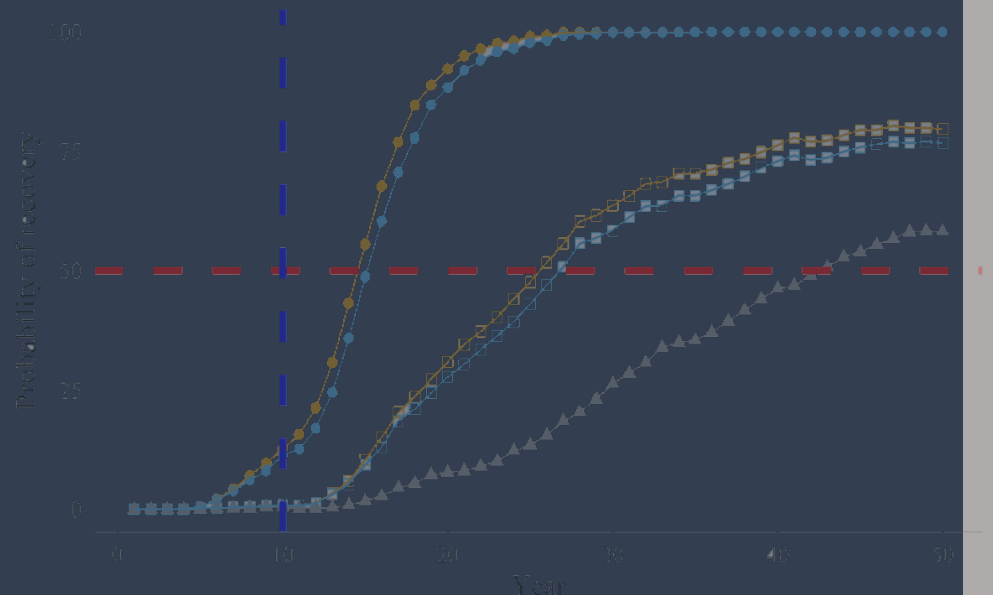
St Matthew Island blue king crab

Rebuilding Plan Initial Review



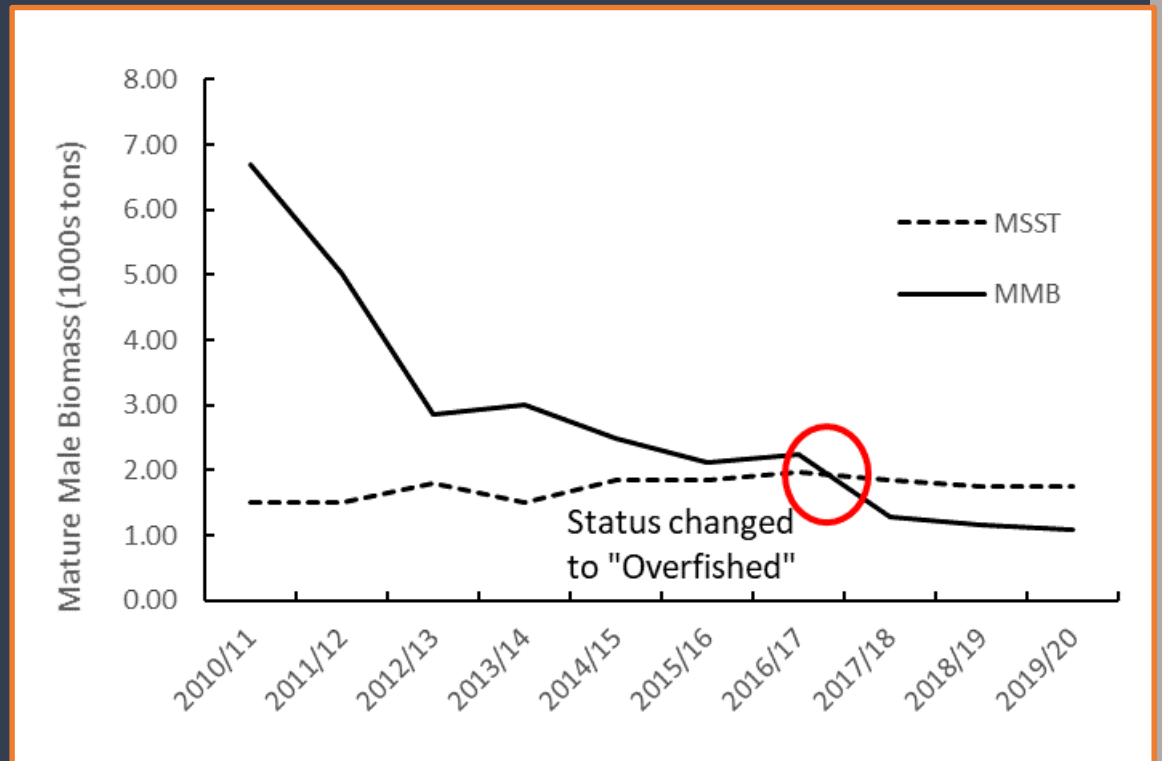
December 2019

Outline

	Chapter
• Introduction • Status change, required action, Statutory, NS1, Crab SAFE	1.0
• Alternatives	2.0
• Other considerations • Bycatch, Existing protections, Ecosystem conditions	3.2.2 –3.2.4
• Rebuilding analysis • Recruitment, Harvest (Alternatives), Timeframes	3.2.5 – 3.2.9
• Socio-econ Impacts	3.3

1. Introduction

- October 22, 2018 – declared overfished
  - $MSST_{2018}$ 1.85
  - $MMB_{2017/2018}$ 1.29
- Rebuilding plan in 2 years
- Time frame to rebuild
- NS1 Guidelines on minimum rebuild time



1. Introduction

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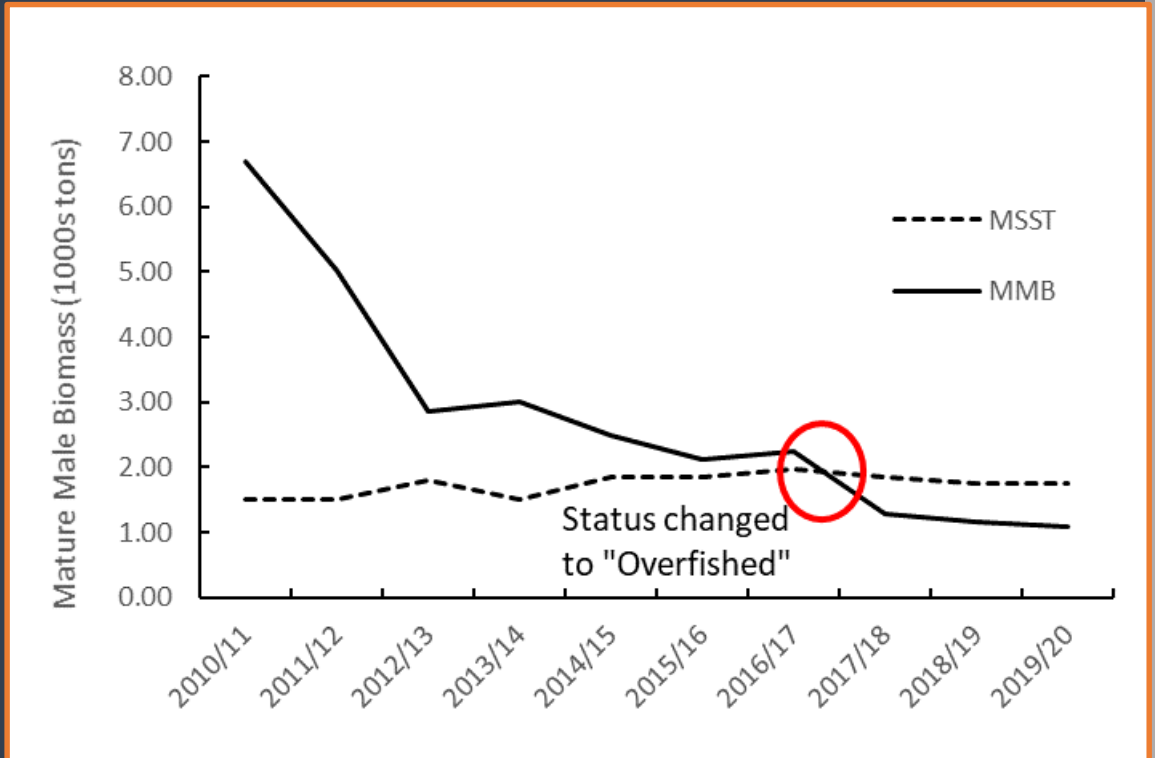

1.2.2 T_{min} and T_{max}

- T_{min}
  - F = 0
  - years for p(B = B_{msy}) ≥ 50 %
  - Starting year for the T_{min} is first year rebuilding plan is in place.
- If T_{min} > 10 yrs, T_{max}
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  - Tmin + 1 generation time
  - Time at 75% MFMT
  - Tmin x 2

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Average age of spawners in unfished stock

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Average age of spawners in unfished stock = 14

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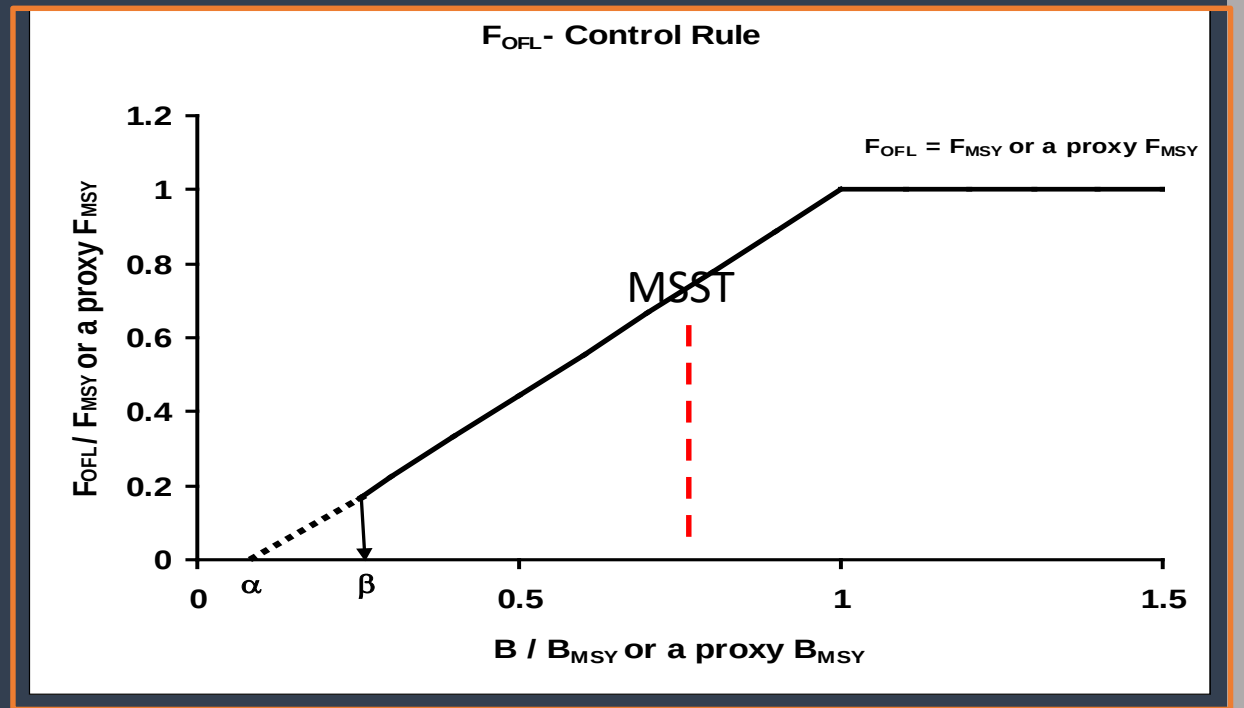
T_{min} ~ 14.5 years

