BSAI Crab Management: SAFE Report and Crab Plan Team Report
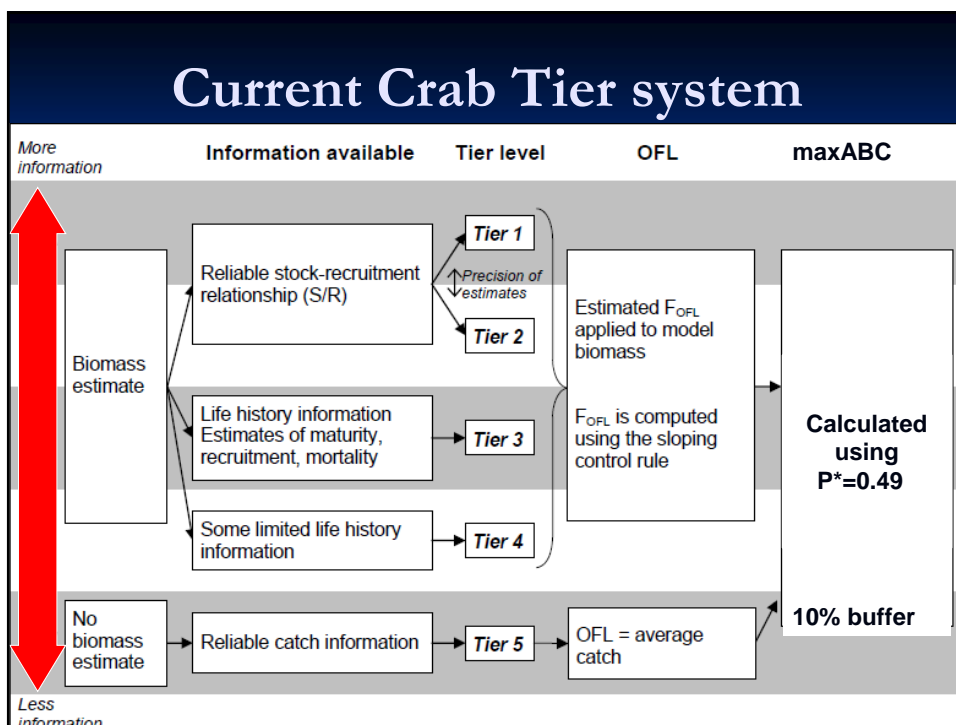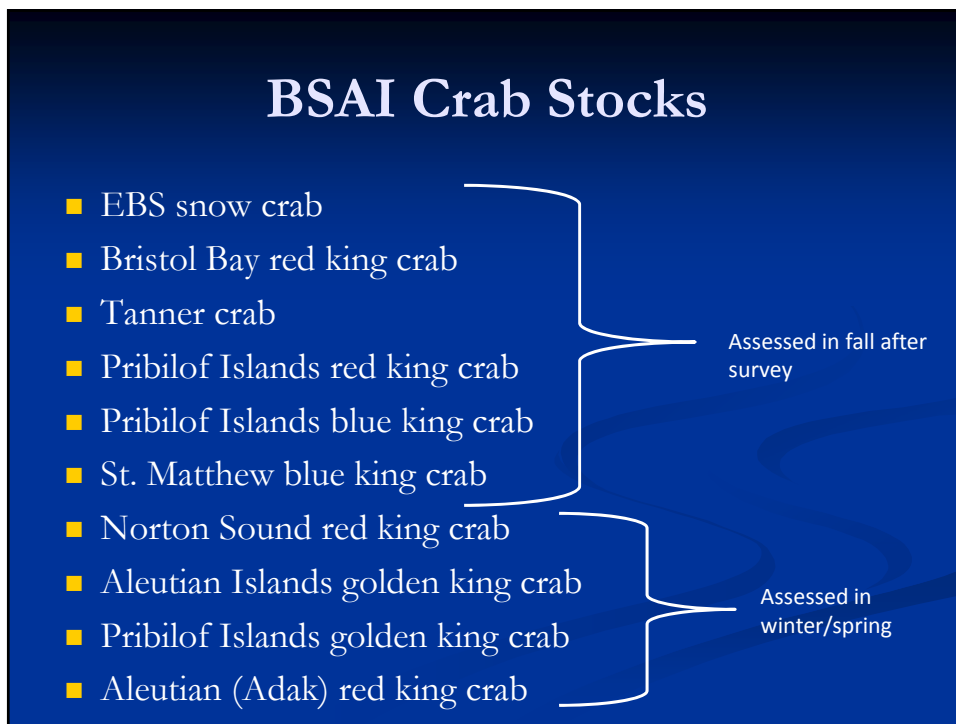
C-3

Council

October 2014
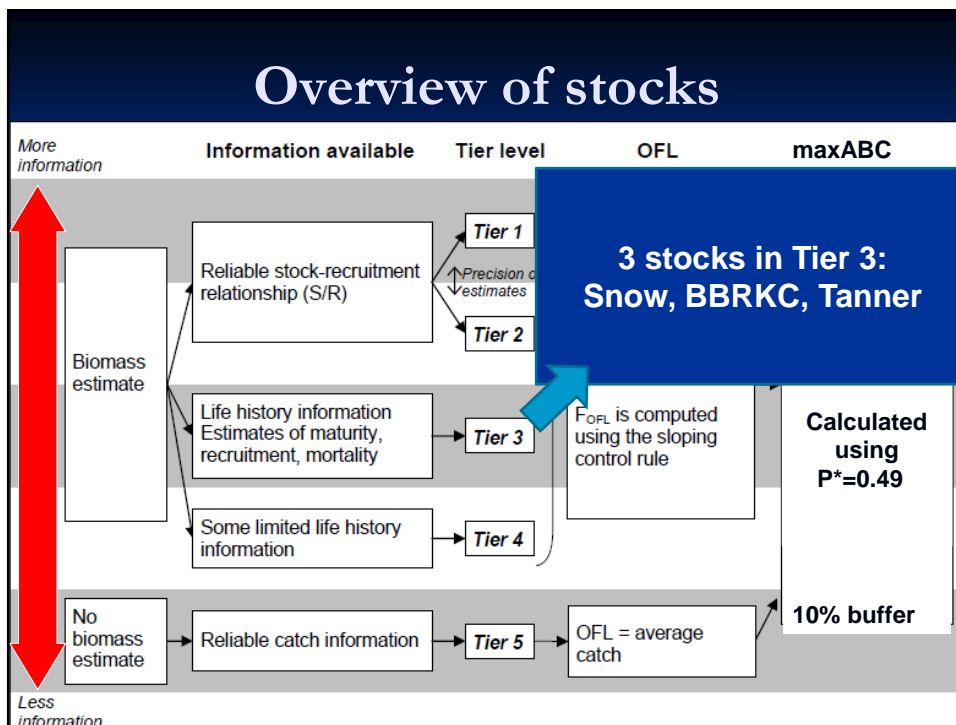

**BSAI
Crab Plan Team:**

Bob Foy (NOAA Fisheries /AFSC-Kodiak), Chair
Karla Bush (ADF&G-Juneau), Vice-Chair
Ginny Eckert (UAF/UAS)
Diana Stram (NPFMC)
Doug Pengilly (ADF&G-Kodiak)
Jason Gasper (NOAA Fisheries –Juneau)
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Jack Turnock (NOAA Fisheries/AFSC-Seattle)
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Martin Dorn(NOAA Fisheries/AFSC-Seattle)
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Bill Bechtol (UAF)
Brian Garber-Yonts (NOAA Fisheries/AFSC-Seattle)
Buck Stockhausen (NOAA Fisheries/AFSC-Seattle)

BSAI Crab Stocks

- 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 fall after survey

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

Assessed in winter/spring

Current Crab Tier system

More information	Information available	Tier level	OFL	maxABC
Biomass estimate	Reliable stock-recruitment relationship (S/R)	Tier 1 / Precision of estimates / Tier 2	Estimated F_{OFL} applied to model biomass	Calculated using P*=0.49
	Life history information Estimates of maturity, recruitment, mortality	Tier 3	F_{OFL} is computed using the sloping control rule	
	Some limited life history information	Tier 4		
No biomass estimate	Reliable catch information	Tier 5	OFL = average catch	10% buffer

Less information

Overview of stocks

More information	Information available	Tier level	OFL	maxABC
Biomass estimate	Reliable stock-recruitment relationship (S/R)	Tier 1 / Tier 2	**No stocks in Tiers 1 or 2**	
	Life history information Estimates of maturity, recruitment, mortality	Tier 3	F_{OFL} is computed using the sloping control rule	Calculated using P*=0.49
	Some limited life history information	Tier 4		
No biomass estimate	Reliable catch information	Tier 5	OFL = average catch	10% buffer

Precision of estimates

Overview of stocks

More information	Information available	Tier level	OFL	maxABC
Biomass estimate	Reliable stock-recruitment relationship (S/R)	Tier 1 / Tier 2	**3 stocks in Tier 3: Snow, BBRKC, Tanner**	
	Life history information Estimates of maturity, recruitment, mortality	Tier 3	F_{OFL} is computed using the sloping control rule	Calculated using P*=0.49
	Some limited life history information	Tier 4		
No biomass estimate	Reliable catch information	Tier 5	OFL = average catch	10% buffer

Precision of estimates

Overview of stocks

(Slide 1) More information / Less information. Information available — Tier level — OFL — maxABC. Biomass estimate: Reliable stock-recruitment relationship (S/R) → Tier 1, Tier 2 (Precision of estimates). Life history information, Estimates of maturity, recruitment, mortality → Tier 3. Some limited life history information → Tier 4. No biomass estimate: Reliable catch information → Tier 5.

OFL: Estimated F_{OFL} applied to model biomass. F_{OFL} is computed using the sloping control rule. maxABC: Calculated using P*=0.49.

4 stocks in Tier 4: PIRKC, PIBKC, SMBKC, NSRKC

Overview of stocks

(Slide 2) More information / Less information. Information available — Tier level — OFL — maxABC. Biomass estimate: Reliable stock-recruitment relationship (S/R) → Tier 1, Tier 2 (Precision of estimates). Life history information, Estimates of maturity, recruitment, mortality → Tier 3. Some limited life history information → Tier 4. No biomass estimate: Reliable catch information → Tier 5. OFL = average catch. 10% buffer.

3 stocks in Tier 5: AIGKC, PIGKC, AIRKC

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

Overfishing limit (OFL)

Projected stock status in relation to biological reference points

Biomass > B_{MSY}	Biomass < B_{MSY}	Biomass < ½ B_{MSY} (MSST)	Biomass and status unknown
EBS Tanner crab	EBS Snow crab Bristol Bay red king crab Pribilof Island red king crab St. Matthew blue king crab Norton Sound red king crab	Pribilof Island blue king crab	Aleutian Island golden king crab Pribilof Island golden king crab Aleutian Island (Adak) red king crab

Consideration of uncertainty in establishing ABC buffers

- Tier system for OFL
- maxABC control rule ➡️ ABC $\simeq$ OFL
- Since 2011 only Tier 5 have used maxABC
  - All Tier 3-4 stocks ABC <maxABC
  - Relative buffers do not always align with Tier system
- Council direction to CPT to continue to evaluate how to best approximate relative uncertainty
  - CPT discussion of uncertainty and ABC buffers (2014)

Stock	Tier	Model CV	Key pop dyn params pre-specified	Survey Q fixed	Basis for F_{MSY}	Uncertainty in B_{MSY} estimation	Additional considerations
Bristol Bay red king crab	3	0.05	Yes	Yes	Yes	Yes	
EBS snow crab	3	0.086	Some	No	Yes	Yes	
Tanner crab	4	0.01 (estimated unreliable-not used) 0.140 (survey)	Yes	Yes	Yes	Considerable	Model under development
St. Matthew blue king crab	4	0.160	Yes	Yes	Yes	Considerable	Uncertainty in trawl survey distribution
Aleutian Island golden king crab	5	0.021 (Dutch) 0.027 (Adak)	Yes	Yes	Yes	Yes	Model under development, no trawl survey data
Pribilof Island red king crab	4	0.574 (survey data) 0.180 (model)	Yes (M)	Yes	Yes	Considerable	Model under development; CV on MMB range from 0.0357-0.0786 since 1995
Pribilof Island blue king crab	4	0.713 (survey data) 0.271 (model)	Yes (M)	Yes	Yes	Considerable	Model under development
Norton Sound red king crab	4	0.110	Yes	Yes	Yes	Considerable	No bycatch estimates, periodic surveys only
Pribilof Island golden king crab	5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	Tier 5 fishery with no effort on 150,000-lb GHL during 2006–2009
Adak (AI) red king crab	5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	N/A – Tier 5	Fishery closed due to stock concerns

Stock	Tier	ABC buffer (%) in 2011/12	ABC buffer (%) in 2013/14	CPT ABC buffer (%) in 2014/15
EBS snow crab	3	10%	10%	10%
BB red king crab	3	10%	10%	10%
EBS Tanner crab	3	10%	30%	20%
Pribilof Islands red king crab	4	22%	20%	15%
Pribilof Islands blue king crab	4	10%	10%	25%
St. Matthew Island blue king crab	4	10%	20%	20%
Norton Sound red king crab	4	10%	10%	10%
AI golden king crab	5	10%	25%	25%
Pribilof Island golden king crab	5	10%	10%	25%
Adak red king crab	5	75%	40%	40%

Stock	Tier	ABC buffer (%) in 2011/12	ABC buffer (%) in 2013/14	CPT ABC buffer (%) in 2014/15
EBS snow crab	3	10%	10%	10%
BB red king crab	3	10%	10%	10%
EBS Tanner crab	3	10%	30%	20%
Pribilof Islands red king crab	4	22%	20%	15%
Pribilof Islands blue king crab	4	10%	10%	25%
St. Matthew Island blue king crab	4	10%	20%	20%
Norton Sound red king crab	4	10%	10%	10%
AI golden king crab	5	10%	25%	25%
Pribilof Island golden king crab	5	10%	10%	25%
Adak red king crab	5	75%	40%	40%

