

BSAI Crab Management: SAFE Report and Crab Plan Team Report

C-7

May 2017



BSAI Crab Plan Team:

Bob Foy (NOAA Fisheries /AFSC-Kodiak), Chair
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Ginny Eckert (UAF/UAS)
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Miranda Westphal (ADF&G-Dutch Harbor)
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André Punt (Univ. Of Washington)
Bill Bechtol (UAF)
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Laura Slater(ADF&G-Kodiak)



May 2017 Crab Plan Team Report

- SSC requests
- Stock Prioritization
- Recommend final OFL/ABC for 3 crab stocks (AIGKC, PIGKC, WAIRKC)
- Generalized Modeling for Alaskan Crab Stocks (GMACS) for Bristol Bay red king crab
- New Tanner crab model
- Other model updates (BBRKC, SC, PIRKC)
- Other updates (Bycatch, Tanner crab harvest strategy)
- Research Priorities on C8 agenda item

May 2017 Crab Plan Team Report

- Stock Prioritization (to start in 2017/18 cycle)
 - Biennial: PIRKC, NSRKC (likely 1 year)
 - Analysis of effect on Norton Sound pending
 - Triennial: PIBCK, PIGKC, WAIRKC
 - Off cycle assessment
 - Overfished or overfishing
 - New interest in directed fishery
 - Shifts in survey results
 - Proposed change in assessment approach
 - CPT recommends no change in ABC buffer
 - Not enough info
 - Revisit this plan in 4 years.

BSAI Crab Stocks Management Timing

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

Assessed in
May/June

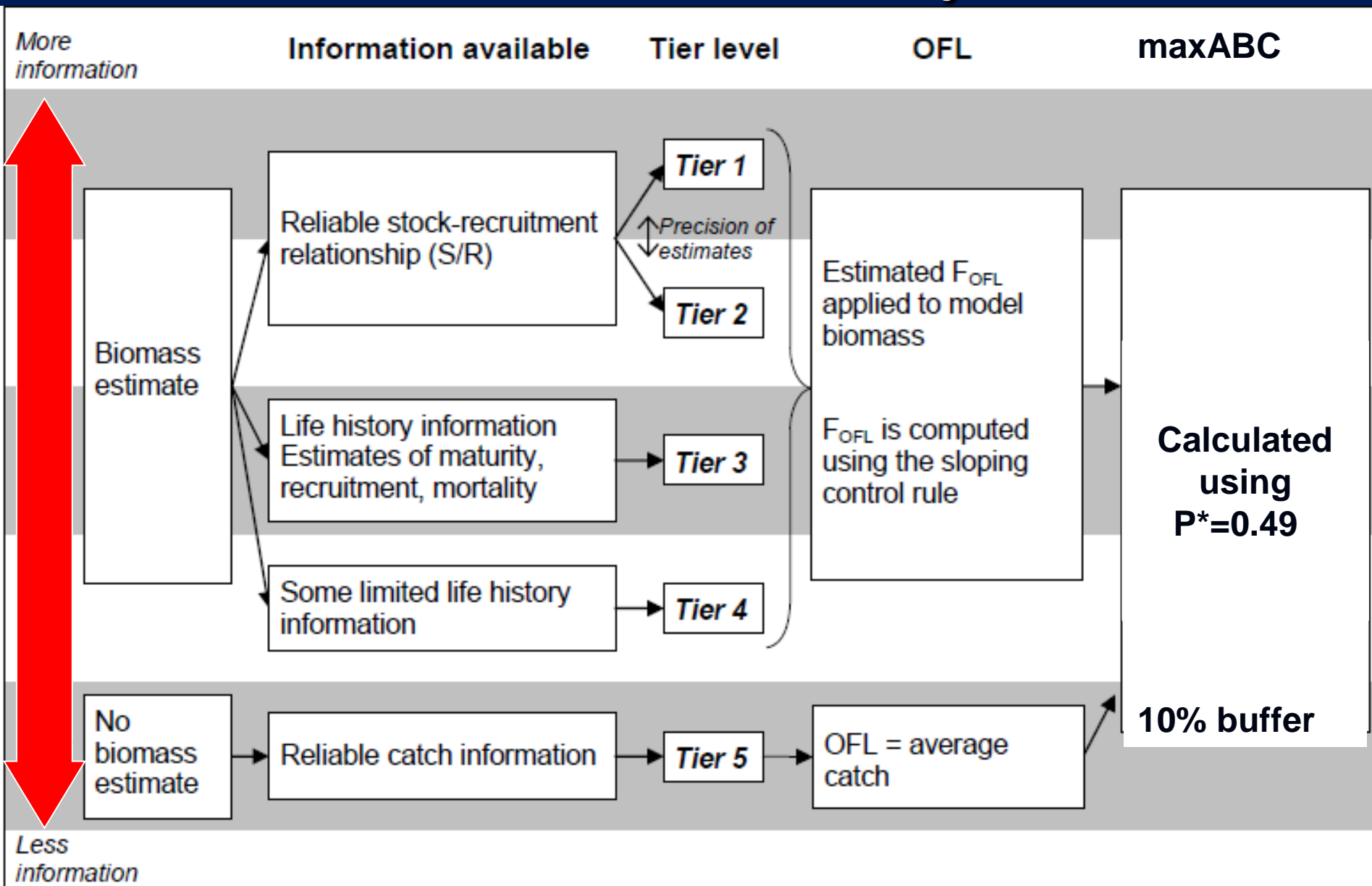
EBS snow crab
Bristol Bay red king crab
Tanner crab
Pribilof Islands red king crab
Pribilof Islands blue king crab
St. Matthew blue king crab

