

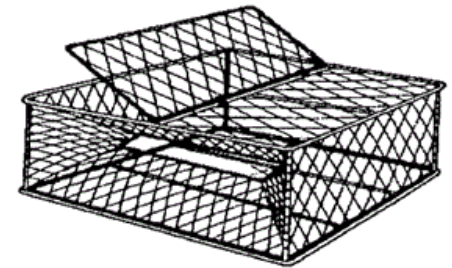
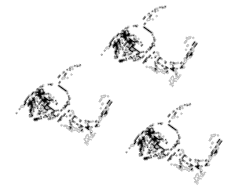
Crab Plan Team Report

Sept 16-20, 2019

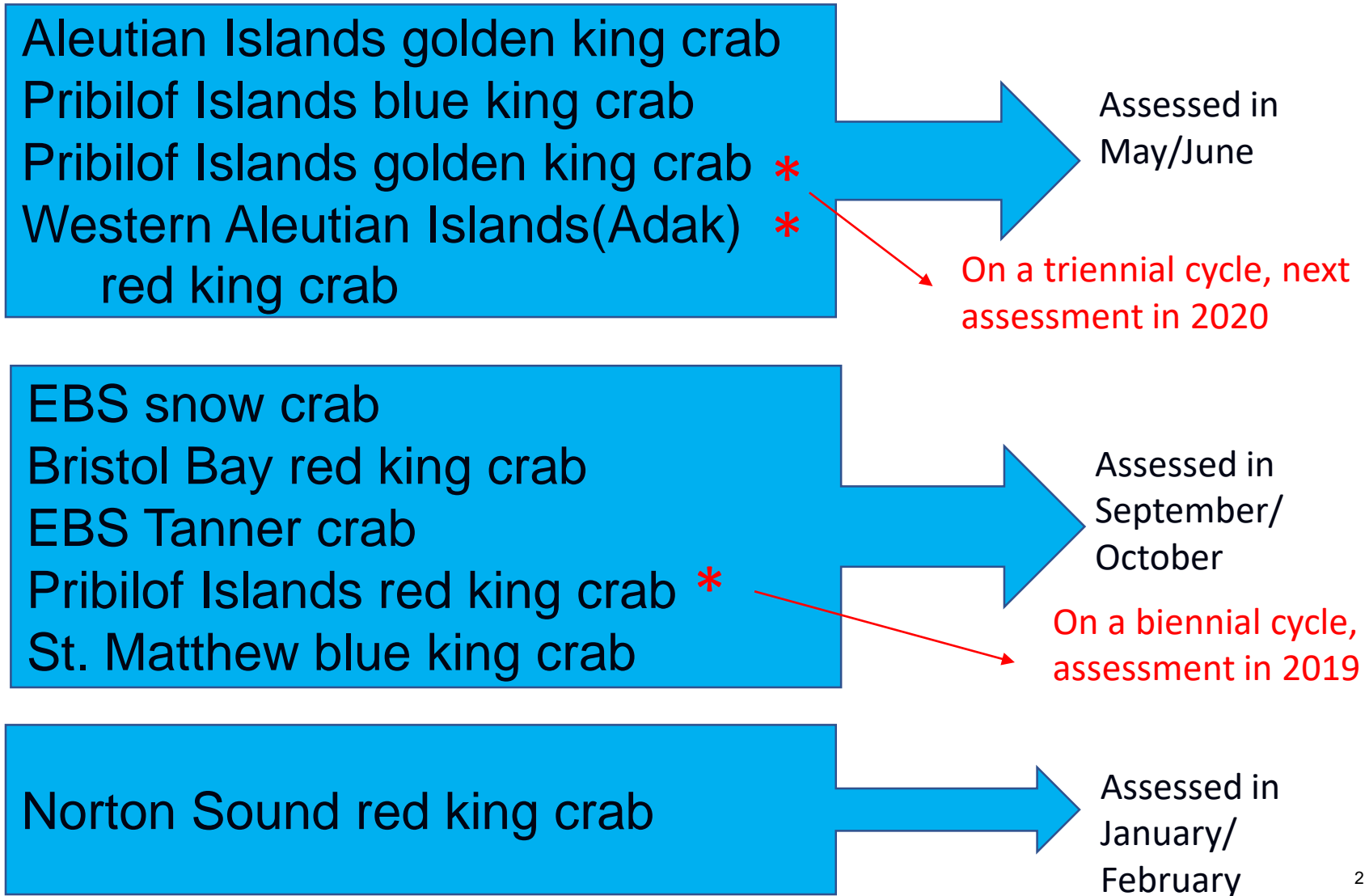
Seattle, WA

Membership:

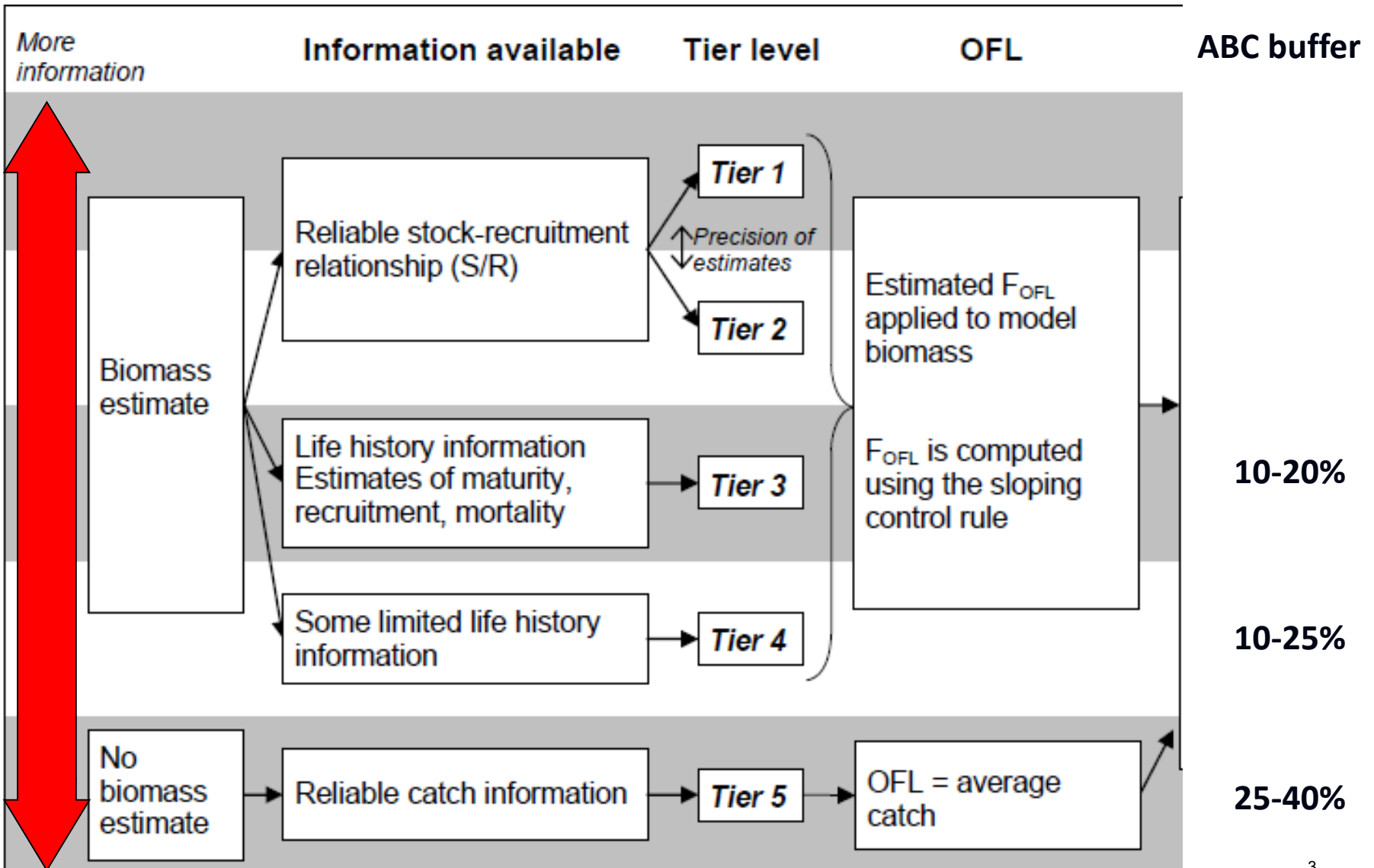
- Martin Dorn, Co-Chair (AFSC Seattle)
- Katie Palof, Co-Chair (ADF&G Juneau)
- Jim Armstrong, Coordinator (NPFMC)
- Bill Bechtol (UAF Homer)
- Ben Daly, (ADF&G Kodiak)
- Ginny Eckert (UAF Juneau)
- Brian Garber-Yonts (AFSC Seattle)
- Krista Milani (NMFS Dutch Harbor)
- Andre Punt (Uni. Wash.) Absent
- Shareef Siddeek (ADF&G Juneau)
- Cody Szuwalski (AFSC Seattle)
- William Stockhausen (AFSC Seattle)
- Miranda Westphal (ADF&G Dutch Harbor)
- Jie Zheng (ADF&G)
- Vacant (AFSC Kodiak)



BSAI Crab Stocks Management Timing



BSAI Crab Stocks Management



Crab Plan Team Report

- 2019 EBS and NBS survey report
- Recommend final OFL/ABCs
 - Bristol Bay Red King Crab
 - Tanner crab
 - St Matthew Blue King Crab
 - Ecosystem and socioeconomic profile
 - Rebuilding analysis
 - Snow crab
 - Pribilof Islands Red King Crab
- SAFE chapter updates
 - Pribilof Islands Blue King Crab
 - Western Aleutians Red King Crab
 - Pribilof Islands Golden King Crab
- Other agenda items not up for Council action



**NOAA
FISHERIES**

Alaska Fisheries
Science Center-
Kodiak Lab

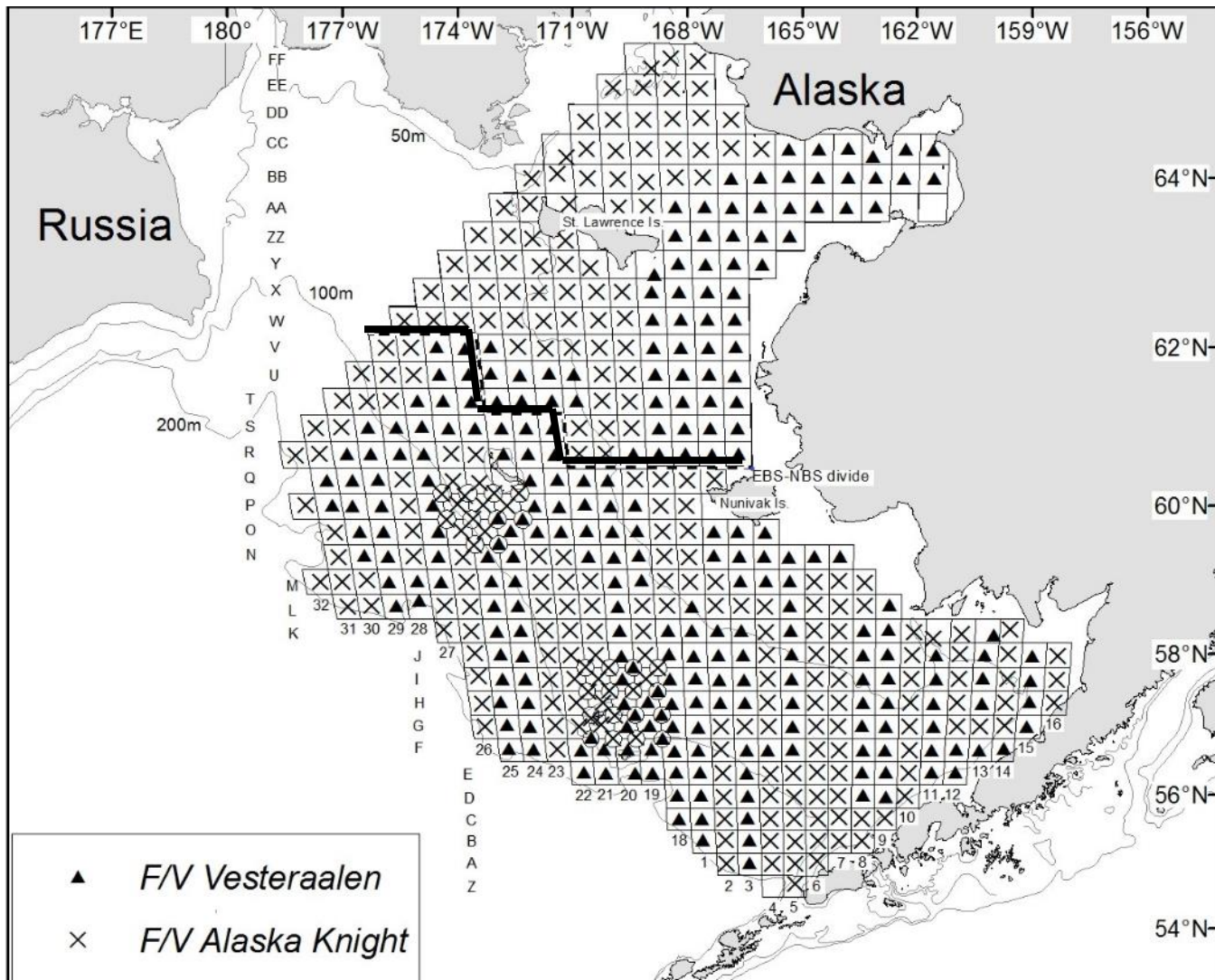
The 2019 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species

Jonathan Richar, Leah Zacher
AFSC SAP and GAP programs

Crab Plan Team
September 2019

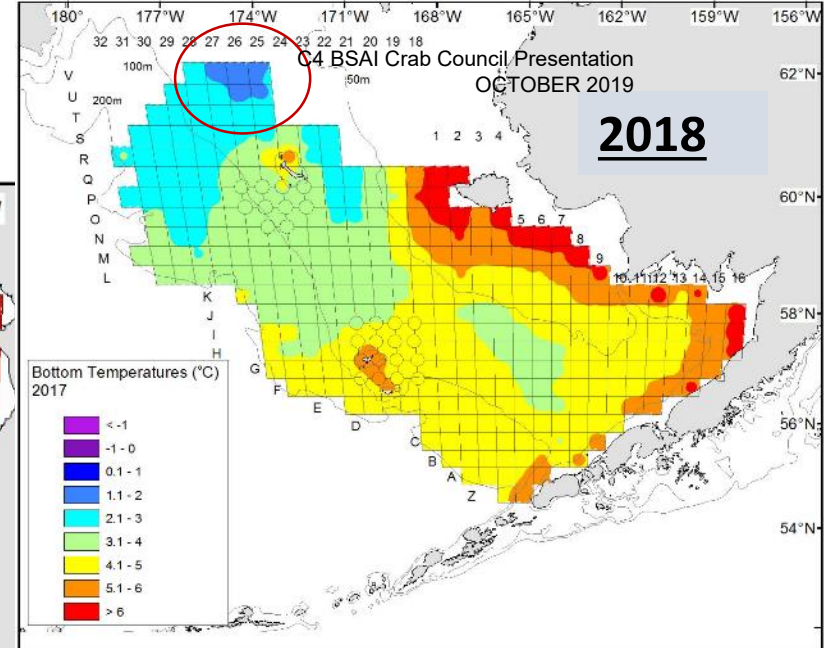
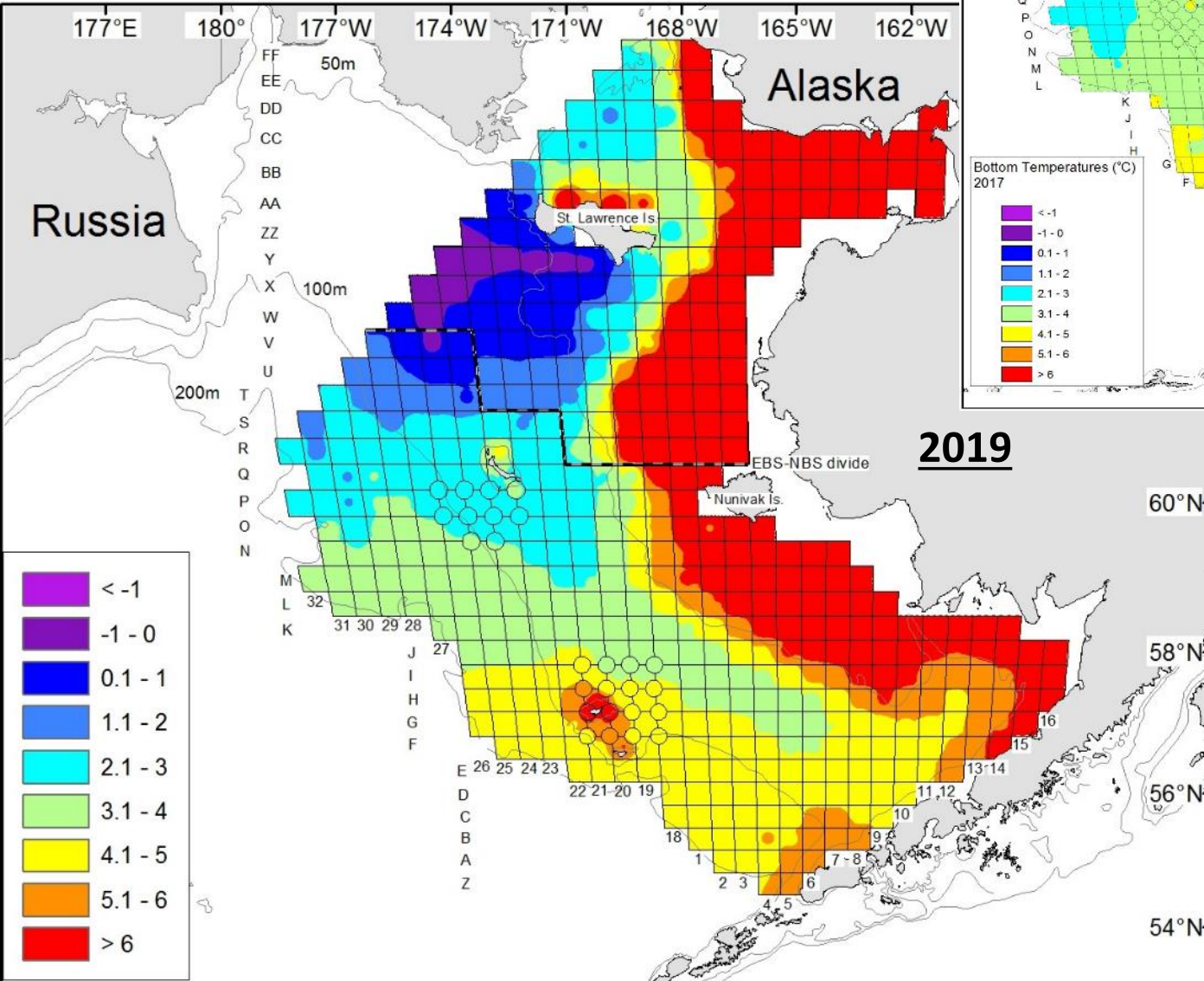
2019 standard Bering Sea survey

C4 BSAI Crab Council Presentation
OCTOBER 2019

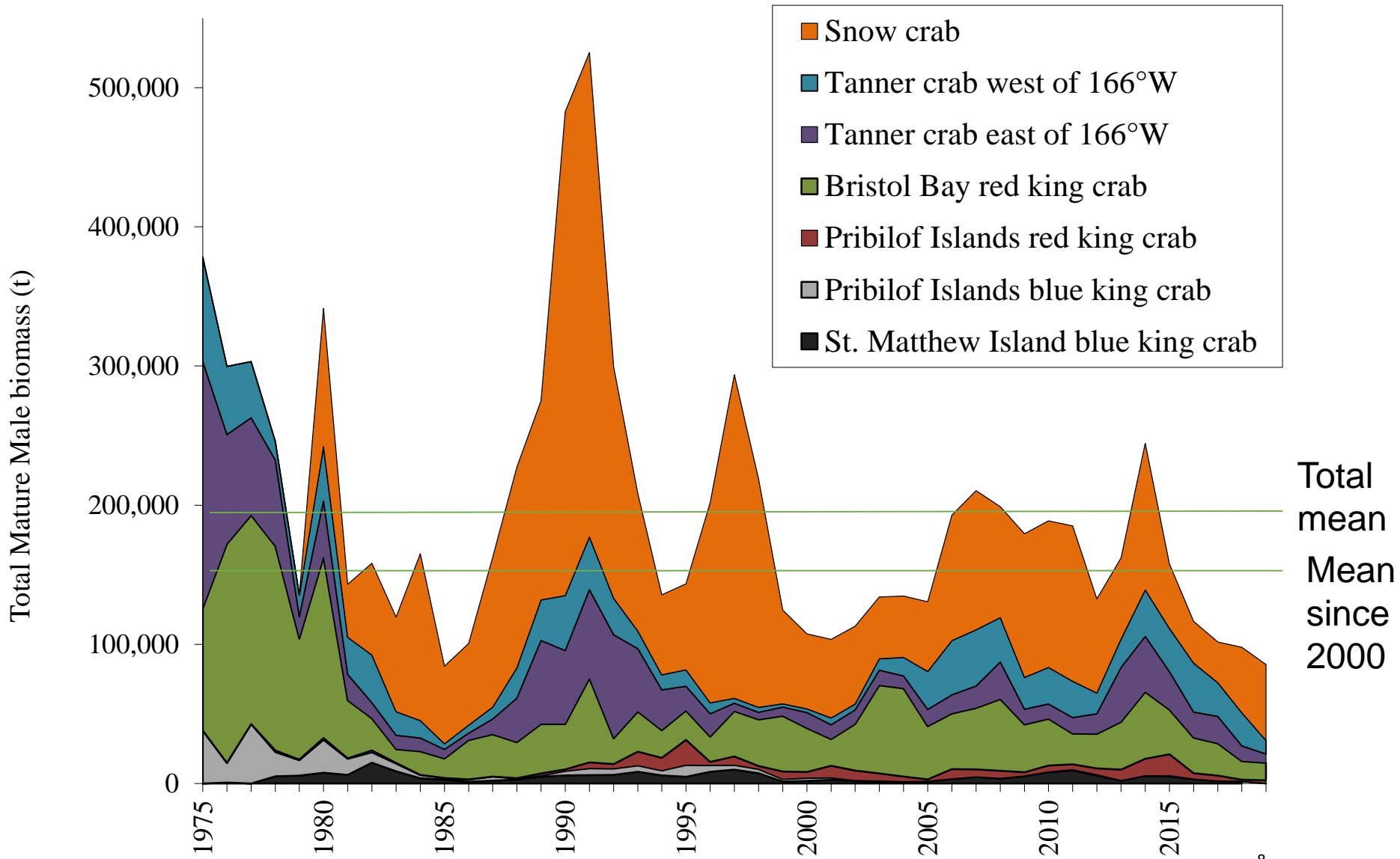


HIGHLIGHTS

- Eastern Bering Sea survey
 - June 3– July 28
 - 375 standard stations
 - 139,949 nmi²
 - 9 special crab projects
 - Warm water
-
- Northern Bering Sea survey
 - July 28-Aug 20
 - 144 standard stations
 - 57,744 nmi²



