

BSAI Crab Management

SAFE Report and Crab Plan Team Report

Agenda Item C-3
October 2017

**BSAI
Crab Plan Team:**

Bob Foy (NOAA Fisheries /AFSC-Kodiak), Chair

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October 2017 Crab Plan Team Report

- Overview of crab process
- EBS Survey update
- Recommend final OFL/ABC for 6 crab stocks
- Aleutian Islands golden king crab model
- NSRKC model update
- Other business

BSAI Crab Stocks Management Timing

Norton Sound red king crab

Assessed in
January/February

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

Assessed in
May/June

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

Assessed in
September/October

Model timing

Stock	CPT review and recommendations to SSC	SSC review and recommendations to Council	Assessment frequency	Year of next Assessment
Norton Sound red king crab (NSRKC)	January	February	Annual	2018
Aleutian Is. golden king crab (AIGKC)	May	June	Annual	2018
Pribilof Is. golden king crab (PIGKC)	May	June	Triennial	2020
Western Aleutian Is. red king crab (WAIRKC)	May	June	Triennial	2020
EBS snow crab	September	October	Annual	2018
Bristol Bay red king crab (BBRKC)	September	October	Annual	2018
EBS Tanner crab	September	October	Annual	2018
Pribilof Is. red king crab (PIRKC)	September	October	Biennial	2019
Pribilof Is. blue king crab (PIBKC)	September	October	Triennial	2020
Saint Matthew blue king crab (SMBKC)	September	October	Annual	2018

Overfishing limit (OFL)

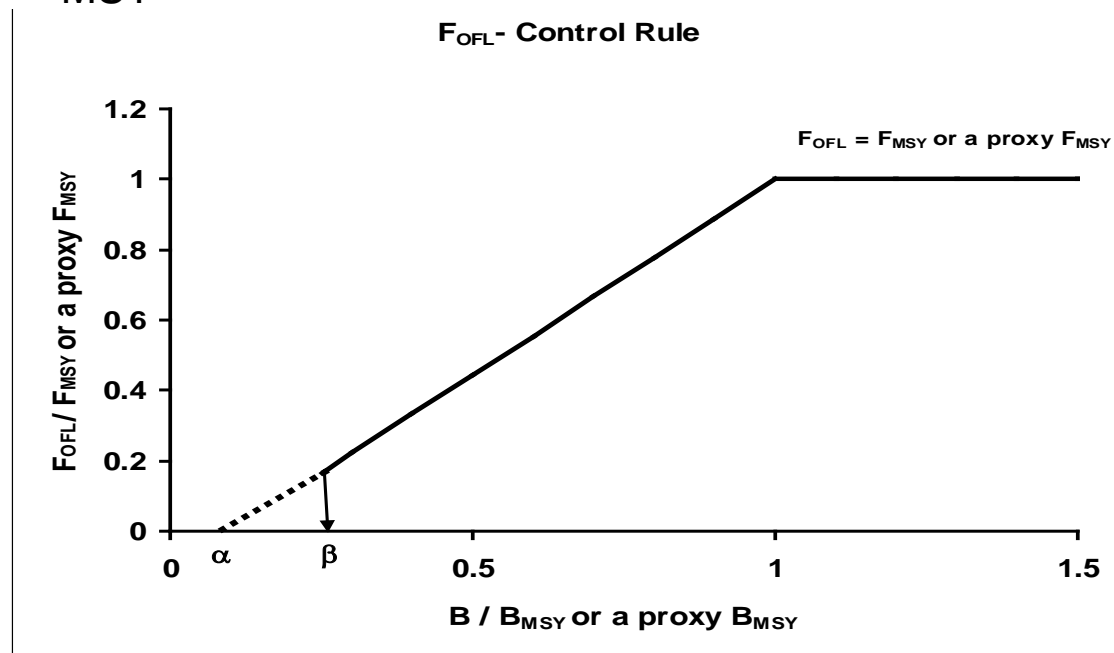
Overfishing rule limits catch to prevent overfishing and avoid overfished status ($0.5 B_{MSY}$)

Set by OFL fishing mortality rate (F_{OFL})

