

C-1 BSAI Halibut Abundance Based Management (ABM)

AP presentation

Homer, AK

October 1, 2019

Document structure

1. Introduction/Purpose and Need
2. Description of Alternatives
3. Groundfish stock status and fishery description
4. Halibut stock status and fishery description
5. Methodology
6. Impacts Analysis for Groundfish and Halibut
7. Other resource categories
8. Preparers
9. References
10. Appendices including SIA, other indices previously considered, Model validation, model results by alternative, model sensitivity

Key discussions and decision points for the Council meeting

- Review the suite of Alternatives and provide any revisions as desirable. Key considerations include:
 - Do these Alternatives as currently constructed meet the intent of the Council's action?
 - Could complexity and redundancy be reduced and still address the Council's intent?
- Review the halibut simulation model, including analytical assumptions and application for purposes of informing the Council's policy decisions for this analysis.
- Review the suite of draft performance metrics and revise as needed. Revised performance metrics may better characterize results across alternatives to indicate where they address conflicting Council objectives.

Purpose and Need

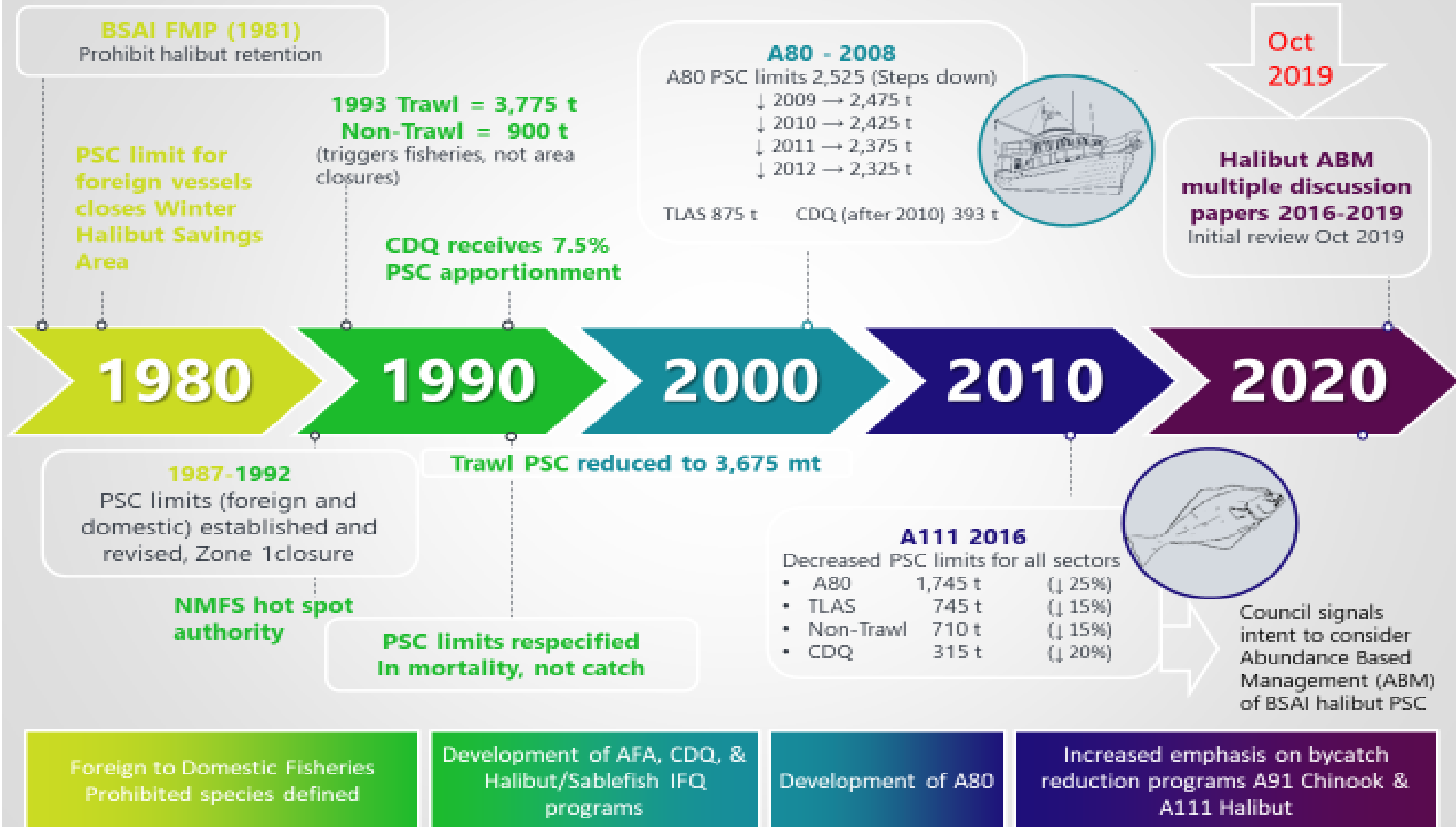
Objectives derived from purpose and need page 24 to guide alternative management actions

- Halibut PSC limits should be indexed to halibut abundance
- Halibut spawning stock biomass should be protected especially at lower levels of abundance
- There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high
- Provide for directed halibut fishing operations in the Bering Sea.
- Provide for some stability in PSC limits on an inter-annual basis.



HALIBUT PROHIBITED SPECIES CATCH (PSC) MEASURES OVER TIME

TIMELINE OF MANAGEMENT MEASURES TO ADDRESS BSAI HALIBUT PSC: 1981-PRESENT



Focus of
discussion
paper reviews

Indices

Control rules

Alternative

Performance metrics

Alternatives

Alternative 1: Status Quo

Halibut PSC Limits for Groundfish sectors

	PSC limit
Amendment 80 cooperatives	1,745 t
BSAI trawl limited access fisheries	745 t
Non-trawl fisheries	710 t
CDQ fisheries	315 t
TOTAL	3,515 t

Status Quo allocation and apportionment among Groundfish Sectors and targets

Total PSC limit
3,515

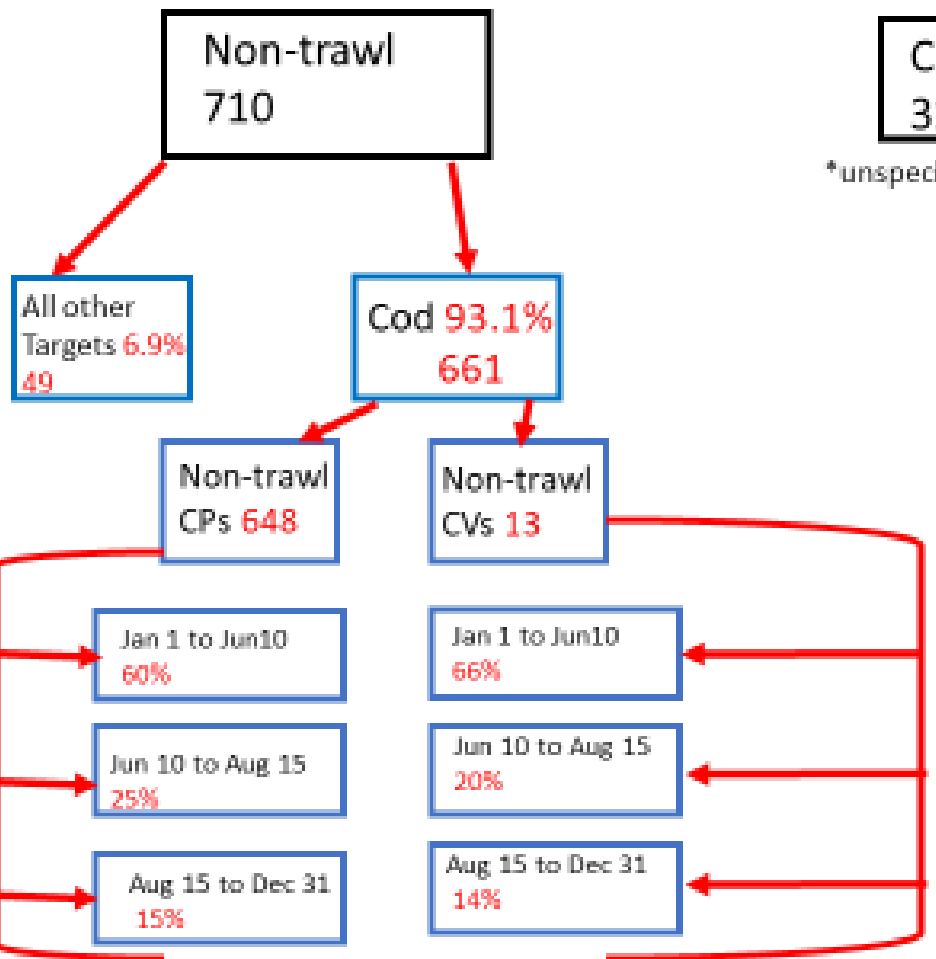
CDQ*
315

*unspecified gear limit

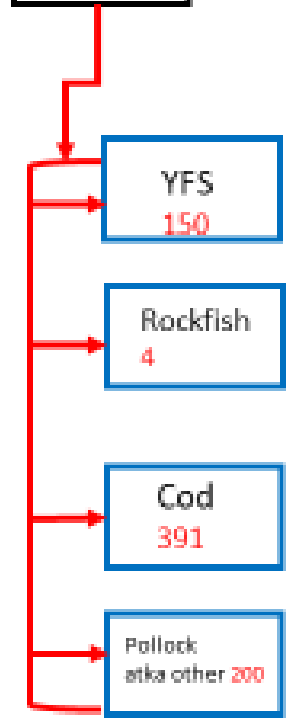
A80
1,745

TLAS
745

Trawl non-CDQ



→ Fixed in FMP and regulation
→ Apportioned to target and season in harvest specifications



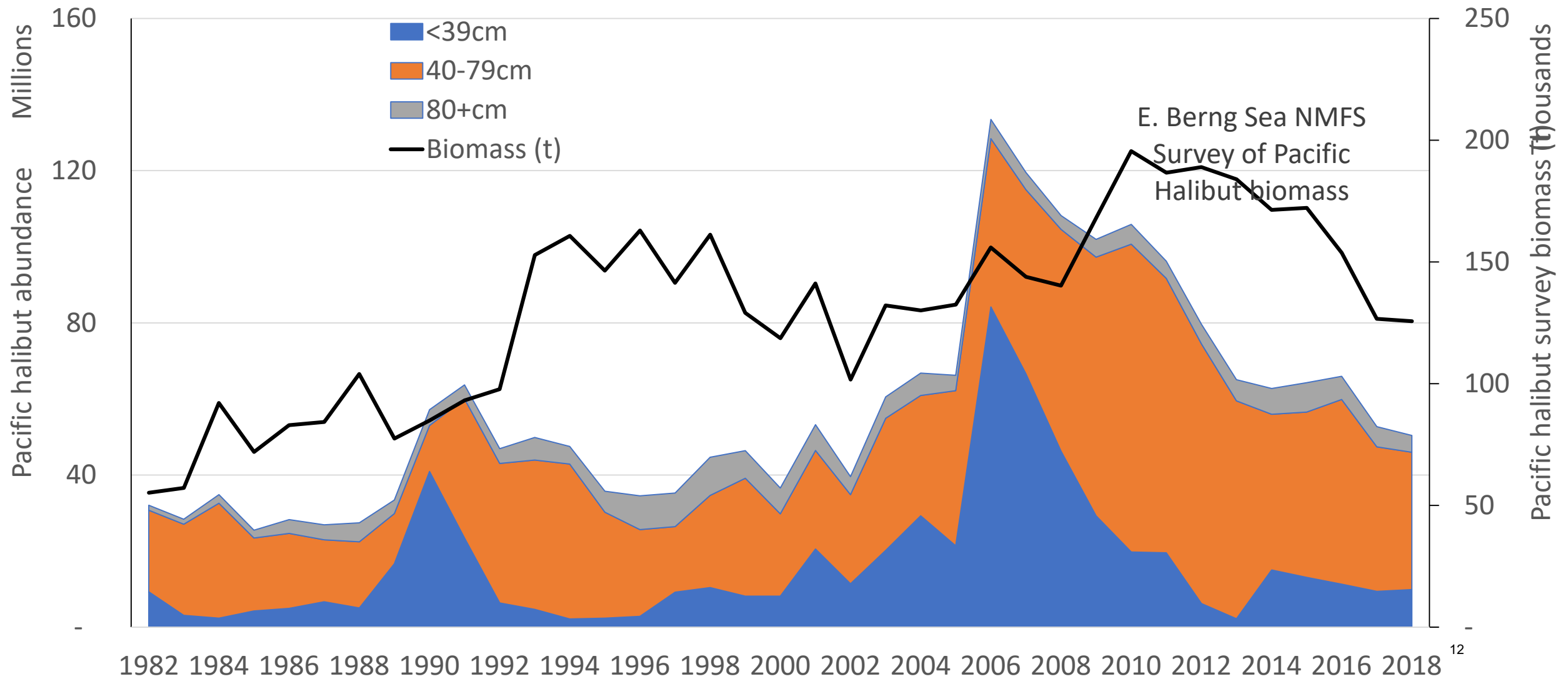
Indices to make Pacific
halibut PSC based on
abundance...

for

Alternatives 2 and 3

Estimated abundance (numbers of Pacific halibut) by length category, total biomass (pounds) as estimated by the NMFS Bering Sea Trawl survey data, 1982-2018

Fig 1-5



Actual EBS trawl survey index used

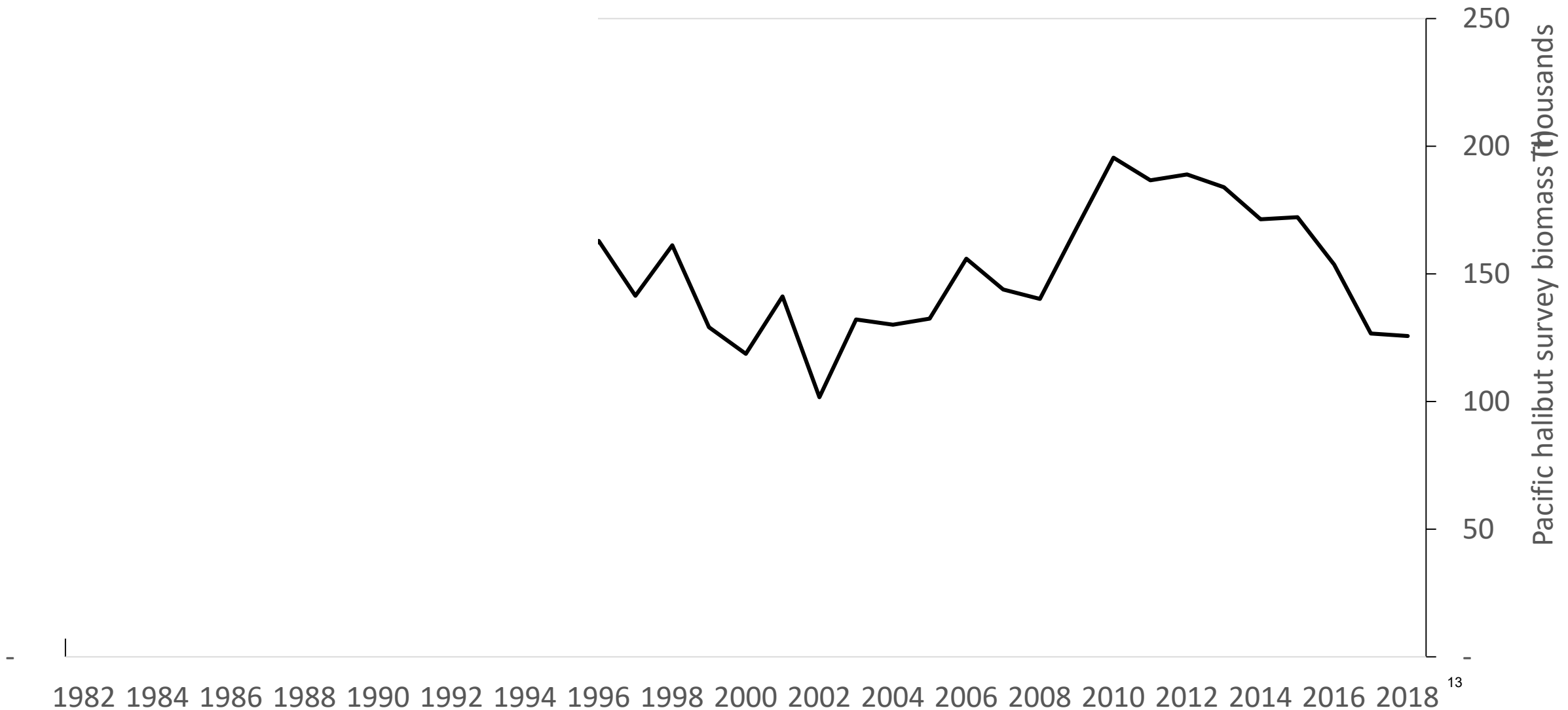


Figure 1-7 IPHC
Setline survey
WPUE all Pacific
halibut (Total) for
IPHC Regulatory
Areas in Area 4
standardized to the
mean of the time
series (1998-2017)
for each Area

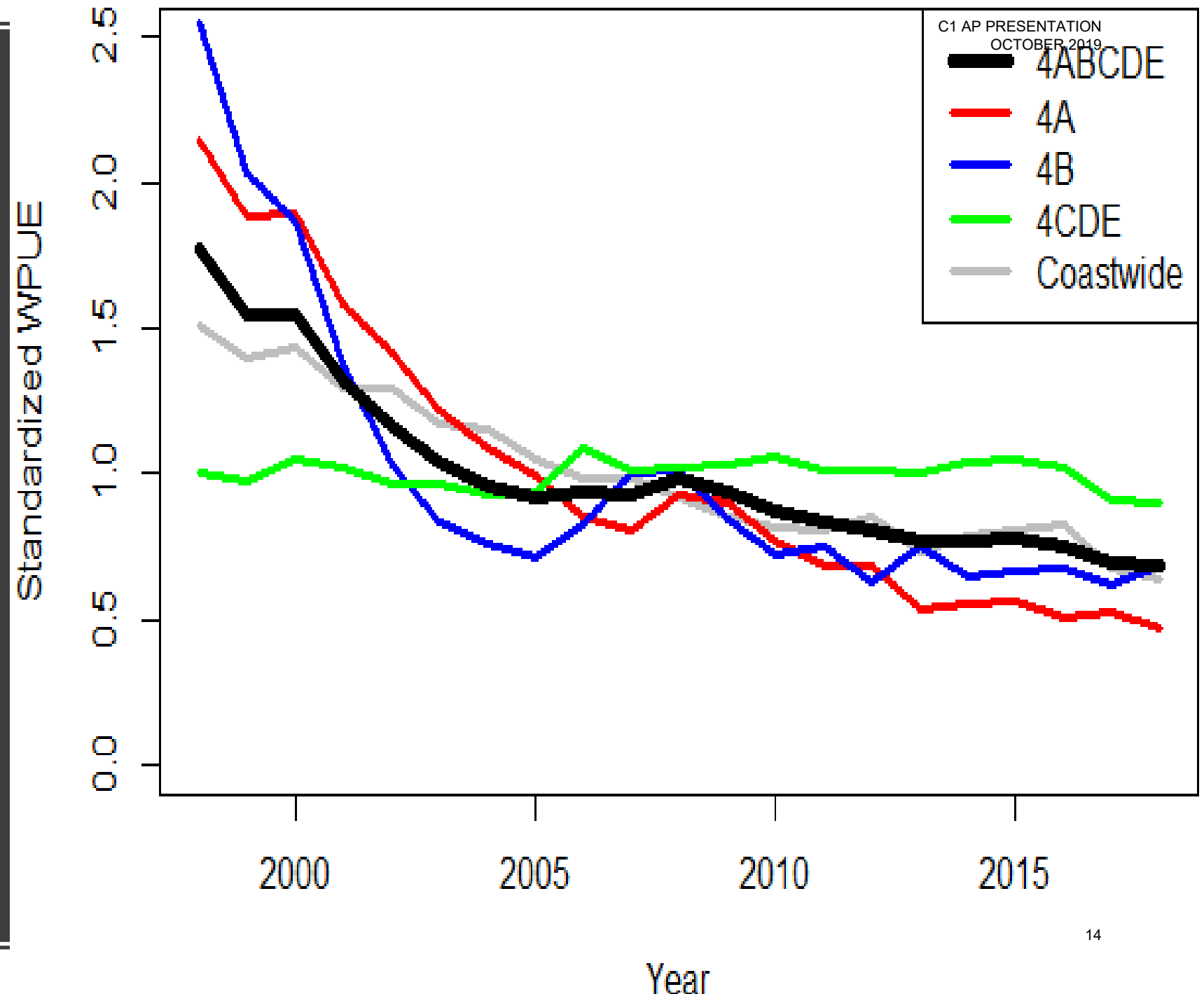
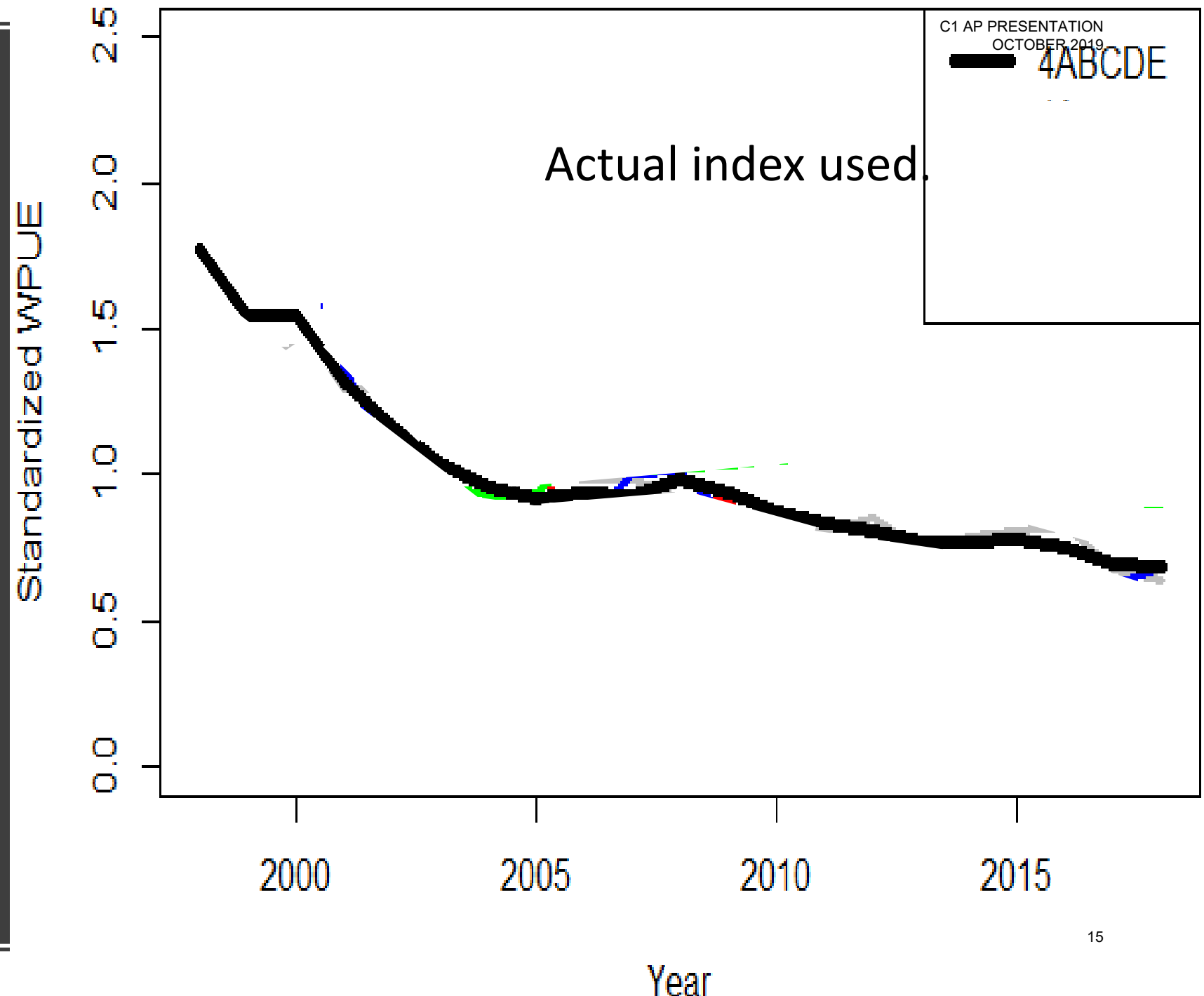
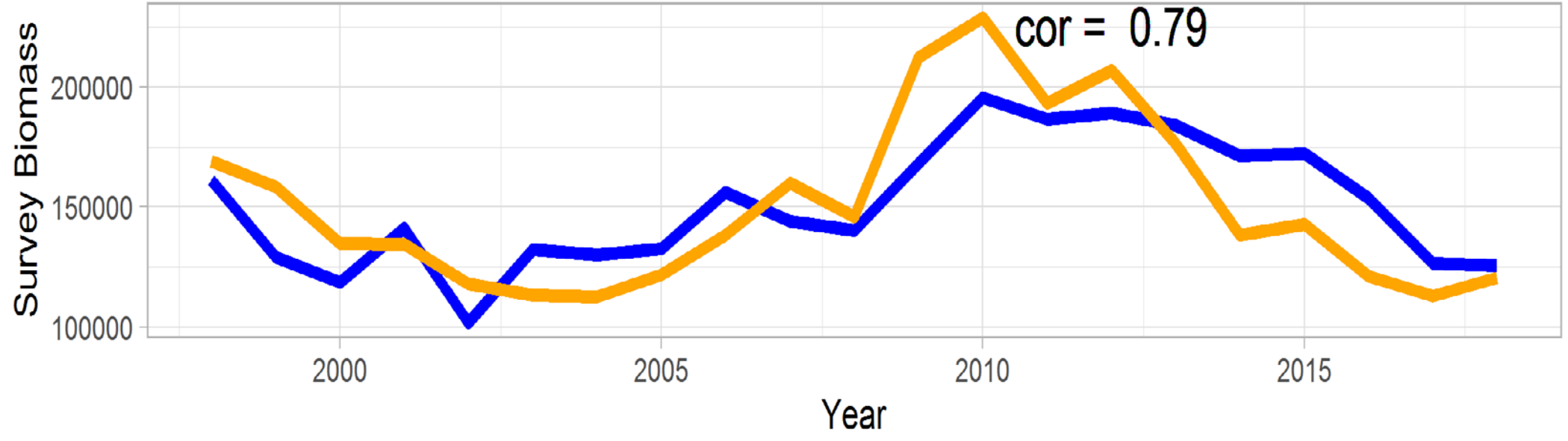


Figure 1-7 IPHC
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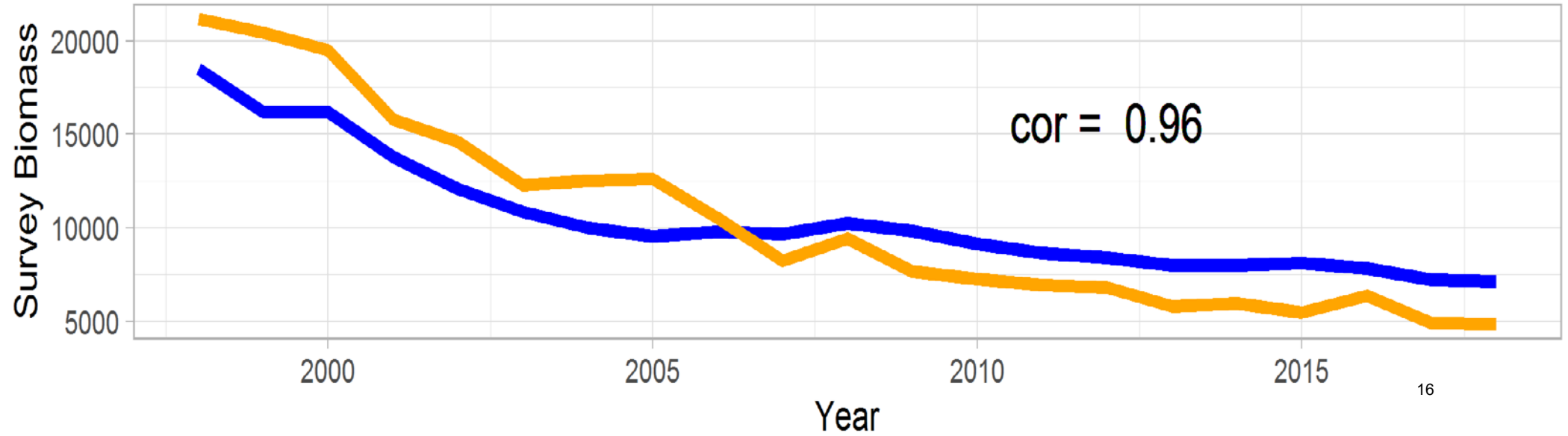


EBS Bottom Trawl Survey (Observed is blue)



Bottom
Trawl
Survey

4ABCDE Setline Survey (Observed is blue)



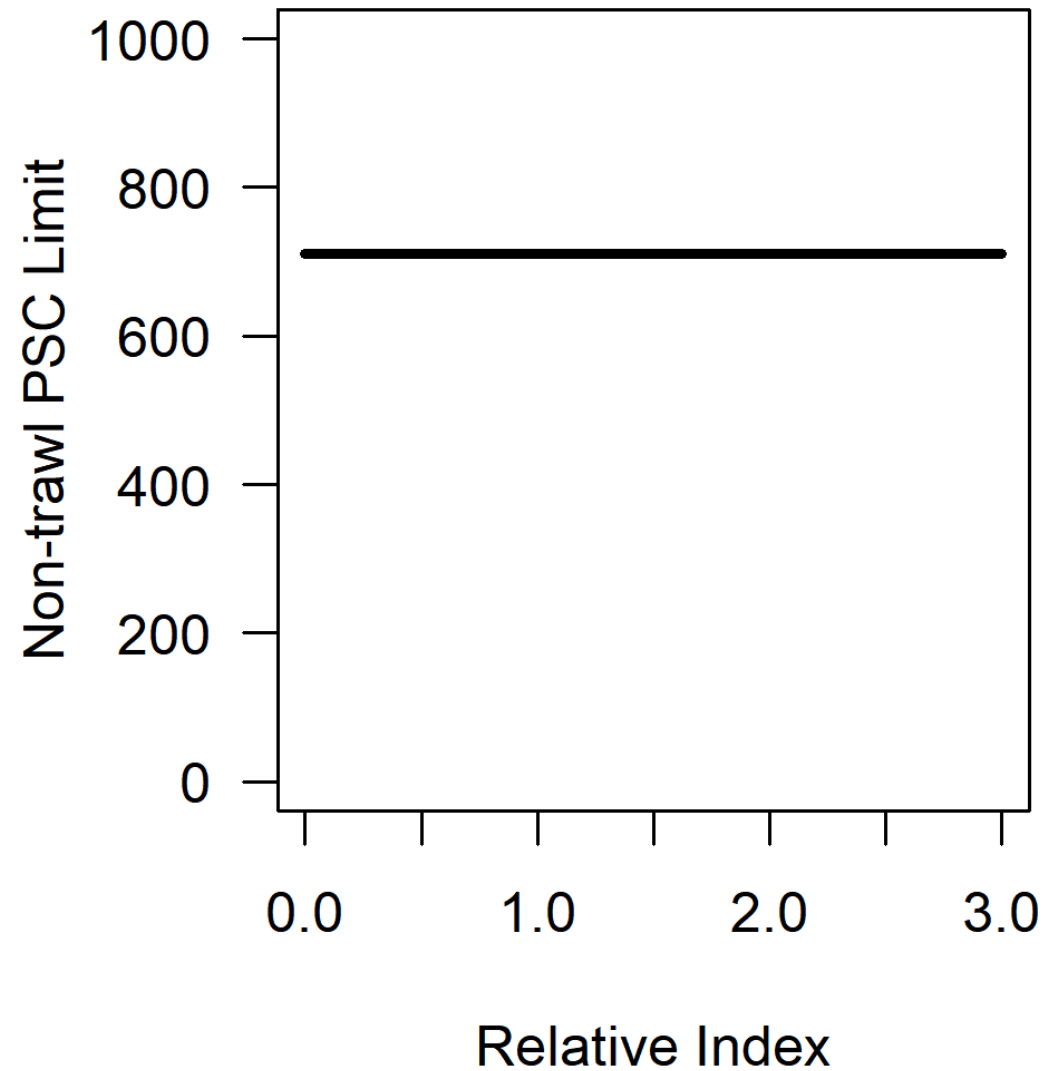
Setline
survey

Alternatives 2 and 3

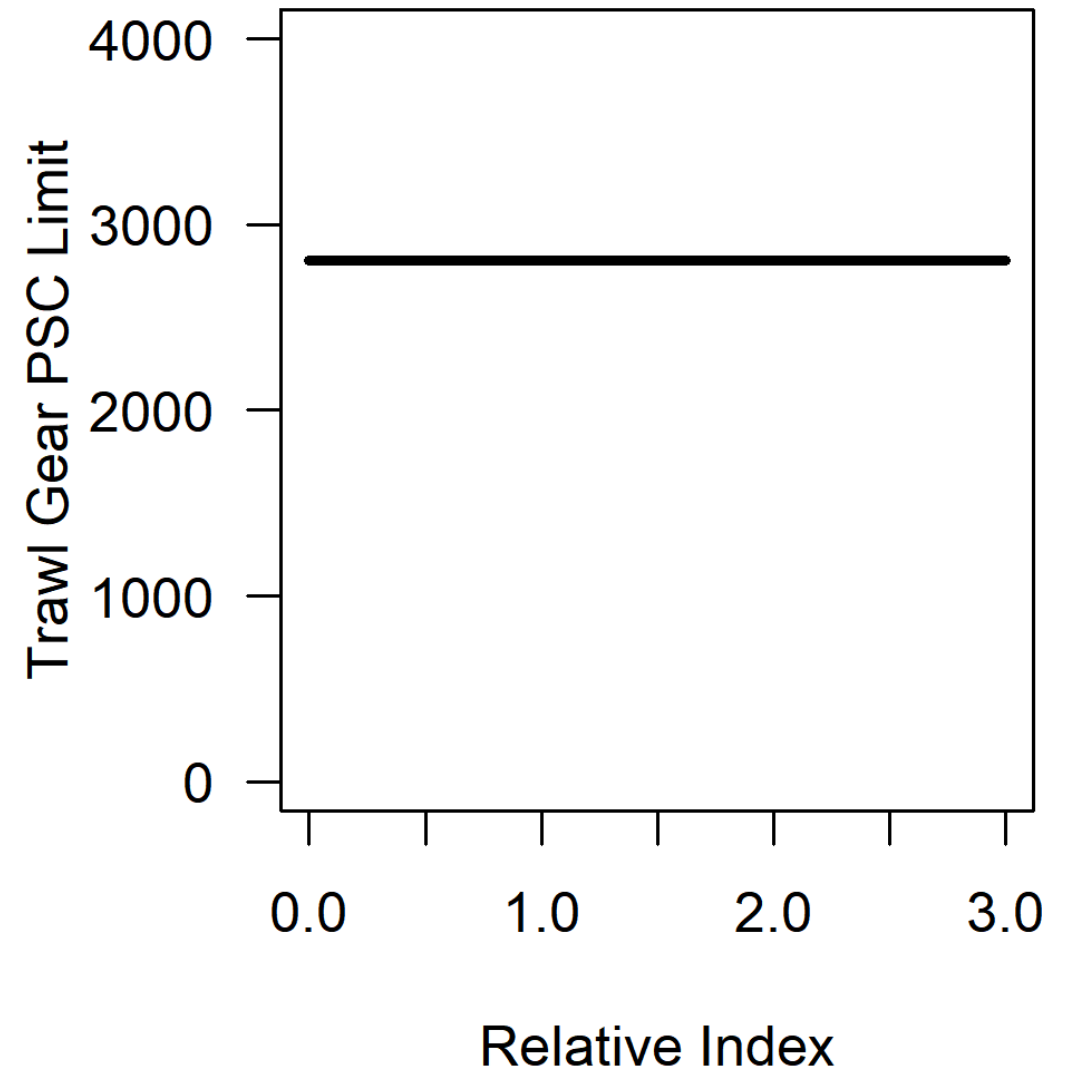
Alternative	Primary index	Secondary index	Standardization
2	Trawl or Setline	none	2018 (default); 2 year average
3	Trawl or Setline	Trawl or Setline	Primary: 2018 (default); 2 year average Secondary: mean or 2018

Element	Description	Range	Optional?
1	Starting Point	1,958-3,515 t	No
2	Ceiling	3,515-4,426 t	No
3	Floor	1,000-2,354 t	No
4	Breakpoint	Breakpoint occurs when index value is greater than or less than one of the 2 values below: 25% average of index or average value of index	Yes For Alt 2 No for Alt 3 (unless Element 7 selected)
5	Response	1:1 >1:1 <1:1	No (unless Element 7 selected)
6	Constraint	5-25%	Yes
7	Look up Table	Up to 12 breakpoints; standard to mean or 2018	Yes

