C-1 BSAI Halibut Abundance Based Management (ABM)

Council presentation

Homer, AK

October 3, 2019

Inter-Agency Working Group

- Council Staff
- NOAA Alaska Fisheries Science Center
- International Pacific Halibut Commission
- NMFS Alaska Regional Office

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

BSAI FMP (1981)
Prohibit halibut retention

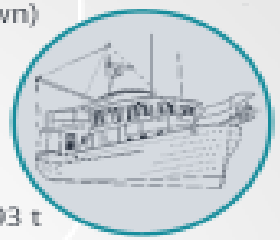
PSC limit for foreign vessels closes Winter Halibut Savings Area

1993 Trawl = 3,775 t
Non-Trawl = 900 t
(triggers fisheries, not area closures)

CDQ receives 7.5% PSC apportionment

A80 - 2008
A80 PSC limits 2,525 (Steps down)
↓ 2009 → 2,475 t
↓ 2010 → 2,425 t
↓ 2011 → 2,375 t
↓ 2012 → 2,325 t

TLAS 875 t CDQ (after 2010) 393 t



Oct 2019

Halibut ABM multiple discussion papers 2016-2019
Initial review Oct 2019

1980 | 1990 | 2000 | 2010 | 2020

1987-1992
PSC limits (foreign and domestic) established and revised, Zone 1closure

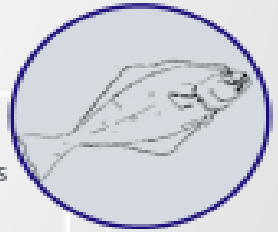
NMFS hot spot authority

Trawl PSC reduced to 3,675 mt

PSC limits respecified In mortality, not catch

A111 2016
Decreased PSC limits for all sectors

• A80	1,745 t	(↓ 25%)
• TLAS	745 t	(↓ 15%)
• Non-Trawl	710 t	(↓ 15%)
• CDQ	315 t	(↓ 20%)



Council signals intent to consider Abundance Based Management (ABM) of BSAI halibut PSC

Foreign to Domestic Fisheries Prohibited species defined

Development of AFA, CDQ, & Halibut/Sablefish IFQ programs

Development of A80

Increased emphasis on bycatch reduction programs A91 Chinook & A111 Halibut

Focus of discussion paper reviews

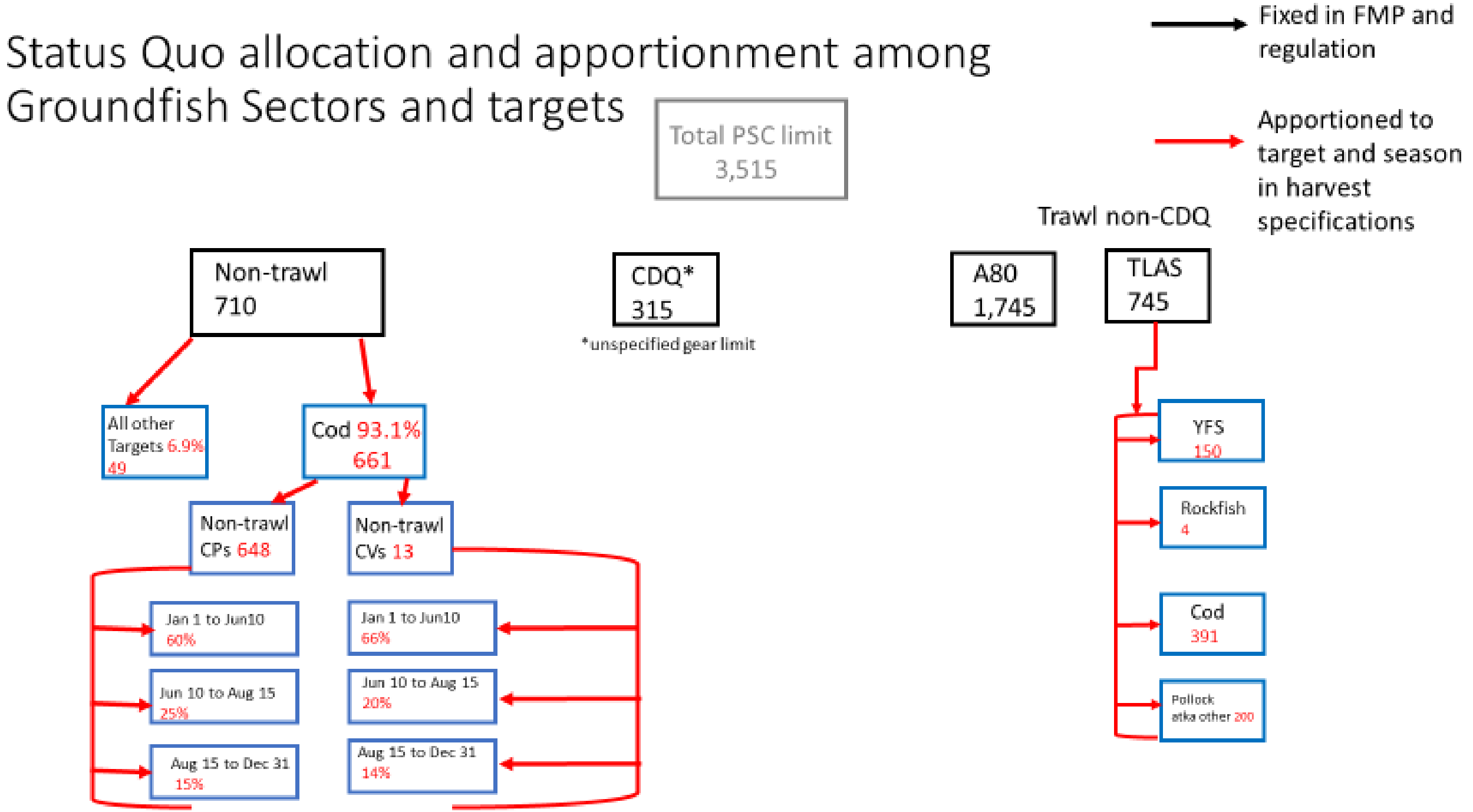
- Indices
- Control rules
- Alternative
- Performance metrics

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



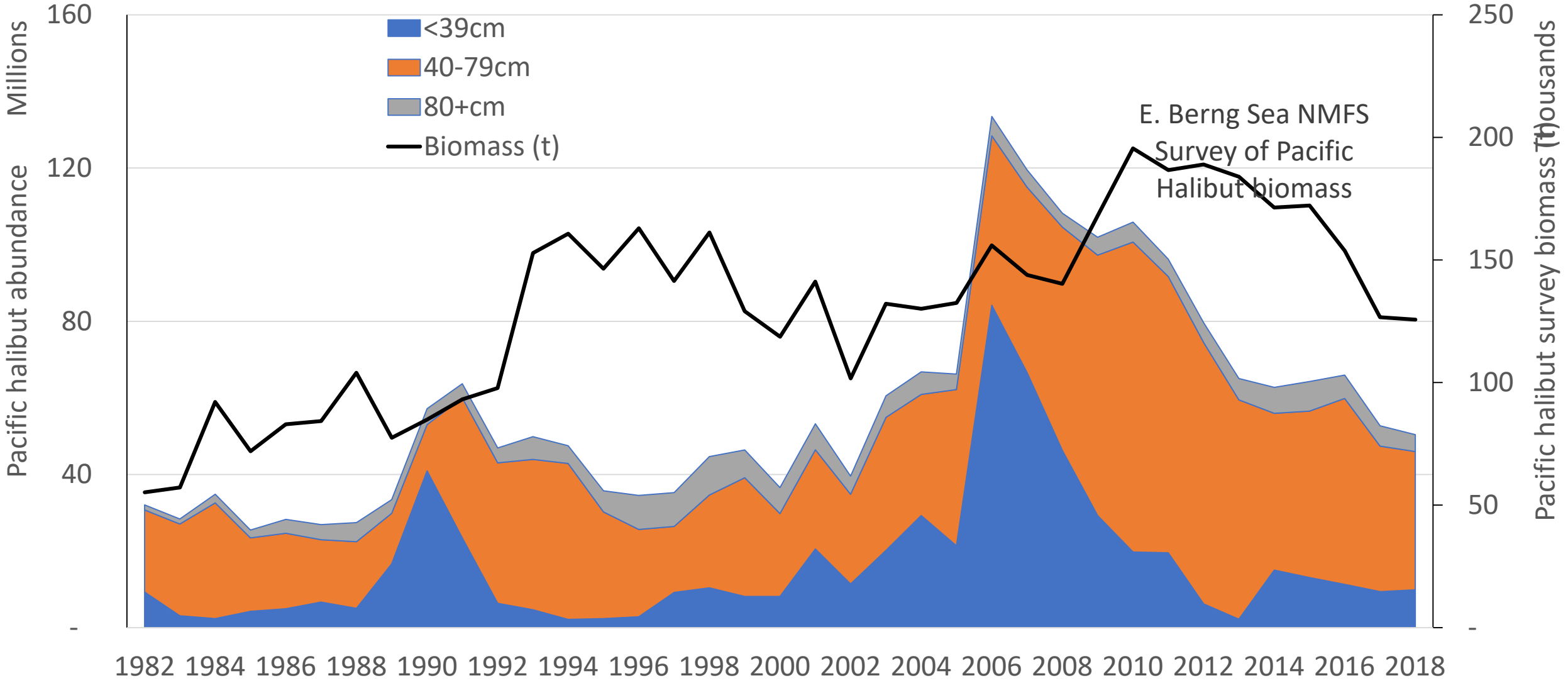
Indices to make Pacific halibut PSC based on abundance…