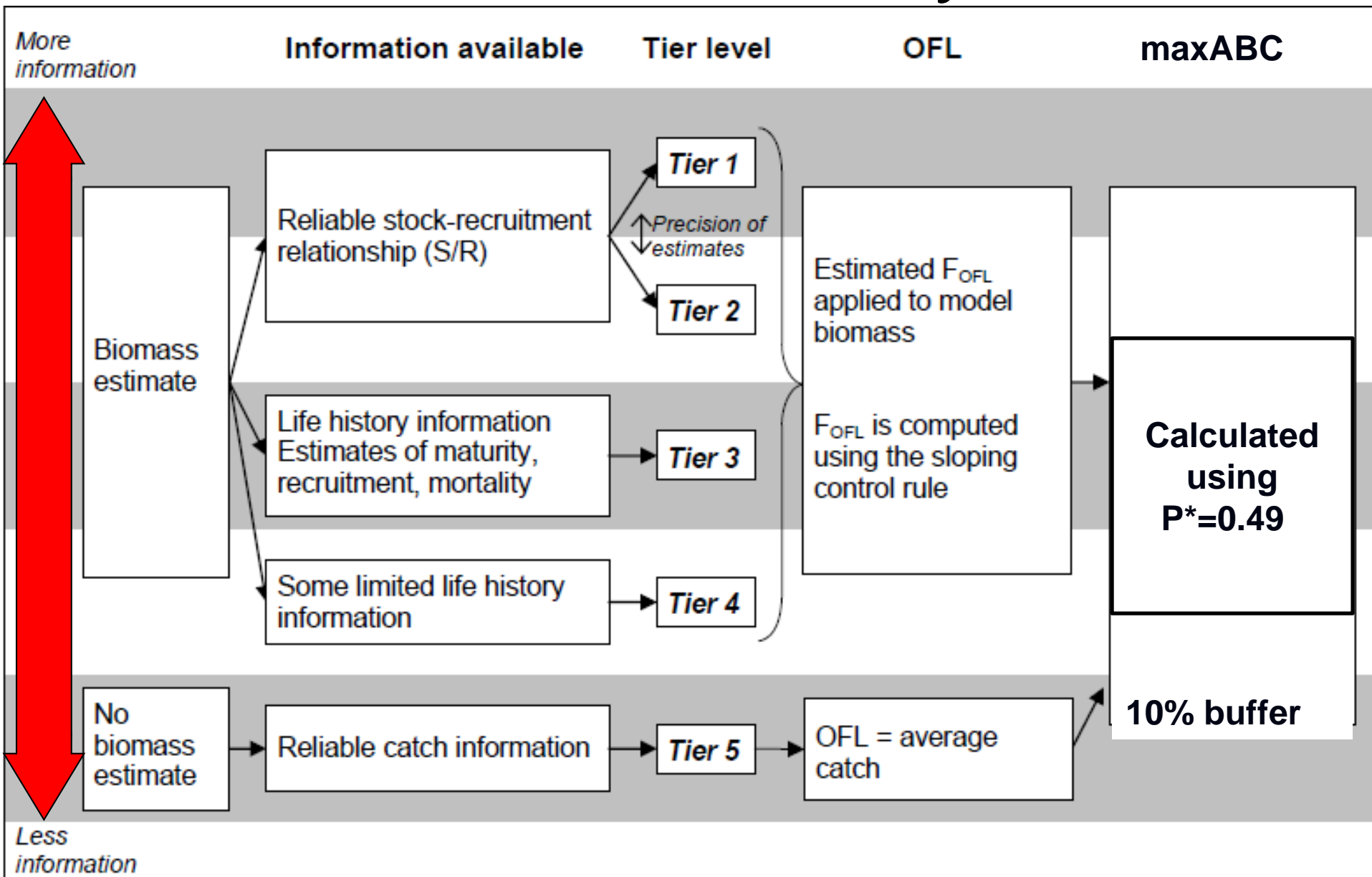
F_{OFL} prescribed by Tier system

Stock $\geq B_{MSY}$: $F_{OFL} = F_{MSY}$

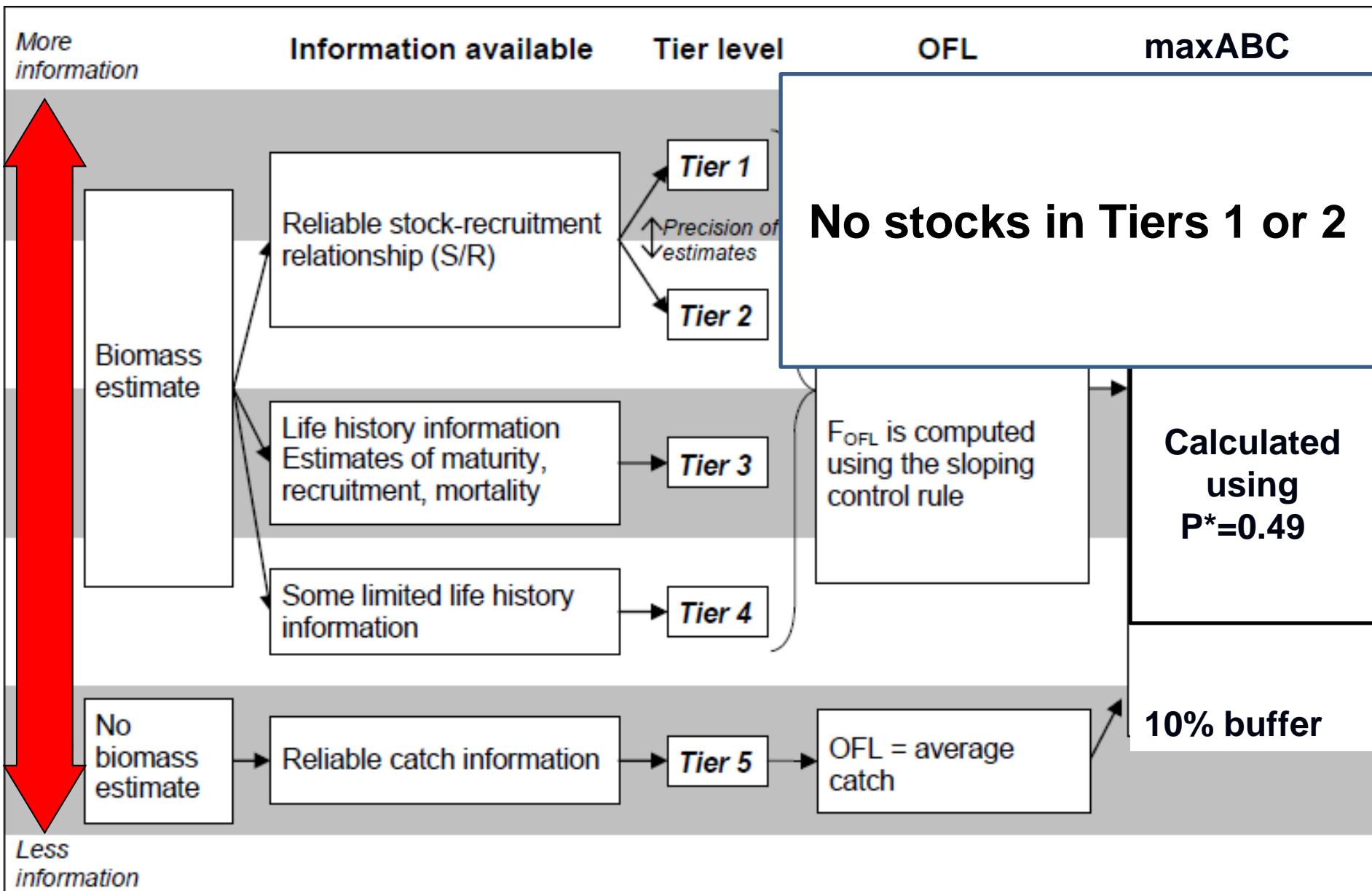
Stock $< B_{MSY}$: $F_{OFL} < F_{MSY}$



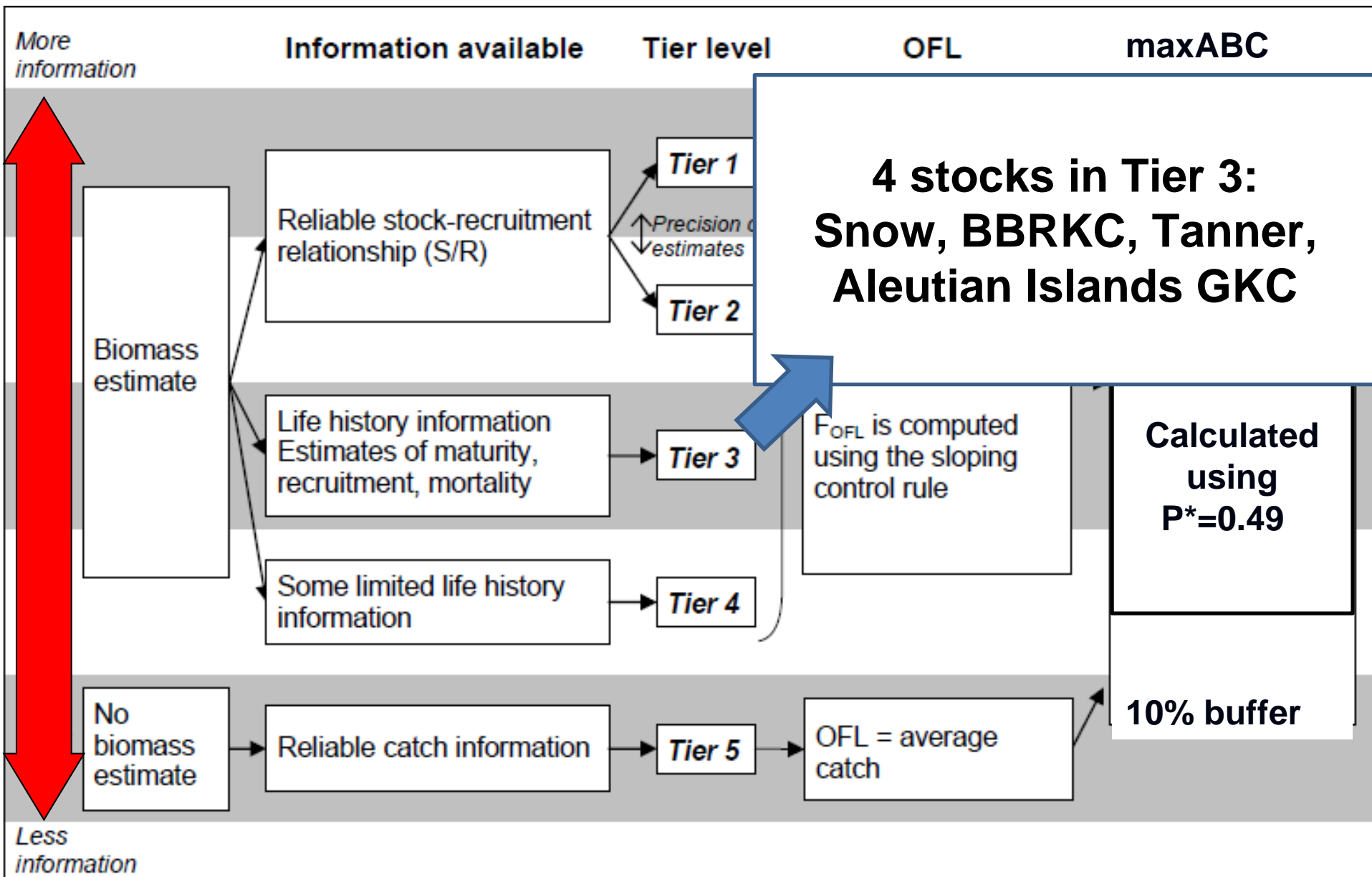
Current Crab Tier system



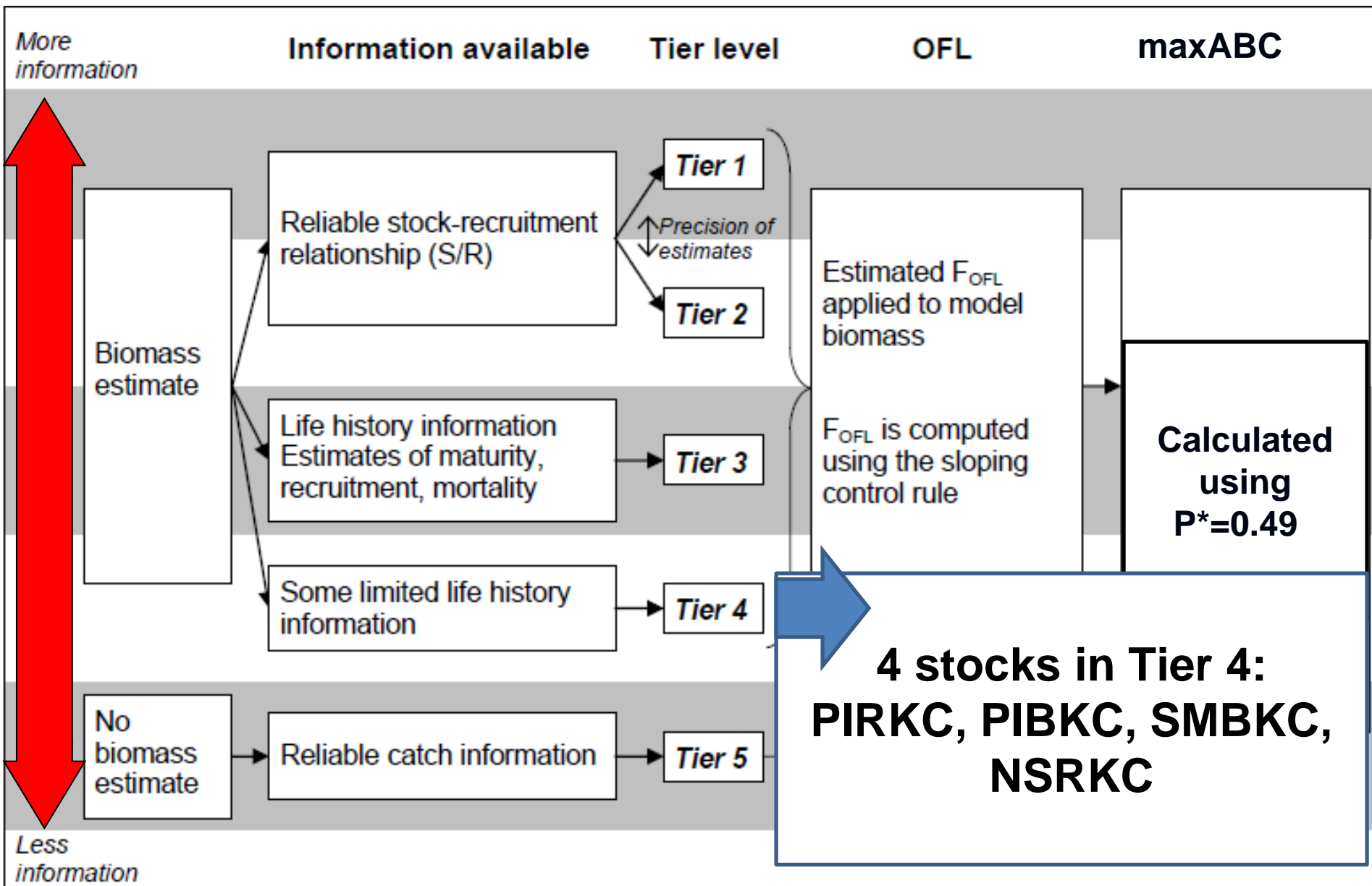
Overview of stocks



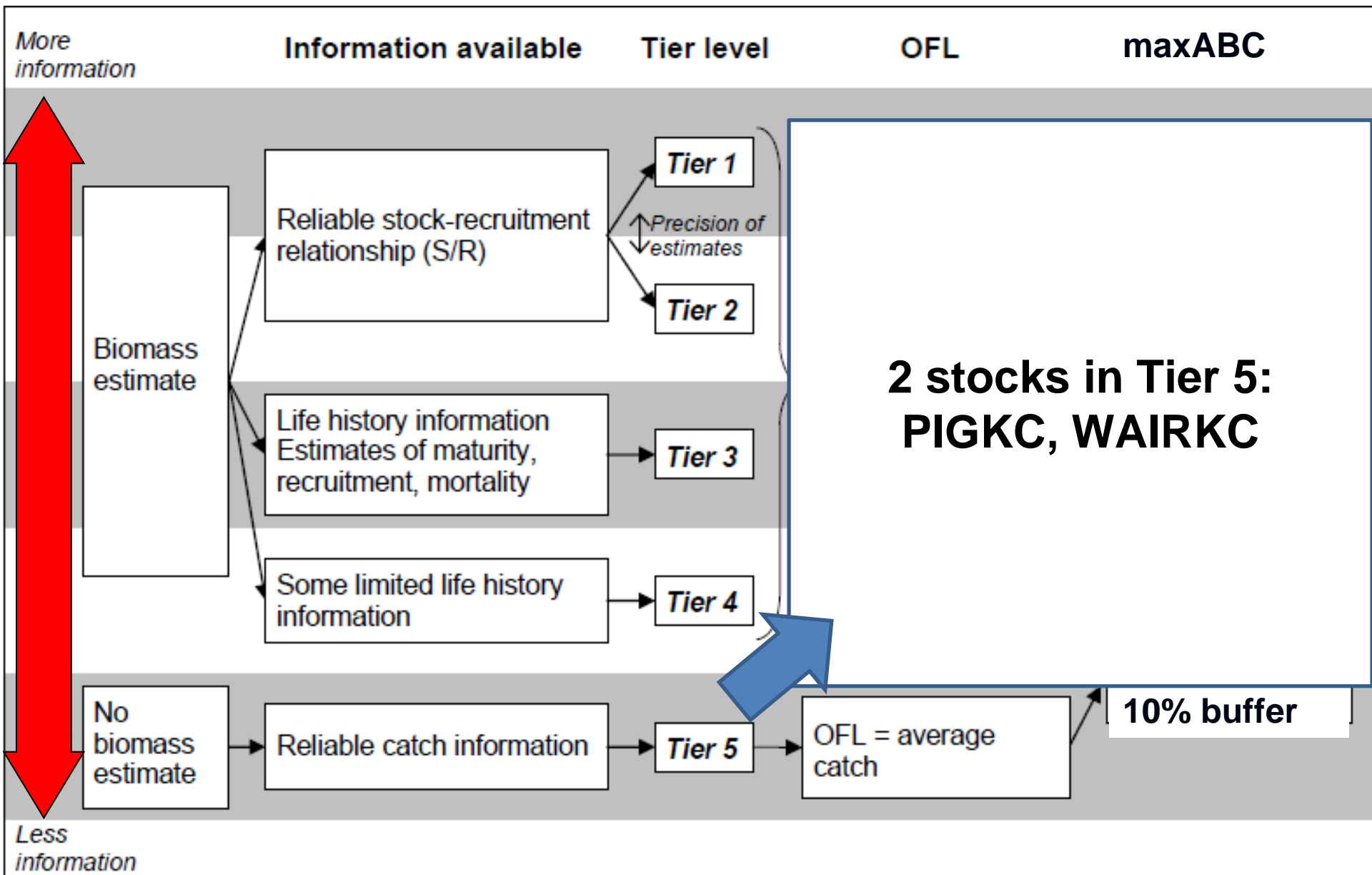
Overview of stocks



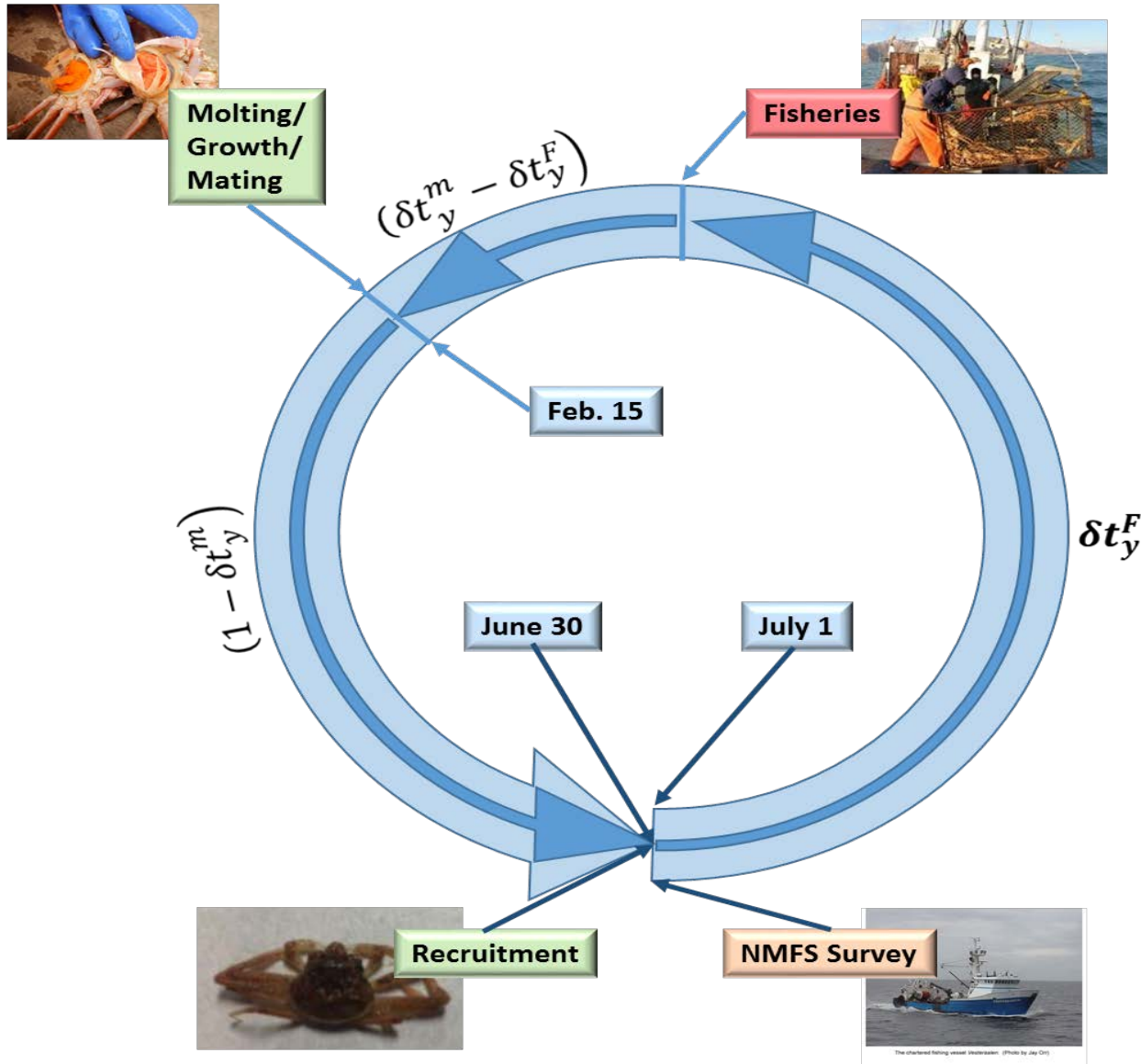
Overview of stocks



Overview of stocks

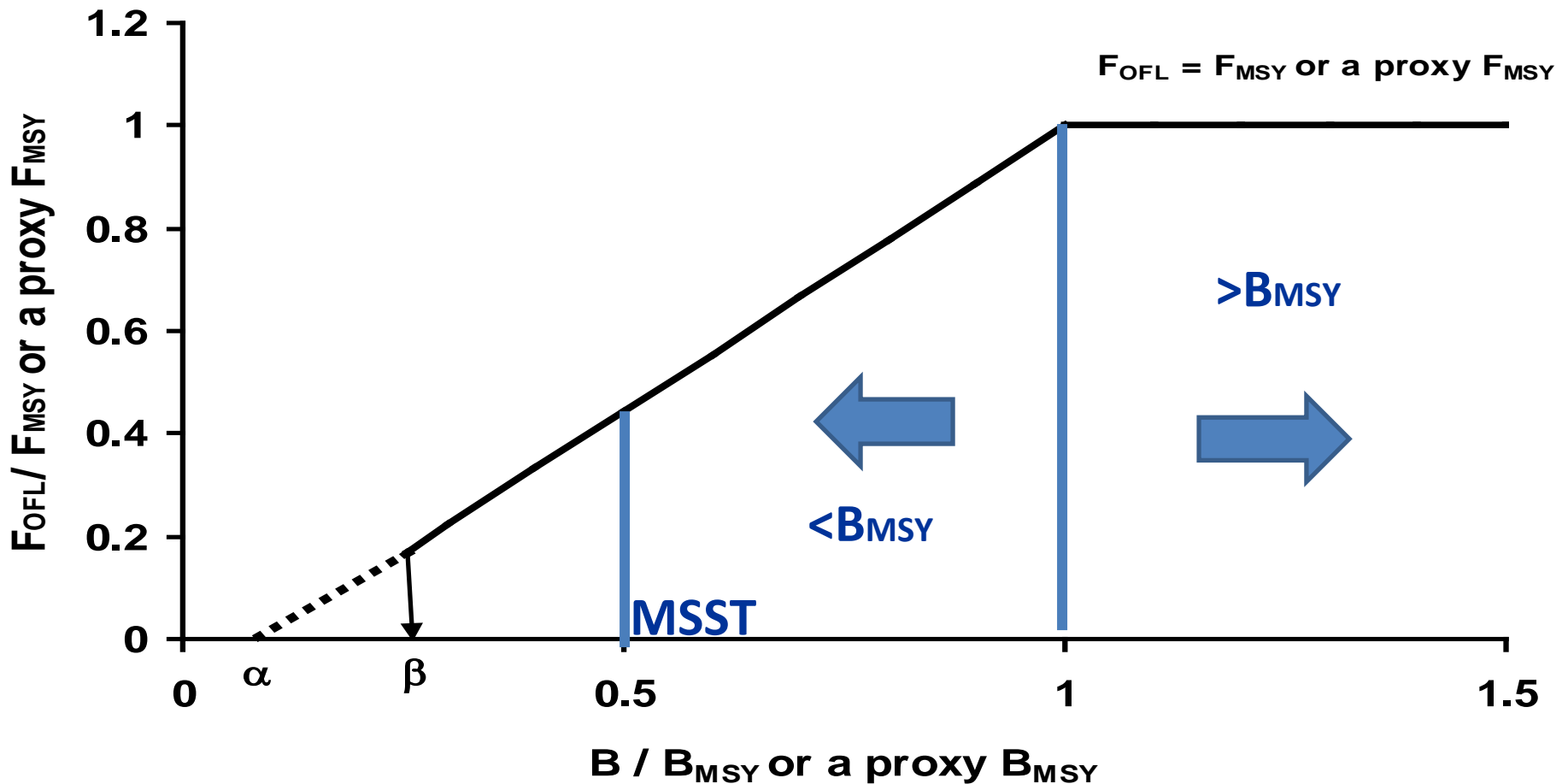


Tier 3 stage/size-based population dynamics model



Overfishing limit (OFL)

F_{OFL} - Control Rule



Projected stock status in relation to biological reference points

Biomass
> B_{MSY}

- EBS Tanner crab
- Norton Sound red king crab
- Aleutian Islands golden king crab

Biomass
< B_{MSY}

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

Biomass
< $\frac{1}{2} B_{MSY}$
(MSST)

- Pribilof Islands blue king crab

Biomass and status unknown

- Pribilof Islands golden king crab
- Aleutian Islands (Adak) red king crab



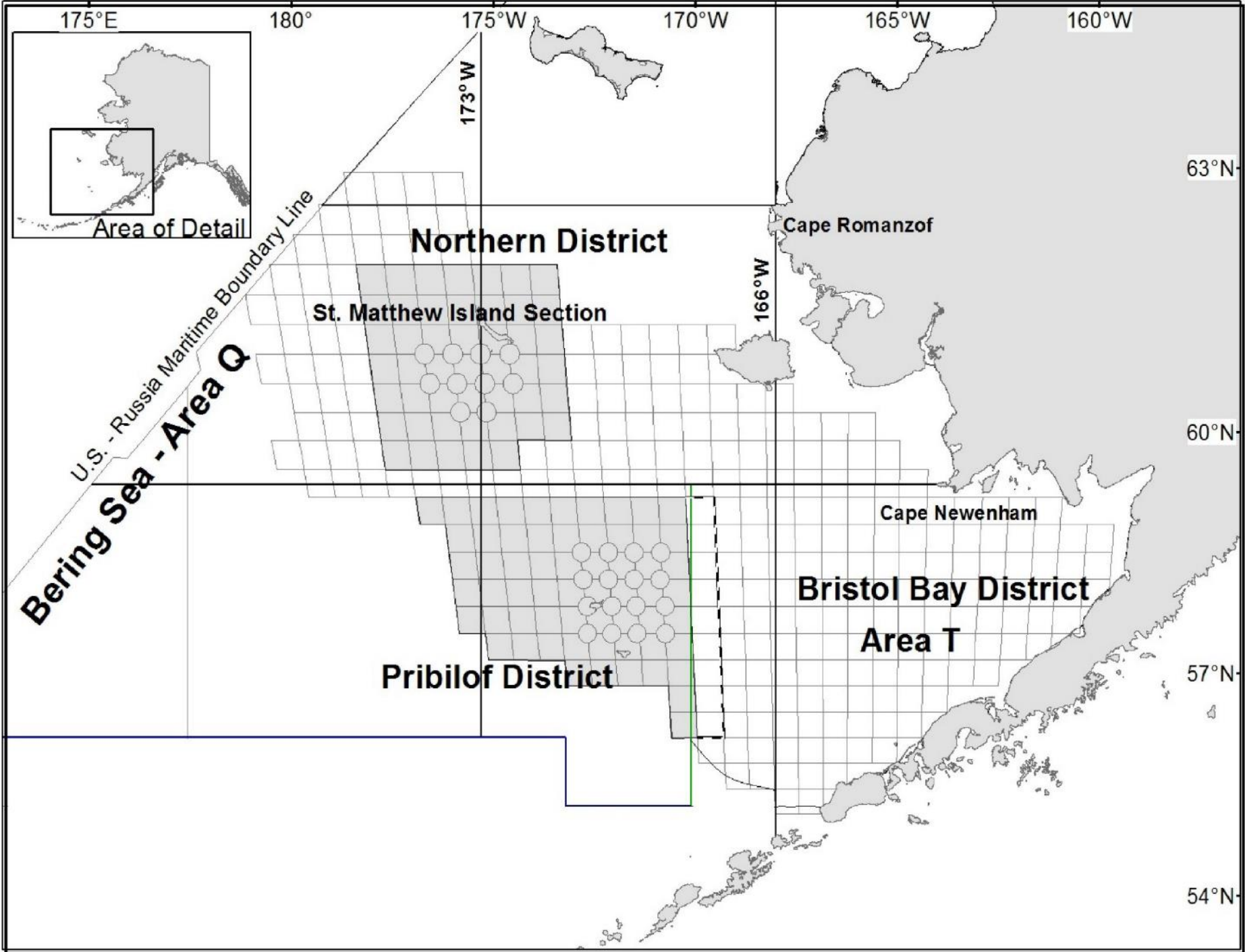
**NOAA
FISHERIES**

Alaska
Fisheries
Science Center-
Kodiak Lab

The 2017 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species

- Christie Lang, Jon Richar,
Robert Foy,
- AFSC SAP and GAP
programs

Crab Plan Team
September 2017



175°E

180°

175°W

170°W

165°W

160°W

173°W

63°N

Cape Romanzof

Northern District

St. Matthew Island Section

166°W

60°N

Cape Newenham

Bristol Bay District

Area T

Pribilof District

57°N

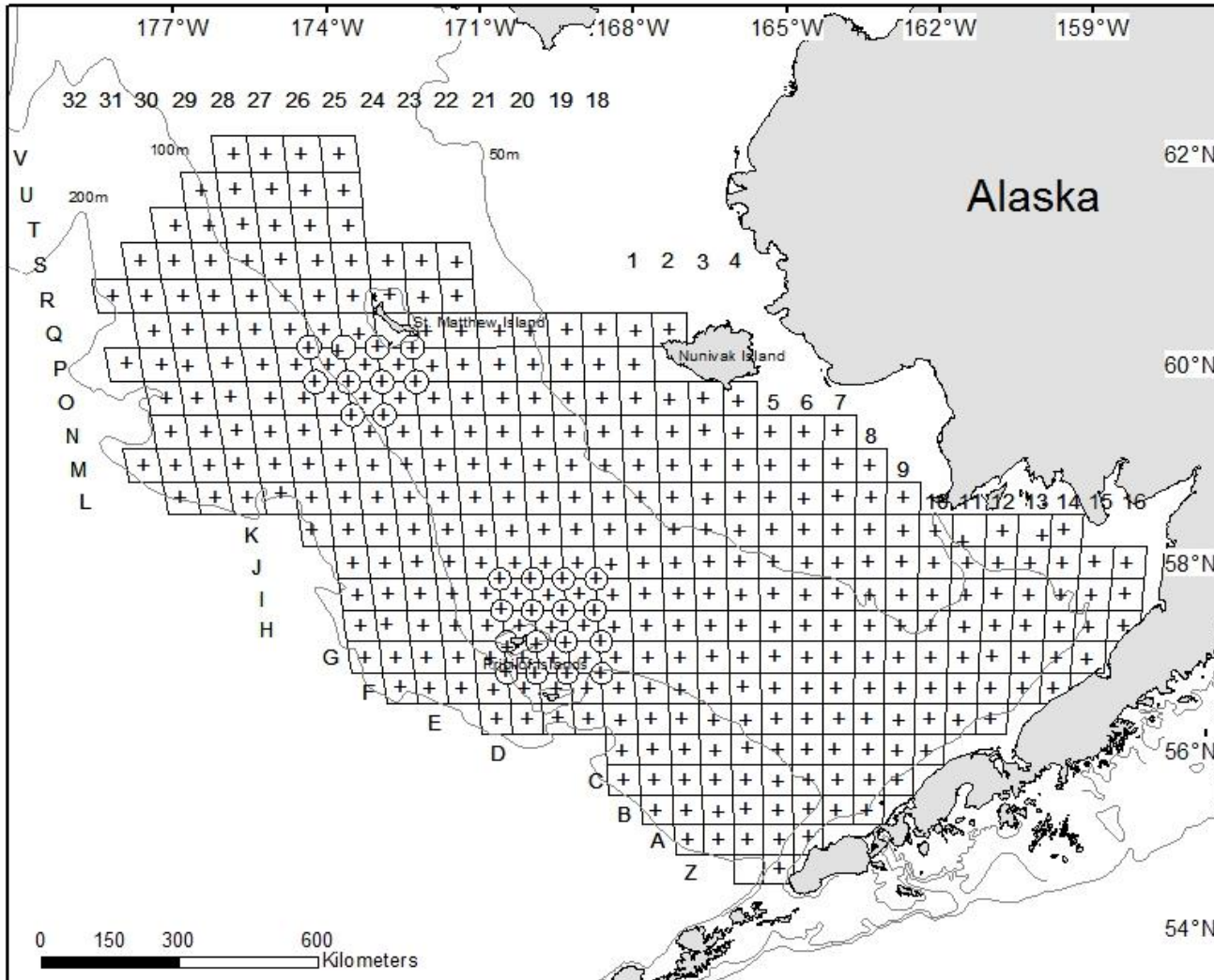
54°N

U.S. - Russia Maritime Boundary Line

Bering Sea - Area Q

Area of Detail

2017 standard Bering Sea survey



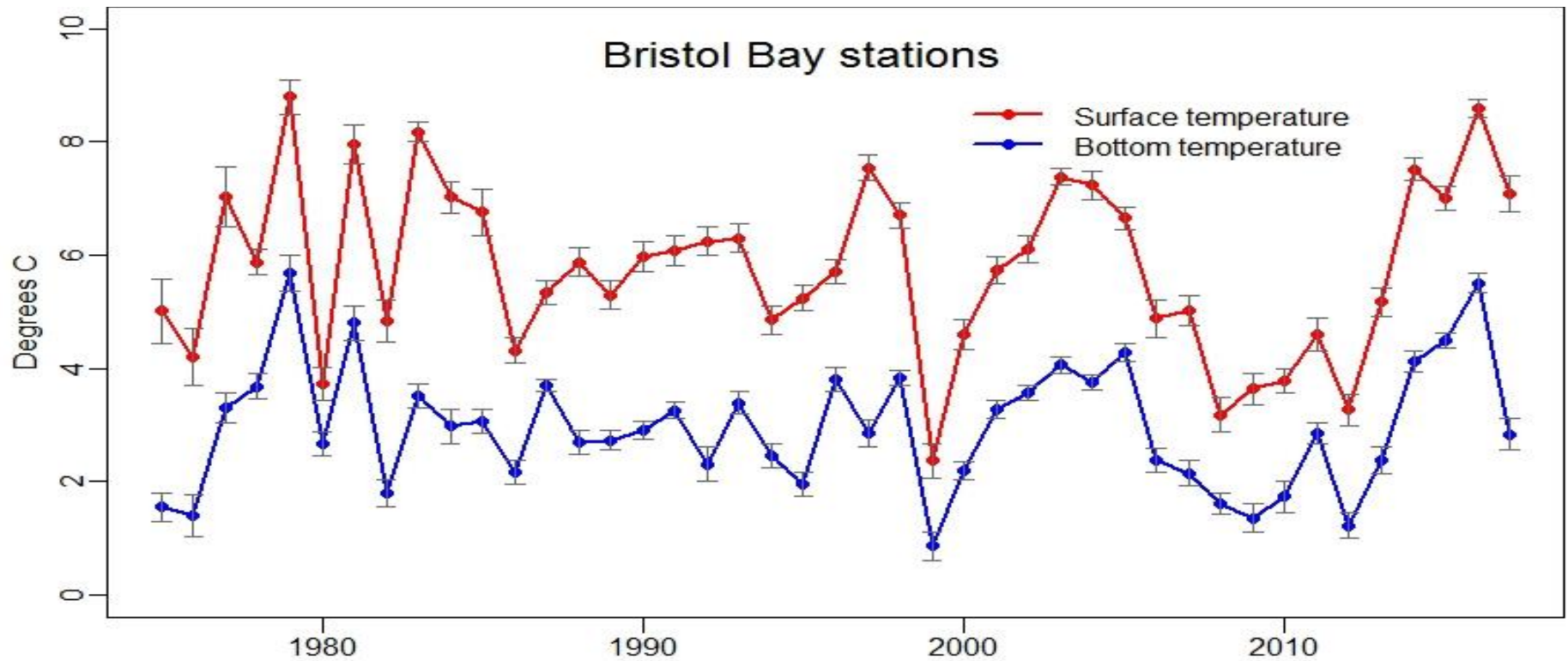
HIGHLIGHTS

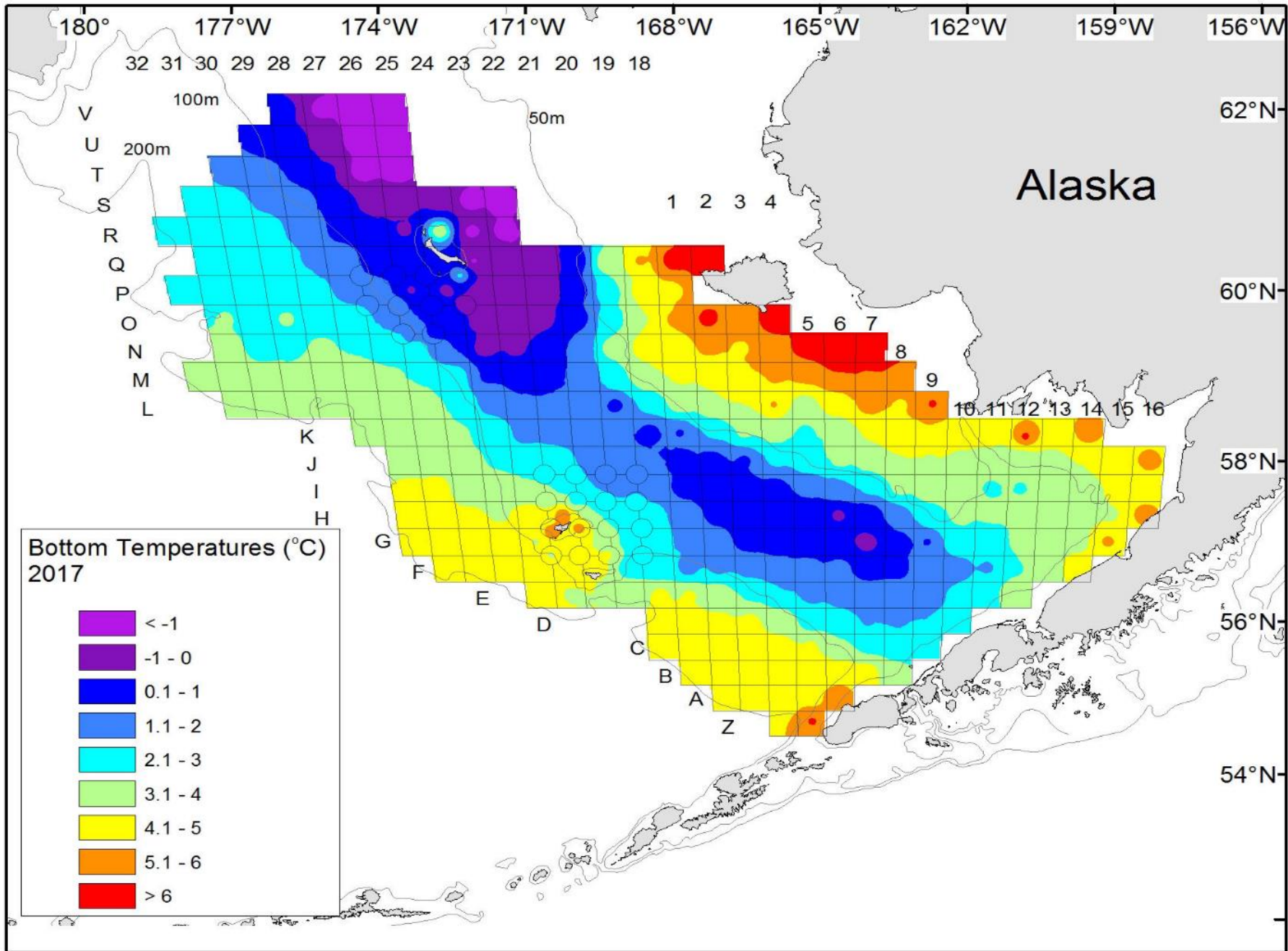
- June 4– July 31
- 375 standard stations
- 139,949 nm²
- 6 special crab projects
- Colder water!
- RESAMPLE 20 stations in Bristol Bay
- Northern Bering Sea

