Sablefish assessment 2019
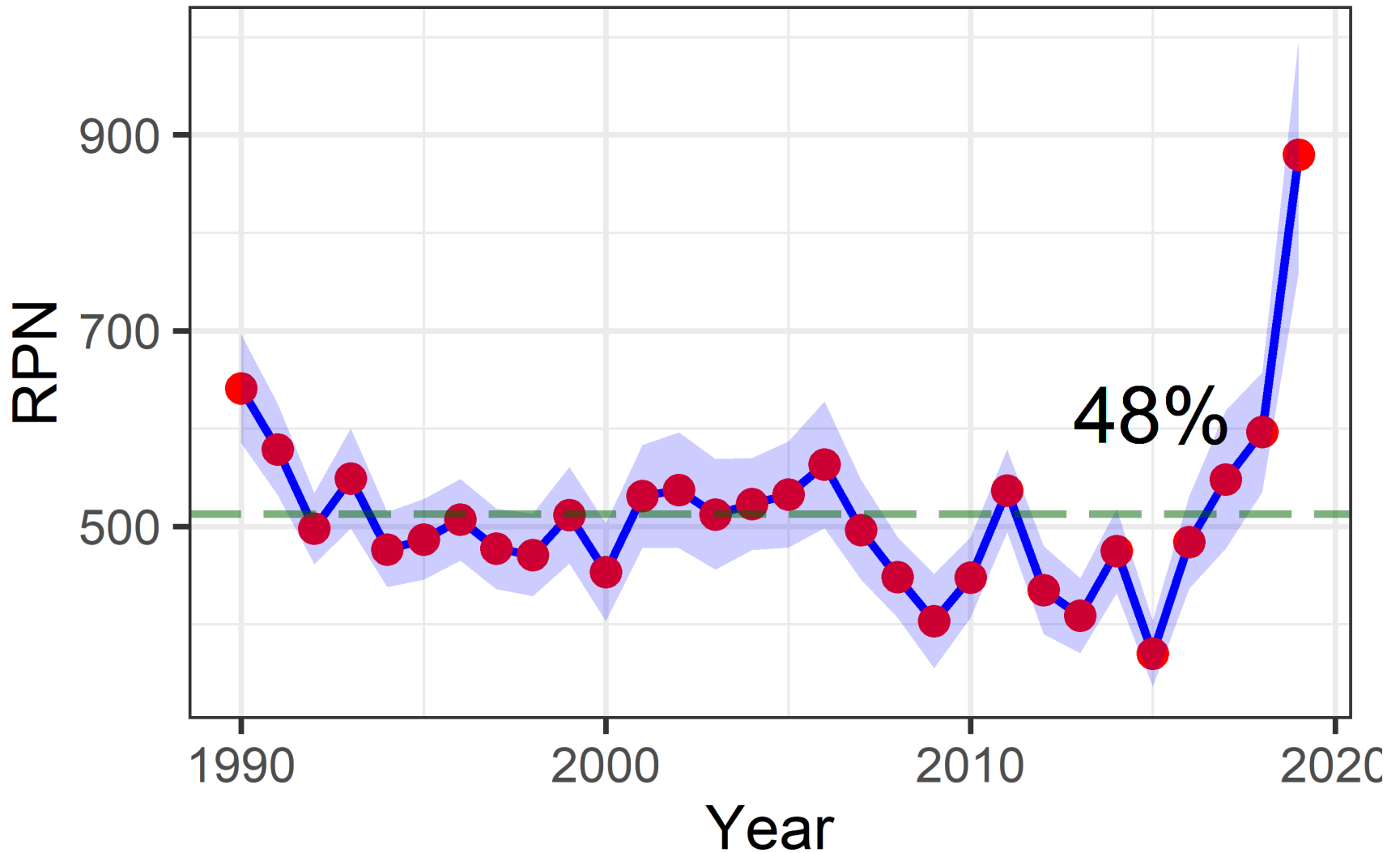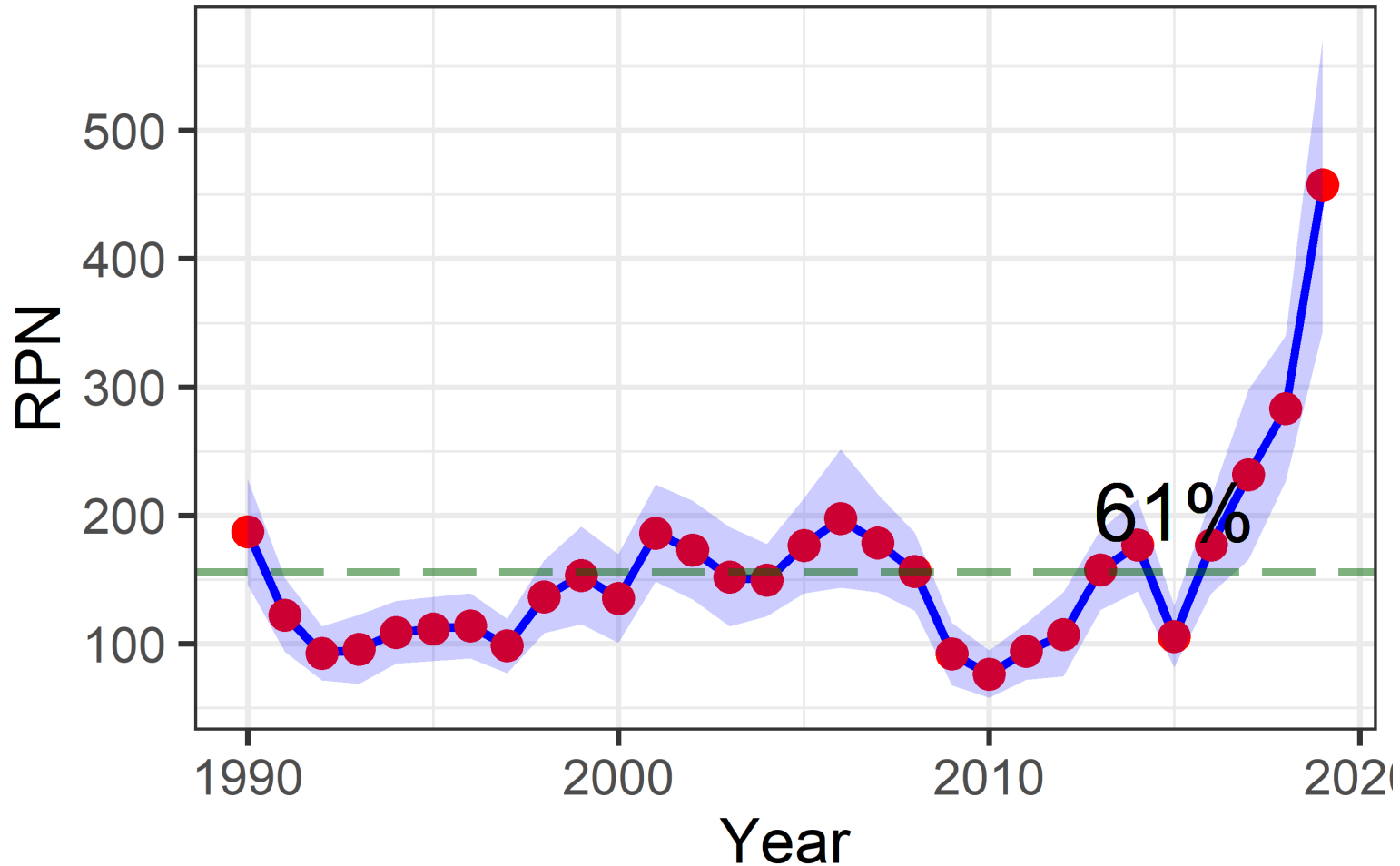
1) New data in hand