for

Alternatives 2 and 3

Fig 1-5

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



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

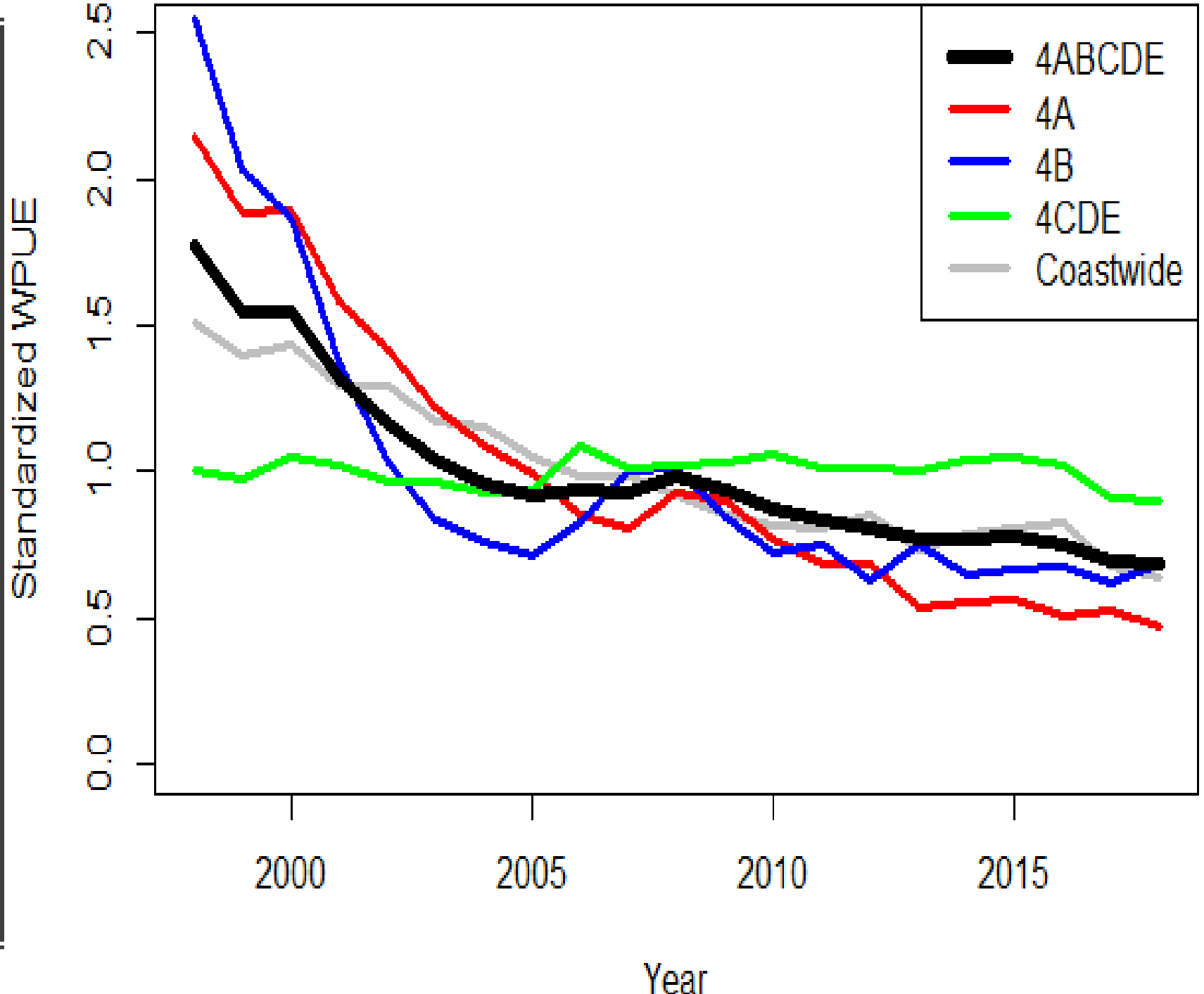
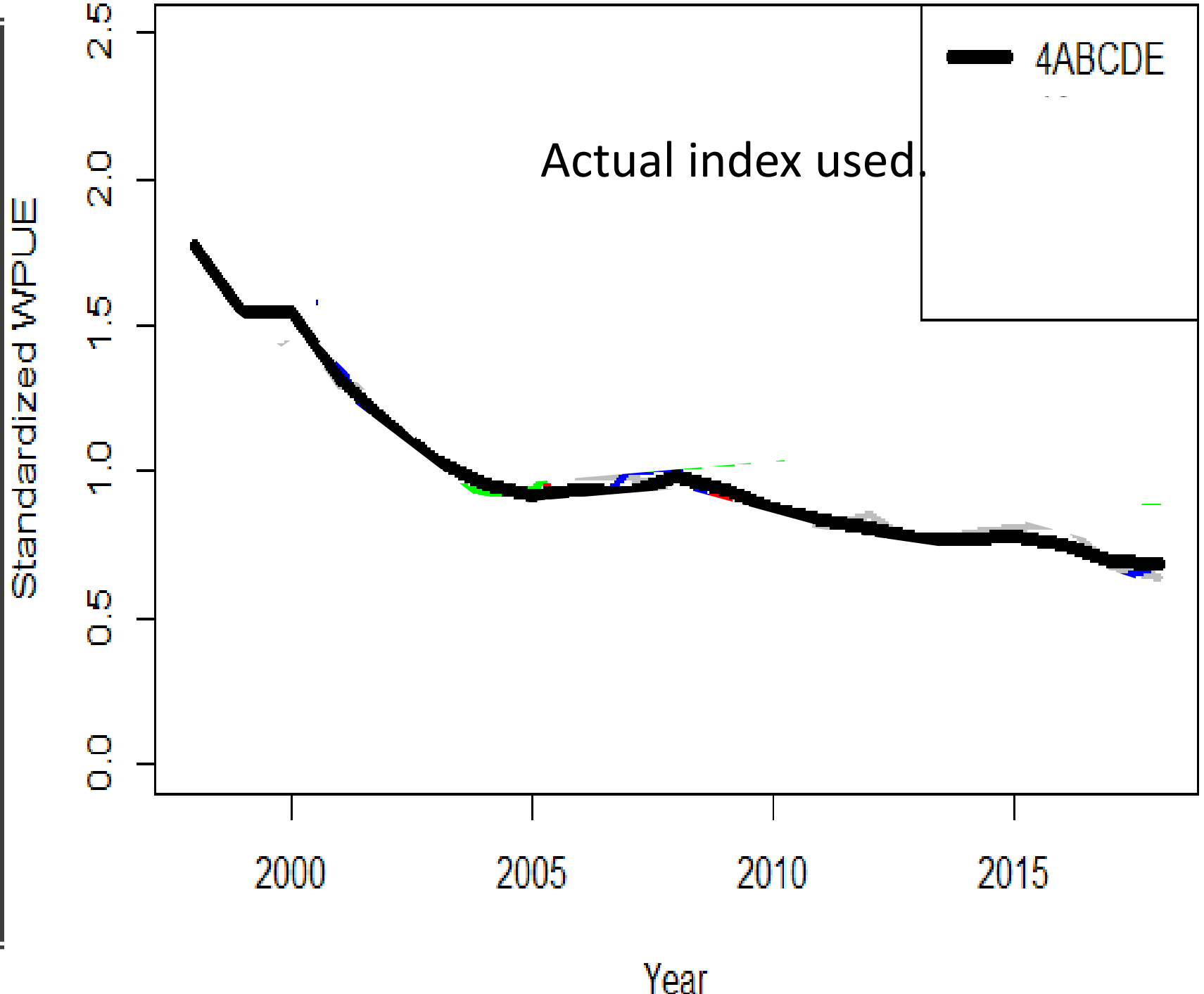
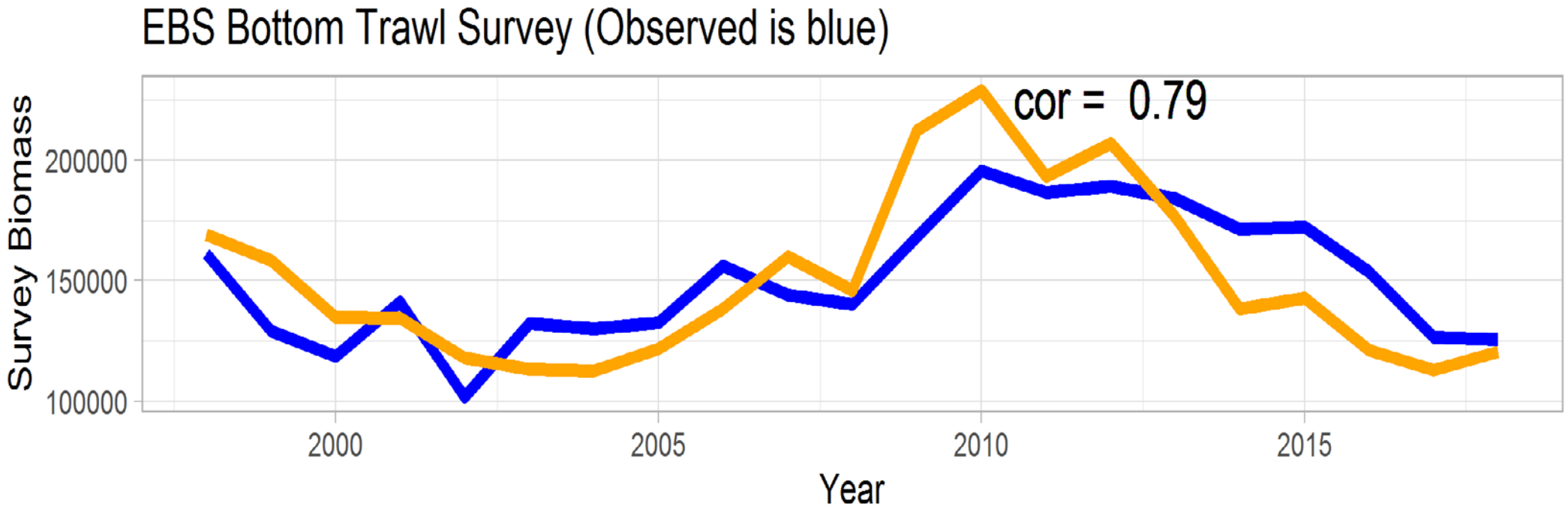


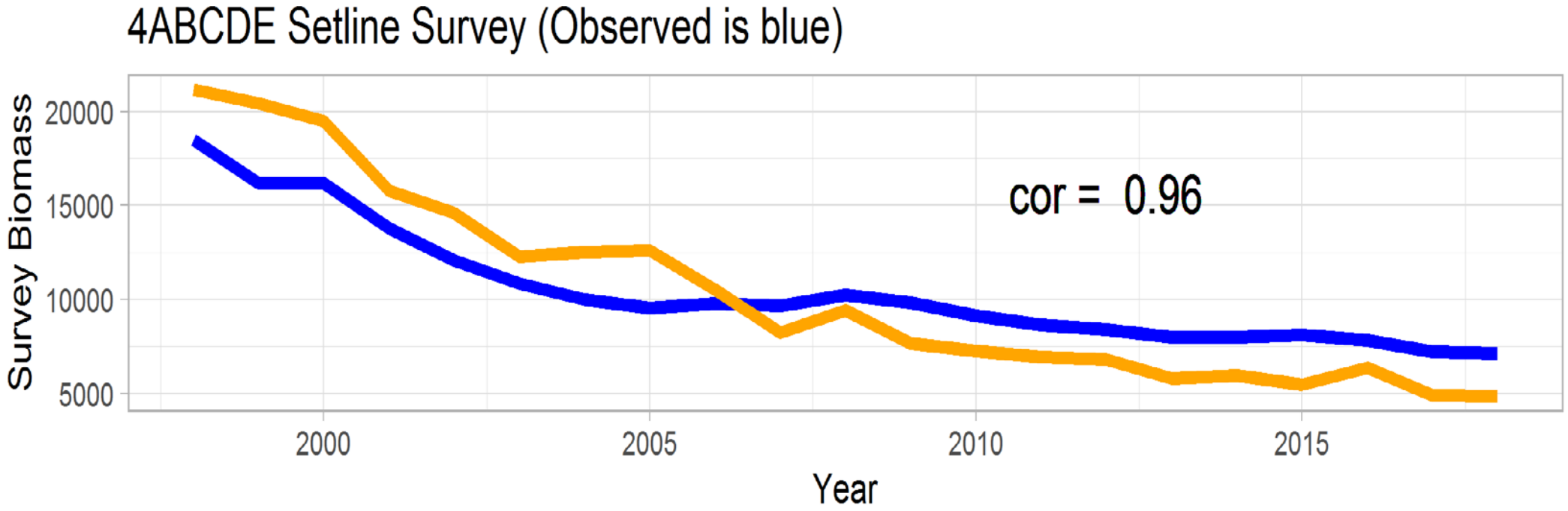
Figure 1-7 IPHC Setline survey WPUE all Pacific halibut (Total) for IPHC Regulatory Areas in Area 4 standardized to the mean of the time series (1998-2017) for each Area