Stock	Tier	ABC buffer (%) in 2011/12	ABC buffer (%) in 2013/14	CPT ABC buffer (%) in 2014/15
EBS snow crab	3	10%	10%	10%
BB red king crab	3	10%	10%	10%
EBS Tanner crab	3	10%	30%	20%
Pribilof Islands red king crab	4	22%	20%	15%
Pribilof Islands blue king crab	4	10%	10%	25%
St. Matthew Island blue king crab	4	10%	20%	20%
Norton Sound red king crab	4	10%	10%	10%
AI golden king crab	5	10%	25%	25%
Pribilof Island golden king crab	5	10%	10%	25%
Adak red king crab	5	75%	40%	40%

Moving forward in characterizing uncertainty

- Crab SAFE:
  - Develop scorecards to incorporate in each assessment with metrics for characterization of uncertainty
    - Use to indicate when uncertainty in parameters changes
  - Include summary tables of buffer levels and rationale for inclusion in annual SAFE
- Future planning to inform control rules:
  - Session on incorporation of uncertainty in 2015 data-poor workshop

BSAI survey overview
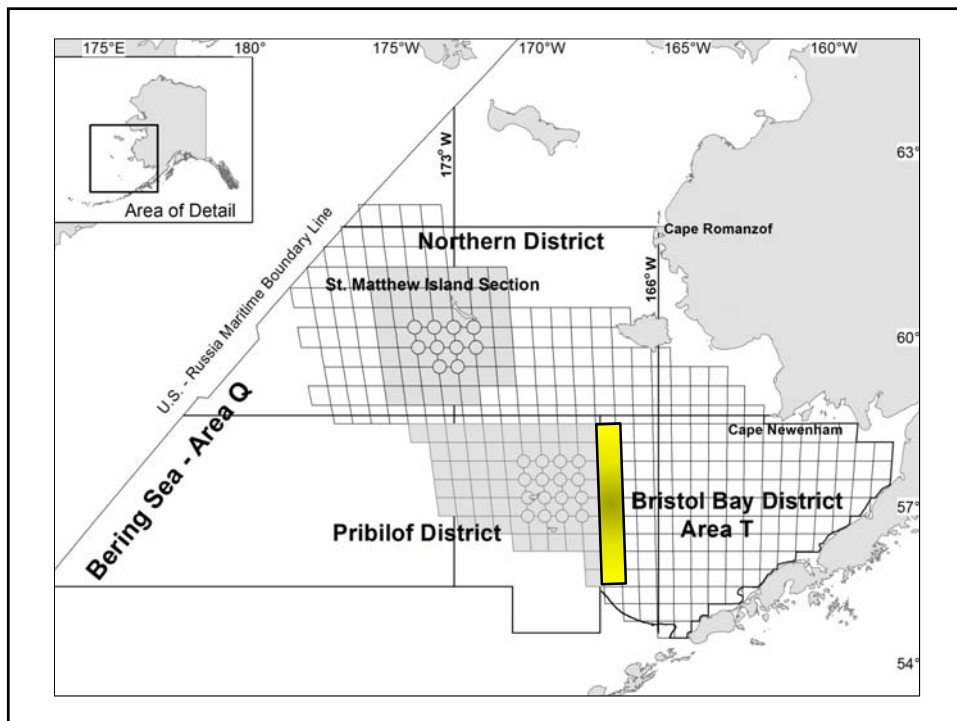
2014 standard Bering Sea survey
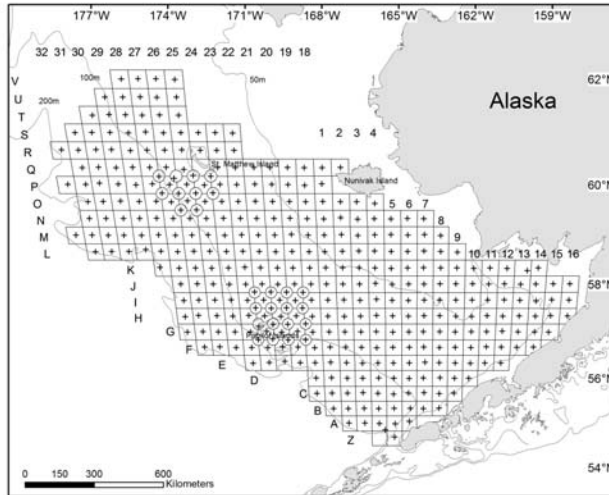
HIGHLIGHTS

• June 8 – 2 Aug

• 376 standard stations

• 140,350 nm^2

• 10 special crab projects

• Warmer water: red king crab female reproductive status

• NO resample

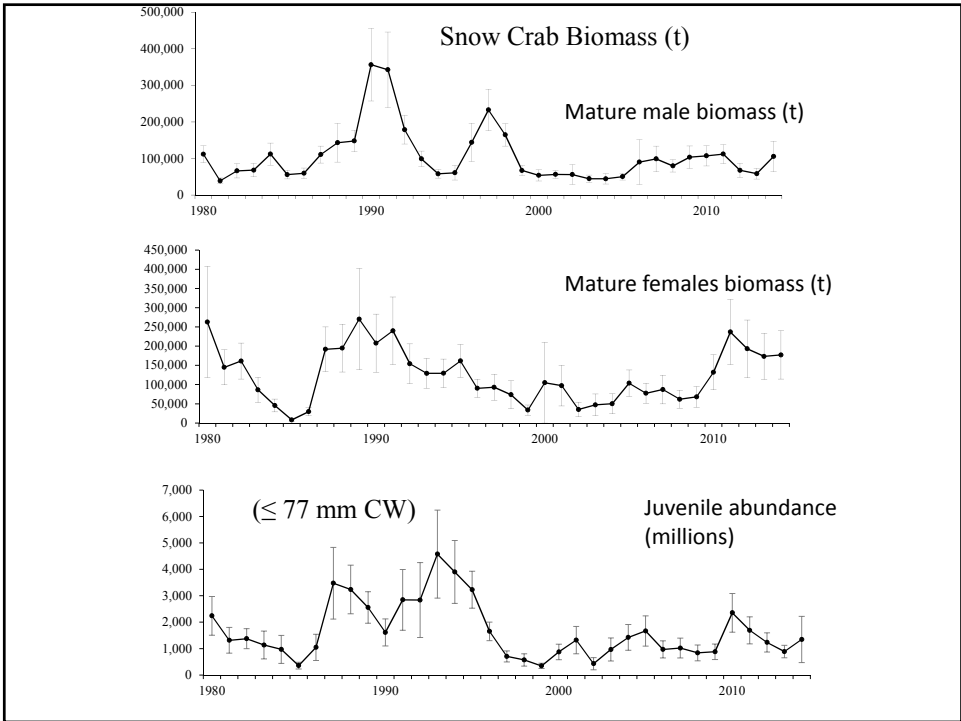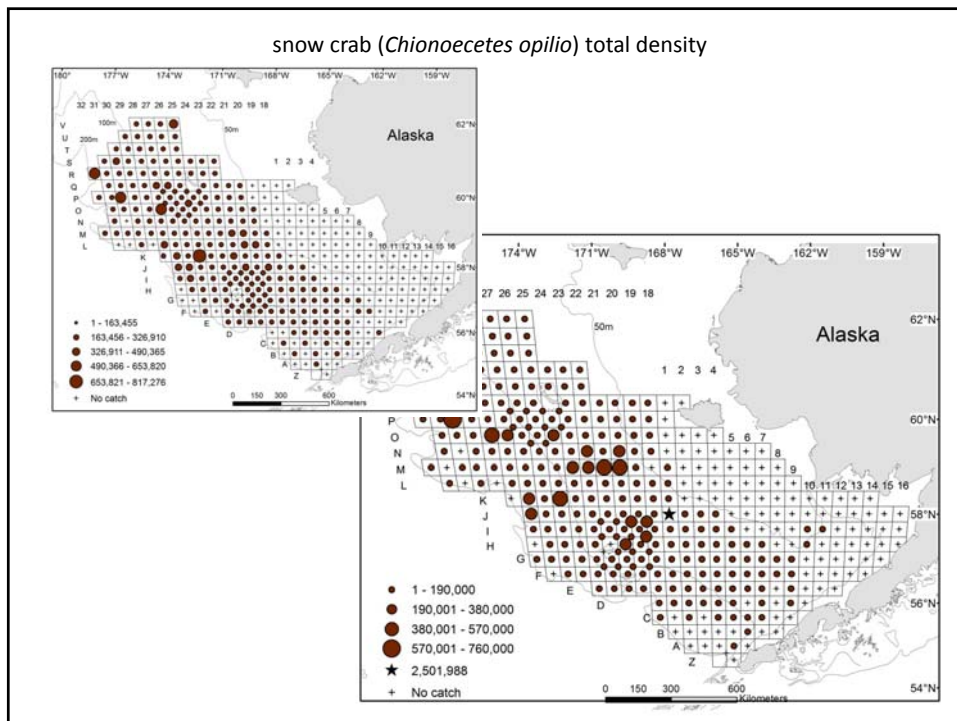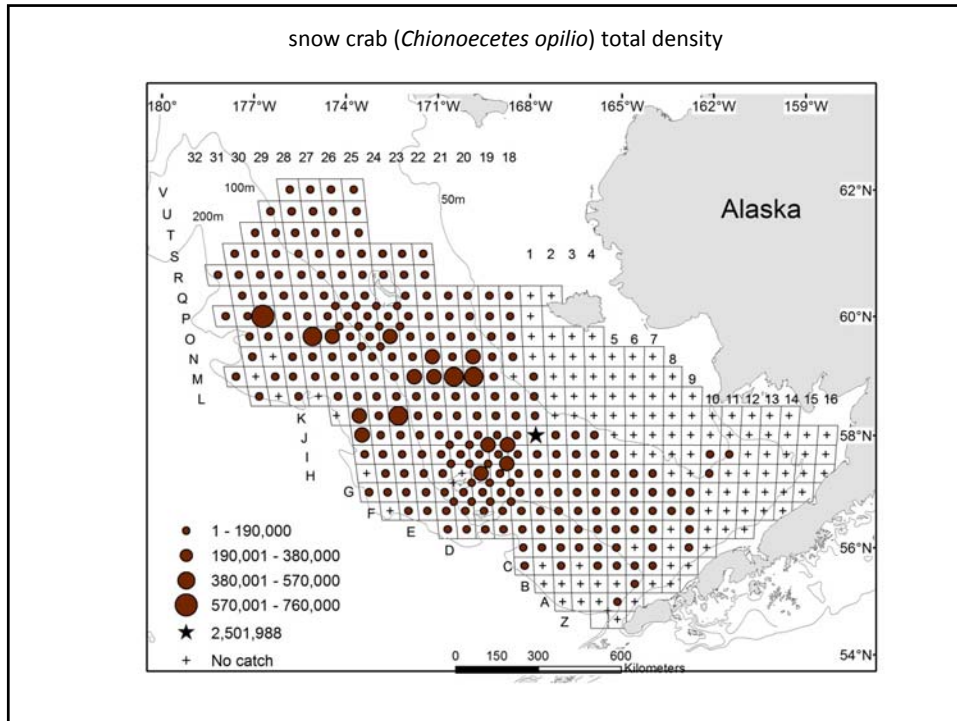## Bristol Bay Surface (dashed) and Bottom (solid) temperatures
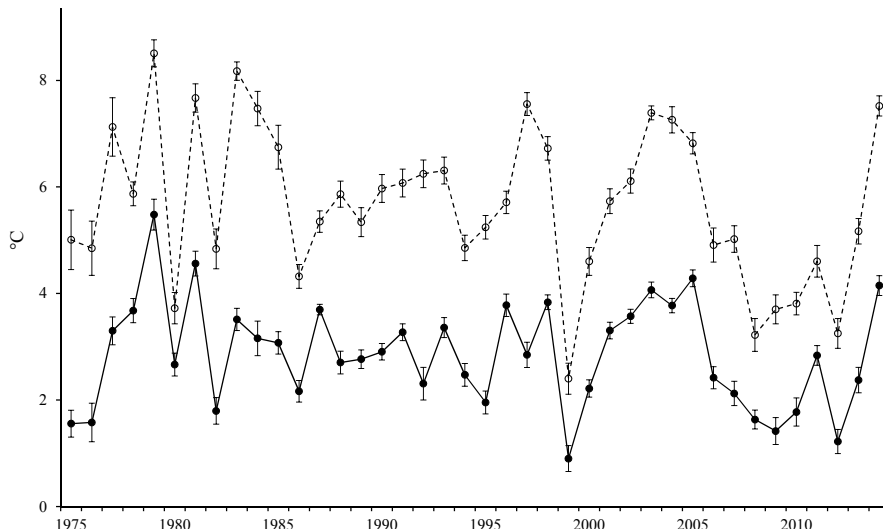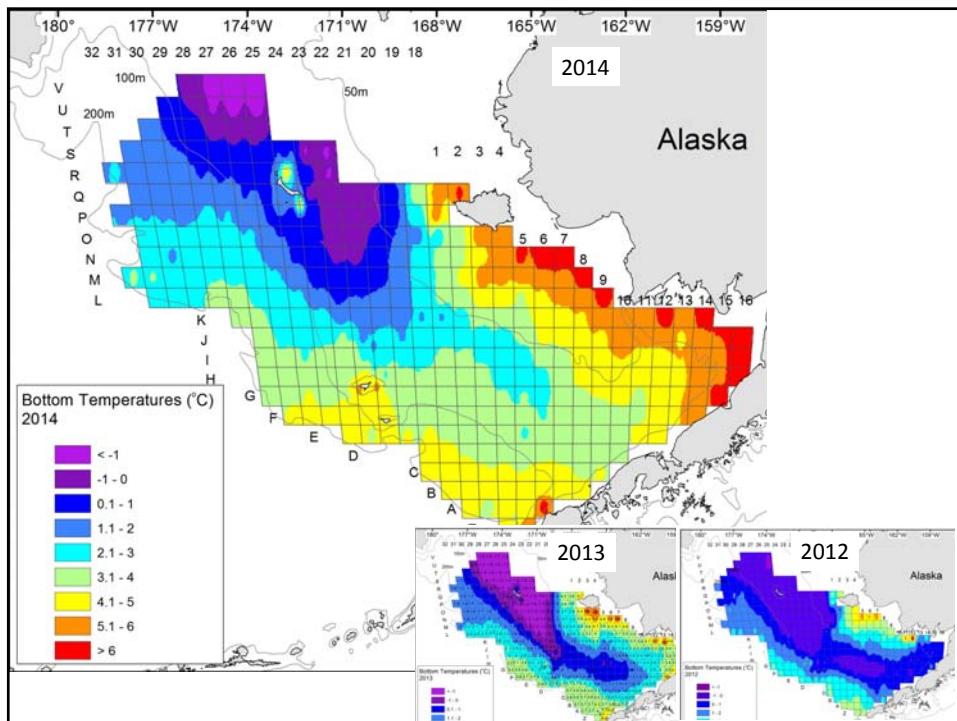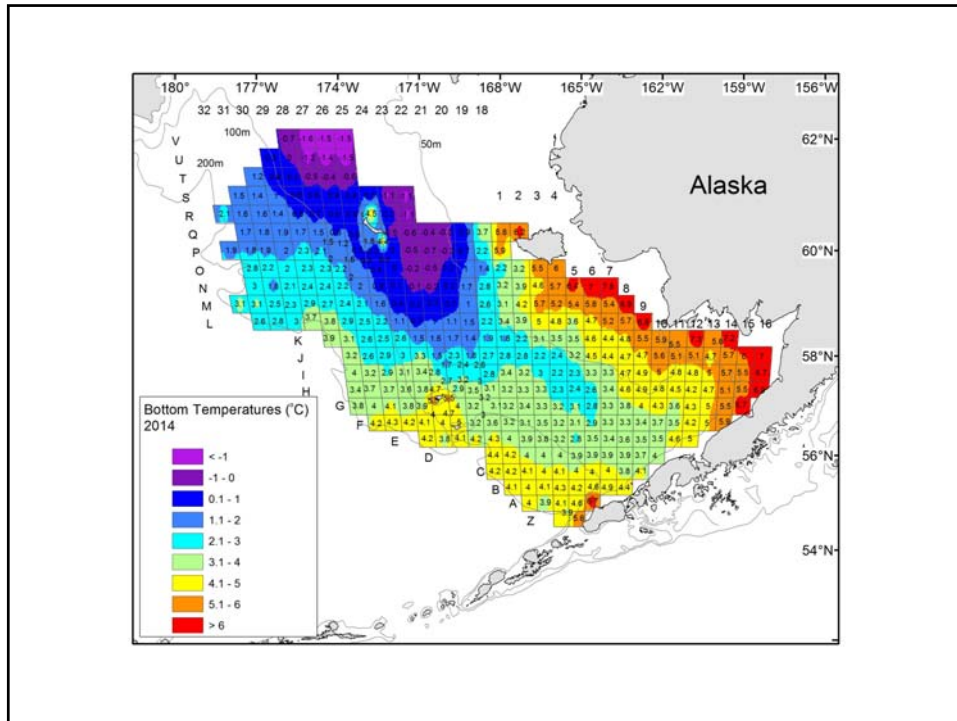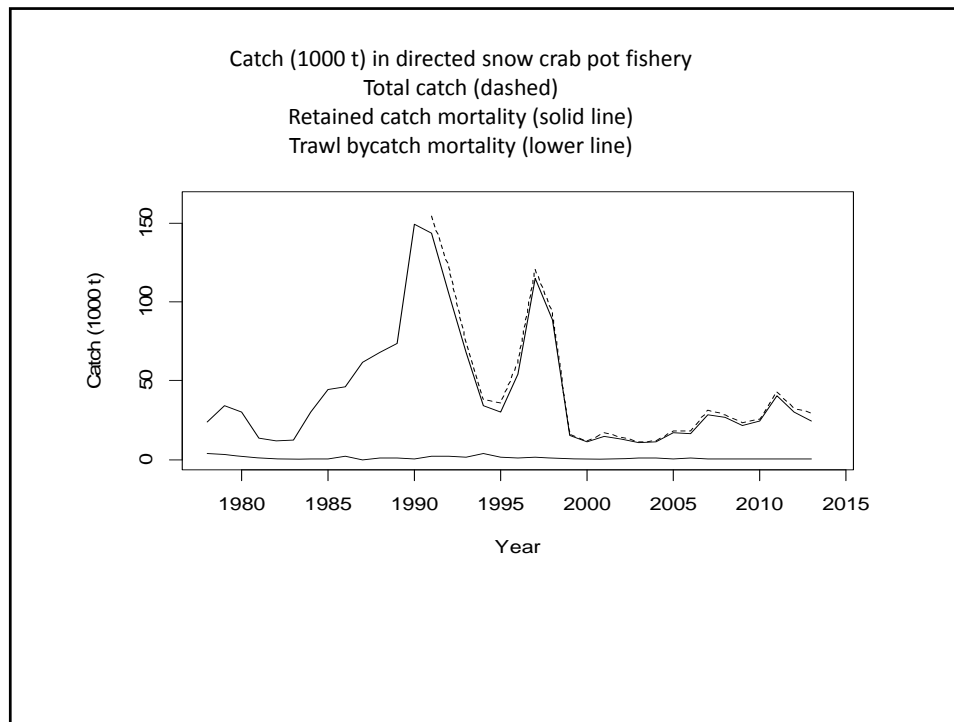
Special projects related to crab species