Assessed in
September/October

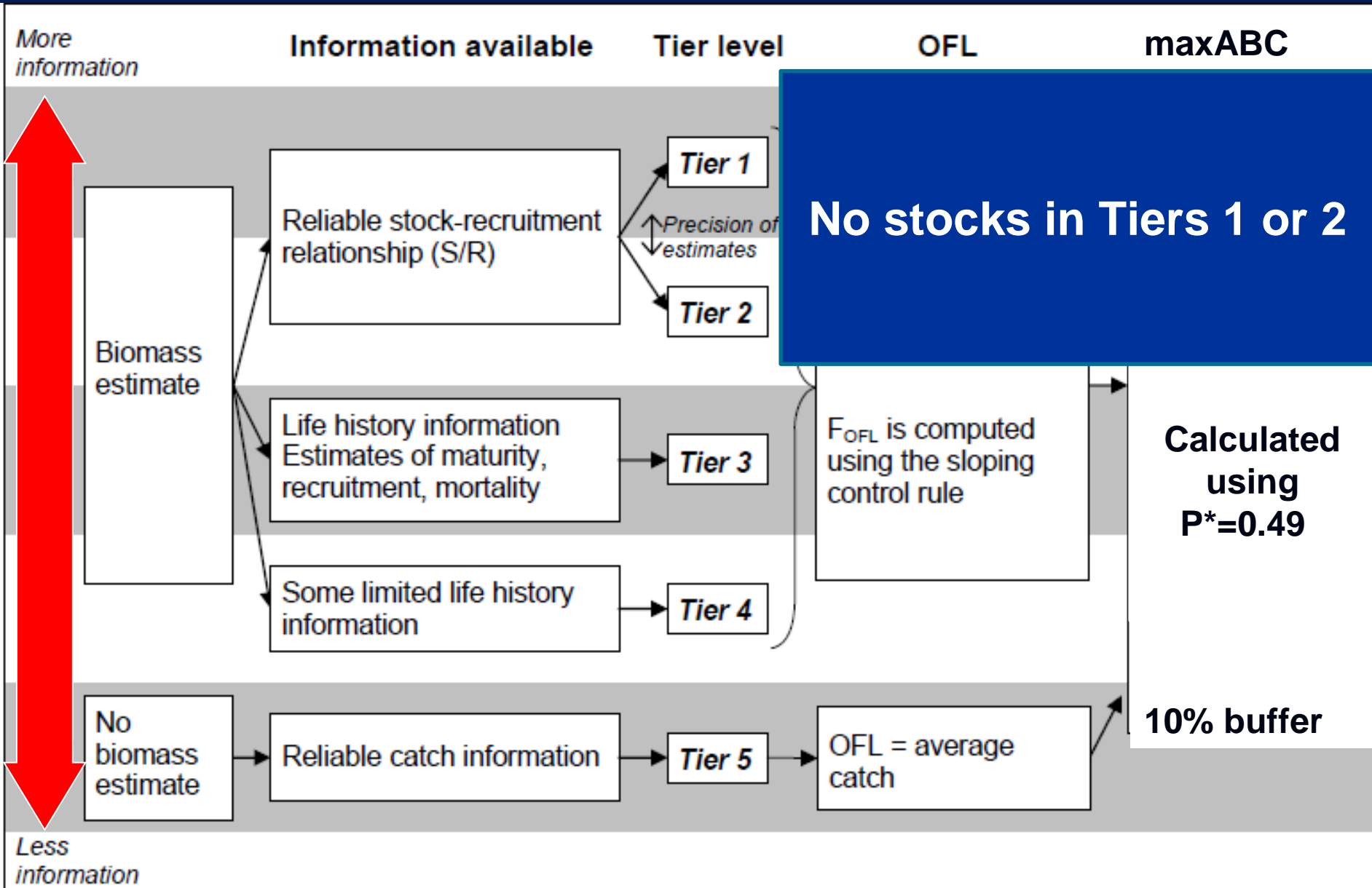
Norton Sound red king crab

Assessed in
January/February

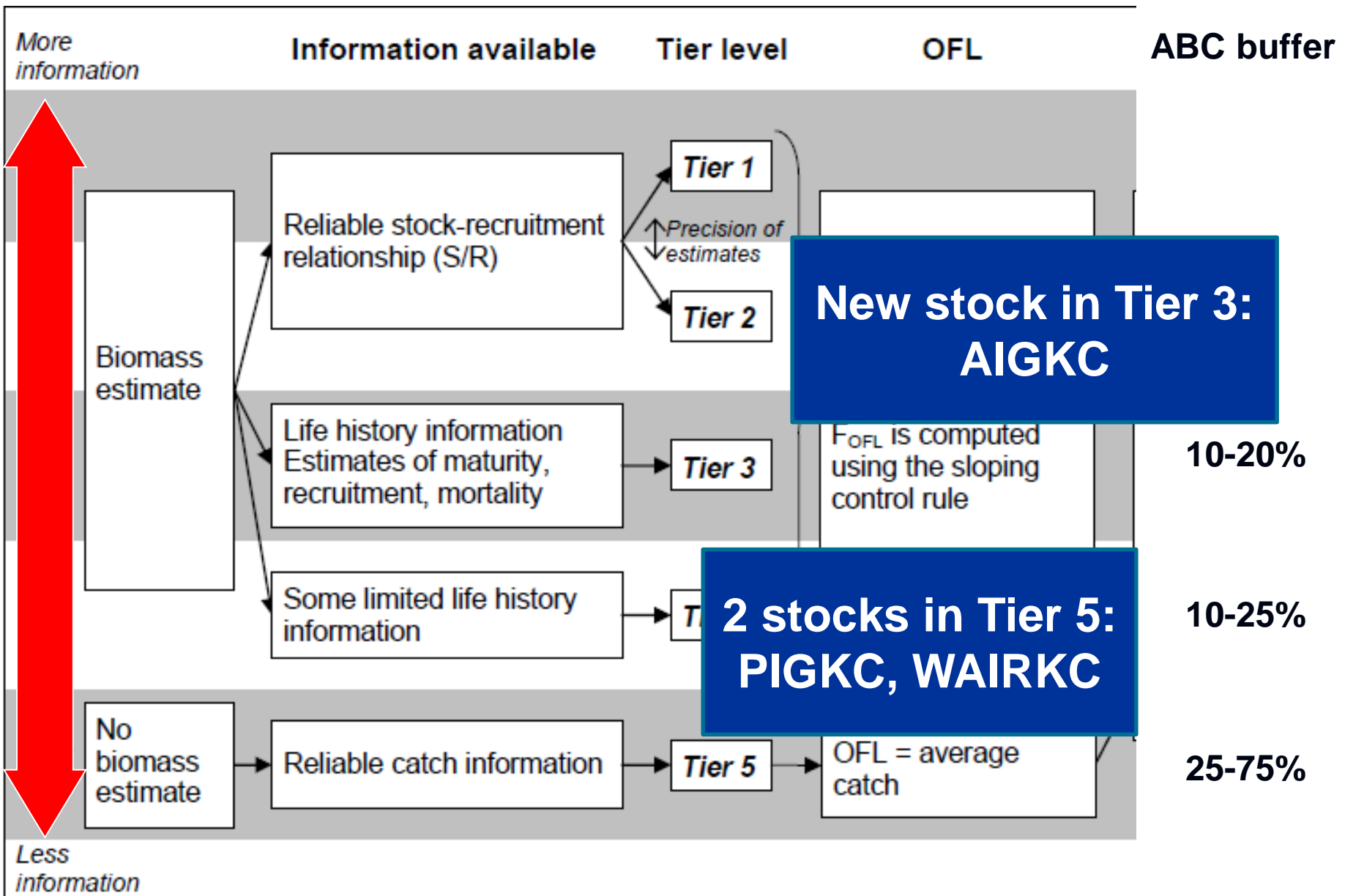
Current Crab Tier system



Overview of stocks



BSAI Crab Stocks Management



Aleutian Islands Golden King Crab (*Lithodes aequispinus*) Model-Based Stock Assessment in Spring 2017

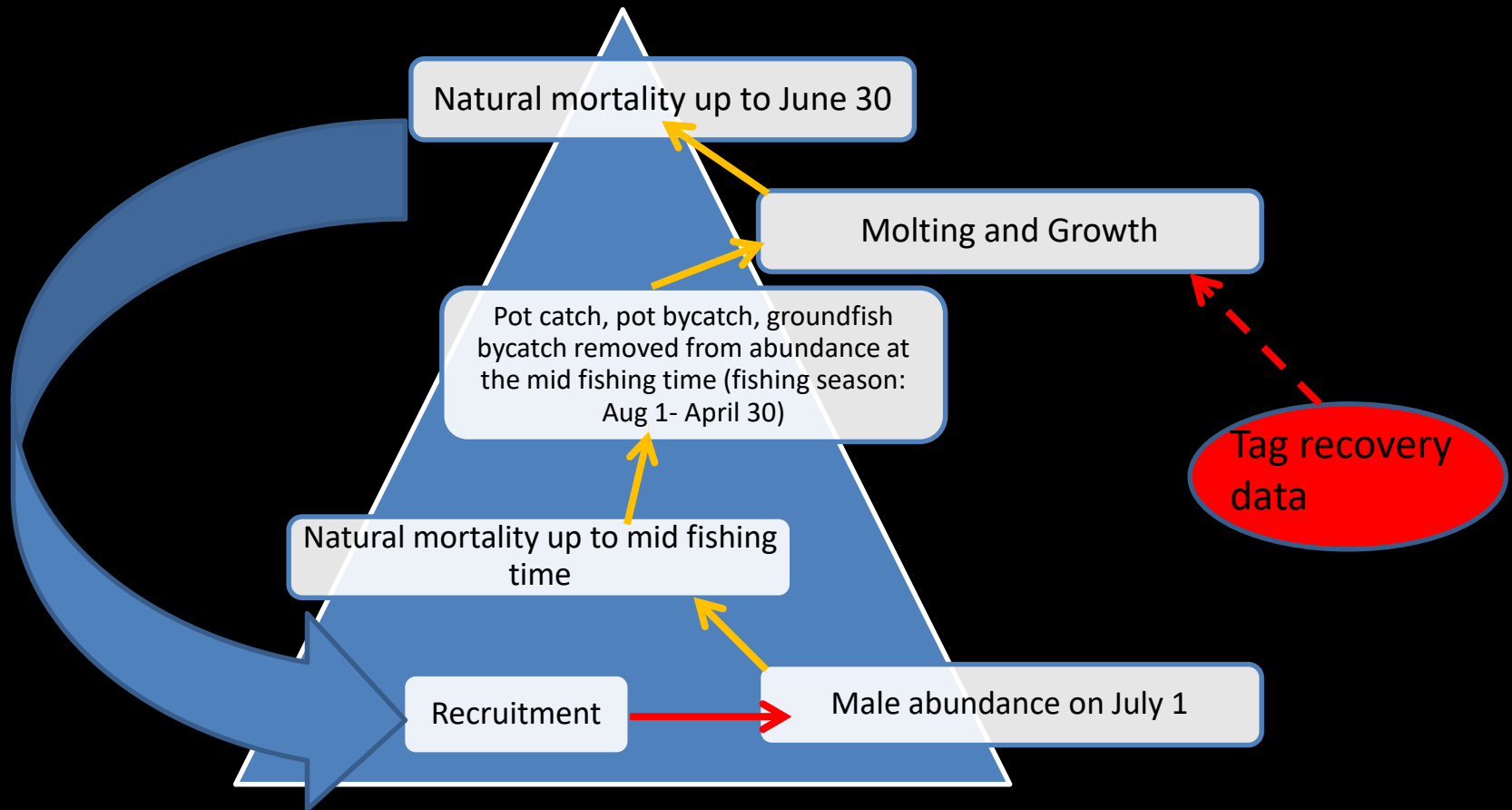
Draft report for the June 2017 SSC Meeting