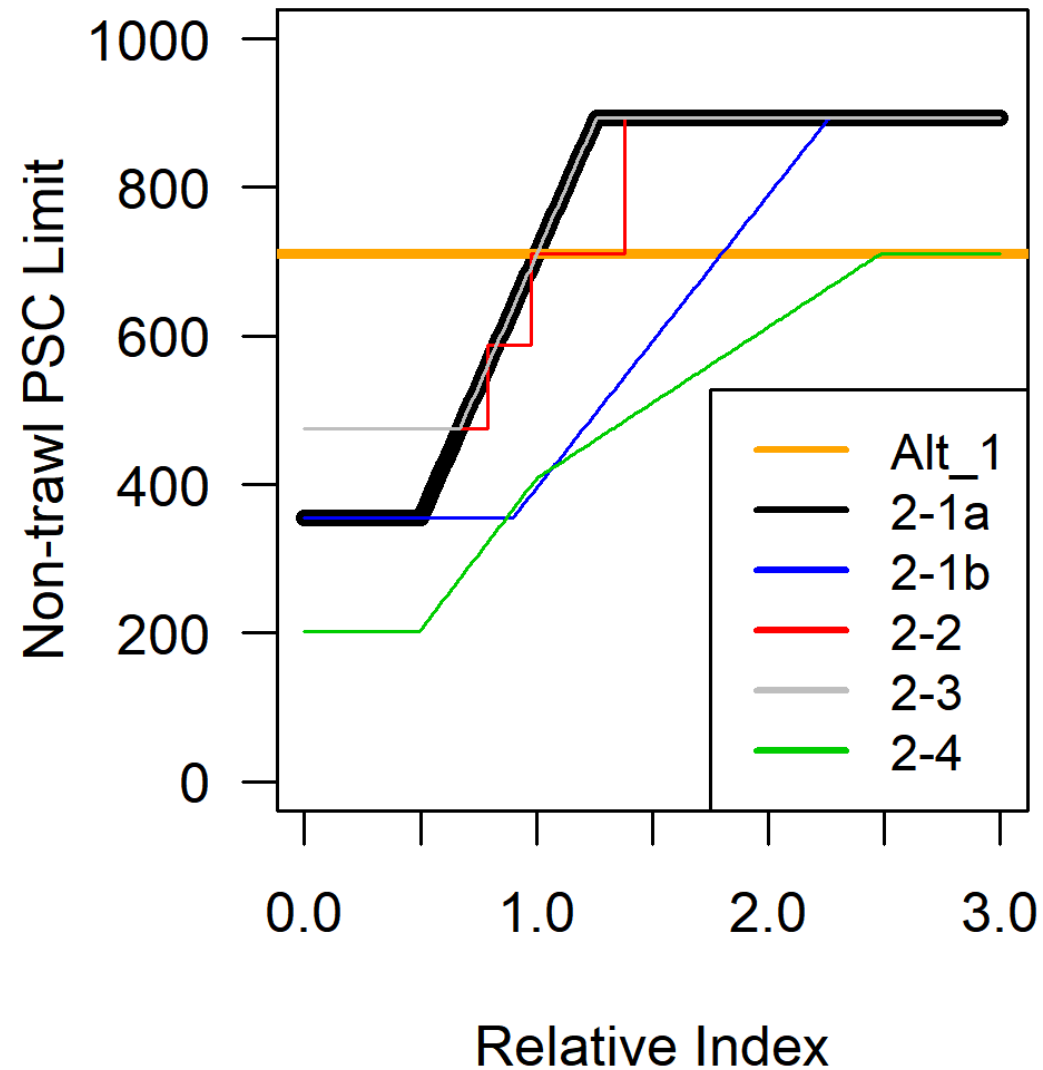
Non-trawl



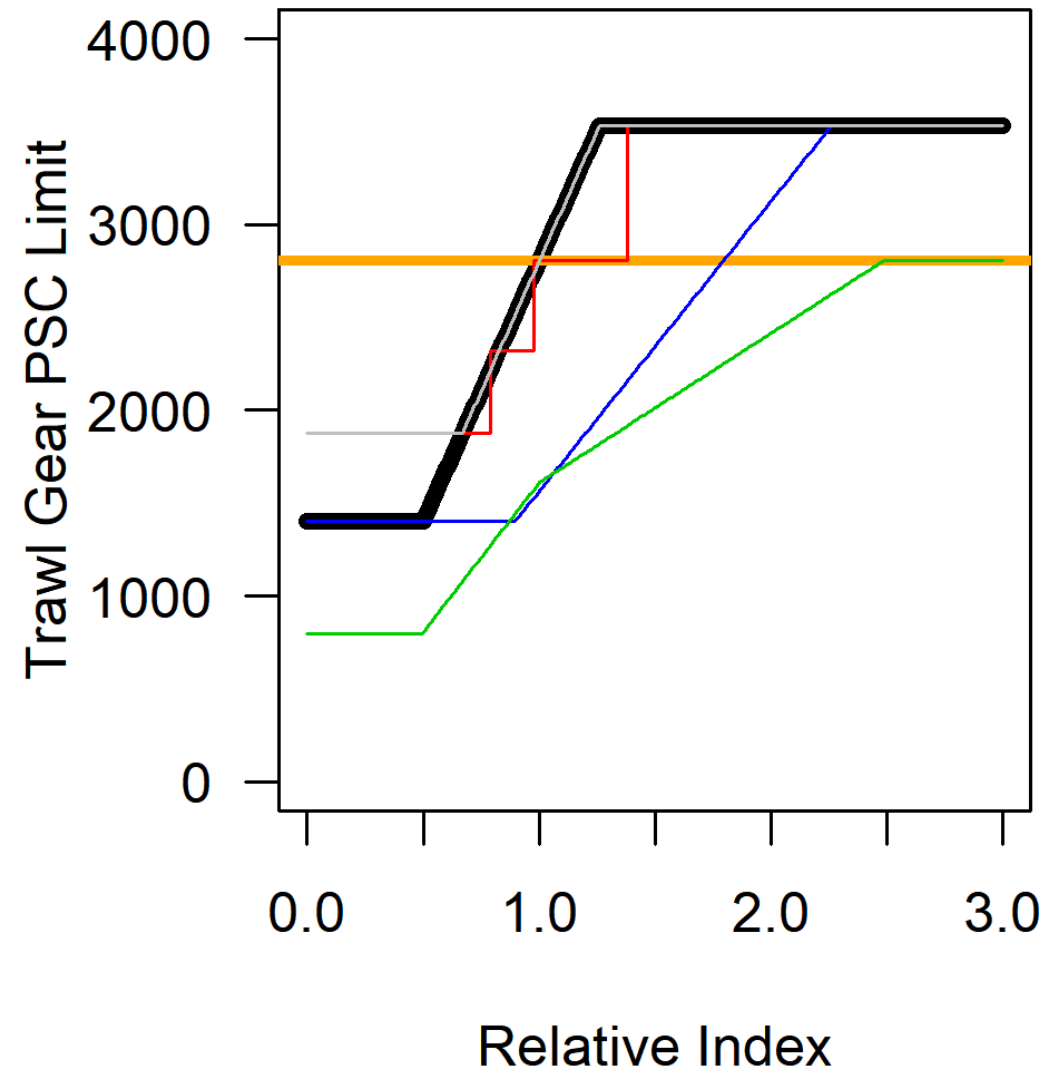
Trawl gear

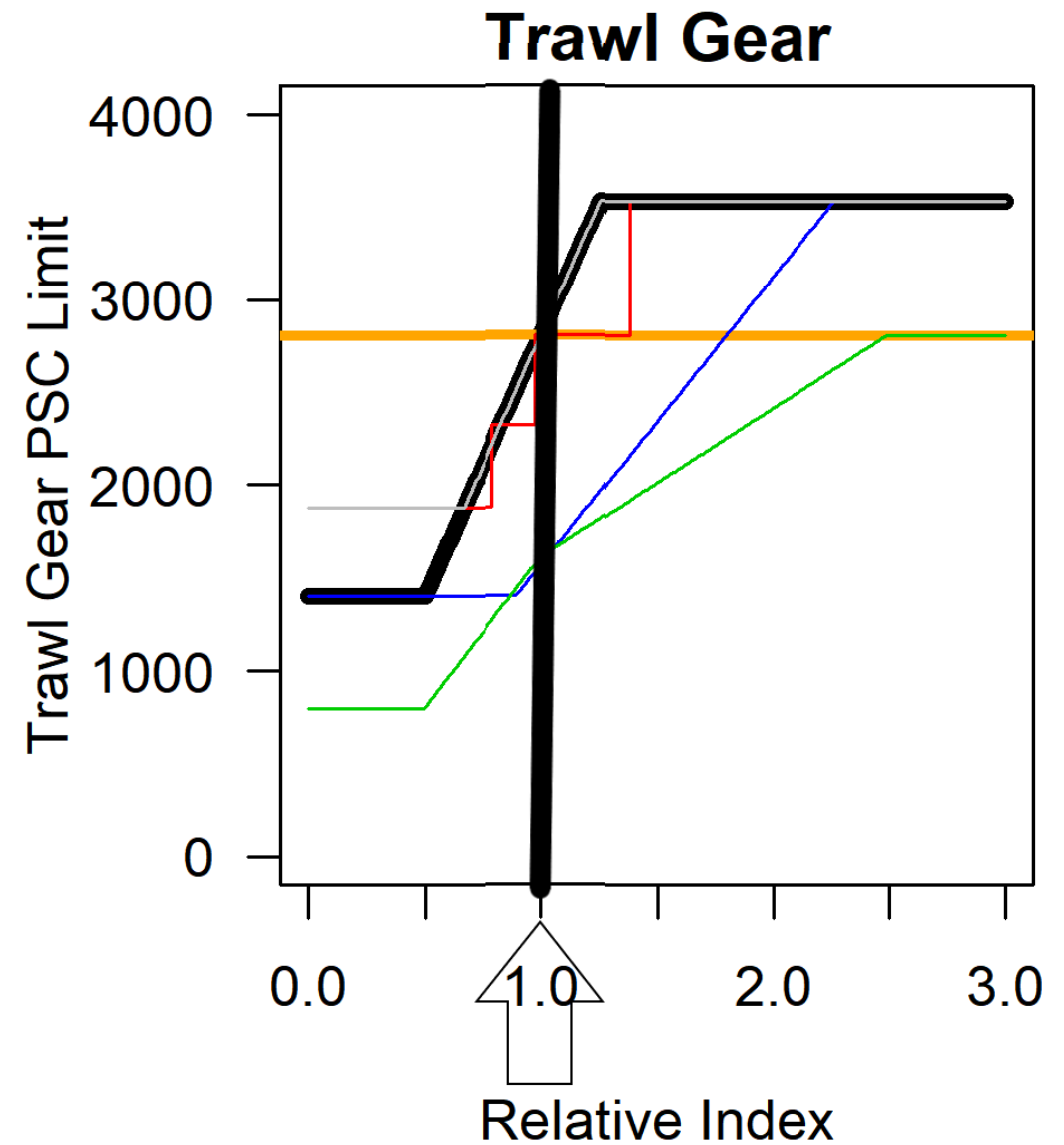
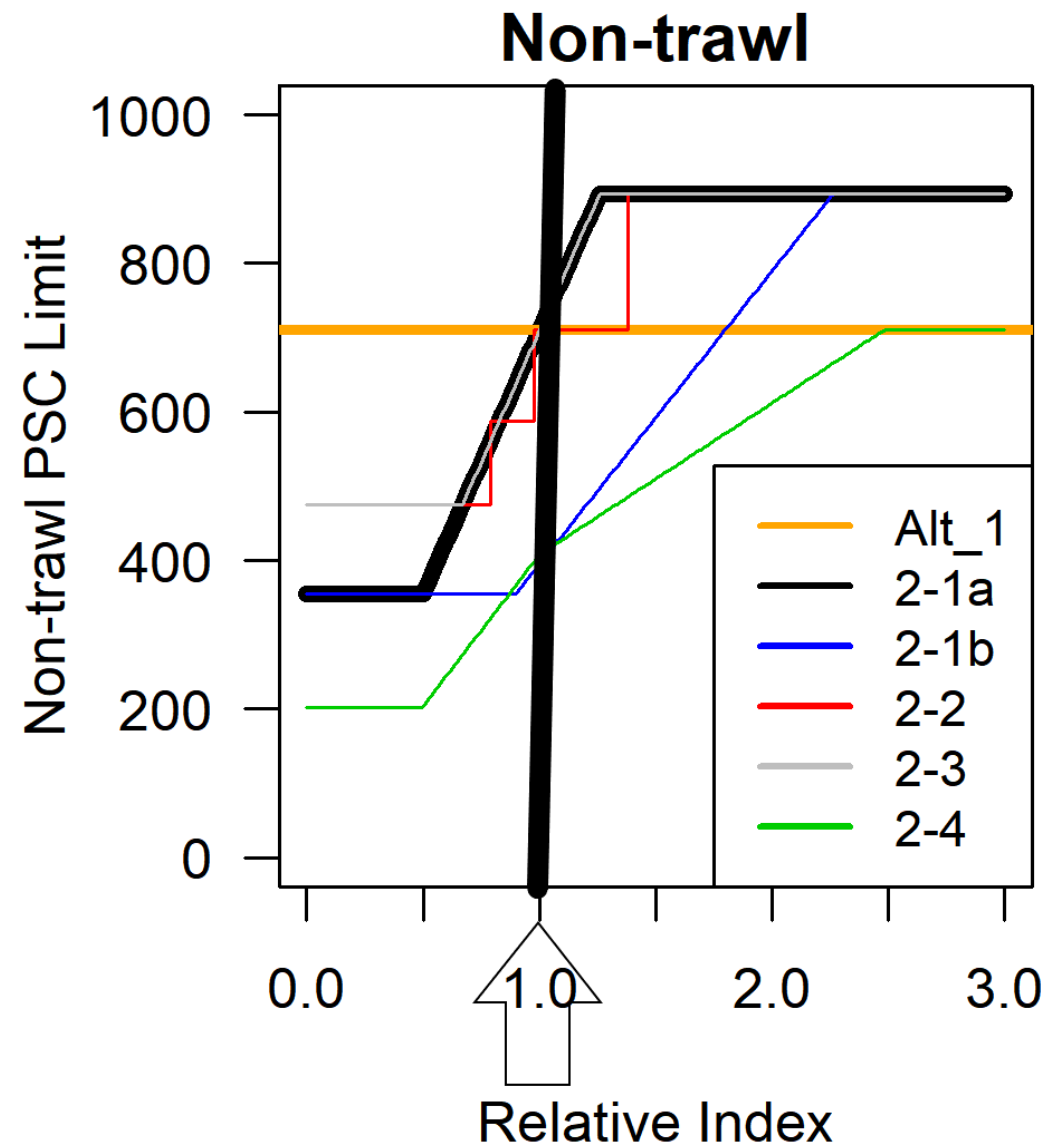


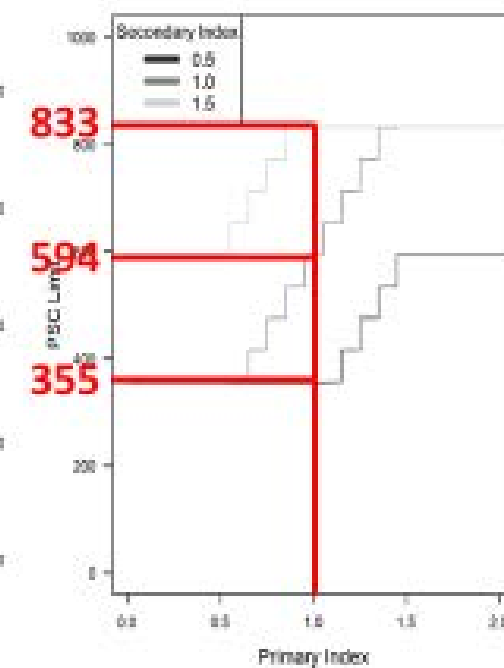
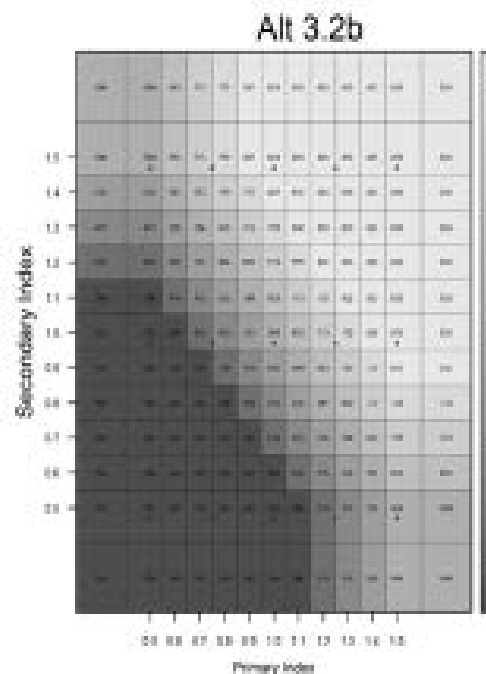
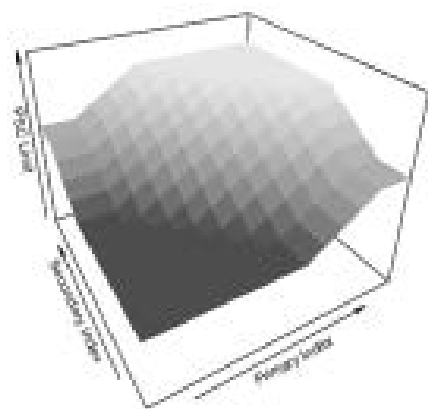
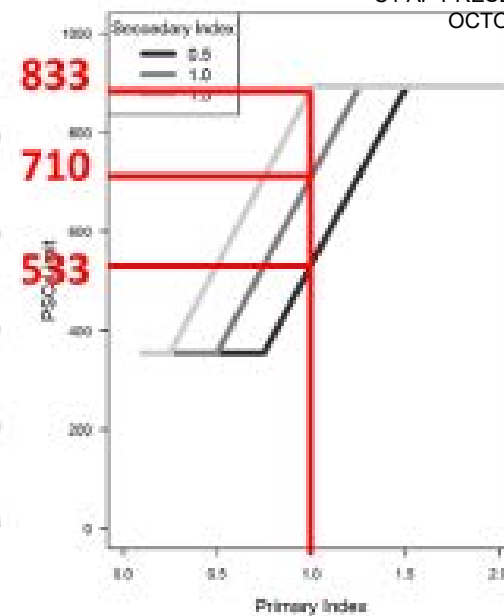
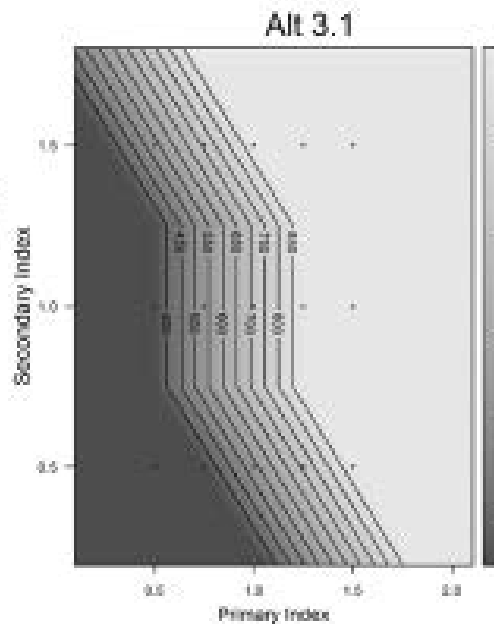
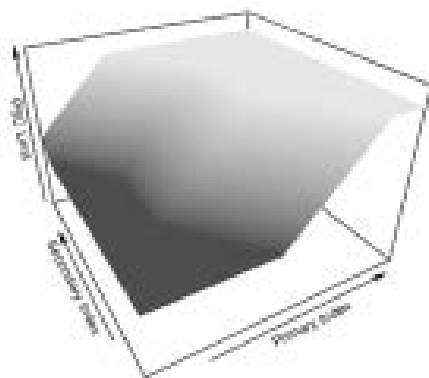
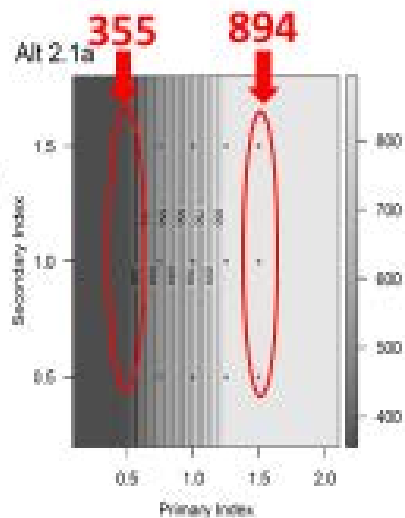
Non-trawl

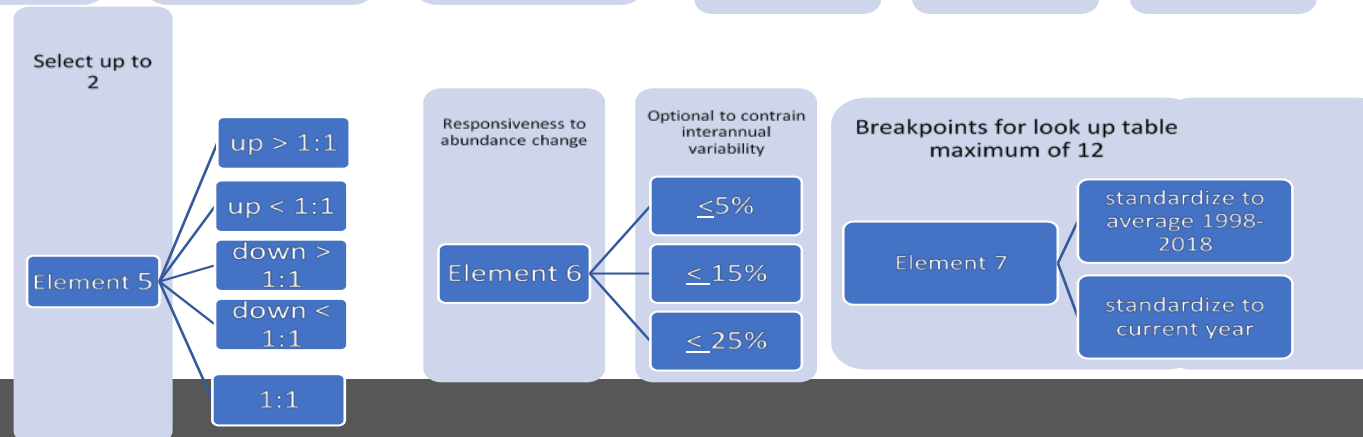
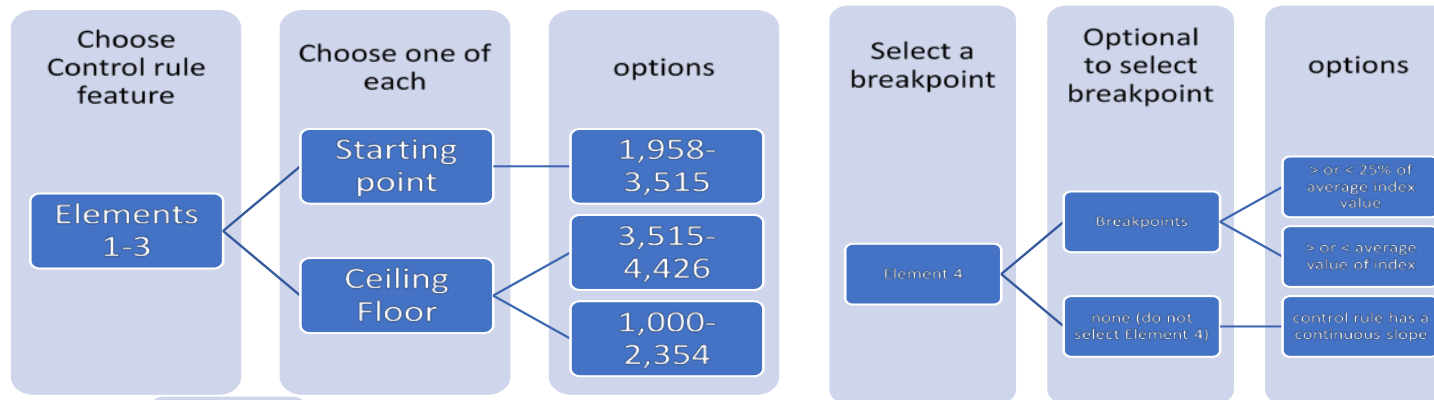
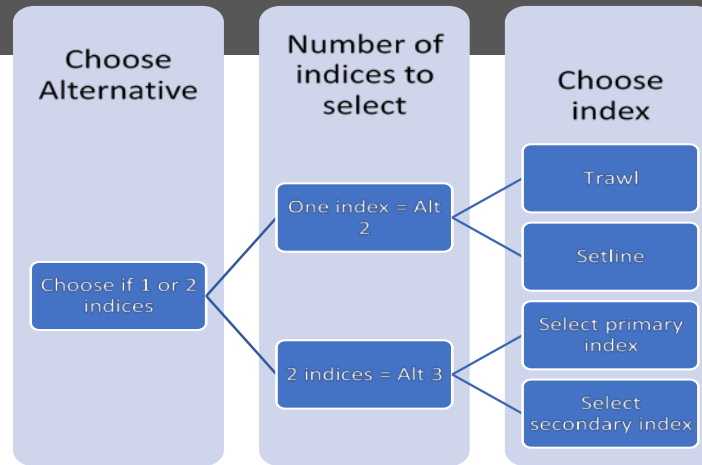


Trawl Gear









Sub-
alternatives
analyzed
(Table 2-4)

- Process for selection of Alternatives 2 and 3:
 - Base Case 2-1, 3-1: same Elements and options selected except for breakpoints (none in 2-1)
 - Change one element:
2-1a, 2-1b; 3-1a, 3-1b, 3-1c, 3-1d
 - Stakeholder submissions:
2-2, 2-3, 2-4; 3-2a, 3-3a
 - Contrasting alternatives for one Element:
3-2b, 3-3b

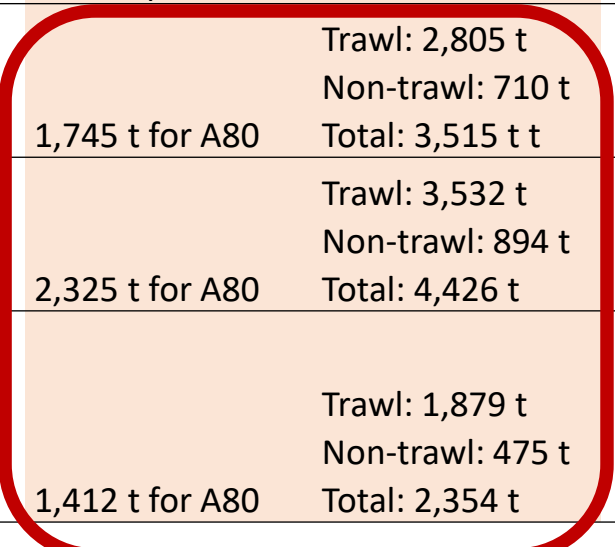
Table 2-4

<i>Alternative</i>	Source	Indices used		Elements							
		Primary	Secondary	1 Starting point	2 Ceiling	3 Floor	4 Break points	5 Responsiveness	6 Constraint	7 Type	
<i>1</i>	Status quo	NA	NA	3,515							
<i>2-1</i>	WG	By gear	NA	3,515	4,426	1,758	none	1:1	15% max	Continuous	
<i>2-1.a</i>	WG	By gear	NA	3,515	4,426	1,758	none	1:1	none	Continuous	
<i>2-1.b</i>	SSC	By gear	NA	1,958	4,426	1,758	none	1:1	15% max	Continuous	
<i>2-2</i>	Stakeholder	By gear	NA	3,515	4,426	2,354	specified	Stairsteps	2 yr avg	Continuous	
<i>2-3</i>	Stakeholder	By gear	NA	3,515	4,426	2,354	none	1:1	15% max	Continuous	
<i>2-4</i>	Stakeholder	By gear	NA	2,018	3,515	1,000	Start	1:1 (low) 0.5:1 (high)	15% max	Continuous	
<i>3-1</i>	WG	By gear	Other (mean)	3,515	4,426	1,758	±25%	1:1	15% max	Continuous	
<i>3-1.a</i>	WG	By gear	Other (mean)	3,515	4,426	1,758	±25%	1:1	none	Continuous	
<i>3-1.b</i>	WG	By gear	Other (mean)	3,515	4,426	1,758	±25%	2 nd Index 0.5:1 (low), 1.5:1 (high)		15% max	Continuous
<i>3-1.c</i>	WG	By gear	Other (mean)	3,515	4,426	1,758	±25%	1:1	15% max	Discrete	
<i>3-1.d</i>	SSC	By gear	Other (mean)	1,958	4,426	1,758	±25%	1:1	15% max	Continuous	
<i>3-2.a</i>	Stakeholder	Gear (mean)	Other (mean)	2,941	4,124	1,758	none	Interpolated	15% max	Discrete	
<i>3-2.b</i>	WG	Gear (mean)	Other (mean)	2,941	4,124	1,758	none	1:1	15% max	Discrete	
<i>3-3a</i>	Stakeholder	Setline	Trawl (mean)	1,958	3,515	1,000	S.P	Secondary 0.35:1	20% max	Continuous	
<i>3-3a_update</i>	Stakeholder	Setline	Trawl (2018)	1,958	3,515	1,000	S.P	Secondary 0.35:1	20% max	Continuous	
<i>3-3b</i>	WG	Trawl	Setline (mean)	1,958	3,515	1,000	S.P	Secondary 0.35:1	20% max	Continuous	

Alternatives analyzed and stakeholder intent

- Proposals documented before February stakeholder meeting
- A few differences between proposal and alternative
 - May be a clear difference or a necessary interpretation
- Inconsistencies with the motion are not highlighted here
 - Retention of the intent of the proposal was attempted

February 2019 Motion		A80 Proposal	Alternative 2-2	UCB Proposal	Alternative 2-4	FLC Proposal	Alternative 3.2a
Applies to		A80 PSC Limit	Trawl Non-trawl	Total PSC Limit	Trawl Non-trawl	Non-trawl PSC limit	Trawl Non-trawl
Indices	1998-2018 Primary standardized to recent year 1. Secondary to recent year 2. Primary averaged over recent 2 yrs	Trawl survey averaged over recent 2 years	Trawl survey averaged over recent 2 years	Trawl survey for trawl	Trawl survey for trawl Setline for non-trawl	Both	Both
Alternative	1. No action 2. Single index 1: EBS bottom trawl survey. 2: IPHC setline survey 3. Primary & secondary 1: trawl then setline. 2: setline then trawl	Alt 2, Option 1	Alternative 2	Alt 2, Option 1	Alternative 2	Alternative 3	Alternative 3
Element 1 Starting point	1. 2016 PSC limit (3,515 t) 2. 2016 use (2,354 t) 3. 2017 use (1,958 t)	1,745 t for A80	Trawl: 2,805 t Non-trawl: 710 t Total: 3,515 t t	3,515 t	Trawl: 2,805 t Non-trawl: 710 t Total: 3,515 t	594 t	Trawl: 2,347 t Non-trawl: 594 t Total: 2,941 t
Element 2 Ceiling	1. 2016 PSC limit (3,515 t) 2. 2015 PSC limit (4,426 t)	2,325 t for A80	Trawl: 3,532 t Non-trawl: 894 t Total: 4,426 t		Trawl: 3,532 t Non-trawl: 894 t Total: 4,426 t	833 t	Trawl: 3,291 t Non-trawl: 833 t Total: 4,124 t
Element 3 Floor	1. 2,354 t 2. 1,758 t 3. 1,177 t 4. 1,000 t	1,412 t for A80	Trawl: 1,879 t Non-trawl: 475 t Total: 2,354 t	2,354 t	Trawl: 1,879 t Non-trawl: 475 t Total: 2,354 t	355 t	Trawl: 1,403 t Non-trawl: 355 t Total: 1,758 t



February 2019 Motion		A80 Proposal	Alternative 2-2	UCB Proposal	Alternative 2-4	FLC Proposal	Alternative 3.2a
Element 4 Breakpoint	1. 25% below/above average 2. above or below average						
Element 5 Responsiveness	1. Up faster than 1:1 2. Up slower than 1:1 3. Down faster than 1:1 4. Down slower than 1:1 5. 1:1	NA	NA	1:1	1:1.		
Element 6: Constraint	1. 5% constraint 2. 15% constraint 3. 25% constraint Suboption: limit change from current and implementation	Index is average of recent two years	Index is average of recent standardized two years	15% maximum	15% maximum	15% maximum	15% maximum
Element 7: Breakpoints	Specify breakpoints in a lookup table with a maximum of 12 breakpoints in each dimension. Each index standardized using Option 1: standardize to average of 1998-2018 Option 2: standardize to current year	Breakpoints in a single dimension	Breakpoints translated to gear index and standardized to 2018	NA	NA	Evenly space breakpoints between floor and ceiling with starting point at 1 and 1. Both indices standardized to mean	Evenly space breakpoints between floor and ceiling with starting point at 1 and 1. Both indices standardized to mean

February 2019 Motion		FVOA Proposal	Alternative 2-4	Directed Users Proposal	Alternative 3-3a
Applies to		Total PSC Limit	Trawl Non-trawl	Total PSC limit	Trawl Non-trawl
Indices	1998-2018 Primary standardized to recent year 1. Secondary to recent year 2. Primary averaged over recent 2 yrs	<div style="border: 2px solid red; padding: 5px; display: inline-block;">The intent was to use only setline</div> Setline for total	Trawl survey for trawl Setline for non-trawl	Primary: Standardize to 2017 Trawl survey secondary, Standardize to mean	Setline Primary, standardize to 2018 Trawl survey secondary, standardize to mean
Alternative	1. No action 2. Single index 1: EBS bottom trawl survey. 2: IPHC setline survey 3. Primary & secondary 1: trawl then setline. 2: setline then trawl	Alt 2, option 2	Alternative 2	Alt 3: Option 2	Alt 3: Option 2
Element 1 Starting point	1. 2016 PSC limit (3,515 t) 2. 2016 use (2,354 t) 3. 2017 use (1,958 t)	2,018 t 2,127 t	Trawl: 1,610 t Non-trawl: 408 t Total: 2,018 t	3: 1,958 t	Trawl: 1,563 t Non-trawl: 395 t Total: 1,958 t
Element 2 Ceiling	1. 2016 PSC limit (3,515 t) 2. 2015 PSC limit (4,426 t)	3,515 t	Total: 3,515 t	1: 3,515 t	Trawl: 2,805 t Non-trawl: 710 t Total: 3,515 t
Element 3 Floor	1. 2,354 t 2. 1,758 t 3. 1,177 t 4. 1,000 t	<div style="border: 2px solid red; border-radius: 15px; padding: 10px; display: inline-block;">0</div>	Total: 1,000 t	4: 1,000 t	Trawl: 798 t Non-trawl: 202 t Total: 1,000 t

The intent post-meeting was to standardize the secondary index to current year

February 2019 Motion		FVOA Proposal	Alternative 2-4	Directed Users	
				Proposal	Alternative 3-3a
Element 4 Breakpoint	<ol style="list-style-type: none"> 25% below/above average above or below average 	Primary: Starting point	Primary: Starting point		
Element 5 Responsiveness	<ol style="list-style-type: none"> Up faster than 1:1 Up slower than 1:1 Down faster than 1:1 Down slower than 1:1 1:1 	slower when above starting point (0.5:1). Otherwise 1:1.	slower when above starting point (0.5:1). Otherwise 1:1.	1:1	1:1.
Element 6: Constraint	<ol style="list-style-type: none"> 5% constraint 15% constraint 25% constraint Suboption: limit change from current and implementation	15% maximum	15% maximum	15% maximum	15% maximum
Element 7: Breakpoints	Specify breakpoints in a lookup table with a maximum of 12 breakpoints in each dimension. Each index standardized using Option 1: standardize to average of 1998-2018 Option 2: standardize to current year	NA	NA	NA	NA

Alternatives analyzed and stakeholder intent

- A80 proposal (2-2)
 - Calculated trawl and non-trawl elements from A80-specific elements
 - Starting point, floor, ceiling
 - Standardized index to current year
 - Should not make a difference, being aware of appropriate determination of breakpoints given year standardized to
- FVOA proposal (3-2a)
 - Intent of proposal may have been to use setline survey for trawl and non-trawl
 - Had to pick a floor, thus 1,000 t was used based on discussion during Council meeting in February
- Directed users proposal (3-3a)
 - Post-meeting, intent was to standardize secondary index to current year

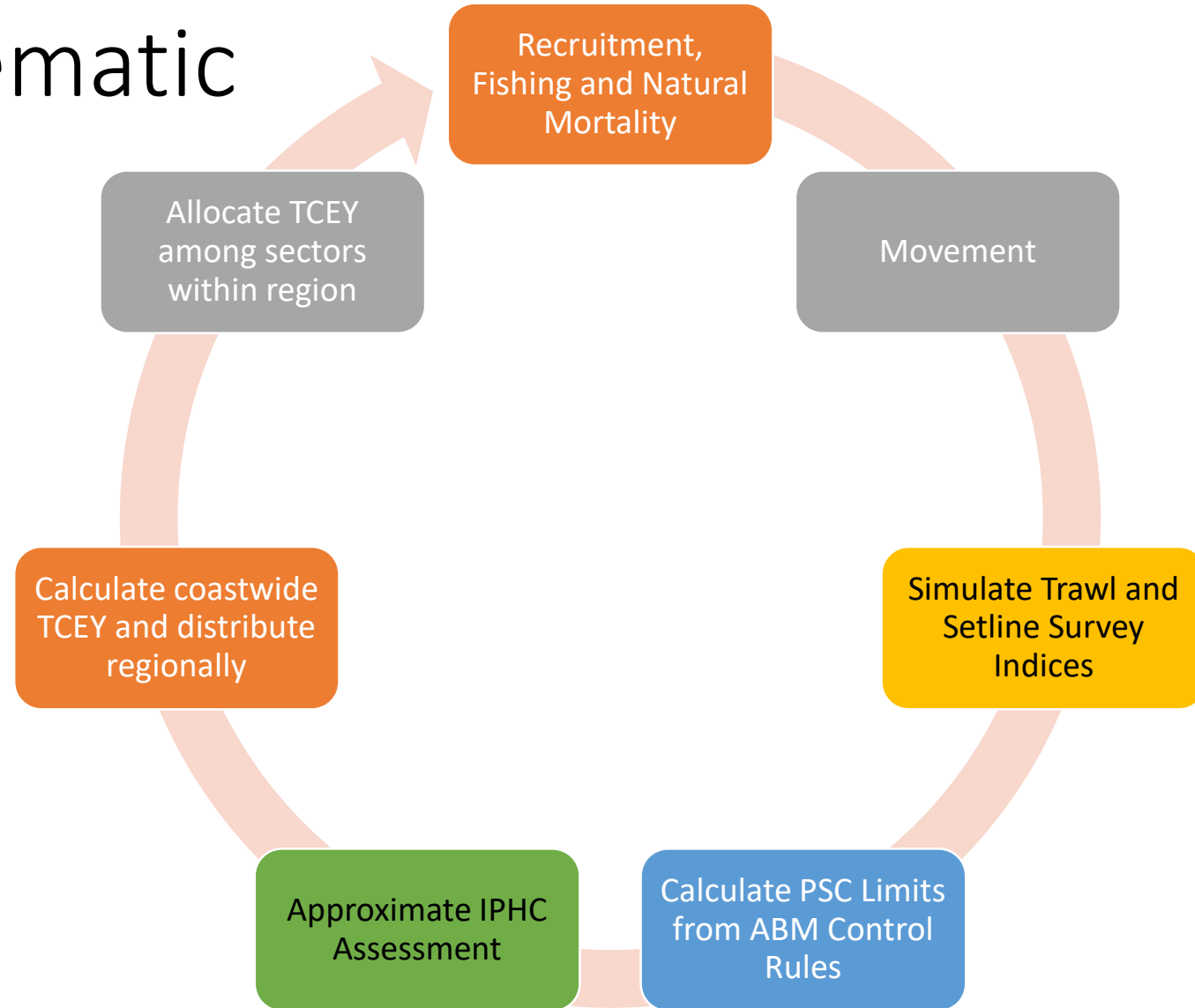
Additional fixed limits analyzed

- Per SSC request additional fixed lower limits were analyzed
- For model sensitivity 2 additional options included

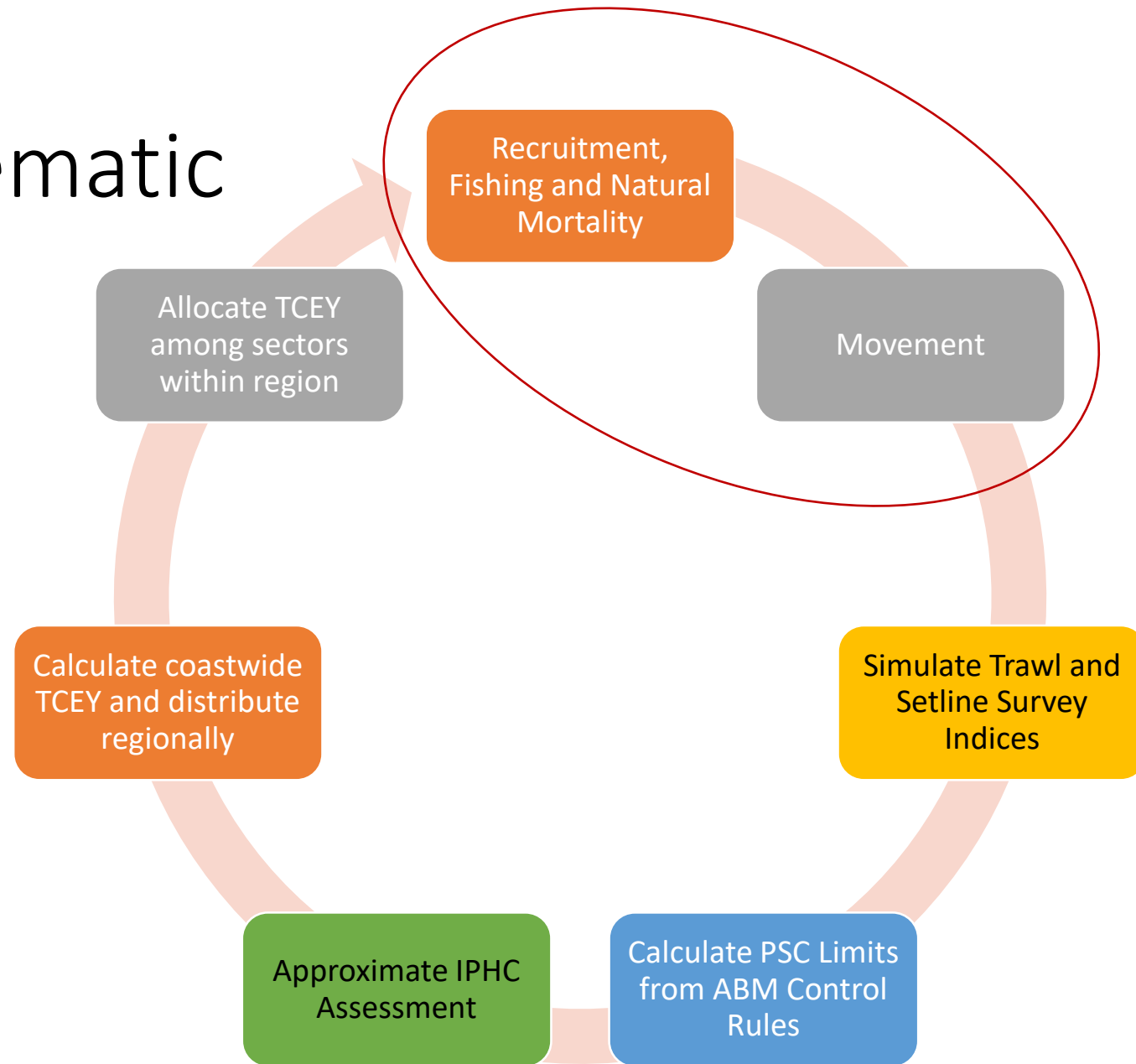
	Gear	Non-trawl	Trawl
Alternative	Source	Starting Point	Starting Point
<i>1</i>	Status quo	710	2,805
<i>1.a</i>	SSC	475	1,879
<i>1.b</i>	SSC	395	1,563
<i>1.c</i>	WG	0	0
<i>1.d</i>	WG	10,000	10,000

