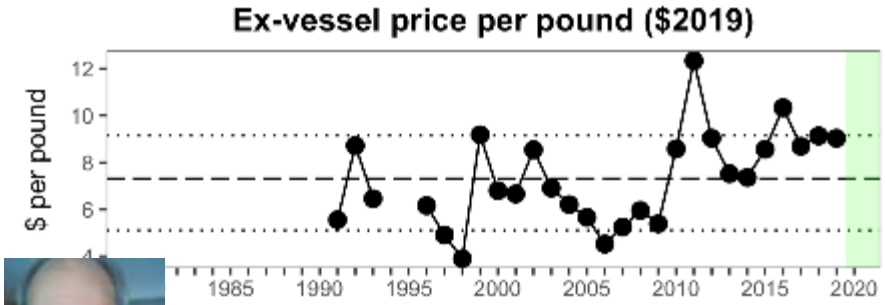
BBRKC SOCIOECONOMIC INDICATOR TIME SERIES

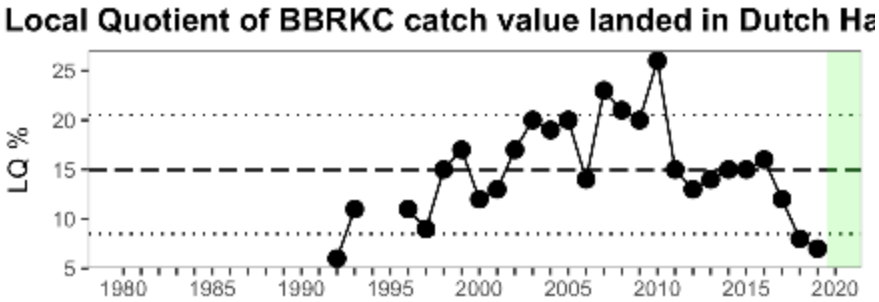












STAGE 1 INDICATOR ANALYSIS:
SOCIOECONOMIC INDICATORS

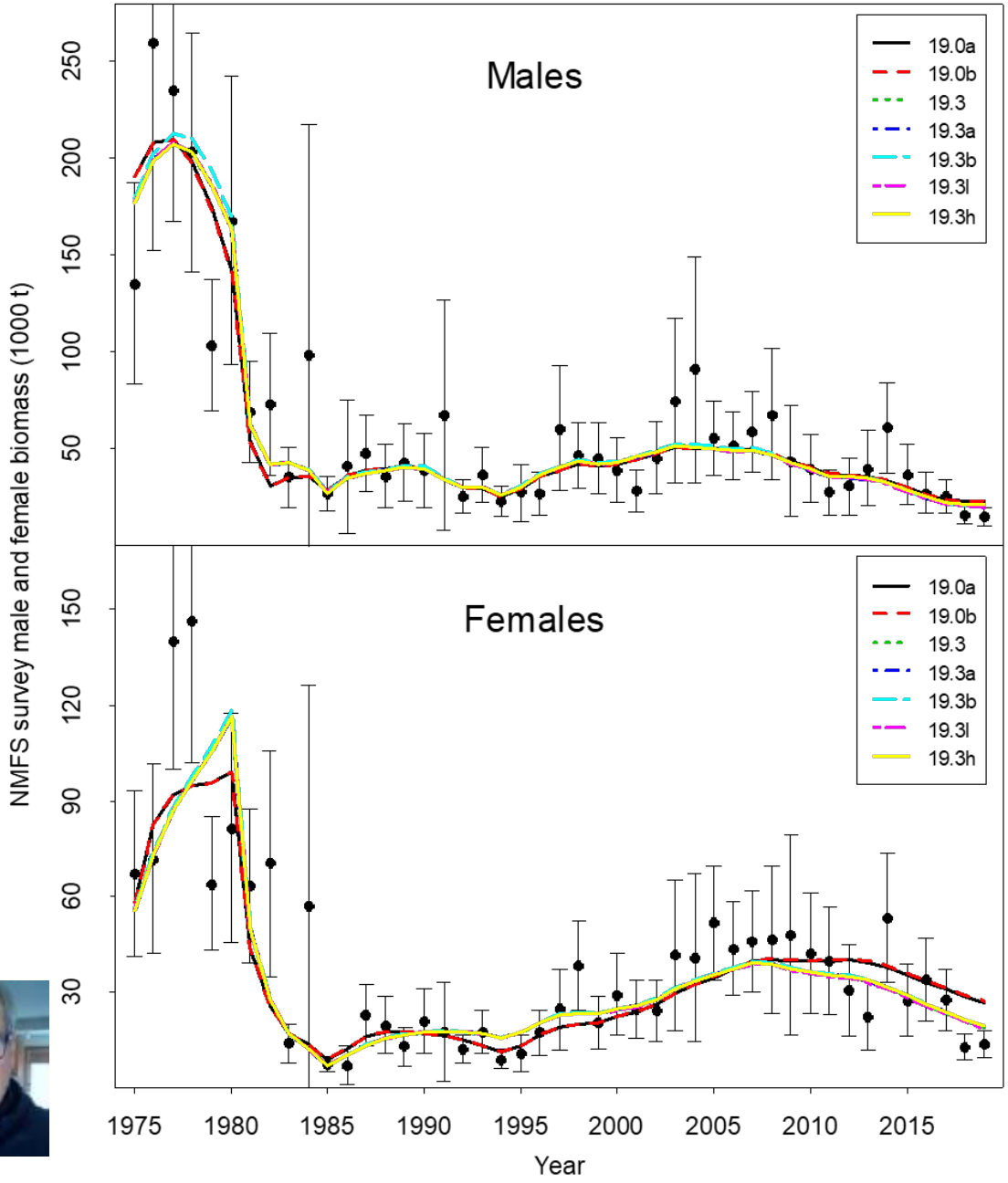
Title	Description	Recent
CPUE	Fishing effort efficiency, as measured by estimated mean number of retained BBRKC per potlift	●
Vessels active in fishery	Annual count of crab vessels that delivered commercial landings of BBRKC to processors[2]	–
Total Potlifts	Fishing effort, as measured by estimated number of crab pots lifted by vessels during the BBRKC fishery	●
BBRKC Male Bycatch in Groundfish Fishery	Incidental bycatch biomass estimates of male BBRKC (tons) in trawl and fixed gear fisheries	●
TAC Utilization	Percentage of the annual BBRKC TAC (GHL prior to 2005) that was harvested by active vessels, including deadloss discarded at landing.	●
Ex-vessel value of BBRKC landings	Aggregate ex-vessel value of BBRKC landings (as adjusted by CFEC to account for post-season adjustments to ex-vessel settlements), summed over all ex-vessel sales reported.	–
Ex-vessel price per pound	Commercial value per unit (pound) of BBRKC landings (as adjusted by CFEC to account for post-season adjustments to ex-vessel settlements), measured as weighted average value over all ex-vessel sales reported.	●
BBRKC ex-vessel revenue share	BBRKC ex-vessel revenue share as percentage of total calendar year ex-vessel revenue from all commercial landings in Alaska fisheries, mean value over all vessels active in BBRKC during the respective year.	–
Processors active in fishery	Total number of crab processors that purchased landings of BBRKC from delivering vessels during the calendar year.	–
Processing Employment in BBRKC	Crab processing employment generated in BBRKC fishery as measured by total paid hours of labor input by processing employees, summed over all shore-based plants that processed BBRKC landings.	–
Local Quotient of BBRKC landed catch in Dutch Harbor	Ex-vessel value share of BBRKC landings to Unalaska/Dutch Harbor, as percentage of total value of commercial landings to processors in the community from all commercial Alaska fisheries, as aggregate percentage over all landings during the respective year.	–

Socioeconomic Considerations:

- Counts of active vessels and processors in declining trend since 2005
- Ex-vessel price above the long-term average since 2010, partially mitigating some income effects of declining BBRKC production
- While aggregate BBRKC ex-vessel value was at a historical low in 2019, BBRKC ex-vessel revenue share on average for active vessels was only moderately below average during 2019.
- The local quotient for BBRKC catch value of landings to Dutch Harbor also declined to a historical low in 2019.

BBRKC FINAL ASSESSMENT 2020

- Declining trend, survey biomass decreased ~50% in 2018, 2019
- New data: directed fishery data, groundfish bycatch (abundance and size comps)
- Model biased high compared to low 2018 and 2019 survey estimates
- Recruitment estimate in terminal year unrealistically high (not used for estimating $B_{35\%}$)
- Model 19.3 identified as the preferred model by CPT
  - Model has simpler pattern of changes in natural mortality.
  - Fits the data better with one less parameter than 19.0a



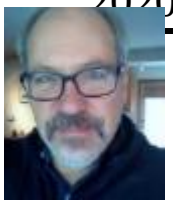
Comparisons of area-swept estimates of total NMFS survey biomass and model prediction for model estimates in 2020 under seven models. The error bars are plus and minus 2 standard deviations.

Status and catch specifications (1,000 t) (model 19.3):

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2016/17	12.53[A]	25.81[A]	3.84	3.92	4.37	6.64	5.97
2017/18	12.74[B]	24.86[B]	2.99	3.09	3.60	5.60	5.04
2018/19	10.62[C]	16.92[C]	1.95	2.03	2.65	5.34	4.27
2019/20	12.72[D]	14.24[D]	1.72	1.78	2.22	3.40	2.72
2020/21		14.93[D]				2.14	1.61

Basis for the OFL: Values in 1,000 t (model 19.3):

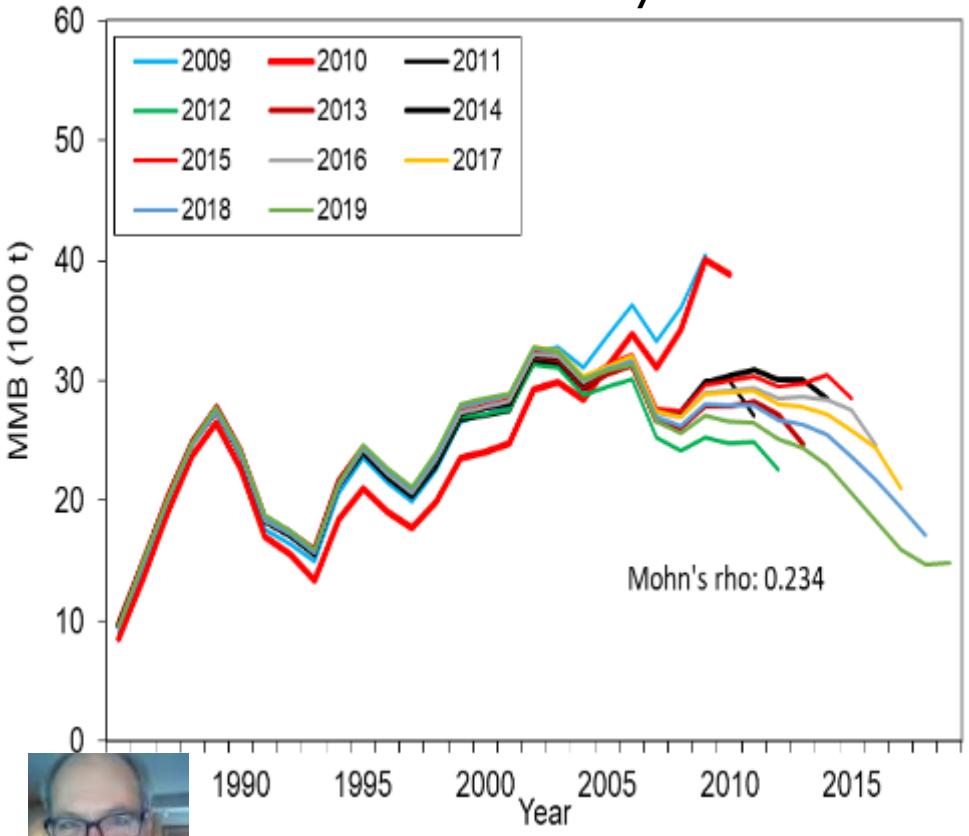
Year	Tier	B_{MSY}	Current MMB	B/B_{MSY} (MMB)	F_{OFL}	Years to define B_{MSY}	Natural Mortality
2016/17	3b	25.8	24.0	0.93	0.27	1984-2016	0.18
2017/18	3b	25.1	21.3	0.85	0.24	1984-2017	0.18
2018/19	3b	25.5	20.8	0.82	0.25	1984-2017	0.18
2019/20	3b	21.2	16.0	0.75	0.22	1984-2018	0.18
2020/21	3b	25.4	14.9	0.59	0.16	1984-2019	0.18



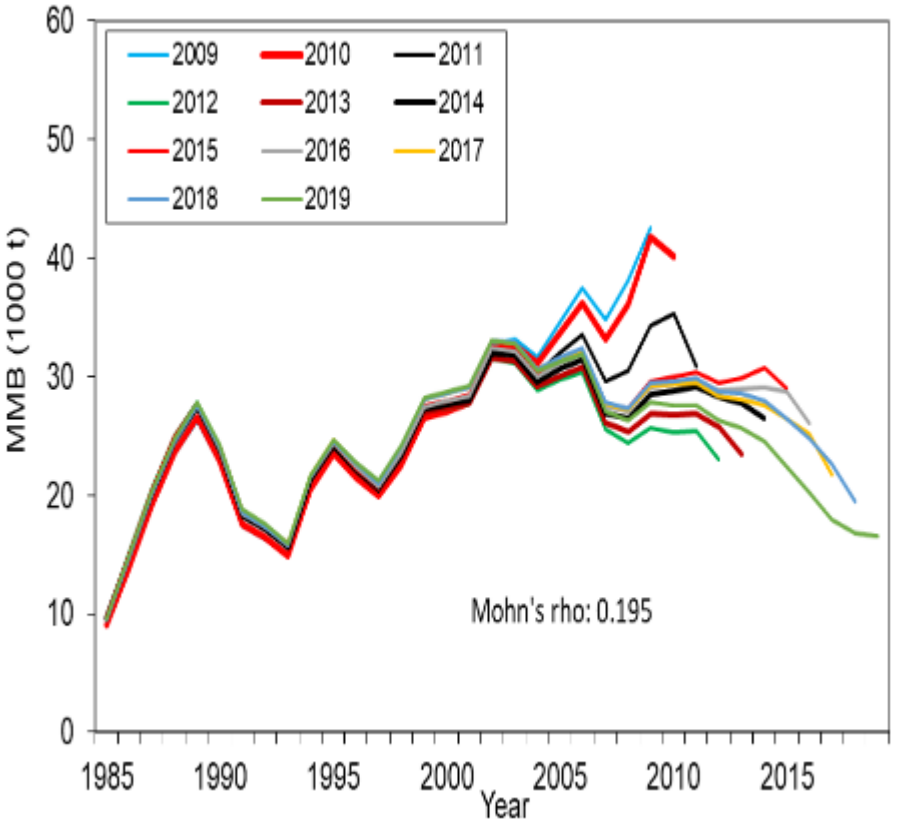
App D. Uncertainty from cancelled 2020 survey

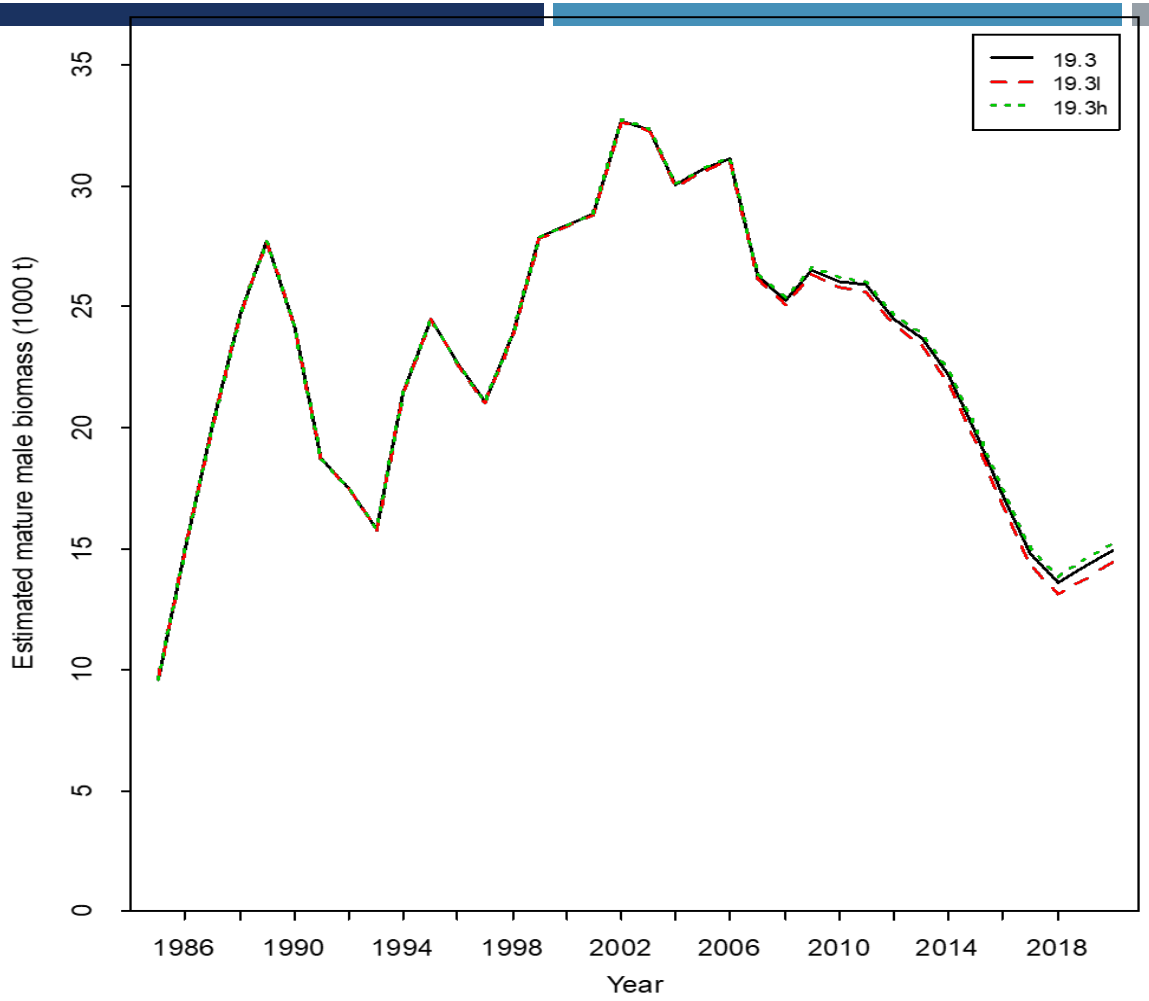
Approaches 1 & 2: Retrospective analysis with two sets of runs: with & without survey in the terminal years.