Mature male biomass



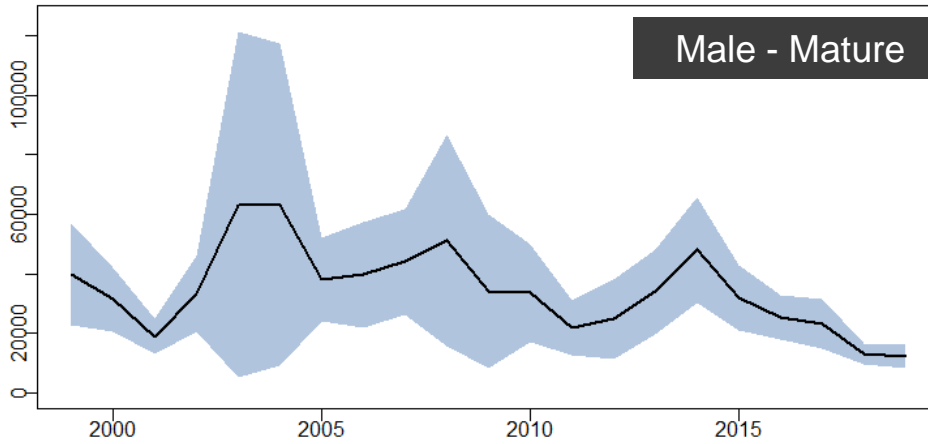
Bristol Bay Red King Crab Assessment in Fall 2019

J. Zheng and M.S.M. Siddeek
ADF&G, Juneau



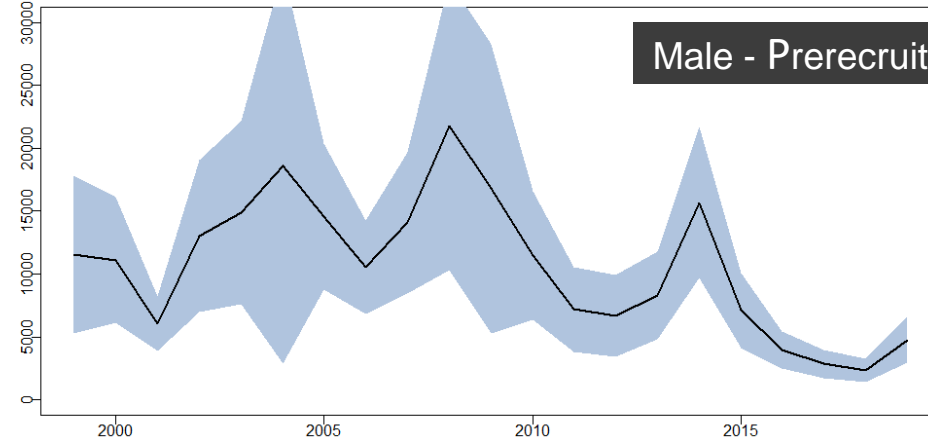
Bristol Bay red king crab

Biomass (t)

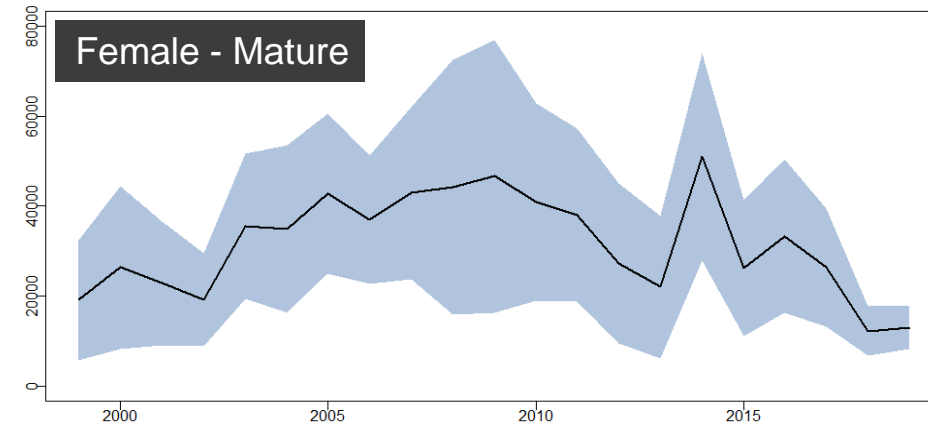


Legal male
 -25%

Mature male
 -6%



Pre-recruit males
 +105%

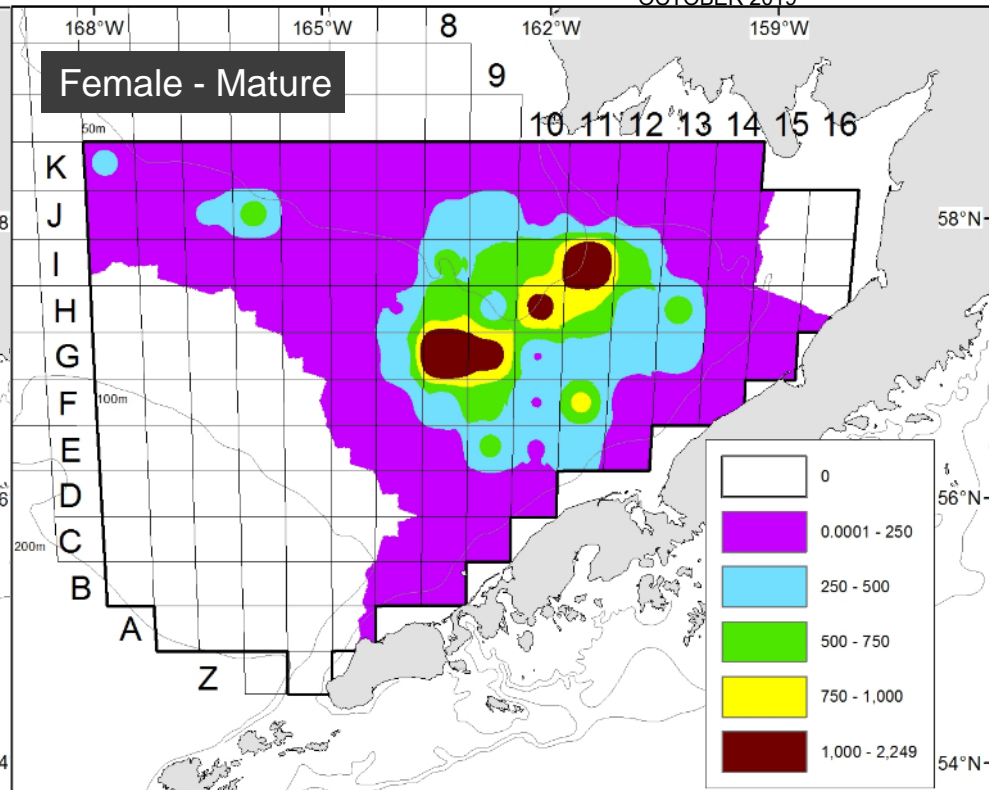
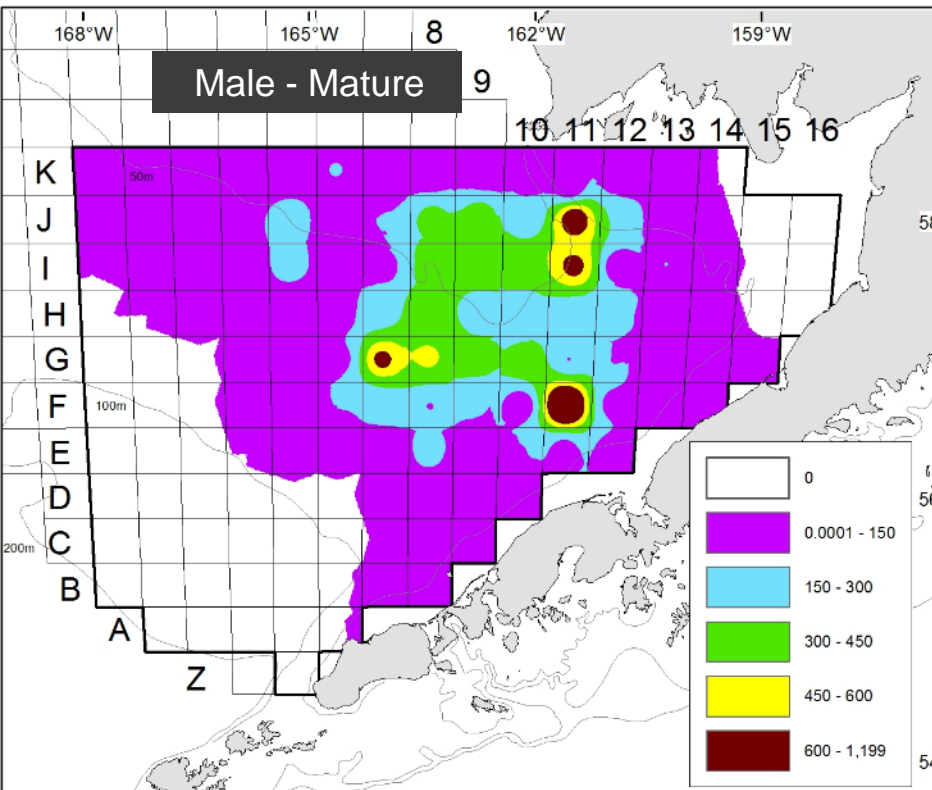


Mature female
 +6.6%

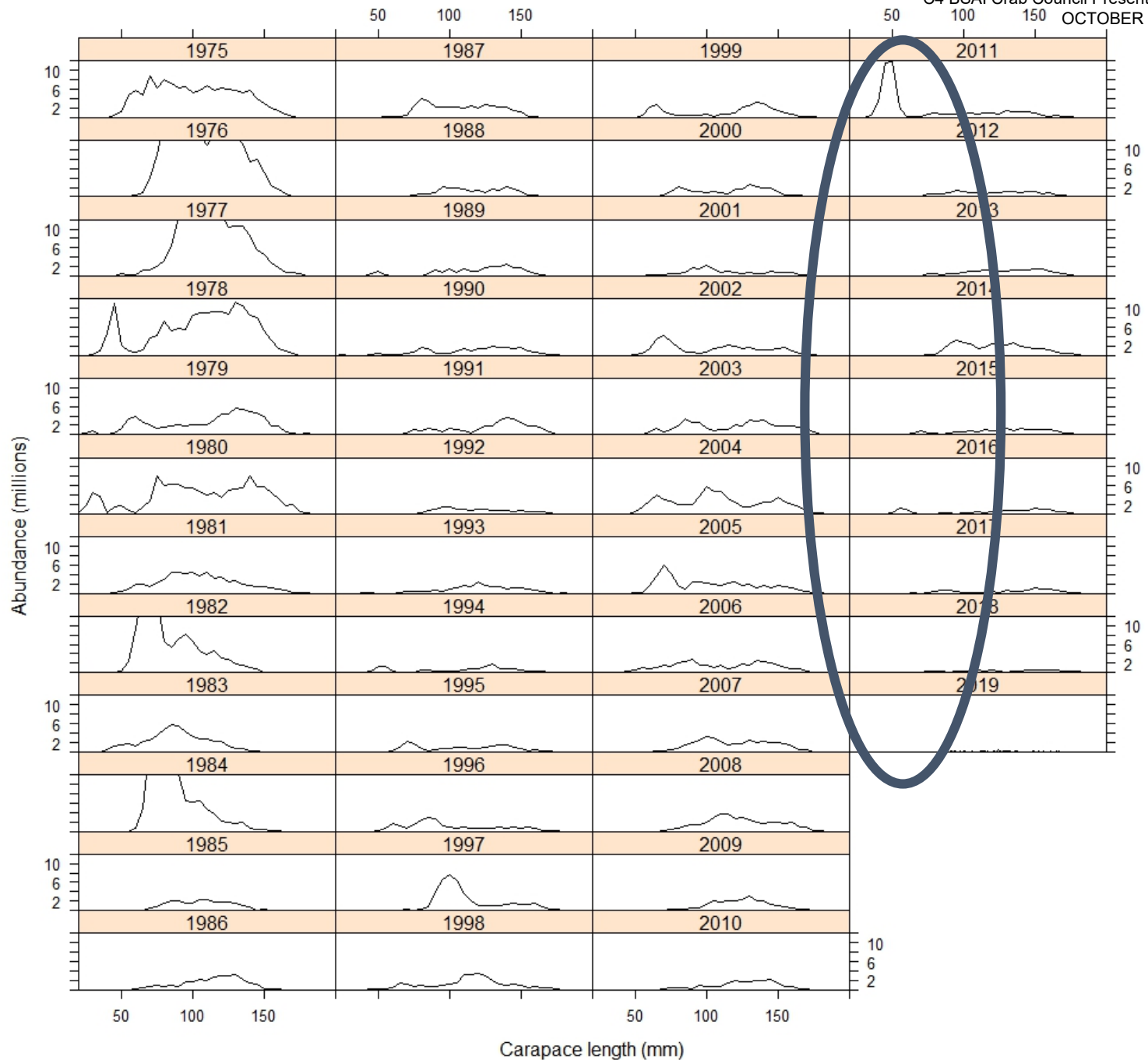
Juveniles
 Male -1%
 Female -32%

Bristol Bay red king crab

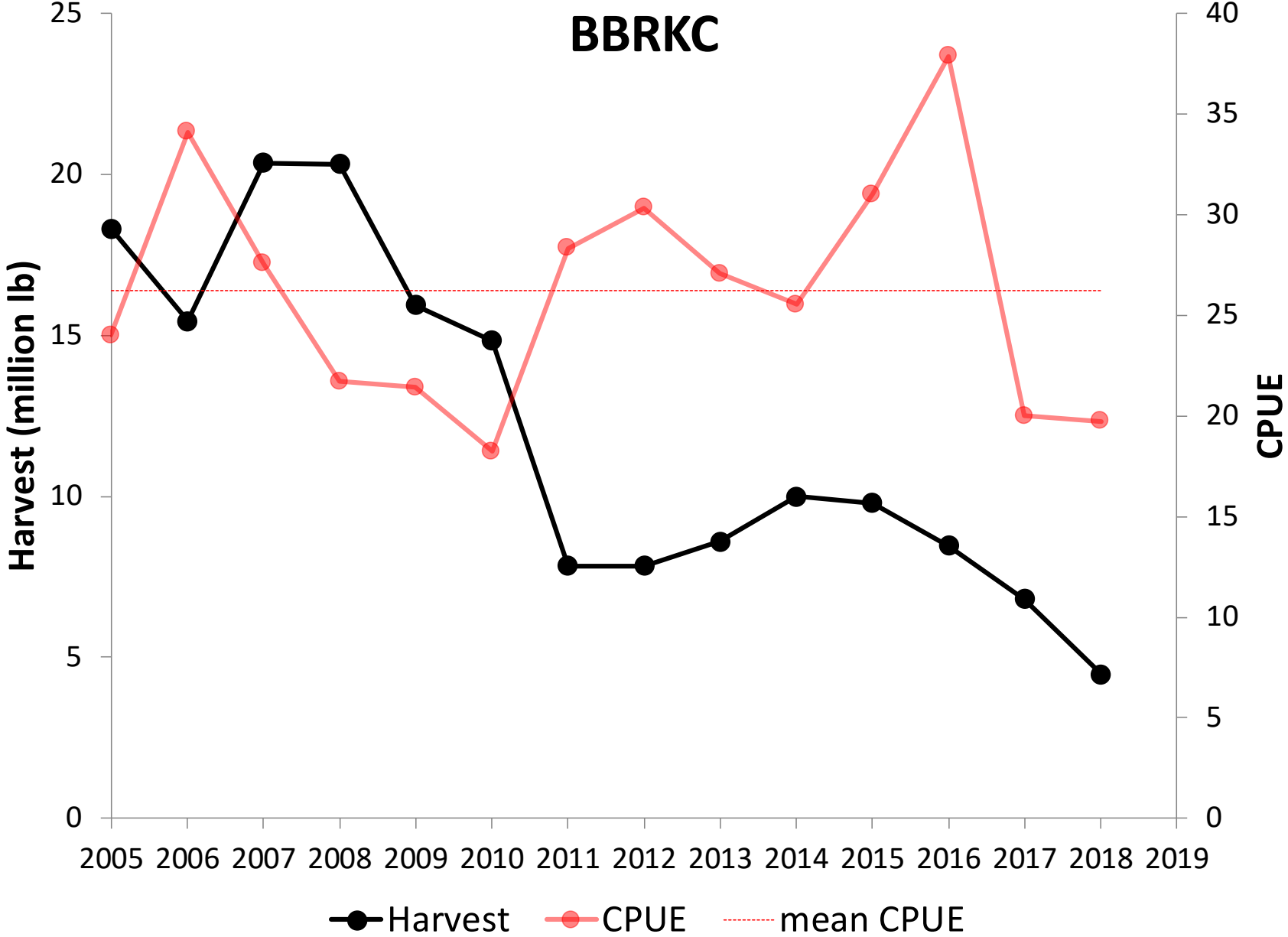
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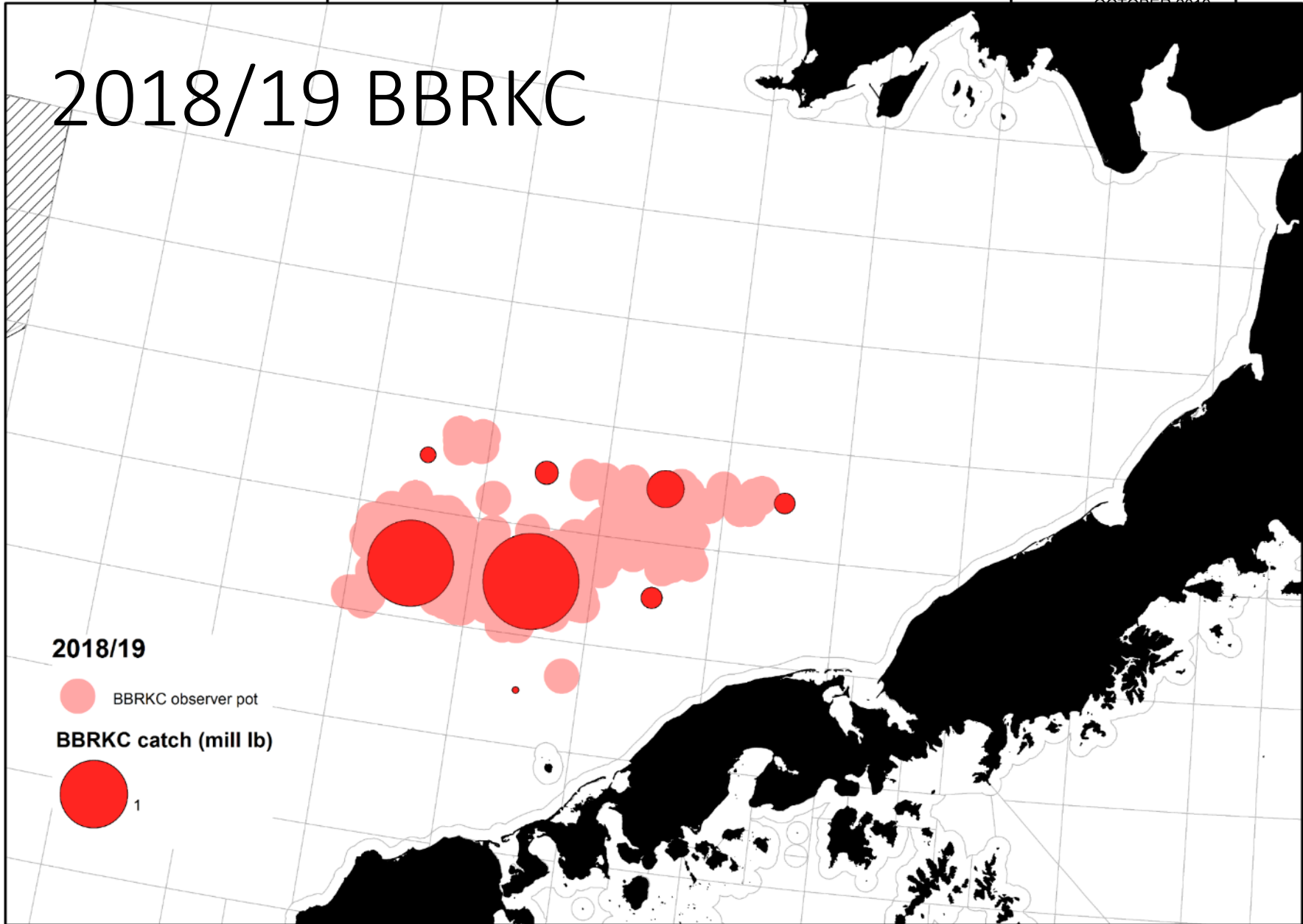
Bristol Bay Red King Crab (male)



