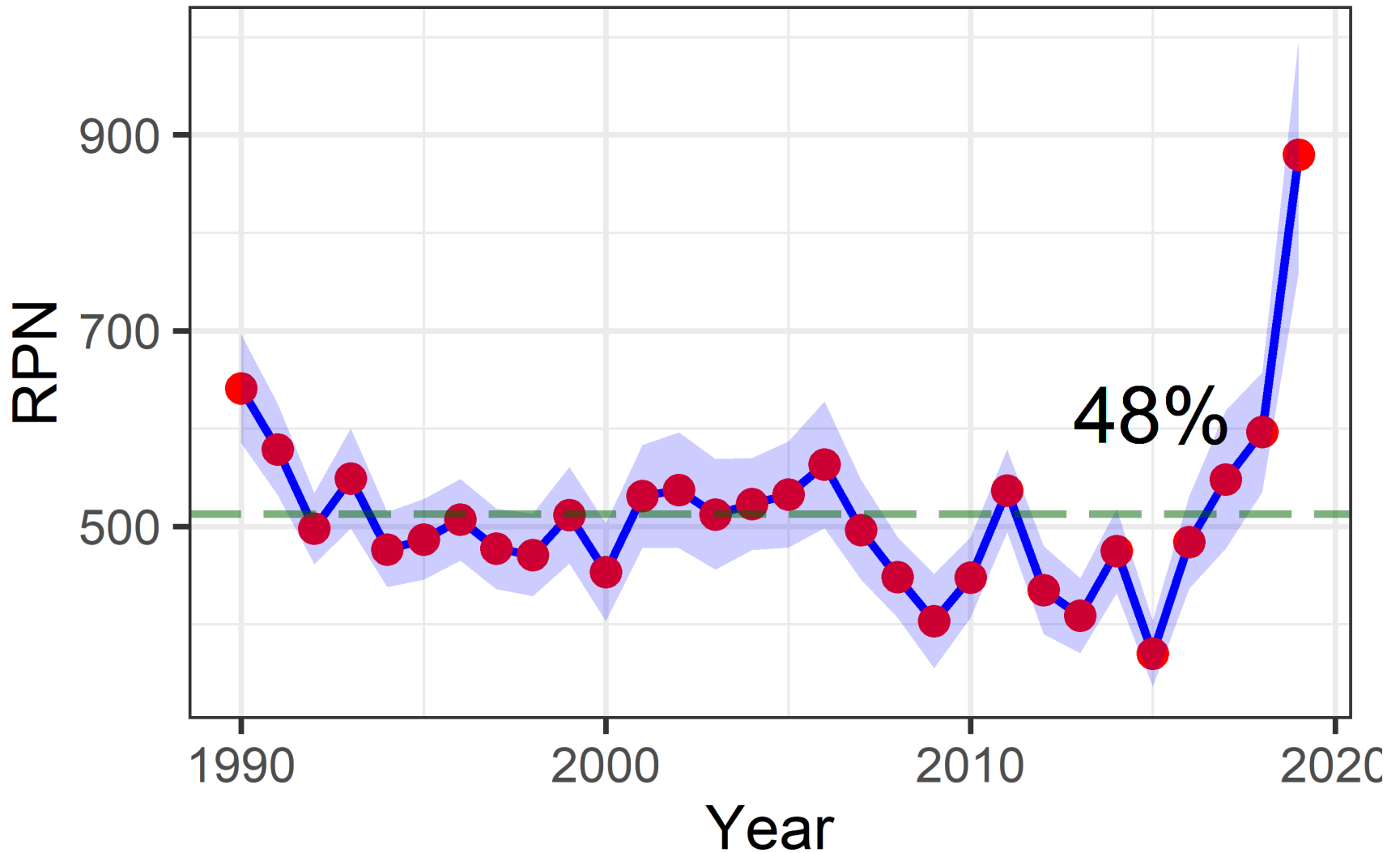


Sablefish assessment 2019

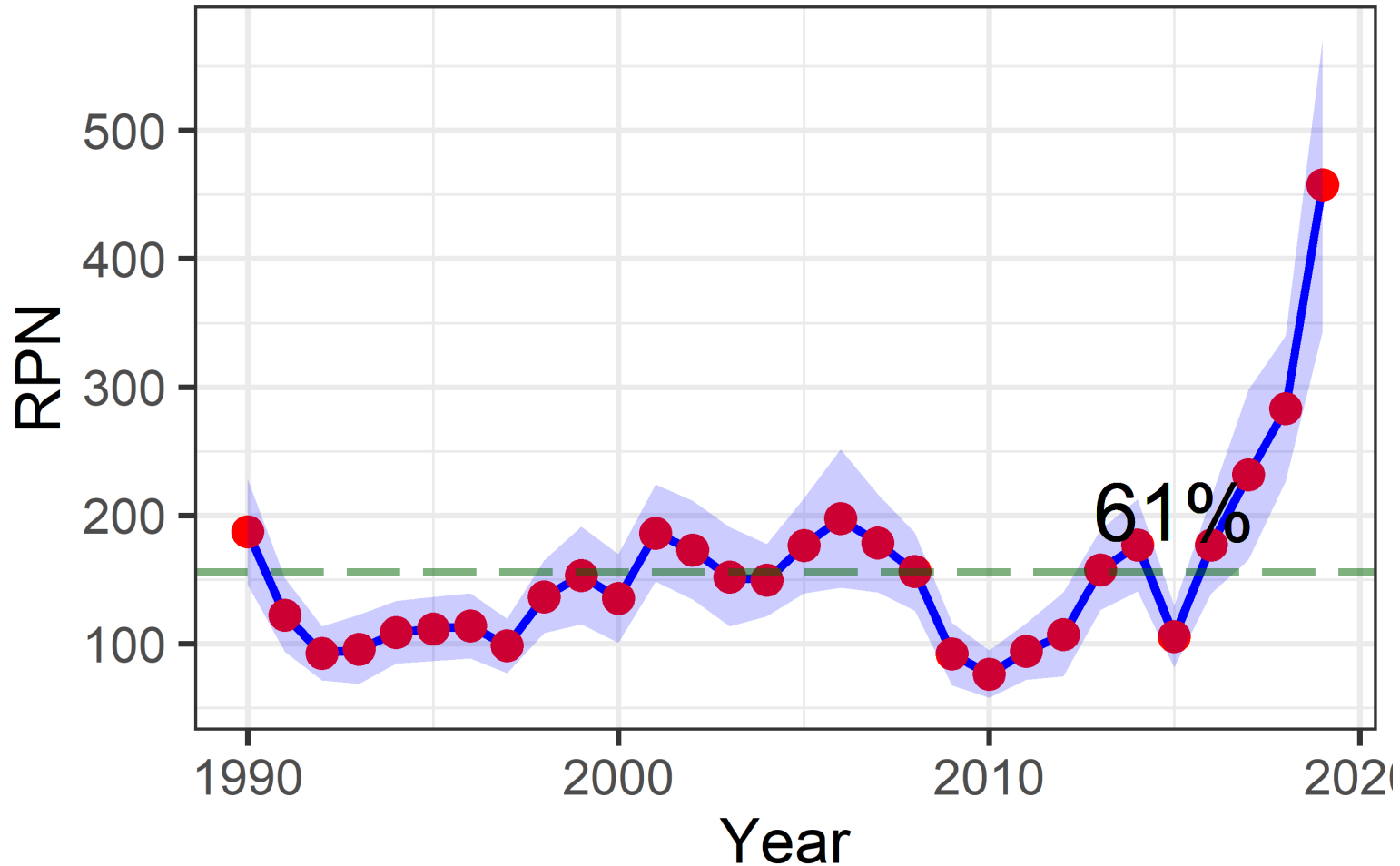
- 1) New data in hand
- 2) 2020 outlook
- 3) Apportionment update
- 4) Tag-recovery website rollout