Bottom Trawl Survey

Setline survey

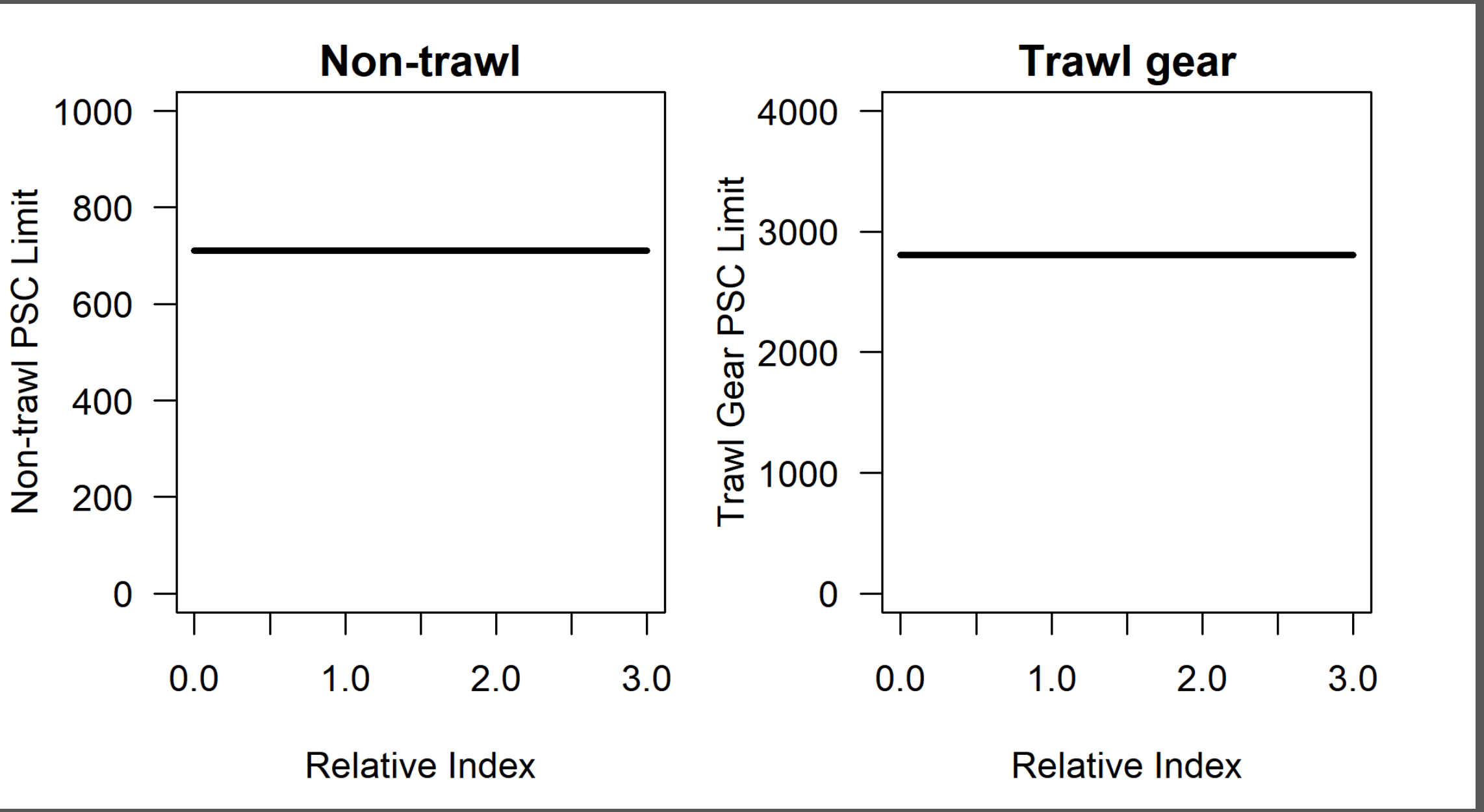


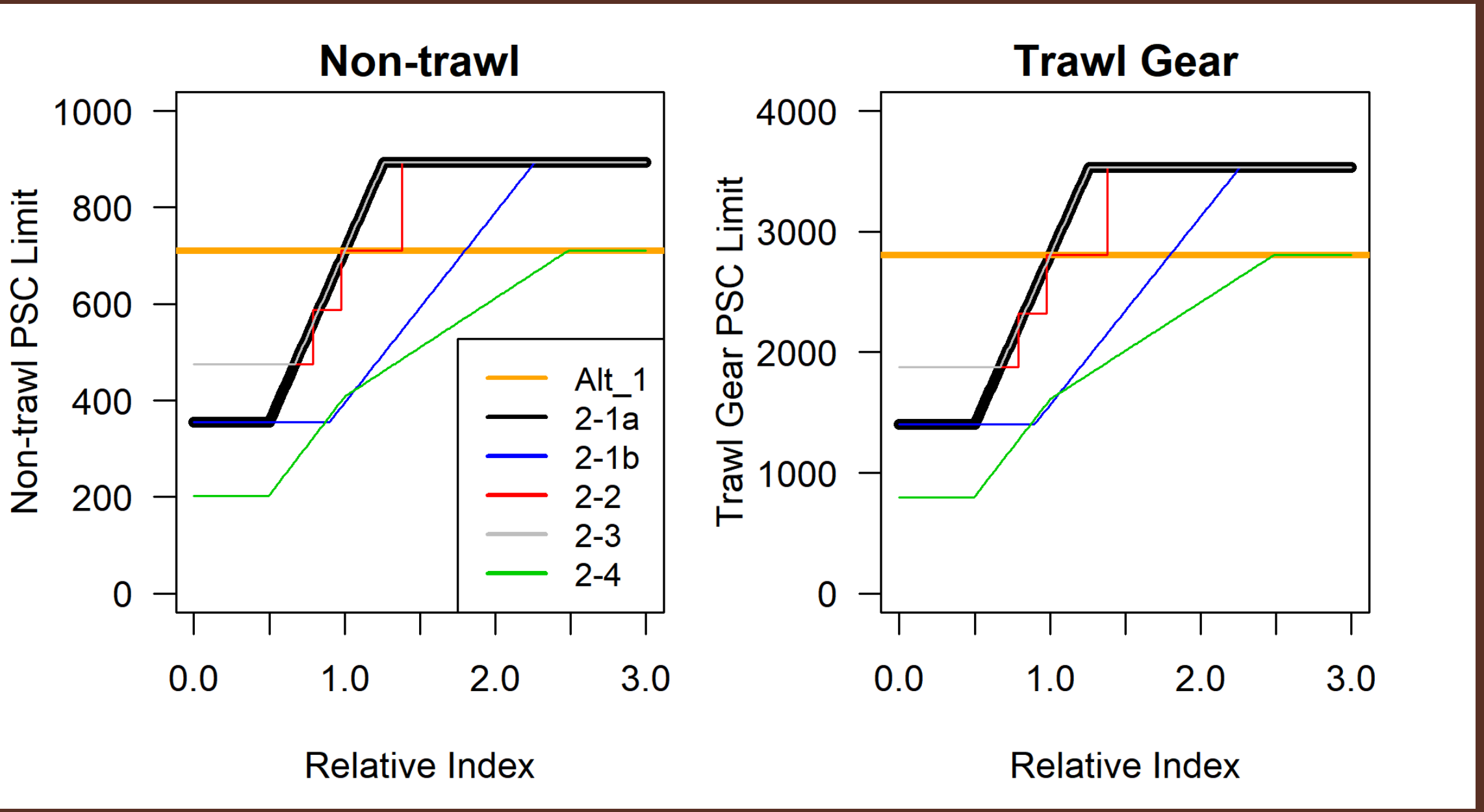


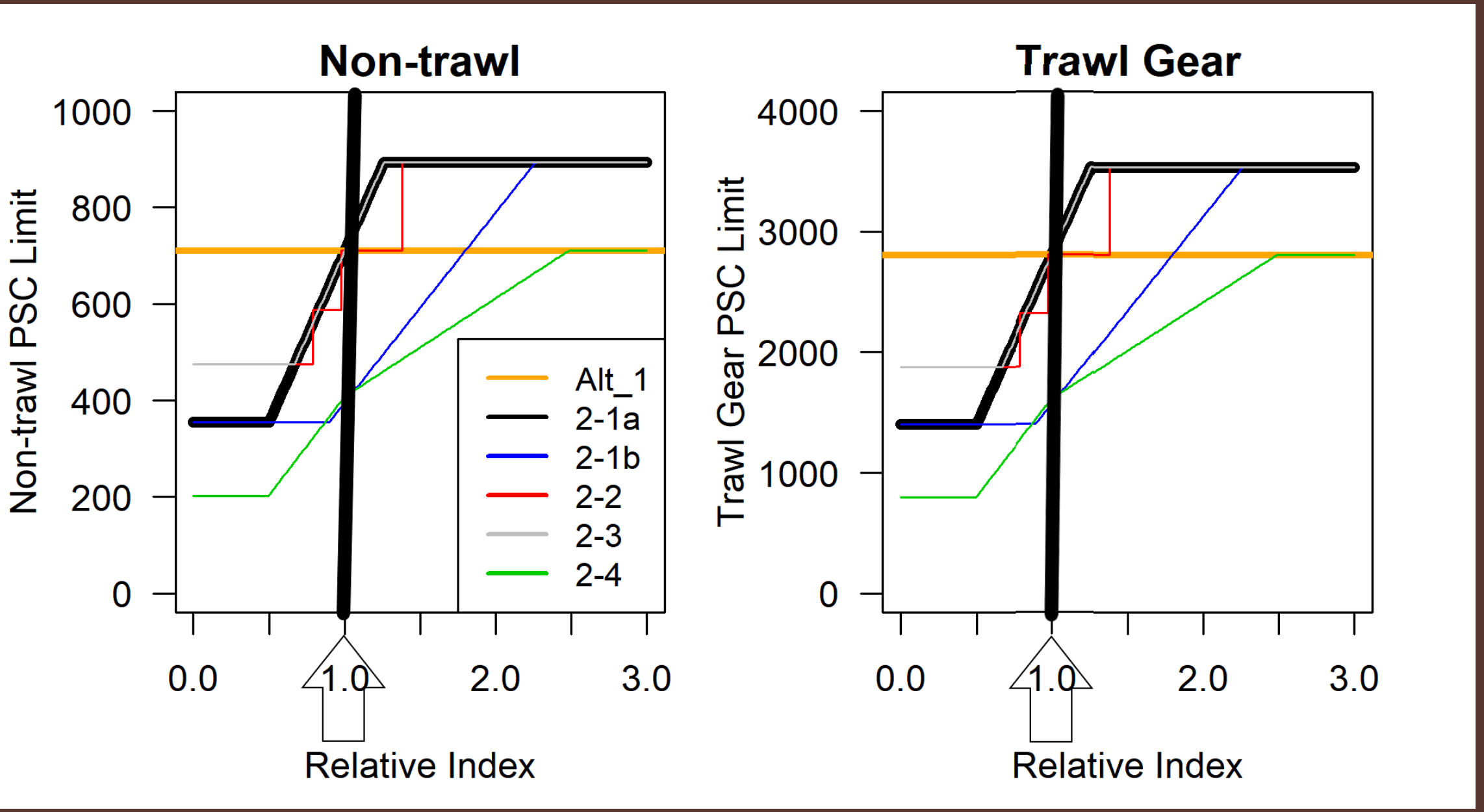
Alternatives 2 and 3

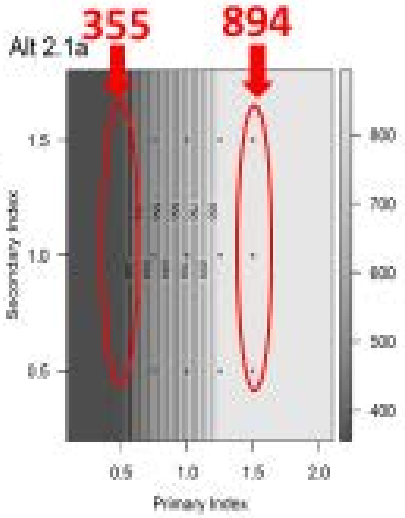
Alternative	Primary index	Secondary index	Standardization
2	Trawl or Setline	none	2018 (default); 2 year average
3	Trawl or Setline	Trawl or Setline	Primary: 2018 (default); 2 year average Secondary: mean or 2018