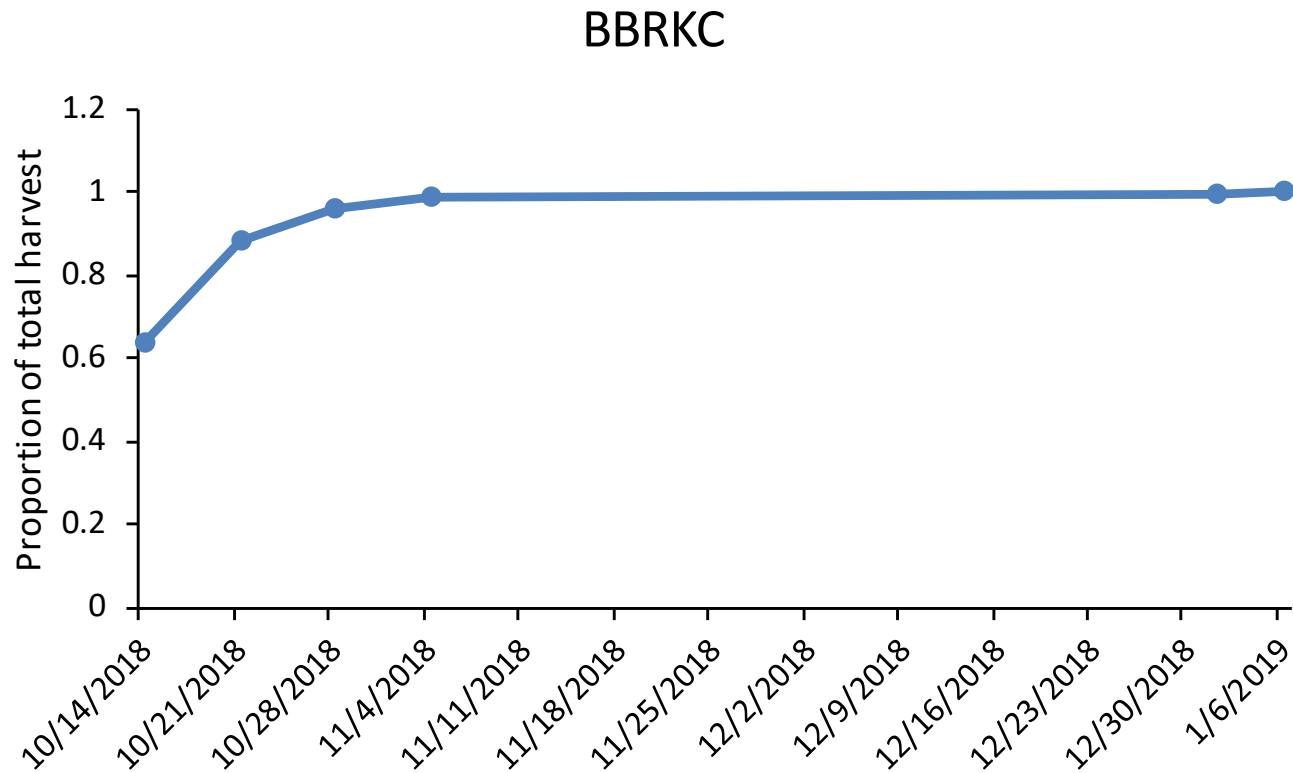
BBRKC

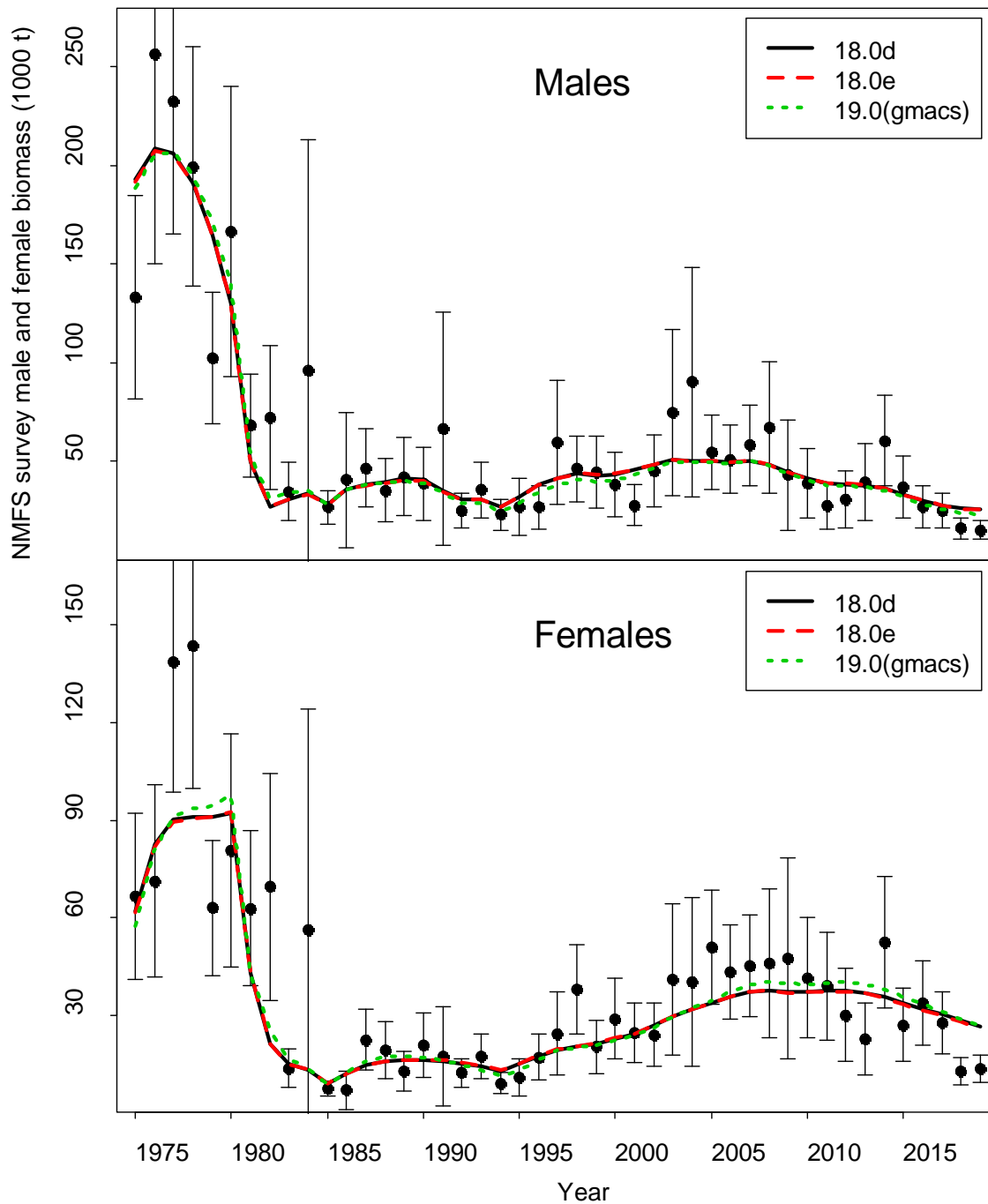


2018/19 BBRKC



2018/19 BBRKC





Comparisons of area-swept estimates of total NMFS survey biomass and model prediction for model estimates in 2019 under models 18.0d, 18.0e, and 19.0. The error bars are plus and minus 2 standard deviations.

BBRKC assessment issues

- Drop in survey biomass that none of the models can fit.
- Whether to continue with the old assessment model or use Gmacs, a standardized modeling approach.
- The CPT recommended using Gmacs.

Status and catch specifications (1,000 t) (model 18.0e or 19.0):

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2015/16	12.89 ^A	27.68 ^A	4.52	4.61	5.30	6.73	6.06
2016/17	12.53 ^B	25.81 ^B	3.84	3.92	4.37	6.64	5.97
2017/18	12.74 ^C	24.86 ^C	2.99	3.09	3.60	5.60	5.04
2018/19 ^{18.0e}	12.53 ^D	18.800 ^D	1.95	2.03	2.65	5.34	4.27
2019/20 ^{18.0e}		17.72 ^D				3.56	2.85
2018/19 ^{19.0}	10.62 ^D	16.92 ^D	1.95	2.03	2.65	5.34	4.27
2019/20 ^{19.0}		15.96 ^D				3.40	2.72

Basis for the OFL: Values in 1,000 t (model 18.0e or 19.0):

Year	Tier	B_{MSY}	Current MMB	B/B_{MSY} (MMB)	F_{OFL}	Years to define B_{MSY}	Natural Mortality
2015/16	3b	26.1	24.7	0.95	0.27	1984-2015	0.18
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 ^{18.0e}	3b	25.1	17.7	0.71	0.21	1984-2018	0.18
2019/20 ^{19.0}	3b	21.2	16.0	0.75	0.22	1984-2018	0.18

2019 Tanner Crab Stock Assessment

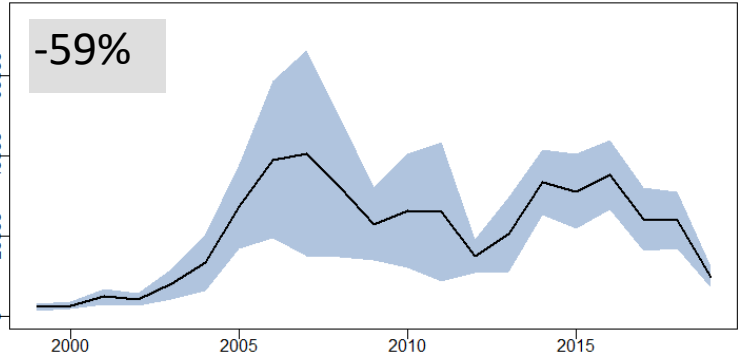
William Stockhausen
AFSC/NMFS/NOAA
October 1, 2019



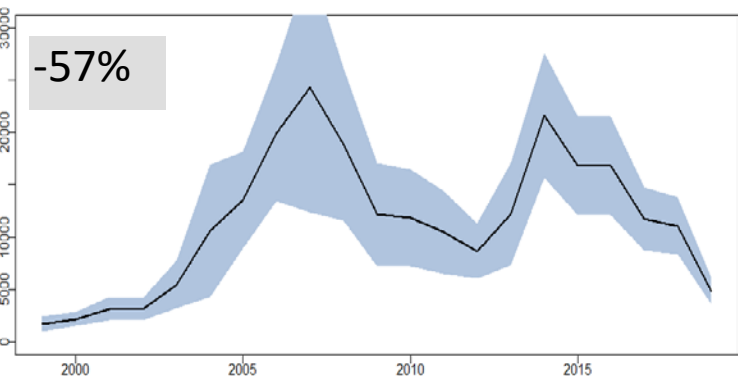
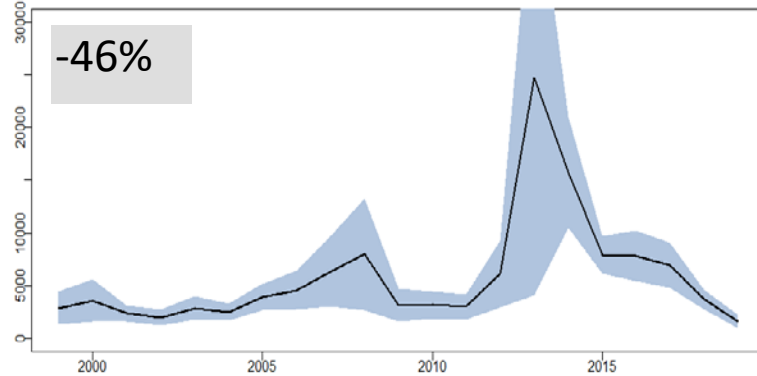
Tanner crab east of 166°W

Tanner crab west of 166°W

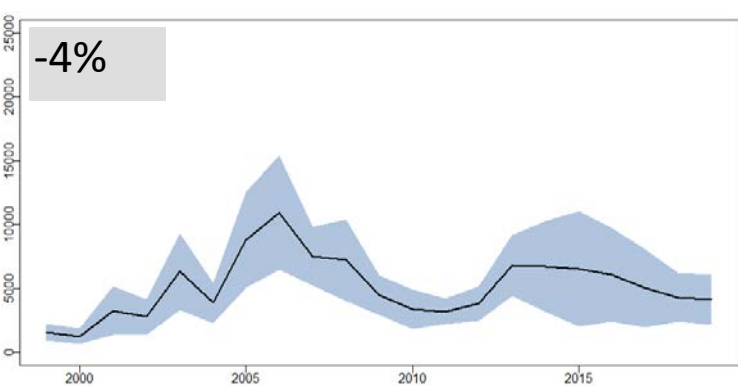
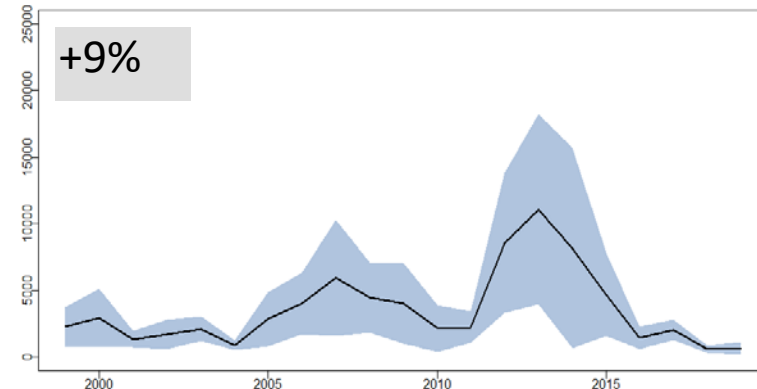
Biomass (t)



Male -
Mature



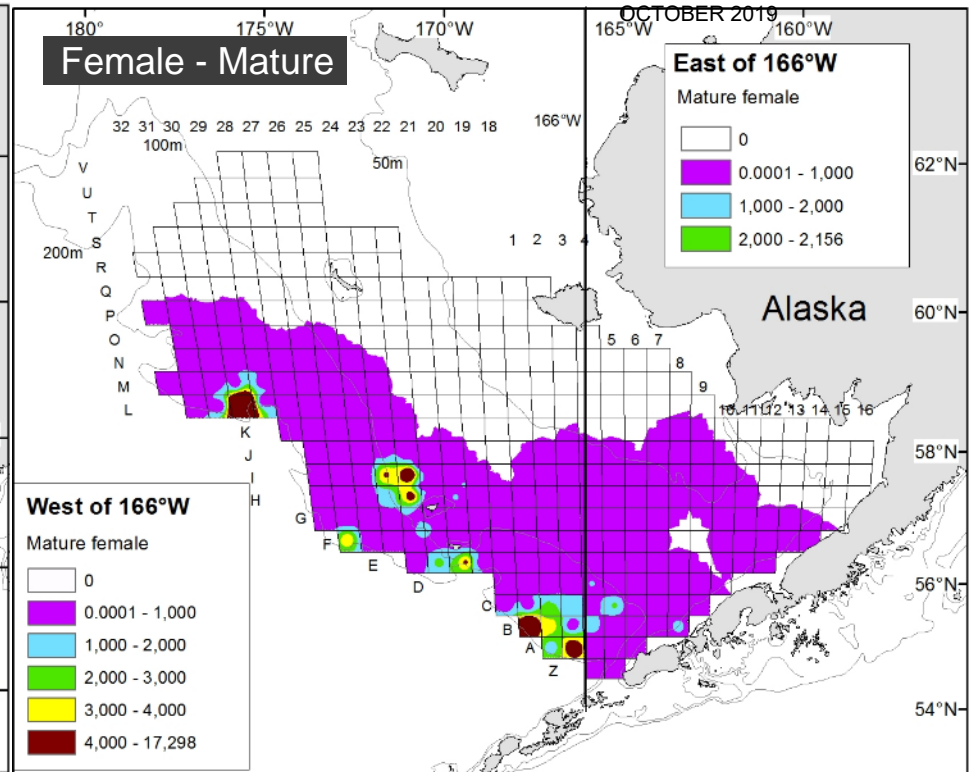
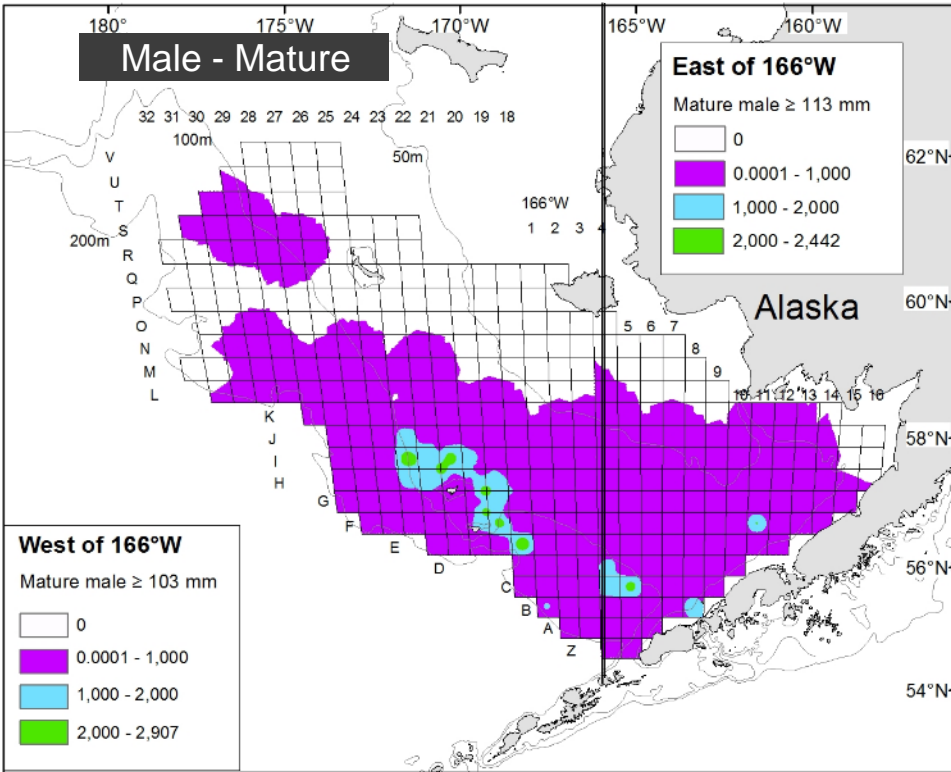
Male -
Pre-recruit