With survey



Without survey





	19.3l	19.3	19.3h	(19.3h-19.3l)/19.3
B35%	25.324	25.445	25.523	0.78%
MMB-terminal	14.422	14.928	15.220	5.34%
F35%	0.290	0.291	0.291	0.17%
Fofl	0.152	0.157	0.160	5.66%
OFL	1.997	2.141	2.224	10.58%
MMB/B35%	0.570	0.587	0.596	4.57%

Approach 3: Sensitivity analysis with high and low proxy surveys:

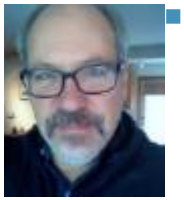
Adding 25th (model 19.3l) and 75th (model 19.3h) model-expected percentile survey biomass to the terminal year (2020).

Summary:

1. Overall, differences of results from these three approaches are very small.
2. Retrospective results are better without terminal survey than with terminal survey, maybe due to unexpected survey biomass in 2014, 2018 and 2019.

CPT DISCUSSION ON ABC BUFFERS FOR BBKRC

- 2019 ABC buffer 20%
  - Similar uncertainties exist
    - Model's lack of fit to 2018 and 2019 NMFS EBS trawl survey data
    - Retrospective patterns
    - Recent environmental conditions
    - Lack of recent recruitment
- Uncertainty due to cancelled 2020 survey
  - Additional positive retrospective bias in OFL ~5%
  - Missing critical information on if this stock is approaching an overfished status
  - King crab in Alaska do not rebuild easily, therefore important to avoid overfished status
  - Recommend an additional 5% buffer
- Total 2020 buffer of 25%

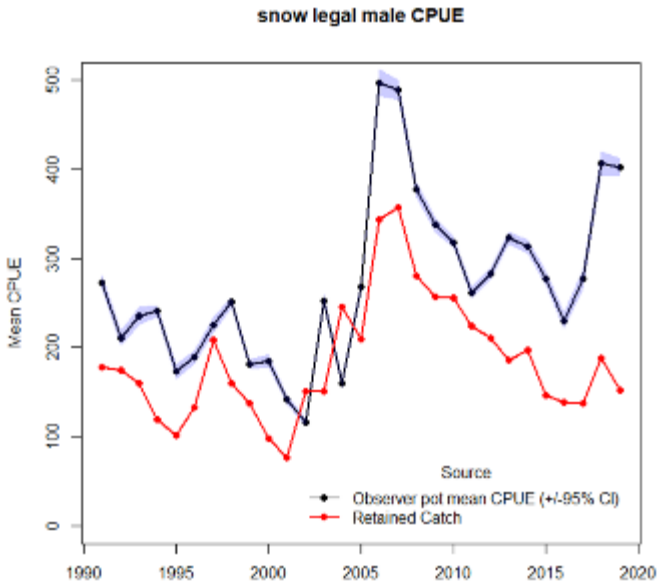


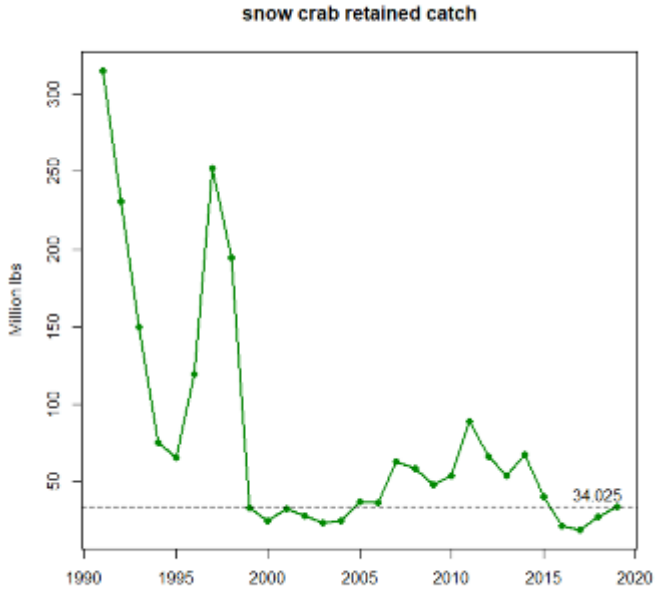
SNOW CRAB

FINAL ASSESSMENT 2020

SNOW CRAB FISHERY UPDATE

- Harvest for 2019/20 34.025 million lb
- Legal male (>3.1 inches) CPUE high in observer sample pots
- Retained catch (industry preferred size) CPUE (≥4 inches) was low
- North and west of PI with sea ice limited fishing on northern grounds for first two months of the fishery
- Harvest occurred over 4.5 months
- Heavy sorting on the grounds due to high abundance of legal but not industry preferred size crab
- Increase in average weight of retained catch
- Groundfish bycatch – under 60-ft P.cod pot and yellowfin sole trawl





23

SUMMARY

- Model scenarios and fits
- OFL and projections
- Uncertainty and buffers

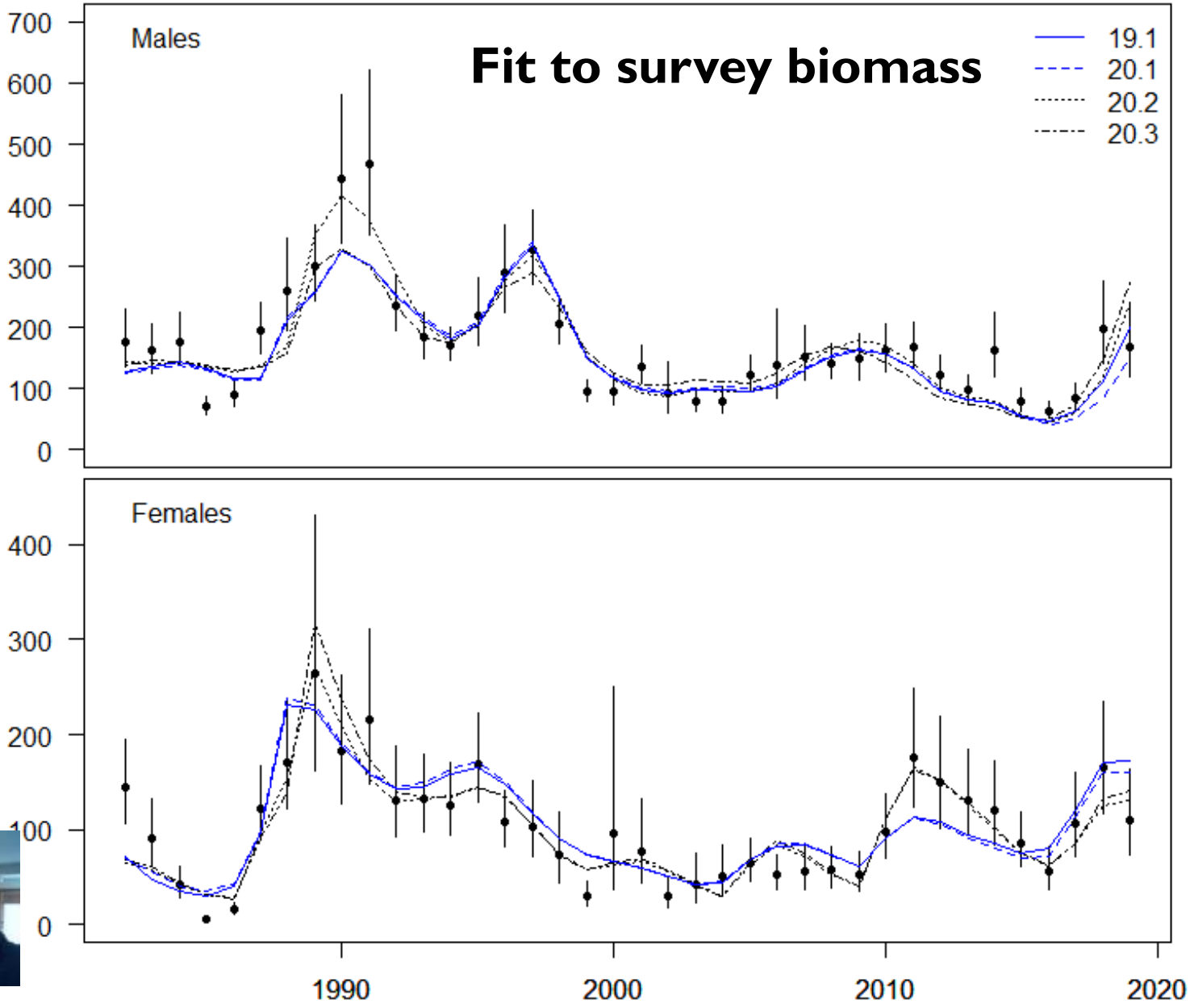
MODEL SCENARIOS

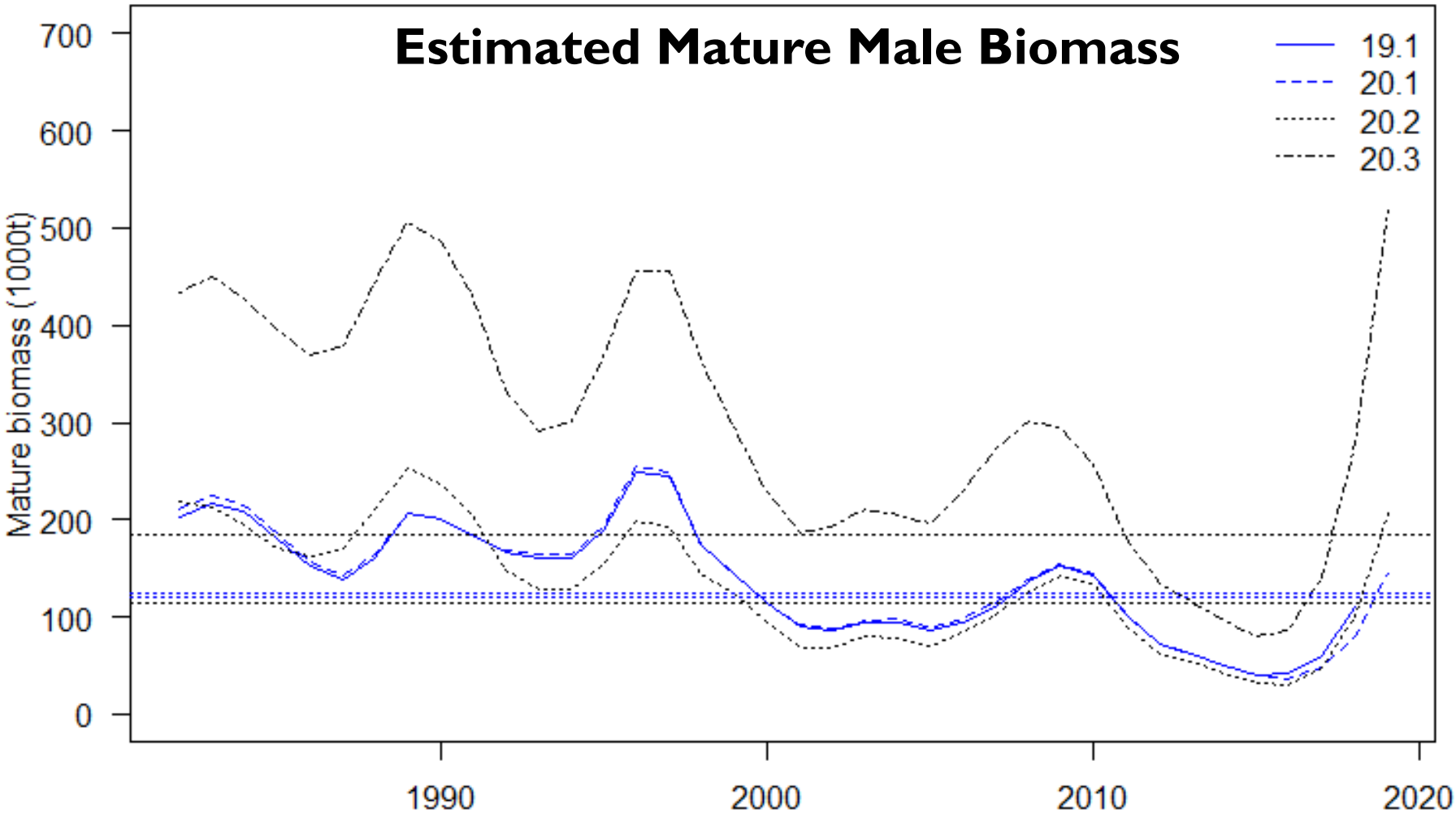
- **19.1**: Reference model
- **20.1**: 19.1 fit to updated catch data
- **20.2**: GMACS fit to same data as 20.1
- **CPT selected model 20.2 (GMACs) as the preferred model**
- **SSC selected model 20.1 (last year's model) as the preferred model**

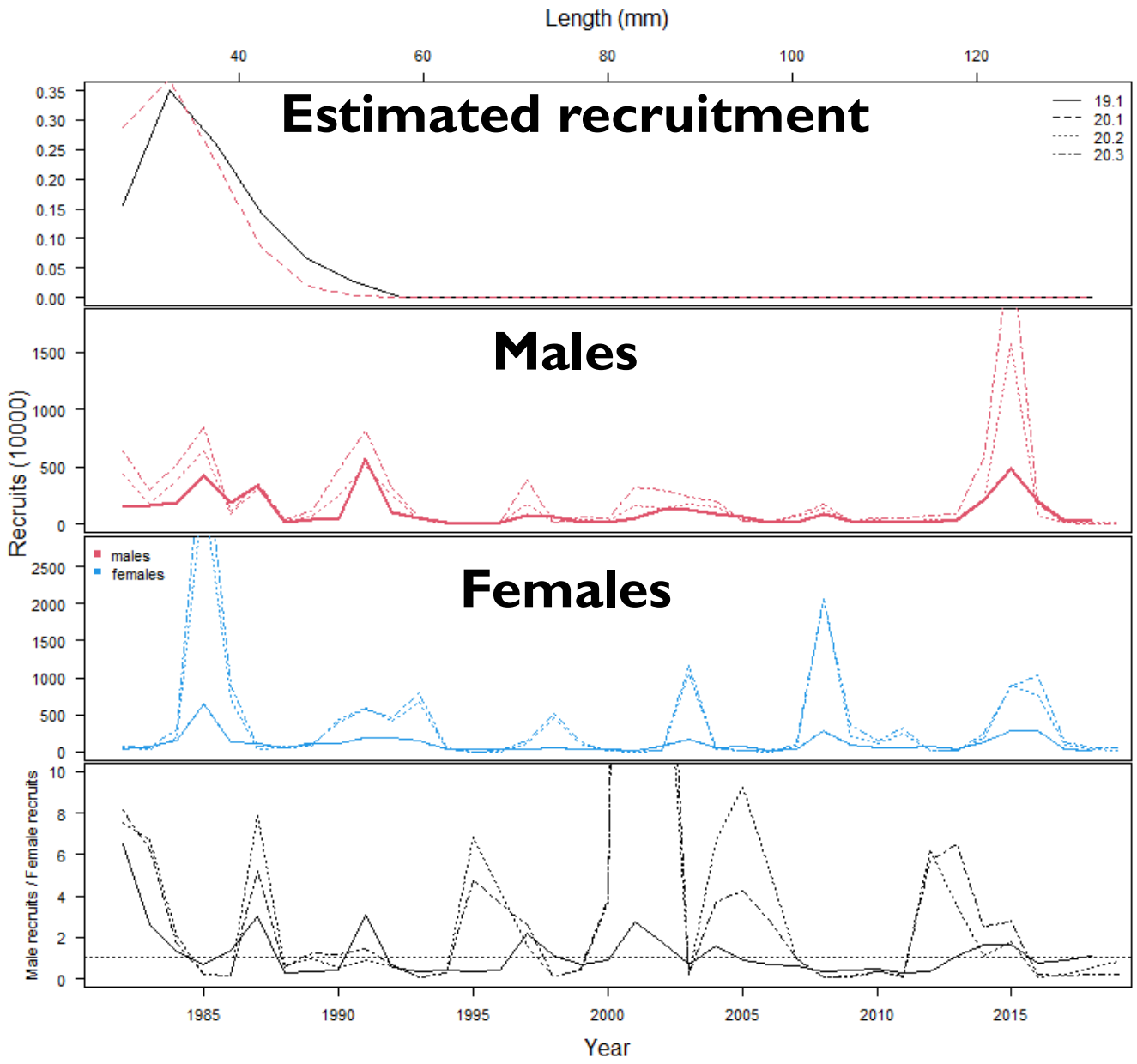
MODEL FITS

- GMACS fit the data as well (or better) than the status quo in nearly all instances
- Changes in model structure in GMACS are improvements over the status quo

Fit to survey biomass




Estimated Mature Male Biomass
19.1
20.1
20.2
20.3
Mature biomass (1000t)
700
600
500
400
300
200
100
0
1990
2000
2010
2020


Length (mm)
40
60
80
100
120
Estimated recruitment
19.1
20.1
20.2
20.3
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Males
Females
Recruits (10000)
males
females
1500
1000
500
0
2500
2000
1500
1000
500
0
Male recruits / Female recruits
10
8
6
4
2
0
1985
1990
1995
2000
2005
2010
2015
Year