- If T_{min} > 10 yrs, T_{max}
- T_{max}
  - Tmin + 1 generation time
  - Time at 75% MFMT (not analyzed, 43 yr)
  - Tmin x 2 (not analyzed, 29 yr)

T_{max} ~ 28.5 years

1.2.3, 1.2.4 Crab SAFE

- 5 Tier system
  - SMBKC is Tier 4
  - Stock status level (a,b,c)
- F_{OFL} Control Rule
- β = 25%
- MSST = 50%

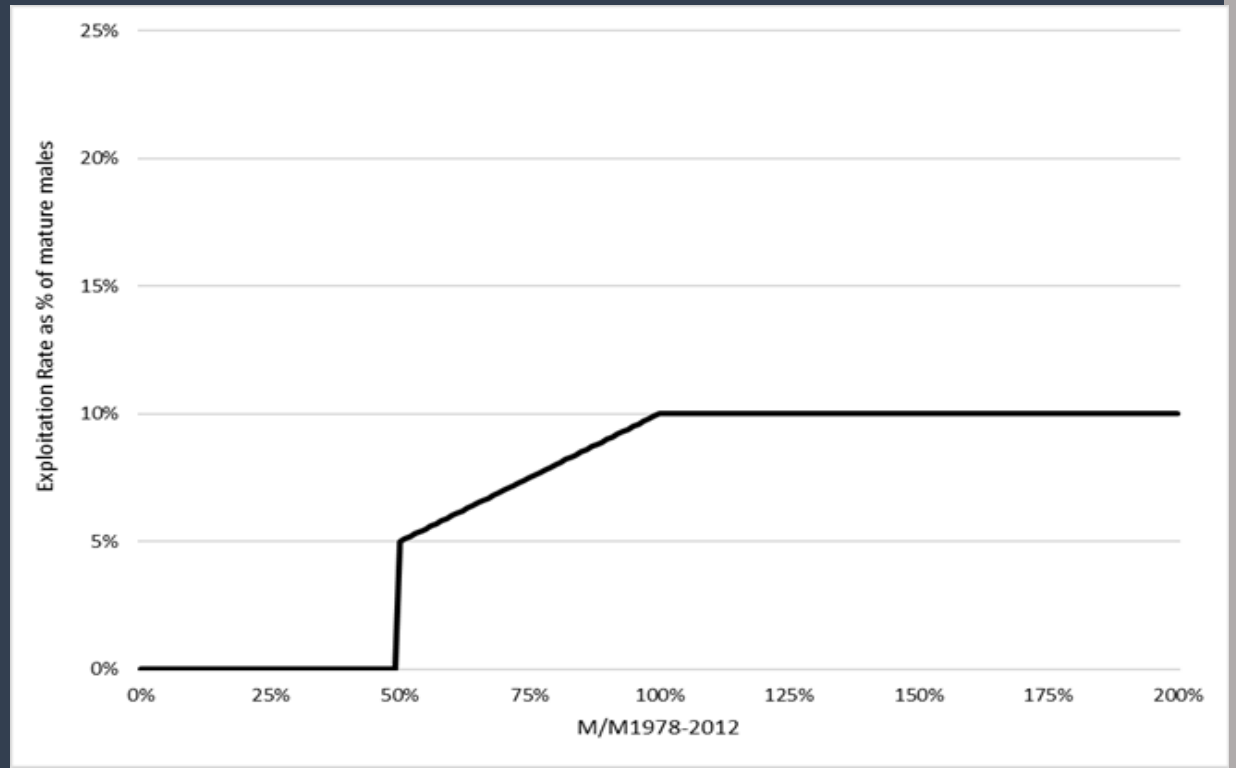


2. Description of Alternatives

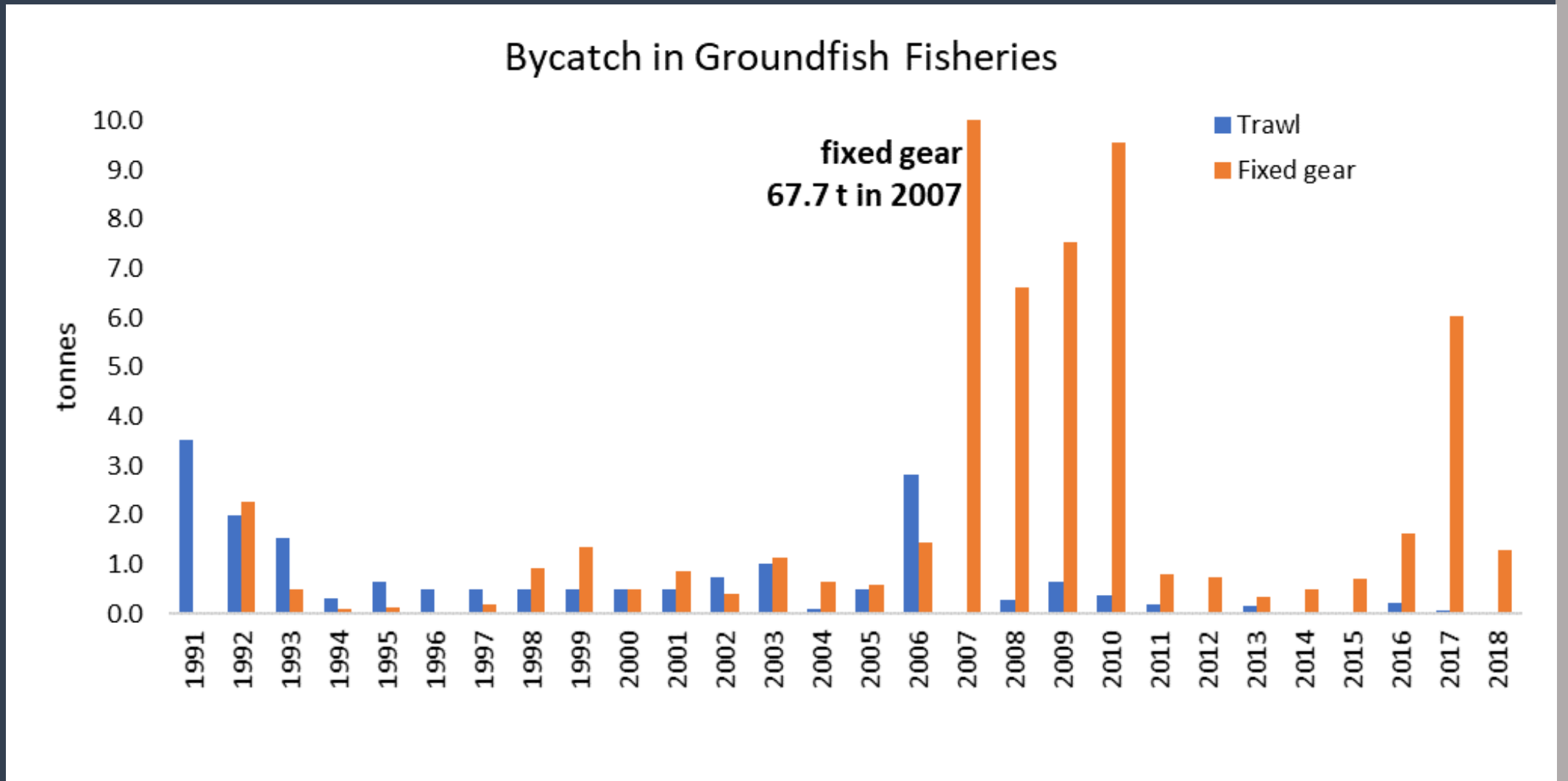
- Alternative 1 (No Action)
  - No rebuilding plan, ABC in projections
- Alternative 2 (Rebuilding)
  - Option 1 – no harvest during rebuilding
  - Option 2 – State Harvest Strategy

2.2 Alternative 2, Option 2

- Option 2 – State Harvest Strategy (5 AAC 34.917)
  - Open if MMB ≥ 50% Average 1978-2012
  - Max 10% Exploitation
  - Assessment provides basis
  - Closed fishery prior to “Overfished” status



