

BSAI Crab Management

SAFE Report and Crab Plan Team Report

Agenda Item C-1
October 2018

BSAI
Crab Plan Team:

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

Ben Daly (ADF&G-Kodiak), Vice-Chair

Diana Stram (NPFMC)

Bill Bechtol (University of Alaska Fairbanks)

Martin Dorn (NOAA Fisheries/AFSC-Seattle)

Ginny Eckert (UAF/UAS)

Brian Garber-Yonts (NOAA Fisheries/AFSC-Seattle)

Krista Milani (NOAA Fisheries/AKRO-Juneau)

Katie Palof (ADF&G-Juneau)

André Punt (University Of Washington)

Shareef Siddeek (ADF&G-Juneau)

Buck Stockhausen (NOAA Fisheries/AFSC-Seattle)

Cody Szuwalski (NOAA Fisheries/AFSC-Seattle)

Miranda Westphal (ADF&G-Dutch Harbor)



October 2018 Crab Plan Team Report

- EBS survey update
- Recommend final OFL/ABC for 4 crab stocks
 - Survey and catch updates
- 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)			to be biennial for rebuilding information	Triennial	2019
Saint Matthew blue king crab (SMBKC)	September	October	Annual	2018	

Overfishing limit (OFL)

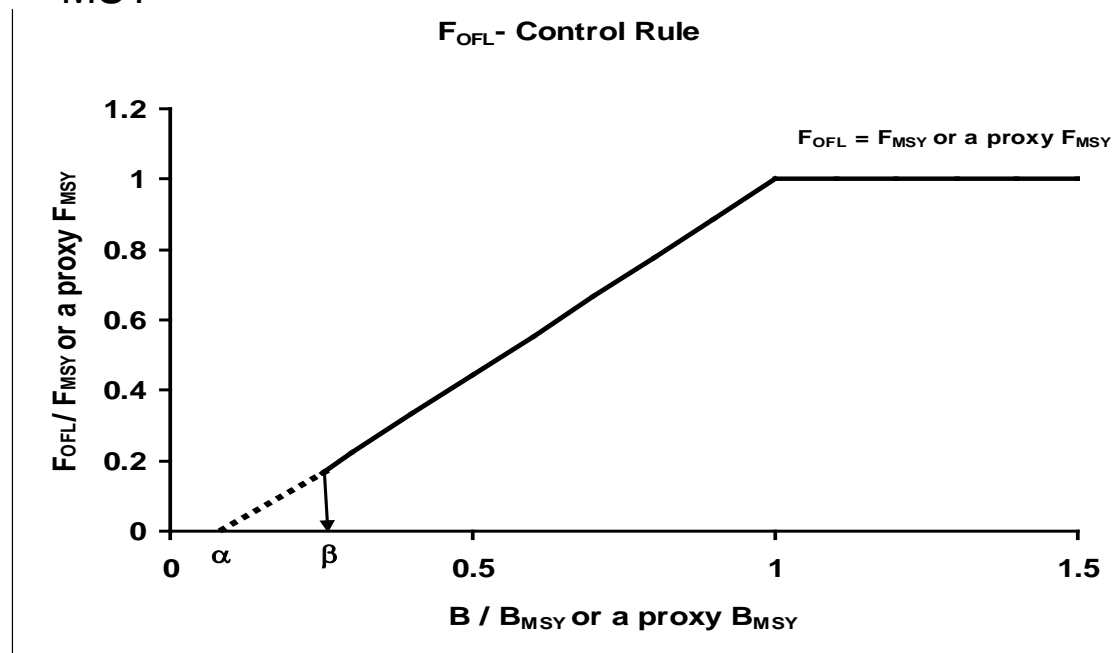
Overfishing rule limits catch to prevent overfishing and avoid overfished status ($0.5 B_{MSY}$)

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

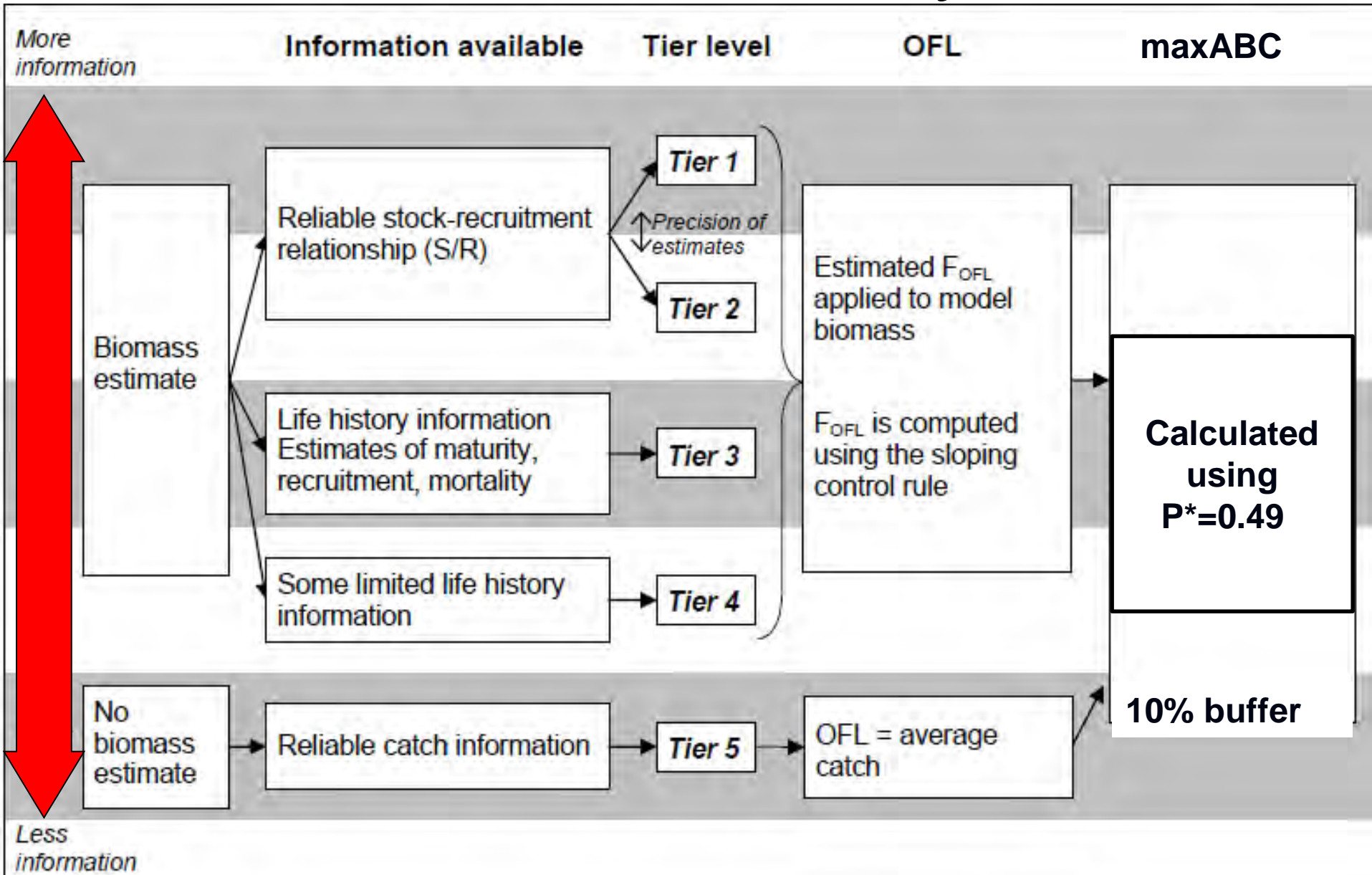
F_{OFL} prescribed by Tier system

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

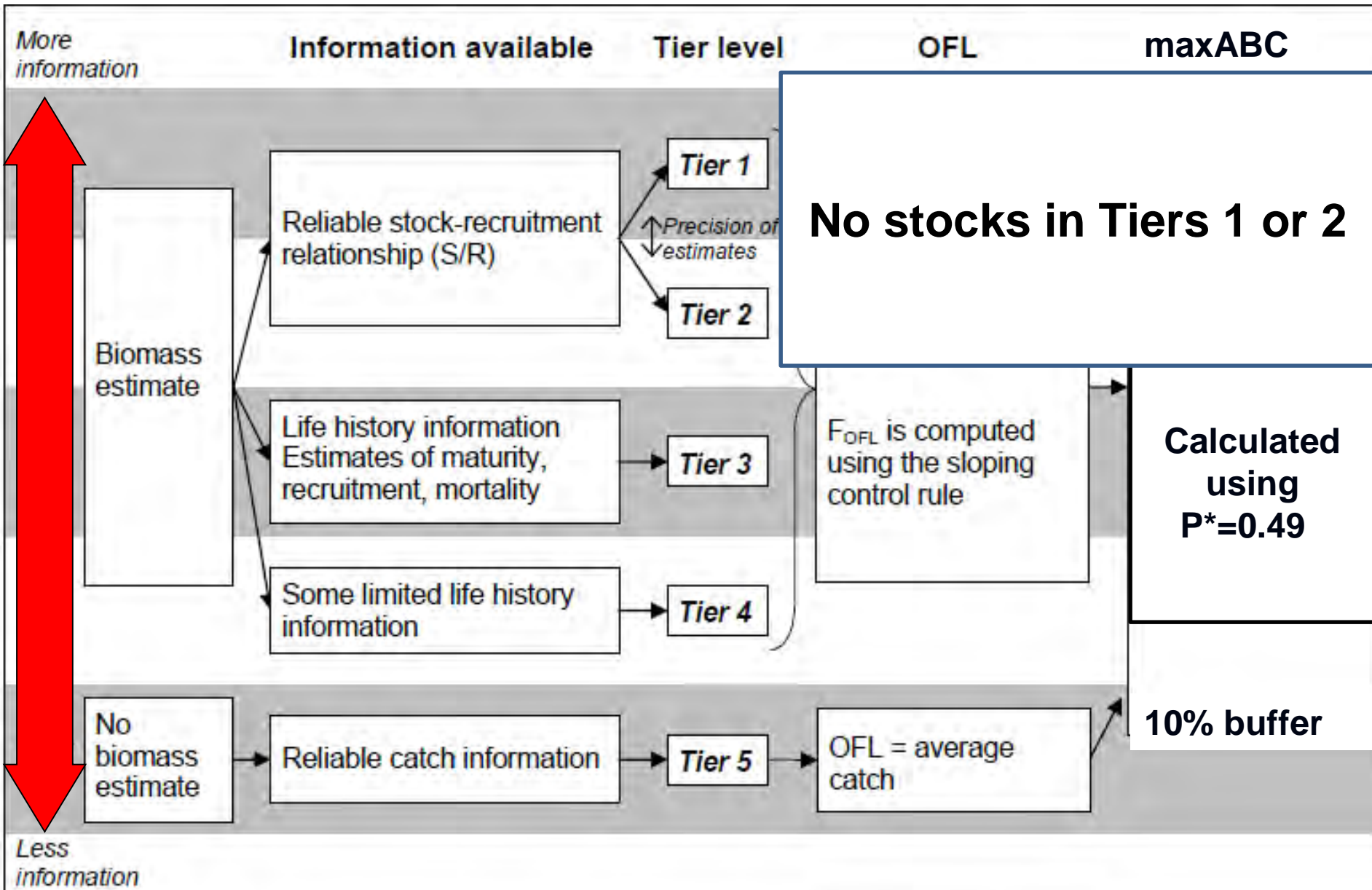
$$\text{Stock} < B_{MSY}: \quad F_{OFL} < F_{MSY}$$



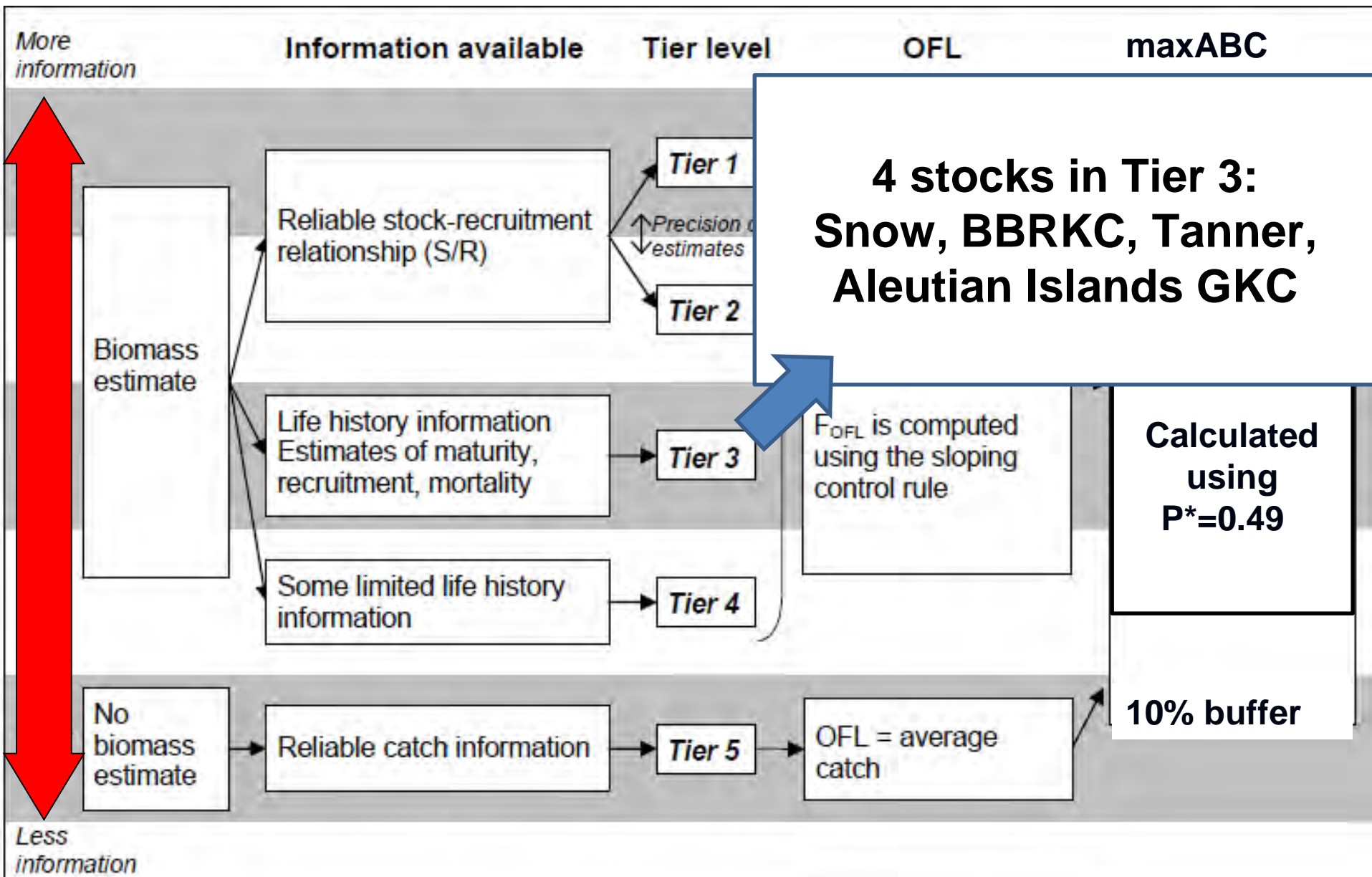
Current Crab Tier system



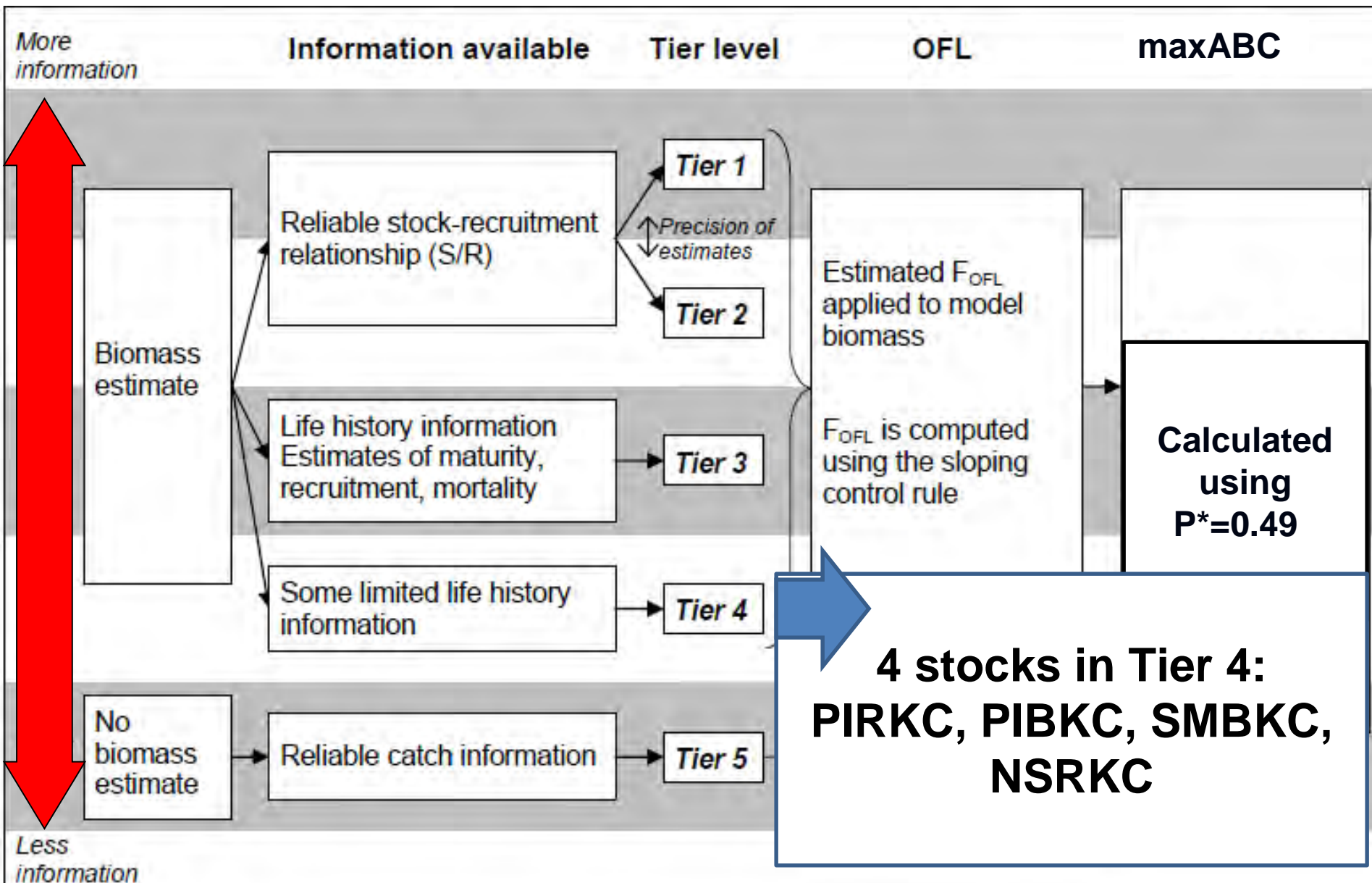
Overview of stocks



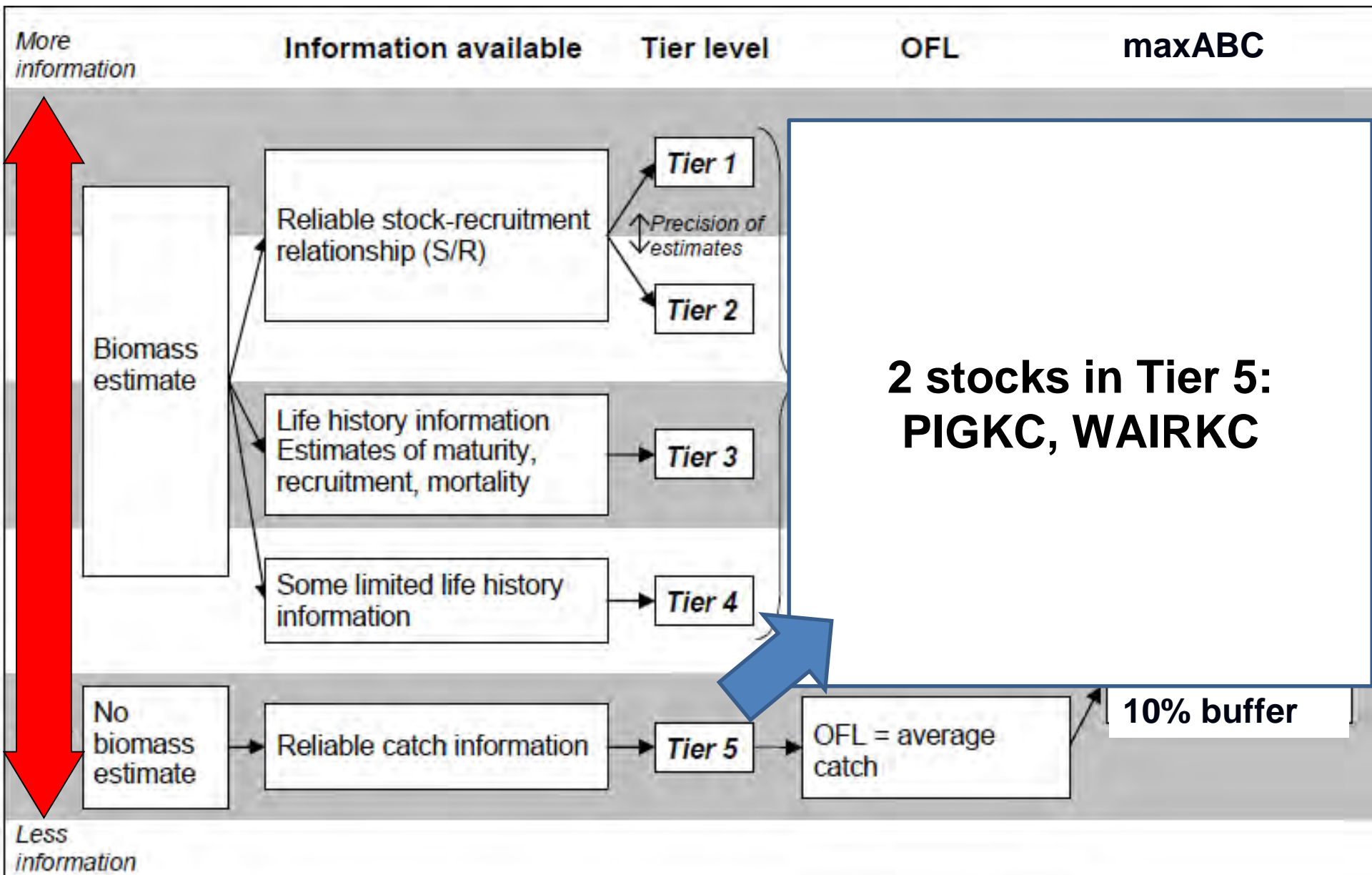
Overview of stocks



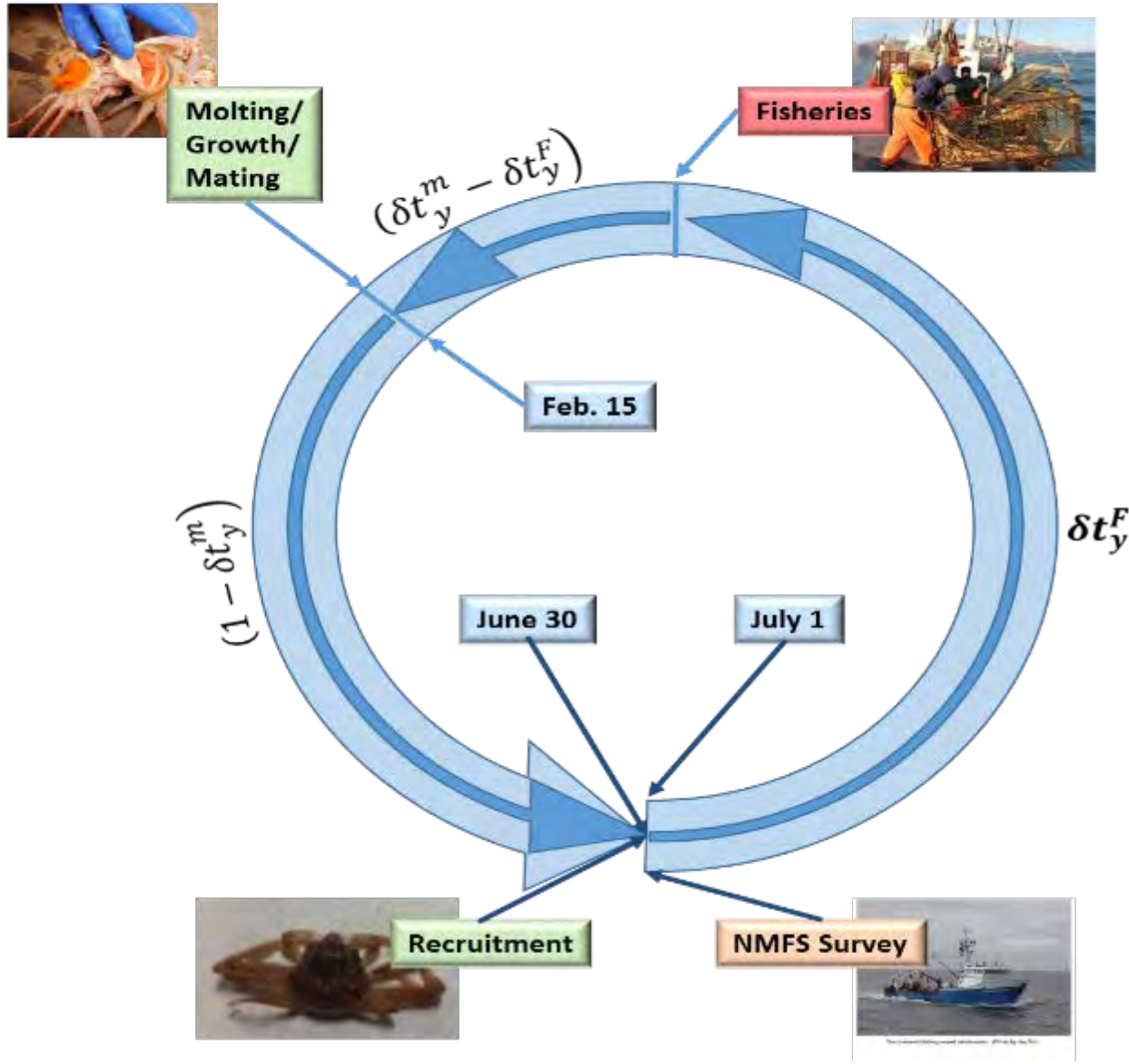
Overview of stocks



Overview of stocks

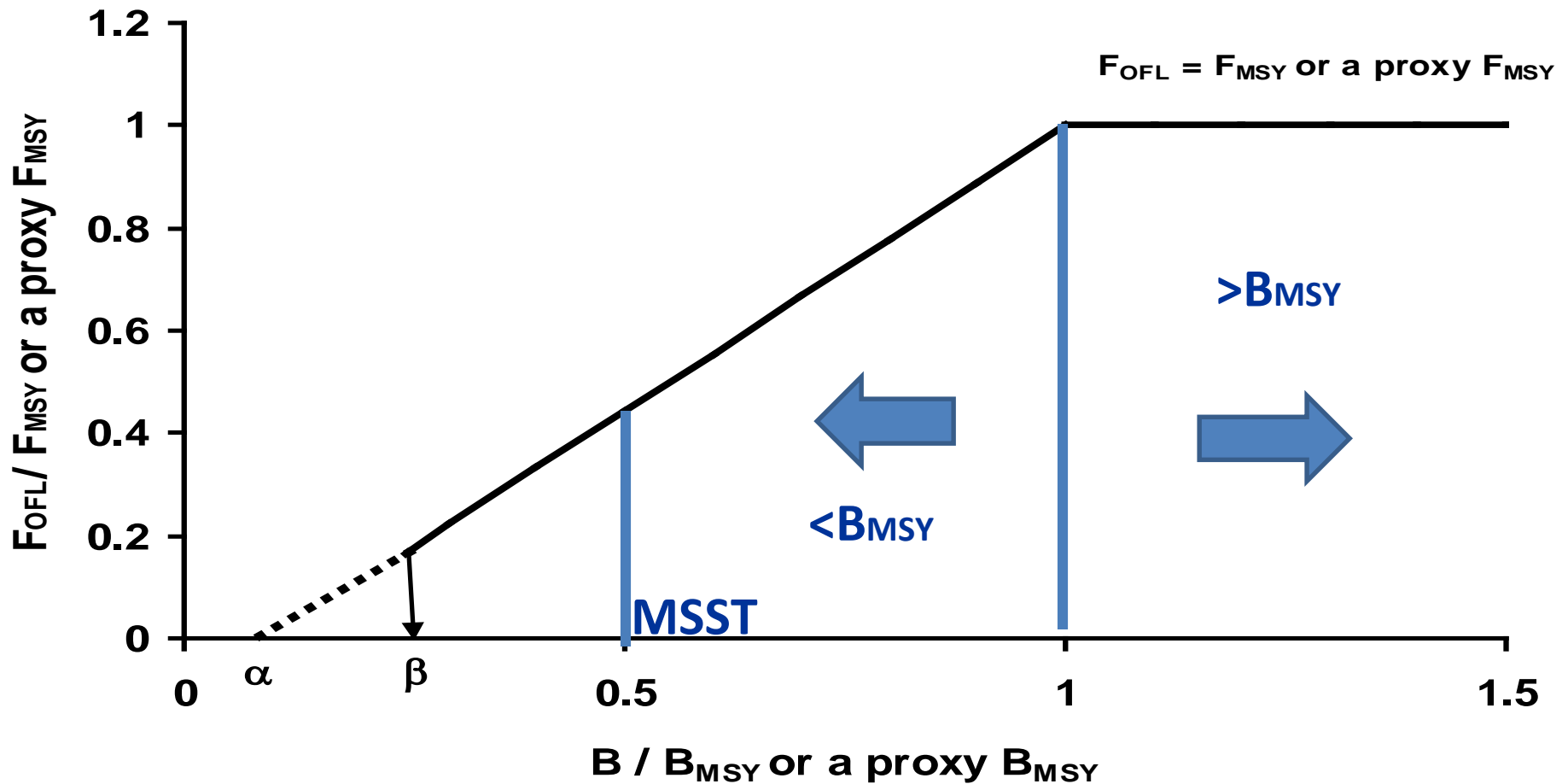


Tier 3 stage/size-based population dynamics model



Overfishing limit (OFL)