M.S.M. Siddeek, J. Zheng, C. Siddon, and B. Daly
Alaska Department of Fish and Game, Juneau and
Kodiak, Alaska

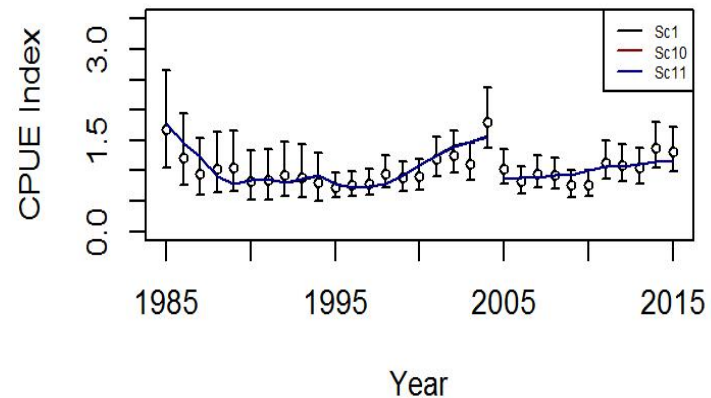
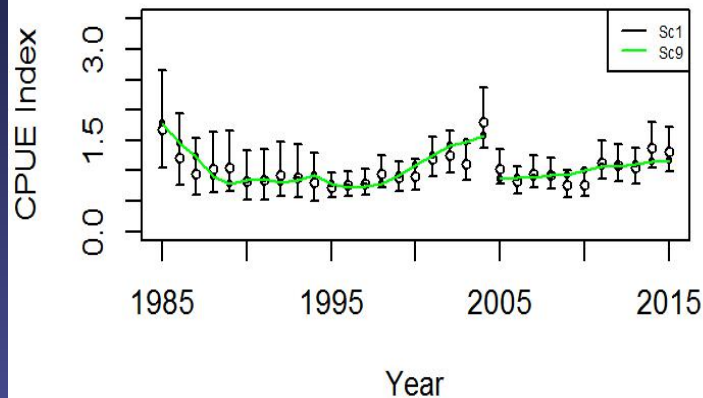
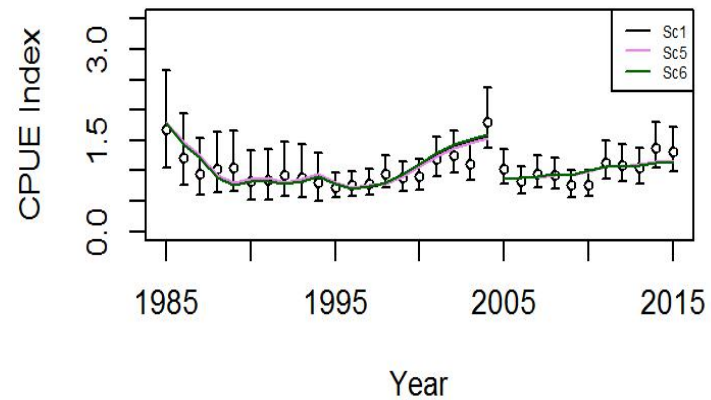
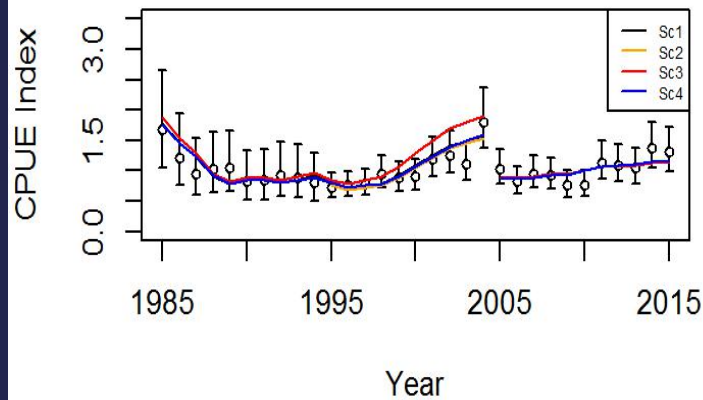
June 5, 2017, Juneau, Alaska