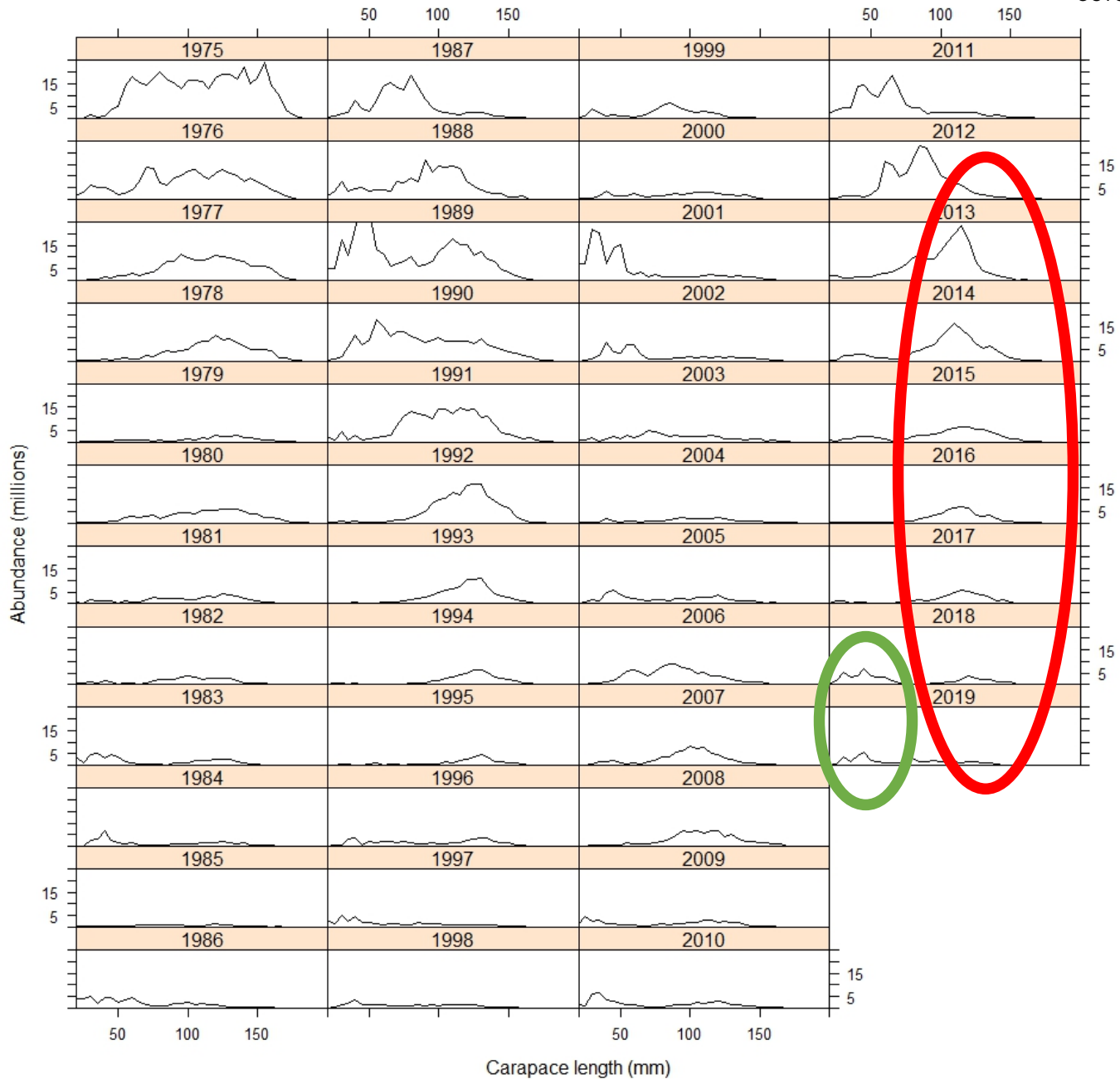
Female -
Mature

Tanner crab

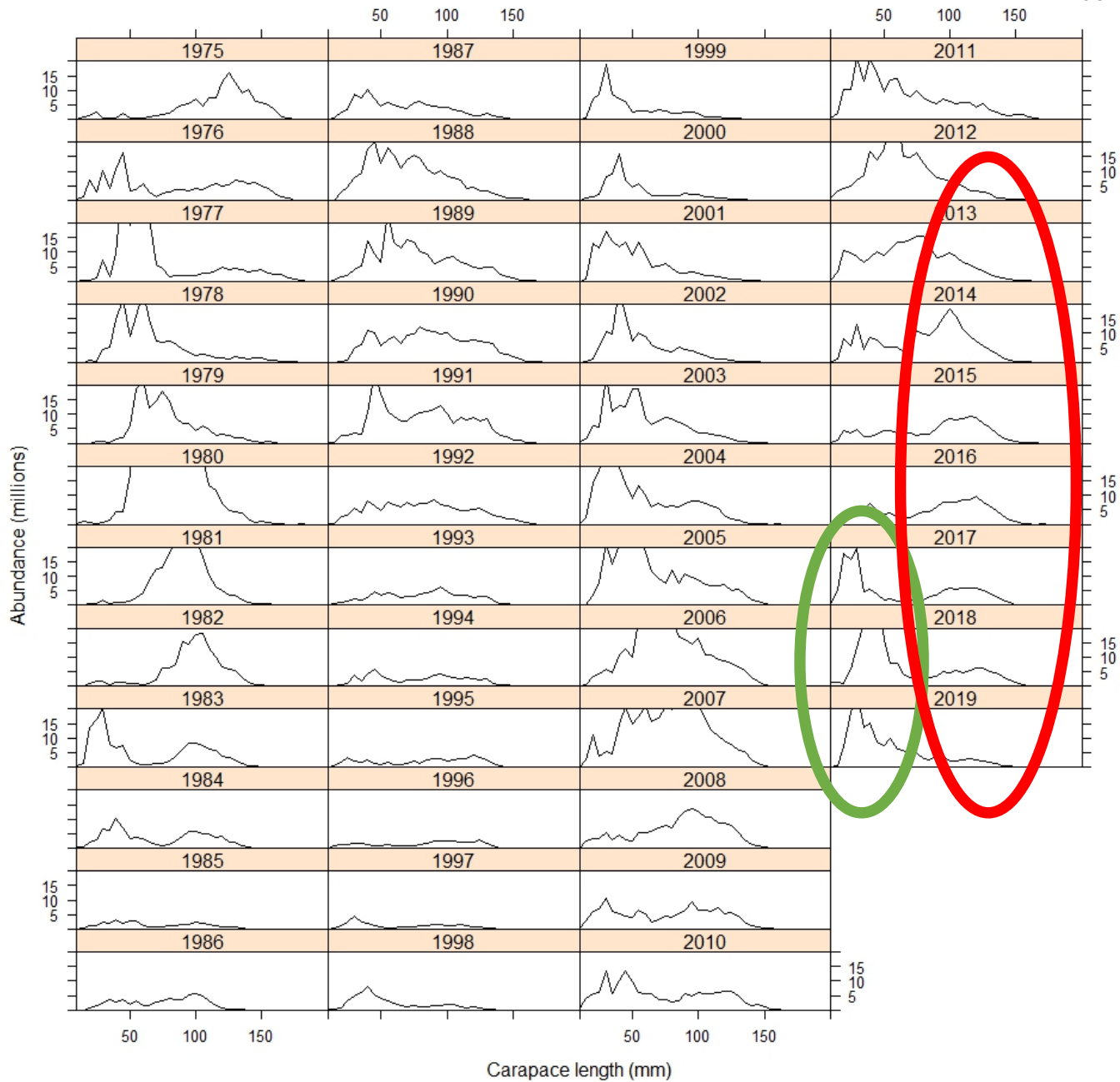
OCTOBER 2019



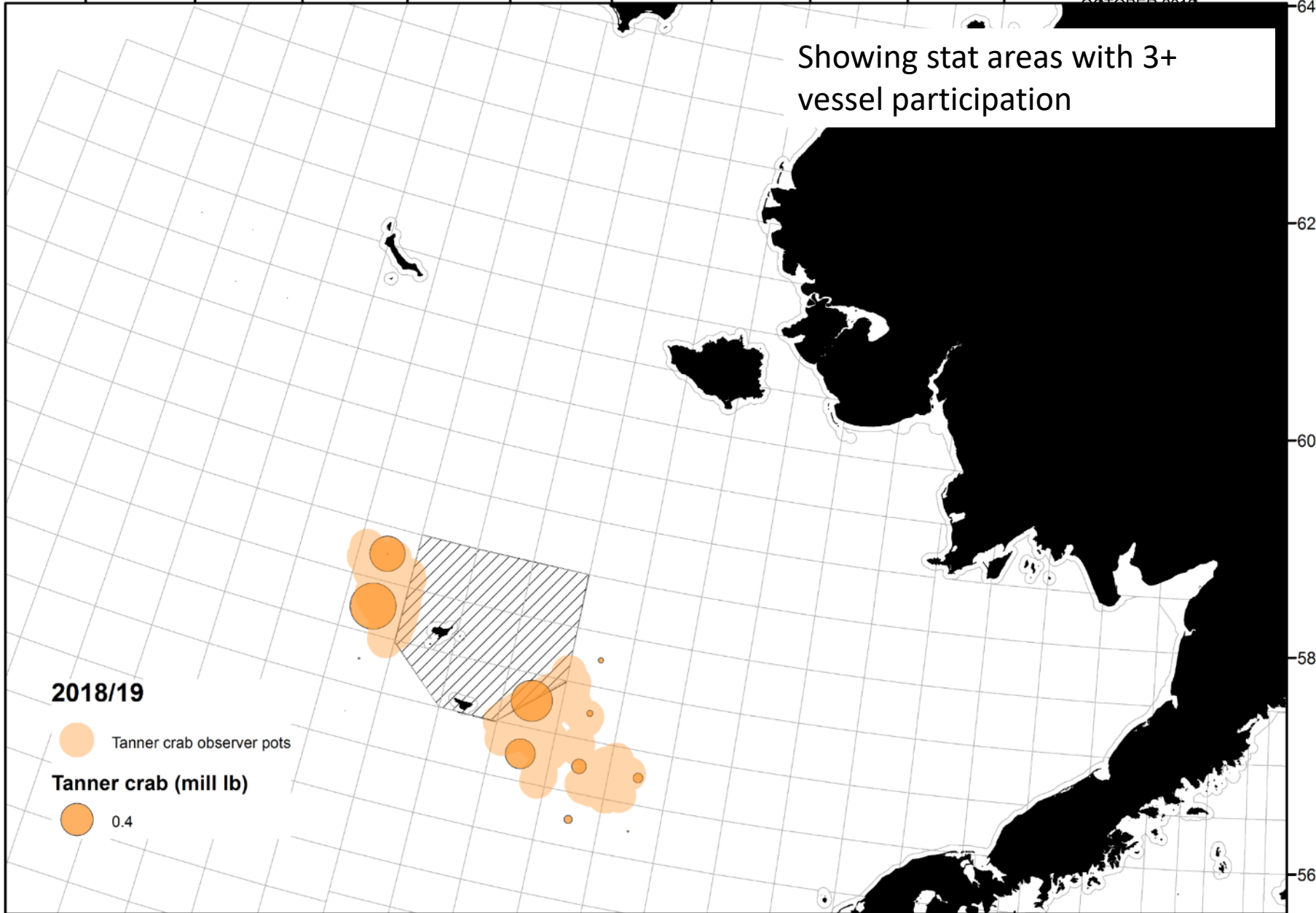
Tanner Crab east of 166W (male)

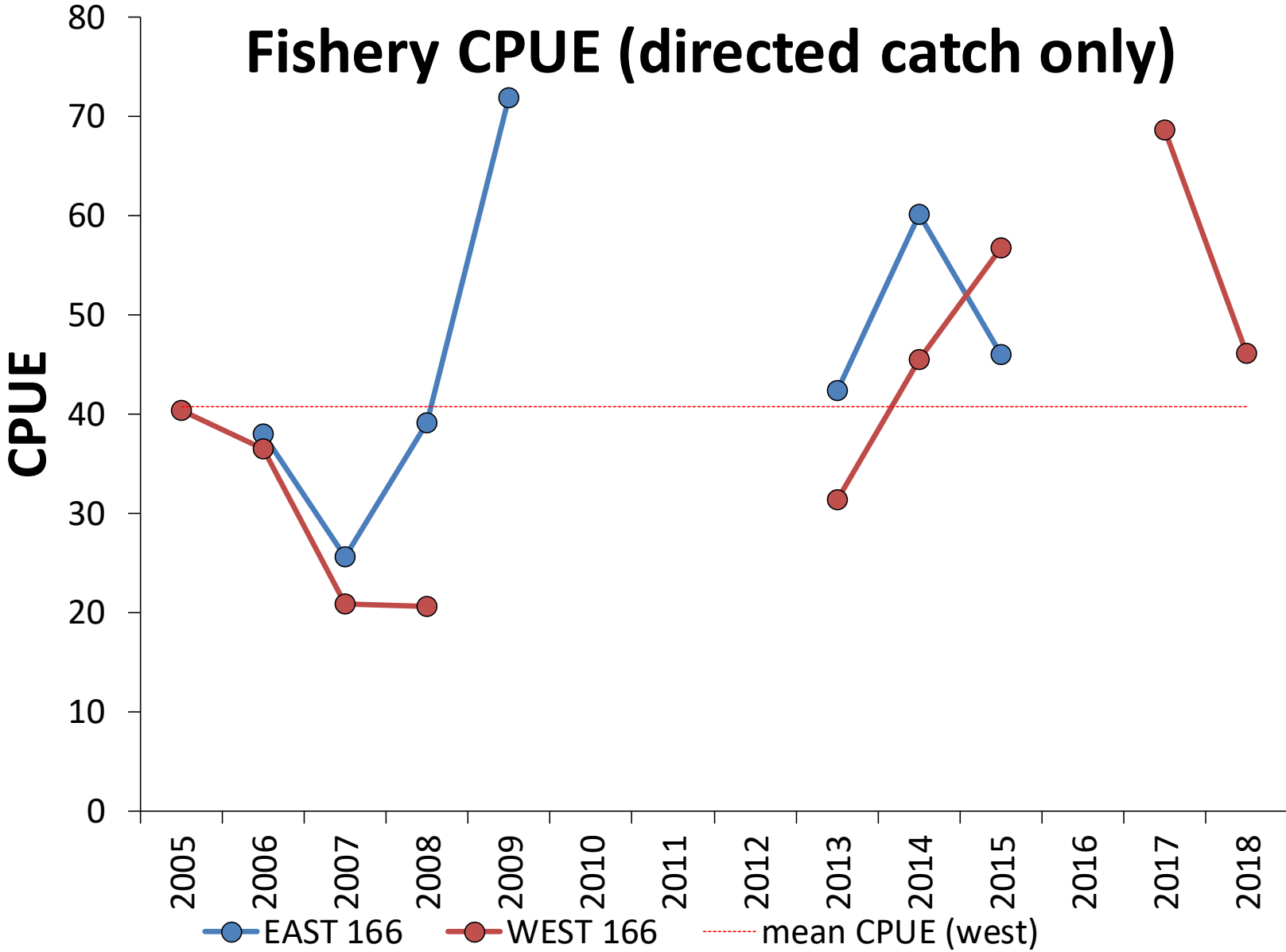


Tanner Crab west of 166W (male)

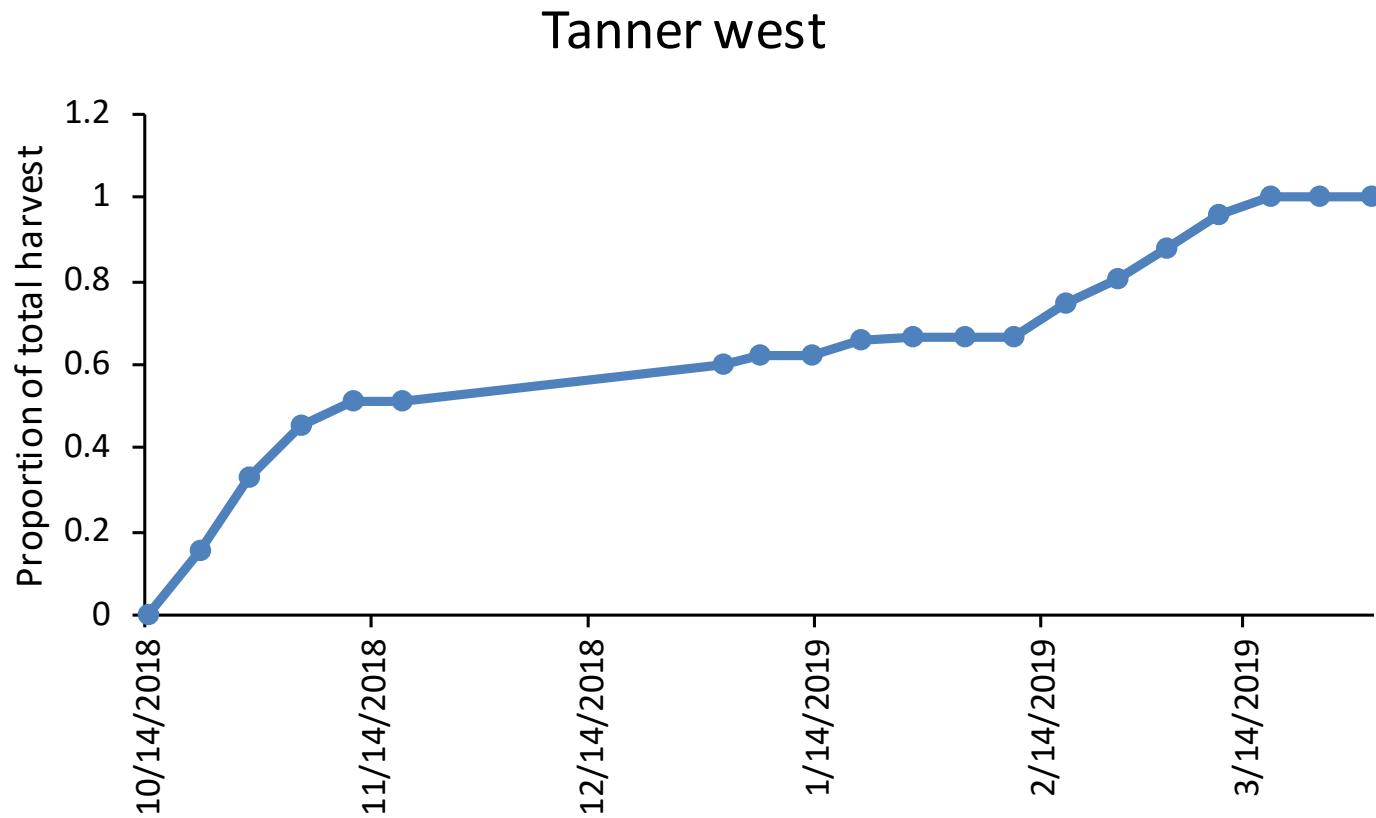


Showing stat areas with 3+ vessel participation

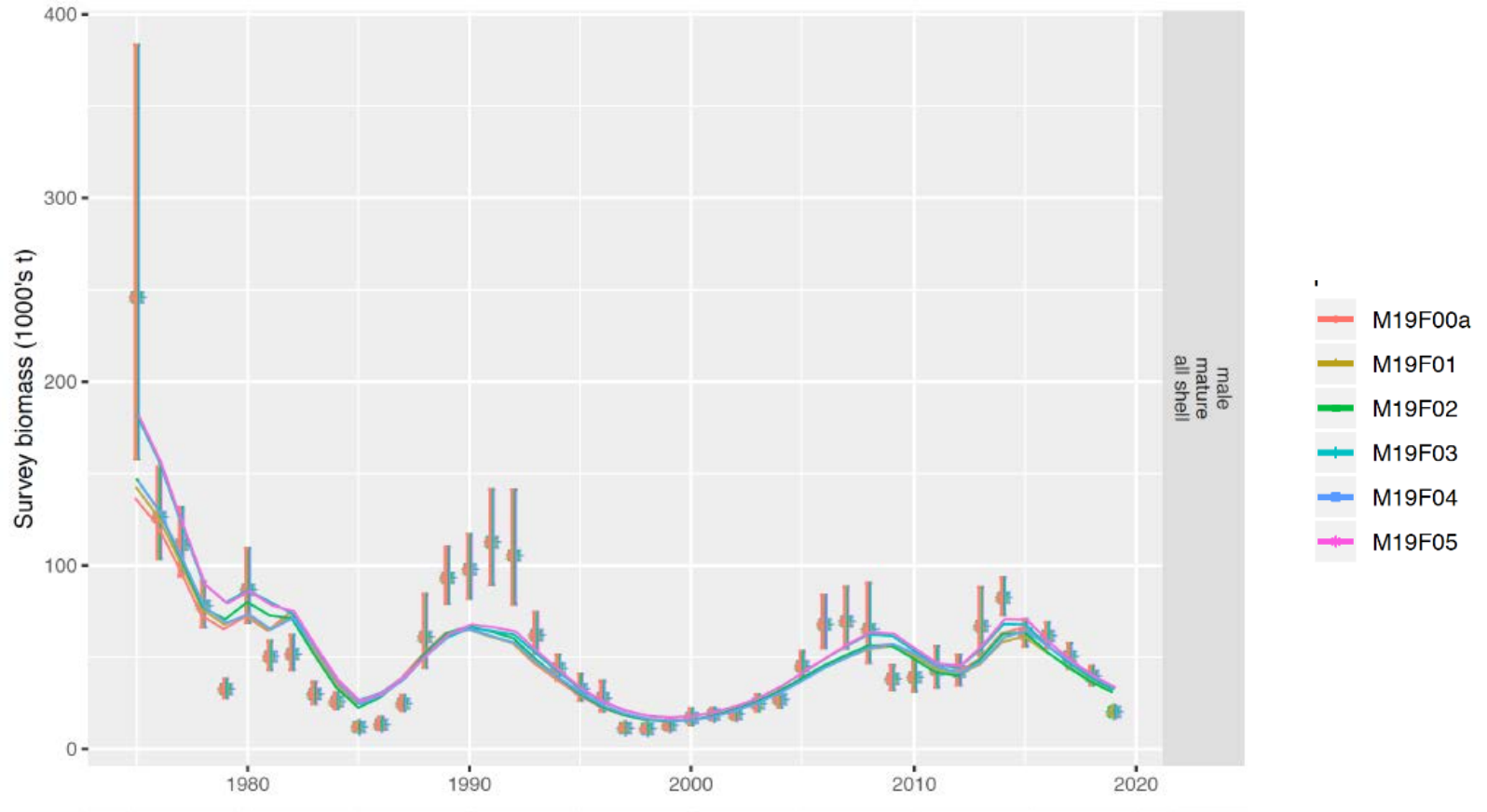




2018/19 Tanner west



Fits to NMFS EBS mature male survey biomass



Tanner crab assessment issues

- Survey biomass declined steeply in 2019
- Revised historical crab fisheries data caused a large and unexpected increase in biomass.
- Whether to incorporate of maturity estimates based on chela height.
- Whether to use the BSFRF data in the assessment.
- The CPT recommended a model that used the revised catch numbers and the chela height data, but did not include the BSFRF data.