2) 2020 outlook

3) Apportionment update

4) Tag-recovery website rollout

Longline survey 2019
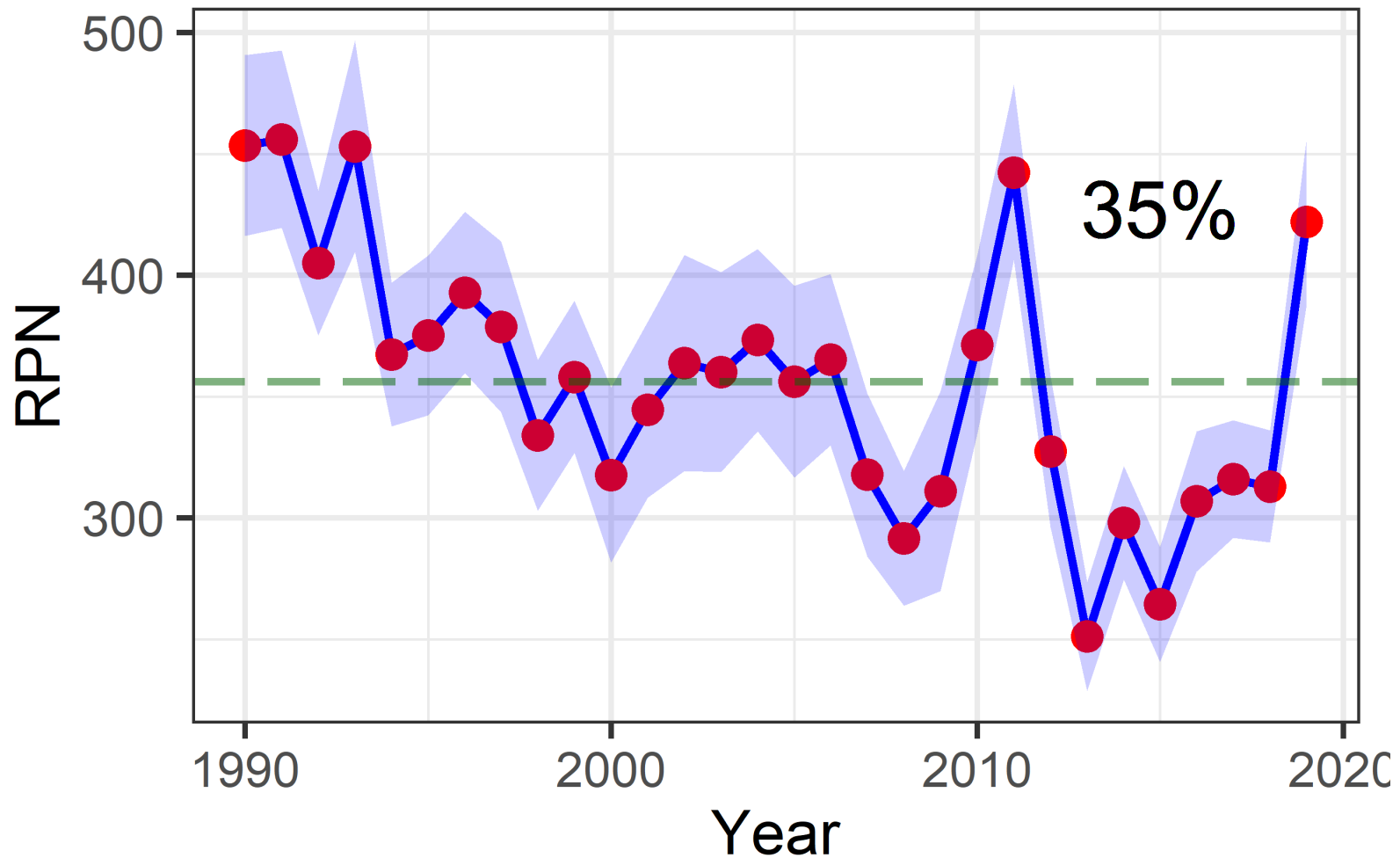

48%

Longline survey 2019
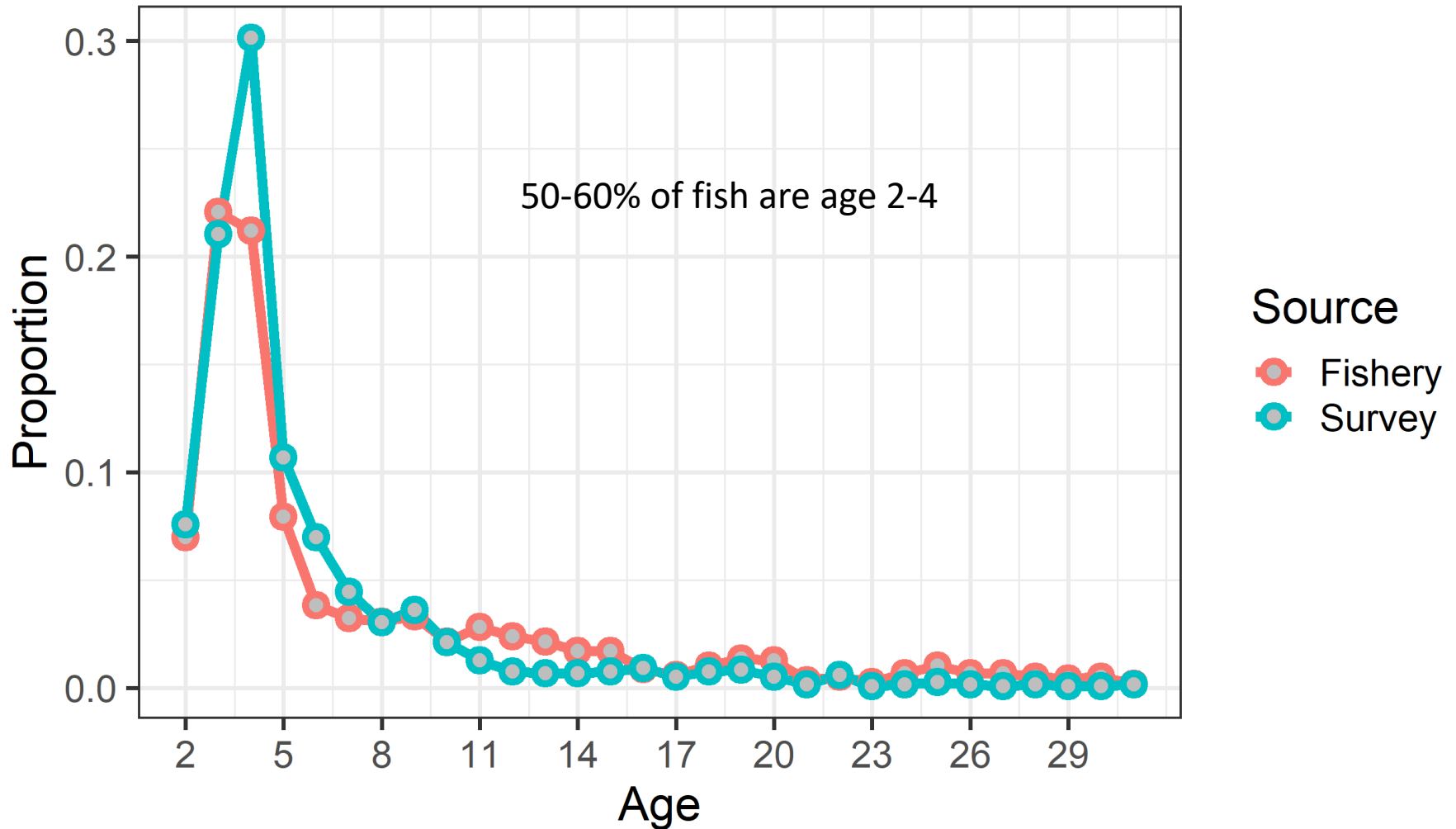

BSAI Sablefish longline survey RPN

Longline survey 2019

GOA Sablefish longline survey RPN

35%

The youth are the future

Age compositions 2018

50-60% of fish are age 2-4

Source: Fishery, Survey

Looks normal

Catch and limits

Unavoidable

Bering Sea bar chart showing Kilotons Sablefish. Catch: 2.83, ABC: ~1.5, OFL: 3.22 for BS. Legend: Catch, ABC, OFL.

Better together?