F_{OFL} - Control Rule



Projected stock status in relation to biological reference points

Biomass

$> B_{MSY}$

- EBS Tanner crab
- Aleutian Islands golden king crab

Biomass

$< B_{MSY}$

- EBS snow crab
- Bristol Bay red king crab
- Pribilof Islands red king crab
- Norton Sound red king crab

Biomass

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

- Pribilof Islands blue king crab
- St. Matthew blue king crab

Biomass and status unknown

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



**NOAA
FISHERIES**

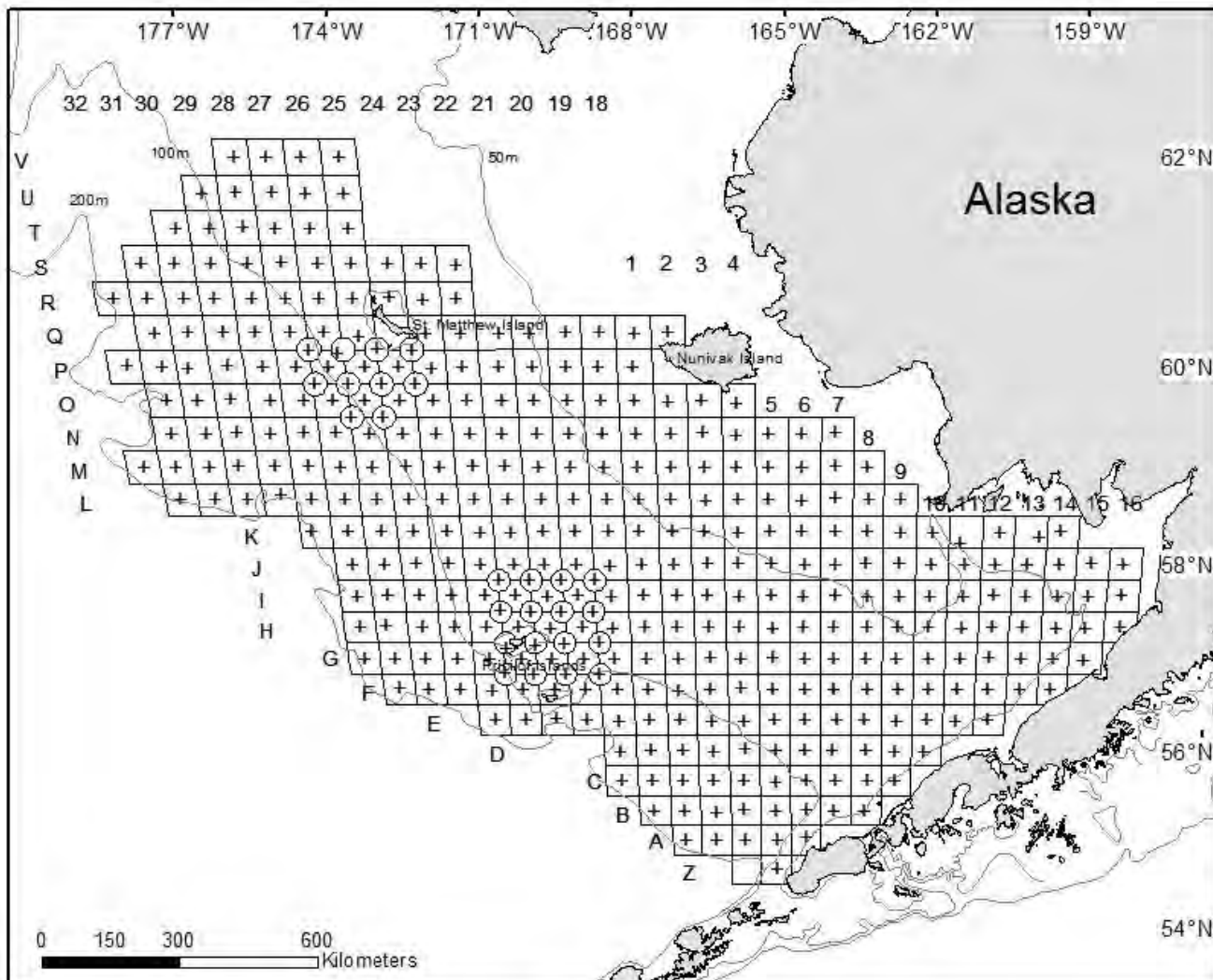
Alaska Fisheries
Science Center-
Kodiak Lab

The 2018 Eastern Bering Sea Continental Shelf Bottom Trawl Survey: Results for Commercial Crab Species

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

SSC,AP,Council
September 2018

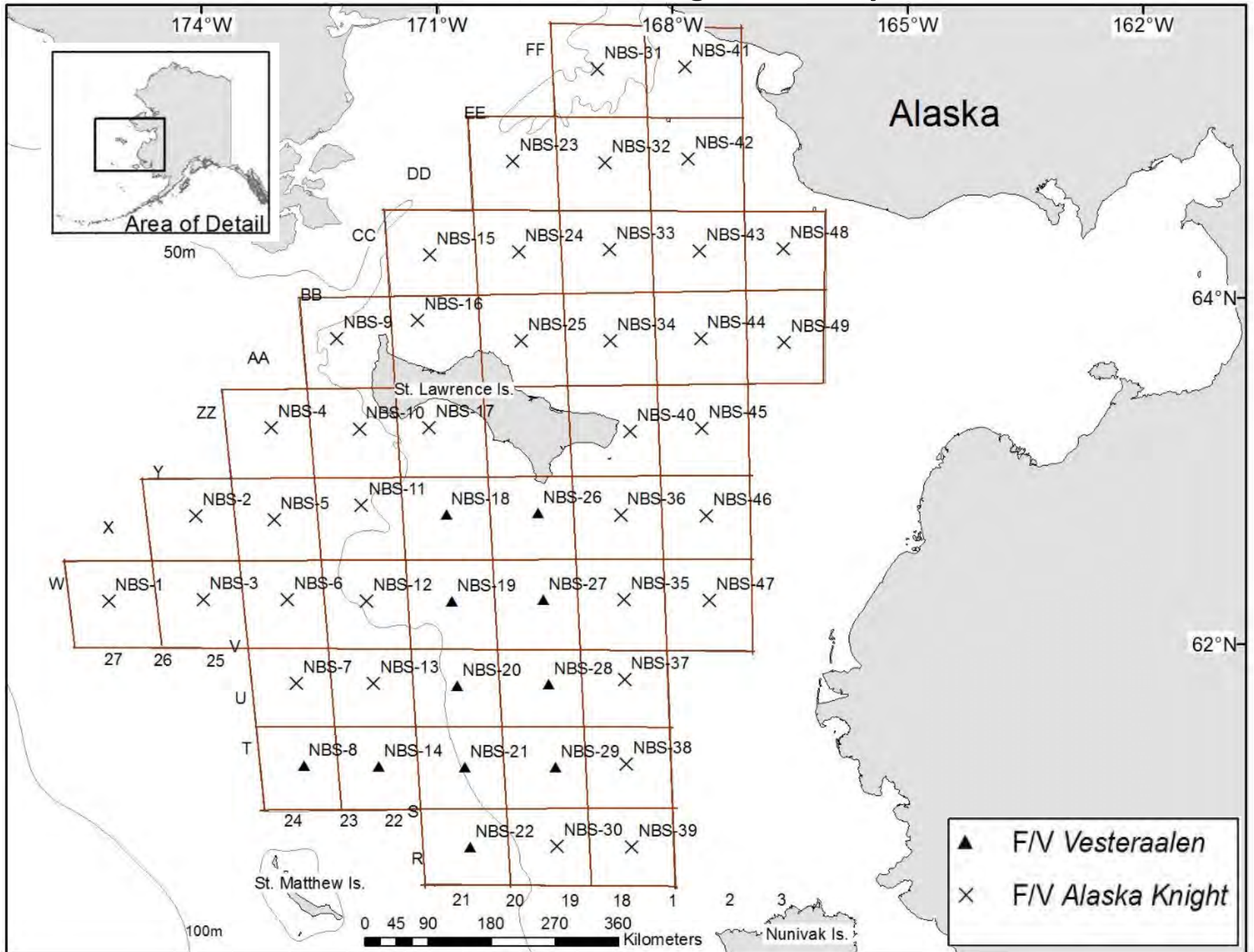
2018 standard Bering Sea survey



HIGHLIGHTS

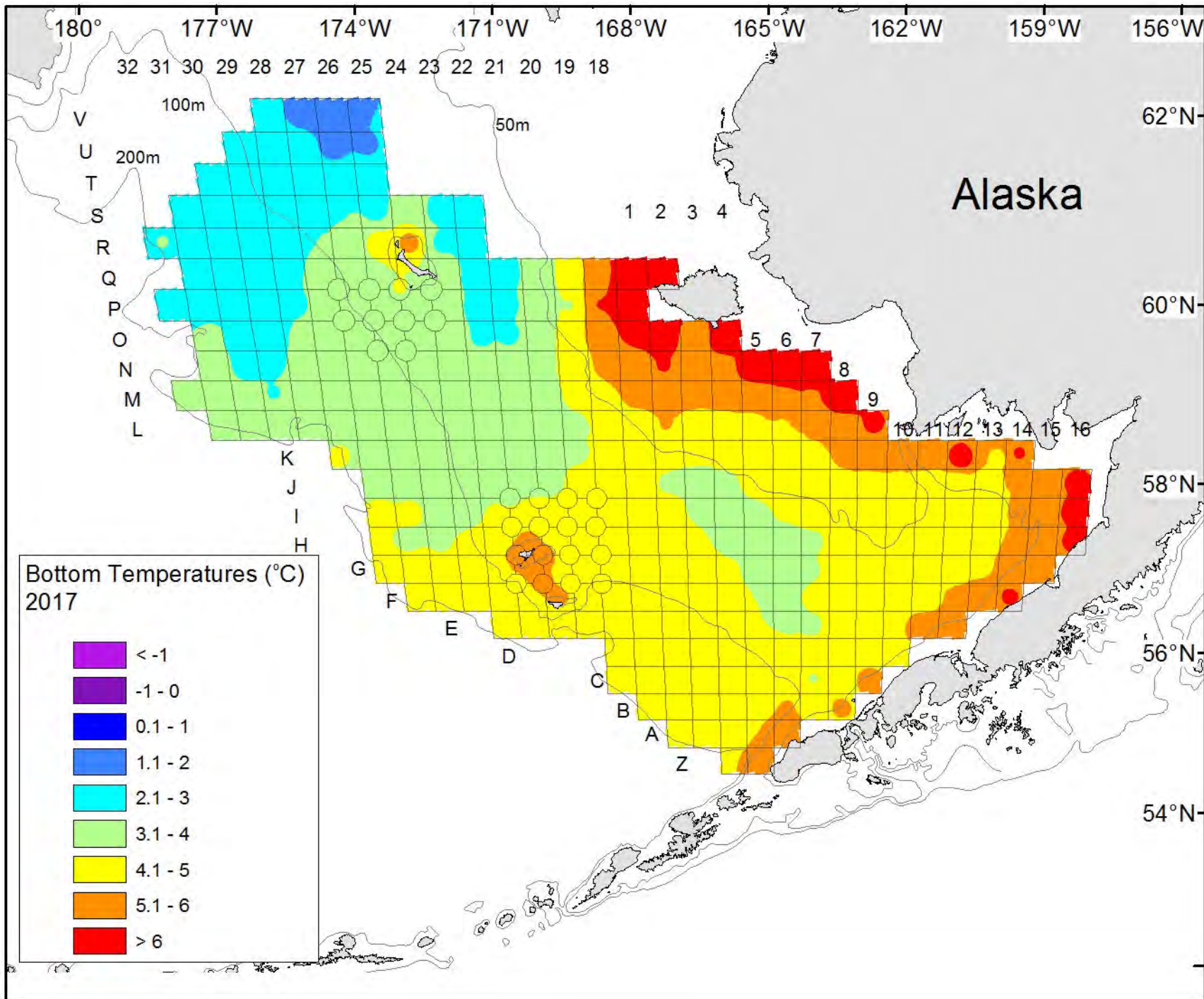
- June 3– July 31
- 375 standard stations
- 139,949 nm²
- 6 special crab projects
- Warm water
- Northern Bering Sea

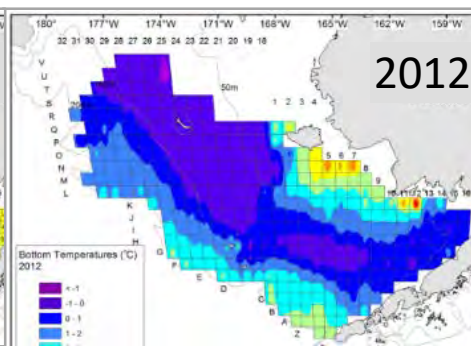
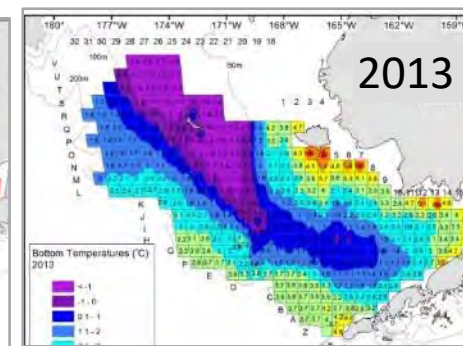
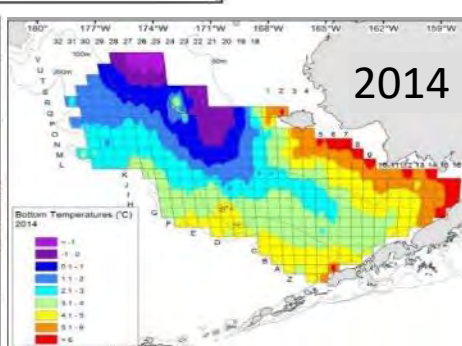
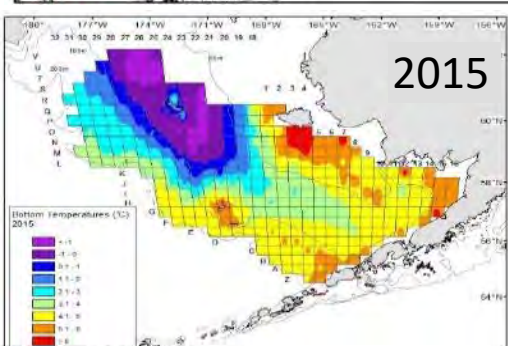
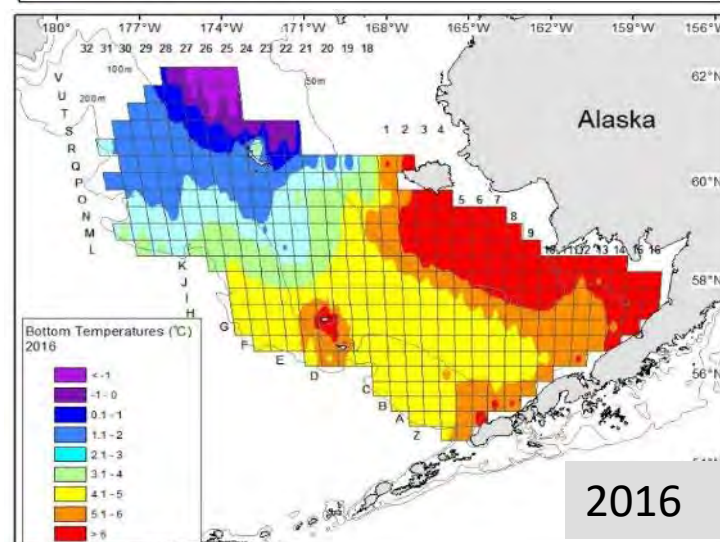
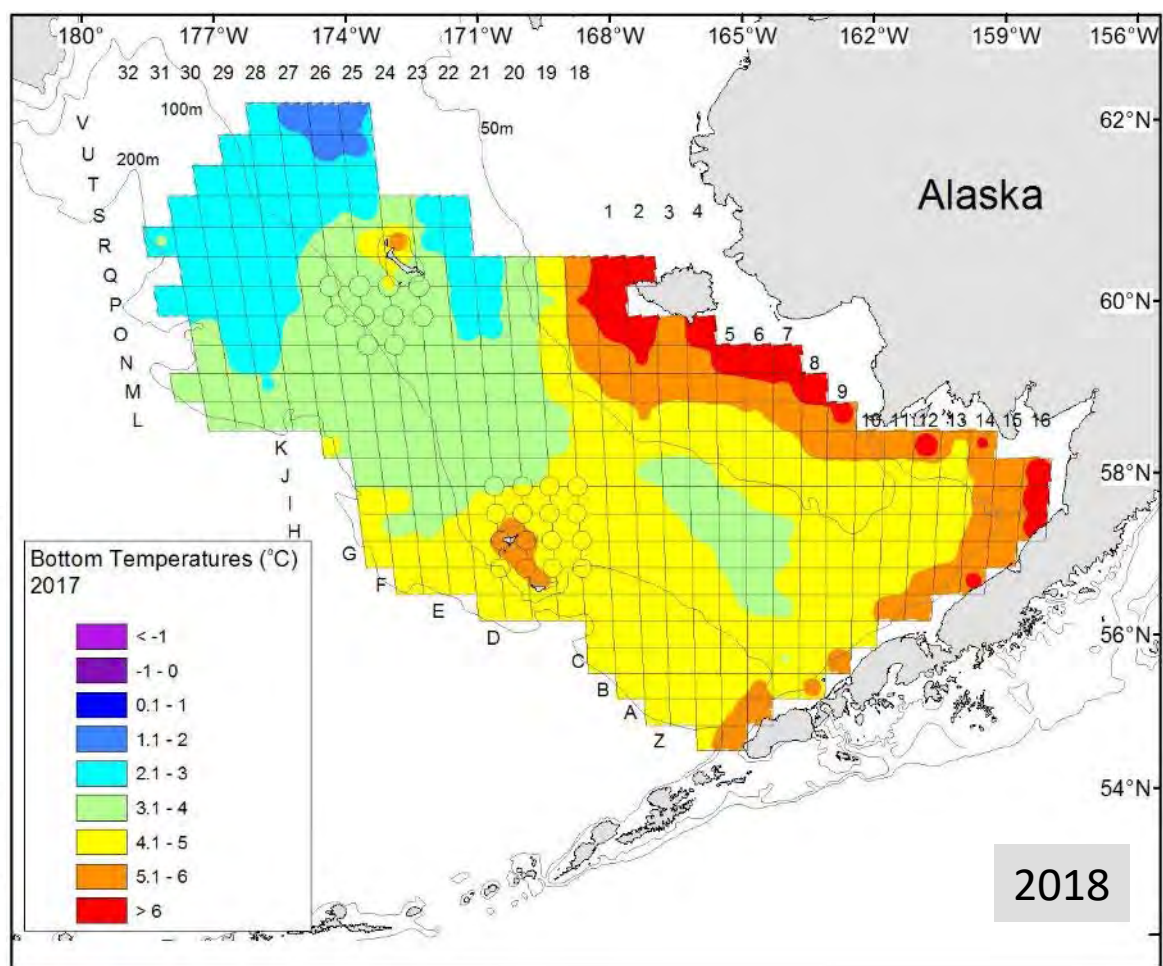
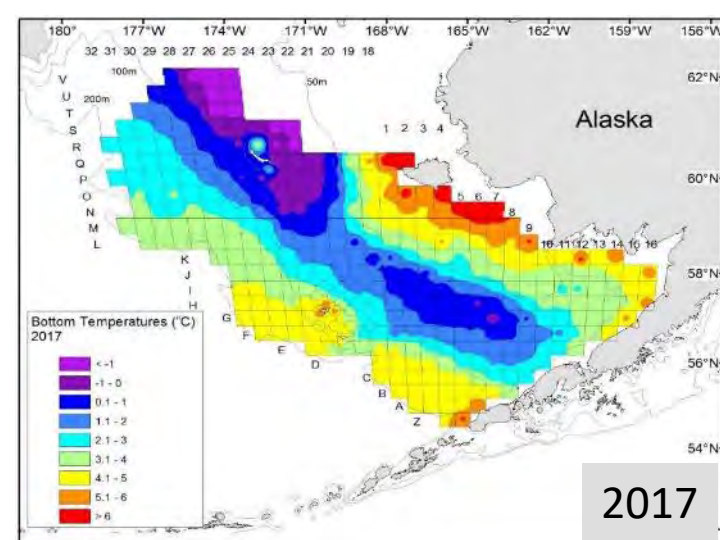
2018 Northern Bering Sea Survey



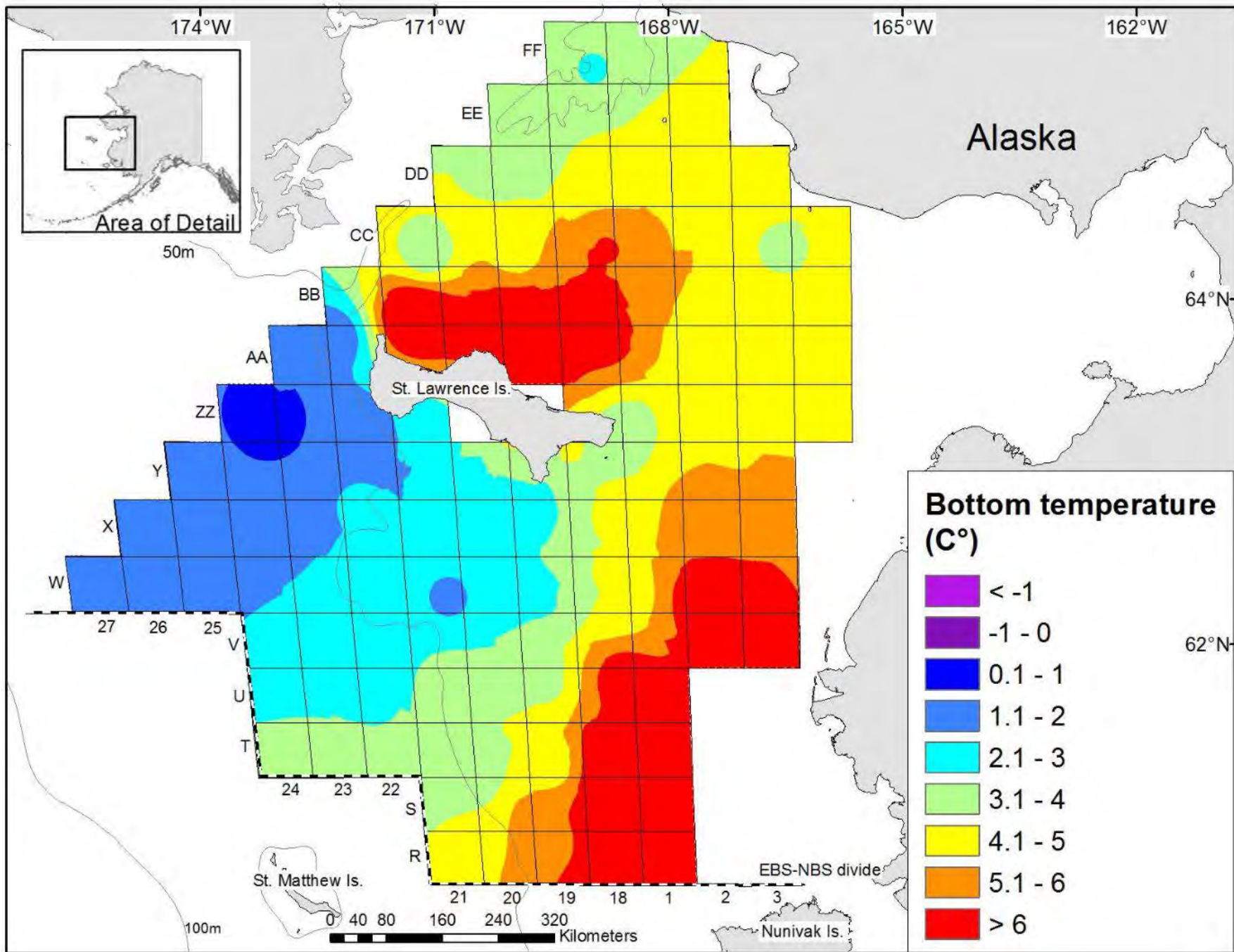
Special projects related to crab species

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
Population genomic structure of EBS Tanner crab	T Jackson	ADF&G
Genetics of mating dynamics in EBS snow crab	T Jackson	ADF&G
Crabs for outreach	L Slater	ADF&G
Population genomics of red king crab	J-I Westgaard	Inst. Mar. Res. Norway