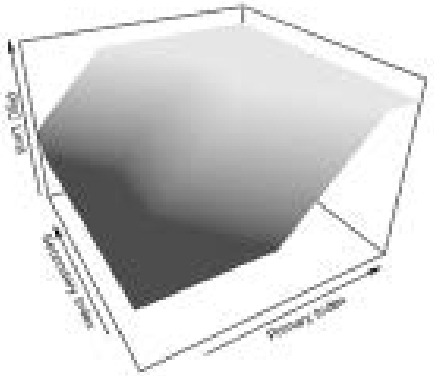
Element	Description	Range	Optional?
1	Starting Point	1,958-3,515 t	No
2	Ceiling	3,515-4,426 t	No
3	Floor	1,000-2,354 t	No
4	Breakpoint	Breakpoint occurs when index value is greater than or less than one of the 2 values below: 25% average of index or average value of index	Yes For Alt 2 No for Alt 3 (unless 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

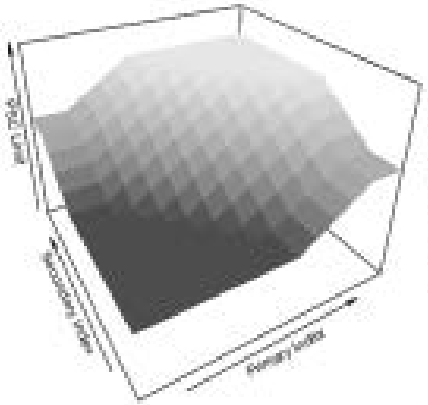

Non-trawl
Non-trawl PSC Limit
1000
800
600
400
200
0
0.0
1.0
2.0
3.0
Relative Index
Trawl gear
Trawl Gear PSC Limit
4000
3000
2000
1000
0
0.0
1.0
2.0
3.0
Relative Index

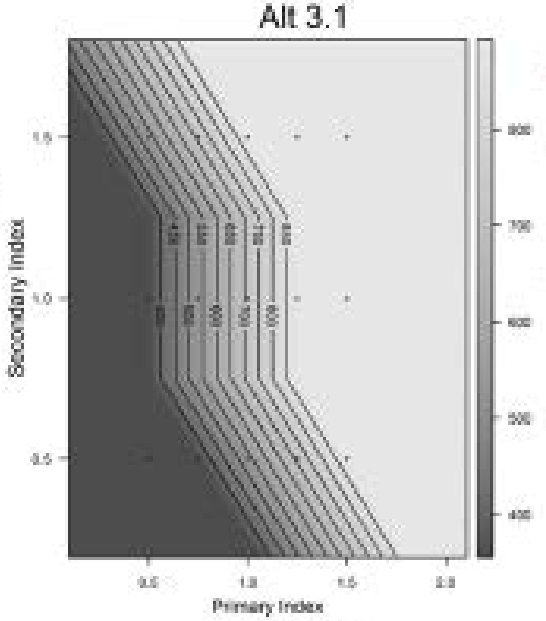

Non-trawl
Non-trawl PSC Limit
1000
800
600
400
200
0
0.0
1.0
2.0
3.0
Relative Index
Alt_1
2-1a
2-1b
2-2
2-3
2-4
Trawl Gear
Trawl Gear PSC Limit
4000
3000
2000
1000
0
0.0
1.0
2.0
3.0
Relative Index

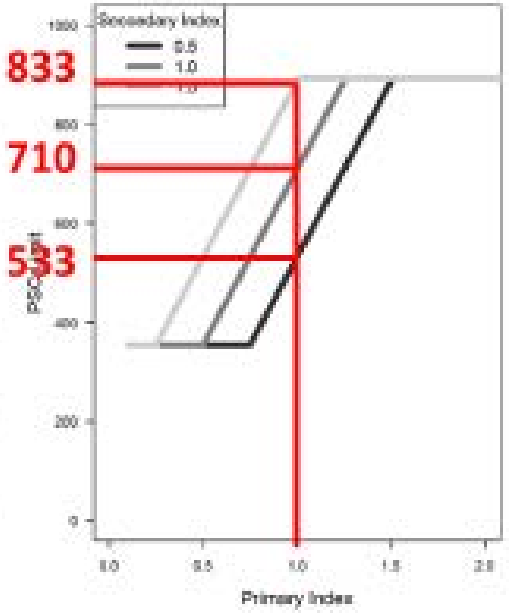

Non-trawl
Non-trawl PSC Limit
1000
800
600
400
200
0
0.0
1.0
2.0
3.0
Relative Index
Alt_1
2-1a
2-1b
2-2
2-3
2-4
Trawl Gear
Trawl Gear PSC Limit
4000
3000
2000
1000
0
0.0
1.0
2.0
3.0
Relative Index

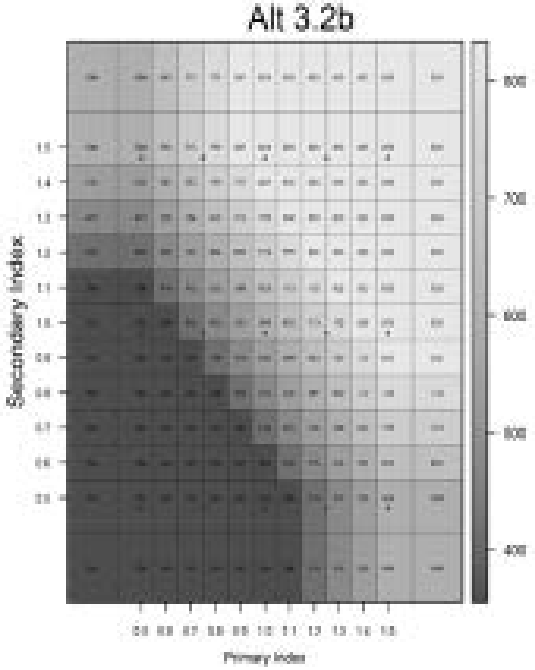

Alt 2.1a
355
894
Secondary Index
Primary Index

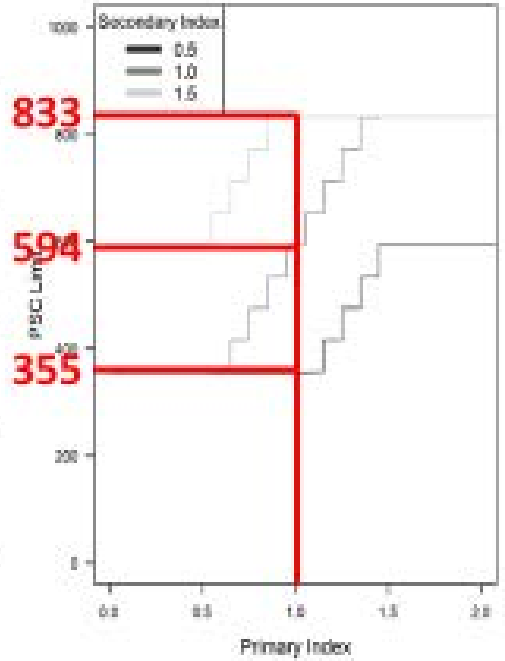





Alt 3.1
Secondary Index
Primary Index


Secondary Index
0.5
1.0
833
710
533
Primary Index


Alt 3.2b
Secondary Index
Primary Index


Secondary Index
0.5
1.0
1.5
833
594
355
Primary Index

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

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

The index was standardized in our Alternative but not in the proposal

	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	Setline for total	Trawl survey for trawl Setline for non-trawl	Primary: Standardize 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	0	Total: 1,000 t	4: 1,000 t	Trawl: 798 t Non-trawl: 202 t Total: 1,000 t

The intent was to use only setline

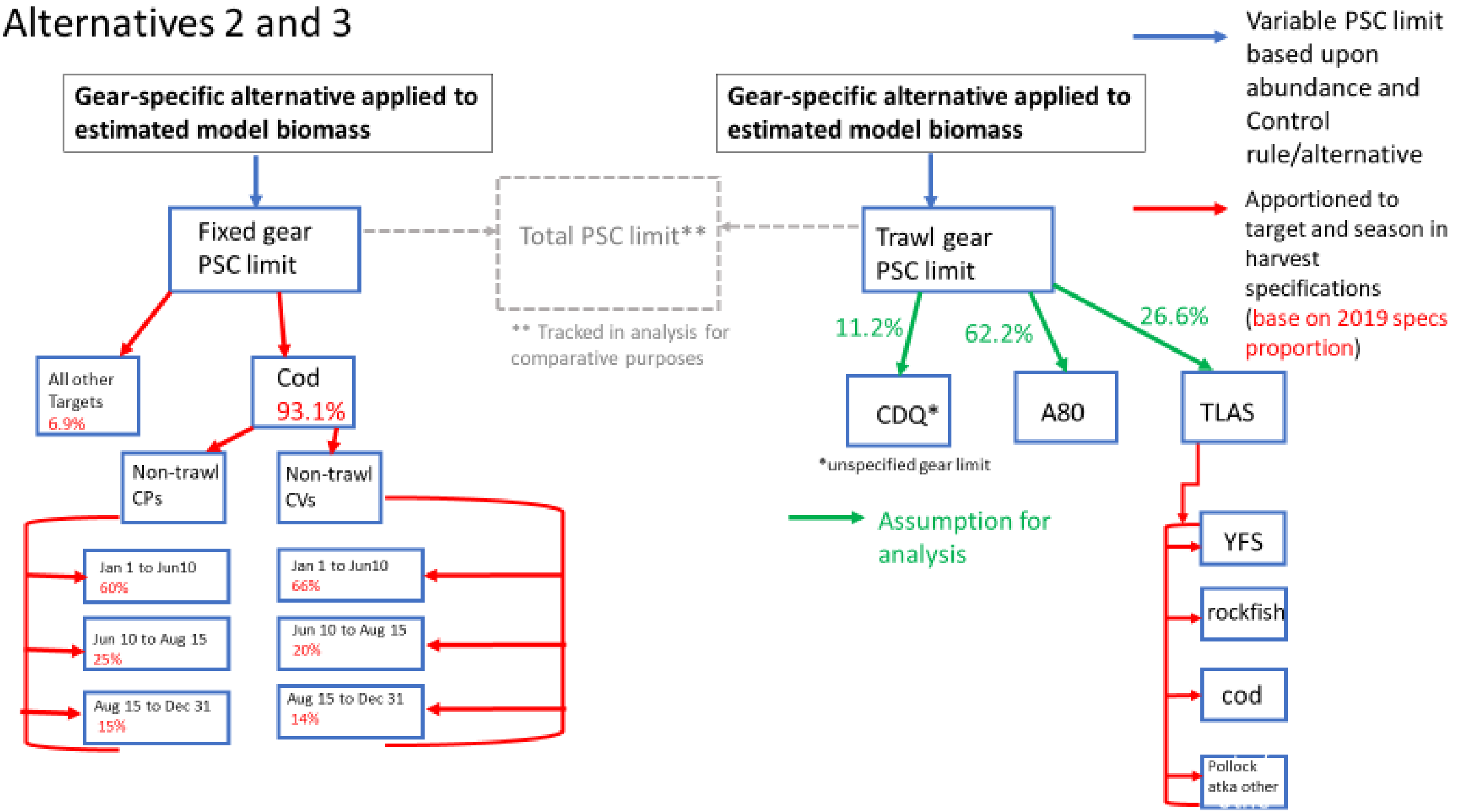
The intent post-meeting was to standardize the secondary index to current year

Additional fixed limits analyzed

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

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

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.