Bering Sea/Aleutian Islands
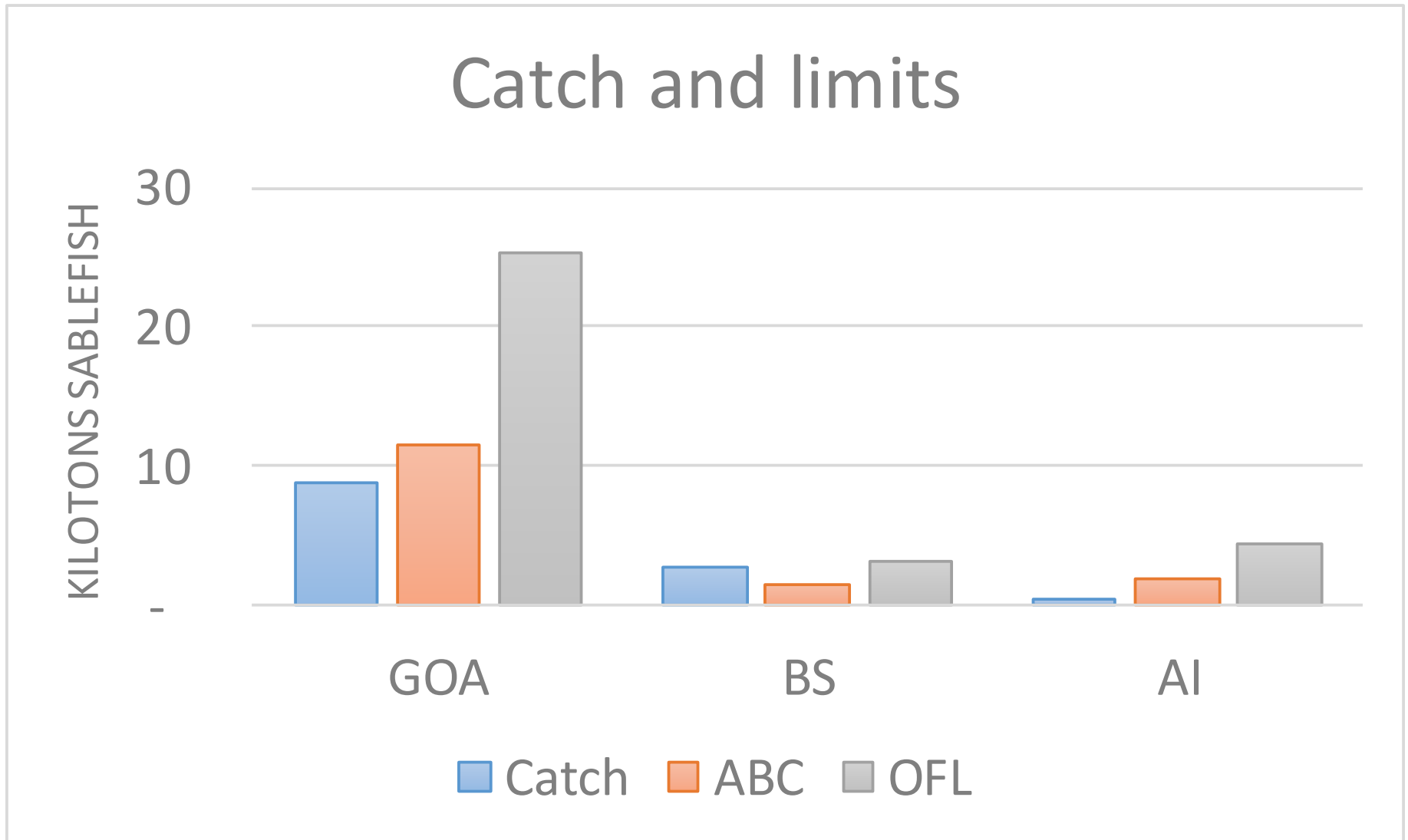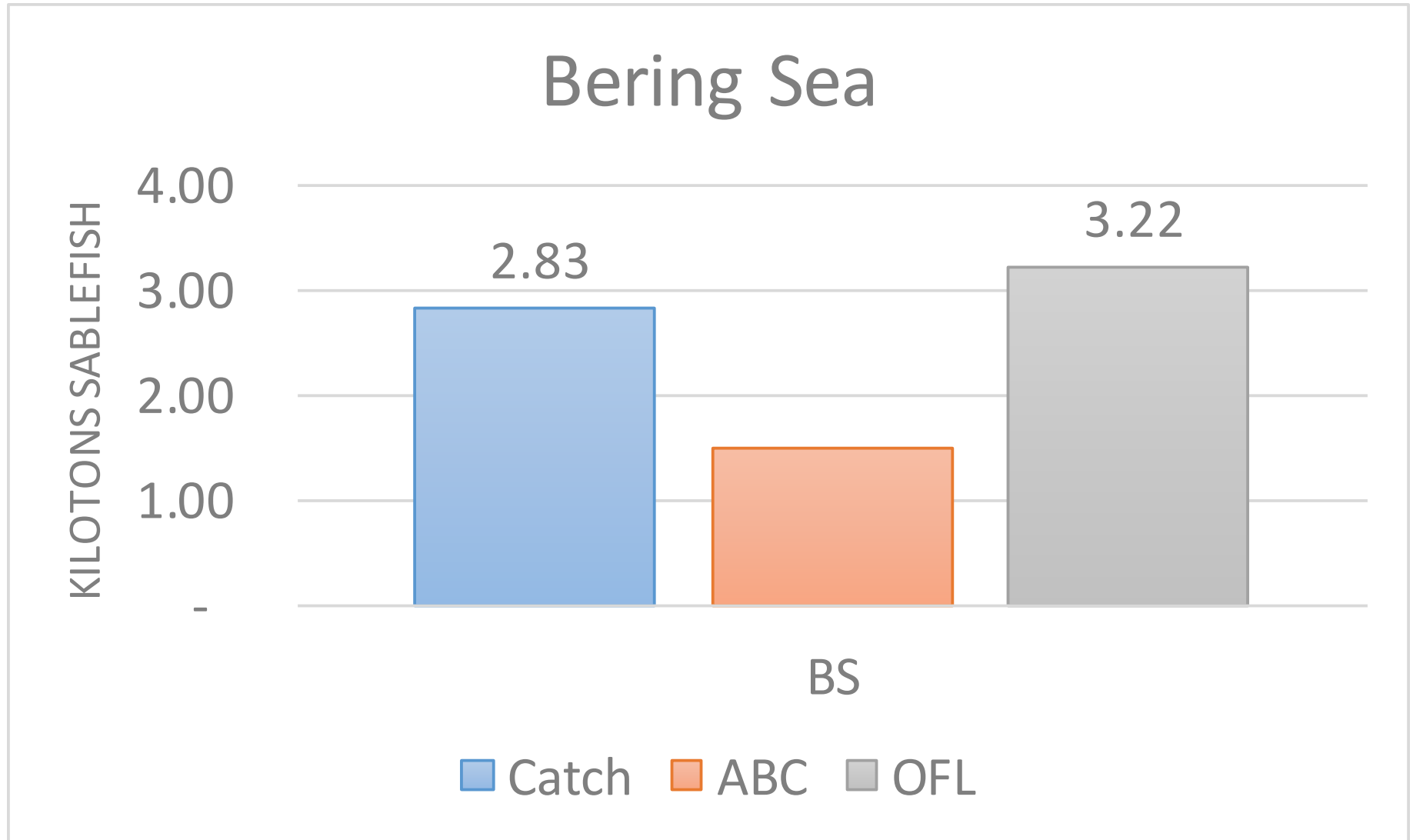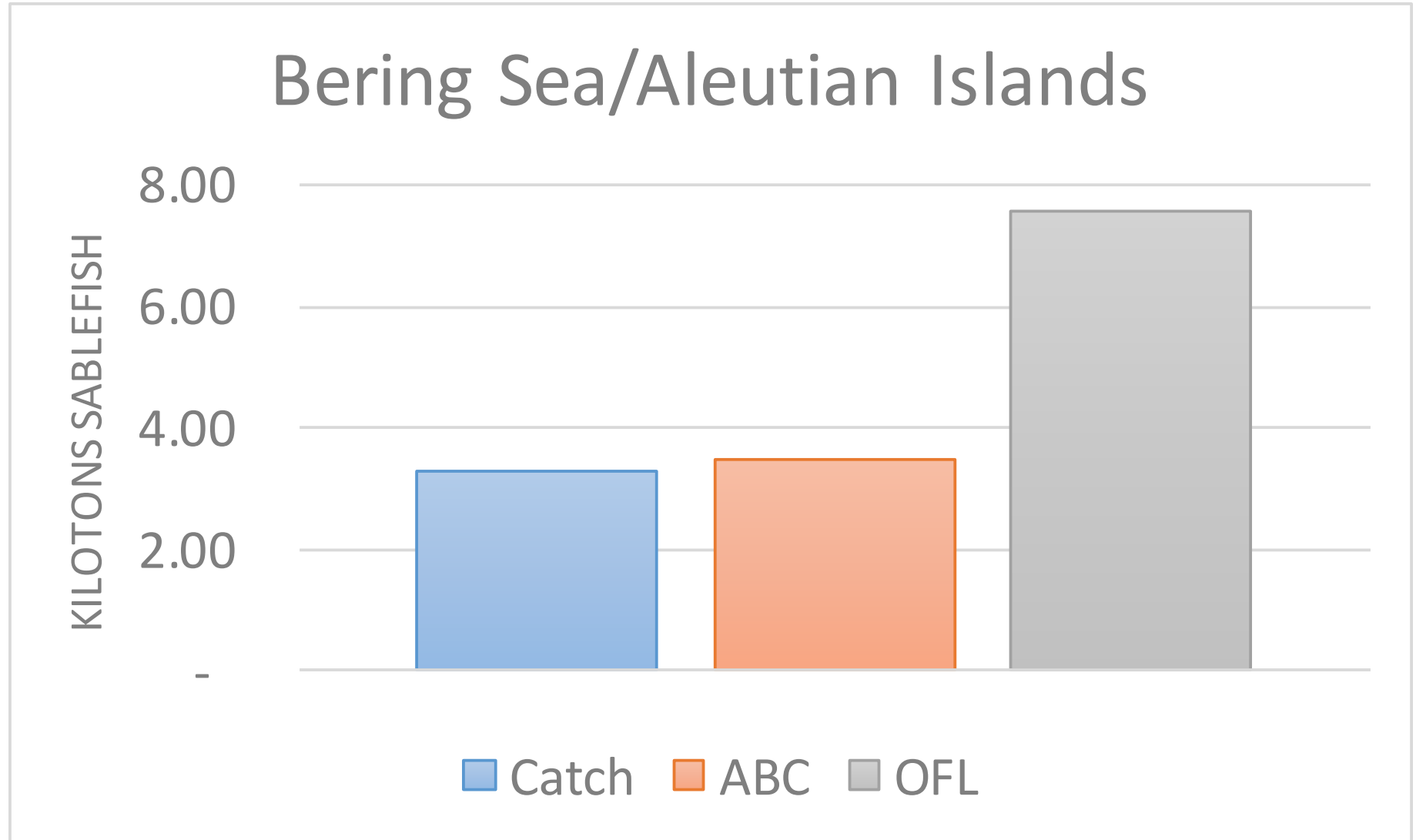
Sablefish November 2019

1) No new models

2) Sensitivity runs

3) Apportionment Preliminary Results

4) Ecosystem and Socioeconomic Profile

5) Risk Table

Preliminary evaluation of alternative sablefish apportionment strategies

**Kari Fenske, Dana Hanselman, Curry Cunningham**

Overview

- **Why** we are looking at this
- **How** we have approached the analyses - methods
- **What** were are finding (so far)
- **What** we need from PT

# Sablefish apportionment - context

- ABC apportionment fixed at 2013 proportions since 2014

- 2000-2013 apportionment method

- Examine performance of 10 sablefish ABC apportionment methods

Methods

- 6-area OM – simulates the population
  - can simulate spatial dynamics in fleet or fish behavior via
  - catchability, selectivity, fish movement
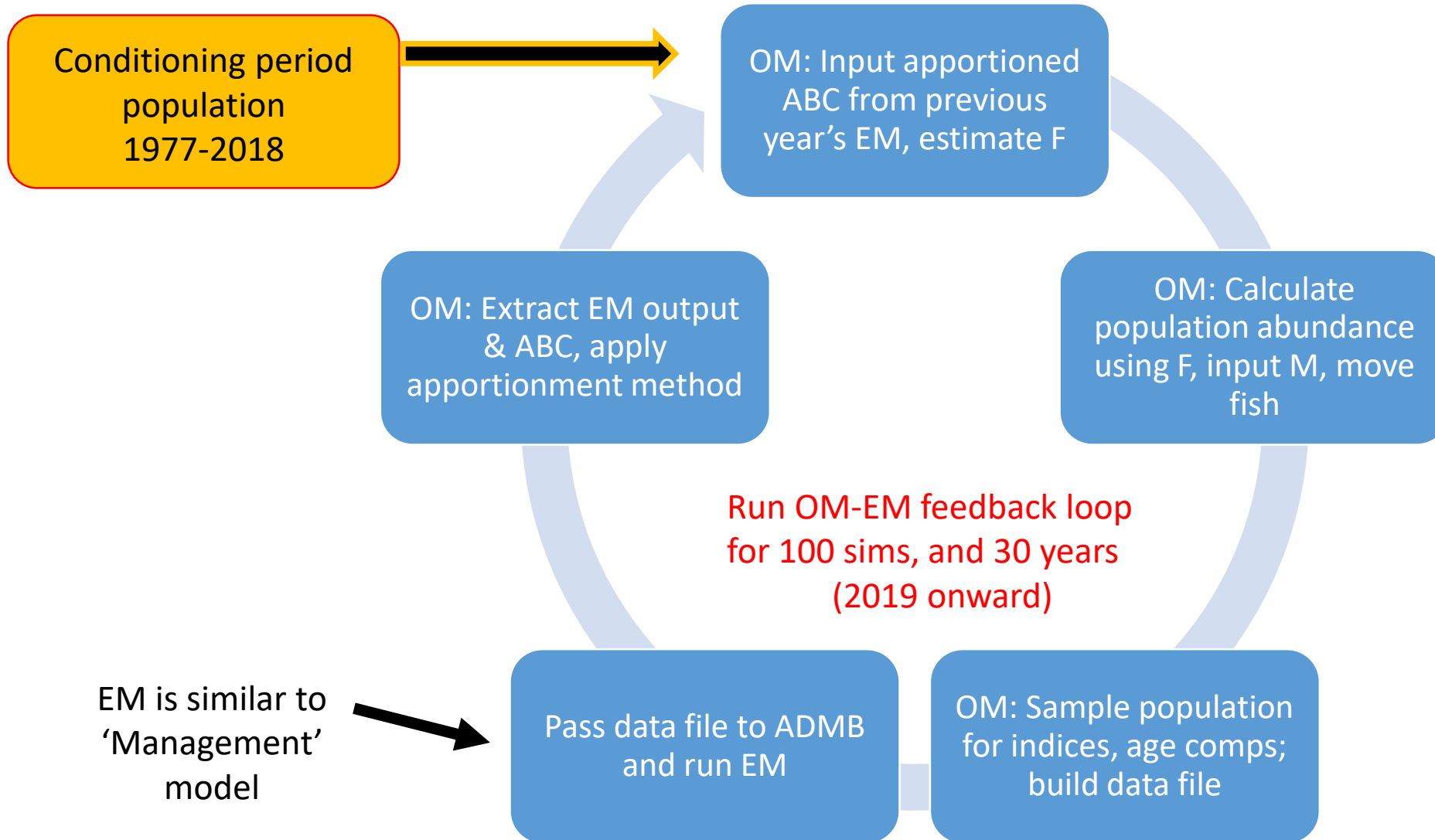- 1-area EM – the assessment model
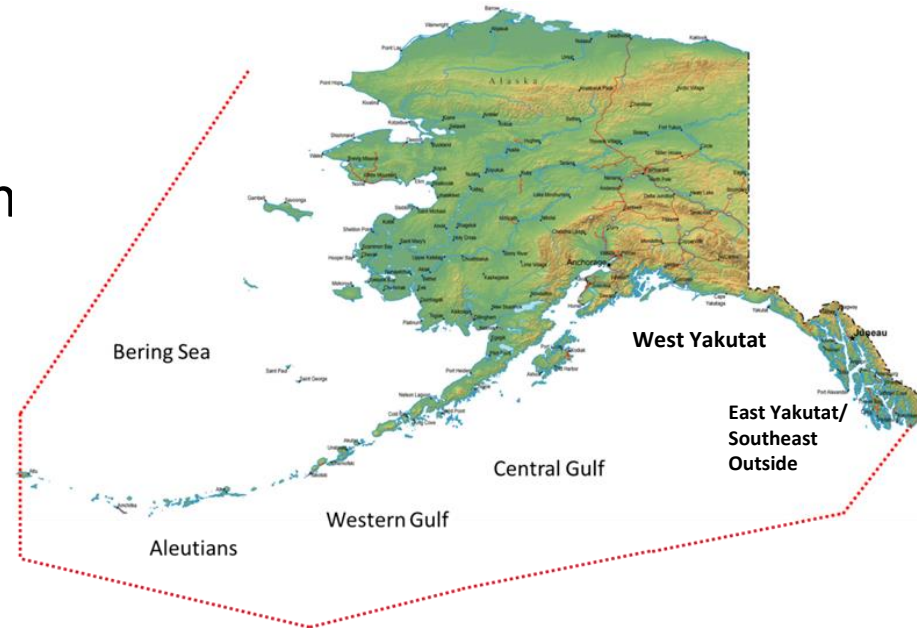
Methods – OM Simulates population in two periods