Length based modeling approach

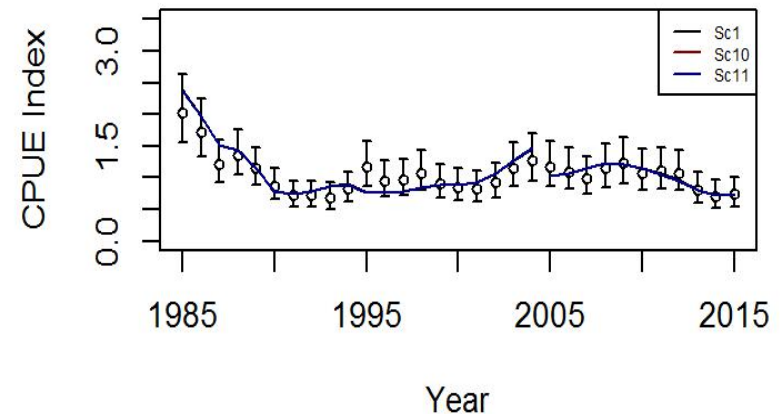
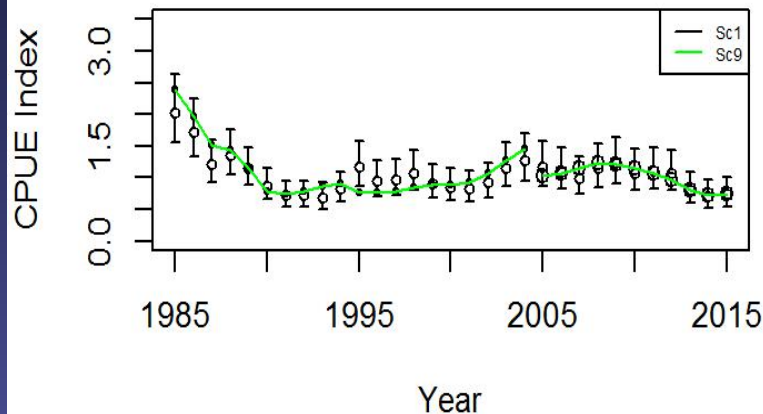
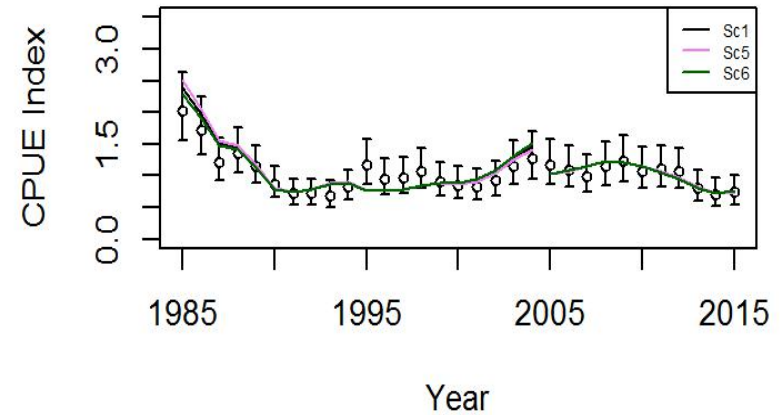
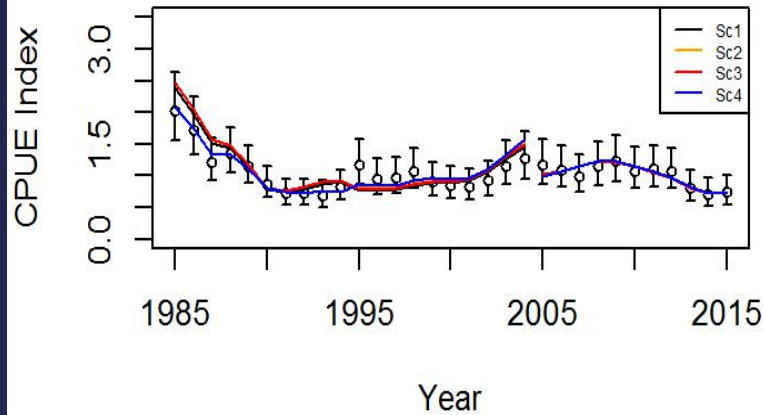
- An integrated length based model. This is the only FMP crab stock modelled with fishery dependent catch and CPUE data without survey information.
- Estimated M in the model.
- Projected the abundance from unfished equilibrium in 1960 to initialize the 1985 abundance.
- Eleven scenarios were run for EAG and WAG.
- Francis re-weighting method was used for Stage-2 effective sample sizes calculation for all scenarios.



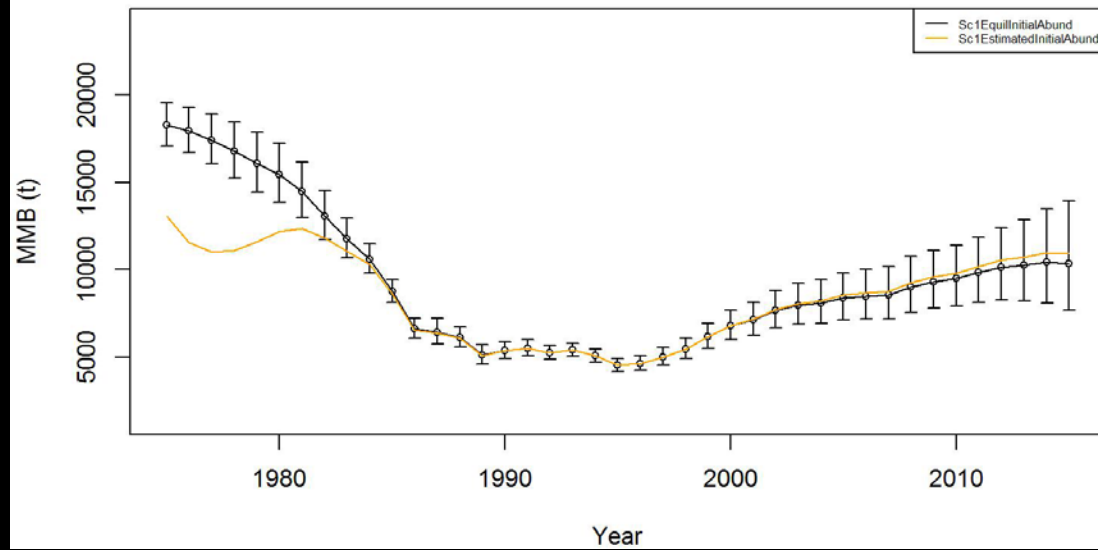
Figs. 26. Comparison of input **CPUE indices** (open circles with ± 2 SE) with predicted CPUE indices (colored solid lines) for scenarios (Sc.) 1 to 11 fits to **EAG** data 1985/86 – 2015/16



Figs. 45. Comparison of input **CPUE indices** (open circles with ± 2 SE) with predicted CPUE indices (colored solid lines) for scenarios (Sc.) 1 to 11 fits to **WAG** data 1985/86 – 2015/16



EAG



WAG

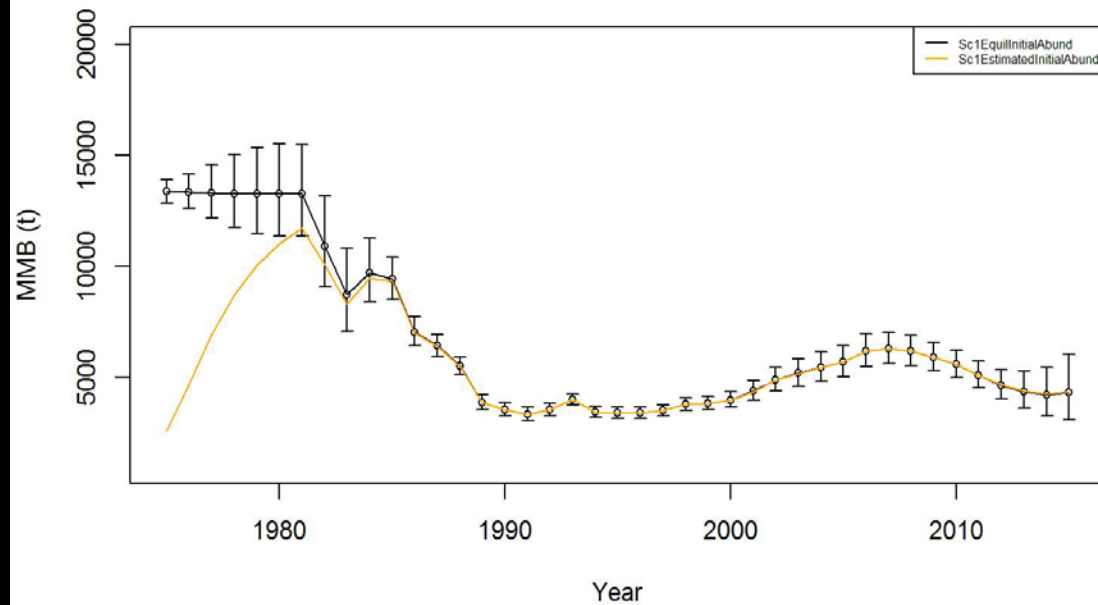
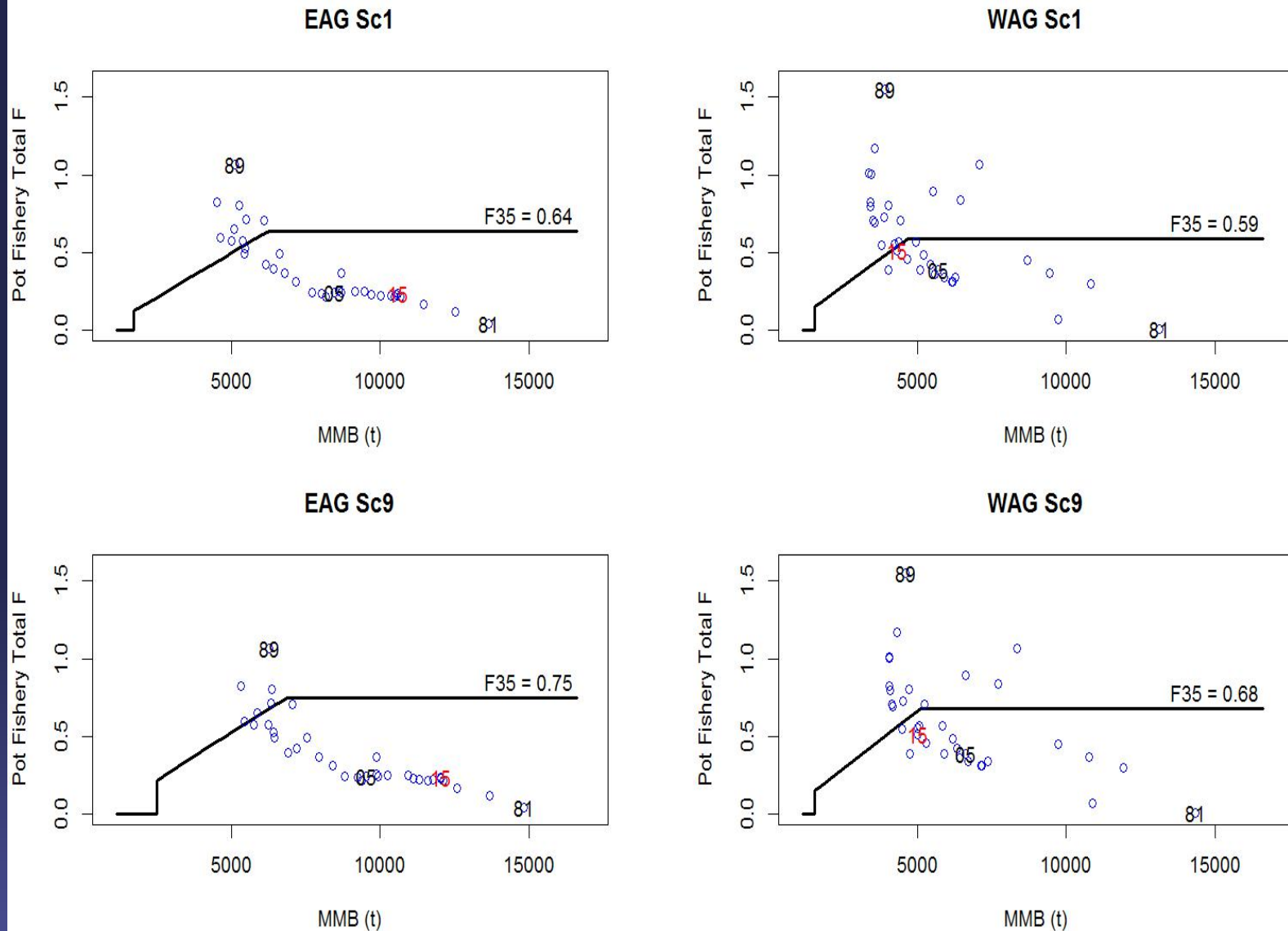