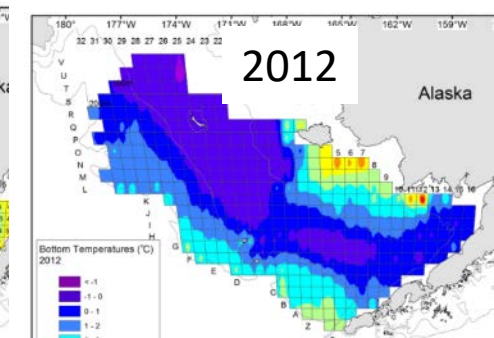
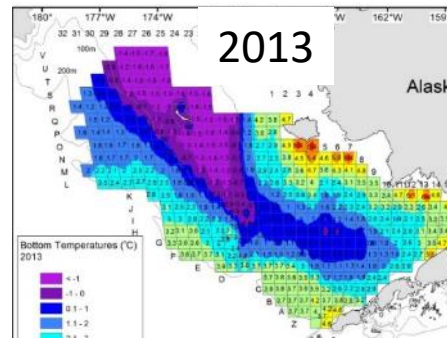
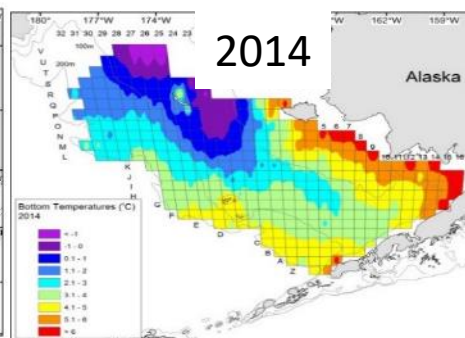
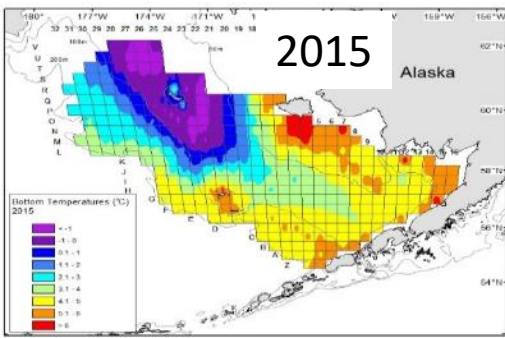
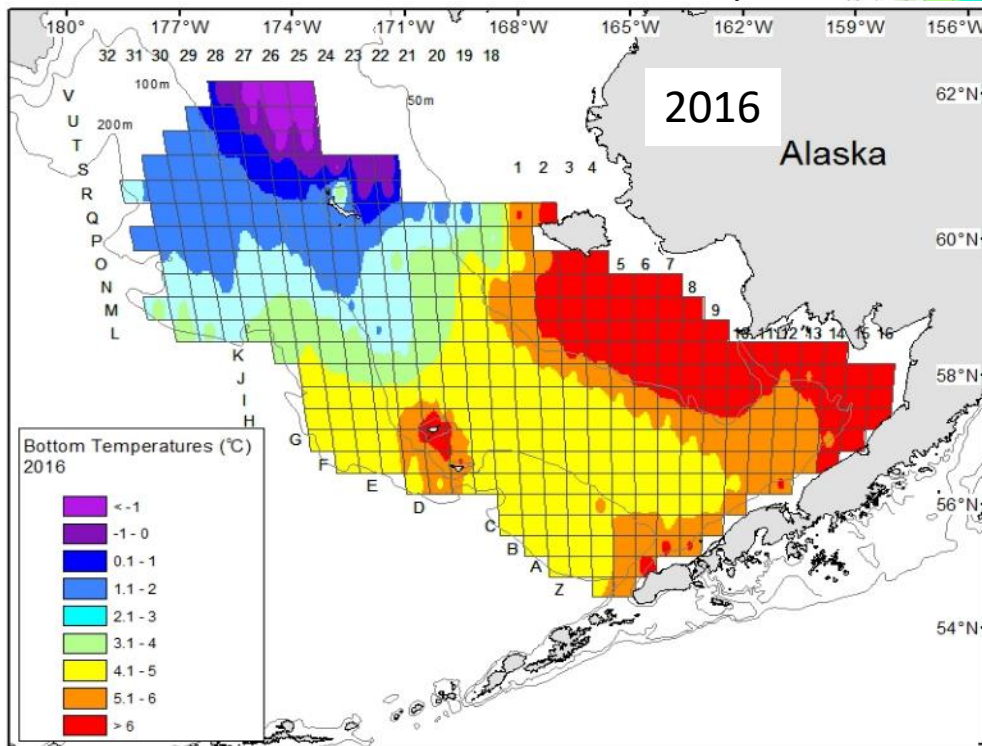
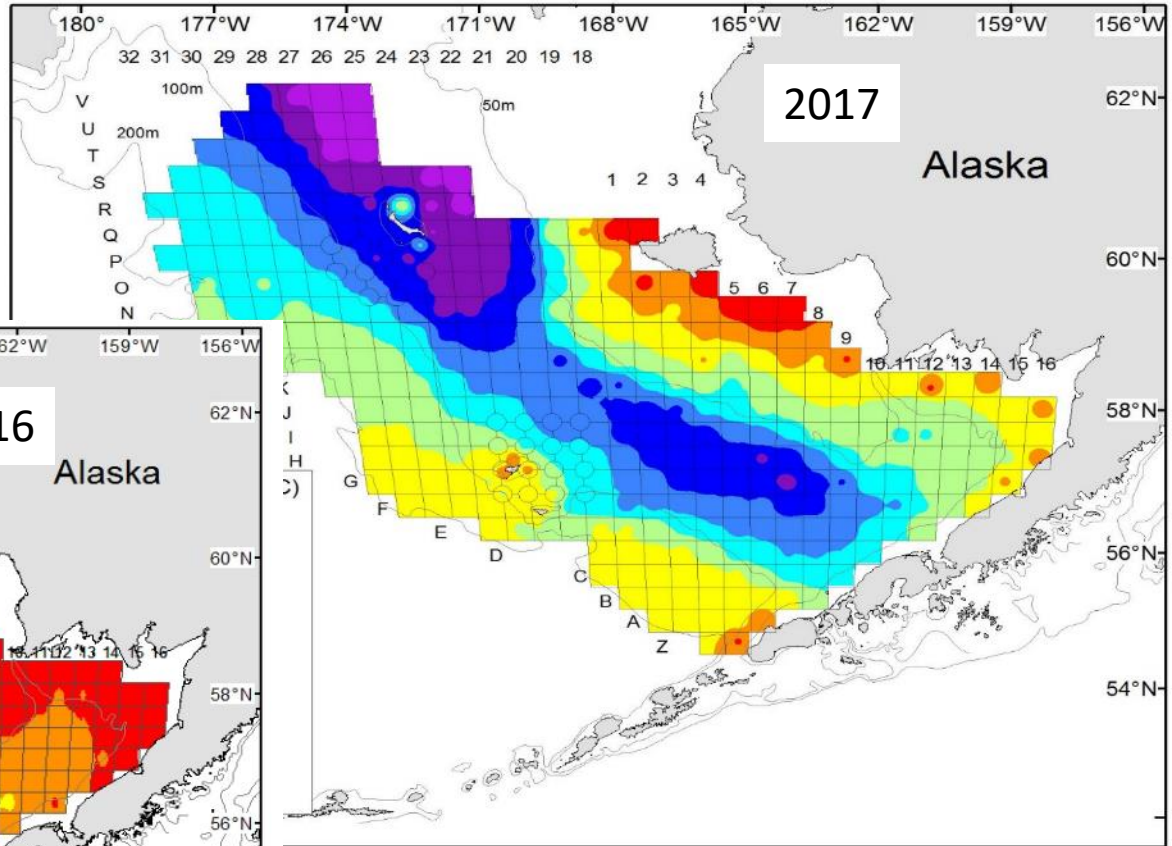
Special projects related to crab species

Project title	Principle Investigator	Agency
Bitter crab syndrome	P Jensen	RACE-SAP
Annual vs. biennial snow crab reproductive cycle	J Newby; R Foy	RACE-SAP
Spatial variance in snow crab shell structure	R Foy	RACE-SAP
Snow and Tanner crab growth	Cliff Ryer	RACE-FBE
Tanner crab chela	B. Stockhausen; R. Foy	REFM/RACE
Genetics of mating dynamics in EBS snow crab	Tyler Jackson	ADF&G

Bristol Bay Surface (red) and Bottom (blue) temperatures







2017 Mature Males (2016 value in parentheses)

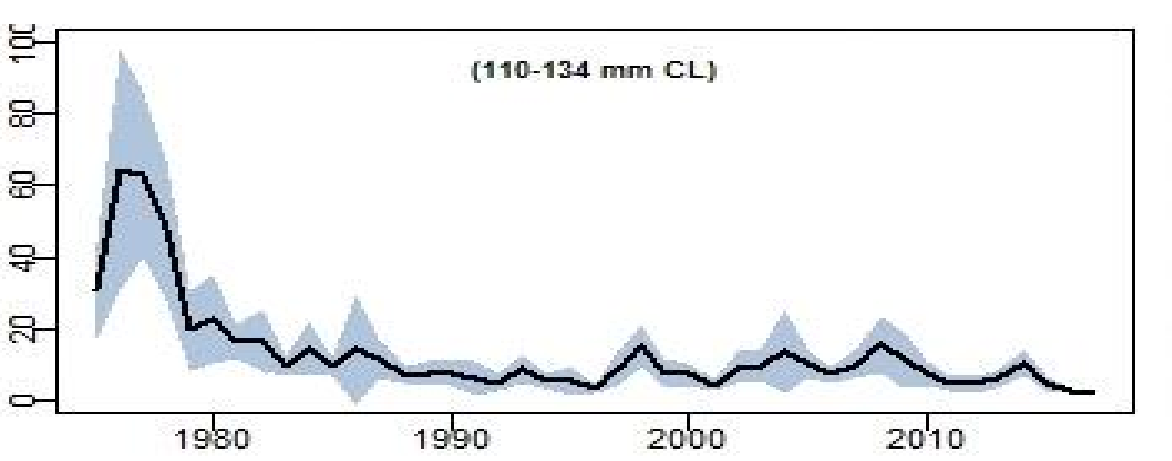
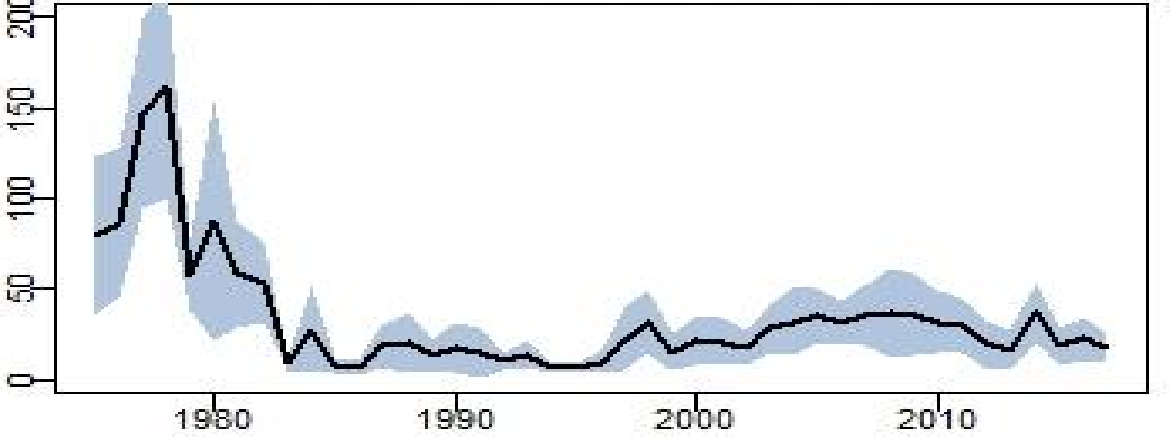
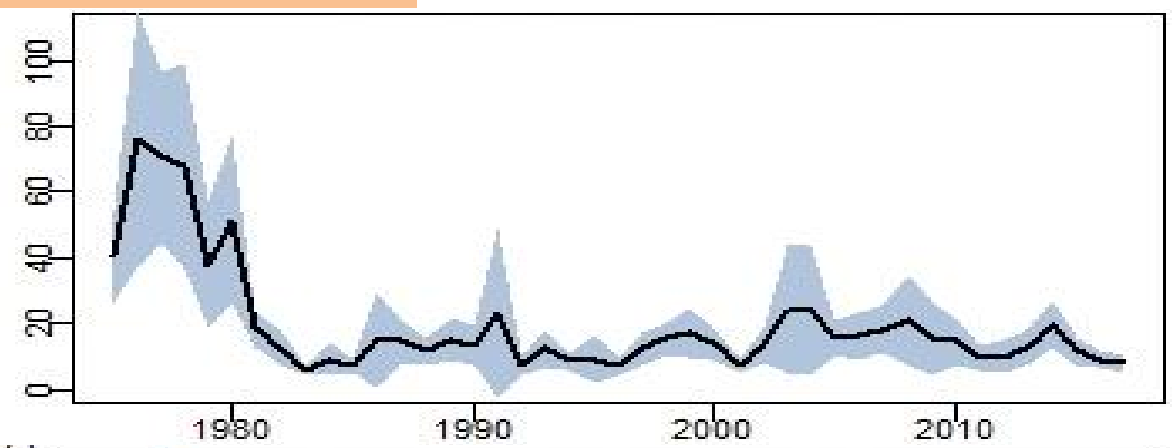
	# tows	#tows with crab	# caught	% measured	Biomass (t)
BB RKC	136	64 (59)	266 (302)	100%	23,102 (25,481)
PI RKC	77	8 (5)	57 (69)	100%	3,658 (4,150)
PI BKC	86	4 (3)	4 (3)	100%	253 (129)
SM BKC	56	13 (16)	39 (83)	100%	1,721 (3,072)
TC east	120	80 (99)	1,053 (1,011)	100%	19,313 (18,523)
TC west	255	107 (112)	1,955 (2,797)	99%	24,268 (35,119)
SC	375	167 (190)	2,198 (2,191)	96% (86%)	29,240 (29,961)

Bristol Bay Red King Crab Final Stock Assessment

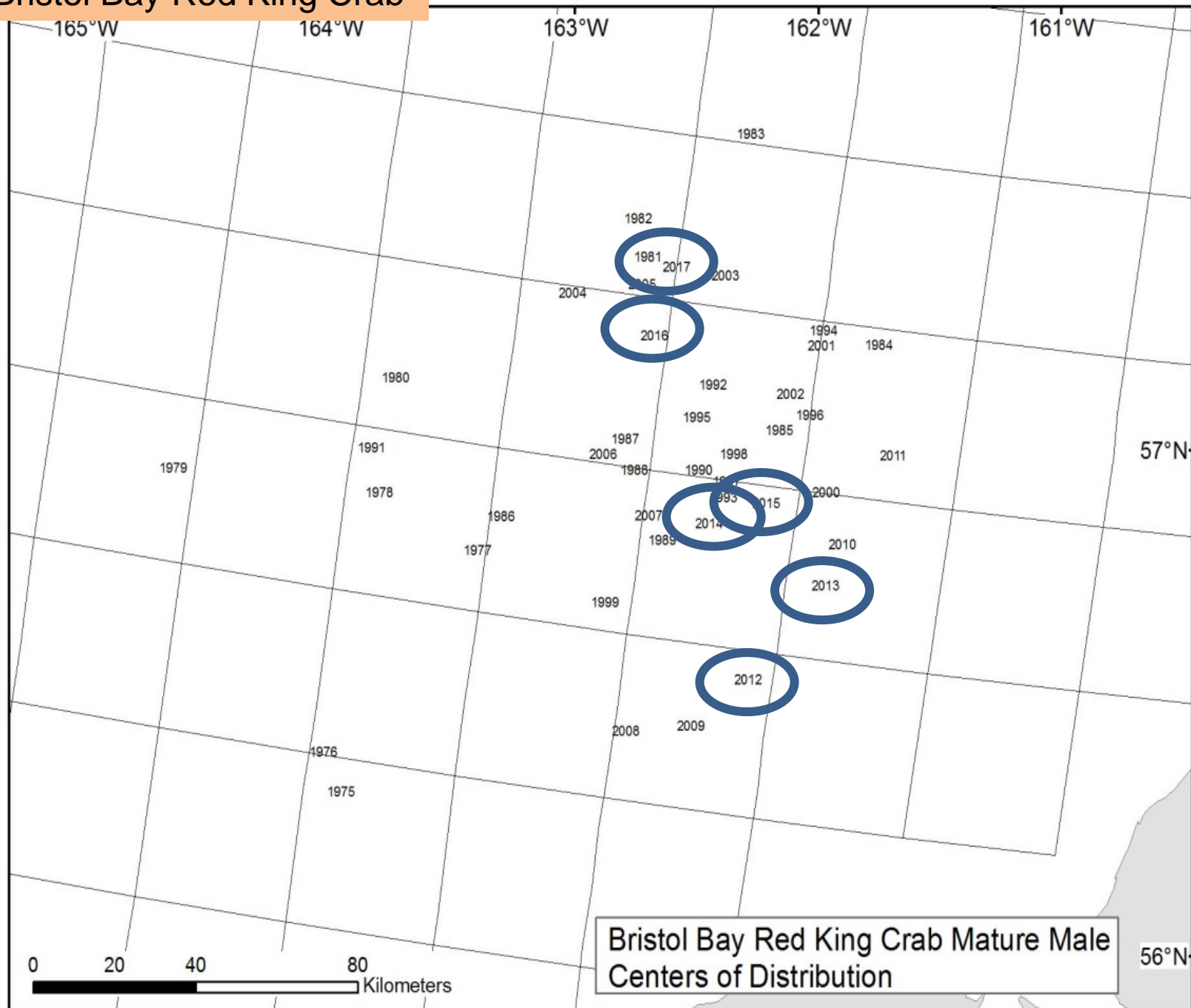


Bristol Bay Red King Crab

Abundance (millions)

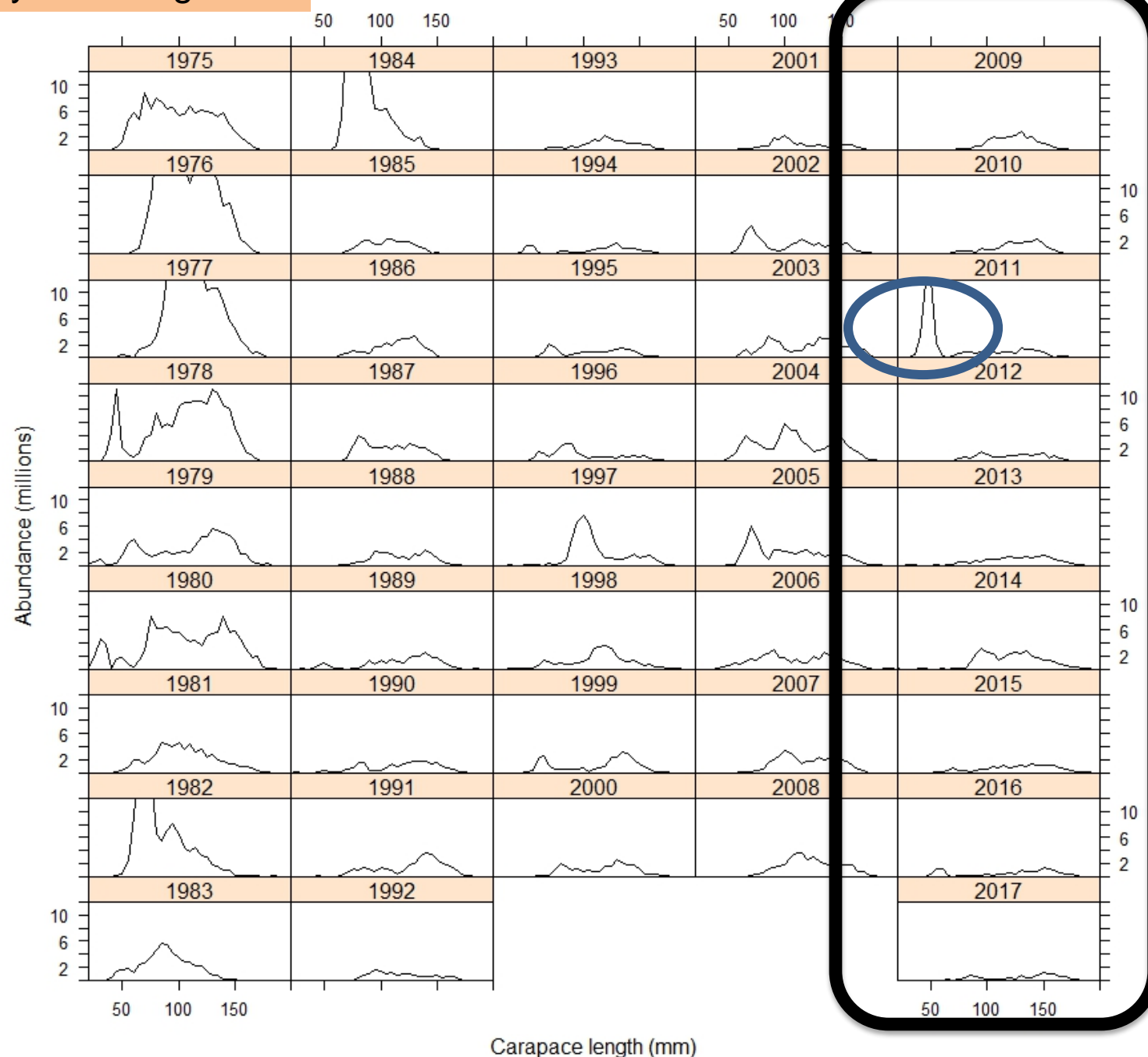


Bristol Bay Red King Crab



Bristol Bay Red King Crab

Bristol Bay Red King Crab (male)

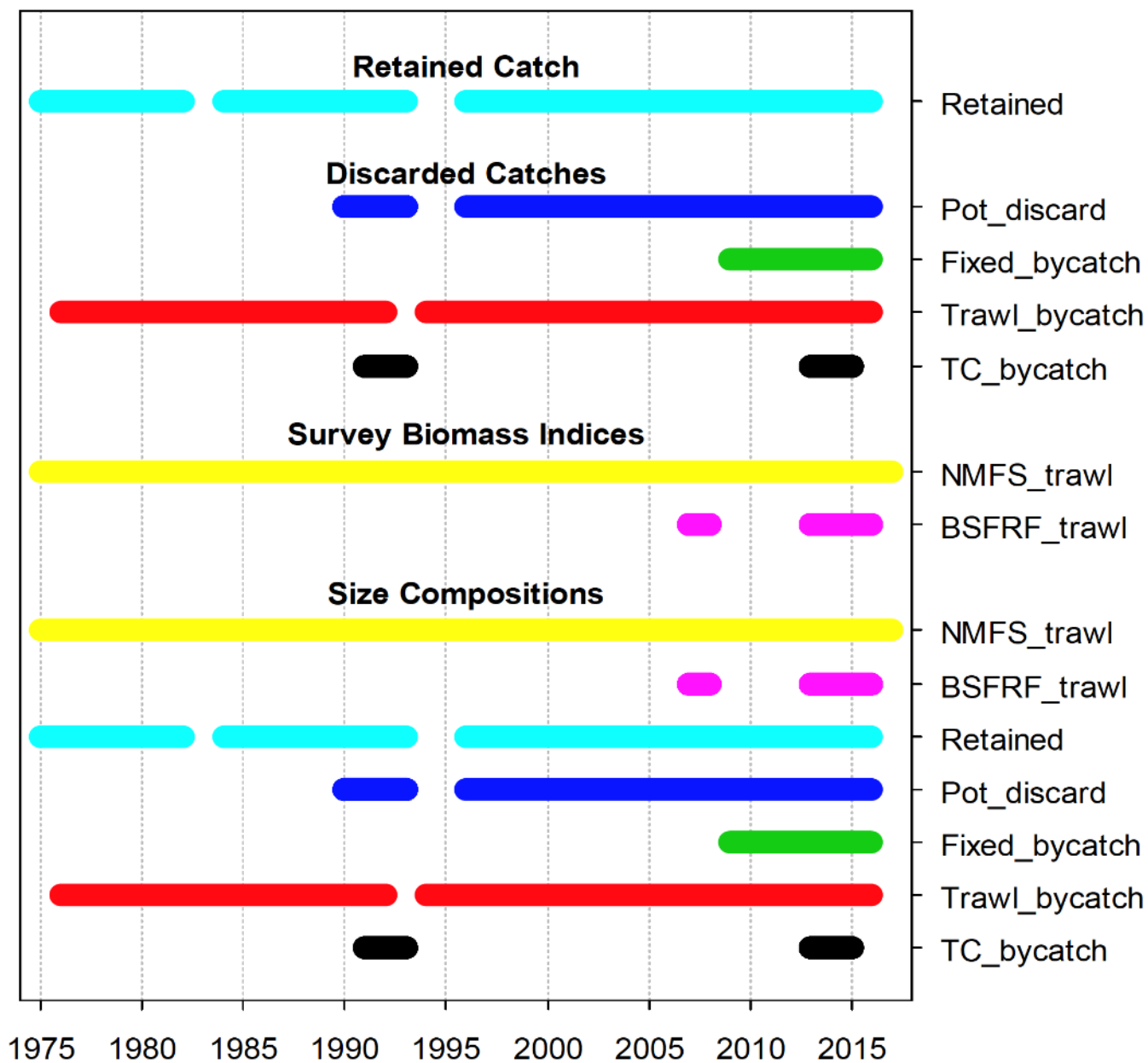


Carapace length (mm)