Halibut simulation model overview

Two-area Model Schematic

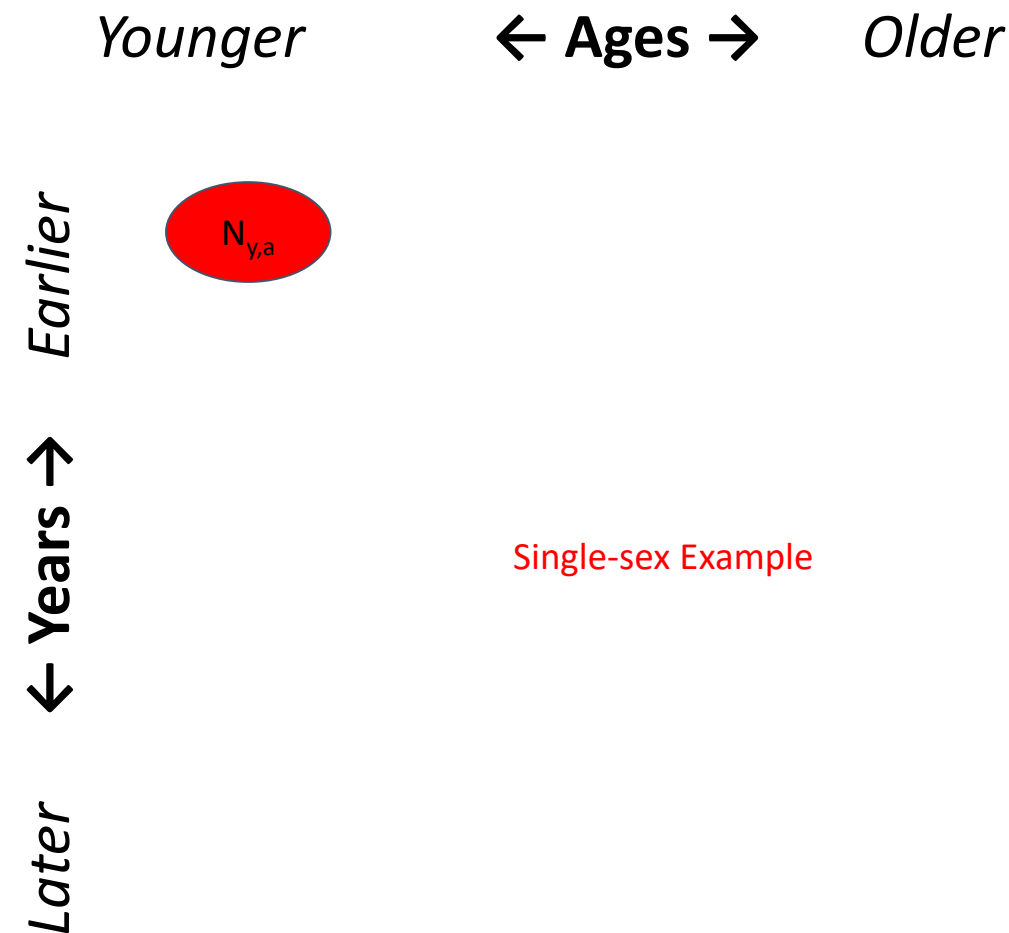


Two-area Model Schematic



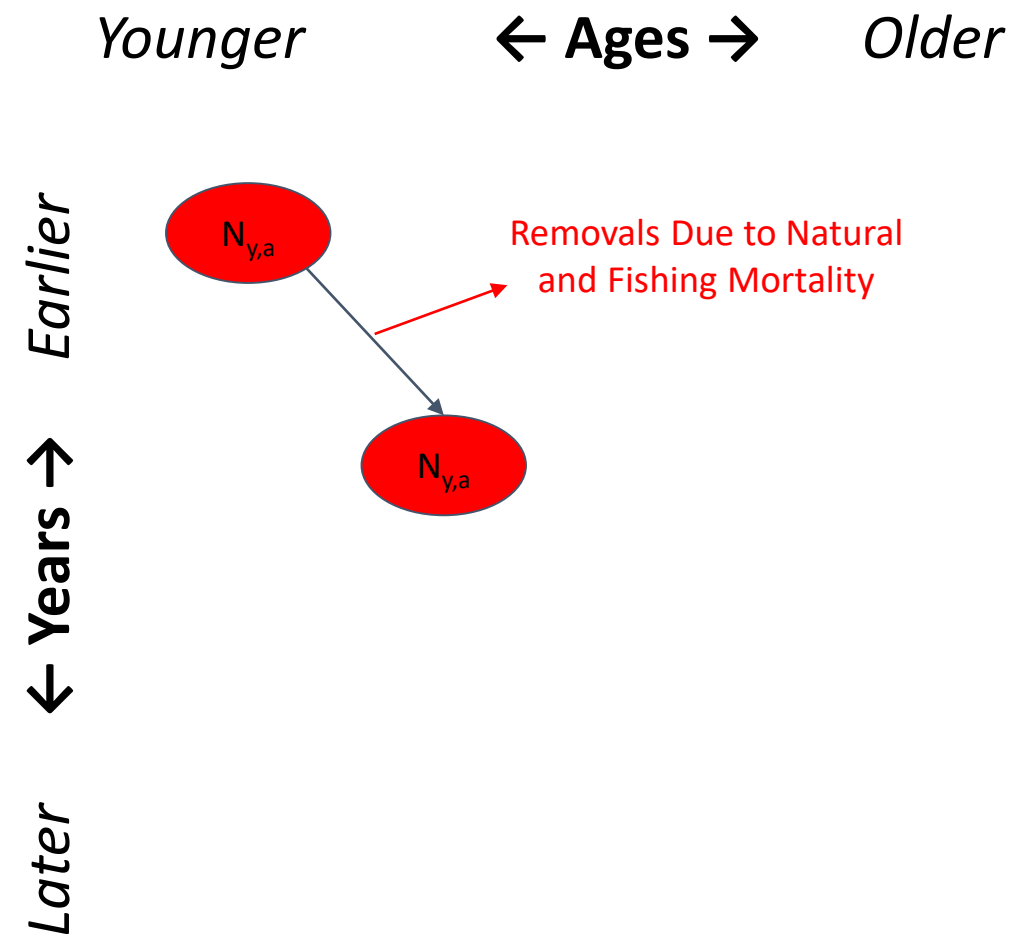
Two-area operating Model (OM) overview

- Sex and age-structured
- 2 Areas
 - BSAI region
 - Remaining GOA, BC, West Coast distribution
- Recruitment
 - Allocated among areas, time-varying
 - Function of Pacific Decadal Oscillation index
- Age-specific movement between areas



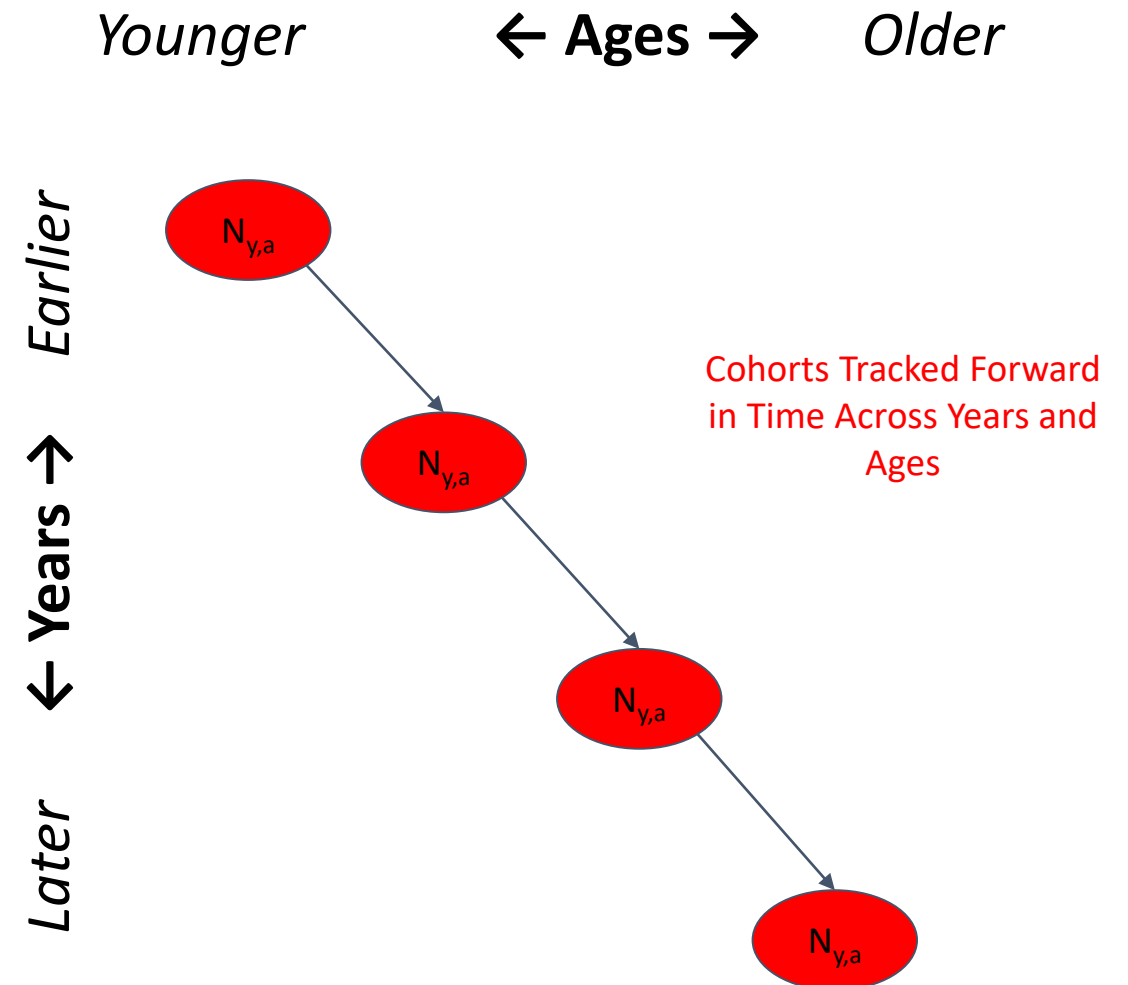
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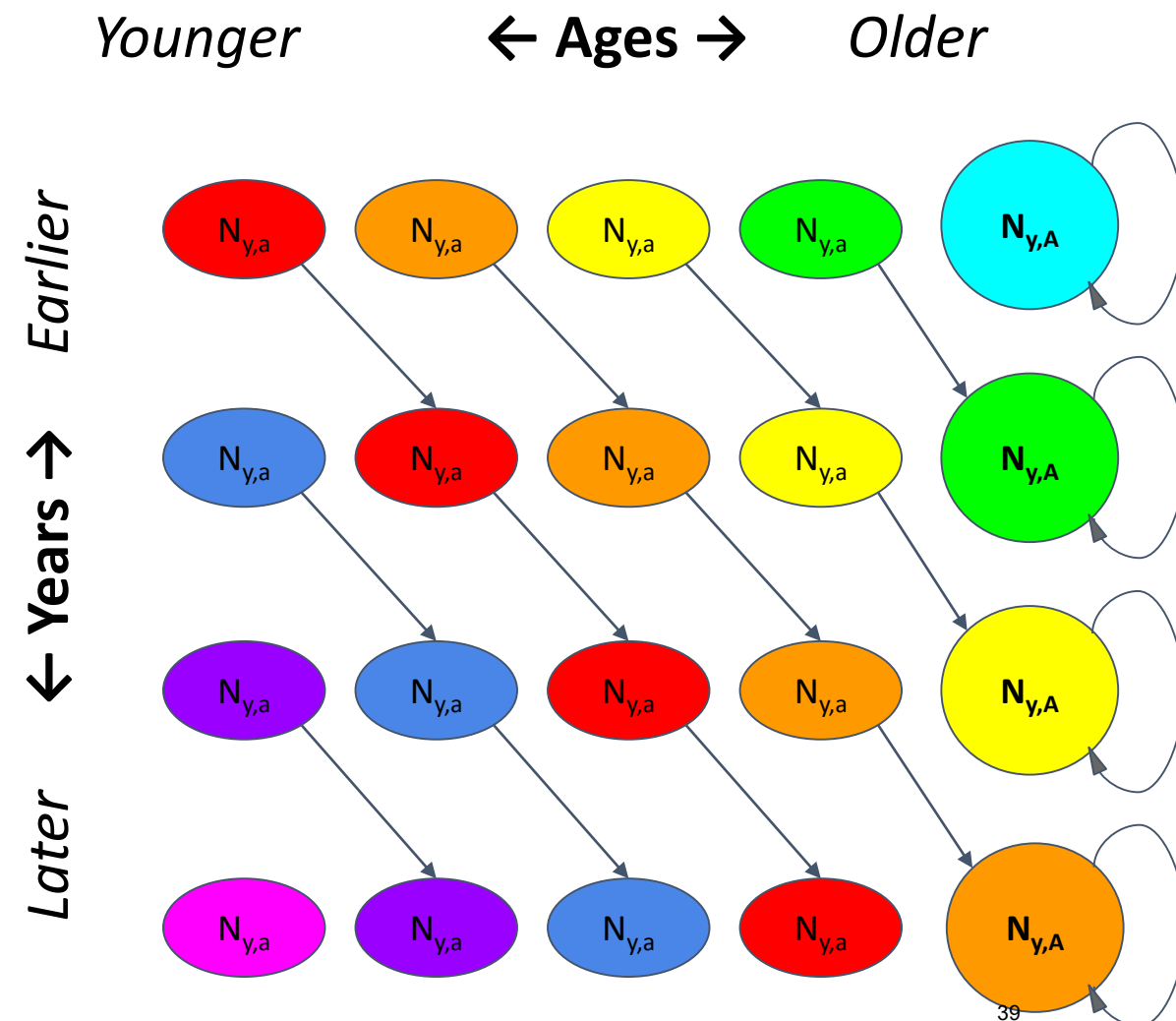
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Two-area operating Model (OM) overview

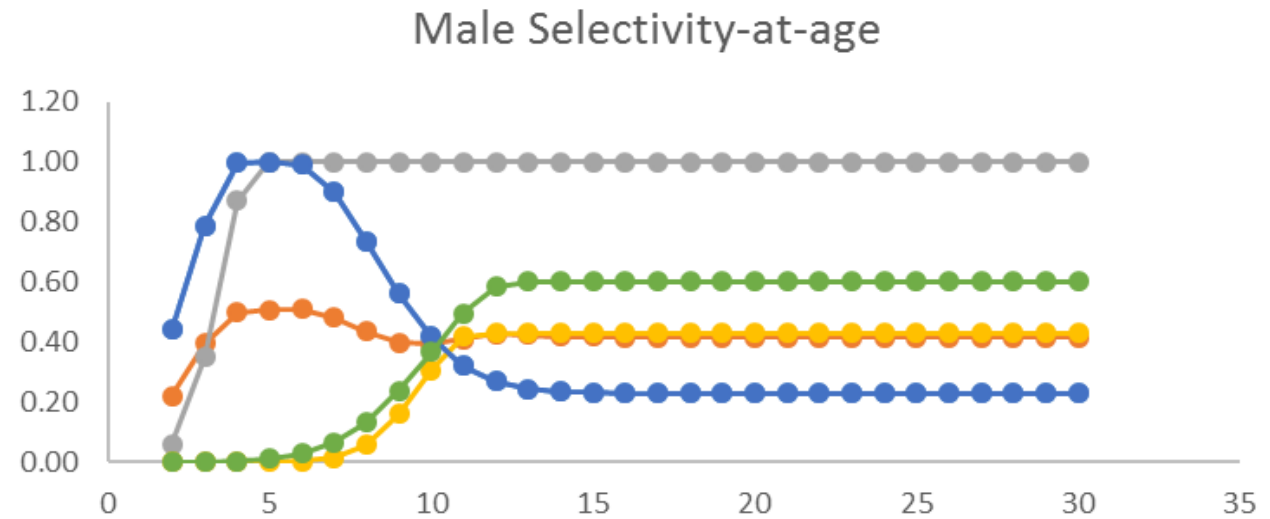
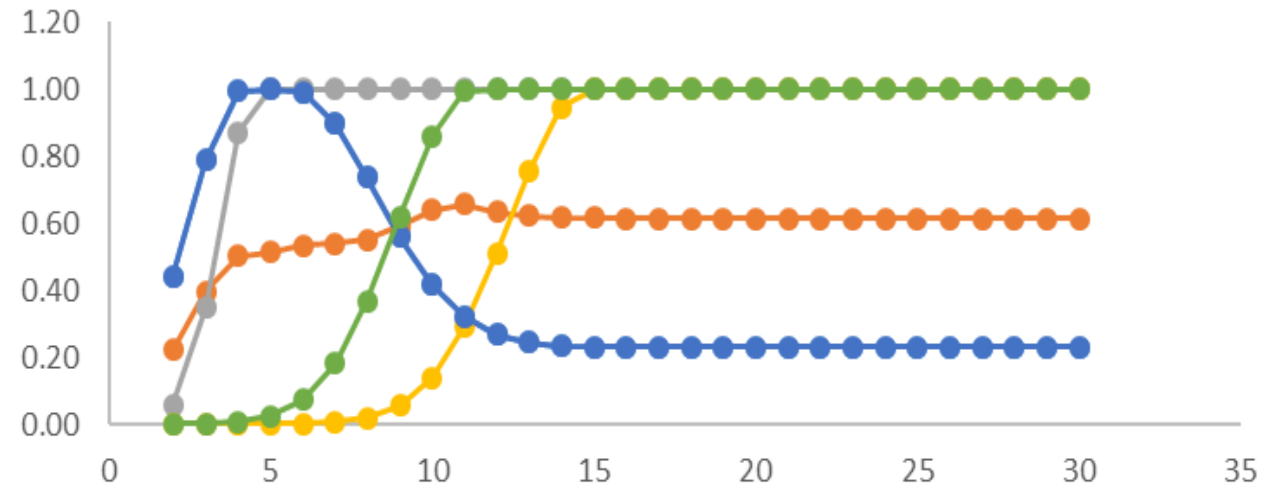
- Sex and age-structured
- 2 Areas
 - BSAI region
 - Remaining GOA, BC, West Coast distribution
- Recruitment
 - Allocated among areas, time-varying
 - Function of Pacific Decadal Oscillation index
- Age-specific movement between areas



Gear types modeled

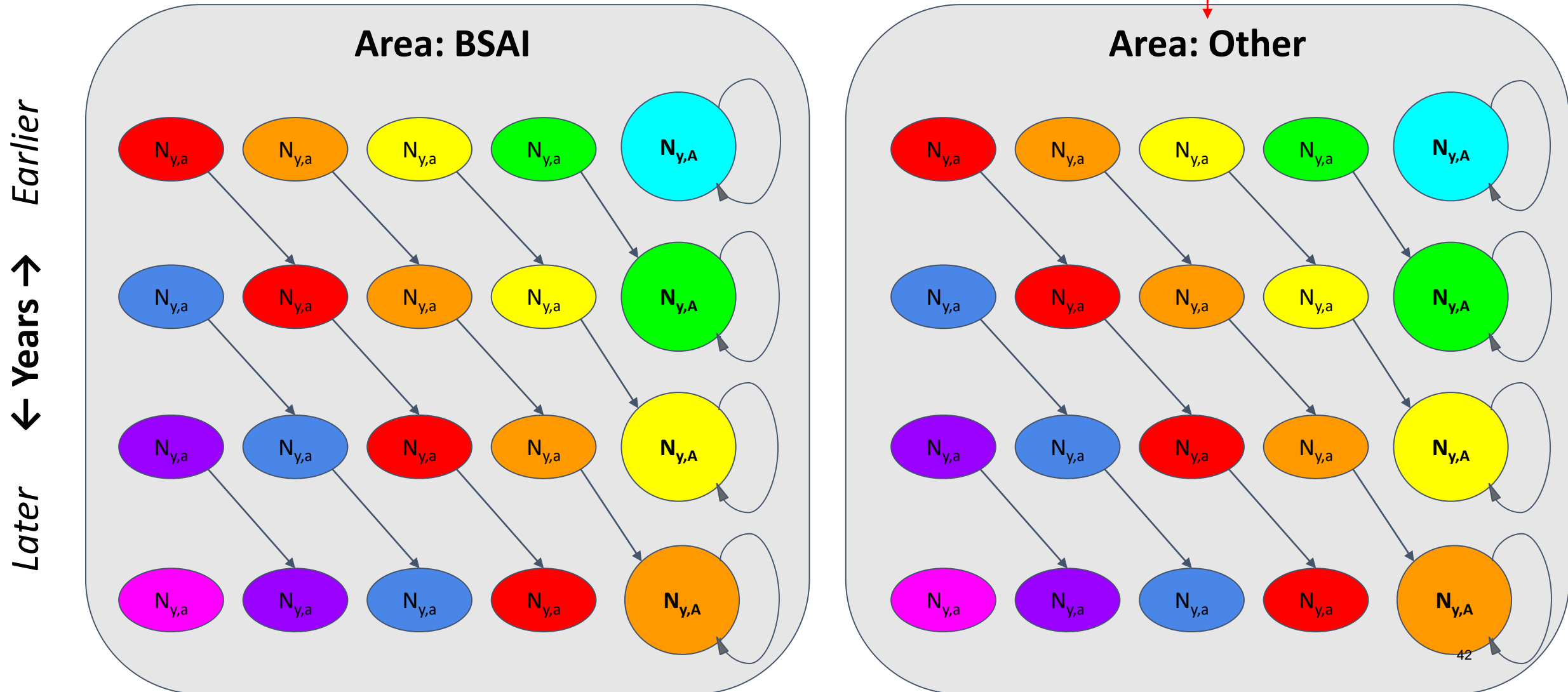
- BSAI Trawl PSC selectivity:
 - Set equal to trawl survey selectivity
 - Rationale: Best available information on plausible selectivity for trawl PSC alone
- BSAI Longline PSC selectivity:
 - Average of the 4ABCDE setline and the BS trawl survey selectivities for most recent year
 - Rationale: % O32 fish in the longline-caught PSC is much lower than for the setline survey, but higher than for trawl PSC. Hooks for Pacific cod are smaller than for the halibut setline survey.
- Halibut fishery selectivity (in BSAI and the other area):
 - Commercial fishery selectivity from the 2018 coastwide long assessment model
 - Rationale: Uses assessment results directly
- Other area bycatch fishery selectivity
 - Coastwide gear-aggregated bycatch selectivity from the 2018 coastwide long assessment model

Selectivity



- Trawl PSC BSAI
- Bycatch Other Area
- Bottom Trawl Survey
- Non-trawl PSC BSAI
- Halibut Fishery BSAI & Other Area
- Fishery Independent Setline Survey

Movement Among Areas

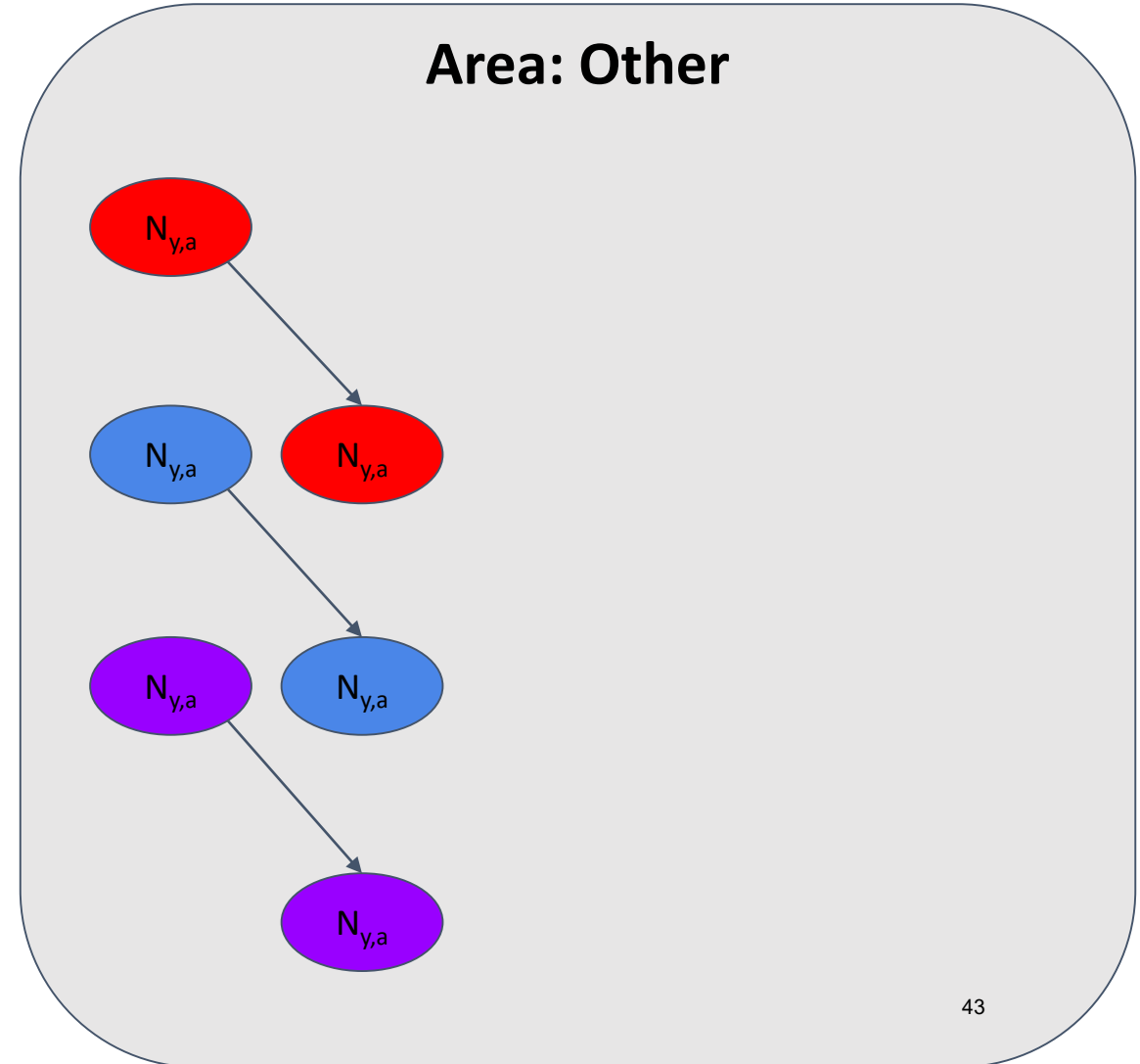
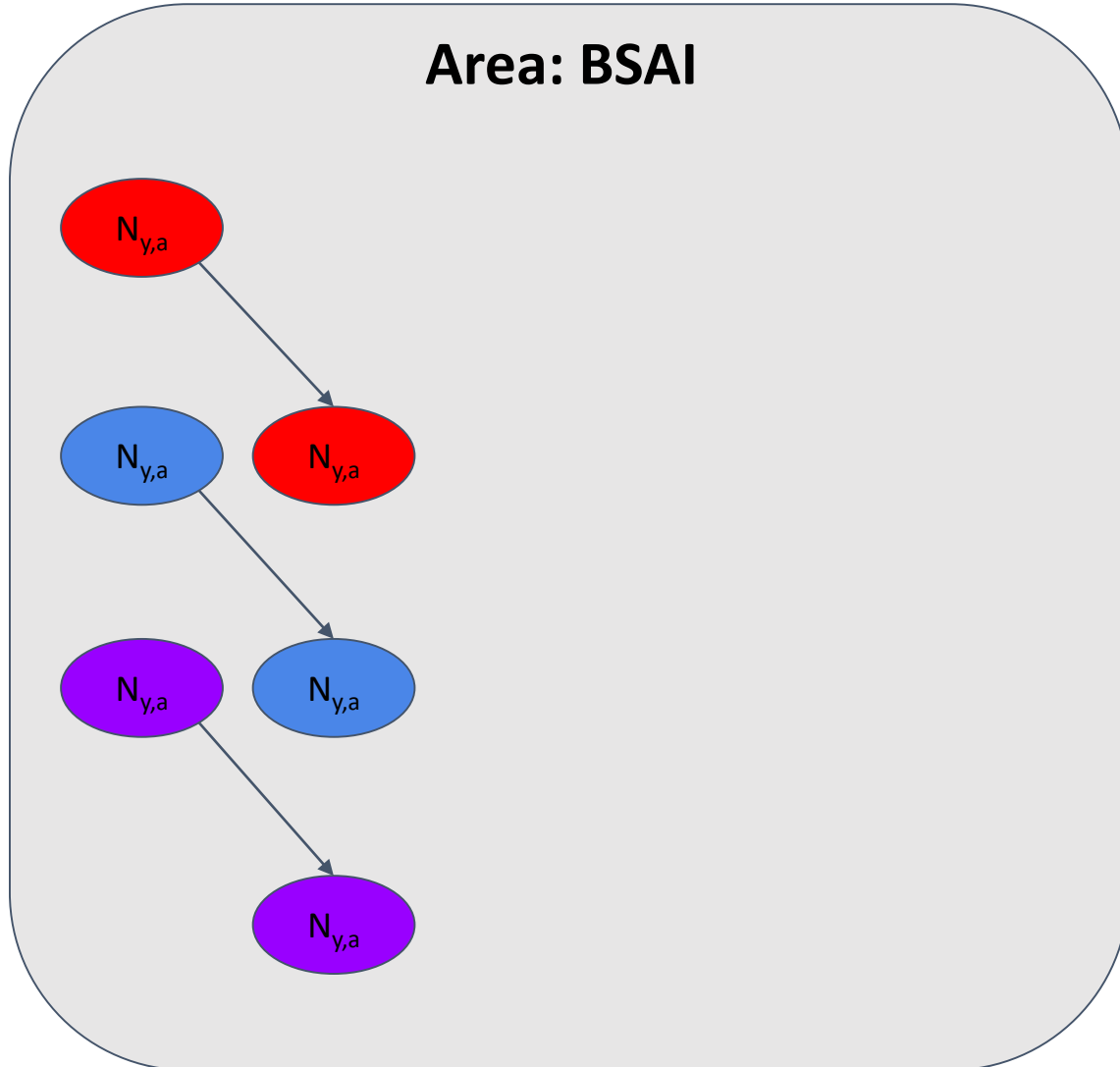