3.2.2 Bycatch


Bycatch in Groundfish Fisheries
tonnes
10.0
9.0
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1.0
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fixed gear
67.7 t in 2007
Trawl
Fixed gear
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1992
1993
1994
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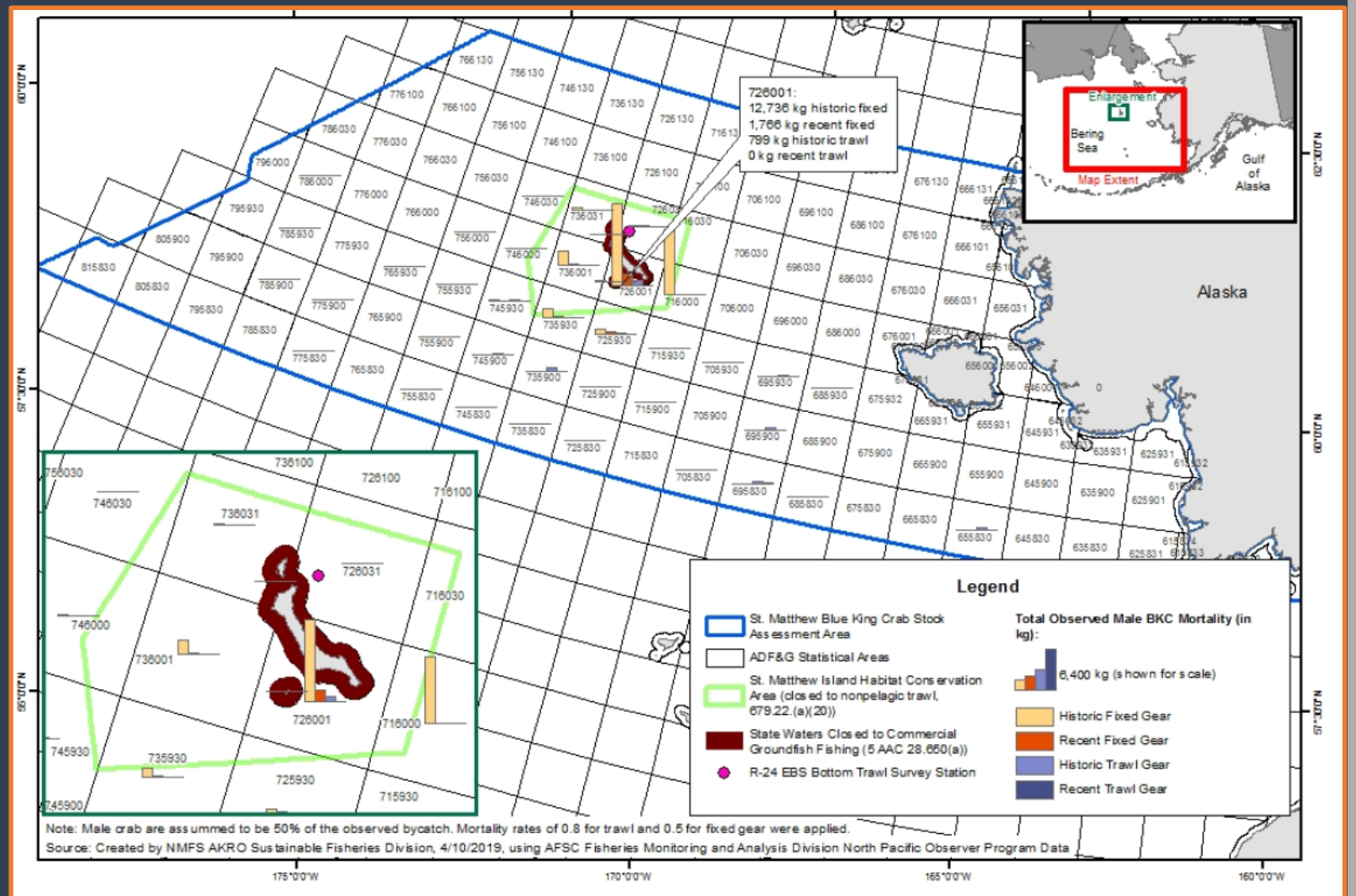
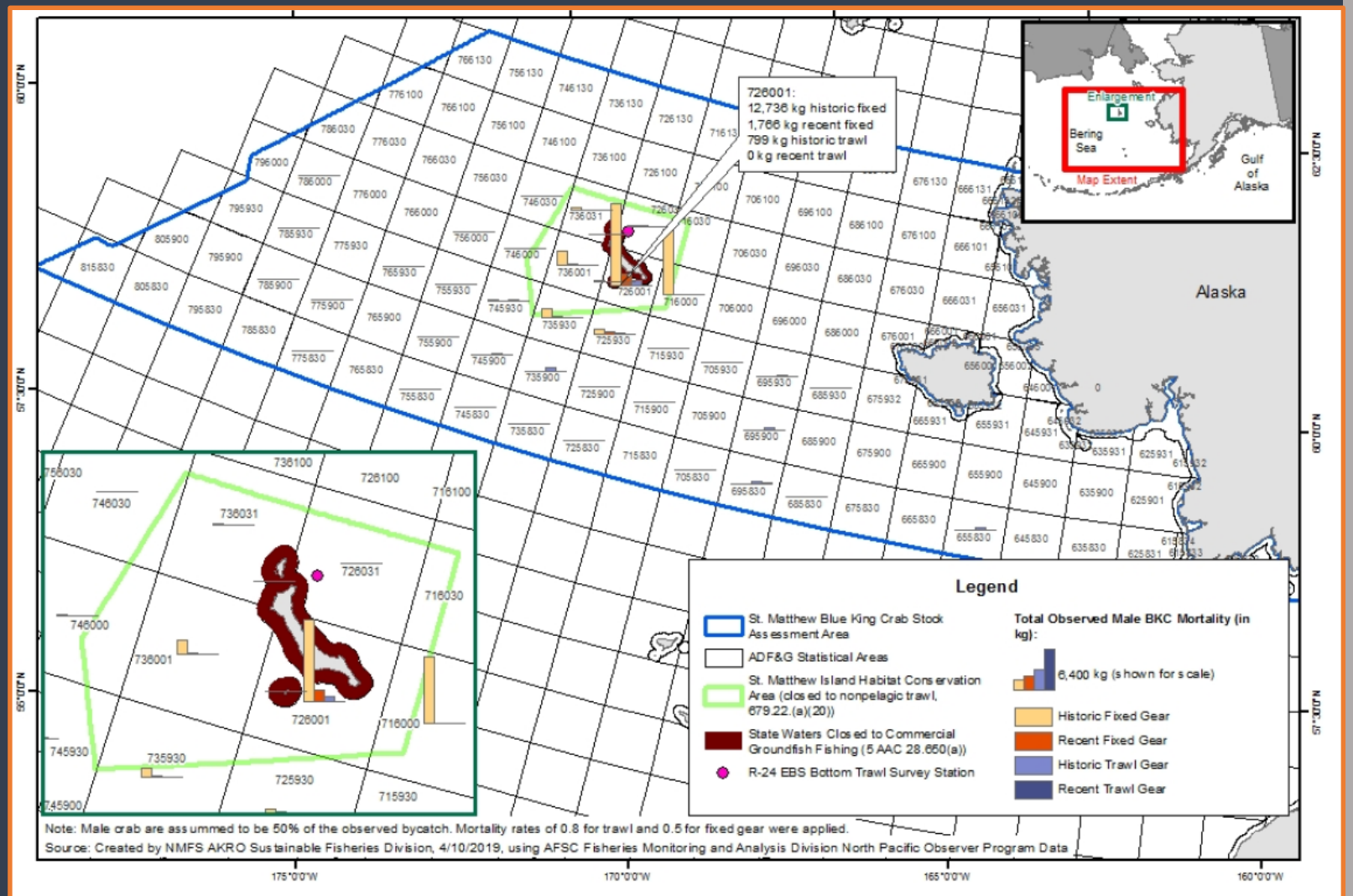
2018

3.2.2 Bycatch


726001:
12,736 kg historic fixed
1,766 kg recent fixed
799 kg historic trawl
0 kg recent trawl
Enlargement
Bering Sea
Map Extent
Gulf of Alaska
Alaska
Legend
St. Matthew Blue King Crab Stock Assessment Area
ADF&G Statistical Areas
St. Matthew Island Habitat Conservation Area (closed to nonpelagic trawl, 679.22.(a)(20))
State Waters Closed to Commercial Groundfish Fishing (5 AAC 28.650(a))
R-24 EBS Bottom Trawl Survey Station
Total Observed Male BKC Mortality (in kg):
6,400 kg (shown for scale)
Historic Fixed Gear
Recent Fixed Gear
Historic Trawl Gear
Recent Trawl Gear
Note: Male crab are assumed to be 50% of the observed bycatch. Mortality rates of 0.8 for trawl and 0.5 for fixed gear were applied.
Source: Created by NMFS AKRO Sustainable Fisheries Division, 4/10/2019, using AFSC Fisheries Monitoring and Analysis Division North Pacific Observer Program Data
175°0'0"W
170°0'0"W
165°0'0"W
160°0'0"W

3.2.3 Existing Protections



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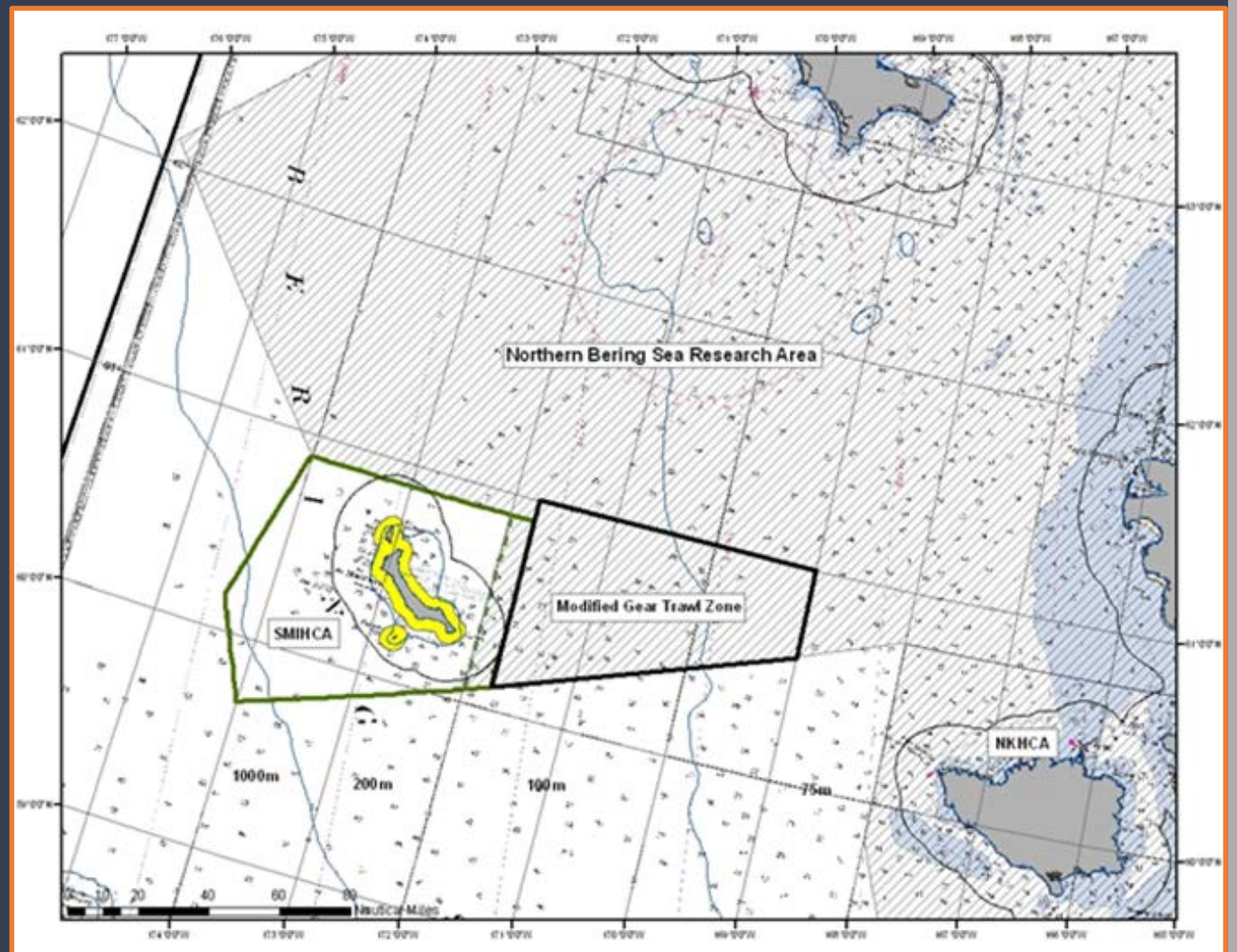
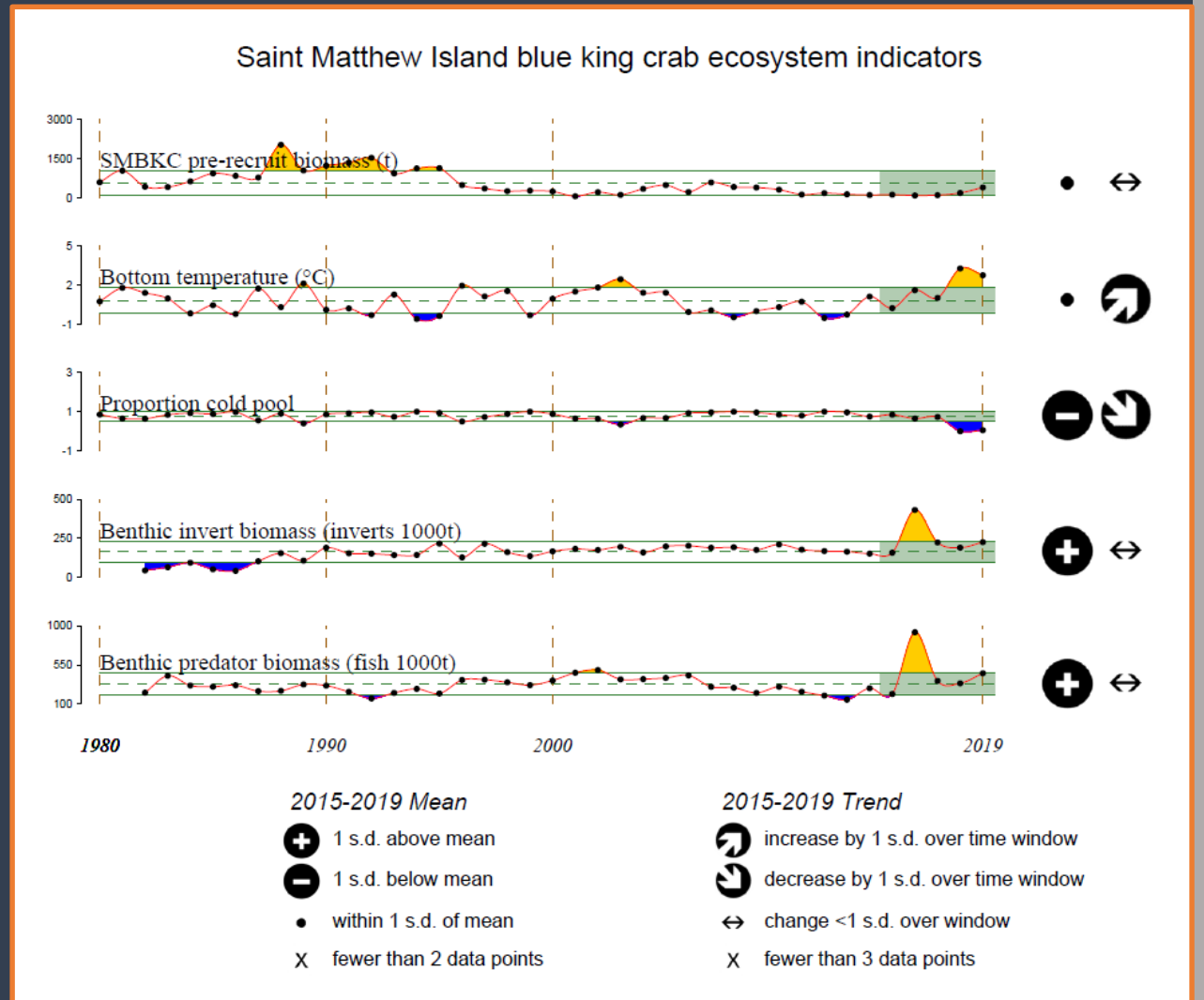