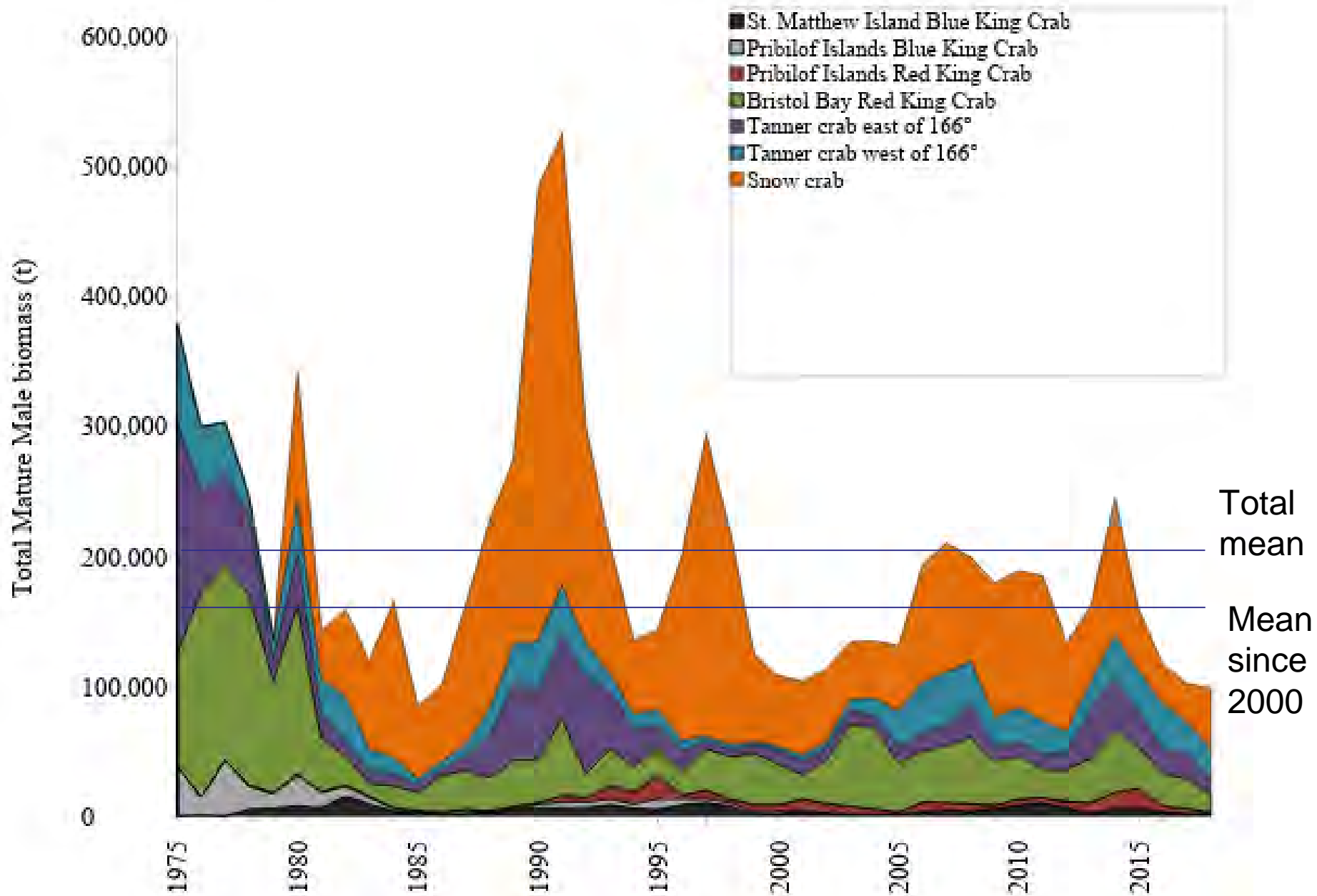




2018 Northern Bering Sea Survey



Mature male biomass



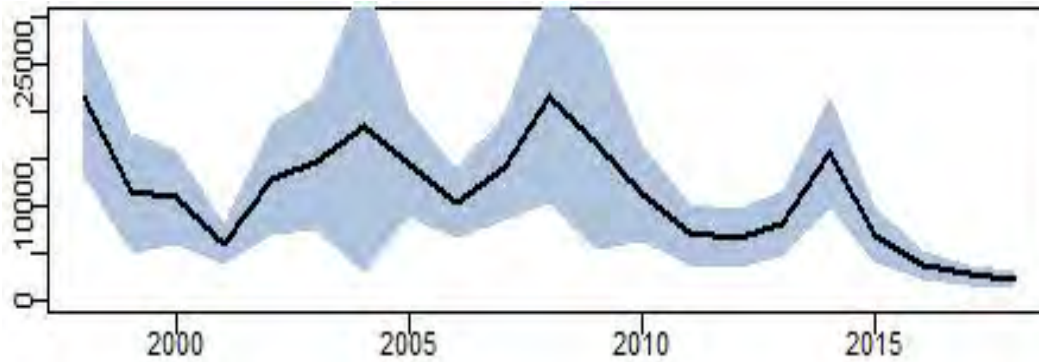
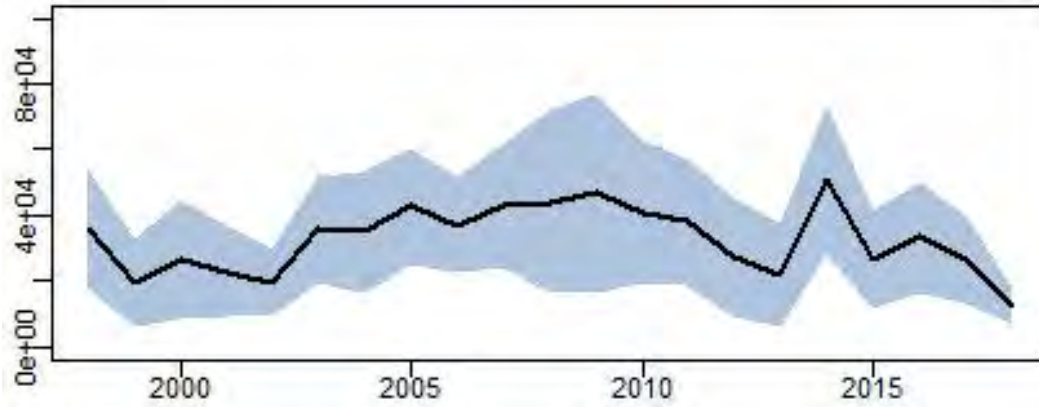
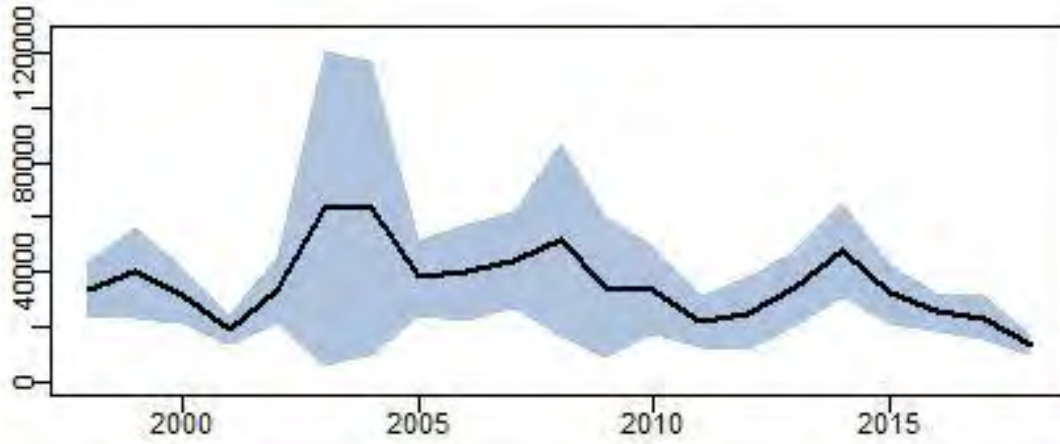
Bristol Bay Red King Crab Final Stock Assessment



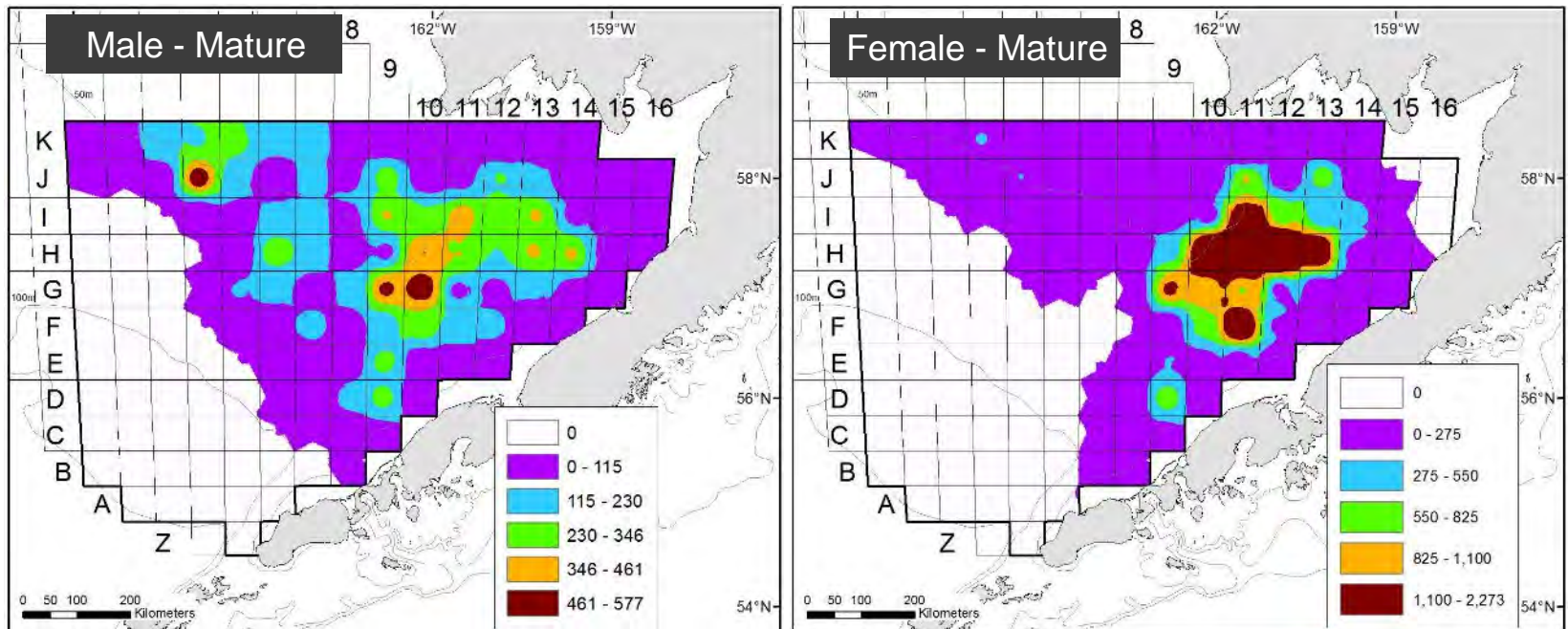
J. Zheng and M.S.M. Siddeek
ADF&G, Juneau

Bristol Bay red king crab

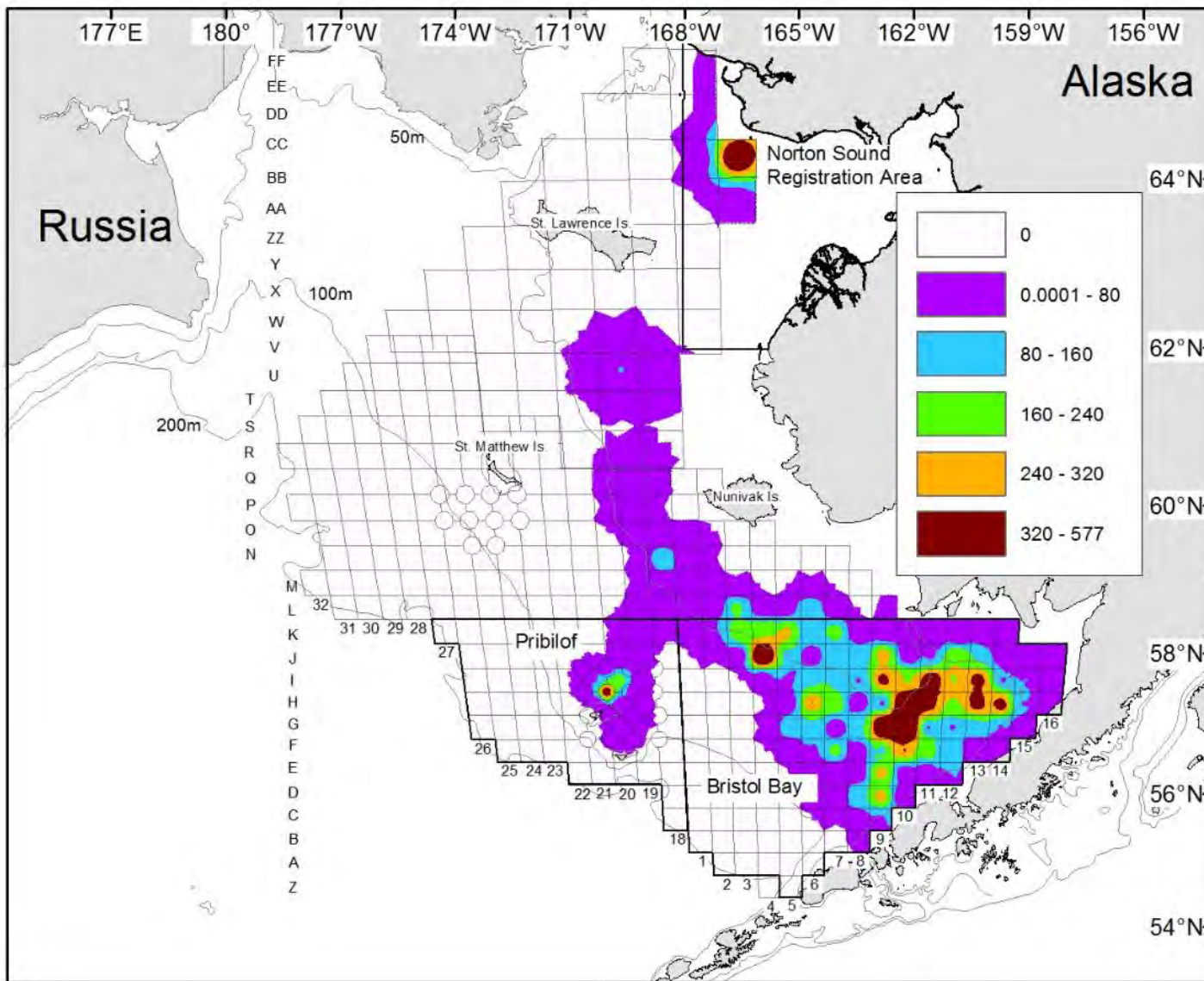
Biomass (t)



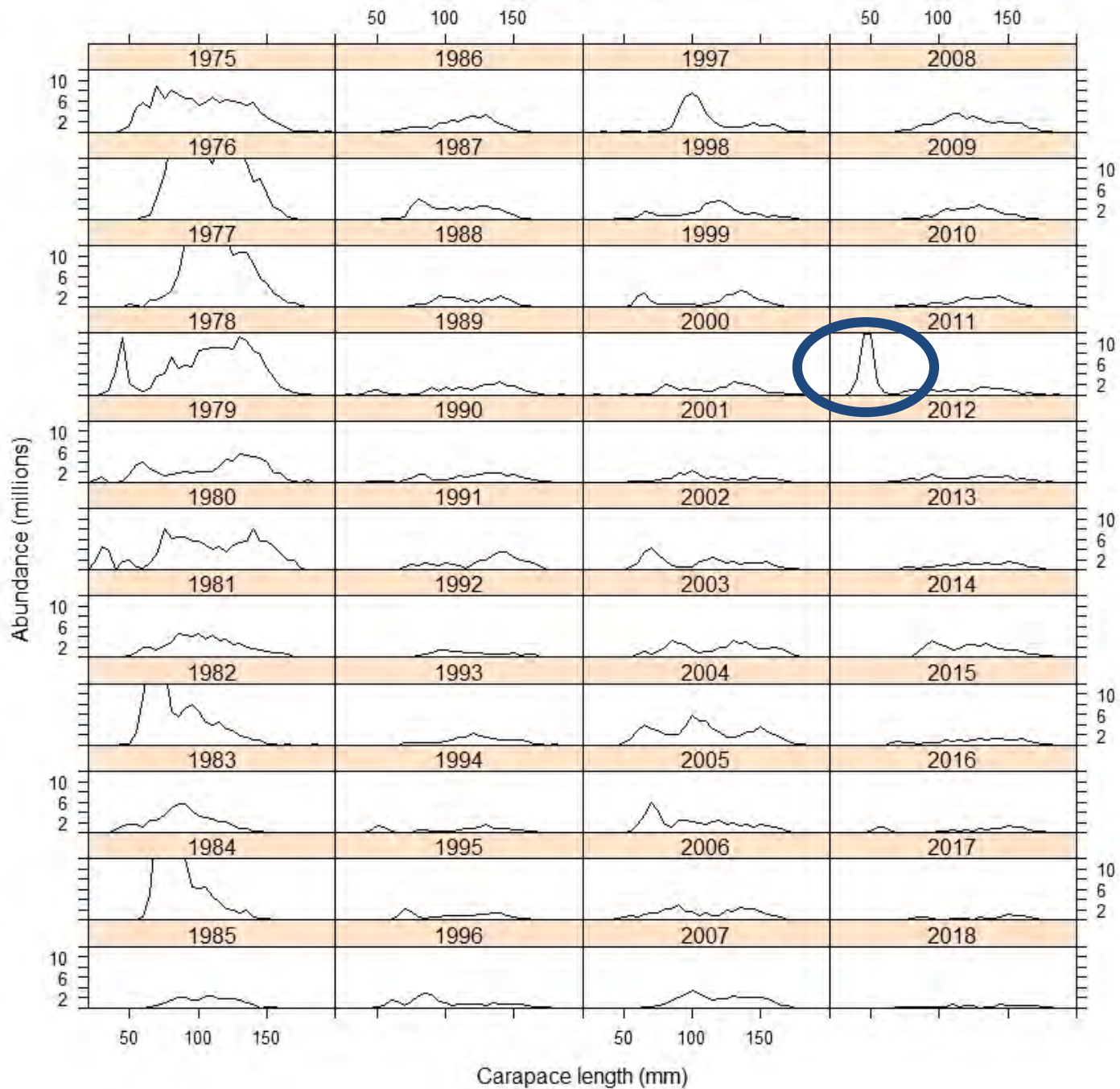
Bristol Bay red king crab



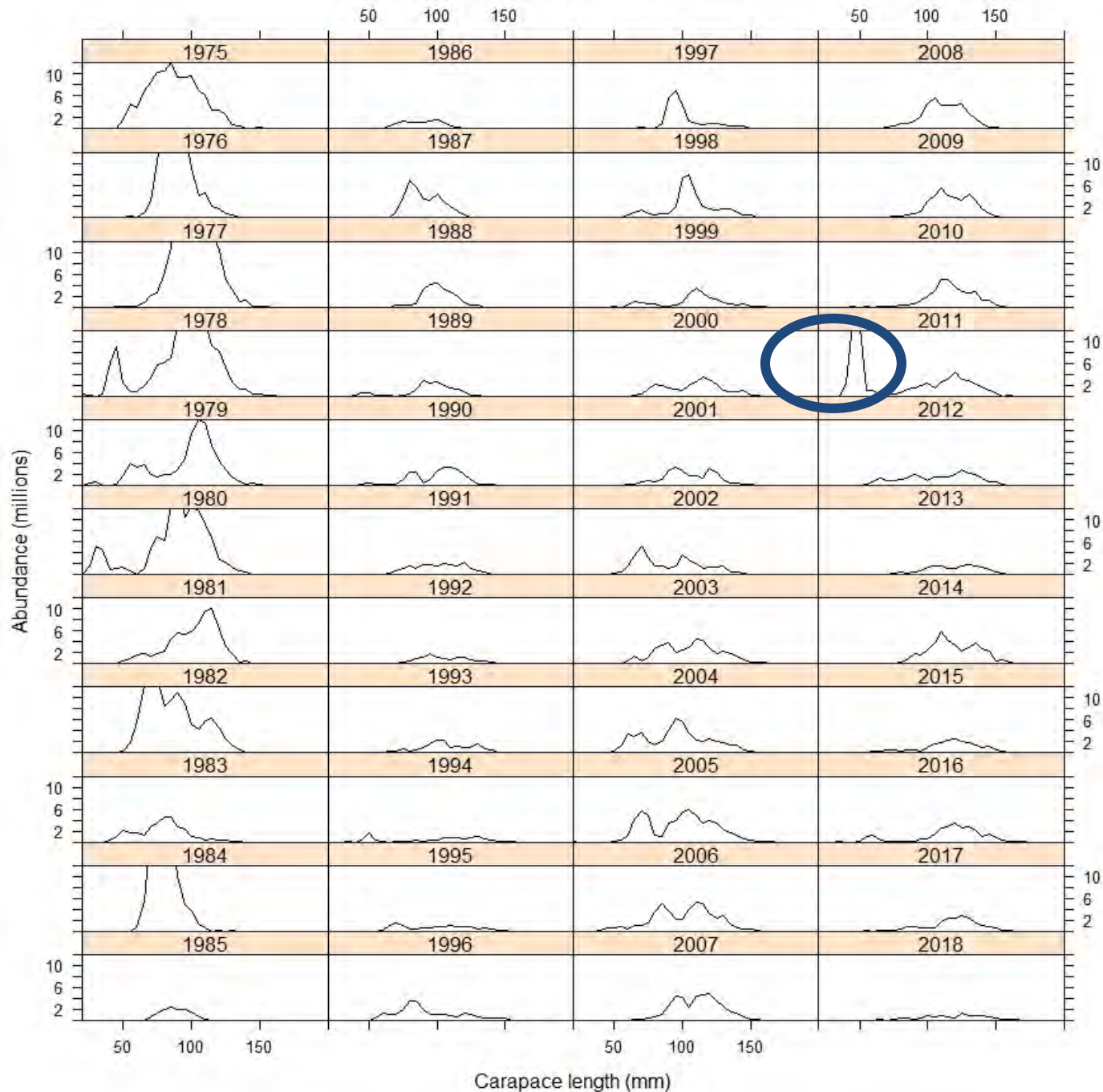
ALL mature male red king crab



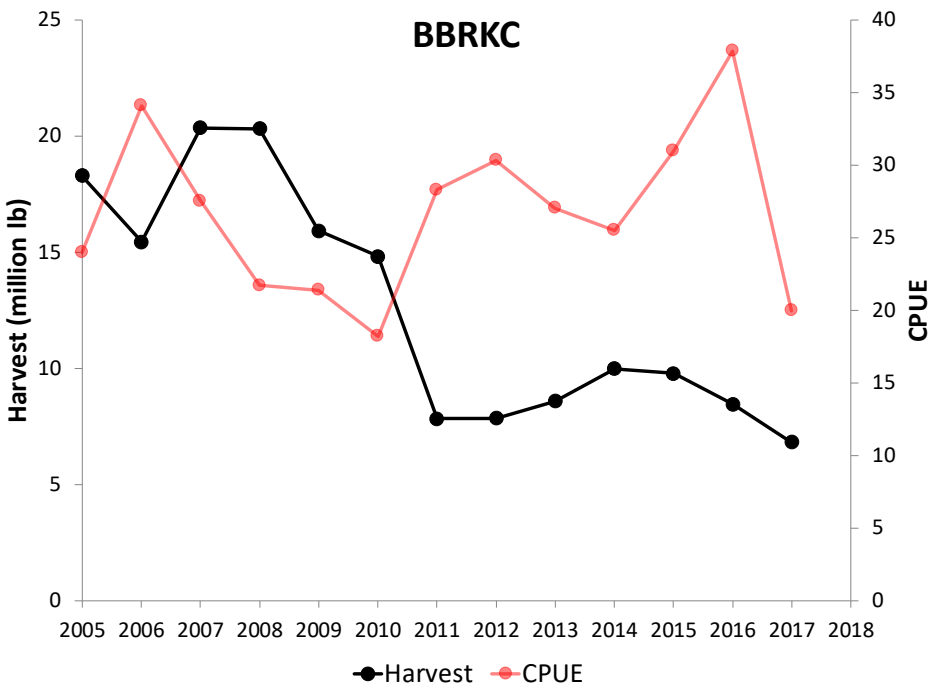
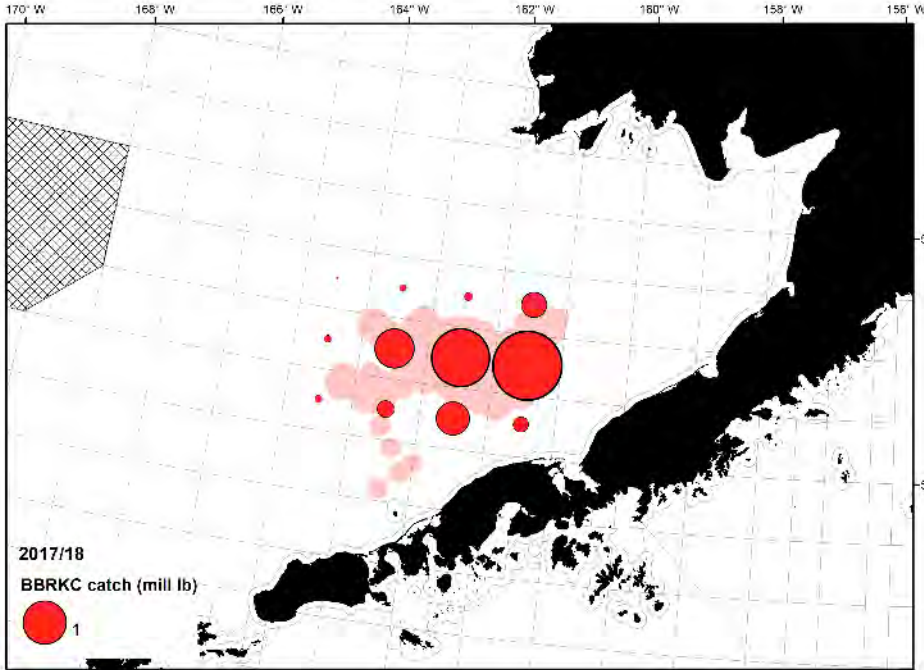
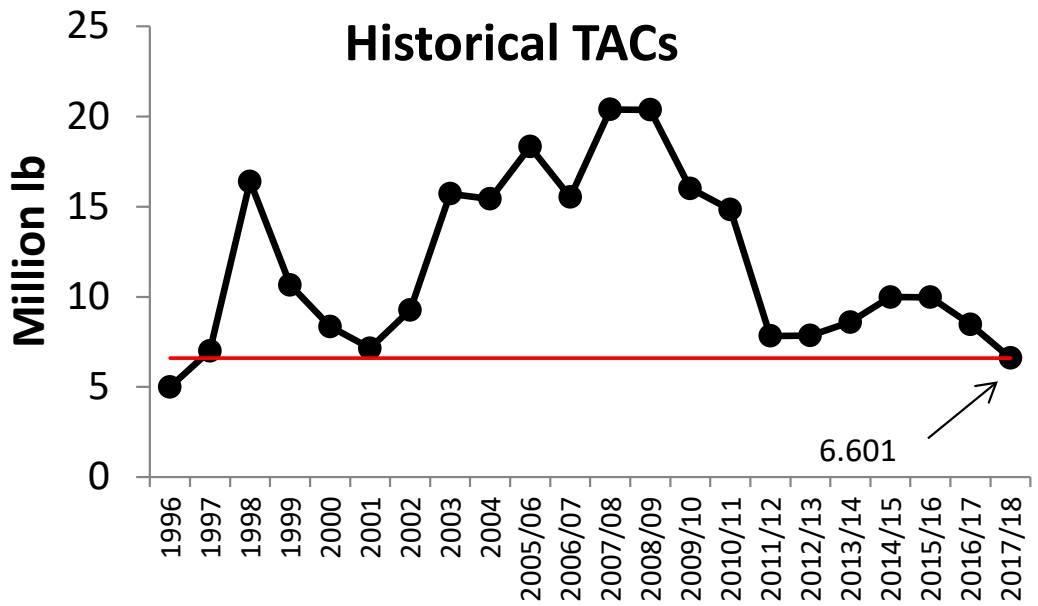
Bristol Bay Red King Crab (male)