| Conditioning period (1977-2018) | → | Forward Projection period (2019-2029+) |
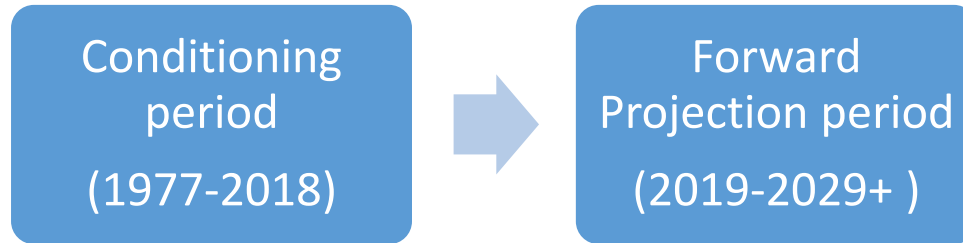
- Deterministic conditioning period
  - Same across simulations
  - Input recruitment, catch
  - Intended to closely match Management EM
- Stochastic forward projecting portion which runs for years 2019-2029
  - Lognormal recruitment (sigma=0.8)
  - Lognormal sample for indices, multinomial/Dirichelet multinomial sample age comps

Methods – OM-EM feedback

Conditioning period population 1977-2018

OM: Input apportioned ABC from previous year's EM, estimate F

OM: Calculate population abundance using F, input M, move fish

OM: Extract EM output & ABC, apply apportionment method

Run OM-EM feedback loop for 100 sims, and 30 years (2019 onward)

Pass data file to ADMB and run EM

OM: Sample population for indices, age comps; build data file

EM is similar to 'Management' model

Apportionment types

1. Equal: Each region receives 1/6 of the ABC.

2. Fixed: The apportionment proportions from the 2013 assessment that have been applied as fixed proportions for 2014-2018.

3. Equilibrium: Based on the stationary distribution of the movement rates.

4. NPFMC: A 5-yr exponentially weighted moving average of fishery and survey indices; survey weight is 2x fishery weight.

5. Exp_survey_wt: Similar to 'NPFMC' option but using survey index only.

6. Exp_fishery_wt: Similar to 'NPFMC' option but using fishery index only.

7. Non-Exp_NPFMC: A 5-yr moving average of fishery and survey indices.

8. Partial_fixed: BS and AI receive 10% of the ABC each, WG, CG, WY, and EY are apportioned based on NPFMC method.

9. Age_based: Based on the proportions of fish at age of 50% maturity in each area - i.e. areas with greater proportion of fish at age of 50% maturity or greater will be apportioned a greater proportion of ABC.

10. Term_LLsurv: Terminal year of longline survey (no exponential weighting).

11. All_to_one: All ABC taken out of a single area, as an extreme example.

# Caveats and important OM details

- The NPFMC Tier 3 harvest control rules are still in place and used for determining ABC in the EM, we are only simulating different methods for apportioning ABC to management areas.

- We assume ABC=TAC and 100% of apportioned ABC is caught in each region.

- We do not correct for whale depredation in the ABC or survey index.

- Movement rates (between 6 areas) are input

- Recruitment for the 2014 year class has been reduced in the conditioning period from 150 million fish to 50 million to improve EM convergence and reduce crashing.

- Recruitment draws for the forward projecting period are also capped at 50 million.