3.2.4 Ecosystem Conditions

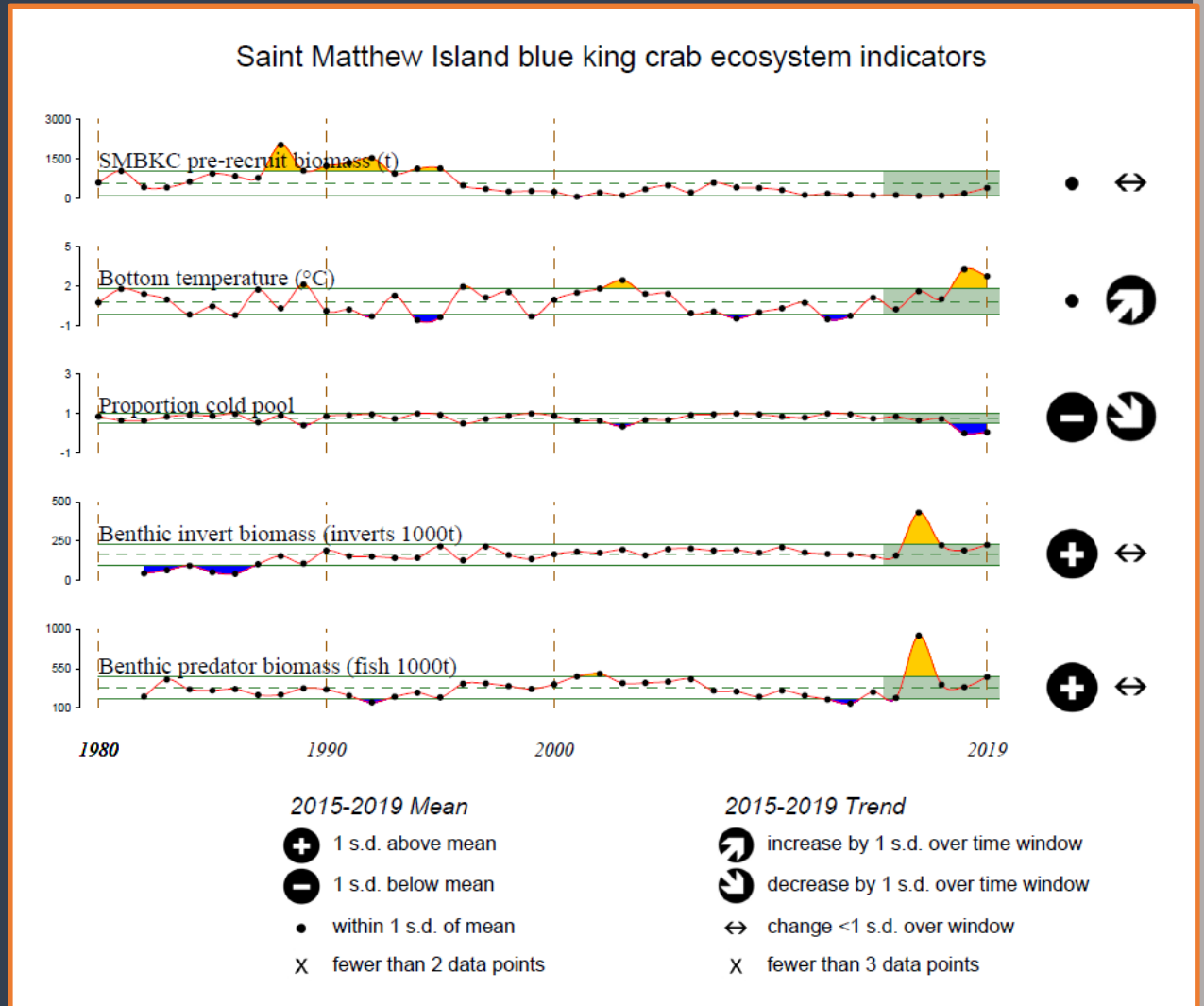
1. Pre-recruit biomass
2. Bottom temperature
3. Cold pool extent
4. Benthic invertebrate biomass
5. Benthic predator biomass.



3.2.4 Ecosystem Conditions

Poor conditions in recent years

1. Environmental factors impeding recruitment and recovery.
2. Thermal and habitat requirements limit mobility
3. Pacific cod increases preceded declines



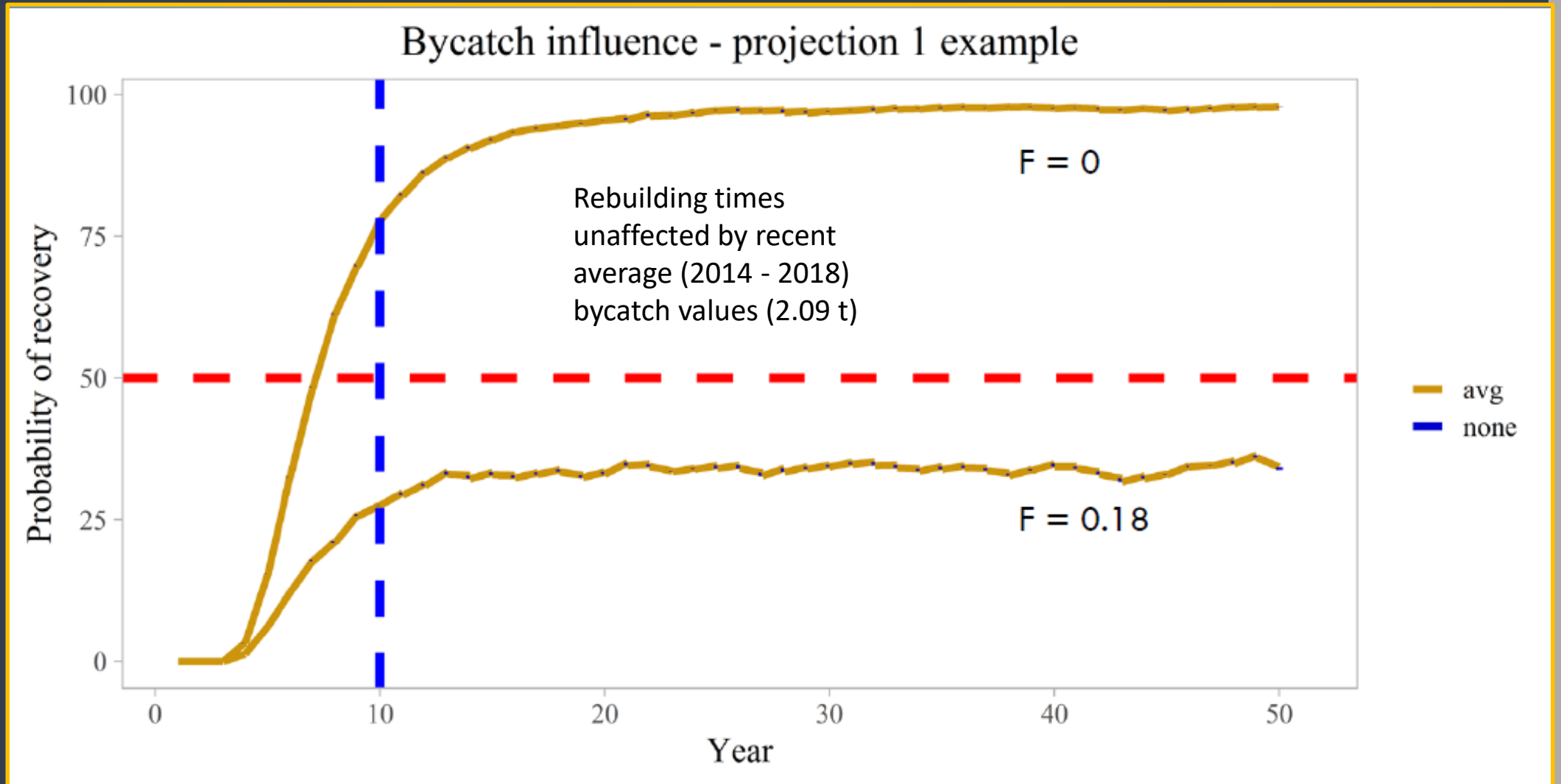
3.2.6 Effects of Alternatives

- Description of the assessment
  - Outputs (starting conditions)
- Bycatch assumptions
  - Average
  - Maximum
- Recruitment
  - Random
  - Ricker
- Breakpoint Analysis
  - B_{msy}