Revised Table 6-8

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)

	Trawl				Non-trawl (NT)		
PSC allocation %	**A80 62.3%**	**TLAS 26.6%**	**CDQ 11.1%**	**Trawl Total 100%**	**Cod 93.1%**	**Other 6.9%**	**NT Total 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

* 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).

Process for Specifying Limits Under Alternatives 2 & 3

September
EBS Trawl survey data available

IF PSC limits depend only on trawl survey

IF PSC limits depend on setline survey (only) OR w/ EBS Trawl

October
Proposed specifications including next years PSC limits
- Allocation to sector fixed in FMP & regs
- Appointment to target & seasons in proposed specs

October
Proposed specifications based on previous year's limits

November
IPHC survey data available PSC limits calculated based on IPHC survey or IPHC + Trawl

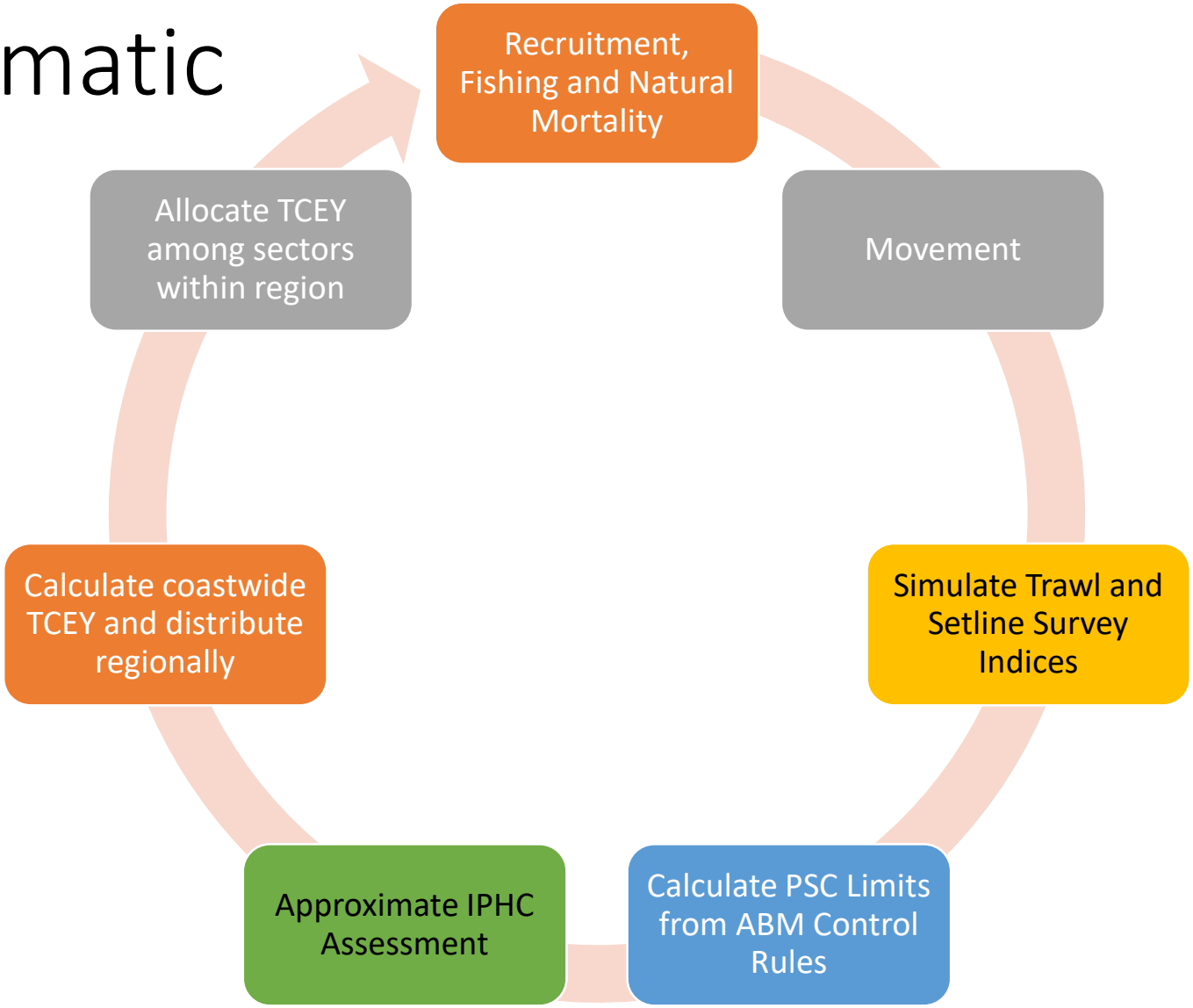
December Council
- Specifications set new PSC limits available

December Council
- Specifications set new PSC limits available
- Allocation to sector fixed in FMP & regs
- Appointment to target & seasons in proposed specs

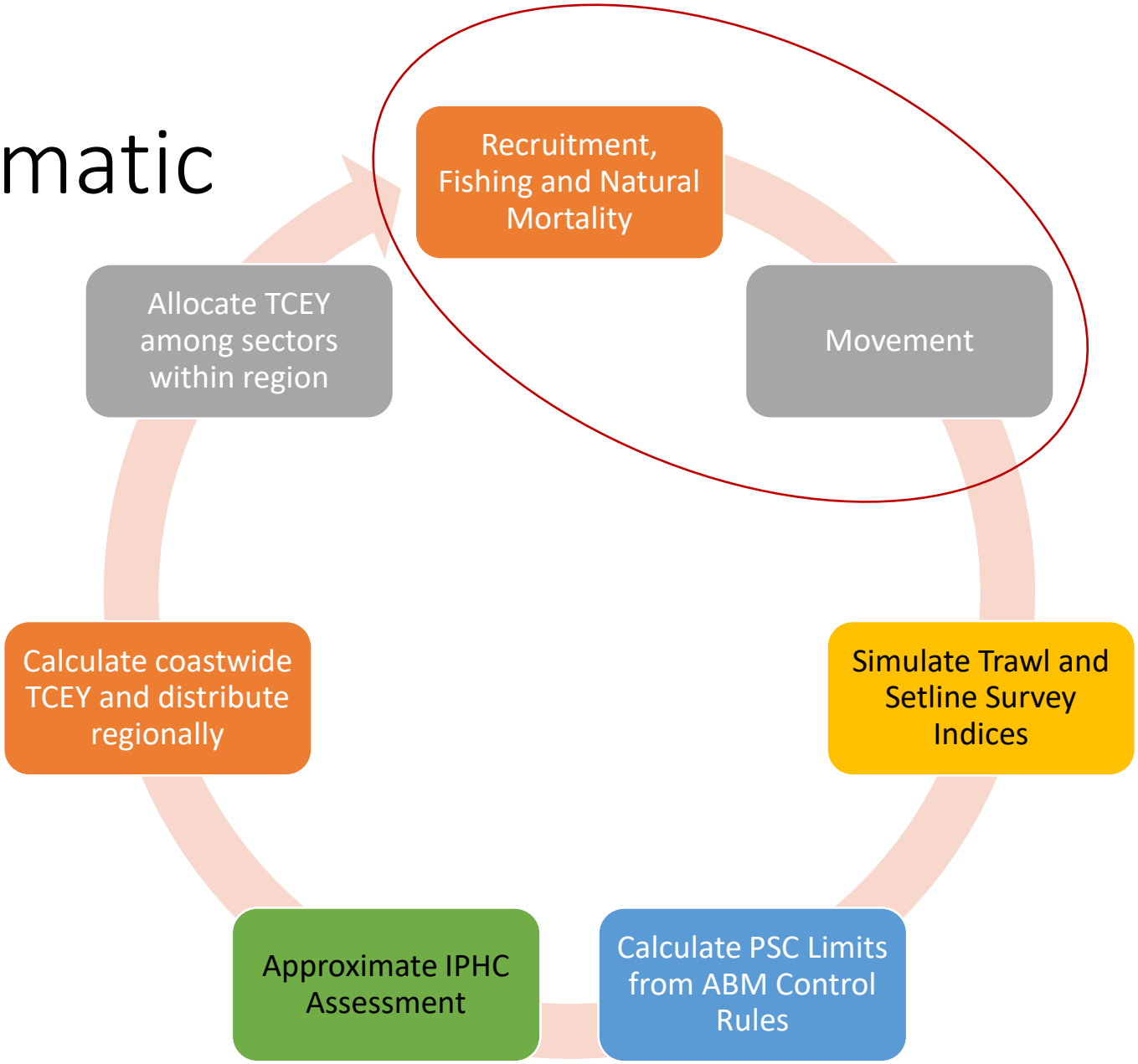
Halibut simulation model overview

Goal: To compare the ability of alternatives **relative to one another** to meet Council Objectives