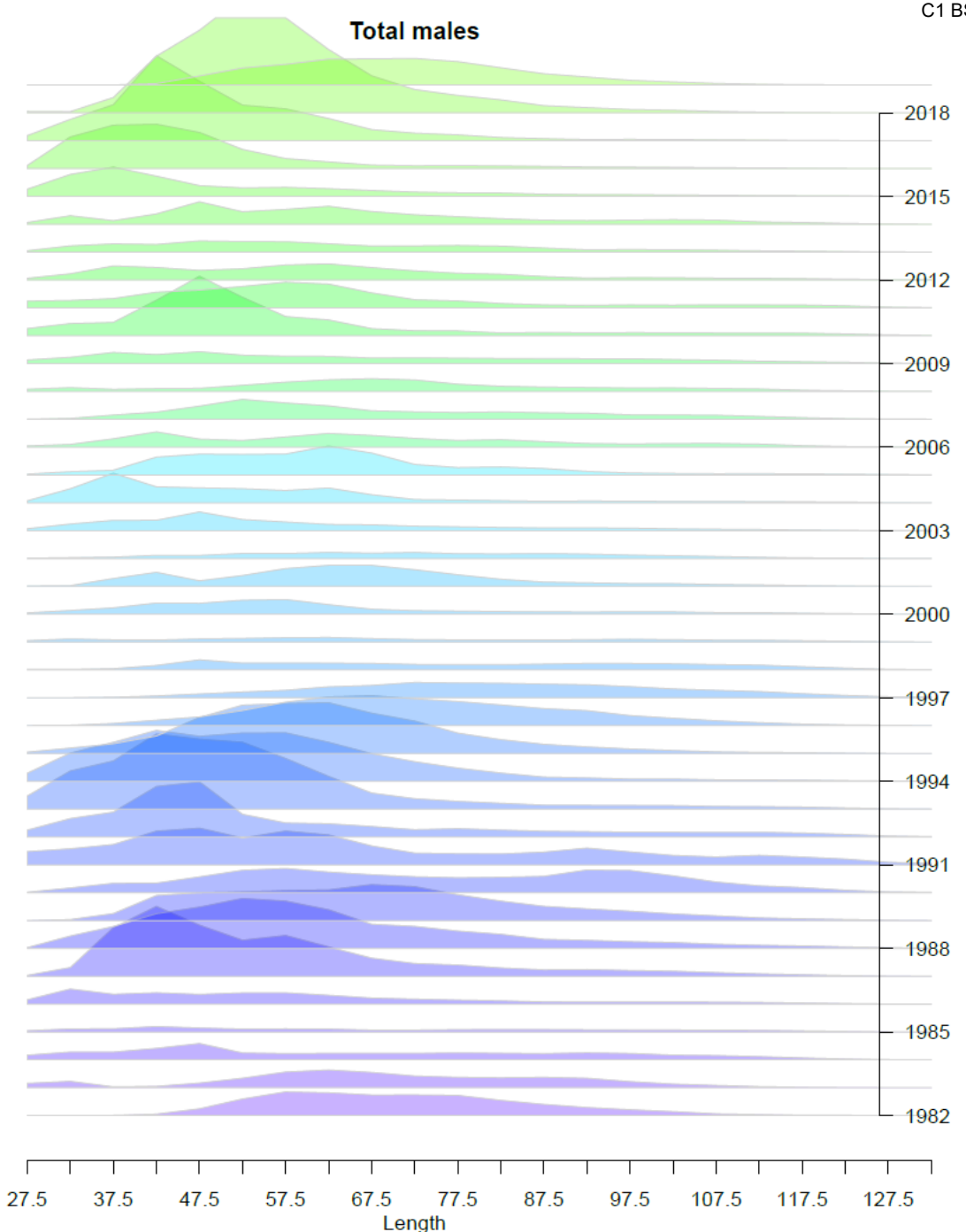
PREFERRED MODEL

- 20.2 (GMACS)
  - Model improvements
  - Comparable model fits and reference points
  - Fit recent years of survey MMB best

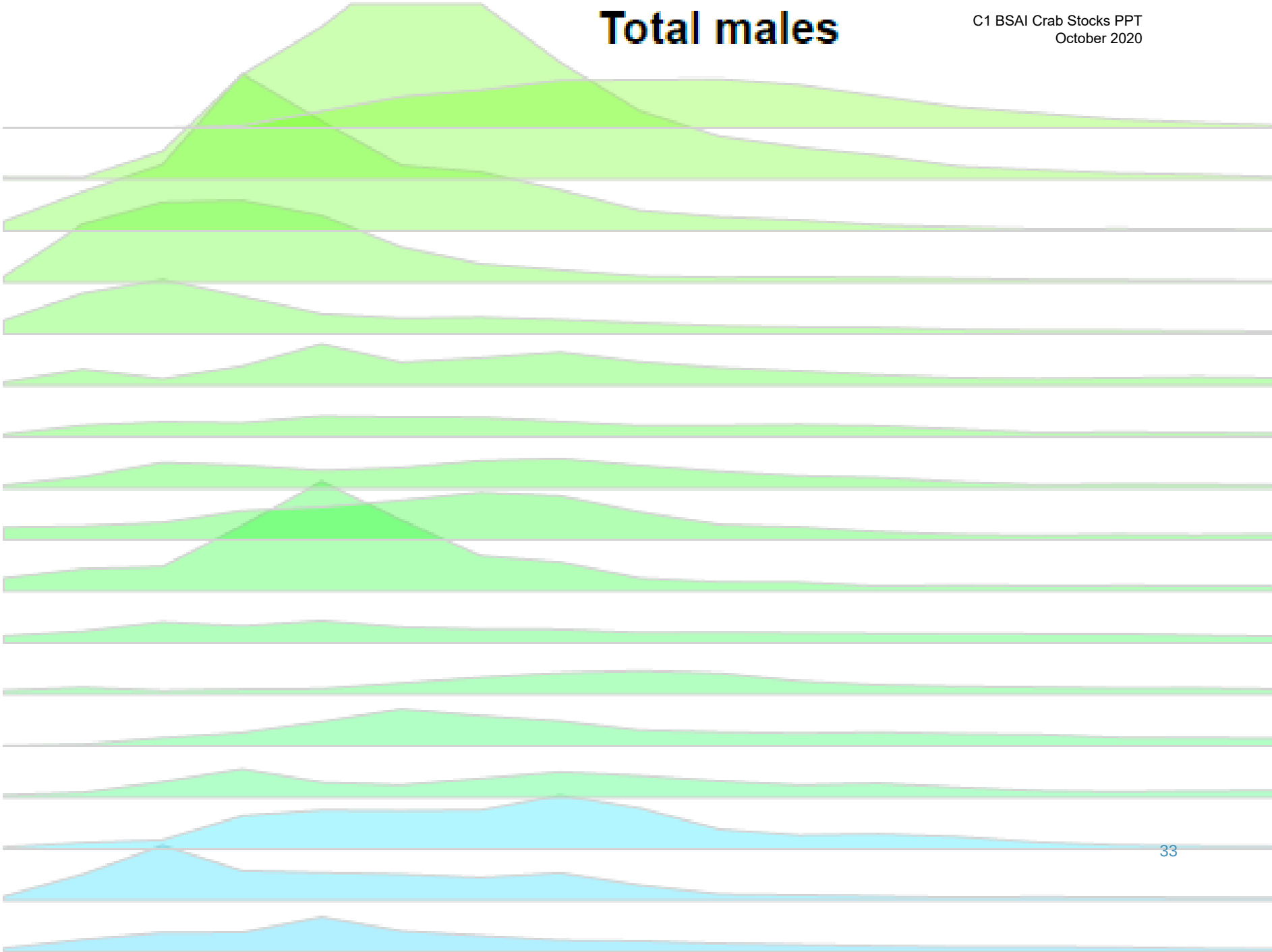
Model	MMB	B35	F35	FOFL	OFL	M	avg_rec
19.1	109.56	123.71	1.80	1.80	54.05	0.30	113.68
20.1	144.29	120.51	1.60	1.60	95.40	0.30	109.55
20.2	207.19	113.66	1.65	1.65	184.91	0.36	169.96
20.3	517.13	183.95	2.61	2.61	448.38	0.36	265.31

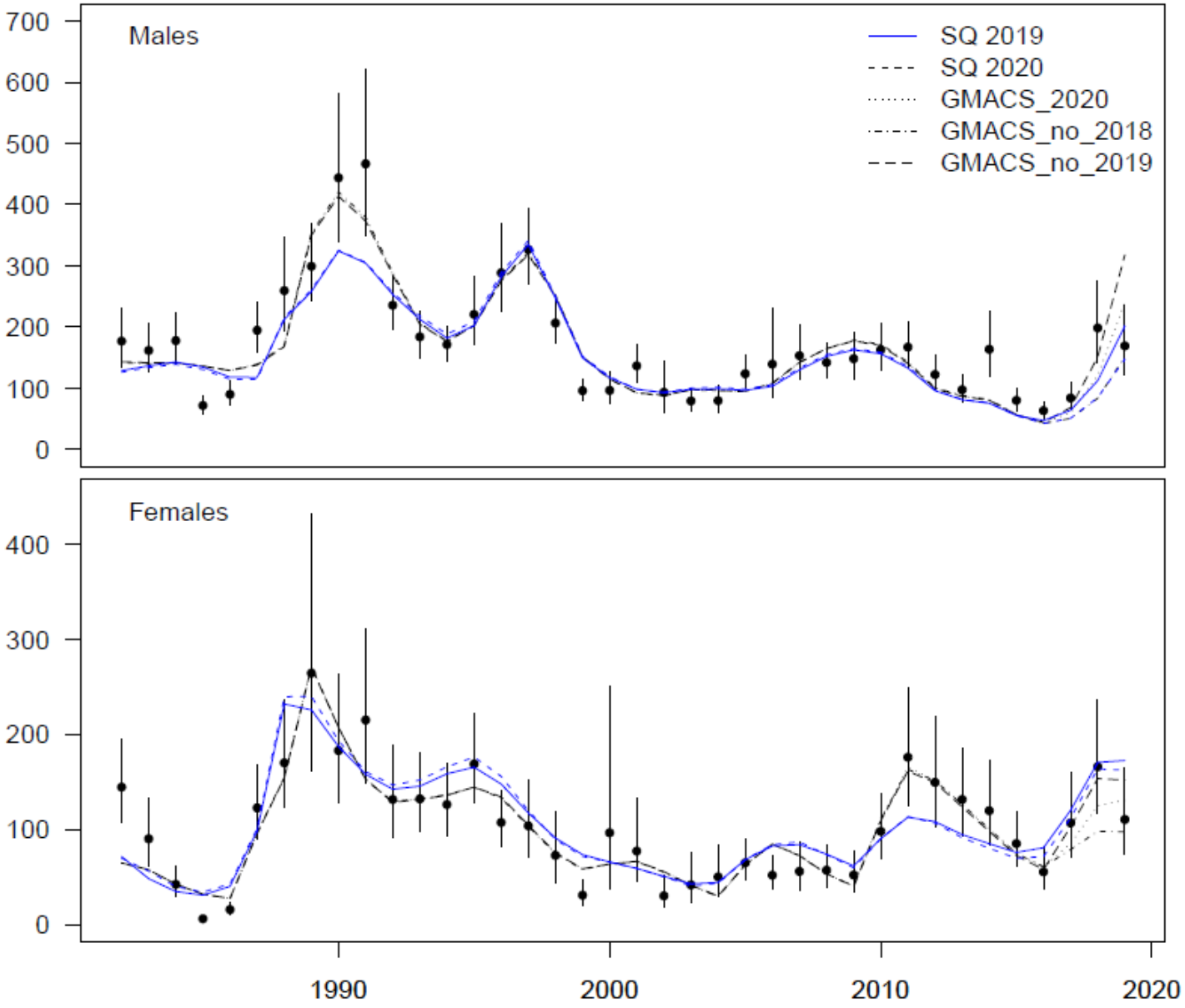
UNCERTAINTY IN THE OFL

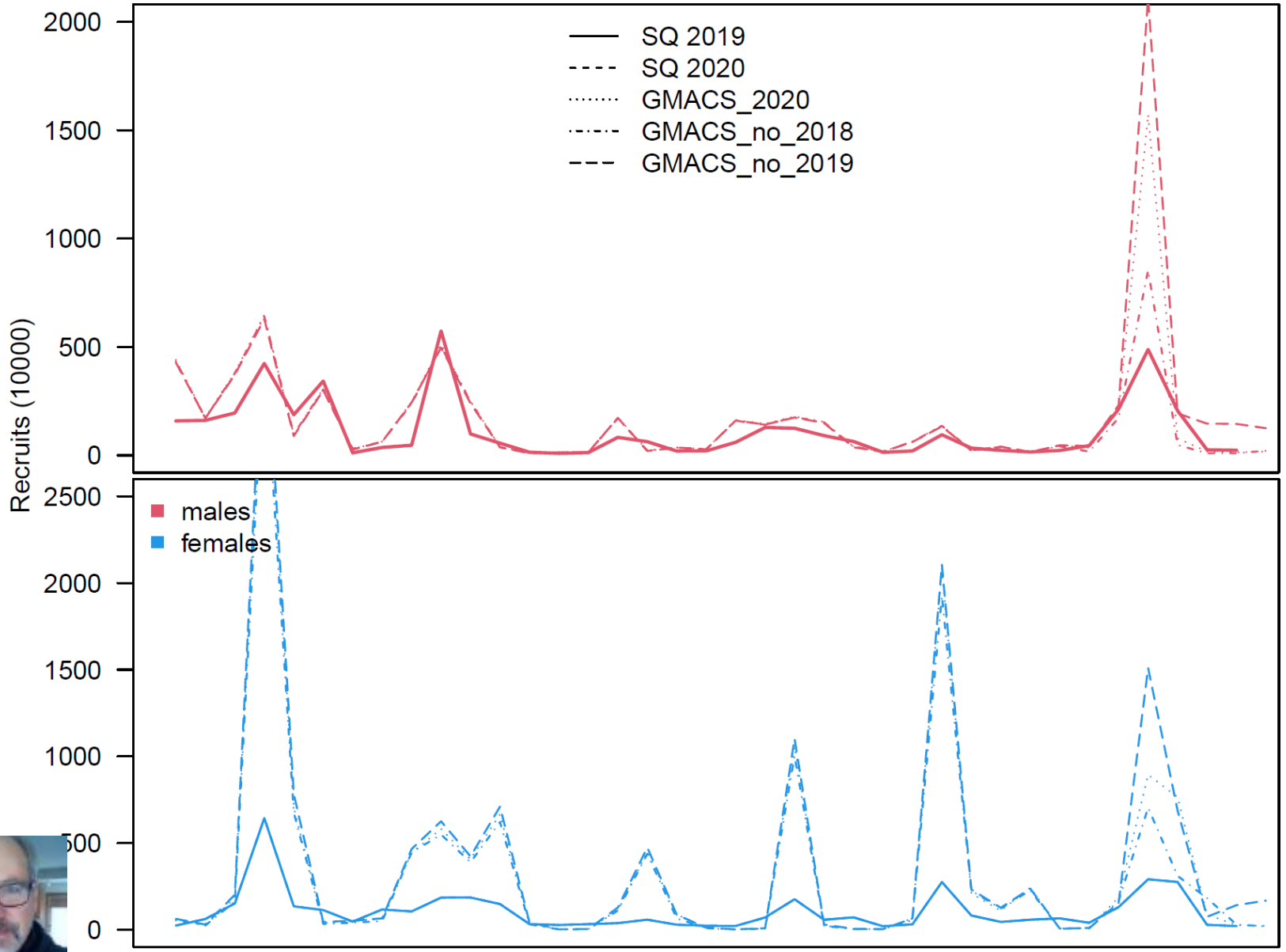
- Missed survey
- Mismatch between the 2018 and 2019 survey data
- Retrospective patterns
- Differences in estimated recruitment from 2019 to 2020

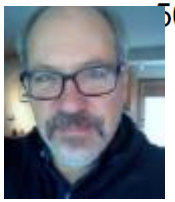

Total males
2018
2015
2012
2009
2006
2003
2000
1997
1994
1991
1988
1985
1982
27.5
37.5
47.5
57.5
67.5
77.5
87.5
97.5
107.5
117.5
127.5
Length

Total males




Males
SQ 2019
SQ 2020
GMACS_2020
GMACS_no_2018
GMACS_no_2019
700
600
500
400
300
200
100
0
Females
400
300
200
100
0
1990
2000
2010
2020


SQ 2019
SQ 2020
GMACS_2020
GMACS_no_2018
GMACS_no_2019
Recruits (10000)
2000
1500
1000
500
0
males
females
2500
2000
1500
1000
500
0