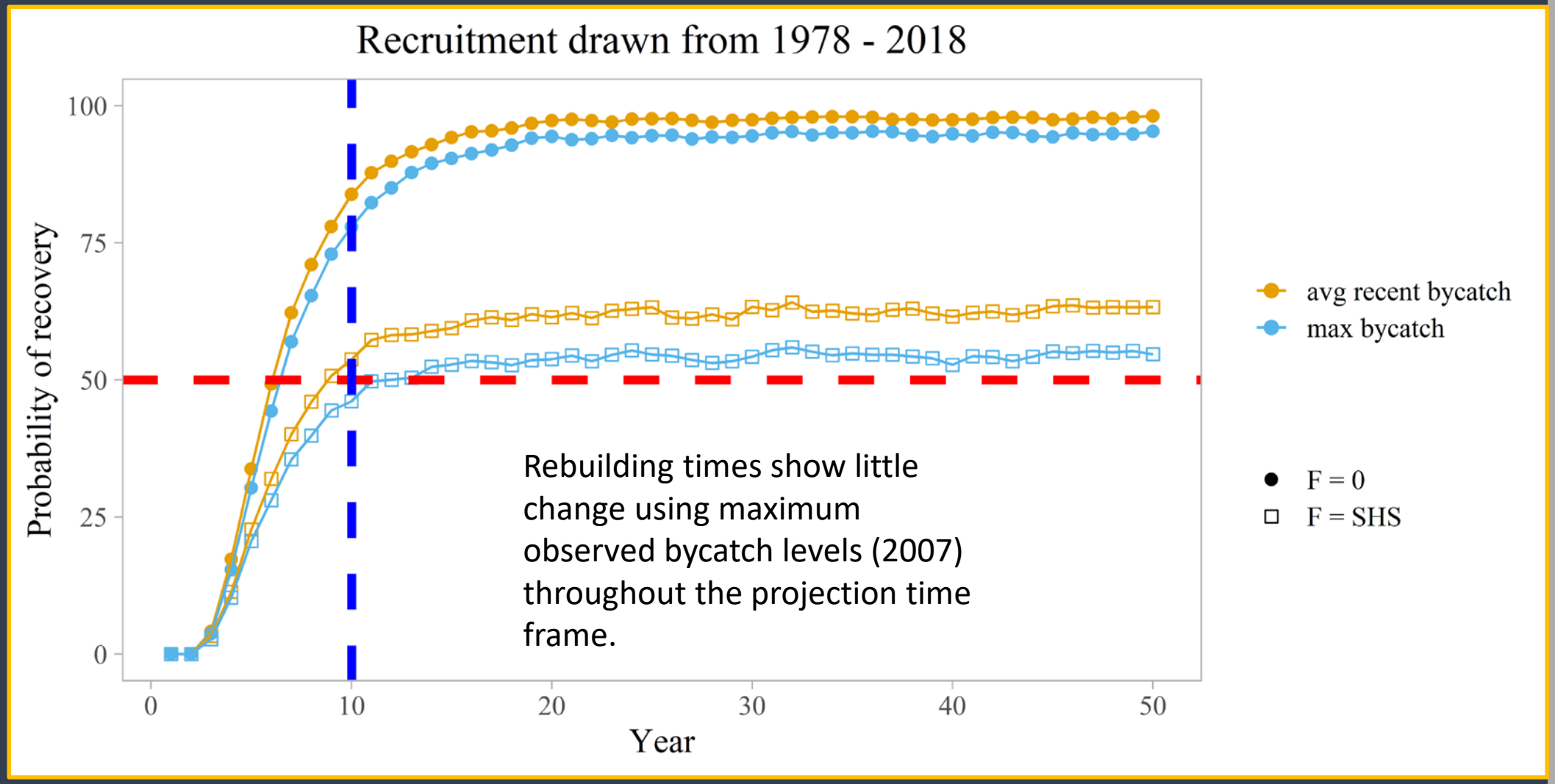
3.2.7 Starting Conditions

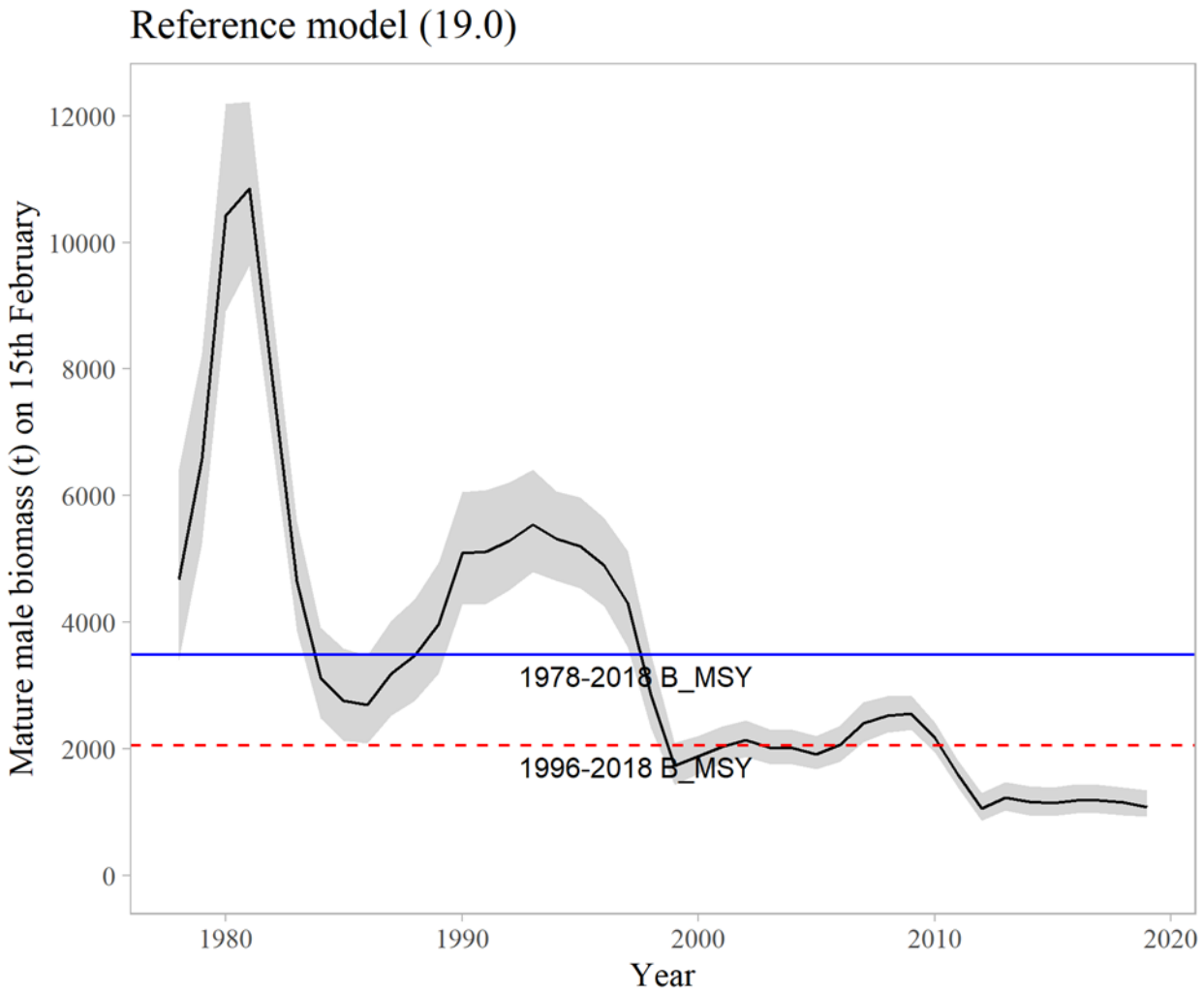
Year	Basis for B_{MSY} proxy	B_{MSY} proxy	MSST	B_{2019}	B/B_{MSY}	F_{OFL}	M
2019/20	Ave. Annual MMB from 1978-2018	3.484 kt MMB	1.742 kt MMB	1.081 kt MMB	0.31	0.042	0.18