Longline survey 2019



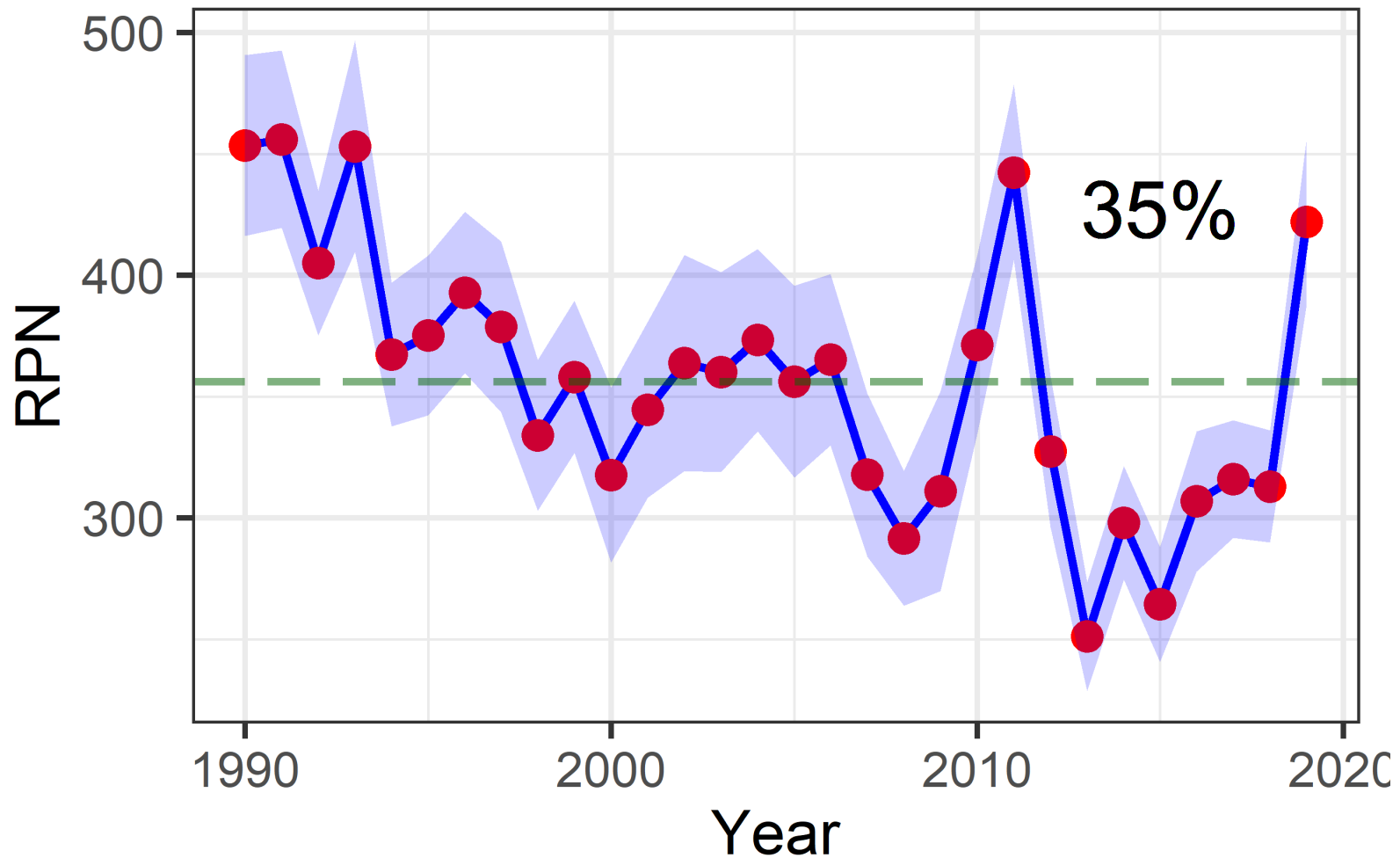
Longline survey 2019

BSAI Sablefish longline survey RPN



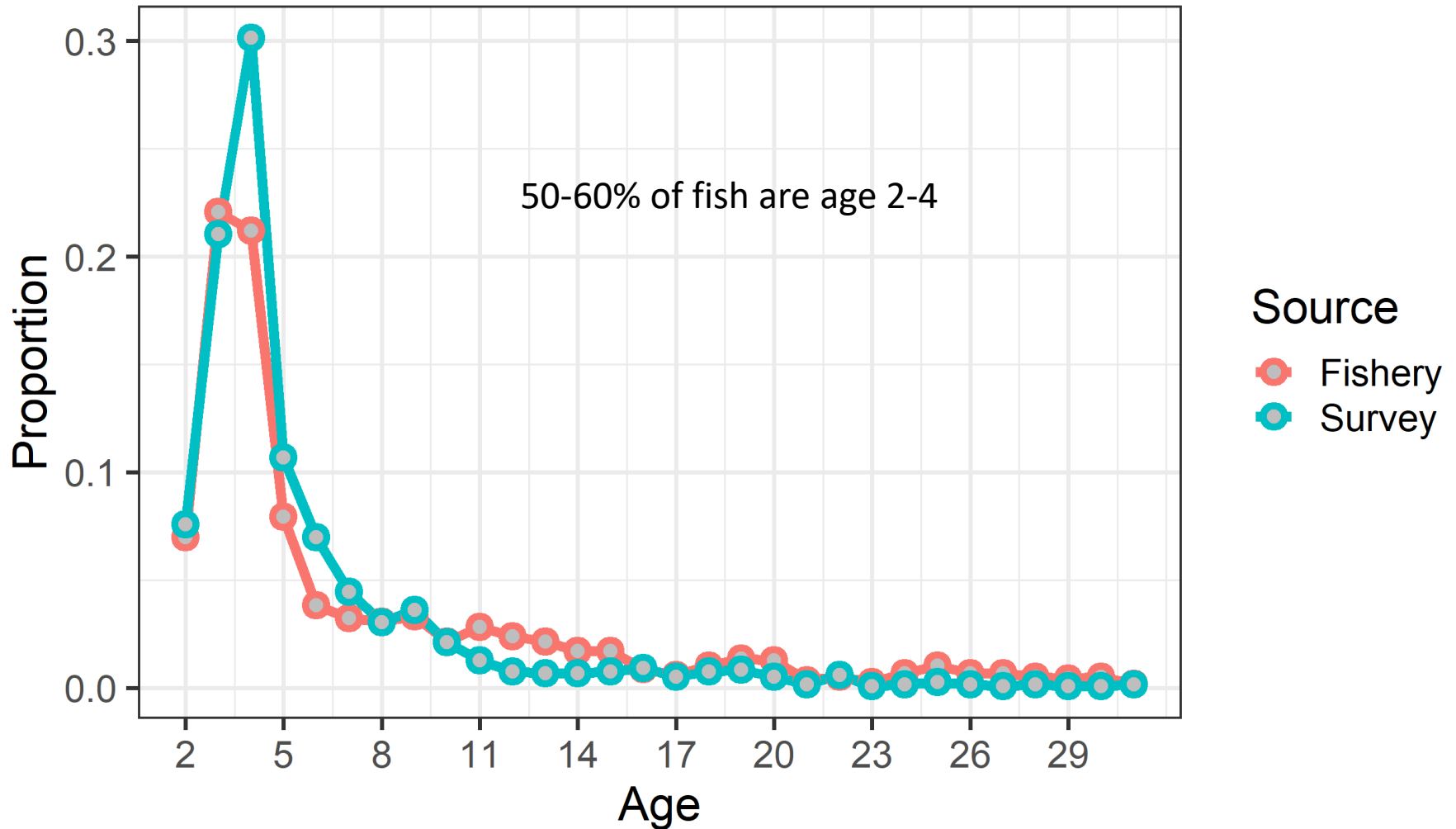
Longline survey 2019

GOA Sablefish longline survey RPN

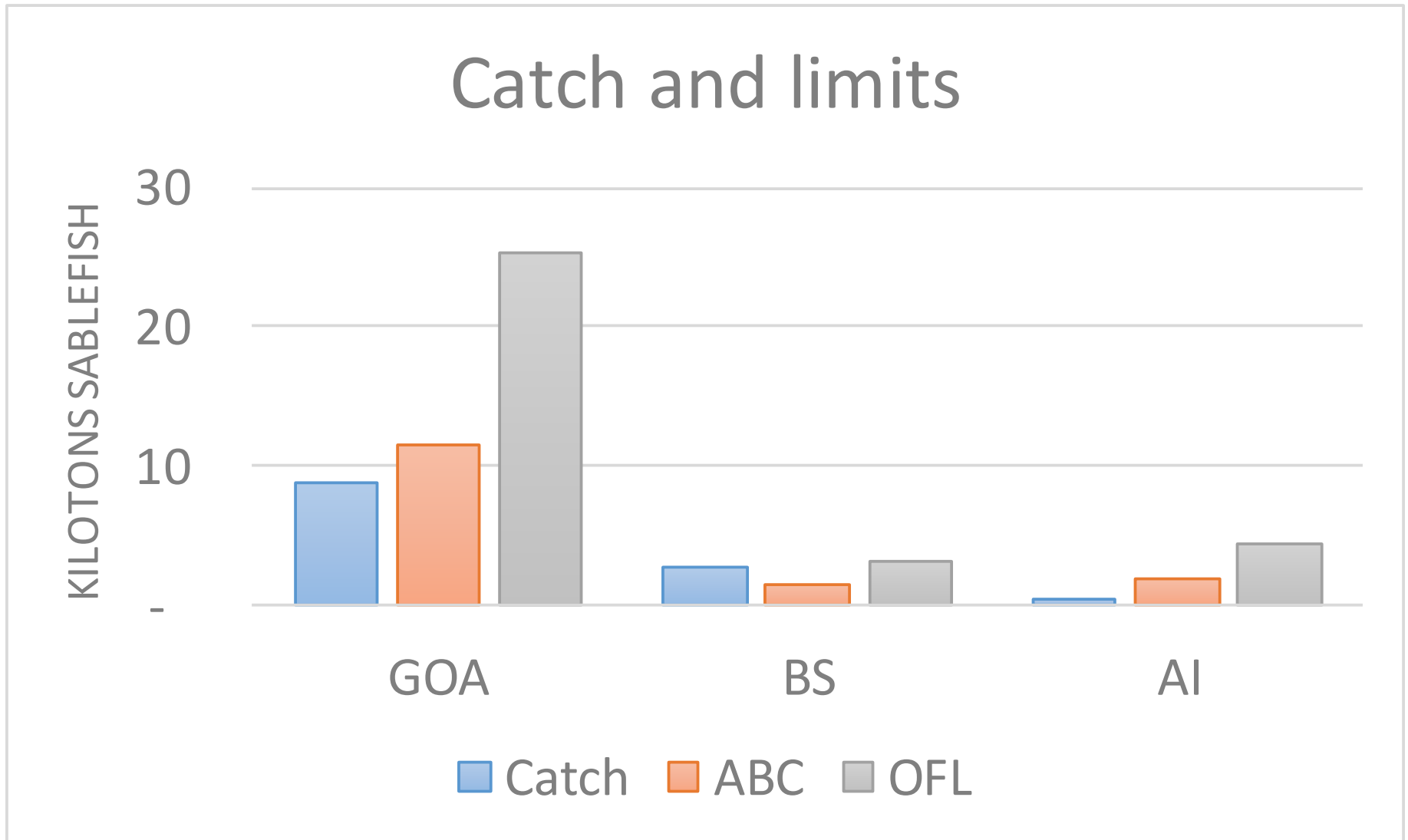


The youth are the future

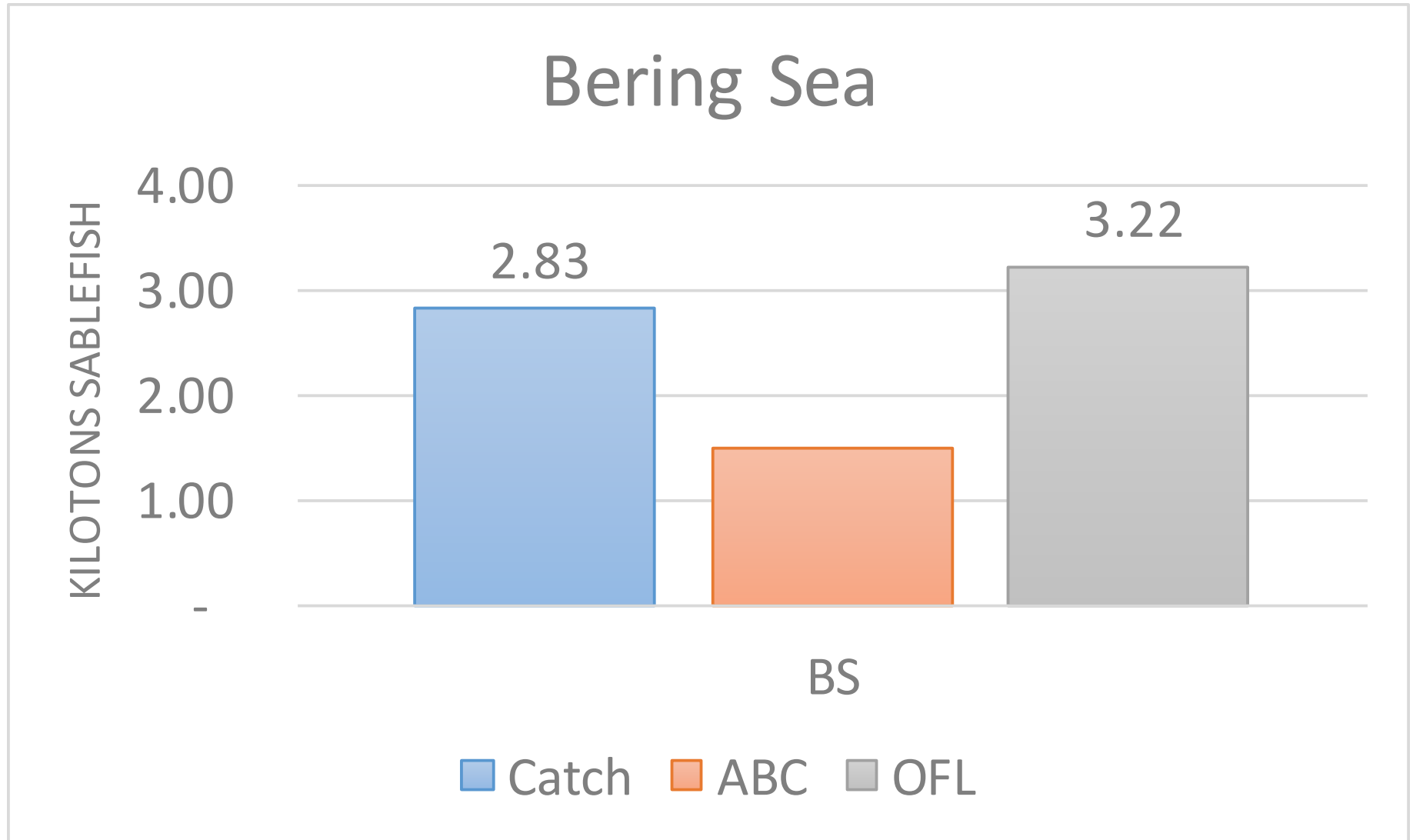
Age compositions 2018



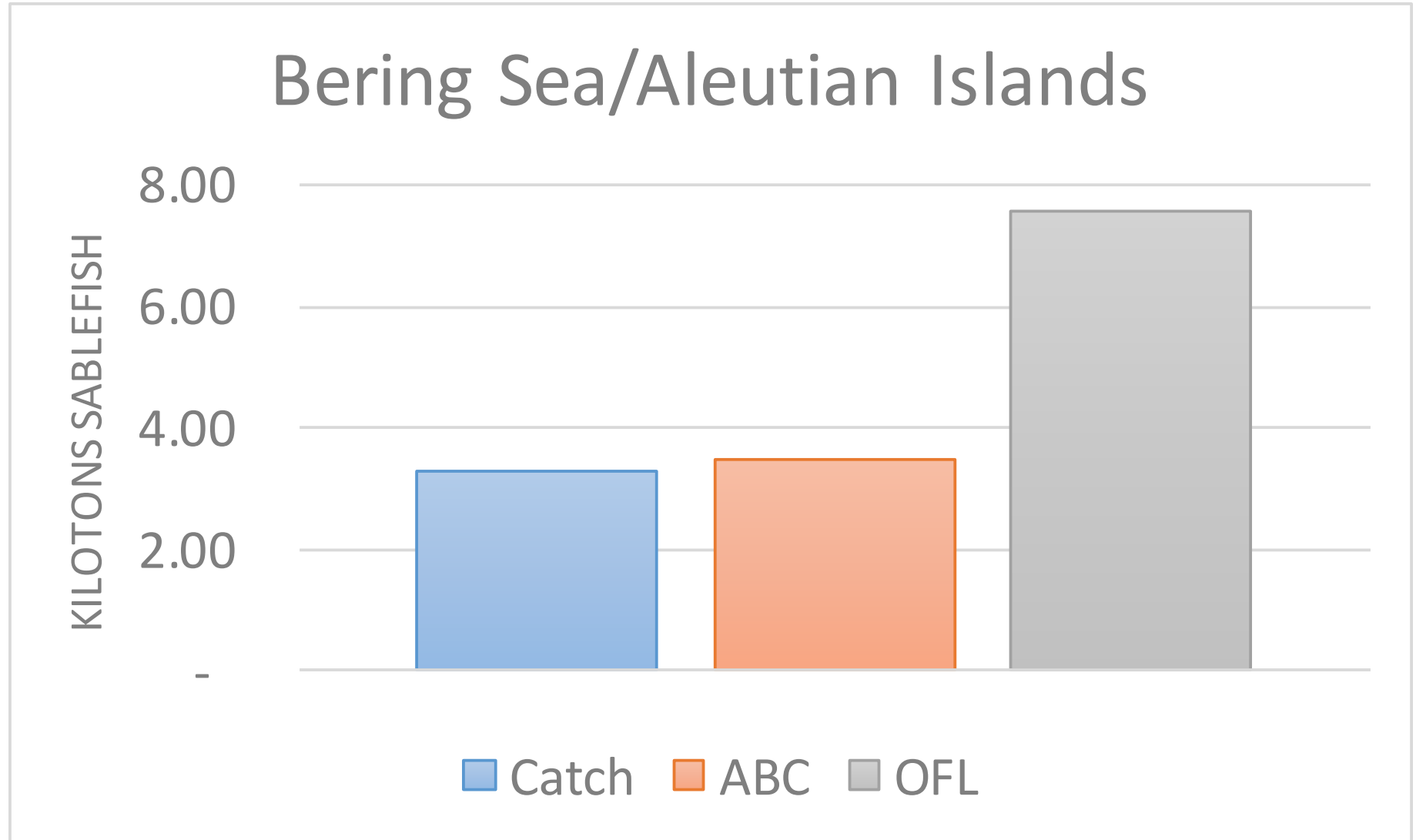
Looks normal



Unavoidable



Better together?



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

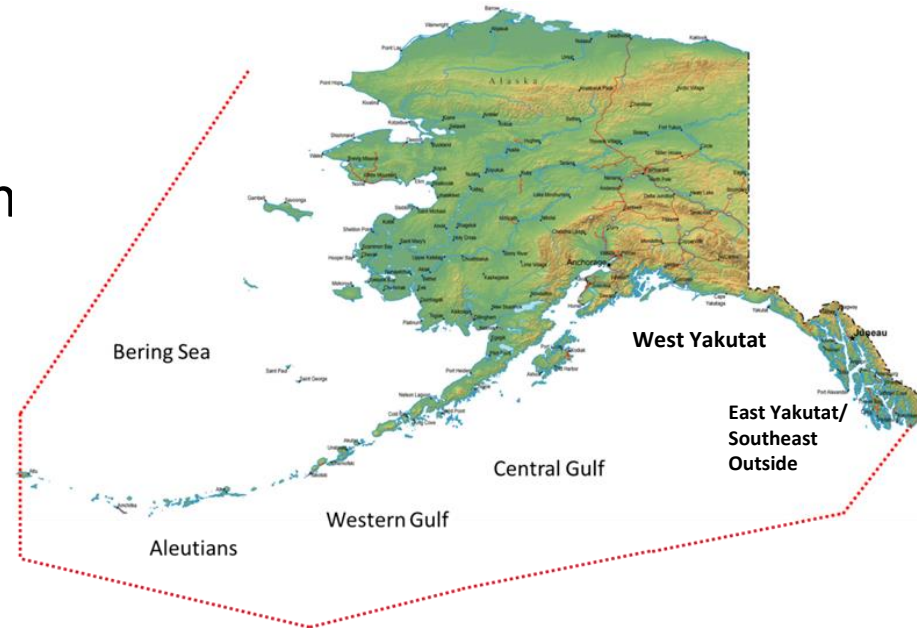
- **Why** we are looking at this