Two-area Model Schematic

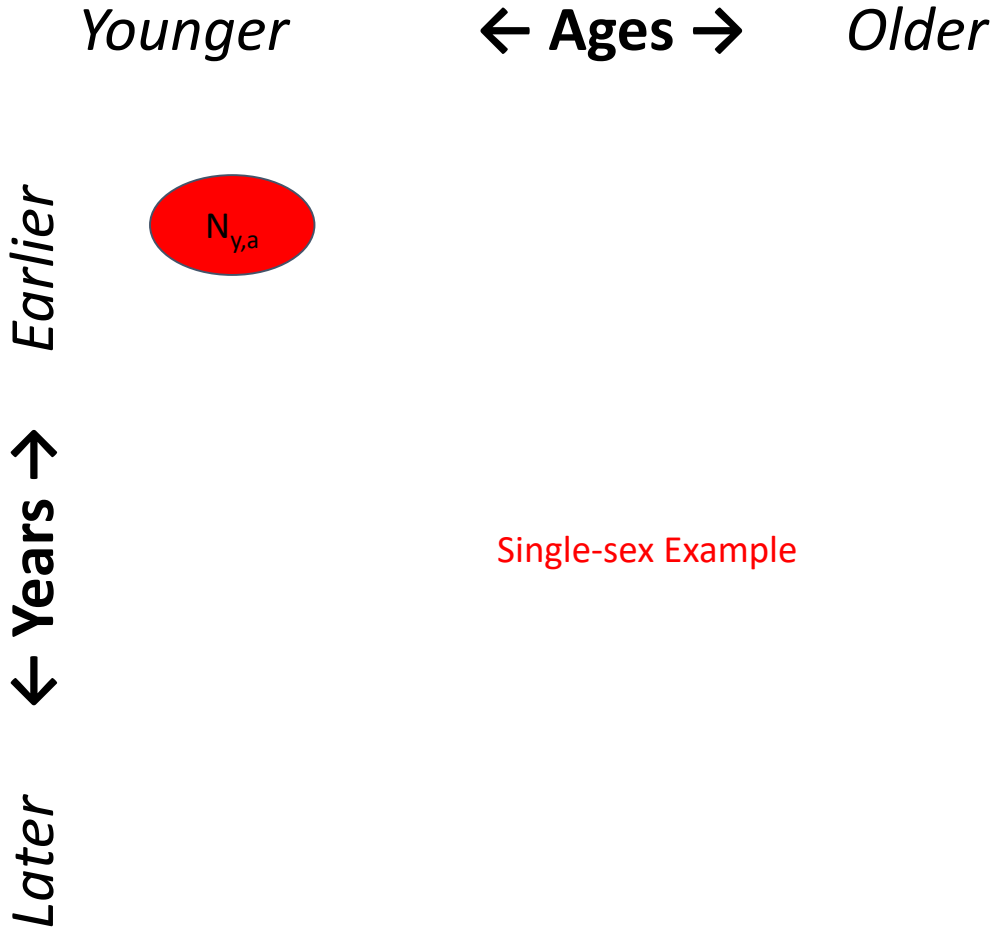


Two-area Model Schematic



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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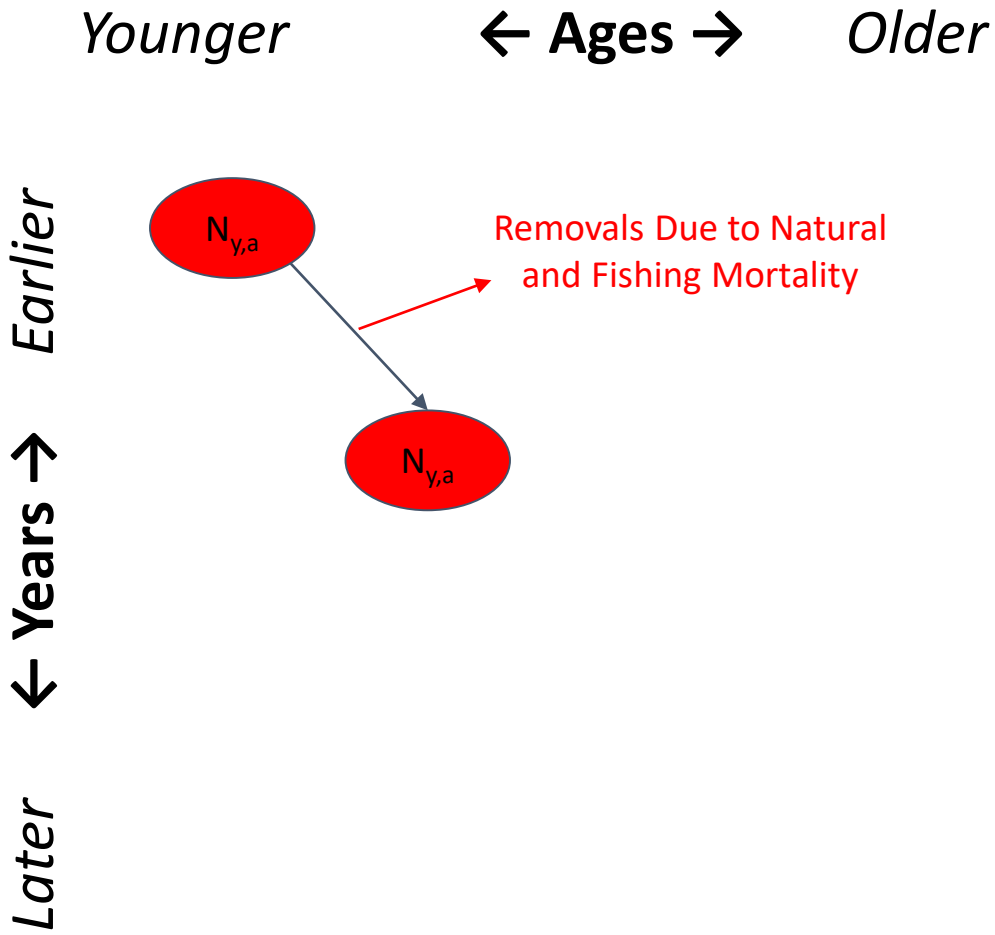

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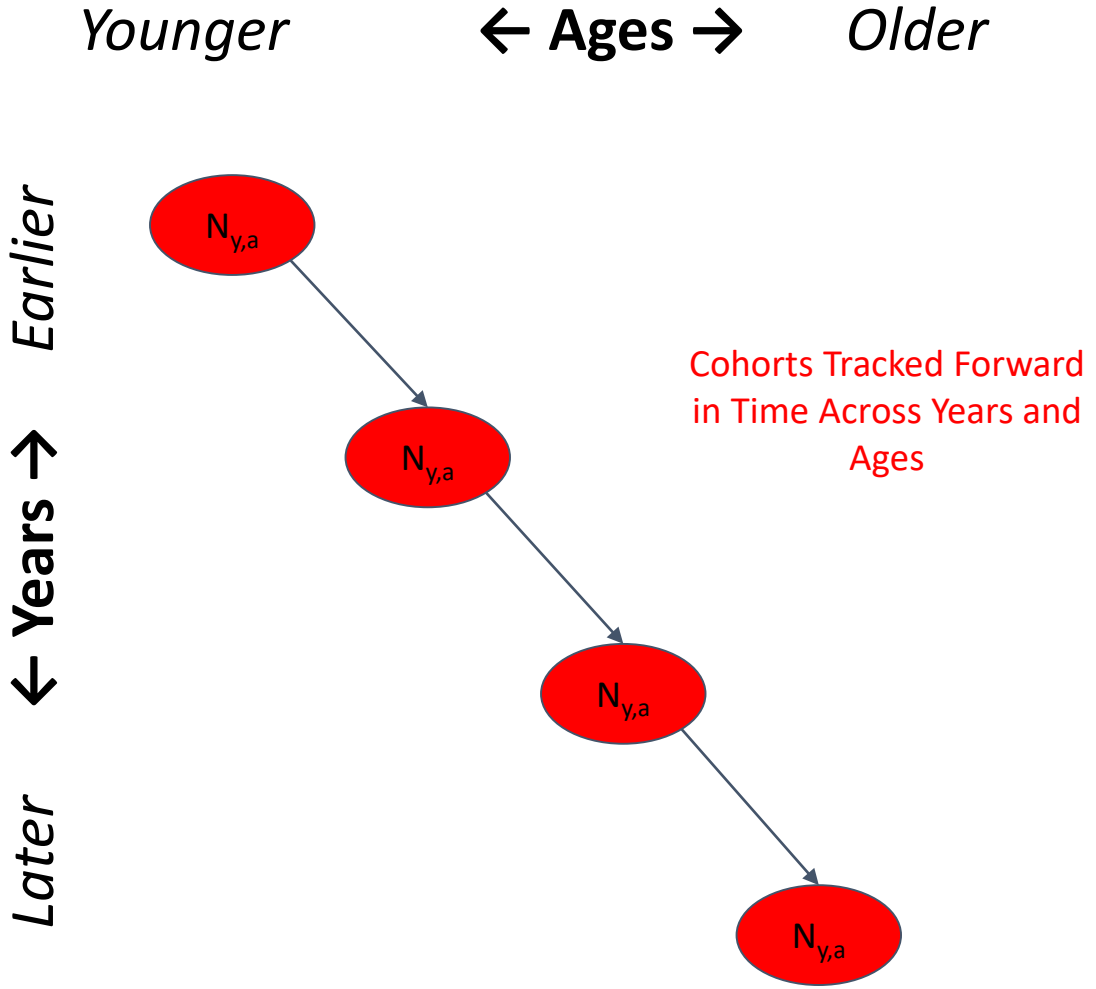