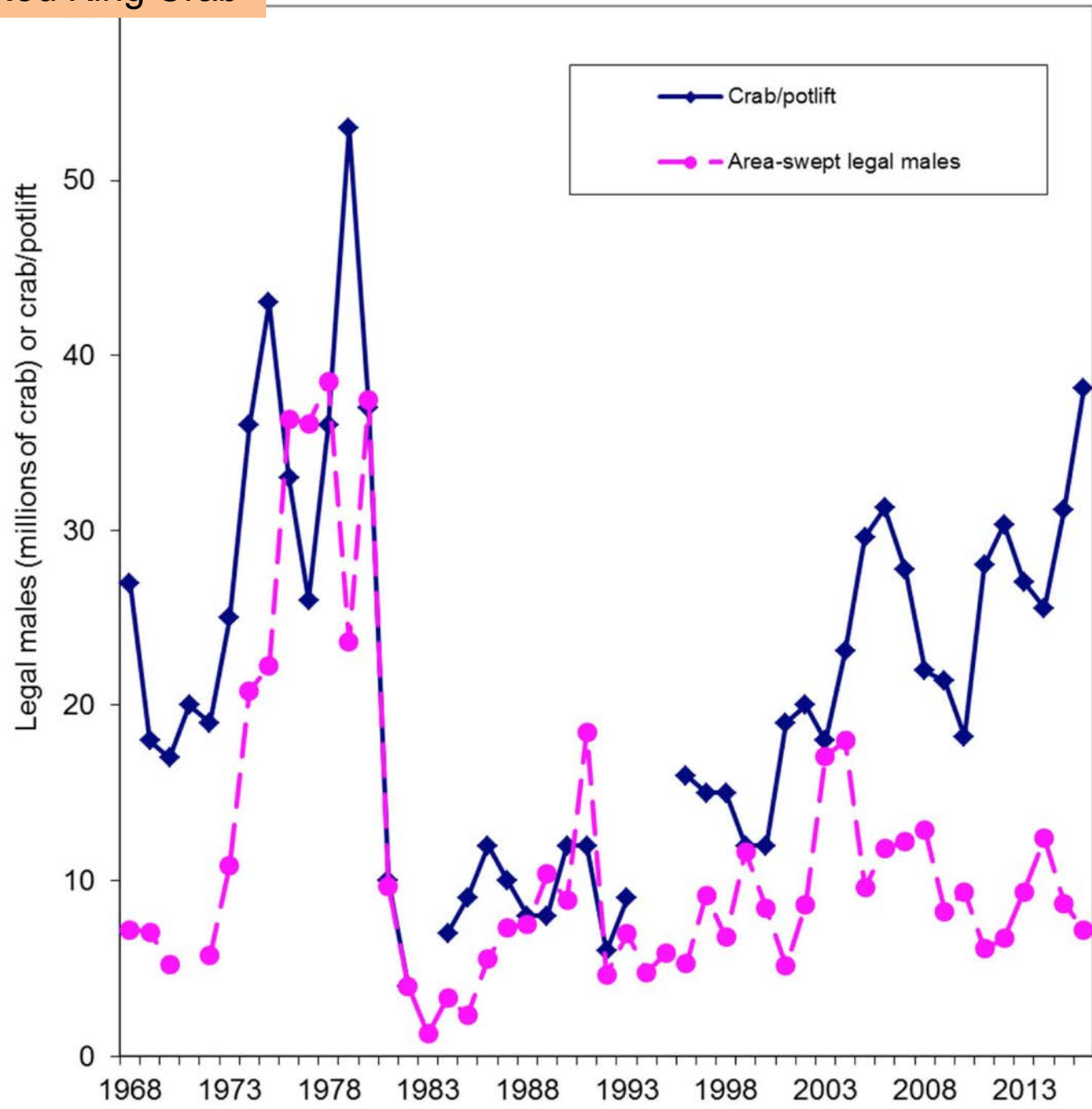
Major changes in 2017

- Data
 - 2017 NMFS EBS trawl survey data
 - 2016 BSFRF survey biomass estimate updated (11% decrease)
 - 2016/17 directed catch and bycatch added
 - bycatch in groundfish fisheries disaggregated by gear type
- Assessment methodology
 - Fits to bycatch in groundfish fisheries disaggregated by gear type
 - Francis iterative re-weighting implemented using two approaches
 - based on sex-specific size compositions
 - based on "extended" size compositions

Data by type and year

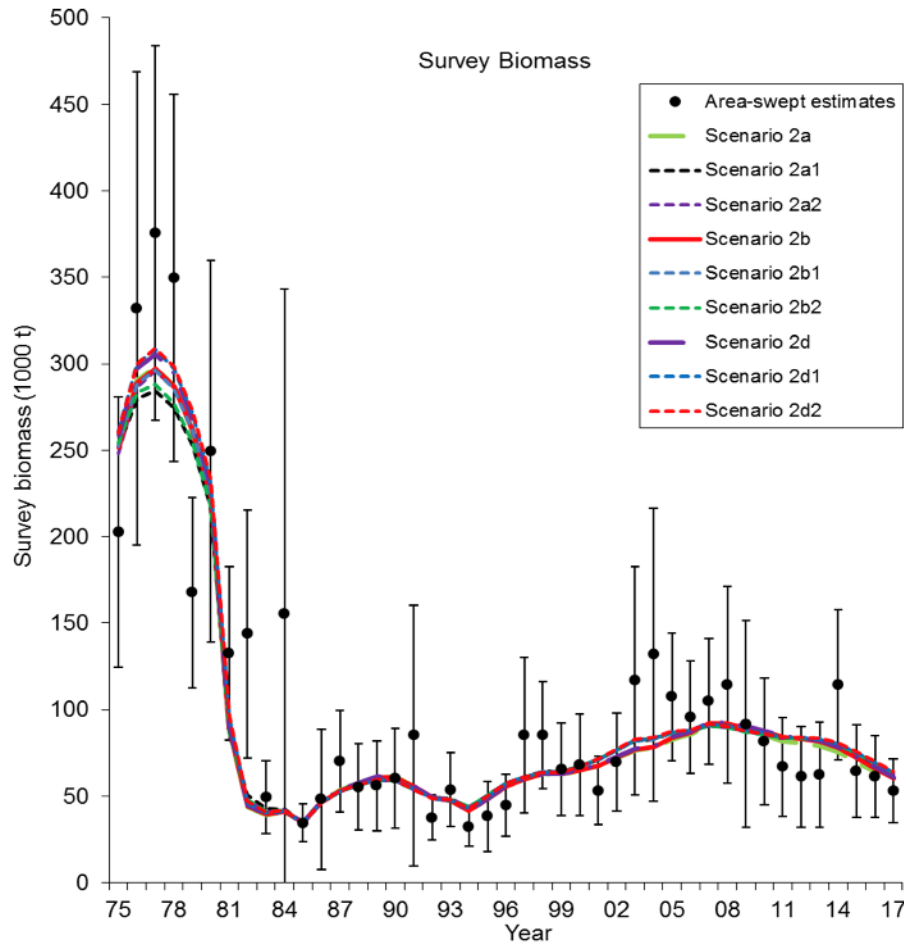


Bristol Bay Red King Crab

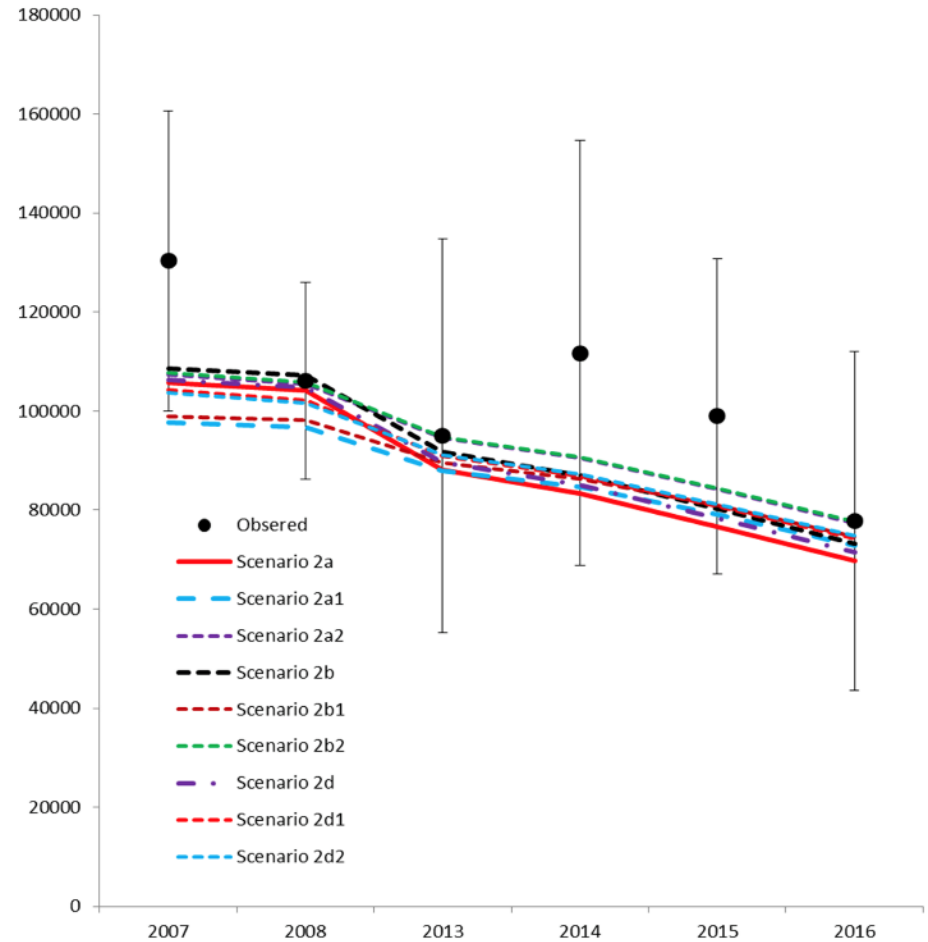


Fits to survey biomass

NMFS



BSFRF



- High NMFS survey Q estimates forced by rapid decline in 1980's abundance, given observed catch levels
- CPT recommended model that addresses the survey selectivity.

CPT Discussion and Recommendations

- Discussion on the model underestimate of BSFRF data and subsequent overestimate of NMFS survey data in past 8 years.
- CPT preferred models that disaggregate the GF discard between pot and trawl.
- Reconsider alternative weighting
- Explore why Q is 1 for AFSC survey

Tier, OFL, and ABC Recommendations

- CPT and author recommended 10% buffer
- CPT concurred with Author recommendation for Tier 3b.

- Biomass (MMB) = 21.31 thousand t
- Total catch OFL = 5.60 thousand t
- ABC (less than max permissible) = 10%
buffer = 5.04 thousand t

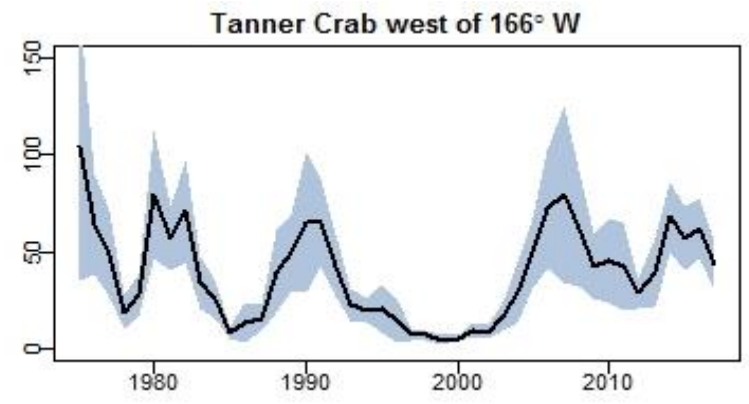
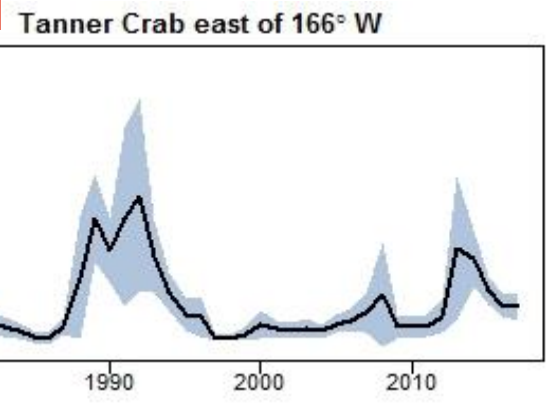
Tanner Crab

Final Stock Assessment

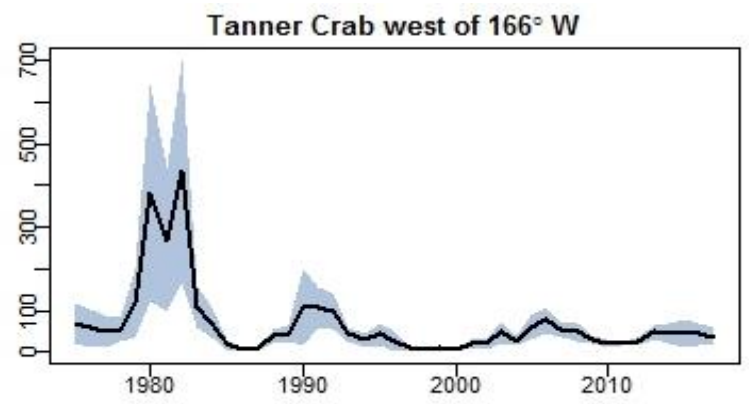
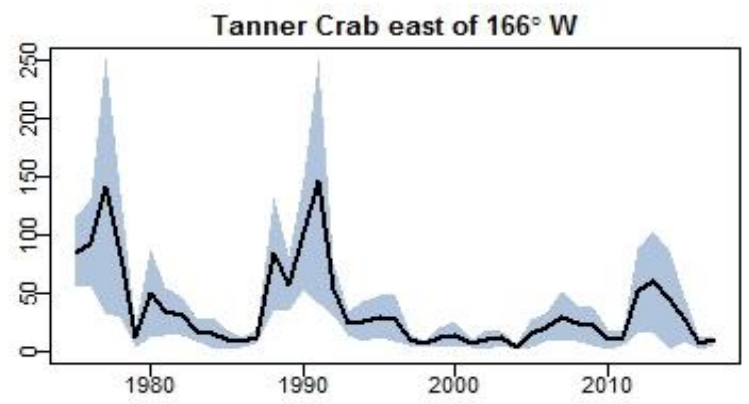


William Stockhausen
Alaska Fisheries Science Center

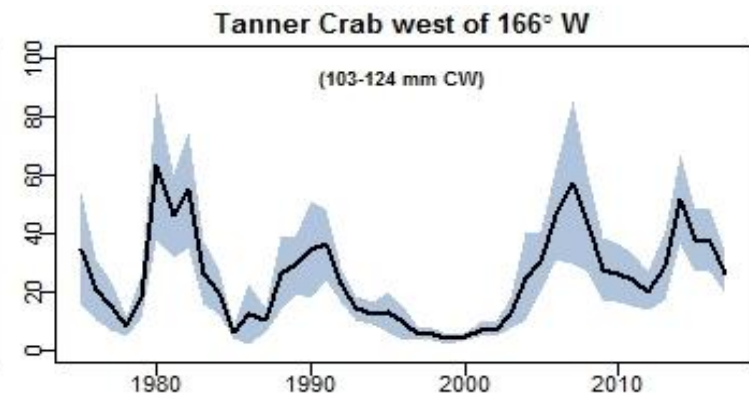
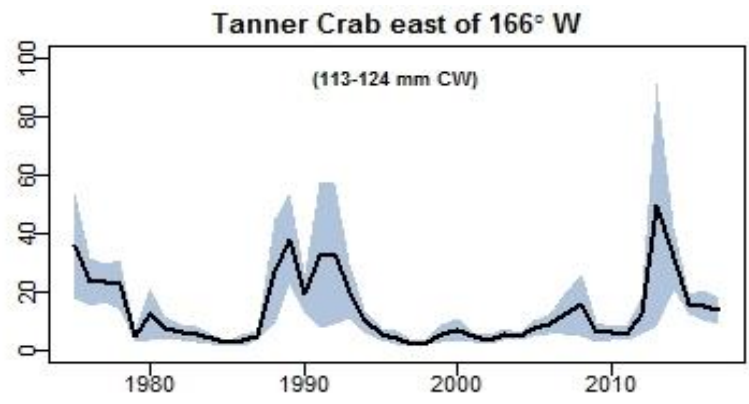
Tanner Crab