- **How** we have approached the analyses - methods
- **What** we are finding (so far)
- **What** we need from PT

Sablefish apportionment - context

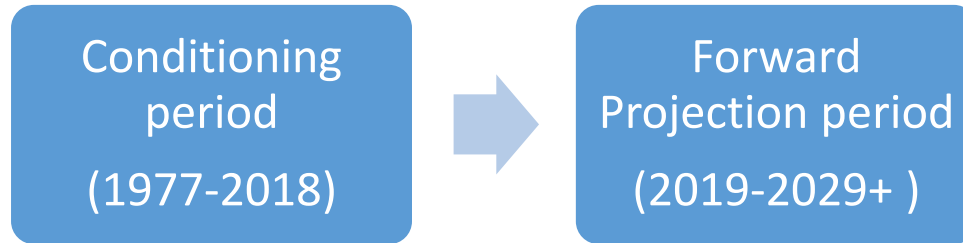
- ABC apportionment fixed at 2013 proportions since 2014
- 2000-2013 apportionment method
- Examine performance of 10 sablefish ABC apportionment methods

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

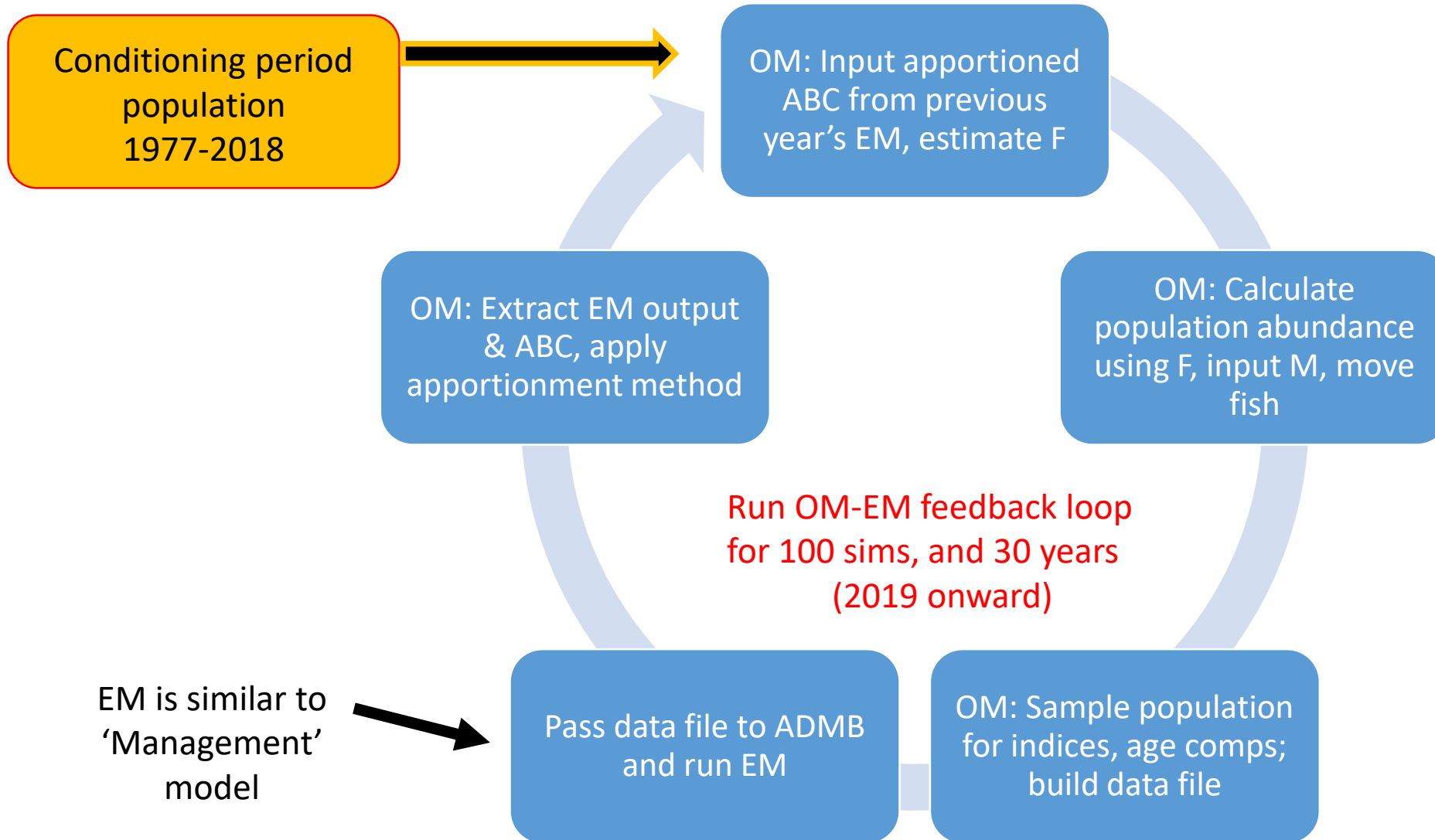


Methods – OM Simulates population in two periods



- 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/Dirichlet multinomial sample age comps