Bristol Bay Red King Crab (female)



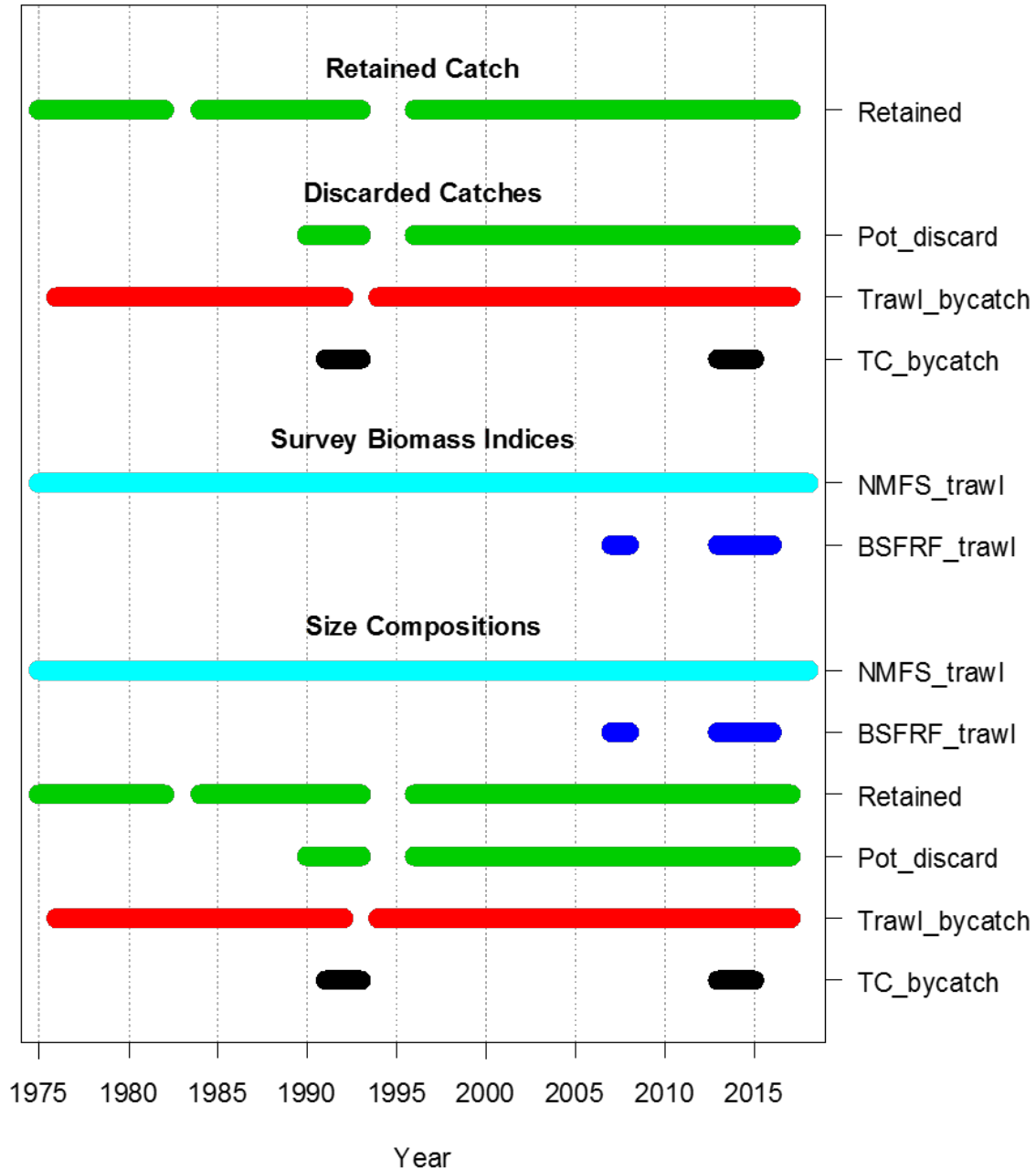
Bristol Bay
 Red king crab
 CATCH review

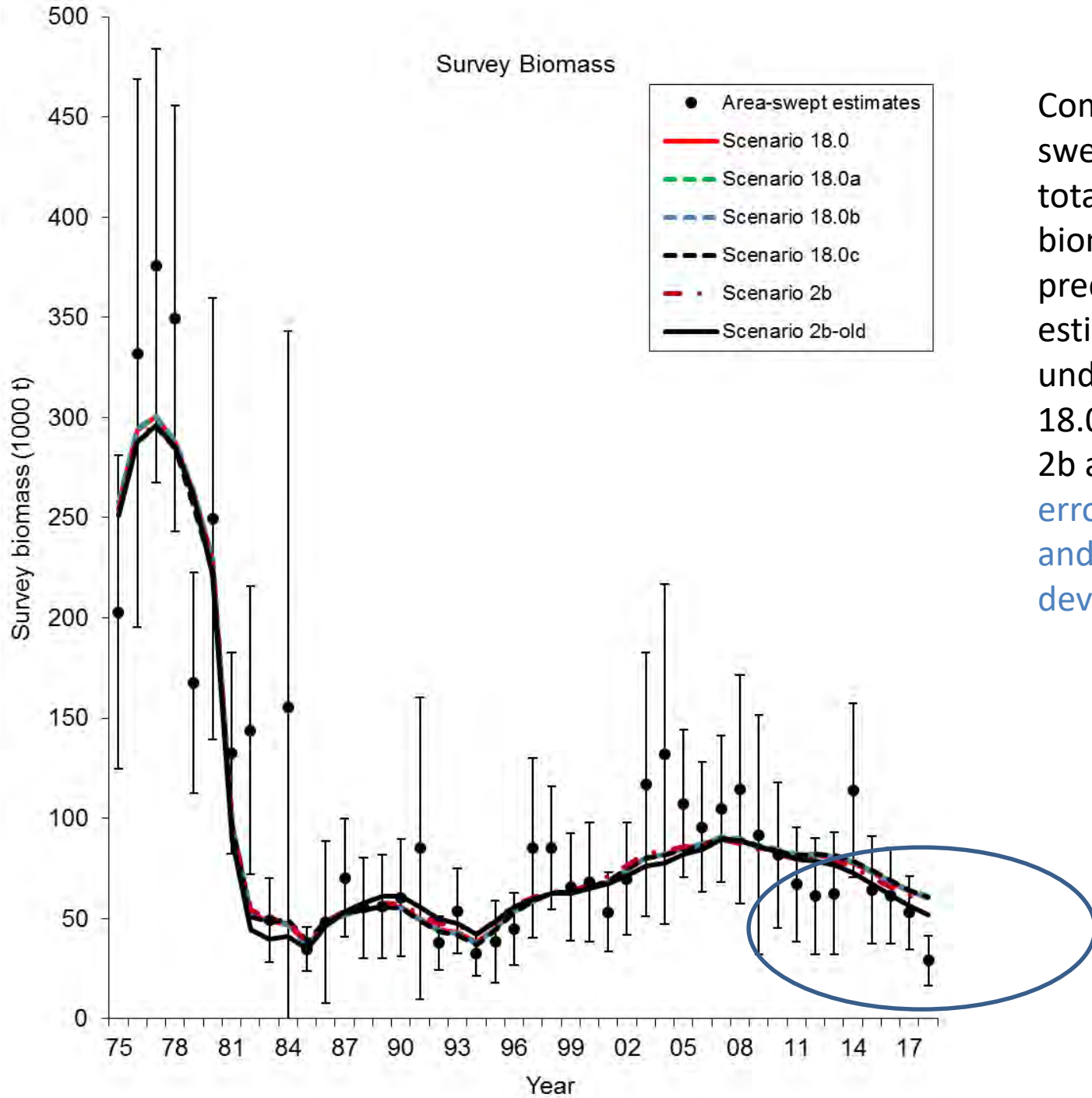


Summary of Major Changes in 2018 red king crab assessment

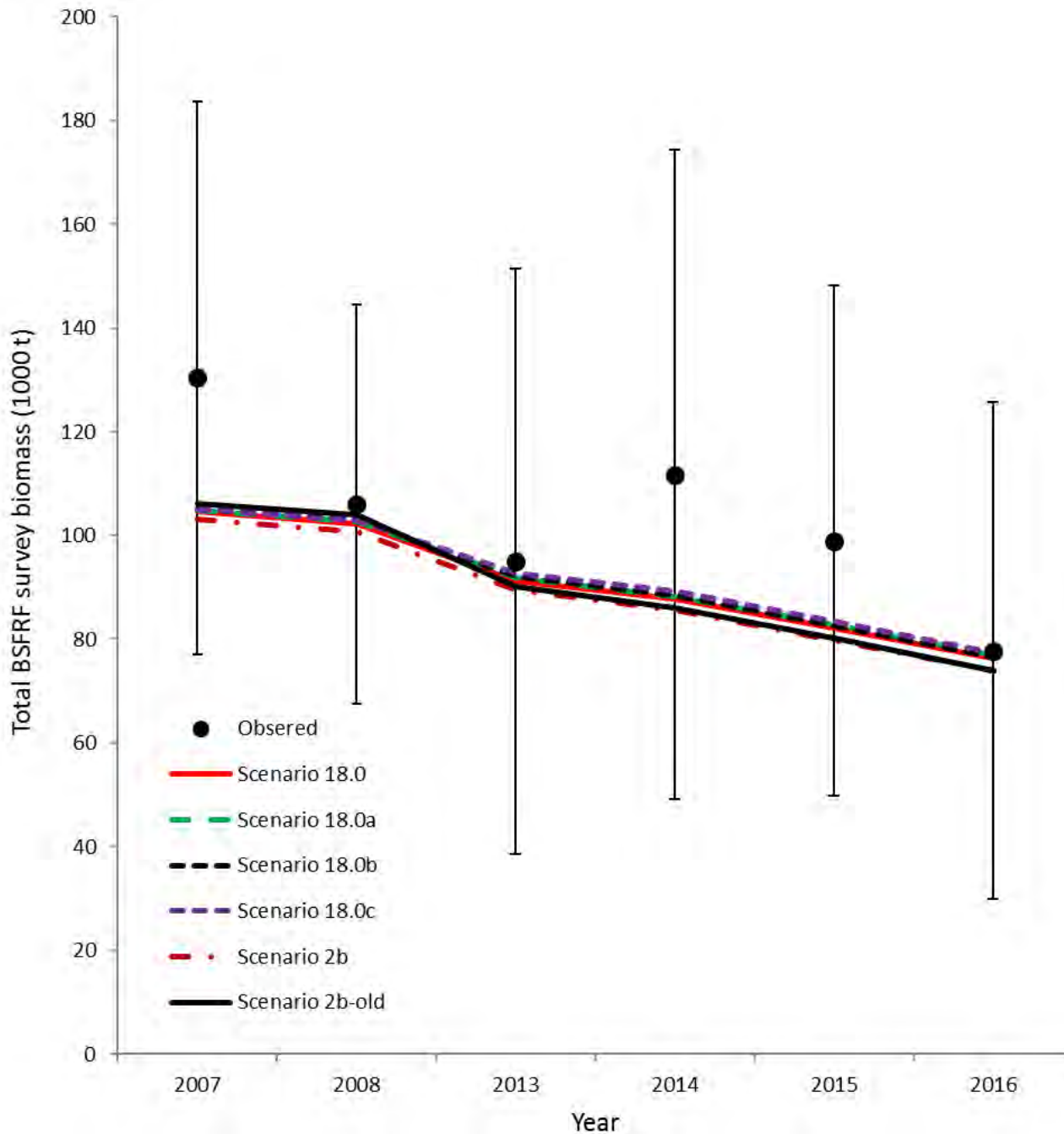
1. Changes to the input data:
 - a. The new 2018 NMFS trawl survey data.
 - b. Catch and bycatch data were updated through 2018.

Data by type and year



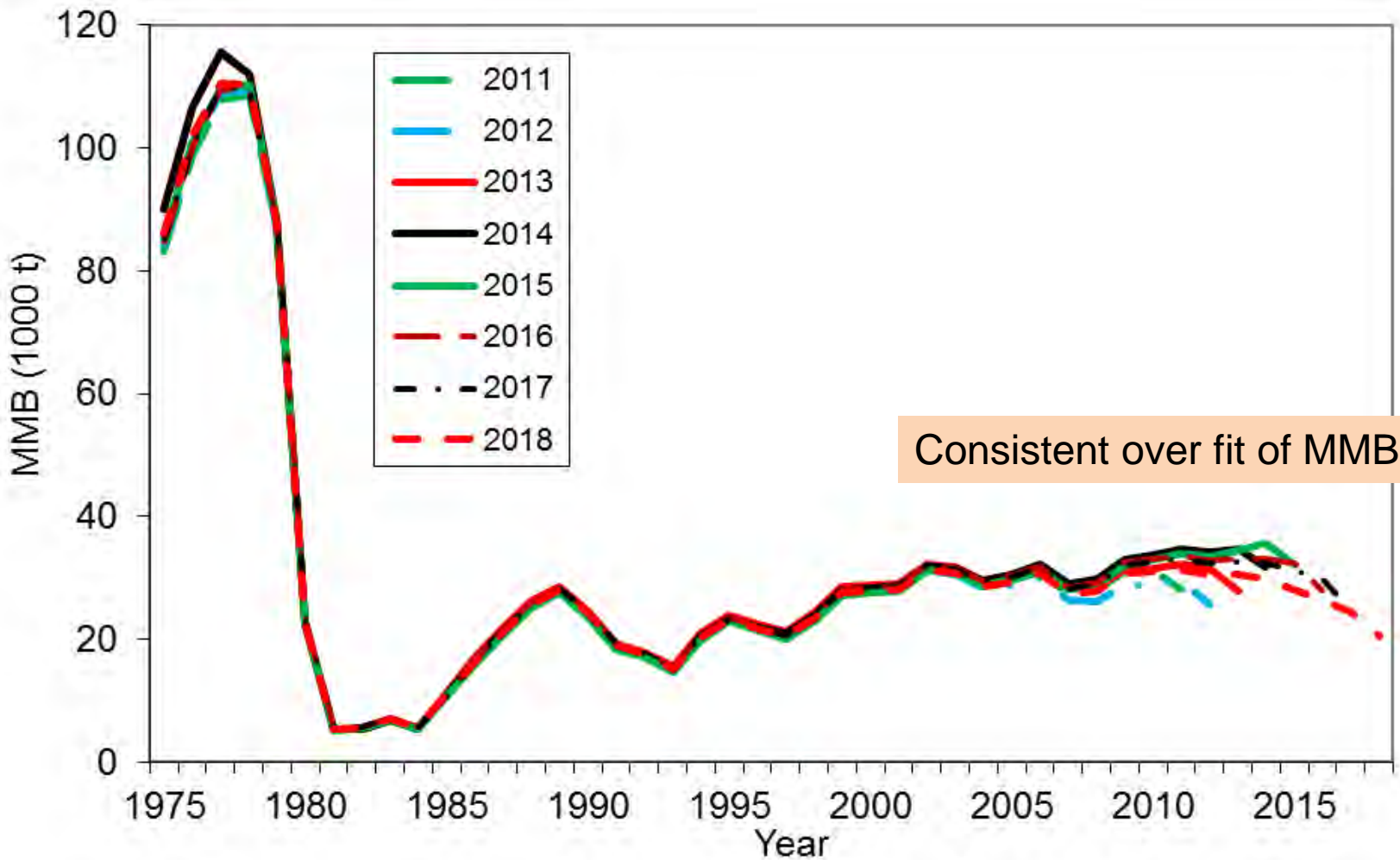


Comparisons of area-swept estimates of total NMFS survey biomass and model prediction for model estimates in 2018 under scenarios 18.0, 18.0a, 18.0b, 18.0c, 2b and 2b-old. The error bars are plus and minus 2 standard deviations.



Comparisons of total survey biomass estimates by the BSFRF survey and the model for model estimates in 2018 (scenarios 18.0, 18.0a, 18.0b, 18.0c, 2b and 2b-old). The error bars are plus and minus 2 standard deviations of scenario 18.0.

Scenario 18.0, 2018 model results



CPT Discussion and Recommendations

- Model Choice

- Model results and fit similar across models.
- No models adequately fit the decline in survey data form 2017-2018.
- Models overfit MMB (based on retrospective)

- CPT recommendation for Tier 3b.
- Biomass (MMB) = 20.80 thousand t
- Total catch OFL = 5.34 thousand t
- ABC (less than max permissible) = CPT recommended 20% buffer (10% increase from 2017): 4.27 thousand t
 - Consistent inability to react to large changes in survey
 - Consistent among Tier 3 stocks with uncertainty relative to survey fit

Stock Status

- 2017/2018 total catch = 3.48 thousand t
- 2017/2018 OFL = 5.60 thousand t

Overfishing did not occur

- 2017/2018 MSST=12.74 thousand t
- 2017/2018 MMB = 24.86 thousand t

Stock is not overfished (97%)

- 2018/2019 MMB = 20.80 thousand t

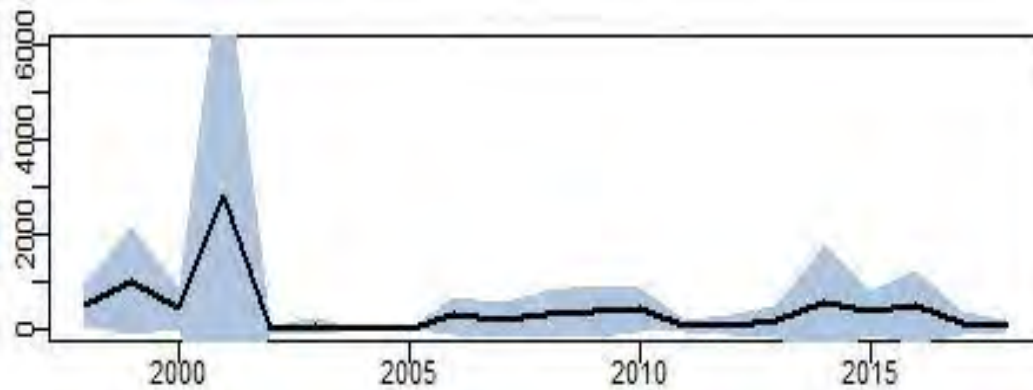
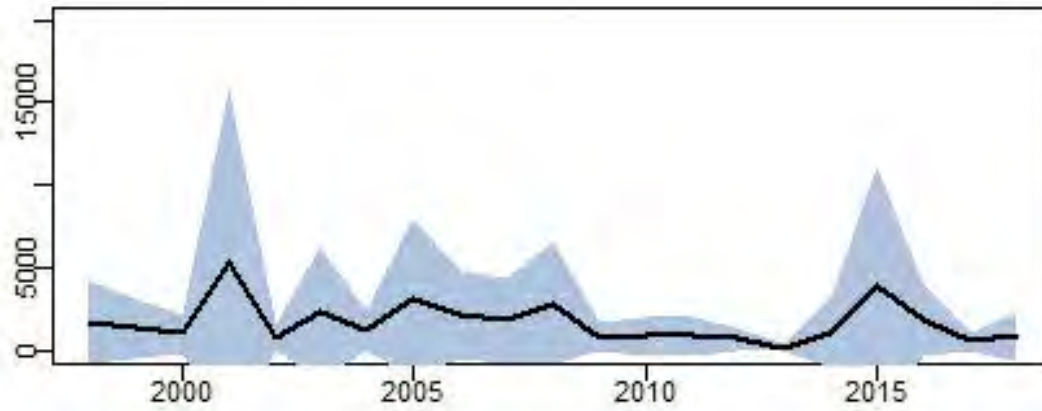
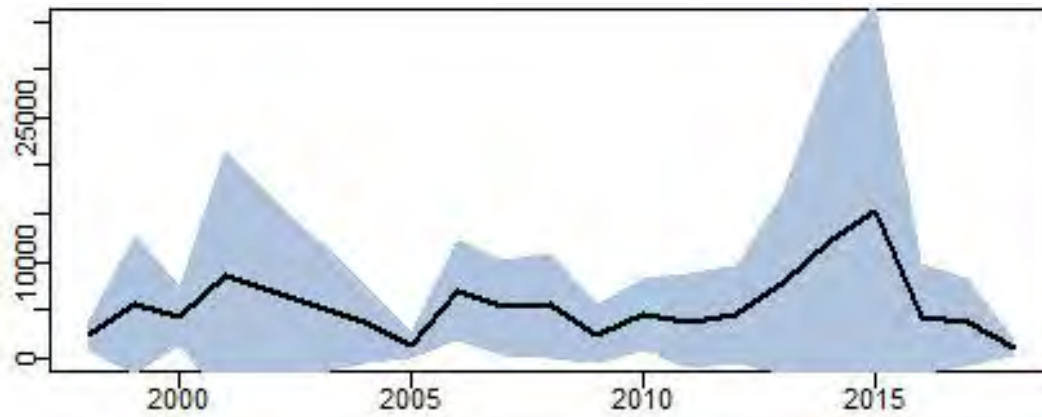
Stock is not approaching overfished

Pribilof Islands Red King Crab Status Update

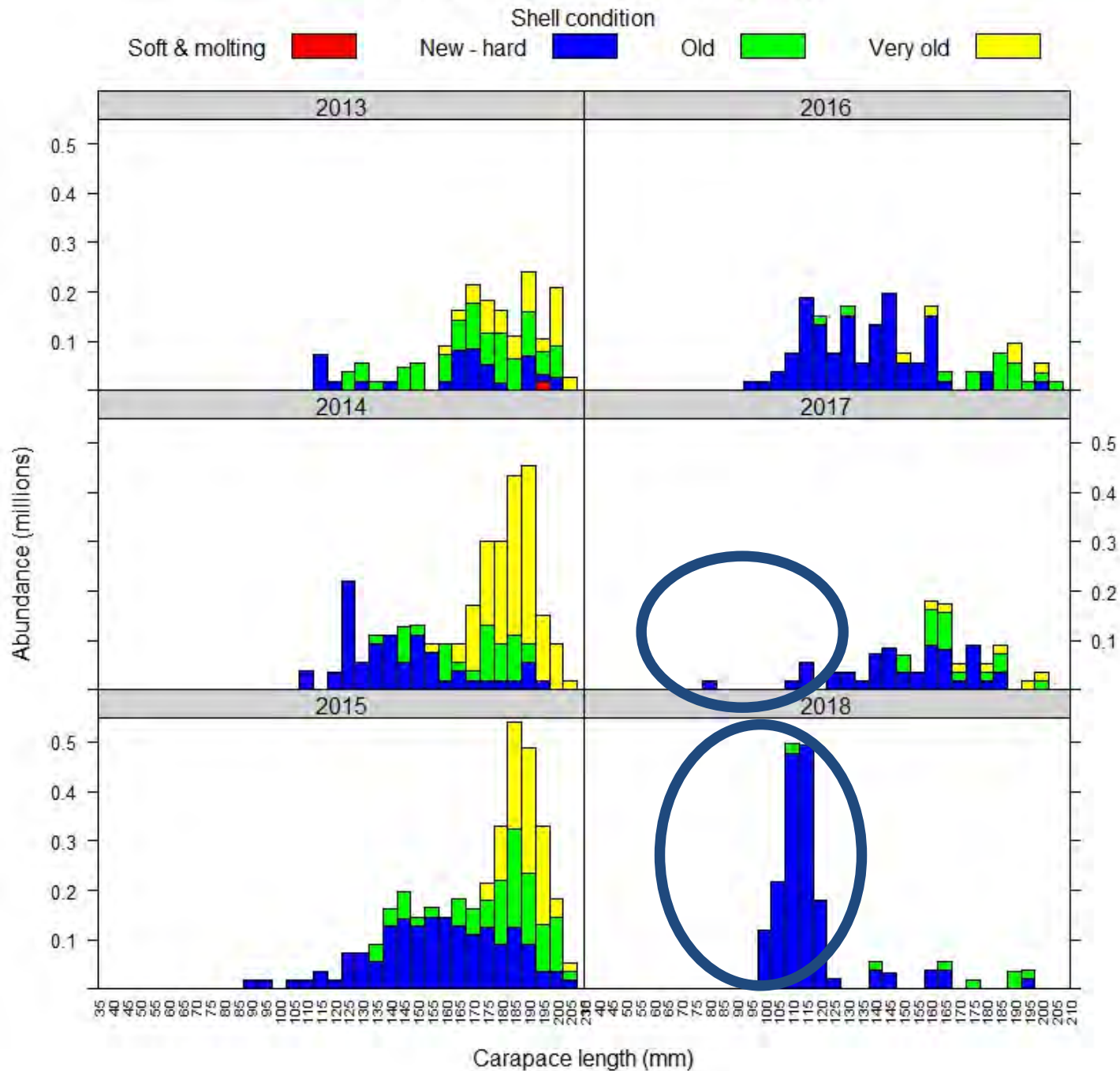


Pribilof Islands red king crab

Biomass (t)



Pribilof Islands Red King Crab (male)



Stock Status

- No retained catch
- 131 kg and 269 kg in fixed and trawl gear
- 168 kg in snow crab fishery

- Stock now on biennial assessment cycle
 - 2019
- Updated catch and survey data annually

- 2017/2018 total catch = 0.280 t
- 2017/2018 OFL = 480 t

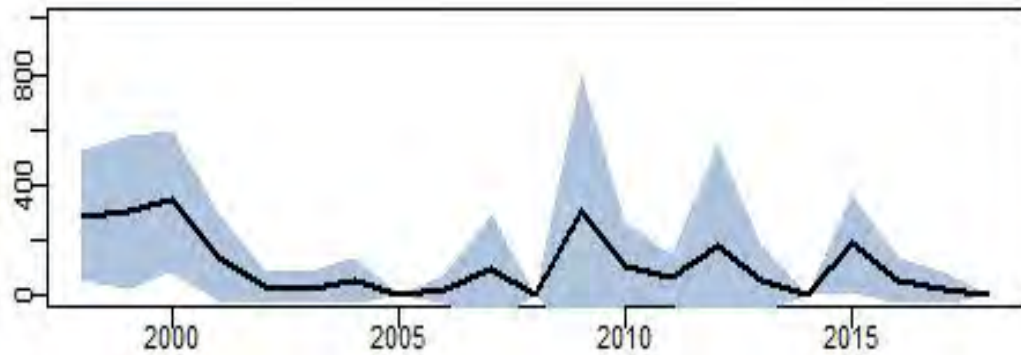
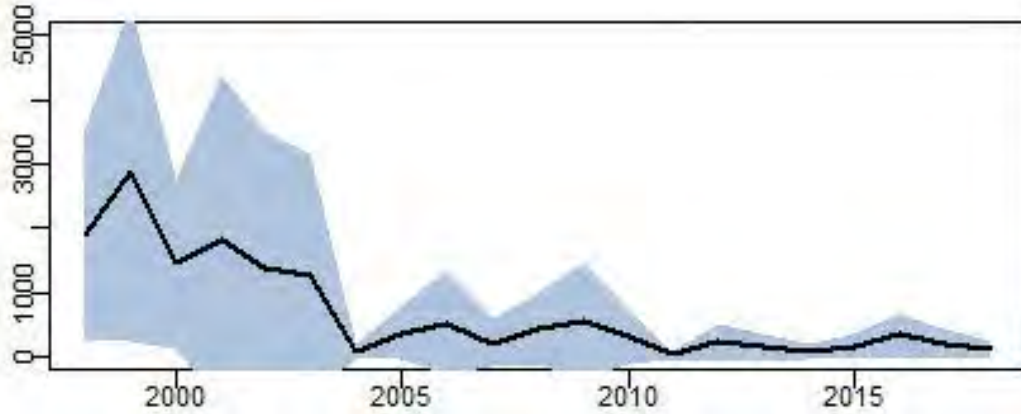
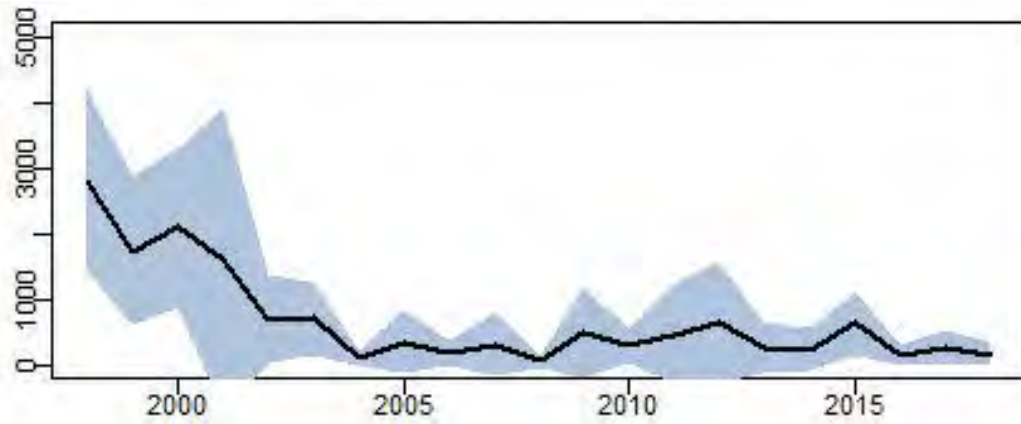
Overfishing did not occur