Conditioning period OM results

Biomass with recruitment change
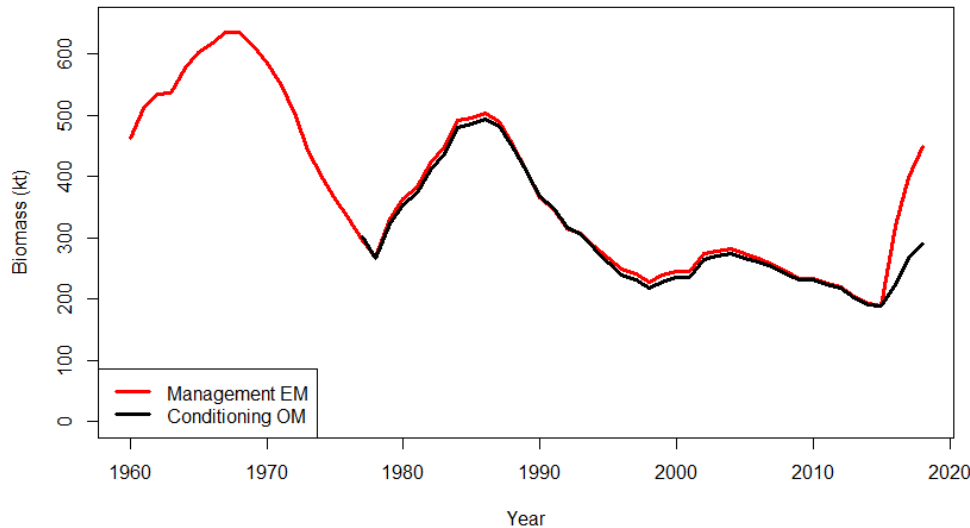
Biomass without recruitment change
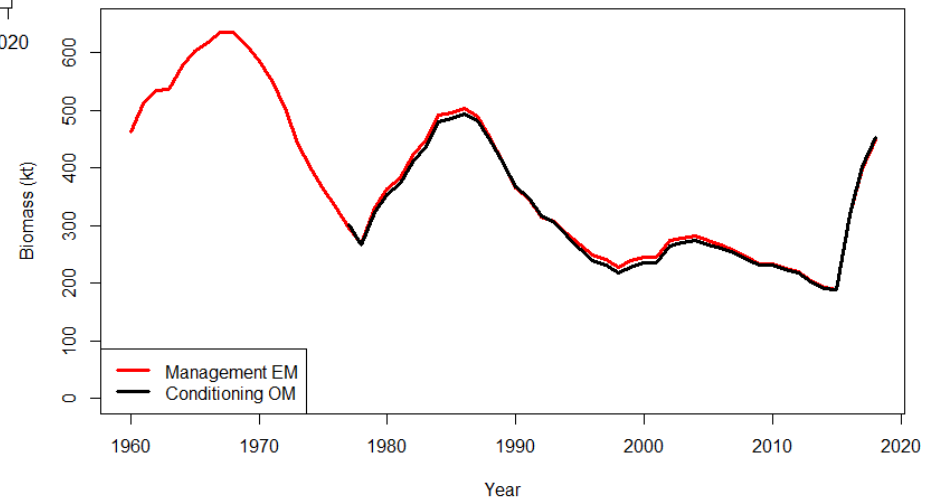
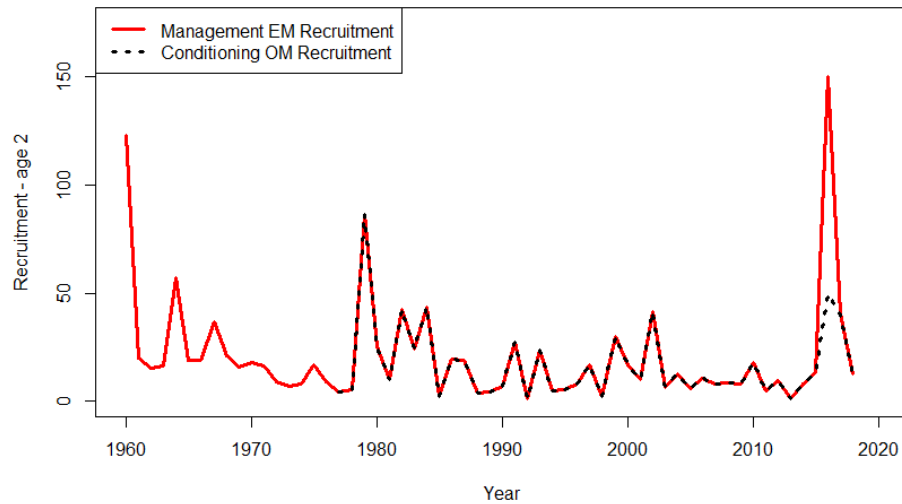# Conditioning period OM results Spawning biomass
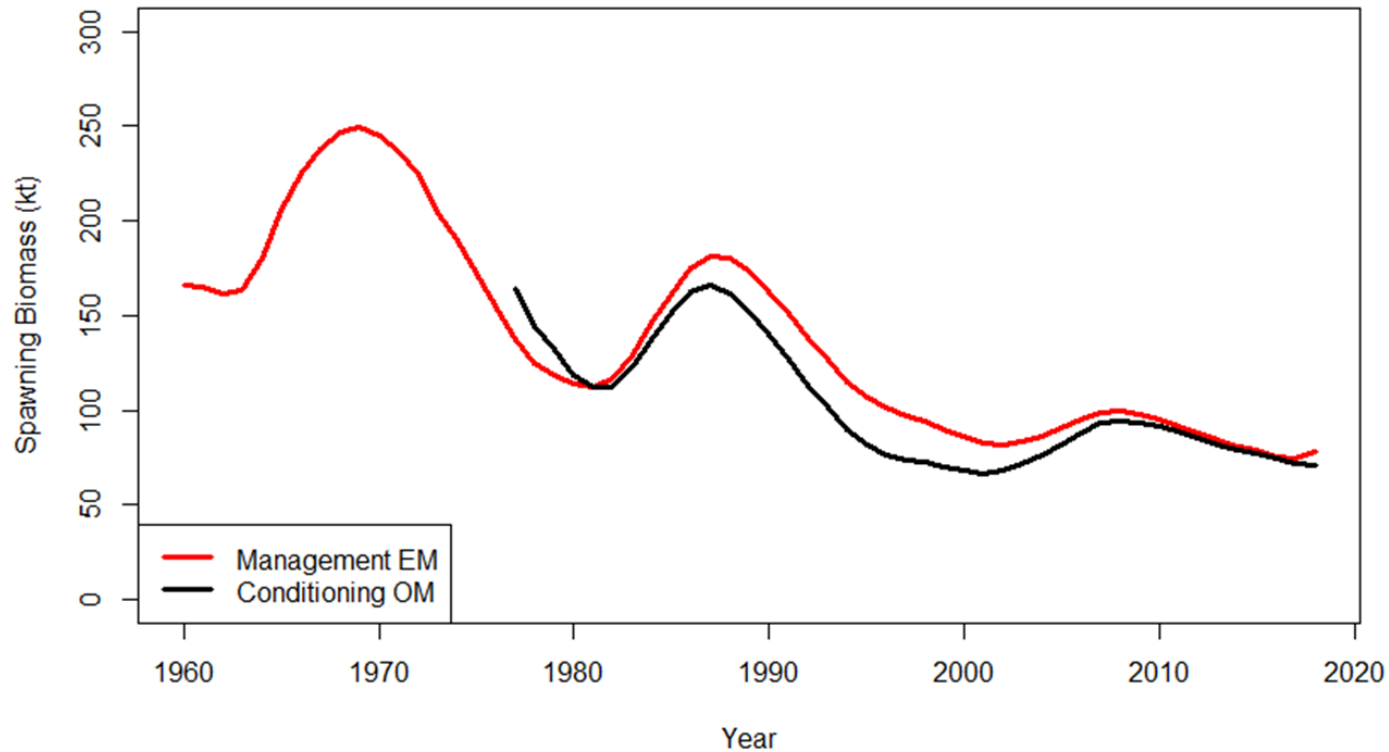
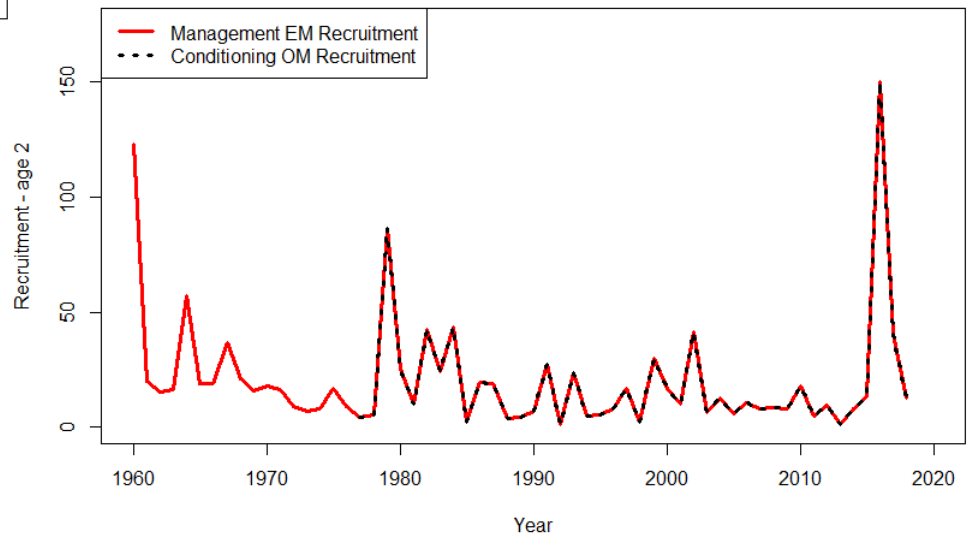# Conditioning period OM results Catch
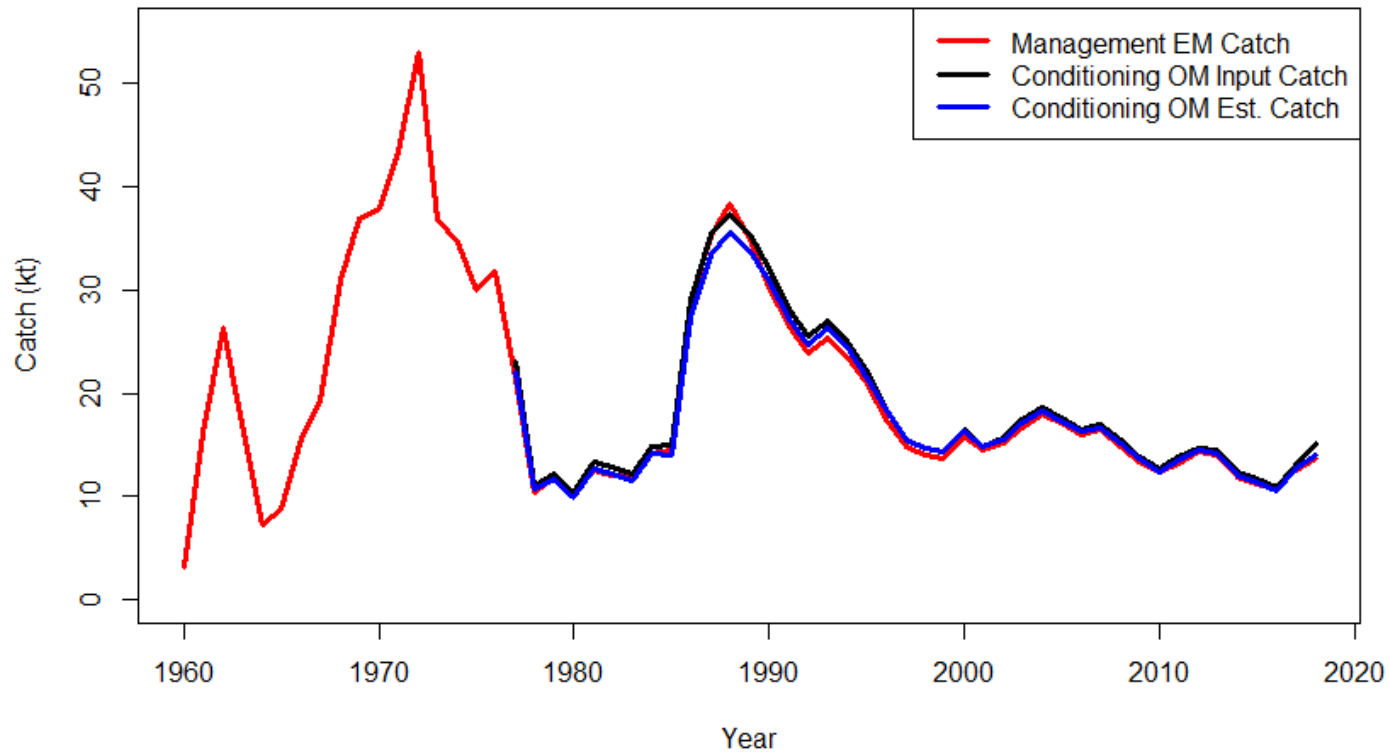
Conditioning period OM results Recruitment

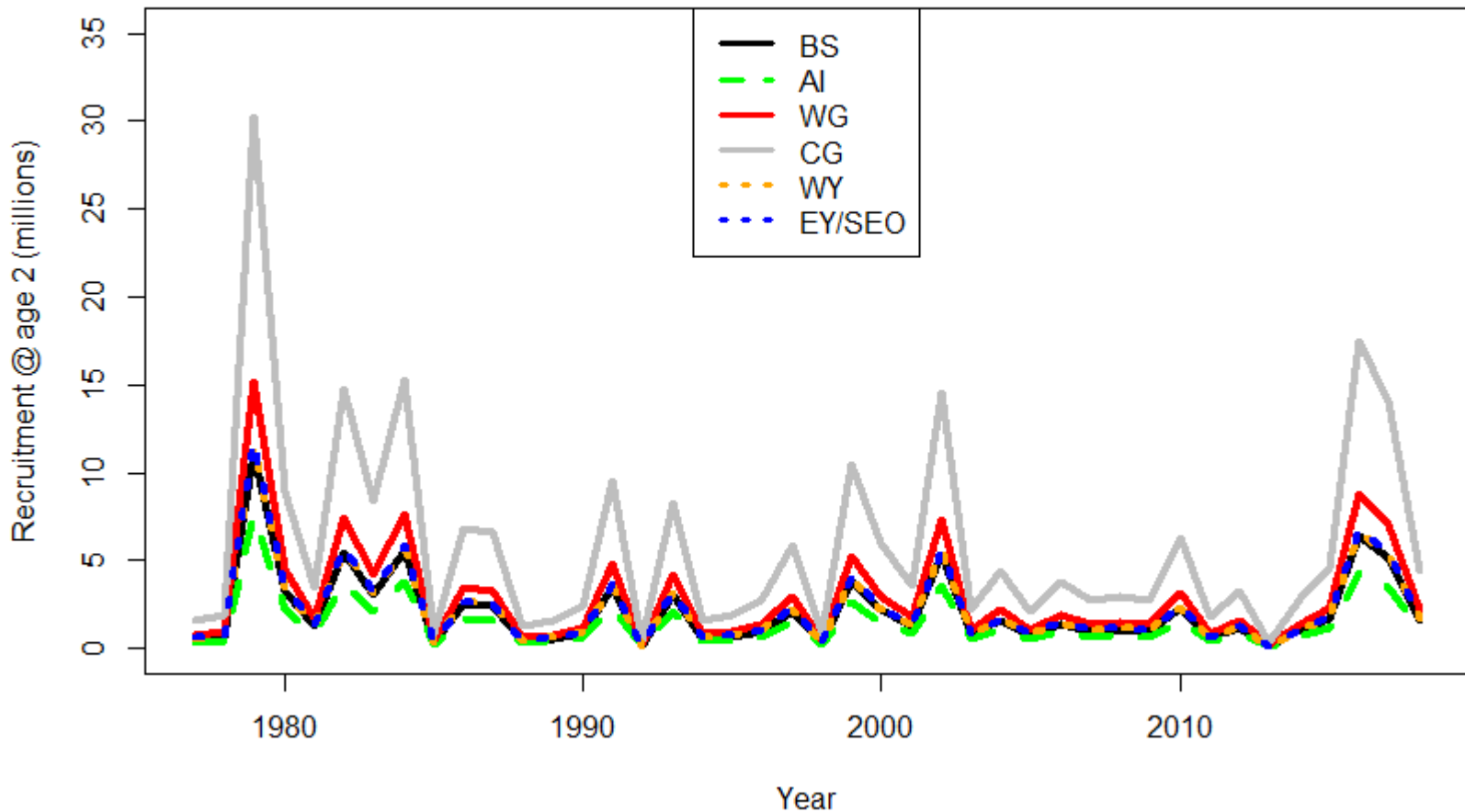Recruitment with 2014 year class artificially reduced
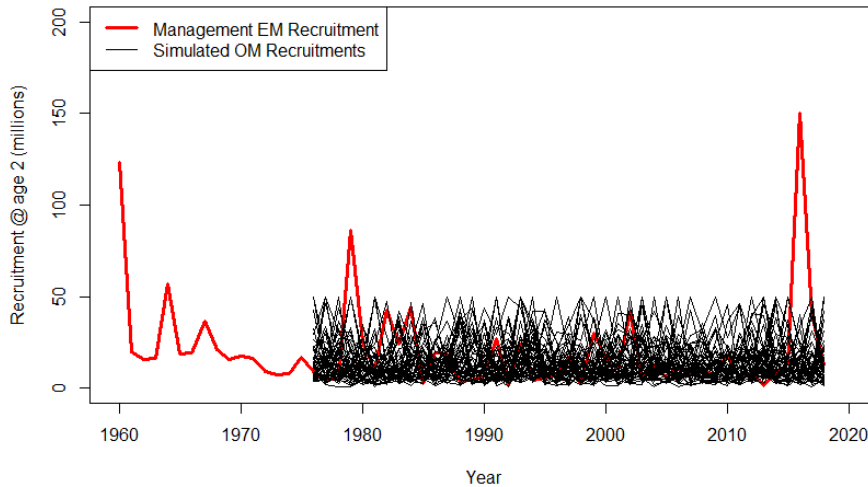