Movement Among Areas

Earlier
← Years →
Later

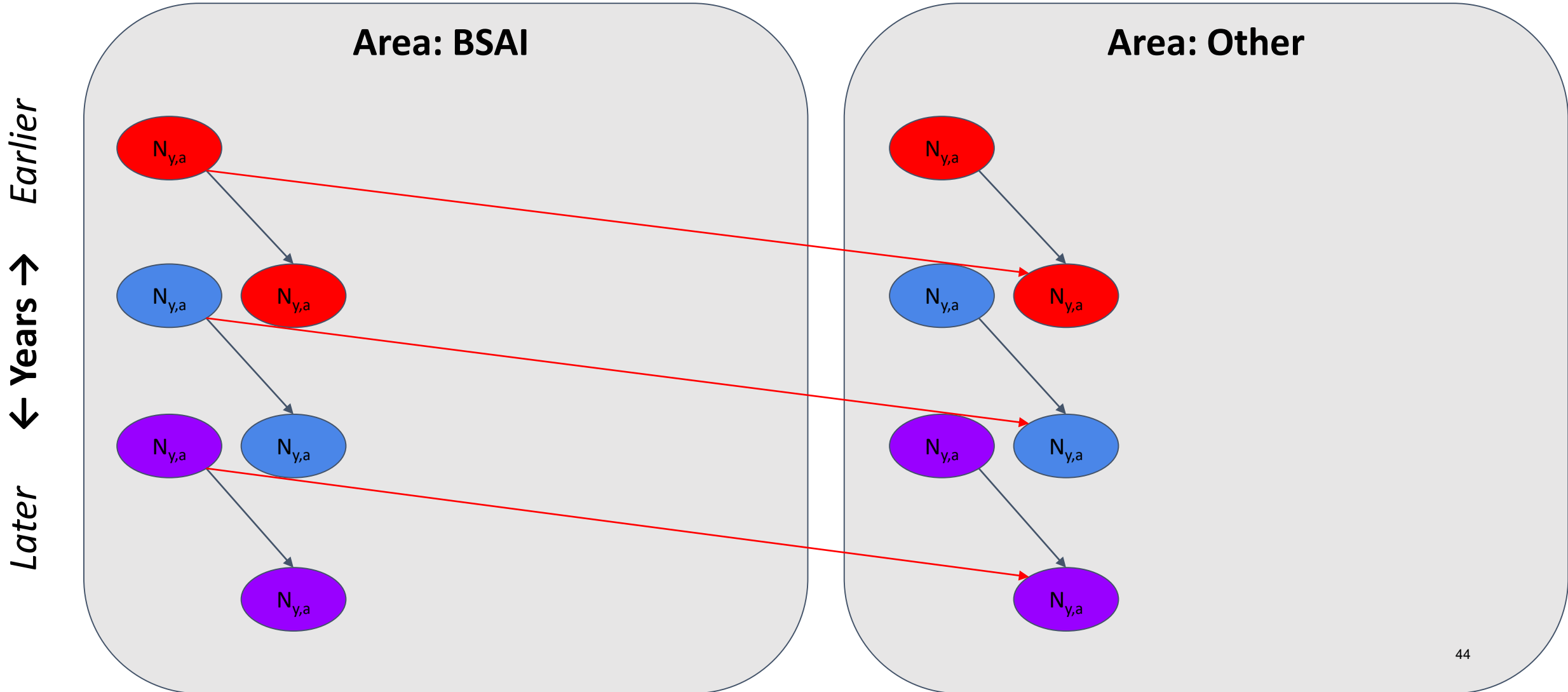
Area: BSAI

Area: Other



Movement **Out of**
BSAI

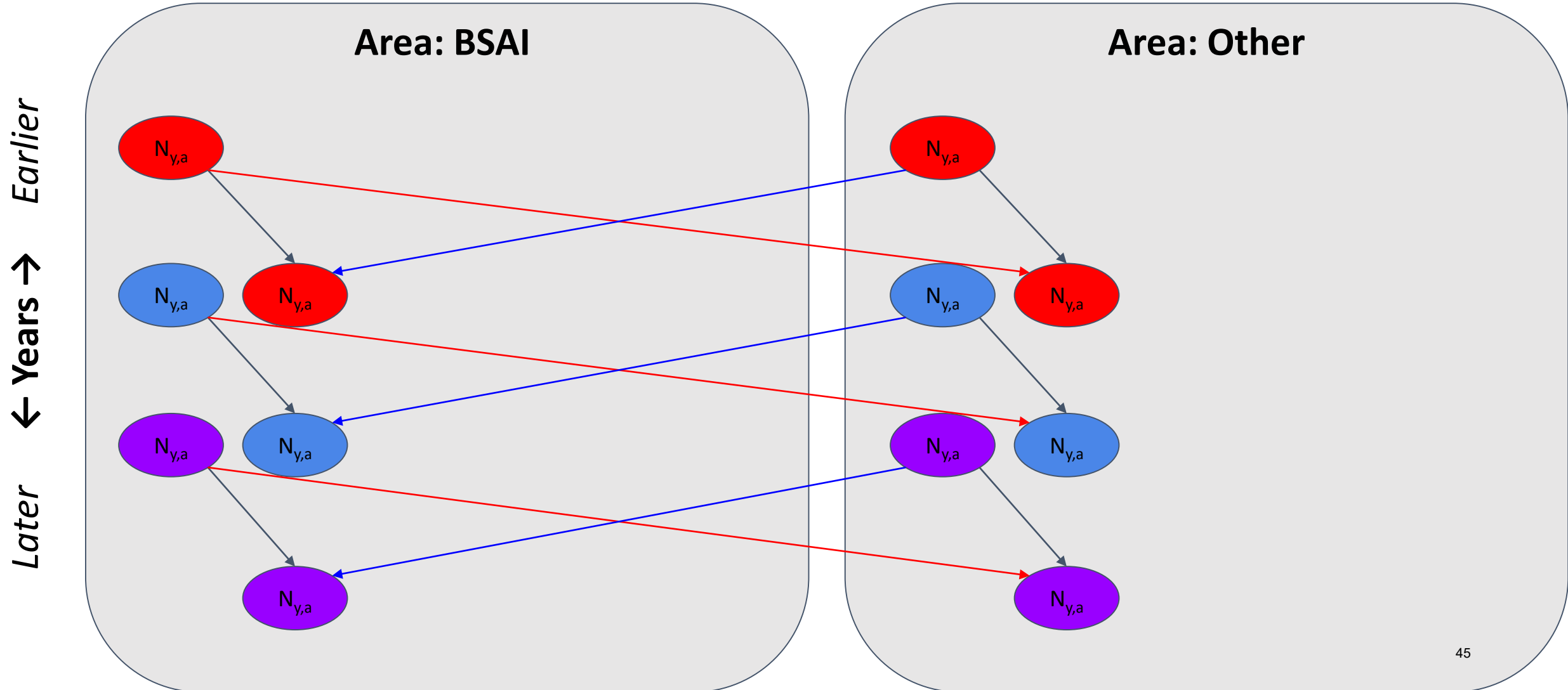
Movement Among Areas



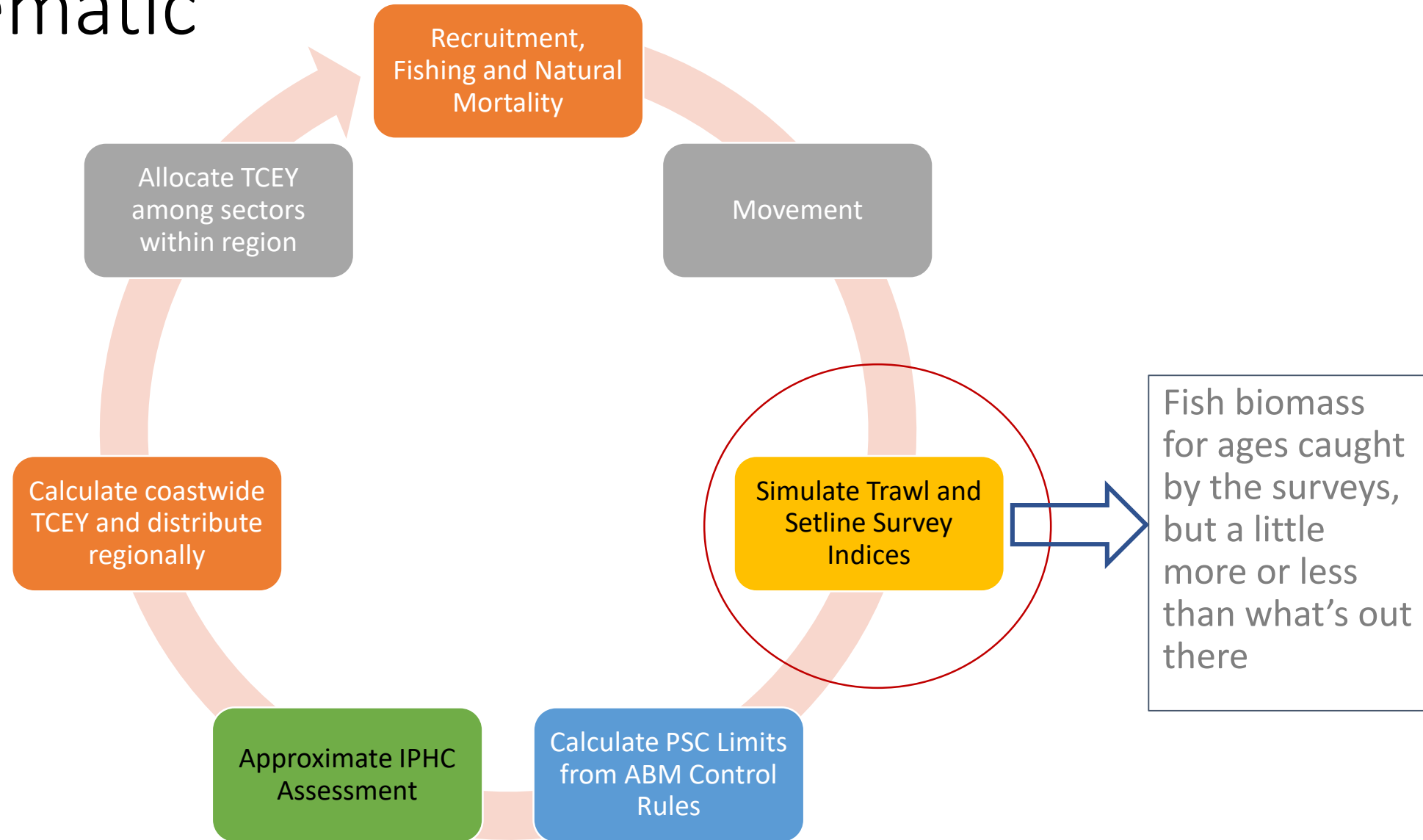
Movement Among Areas

Movement **Out of**
BSAI

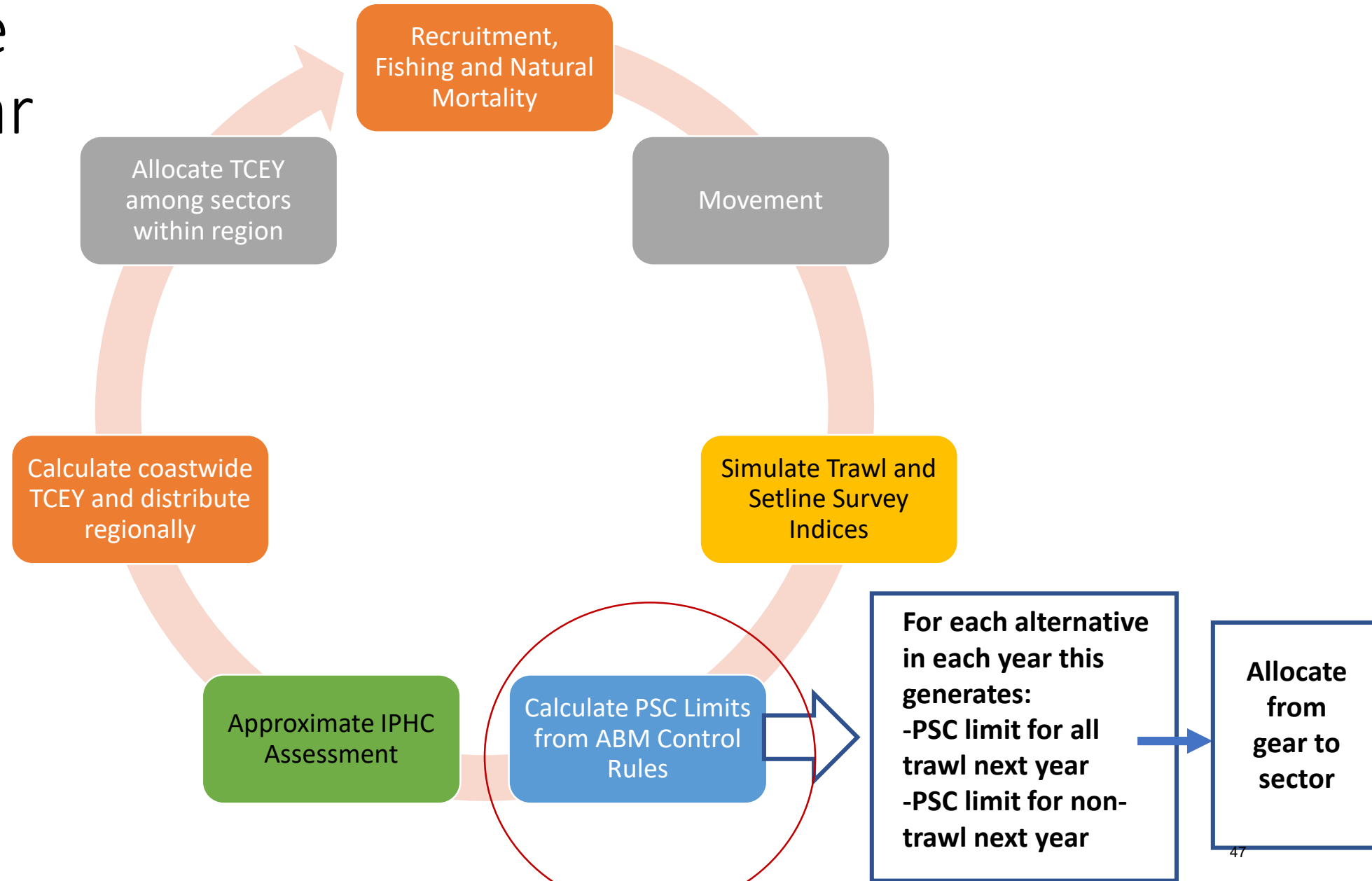
Movement **Into** BSAI



Model Schematic

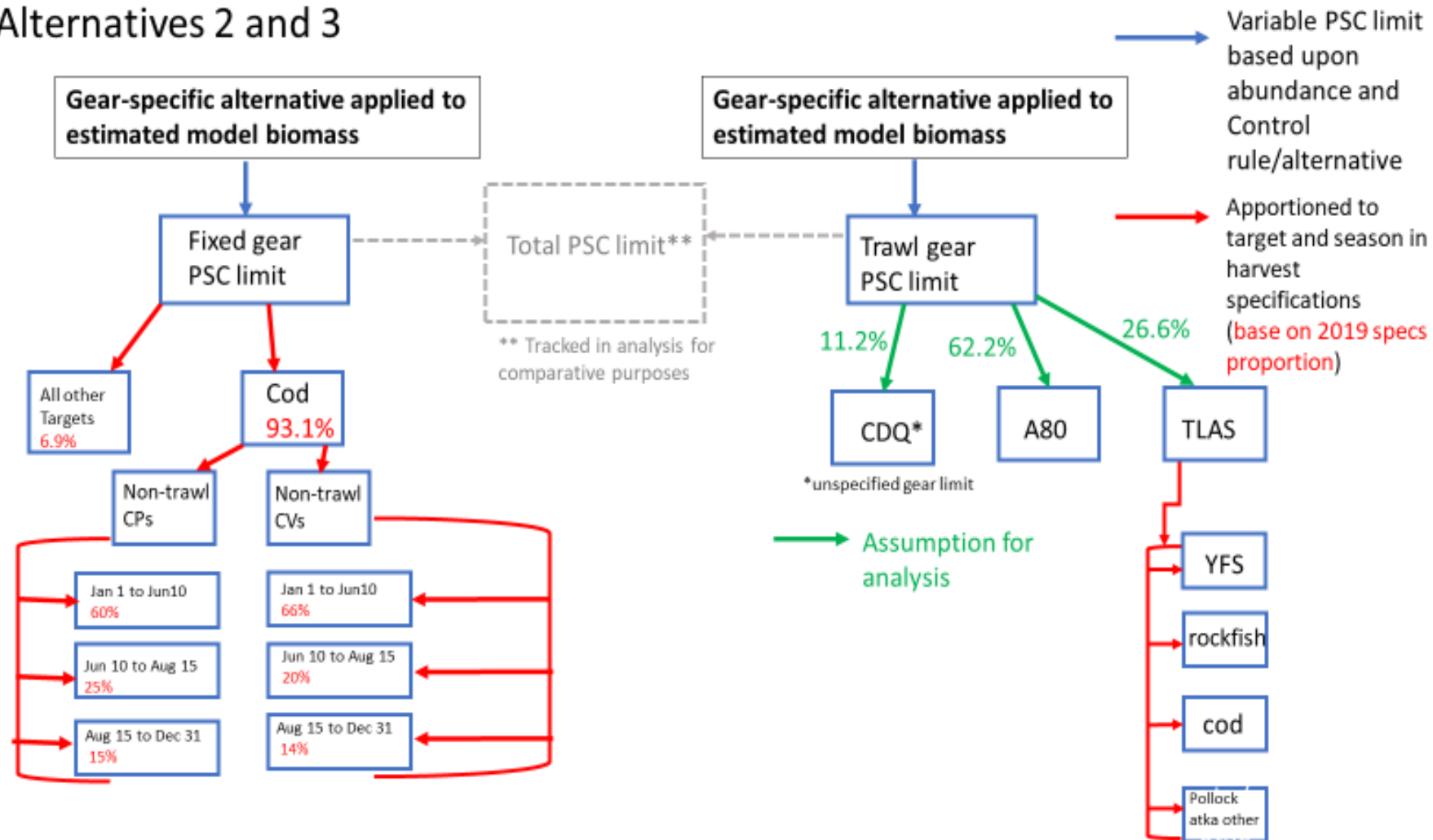


Calculating PSC Limits for the following year



Sector allocation assumptions

Alternatives 2 and 3



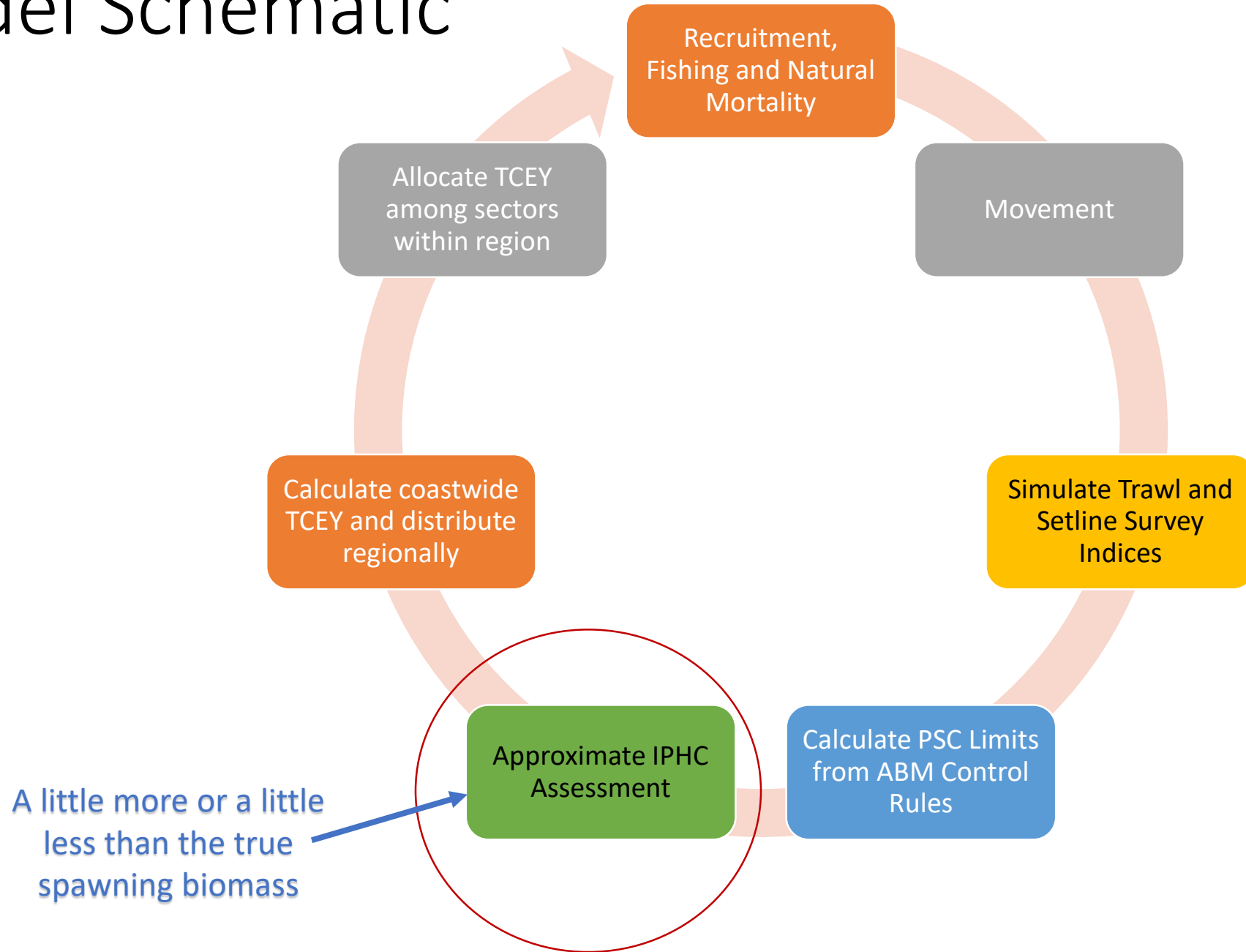


CDQ
allocation

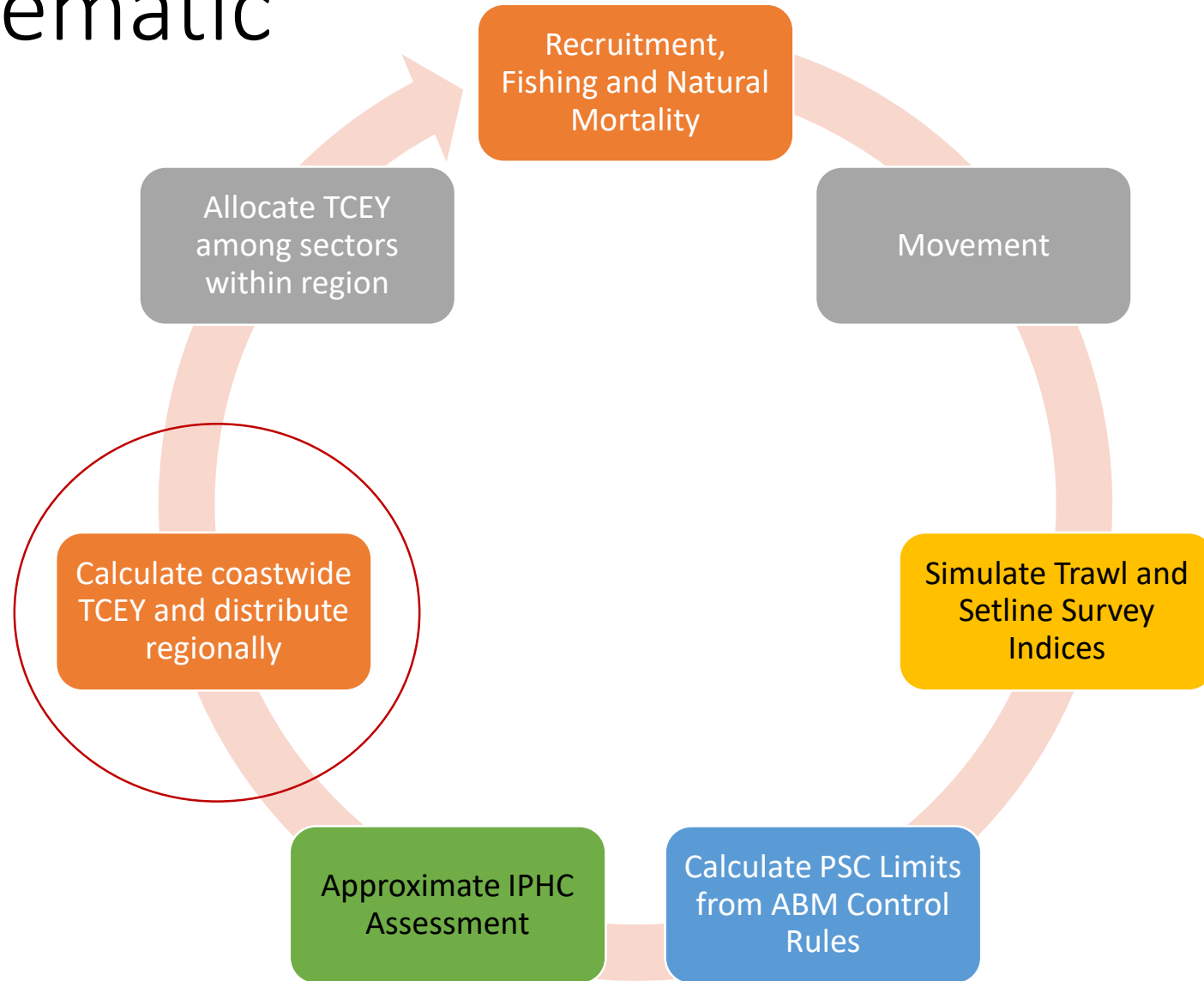
Year	Trawl		Non-Trawl		Total
2010	85	52%	79	48%	164
2011	173	71%	70	29%	243
2012	215	79%	59	21%	274
2013	207	77%	60	23%	267
2014	206	84%	39	16%	245
2015	108	83%	23	17%	130
2016	149	86%	24	14%	173
2017	135	88%	18	12%	154
2018	144	92%	12	8%	156
Average	158	79%	42.67	21%	200.67

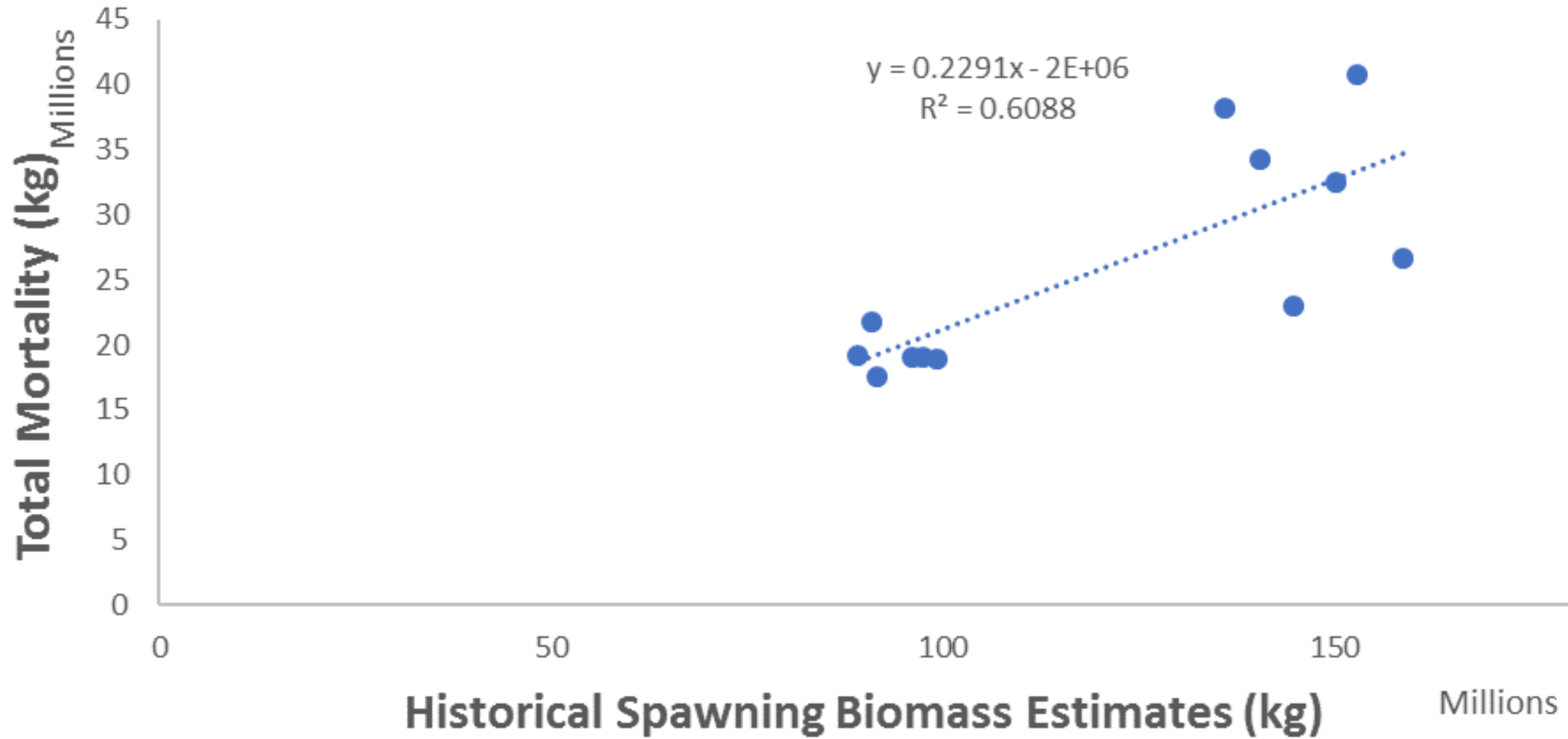
- Percentage usage of CDQ PSQ by gear type from 2010-2018.

Model Schematic



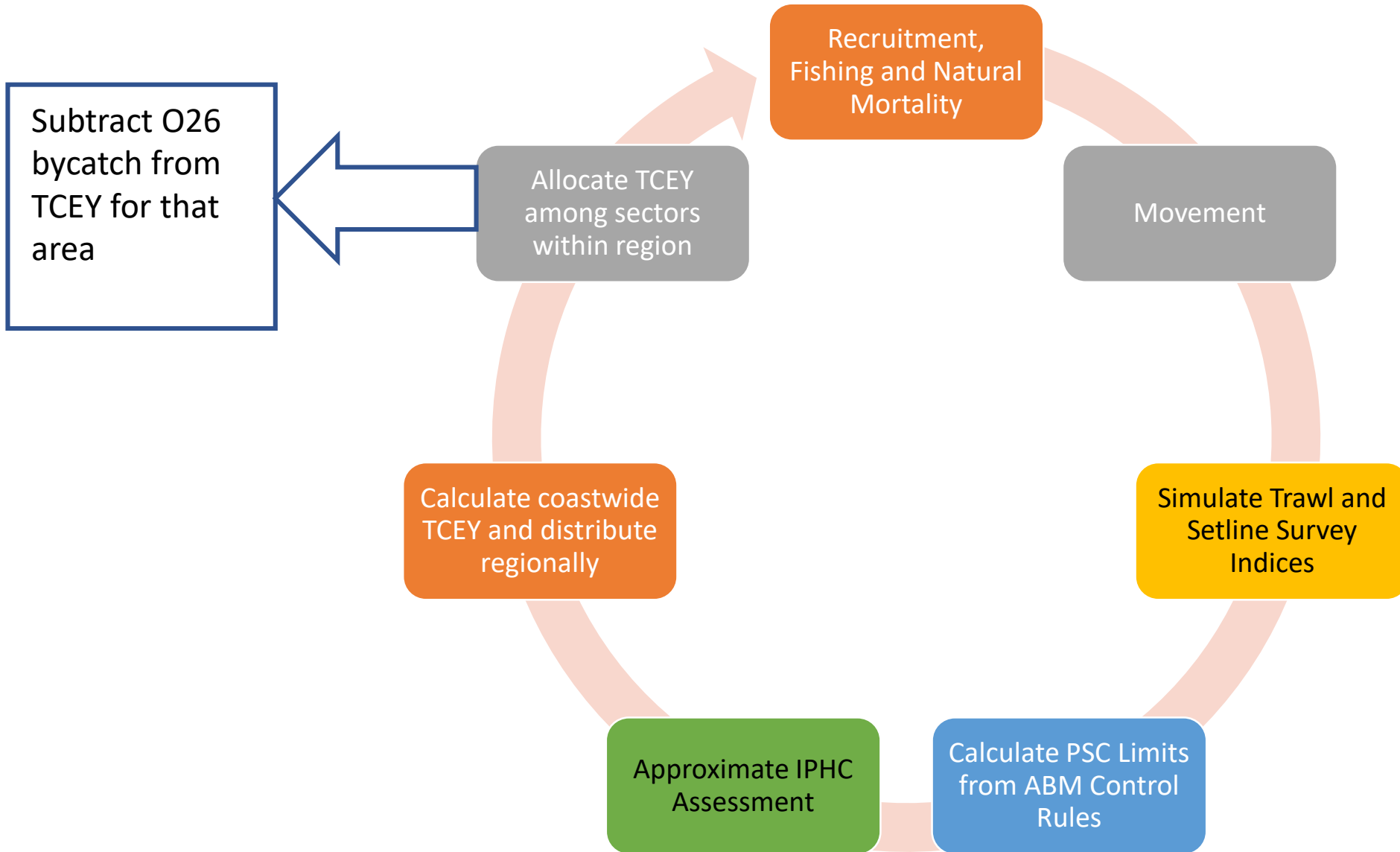
Model Schematic





Model distribution of TCEY proxy between BSAI and the other area

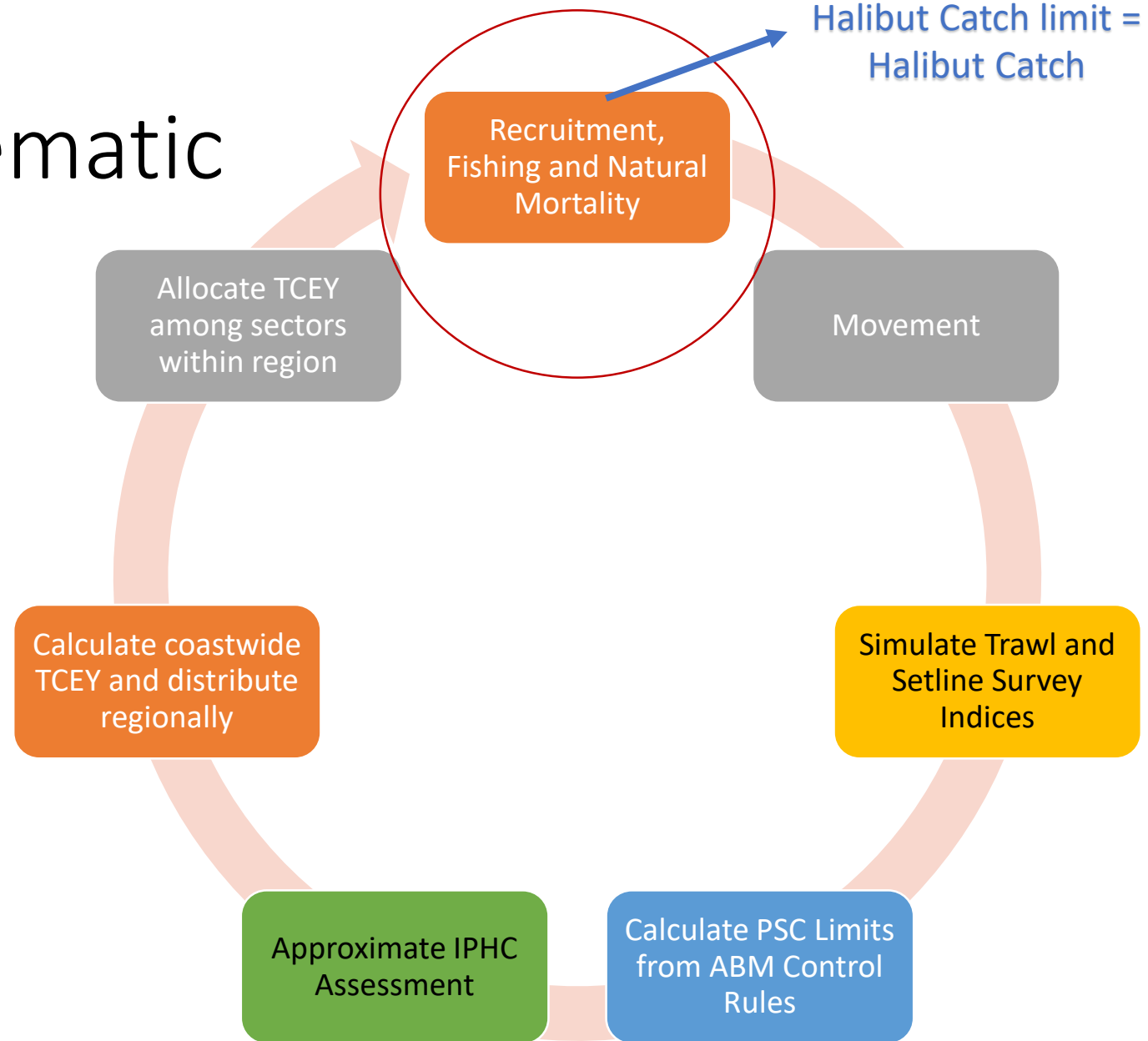
- TCEY in BSAI = that year's proportion of modeled setline survey biomass in the BSAI
- Allows for responsiveness of TCEY to changes in the distribution of biomass over time



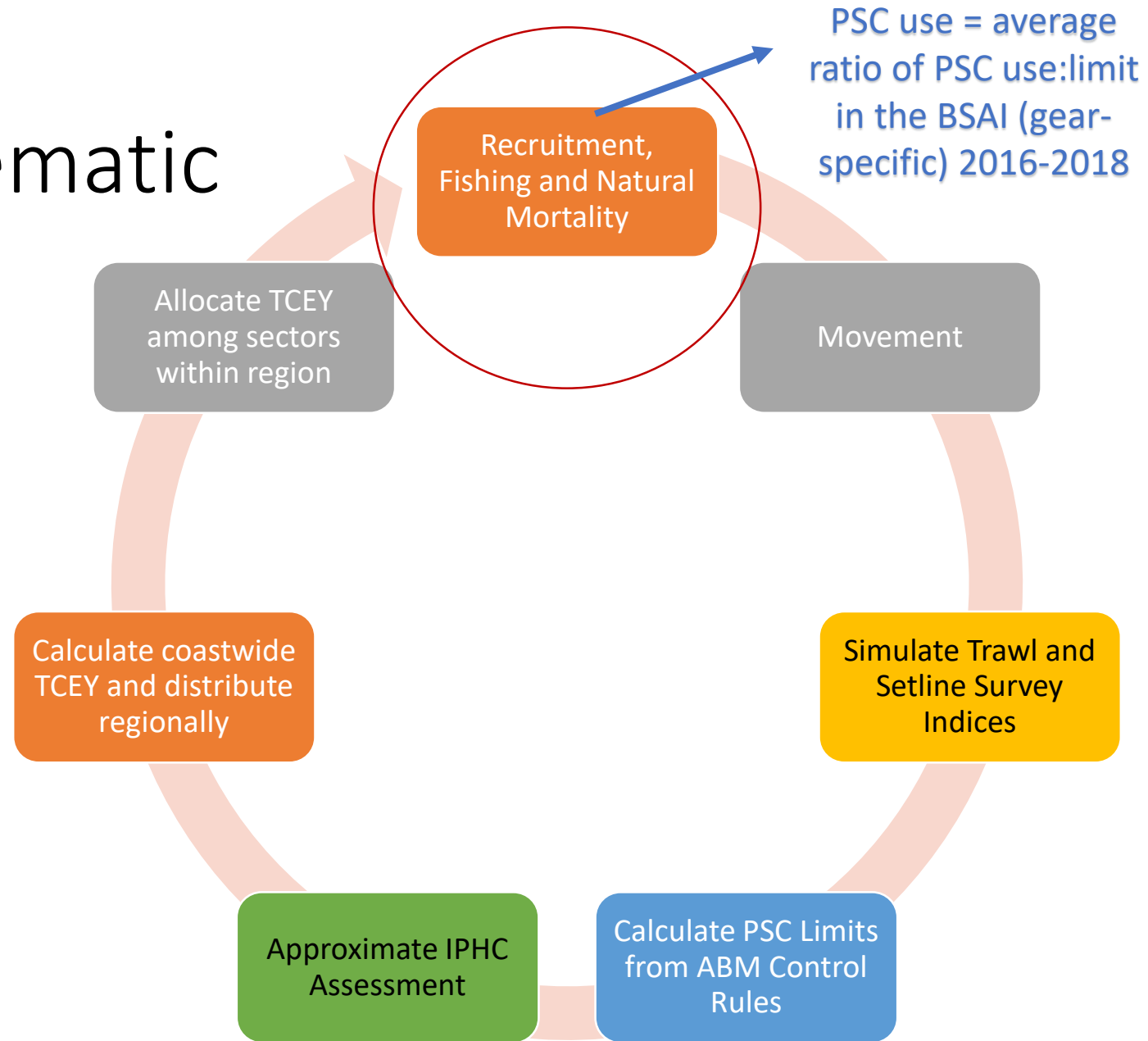
Calculating halibut fishery catch from TCEY

- A 26 inch fish corresponds to a 7-year old in the model
- The model subtracts over-7-year-old PSC (or bycatch) from the TCEY in each area
- Model tracks ages (therefore lengths tracked implicitly)

Two-area Model Schematic



Two-area Model Schematic



PSC usage relative to the limit

- Used the 3-year average proportion of the PSC usage:PSC limit from the data
 - This assumes that the relationship between usage and limit is independent of the abundance of halibut and the PSC limit itself
- Other assumptions were considered, but for initial model results this assumption allows us to see the behavior of each alternative clearly

Model validation

Can the model mimic halibut population dynamics?

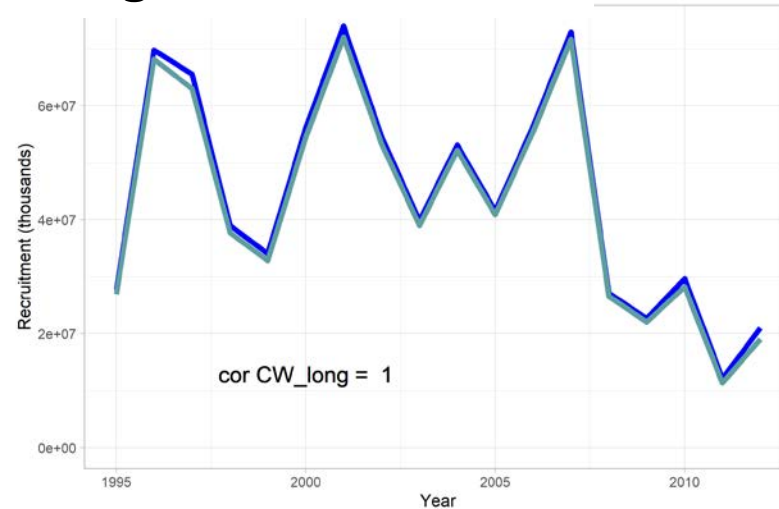
Test using past catches and recruitments

Features

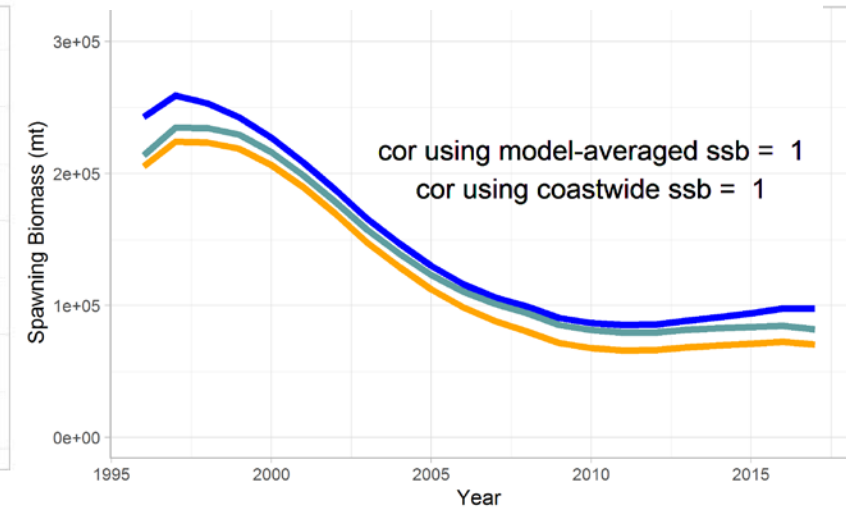
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

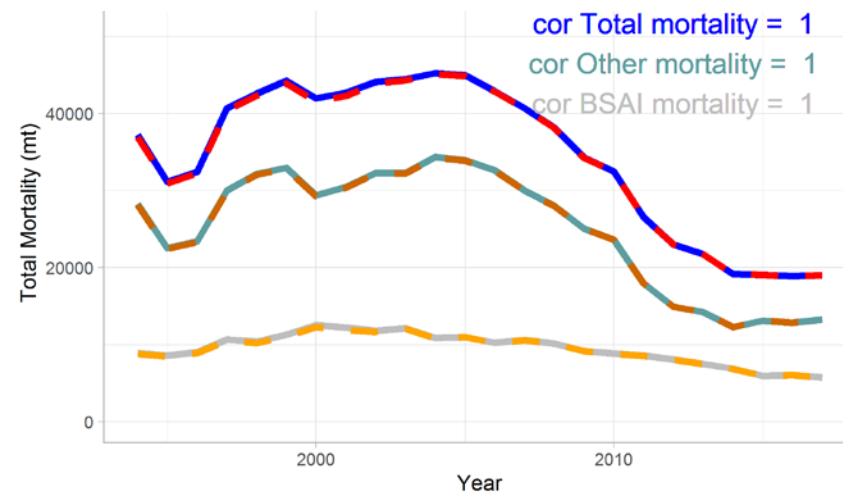
Age-2 Recruitment



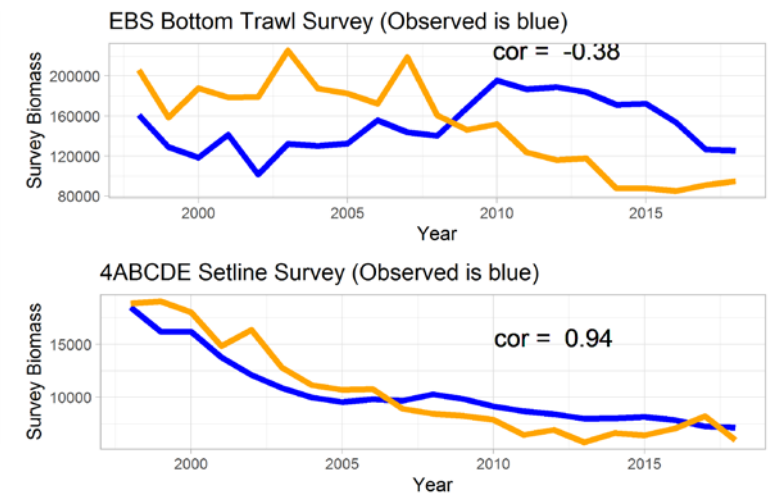
Spawning biomass



Catches (directed, PSC, other bycatch)



Surveys

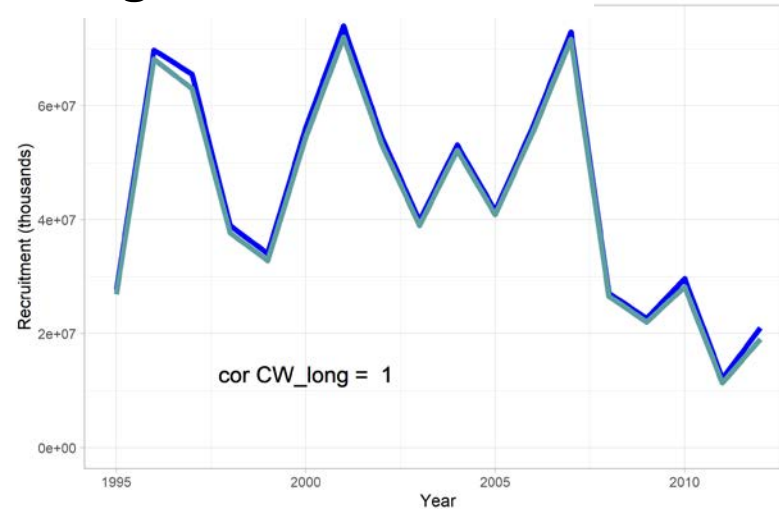


Features

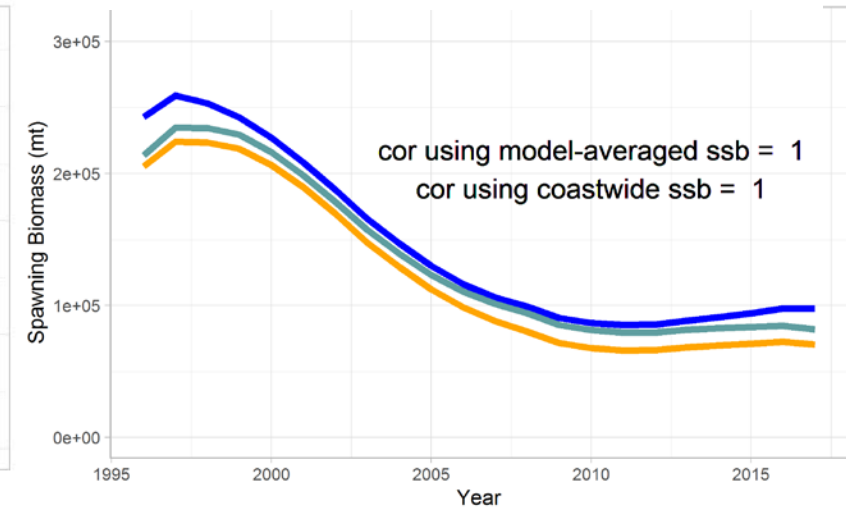
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

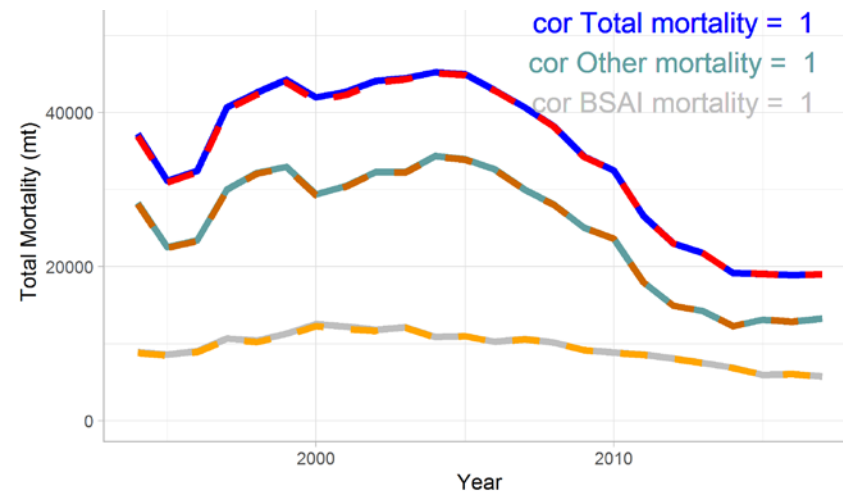
Age-2 Recruitment



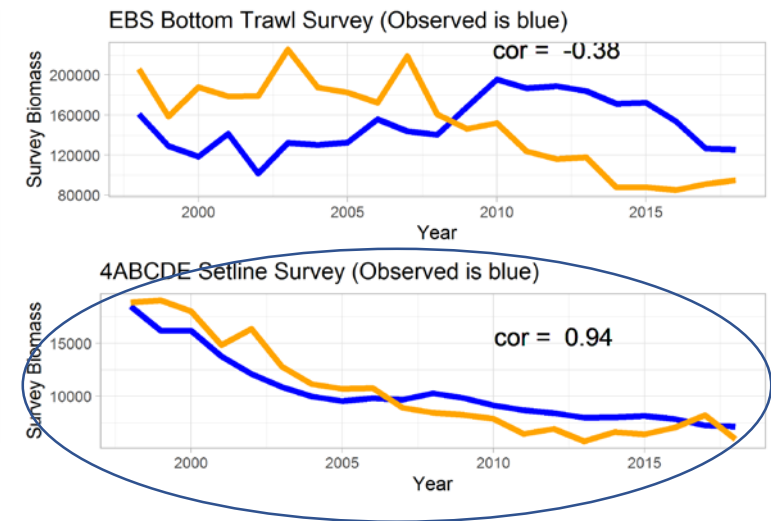
Spawning biomass



Catches (directed, PSC, other bycatch)



Surveys

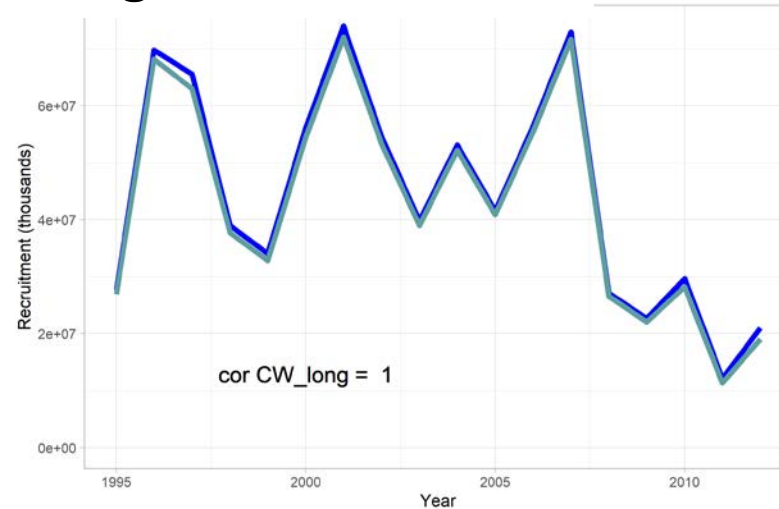


Features

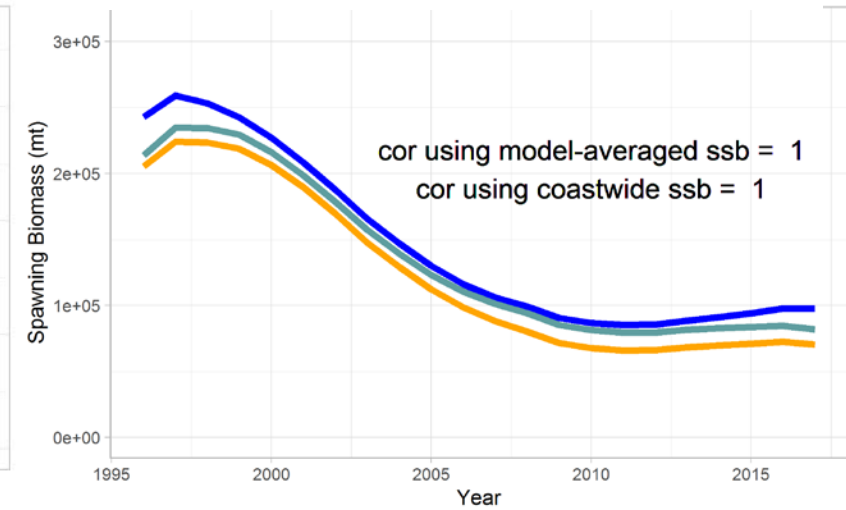
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

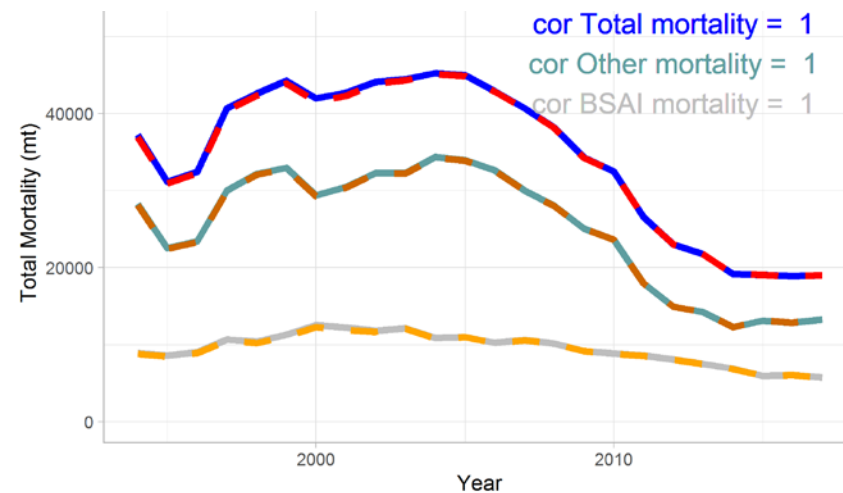
Age-2 Recruitment



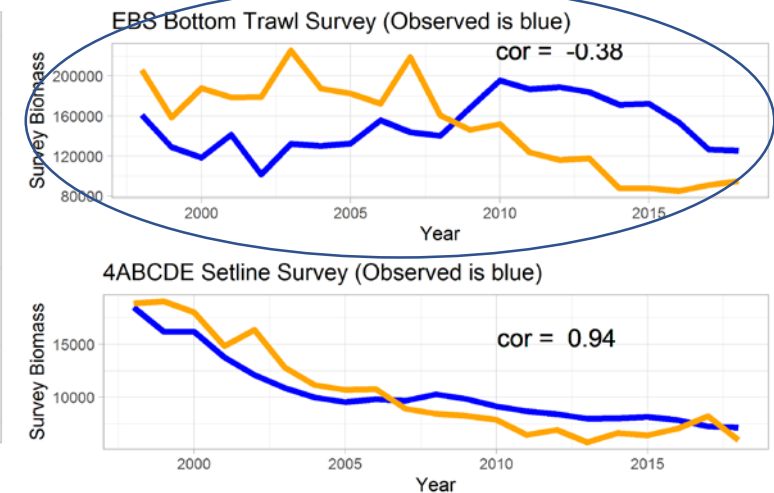
Spawning biomass



Catches (directed, PSC, other bycatch)