Pribilof Islands Blue King Crab Status Update



Pribilof Islands blue king crab

Biomass (t)



Stock Status



- No retained catch
- 0.5 kg and 397 kg in fixed and trawl gear
- 64 kg in Tanner fishery

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

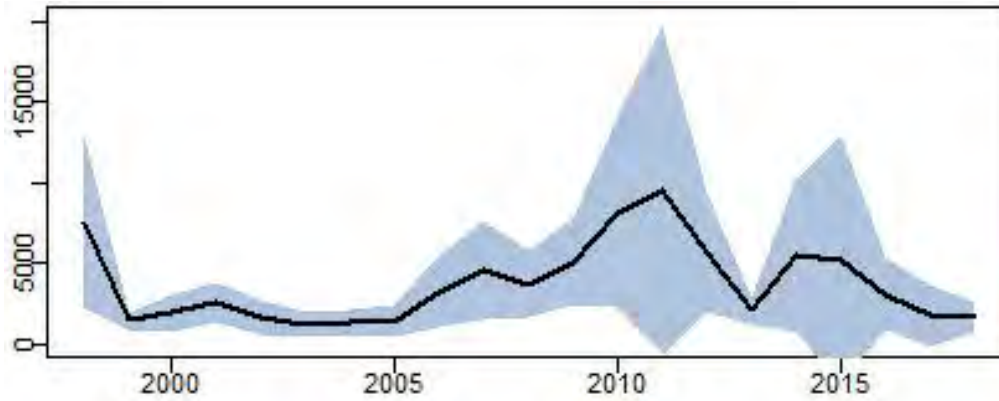
- 2017/2018 total catch = 0.330 t
- 2017/2018 OFL = 1.16 t

Overfishing DID NOT occur

St. Matthew Island Blue King Crab Final Stock Assessment

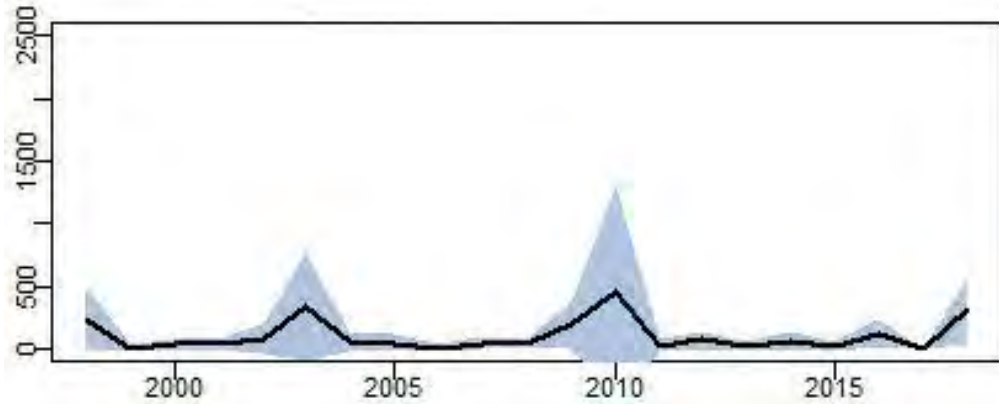
St. Matthew Island blue king crab

Biomass (t)

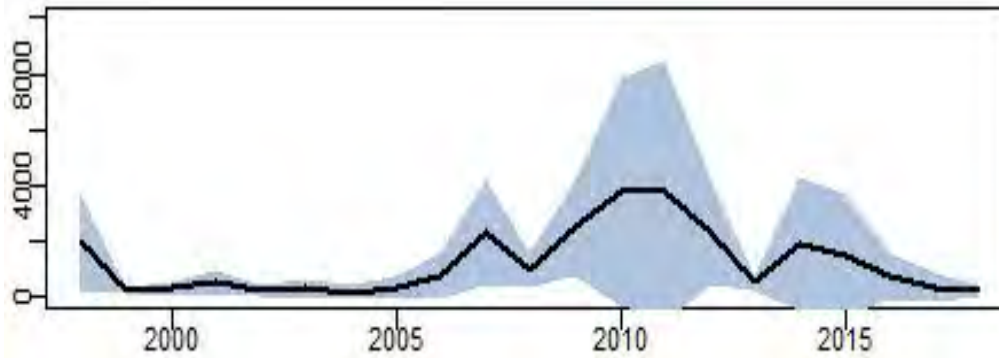


Mature male

-6%

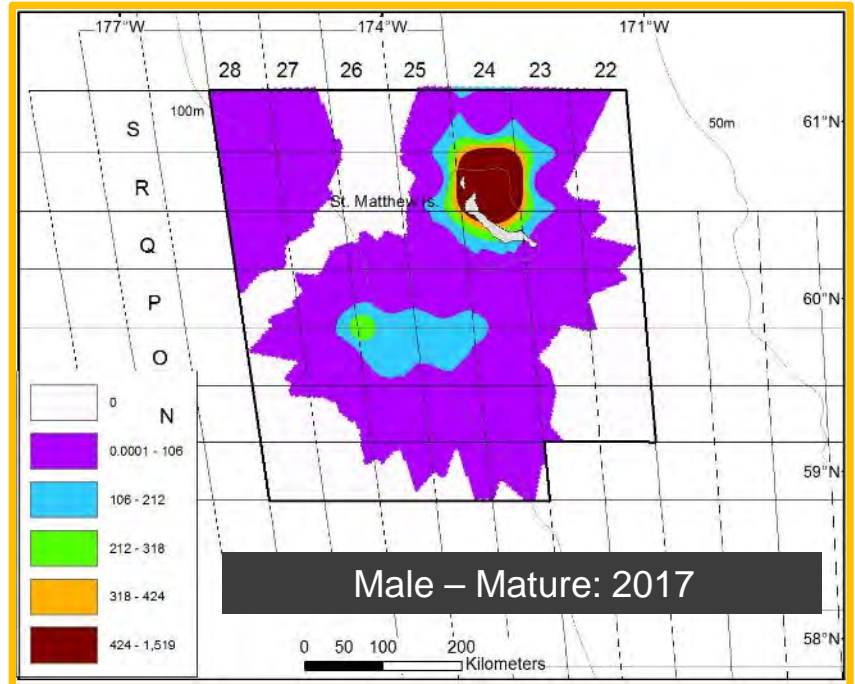
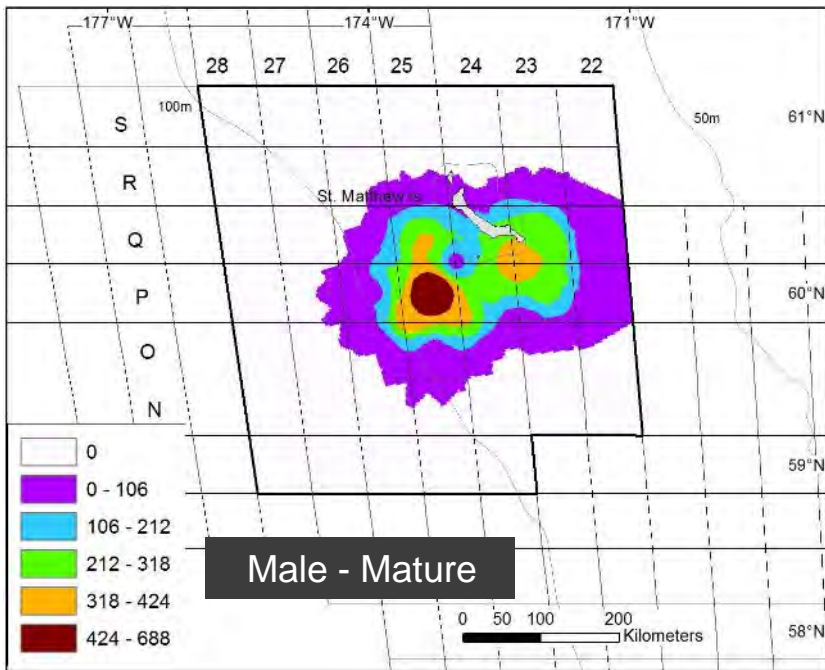


Mature female

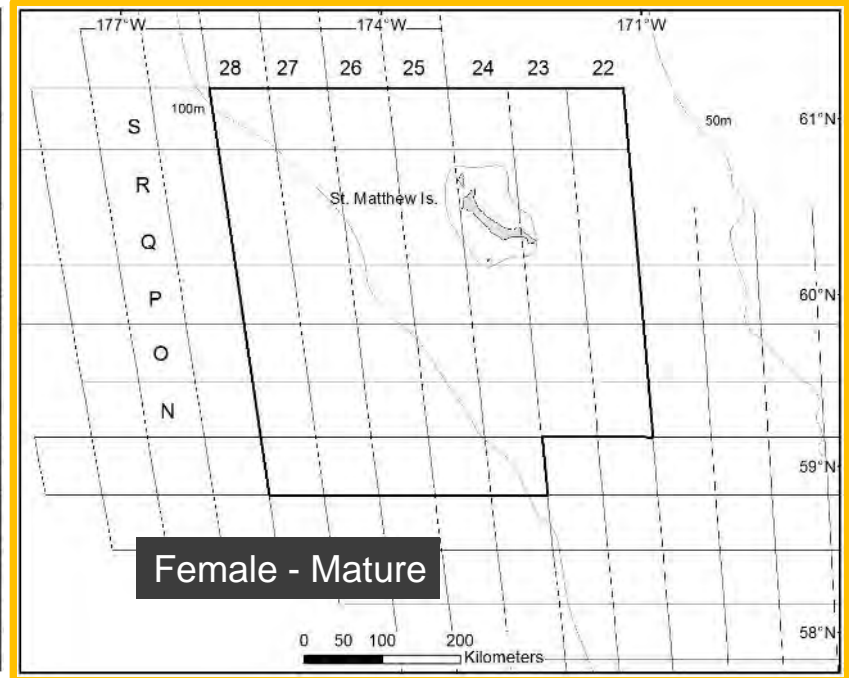
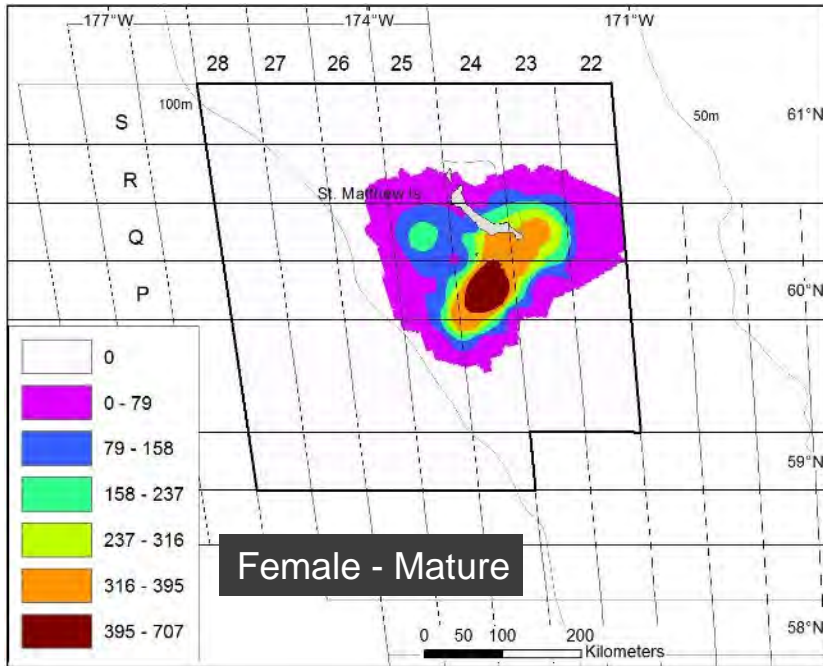


Juveniles

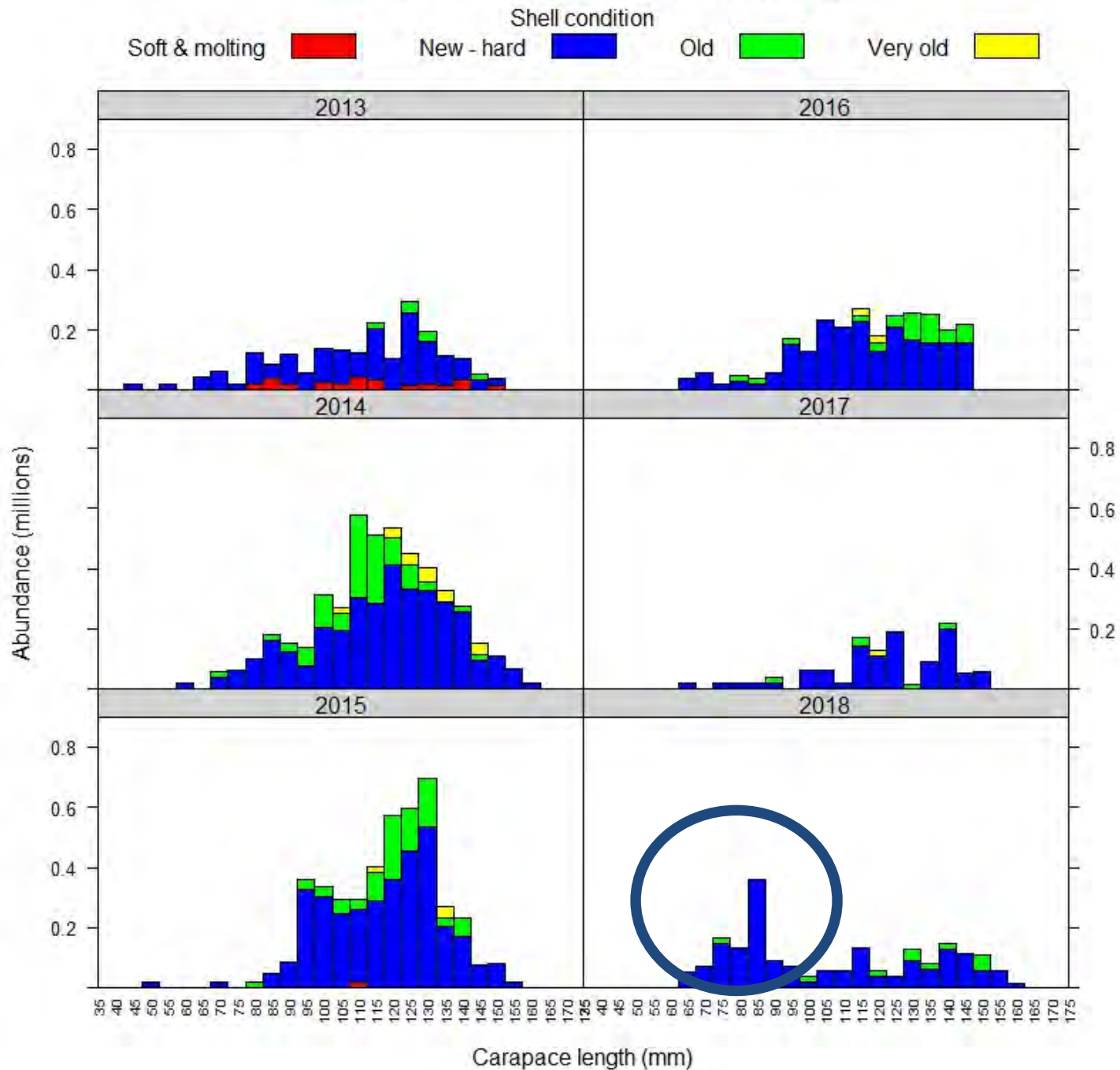
St. Matthew Island blue king crab



St. Matthew Island blue king crab



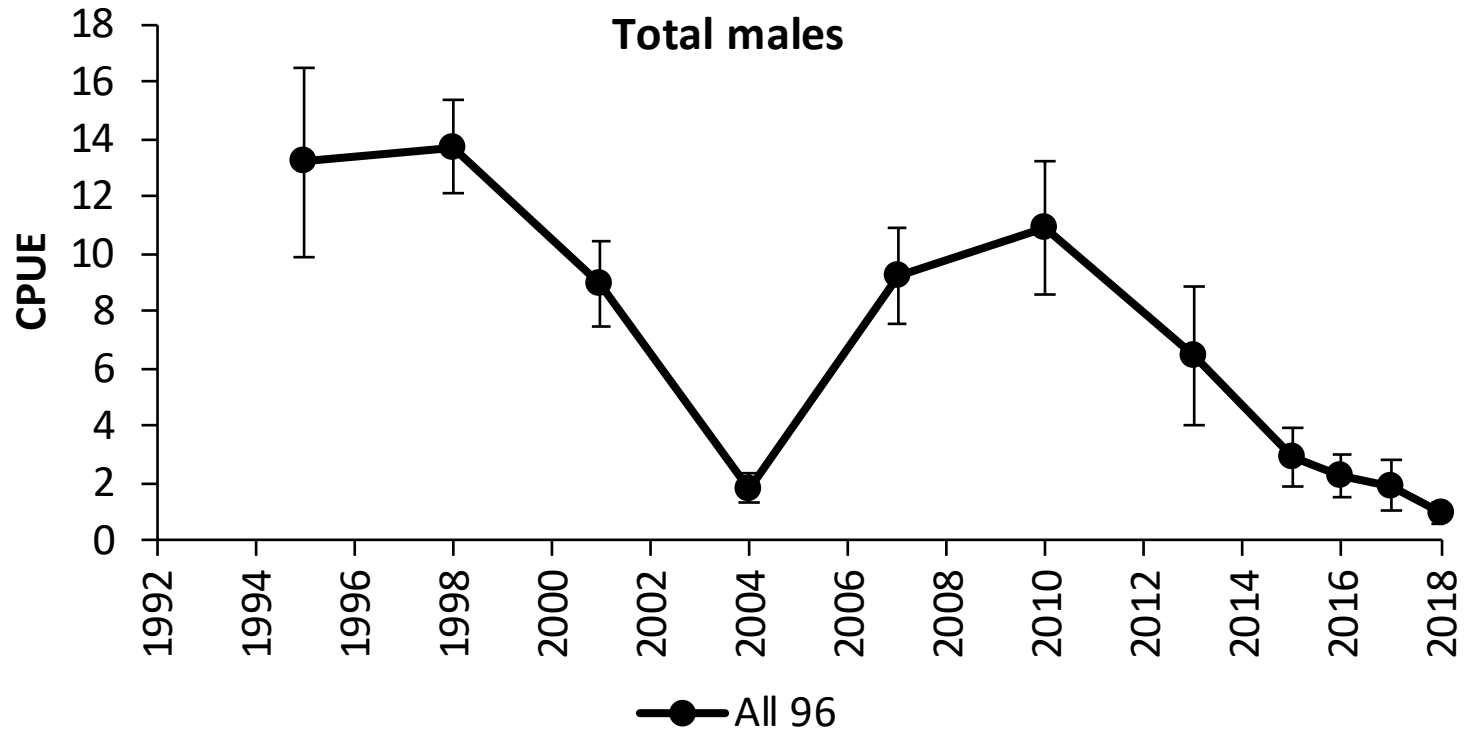
St. Matthew Island Blue King Crab (male)