Two-area operating Model (OM) overview

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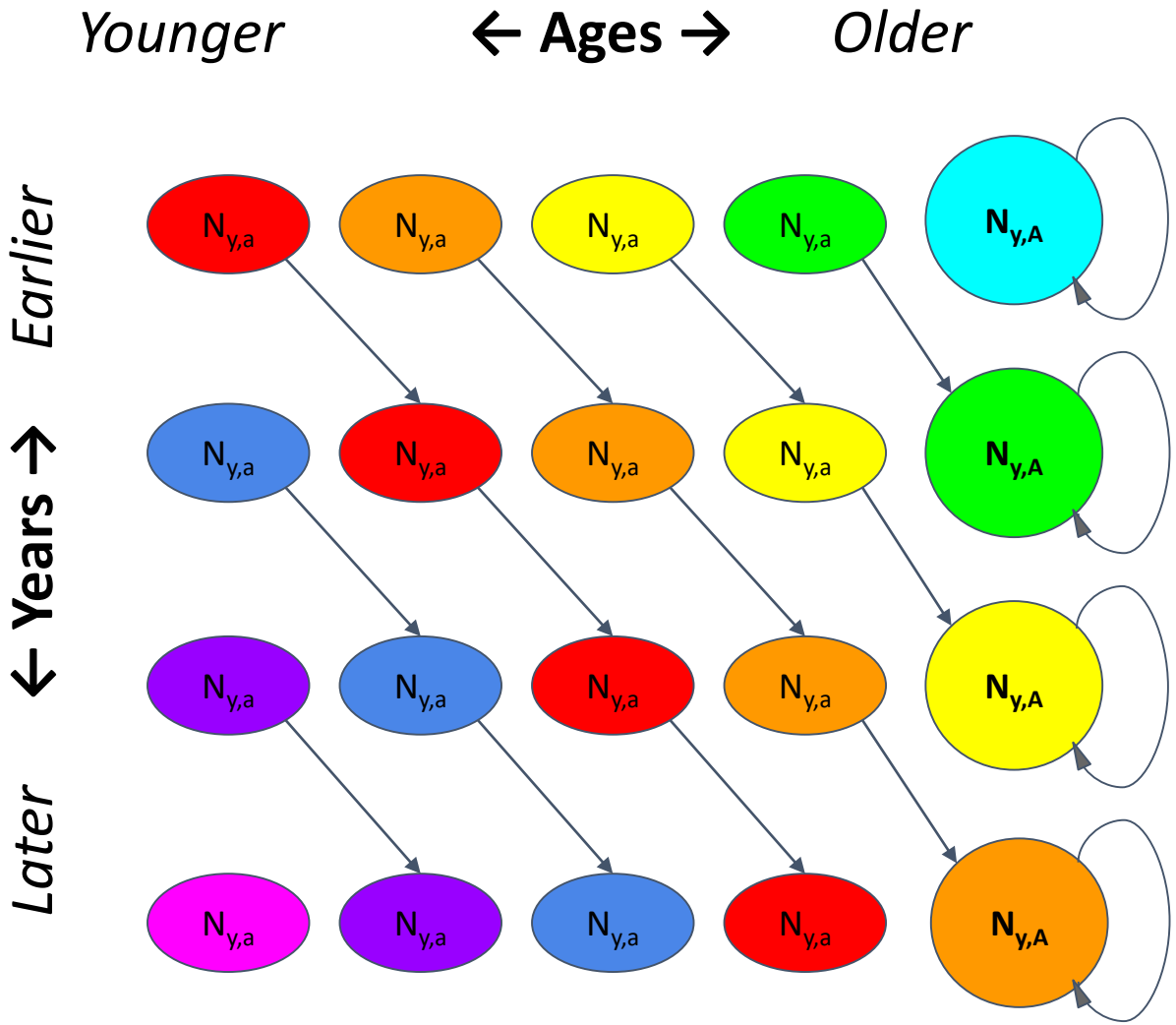
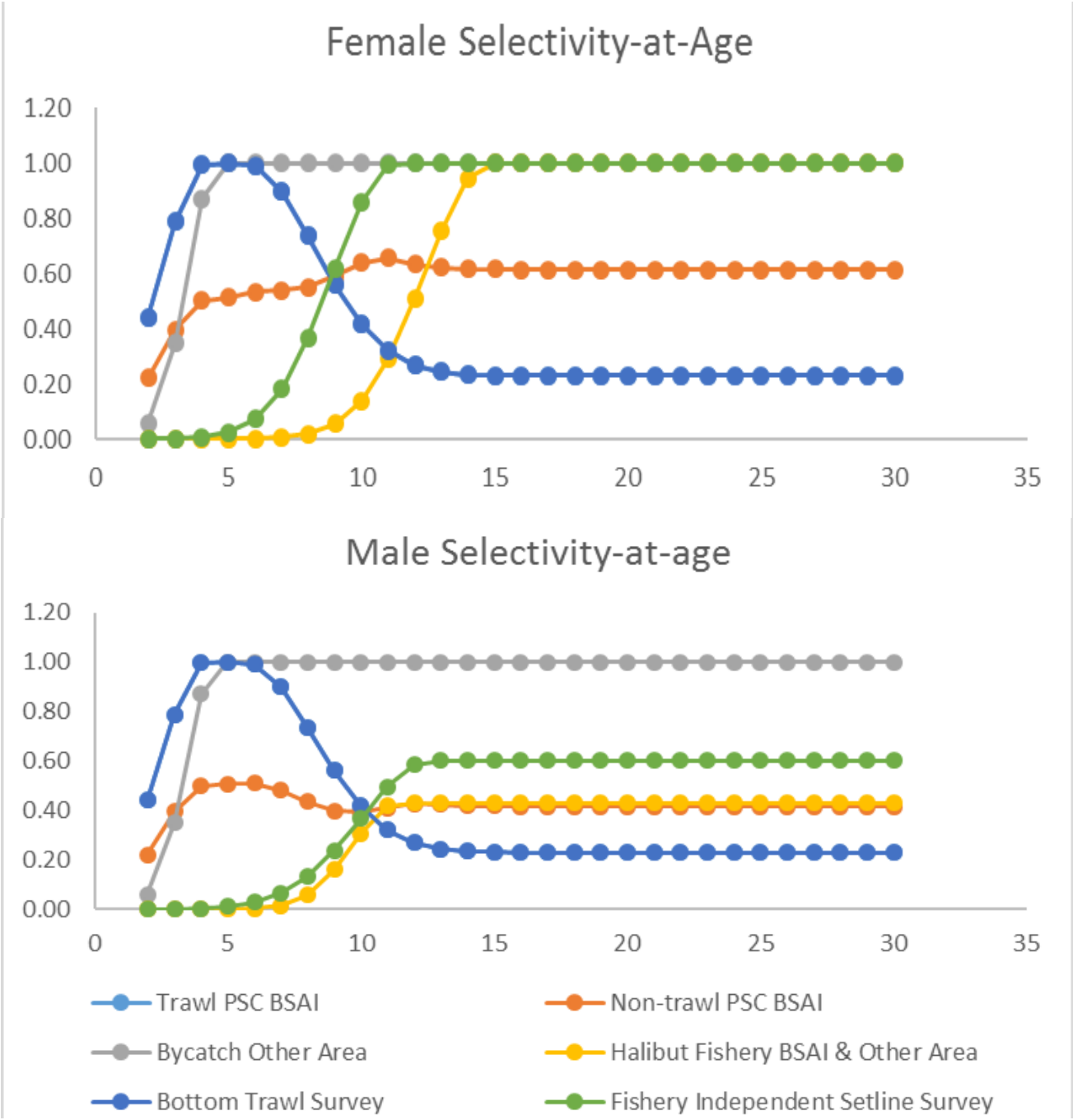


Gear types modeled

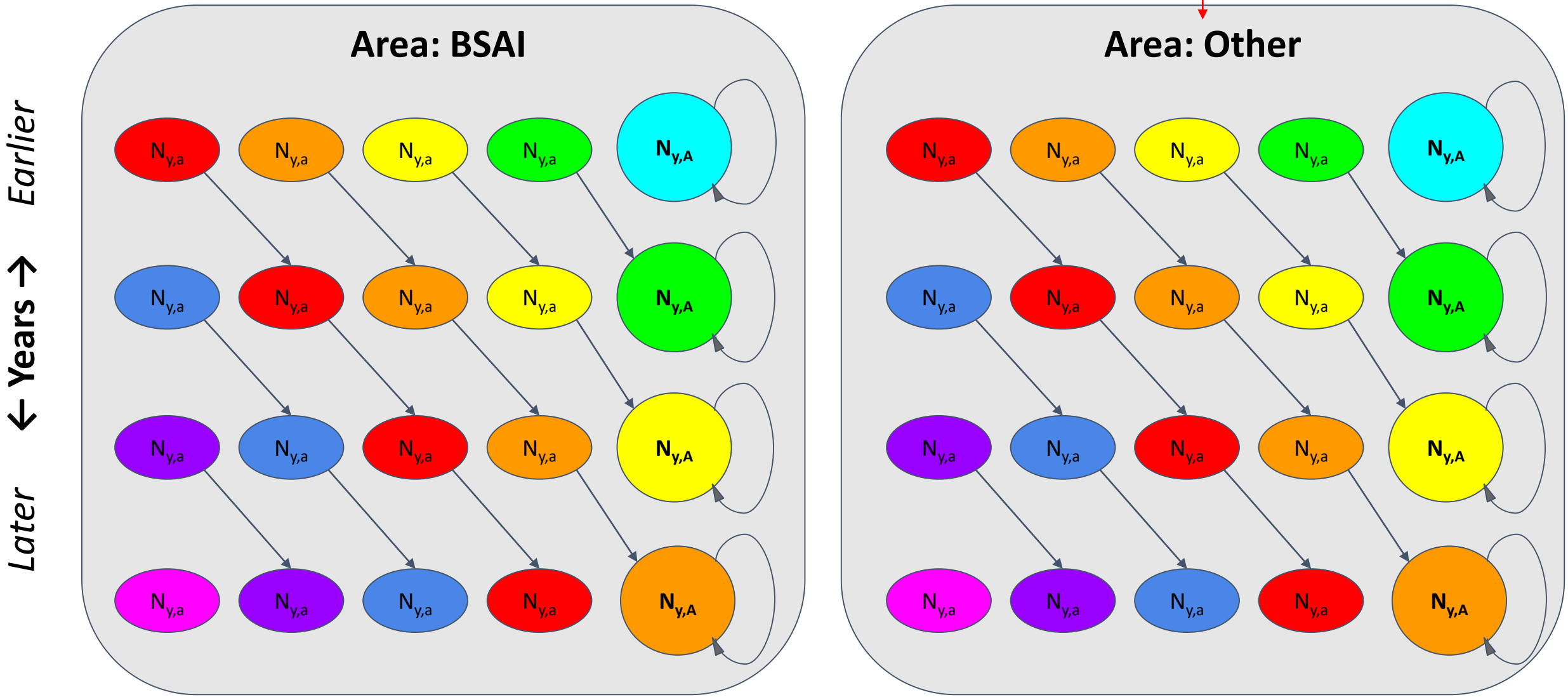
- BSAI Trawl PSC selectivity:
  - Set equal to trawl survey selectivity
  - Rationale: Best available information on plausible selectivity for trawl PSC alone
- BSAI Longline PSC selectivity:
  - Average of the 4ABCDE setline and the BS trawl survey selectivities for most recent year
  - Rationale: % 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