Surveys



BSAI-specific relative recruitment estimates

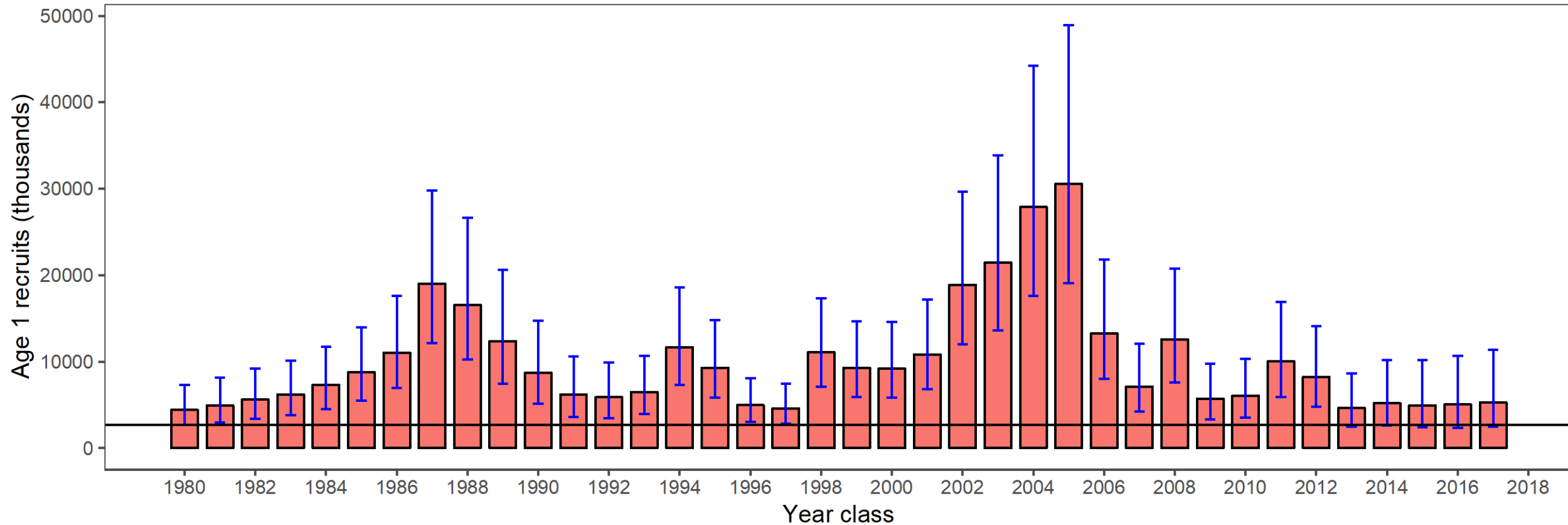
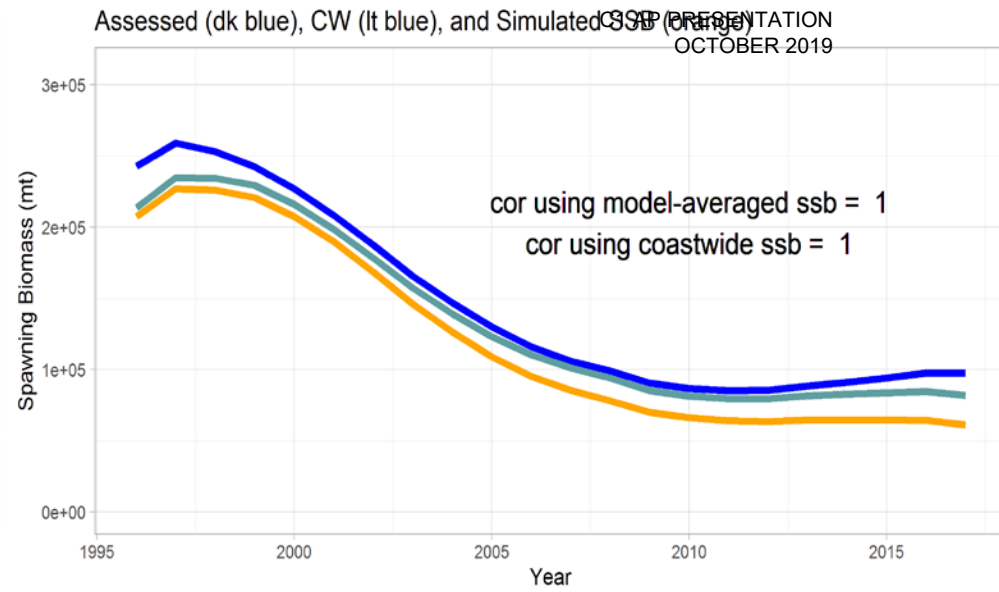
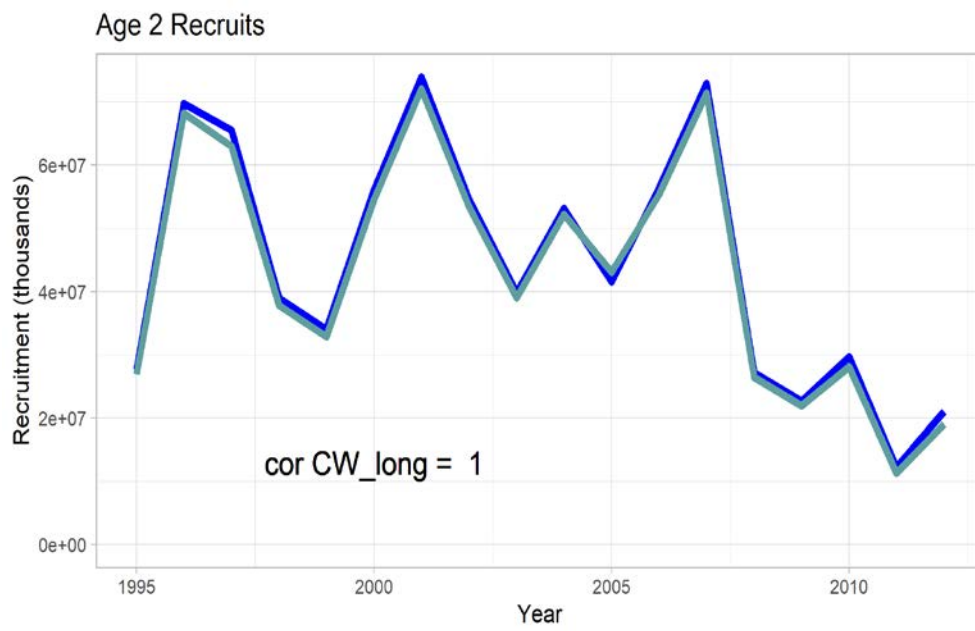
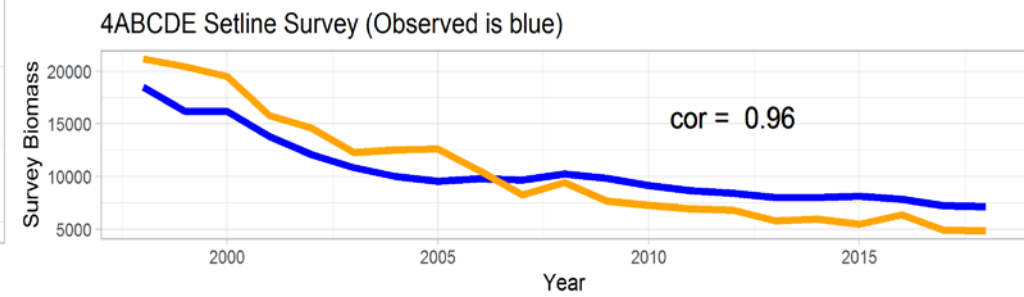
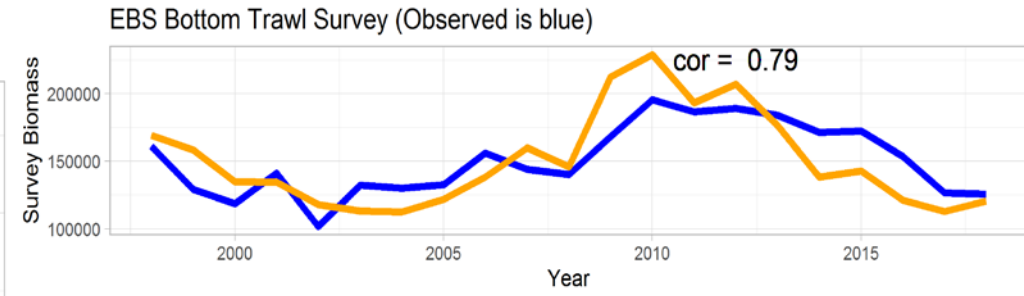
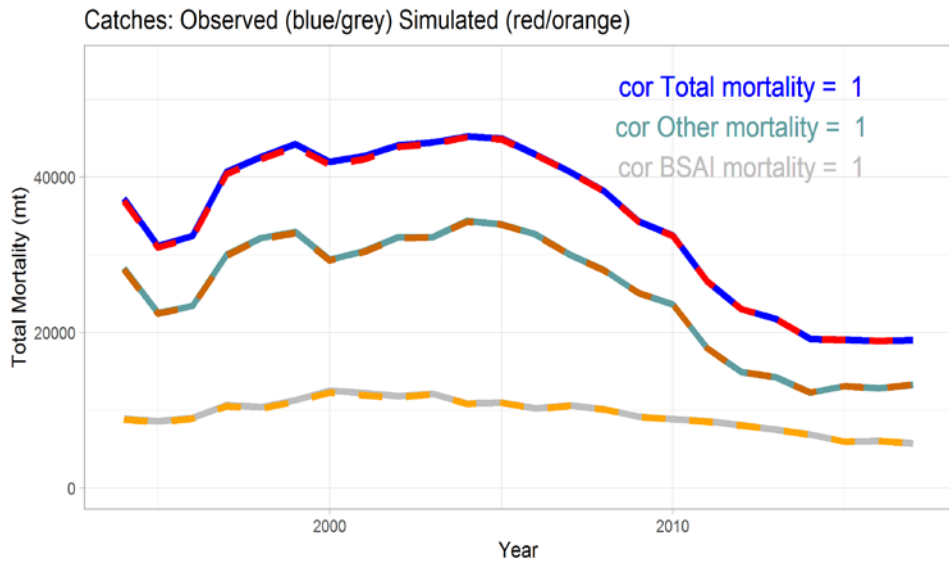


Figure A3-4. Age-1 Recruitment estimates from the BSAI sub-model. These relative values were used to evaluate the process error component of the BTS in OM projections relative to the OM conditioned to mimic the 2018 coastwide long assessment by the IPHC.

- Age-2 recruitment from BSAI
- “Other” area recruitment = coastwide – BSAI



- **Matches both survey indices: proportion of recruitment to the BSAI varies over time**



What we don't know:

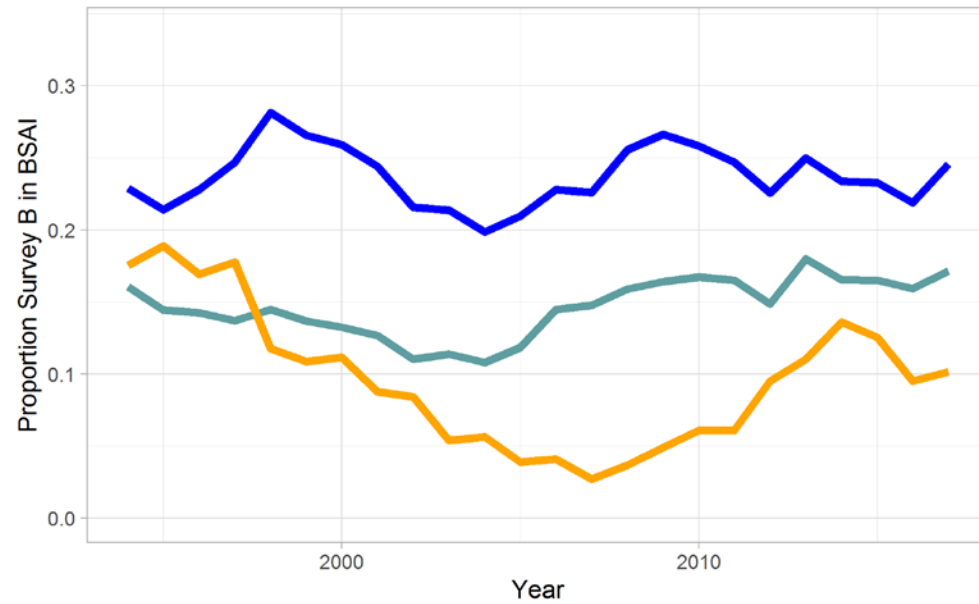
- Average proportion of recruitment to BSAI
- Juvenile movement between areas

What we do know:

- Historical setline survey biomass in the BSAI and other area

Initial guess about juv movt and recruitment to BSAI

Obs. All Area 4 (dk blue), Obs. 4BCDE (lt blue), Sim. BSAI (orange)



What we don't know:

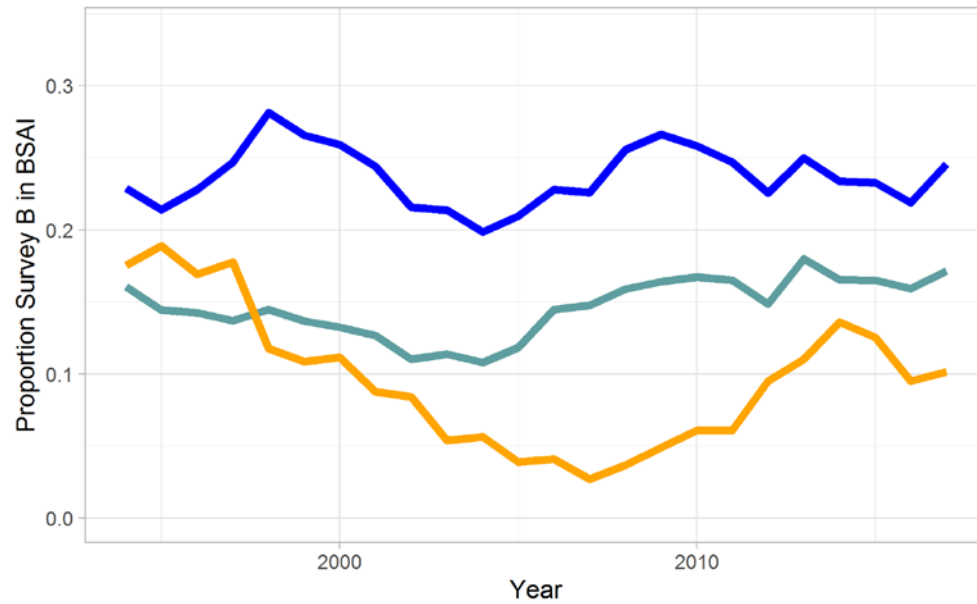
- Average proportion of recruitment to BSAI
- Juvenile movement between areas

What we do know:

- Historical setline survey biomass in the BSAI and other area

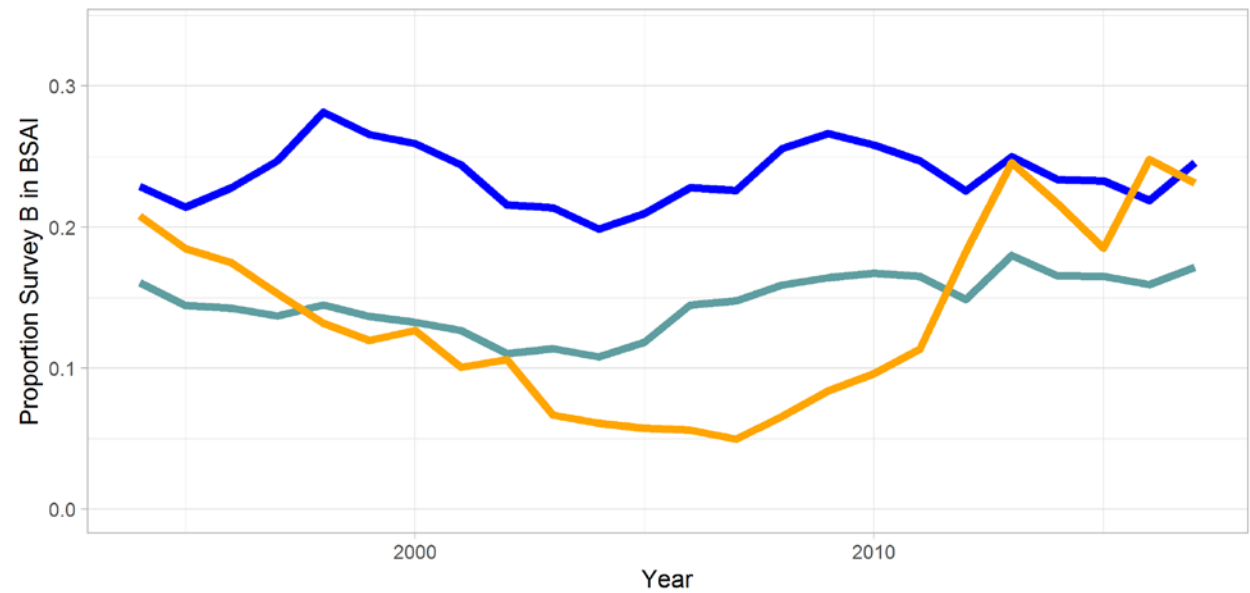
Initial guess about juv movt and recruitment to BSAI

Obs. All Area 4 (dk blue), Obs. 4BCDE (lt blue), Sim. BSAI (orange)



Updated juv movt and recruitment to BSAI to match observations

Obs. All Area 4 (dk blue), Obs. 4BCDE (lt blue), Sim. BSAI (orange)



Overview of Alternative results

General Trends

Conclusions on major features of control rules

Effects of Elements and options

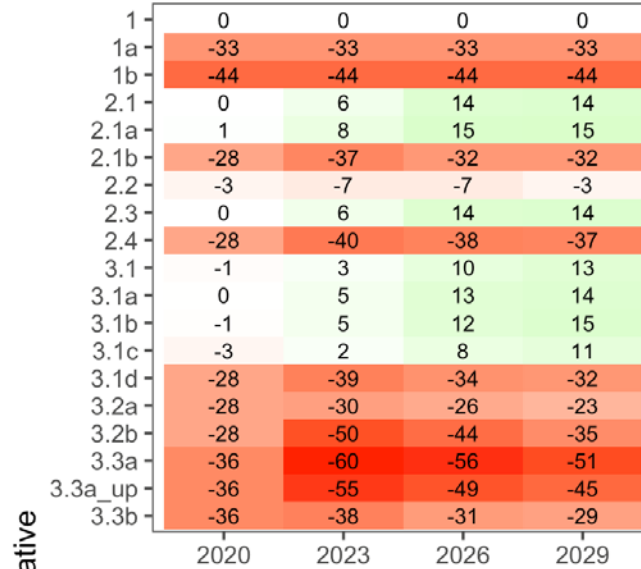
Sector specific PSC limits under Alternatives

Performance metrics

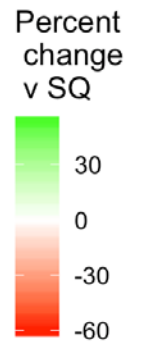
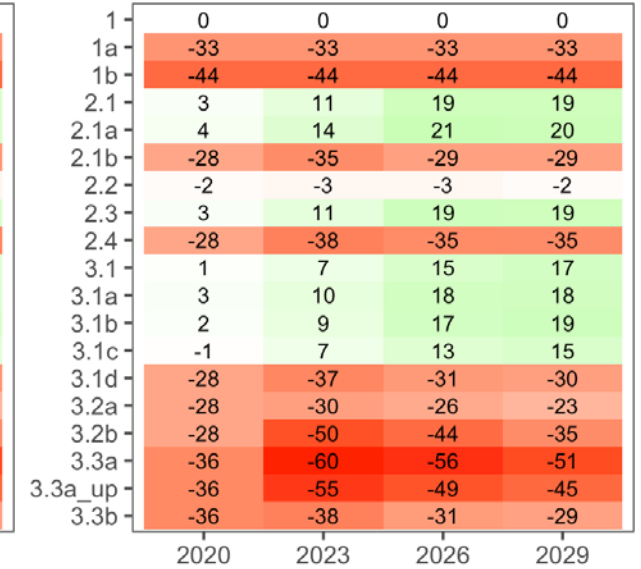
General trends

- Revised Table 6-1
- Projected median % change from status quo alternative

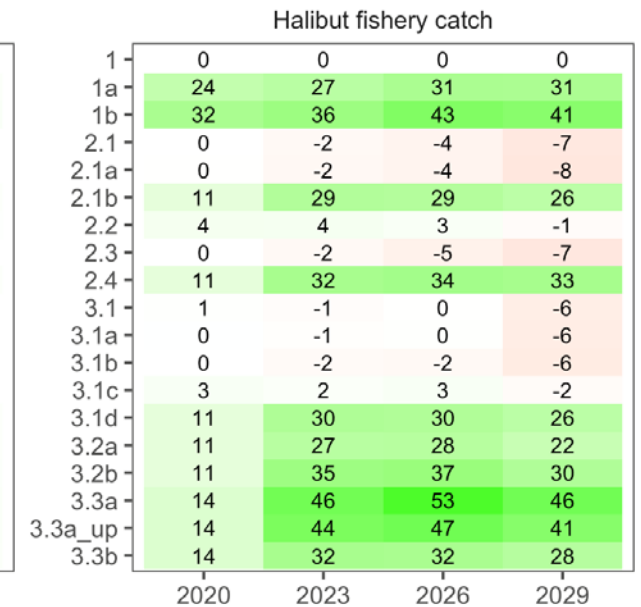
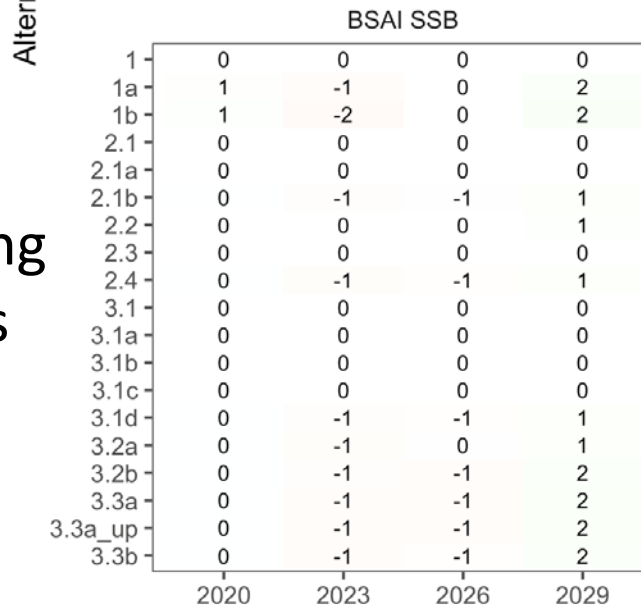
PSC limit



PSC usage

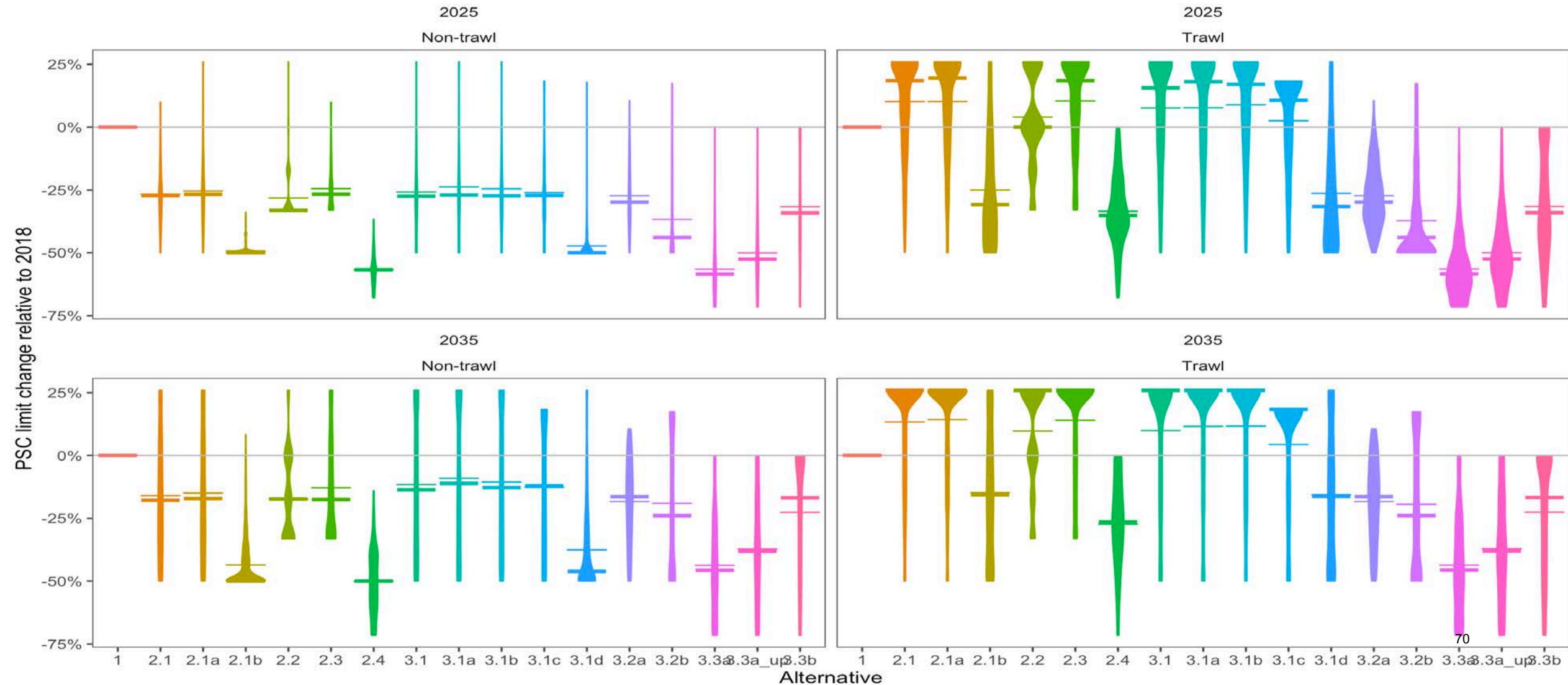


Spawning biomass

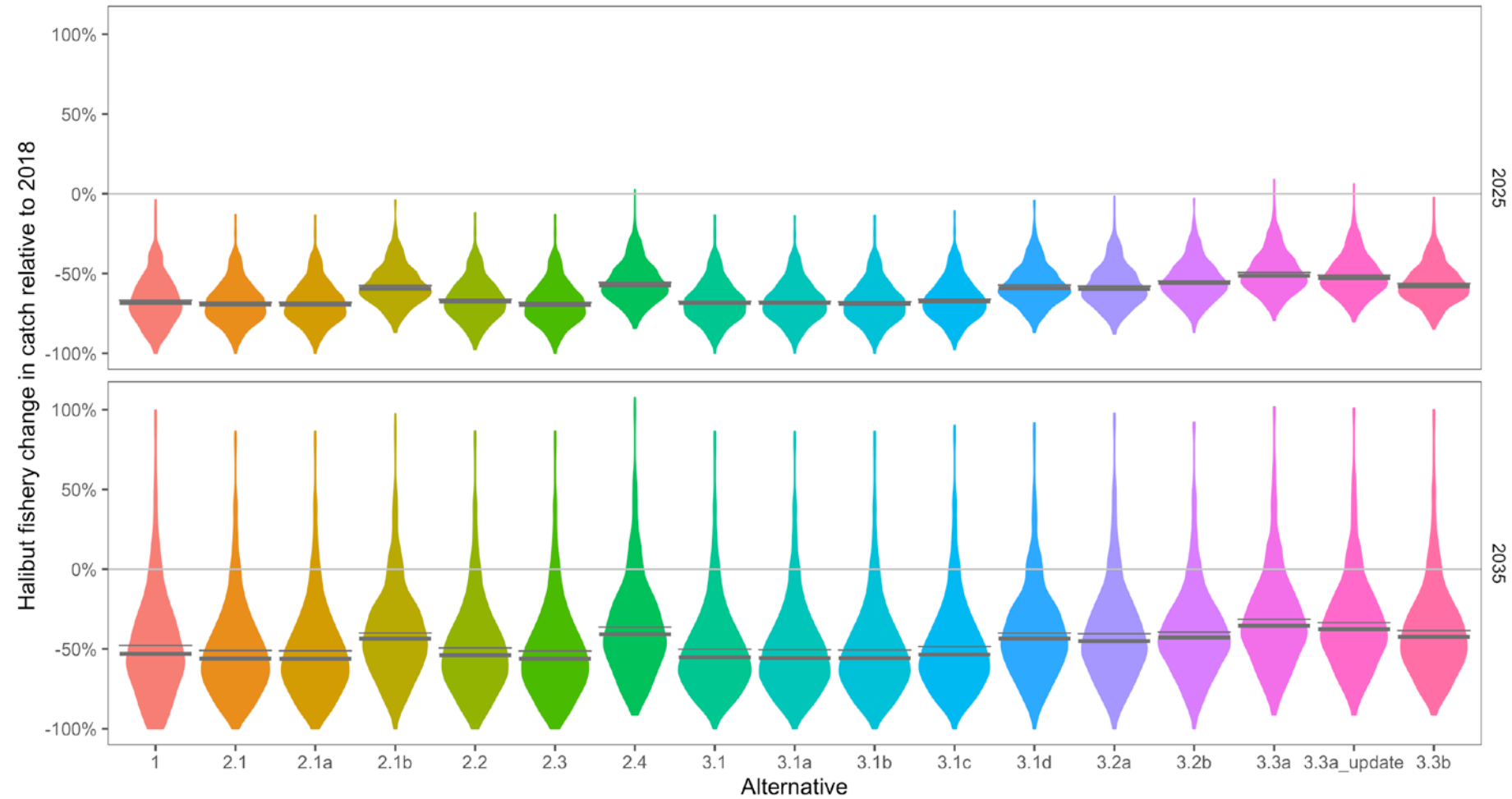


Halibut fishery catch

- BSAI PSC limits relative to 2018 value in 2025 and 2035
- **Compare across alternatives**
- Thick and thin horizontal bars: median and mean
- Thickness of vertical lines show number of simulations at a particular % change



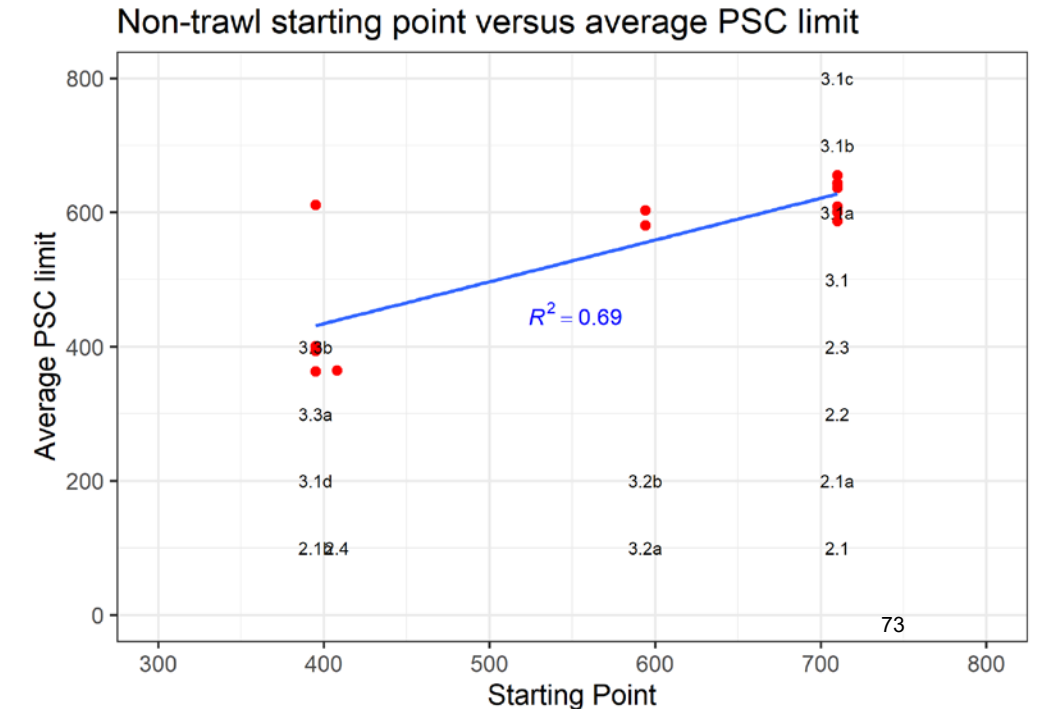
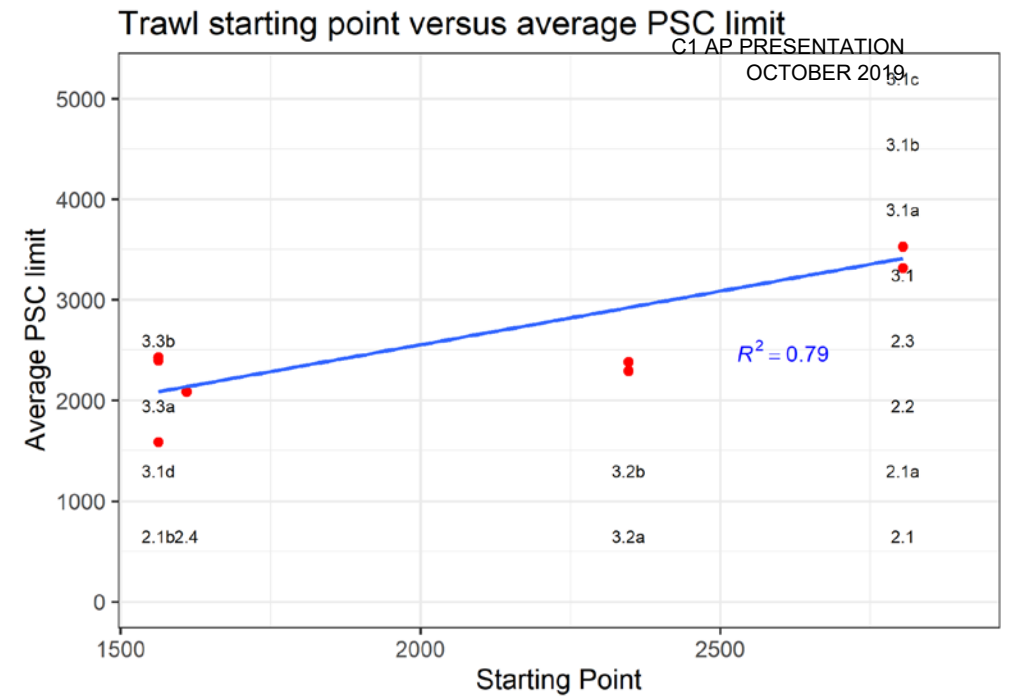
- Halibut fishery catch relative to 2018 value in 2025 and 2035
- **Compare across alternatives**
- Thick and thin horizontal bars: median and mean
- Thickness of vertical lines show number of simulations at a particular % change



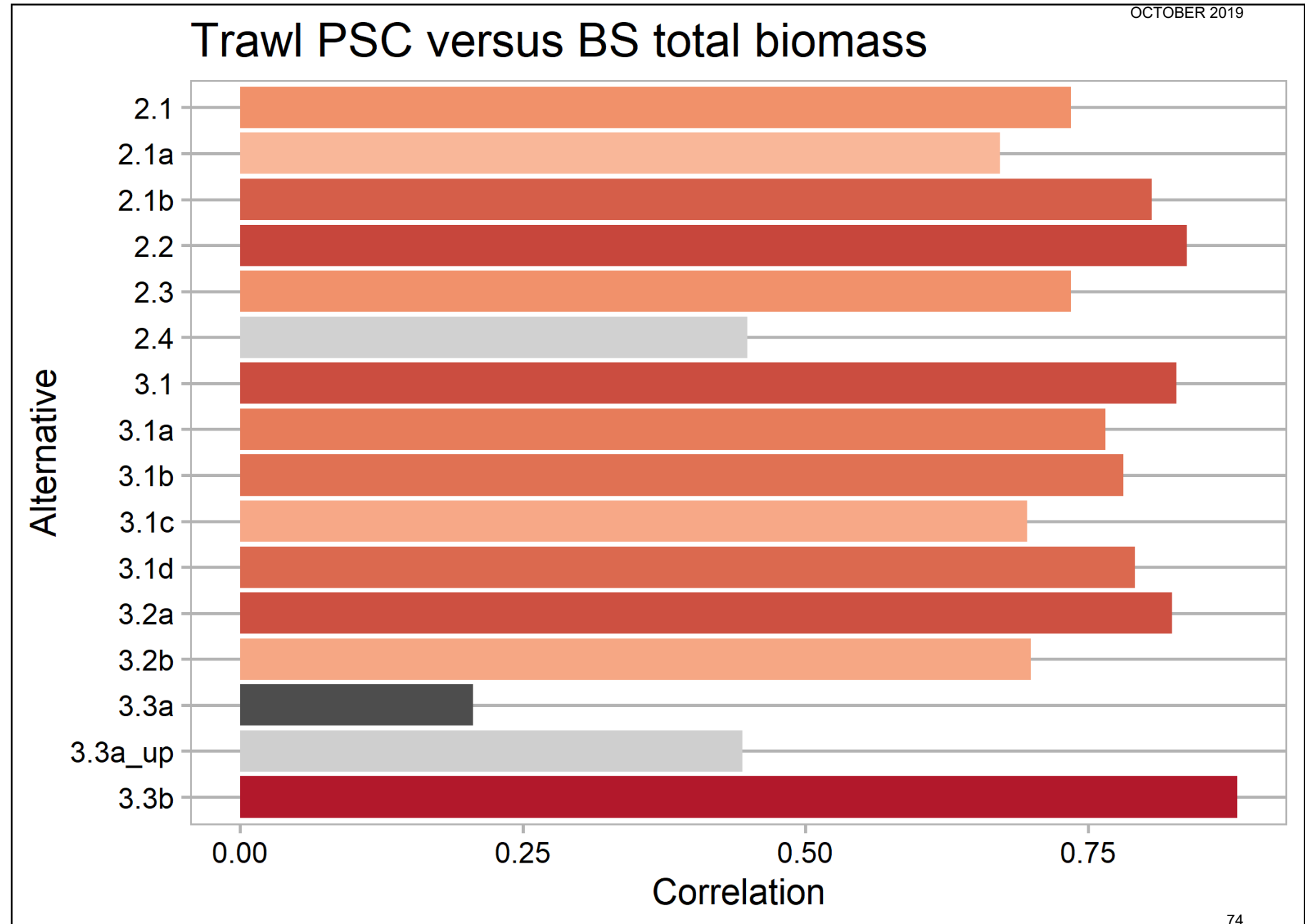
Conclusions on major features of control rules

PSC limit most sensitive to starting point

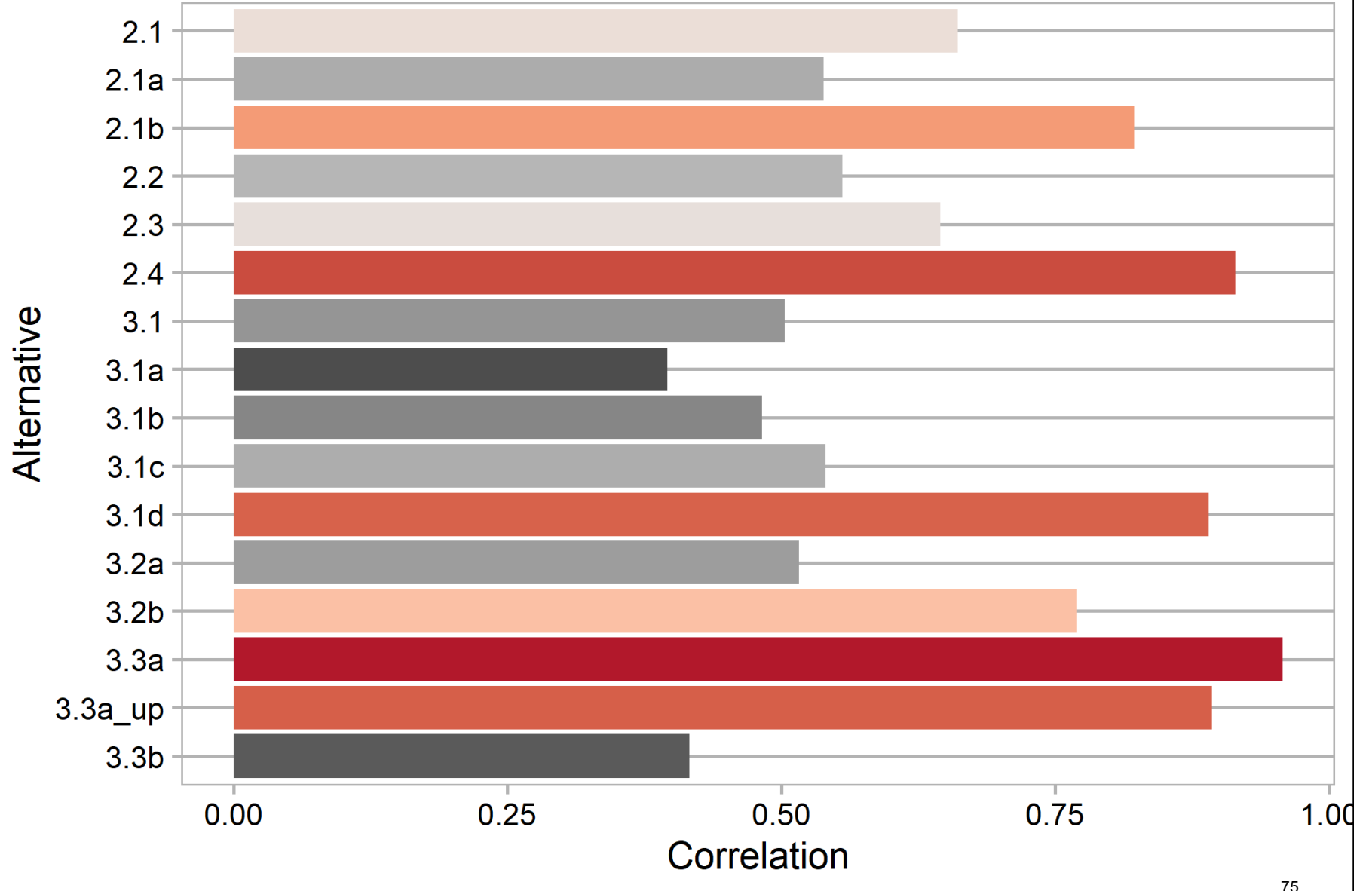
Average = last 5 year's average PSC limit



PSC limits
are (mostly)
correlated
to halibut
biomass



Non-trawl PSC versus BS spawning biomass



PSC limits are (mostly) correlated to halibut biomass

Some alternative PSC limits often stuck on floors and ceilings

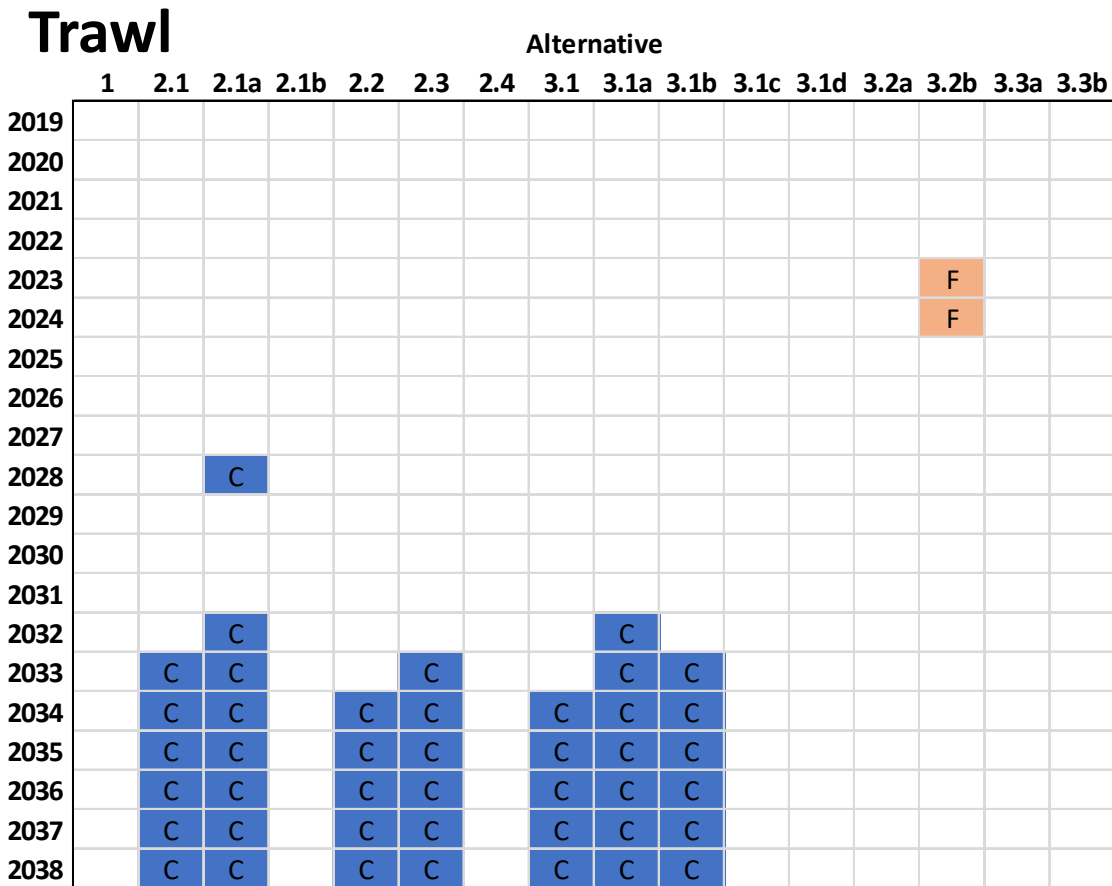


Figure 6-11. Occurrence of median trawl PSC limits reaching a floor (F, pink) or a ceiling (C, blue) for each alternative and year in the simulation.