Recruitment without reduction in 2014

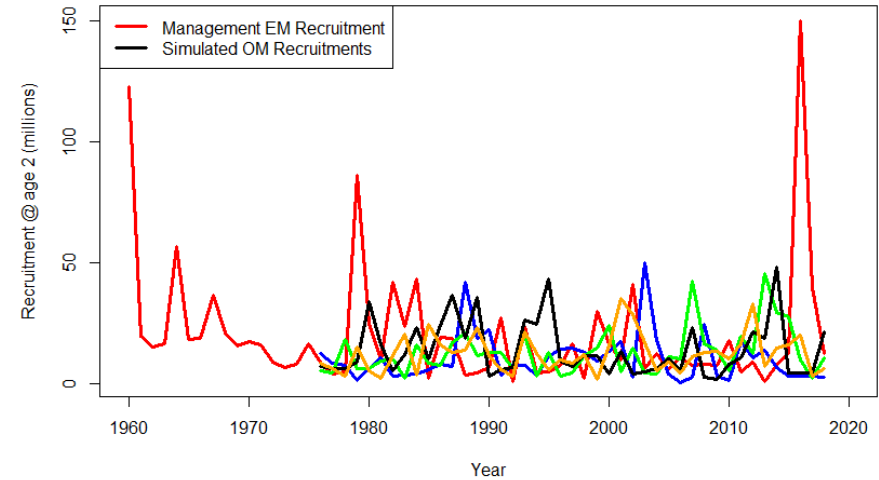# Conditioning period OM results Recruitment by area

Conditioning period OM results

All 50 simulated recruitment time series'

A few individual time series

Results

- *Using the proportion of survey biomass in each management area to allocate quota performed best for maximizing system yield when true spatial structure was unknown...outperforming equal and recruitment-based allocation.*

- *However, all methods of quota allocation sometimes led to unintended depletion within management units.*

Fisheries Research, December 2019:

Overcoming challenges of harvest quota allocation in spatially structured populations

Katelyn M.Bosley, Daniel R.Goethel, Aaron M.Berger, Jonathan J.Deroba, Kari H.Fenske, Dana H.Hanselman, Brian J.Langseth, Amy M.Schueller

Comparing apportionment types

Compare apportionment types for their performance relative to:
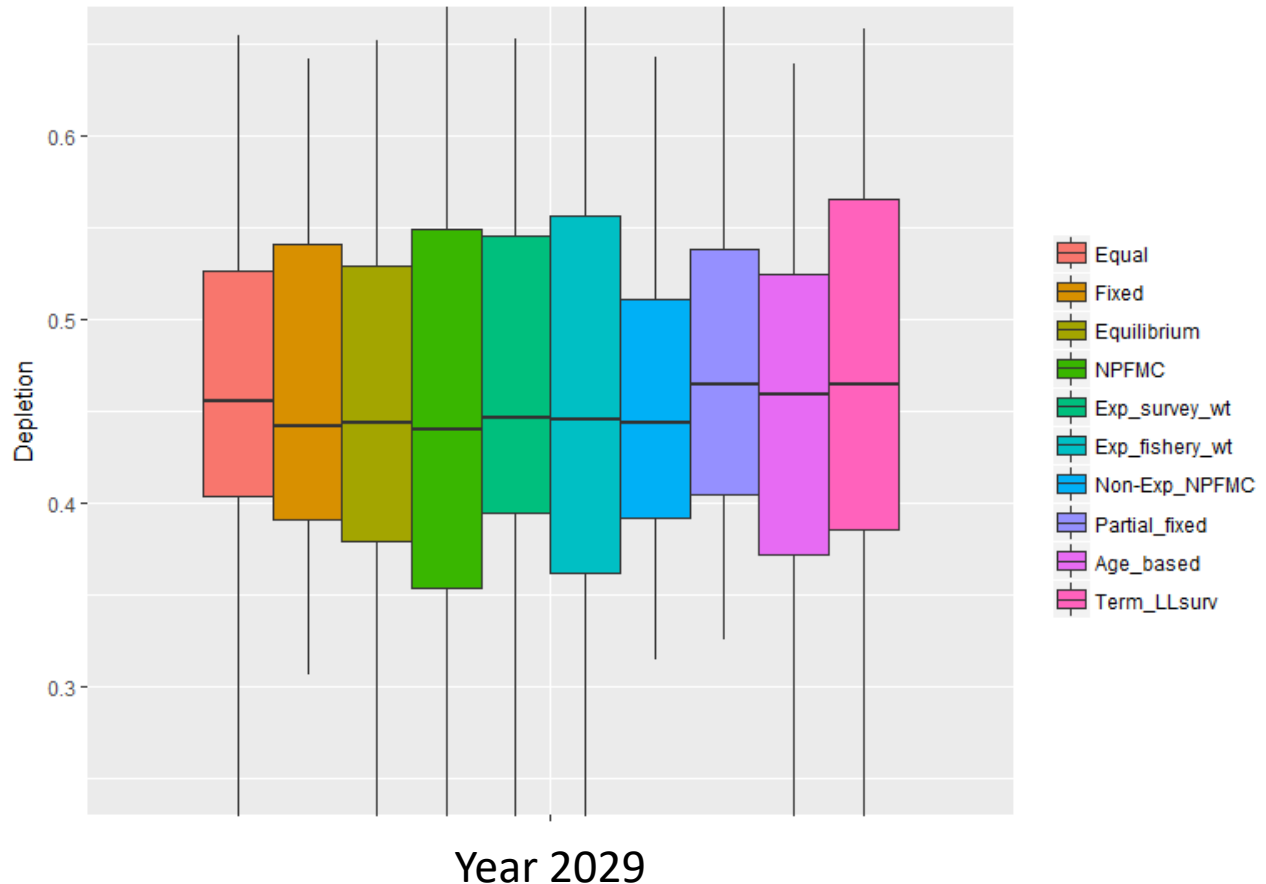
Sustainability

Variability

Economic/Yield

All figures and tables are for illustrative purposes only

Comparing apportionment types
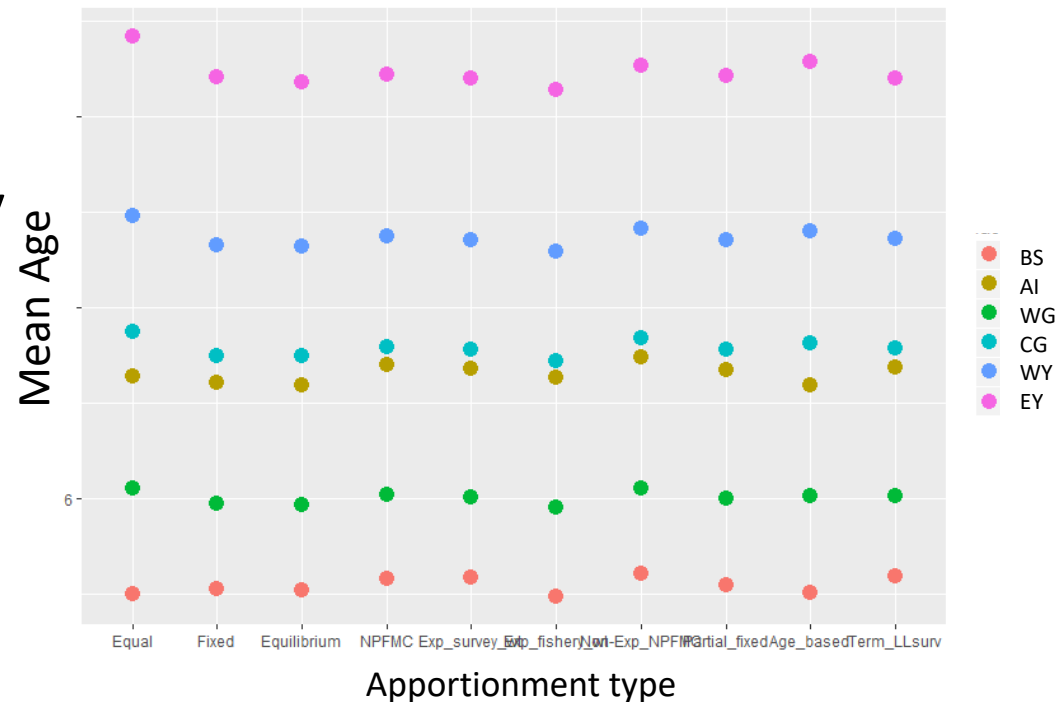
Sustainability: Depletion $SSB_{end\_year}/SSB_{1977}$

Comparing apportionment types

Sustainability: Depletion: $SSB_{end\_year}/SSB_{1977}$

Median Ranges
0.44-0.46

Year 2029

Comparing apportionment types

Economics/Yield and Other

- Mean ABC by area

- Mean age by area
  - Mean value of catch by area

Issues and ongoing work

- Non-convergence and crashing, may be the source of outliers in current output
  - Working on removing crashed/non-converged runs from summary analyses
- Still coding in some of the performance metrics
- Still validating OM

Seeking feedback

- Longer runs (more years) tend to crash more – how many years of forward projecting is enough? Plan is for 30 years.

- Addressing high 2014 recruitment – reduce or not?

- Any caveats you can't live with?

- What's the end goal? What do we want out of these analyses? What do you want to be deciding in November and what can we show to help?

Food for thought:

Early evidence (and other research) suggests

- Movement rates are high, our HCR works as intended, and those things dominate apportionment biologically...