Methods – OM-EM feedback



Apportionment types

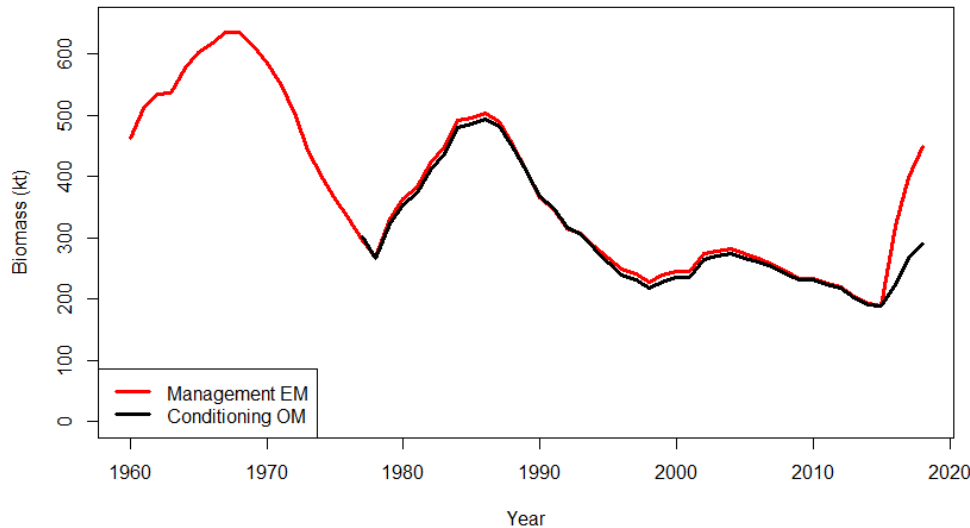
1. Equal: Each region receives 1/6 of the ABC.
2. Fixed: The apportionment proportions from the 2013 assessment that have been applied as fixed proportions for 2014-2018.
3. Equilibrium: Based on the stationary distribution of the movement rates.
4. NPFMC: A 5-yr exponentially weighted moving average 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

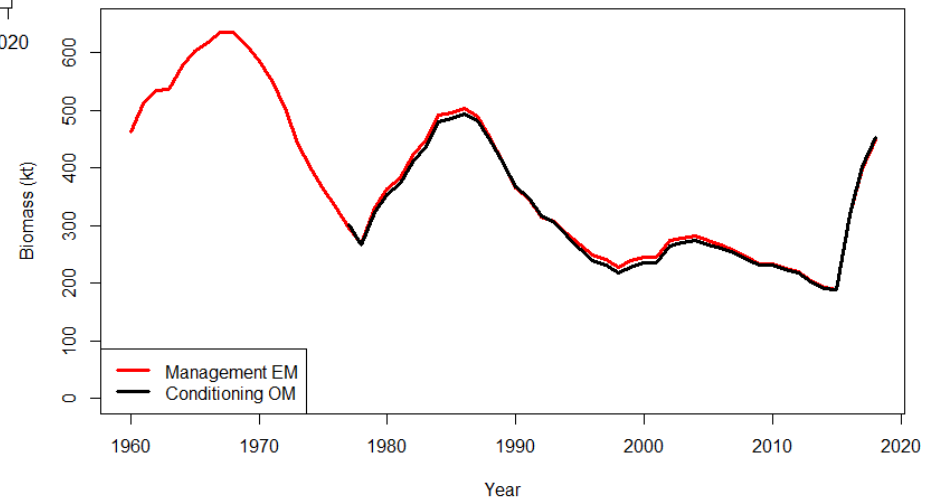
- The NPFMC Tier 3 harvest control rules are still in place and used for determining ABC in the EM, we are only simulating different methods for apportioning ABC to management areas.
- We assume $ABC=TAC$ and 100% of apportioned ABC is caught in each region.
- We do not correct for whale depredation 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