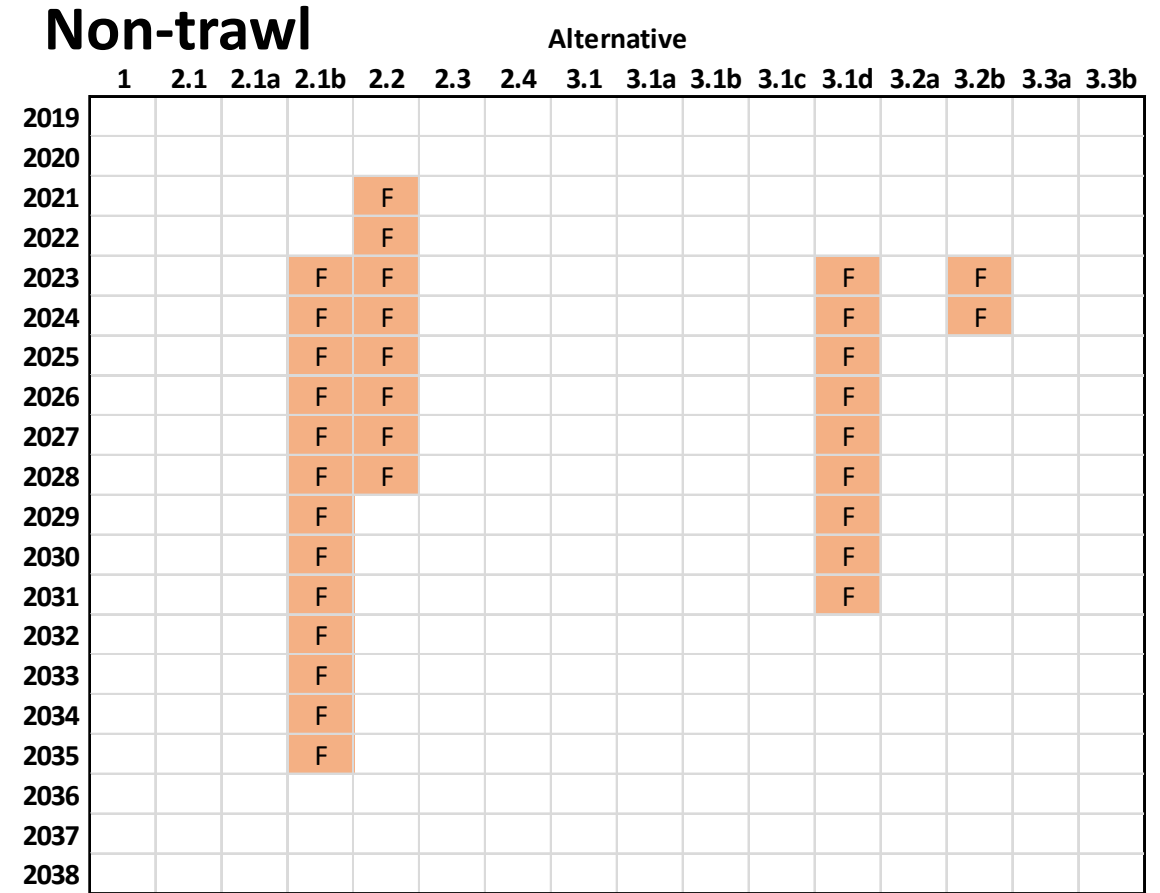
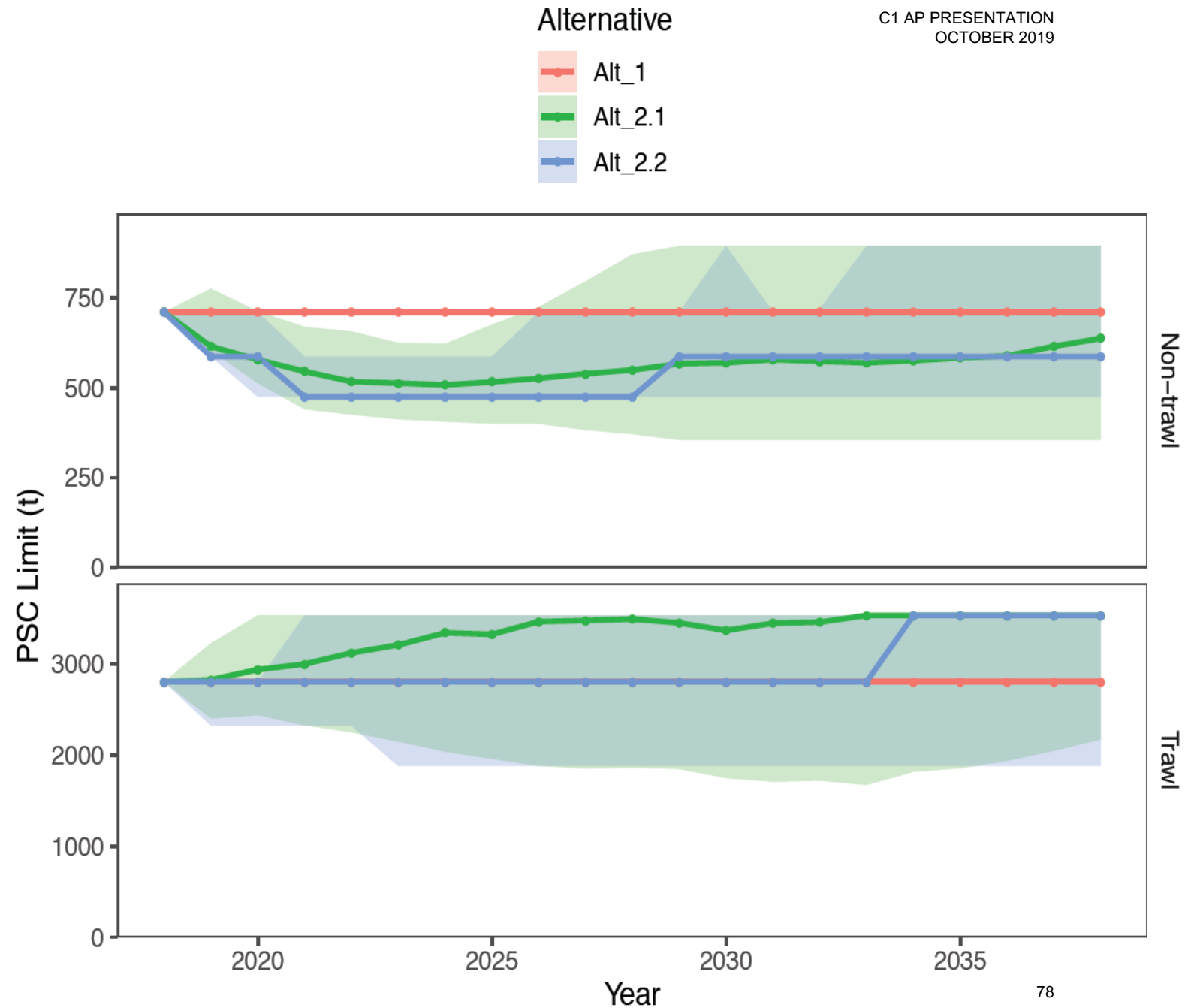


Figure 6-12. Occurrence of median non-trawl PSC limits reaching a floor (F, pink) or a ceiling (C, blue) for each alternative and year in the simulation.

Examples

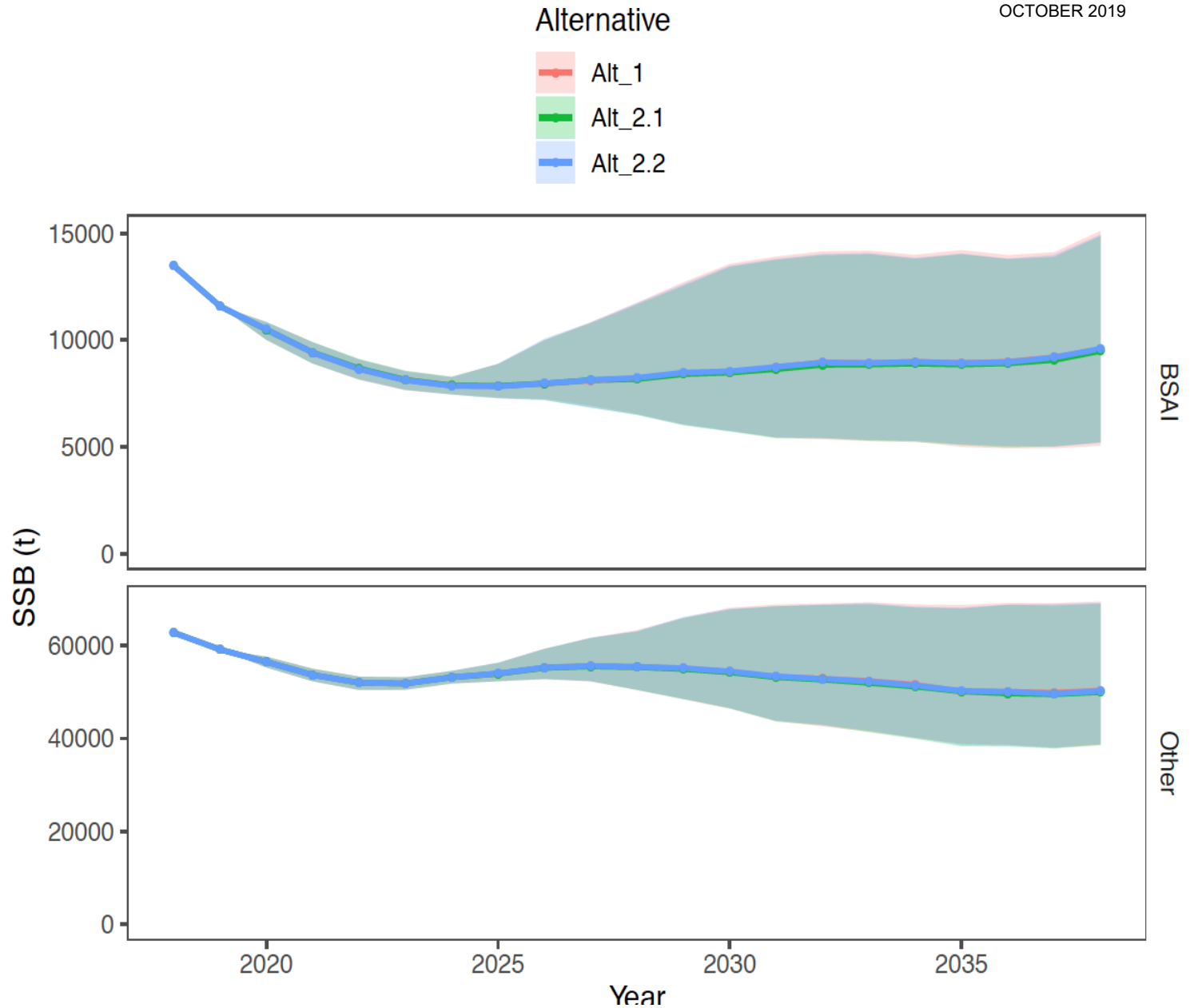
Examining effects of
Elements and
options:

15% constraint (Alt
2.1) compared with
stairstep (Alt 2.2)



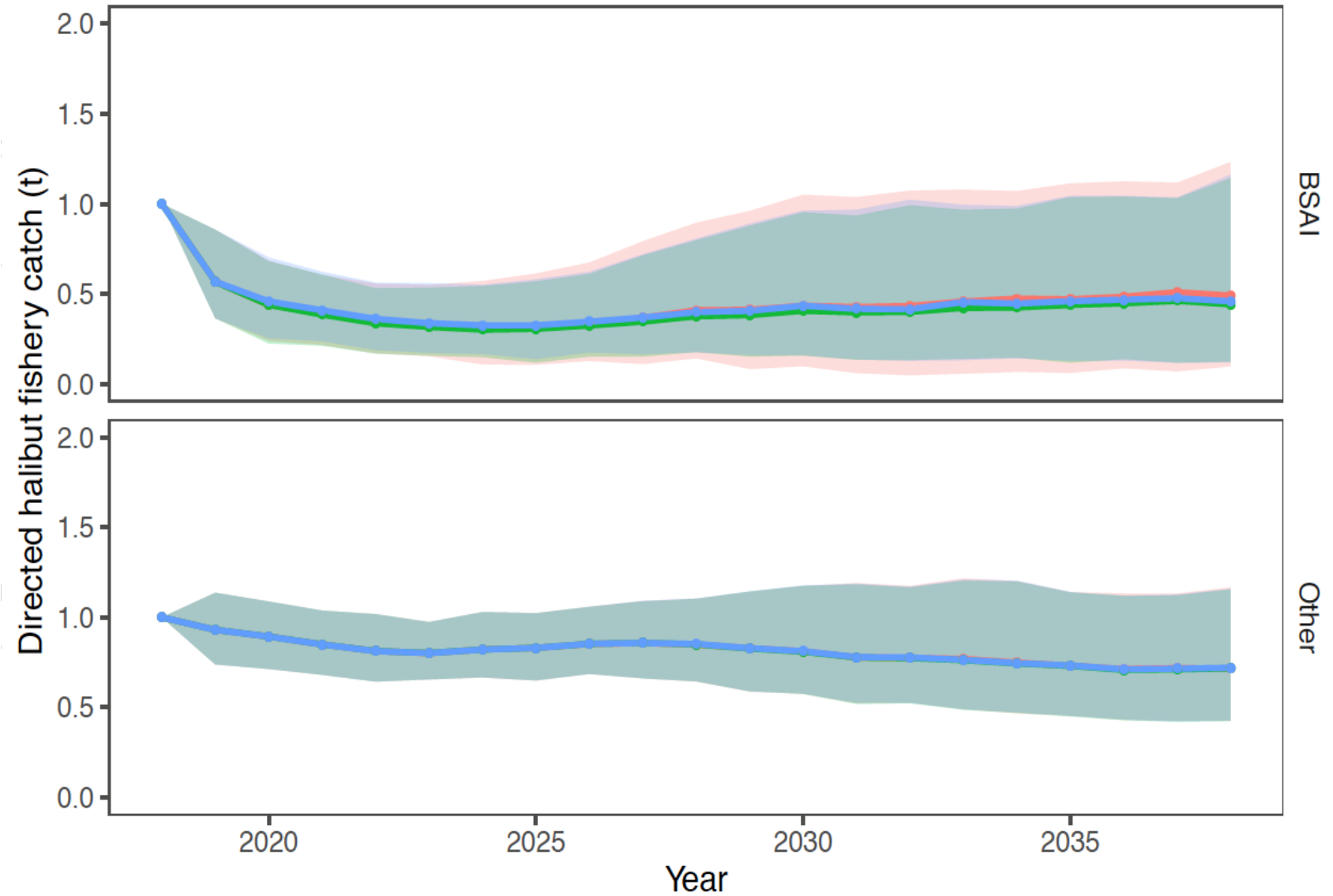
Examining effects of
Elements and
options:

15% constraint (Alt
2.1) compared with
stairstep (Alt 2.2)



Examining effects of
Elements and
options:

15% constraint (Alt
2.1) compared with
stairstep (Alt 2.2)



Examining effects of Elements and options (2.1 and 3.1):

Addition of secondary index (3.1) for similar stock status trajectory

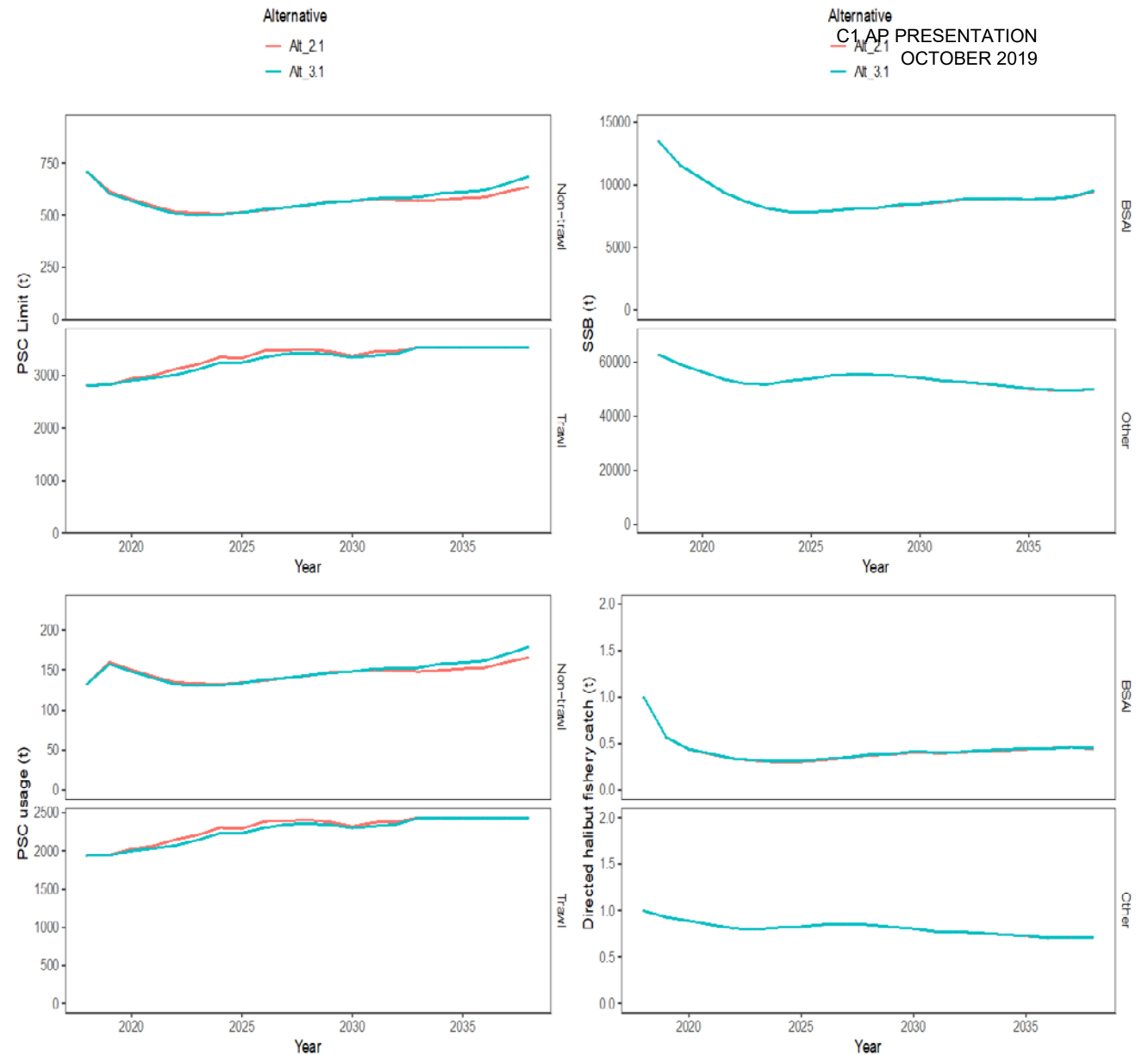


Figure 6-17. A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch for Alternative 2.1 and Alternative 3.1.

Examining effects of Elements and options (3.2a, 3.2b):

Change in responsiveness

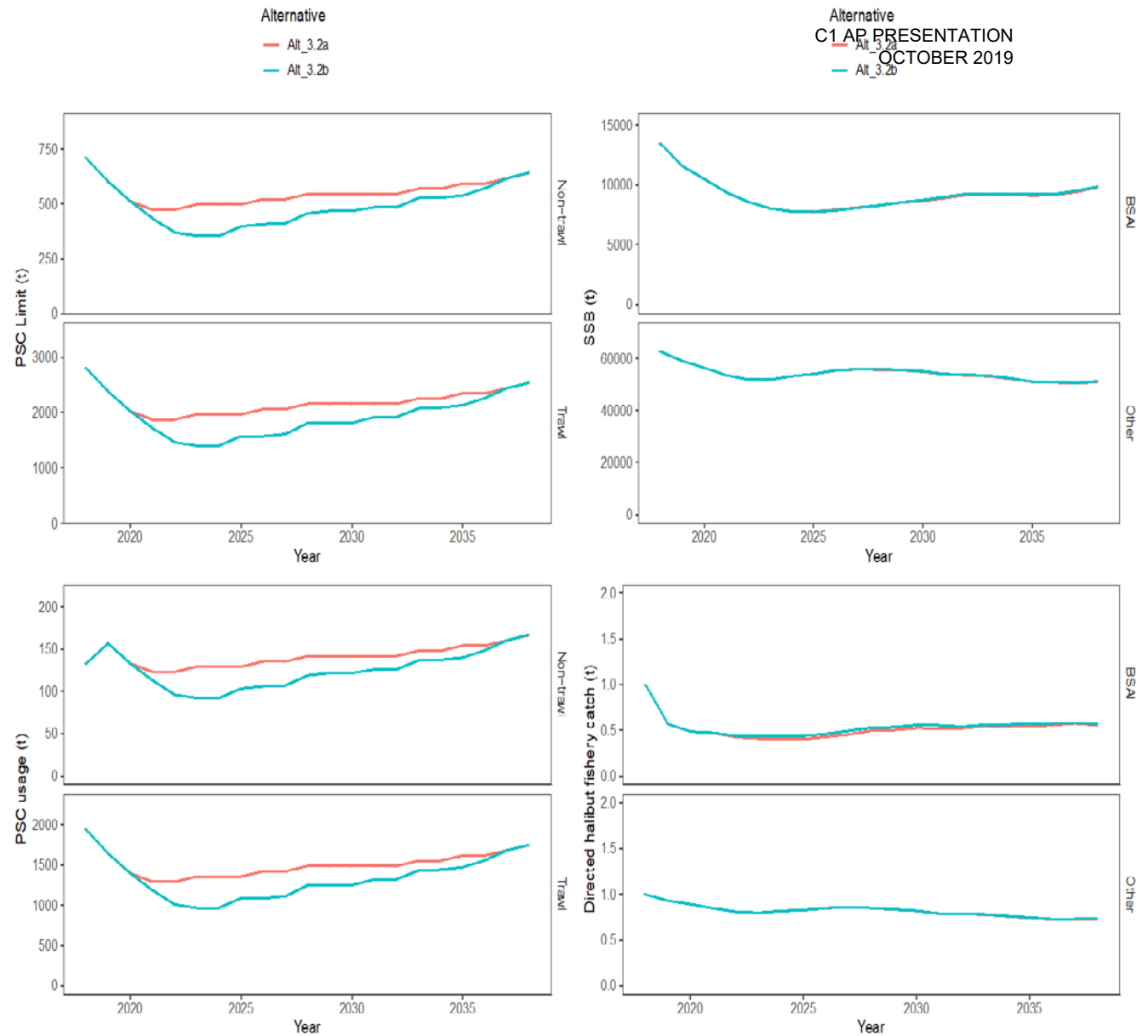
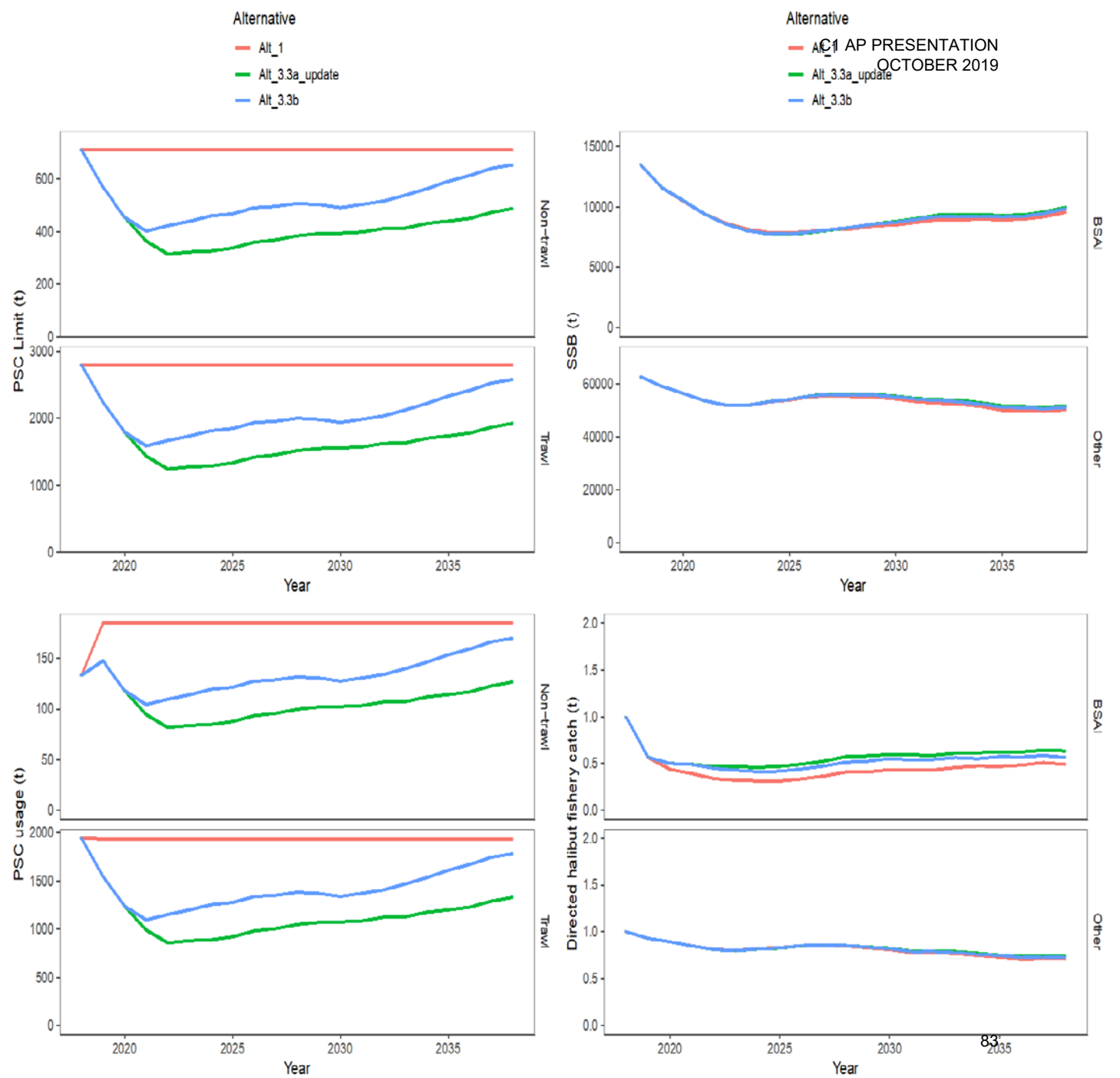


Figure 6-18. A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch for Alternatives 3.2a and 3.2b.

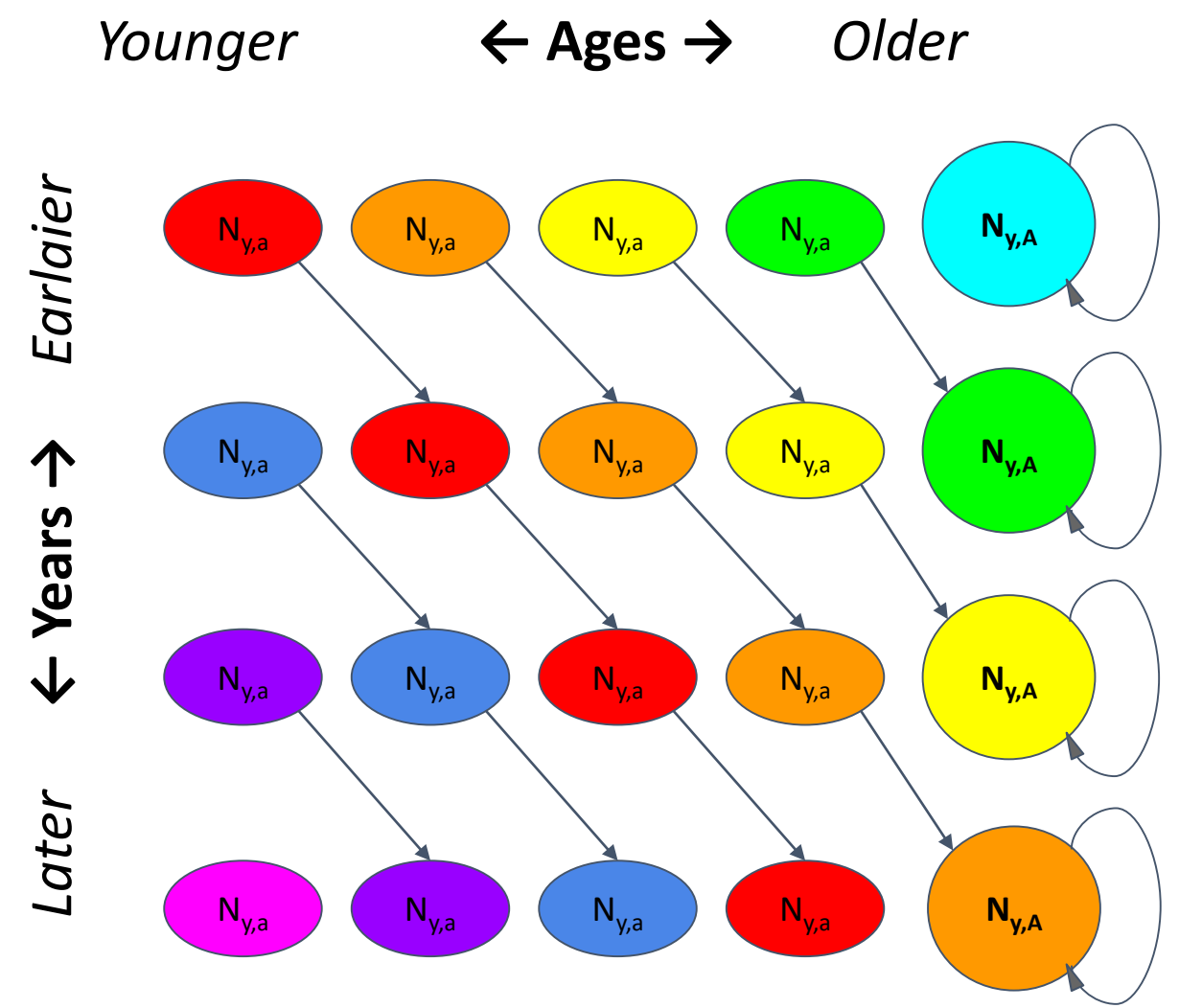
Examining effects of Elements and options (3.3a and 3.3b):

Using the same primary index for both gear types



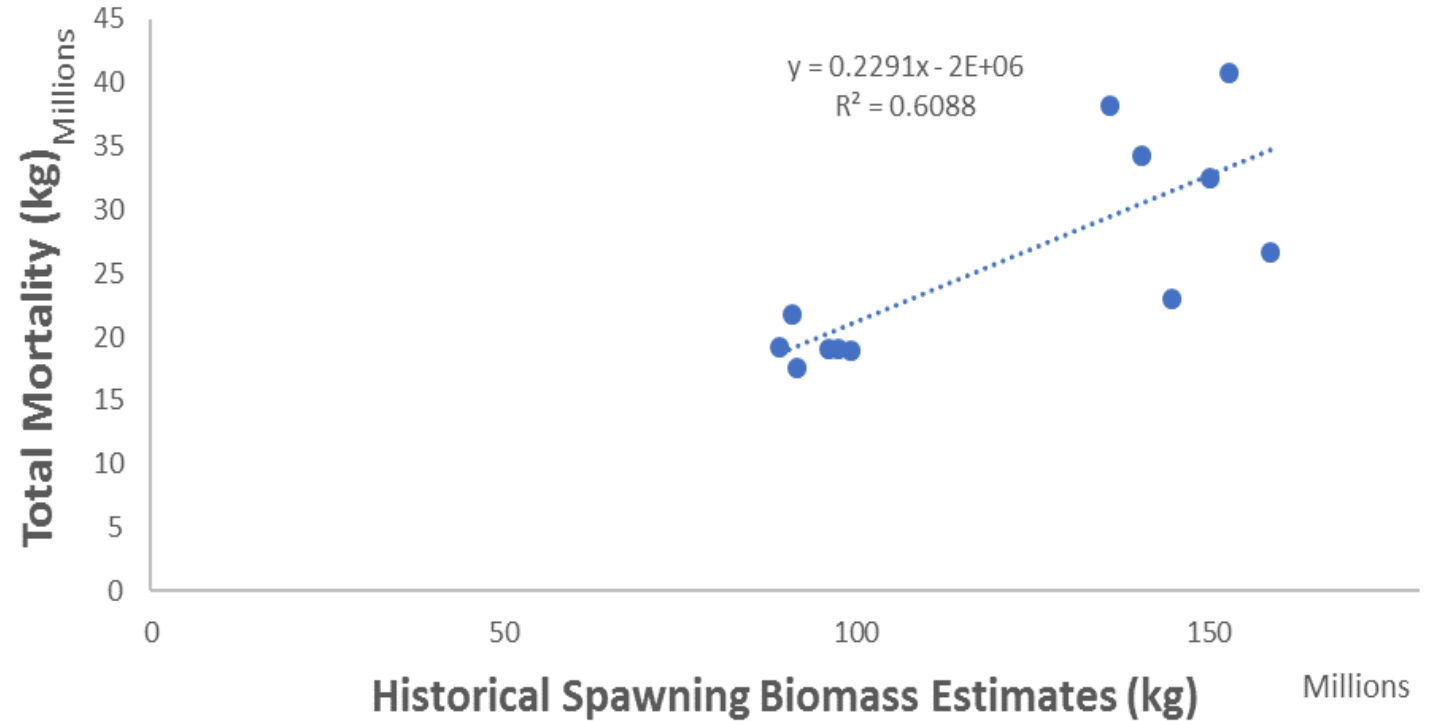
How and where are U26 fish taken into account?

All ages
(and implicitly all lengths)
are included in the model



How and where are U26 fish taken into account?

TCEY
determination
accounts for U26
on average, to
the extent that it
was taken into
account
historically



How and where are U26 fish taken into account?

- Previous year's O26 realized PSC usage is subtracted from current year's BSAI TCEY to arrive at BSAI directed halibut fishery catch limit, as is the practice at IPHC
- Average length-at-age relationship to define ages at 26 year old fish
- 26-inch fish is on average a 7 yo
- Forward simulations currently assume 2018 weight-at-age in all years

How and where are U26 fish taken into account?

- We did not model an operating model scenario with TCEY determination as a function of spawning potential ratio.
- Application of an SPR-based fishing intensity would take into account yearly fluctuations in U26 fish

Sector specific PSC limits under Alternatives

Table 6-8 Comparison of sector allocation of Pacific halibut PSC limits (t) by alternative for median values of the projection simulations to 2024 (top section) and 2030 (bottom section)

Revised Table 6-8

PSC allocation %	Trawl				Non-trawl (NT)		
	A80	TLAS	CDQ	Trawl Total	Cod	Other	NT Total
Status quo limit	1,745	745	315	2,805	661	49	710
Avg. usage (2016-18)	1,307	431	153	1,892	163*		
2024	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,080	890	371	3,341	473	35	508
Alternative 2.1a	2,116	905	378	3,398	474	35	509
Alternative 2.1b	1,207	516	215	1,938	331	24	355
Alternative 2.2	1,746	747	312	2,805	442	33	475
Alternative 2.3	2,080	890	371	3,341	476	35	511
Alternative 2.4	1,334	485	202	1,822	279	21	300
Alternative 3.1	2,016	862	360	3,239	469	35	504
Alternative 3.1a	2,041	873	364	3,279	471	35	506
Alternative 3.1b	2,042	873	364	3,280	476	35	511
Alternative 3.1c	1,934	827	345	3,106	481	36	517
Alternative 3.1d	1,180	505	211	1,896	331	24	355
Alternative 3.2a	1,226	524	219	1,969	464	34	498
Alternative 3.2b	874	374	156	1,403	331	24	355
Alternative 3.3a	696	298	124	1,119	263	20	283
<i>Alternative 3.3a update</i>	<i>803</i>	<i>343</i>	<i>143</i>	<i>1,289</i>	<i>303</i>	<i>22</i>	<i>326</i>
Alternative 3.3b	1,131	484	202	1,816	427	32	459
2030	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,097	897	374	3,367	530	39	570
Alternative 2.1a	2,160	924	385	3,469	537	40	577
Alternative 2.1b	1,251	535	223	2,009	331	24	355
Alternative 2.2	1,746	747	312	2,805	547	41	587
Alternative 2.3	2,096	897	374	3,367	530	39	570
Alternative 2.4	1,153	493	206	1,852	323	24	347
Alternative 3.1	2,078	888	371	3,337	531	39	570
Alternative 3.1a	2,135	913	381	3,430	541	40	581
Alternative 3.1b	2,096	896	374	3,366	538	40	578
Alternative 3.1c	2,067	884	369	3,319	531	39	571
Alternative 3.1d	1,235	528	220	1,984	331	24	355
Alternative 3.2a	1,344	575	240	2,158	509	38	546
Alternative 3.2b	1,128	483	201	1,812	437	32	469
Alternative 3.3a	864	370	154	1,388	327	24	351
<i>Alternative 3.3a update</i>	<i>970</i>	<i>415</i>	<i>173</i>	<i>1,558</i>	<i>367</i>	<i>27</i>	<i>394</i>
Alternative 3.3b	1,209	517	216	1,942	457	34	491

* The 2016-2018 average usage for non-trawl includes both the HALCP and HALCV sectors. **Error! Reference source not found.** illustrates that halibut PSC for the non-trawl category is divided by target species (Pacific cod and 'all other targets'). Though not shown in this table, the non-trawl Pacific cod fishery PSC limit (status quo = 661 t) is further divided through harvest specifications between non-trawl CPs (status quo = 648 t) and non-trawl CVs (status quo = 13 t).