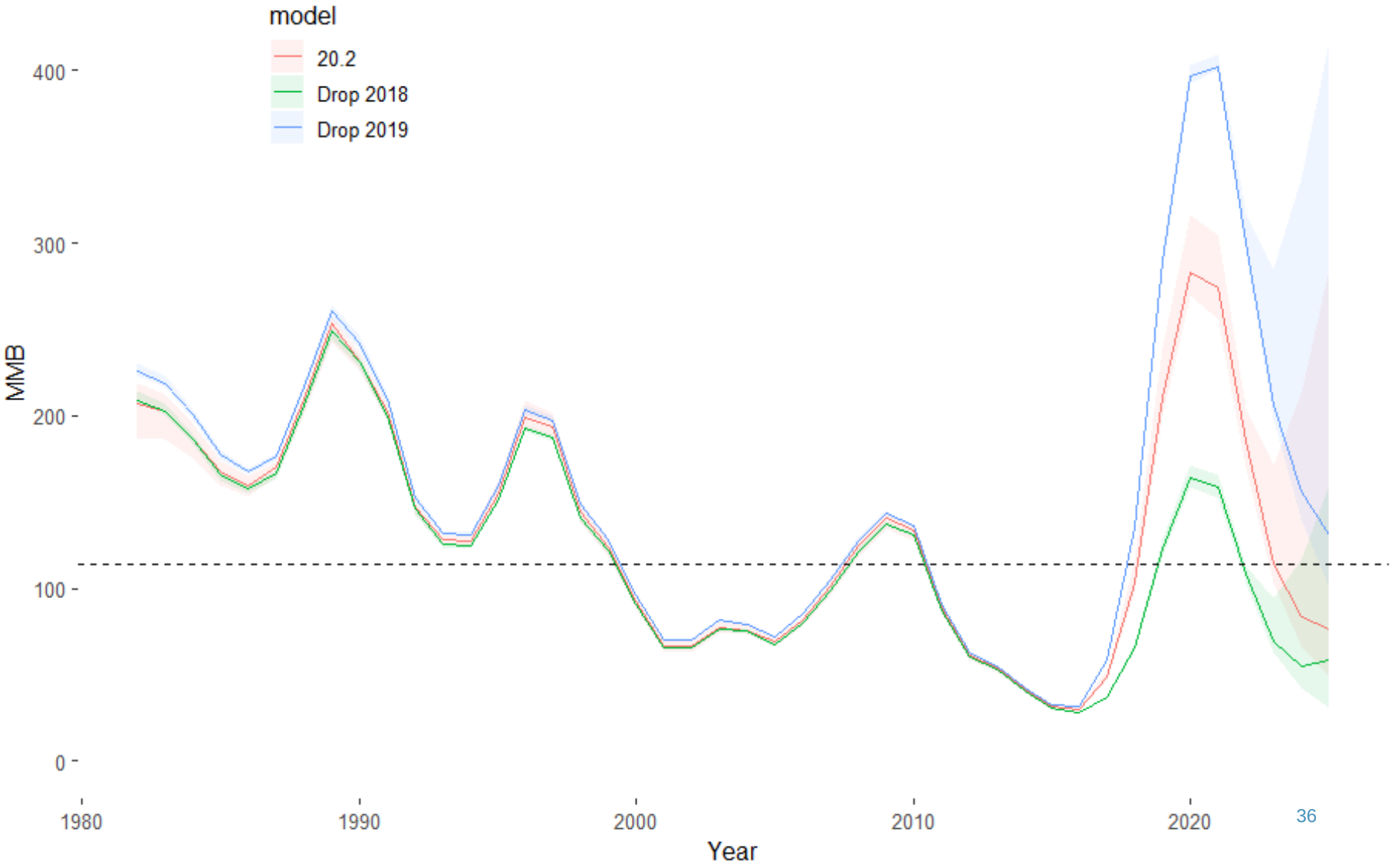
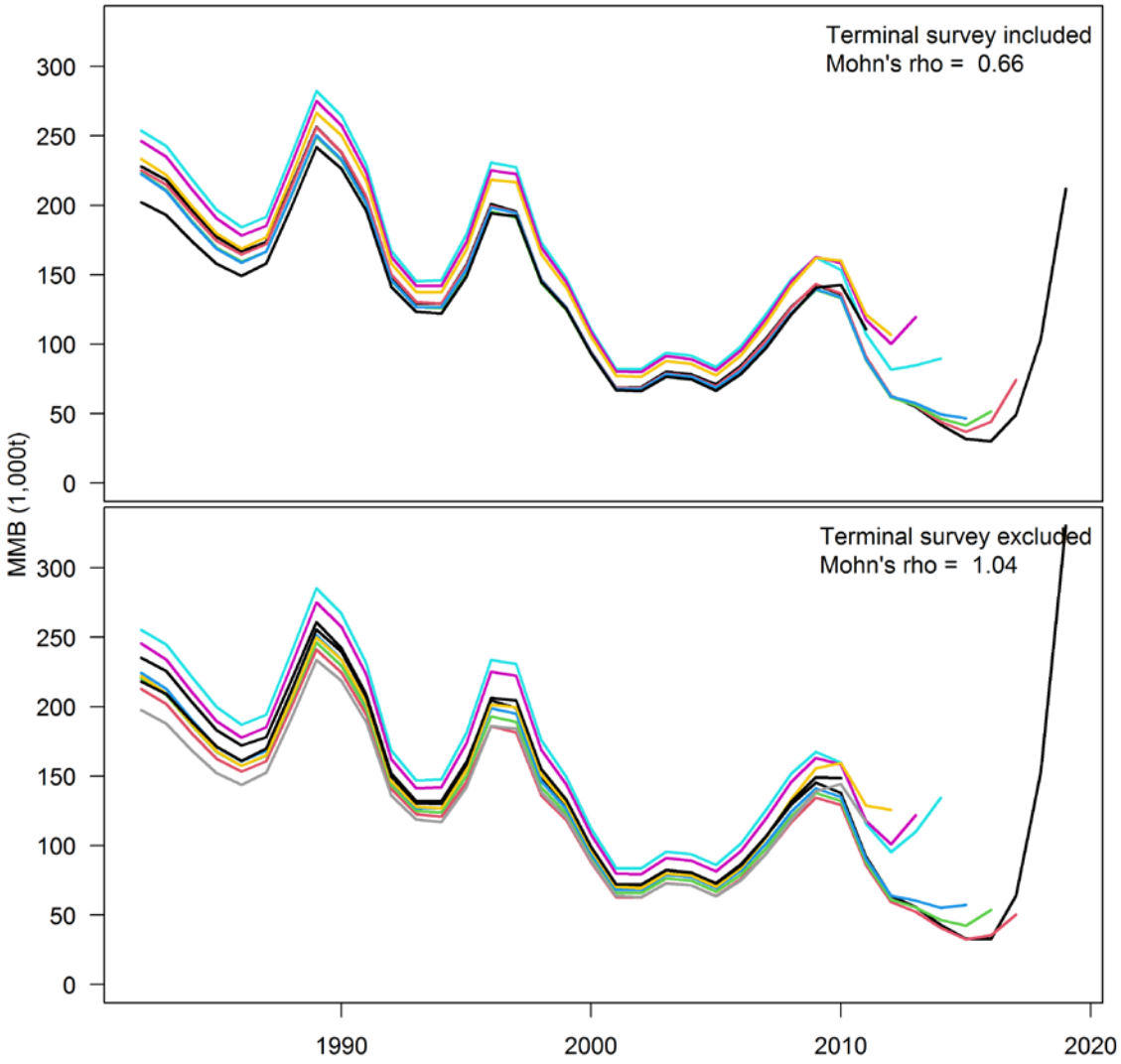

model
20.2
Drop 2018
Drop 2019
400
300
200
100
0
MMB
1980
1990
2000
2010
2020
Year

Table 1: Changes in management quantities for each scenario considered. Reported management quantities are derived from maximum likelihood estimates.

Model	MMB	B35	F35	FOFL	OFL
SQ 2019	109.56	123.71	1.80	1.80	54.05
SQ 2020	142.85	151.25	1.63	1.63	93.63
GMACS_2020	207.19	113.66	1.65	1.65	184.91
GMACS_no_2018	119.68	96.96	1.60	1.60	104.82
GMACS_no_2019	283.66	132.48	1.64	1.64	250.33

RETROSPECTIVE PATTERNS



SUMMARY OF CPT DISCUSSION ON ABC BUFFERS FOR SNOW CRAB

- Yearly buffer related to scientific uncertainty
  - 20% → 25%
  - Rationale:
    - Large positive retrospective pattern (20%)
    - New uncertainty in 2015 recruitment (5%)
- Additional buffer related to missing a survey
  - +25%
  - Rationale:
    - Increased positive retrospective pattern when excluding terminal year of survey resulted in 21% higher OFL on average (but with some years much higher than that)
    - Discrepancy in the 2018 and 2019 survey data—the most recent survey data indicated an unexpected drop in numbers and biomass
- Total CPT recommended ABC buffer: 50%

SNOW CRAB HARVEST SPECIFICATION TABLE

Year	MSST	Biomass (MMB)	TAC	Retained catch	Total catch	OFL	ABC
2015/2016	75.8	91.6	18.4	18.4	21.4	83.1	62.3
2016/2017	69.7	96.1	9.7	9.7	11	23.7	21.3
2017/2018	71.4	99.6	8.6	8.6	10.5	28.4	22.7
2018/2019	63	123.1	12.5	12.5	15.4	29.7	23.8
2019/2020	56.8	167.3	15.4	15.4	20.8	54.9	43.9
2020/2021		276.7				184.9	92.5

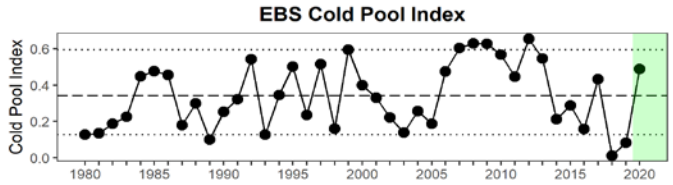
SMBKC

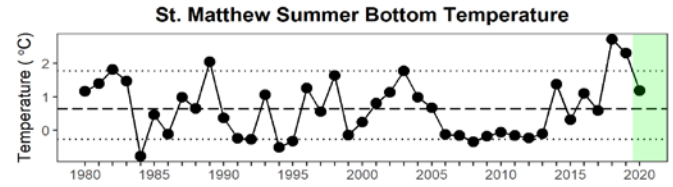
FINAL ASSESSMENT 2020

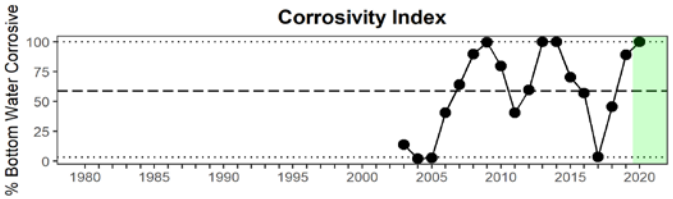
SAINT MATTHEW BLUE KING CRAB FINAL 2020 SAFE

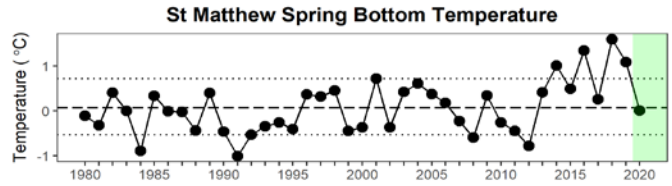
- ESP update for SMBKC
- Stock assessment
- CPT discussion of ABC buffers for SMBKC

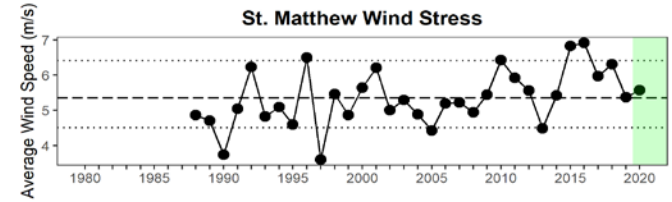
SMBKC ECOSYSTEM INDICATOR TIME SERIES

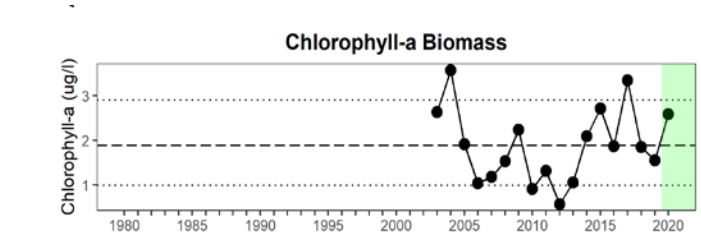


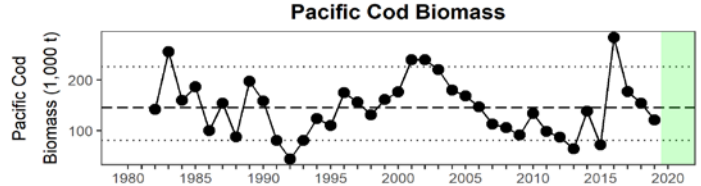


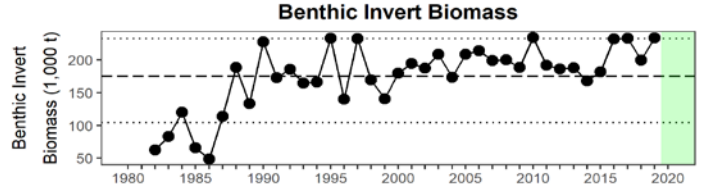


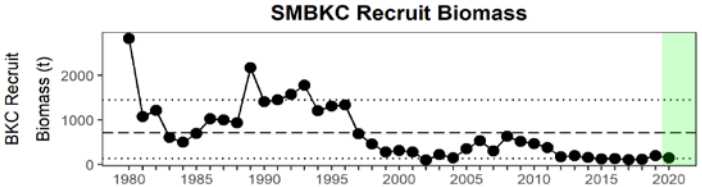












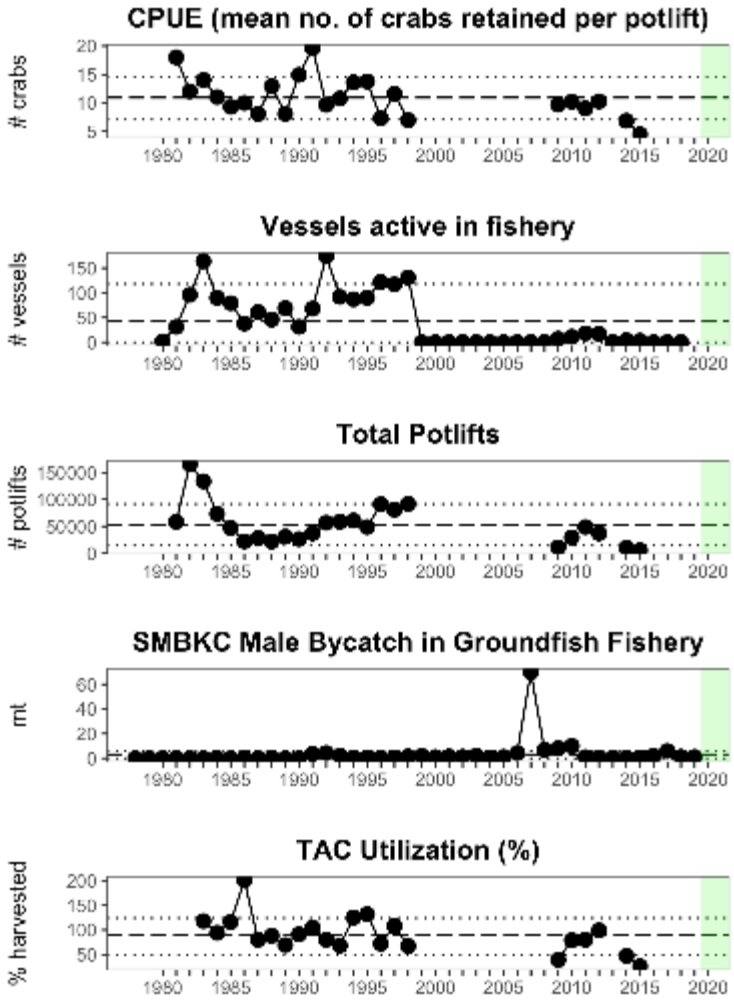
STAGE 1 INDICATOR ANALYSIS: TRAFFIC LIGHT TEST FOR ECOSYSTEM INDICATORS

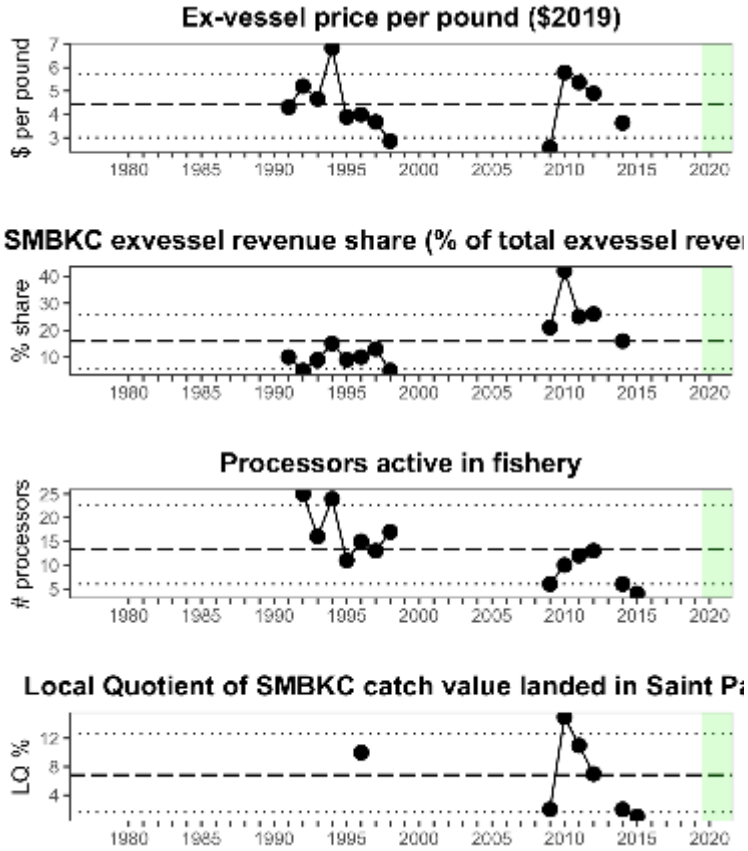
Title	Description	Recent
Cold Pool Index	Fraction of the EBS BT survey area with bottom water less than 2°C on 1 July of each year from Bering10K ROMS model output hindcasts	●
Summer Bottom Temperature	Average of June-July bottom temperatures (° C) within the SMBKC management boundary from the Bering 10K ROMS model output hindcasts	●
Corrosivity Index	Percent of the SMBKC management area containing an average bottom aragonite saturation state of < 1 from Feb-April	+
Spring Bottom Temperature	Average of Feb-March bottom temperatures (° C) within the SMBKC management boundary from the Bering 10K ROMS model output hindcasts	●
Wind Stress	June ocean surface wind stress within the SMBKC management boundary. Product of NOAA blended winds and MetOp ASCAP sensors from multiple satellites	●
Chlorophyll-a Biomass	April-June average chlorophyll-a biomass within the St. Matthew region; calculated with 8-day composite data from MODIS satellites	●
Pacific cod biomass	Biomass (1,000t) of Pacific cod within the SMBKC management boundary on the EBS bottom trawl survey	●
Benthic invertebrate biomass	Combined biomass (1,000t) of benthic invertebrates within the SMBKC management boundary on the EBS bottom trawl survey	+
SMBKC Pre-recruit Biomass	Model estimates for SMBKC recruitment. Includes male crab (90-104 mm CL) that will likely enter the fishery the following year.	●

Ecosystem Considerations:

- Trend modeling for SMBKC ecosystem indicators revealed near-average conditions for SMBKC in 2020
- Persistent, corrosive bottom waters surrounding St. Matthew Island suggest potential impacts on shell formation, growth and survival of BKC

SMBKC SOCIOECONOMIC INDICATOR TIME SERIES





Title	Description	Recent
Vessels active in fishery	Annual count of crab vessels that delivered commercial landings of SMBKC to processors[1]	●
TAC Utilization	Percentage of the annual SMBKC TAC (GHL prior to 2005) that was harvested by active vessels, including deadloss discarded at landing.	●
Total Potlifts	Fishing effort, as measured by estimated number of crab pots lifted by vessels during the SMBKC fishery	+
CPUE	Fishing effort efficiency, as measured by estimated mean number of retained SMBKC per potlift	●
Ex-vessel price per pound	Commercial value per unit (pound) of SMBKC landings (as adjusted by CFEC to account for post-season adjustments to ex-vessel settlements), measured as weighted average value over all ex-vessel sales reported.	●
SMBKC ex-vessel revenue share	SMBKC ex-vessel revenue share as percentage of total calendar year ex-vessel revenue from all commercial landings in Alaska fisheries, mean value over all vessels active in SMBKC during the respective year.	●
Processors active in fishery	Total number of crab processors that purchased landings of SMBKC from delivering vessels during the calendar year.	-
Local Quotient of SMBKC landed catch in St. Paul	Ex-vessel value share of SMBKC landings to communities on St. Paul Island, as percentage of total value of commercial landings to St. Paul processors from all commercial Alaska fisheries, aggregate percentage over all landings during the respective year.	●
SMBKC Male Bycatch in Groundfish Fishery	Incidental bycatch biomass estimates of male SMBKC (tons) in trawl and fixed gear fisheries	●

STAGE 1 INDICATOR ANALYSIS: TRAFFIC LIGHT TEST FOR SOCIOECONOMIC INDICATORS

Socioeconomic Considerations:

- In the most recent open seasons, the active fleet has been reduced to 3-4 vessels, with TAC utilization also declining to 26% during the 2015/16 season.