Summary

- Directed fishery closed in eastern management area
- TAC: 1,106 t. Retained catch: 1,107 t
- NMFS EBS survey results
 - mature male biomass: 20,100 t (-50%) immature male biomass: 8,540 t (+16%)
 - mature female biomass: 4,800 t (-2%) immature female biomass: 4,900 t (-2%)

Year	MSST	Biomass (MMB)	TAC (East + West)	Retained Catch	Total Catch Mortality	OFL	ABC
2015/16	12.82	73.93	8.92	8.91	11.38	27.19	21.75
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		39.55				28.86	23.09

- Stock in Tier 3b.
- Not overfished. Overfishing did not occur.

SMBKC

(Saint Matthew blue king crab)

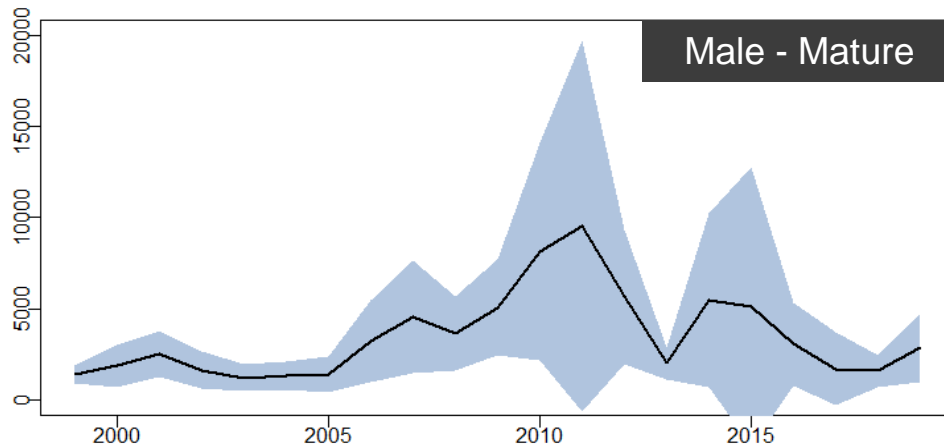
- Declared “Overfished”, no overfishing occurring
- Rebuilding plan currently being constructed
 - Needs to be implemented by Oct. 2020
 - Initial rebuilding projections presented in May/June
 - Initial review will occur in December
- Reference model used for spec setting
 - One new data point: 2019 NOAA trawl survey biomass (of >90mm males) up 89% from 2018.
- Still overall poor model fit to recent years in the two surveys

St. Matthew Island blue king crab

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Biomass (t)

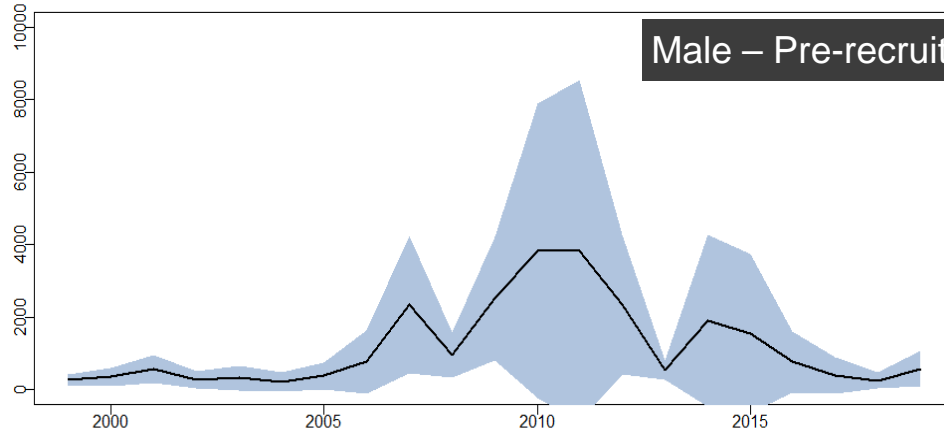


Legal males

+70%

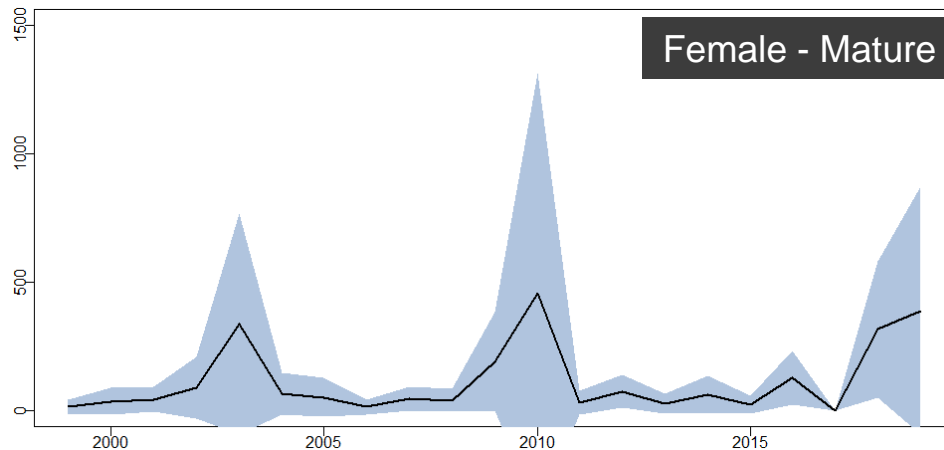
Mature males

+79%



Pre-recruit males

+126%



Mature females

+22%

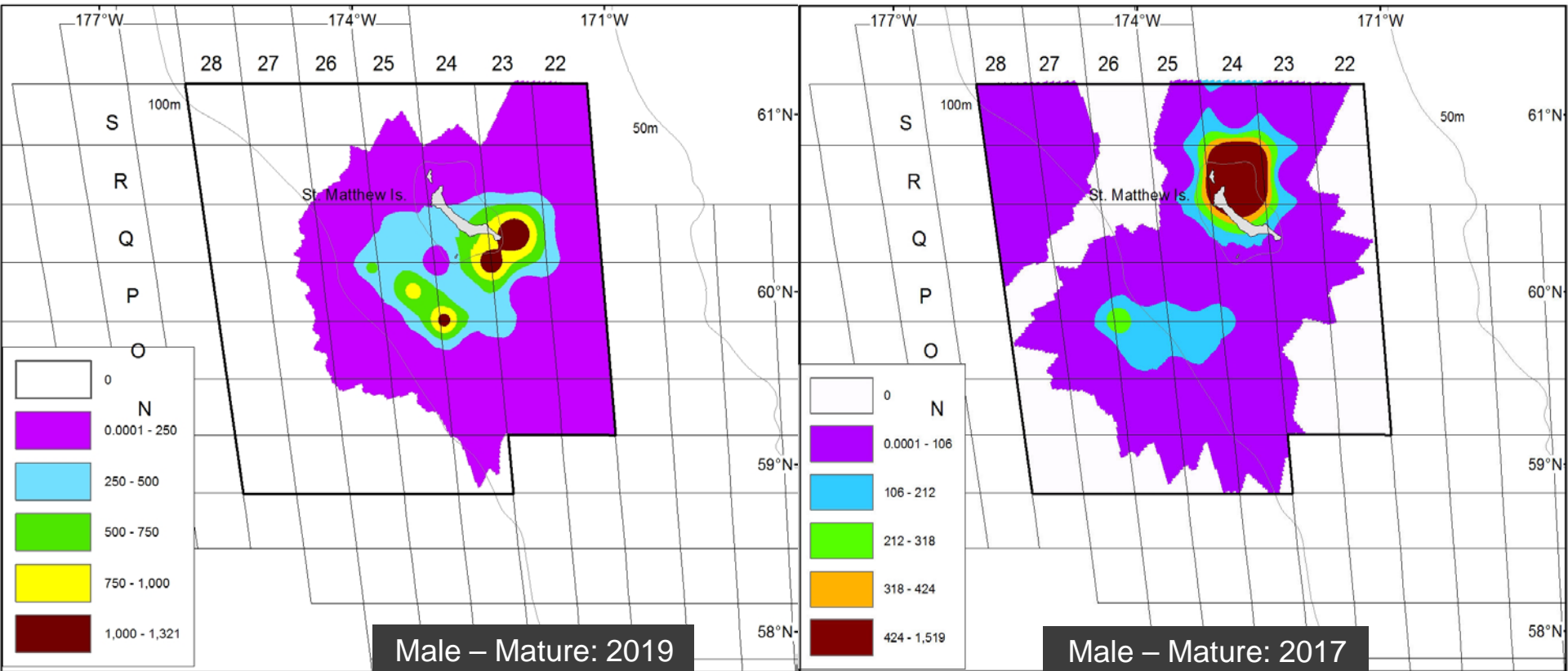
Juveniles

Males +76%

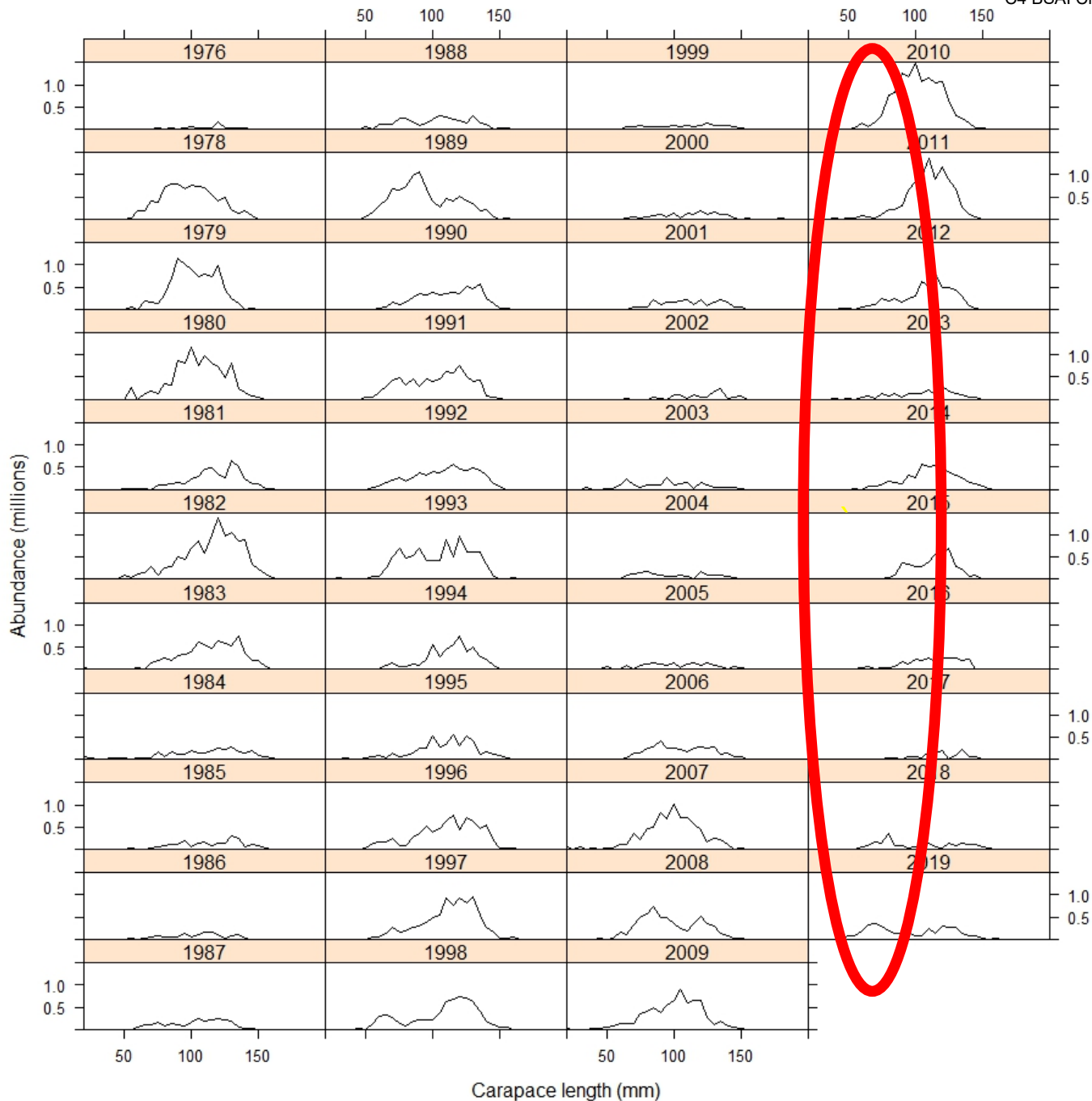
Females +68%³¹

St. Matthew Island blue king crab

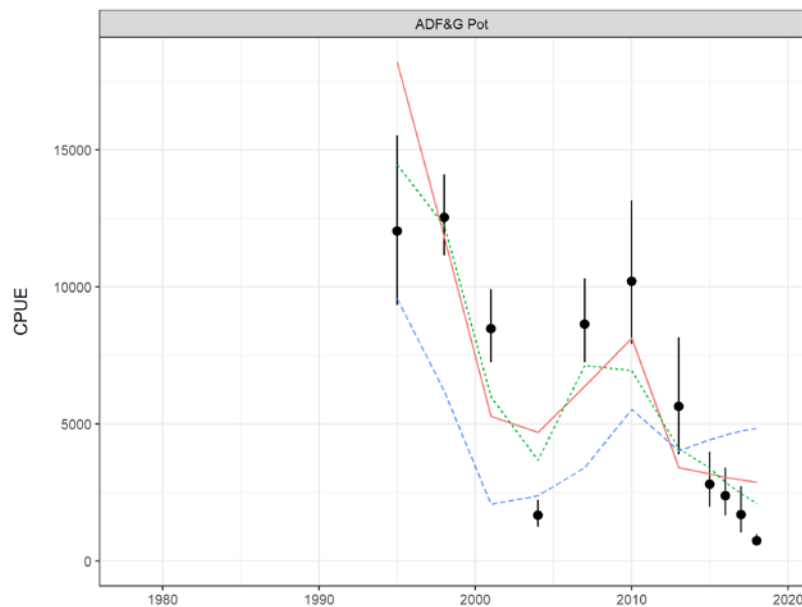
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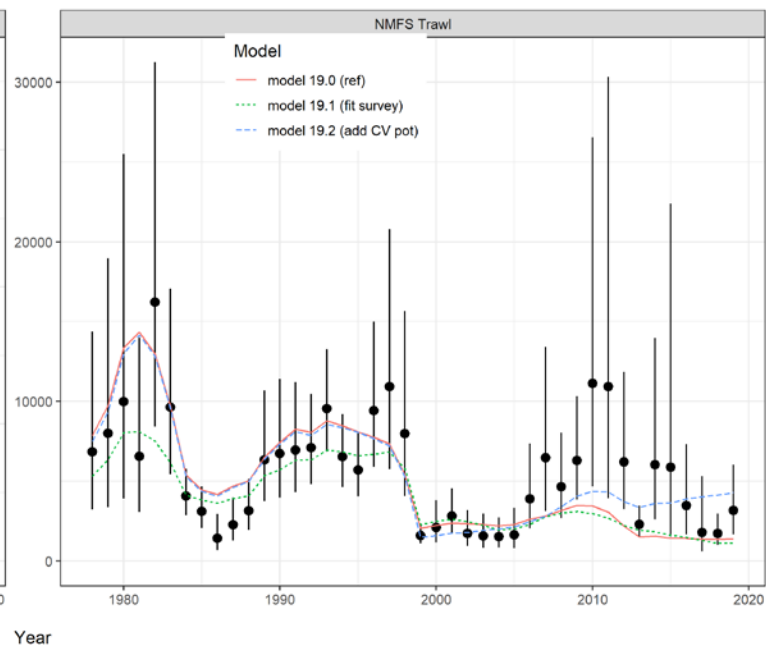
St. Matthew Island Blue King Crab (male)



ADF&G pot survey



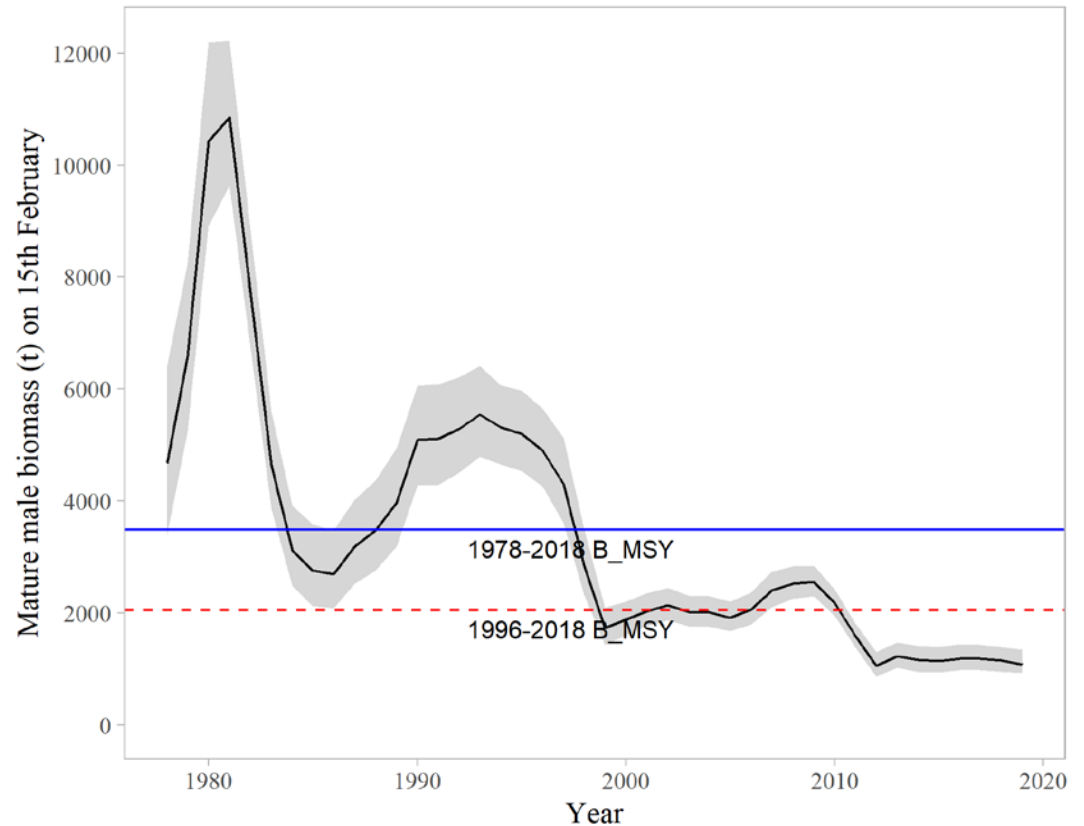
NMFS bottom trawl survey



Reference point time frame?

- Both STARS and breakpoint analysis suggest a break in recruitment in 1996
- Responds to current regime and sets realistic expectations
- Concerns:
 - Both methods are based on model output
 - Cannot rule out fishery influence in current regime state

Reference model (19.0)



SMBKC assessment issues

- Survey trends for the pot survey and the NMFS survey are contradictory. How they are weighted has a large influence on the assessment
- Whether to change the BMSY calculation to use 1996 onwards rather than the full time period. The choice has a large influence on the rebuilding plan.
- The CPT recommend use of the reference model, and recommended the full time period be used to calculate BMSY

Table 1: Status and catch specifications (1000 t) for the reference model. Alternative reference point time frame included for comparison for projection year (alt).

Year	Biomass			Retained catch	Total		
	MSST	(MMB_{mating})	TAC		male catch	OFL	ABC
2014/15	1.86	2.48	0.30	0.14	0.15	0.43	0.34
2015/16	1.84	2.11	0.19	0.05	0.053	0.28	0.22
2016/17	1.97	2.23	0.00	0.00	0.001	0.14	0.11
2017/18	1.85	1.29	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		1.08				0.04	0.03
2019/20alt		1.04				0.08	0.07

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

Year	Tier	Biomass					Basis for B_{MSY}	Natural mortality
		B_{MSY}	(MMB_{mating})	B/B_{MSY}	F_{OFL}	γ		
2014/15	4b	3.28	2.71	0.82	0.14	1	1978-2014	0.18
2015/16	4b	3.71	2.45	0.66	0.11	1	1978-2015	0.18
2016/17	4b	3.67	2.23	0.61	0.09	1	1978-2016	0.18
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	1.08	0.31	0.042	1	1978-2018	0.18
2019/20	4b	2.05	1.04	0.51	0.082	1	1996-2018	0.18

An Ecosystem and Socioeconomic Profile (ESP) is a standardized framework that integrates relevant indicators for each life history stage from both the ecosystem and socioeconomic perspectives

Why an ESP for SMBKC?