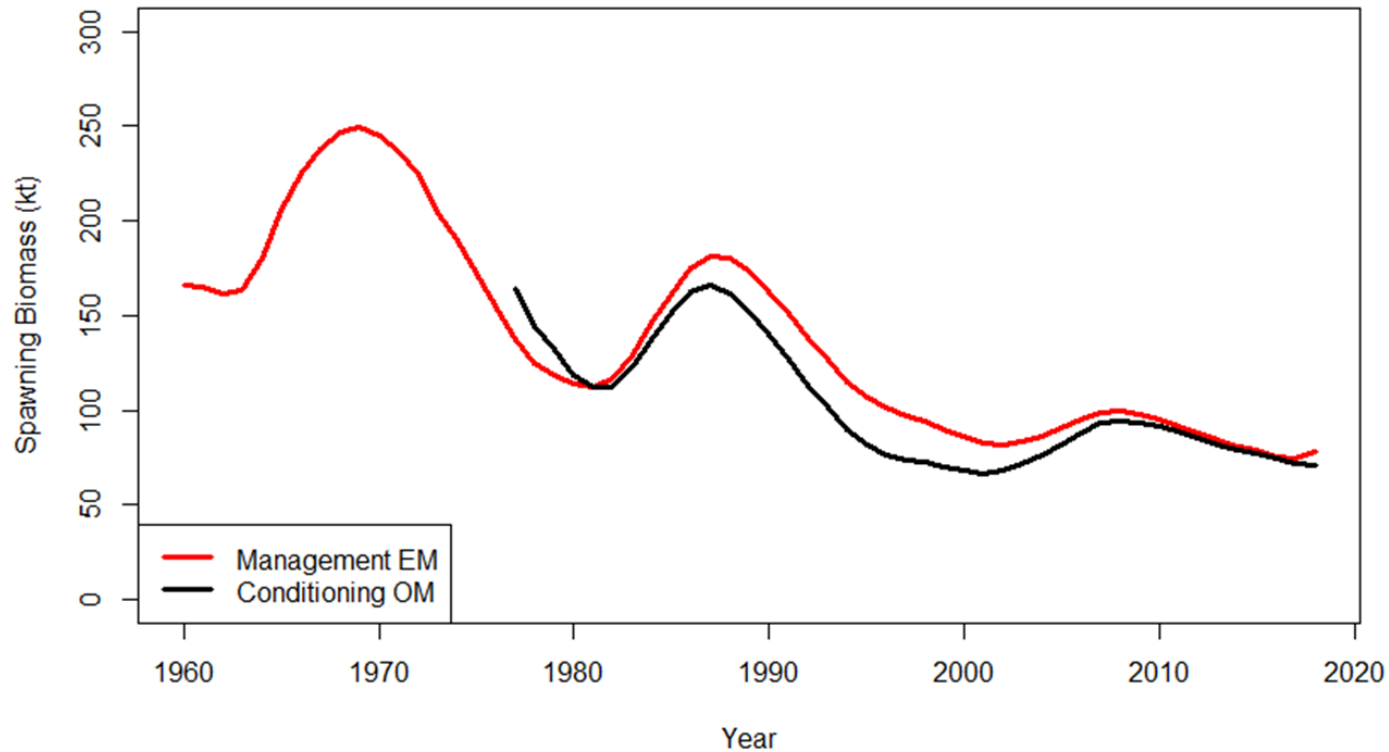


Biomass without recruitment change



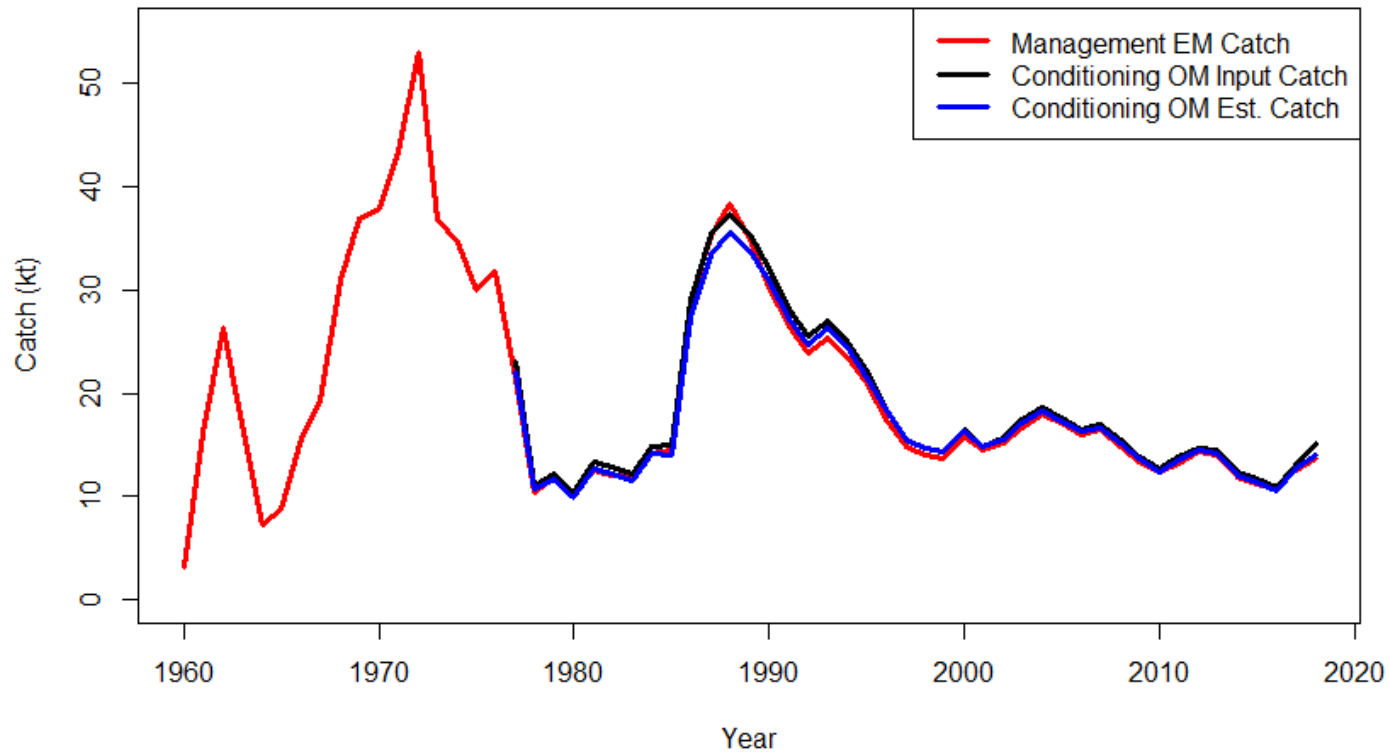
Conditioning period OM results

Spawning biomass



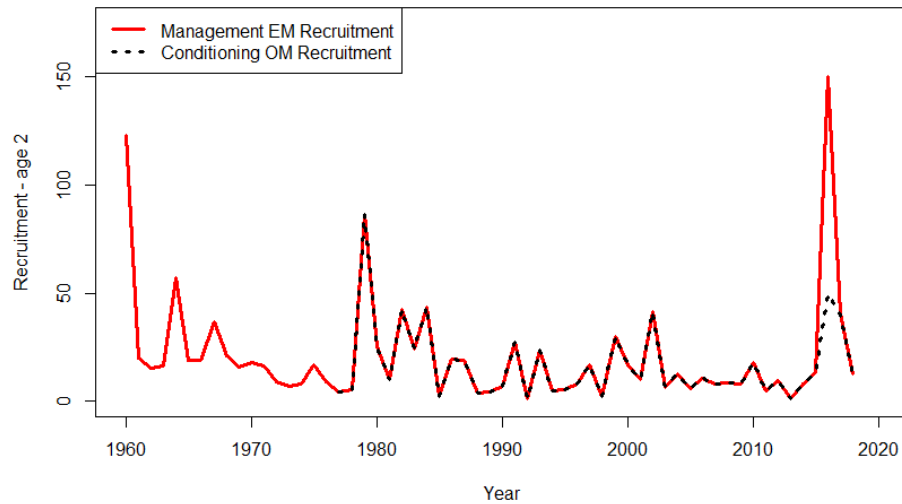
Conditioning period OM results

Catch

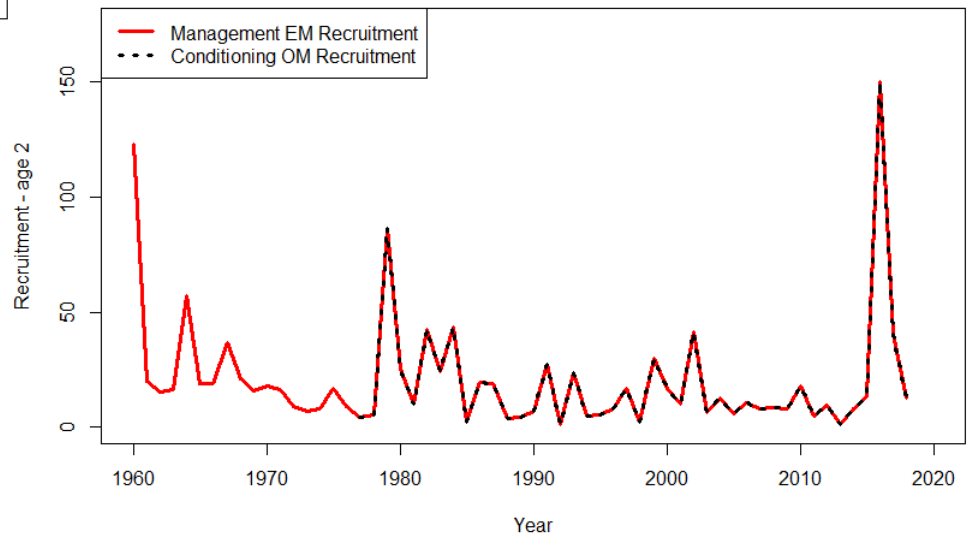


Conditioning period OM results Recruitment

Recruitment with 2014 year class artificially reduced

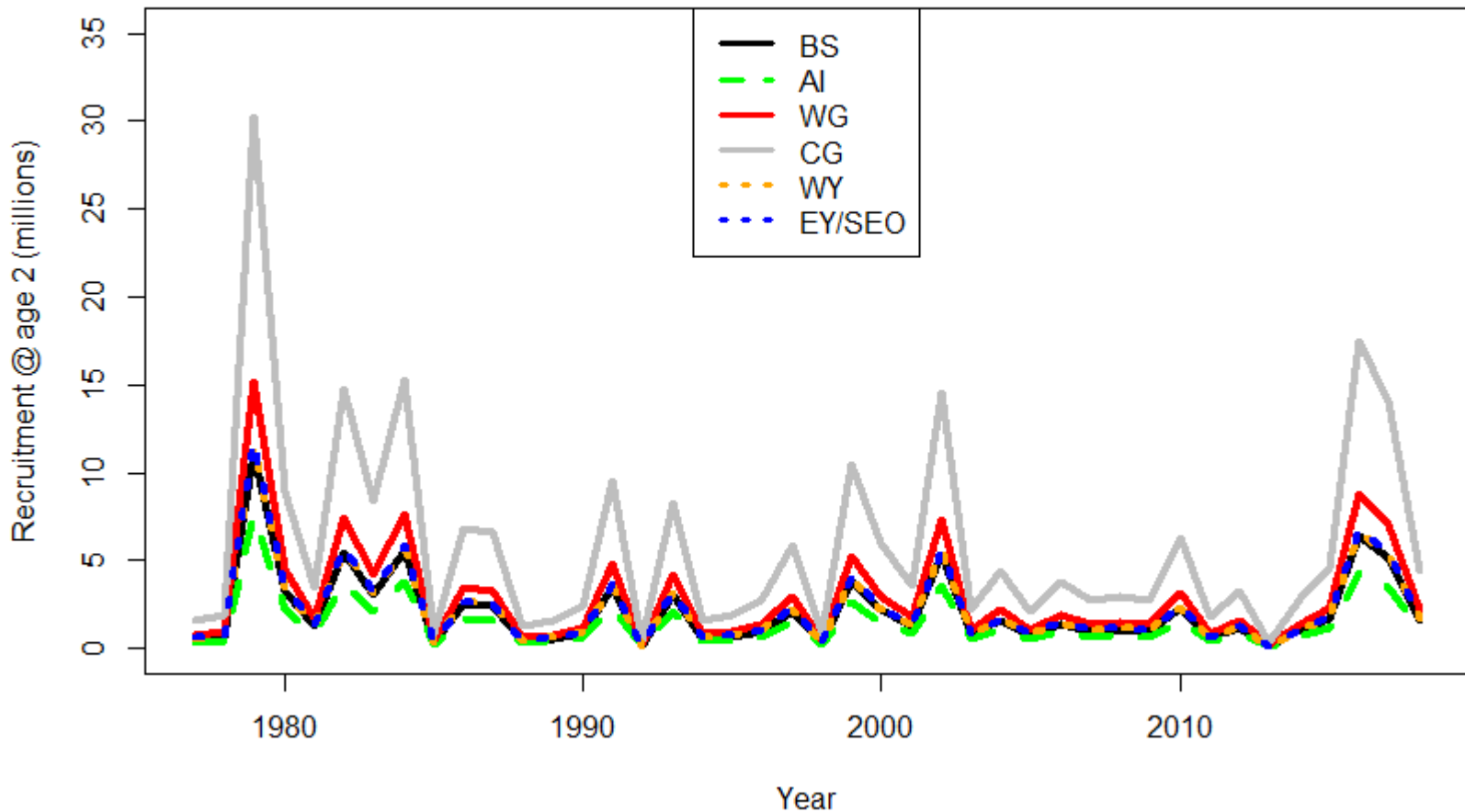


Recruitment without reduction in 2014



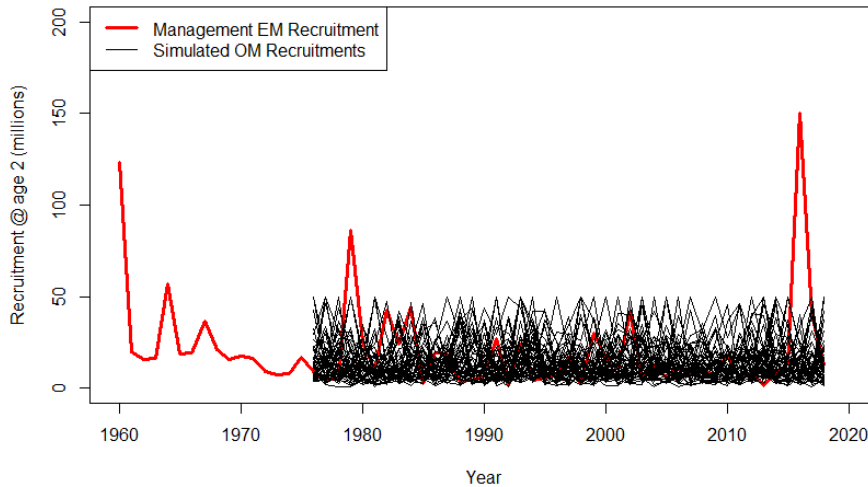
Conditioning period OM results

Recruitment by area

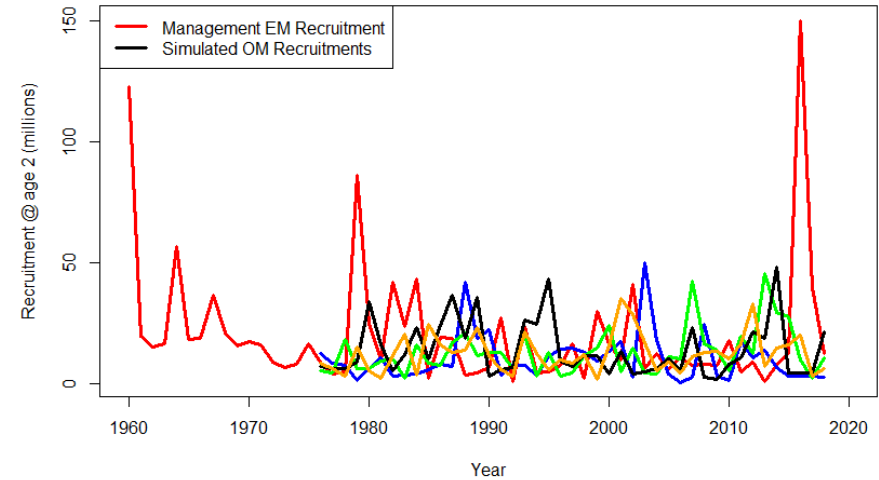


Conditioning period OM results

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

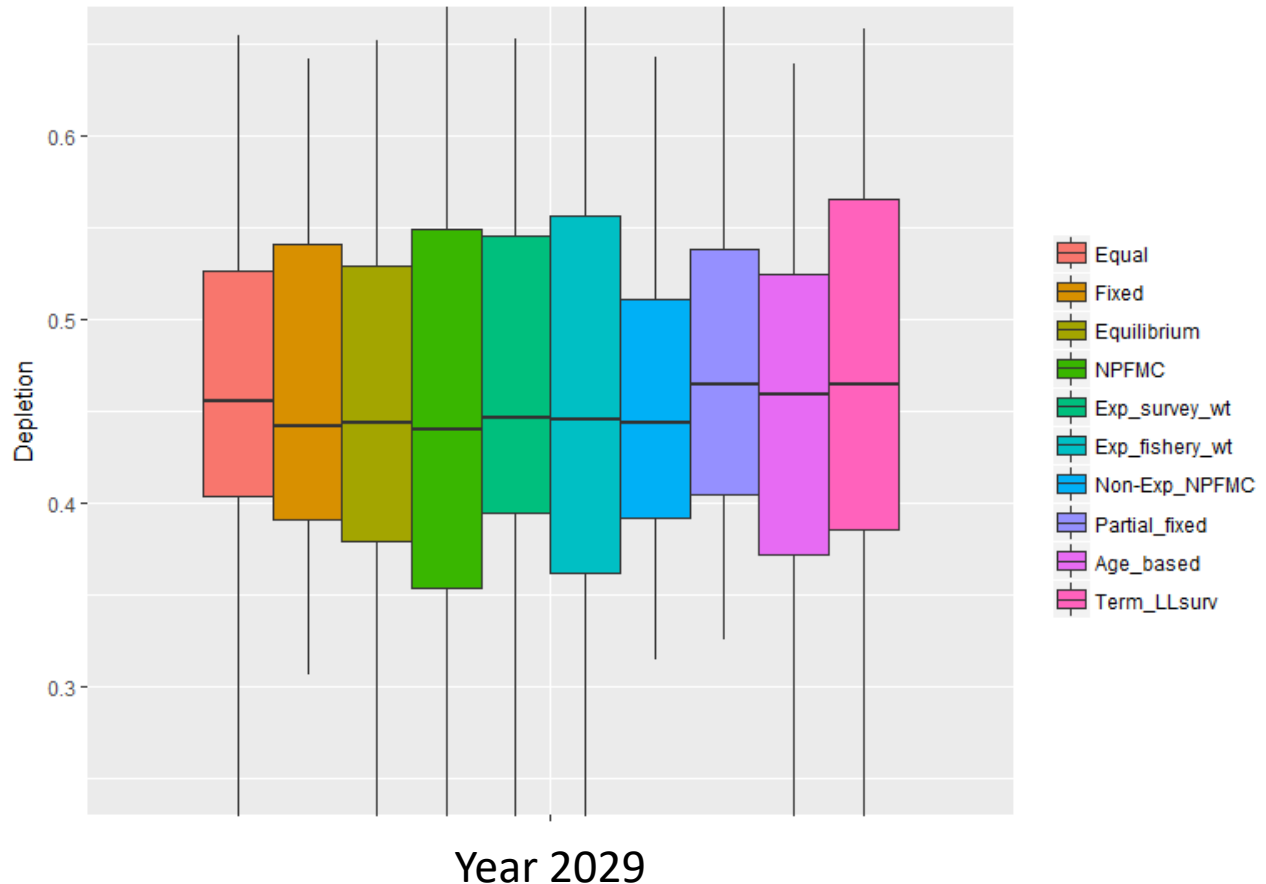
Economic/Yield

**All figures and tables
are for illustrative
purposes only**

Comparing apportionment types

Sustainability: Depletion: $SSB_{\text{end_year}}/SSB_{1977}$

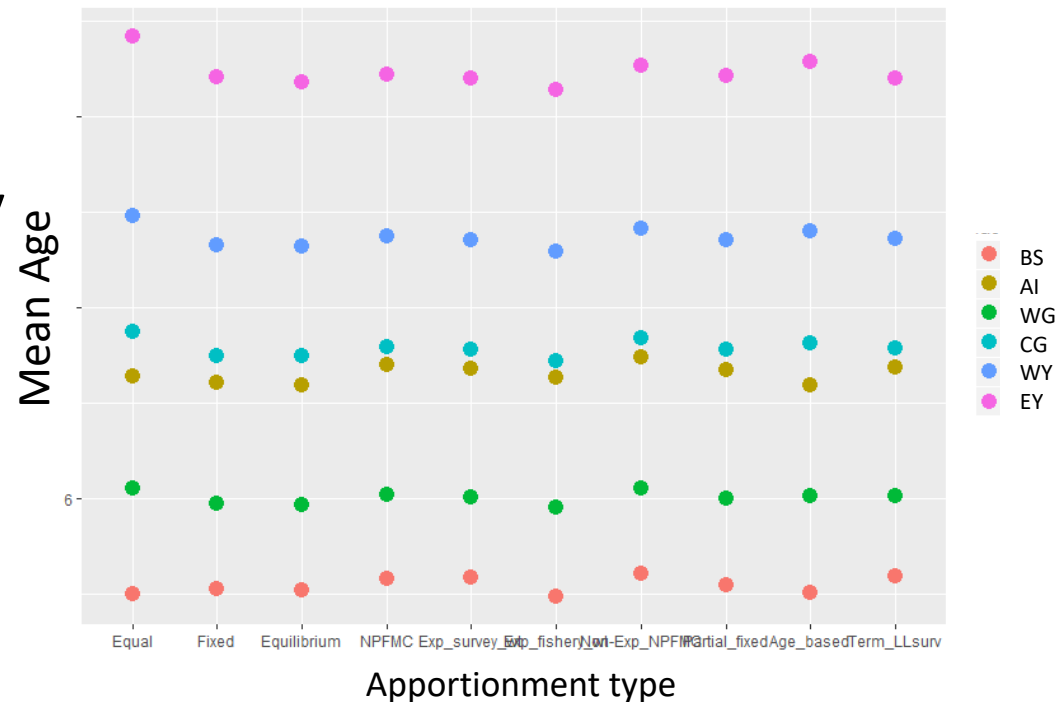
Median Ranges
0.44-0.46



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

AFSC GROUND FISH TAGGING



- Tag Map
- Graphs
- Tables
- About

Filters for Tagmap

- Single Tag
- Multi Tag

- Status**
- Release
 - Recovery
 - Release & Recovery
- Year Range**
- 2019 - 2019
- Species**
- Toggle All
 - Greenland Turbot
 - Lingcod
 - Pacific Sleeper Shark
 - Rougheye Rockfish
 - Sablefish (Adult release)
 - Sablefish (Juvenile release)
 - Salmon Shark
 - Spiny Dogfish
 - Shortspine Thornyhead
- Areas**
- Toggle All
 - Bering Sea
 - Aleutian Islands
 - Western Gulf
 - Central Gulf
 - West Yakutat
 - East Yakutat/Southeast



Reset Map Search

Click on tag icon for more detailed information.

To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations.

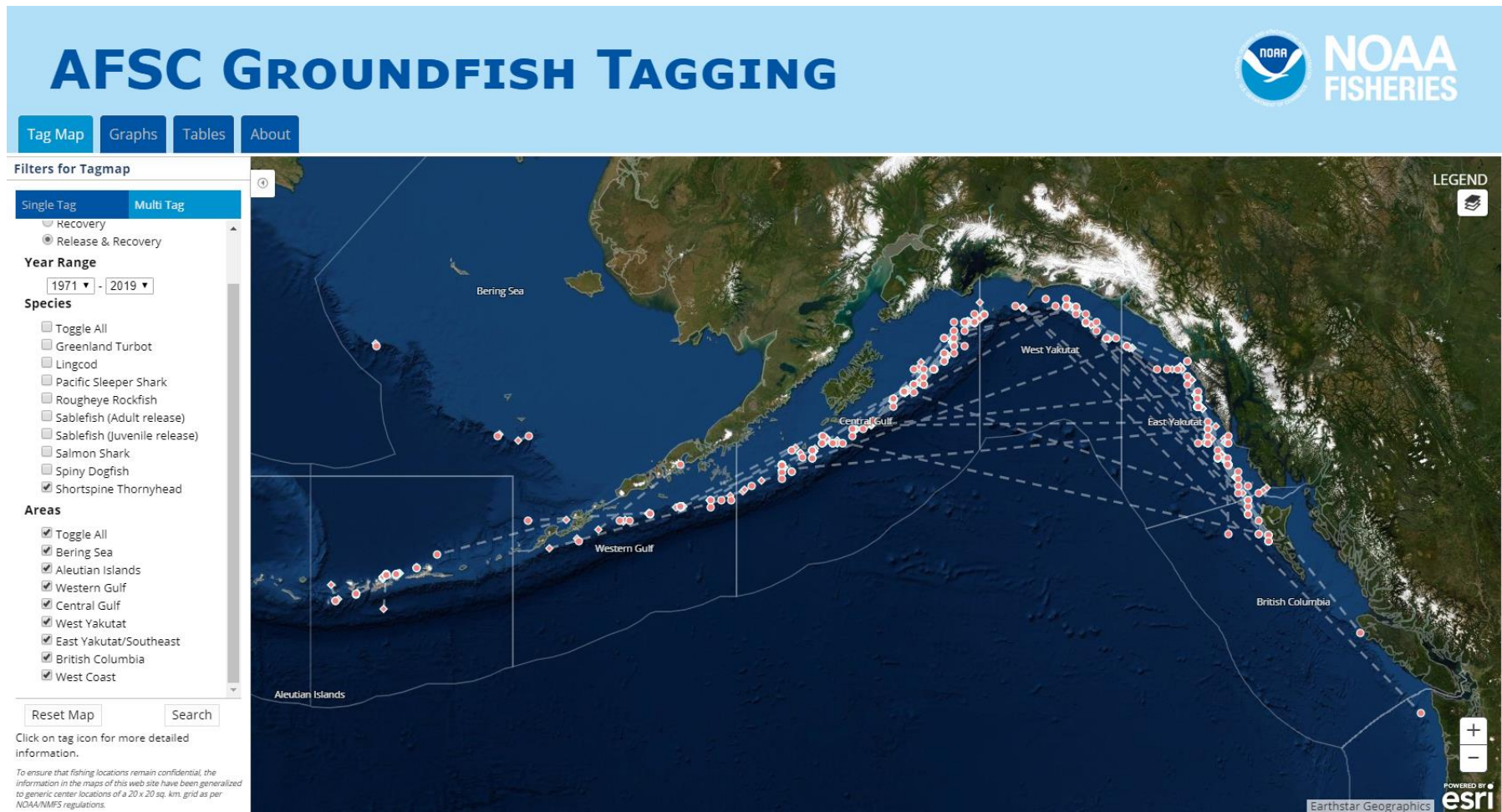
Handling of Confidential Fishery Data

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