- Ex-vessel revenue share and the Local Quotient for Saint Paul both reached high values during 2010, concurrent with a peak in ex-vessel price.

- Large declines in both metrics over the subsequent open seasons, despite relatively high ex-vessel prices during the next four open SMBKC seasons indicate that both vessels and processors active during those years have shifted into other fisheries.

SMBKC MODEL APPROACH

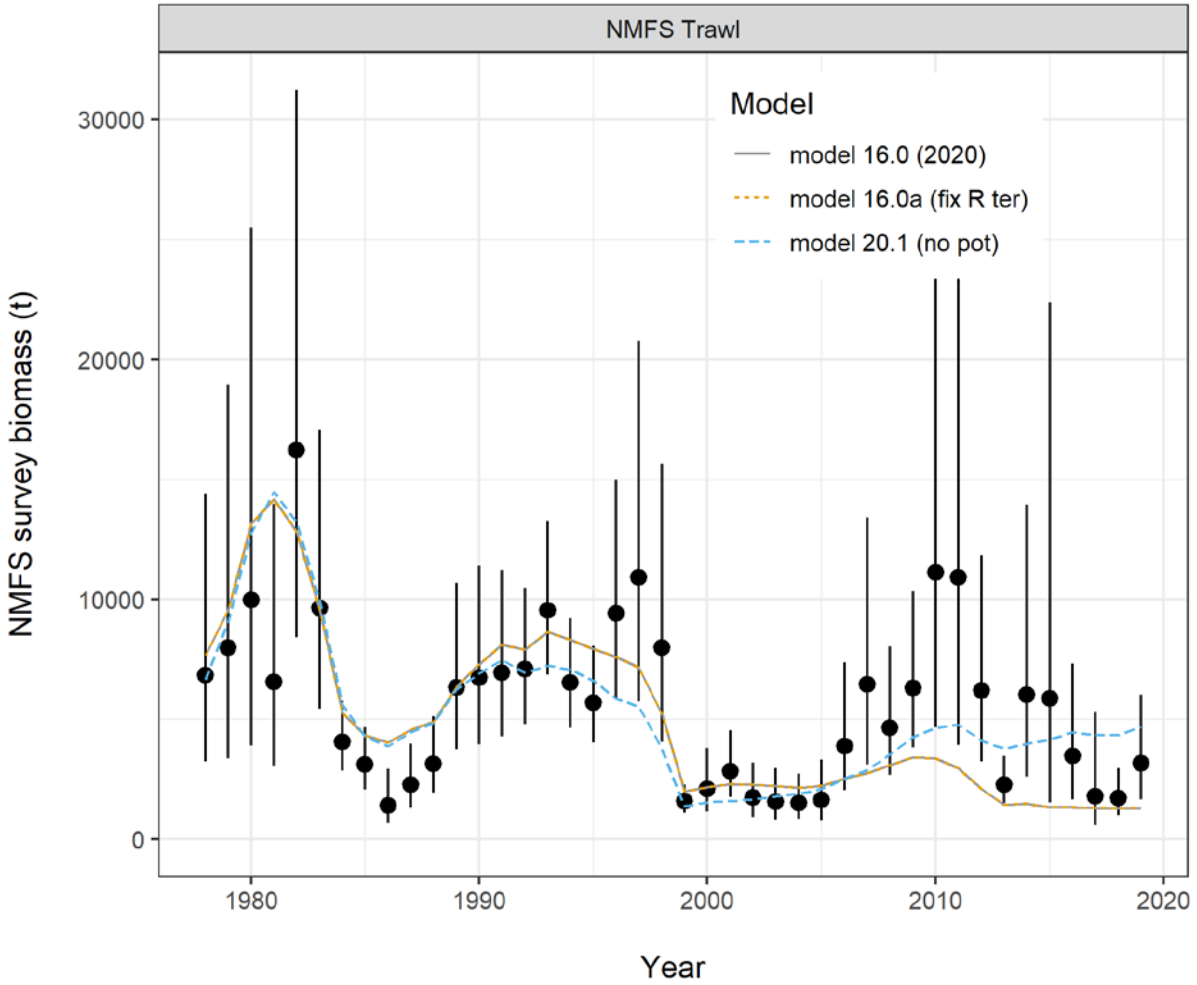
- Assessment has used GMACS since 2016
- Male only assessment
- Three size bins
- Fit to NMFS bottom trawl survey and ADF&G pot survey

16.0 – 2020 Reference Model

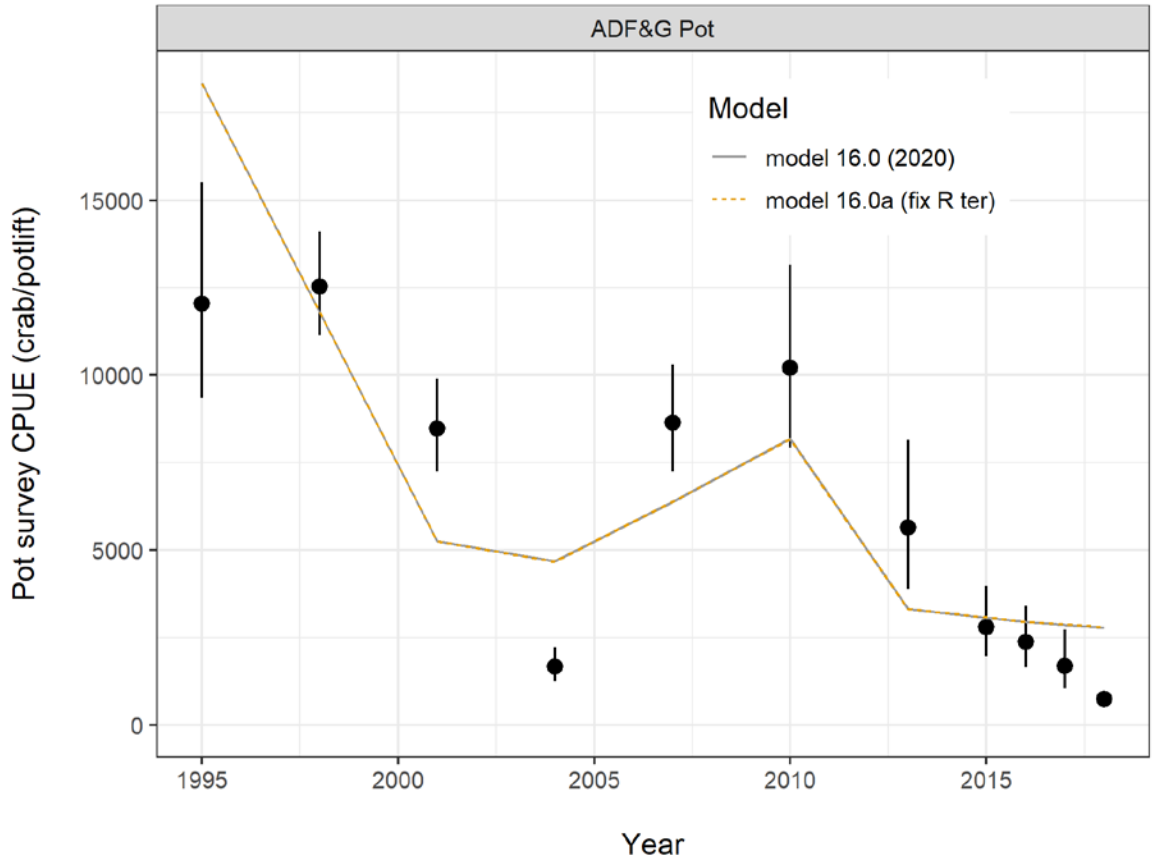
- 2019 accepted model updated with 2010 – 2019 groundfish bycatch

CPT agreed with the assessment author's recommendation of 16.0 as the preferred model