3.2.7 Bycatch Assumptions

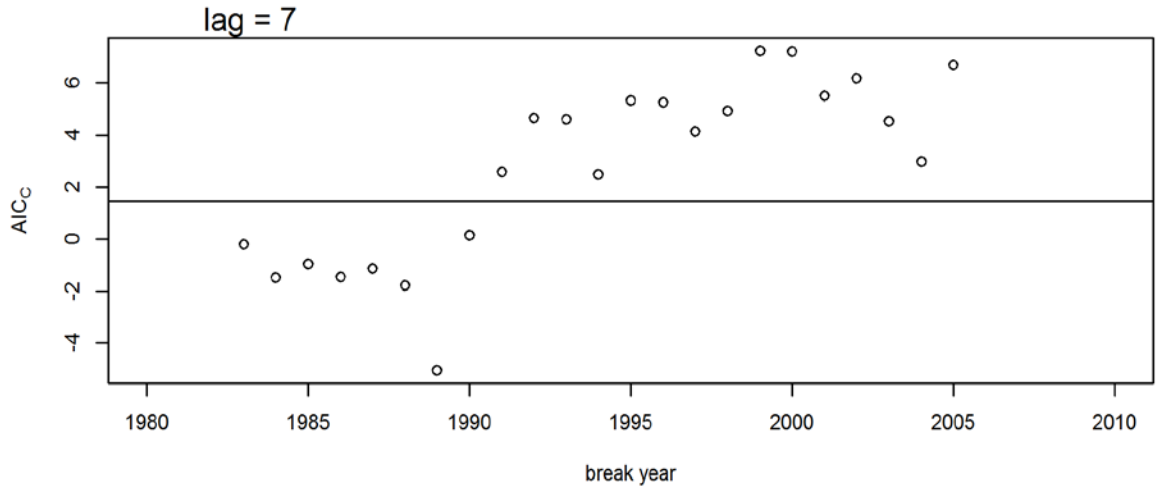


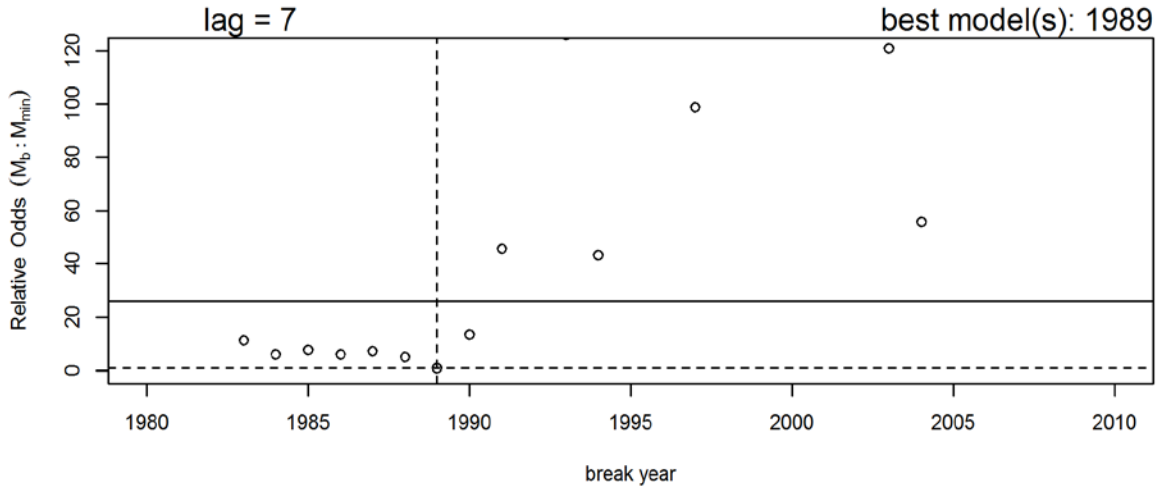
3.2.7 Bycatch Assumptions





Breakpoint Analysis

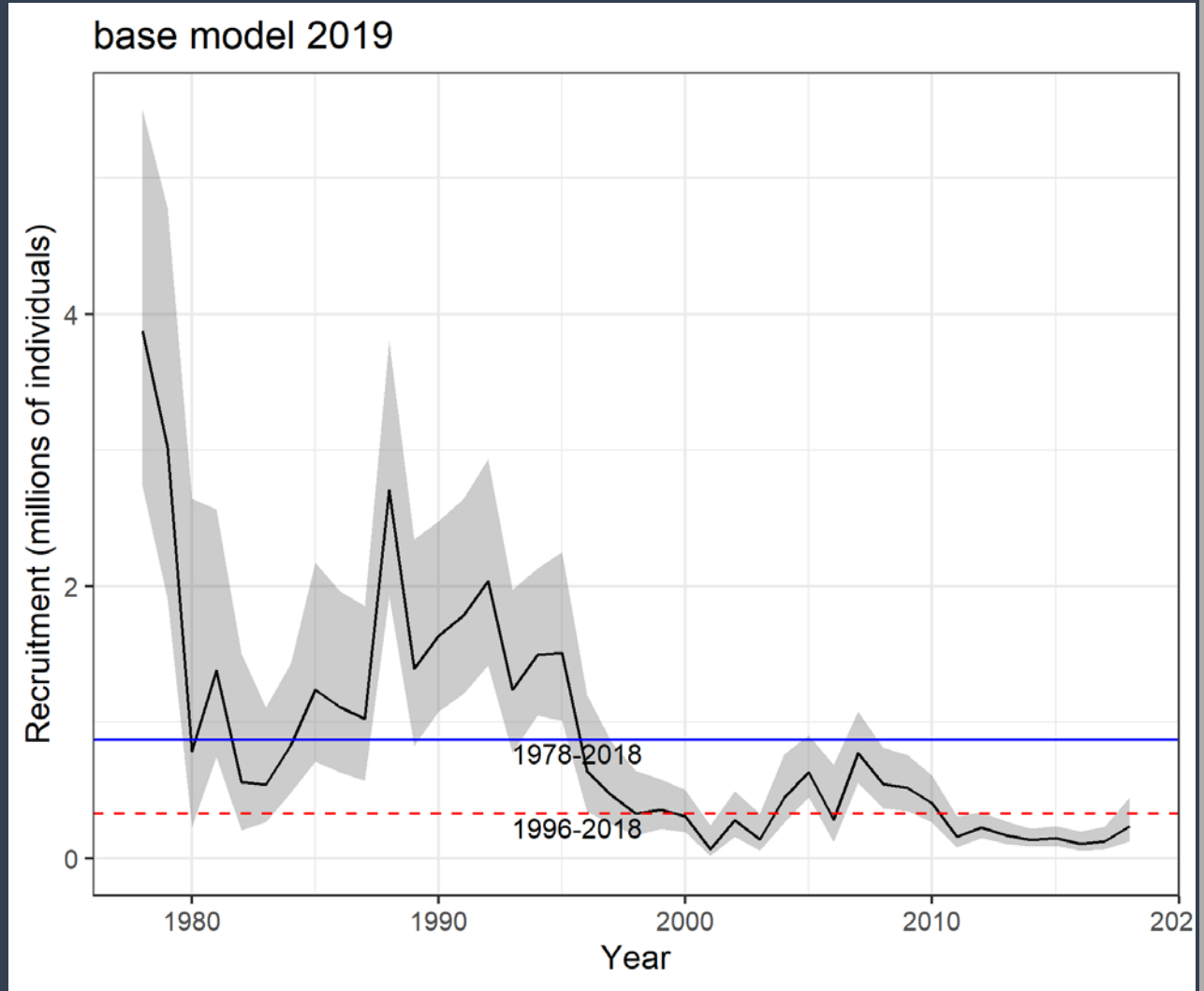




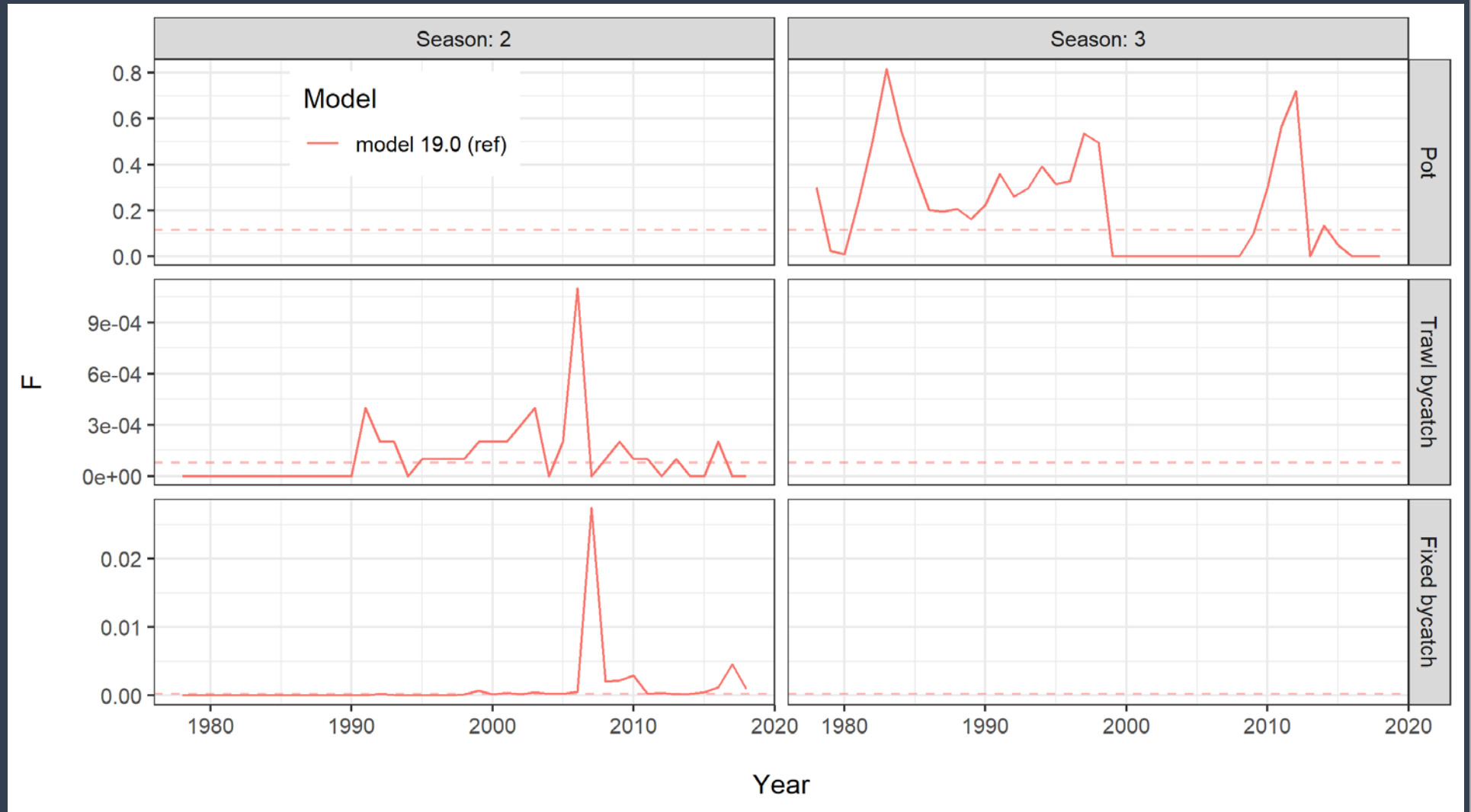
Breakpoint Analysis

Breakpoint / STARS analysis

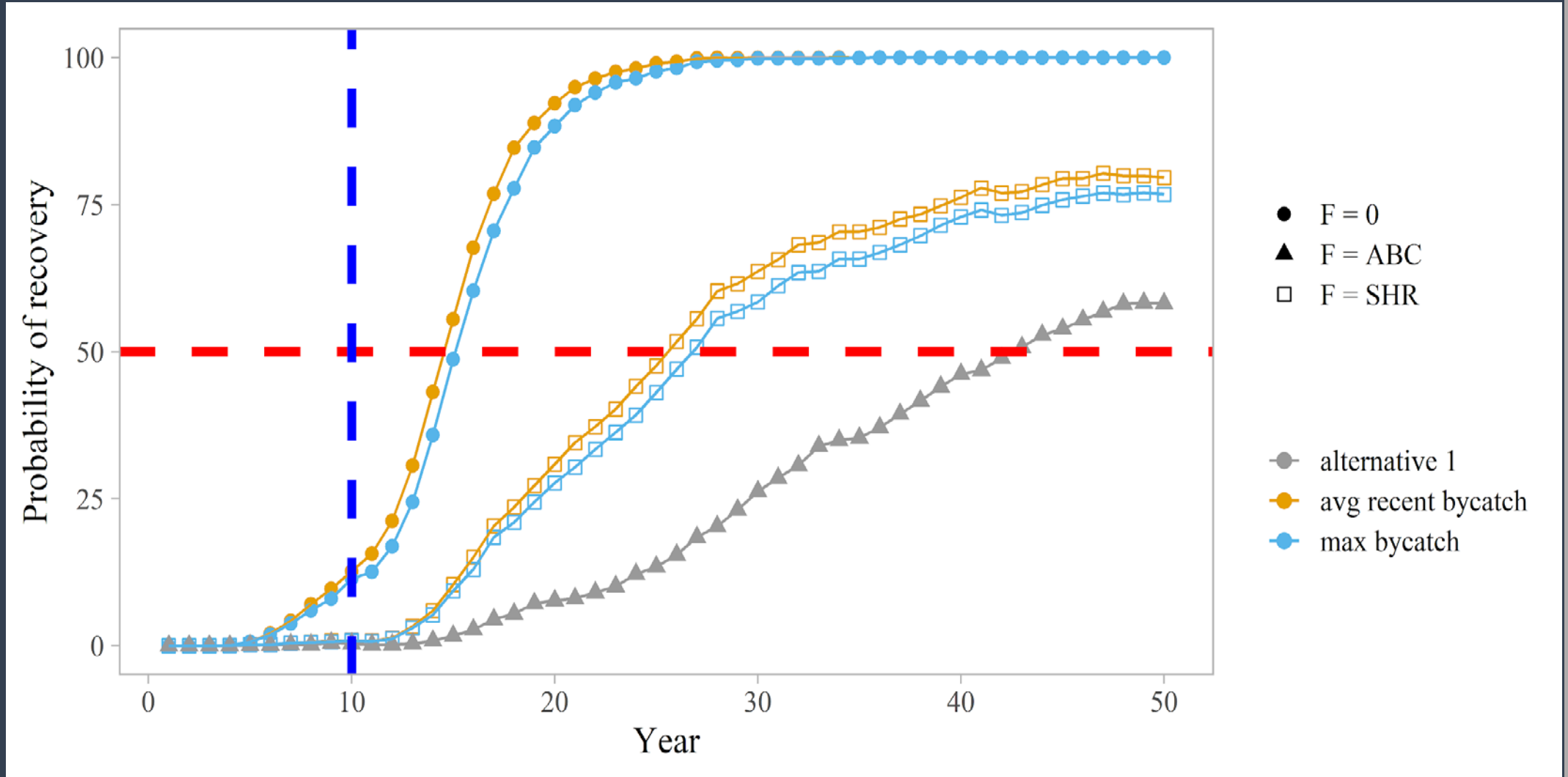
- Break in recruitment in 1996
- No obvious link to environmental change
  - “baby” regime shift in Bering Sea around this time
- Fishing mortality high in 90s prior to previous rebuilding plan
  - Can’t rule out fishing pressure contributing to low recruitment
- Keep reference time frame to all years