- Moderate to high scores for national prioritization initiatives
- CPT requested evaluation of ecosystem considerations at May 2019 meeting after initial rebuilding projections
- ESP presented at September CPT meeting to provide ecological context for rebuilding analysis

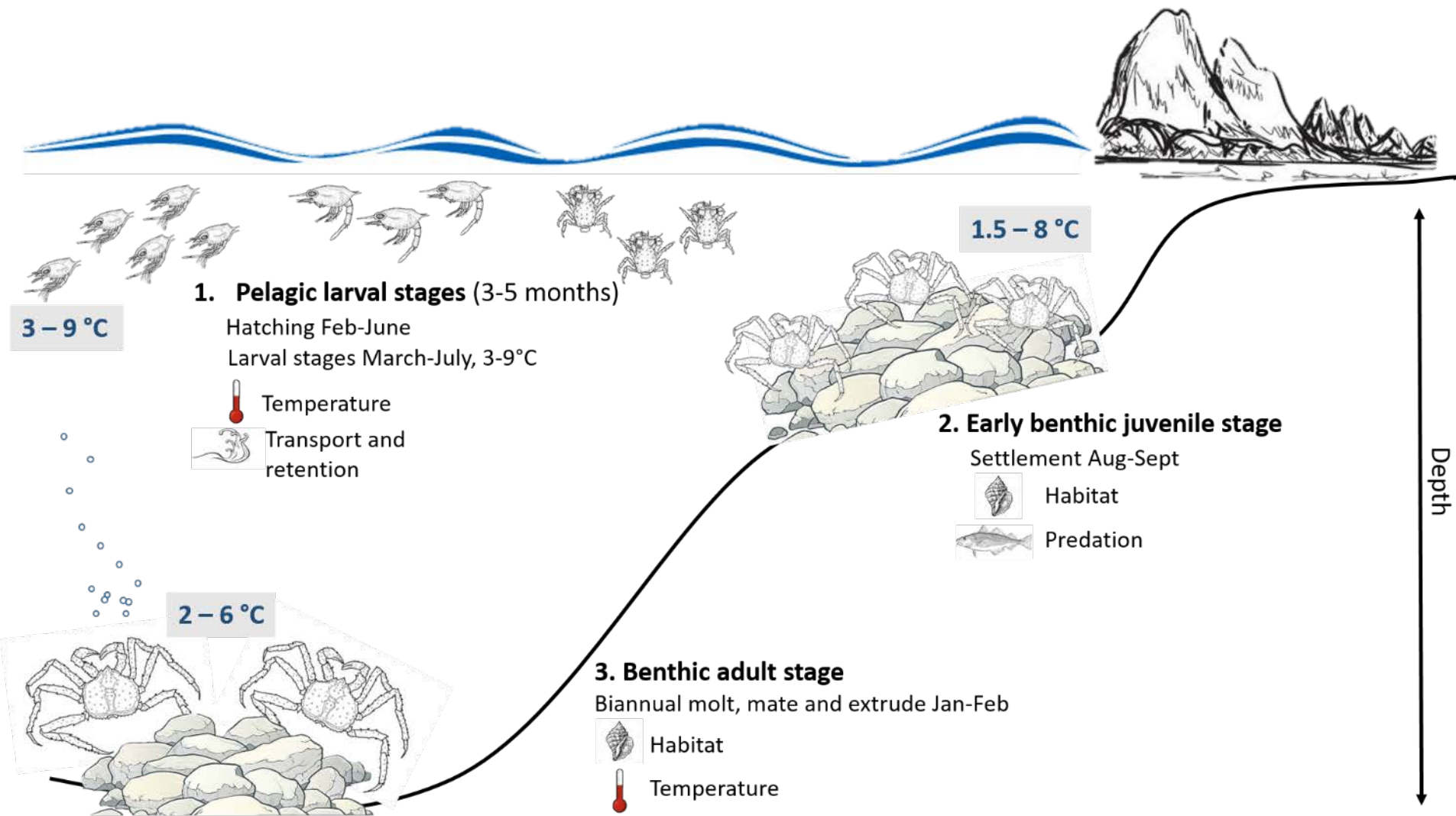
Ecosystem and Socioeconomic Profile of the Saint Matthew Blue King Crab stock in the Bering Sea

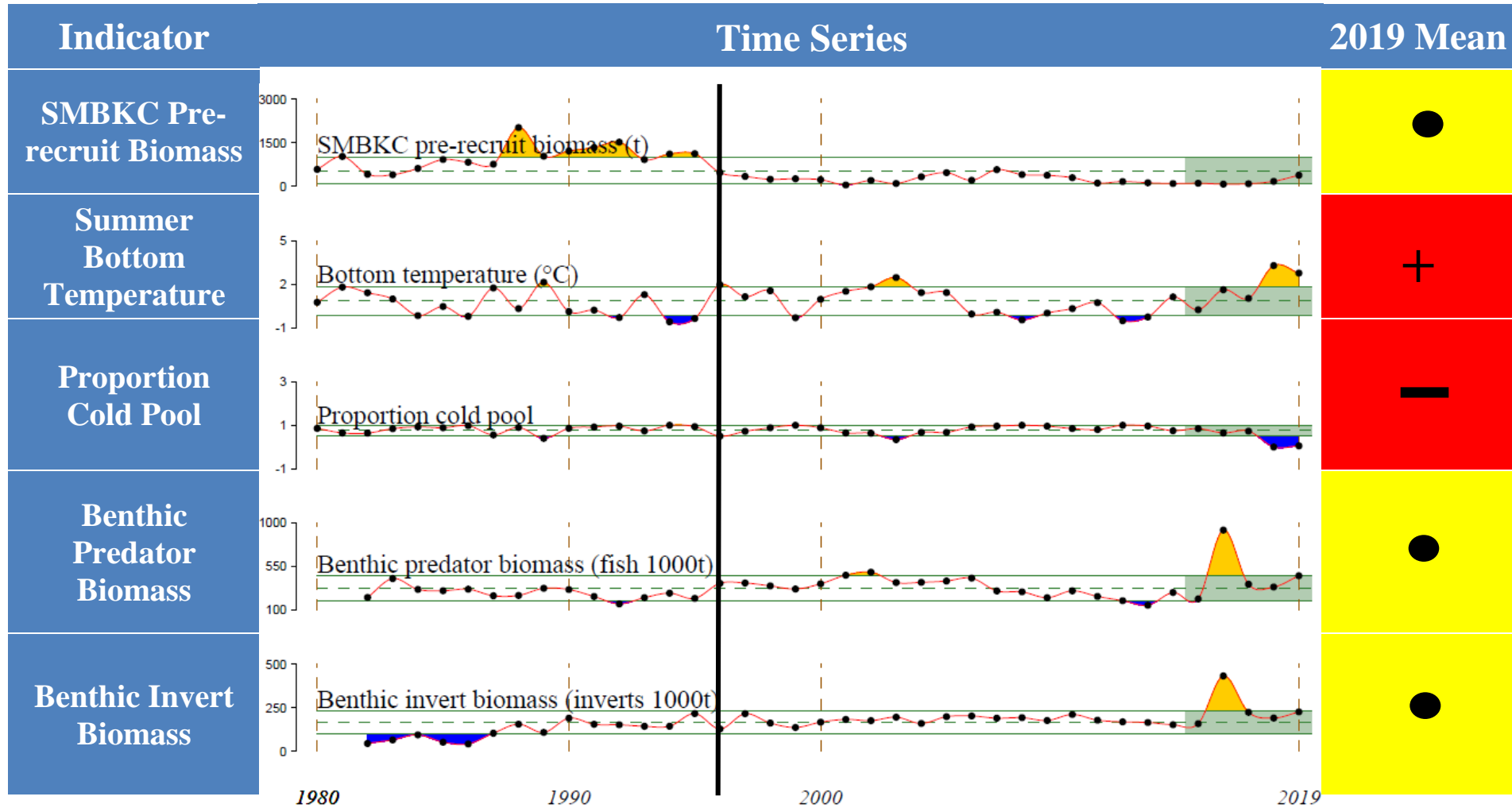
Erin Fedewa, Brian Garber-Yonts, Kalei Shotwell and Katie Palof

September 2019



Ecosystem processes were evaluated across BKC life history stages to identify potential bottlenecks in productivity and relevant indicators for monitoring





Proposed rebuilding plan

- Direct fishery closure until rebuilt
- No bycatch closure areas needed
 - Insensitive to current levels of bycatch
 - Small sensitivity to higher bycatch levels
- Goal of Sept / Oct
 - Determine base model reference point time frame
 - Determine appropriate T_{\min} and T_{\max} values for rebuilding plan
- Projections depend on assumptions for future recruitment
- $T_{\min} > 10$, therefore T_{\max} defaults to rebuilding framework.
 - CPT agreed that 10 + generation time (~14 years) = 24 years for T_{\max} would be appropriate
 - Allows time for stock to rebuild if the stock can overcome unfavorable environment
- Initial review will occur in December to the Council

Eastern Bering Sea snow crab stock assessment

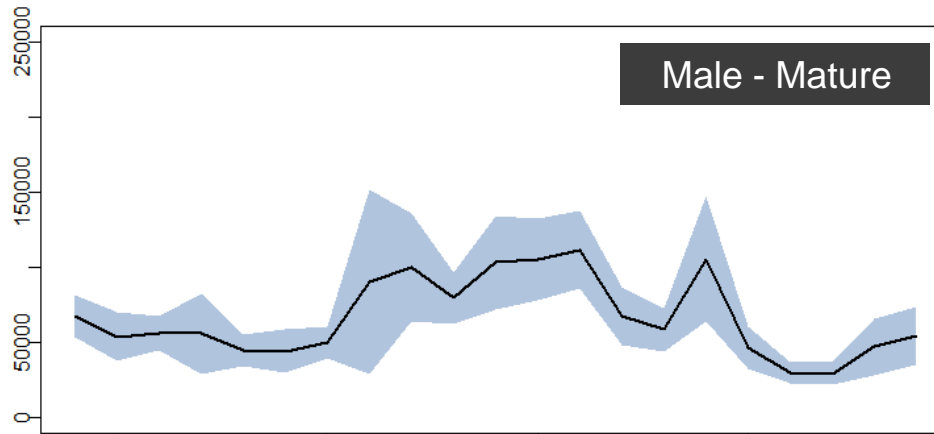
Cody Szuwalski, AFSC

October 1, 2019



Snow crab

Biomass (t)

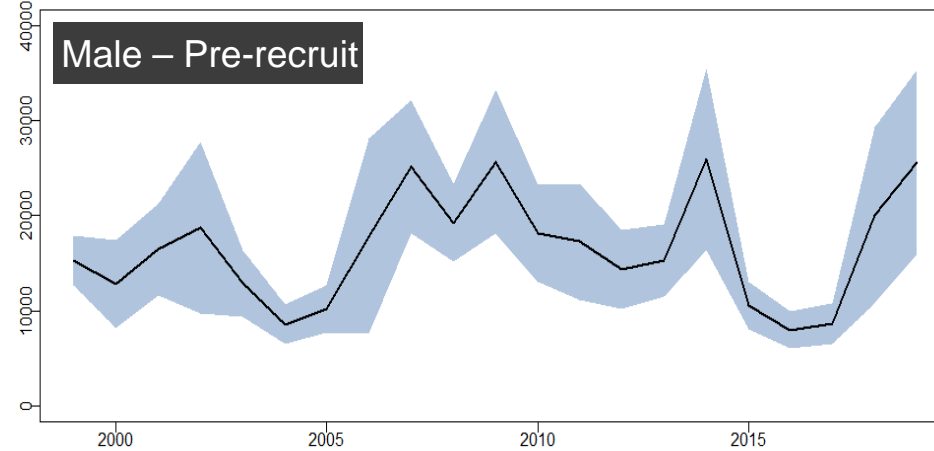


Preferred males

+7%

Mature males

+16%

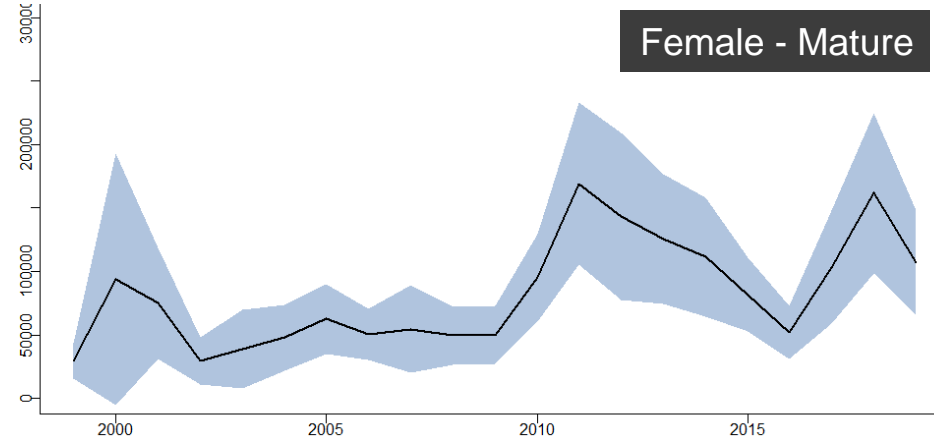


Legal males

+35%

Pre-recruit males

+28%



Mature females

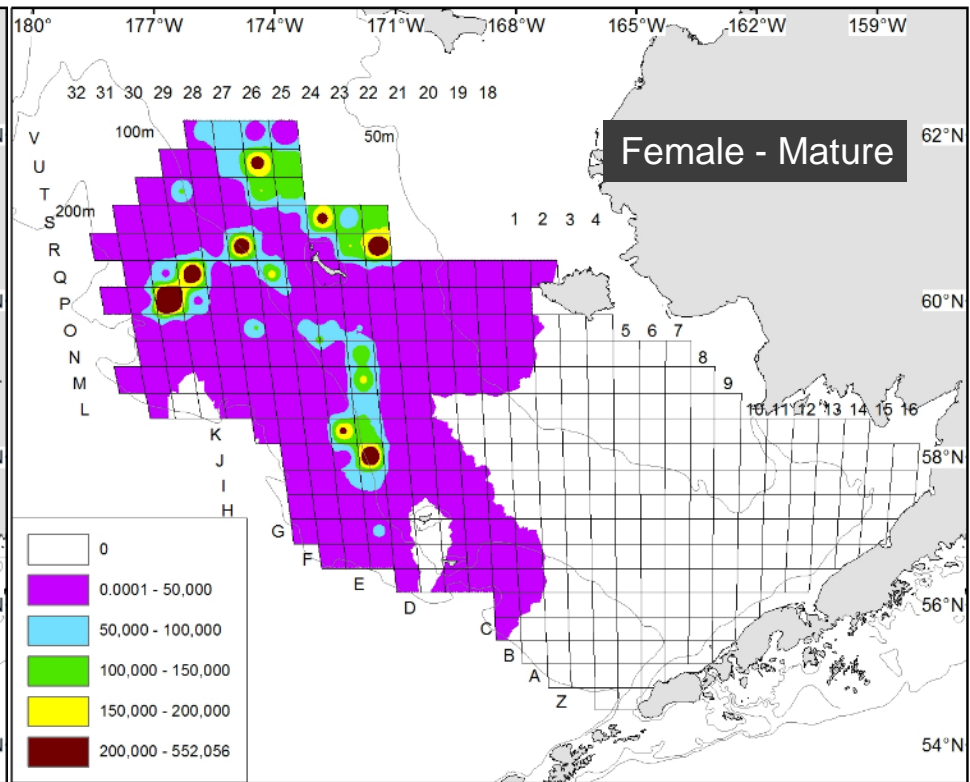
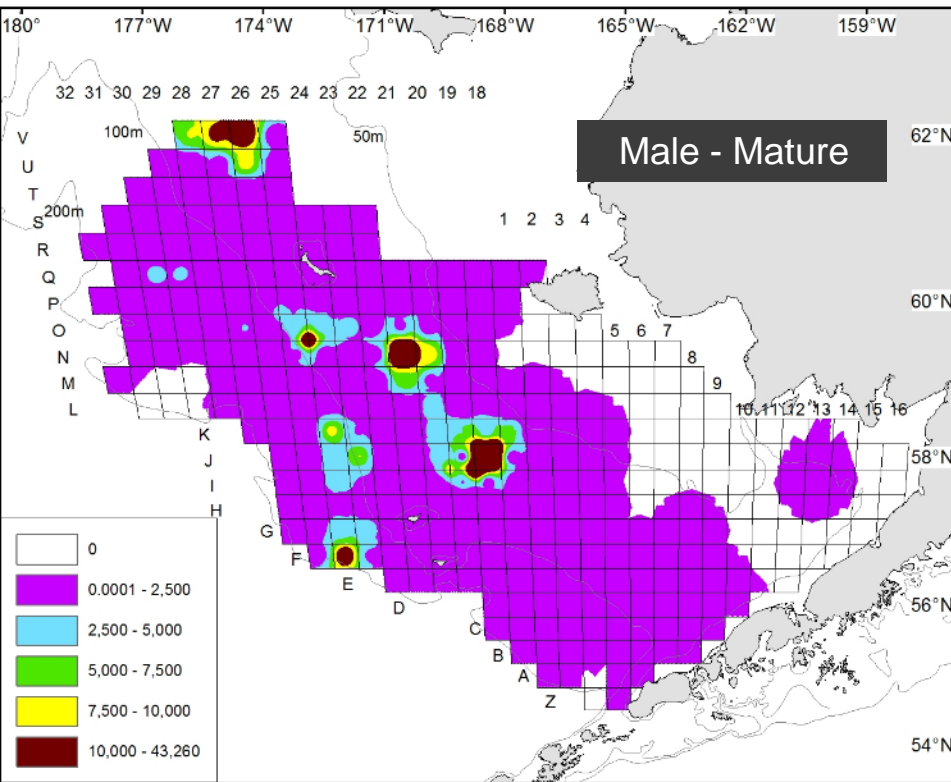
-34%%

Juveniles

Male -38%

Female -94 %

Snow crab



177°E 180° 177°W 174°W 171°W 168°W 165°W 162°W 159°W 156°W

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Russia

Alaska

FF
EE
DD
CC
BB
AA
ZZ
YY
XX
WW
VV
UU
TT
SS
RR
QQ
PP
OO
NN
MM
LL
KK

50m
100m
200m
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31 30 29 28
27
26
25 24 23
22 21 20 19
18
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2
1

64°N
62°N
60°N
58°N
56°N
54°N

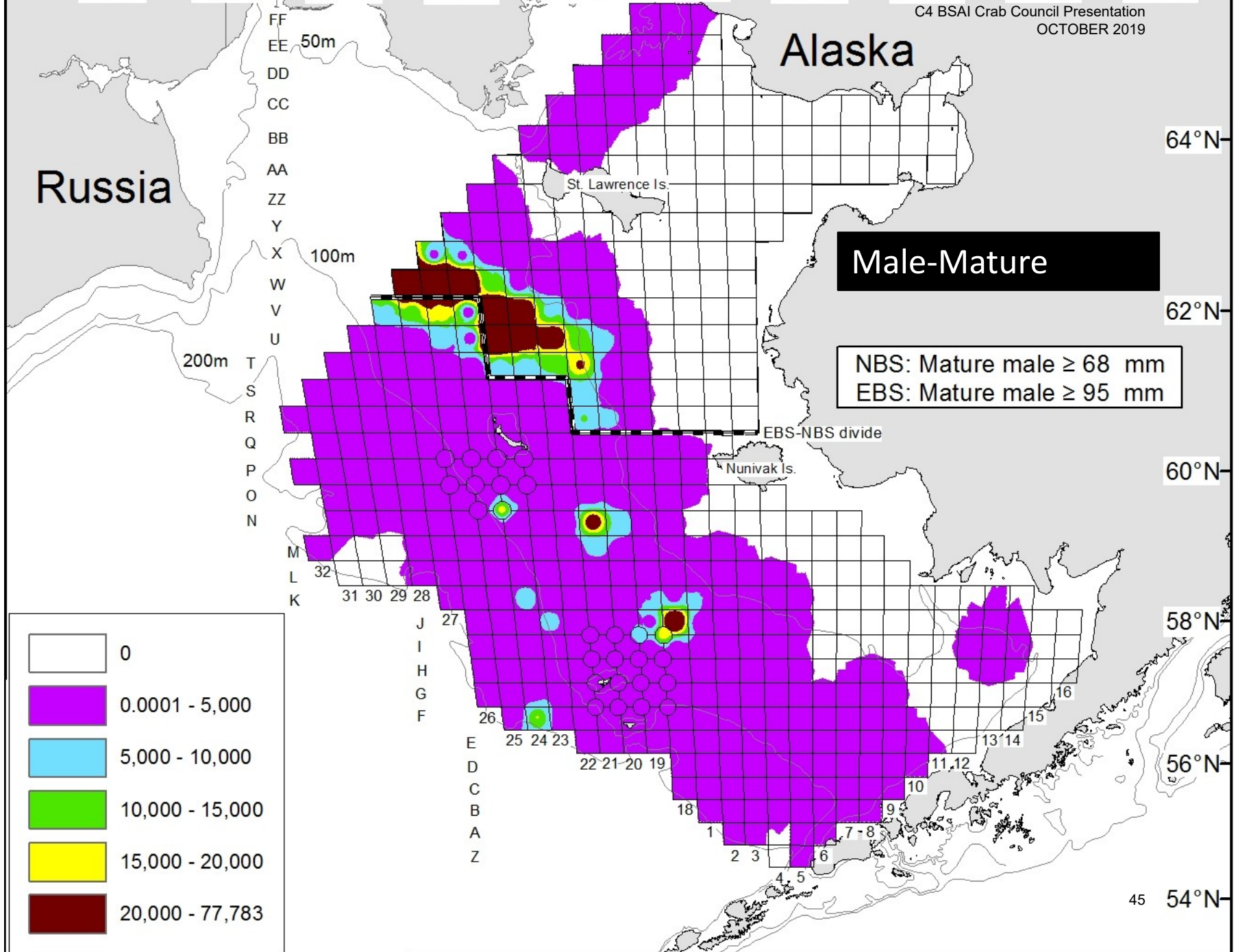
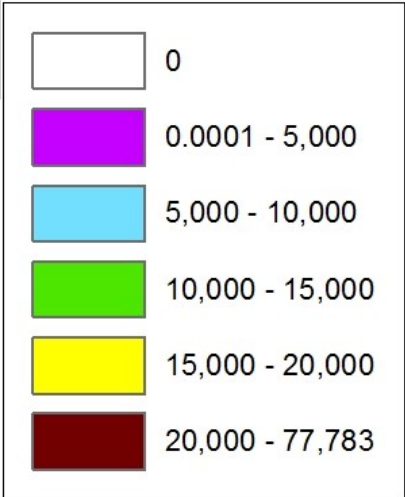
Male-Mature

NBS: Mature male ≥ 68 mm
EBS: Mature male ≥ 95 mm

EBS-NBS divide

St. Lawrence Is.