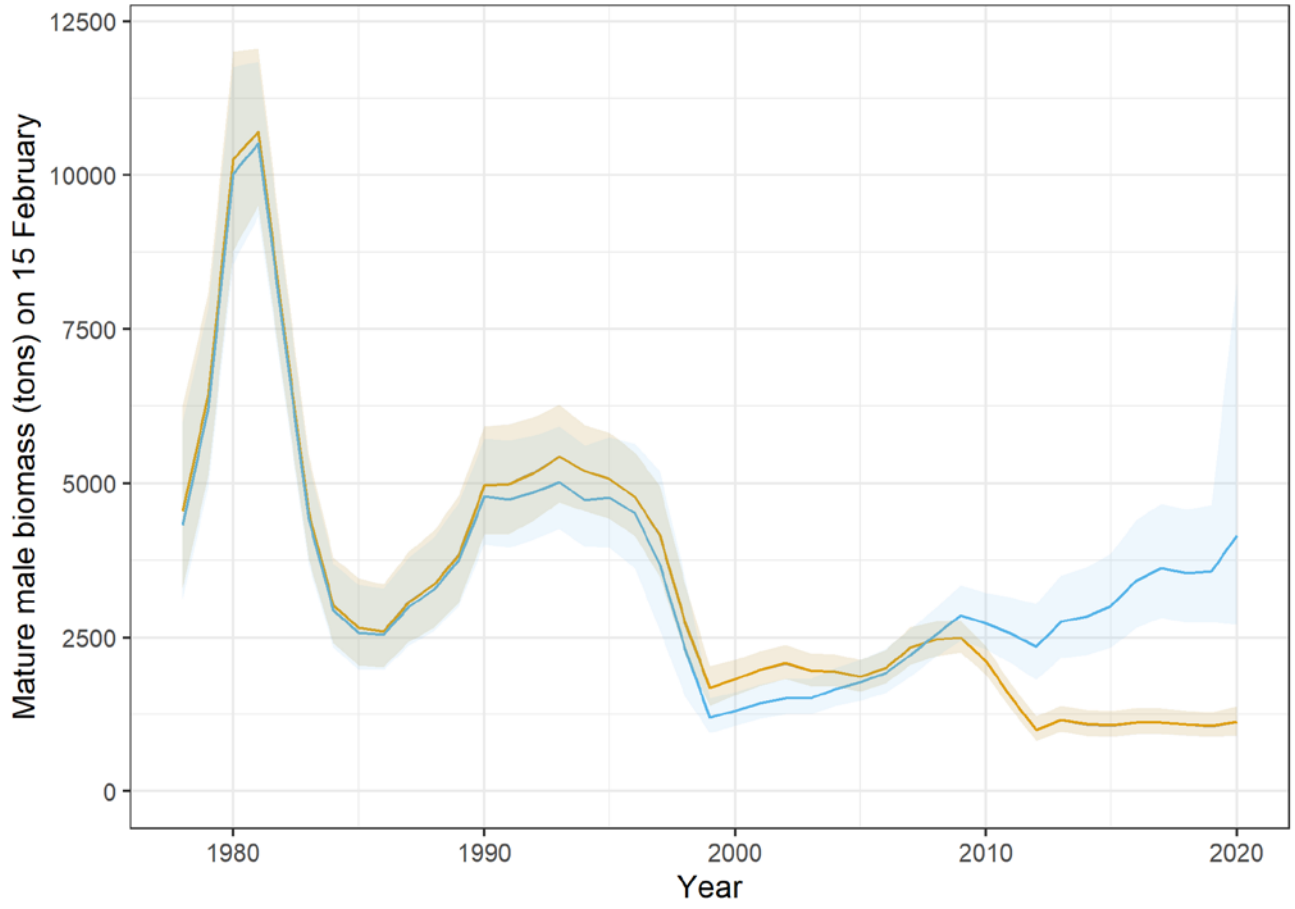
FIT TO NMFS BOTTOM TRAWL SURVEY



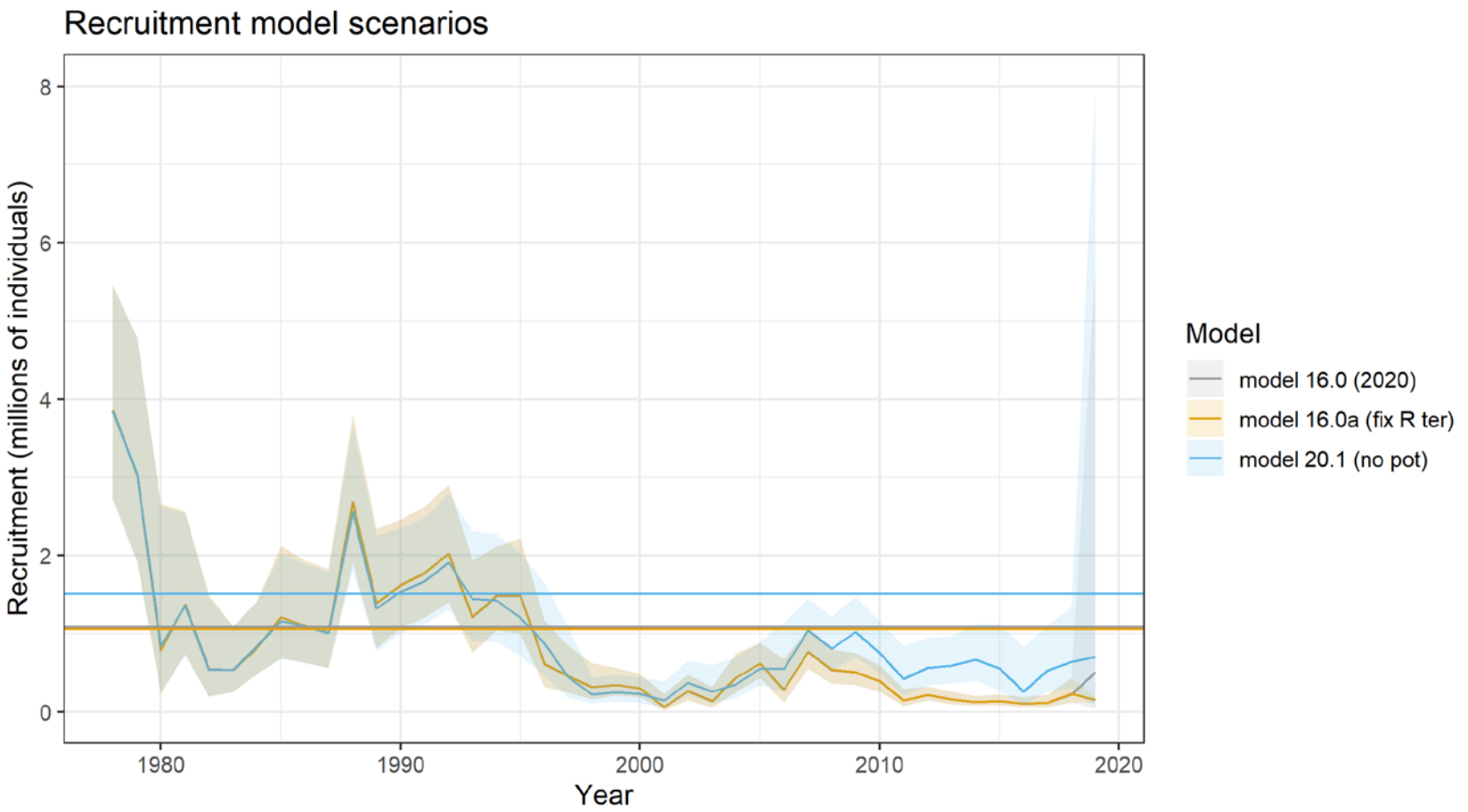
FIT TO ADF&G POT SURVEY



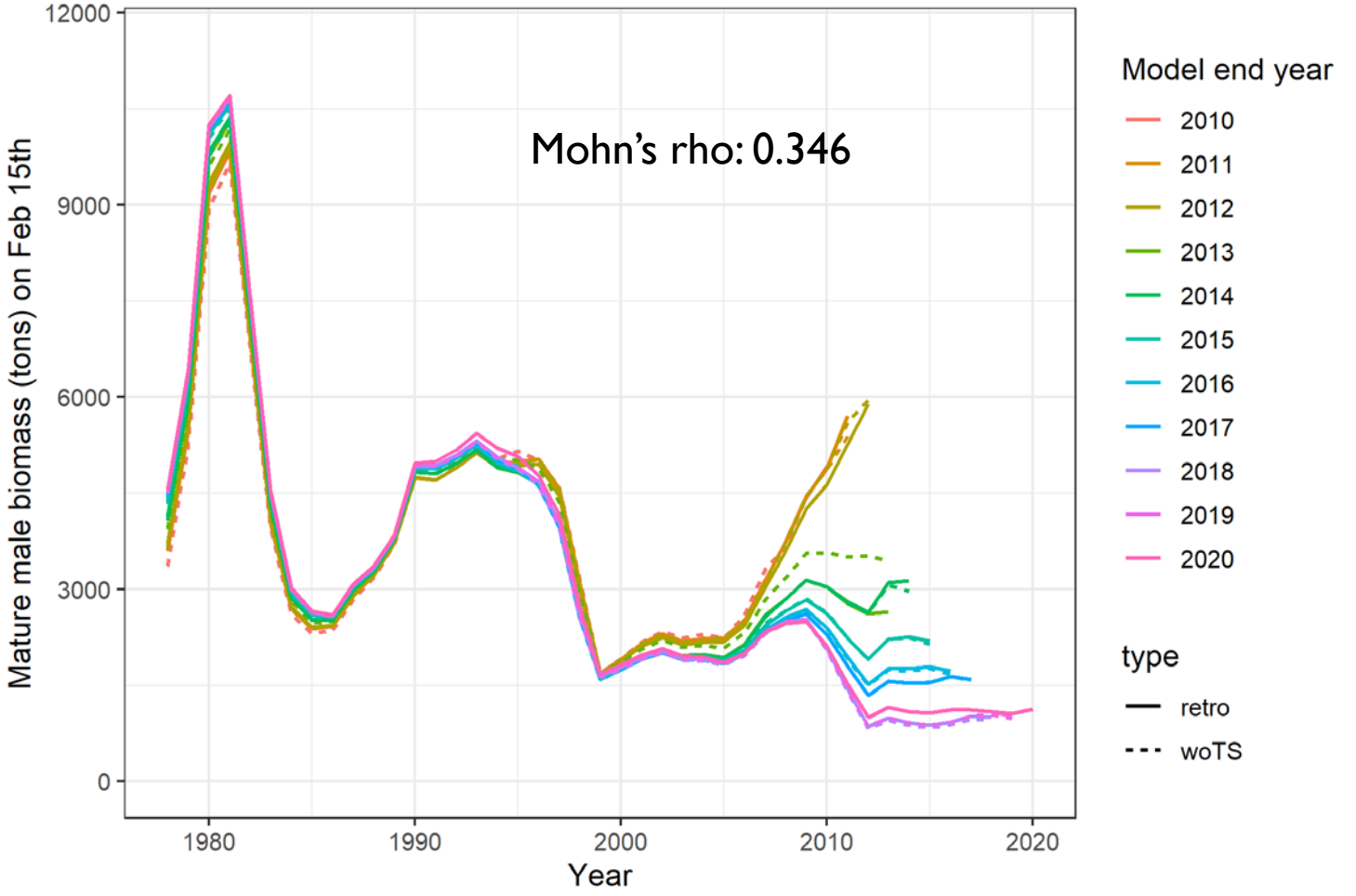
MATURE MALE BIOMASS



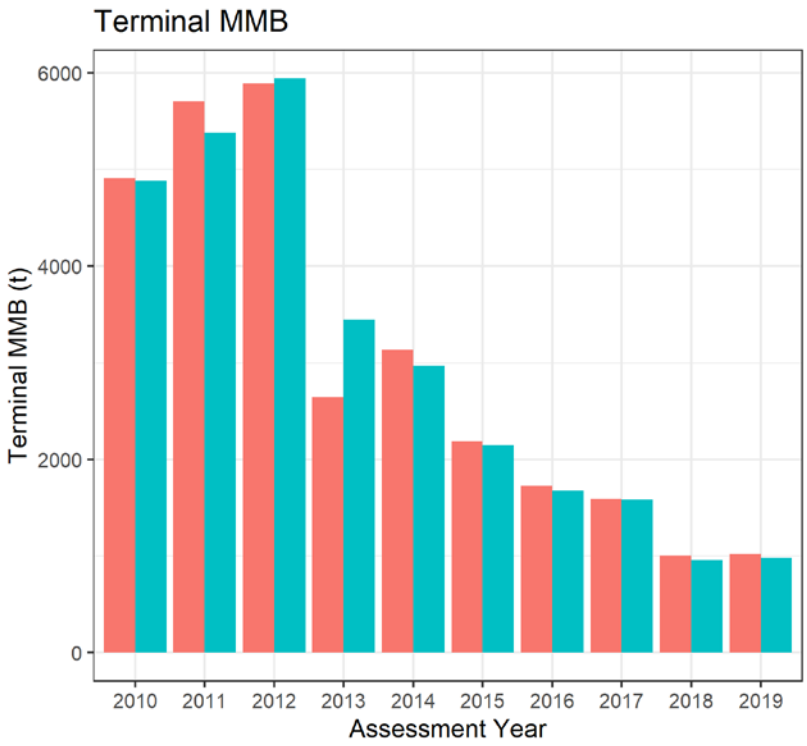
RECRUITMENT

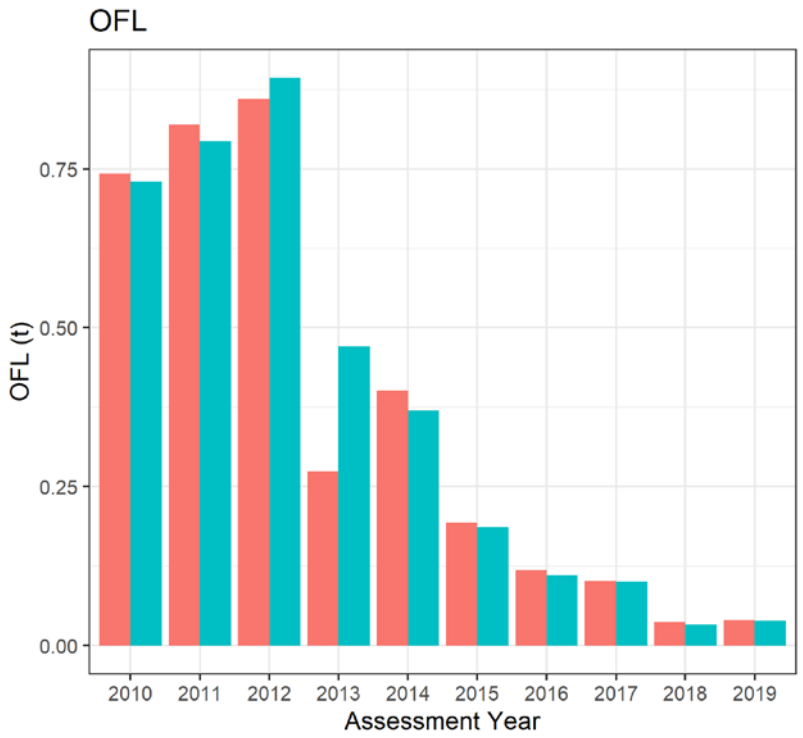


RETROSPECTIVE (MMB)- WITH & WITHOUT TERMINAL YEAR OF SURVEY DATA



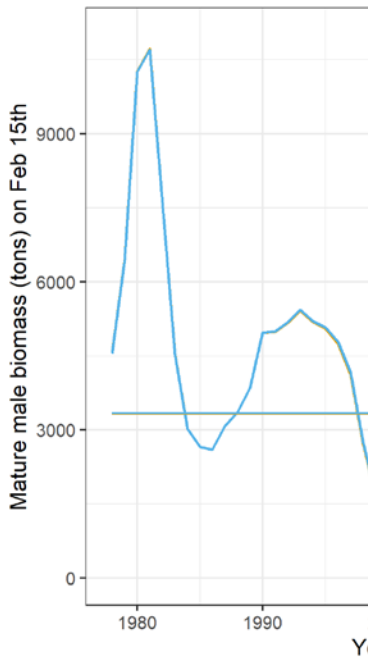
RETROSPECTIVE (MMB)- WITH & WITHOUT TERMINAL YEAR OF SURVEY DATA

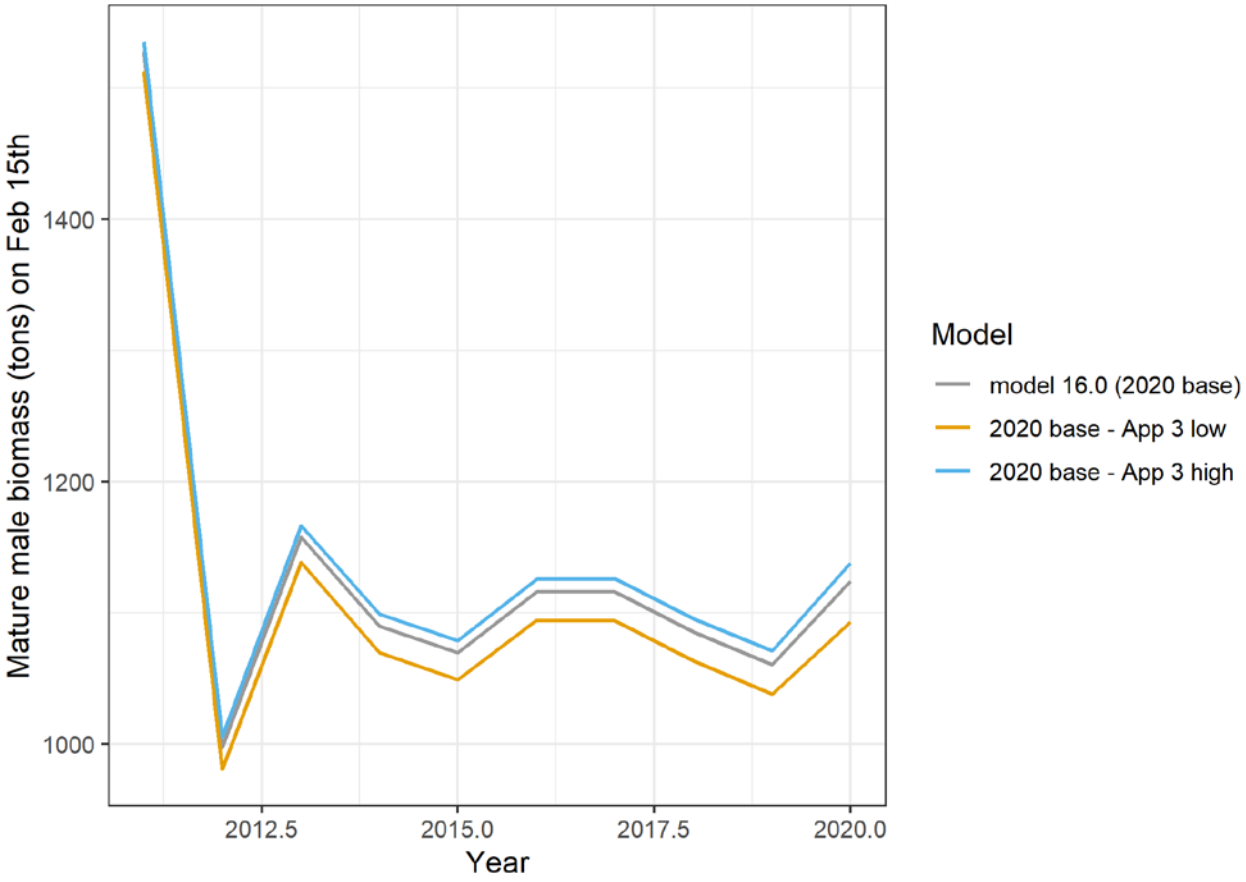




Type
Retrospective
MissingSurvey

APPROACH 3 – HIGH AND LOW 2020 SURVEY VALUES





BASED ON MODEL 16.0 (REFERENCE MODEL)

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

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2016/17	1.97	2.23	0.00	0.00	0.001	0.14	0.11
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				0.05	0.04

Table 2: Status and catch specifications (million pounds) for the reference model.

Year	MSST	Biomass (MMB_{mating})	TAC	Retained catch	Total male catch	OFL	ABC
2016/17	4.3	4.91	0.000	0.000	0.002	0.31	0.25
2017/18	4.1	2.85	0.000	0.000	0.007	0.27	0.22
2018/19	3.84	2.54	0.000	0.000	0.002	0.08	0.07
2019/20	3.68	2.34	0.000	0.000	0.002	0.096	0.08
2020/21		2.48				0.112	0.08

CPT DISCUSSION ON ABC BUFFERS FOR SMBKC

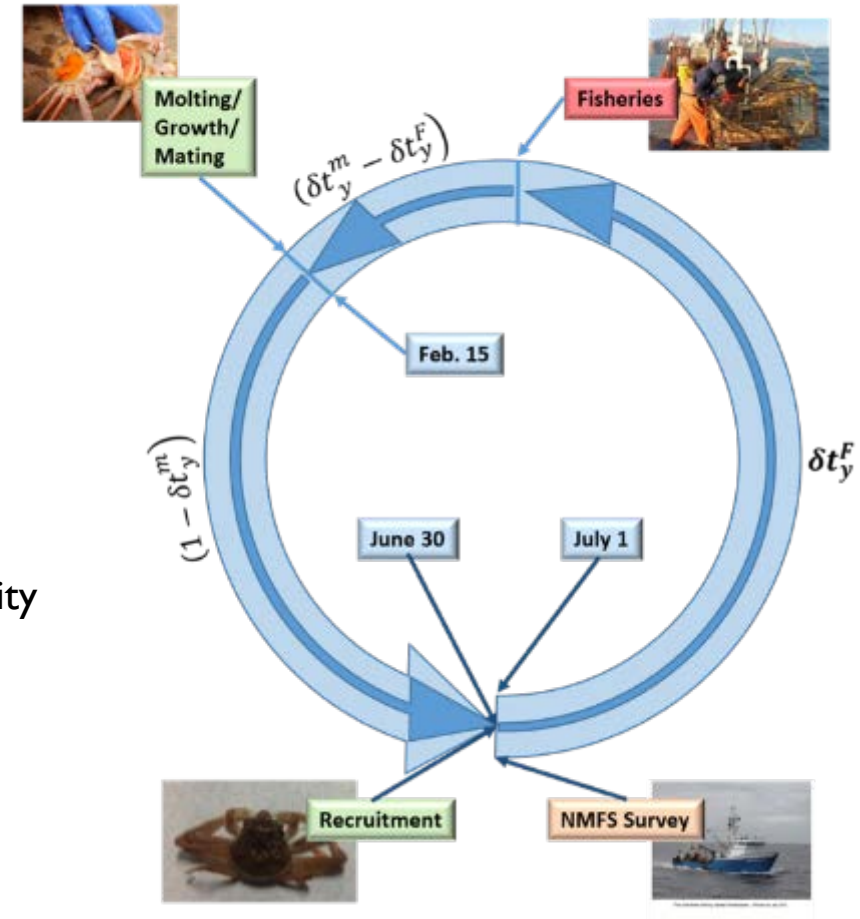
- SSC increased the buffer to 25% in 2017 to reflect concerns about the assessment and the fact that SMBKC is a data-limited assessment.
- Last year the buffer was mistakenly set at 20%.
- The assessment has a strong retrospective pattern, but it does not seem to be made much worse when a terminal year survey is missing
- The high/low 2020 survey sensitivity analysis indicated low to moderate sensitivity.
- The CPT recommends that the SSC continue to use a buffer of 25% to deal with assessment uncertainties. No additional buffer is recommended deal with the cancellation of the 2020 survey.

TANNER CRAB

FINAL ASSESSMENT 2020

TANNER CRAB STOCK ASSESSMENT MODEL

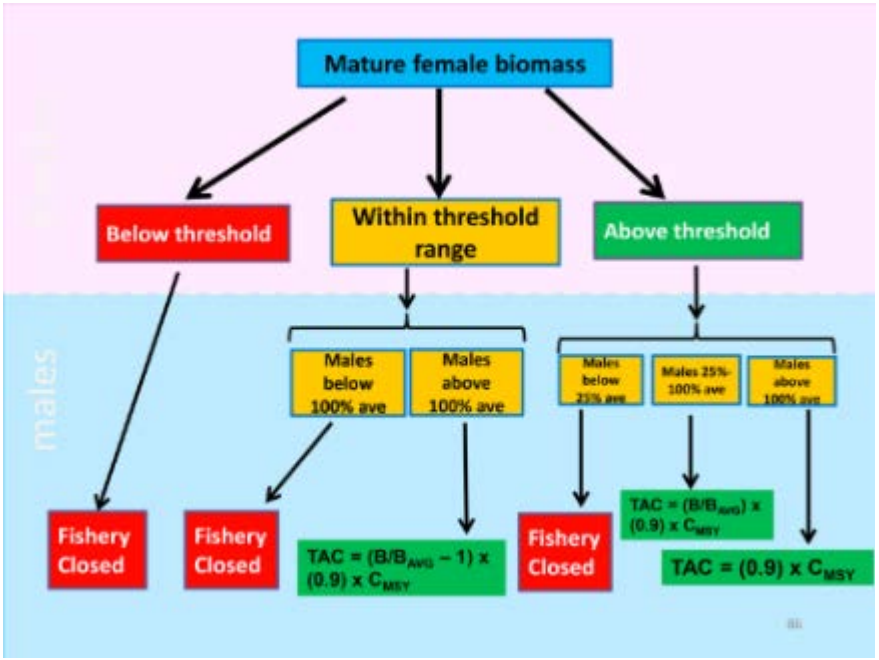
- TCSAM02 was endorsed by the SSC in 2017
- Model is structured by size, sex, shell condition, maturity state
- Model includes priors on natural mortality, smoothing penalties on recruitment and the proportion maturing
- sex-specific growth & maturity
- size-specific probability of terminal molt to maturity



STATE MANAGEMENT: NEW HARVEST CONTROL RULE

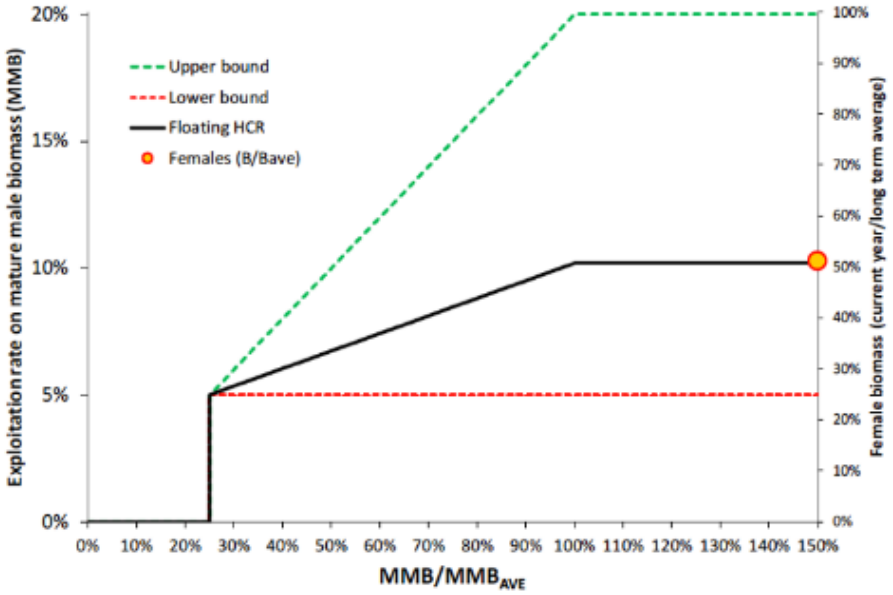
- Based on
  - BSFRF, ADFG, UW, AFSC cooperative research
  - Madi Shipley MS Thesis (successfully defended 9/11/20!!)
  - Daly et al., 2020

OLD



New!