Figure 48. Relationships between full fishing mortalities and mature male biomass during 1985–2015 under scenarios 1 and 9 for **EAG** and **WAG**.



Stock Status

Year	MSST	Biomass (MMB)	TAC	Retained Catch ^a	Total Catch ^a	OFL	ABC
2013/14	N/A	N/A	2.853	2.894	3.192	5.69	5.12
2014/15	N/A	N/A	2.853	2.771	3.079	5.69	4.26
2015/16	N/A	N/A	2.853	2,729	3,073	5.69	4.26
2016/17	N/A	N/A	2.515			5.69	4.26
2017/18 ^b	6.044	14.205				6.048	4.838

a. Total retained catch plus estimated bycatch mortality of discarded bycatch during crab fisheries and groundfish fisheries.

b. Approach 2 above

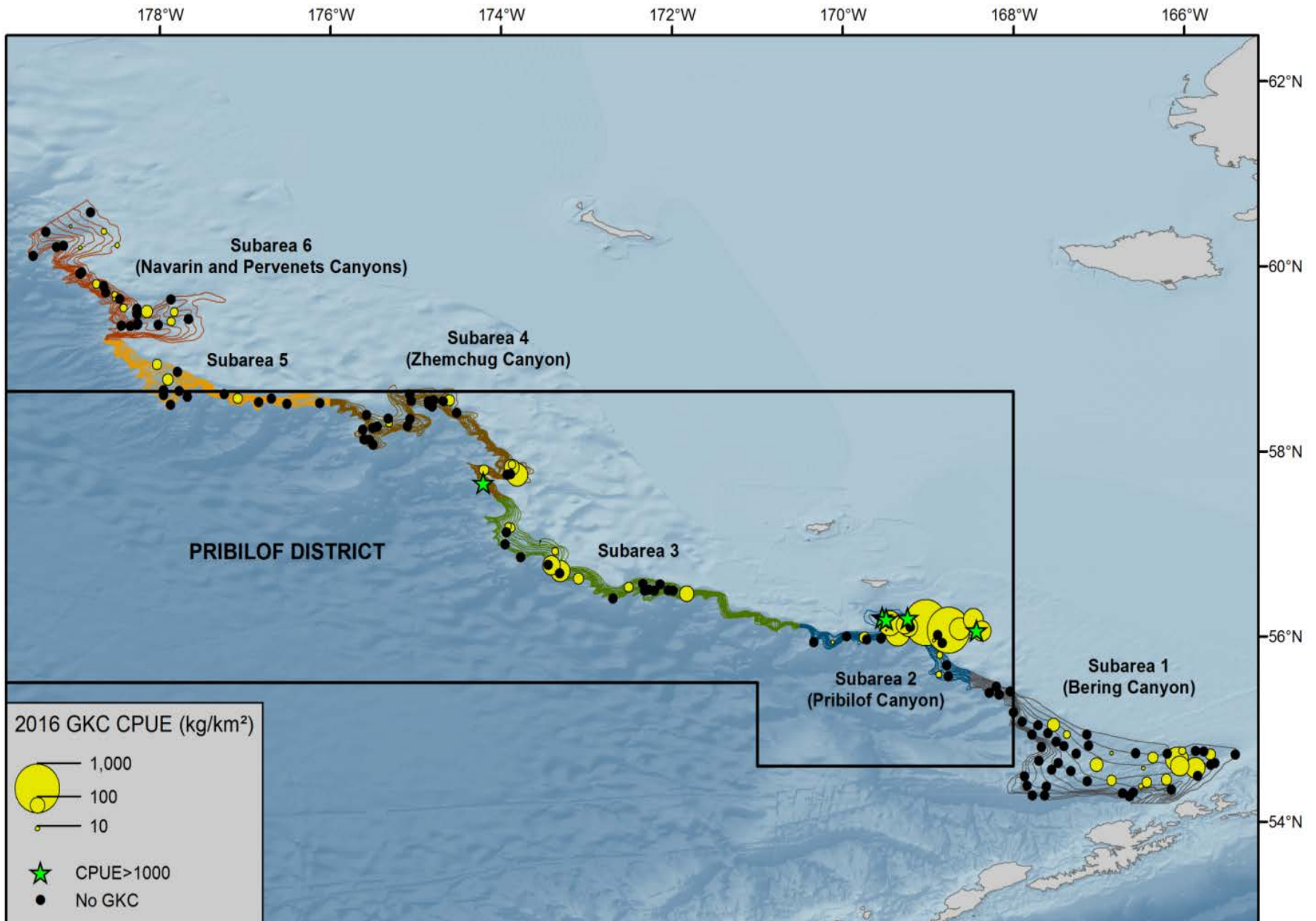
- 2016/2017 total catch = 3.10 thousand t
- 2016/2017 OFL = 5.69 thousand t
- Overfishing is not occurring; 2016/17 data not available
- 2017/2018 MSST= 6.05 t
- 2017/2018 MMB = 14.21 t
- Stock is not overfished (based on combined areas)

Tier, OFL, and ABC Recommendations

- CPT concurred with Author recommendation for Tier 3, OFL, and ABC based on model 9.
- Biomass (MMB) = 14.2 t
- Total catch OFL = CPT recommended 2nd approach to calculate OFL after stock status determined for whole area.
- OFL = 6,048 t
- ABC = 20% buffer = 4,838 t
- SSC changed to 25%