Model estimated Fishing mortality

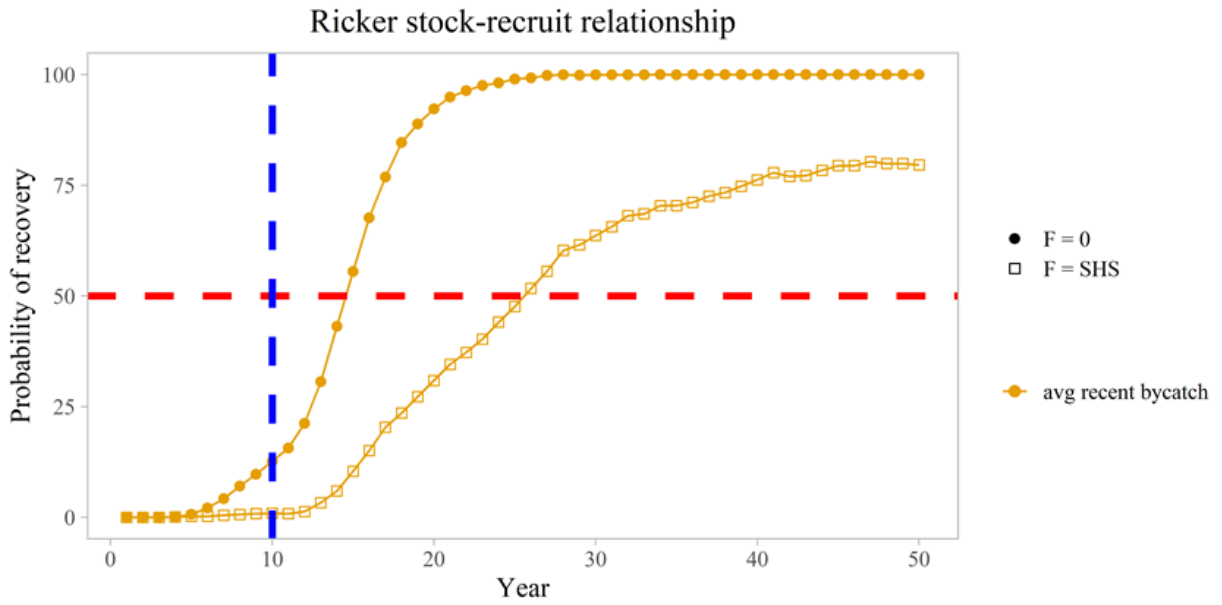


Projections

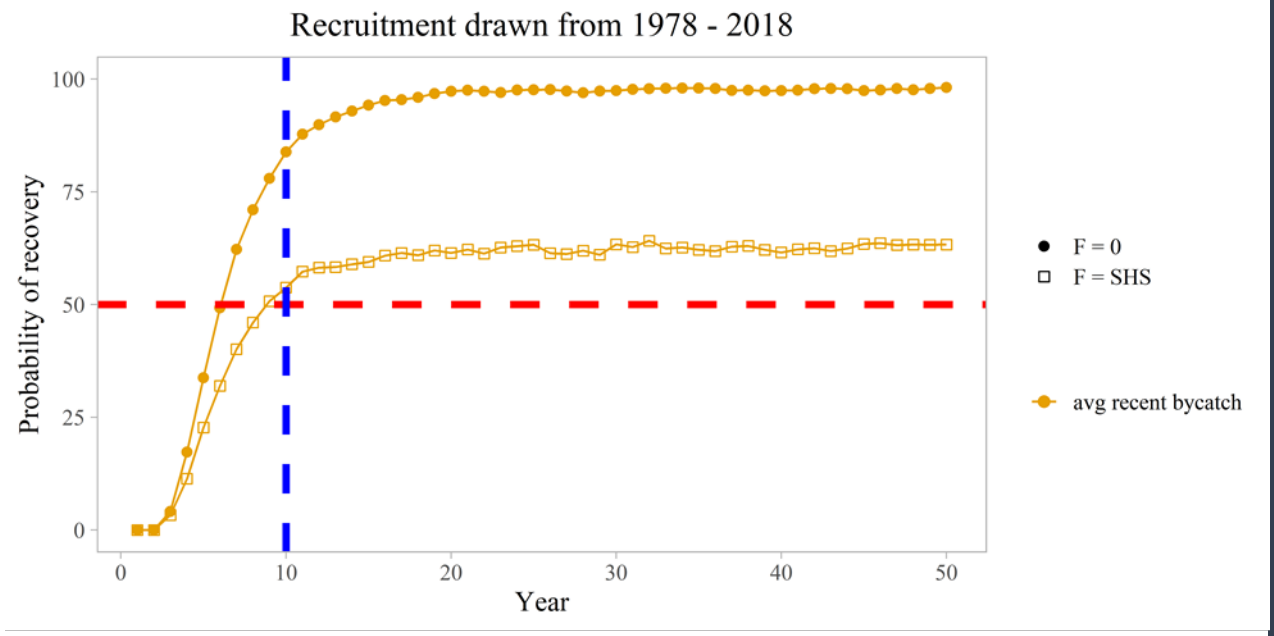


Projection Module

- Run using GMACS
- Uses the current operating model and projections into the future
- Recruitment options: random draws or stock-recruit relationship
- Harvest policy options: current ABC, state harvest strategy, directed F = 0
- Bycatch mortality: can be turned off/on
  - Current levels of bycatch mortality produced identical rebuilding projections
  - Maximum bycatch levels (7x higher than current) did not greatly influencing rebuilding time frames under any projections