Project Title	Principle Investigator	Agency
Bitter crab syndrome	Pam Jensen	RACE[1]-SAP[2]
Snow crab age determination	Pam Jensen	RACE[1]-SAP[2]
Cod predation on red king crabs	Ben Daly	RACE[1]-SAP[2]
Effects of ocean acidification on snow crabs	Kathy Swiney	RACE[1]-SAP[2]
Male snow crab physiological maturity	Kathy Swiney	RACE[1]-SAP[2]
Annual vs. biennial snow crab reproductive cycle	Kathy Swiney	RACE[1]-SAP[2]
Location of red king crab spawning grounds	Chris Long	RACE[1]-SAP[2]
Snow crab growth and habitat associations	Cliff Ryer	RACE[1]-FBE[3]
Reproductive potential of female Tanner crabs	Laura Stichert	ADF&G[4]
Reproductive potential of female snow crabs	Laura Stichert	ADF&G[4]

2014 Stock Assessments

Bering Sea snow crab

snow crab (*Chionoecetes opilio*) total density

snow crab (*Chionoecetes opilio*) total density

Catch (1000 t) in directed snow crab pot fishery
Total catch (dashed)
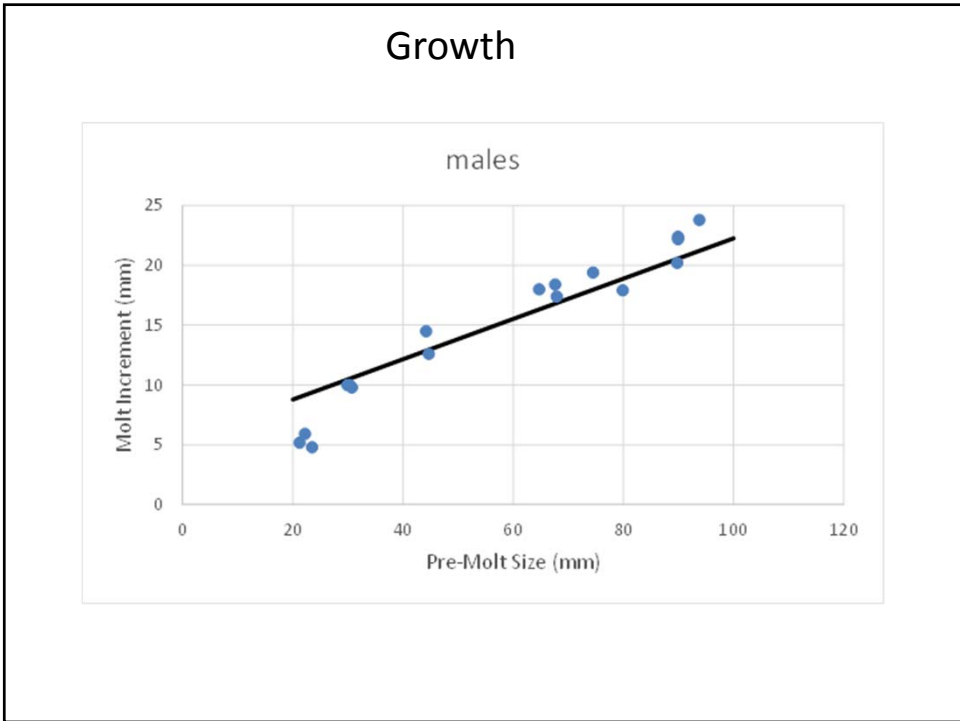Retained catch mortality (solid line)
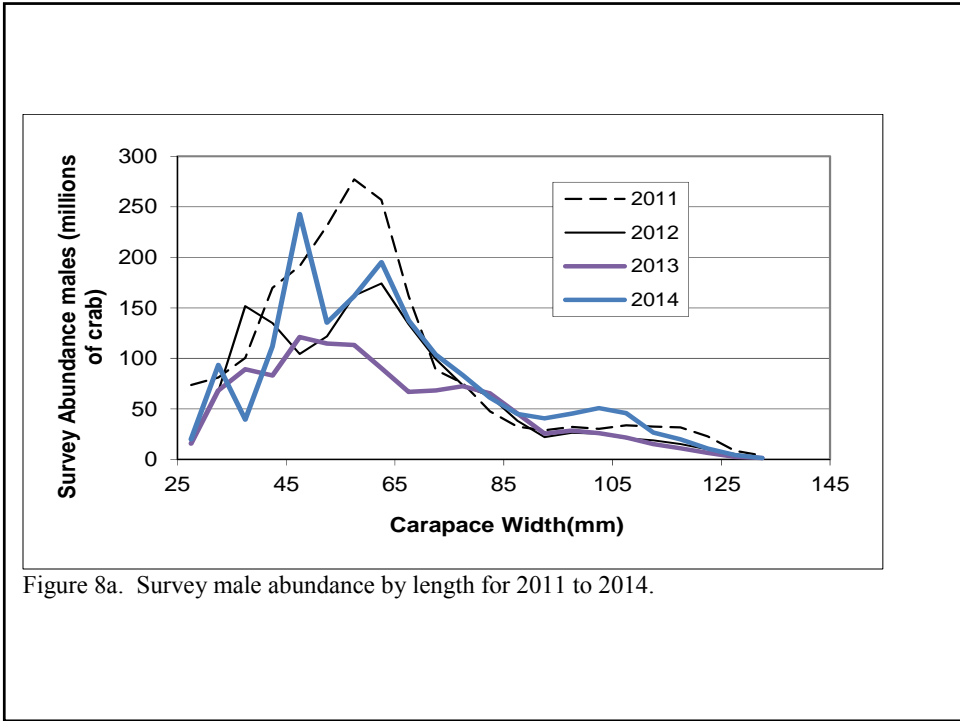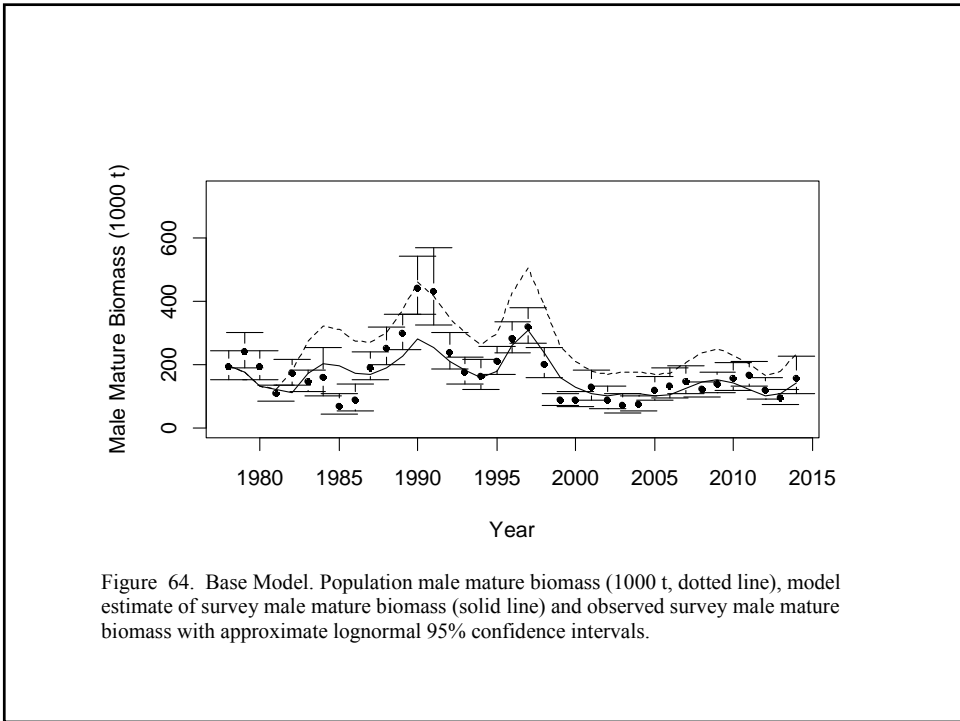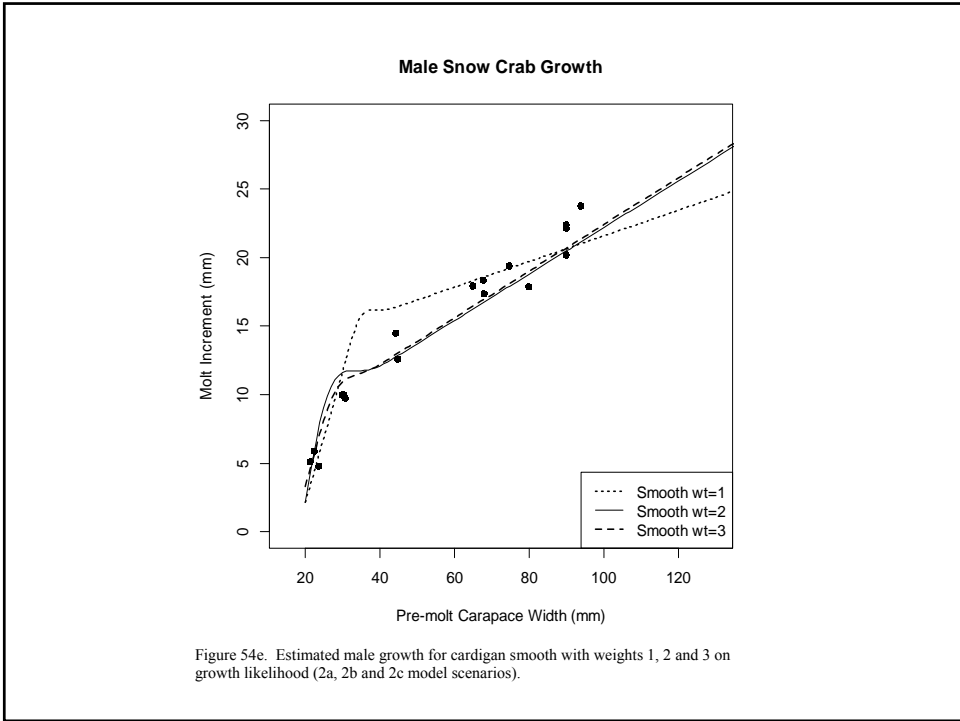Trawl bycatch mortality (lower line)