2020 HCR

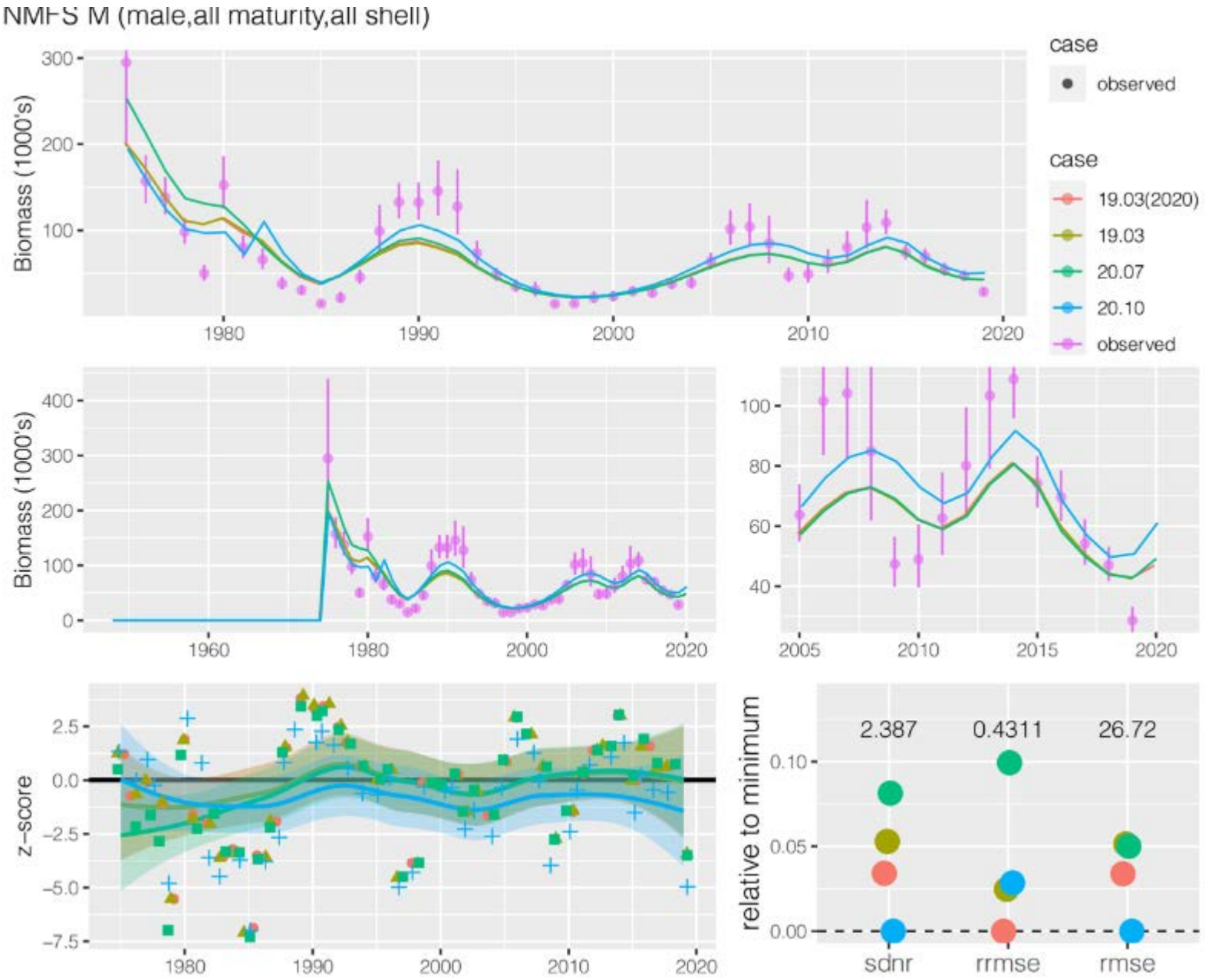


MODEL SCENARIOS

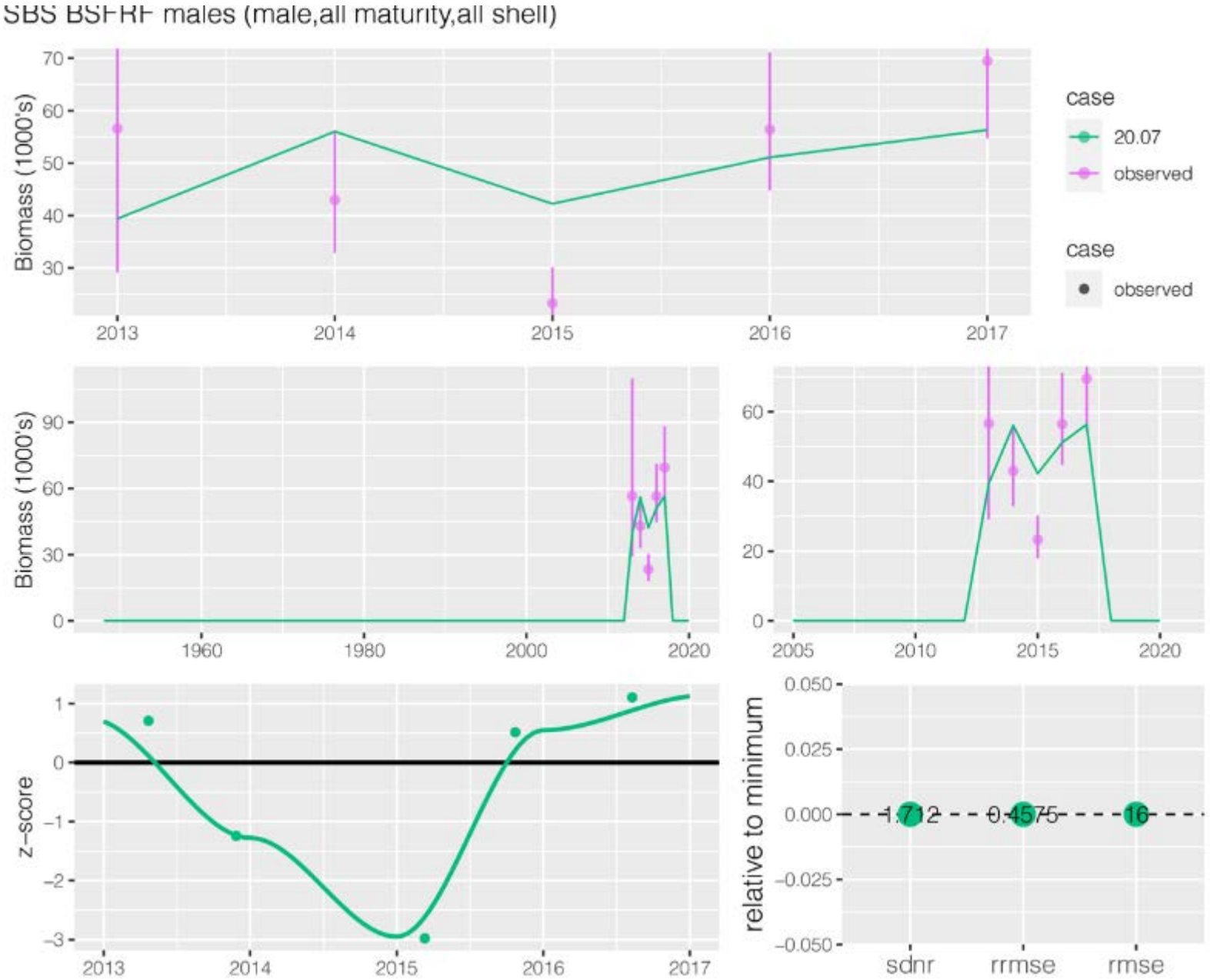
Assessment

- 3 scenarios evaluated for 2020 assessment
- 19.03(2020): updated 2019 assessment model
  - Bycatch data added for 2019/20
- New models use BSFRF side-by-side data
  - 20.07: fits BSFRF side-by-side data in the model
  - 20.10: fits to NMFS data only, catchability estimated outside the model using BSFRF side-by-side data
- **Author's preferred scenario was 20.07. The CPT agreed with the author.**
  - Includes BSFRF SBS data to establish scale
  - Fits to data similar to base model
  - Slightly better retrospective patterns

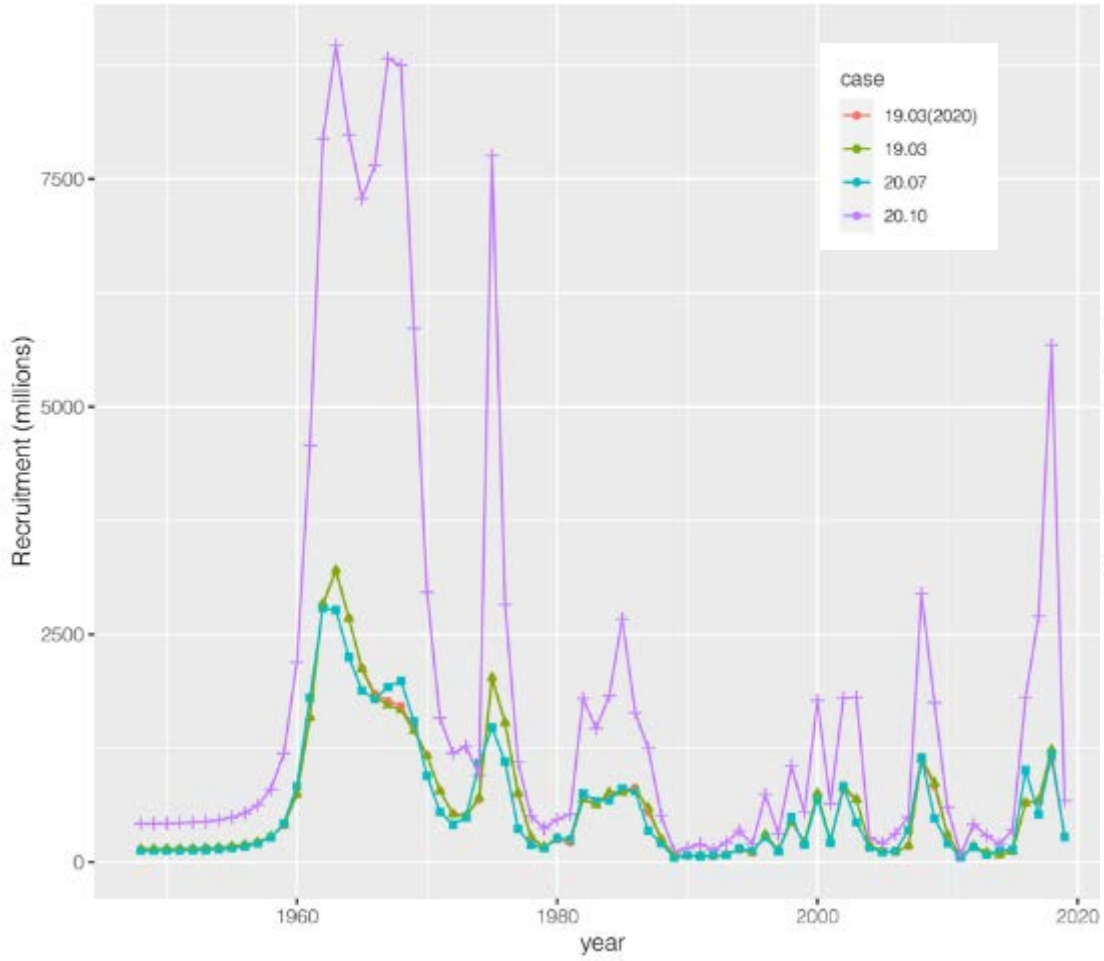
Model Evaluation: Fits to NMFS Survey Biomass