Less than Status quo limit

Less than Avg. usage (2016-18)

	Trawl				Non-trawl (NT)		
	A80	TLAS	CDQ	Trawl Total	Cod	Other	NT Total
PSC allocation %	62.30%	26.60%	11.10%	100%	93.10%	6.90%	100%
Status quo limit	1,745	745	315	2,805	661	49	710
Avg. usage (2016-18)	1,307	431	153	1,892	163*		
2024	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,080	890	371	3,341	473	35	508
Alternative 2.1a	2,116	905	378	3,398	474	35	509
Alternative 2.1b	1,207	516	215	1,938	331	24	355
Alternative 2.2	1,746	747	312	2,805	442	33	475
Alternative 2.3	2,080	890	371	3,341	476	35	511
Alternative 2.4	1,334	485	202	1,822	279	21	300
Alternative 3.1	2,016	862	360	3,239	469	35	504
Alternative 3.1a	2,041	873	364	3,279	471	35	506
Alternative 3.1b	2,042	873	364	3,280	476	35	511
Alternative 3.1c	1,934	827	345	3,106	481	36	517
Alternative 3.1d	1,180	505	211	1,896	331	24	355
Alternative 3.2a	1,226	524	219	1,969	464	34	498
Alternative 3.2b	874	374	156	1,403	331	24	355
Alternative 3.3a	696	298	124	1,119	263	20	283
Alternative 3.3a update	803	343	143	1,289	303	22	326
Alternative 3.3b	1,131	484	202	1,816	427	32	459
2030	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,097	897	374	3,367	530	39	570
Alternative 2.1a	2,160	924	385	3,469	537	40	577
Alternative 2.1b	1,251	535	223	2,009	331	24	355
Alternative 2.2	1,746	747	312	2,805	547	41	587
Alternative 2.3	2,096	897	374	3,367	530	39	570
Alternative 2.4	1,153	493	206	1,852	323	24	347
Alternative 3.1	2,078	888	371	3,337	531	39	570
Alternative 3.1a	2,135	913	381	3,430	541	40	581
Alternative 3.1b	2,096	896	374	3,366	538	40	578
Alternative 3.1c	2,067	884	369	3,319	531	39	571
Alternative 3.1d	1,235	528	220	1,984	331	24	355
Alternative 3.2a	1,344	575	240	2,158	509	38	546
Alternative 3.2b	1,128	483	201	1,812	437	32	469
Alternative 3.3a	864	370	154	1,388	327	24	351
Alternative 3.3a update	970	415	173	1,558	367	27	394
Alternative 3.3b	1,209	517	216	1,942	457	34	491

	Trawl				Non-trawl (NT)		
	A80	TLAS	CDQ	Trawl Total	Cod	Other	NT Total
PSC allocation %	62.30%	26.60%	11.10%	100%	93.10%	6.90%	100%
Status quo limit	1,745	745	315	2,805	661	49	710
Avg. usage (2016-18)	1,307	431	153	1,892	163*		
2024	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,080	890	371	3,341	473	35	508
Alternative 2.1a	2,116	905	378	3,398	474	35	509
Alternative 2.1b	1,207	516	215	1,938	331	24	355
Alternative 2.2	1,746	747	312	2,805	442	33	475
Alternative 2.3	2,080	890	371	3,341	476	35	511
Alternative 2.4	1,334	485	202	1,822	279	21	300
Alternative 3.1	2,016	862	360	3,239	469	35	504
Alternative 3.1a	2,041	873	364	3,279	471	35	506
Alternative 3.1b	2,042	873	364	3,280	476	35	511
Alternative 3.1c	1,934	827	345	3,106	481	36	517
Alternative 3.1d	1,180	505	211	1,896	331	24	355
Alternative 3.2a	1,226	524	219	1,969	464	34	498
Alternative 3.2b	874	374	156	1,403	331	24	355
Alternative 3.3a	696	298	124	1,119	263	20	283
Alternative 3.3a update	803	343	143	1,289	303	22	326
Alternative 3.3b	1,131	484	202	1,816	427	32	459
2030	A80	TLAS	CDQ	Trawl limit	Cod	Other	NT limit
Alternative 1	1,745	745	315	2,805	661	49	710
Alternative 2.1	2,097	897	374	3,367	530	39	570
Alternative 2.1a	2,160	924	385	3,469	537	40	577
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Alternative 2.2	1,746	747	312	2,805	547	41	587
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Alternative 2.4	1,153	493	206	1,852	323	24	347
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Alternative 3.1a	2,135	913	381	3,430	541	40	581
Alternative 3.1b	2,096	896	374	3,366	538	40	578
Alternative 3.1c	2,067	884	369	3,319	531	39	571
Alternative 3.1d	1,235	528	220	1,984	331	24	355
Alternative 3.2a	1,344	575	240	2,158	509	38	546
Alternative 3.2b	1,128	483	201	1,812	437	32	469
Alternative 3.3a	864	370	154	1,388	327	24	351
Alternative 3.3a update	970	415	173	1,558	367	27	394
Alternative 3.3b	1,209	517	216	1,942	457	34	491

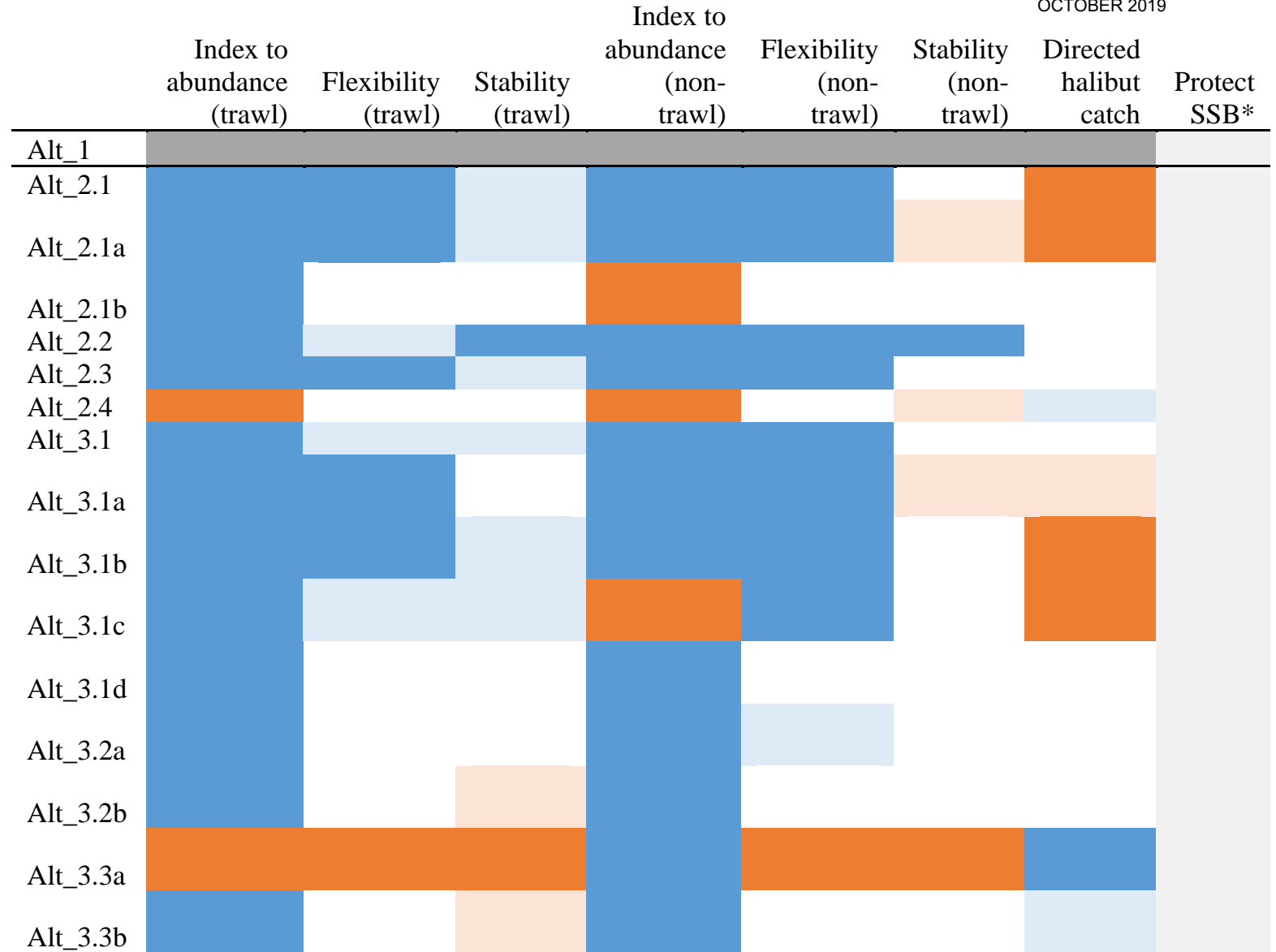
Performance metrics relative to Council objectives

Overall
performance
metrics:
Evaluate how
alternatives
meet Council's
objectives

- Halibut PSC limits should be indexed to halibut abundance
- There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high
- Provide for some stability in PSC limits on an inter-annual basis.
- Provide for directed halibut fishing operations in the Bering Sea.
- Halibut spawning stock biomass should be protected especially at lower levels of abundance

General trends summarized for 20 year simulations

Detailed results are contained in Table 6-2 through Table 6-4.



	Metric = best value Biomass= high correlation
	Metric = metric was somewhat met but did not produce the 'best' value
	Metric= worst value for that metric Biomass= low correlation
	Metric= improvement over the worst value but still in a lower range

General results

- PSC and directed halibut fishery catch are most sensitive to the starting point value.
- The additional constraint of Element 6 = slow trajectory to low starting point values when starting at the 2018 value.
- Floors and ceilings further dampen variability
 - some of the Alternatives result in control rules which are stuck on floors and ceilings.

General results (ctd.)

- Most trawl and non-trawl PSC limits are highly correlated with the indices that were used as the primary index for those limits.
 - Where PSC limits do not track abundance closely due to additional constraints that limit variability
- Impacts to spawning stock biomass (SSB) in the BSAI is minimal across all alternatives
- SSB does decline when very high PSC levels (10,000 t)
- Limited impact on the overall performance from the addition of a secondary index but adds variability in PSC limits and usage.
- Features of the control rules are more influential than combining two indices under the current trajectory of SSB simulated.

General results (ctd.)

- Trade-off between PSC usage and halibut fishery catch
 - mortality limit of over 26" (O26) halibut (TCEY) is composed of halibut fishery catch and O26 PSC usage.
- Halibut fishery catch limits are reduced from 2018 levels due to declines in the SSB trajectory.
- Different model validation scenario with increase in SSB may show an increase in halibut fishery catch relative to 2018 levels.

General results (ctd.)

- Non-Trawl PSC limits for 2024 and 2030 are reduced from current limits
 - reductions from current PSC limits, not represent reductions from recent PSC use.
- Trawl fishery receives reductions in PSC limits under 7 of the 15 calculated alternatives
- The 2030 non-trawl PSC limits are generally larger than those in 2024
 - spawning biomass (and thus the setline trend) stabilizes in the BSAI and show a very slight increase between 2025 and 2030.

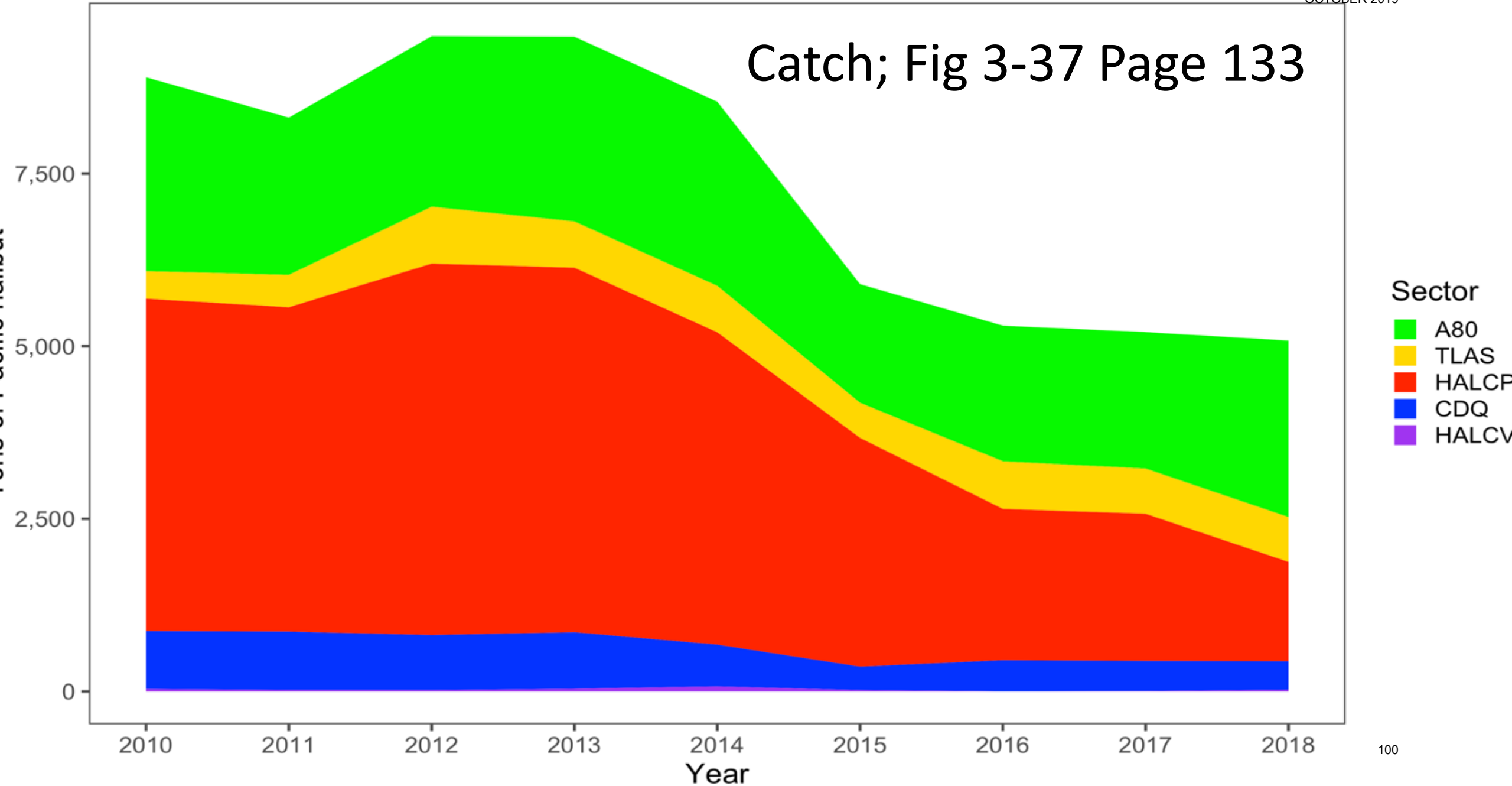
Key discussions and decision points for the Council meeting

- Review the suite of Alternatives and provide any revisions as desirable. Key considerations include:
 - Do these Alternatives as currently constructed meet the intent of the Council's action?
 - Could complexity and redundancy be reduced and still address the Council's intent?
- Review the halibut simulation model, including analytical assumptions and application for purposes of informing the Council's policy decisions for this analysis.
- Review the suite of draft performance metrics and revise as needed. Revised performance metrics may better characterize results across alternatives to indicate where they address conflicting Council objectives.

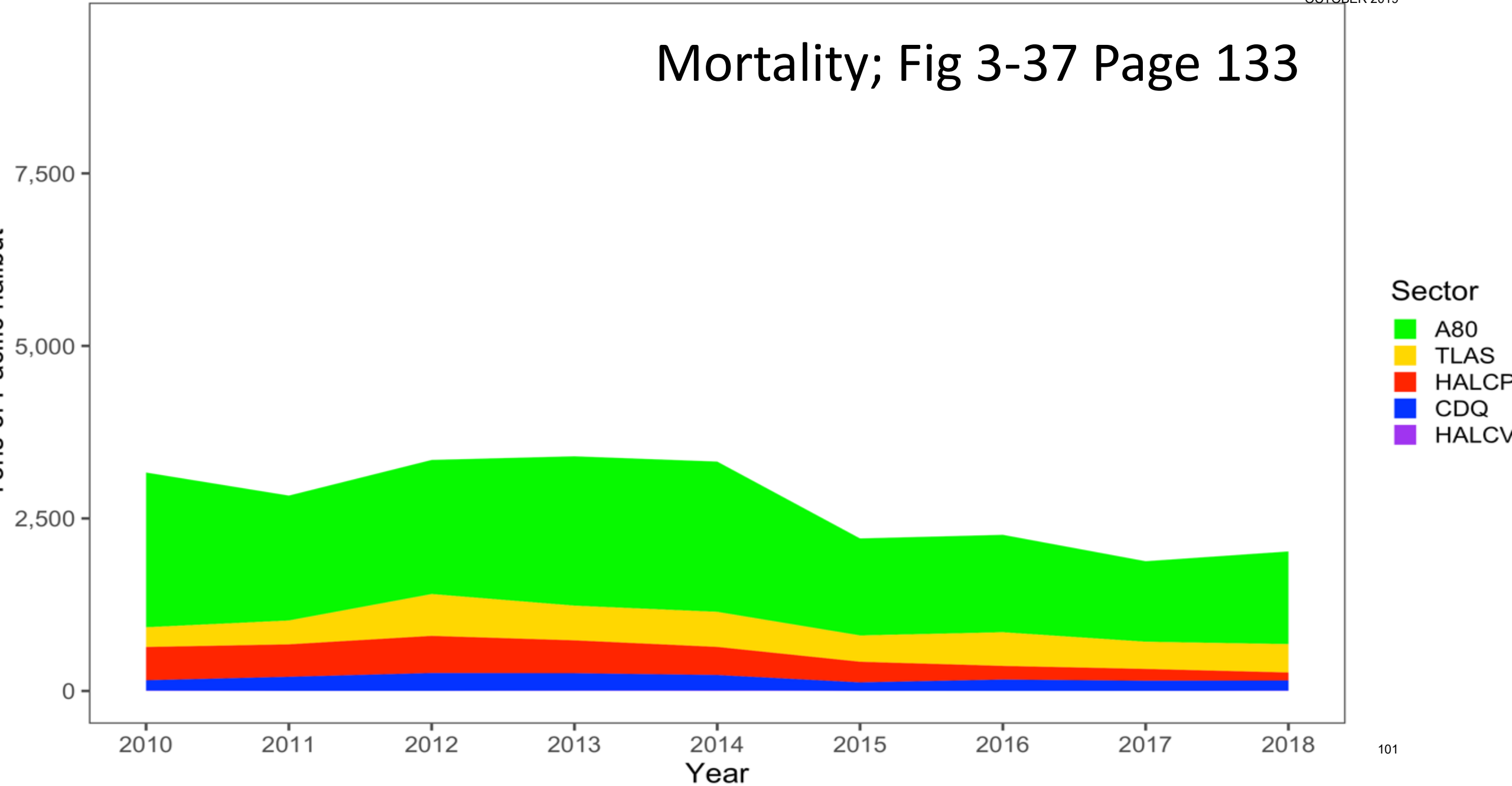
Overview of encounter rates...

Pacific Halibut catch

Catch; Fig 3-37 Page 133

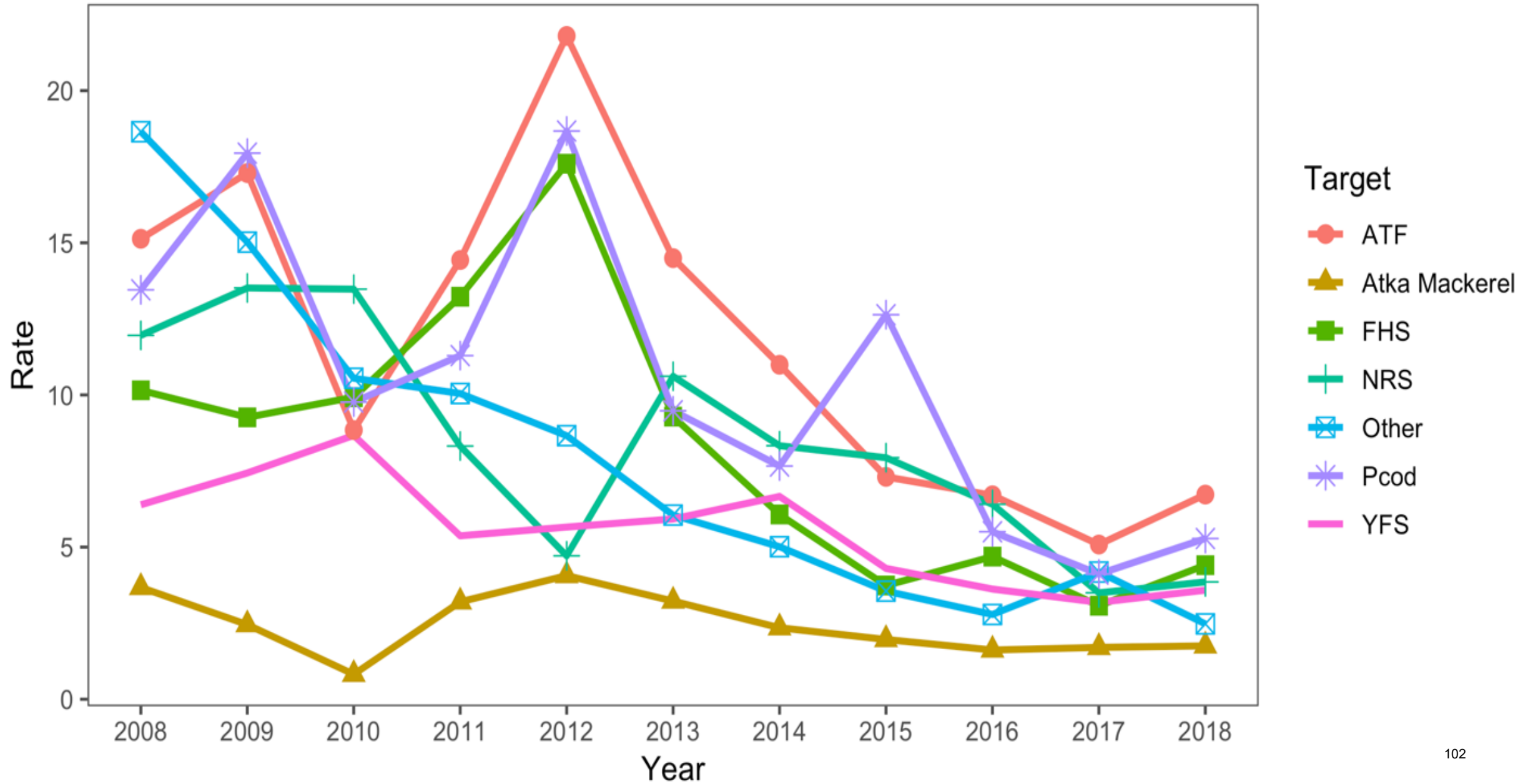


Mortality; Fig 3-37 Page 133



Halibut mortality (kg) per ton of groundfish, A80

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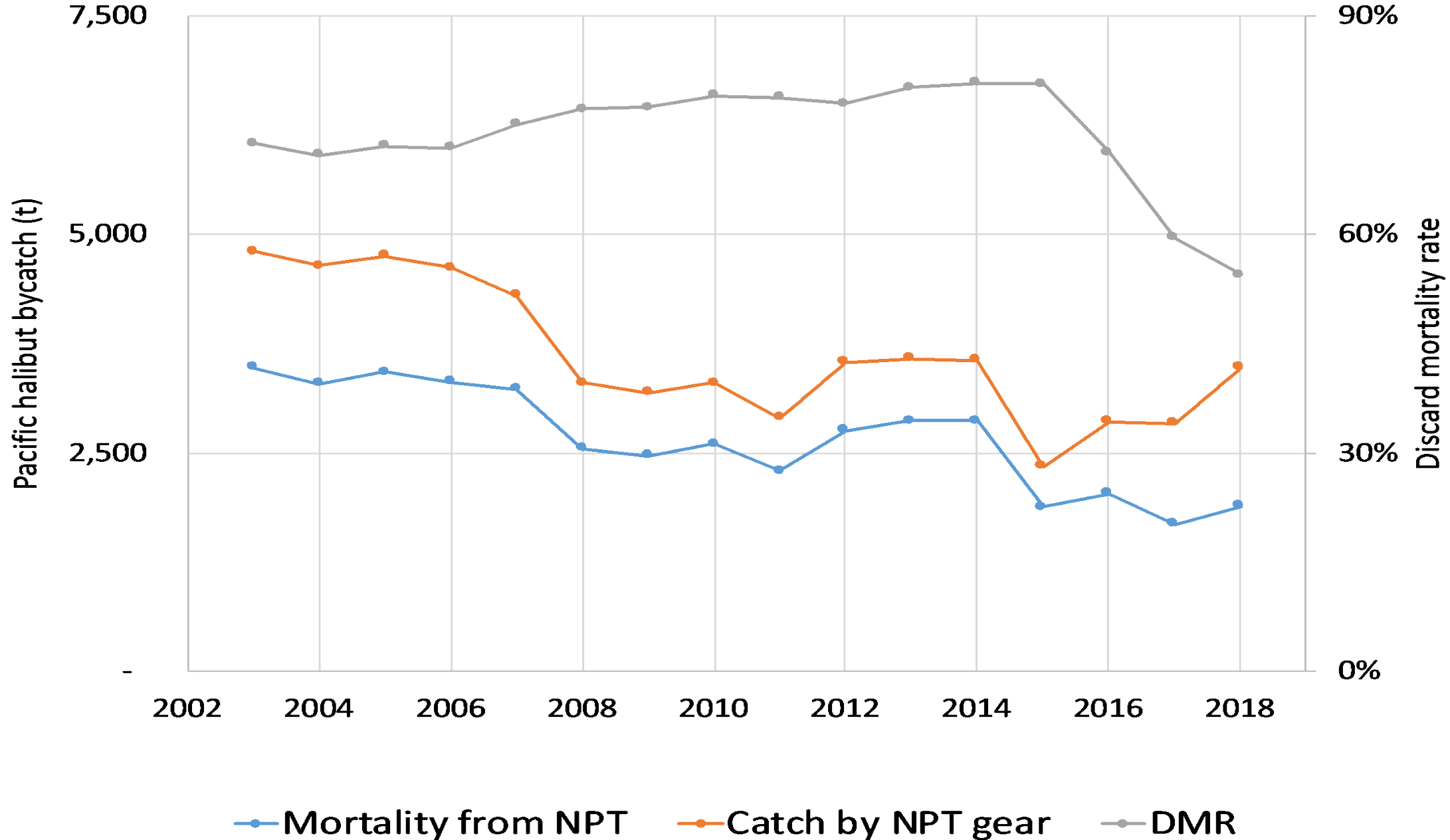
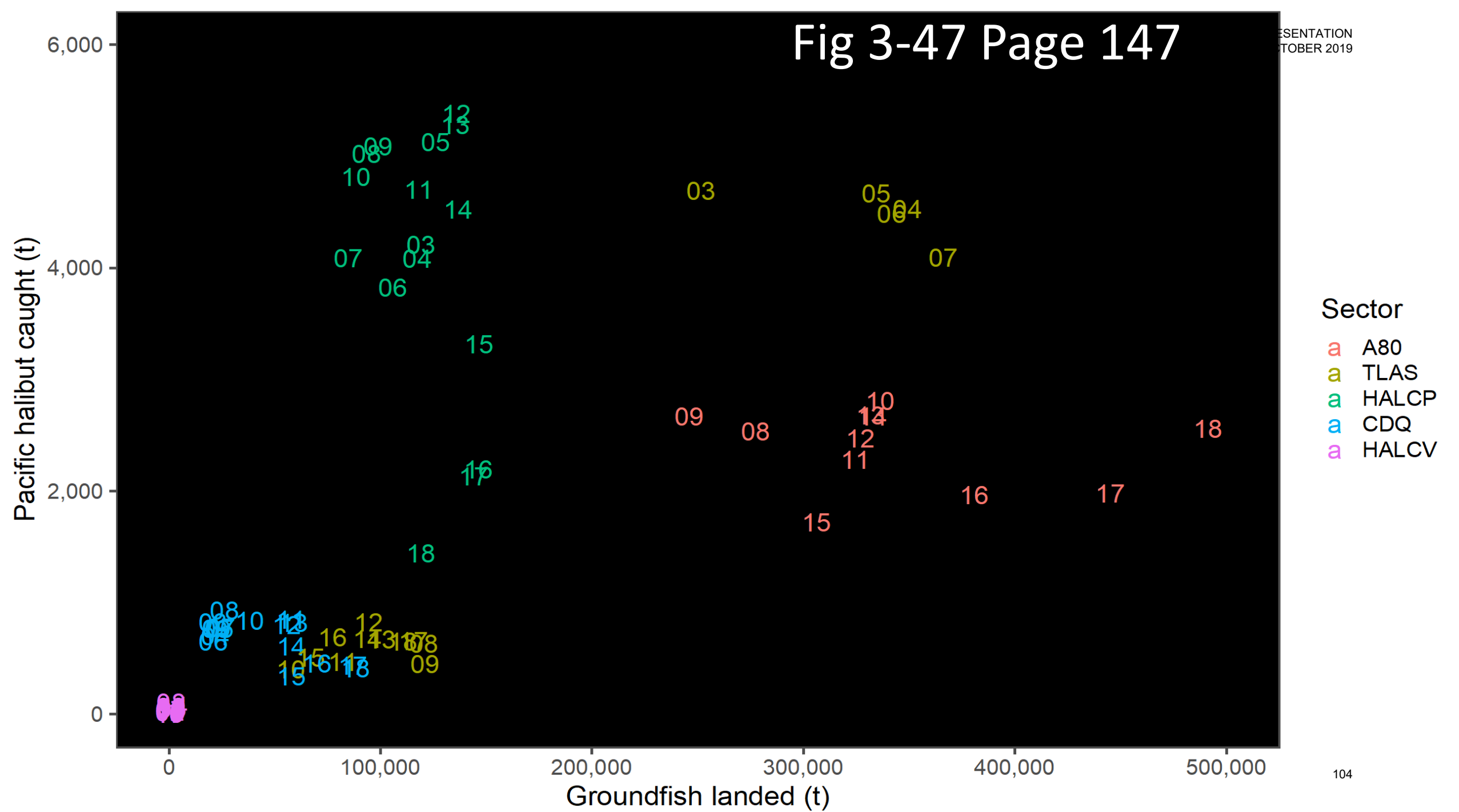


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Pacific Halibut catch, A80 sector

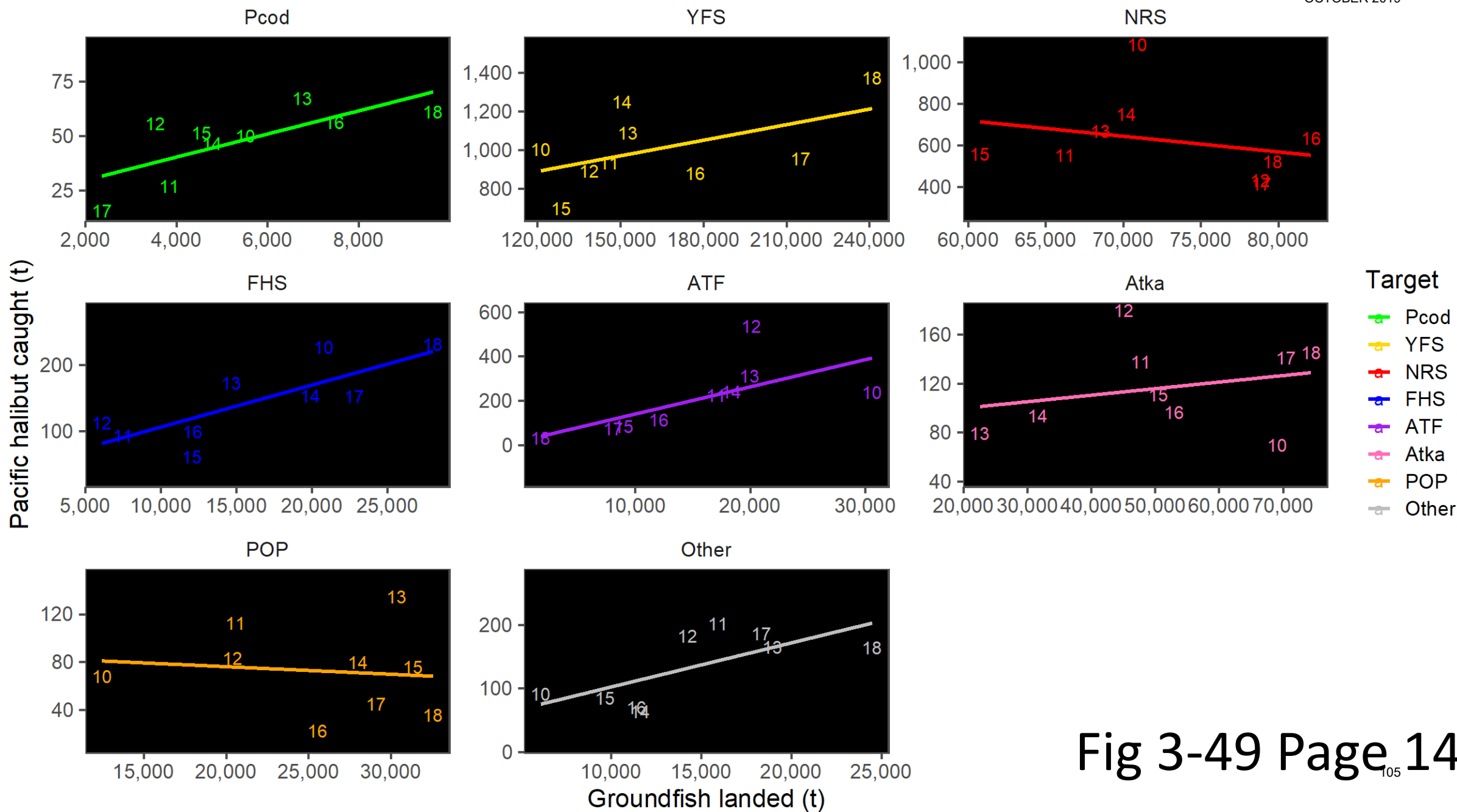
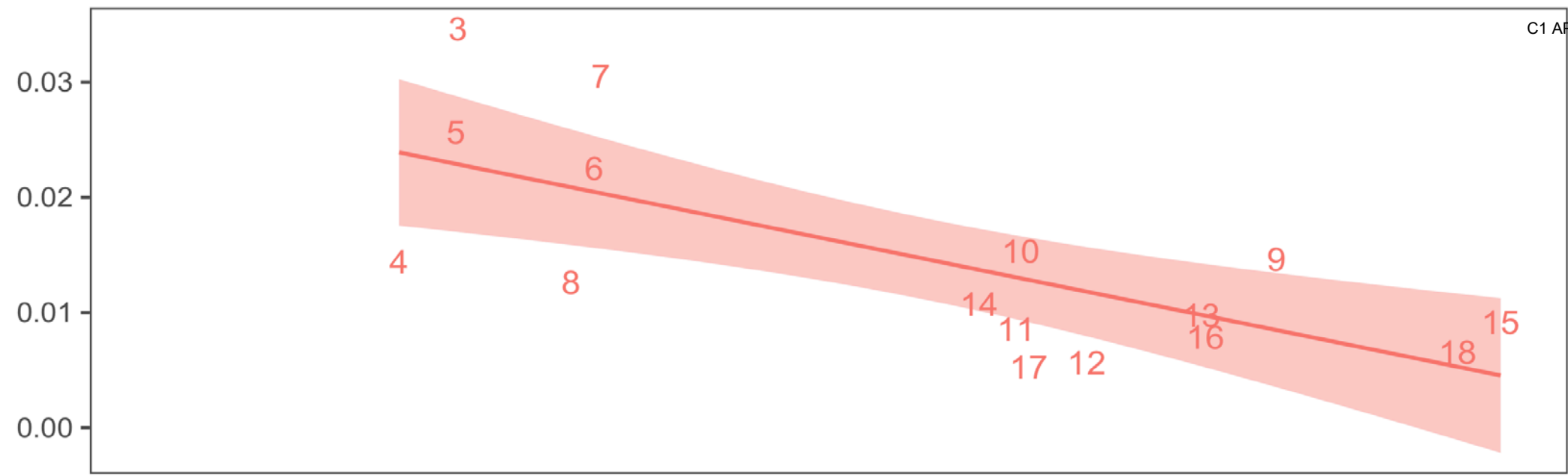


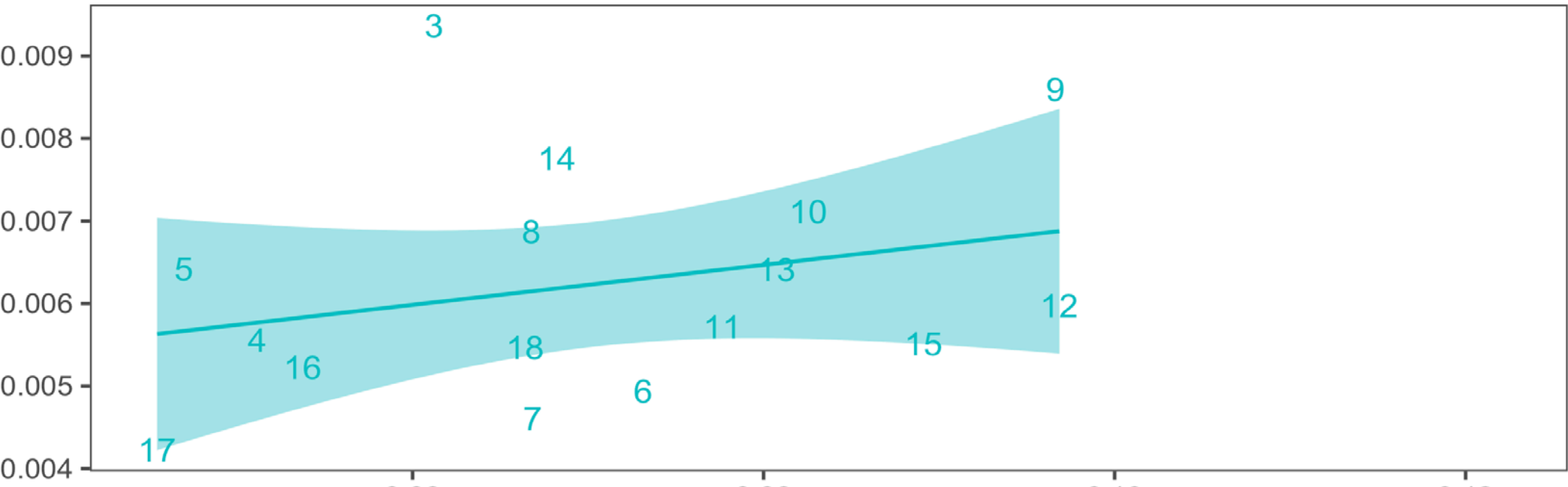
Fig 3-49 Page 149

Halibut PSC catch / Groundfish catch



Species
NRS
YFS

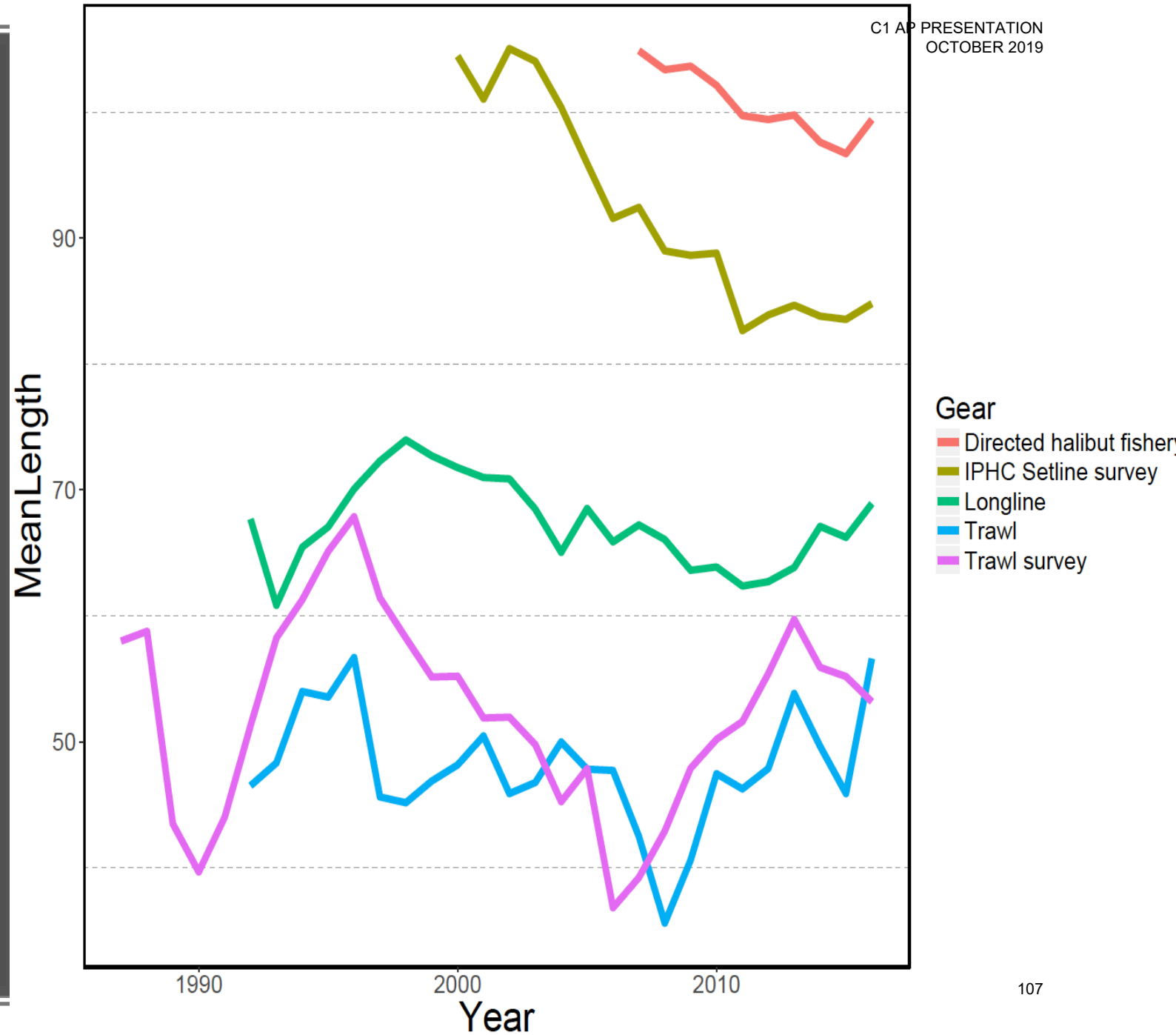
Halibut PSC catch / Groundfish catch



NMFS BTS halibut biomass / BTS species biomass

Mean Pacific halibut lengths by gear

Fig 3-51
Page 151



Pacific Halibut catch A80

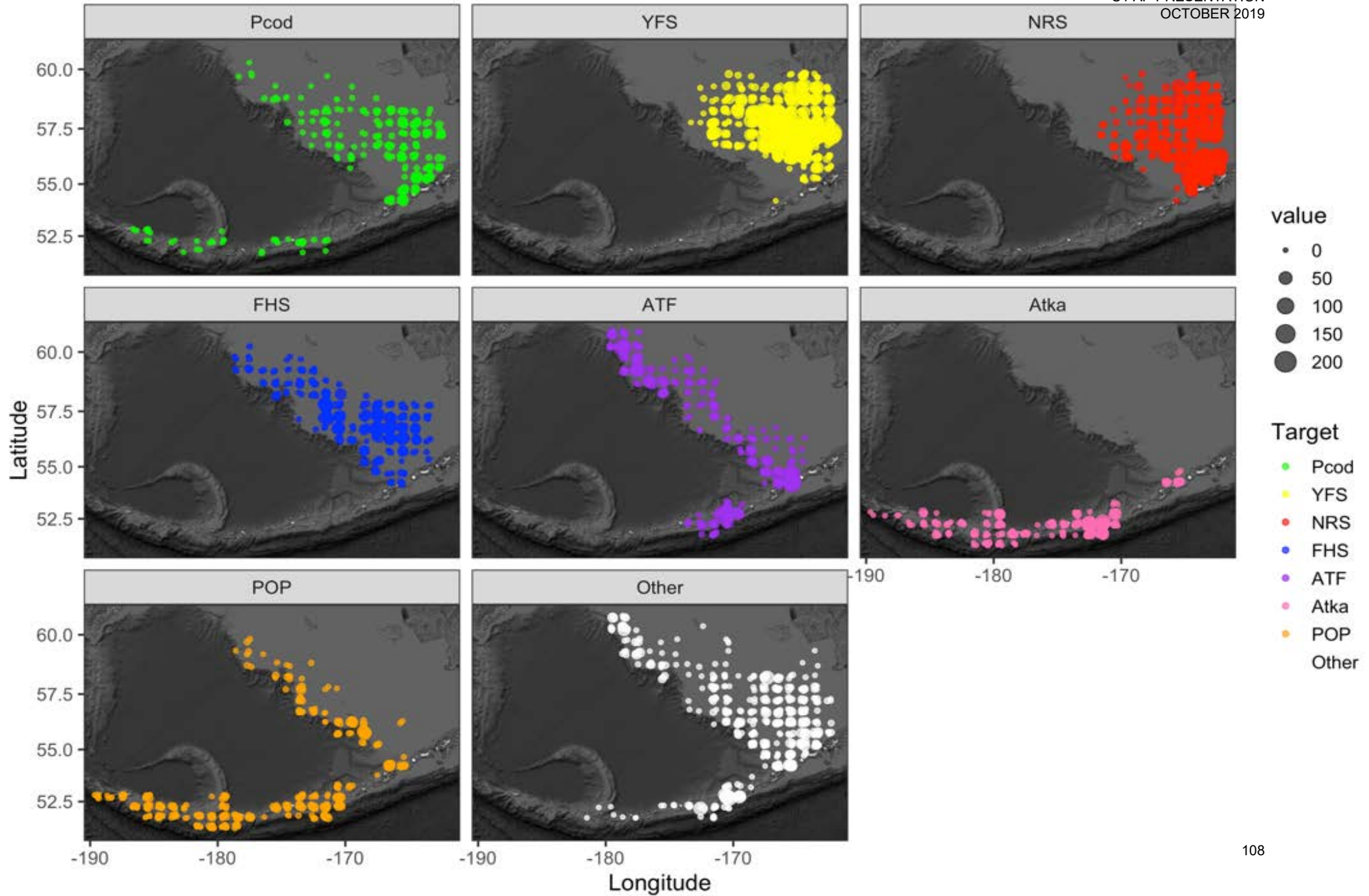


Fig 3-54
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Pacific Halibut catch A80