2018 ADFG Pot survey Sampling

St. Matthew Island

- Strata 1 & 2:
 - 96 in-common stns
 - 6 additional stns
- Stratum 3
 - 10 stns



Saint Matthew Island Blue King Crab Stock Assessment 2018

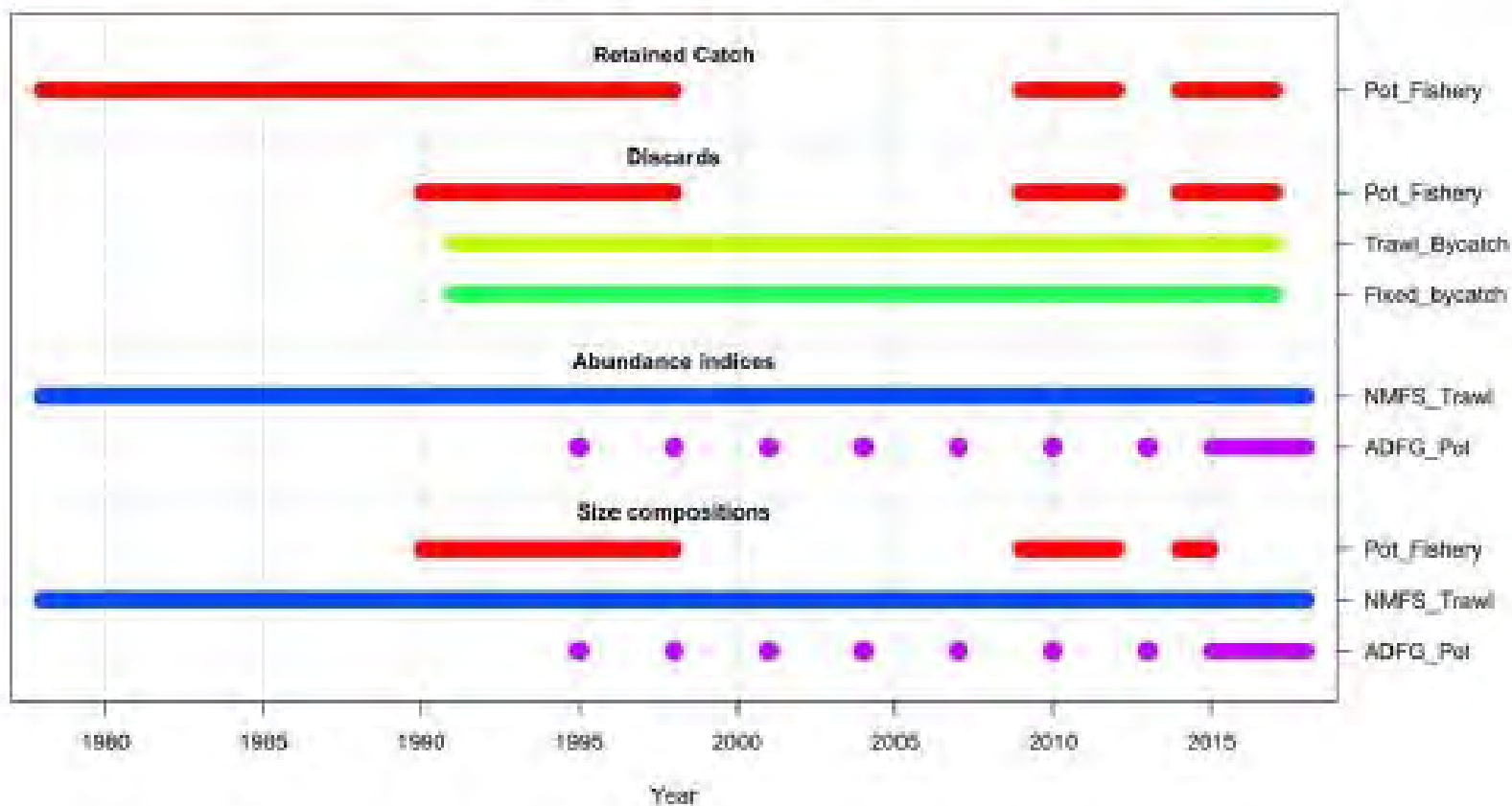
Jie Zheng¹ and James Ianelli²

¹Alaska Department of Fish and Game, jie.zheng@alaska.gov

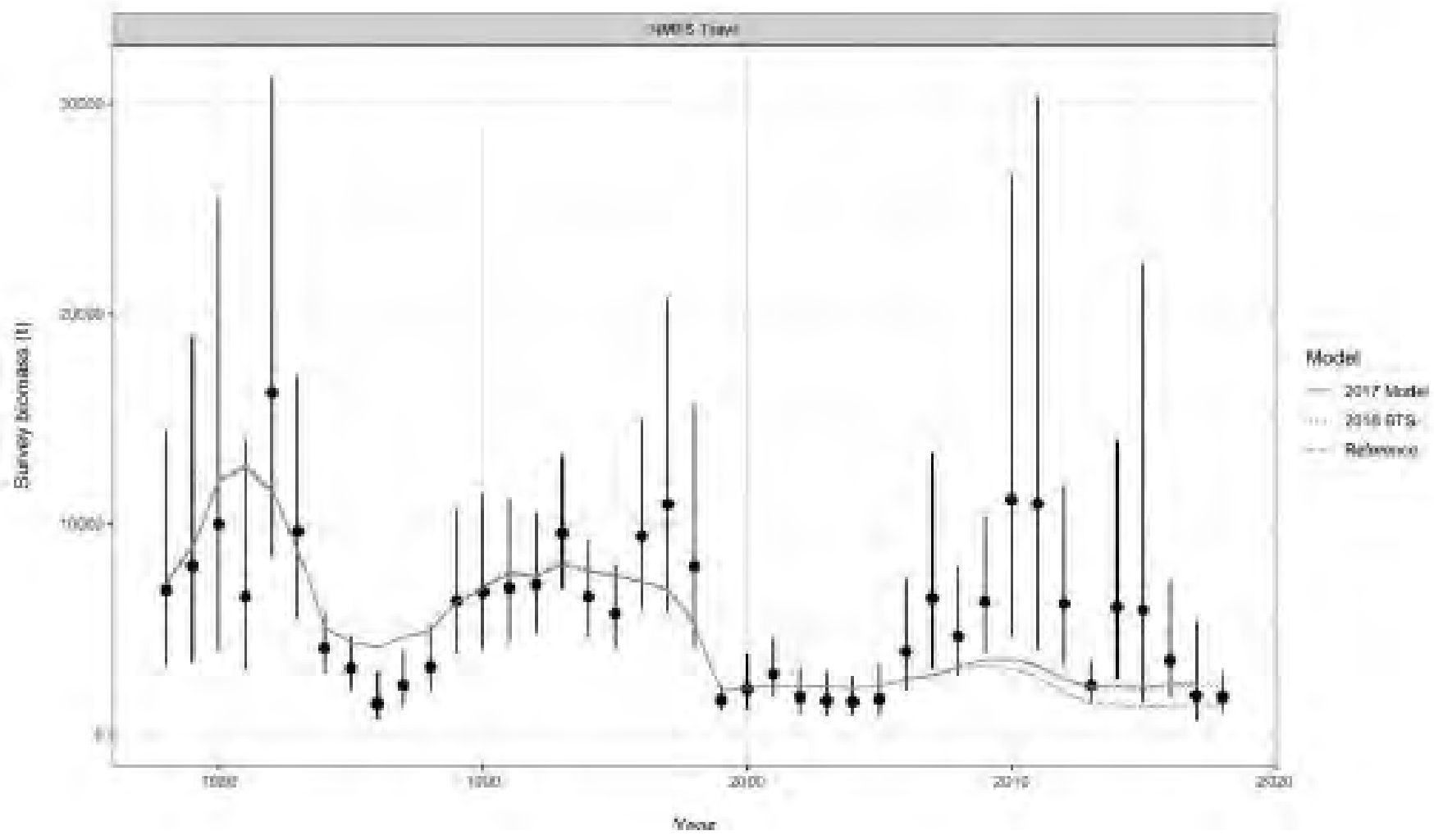
²NOAA, jim.ianelli@noaa.gov

September 2018

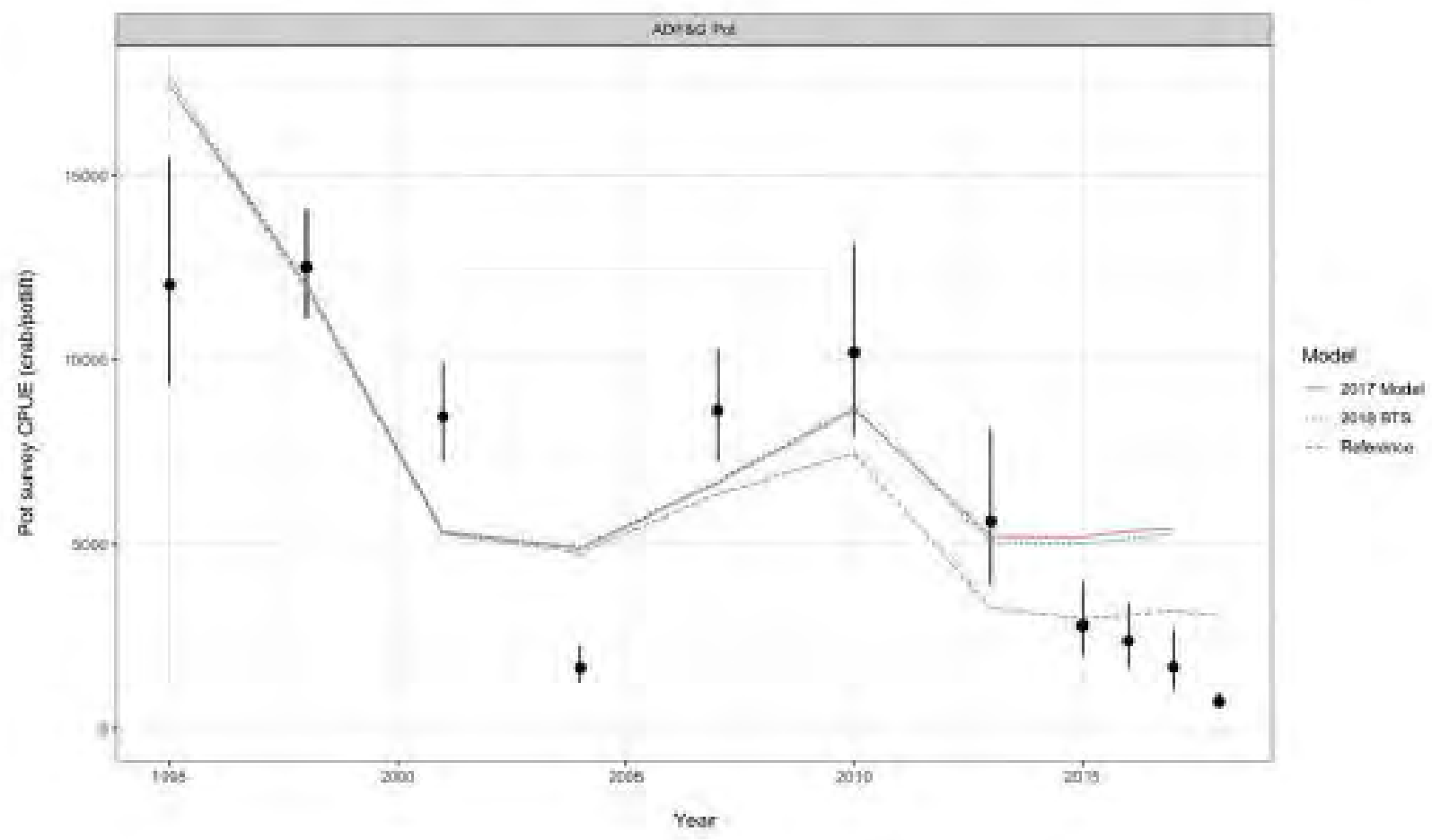
Data by type and year



St Matthew Island blue king crab



St Matthew Island blue king crab



Tier, OFL, and ABC Recommendations

- CPT and authors recommended reference model with new trawl and pot survey.
- CPT and author recommended 20% buffer
- CPT concurred with Author recommendation for Tier 4c (indicating overfished).

- Biomass (MMB) = 1.31 thousand t
- Total catch OFL = 0.04 thousand t
- ABC (less than max permissible) = 20% buffer = 0.03 thousand t

- SSC increased buffer to 25%

Stock Status

- 2017/2018 total catch = 0.010 thousand t
- 2017/2018 OFL = 0.120 thousand t

Overfishing did not occur

- 2017/2018 MSST = 1.85 thousand t
- 2017/2018 MMB = 1.29 thousand t

Stock biomass (35% B_{MSY}) indicates **overfished**

- 2018/2019 MMB = 1.31 thousand t

Stock biomass estimate below MSST

CPT Discussion and Recommendations

- Rebuilding planning
 - Indications that stock is overfished
 - NMFS will make declaration
 - January CPT discussion
 - Projection model needed (GMACS?)
 - Bycatch in crab and gf fisheries
 - In season bycatch management cooperation between NMFS and ADFG
 - Confidentiality waivers?
 - BOF engagement
 - Ecosystem discussion (cod predation?)

Tanner Crab

Final Stock Assessment

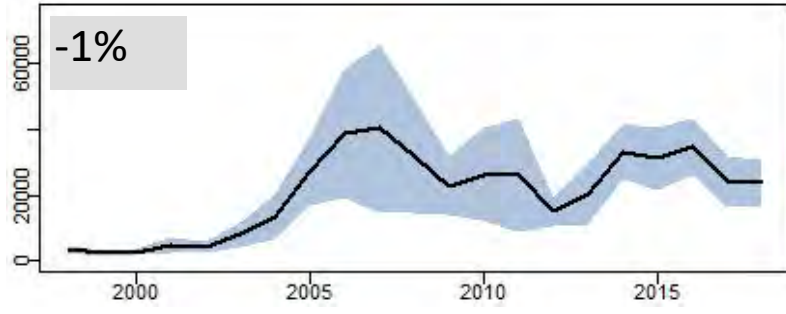
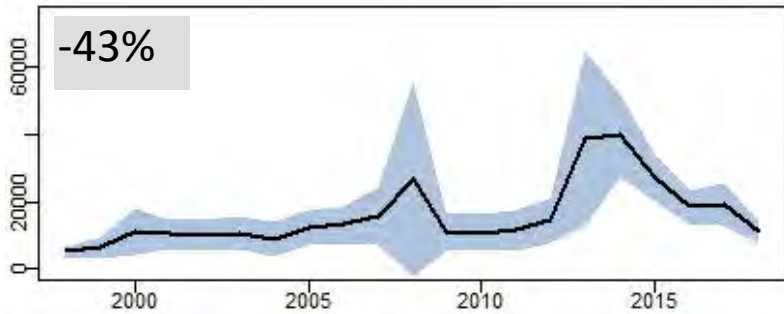


William Stockhausen
Alaska Fisheries Science Center

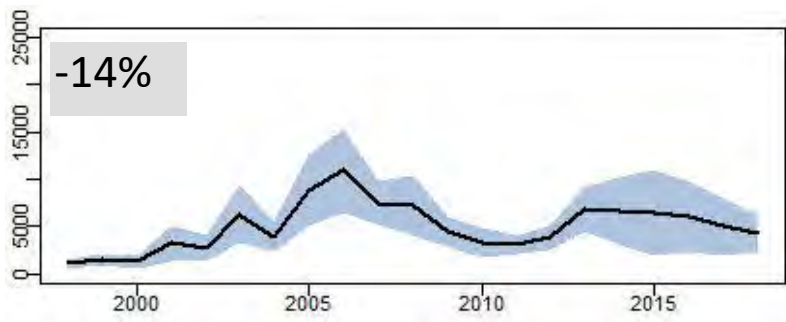
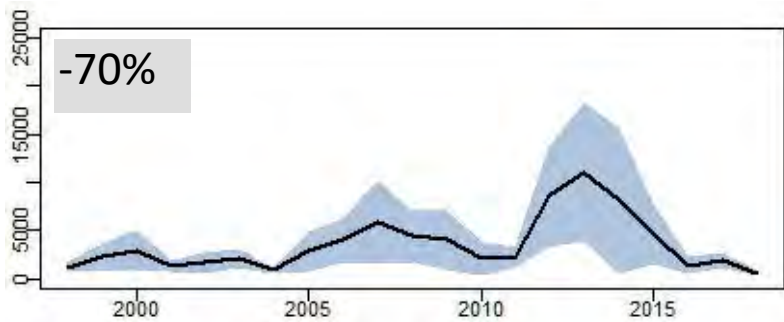
Tanner crab east of 166°W

Tanner crab west of 166°W

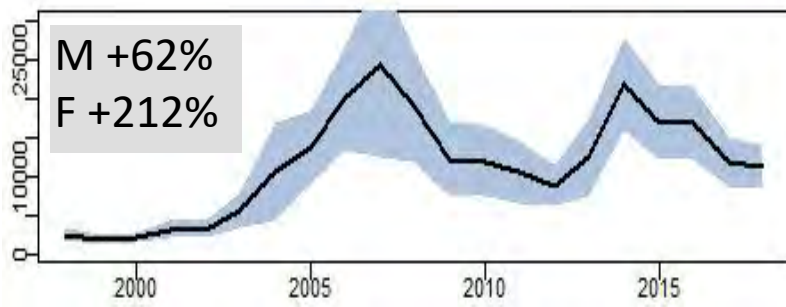
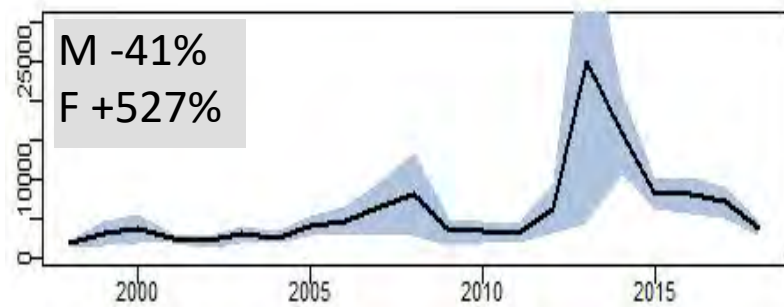
Biomass (t)



Mature
male

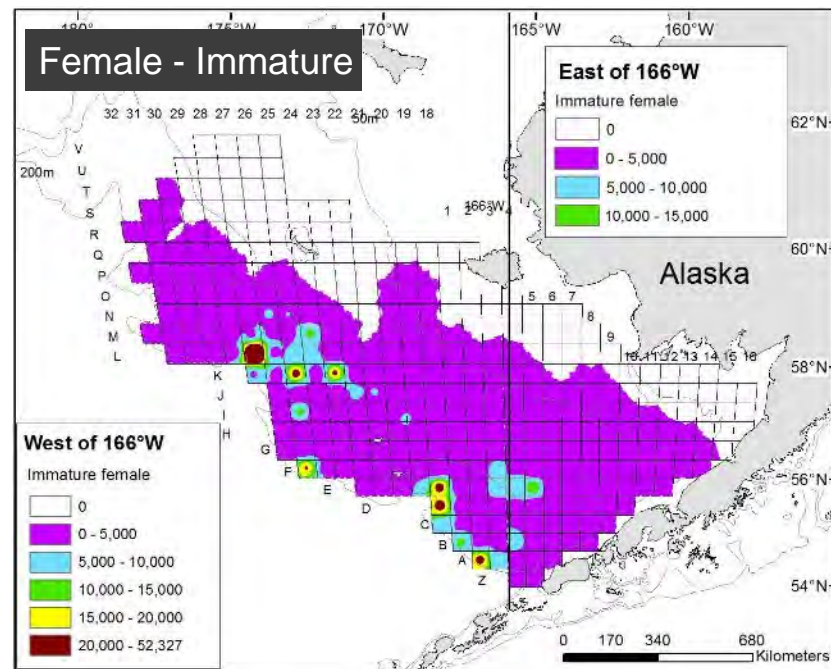
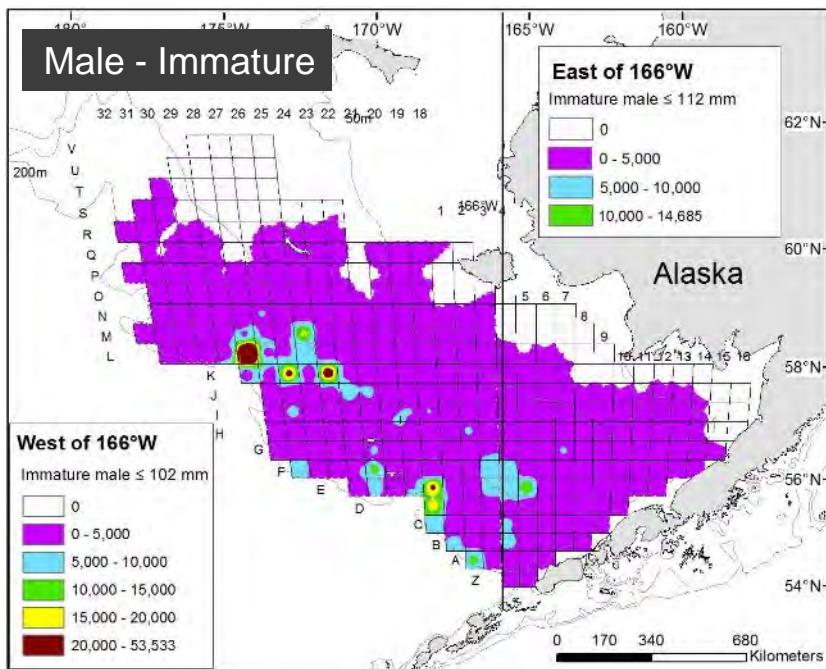
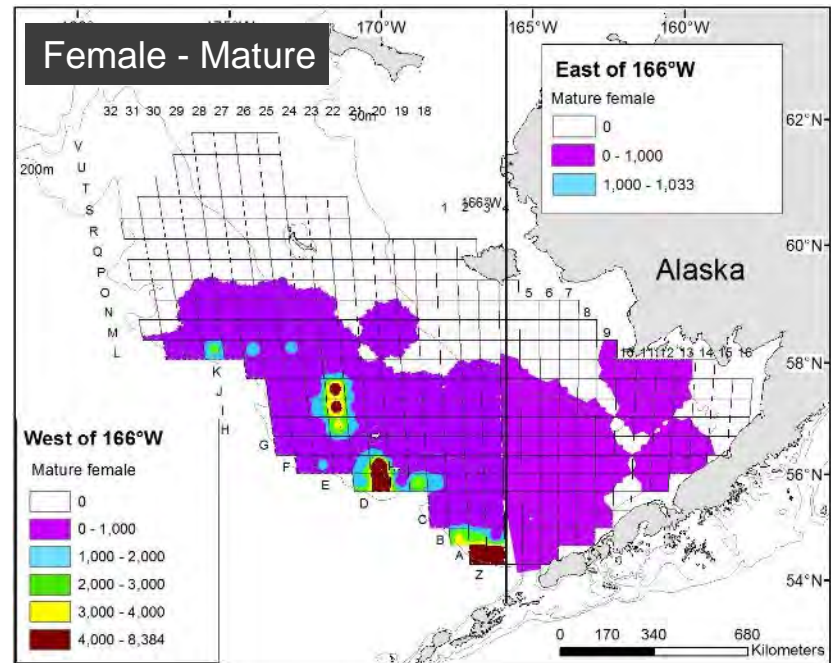
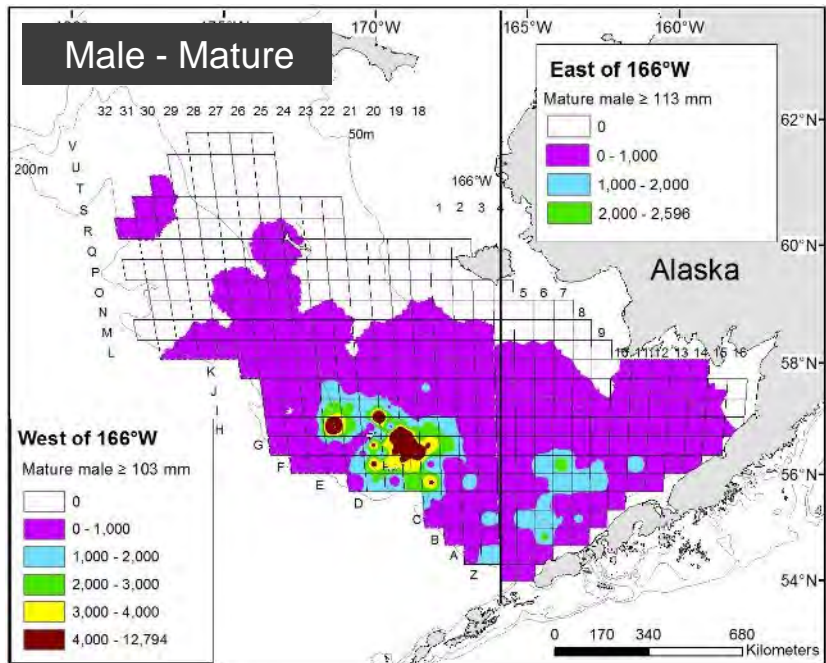


Mature
female



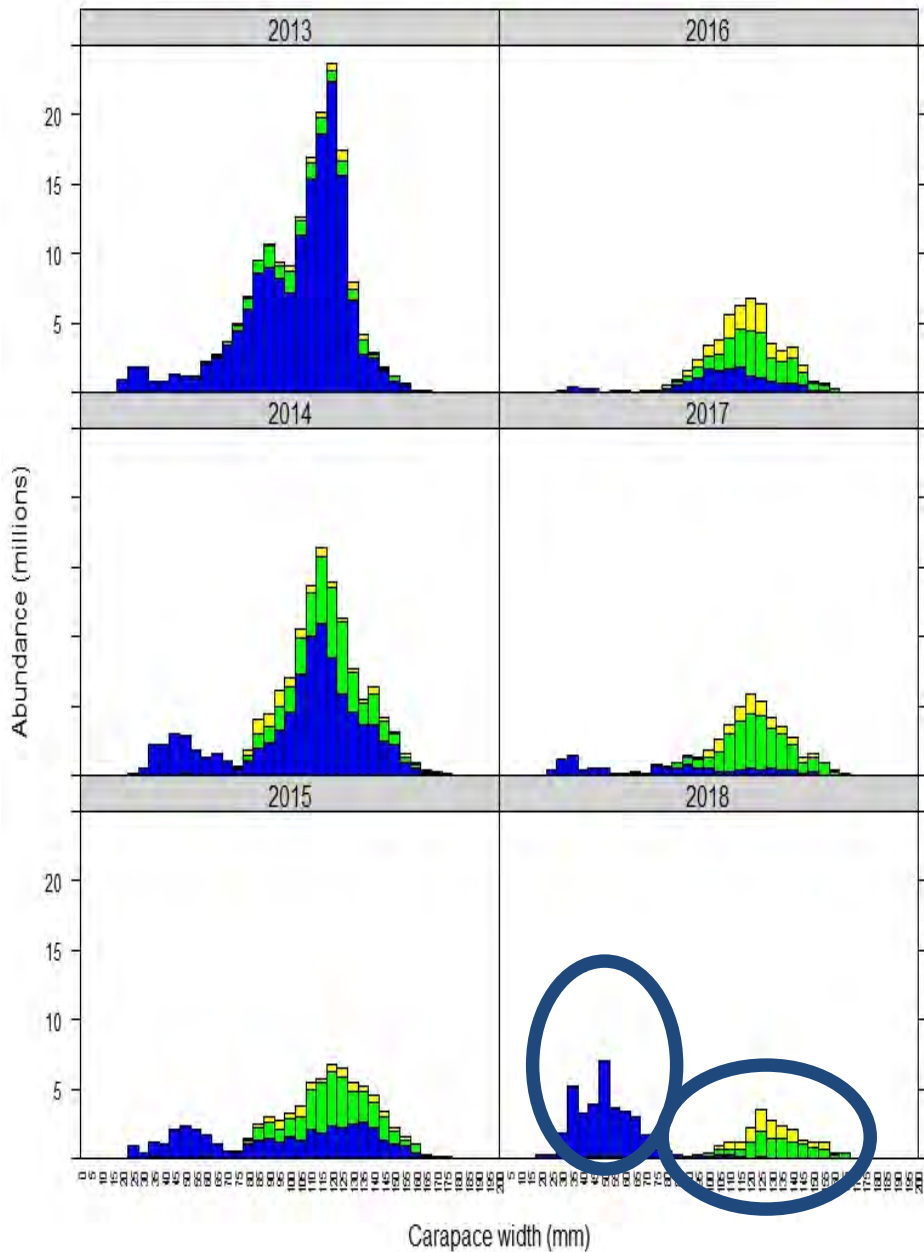
Juveniles

Tanner crab



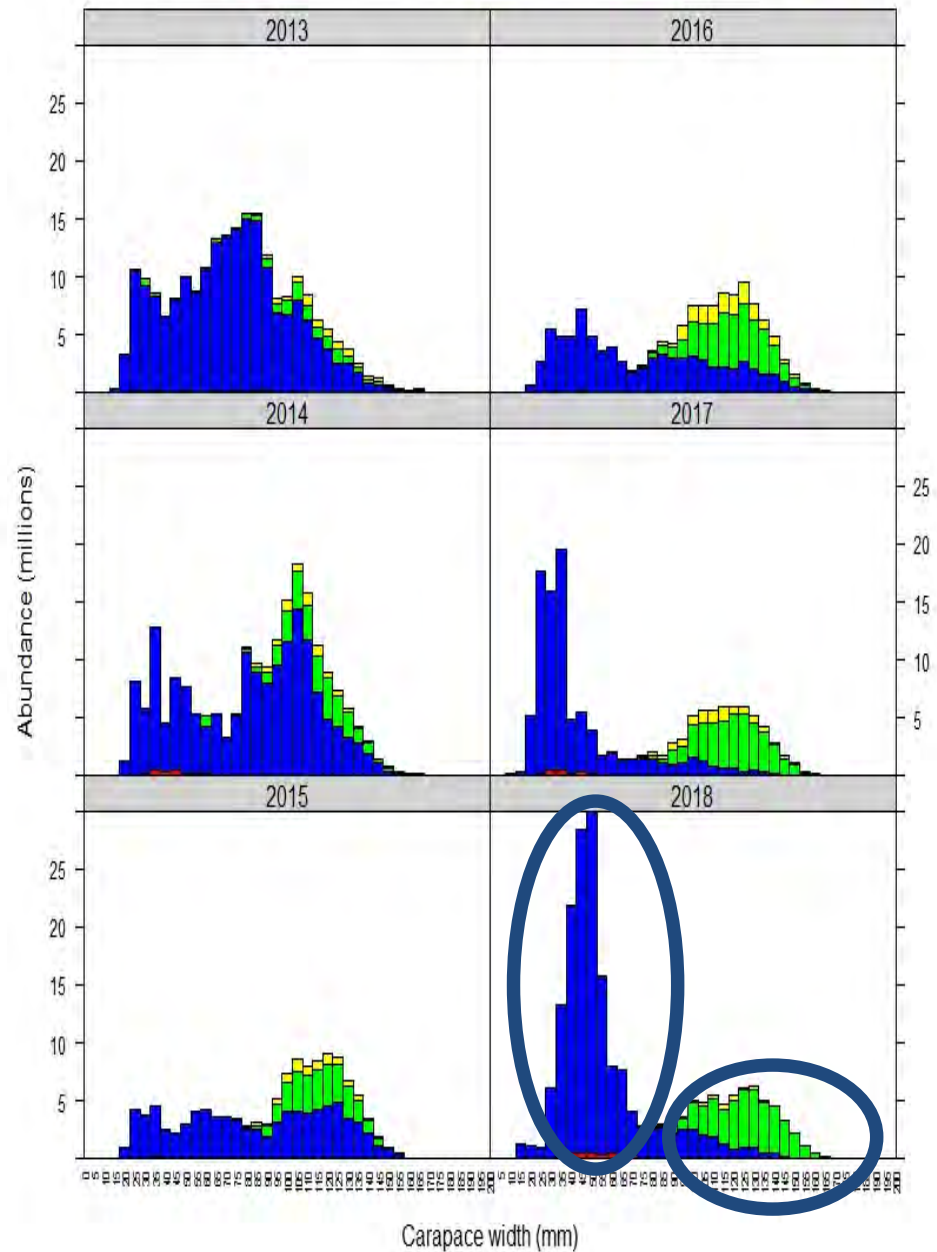
Tanner Crab east of 166W (male)

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



Tanner Crab west of 166W (male)