- Economic considerations are an important issue

- There's not likely to be a 'golden ticket' here that will solve everything for sablefish (allocation issues, high recruitment (lots of small fish, few big fish), uncertainty in spawning locations and importance in preserving regional spawning potential, etc)...apportionment is just one piece.

These outputs will be tools for the Council and SSC to weigh and to choose based on what's important to them.

Fin.

AFSC Groundfish Tag Website

A preview of the tag database website: default opening page

Handling of Confidential Fishery Data

An acknowledgment of the masking of confidential recovery data opens EVERY time website is opened

Tag Map Tab: Multi Tag

Ability to query Release, Recovery, or Release/Recovery tag data, by species, year range, & area for multiple tags
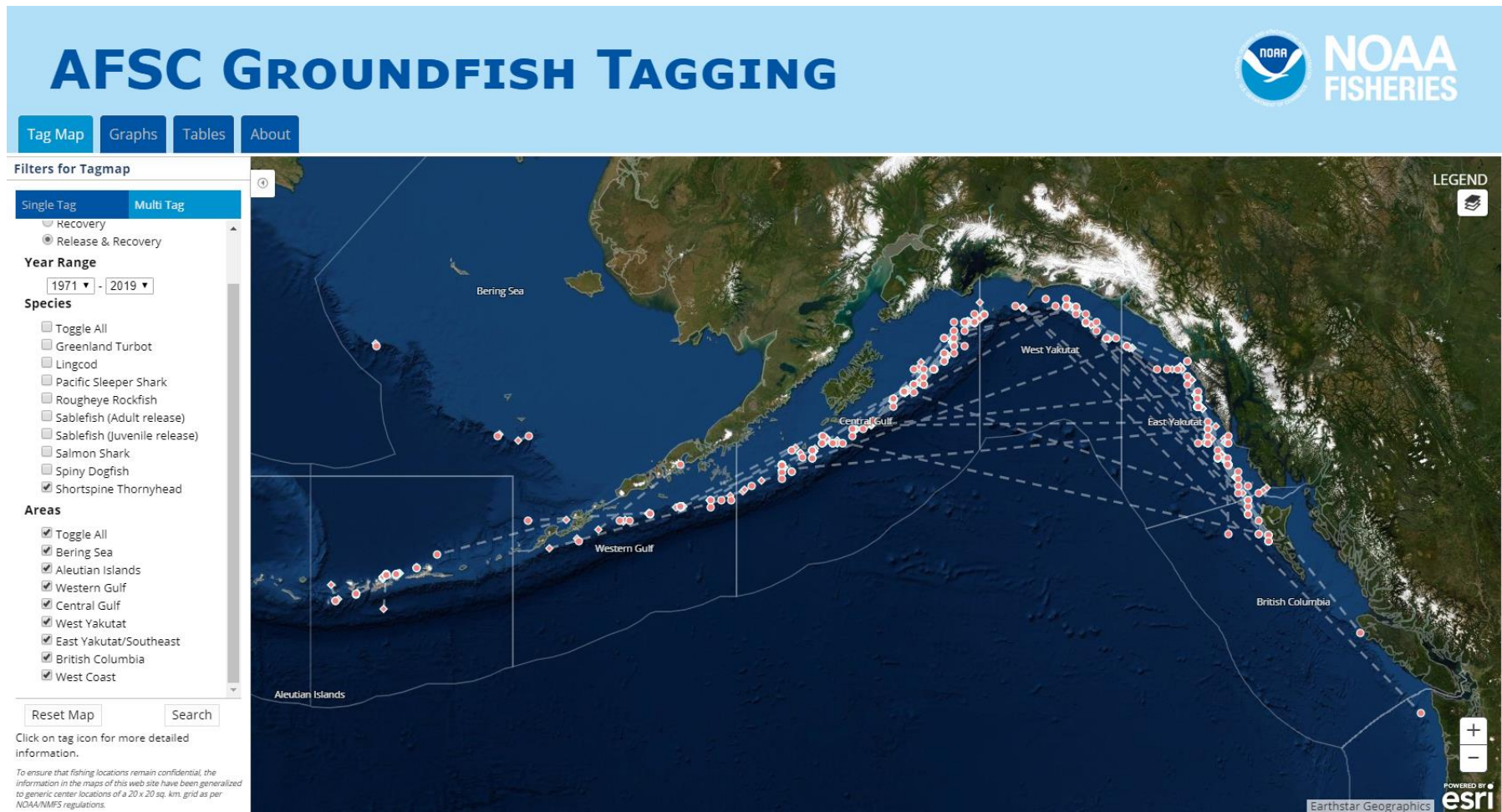
Tag Map Tab: Multi Tag

Can then click on an icon to retrieve a tag's release or recovery information

Tag Map Tab: Single Tag

Single Tag – more informative for quick release info once a tag has been recovered

Graphs Tab

Click on a region's icon to display release data graphically by species and year range

Graphs Tab

Click on a region's icon to display recovery data graphically by species, year range, and release area

Tables Tab

Six tables displaying tagging data in various formats

Tables Tab: Table 3

Example Table 3: showing the % of SST recovered in each management area from each release area

AFSC GROUNDFISH TAGGING

NOAA FISHERIES

Tag Map | Graphs | **Tables** | About

⊙ **Table 1: Total Releases by Year**

⊙ **Table 2: Releases and Recoveries by Year**

⊙ **Table 3: Percentage of Recoveries**

Percentage of
[shortspine thornyhead ▼]
recovered by management area.

[Show] [CSV]

Percentage of fish recovered by management area.

Release Area	Total Number of Fish	Recovery Area								
		BS	AI	WG	CG	WY	EY	BC	WC	OUT
BS	4	75%	25%	0	0	0	0	0	0	0
AI	16	0	100%	0	0	0	0	0	0	0
WG	19	5%	0	79%	16%	0	0	0	0	0
CG	119	0	0	< 1%	80%	3%	3%	2%	0	0
WY	56	0	0	0	11%	59%	14%	11%	0	0
EY	69	0	0	0	0	0	71%	22%	0	0
BC	0	0	0	0	0	0	0	0	0	0
WC	0	0	0	0	0	0	0	0	0	0
OUT	0	0	0	0	0	0	0	0	0	0

Areas: Bering Sea (BS), Aleutian Islands (AI), Western Gulf (WG), Central Gulf (CG), West Yakutat (WY), East Yakutat/Southeast (EY), British Columbia (BC), West Coast (WC), Outside Reporting Areas (OUT)

⊙ **Table 4: Distance Traveled**

⊙ **Table 5: Percentage of Recoveries by Time**

⊙ **Table 6: Distance Traveled by Time**

Tables Tab: Table 6

Example Table 6: average distance traveled by adult sablefish by the number of yrs @ liberty

AFSC GROUNDFISH TAGGING — NOAA FISHERIES

Tag Map | Graphs | Tables | About

- Table 1: Total Releases by Year
- Table 2: Releases and Recoveries by Year
- Table 3: Percentage of Recoveries
- Table 4: Distance Traveled
- Table 5: Percentage of Recoveries by Time
- Table 6: Distance Traveled by Time

The average distance (nm) traveled of
[sablefish (adult release) ▼]
by number of years at liberty.

[Show] [CSV]

Table 6: Distance Traveled by Time

The average distance (nm) traveled by number of years at liberty.

Number of years at liberty	Avg distance traveled (nm)	Count
0 - 1	580	6,072
2 - 3	371	9,355
4 - 5	553	5,633
6 - 7	672	4,047
8 - 10	706	3,928
11 - 20	652	4,580
21+	736	1,253

Table Tab: Table export

Tables can be exported to CSVs

We're hoping to get this live as soon as possible!

Comments, suggestions, concerns – please email or call Katy Echave

katy.echave@noaa.gov

907 789 6006

OM movement rates

		To				
From		**EY**	**WY**	**CG**	**WG**	**BS**	**AI**
EY	0.74	0.08	0.15	0.03	0.00	0.00
WY	0.14	0.19	0.48	0.15	0.02	0.02
CG	0.11	0.19	0.49	0.16	0.03	0.02
WG	0.04	0.12	0.32	0.29	0.12	0.11
BS	0.01	0.03	0.09	0.22	0.63	0.03
AI	0.00	0.01	0.05	0.11	0.05	0.78

General result

Harvest control rule dominates
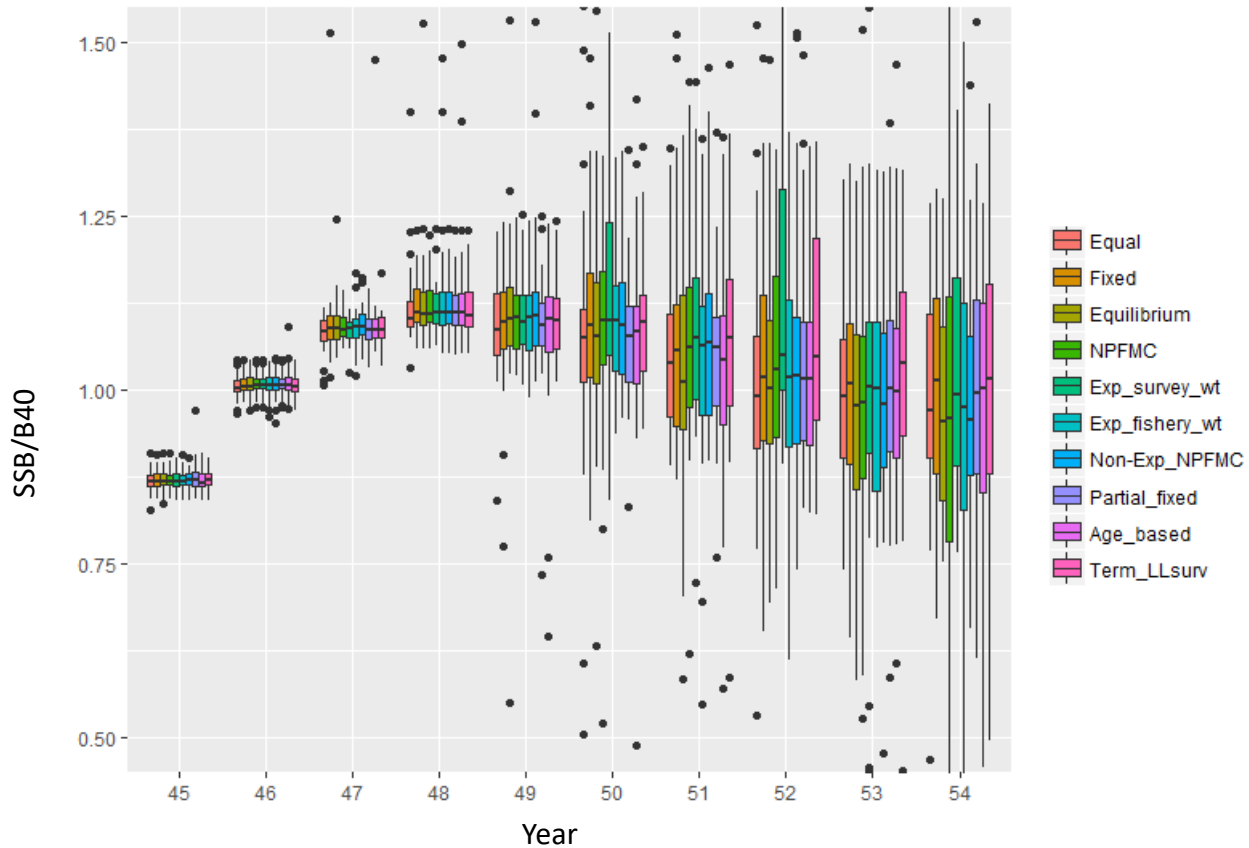
OFV convergence