Pribilof Islands Golden King Crab Final Stock Assessment

- Ben Daly ADFG
- Tier 5
- Calendar year 2018 assessment



Pribilof Islands Golden King Crab

Shaded data used in the OFL assessment

Effort <10%
average

Calendar Year ^a	Crab Fishing Year ^b	Retained catch weight	Discarded catch weight (estimated)			
		Fish tickets	Observer data: lengths, catch per sampled pot		Blend method: Catch Accounting System	
		Directed fishery	Directed fishery	Non-directed crab fisheries	Fixed gear, groundfish	Trawl gear, groundfish
	1981/82	Confidential				
	1982/83	31.74				
	1983/84	388.49				
1984	1984/85	0.00				
1985	1985/86	Confidential				
1986	1986/87	0.00				
1987	1987/88	Confidential				
1988	1988/89	Confidential				
1989	1989/90	Confidential				
1990	1990/91	0.00				
1991	1991/92	0.00			0.05	6.11
1992	1992/93	0.00			3.49	8.87
1993	1993/94	30.60			0.51	9.64
1994	1994/95	40.36		4.95	0.25	3.22
1995	1995/96	155.09		16.28	0.41	1.90
1996	1996/97	149.24		2.58	0.02	0.87
1997	1997/98	81.31		4.05	1.34	0.49
1998	1998/99	16.20		33.00	6.77	0.18
1999	1999/00	80.33		Confidential	4.79	0.65
2000	2000/01	57.70		Confidential	1.63	1.88
2001	2001/02	66.17	17.20	Confidential	1.50	0.36
2002	2002/03	68.24	19.00	1.06	0.55	0.21
2003	2003/04	Confidential	Confidential	Confidential	0.23	0.18
2004	2004/05	Confidential	Confidential	Confidential	0.16	0.39
2005	2005/06	Confidential	Confidential	Confidential	0.09	0.06
2006	2006/07	0.00	0.00	0.00	1.32	0.12
2007	2007/08	0.00	0.00	0.00	8.47	0.16
2008	2008/09	0.00	0.00	0.00	3.99	1.56
2009	2009/10	0.00	0.96	0.96	2.67	2.55
2010	2010/11	Confidential	Confidential	0.00	2.13	1.01
2011	2011/12	Confidential	Confidential	0.27	0.85	1.33
2012	2012/13	Confidential	Confidential	0.27	0.73	0.82
2013	2013/14	Confidential	Confidential	0.58	0.50	2.49
2014	2014/15	Confidential	Confidential	0.12	0.60	0.53
2015	2015/16	0.00	0.00	0.00	0.812	1.890
2016	2016/17	0.00	0.00	0.00	0.231	0.158

Effort <10%
average (1-2
vessels)

Stock Status

Management Performance Table (values in t)

Calendar Year	MSST	Biomass (MMB)	GHL ^a	Retained Catch	Total Catch ^b	OFL	ABC
2013	N/A	N/A	68	Conf. ^c	Conf. ^c	90.7	81.6
2014	N/A	N/A	68	Conf. ^c	Conf. ^c	90.7	81.6
2015	N/A	N/A	59	0	1.92	91	68
2016	N/A	N/A	59	0	0.24	91	68
2017	N/A	N/A	59			93	70
2018	N/A	N/A				93	70

a. Guideline harvest level, established in lb and converted to t.

b. Total retained catch plus estimated bycatch mortality of discarded catch during crab fisheries and bycatch mortality due to groundfish fisheries are included here, but not for 2013 and 2014 because the directed fishery is confidential.

c. Confidential under Sec. 16.05.815 (SOA statute). GHL not attained.

- 2017 total catch = not yet known
- 2017 OFL = 93 t
- Overfishing status TBD
- Overfishing did NOT occur in 2016 (GHL NOT attained)
- 2018 MSST= unknown
- 2018 MMB = unknown
- Unable to assess overfished status

Tier, OFL, and ABC Recommendations

- CPT concurred with Author recommendation for Tier 5, OFL, and ABC.
- Biomass (MMB) = unknown
- Total catch OFL =

$$\text{OFL}_{2018} = (1 + R_{2001-2010}) * \text{RET}_{1993-1998} + \text{BM}_{\text{NC}, 1994-1998} + \text{BM}_{\text{GF}, 92/93-98/99},$$

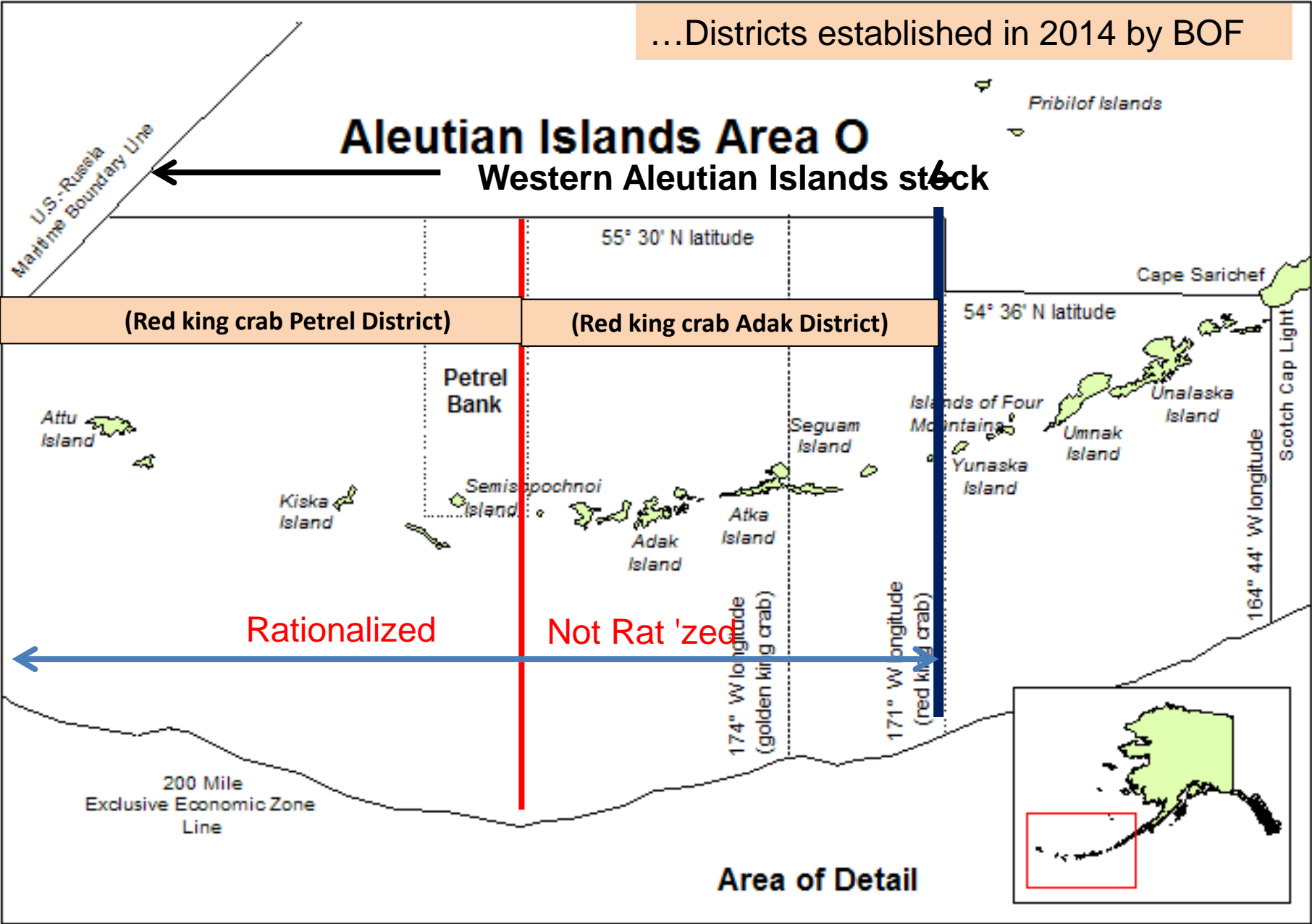
where,

- $R_{2001-2010}$ is the average of the estimated annual ratio of bycatch mortality to retained catch in the directed fishery during 2001–2010
 - $\text{RET}_{1993-1998}$ is the average annual retained catch in the directed crab fishery during 1993–1998
 - $\text{BM}_{\text{NC}, 1994-1998}$ is the estimated average annual bycatch mortality in non-directed crab fisheries during 1994–1998
 - $\text{BM}_{\text{GF}, 92/93-98/99}$ is the estimated average annual bycatch mortality in groundfish fisheries during 1992/93–1998/99.
- OFL for 2018, 2019, 2020 = 93 t
 - ABC for 2018, 2019, 2020 = 25% buffer = 70 t