Model scenarios

- Model 0 – September 2013 model – one linear function by sex to fit growth data
- Model 1 – Two linear functions by sex with a fixed intersection point
- Models 2a, Base model 2b and 2c – **Growth data** fit in model using two linear segments with a smooth transition by sex (**Recommended by CIE review**) with weight of 1, 2 and 3 on growth likelihood (sd 0.47, 0.71 and 1.41).
- Models 2d through 2g – Sensitivity to fishing mortality penalties – weights on penalties relative to the Base model 2b of 0.5, 0.25, 0.1 and 0.001.
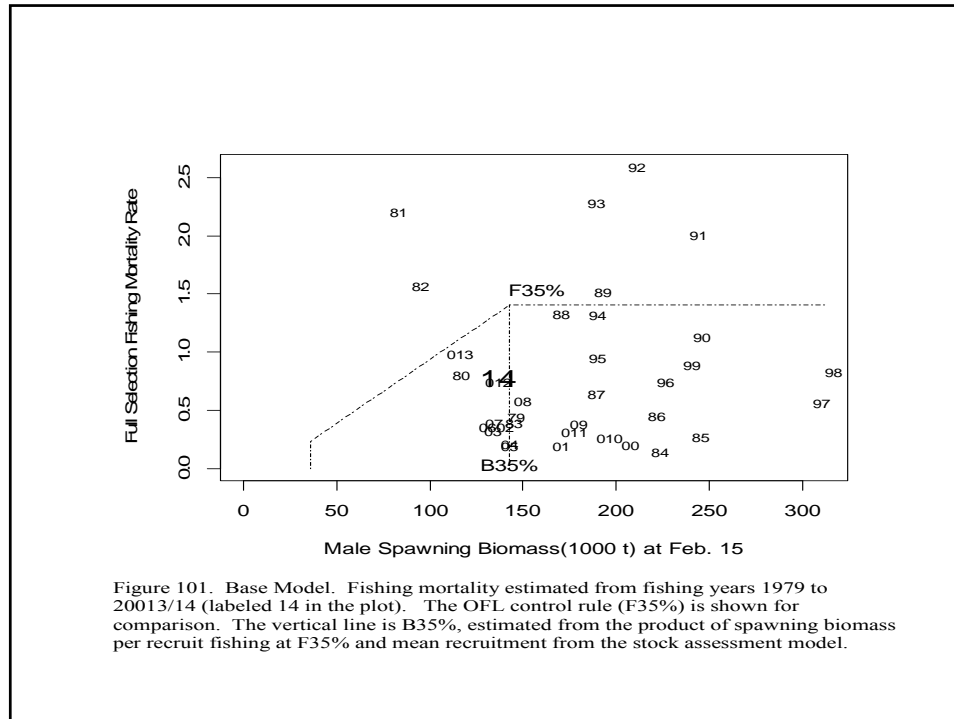
Figure 8a. Survey male abundance by length for 2011 to 2014.

Male Snow Crab Growth

Figure 54e. Estimated male growth for cardigan smooth with weights 1, 2 and 3 on growth likelihood (2a, 2b and 2c model scenarios).

Figure 64. Base Model. Population male mature biomass (1000 t, dotted line), model estimate of survey male mature biomass (solid line) and observed survey male mature biomass with approximate lognormal 95% confidence intervals.

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CPT Discussion

- Issue: although the survey estimate increased in 2014 the OFL was lower.
- In 2013 the model overpredicted the survey data.
- This year the model correctly fit 2013 data with new crab size data. And now the trend is increasing.
- Long term model fit looks good for males but still needs to fit the females better.

Table 14. Reference values for 9 model scenarios.

Model	0	1	2a	2b	2c	2d	2e	2f	2g
	Sept 2013 model	Two line model	Model gr wt 1	Base Model Gr wt 2	Model gr wt 3	0.5 F penalty	0.25 F penalty	0.1 F penalty	0.001 F penalty
B35%	141.9	148.9	141.3	142.9	143.7	141.3	139.7	137.3	134.1
F35%	1.5	1.6	1.5	1.4	1.4	1.5	1.5	1.6	2.0
OFL 2014/15	67.1	81.2	83.6	69.0	70.6	66.9	63.6	59.3	52.7
ABC(p*=.49) 2014/15	66.9	80.9	83.3	68.8	70.3	66.6	63.4	59.1	52.6
ABC(90%OFL) 2014/15	60.4	73.1	75.2	62.1	63.5	60.2	57.2	53.4	47.4
Percent MMB/B35% 2013/14	94.7	99.9	99.9	96.3	97.3	95.4	93.4	91.7	87.8
Survey Q 1989-present	0.61	0.57	0.59	0.61	0.61	0.63	0.64	0.65	0.68
M mature males	0.27	0.27	0.28	0.27	0.27	0.27	0.27	0.27	0.27

Figure 101. Base Model. Fishing mortality estimated from fishing years 1979 to 20013/14 (labeled 14 in the plot). The OFL control rule (F35%) is shown for comparison. The vertical line is B35%, estimated from the product of spawning biomass per recruit fishing at F35% and mean recruitment from the stock assessment model.
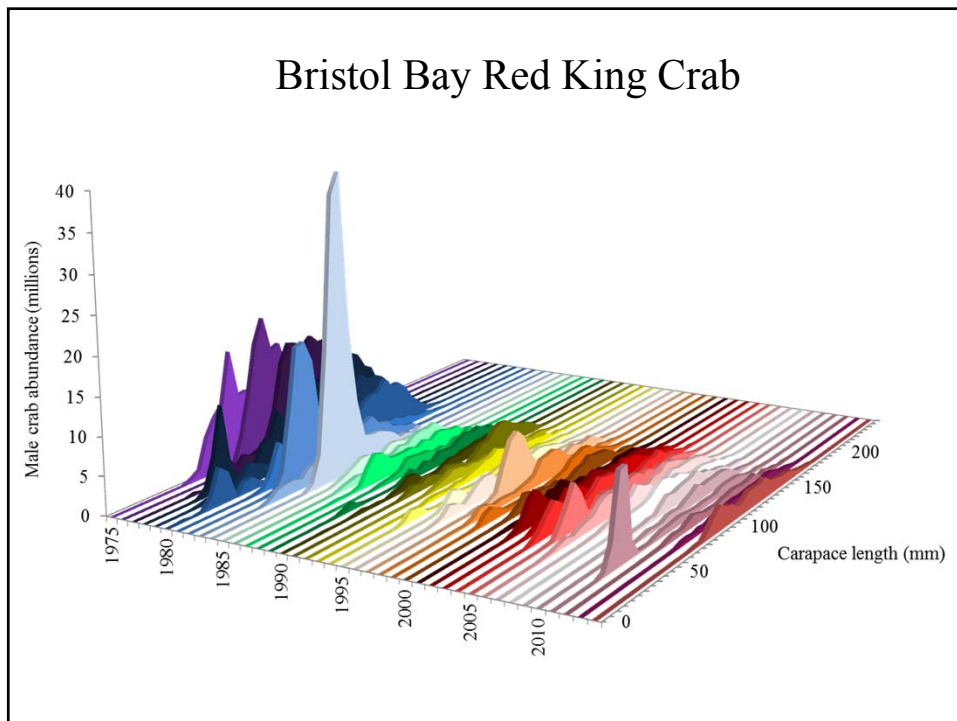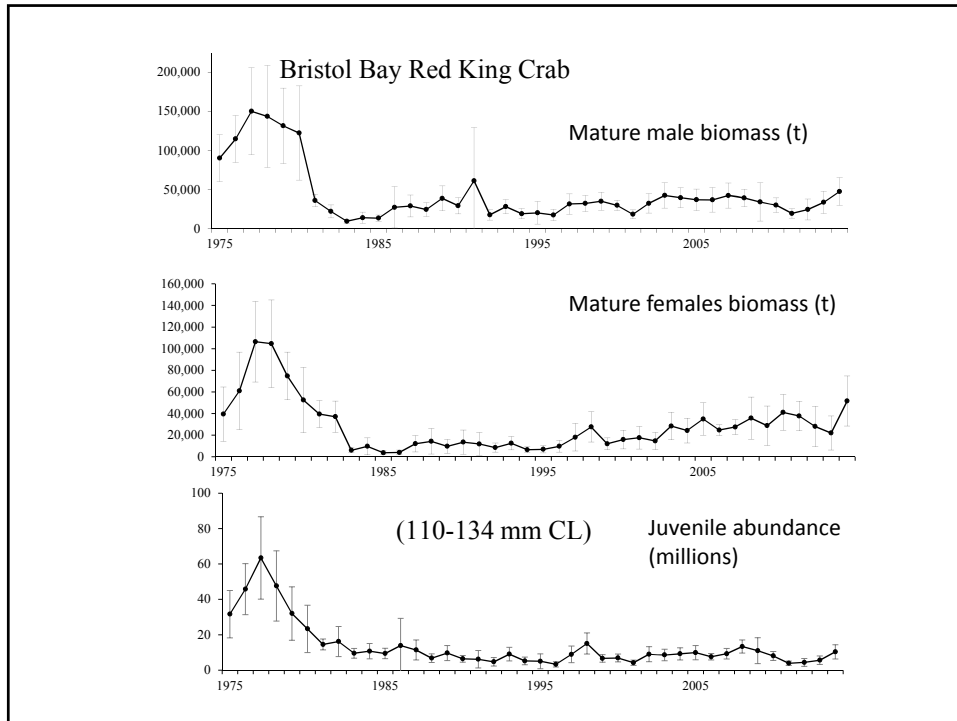
Snow crab status

- 2013/2014 total catch = 28.1 (1000 t)
- 2013/2014 OFL = 78.1 (1000 t)
- Overfishing is not occurring

- 2013/2014 MSST= 71.5 (1000 t)
- 2013/2014 MMB = 126.5 (1000 t)
- Stock is not overfished

Snow crab OFL and ABC recommendations

- CPT and SSC concur with the Authors recommendations for OFL and ABC.

- Biomass (MMB) = 137.6 (1000 t)

- Biomass = 96% of B_{MSY}

- OFL = 69.0 (1000 t)

- ABC = 10% buffer = 62.1 (1000 t)

Bristol Bay Red King Crab Assessment

Bristol Bay Red King Crab

Mature male biomass (t)

Mature females biomass (t)

(110-134 mm CL)   Juvenile abundance (millions)

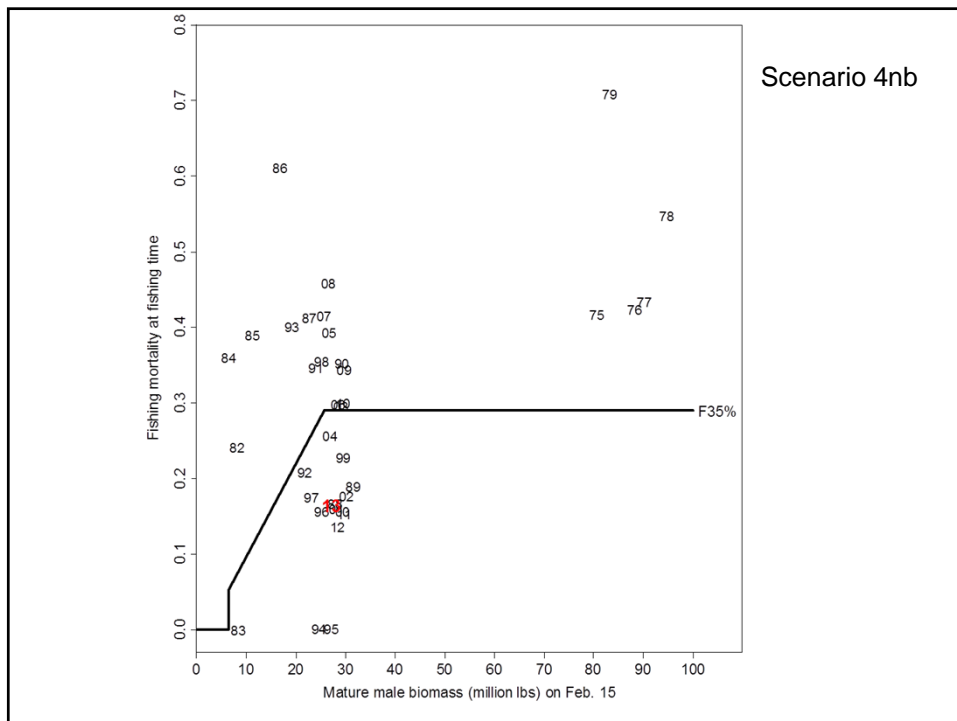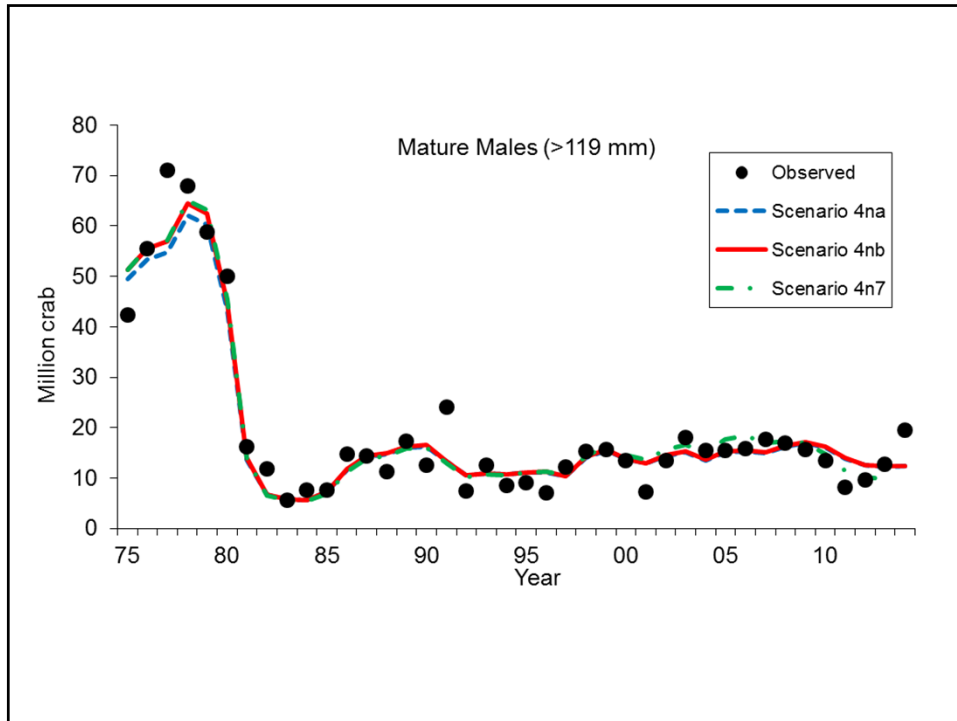Bristol Bay Red King Crab