Using max gradient to remove runs

If MGC < 1.0

Equal	Fixed	Equilibrium	NPFMC	Exp_survey_wt	Exp_fishery_wt	Non-Exp_NPFMC	Partial_fixed	Age_based	Term_LLsurv	All_to_one
0.46	0.5	0.48	0.48	0.48	0.36	0.56	0.44	0.5	0.34	0.1

If MGC < 0.1

Equal	Fixed	Equilibrium	NPFMC	Exp_survey_wt	Exp_fishery_wt	Non-Exp_NPFMC	Partial_fixed	Age_based	Term_LLsurv	All_to_one
0.38	0.28	0.3	0.24	0.24	0.14	0.26	0.22	0.3	0.16	0.08

If MGC < 0.001

Equal	Fixed	Equilibrium	NPFMC	Exp_survey_wt	Exp_fishery_wt	Non-Exp_NPFMC	Partial_fixed	Age_based	Term_LLsurv	All_to_one
0	0.02	0	0.02	0	0	0	0	0	0	0

Interesting that the only two with some good simulations are the two apportionment methods we've been using!

Comparing apportionment types

Sustainability: Biological reference point SSB_{end_year}/B_{40}
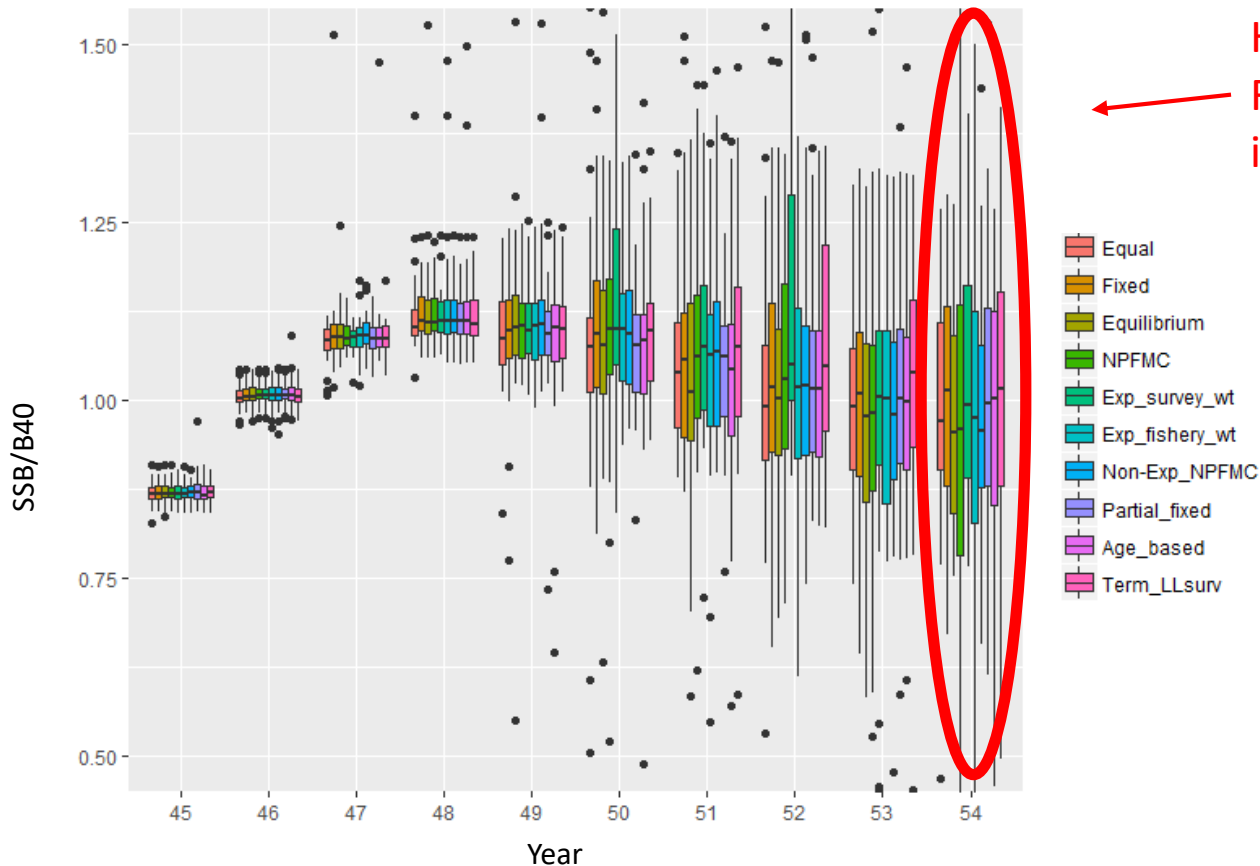
High variability!
Remember these are
illustrative only!

Comparing apportionment types

Sustainability: Biological reference point SSB_{end_year}/B_{40}

Range

0.956 – 1.017

Year 2029
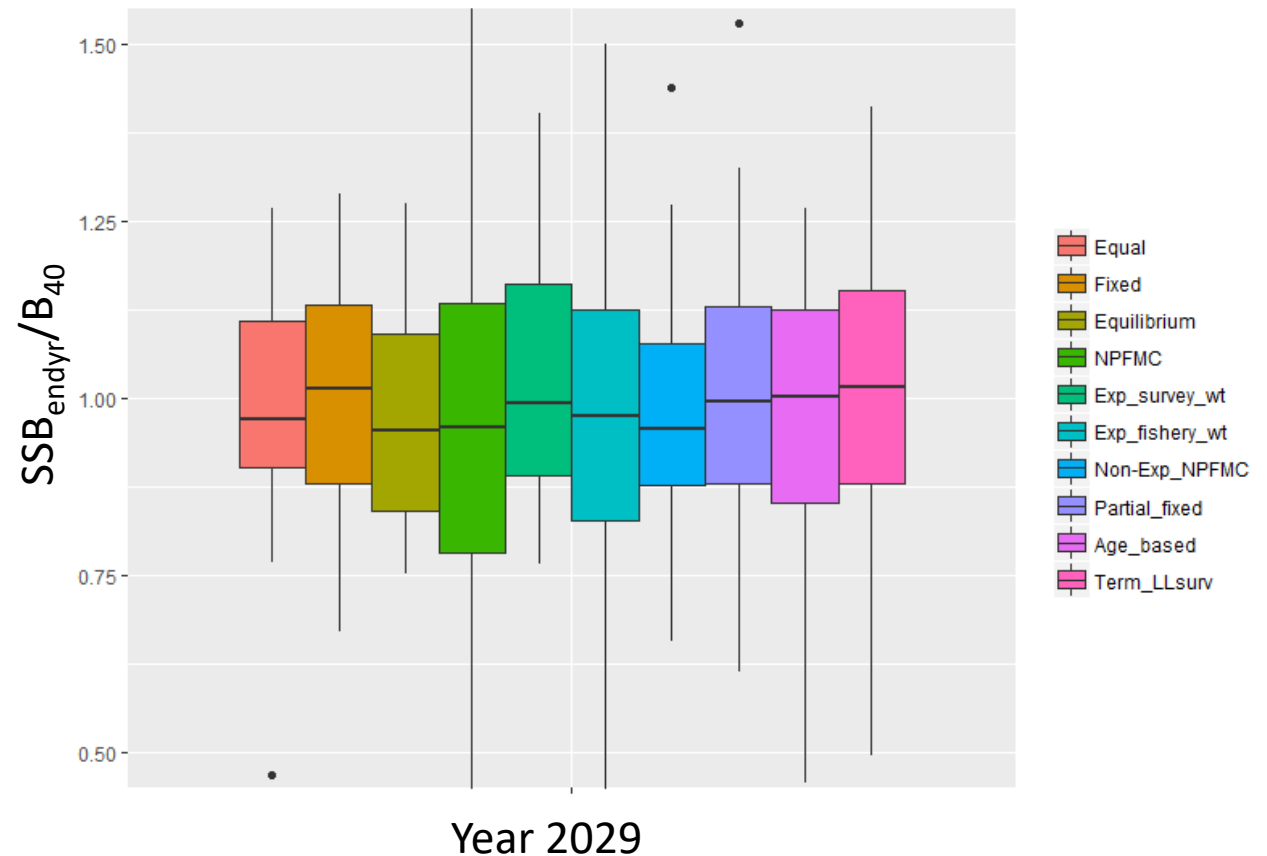
Comparing apportionment types

Sustainability

- Depletion: $SSB_{end\_year}/SSB_{1977}$

- SSB_{end_year}/B_{40}

- Mean percent difference between OM SSB proportions by area and apportioned ABC proportions by area

  - Low percent difference means apportionment more closely matches underlying population.

Comparing apportionment types

Variability

- Mean percent change in ABC from year to year
  - For all areas combined
  - For each management area

Equal	**0**
Fixed	**0**
Equilibrium	**0**
NPFMC	**12.1**
Exp_survey_wt	**2.7**
Exp_fishery_wt	**15.4**
Non-Exp_NPFMC	**2.8**
Partial_fixed	**5.7**
Age_based	**9.2**
Term_LLsurv	
All_to_one	**0**

	Equal	Fixed	Equilibrium	NPFMC	Exp_survey_wt	Exp_fishery_wt	Non-Exp_NPFMC	Partial_fixed	Age_based	Term_LLsurv	All_to_one
BS	0.0	0.0	0.0	20.7	4.3	23.3	5.8	1.0	19.7		
AI	0.0	0.0	0.0	5.6	1.2	10.2	0.0	1.0	4.2		
WGOA	0.0	0.0	0.0	10.1	2.6	12.8	2.5	15.9	7.8		
CGOA	0.0	0.0	0.0	5.3	0.5	4.2	3.4	1.3	4.3		
WY	0.0	0.0	0.0	13.3	2.6	20.3	3.3	6.0	10.2		
EY-SEO	0.0	0.0	0.0	17.7	4.9	21.8	1.6	9.3	8.8		0.0