Western Aleutian Islands Red King Crab (Adak RKC) Final Stock Assessment

- Ben Daly ADFG
- Tier 5
- 2017/2018 assessment

Western Aleutian Islands Red King Crab



Western Aleutian Islands Red King Crab

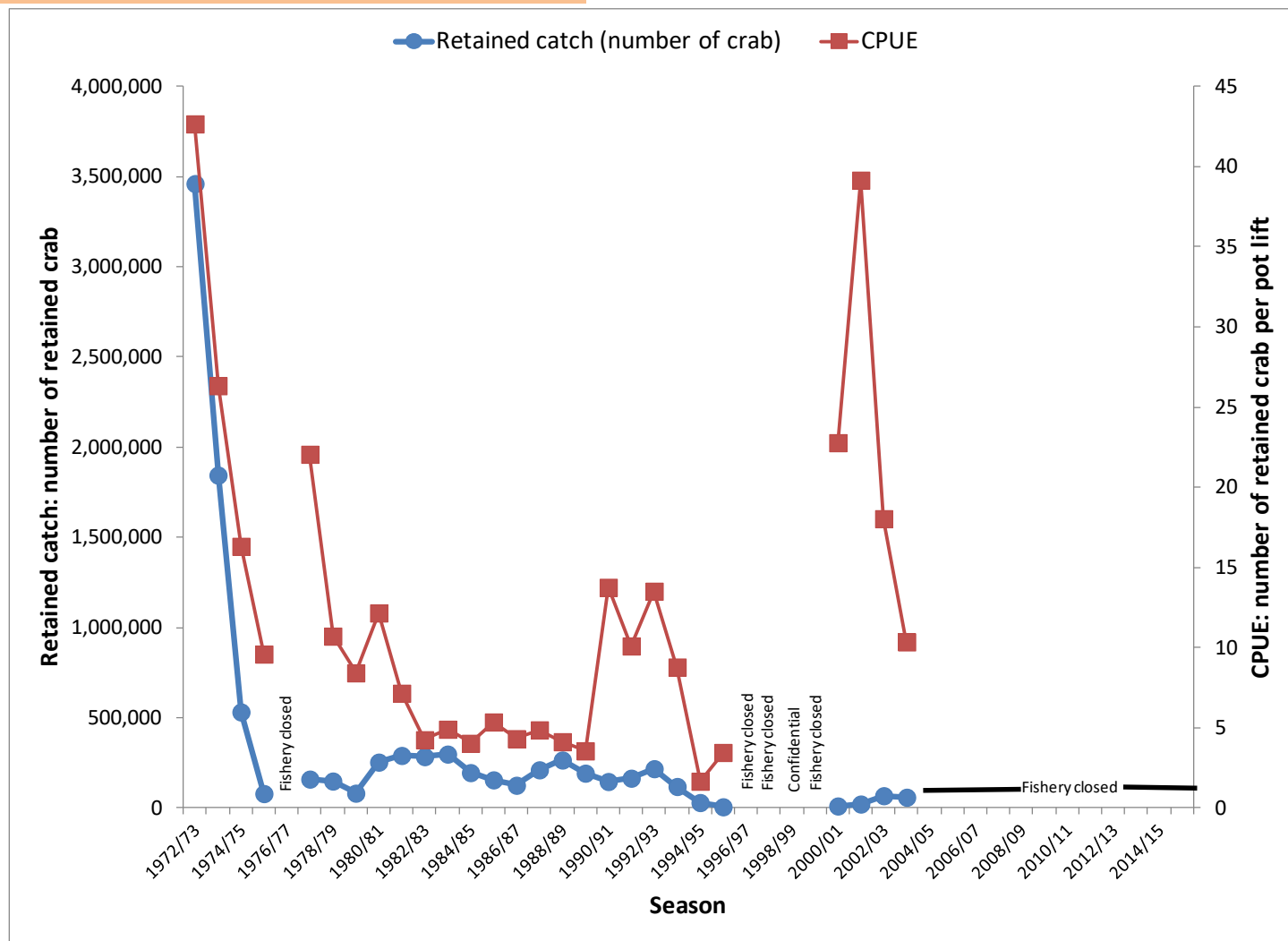


Figure 6. Retained catch (number of crab) and CPUE (number of retained crab per pot lift) in the western Aleutian Islands red king crab fishery, 1972/73–2014/15 (from Table 1a). Data for 1972/73–1983/84 are for the area west of 172° W longitude; data for 1984/85–1997/98, 1999/00, and 2004/05–2014/15 are for the area west of 171° W longitude; data for 1998/99 are for the area west of 174° W longitude; and data for 2000/01–2003/04 are for the area between 179° W longitude and 179° E longitude.

Western Aleutian Islands Red King Crab

Crab Fishing Year	Retained catch weight		Discarded catch weight (estimated)	
	Fish tickets	Observer data: lengths, catch per sampled pot	Blend method; Catch Accounting System	
	Directed fishery		Fixed gear, groundfish	Trawl gear, groundfish
1985/86	394.09	—	—	—
1986/87	323.20	—	—	—
1987/88	550.61	—	—	—
1988/89	710.92	—	—	—
1989/90	501.66	—	—	—
1990/91	375.62	Confidential	—	—
1991/92	431.49	Confidential	—	—
1992/93	583.51	Confidential	—	—
1993/94	316.64	Confidential	0.60	40.09
1994/95	89.34	Confidential	1.36	10.34
1995/96	17.66	22.98	2.63	6.93
1996/97	0.00	2.71	1.30	20.26
1997/98	0.00	0.42	1.73	5.31
1998/99	2.68	3.48	4.60	20.65
1999/00	0.00	0.46	17.13	12.69
2000/01	34.73	0.83	1.22	6.30
2001/02	69.84	16.09	2.42	27.01
2002/03	229.36	21.65	5.12	33.12
2003/04	217.32	17.08	1.62	4.15
2004/05	0.00	1.07	0.36	5.86
2005/06	0.00	0.11	1.61	1.07
2006/07	0.00	0.22	3.08	0.28
2007/08	0.00	1.36	7.70	1.10
2008/09	0.00	0.15	4.89	4.67
2009/10	0.00	0.39	0.14	6.40
2010/11	0.00	2.07	0.04	1.99
2011/12	0.00	0.49	1.19	0.82
2012/13	0.00	0.44	0.01	0.24
2013/14	0.00	1.46	0.01	0.04
2014/15	0.00	0.28	0.00	0.11
2015/16	0.00	0.00	0.03	1.46

CPT Discussion and Recommendations

- 2015/16 increase in GF bycatch noted
 - Request author report GF target and gear
- Increase OFL buffer back to 75%...no additional test fisheries expected

Stock Status

Management Performance Table (values in t)

Fishing Year	MSST	Biomass (MMB)	TAC ^a	Retained Catch	Total Catch	OFL	ABC
2012/13	N/A	N/A	Closed	0	<1	56	34
2013/14	N/A	N/A	Closed	0	<1	56	34
2014/15	N/A	N/A	Closed	0	<1	56	34
2015/16	N/A	N/A	Closed	0	1.3	56	34
2016/17	N/A	N/A	Closed	0		56	34
2017/18	N/A	N/A				56	34

a. Pre-season harvest levels are established as total allowable catch for the rationalized fishery west of 179° W longitude and as a guideline harvest level for the non-rationalized fishery east of 179° W longitude.