The screenshot displays the AFSC Groundfish Tagmap interface. At the top left, the text "AFSC GROUND" is visible. Below it are navigation buttons for "Tag Map", "Graphs", "Tables", and "About". On the right side, the NOAA Fisheries logo is present. A central white dialog box titled "Suppression Notification" contains the following text: "To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations." A blue button labeled "I Understand" is located at the bottom right of the dialog box. The background shows a map of the Bering Sea and Gulf of Alaska regions, with labels for "Bering Sea", "Central Gulf", "West Yakutat", and "East Yakutat". A "LEGEND" icon is visible in the bottom right corner of the map area. On the left side, there are filter controls for "Filters for Tagmap", including "Single Tag" and "Multi Tag" buttons, and a "Status" section with radio buttons for "Release", "Recovery", and "Release & Recovery". Below the status section is a "Year Range" selector set to "2018 - 2018" and a "Species" dropdown menu.

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

AFSC GROUND FISH TAGGING

NOAA FISHERIES

Tag Map | Graphs | Tables | About

Filters for Tagmap

Single Tag | Multi Tag

Recovery
 Release & Recovery

Year Range
1971 - 2019

Species

- Toggle All
- Greenland Turbot
- Lingcod
- Pacific Sleeper Shark
- Rougheye Rockfish
- Sablefish (Adult release)
- Sablefish (Juvenile release)
- Salmon Shark
- Spiny Dogfish
- Shortspine Thornyhead

Areas

- Toggle All
- Bering Sea
- Aleutian Islands
- Western Gulf
- Central Gulf
- West Yakutat
- East Yakutat/Southeast
- British Columbia
- West Coast

Reset Map | Search

Click on tag icon for more detailed information.

To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations.

TH279 (Recovery)

Tag Number	279
Species	Shortspine Thornyhead
Sex	Unknown
Release Date	1997-07-22
Recovery Date	1998-05-22
Release Size	350 mm
Recovery Size	356 mm
Years at Liberty	304 days
Great Circle Dist	8 n.m.

LEGEND

esri

DigitalGlobe, GeoEye, Earthstar Geographics

Tag Map Tab: Single Tag

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

AFSC GROUND FISH TAGGING

NOAA FISHERIES

Tag Map | Graphs | Tables | About

Filters for Tagmap

Single Tag | Multi Tag

Tag: BK 67205

Status

- Release ⓘ
- Recovery ⓘ
- Release & Recovery ⓘ

Reset Map | Search

Click on tag icon for more detailed information.