Shift in distribution 1970s-1980s

- Directed fishery
  - Centroid analysis
- Environmental variables
  - Temperature and winter PDO
- Groundfish fishery
  - GF trawling excluded from breeding area
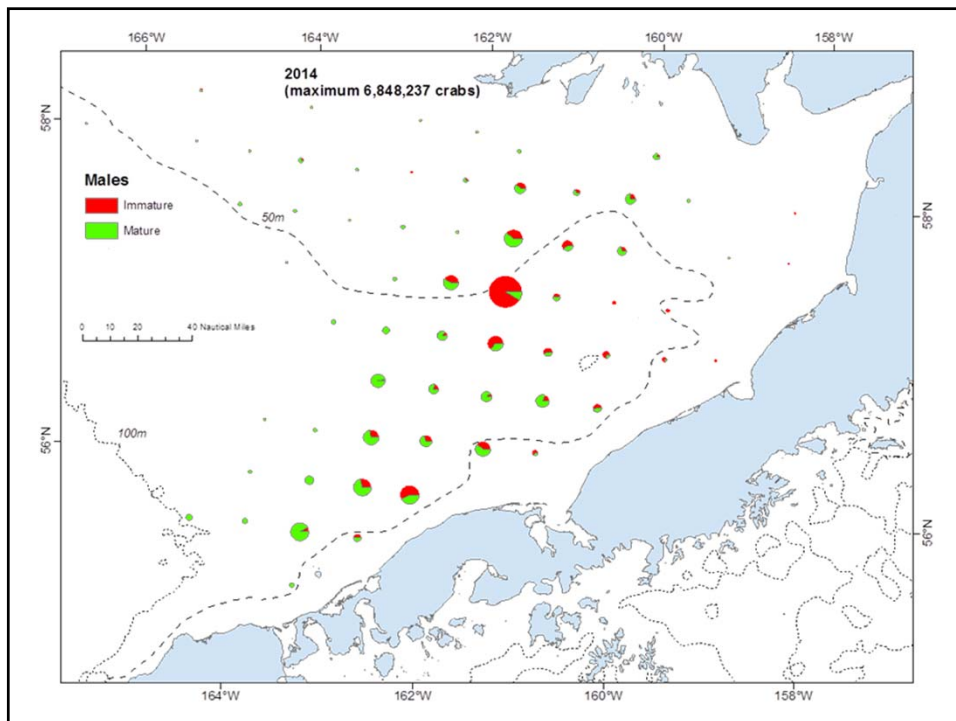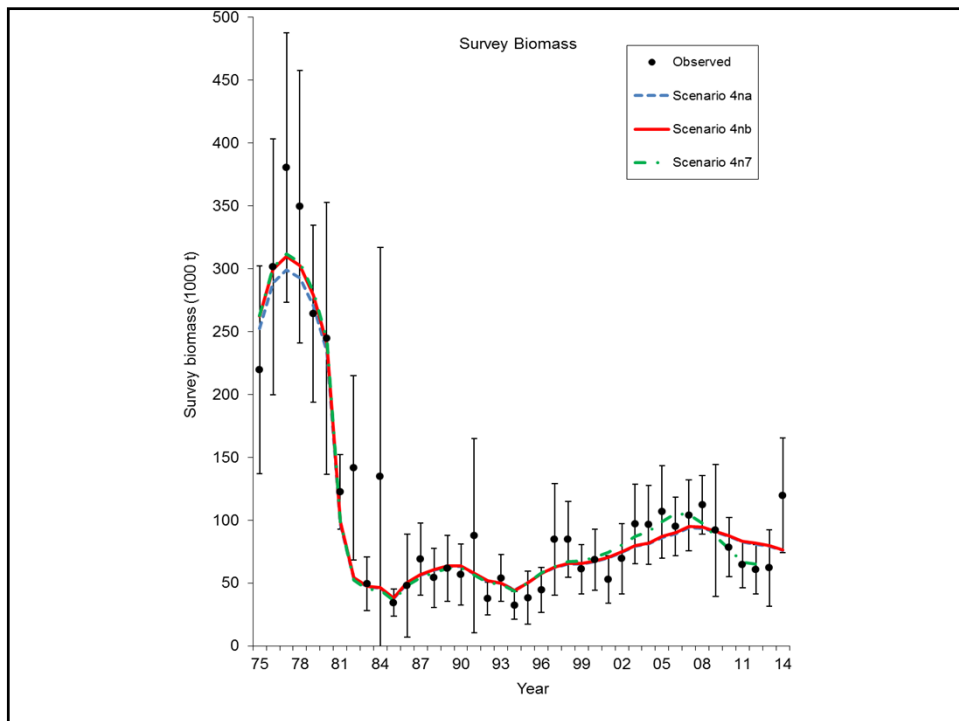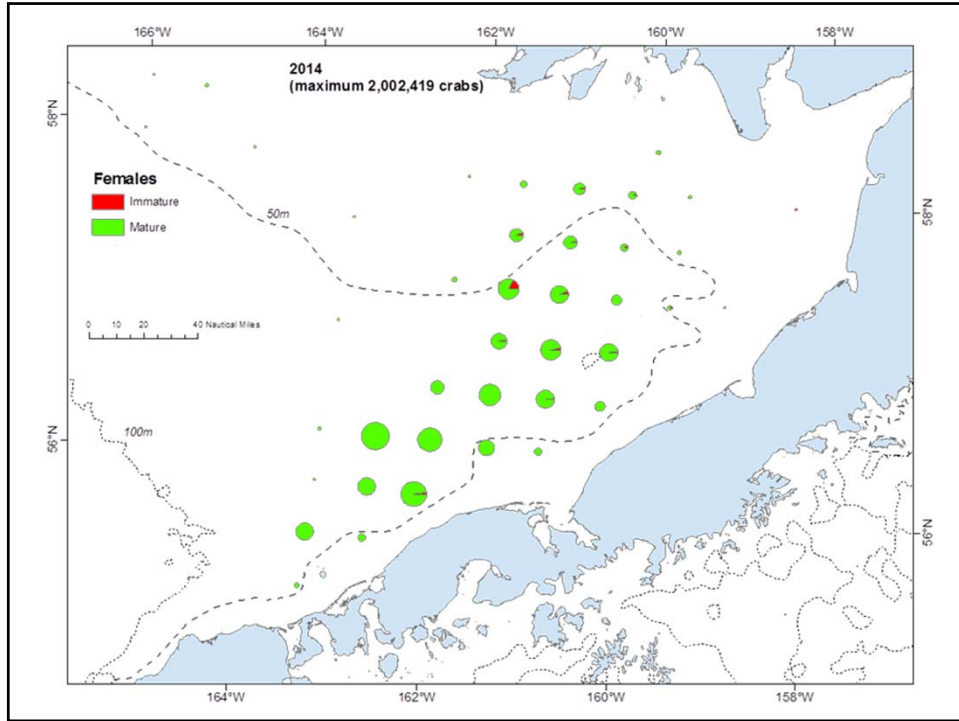
Bristol Bay red king crab status

- 2013/2014 total catch = 4.56 (1000 t)
- 2013/2014 OFL = 7.07 (1000 t)
- Overfishing is not occurring

- 2013/2014 MSST= 12.85 (1000 t)
- 2013/2014 MMB = 27.12 (1000 t)
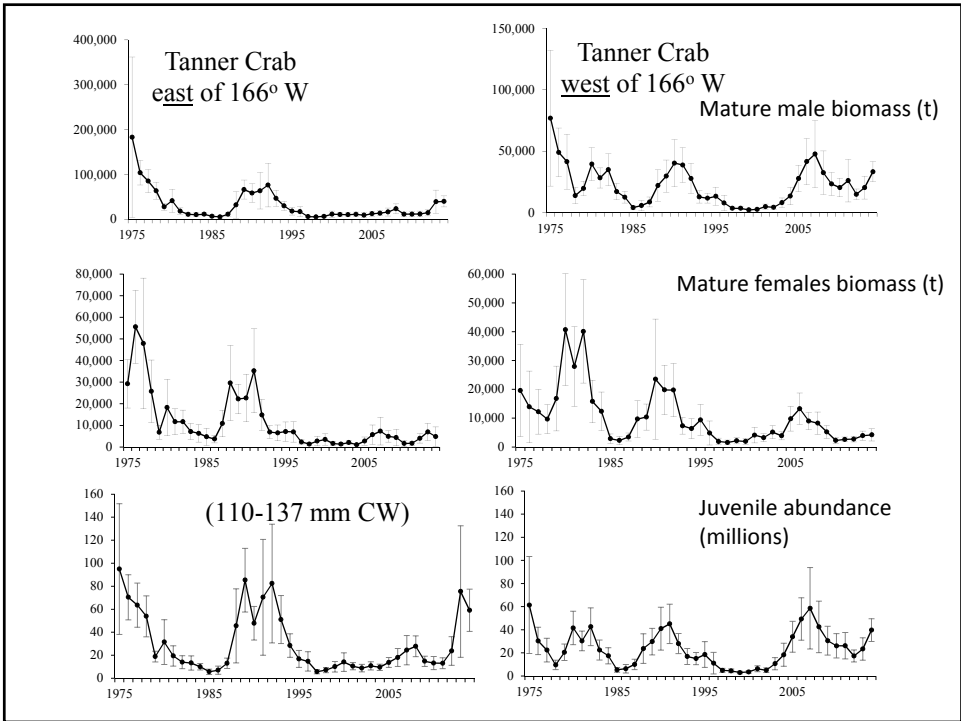- Stock is not overfished

Bristol Bay red king crab OFL and ABC recommendations
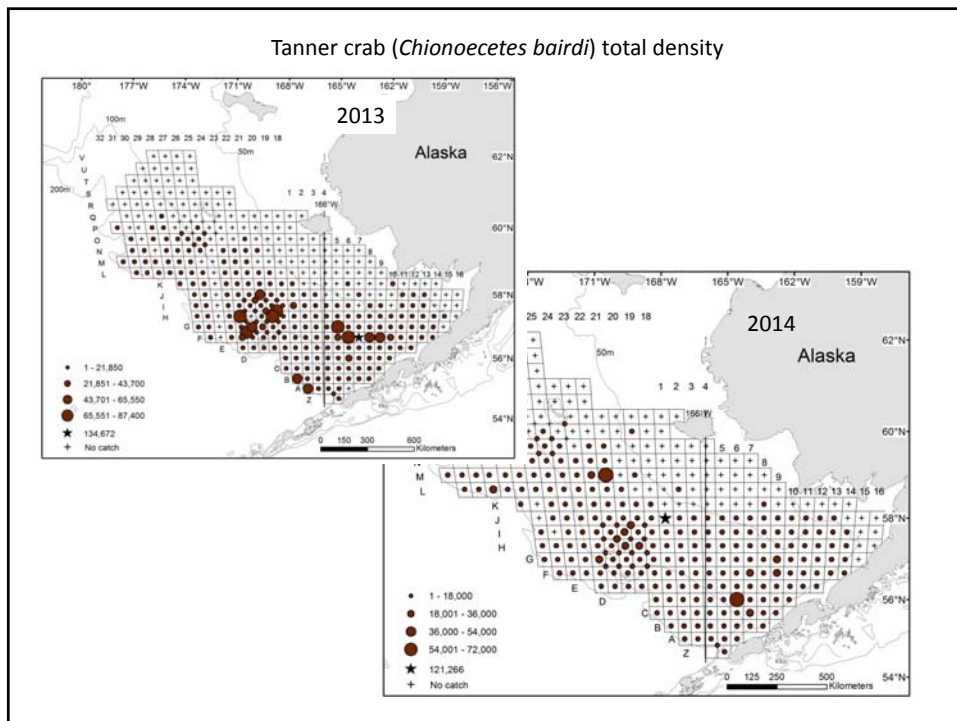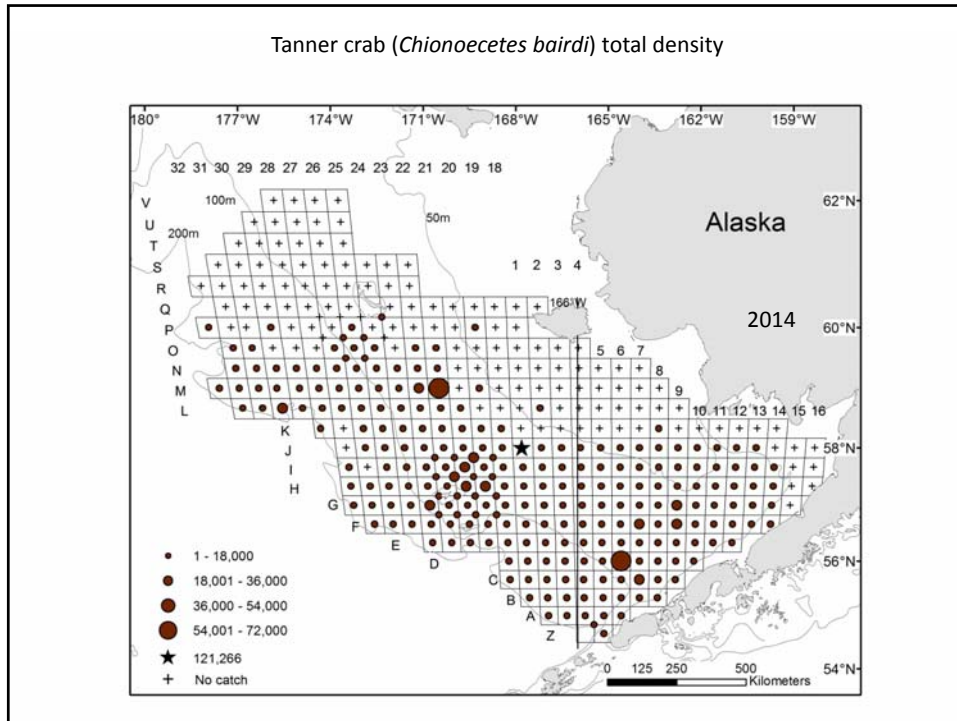
- CPT and SSC concur with the Authors recommendations for model, OFL, and ABC.