- 2016/2017 total catch = not yet known...
- 2016/2017 OFL = 56 t
- Unable to assess stock status
- OFL (3 years) = 56 t
- ABC (3 years) = 75% buffer = 14 t (increased from 40% [34 t] last year)

May 2017 Crab Plan Team Report

- BBRKC Bycatch request to CPT

Council motion (February 2017)

The Council requests the Crab Plan Team evaluate effects of total red king crab bycatch in the groundfish fisheries on MSST, OFL, ABC, and TAC and provide a summary of discussions during the next Crab Plan Team report to the Council.

Total bycatch mortality as reported in assessment as proportion of current year MMB, MSST, OFL and ABC

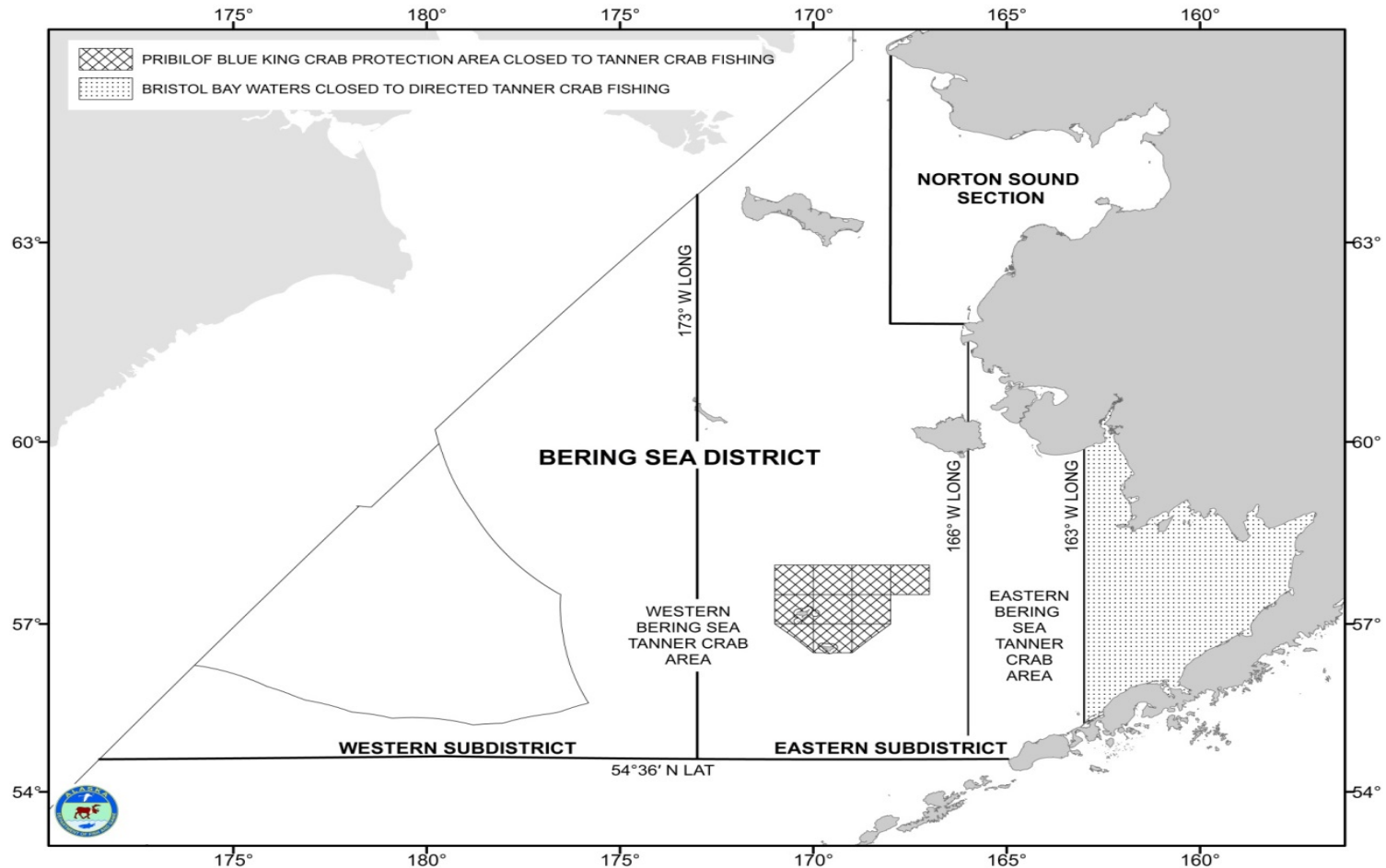
Year	% of B	% of MSST	% of OFL	% of ABC	% of TAC
2012/13	0.21%	0.46%	0.77%	0.85%	1.72%
2013/14	0.50%	1.06%	1.93%	2.14%	3.49%
2014/15	0.81%	1.70%	3.25%	3.61%	4.94%
2015/16	0.54%	1.16%	2.22%	2.47%	3.31%

May 2017 Crab Plan Team Report

- Bycatch Review
 - CPT discussed applying different mortality rates to different areas or gear types.
 - Calculate bycatch ~TAC instead of OFL.
 - CPT recommends investigating increase GF pot fishery bycatch
 - Investigate spatial component in bycatch (see EFH efforts)
 - Need a whole haul study to better understand size/sex of bycatch
 - Pelagic trawl bycatch should be assessed (communicate with pollock fleet)
 - Are PSC caps reasonable to protect crab stocks?
 - Assess cumulative effects of bycatch on population.
 - Incorporate logbook data into analysis (Leah Sloan study)

May 2017 Crab Plan Team Report

- Tanner crab harvest strategy (Ben Daly ADFG)



Historical Timeline

- Mid-August: **2016 Survey results** disseminated
- Sept 6: **Emergency petition** was submitted by Alaska Bering Sea Crabbers to amend language in the harvest strategy, to lower the female threshold and allow a fishery opening
- Oct 10: 2016/17 **Tanner fishery closed by state** because 2016 mature female biomass estimate was below threshold (40% of 1975-2010 average)

Historical Timeline

- Oct: Petition submitted to the BOF at work session
 - BOF developed a board generated proposal to amend the harvest strategy by removing:
 - female threshold, precautionary TAC penalty, fishery east of 166W
- Jan 2017 BOF meeting: **proposal failed**
 - ADF&G tasked with presenting framework for harvest strategy updates that could be implemented prior to the 2017/18 season
- March BOF meeting: ADF&G presented options for analysis
 - BOF developed a board generated proposal to direct state to conduct analysis
 - May 17-18: Special meeting to present analysis

Elements Tasked for Review

- A. Criteria used to determine mature female Tanner crab (female size-at-maturity);
- B. Area used to estimate biomass expanded to consider area west of 173° W. long. and other surveyed areas where biomass estimates are consistently available and areas closed to commercial crab fishing;
- C. Years used to estimate long-term average mature female Tanner crab biomass;
- D. Provision that TAC is reduced 50% in any year succeeding a year in which the mature female Tanner crab biomass falls below 40% of its long-term average.
- E. Alternatives to a single open/close threshold (i.e., alternatives to the on/off switch to facilitate flexibility)
- F. Male threshold – consider upper male threshold to determine harvestable surplus

May 2017 Crab Plan Team Report

- Tanner crab harvest strategy
 - CPT discussed the lack of evidence for separate stocks but need for different management areas based on catch
 - CPT recommended an analysis of how changes district-wide and area regulations affect the harvest strategy.
 - CPT recommended that the stock assessment model be used in the harvest strategy instead of survey only.
 - CPT recommended that there be an annual update on how uncertainty is included in harvest strategy to improve transparency in both the harvest strategy and stock assessment model processes.