Nunivak Is.



177°E

180°

177°W

174°W

171°W

168°W

165°W

162°W

159°W

156°W

C4 BSAI Crab Council Presentation
OCTOBER 2019

Russia

Alaska

FF

EE

50m

DD

CC

BB

AA

ZZ

YY

XX

WW

VV

UU

100m

200m

TT

SS

RR

QQ

PP

OO

NN

MM

LL

KK

32

31

30

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1

0

St. Lawrence Is.

Female-mature

EBS-NBS divide

Nunivak Is.

64°N

62°N

60°N

58°N

56°N

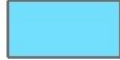
46 54°N



0



0.0001 - 25,000



25,000 - 50,000



50,000 - 75,000



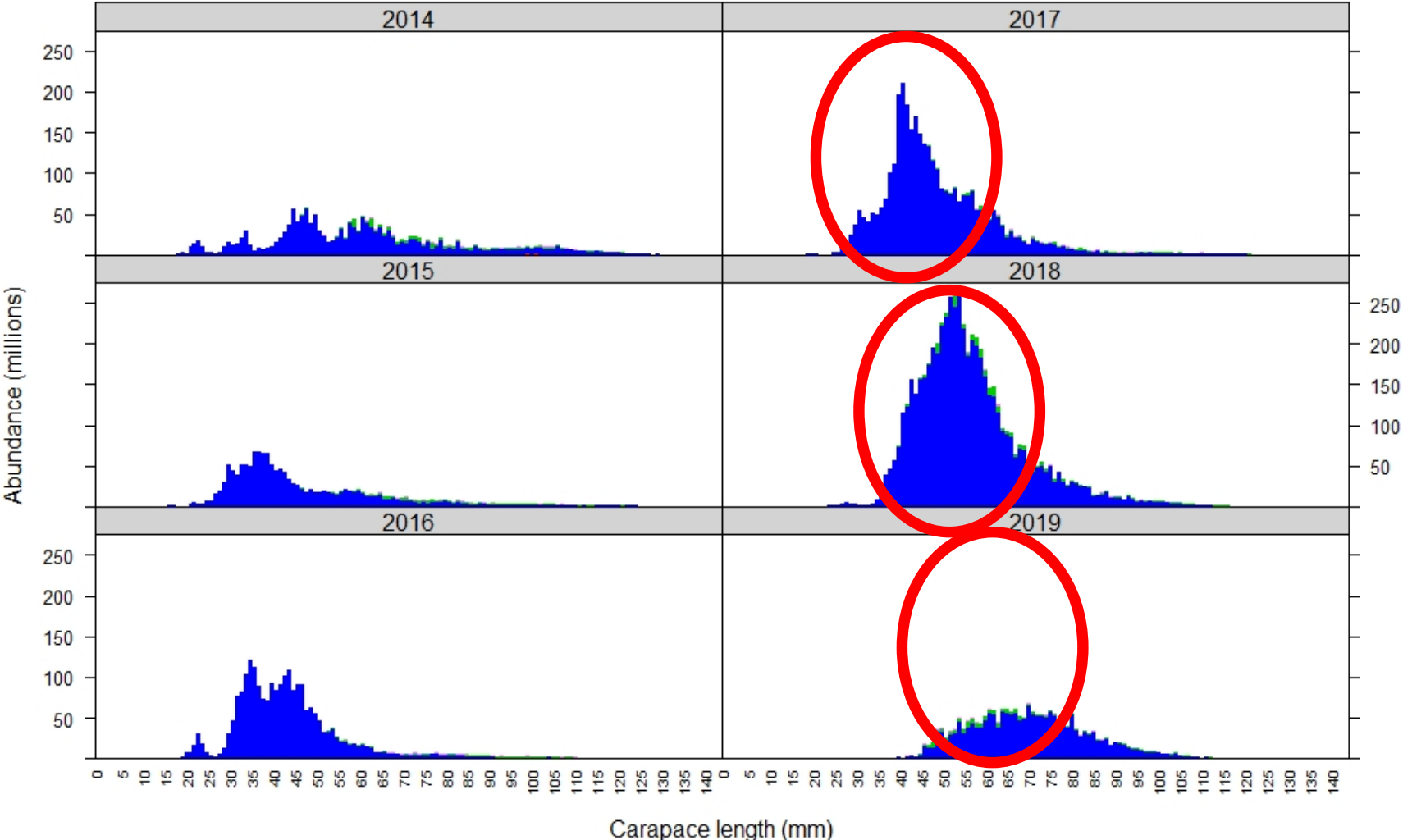
75,000 - 100,000



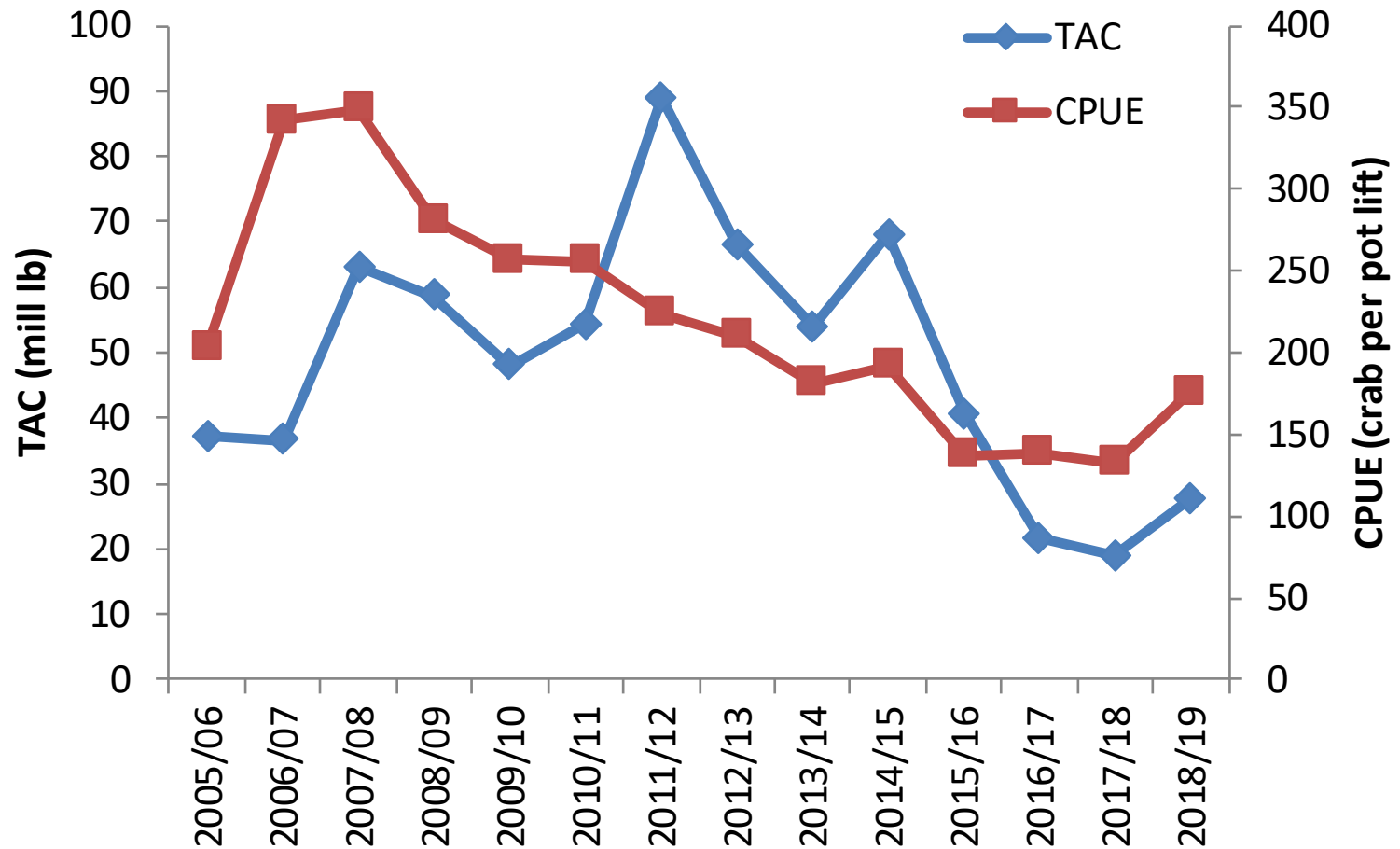
100,000 - 552,056

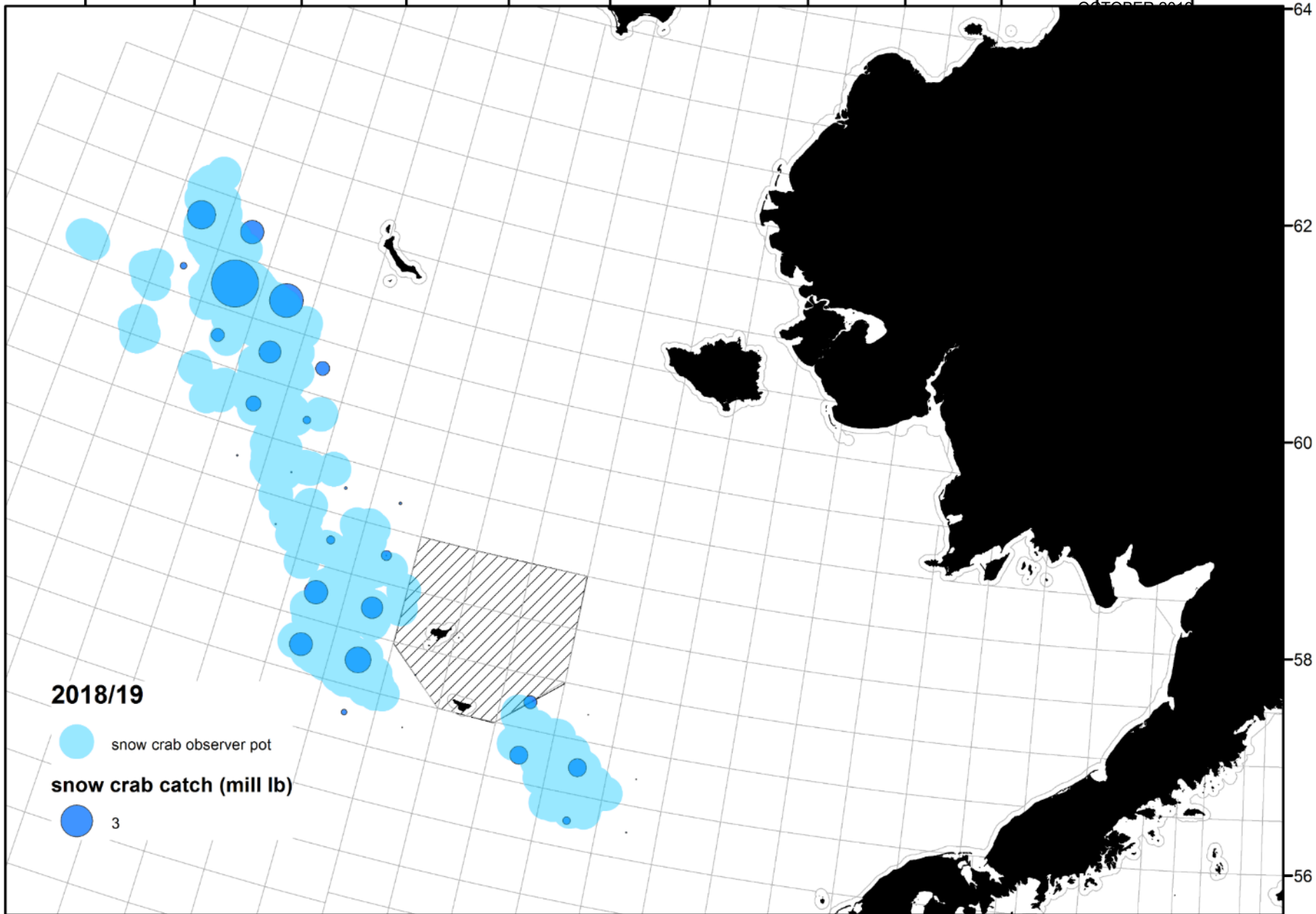
Snow Crab (male)

Shell condition
Molting & soft ■ New - hard ■ Old ■ Very old ■



Snow crab





2018/19

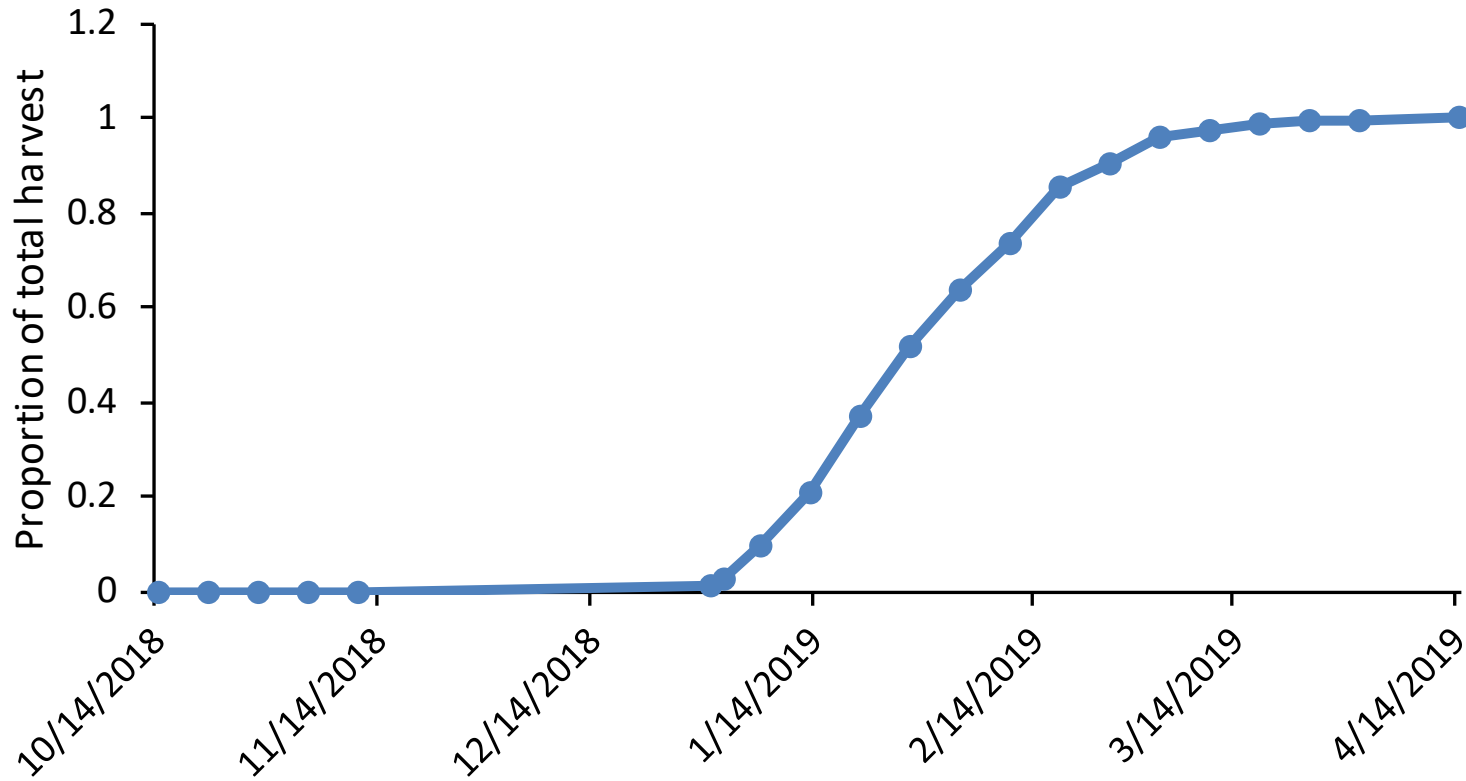
● snow crab observer pot

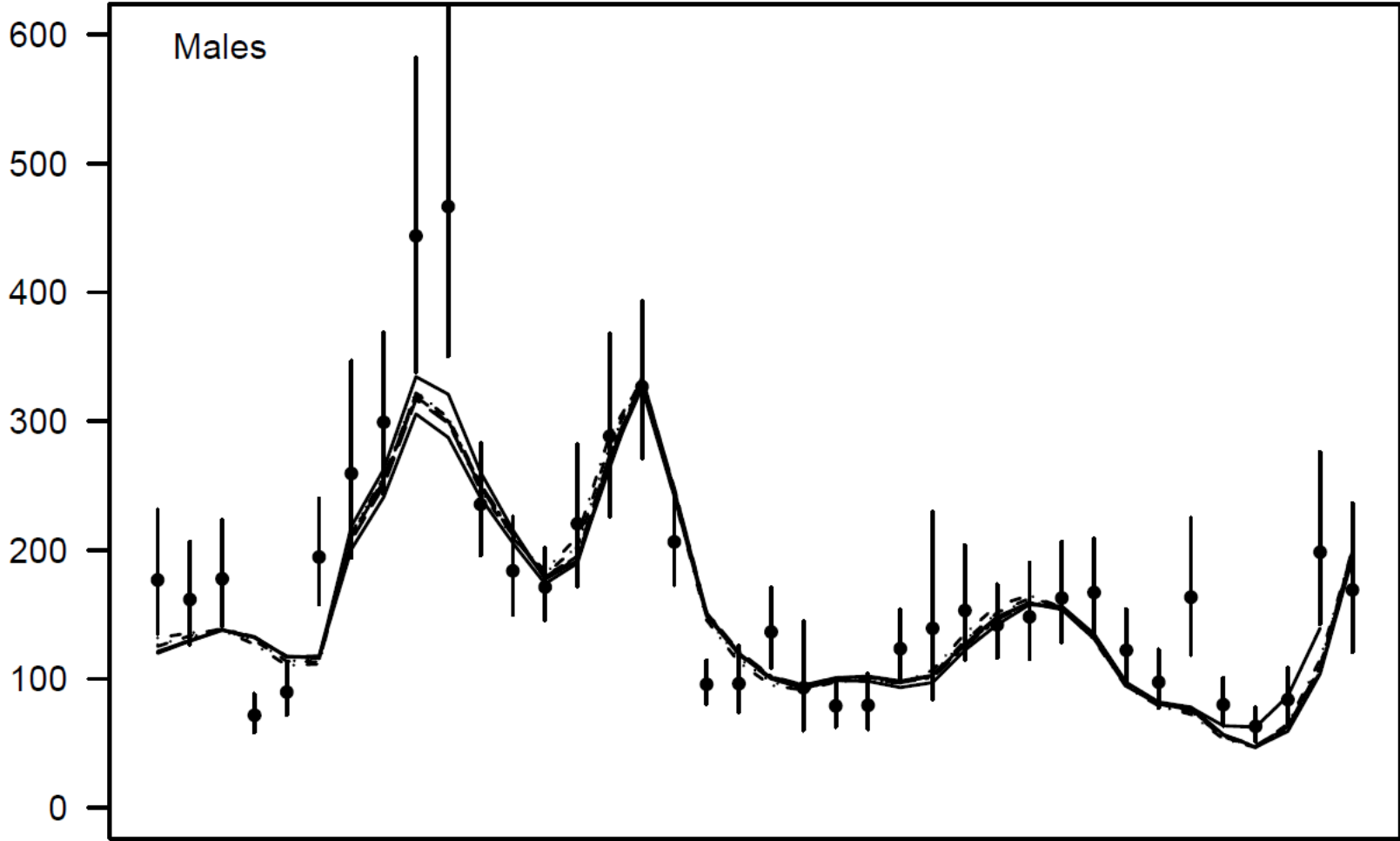
snow crab catch (mill lb)

● 3

2018/19 snow crab

snow





Model predicted MMB increased in 2019, but less than expected based on last year's data.