Mature male



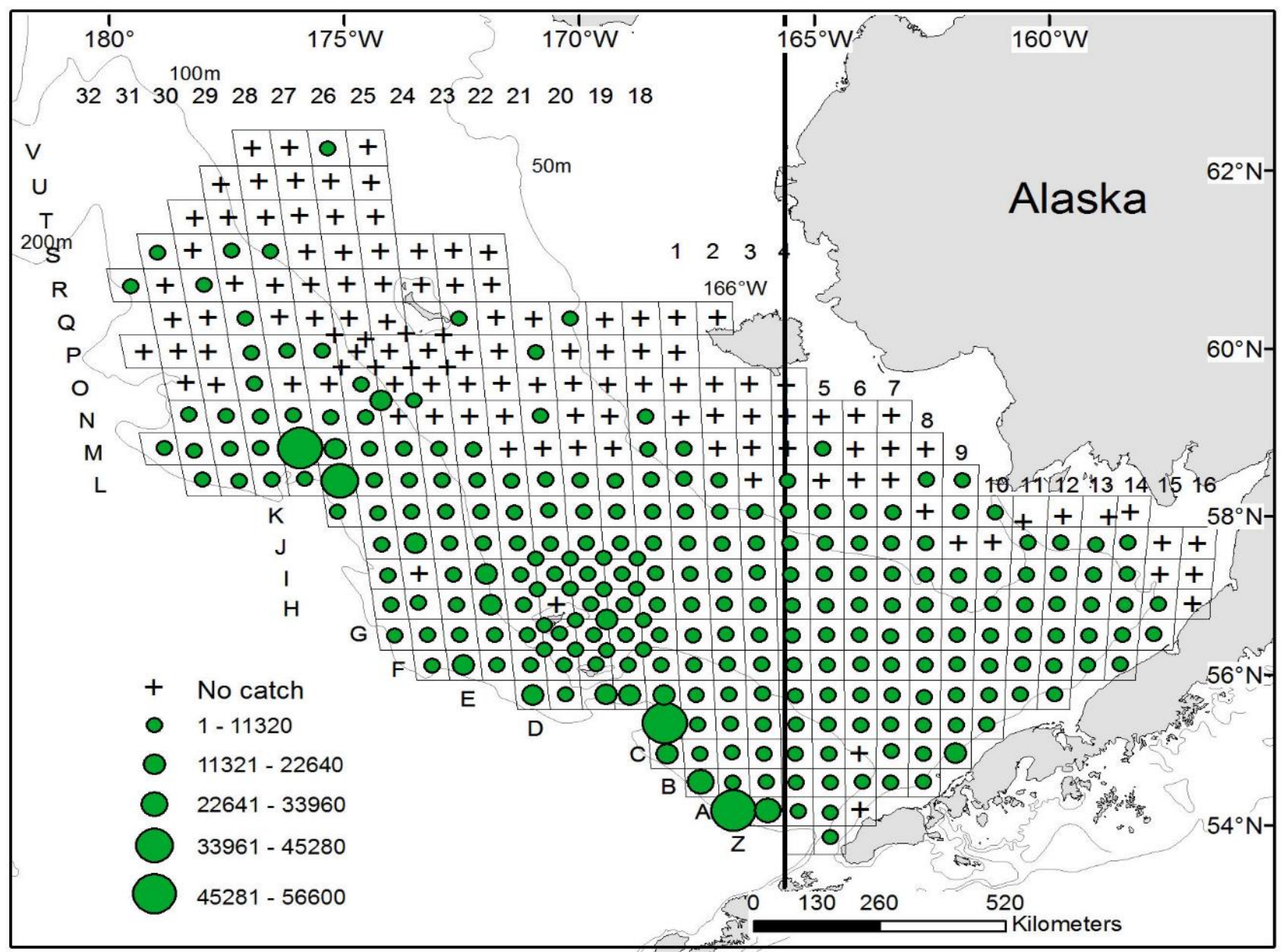
Mature females



Juvenile

Tanner Crab

Tanner crab (*Chionoecetes bairdi*) total density

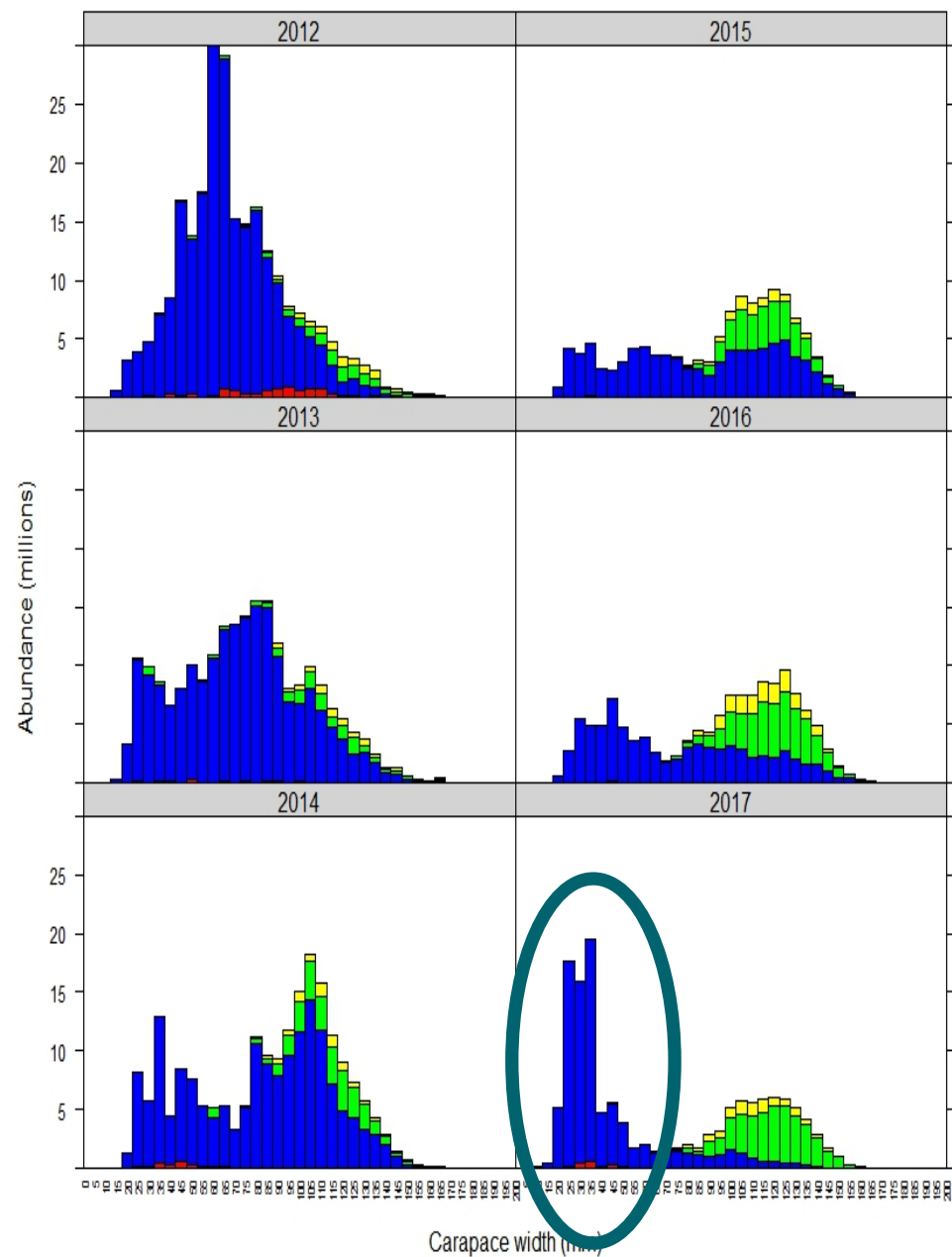
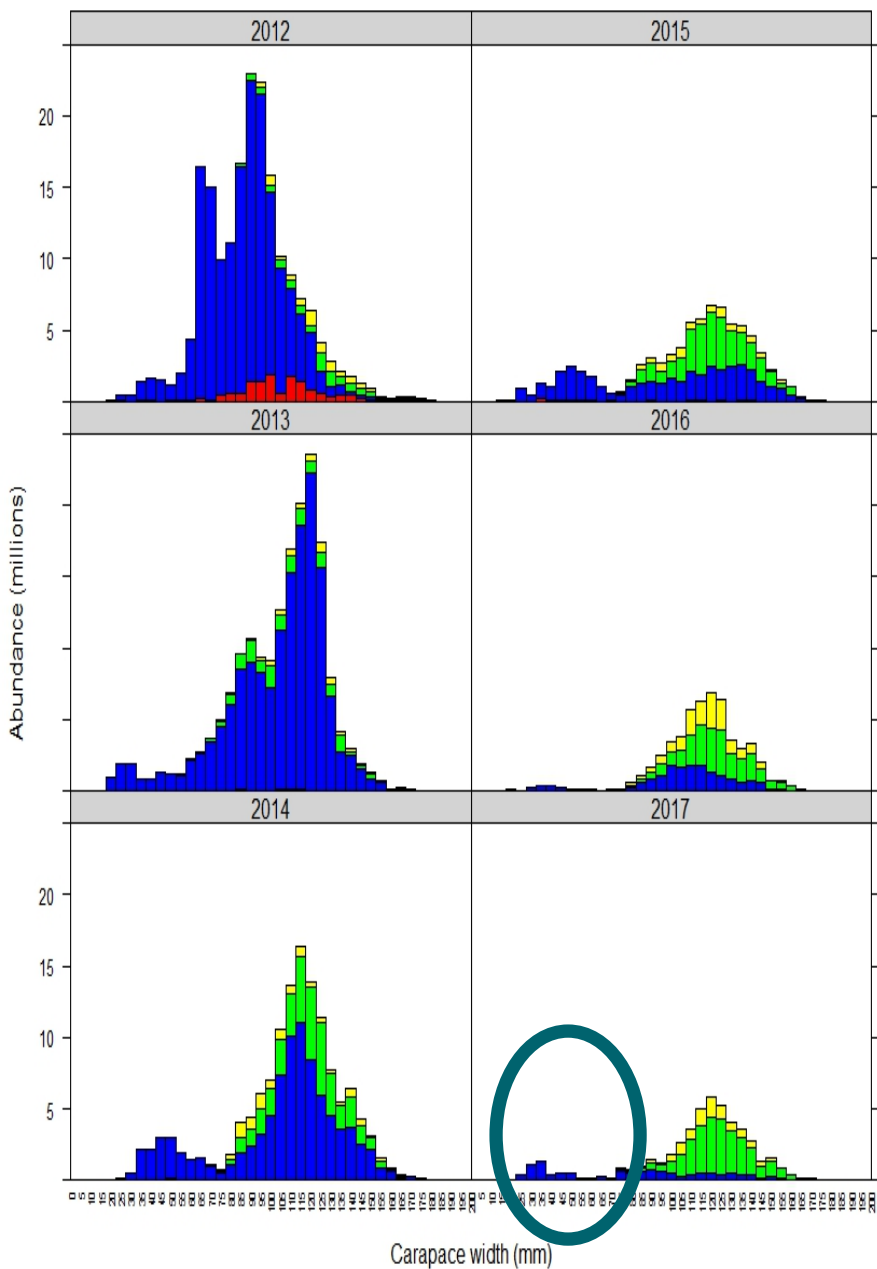


Tanner Crab east of 166W (male)

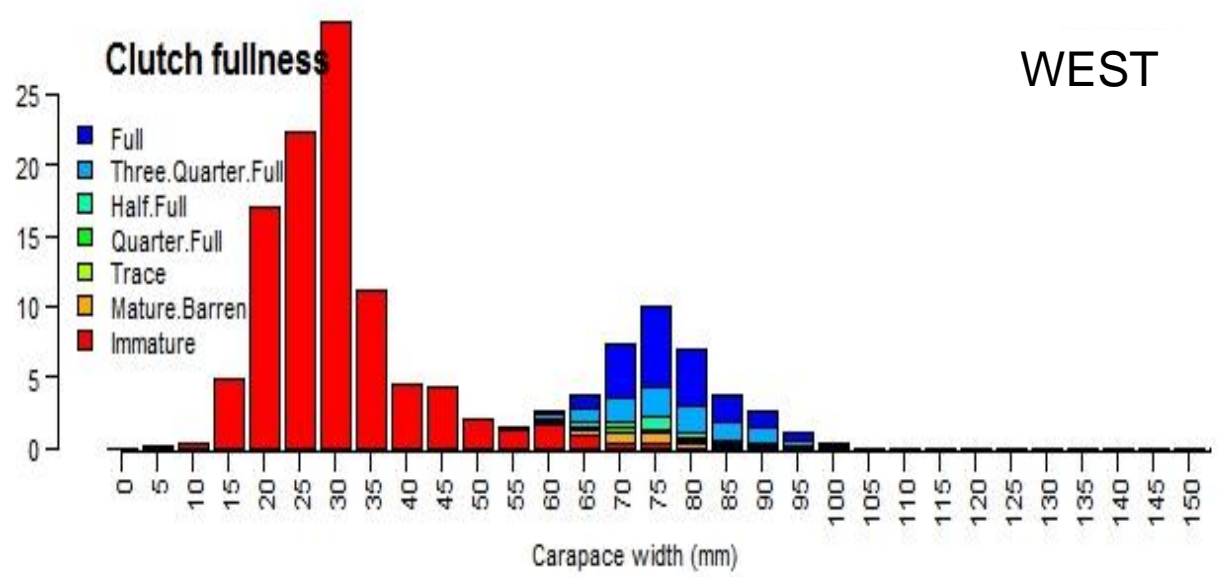
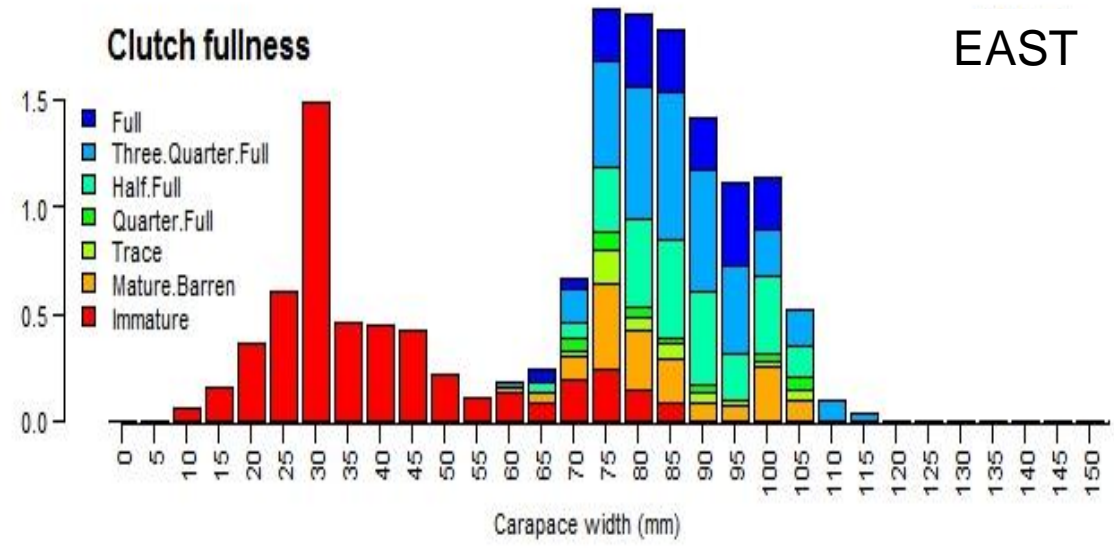
Tanner Crab west of 166W (male)

Shell condition
 Soft & molting █ New - hard █ Old █ Very old █

Shell condition
 Soft & molting █ New - hard █ Old █ Very old █

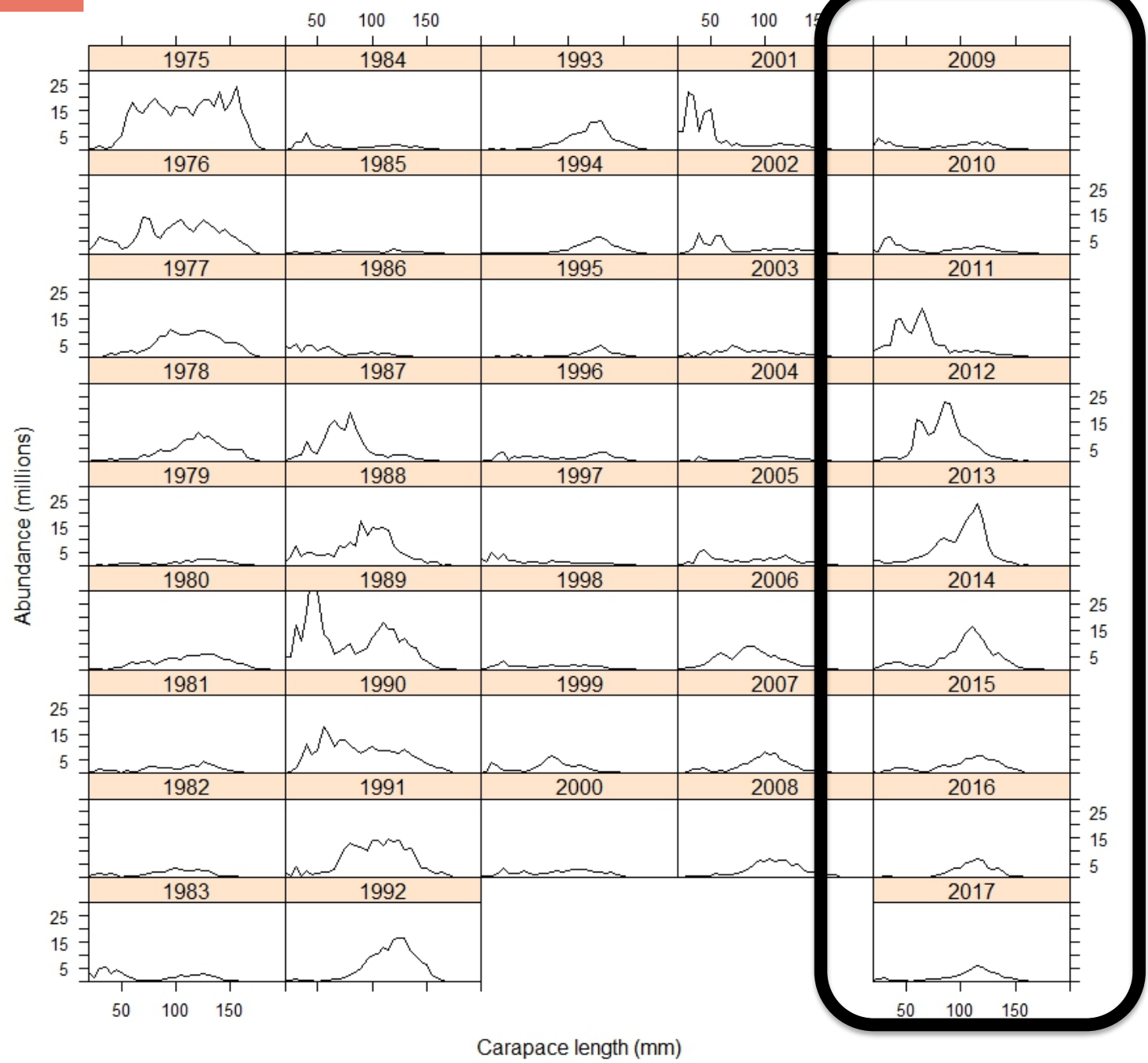


Female clutch fullness in 2017



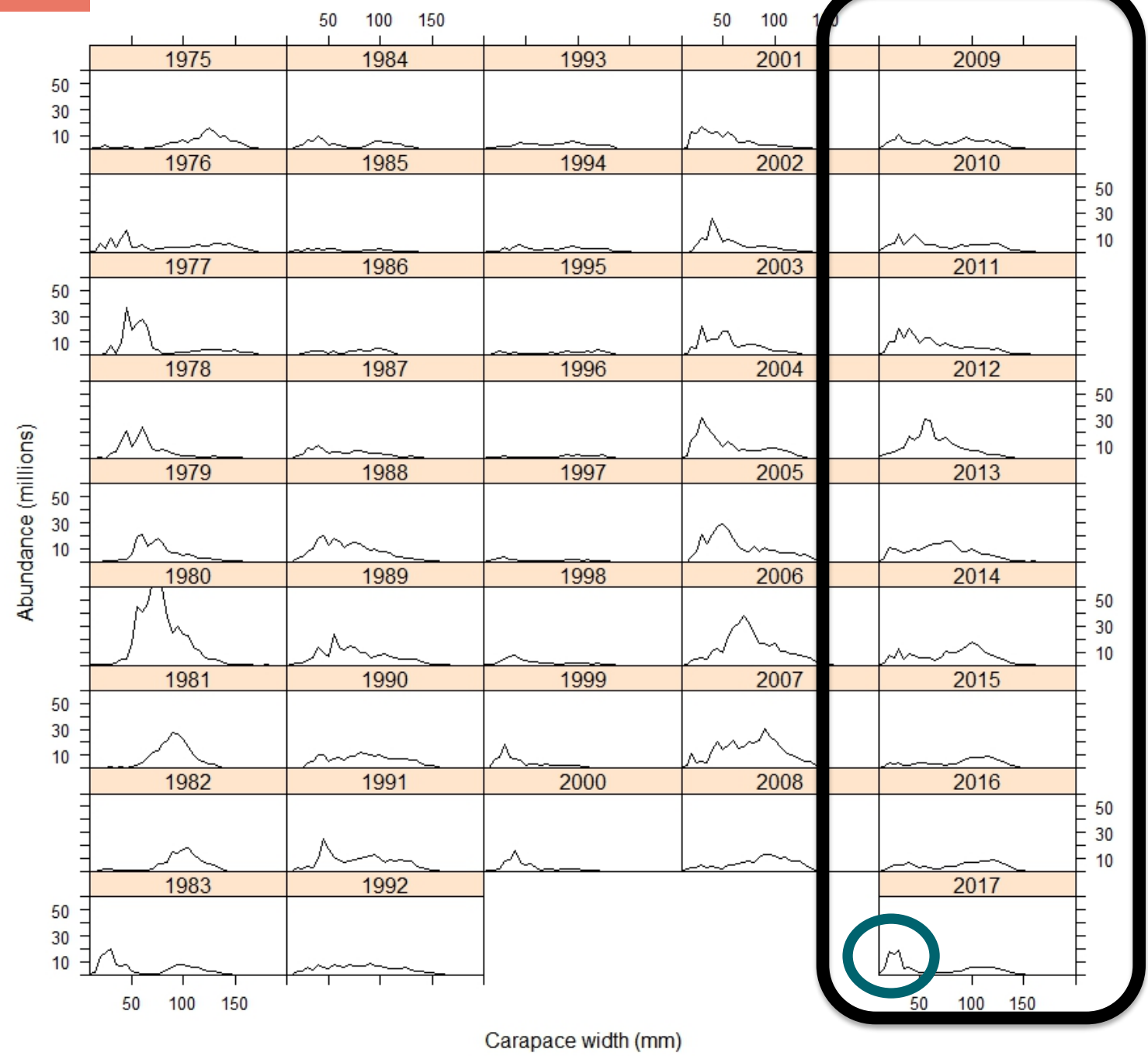
Tanner Crab

Tanner Crab east of 166W (male)



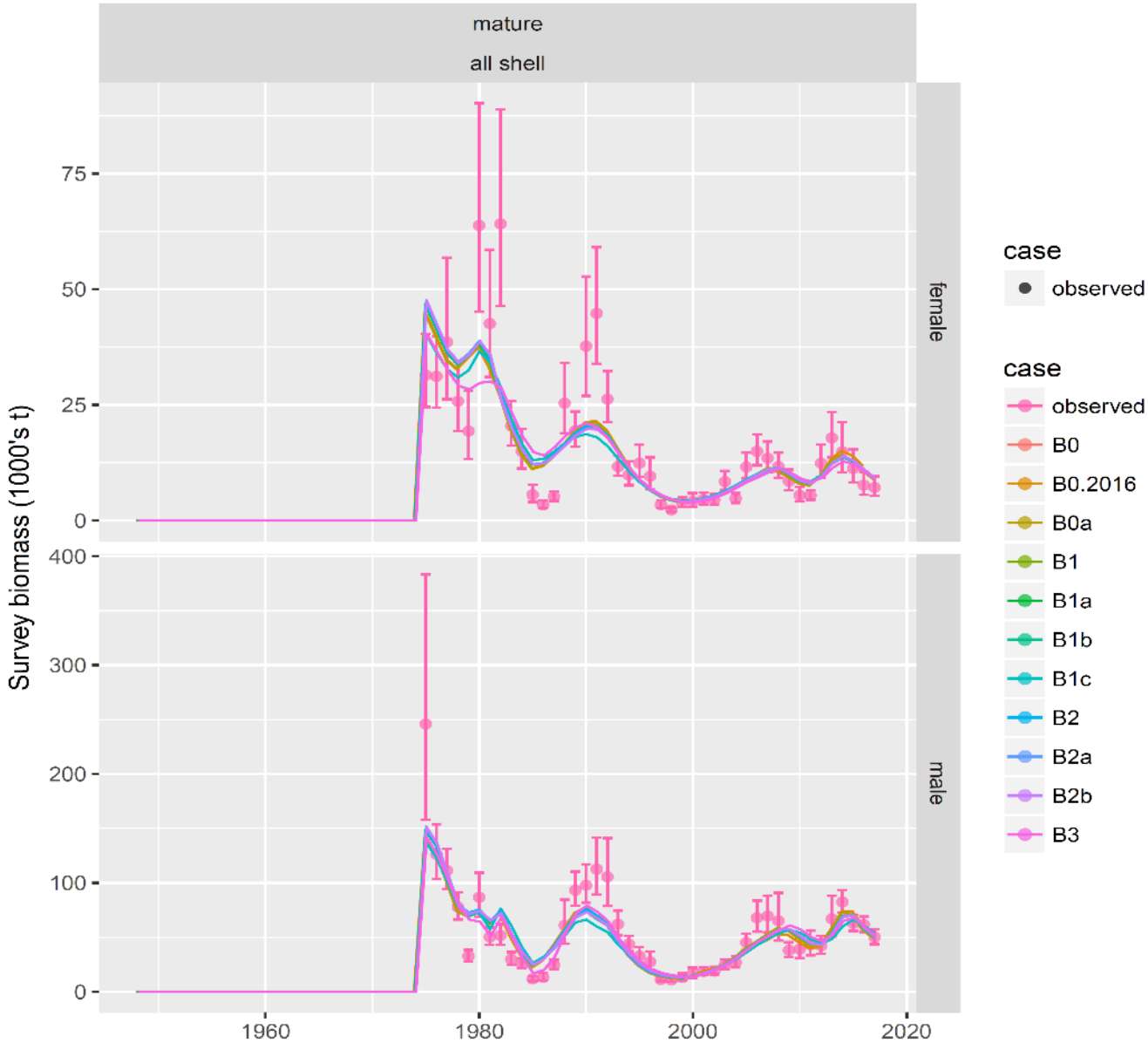
Tanner Crab

Tanner Crab west of 166W (male)



Model fits

NMFS trawl survey



Model B2b

- EBS growth data
- New selectivity parameterization for RKC fishery
- Retention curves for 3 time blocks

CPT Discussion and Recommendations

- Evaluate multiple reweighting methods
- Consider new chela data to define mature males
- Address overestimates of large males

Tier, OFL, and ABC Recommendations

- CPT and author recommended 20% buffer
 - New model but some parameters hit bounds, and large males still overestimated.
- CPT concurred with Author recommendation for Tier 3a.