To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations.

LEGEND

Bering Sea | Central Gulf | Western Gulf

BK67205 (Release)

Tag Number	67205
Species	Sablefish
Sex	Unknown
Release Date	2014-06-24
Release Size	620 mm

Earthstar Geographics | POWERED BY esri

Graphs Tab

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

AFSC GROUND FISH TAGGING



Tag Map **Graphs** Tables About

Filters for All Graphs

Show Species by

- Release
- Recovery

Year Range

1995 - 2019

Species

- Greenland Turbot
- Lingcod
- Pacific Sleeper Shark
- Roughye Rockfish
- Sablefish (Adult release)
- Sablefish (Juvenile release)
- Salmon Shark
- Spiny Dogfish
- Shortspine Thornyhead

Release Area

- Bering Sea
- Aleutian Islands
- Western Gulf
- Central Gulf
- West Yakutat

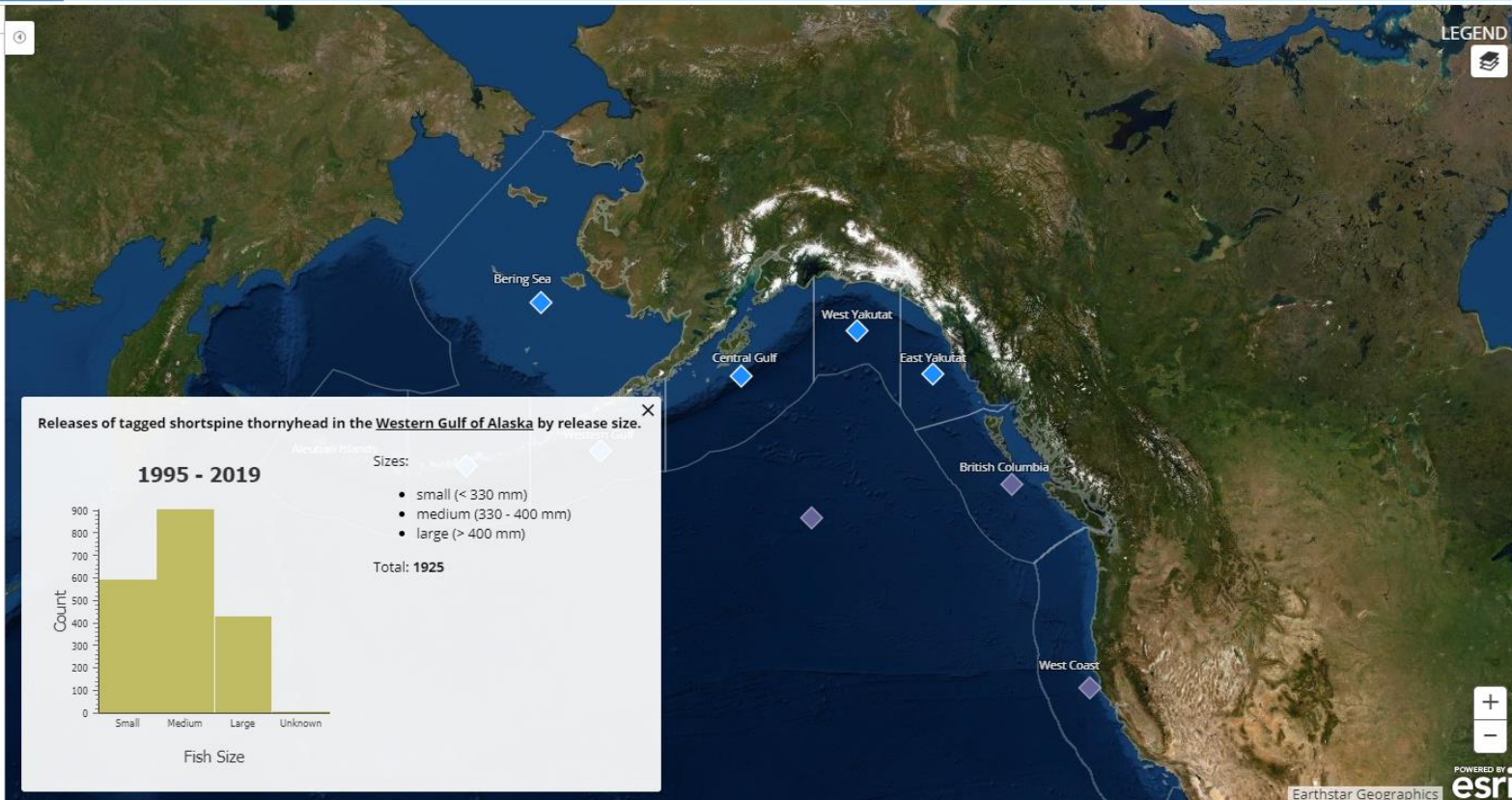
Reset Graph

Search

Geodesic lines will appear originating from the chosen release area out to each of the recovery areas. These lines will be scaled to represent the relative total migration from your search.

Click on the Management Area centroids to display a graph delineating the fish by sex and size.

To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations.



Graphs Tab

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

AFSC GROUND FISH TAGGING



Tag Map **Graphs** Tables About

Filters for All Graphs

Recovery

Year Range

1971 - 2019

Species

- Greenland Turbot
- Lingcod
- Pacific Sleeper Shark
- Roughey Rockfish
- Sablefish (Adult release)
- Sablefish (Juvenile release)
- Salmon Shark
- Spiny Dogfish
- Shortspine Thornyhead

Release Area

- Bering Sea
- Aleutian Islands
- Western Gulf
- Central Gulf
- West Yakutat
- East Yakutat/Southeast
- British Columbia
- West Coast

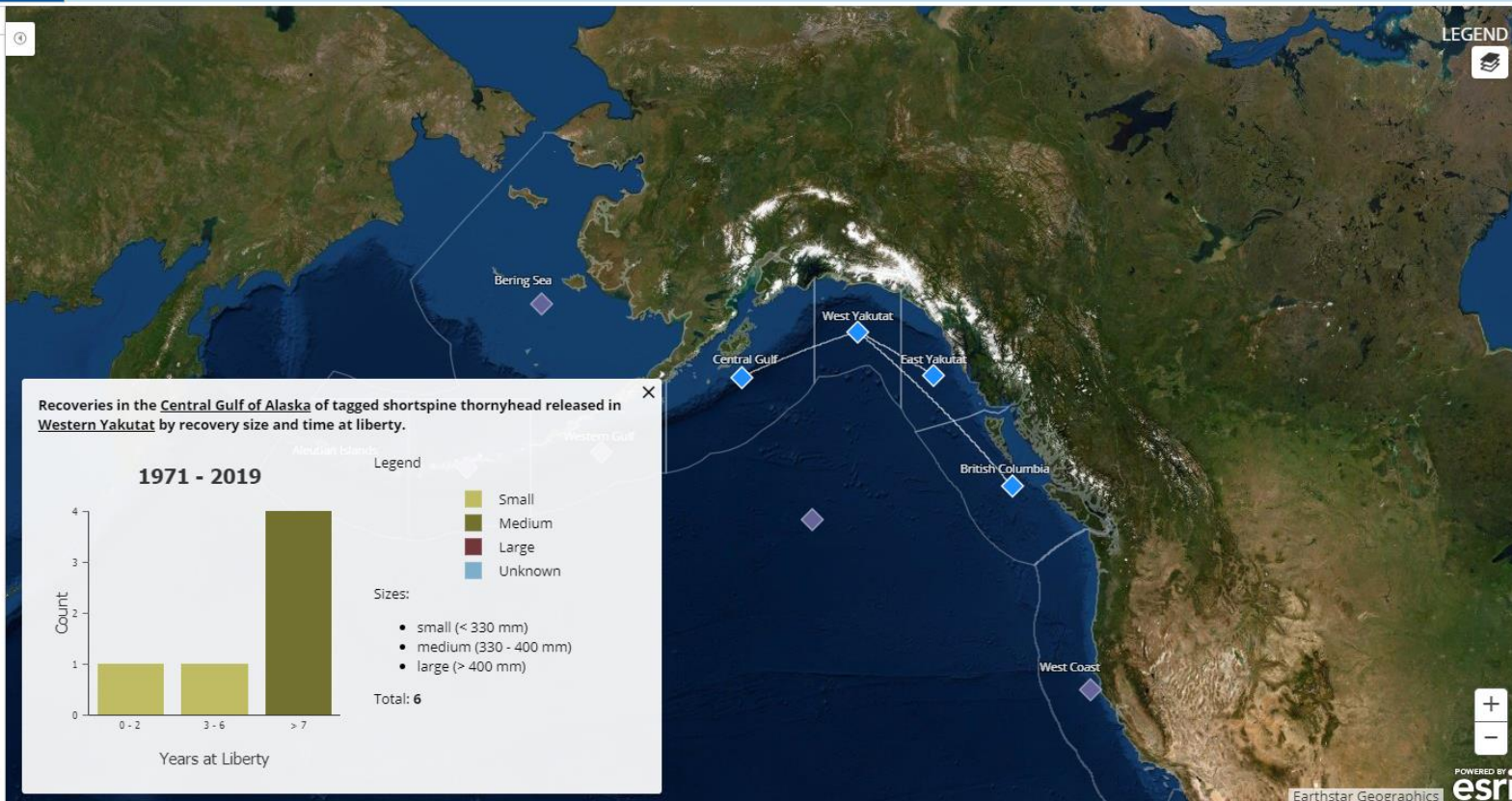
Reset Graph

Search

Geodesic lines will appear originating from the chosen release area out to each of the recovery areas. These lines will be scaled to represent the relative total migration from your search.

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To ensure that fishing locations remain confidential, the information in the maps of this web site have been generalized to generic center locations of a 20 x 20 sq. km. grid as per NOAA/NMFS regulations.



LEGEND



POWERED BY esri

Earthstar Geographics

Tables Tab

Six tables displaying tagging data in various formats

AFSC GROUND FISH TAGGING



- Tag Map
- Graphs
- Tables
- About

Table 1: Total Releases by Year

Total number of
sablefish tag
releases by year.

Show

CSV

Table 1: Total Releases by Year

Total number of tag releases by year.

Year	Adults	Juveniles	Total
2018	3,605	284	4,665
2017	3,322	410	4,621
2016	3,351	985	5,148
2015	2,529	1,134	4,558
2014	2,736	123	3,605
2013	2,589	703	4,534
2012	2,998	497	4,418
2011	4,358	943	6,405
2010	3,739	227	5,239
2009	3,389	312	4,678
2008	3,295	459	4,449
2007	3,827	161	4,859
2006	3,929	84	4,716

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

Tables Tab: Table 3

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

AFSC GROUND FISH TAGGING



- 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
 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 GROUND FISH TAGGING



- 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

DistanceTraveled-sablefish-adult-release-1568696643 - Excel

POSSIBLE DATA LOSS Some features might be lost if you save this workbook in the comma-delimited (.csv) format. To preserve these features, save it in an Excel file format.