- Biomass (MMB) = 24.7 (1000 t)
- Biomass = 96% of B_{MSY}
- OFL = 6.8 (1000 t)

- ABC = 10% buffer = 6.1 (1000 t)

Bering Sea Tanner crab

Tanner crab (*Chionoecetes bairdi*) total density

Tanner crab (*Chionoecetes bairdi*) total density

Model Scenarios

Scenario	Handling Mort.	Data	options
Alt0a	50%	no revised data, 2014 added	2013 model
Alt0b	32.1%	no revised data, 2014 added	2013 model lower handling mortality
Alt1a	50%	all revised data through 2014	sample sizes corrected for GF size comps
Alt4a	50%	all revised data through 2014	same as Alt1a with reparameterized snow crab selectivity function
Alt4b	32.1%	all revised data through 2014	same as Alt1a with reparameterized snow crab selectivity function
Alt4c	23%	all revised data through 2014	same as Alt1a with reparameterized snow crab selectivity function

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Model Fits: Survey Data
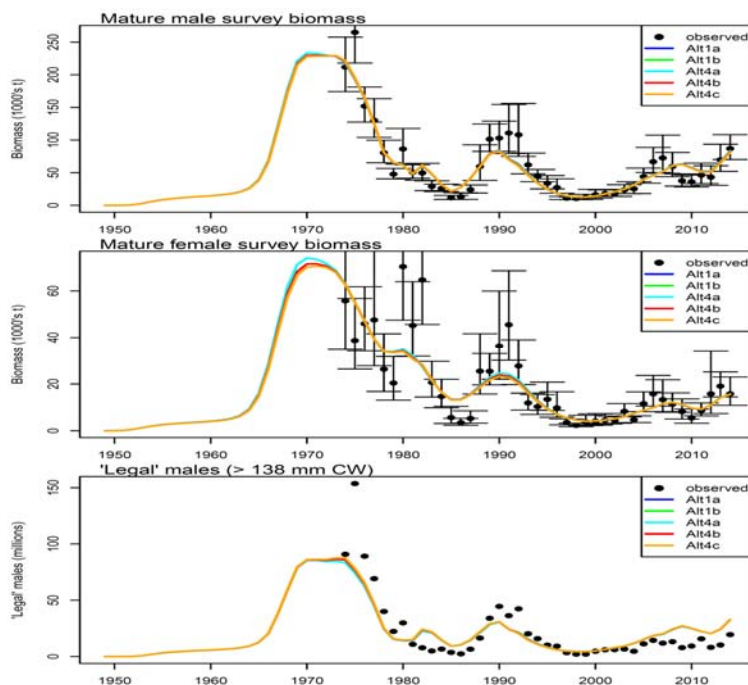
CPT Discussion

- Expect a decrease in handling mortality to lead to higher OFL/ABC.
- Expectations of fishing mortality changed very little suggesting that this model is not sensitive to this parameter.
- Lower handling mortality meant that the model estimated fewer recruits.
- Author to explore the size composition for males in the directed fishery.
- Author to explore how growth is handled in the model.

Tanner crab status

- 2013/2014 total catch = 2.78 (1000 t)
- 2013/2014 OFL = 25.35 (1000 t)
- Overfishing is not occurring

- 2013/2014 MSST= 16.98 (1000 t)
- 2013/2014 MMB = 72.70 (1000 t)
- Stock is not overfished

Tanner crab OFL and ABC recommendations

- CPT and SSC concurred on different model than Author recommendation.
- CPT and SSC concur on OFL and ABC.

- Biomass (MMB) = 63.8 (1000 t)
- Biomass = 214% of B_{MSY}
- OFL = 31.5 (1000 t)

- ABC = 20% buffer = 25.2 (1000 t)

Pribilof Islands red king crab

Pribilof Islands Red King Crab

Mature male biomass (t)

Mature females biomass (t)

(120-134 mm CL)   Juvenile abundance (millions)

Pribilof Islands Red King Crab

2012

2013

2014

Very Old
Old
New - Hard
Soft & Molting

Crab abundance (millions)

Carapace length (mm)
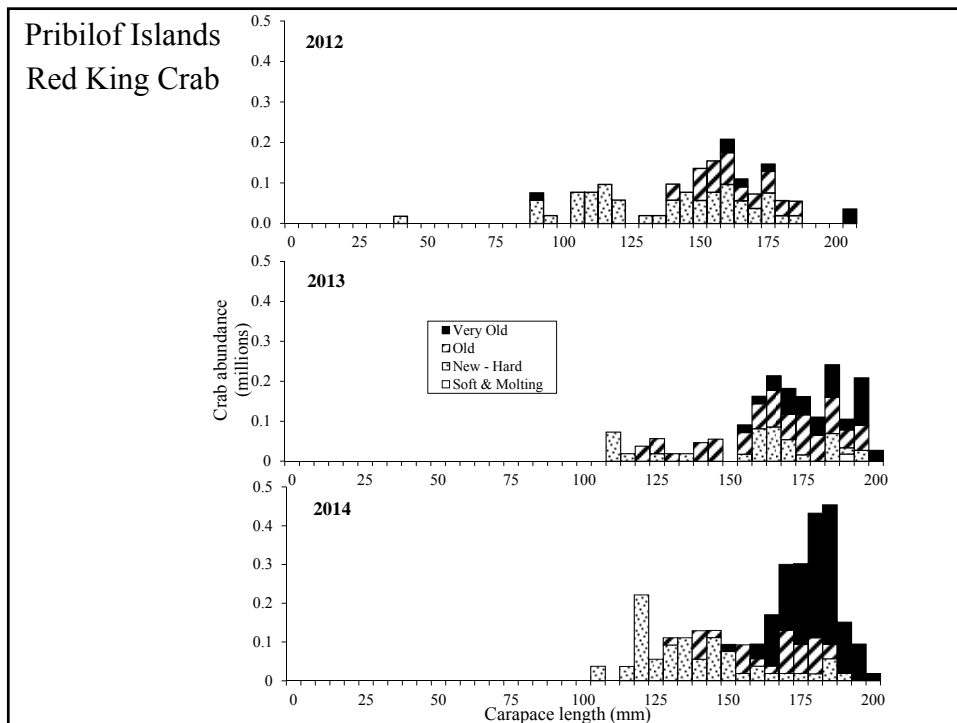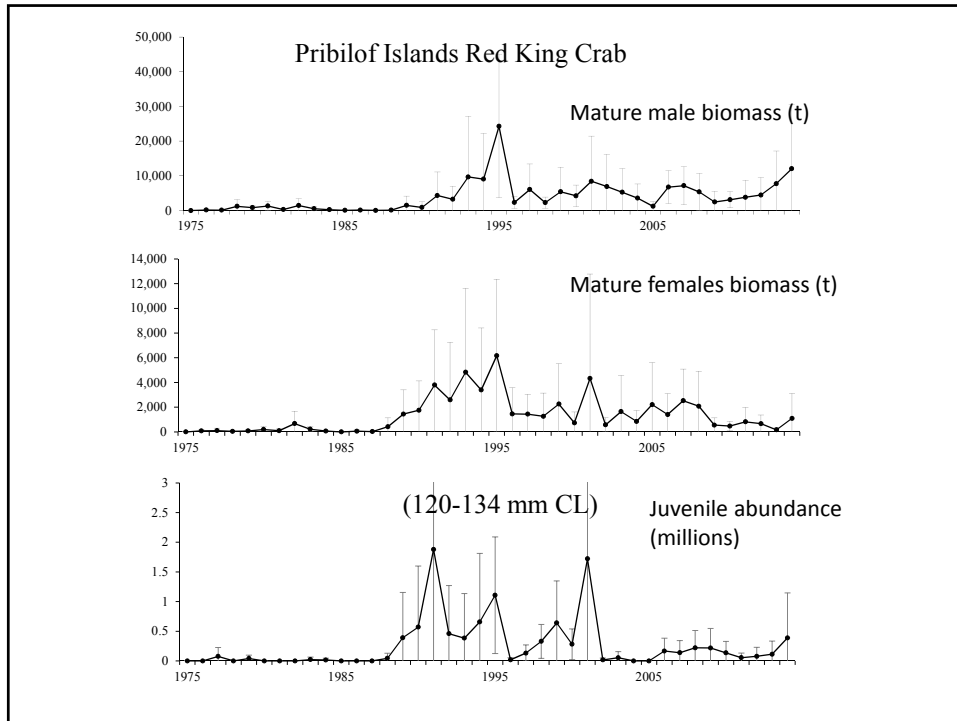
A comparison of three different assessment methods:

Assessment method	Harvest strategy
Weighted 3-year running average	Tier 4 HCR
Integrated assessment	Tier 4 HCR
Integrated assessment	Tier 3 HCR