- Biomass (MMB) = 43.31 thousand t
- Total catch OFL = 25.42 thousand t
- ABC (less than max permissible) = 20%
buffer = 20.33 thousand t

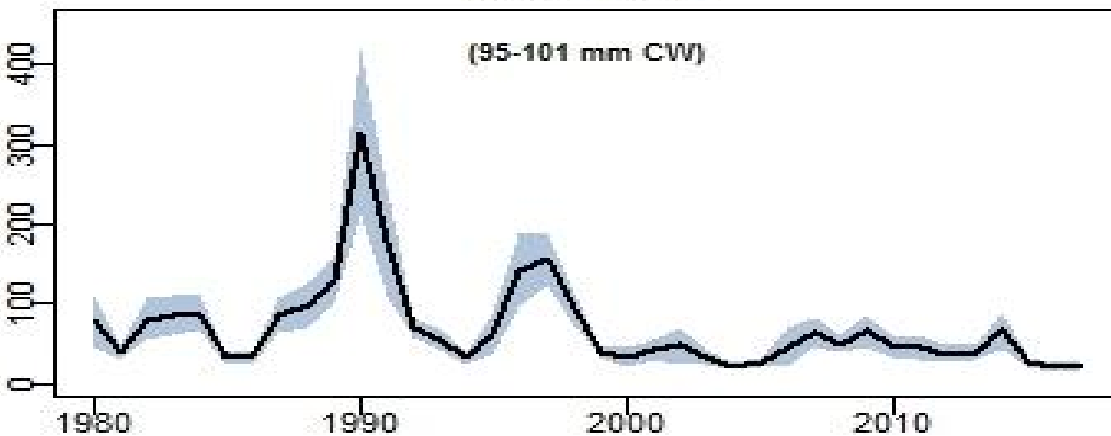
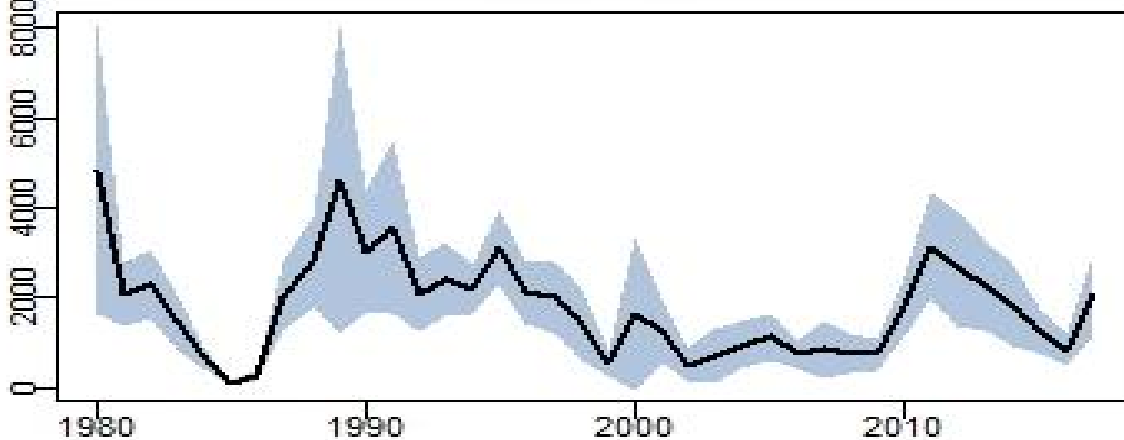
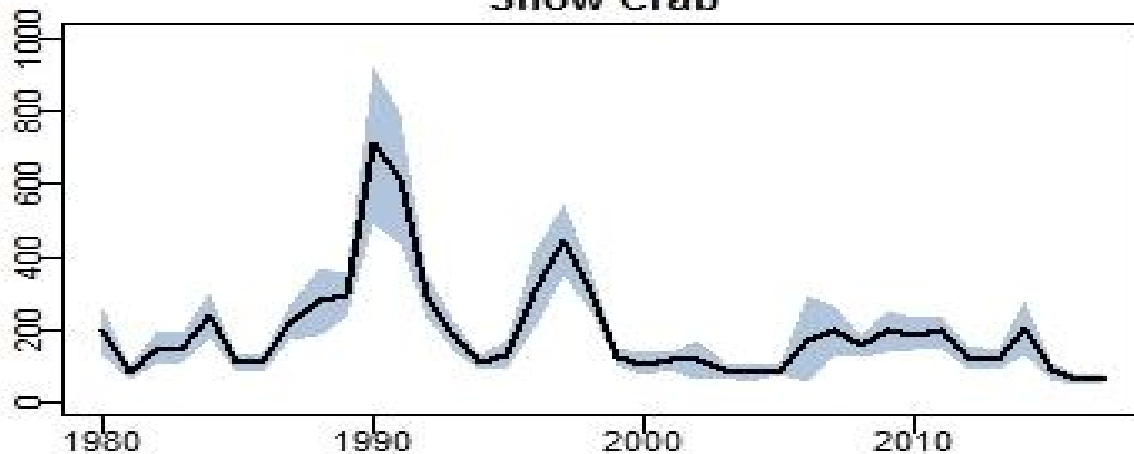
Snow Crab

Final Stock Assessment



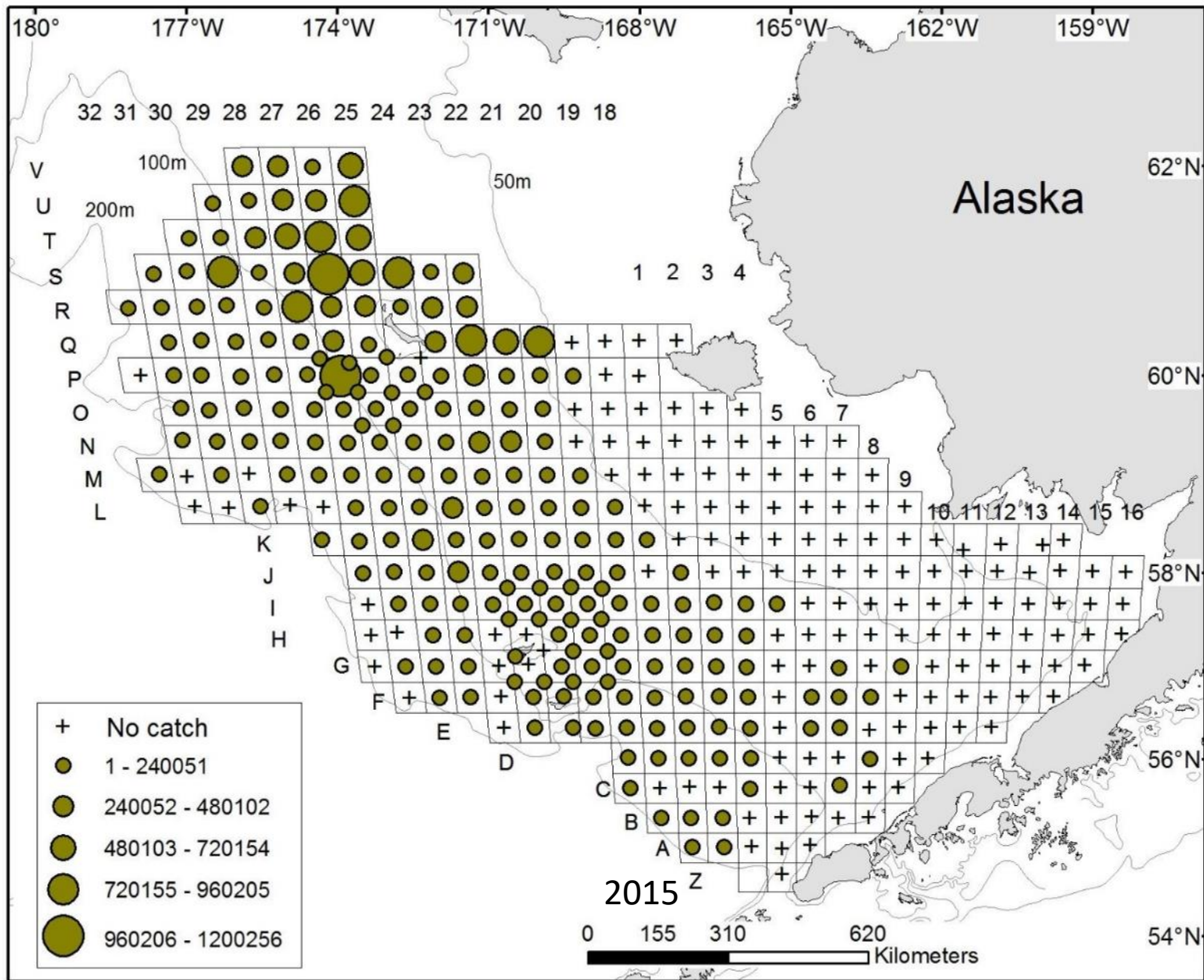
Cody Szuwalski
Alaska Fisheries Science Center

Snow Crab



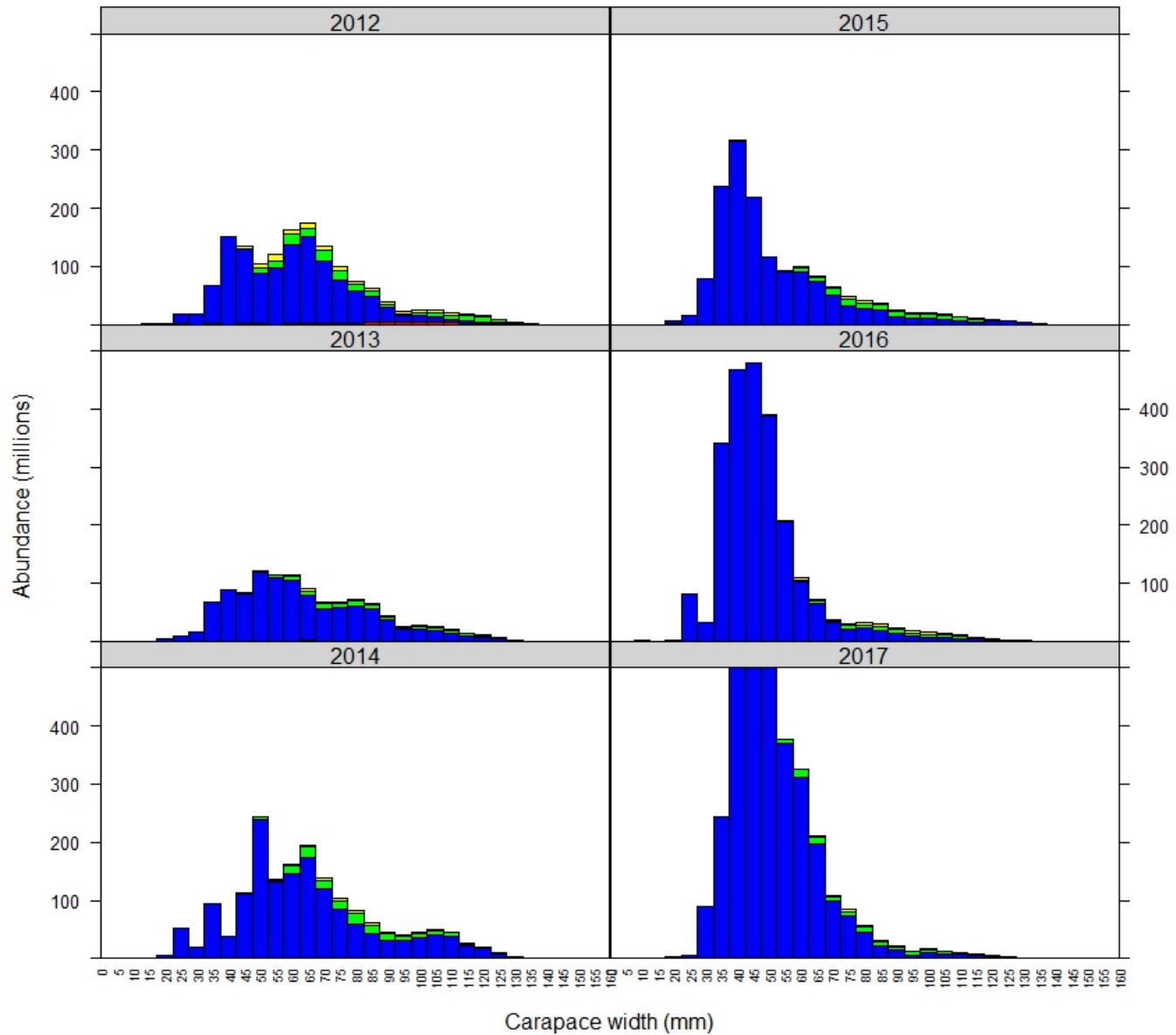
Abundance (millions)

snow crab total density



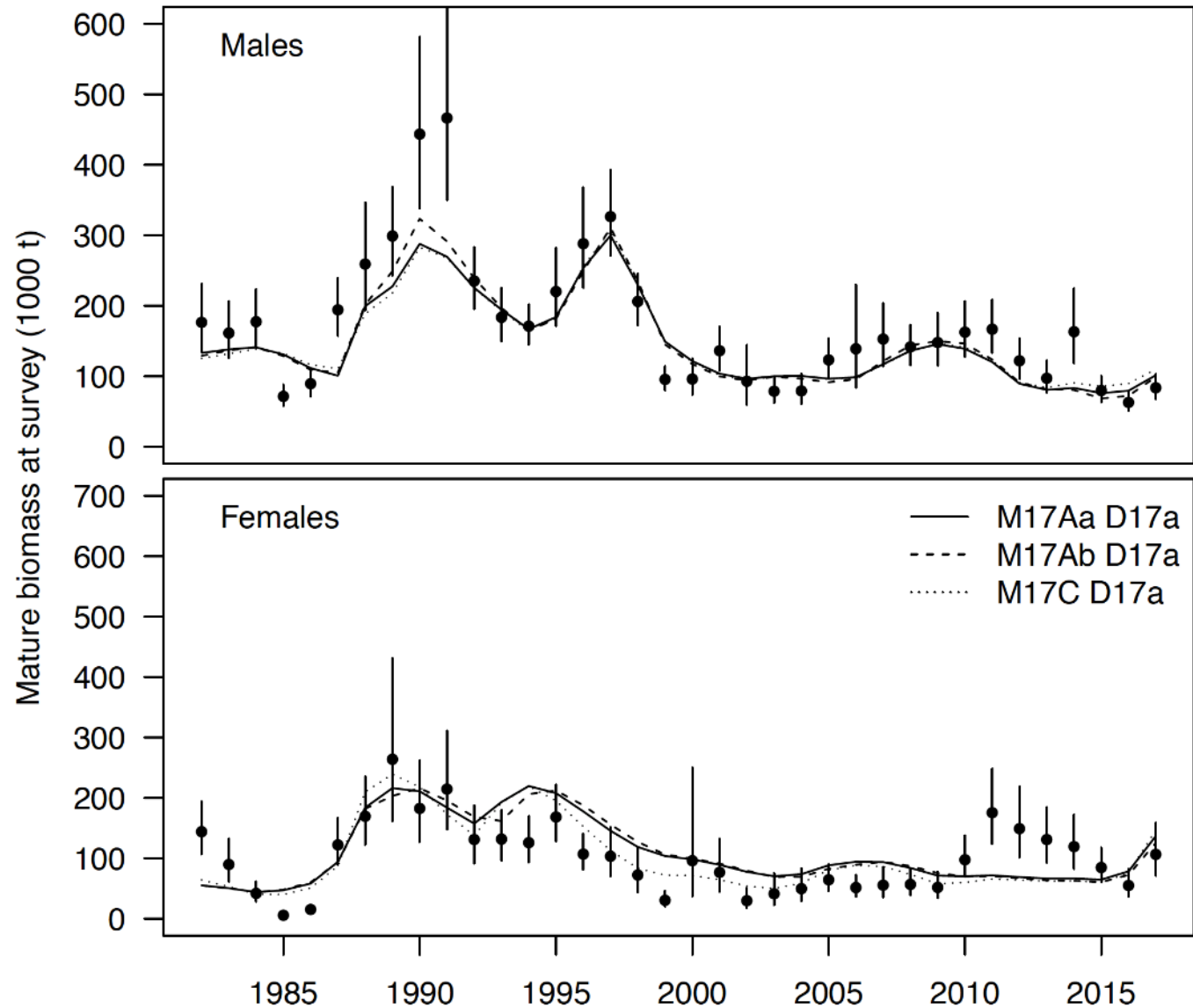
Snow Crab (male)

Shell condition
Soft & molting █ New - hard █ Old █ Very old █

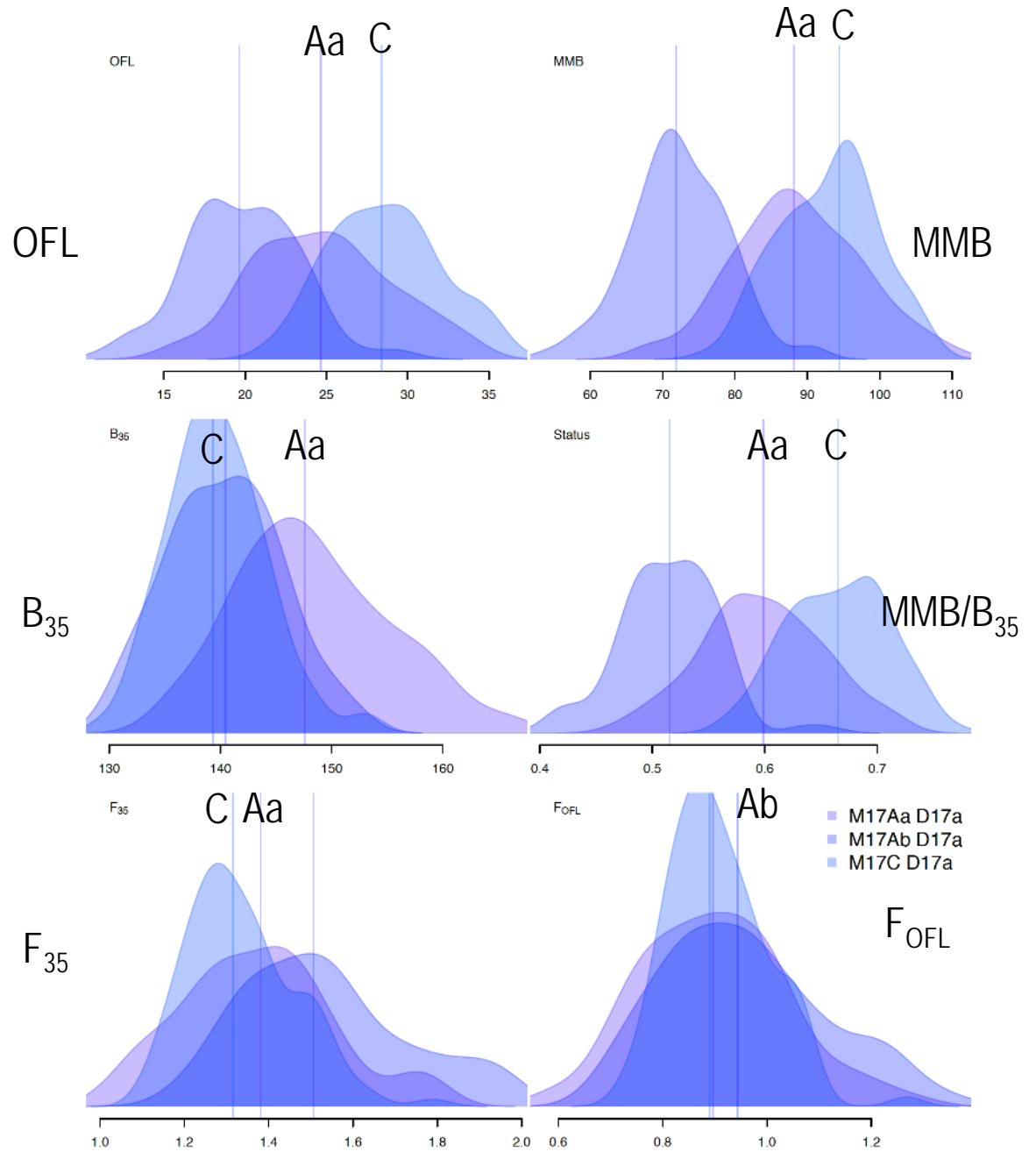


Fits to NMFS mature survey biomass

- Recommended model M17C.D17a
- fits NMFS female survey biomass best
- displays better MCMC characteristics and jittering results
- estimates M for females better



OFL-related Quantities



CPT Discussion and Recommendations

- Incorporate new growth data in 2018 stock assessment
- Reconsider weighting framework

Tier, OFL, and ABC Recommendations

- CPT concurred with author recommended model and Tier status 3b.

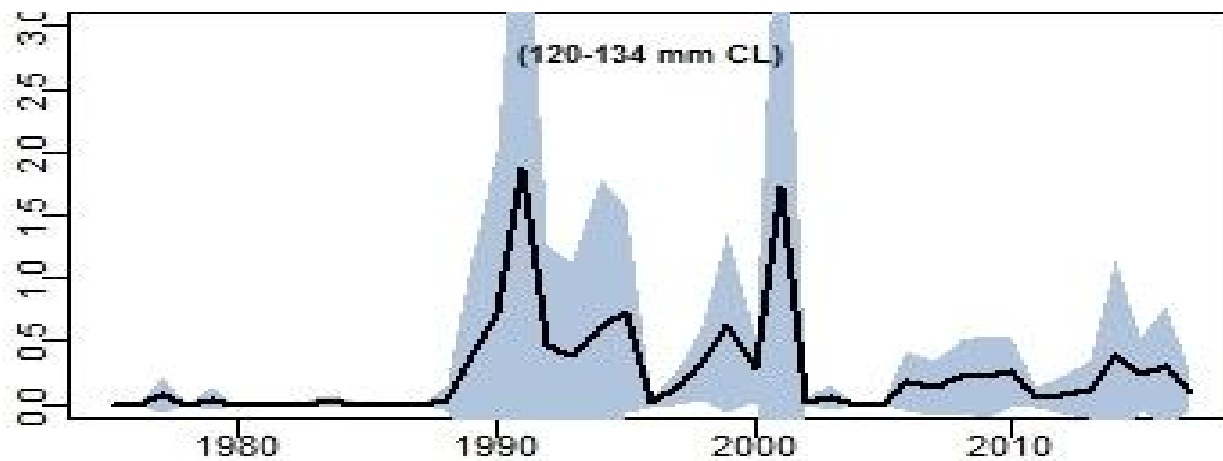
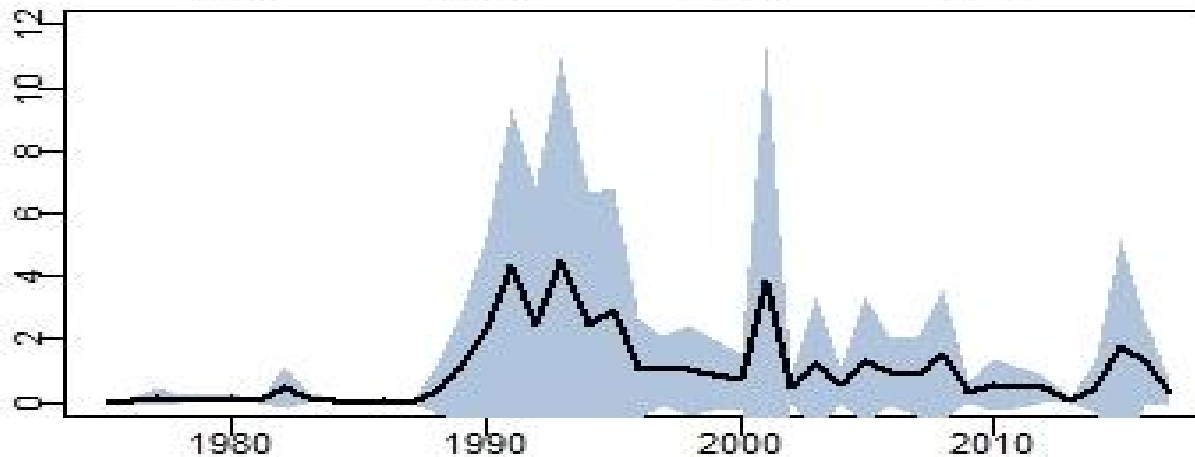
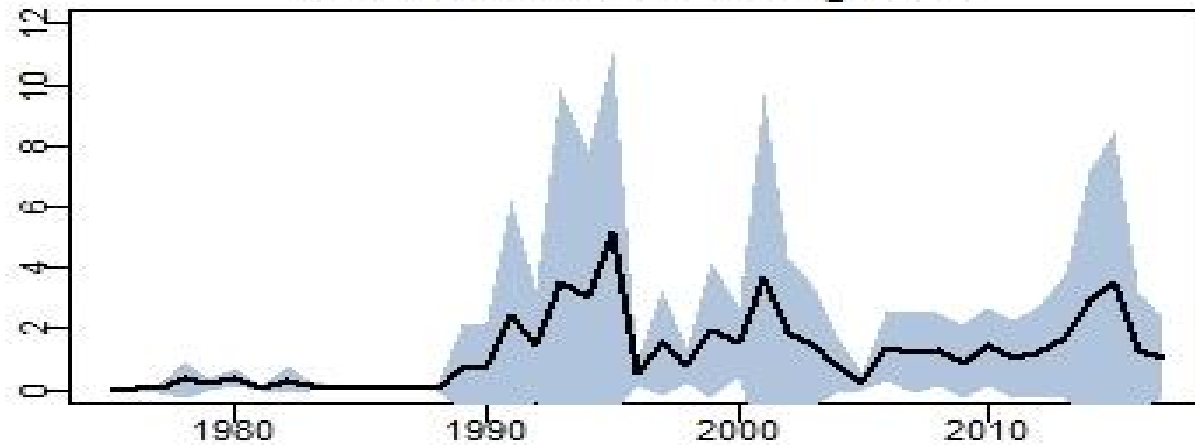
- Biomass (MMB) = 99.6 thousand t
- Total catch OFL = 28.41 thousand t
- ABC (less than max permissible) = 20%
buffer = 25.6 thousand t
 - **CPT recommended 10% last year; Increased uncertainty in appropriate model and large difference in parameter estimates.**