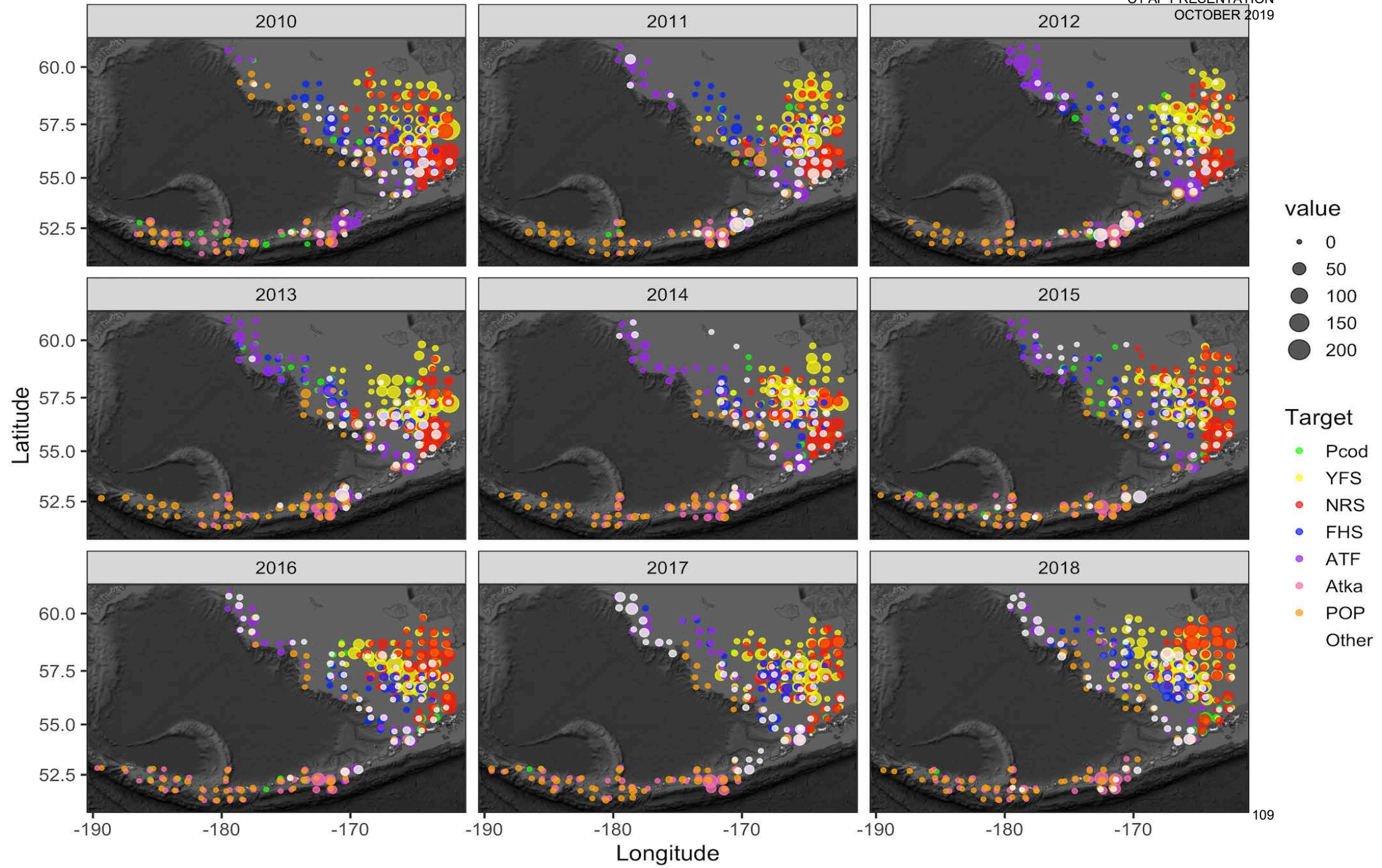
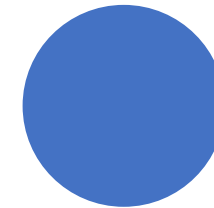


Fig 3-57
Page 157

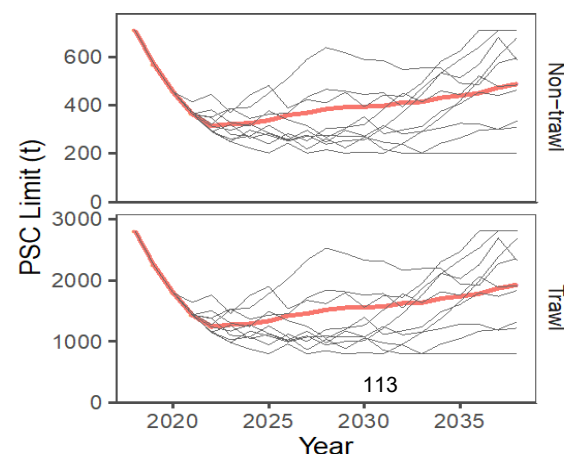
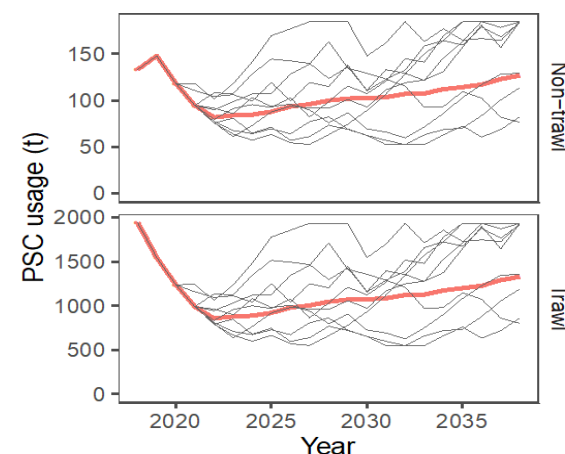
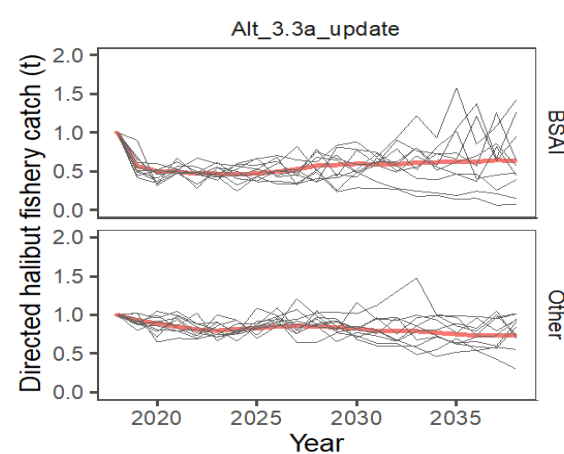
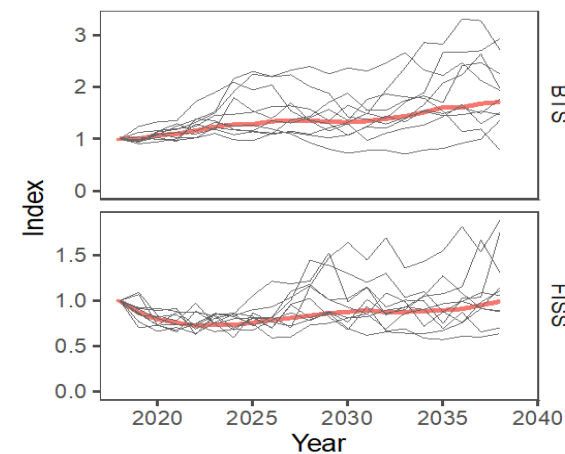
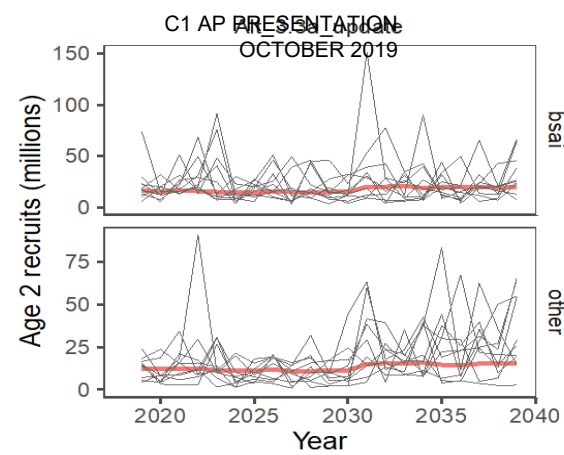
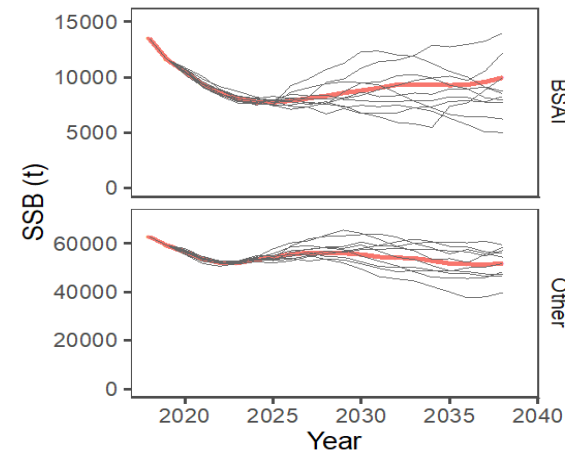
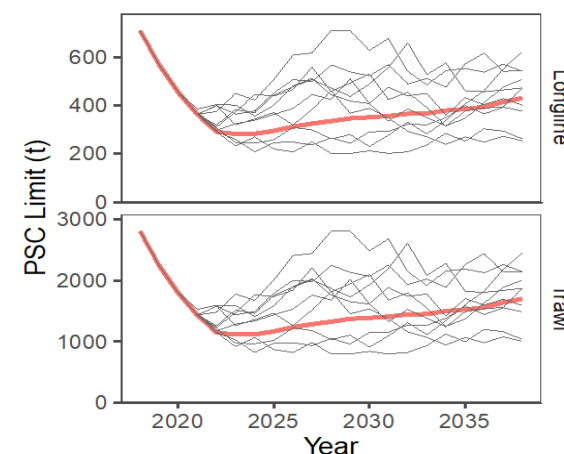
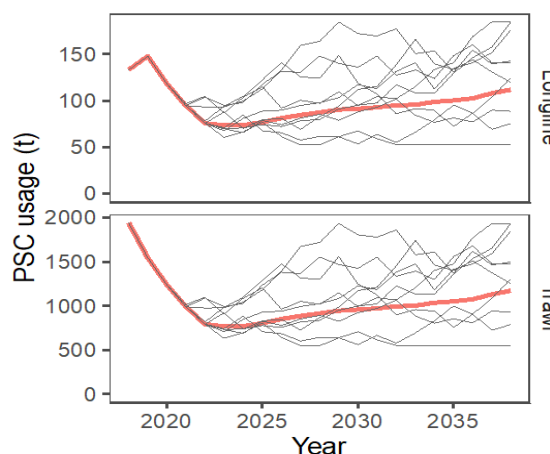
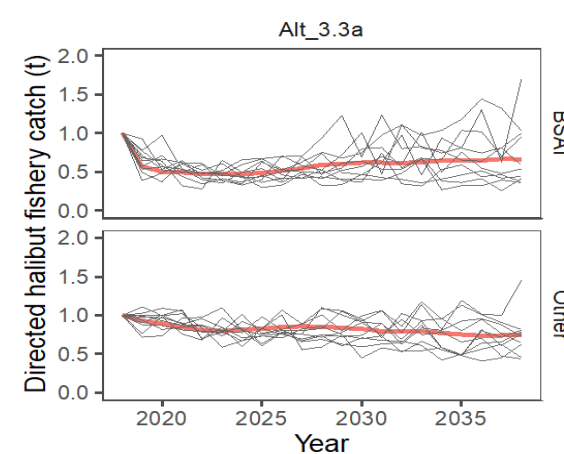
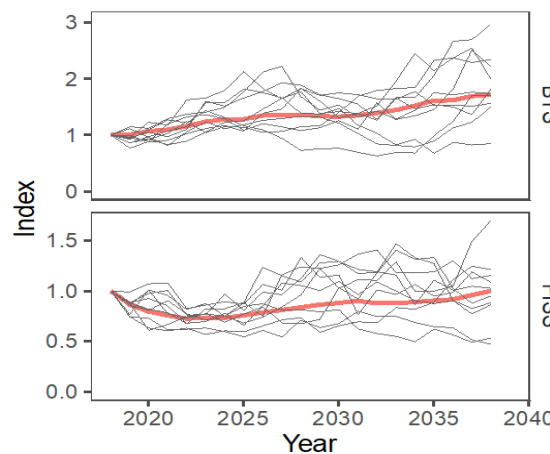
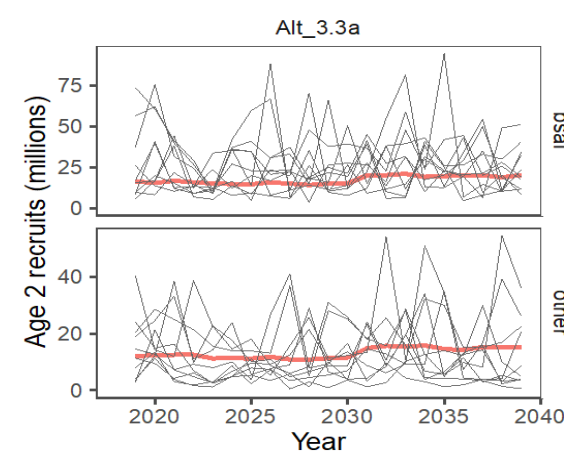
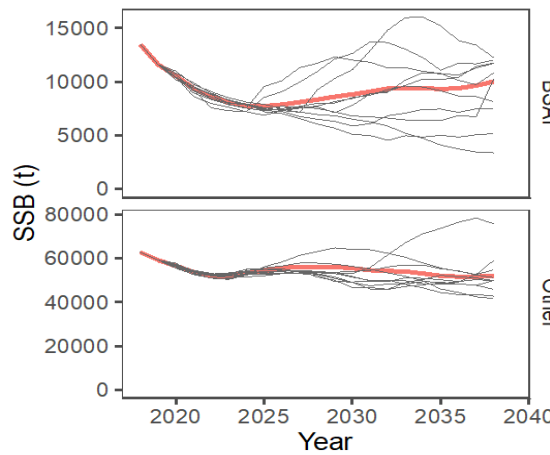
- Bycatch variable in space and time

Summary

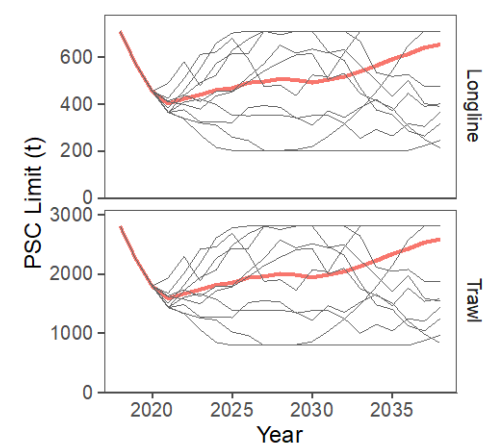
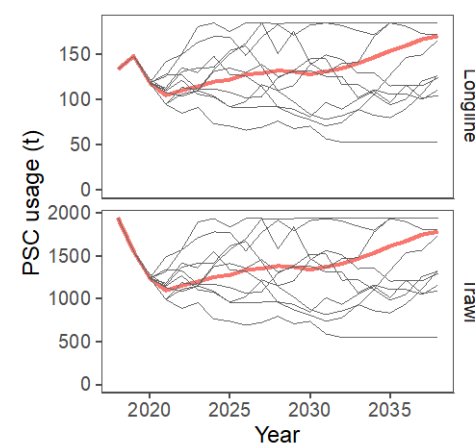
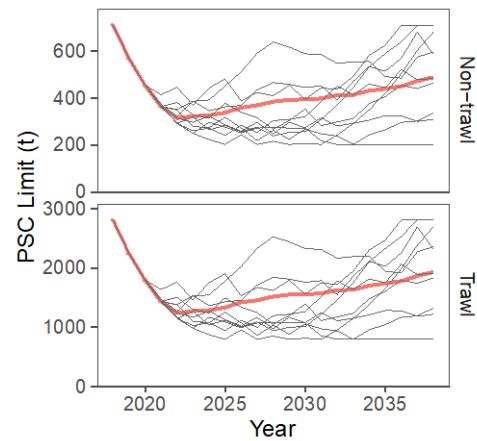
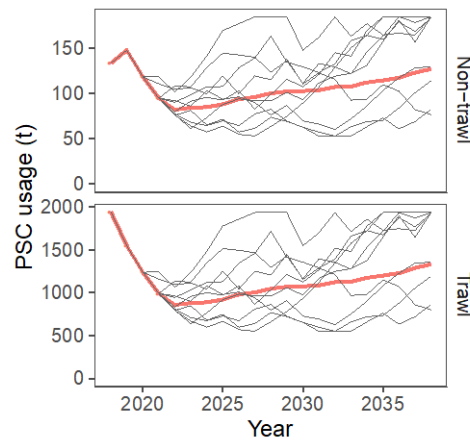
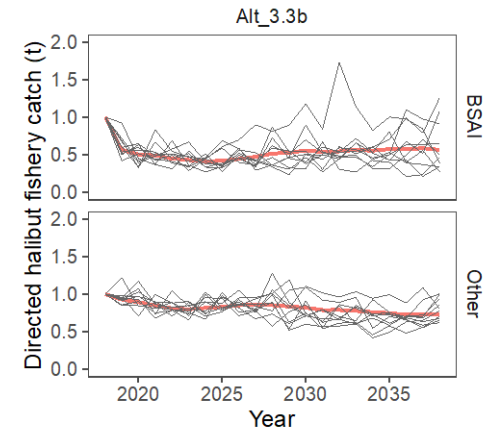
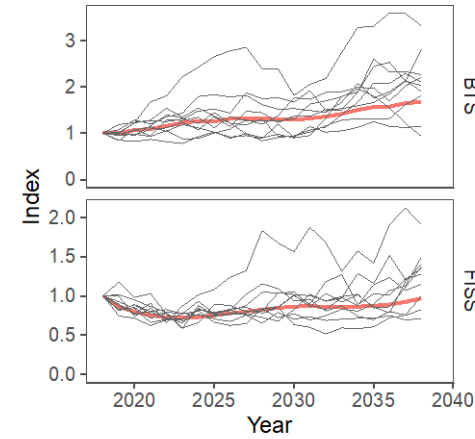
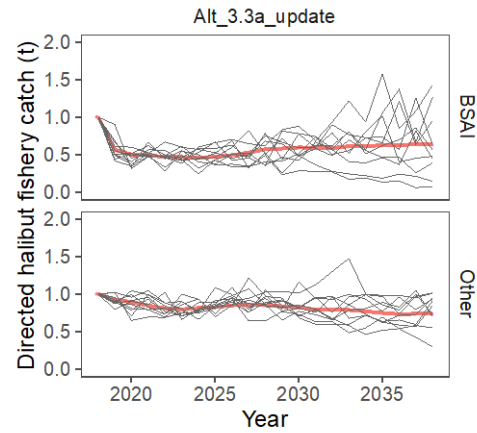
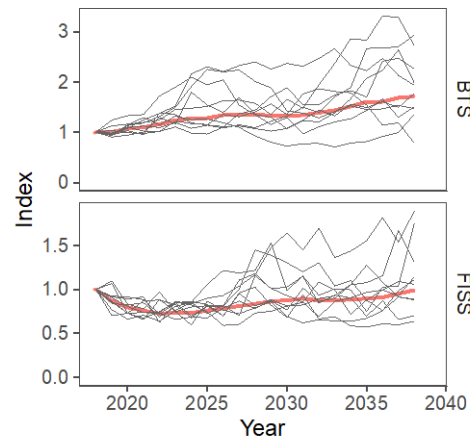
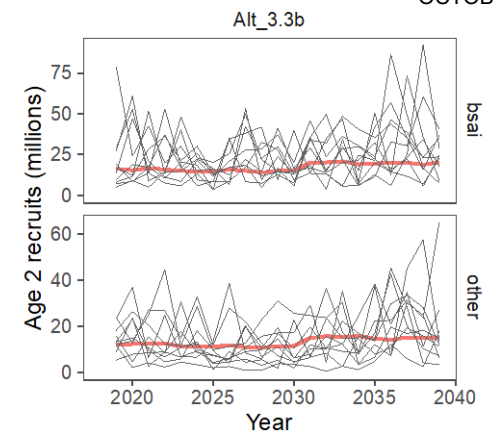
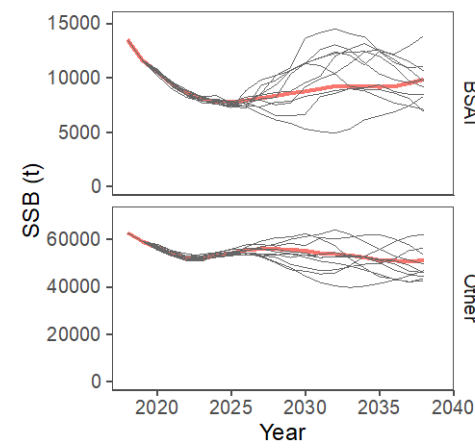
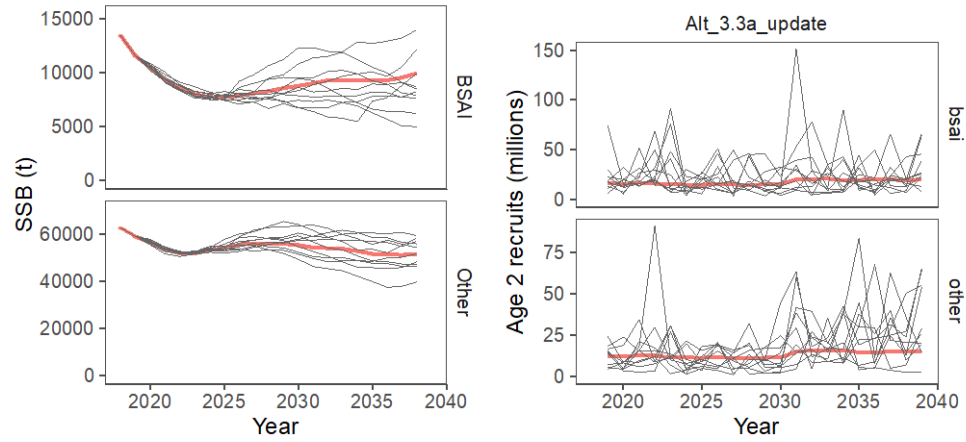


Additional questions?

Results of simulation modeling (Appendix)



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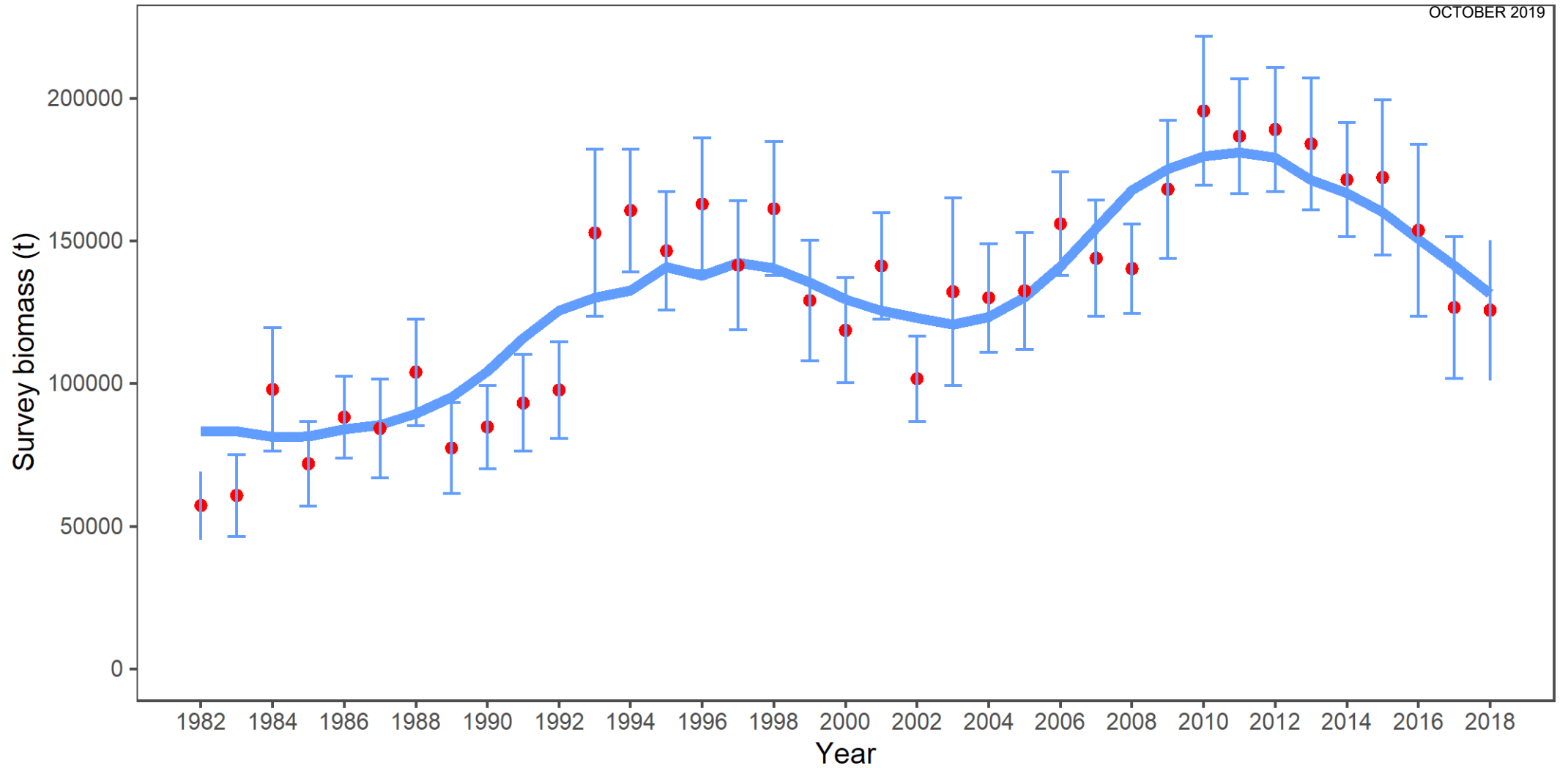


Figure A3-2. The BSAI sub-model (thick blue line) conditioned to fit to the observed BTS biomass index (red dots). Vertical lines show 95% asymptotic intervals about the observed BTS biomass index point estimates.

EBS_BTS index age composition data

(Sub-model for BTS data)

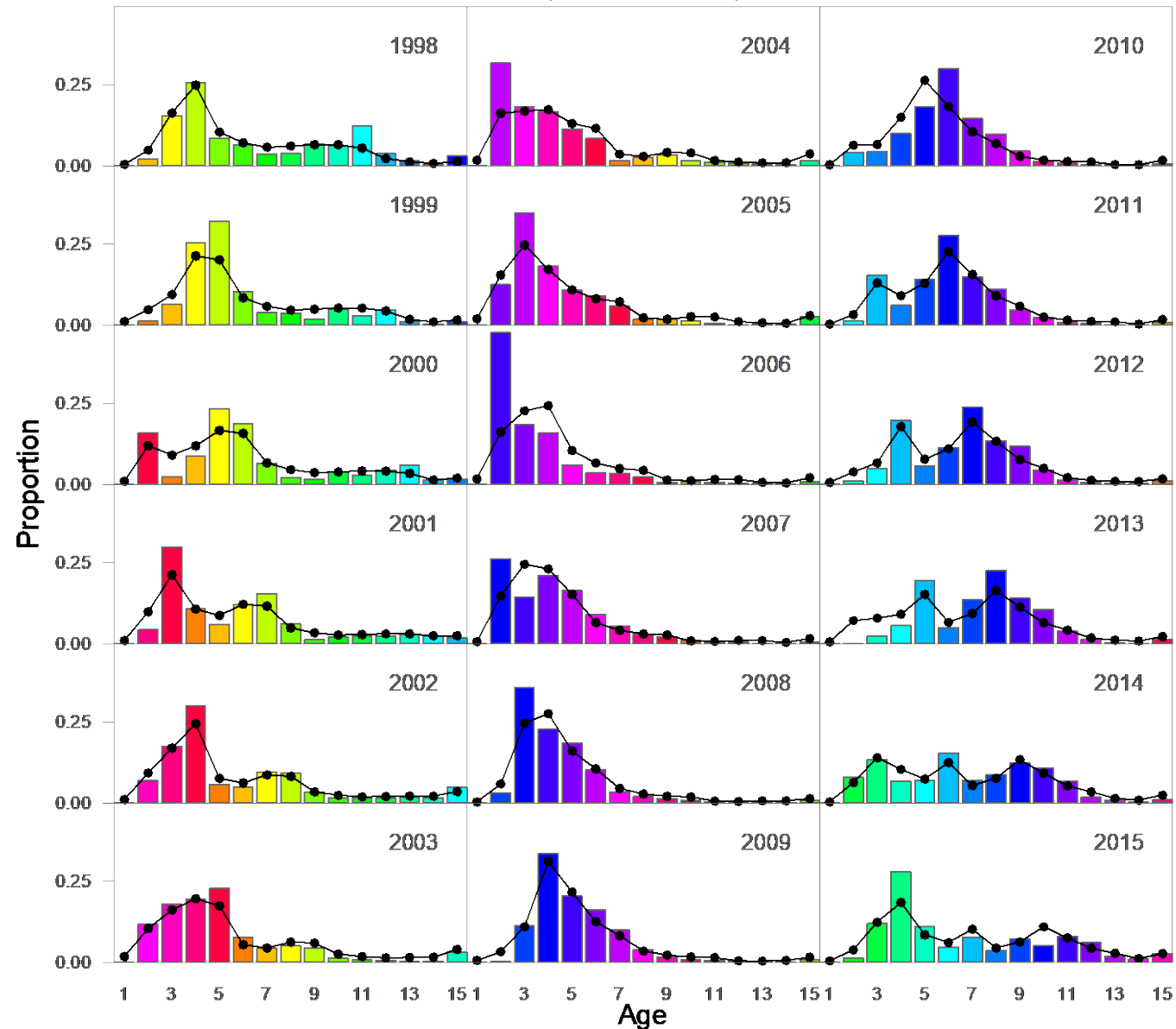


Figure A3-3. The BSAI sub-model conditioned to fit the available yearly BTS age composition data (data are shown as the multi-color frequency histogram, model fits to data are indicated by black dots and line).

PSC limits are (mostly) correlated to halibut biomass

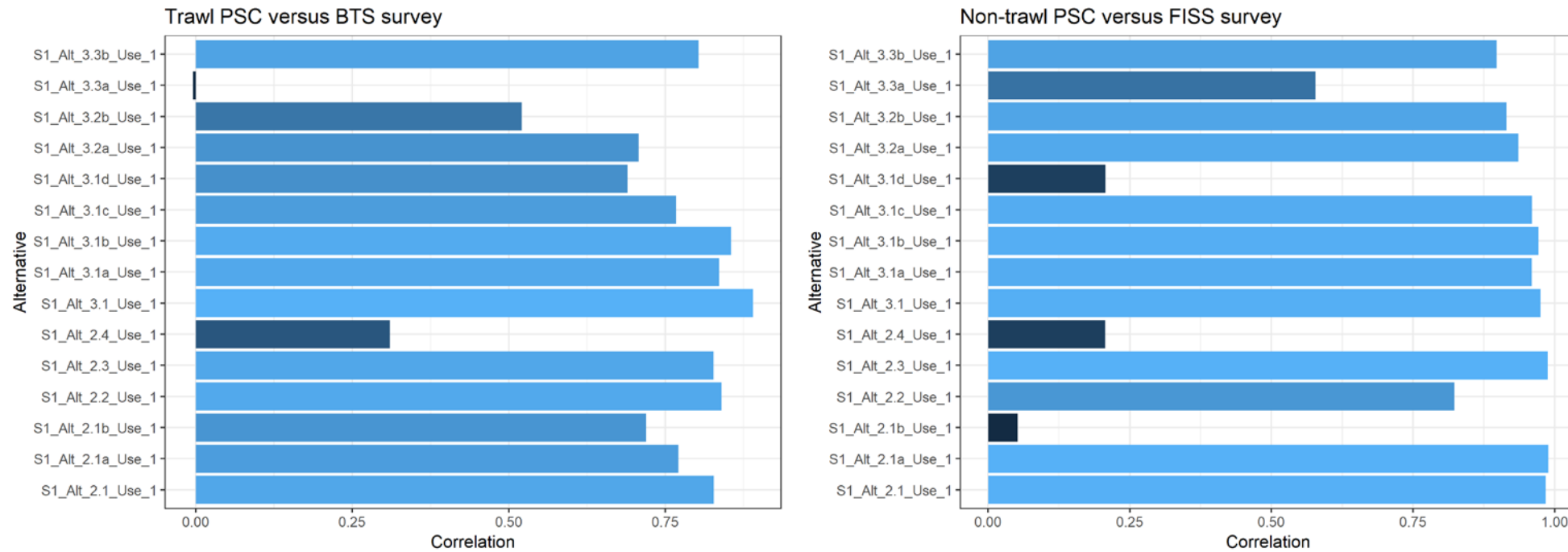
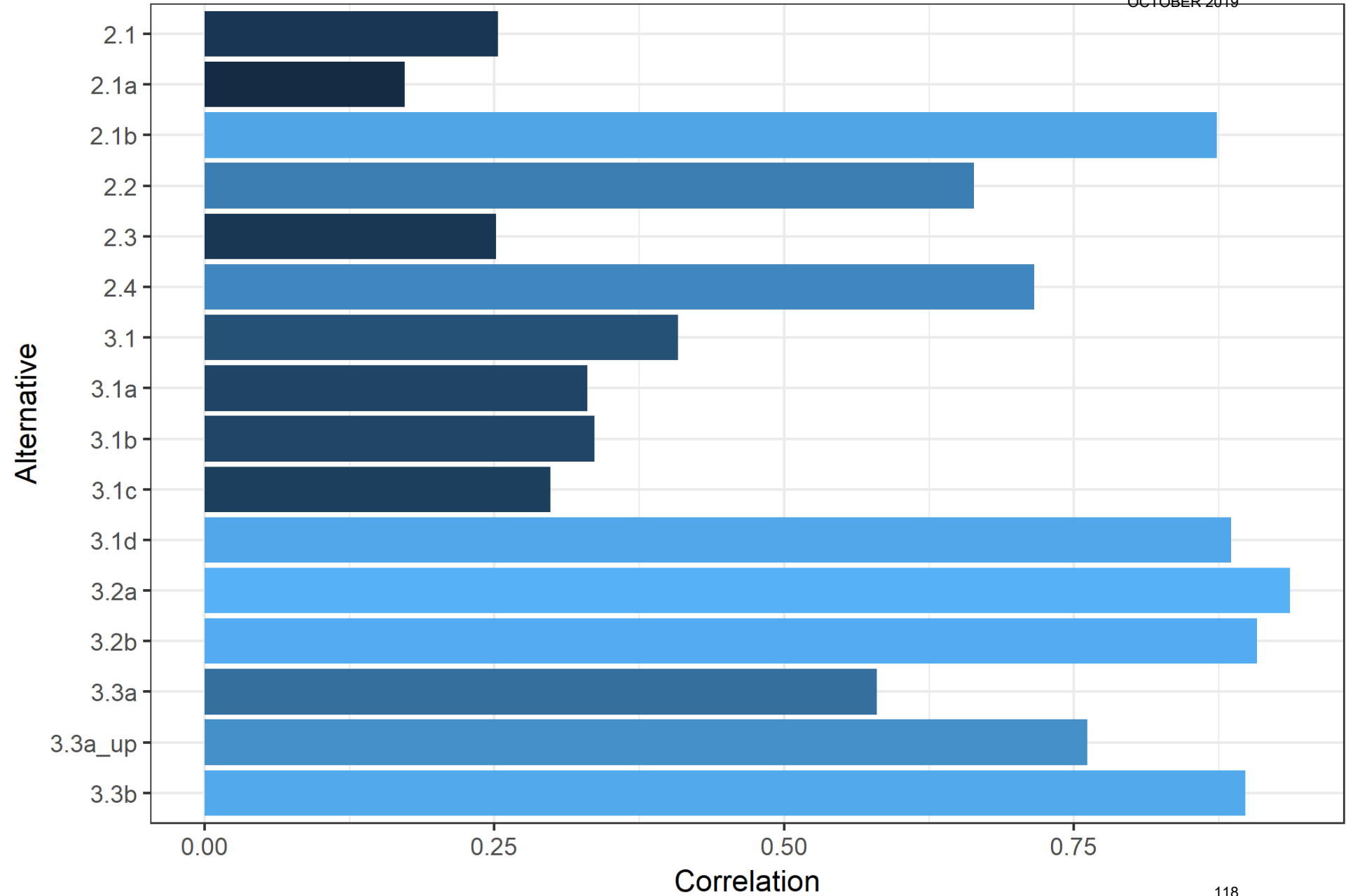


Figure 6-8. Correlations of PSC limits with their respective gear type indices across alternatives for the trawl fishery (left) and the non-trawl fishery (right).

Trawl PSC versus FISS survey



How do they correlate to the opposite survey?

Non-trawl PSC versus trawl survey

How do they correlate to the opposite survey?