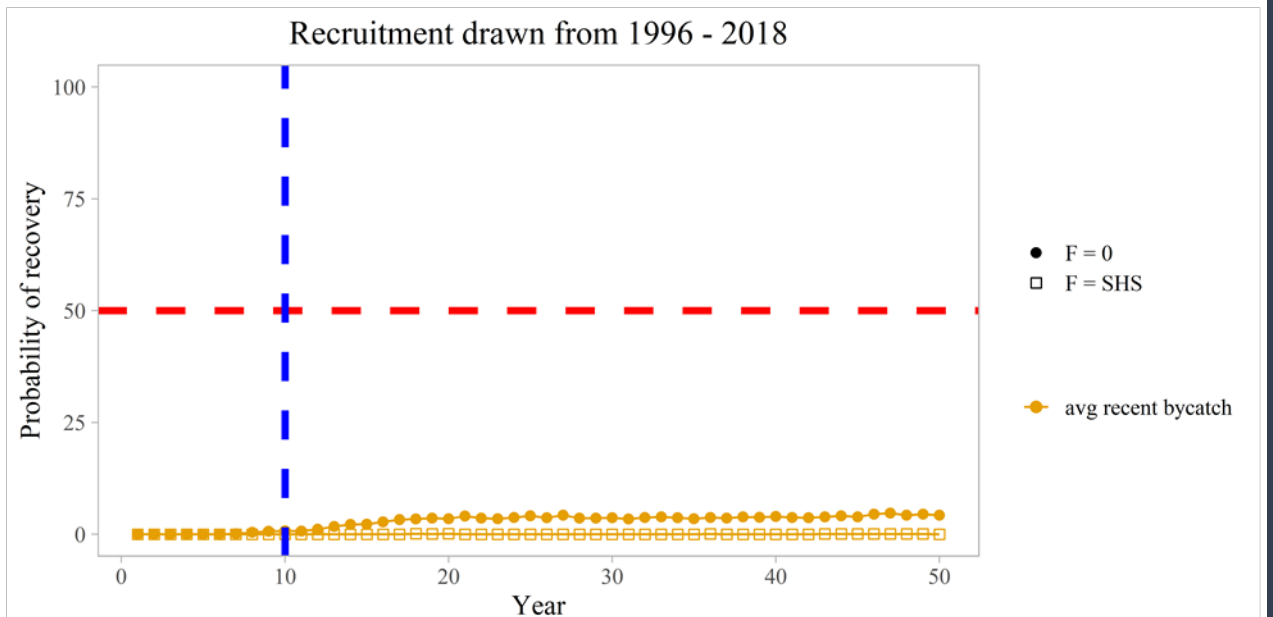


Recruitment Ricker S-R Model



1978-2018

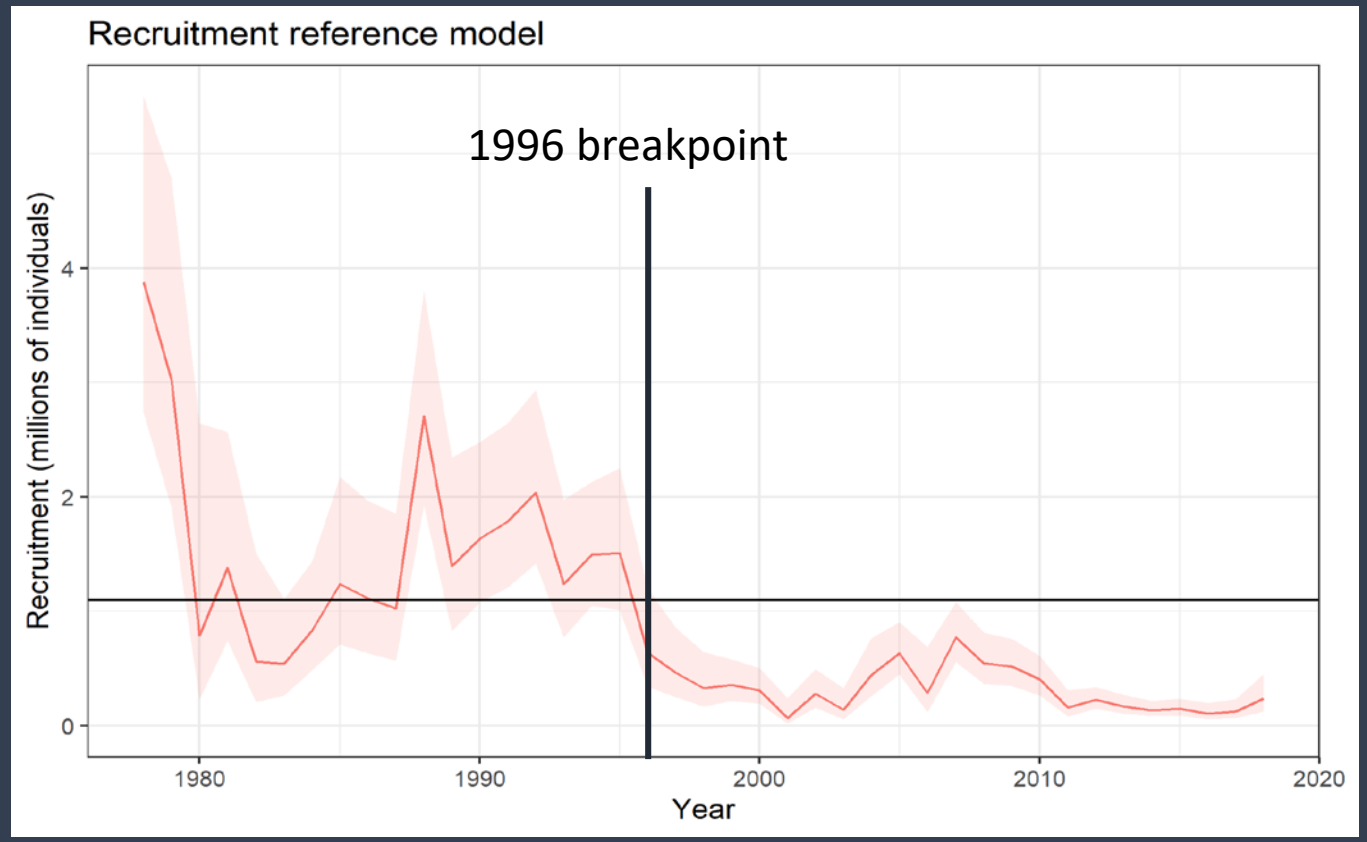
Randomized Recruitment



1996-2018

Summary of projections

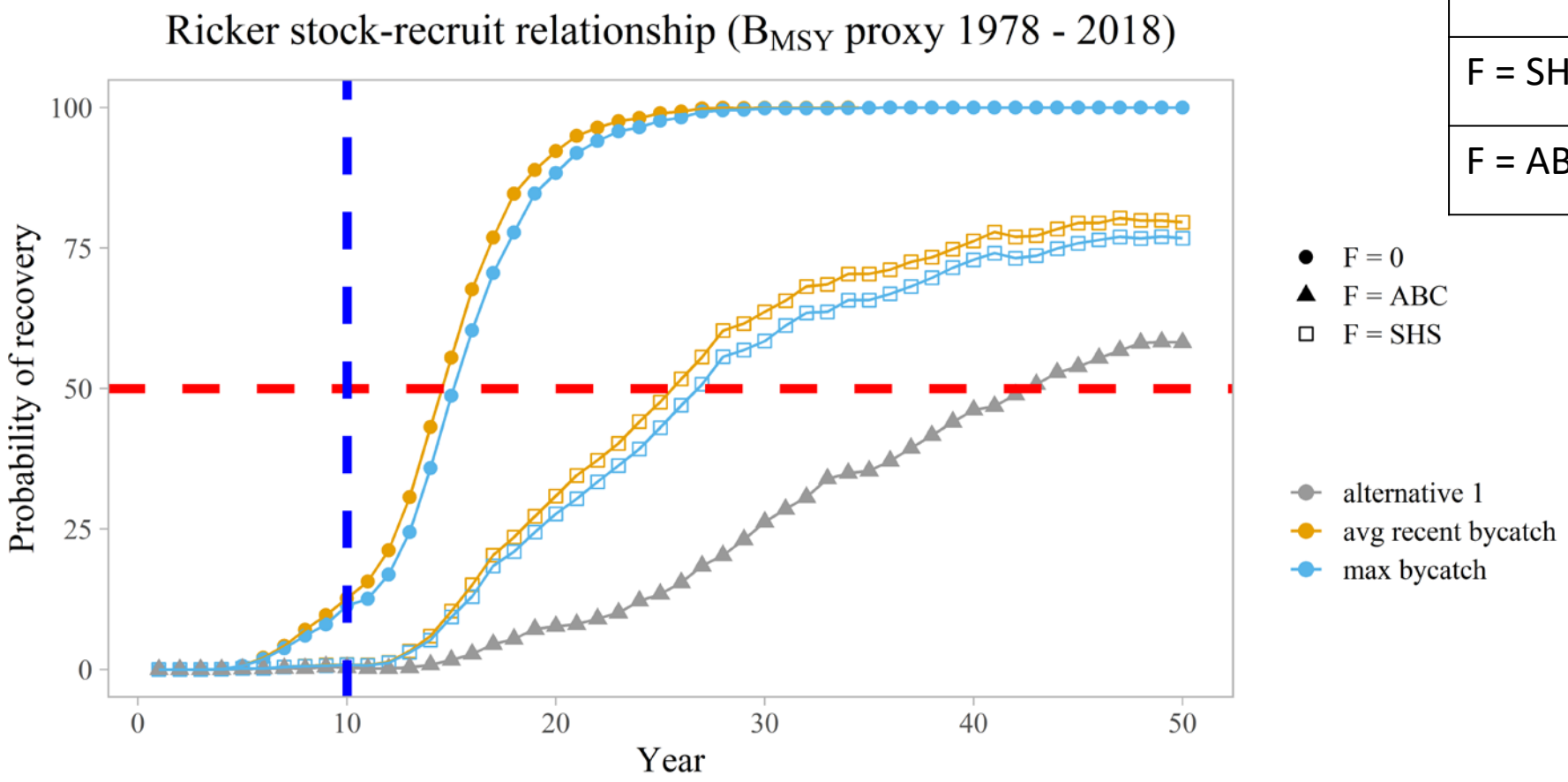
- Random recruitment: All years (1978 – 2018)
  - PRO: allows for high recruitment possibilities
  - CON: optimistic with current environment, stock status, etc.
- Random recruitment: Current regime (1996 – 2018)
  - PRO: realistic recruitment expectations for near future
  - CON: does NOT allow for increased recruitment
- Ricker stock-recruit model
  - PRO: Fluctuates with stock size
  - CON: weak relationship



Ricker stock-recruit recruitment projections

Average bycatch levels

F level	T_{min}
F = 0	14.5 yrs
F = SHS	25.5 yrs
F = ABC	43.0 yrs



3.3 Socioecon Effects

Fishing Year	GHL/TAC (mil lbs)	Crab	Pounds	Value	Pot lifts	CPUE	CVs	Landings	Trips
1999/00 - 2008/09				FISHERY CLOSED					
2009/10	1.17	101,074	460,857	986,770	10,697	9	7	21	16
2010/11	1.6	296,183	1,263,974	6,225,905	29,346	10.1	11	47	39
2011/12	2.54	430,813	1,880,606	8,695,968	48,554	8.9	18	61	58
2012/13	1.63	374,278	1,616,048	6,966,710	37,065	10.1	17	54	46
2013/14				FISHERY CLOSED					
2014/15	0.66	67,872	308,581	*	10,133	6.7	4	18	14
2015/16	0.41	24,045	106,422	*	5,475	4.4	3	6	6
2016/17 - 2018/19				FISHERY CLOSED					

Table 13. Vessels Revenue Dependence on the Saint Matthew Island blue king crab fishery, 2010-2012 (millions of 2018 real dollars).

Geography	Annual Average Number of Vessels	Annual Average Ex-Vessel Gross Revenues	Annual Average Total Ex-Vessel Gross Revenues	Ex-Vessel Value as a Percentage of Total Ex-Vessel Gross Revenue
Alaska Total	5.3	$2.30	$18.90	12.15%
WA and OR	10.0	$5.91	$36.10	16.37%
Grand Total	**15.3**	**$8.21**	**$55.00**	**14.92%**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

Table 14. Community Fishery Revenue Dependence on the Saint Matthew Island blue king crab fishery, 2010-2012 (millions of 2018 real dollars).

Geography	Annual Average Number of Vessels	Annual Average Number of Commercial Fishing CVs in those Same Communities	Annual Average Ex-Vessel Gross Revenues from SMB Fishery	Annual Average Total Ex-Vessel Gross Revenues from All Areas, Gears, and Species Fisheries by Community	Annual Average Saint Matthews Blue King Crab Ex-Vessel Revenue as a Percentage of Total Ex-Vessel Revenue
Alaska Total	5.3	866	$2.30	$270.65	0.85%
WA and OR	10.0	298	$5.91	$608.16	0.97%
Grand Total	**15.3**	**1,164**	**$8.21**	**$878.81**	**0.93%**

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

Table 15. Shore-Based Processors in Alaska Accepting Saint Matthew Island blue king crab Deliveries, 2010-2015 (number of processors).

Geography	2010	2011	2012	2013	2014	2015	Annual Average 2010-2015 (number)	Annual Average 2010-2015 (percent)	Total Unique SBPRs 2010-2015 (number)
Akutan	1	1	1	Fishery Closed	0	0	0.6	21.43%	1
Unalaska/Dutch Harbor	2	2	2		0	0	1.2	42.86%	3
St Paul	1	1	1		1	1	1.0	35.71%	1
Total	**4**	**4**	**4**		**1**	**1**	**2.8**	**100.00%**	**5**

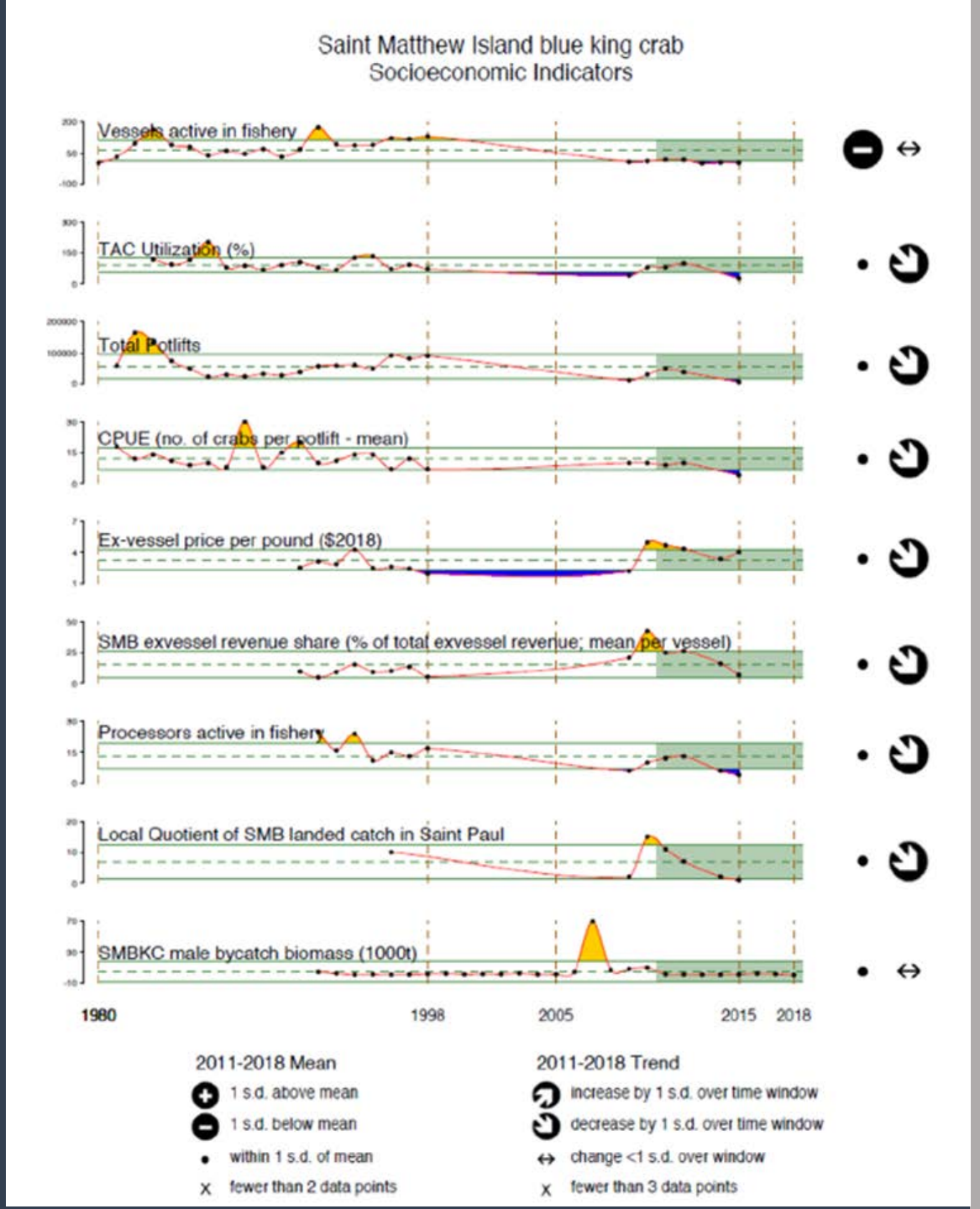
Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

Table 16. Processors Ex-Vessel Values From Saint Matthew Island blue king crab, 2010-2015 (millions of 2018 real dollars).

	2010	2011	2012	2013	2014	2015	Annual Average 2010-2012 ($ millions)	Processor Dependence 2010-2012 (percent)	Community Processing Dependence 2010-2012 (percent)
Shore-Based Processors	$7.15	$9.78	$7.69	NA	*	*	$8.21	1.38%	1.35%

Source: ADFG/CFEC Fish Tickets, data compiled by AKFIN in Comprehensive FT

3.3 Socioecon Effects



Summary

Alternative	Time for 50% Prob of Rebuilt	Fishing mortality	Diff from T_{min} (14.5 years)	Diff from T_{max} (28.5 years)
Alt 1	>40 years	F = M (0.18)	>+25 years	>+12 years
Alt 2, Option 1	14.5 years	zero	$=T_{min}$	-17 years
Alt 2, Option 2	25.5 years	State harvest strategy	+11 years	-3 years

Council actions following initial review draft

Dec

- Council action as necessary
- Public review draft

Apr

- Council Final action
- SOC final analysis

post April

- NMFS approval and regulations as needed
- Implementation prior to October 2020