Pribilof Islands Red King Crab Final Stock Assessment

Jack Turnock
AFSC

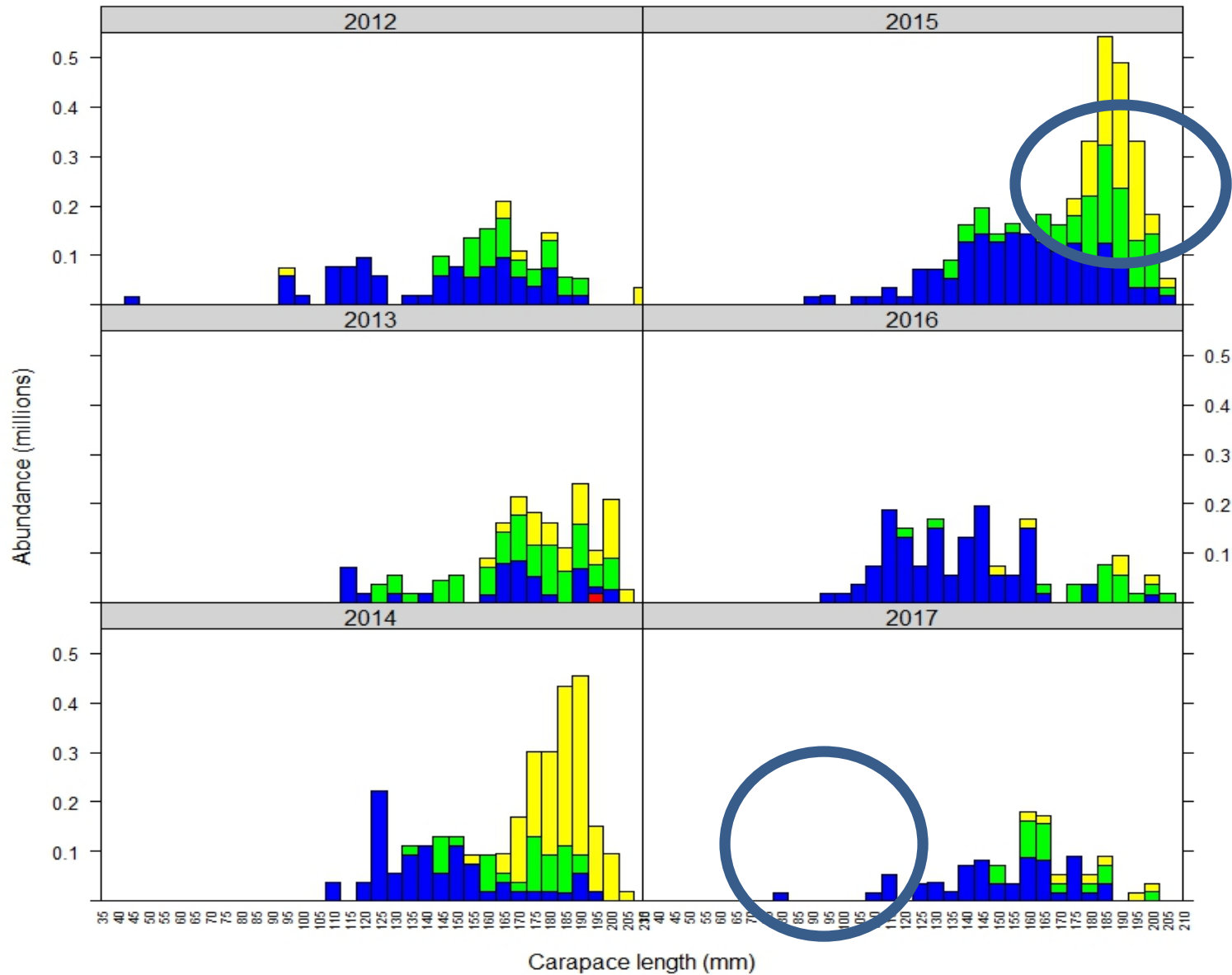
Pribilof Islands Red King Crab

Abundance (millions)

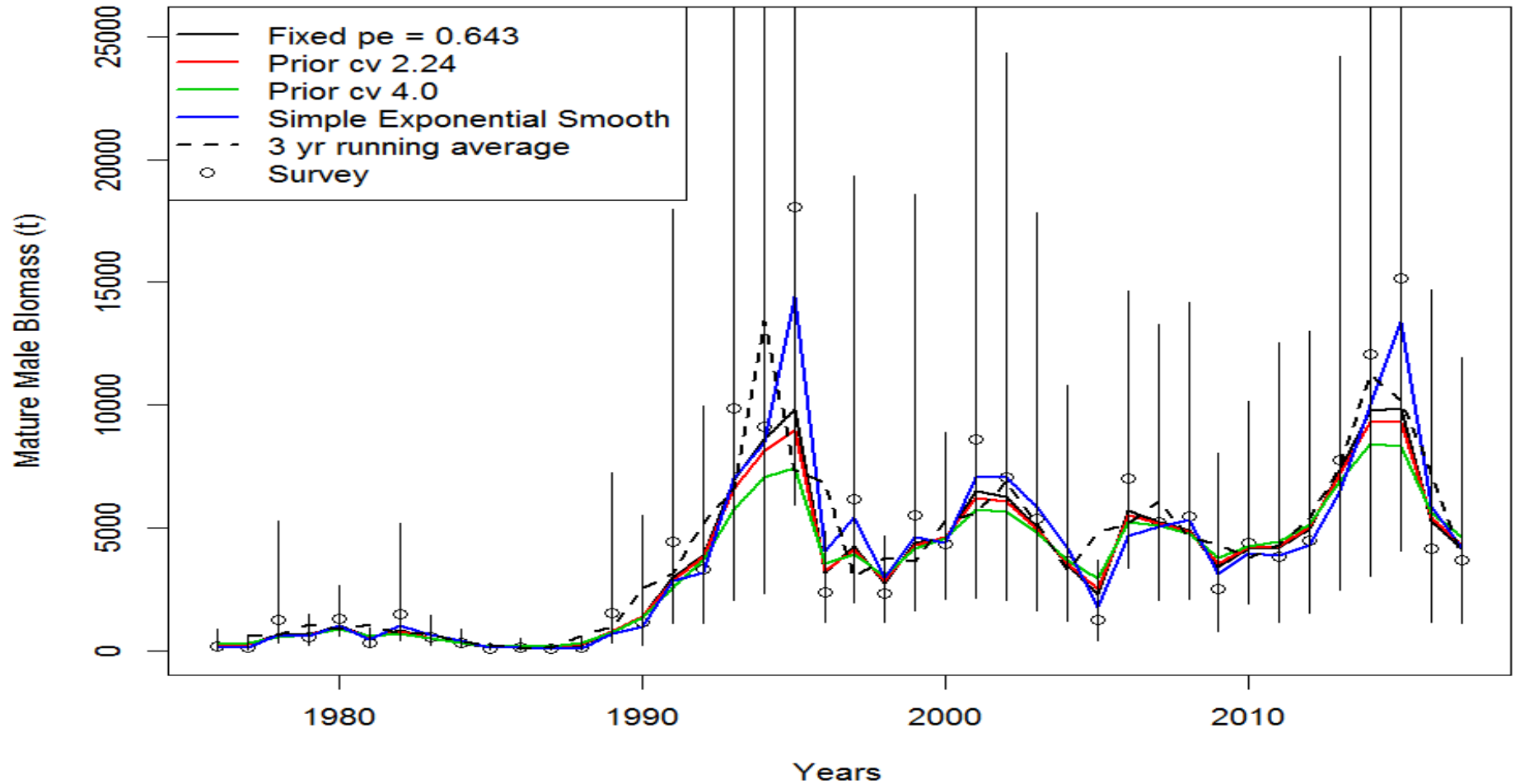


Pribilof Islands Red King Crab (male)

Shell condition
 Soft & molting █ New - hard █ Old █ Very old █



Pribilof Red King Crab



- Random effects model recommended to smooth the survey data

Tier, OFL, and ABC Recommendations

- CPT and author recommended 25% buffer
- CPT concurred with Author recommendation for Tier 4b.

- Biomass (MMB) = 3,364 t
- Total catch OFL = 480 t
- ABC (less than max permissible) =
25% buffer = 360t

Pribilof Islands Blue King Crab Final Stock Assessment

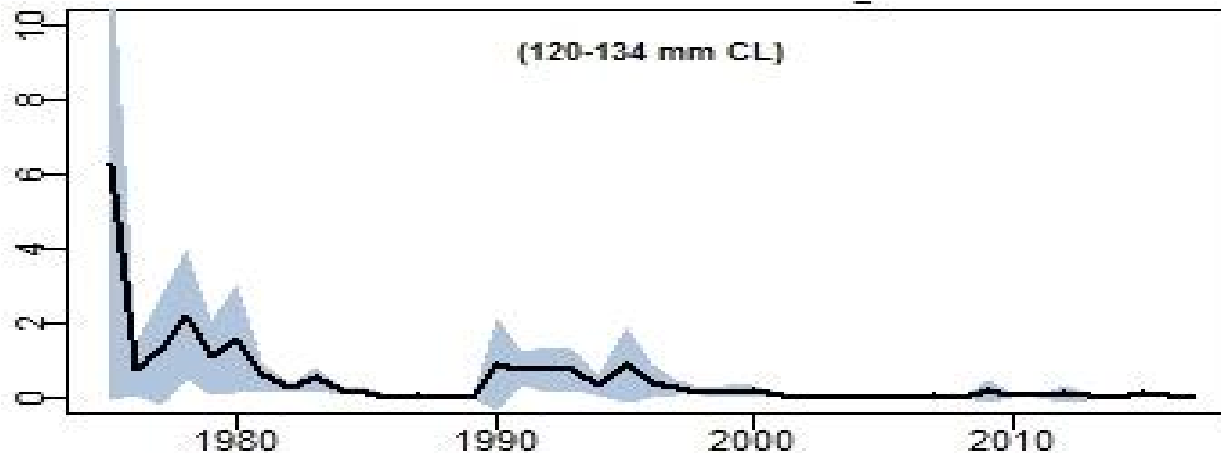
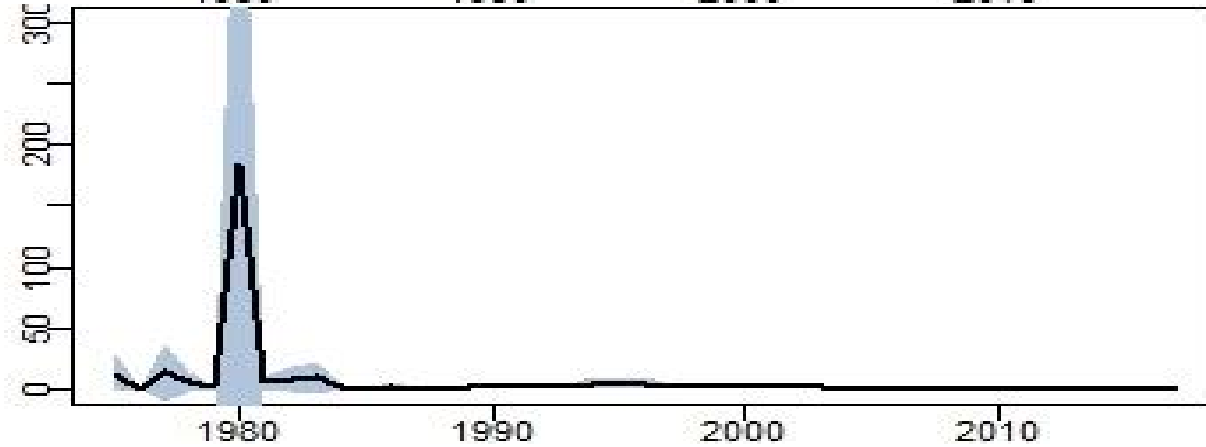
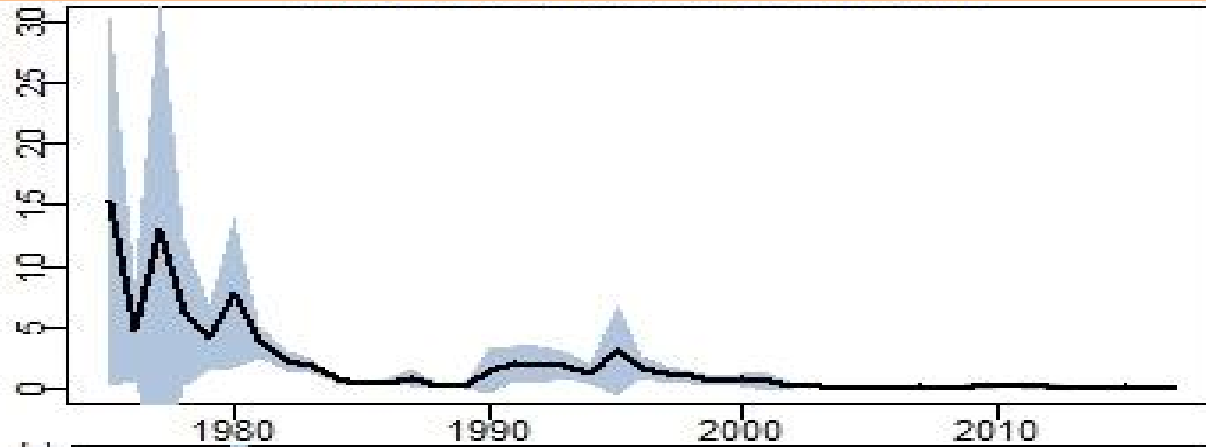


Buck Stockhausen

Alaska Fisheries Science Center

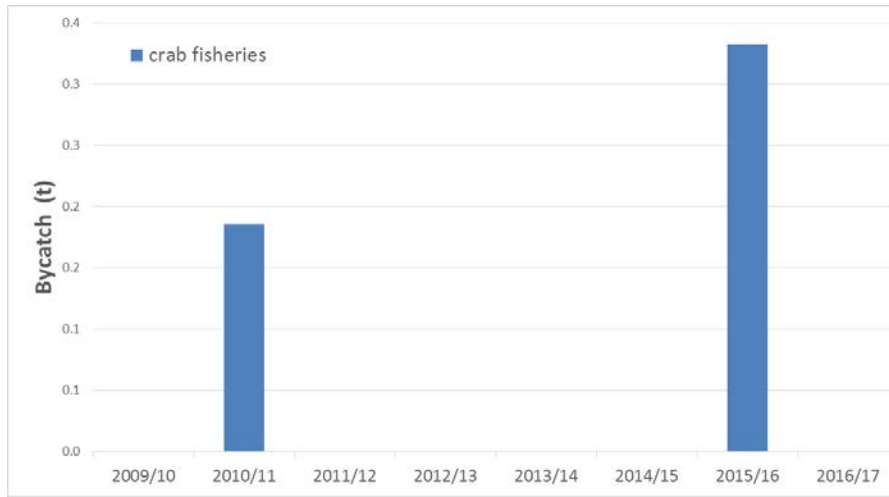
Pribilof Islands blue king crab

Abundance (millions)



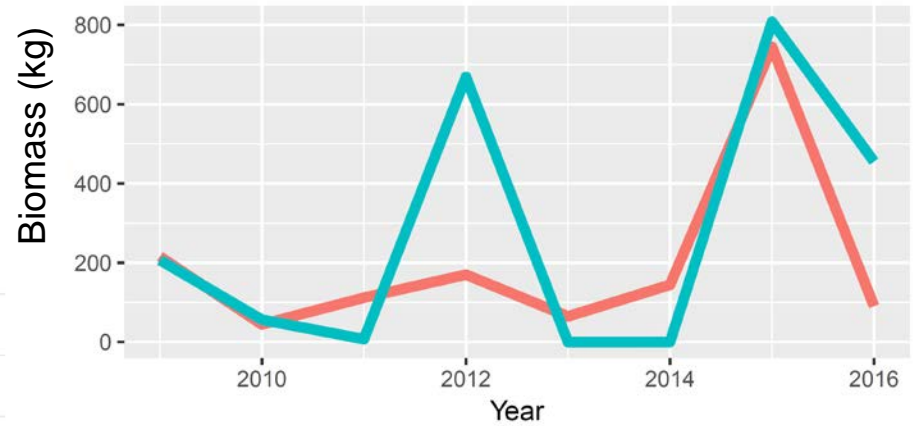
Bycatch in Non-target Fisheries

Groundfish Fisheries

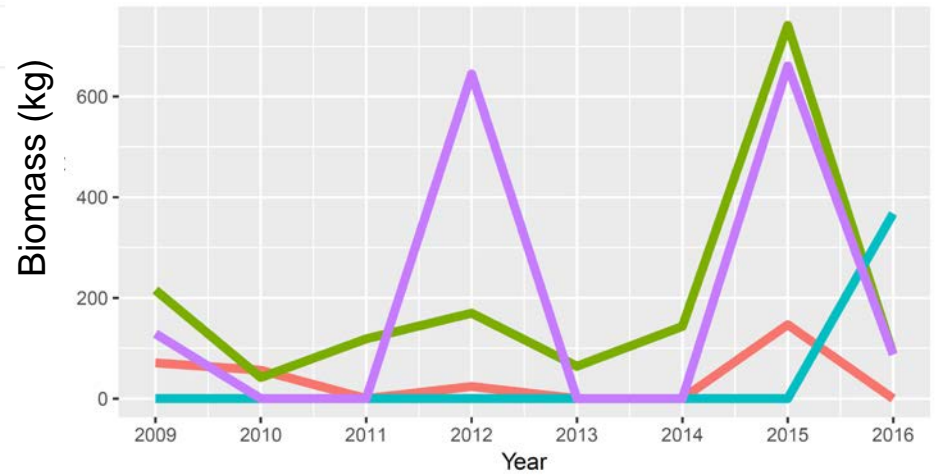


$HM_{\text{fixed}} = 0.2$ (was 0.5)

$HM_{\text{trawl}} = 0.8$



gear fixed trawl

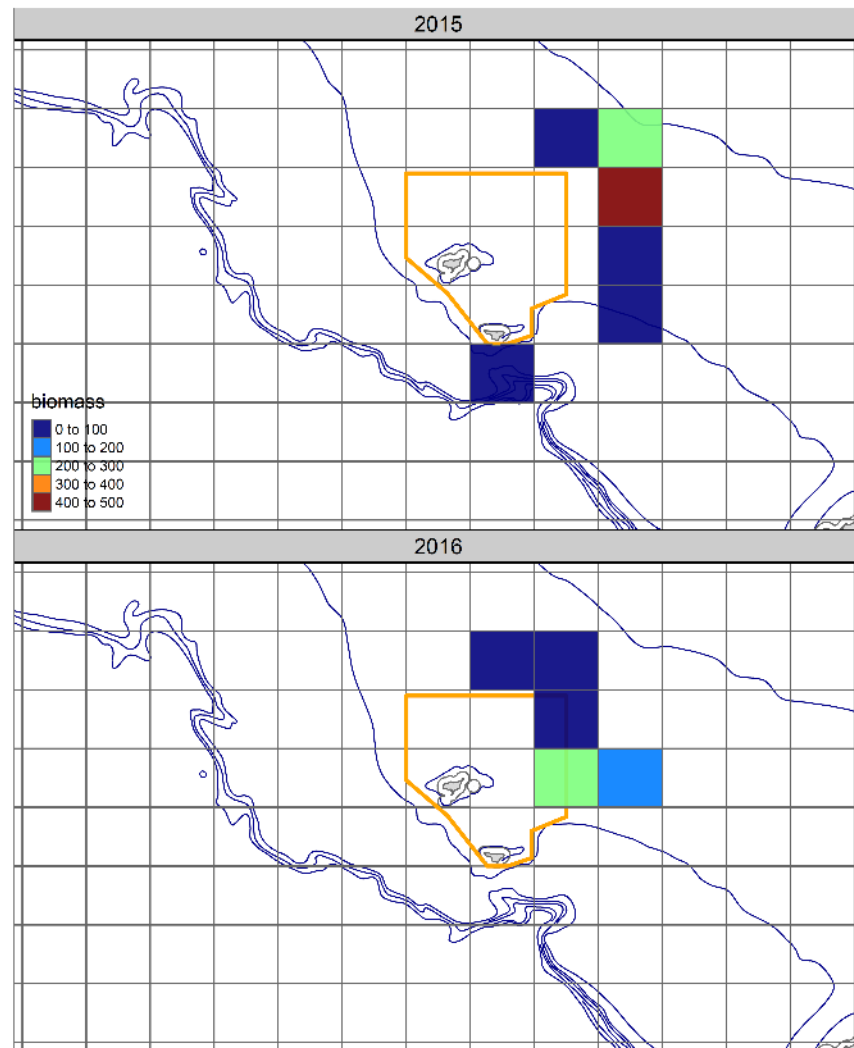
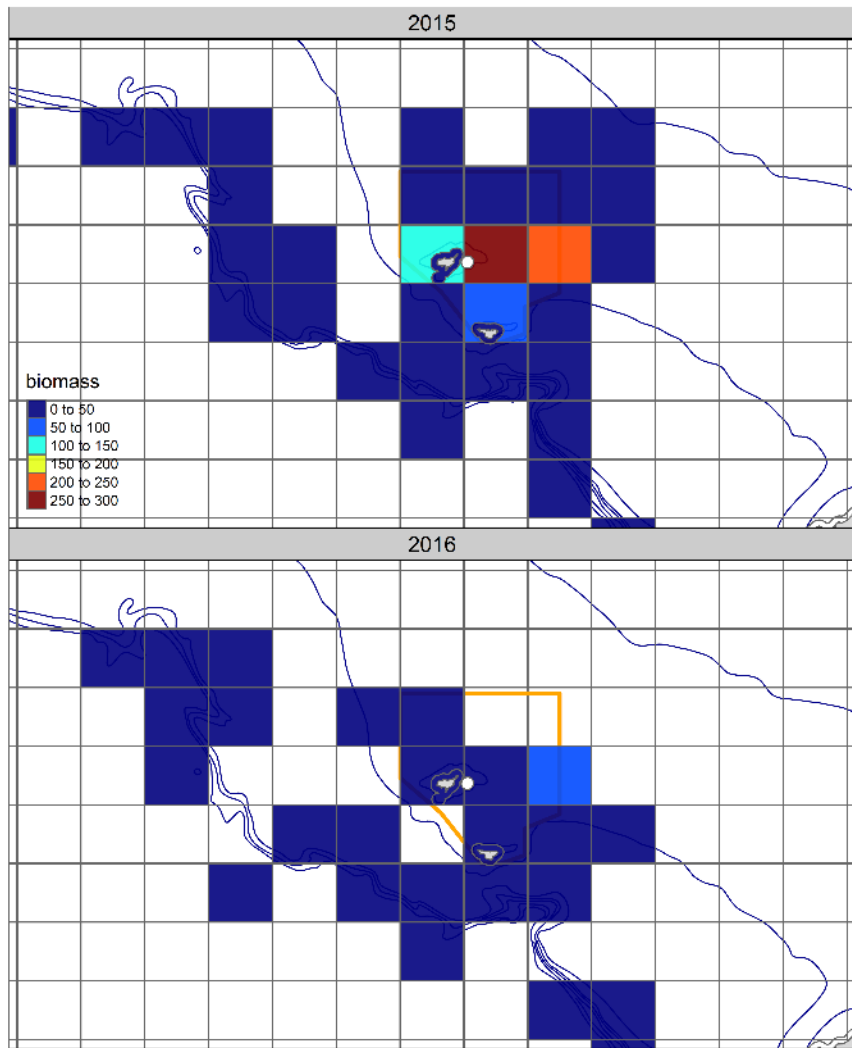


target Flathead Sole Pacific Cod Rock Sole - BSAI Yellowfin Sole - BSAI

Bycatch in Groundfish Fisheries

fixed gear

trawl gear



Tier, OFL, and ABC Recommendations

- CPT concurred with authors random effects model
- CPT and author recommended 25% buffer
- CPT concurred with Author recommendation for Tier 4c.