But, no directed fishery…

Tier	Assessment Method	OFL	B_{MSY}	Cur. MMB	B/B_{MSY} (MMB)	γ	Years to define B_{MSY}	F_{MSY}	P*	ABC
4	Running Average	1359	5742	8894	1.55	1.0	1991/1992-2013/2014 (MMB)	0.18	0.49	1338
3	Integrated assessment	801	1034	2239	2.16	1.0	1983-present (recruitment)	0.53	0.49	771
4	Integrated assessment	320	2754	2239	0.81	1.0	1991/1992-2013/2014 (MMB)	0.18	0.49	311
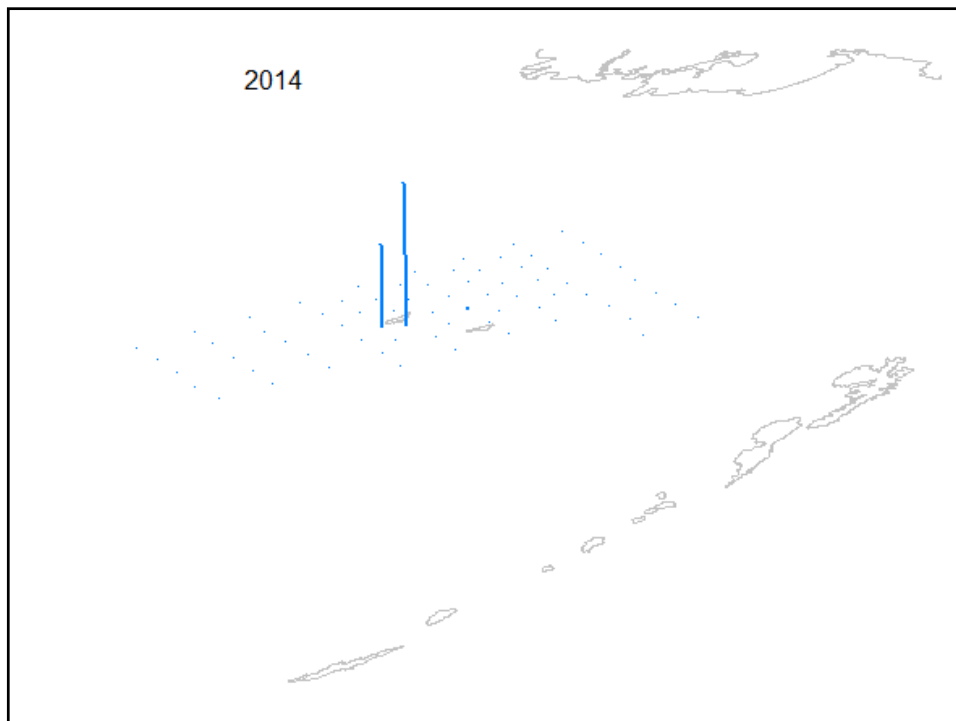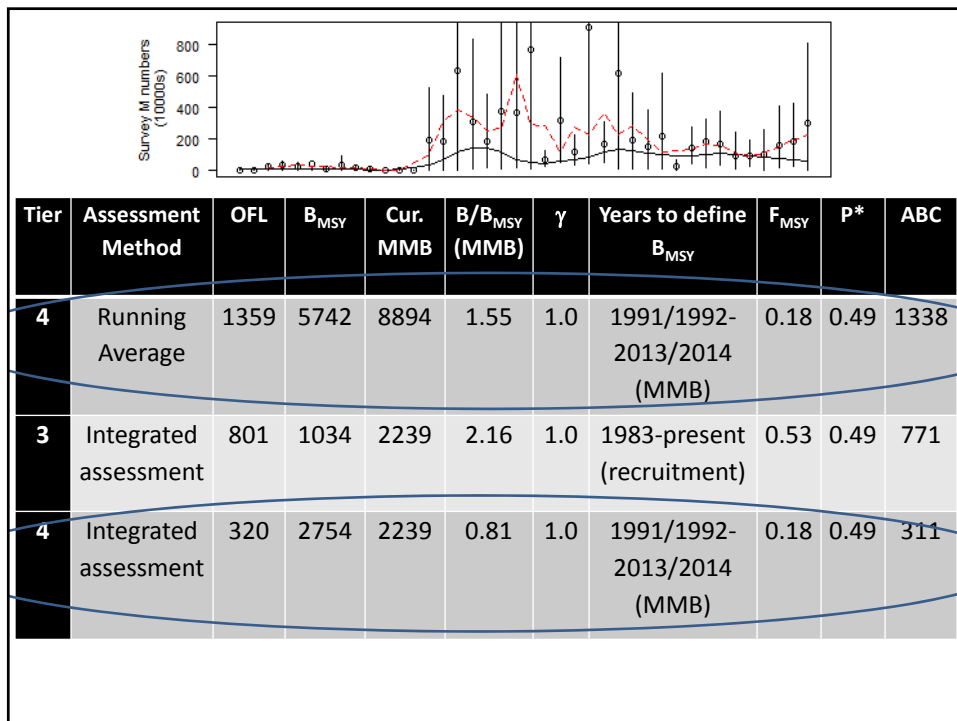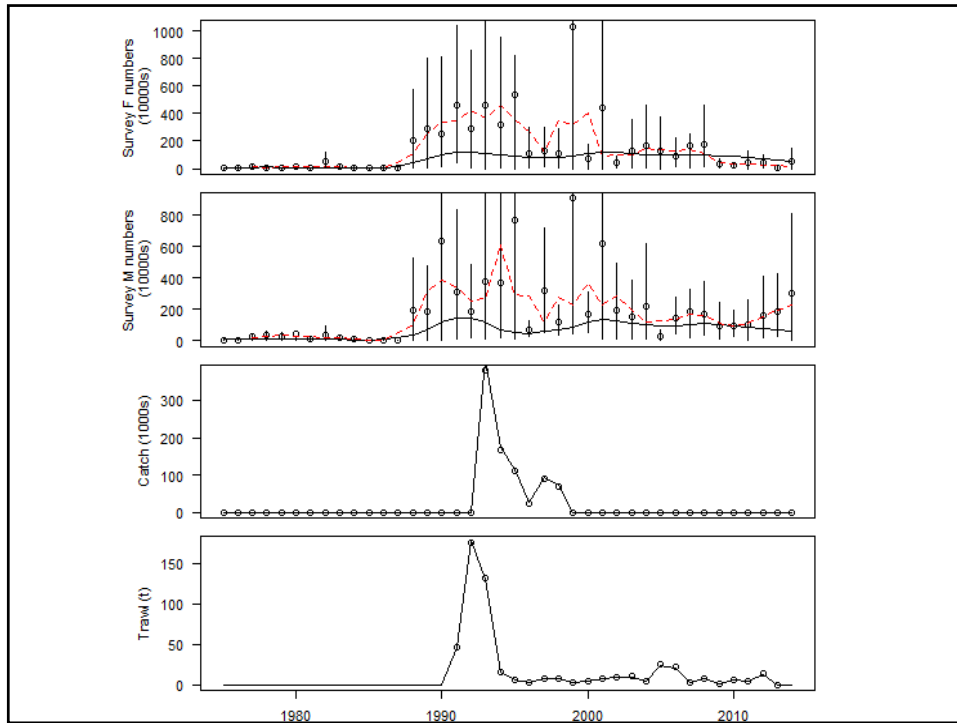
Pribilof Islands red king crab status

- 2013/2014 total catch = 2.25 t
- 2013/2014 OFL = 903 t
- Overfishing is not occurring

- 2013/2014 MSST= 2,582 t
- 2013/2014 MMB = 4,679 t
- Stock is not overfished

Pribilof Islands red king crab OFL and ABC recommendations

- SSC did not agree with the CPT or Author recommended model, OFL, and ABC.
- Use the Tier 4 assessment with survey data until model fits trawl time series better.

- OFL=1,359 t
- ABC = 25% buffer = 1,019t

Pribilof Islands blue king crab

Pribilof Island Blue King Crab Biomass (t)

(120-134 mm CL)
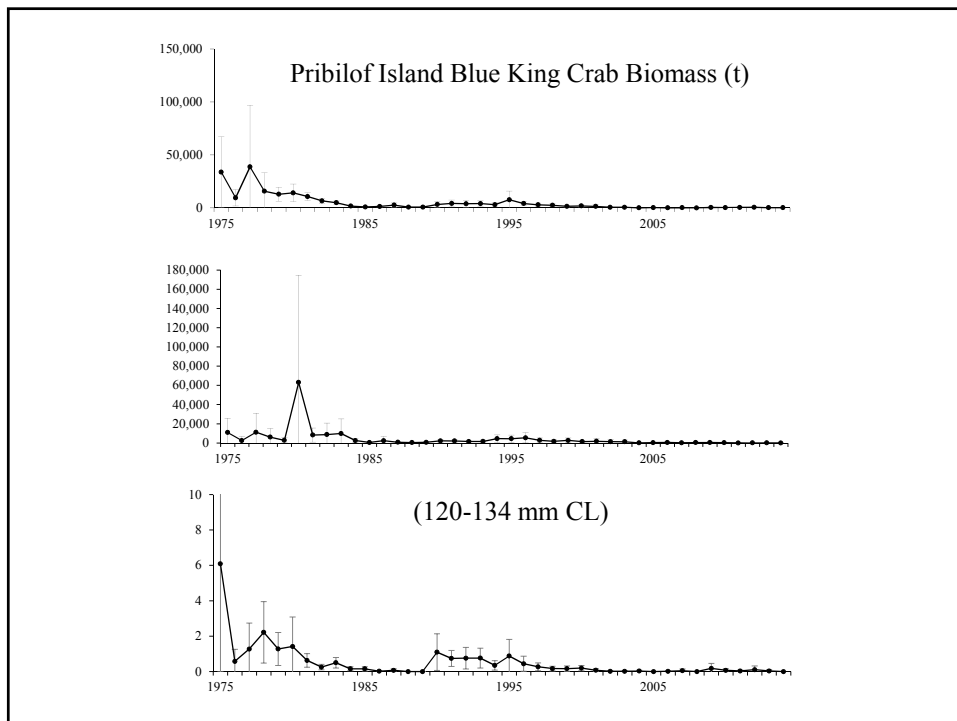
Bycatch in the groundfish fisheries

year	2013 estimates		2014 estimates		% change	
	fixed gear	trawl gear	fixed gear	trawl gear	fixed gear	trawl gear
2009/10	1.04	0.17	0.11	0.17	-89	0
2010/11	0.05	0.05	0.02	0.05	-60	0
2011/12	0.06	0.01	0.06	0.01	0	0
2012/13	0.08	0.54	0.08	0.54	0	0

AKRO improved approach to expanding from observer data to unobserved catch for 2009/10+:
- using state statistical areas for better spatial resolution
- revised last year's approach to filling in missing strata in expansion methods

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Bycatch in the groundfish fisheries

Crab Fishery Year	% bycatch by trip target					total bycatch (# crabs)
	yellowfin sole %	Pacific cod %	flathead sole %	rocksole %	sablefish %	
2003/2004	47.0	22.0	31.0	0.0	0.0	252
2004/2005	0.0	100.0	0.0	0.0	0.0	259
2005/2006	0.0	97.0	3.0	0.0	0.0	757
2006/2007	54.0	20.0	0.0	26.0	0.0	96
2007/2008	3.0	96.0	1.0	0.0	0.0	2,950
2008/2009	77.0	23.0	0.0	0.0	0.0	295
2009/2010	30.5	51.1	16.8	0.0	<1	281
2010/2011	<1	38.5	59.0	0.0	<1	48
2011/2012	<1	99.8	<1	0.0	<1	63
2012/2013	77.2	20.0	2.9	0.0	<1	410
2013/2014	<1	99.2	<1	0.0	<1	26

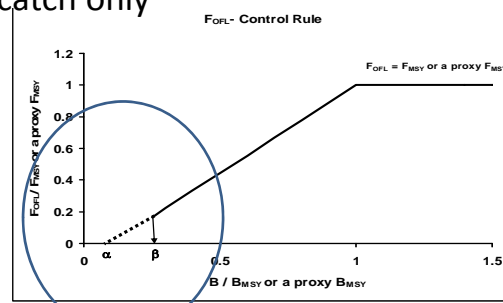| Crab Fishery Year	% bycatch by gear type				total bycatch (# crabs)
	hook and line %	non-pelagic trawl %	pot %	pelagic trawl %	
2003/04	21	79	0	0	252
2004/05	99	1	0	0	259
2005/06	18	3	79	0	757
2006/07	20	20	0	0	96
2007/08	1	3	95	0	2,950
2008/09	23	77	0	0	295
2009/10	7	49	44	0	281
2010/11	41	59	0	0	48
2011/12	94	6	0	0	63
2012/13	20	80	0	0	410
2013/14	100	0	0	0	26

Trawl Survey Results

2014 Survey

Stock Component	Number of tows in District 2014	Tows with crab 2014	Number of crab measured 2014	Number of crab crab caught 2014	Abundance (millions)	Biomass (mt)
Immature male	86	3	5	5	0.091	83
Mature male	86	2	5	5	0.092	233
Legal male	86	2	5	5	0.092	233
Immature female	86	1	1	1	0.028	16
Mature female	86	3	4	4	0.074	91

2013 Survey
- 6 mature males
- 3 immature males
- 6 mature females

OFL and ABC recommendations

- Biomass = 0.28 t

- Biomass = 5% of BMSY

- Tier 4 stock status 'c':
  - Directed F = 0
  - OFL established for bycatch only

F_{OFL}- Control Rule

$F_{OFL} = F_{MSY}$ or a proxy F_{MSY}

y-axis: F_{OFL} / F_{MSY} or a proxy F_{MSY}

x-axis: B / B_{MSY} or a proxy B_{MSY}

Modified Tier 4 specifications

- Base OFL on average catch:
  - 1999/00 – 2005/06 = 1.16
- ABC: CPT recommended 25% buffer
  - applies to bycatch only as directed fishery closed
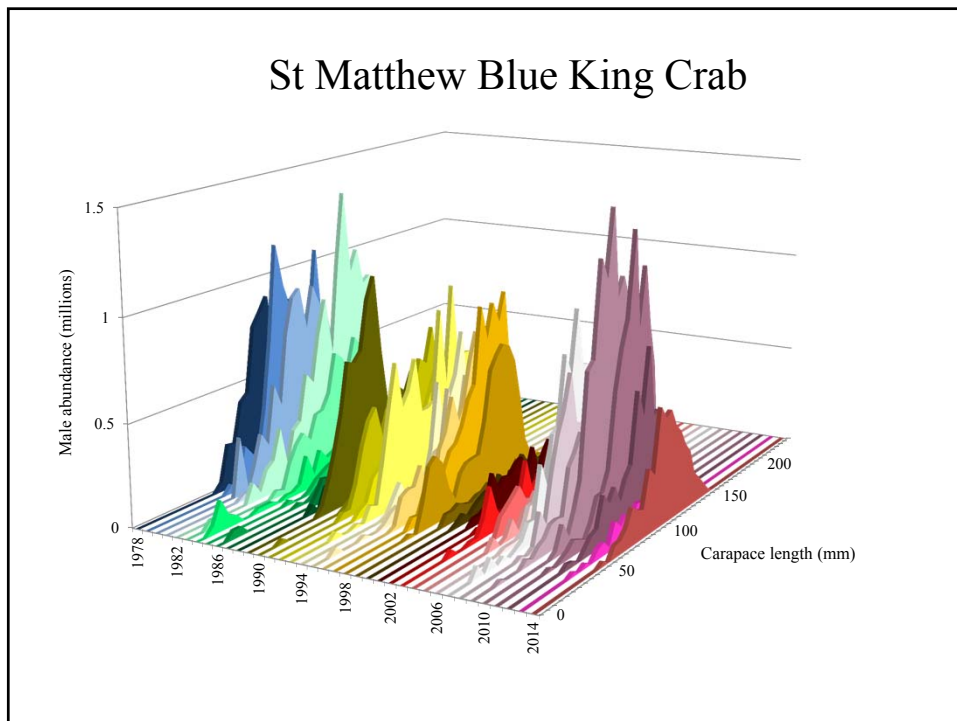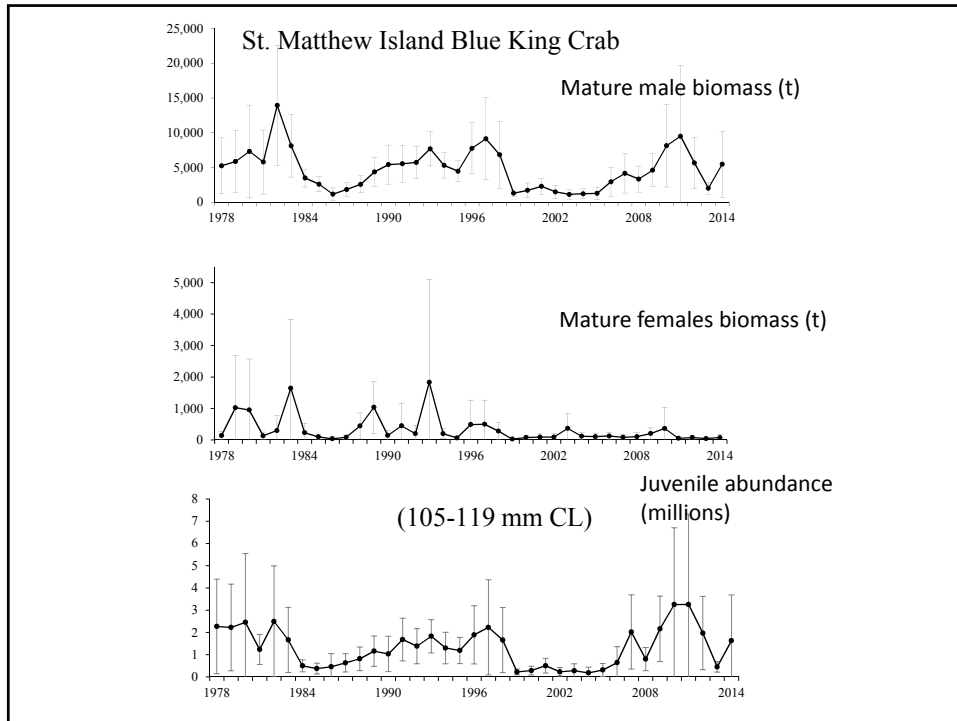
Pribilof Islands blue king crab status

- 2013/2014 total catch = 0.03 t
- 2013/2014 OFL = 1.16 t
- Overfishing is not occurring

- 2013/2014 MSST= 2,001 t
- 2013/2014 MMB = 278 t
- **Stock is overfished**

Pribilof Islands blue king crab OFL and ABC recommendations
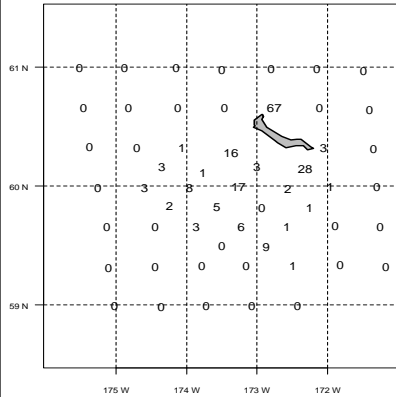
- CPT and SSC concur with Authors recommended model, OFL, and ABC.