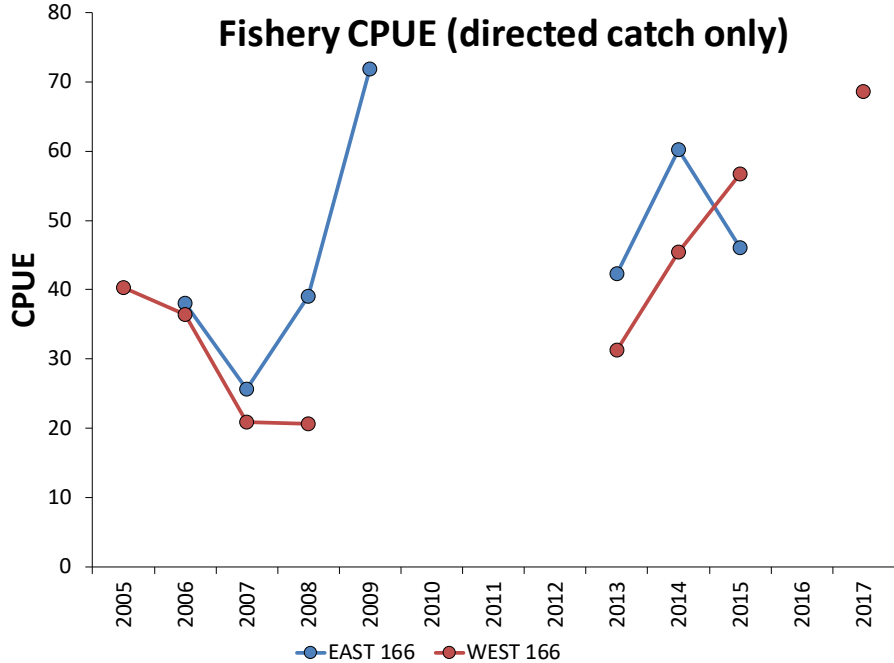
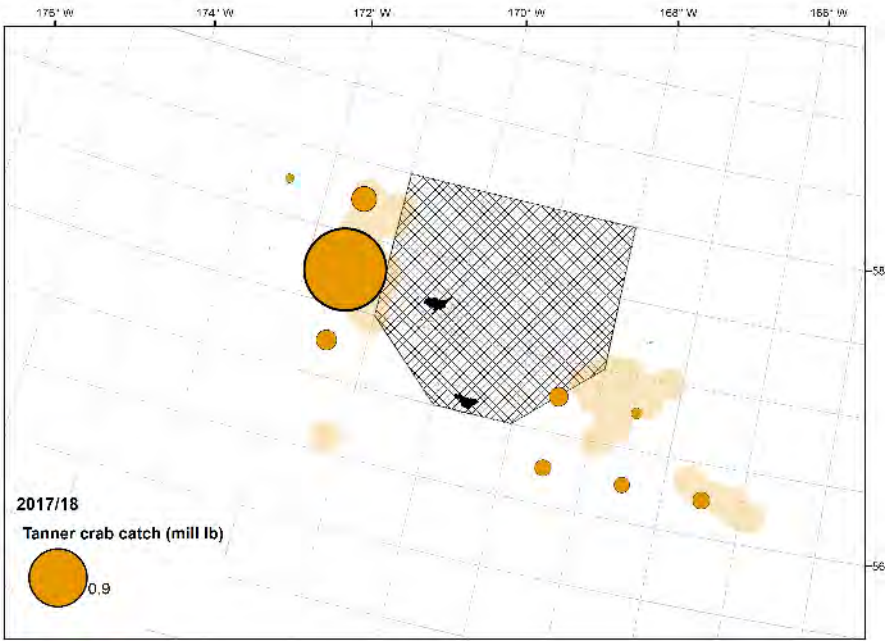
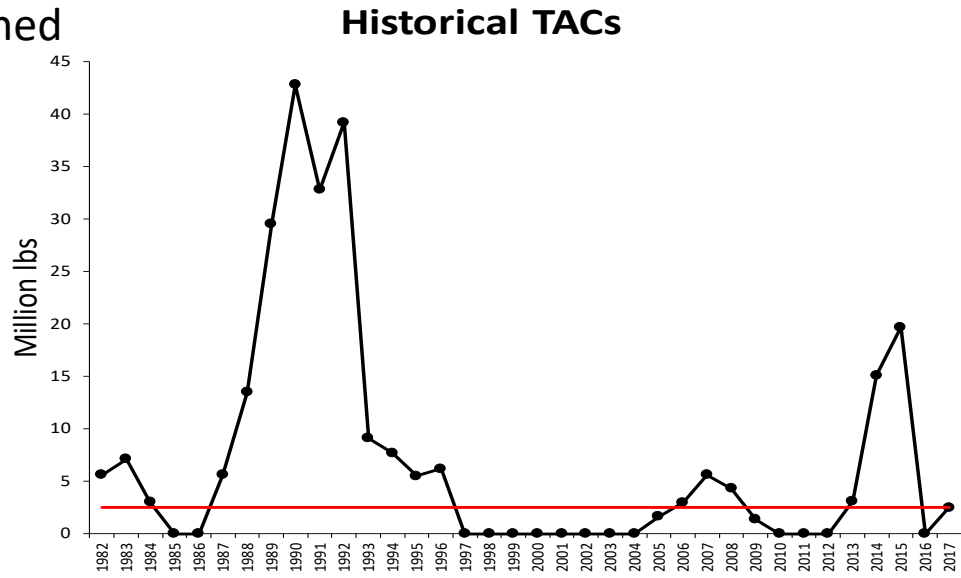
Shell condition
 Soft & molting ■ New - hard ■ Old ■ Very old ■



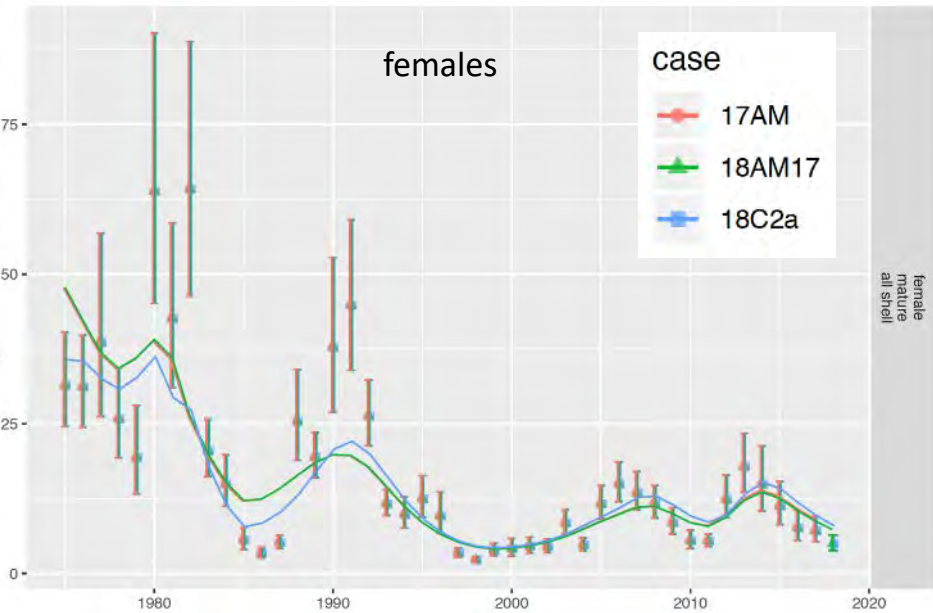
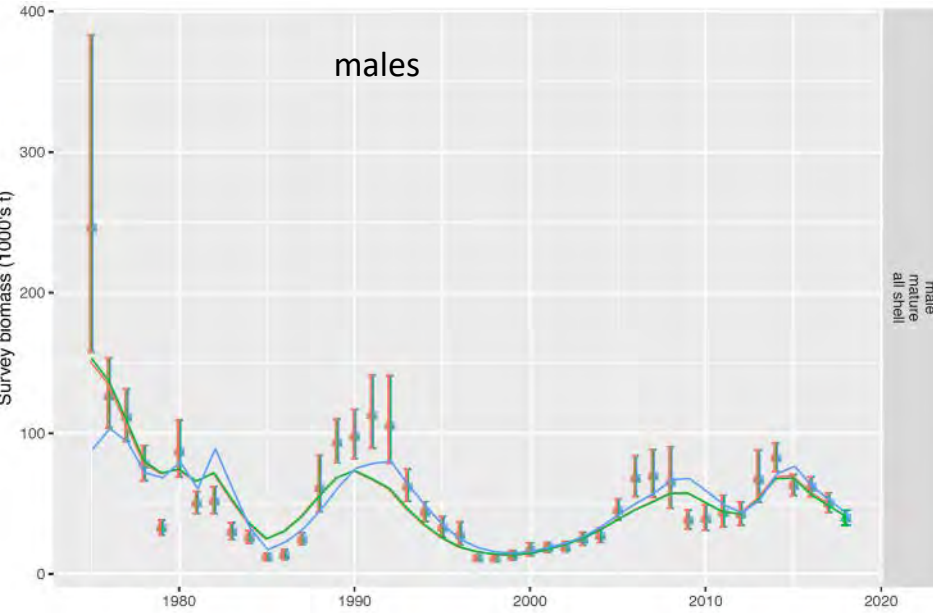
Tanner crab

East and west combined

CATCH SUMMARY



Fits to survey biomass



male
mature
all shell

female
mature
all shell

Tier, OFL, and ABC Recommendations

- CPT and author recommended 20% buffer
 - 2017 model, large males still overestimated, maturity data do not fit.
- CPT concurred with Author recommendation for Tier 3a.
- Biomass (MMB) = 35.95 thousand t
- Total catch OFL = 20.87 thousand t
- ABC (less than max permissible) = 20% buffer = 16.70 thousand t

Stock Status

- 2017/2018 total catch = 2.37 thousand t
- 2017/2018 OFL = 25.42 thousand t

Overfishing did not occur

- 2017/2018 MSST = 15.15 thousand t
- 2017/2018 MMB = 64.09 thousand t

Stock is not overfished

- 2018/2019 MMB = 35.95 thousand t

Stock is not approaching overfished

Snow Crab

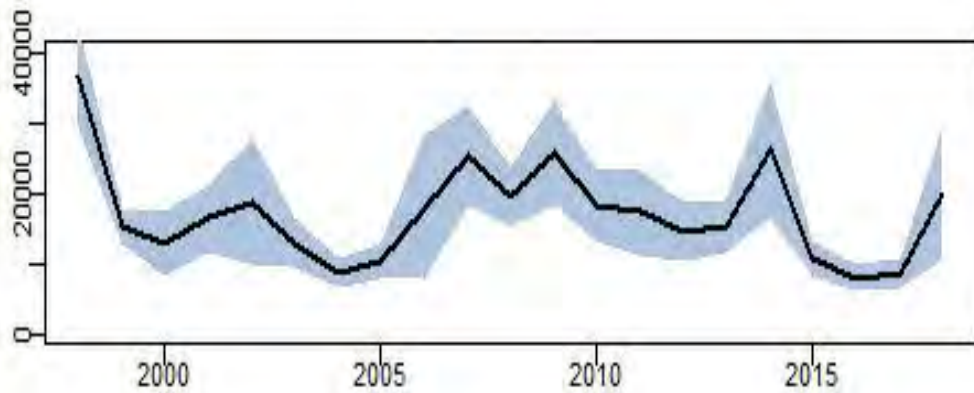
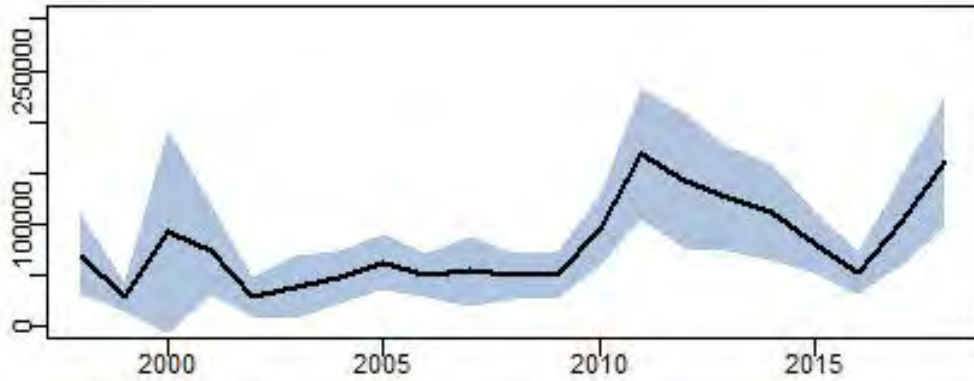
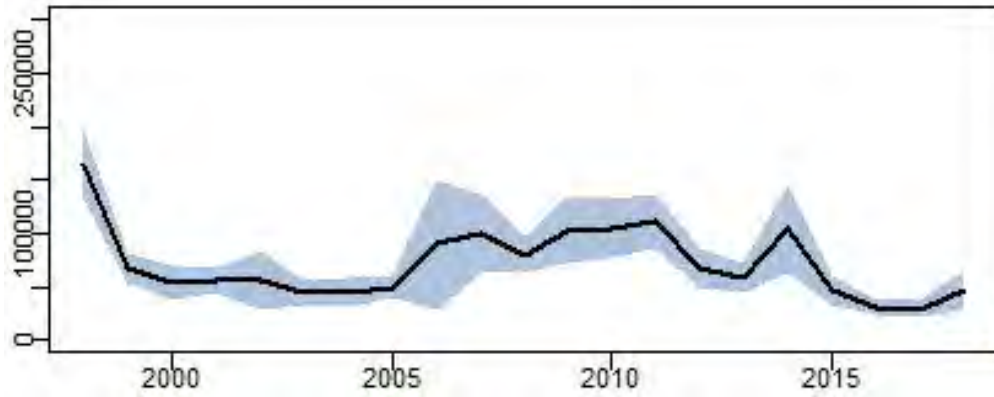
Final Stock Assessment



Cody Szuwalski

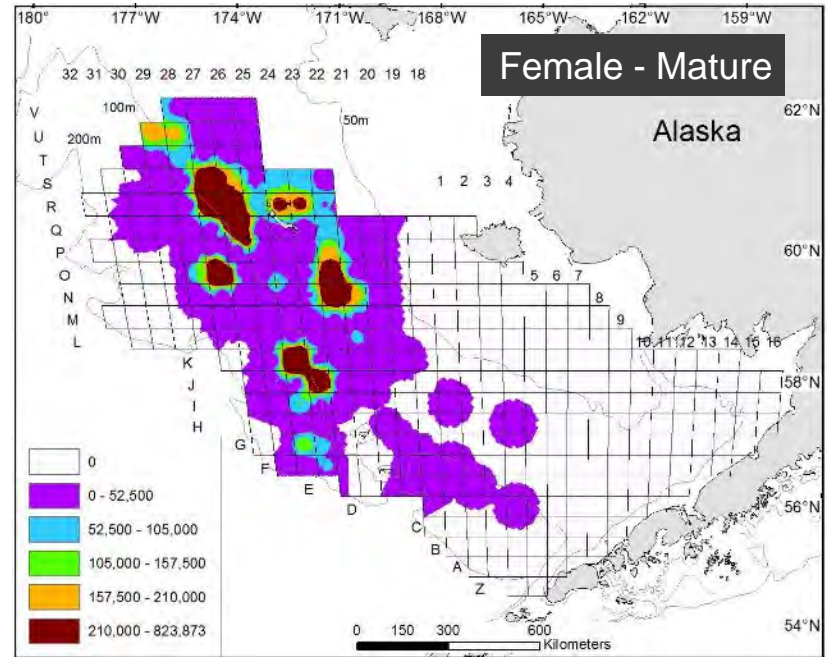
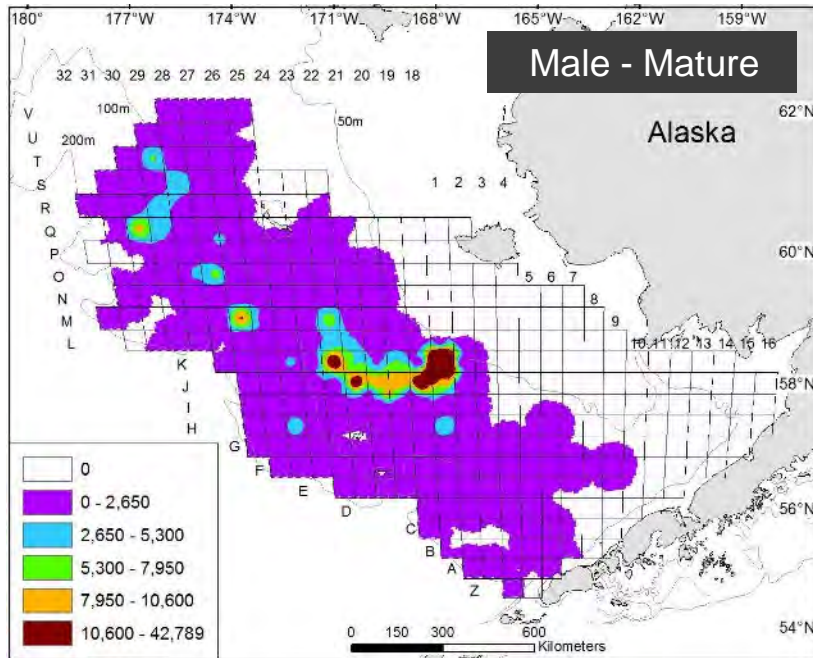
Alaska Fisheries Science Center

Snow crab

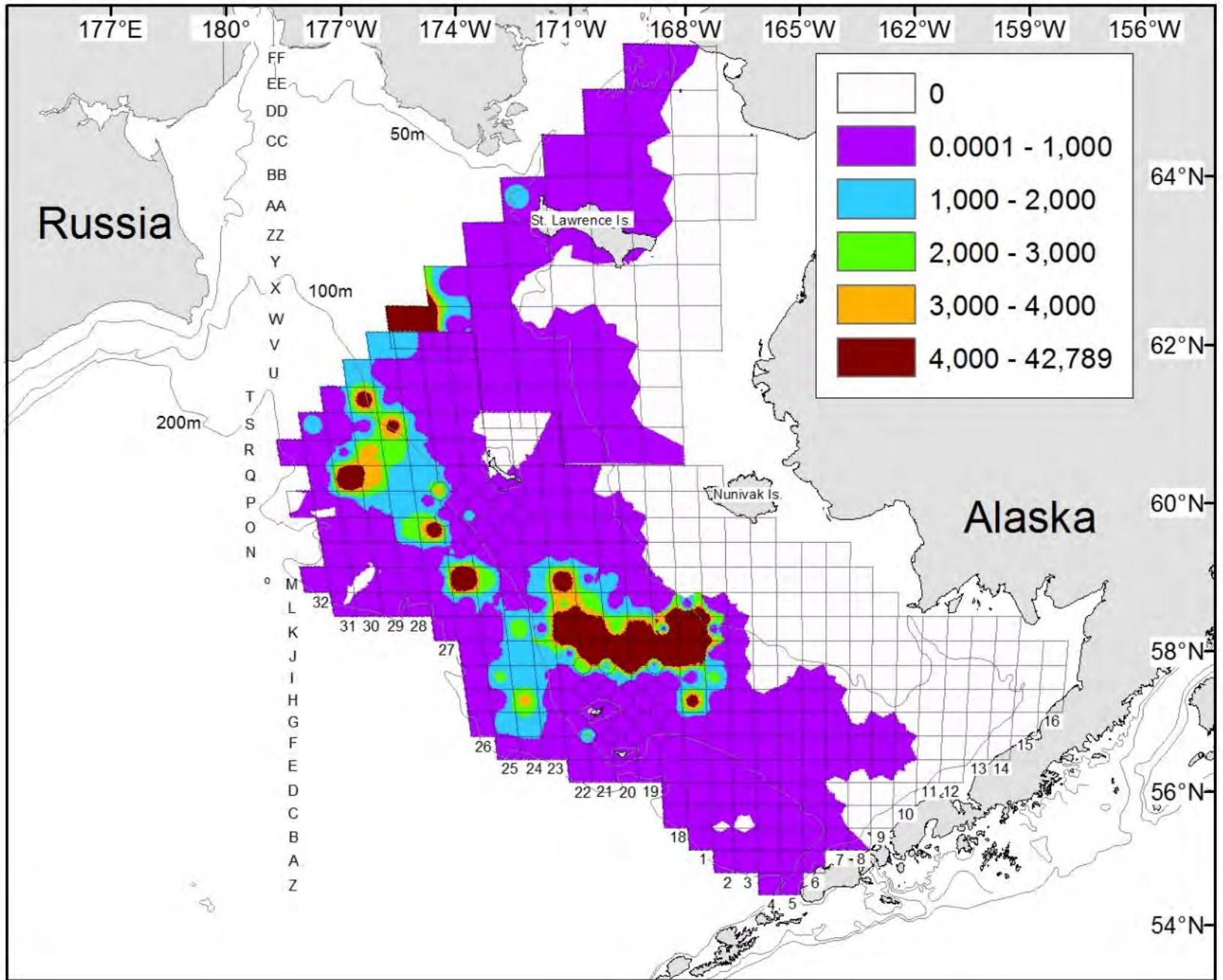


Biomass (t)