- Biomass (MMB) = 233 t
- Total catch OFL = 1.16 t
- ABC (less than max permissible) =
25% buffer = 0.87 t

St. Matthew Island Blue King Crab Final Stock Assessment

Saint Matthew Island Blue King Crab Stock Assessment 2017

James Ianelli¹, D'Arcy Webber², Jie Zheng³, and Alatheia Letaw⁴

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²Quantifish, darcy@quantifish.co.nz

³Alaska Department of Fish and Game, jic.zheng@alaska.gov

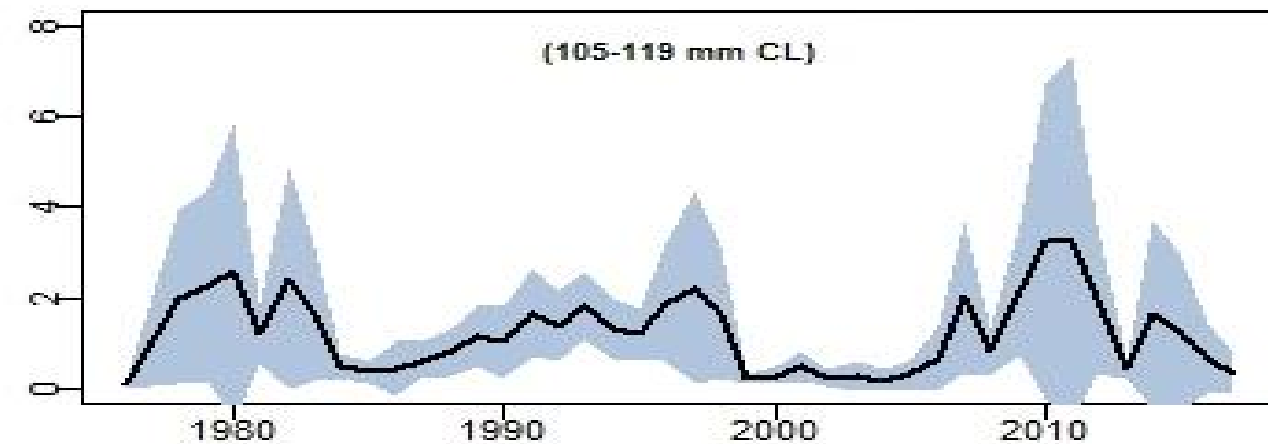
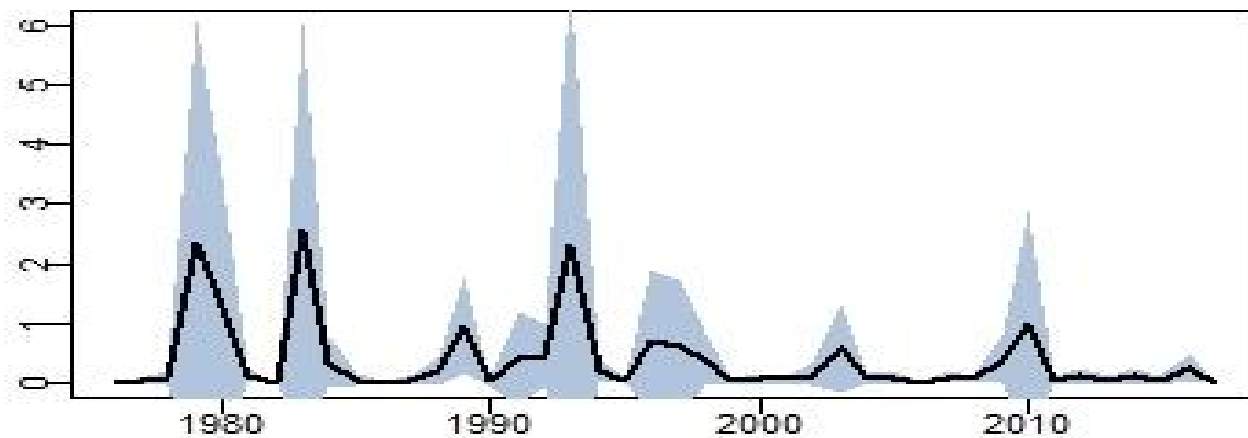
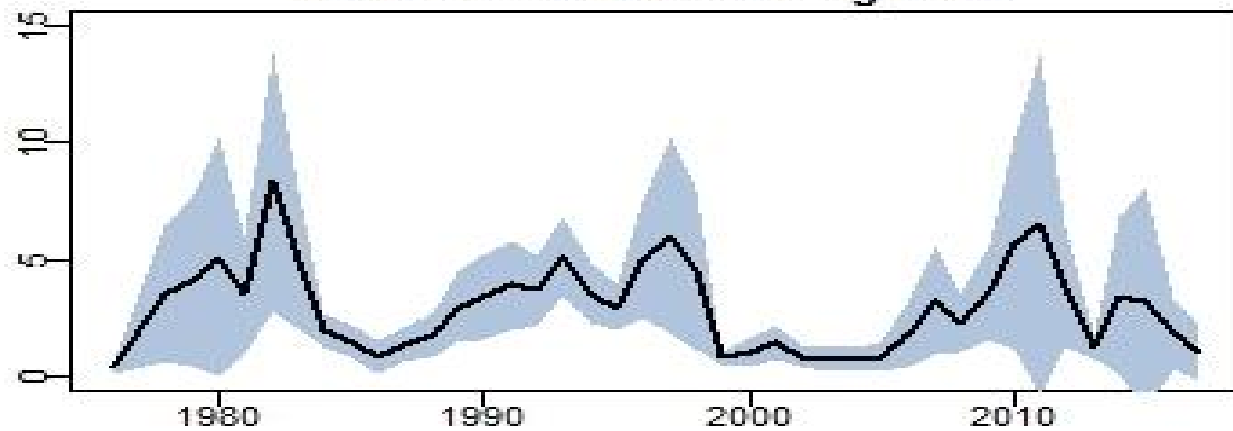
⁴NOAA, alatheia.letaw@noaa.gov

September 2017

Executive Summary

1. **Stock:** Blue king crab, *Paralithodes platypus*, Saint Matthew Island (SMBKC), Alaska.
2. **Catches:** Peak historical harvest was 4288 t (9.454 million pounds) in 1983/84¹. The fishery was

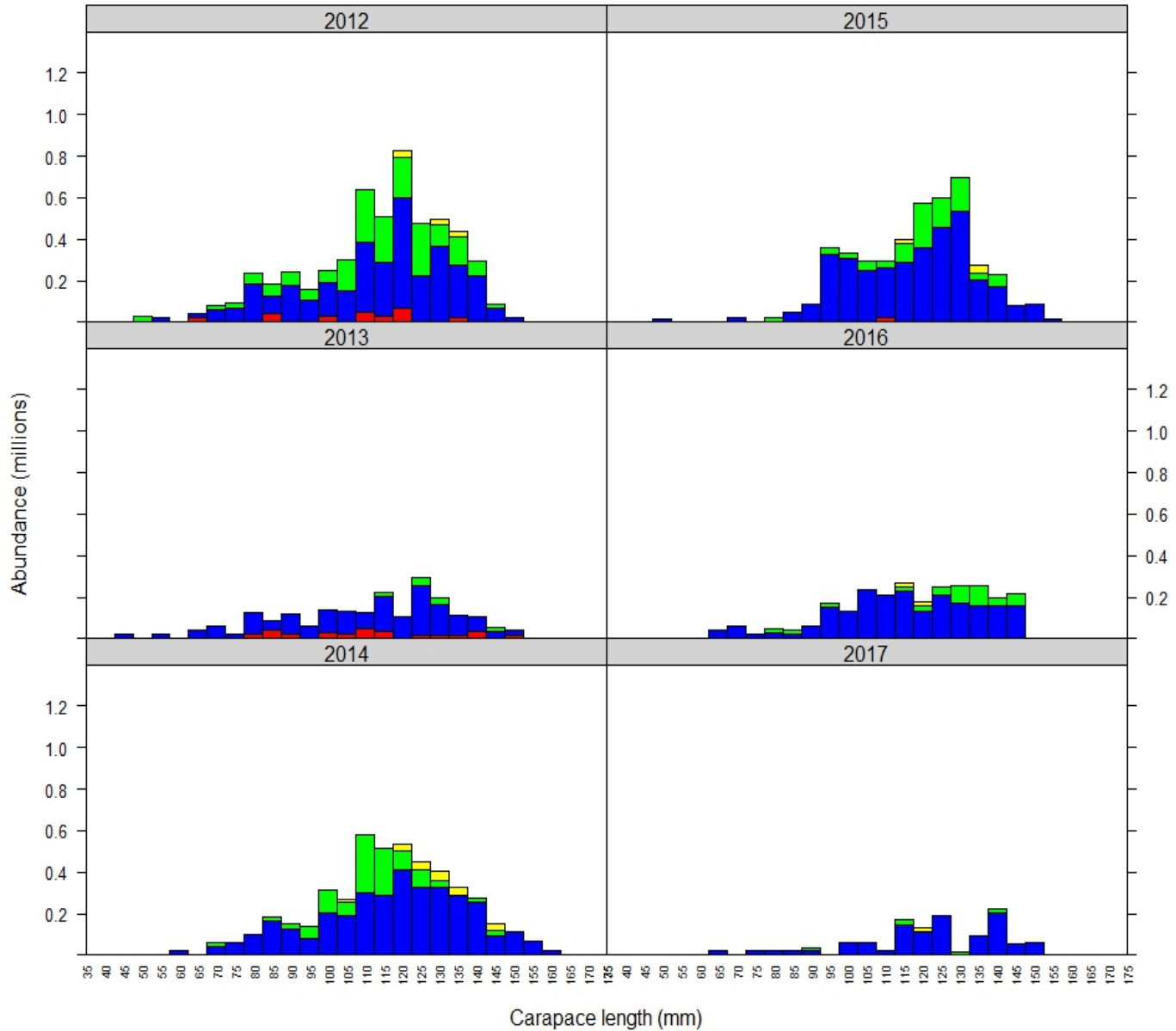
St. Matthew Is. Blue King Crab



Abundance (millions)

St. Matthew Island Blue King Crab (male)

Shell condition
Soft & molting (Red) New - hard (Blue) Old (Green) Very old (Yellow)



SMBKC: Data extent

SMBKC crab

Data by type and year

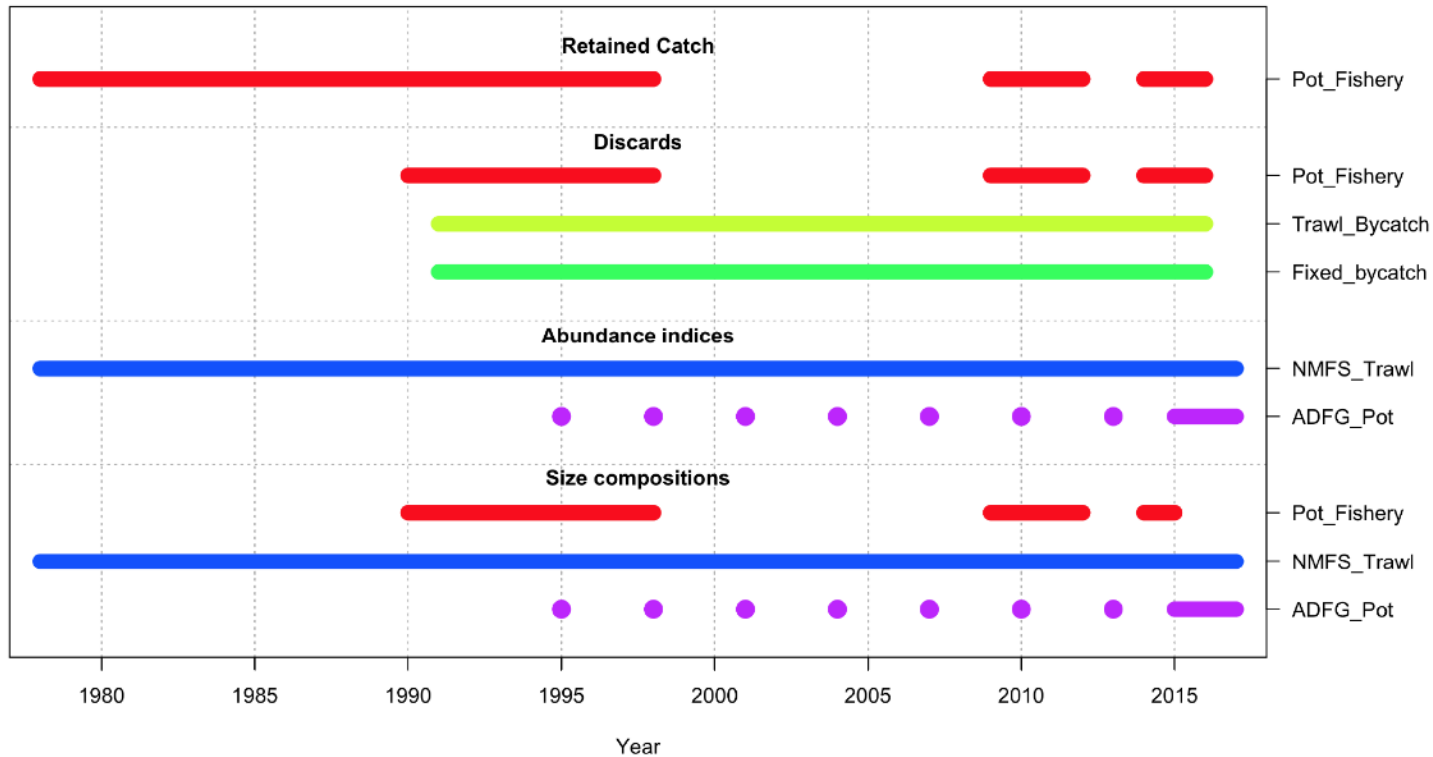
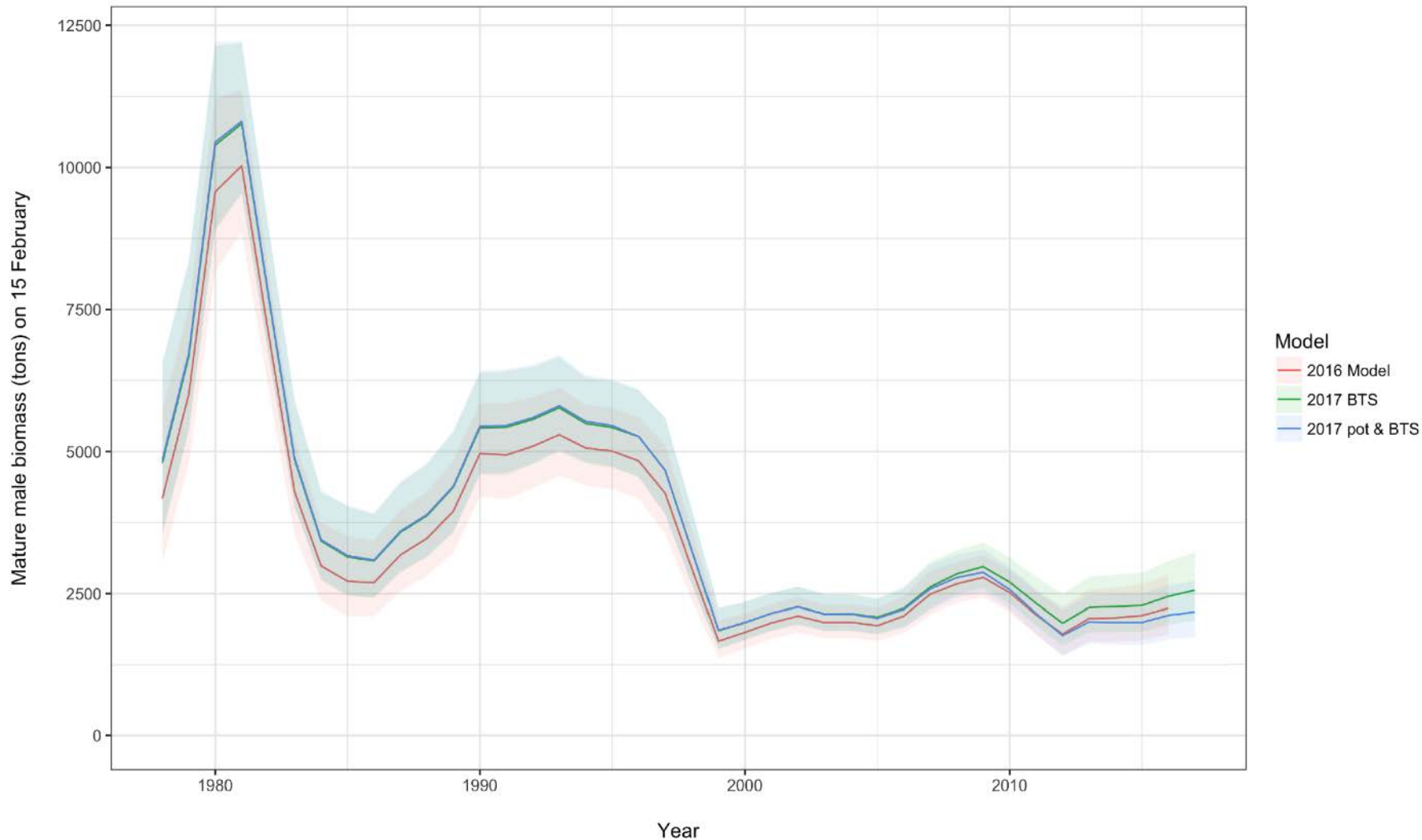
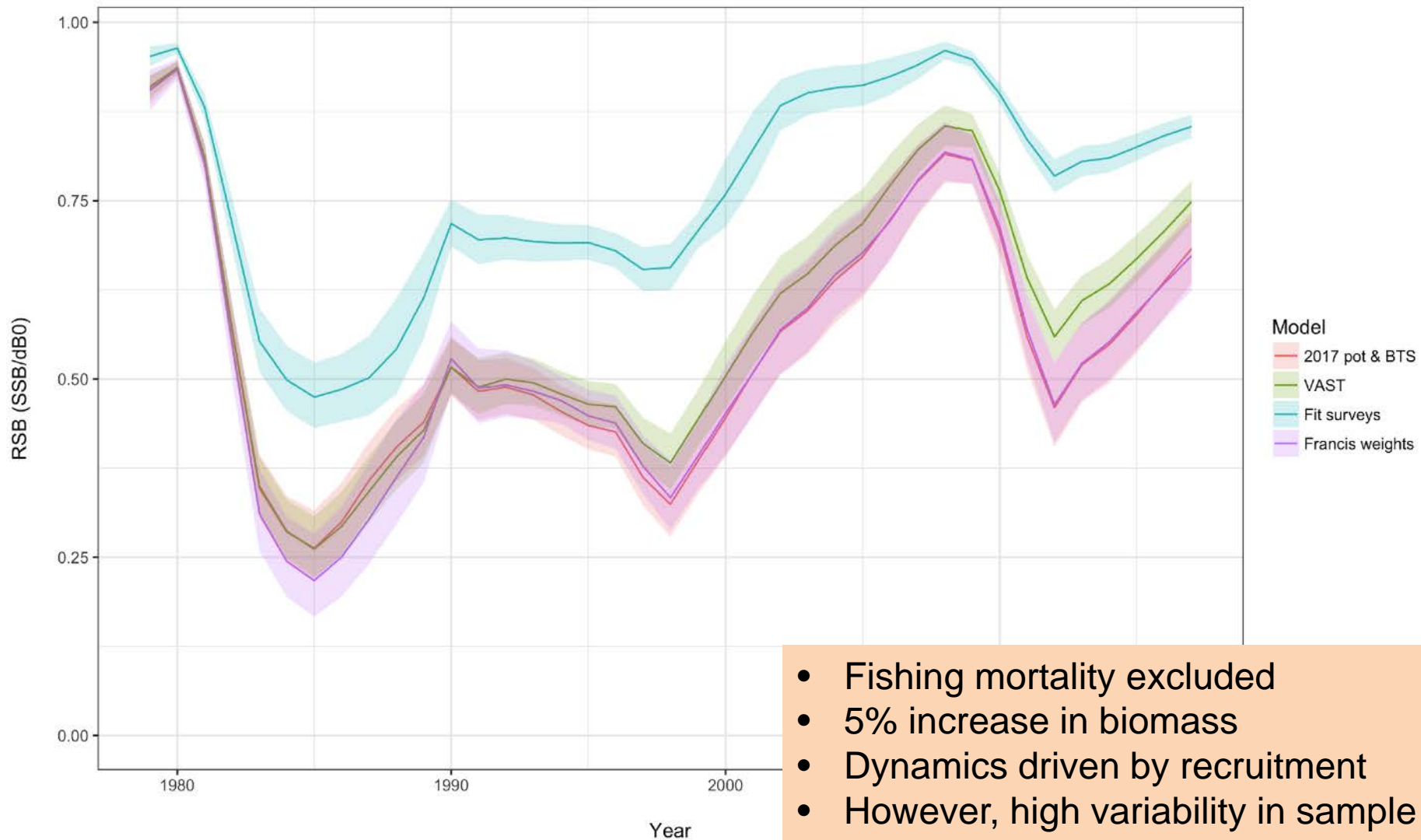


Figure 3: Data extent for the SMBKC assessment (with the 2017 Pot survey included).

Sensitivity to new data



Dynamic B-zero...alternative to evaluate fishing effects



- Fishing mortality excluded
- 5% increase in biomass
- Dynamics driven by recruitment
- However, high variability in sample size each year.

Tier, OFL, and ABC Recommendations

- CPT and author recommended 20% buffer
- CPT concurred with Author recommendation for Tier 4b.

- Biomass (MMB) = 2.18 thousand t
- Total catch OFL = 0.12 thousand t
- ABC (less than max permissible) = 20% buffer = 0.10 thousand t

- SSC increased buffer to 25%=0.09 thousand t

Stock Status

- 2016/2017 total catch = <1 t
- 2016/2017 OFL = 56 t

Overfishing DID NOT occur

- Stock now on triennial assessment cycle (2020)
- Updated catch and survey data annually

Can not assess overfished status

Stock Status

- 2016/2017 total catch = 0.24 t
- 2016/2017 OFL = 91 t

Overfishing DID NOT occur

- Stock now on triennial assessment cycle (2020)
- Updated catch and survey data annually

Can not assess overfished status

September 2017 Crab Plan Team Report

- AIGKC model (M.S.M. Siddeek, J. Zheng, C. Siddon, and B. Daly)
- NSRKC model (Toshihide “Hamachan” Hamazaki, Jie Zheng)
- Ecosystem Report (Stephanie Zador)
- Groundfish bycatch overview (Krista Milani AKRO)
- Crab bycatch overview (Ben Daly)
- BSFRF research update (Scott Goodman)
- January 9-11 CPT meeting planning