- Biomass (MMB) = 218 t

- Biomass = 5% of B_{MSY}

- OFL = 1.16 t

- ABC = 25% buffer = 0.87 t

Saint Matthew Island Blue King Crab

St. Matthew Island Blue King Crab

Mature male biomass (t)

Mature females biomass (t)

(105-119 mm CL)

Juvenile abundance (millions)

St Matthew Blue King Crab

2014 Trawl-Survey Model Quantities

Area Swept Estimates

Stage-1 abundance	0.723 10^6
Stage-2 abundance	1.627 10^6
Stage-3 abundance	1.809 10^6
Model Male Biomass	13.292 10^6 lb (0.45)

181 male crab ≥ 90 mm CL

CPT/SSC Concerns
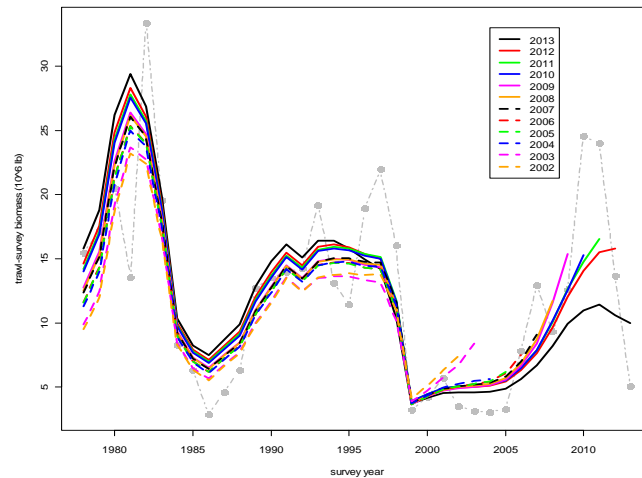
Retrospective plot of trawl-survey model-male (90mm+ CL) biomass for 2013 base-model configuration and terminal years 2002 – 2013. Estimates are based on all available data up to and including terminal-year trawl and pot surveys. (From 2013 SAFE.)

CPT/SSC Concerns
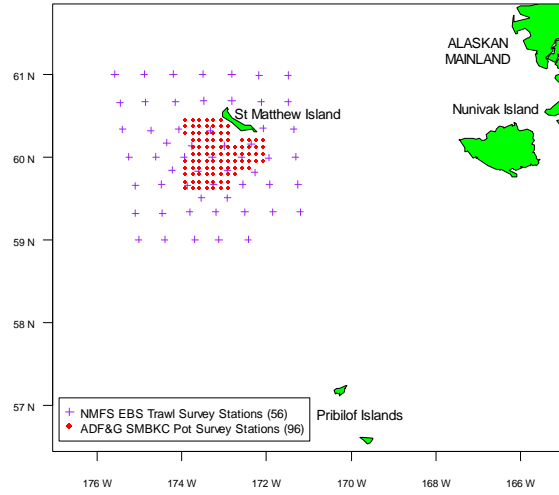
Trawl and pot-survey stations used in the SMBKC stock assessment.

Trawl-survey biomass data
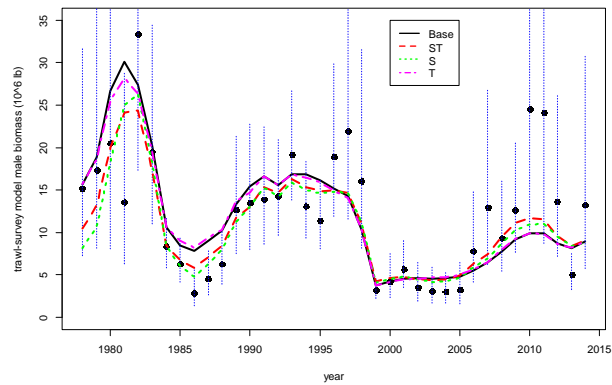
Pot-survey CPUE data
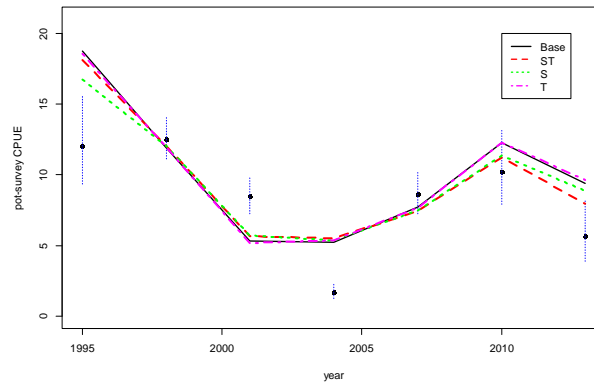
St. Matthew blue king crab status

- 2013/2014 total catch = 0.0003 (1000 t)
- 2013/2014 OFL = 0.56 (1000 t)
- Overfishing is not occurring

- 2013/2014 MSST= 1.5 (1000 t)
- 2013/2014 MMB = 3.04 (1000 t)
- Stock is not overfished

St. Matthew blue king crab OFL and ABC recommendations

- CPT and SSC concurred on different model than Author recommendation.
- CPT and SSC concur on OFL and ABC.

- Biomass (MMB) = 3.04 (1000 t)
- OFL = 0.43 (1000 t)
- ABC = 20% buffer = 0.34 (1000 t)

Pribilof Islands golden king crab

Table 1. Harvest history for the Pribilof District golden king crab fishery from the 1981/82 season through 2013 (from 2013 SAFE, updated with 2013 data provided by J. Shaisnikoff, ADF&G, Kodiak via 27 September 2014 email).

Season	Vessels	Landings	Number of Crabs[a]	Pots lifted	GHL[b]	Harvest[a,c]	Average Weight[c]	CPUE[d]	Length[e]	Deadloss[c]
1981/82	2	CF	CF	CF	-	CF	CF	CF	CF	CF
1982/83	10	19	15,330	5,252	-	69,970	4.6	3	151	570
1983/84	50	115	253,162	26,035	-	856,475	3.4	10	127	20,041
1984	0	0	0	0	-	0	0	0	0	0
1985	1	CF	CF	CF	-	CF	CF	CF	CF	CF
1986	0	0	0	0	-	0	0	0	0	0
1987	1	CF	CF	CF	-	CF	CF	CF	CF	CF
1988	2	CF	CF	CF	-	CF	CF	CF	CF	CF
1989	2	CF	CF	CF	-	CF	CF	CF	CF	CF
1990	0	0	0	0	-	0	0	0	0	0
1991	0	0	0	0	-	0	0	0	0	0
1992	0	0	0	0	-	0	0	0	0	0
1993	5	15	17,643	15,395	-	67,458	3.8	1	NA	0
1994	3	5	21,477	1,845	-	88,985	4.1	12	NA	730
1995	7	22	82,489	9,551	-	341,908	4.1	9	NA	716
1996	6	32	91,947	9,952	-	329,009	3.6	9	NA	3,570
1997	7	23	43,305	4,673	-	179,249	4.1	9	NA	5,554
1998	3	9	9,205	1,530	-	35,722	3.9	6	NA	474
1999	3	9	44,098	2,995	200,000	177,108	4.0	15	NA	319
2000	7	19	29,145	5,450	150,000	127,217	4.4	5	NA	4,599
2001	6	14	33,723	4,262	150,000	145,876	4.3	8	143	8,227
2002	8	20	34,860	5,279	150,000	150,434	4.3	6	144	8,984
2003	3	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2004	5	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2005	4	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2006-2009	0	0	0	0	150,000	0	0	0	0	0
2010	1	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2011	2	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2012	1	CF	CF	CF	150,000	CF	CF	CF	CF	CF
2013	1	CF	CF	CF	150,000	CF	CF	CF	CF	CF

Note: CF = confidential, less than three vessels or processors participated in fishery
[a] Deadloss included.
[b] Guideline harvest level (lb).
[c] lb.
[d] Number of legal crab per pot lift.
[e] Carapace length in millimeters.

Table 2. Weight (in lb) of retained catch and estimated non-retained bycatch of Pribilof golden king crab during crab fisheries, 1993–2013, with total fishery mortality estimated by assuming a bycatch mortality rate of 0.2 for the directed fishery and a bycatch mortality rate of 0.5 for non-directed fisheries (from 2013 Crab SAFE, with update for 2013 catch and bycatch data).

Year	Retained Catch (lb)	Bycatch in crab fisheries (lb; no mortality rate applied) Pribilof Islands golden king crab	Bering Sea snow crab	Bering Sea grooved Tanner crab	Total Mortality (lb)
1993	67,458	no data	0	no data	—
1994	88,985	no data	8,387	2,531	—
1995	341,908	no data	1,391	34,492	—
1996	329,009	no data	526	5,151	—
1997	179,249	no data	8,937	no fishing	—
1998	35,722	no data	72,760	no fishing	—
1999	177,108	no data	0	confidential	—
2000	127,217	no data	0	confidential	—
2001	145,876	39,278	0	confidential	confidential
2002	150,434	41,894	2,335	no fishing	159,980
2003	confidential	confidential	329	confidential	159,184
2004	confidential	confidential	0	confidential	147,552
2005	confidential	confidential	0	confidential	65,817
2006	no fishing	no fishing	0	0	0
2007	no fishing	no fishing	0	0	0
2008	no fishing	no fishing	0	no fishing	0
2009	no fishing	no fishing	2,122[a]	no fishing	1,061[a]
2010	confidential	confidential	0	no fishing	confidential
2011	confidential	confidential	591[b]	no fishing	confidential
2012	confidential	confidential	598[c]	no fishing	confidential
2013	confidential	confidential	1,284[d]	no fishing	confidential

Table 3. Estimated annual weight (lb) of discarded bycatch of Pribilof golden king crab (all sizes, males and females) during federal groundfish fisheries by gear type (fixed or trawl), 1991/92–2012/13, with total bycatch mortality (lb) estimated by assuming bycatch mortality rate = 0.5 for fixed-gear fisheries and bycatch mortality rate = 0.8 for trawl fisheries (updated from 2013 SAFE with 2009/10–2012/13 data provided by R. Foy AFSC, Kodiak Laboratory via 30 July 2014 email).

Season	Bycatch in groundfish fisheries (lb; no mortality rate applied)			Total Mortality (lb)
	Fixed	Trawl	Total	
1991/92	110	13,464	13,574	10,826
1992/93	7,690	19,544	27,234	19,480
1993/94	1,116	21,248	22,364	17,556
1994/95	558	7,103	7,661	5,962
1995/96	895	4,187	5,082	3,797
1996/97	53	1,918	1,971	1,561
1997/98	2,952	1,074	4,026	2,335
1998/99	14,930	395	15,324	7,781
1999/00	10,556	1,426	11,982	6,419
2000/01	3,589	4,134	7,723	5,101
2001/02	3,300	783	4,083	2,276
2002/03	1,219	472	1,691	987
2003/04	503	401	904	572
2004/05	342	860	1,202	859
2005/06	198	126	324	200
2006/07	2,915	254	3,168	1,660
2007/08	18,678	351	19,028	9,619
2008/09	8,799	3,433	12,231	7,145
2009/10	5,299	2,573	7,873	4,708
2010/11	1,431	2,070	3,501	2,372
2011/12	1,614	2,502	4,117	2,809
2012/13	1,549	1,929	3,478	2,318
Average	3,690	4,425	8,116	5,385

Pribilof Islands golden king crab status

- 2013/2014 total catch = Confidential
- 2013/2014 OFL = 91 t
- Overfishing is not occurring

- 2013/2014 MSST= unknown
- 2013/2014 MMB = unknown
- Overfished status unknown

Pribilof Islands golden king crab OFL and ABC recommendations

- CPT and SSC concur with Author recommended method, OFL, and ABC.

- Biomass (MMB) =unknown
- OFL = 91 t
- ABC = 25% buffer = 68 t

Modeling workshop

- January 2015
- Gmacs application
  - BBRKC
  - Norton Sound Red King Crab
  - PIRKC
- EBS crab time series revision
- Tanner crab model
- AI golden king crab

Other CPT Report Items

- AIGKC model
- Ecosystem overview
- BSFRF survey
  - Selectivity and recruitment
- EFH
- Crab Economic SAFE
- Norton Sound dredging