Snow crab assessment issues

- Effect of snow crab in the northern Bering Sea on crab stocks in the EBS.
- Whether the natural mortality value used in the assessment is too low.
- Whether to model crab growth at molting as a kinked line or a straight line.
- The CPT recommended use of a new model with an increase natural mortality and straight line growth for the males only.

Recommended OFL is 54.92 kt

Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2015/16	75.8	91.6	18.4	18.4	21.4	83.1	62.3
2016/17	75.8	96.1	9.7	9.7	11.0	23.7	21.3
2017/18	71.4	99.6	8.6	8.6	10.5	28.4	22.7
2018/19	63.0	123.1	12.5	12.5	15.4	29.7	23.8
2019/20		167.3				54.9	43.9

Pribilof Islands red king crab assessment

Cody Szuwalski, AFSC

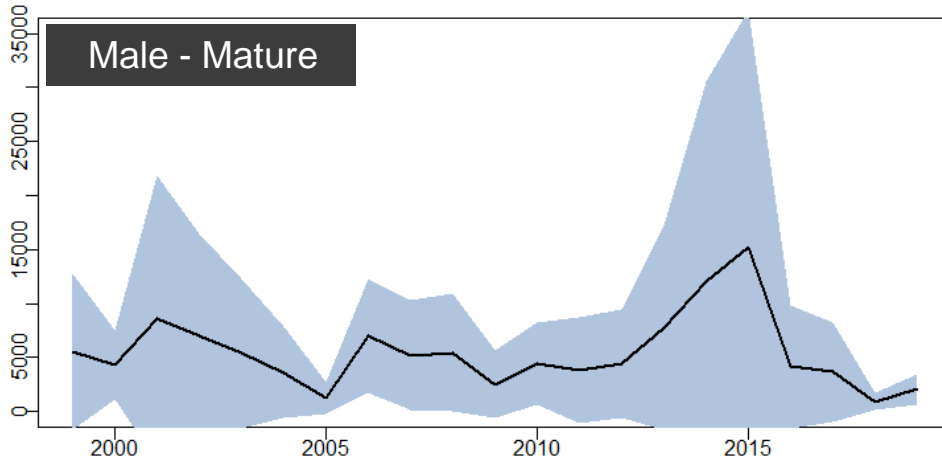
October 1, 2019



Pribilof Islands red king crab

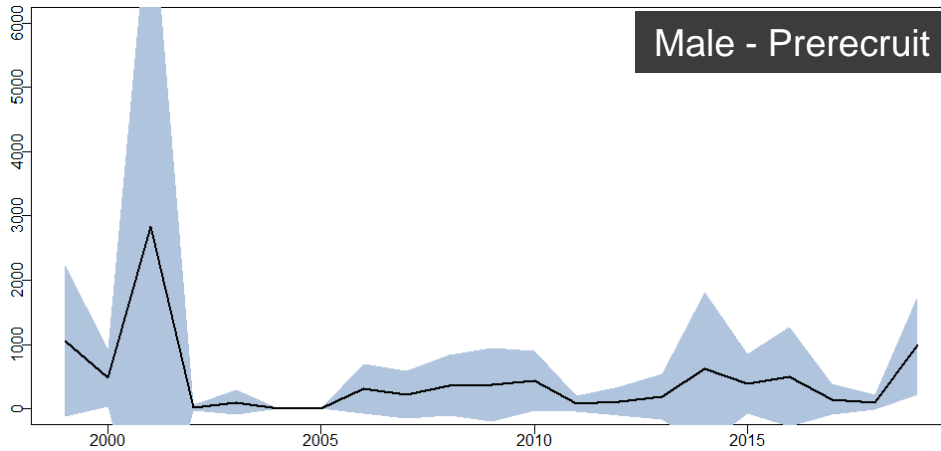
C4 BSAI Crab Council Presentation
OCTOBER 2019

Biomass (t)

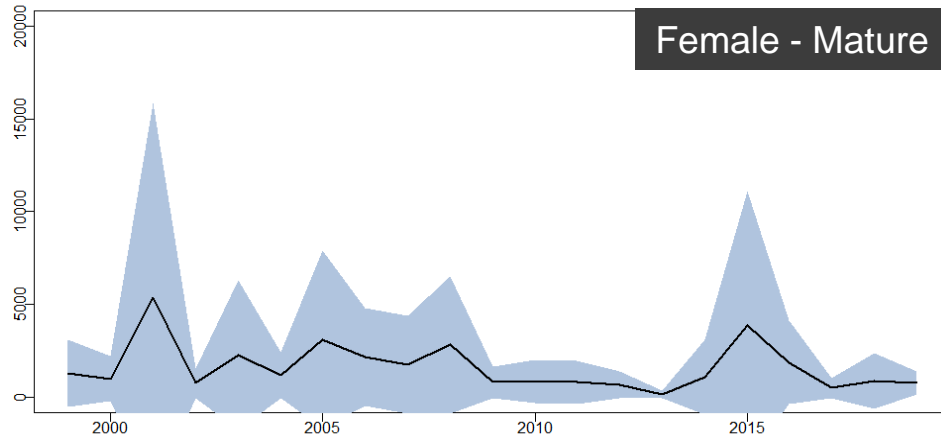


Legal male
+33%

Mature male
+125%



Pre-recruit males
+867%

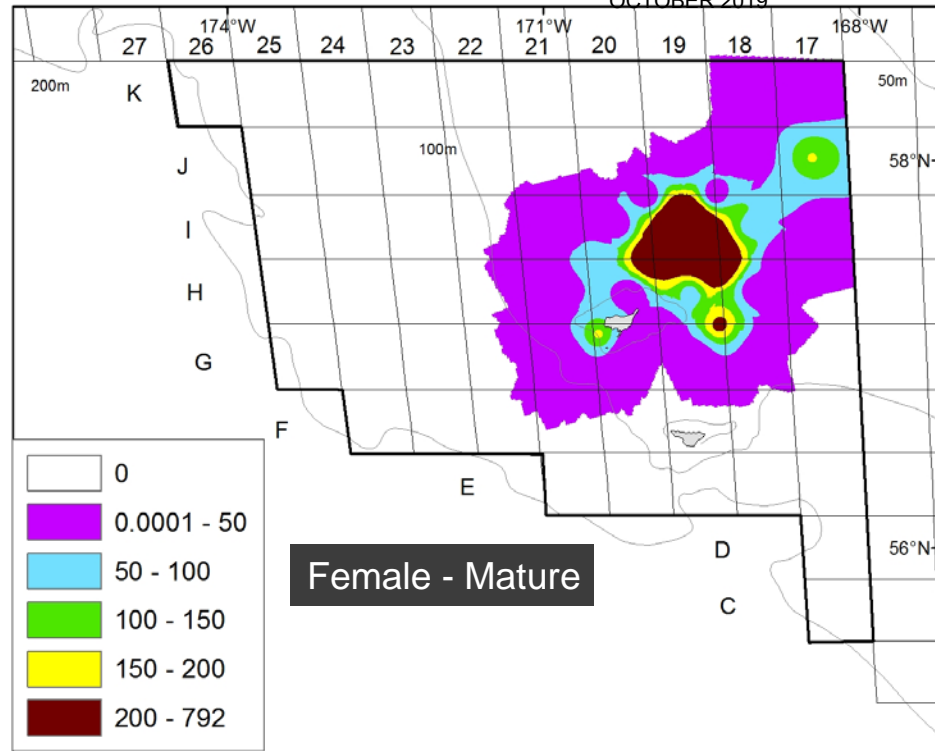
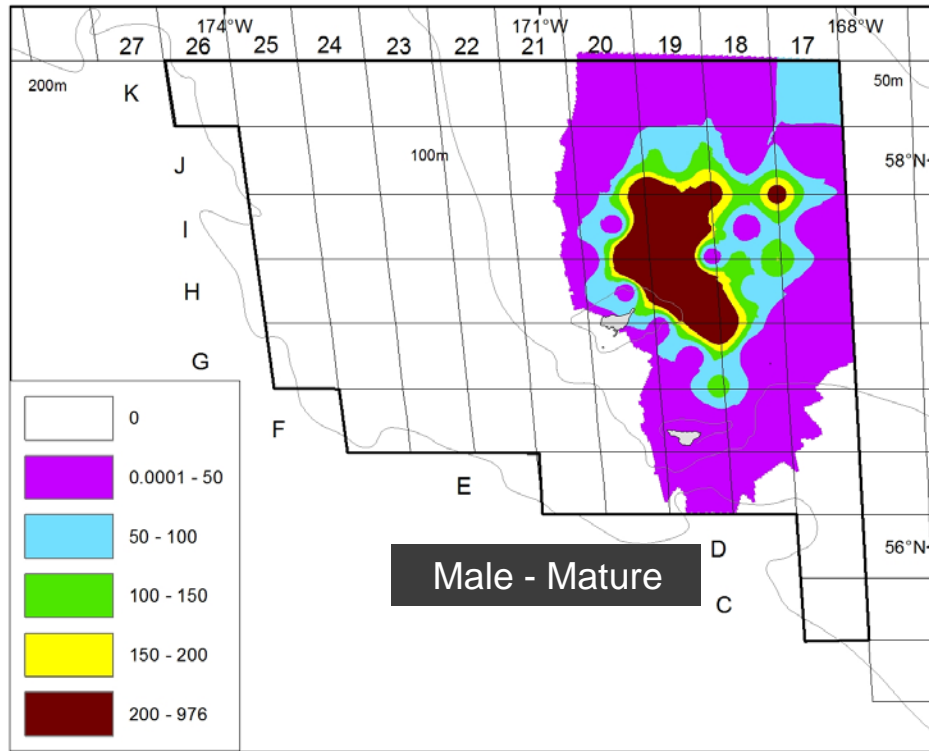


Mature female
-9 %

Juveniles
Male: -77%
Female: none caught
2017/2018

Pribilof Islands red king crab

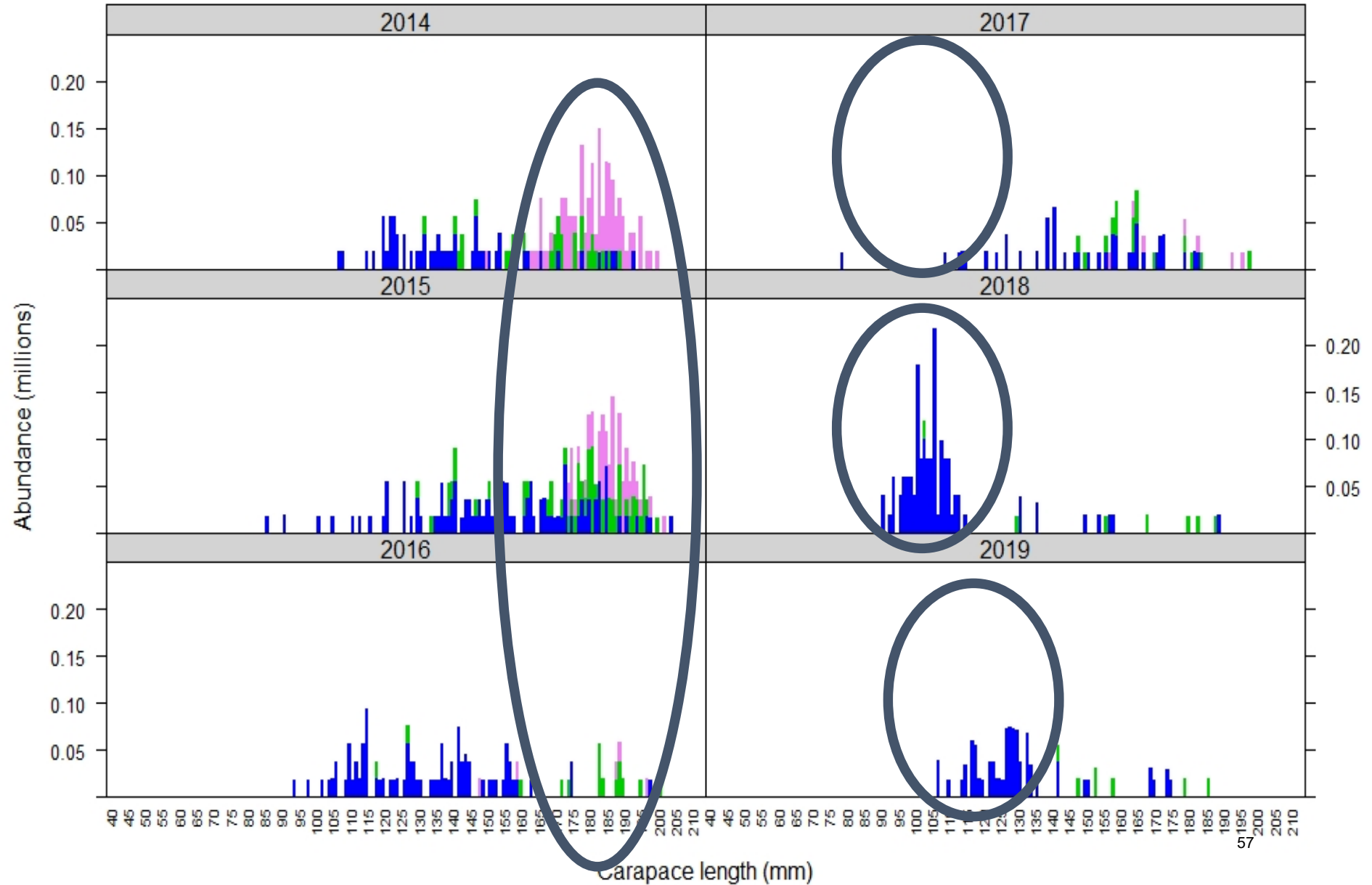
C4 BSAI Crab Council Presentation
OCTOBER 2019

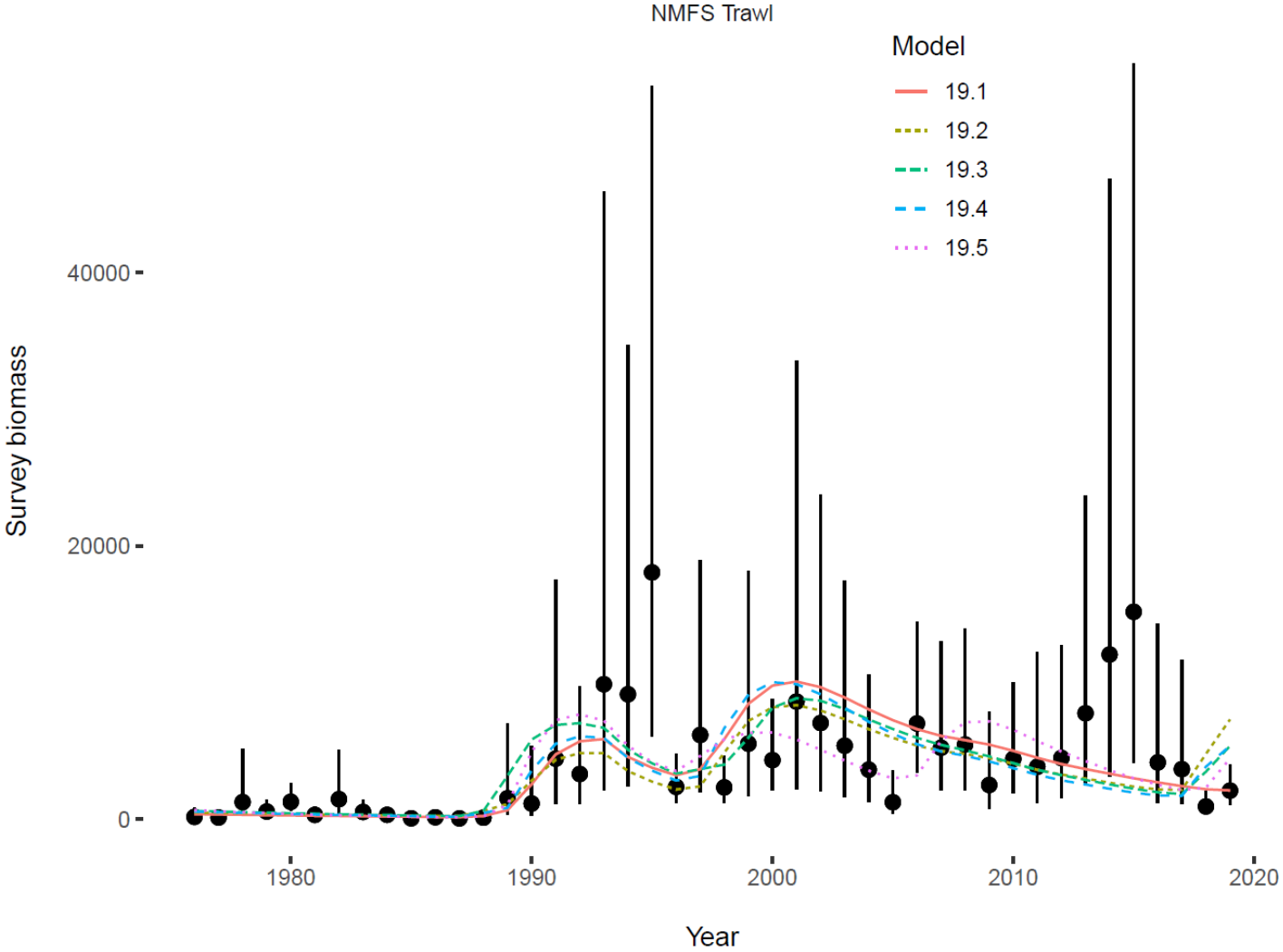


Pribilof Islands Red King Crab (male)

C4 BSAI Crab Council Presentation
OCTOBER 2019

Shell condition
Molting & soft ■ New - hard ■ Old ■ Very old ■





Integrated assessment scenarios estimate higher biomasses than smoothing algorithms.

PIRKC assessment issues

- Whether to use the random effects model or a new integrated assessment using Gmacs.
- The appropriate value of natural mortality to use in the assessment.
- The current BMSY proxy is not consistent with the tier 4 definition, since the stock was fished only 5 years during 1991-2019.
- The CPT recommended use of Gmacs with a higher natural mortality.
- The CPT recommended a new BSMSY based on the assumption that the stock was at unfished levels after 2000.

Pribilof Islands Red King Crab OFL and ABC specifications

Year	MSST	Biomass (MMB_{mating})	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						864	648

Other agenda items:

Overfishing status for PIBKC, PIGKC, and WAIRKC

PIBKC

- SAFE completed May 2019
 - 2018/19 fishing mortality incomplete

- Updated 2018/19 fishing mortality:
 - No directed fishery
 - Bycatch mortality in the crab fisheries: *confidential(?)*
 - Bycatch mortality in the groundfish fisheries: 0.413 t

Year	MSST	Biomass (MMB _{naive})	TAC	Retained Catch	Total Catch Mortality	OFL	ABC
2015/16	2,058 A	361 A	closed	0	1.18	1.16	0.87
2016/17	2,053 A	232 A	closed	0	0.38	1.16	0.87
2017/18	2,053 A	230 A	closed	0	0.33	1.16	0.87
2018/19	2,053 A	230 A	closed	0	0.43	1.16	0.87
2019/20	--	175 B	--	--	--	1.16	0.87

- Overfishing did not occur in 2018/19
- Stock remains overfished

PIGKC

Overfishing did not occur in 2018.

One vessel participated in the 2018 directed fishery. Estimated total fishery mortality in 2018 [REDACTED] resulted from retained catch [REDACTED], bycatch in the directed fishery [REDACTED] and bycatch in groundfish fisheries (1.54 t).

Management Performance Table (values in t)

Calendar Year	MSST	Biomass (MMB)	GHL ^a	Retained Catch	Total Catch ^b	OFL	ABC
2013	N/A	N/A	68	Conf. ^c	Conf. ^c	91	82
2014	N/A	N/A	68	Conf. ^c	Conf. ^c	91	82
2015	N/A	N/A	59	0	1.92	91	68
2016	N/A	N/A	59	0	0.24	91	68
2017	N/A	N/A	59	Conf. ^c	Conf. ^c	93	70
2018	N/A	N/A	59	Conf. ^c	Conf. ^c	93	70

- Guideline harvest level, established in lb and converted to t.
- Total retained catch plus estimated bycatch mortality of discarded catch during crab fisheries and bycatch mortality due to groundfish fisheries are included here, but not for 2013, 2014, 2017, and 2018 because the directed fishery is confidential.
- Confidential under Sec. 16.05.815 (SOA statute).

WAIRKC

Overfishing did not occur in 2018/19.

The directed fishery was closed in 2018/19.

Estimated total fishery mortality in 2018/19 (0.14 t) resulted from bycatch in the AIGKC fishery (0.01 t) and bycatch in groundfish fisheries (0.14 t).

Status and catch specifications (t) of Western Aleutian Islands red king crab

Fishing Year	MSST	Biomass (MMB)	TAC	Retained Catch	Total Catch	OFL	ABC
2013/14	N/A	N/A	Closed	0	<1	56	34
2014/15	N/A	N/A	Closed	0	<1	56	34
2015/16	N/A	N/A	Closed	0	1.3	56	34
2016/17	N/A	N/A	Closed	0	<1	56	34
2017/18	N/A	N/A	Closed	0	<1	56	14
2018/19	N/A	N/A	Closed	0	<1	56	14
2019/20	N/A	N/A				56	14