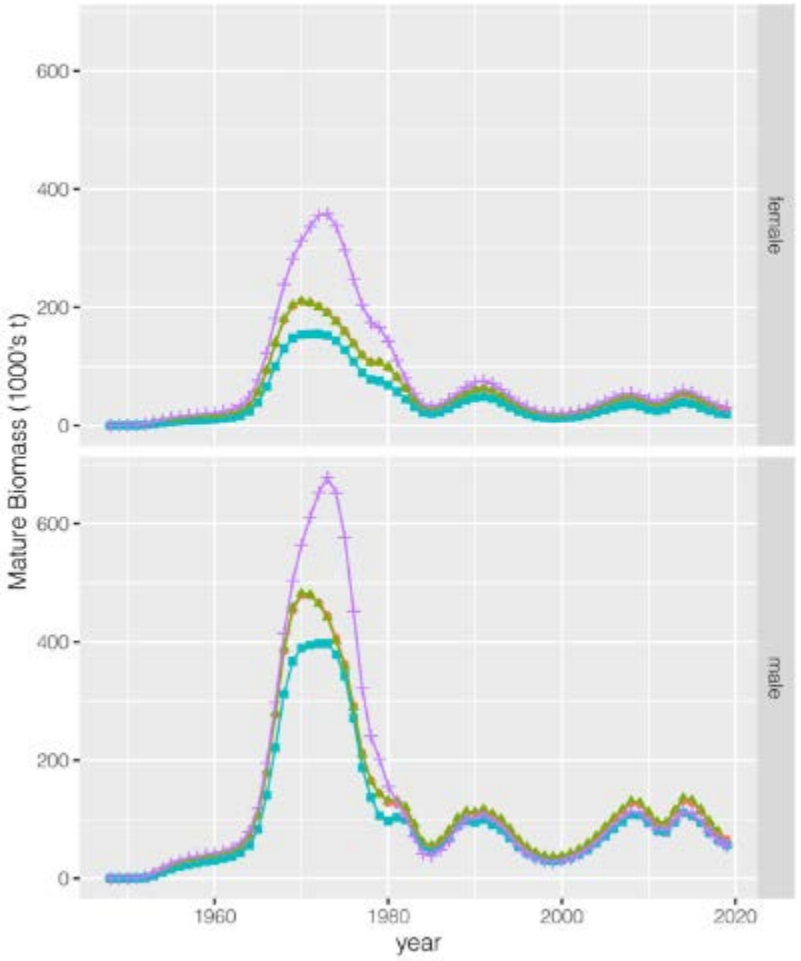


Model Evaluation: Fits to BSFRF SBS Survey Biomass



Model Evaluation: Trends in Recruitment and Mature Biomass

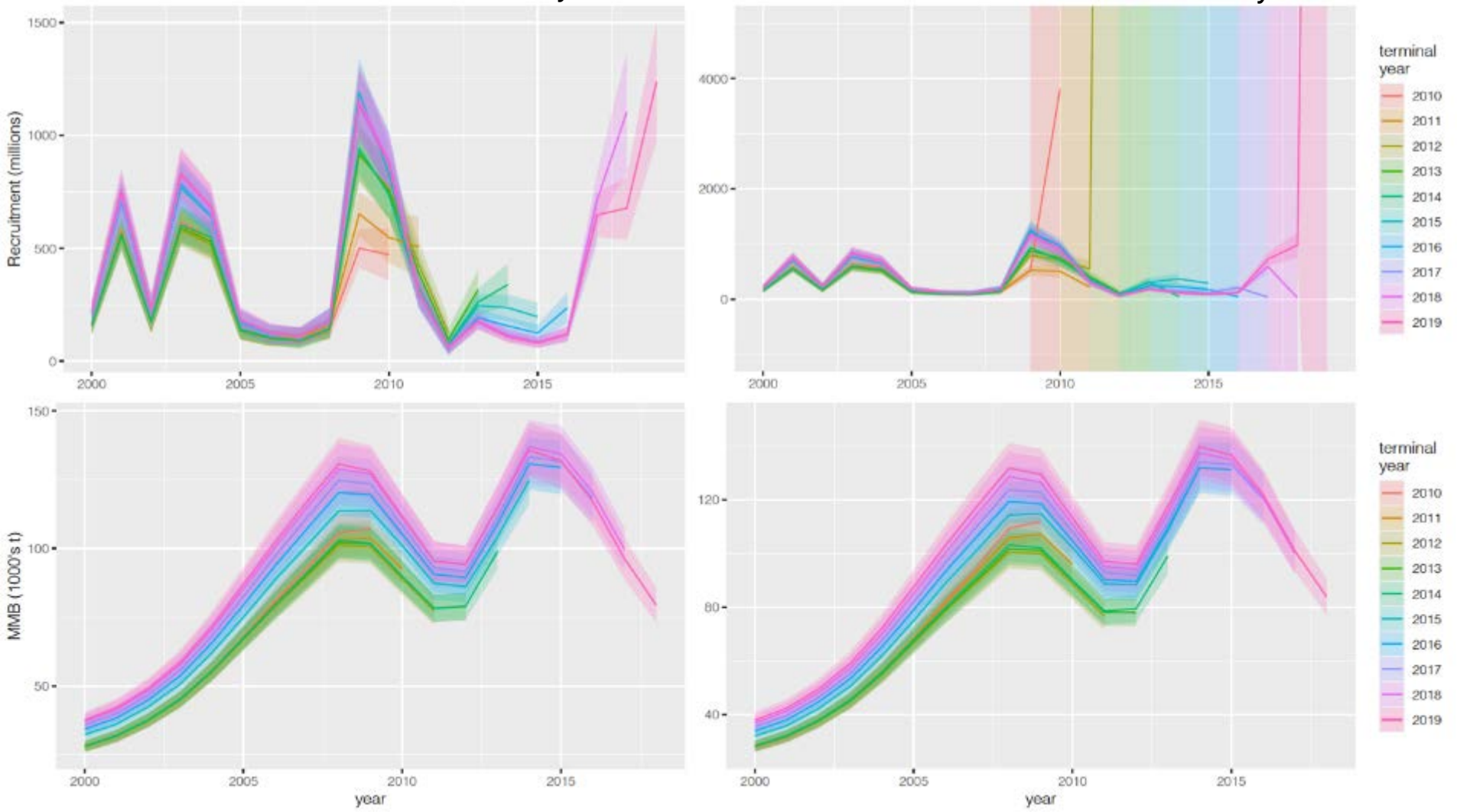




Missing Survey Uncertainty: 19.03 Retrospective Analysis

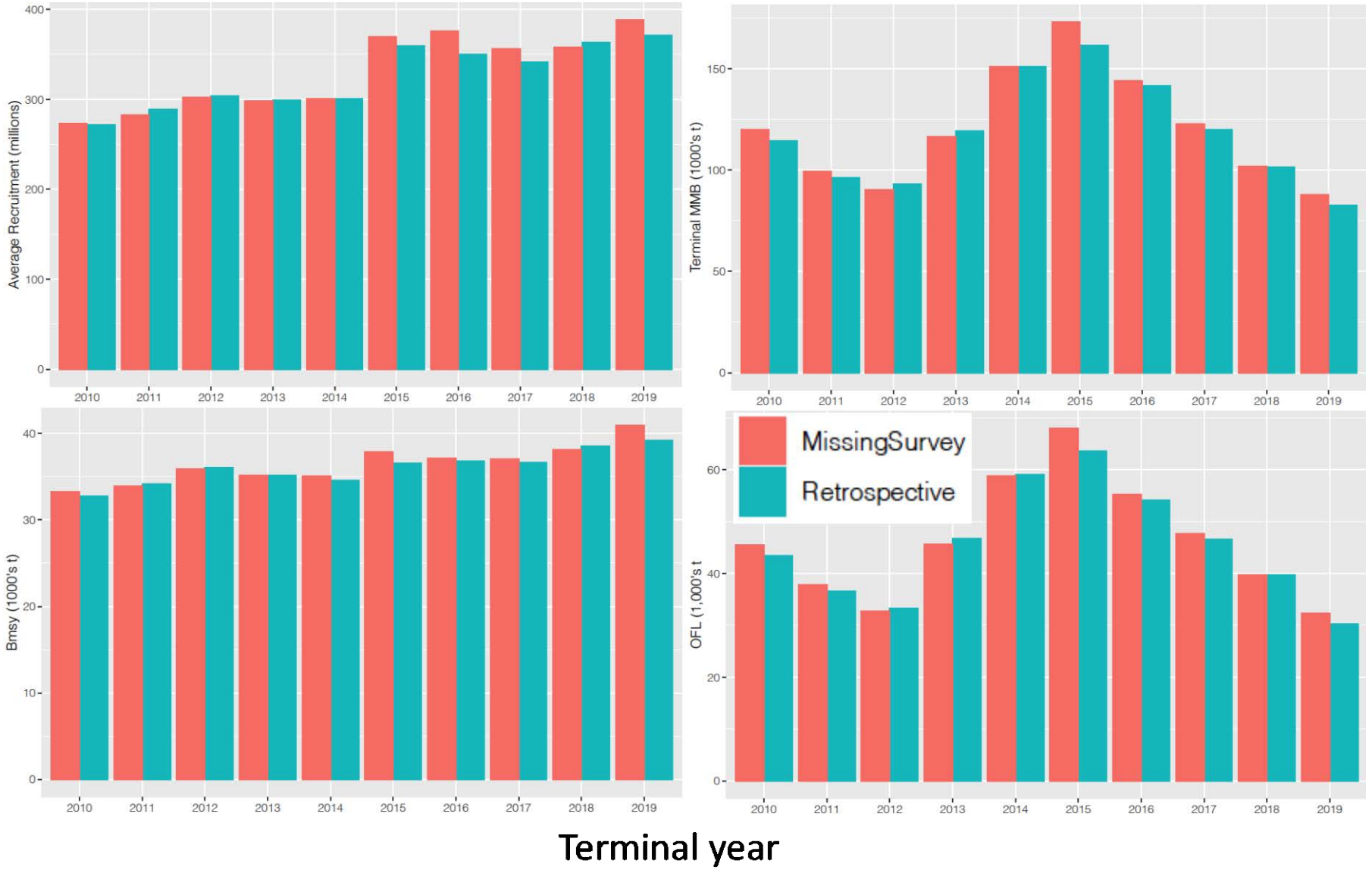
With Terminal Year Survey

Without Terminal Year Survey

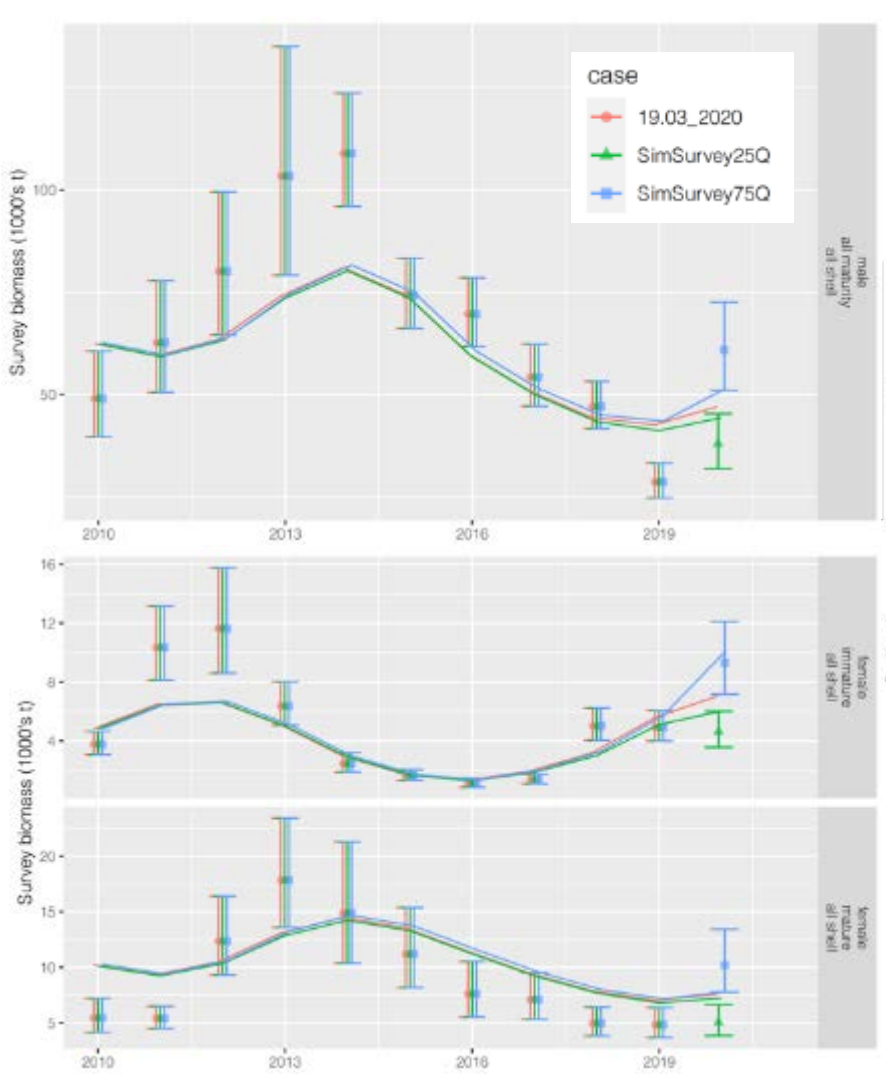


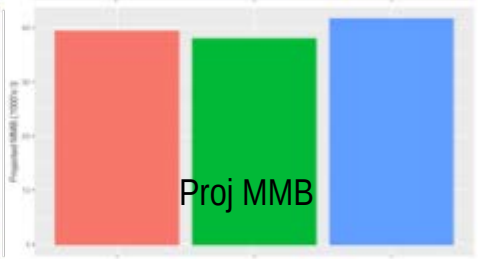
Missing Survey Uncertainty: Retrospective Without Terminal Year Survey

Recruitment averaging: 1982 – (terminal year-1)



Characterizing missing survey uncertainty: simulated 2020 survey





STATUS AND CATCH TABLE

- Author preferred scenario: 20.07
- Period for average recruitment: 1982-2019

20.07: MLE

units: 1000's t

Year	MSST	Biomass (MMB)	TAC (East + West)	Retained Catch	Total Catch Mortality	OFL	ABC
2016/17	14.58	77.96	0.00	0.00	1.14	25.61	20.49
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	18.38	56.15	0.00	0.00	0.54	28.86	23.09
2020/21		35.33				21.13	16.90

CPT DISCUSSION ON ABC BUFFERS FOR TANNER CRAB

- In 2019 the SSC identified poor model performance, such as parameters being hitting bounds and poor convergence properties, as the rationale for recommending that a 20% buffer continue to be used for Tanner crab.
- Although there have been some improvements to the model to address these issues, they are still present in current assessment.
- The CPT noted that retrospective patterns for Tanner crab were minimal and did not increase substantially when the terminal year survey was removed.
- An exception was the estimates of recruitment in the terminal year, which could fluctuate wildly when survey data were not available. This variation did not have management implications since recruiting crab are neither mature nor legal sized.
- The sensitivity analysis with a high and a low hypothetical 2020 survey did not indicate high sensitivity in estimates of the OFL and mature male biomass.
- The CPT recommends that the SSC continue to use a buffer of 20% to deal with assessment uncertainties. No additional buffer is recommended to deal with the cancellation of the 2020 survey.

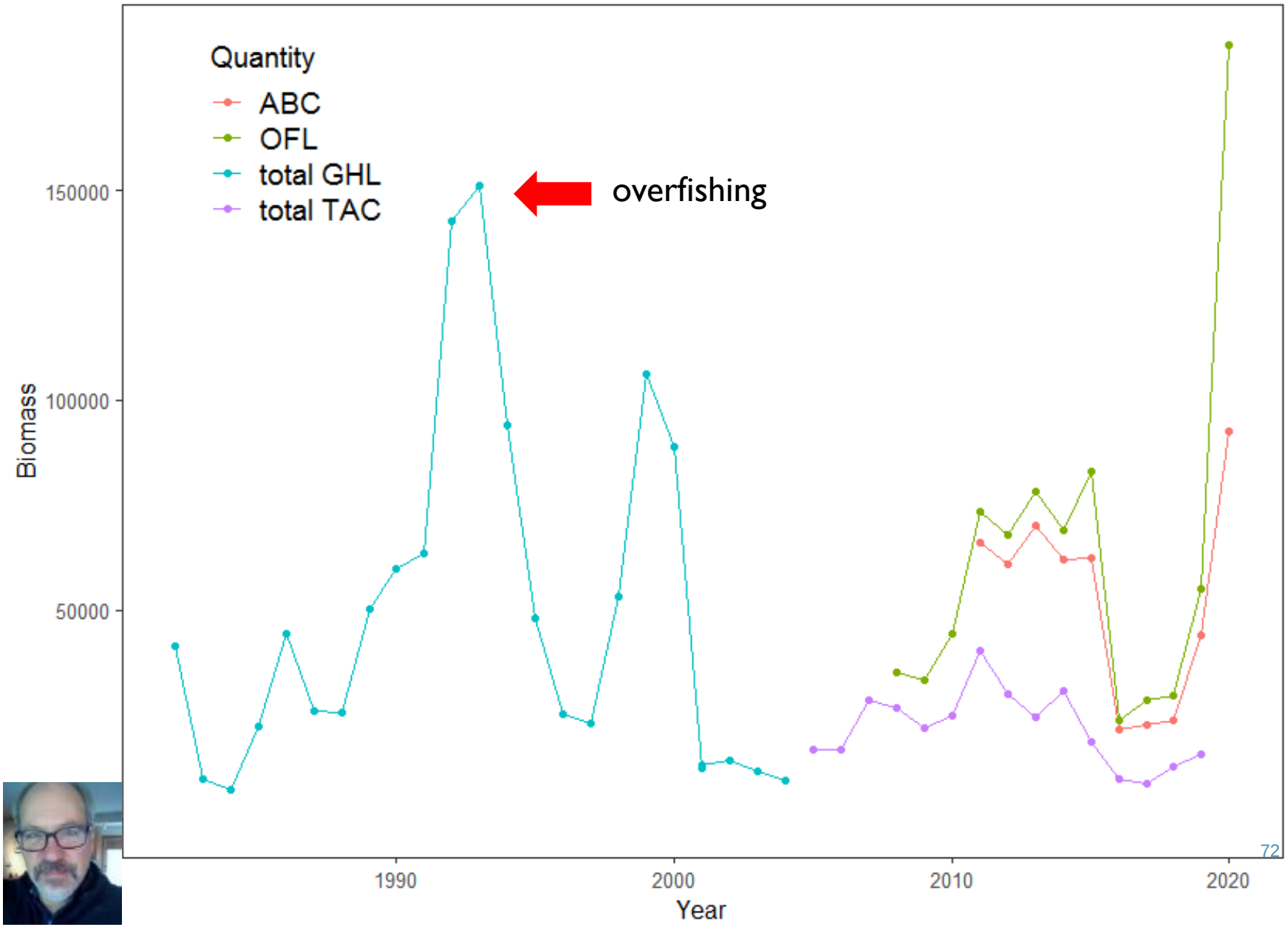
OVERFISHING STATUS UPDATES (OUT OF CYCLE STOCKS)

- WAIRKC (May 2020), PIBKC, PIRKC – closed to direct fishing
  - Total catch below ABC/OFL therefore NO OVERFISHING
- AIGKC (May 2020)
  - Fishery was not complete at May meeting so overfishing evaluated now
  - Total catch below ABC/OFL :: NO OVERFISHING
- PIGKC (May 2020)
  - Directed fishery confidential
  - Total catch below ABC/OFL:: NO OVERFISHING

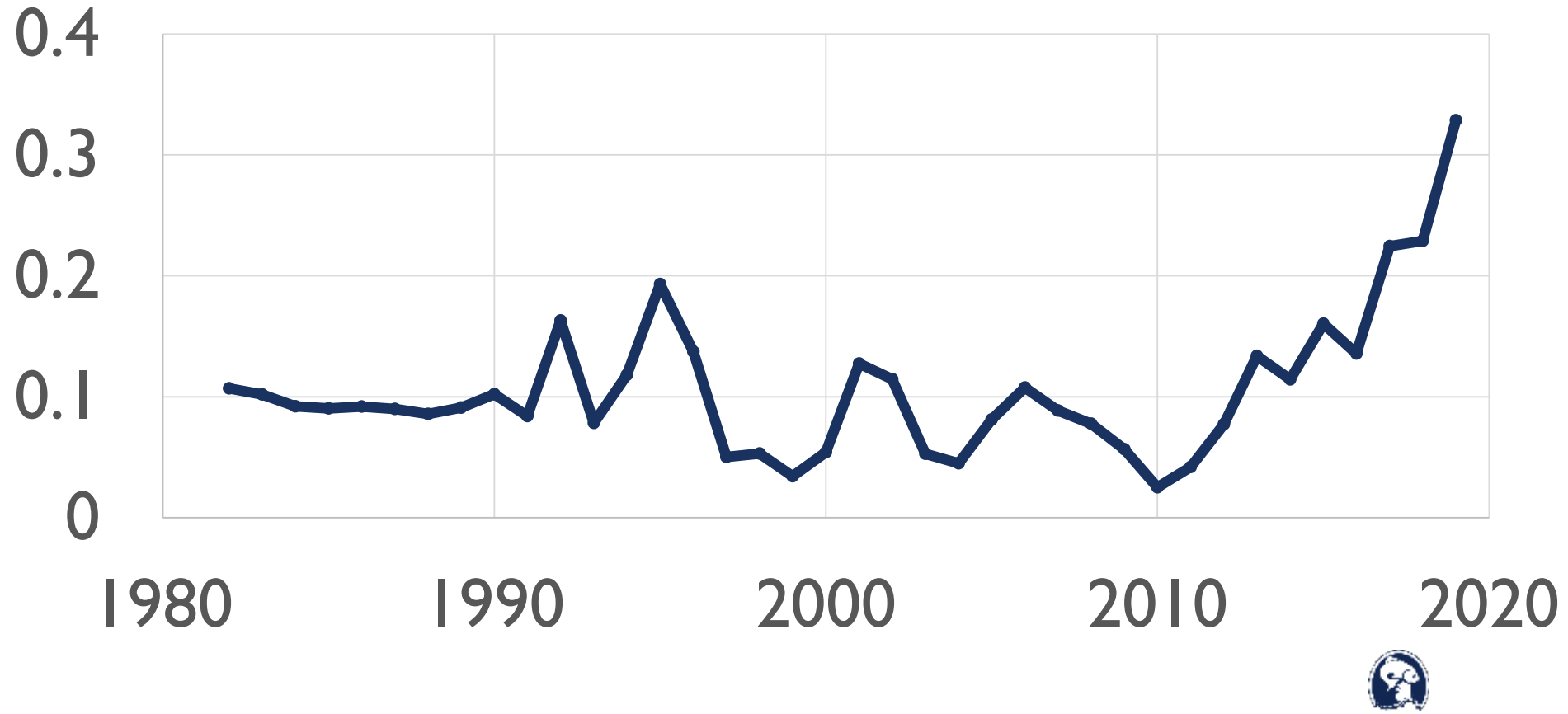
Stock	2019/20 ABC buffer	2020/21 proposed ABC buffer	Rationale	Status/ Trend in MMB	Uncertainty analysis results	Proposed additional 2020 buffer
BBRKC	20%	20%	- Overpredicting recent survey (18,19) - Cold pool distribution shifts - Align with other crab stocks - Long-term declining trend	0.59 / Down	Medium. Reduced ability to determine stock status; stock is close to overfished threshold	5%
Snow	20%	25%	- Model structure uncertainties (unexpected change in recent recruitment, i.e. 2015) - Retrospective patterns - Uncertainty around M - Discrepancy between 2018 and 2019 survey data - Specification of recruitment penalty	2.43 / Up	Strong positive retrospective bias, without survey overestimating OFL. Very sensitive to the terminal survey estimate	25%
SMBKC	20%	25%	- Overfished - Poor model fit to survey data - Data poor stock - Unfavorable environment	0.34 / Flat	Minimal. Recent years underestimate OFL without survey	none
Tanner	20%	20%	- Parameters hitting bounds - Poor convergence	0.96 / Stable (down slightly)	Minimal.	none

QUESTIONS?

- THANKS TO ALL CPT MEMBERS AND CPT ATTENDEES


Quantity
ABC
OFL
total GHL
total TAC
overfishing
150000
100000
50000
Biomass
1990
2000
2010
2020
Year

Discard biomass mortality / retained biomass



Preferred male (biomass t)			
	EBS	NBS	fraction
2010	87099	0	0.0%
2017	20617	38	0.2%
2018	27018	0	0.0%
2019	28955	739	2.5%

Legal male > 78mm (biomass t)			
	EBS	NBS	fraction
2010	134170	8	0.0%
2017	52272	75	0.1%
2018	130474	1195	0.9%
2019	175907	16503	8.6%