	Release Areas																					
	BS			AI			WG			CG			WY			EY			BC			W
	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
4 All*	985	1	7555.939	1,201	0	7720.54	814	0	7598.213	638	1	7359.112	530	0	7043.221	346	0	6826.579	0	0	0	223
5 Female	871	1	7529.016	1,017	1	7700.17	635	0	7455.485	486	1	7298.609	382	1	6917.901	313	0	6807.712	0	0	0	274
6 Male	795	1	7555.939	1,013	1	7703.128	685	1	7569.249	418	1	7334.989	347	0	6917.345	304	0	6813.376	0	0	0	262

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

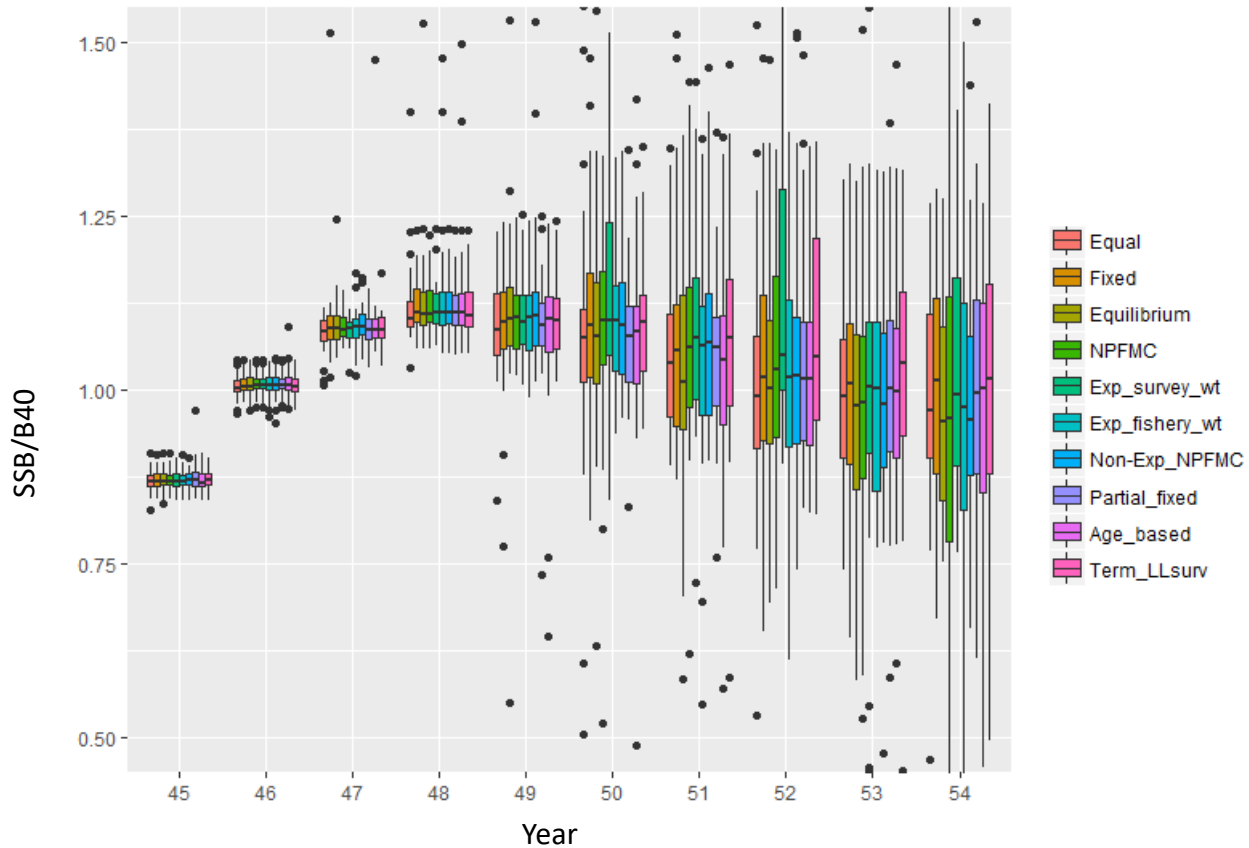


OM movement rates

		To					
		EY	WY	CG	WG	BS	AI
From	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

Convergence • 0 • 1



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

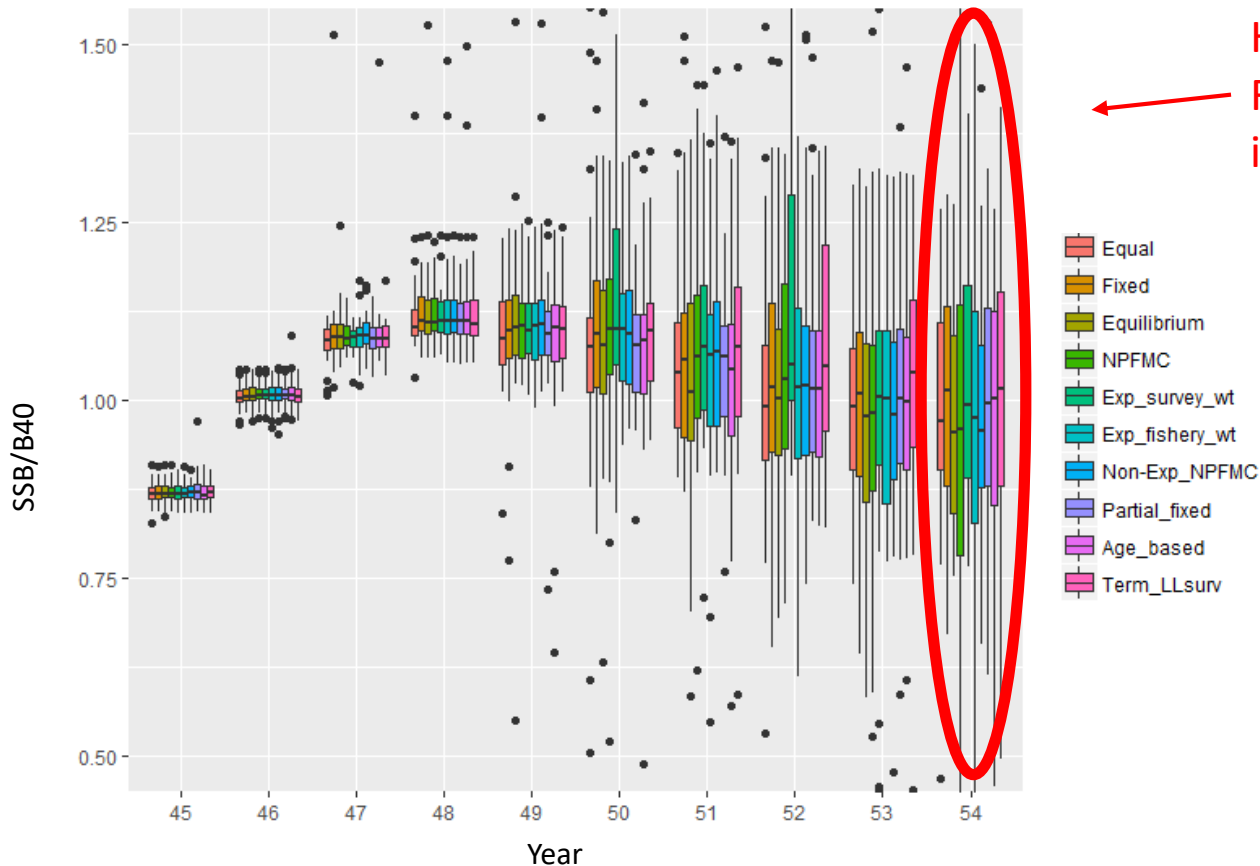
If $MGC < 0.001$

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 $SSB_{\text{end_year}}/B_{40}$



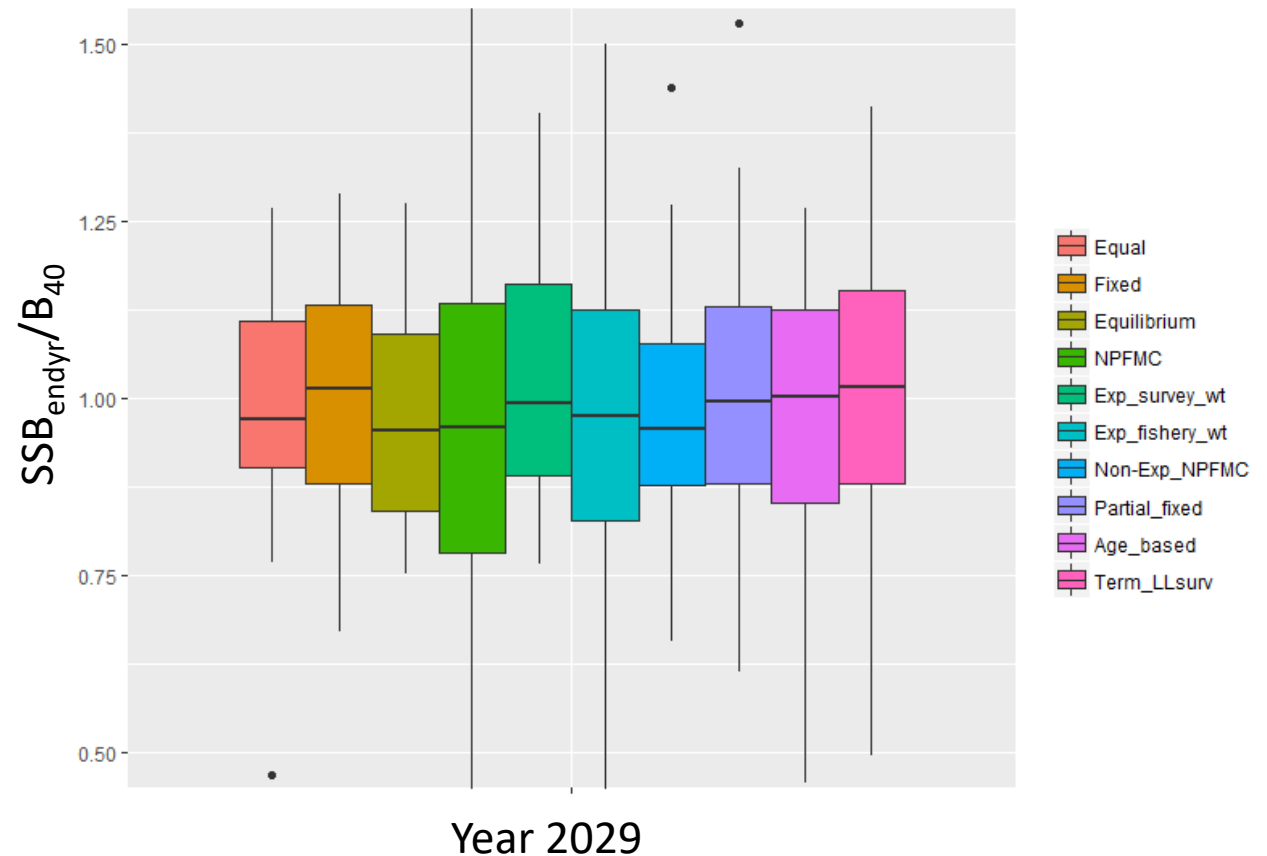
High variability!
Remember these are
illustrative only!

Comparing apportionment types

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

Range

0.956 – 1.017



Comparing apportionment types

Sustainability

- Depletion: $SSB_{\text{end_year}}/SSB_{1977}$
- $SSB_{\text{end_year}}/B_{40}$
- 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