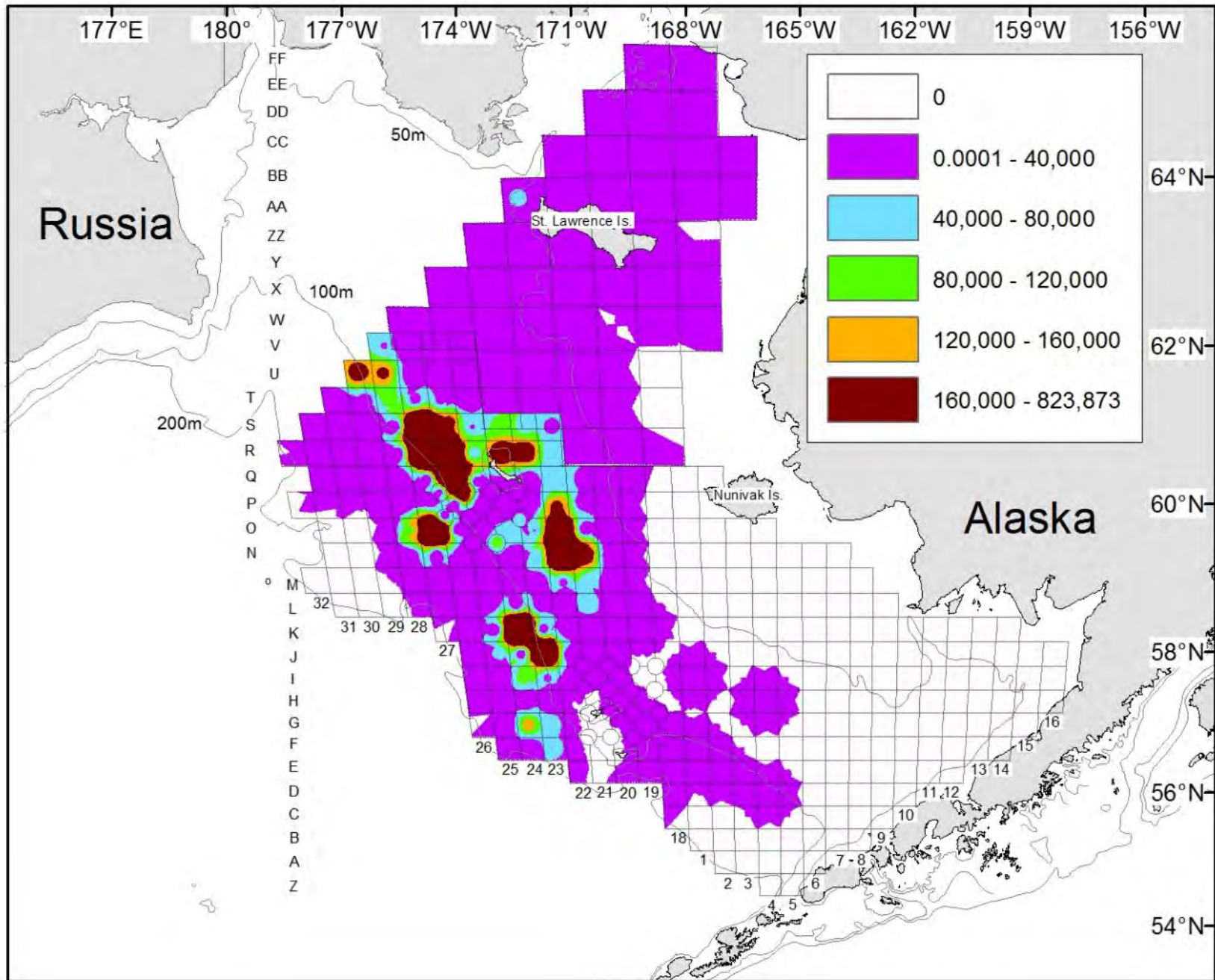
Snow crab



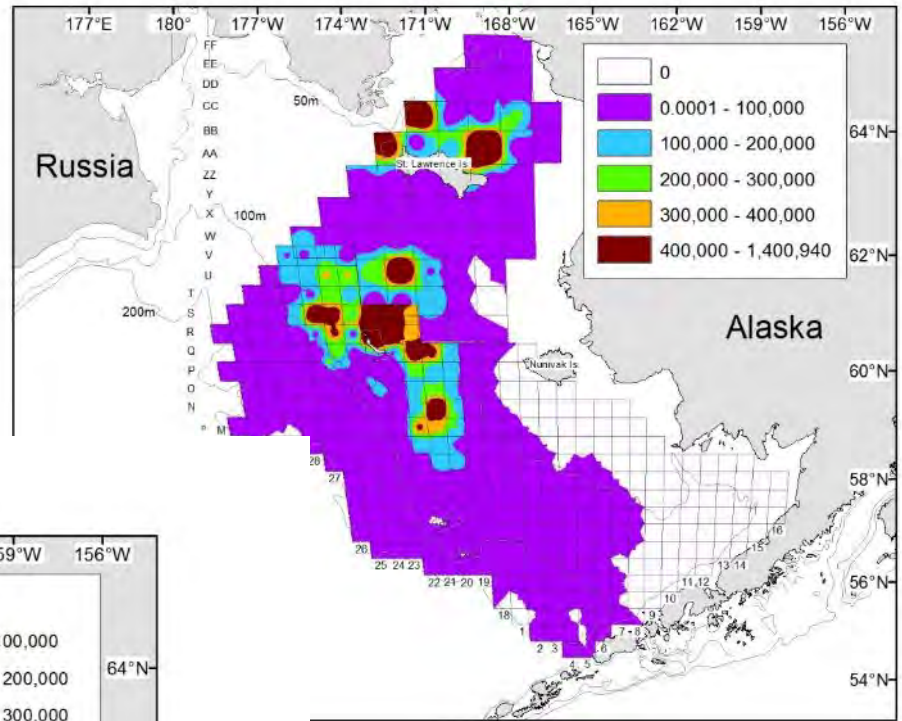
Snow crab mature male



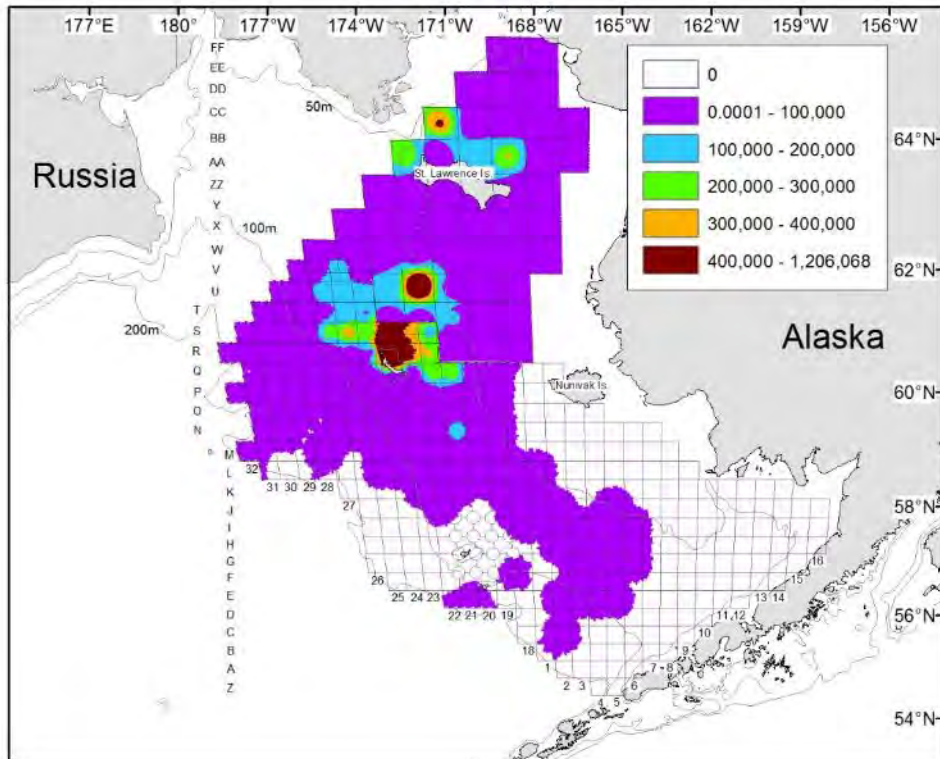
Snow crab mature female



immature male



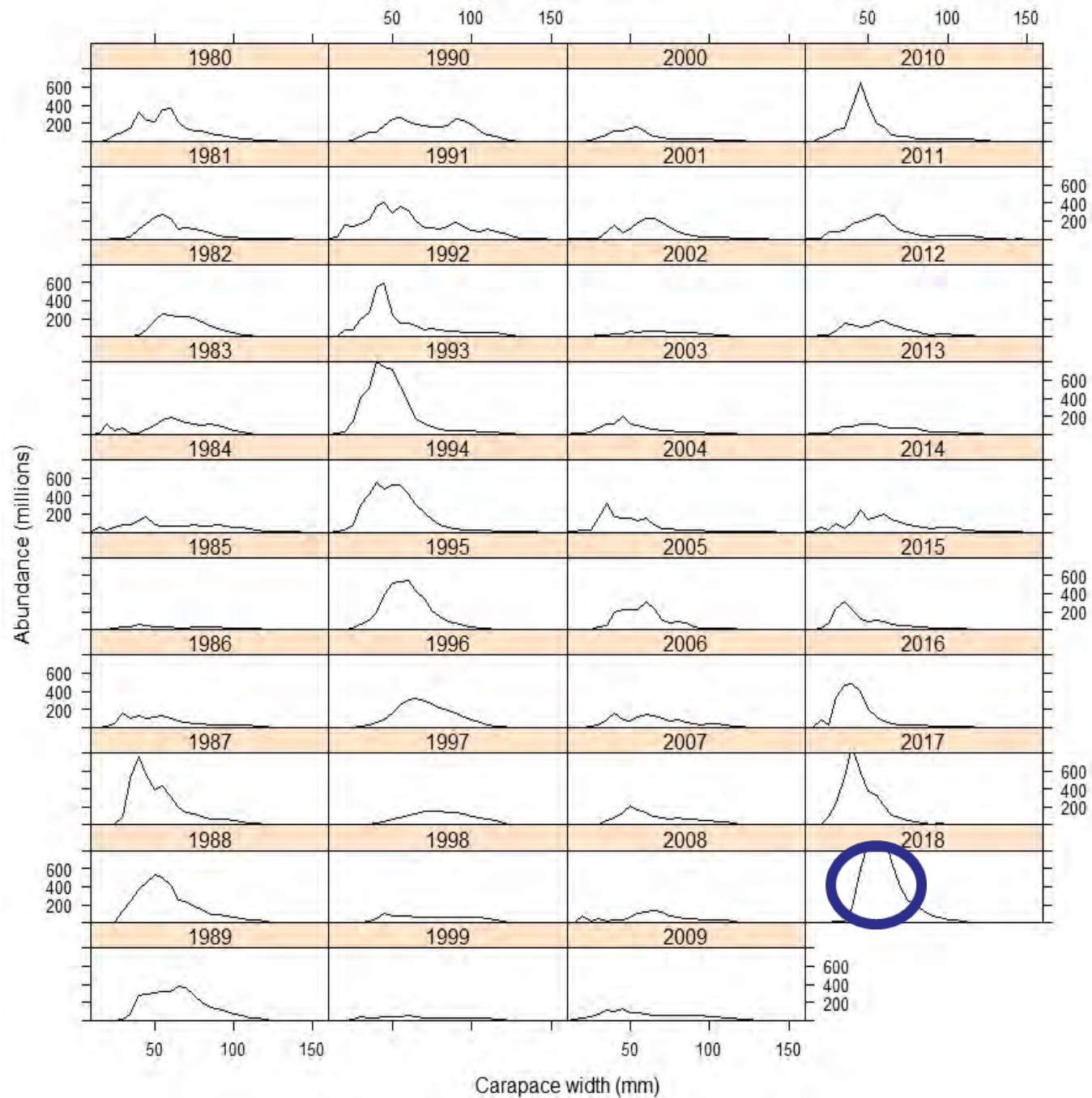
immature female



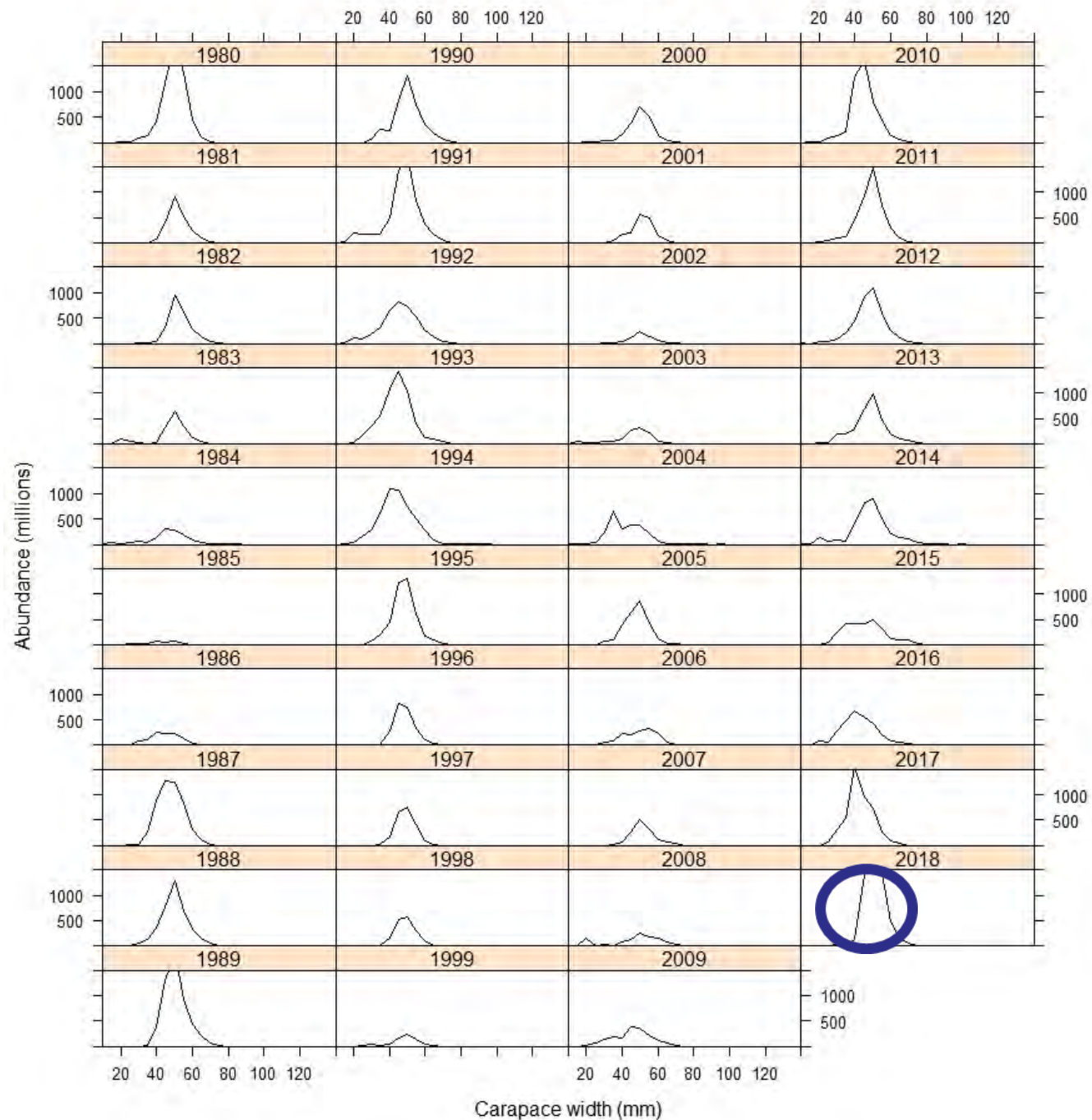
Snow crab: eastern Bering Sea vs. northern Bering Sea

	Station count		Biomass (t)	
	<u>South</u>	<u>North</u>	<u>South</u>	<u>North</u>
Immature male (2017)	204 (205)	35 (103)	458,902 (188,849)	115,491 (135,802)
Mature male (2017)	157 (167)	12 (2)	47,054 (29,240)	3,799 (349)
Immature female (2017)	135 (109)	41 (103)	83,164 (66,240)	56,667 (80,918)
Mature female (2017)	121 (135)	41 (53)	161,573 (103,422)	3,265 (6,147)

Snow Crab (male)

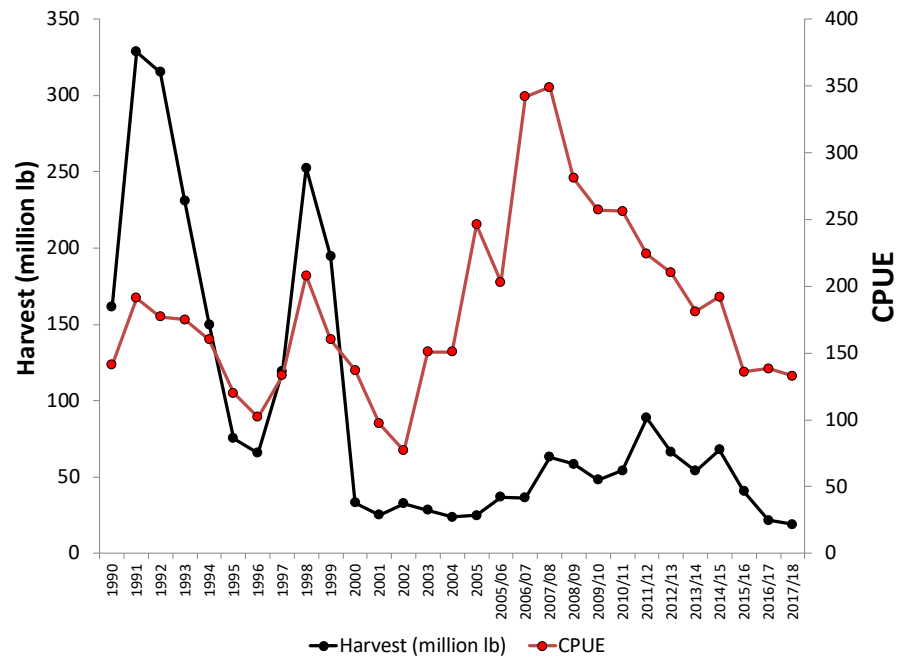
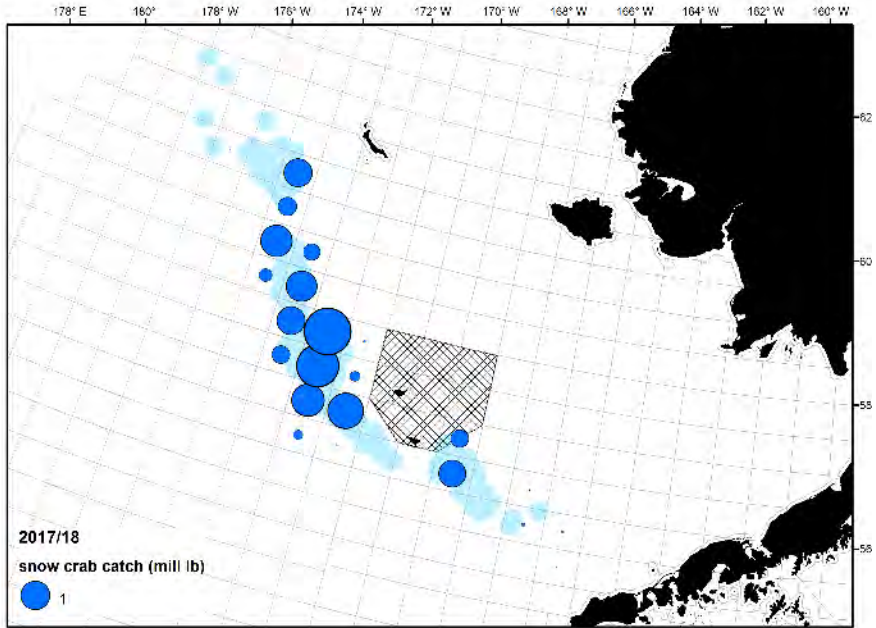
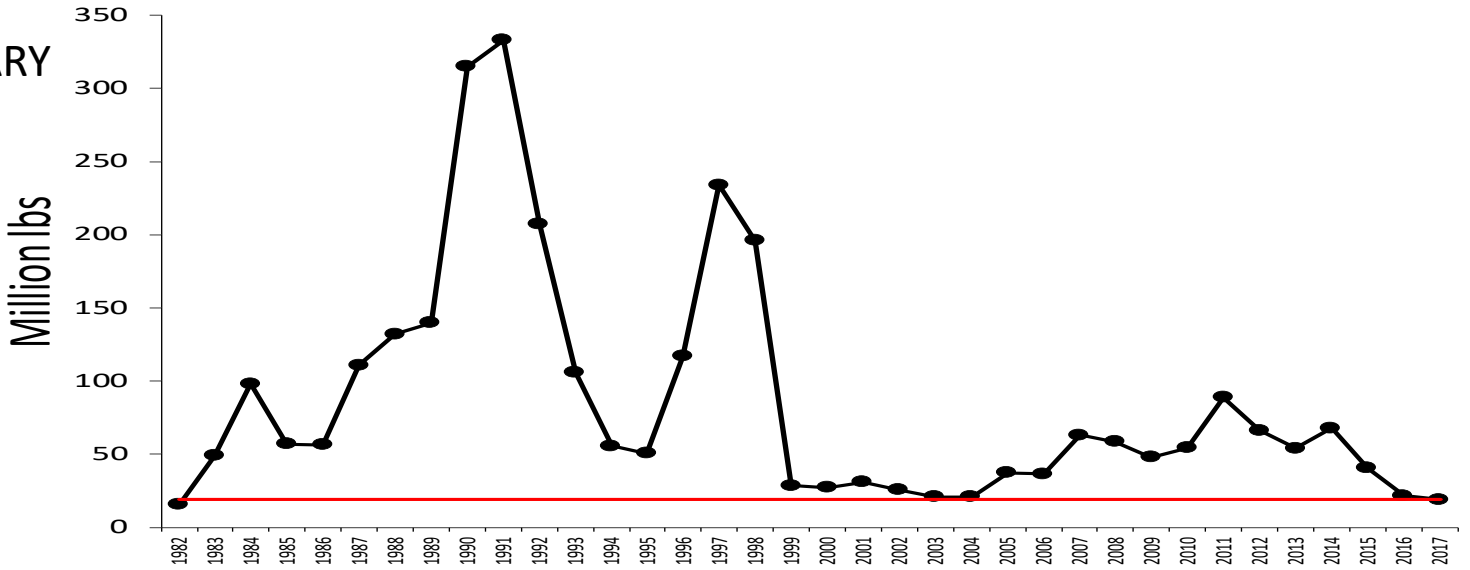


Snow Crab (female)

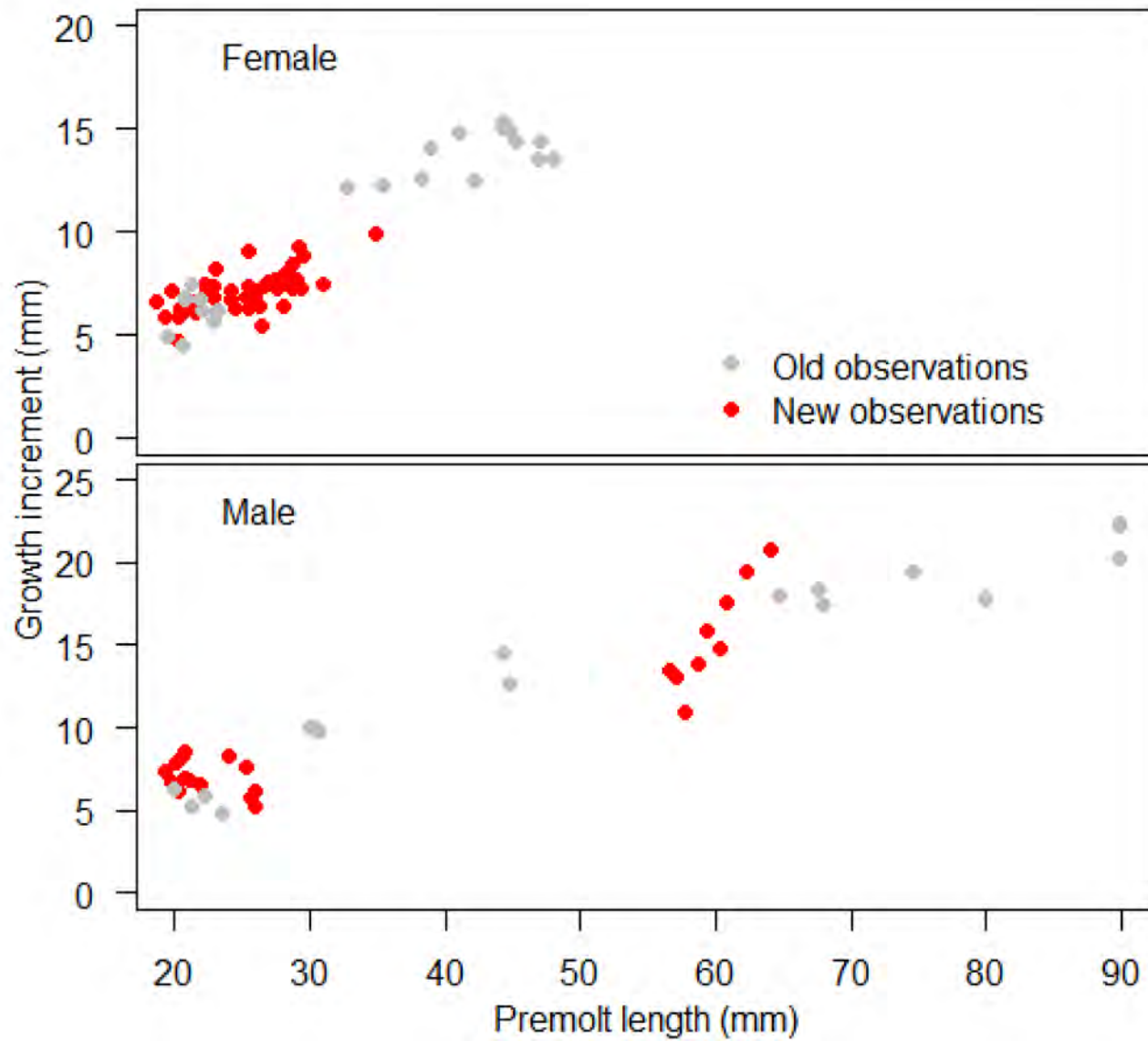


Snow crab
CATCH
SUMMARY

Historical TACs

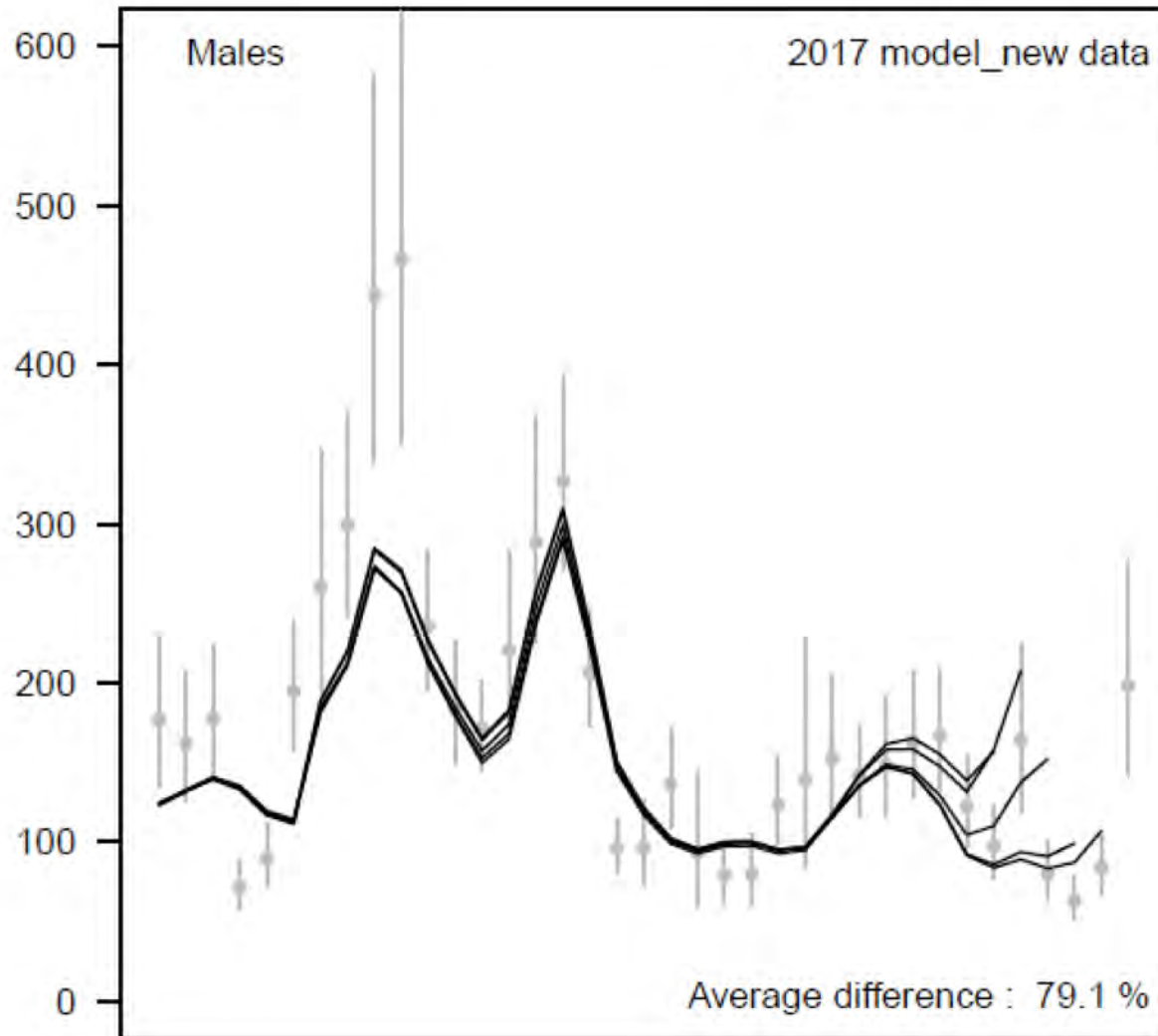


New growth data

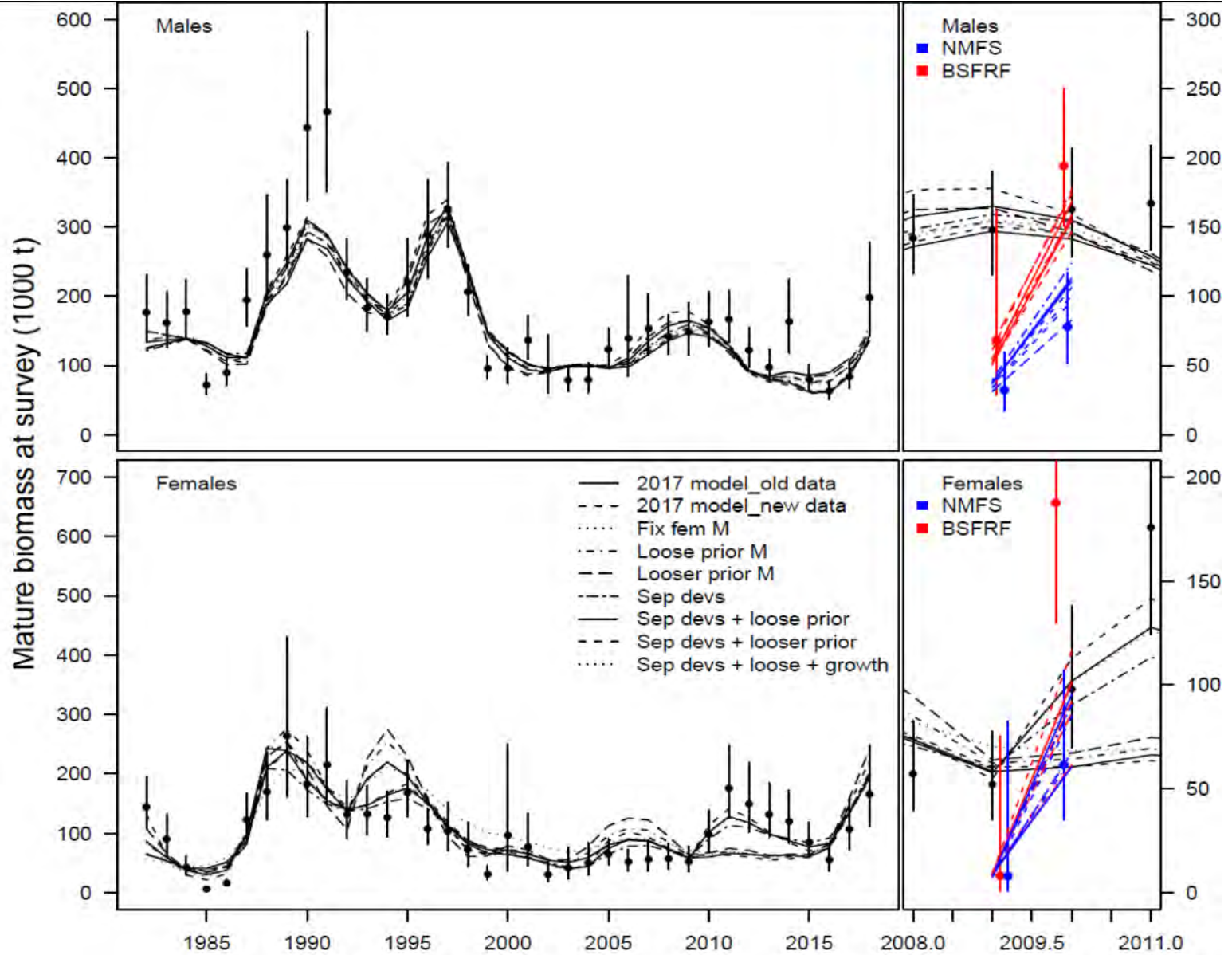


Model instability is back

retrospective patterns



Fits to mature survey biomass



Tier, OFL, and ABC Recommendations

- CPT recommended Tier status 3b.
- Biomass (MMB) = 123.10 thousand t
- Total catch OFL = 29.70 thousand t
- ABC (less than max permissible) = 20% buffer = 23.8 thousand t
 - CPT recommended increase in buffer last year; Continued uncertainty (bimodality) in parameter estimates. Unexplained biological reasoning in model runs.

Stock Status

- 2017/2018 total catch = 10.5 thousand t
- 2017/2018 OFL = 28.4 thousand t

Overfishing did not occur

- 2017/2018 MSST = 71.4 thousand t
- 2017/2018 MMB = 99.60 thousand t

Stock is not overfished (70%)

- 2018/2019 MMB = 123.10 thousand t

Stock is not approaching overfished

Stock Status

	Aleutian Islands golden king crab	Western Aleutian Islands red king crab	Pribilof Islands golden king crab
2017/18 total catch	2.94 thousand t	<1 t	confidential
2017/18 OFL	6.05 thousand t	56 t	91 t
Status	Overfishing did NOT occur	Overfishing did NOT occur	Overfishing did NOT occur
Cycle	Annual	Triennial (2020)	Triennial (2020)

September 2018 Crab Plan Team Report

- Snow Crab PSC review (Steve MacLean and Diana Stram)
 - Council proposed 2 alternatives and status quo (Alt 1)
 - BOTH: Base on total opilio abundance vs survey abundance
 - Alt 2: Remove current min/max and change multiplier
 - Alt 3: Reduce min/max only
 - Use of total abundance should be considered due to exploitation rate on size and sex
 - Why a floor? Does not protect stock at low levels
 - Should legal vs preferred be considered?
 - PSC should reflect status (size) of stock.
 - Biomass should be considered indicator and address large year classes (of small crab)
 - PSC should be flexible to consider changes in biological or physical conditions (temp, predator abundance)

September 2018 Crab Plan Team Report

- BBRKC EFP (Cory Lescher; APU student)
 - RKC in winter flatfish fisheries (YFS and rocksole)
 - 5 vessels
 - Motivation: to inform industry about individual boat variation and to limit crab mortality.
 - Test bycatch estimate by observed estimates vs census.
 - Correlate fishing behavior and environmental conditions to bycatch
 - Pilot study on handling mortality (400 crab)
 - CPT recommended increased sample size to cover catch size, duration strata

September 2018 Crab Plan Team Report

- January 22-25 CPT meeting planning
 - Nome
 - January 2019 CPT meeting topics
 - Norton Sound RKC final assessment
 - Norton Sound research and survey update
 - SMBKC Rebuilding Plan
 - GMACS
 - Crab Ecosystem Indicators (by stock)
 - Catch data (dockside and observer)
 - VAST
 - AIGKC model scenarios
 - Tanner crab assessment
 - Shell condition error
 - Economic SAFE report
 - Chionoecetes mating dynamics
 - Snow crab PSC