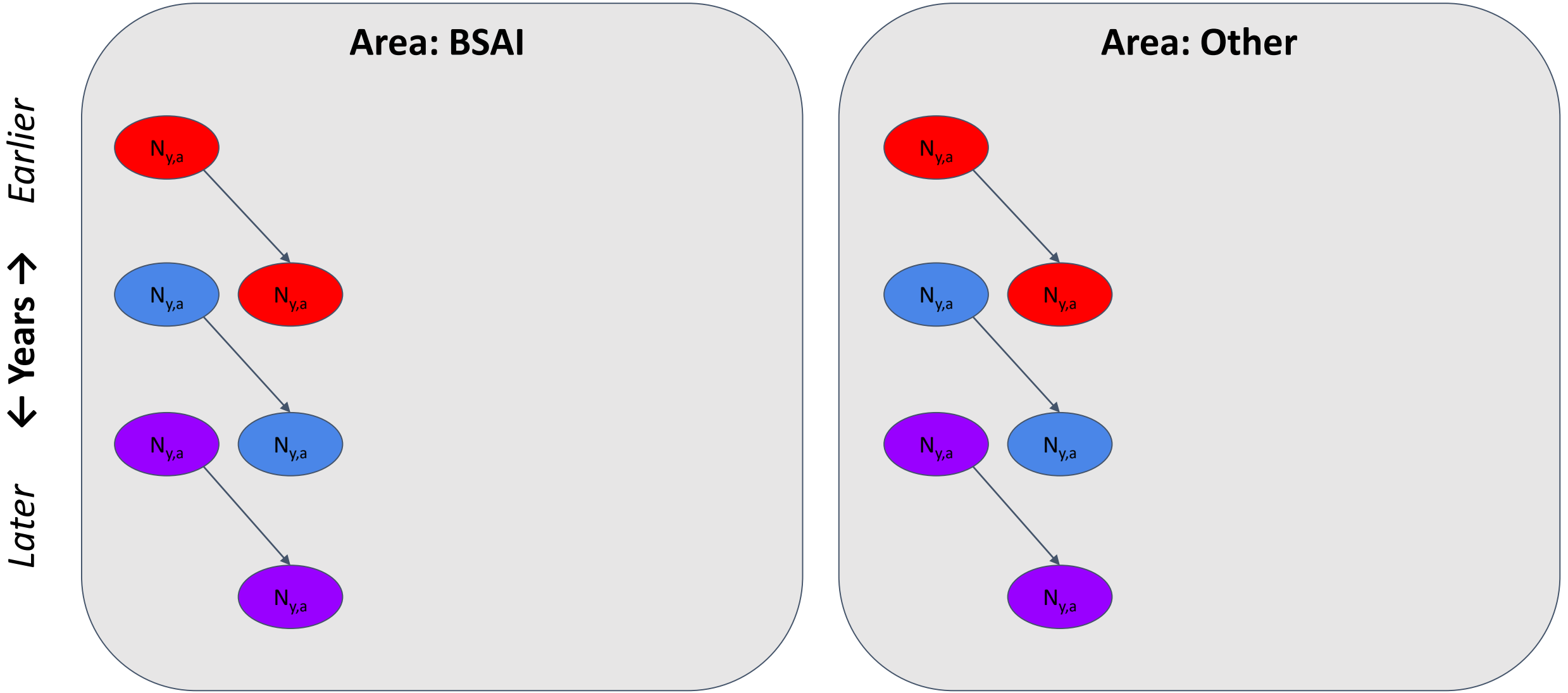
Movement Among Areas

Remaining GOA, BC, West Coast Range



Movement Among Areas

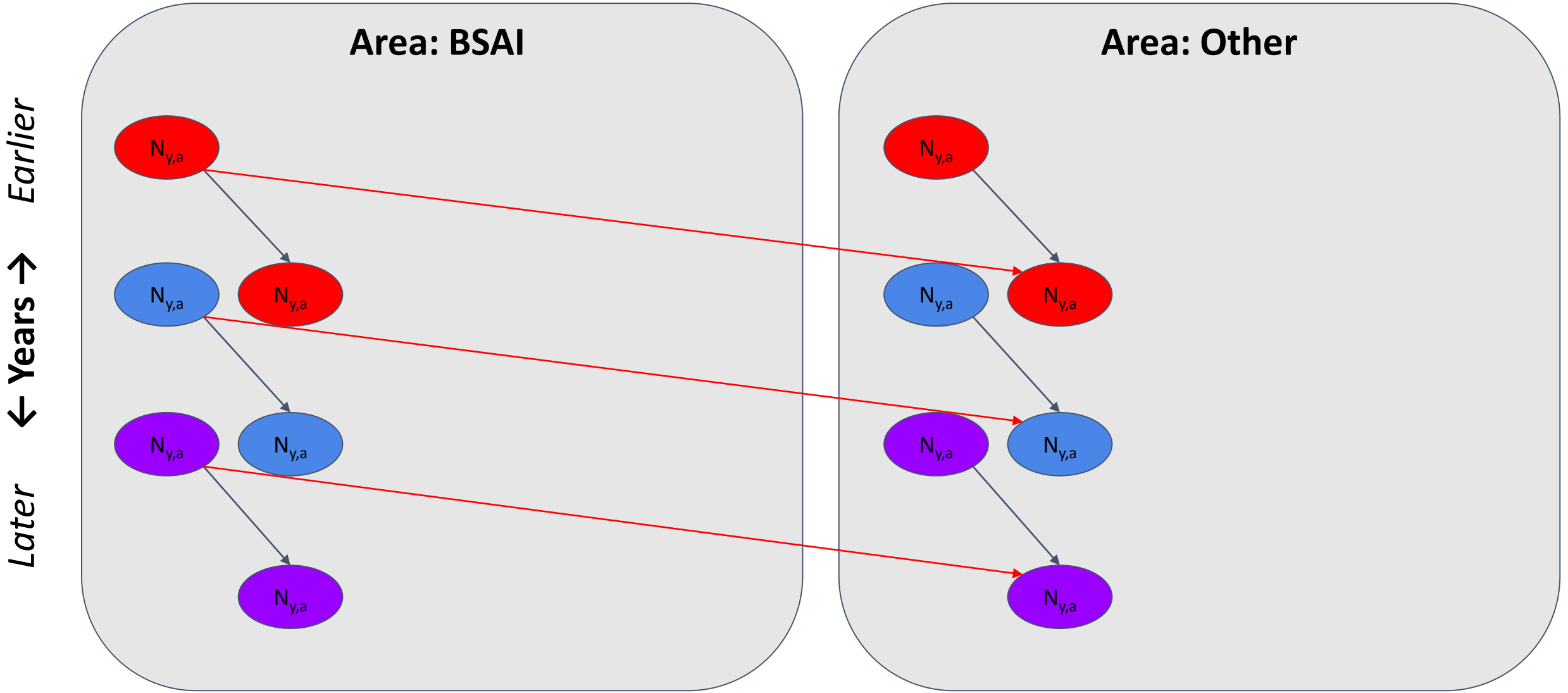
Survival



Movement Among Areas

Survival

Movement **Out** of BSAI

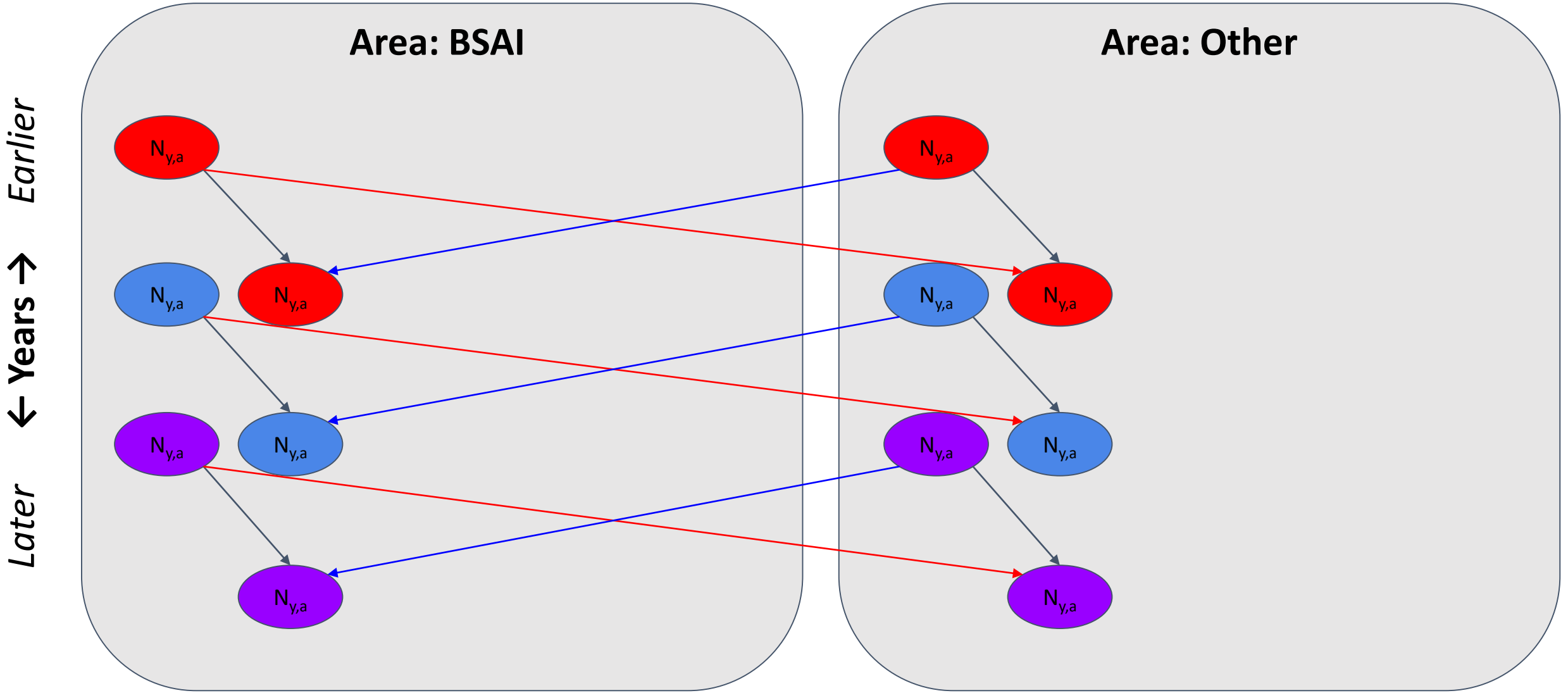


Movement Among Areas

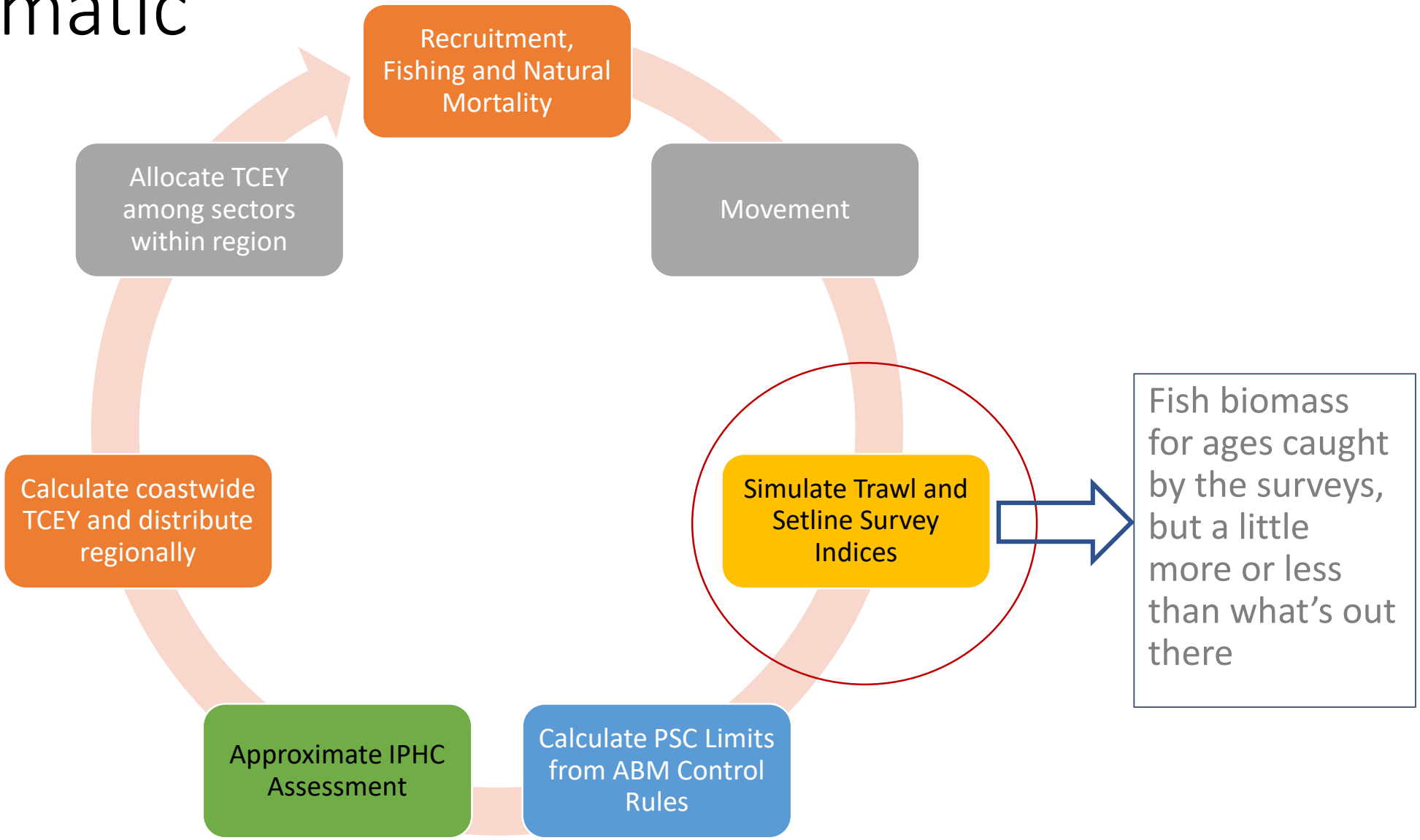
Survival

Movement **Out** of BSAI

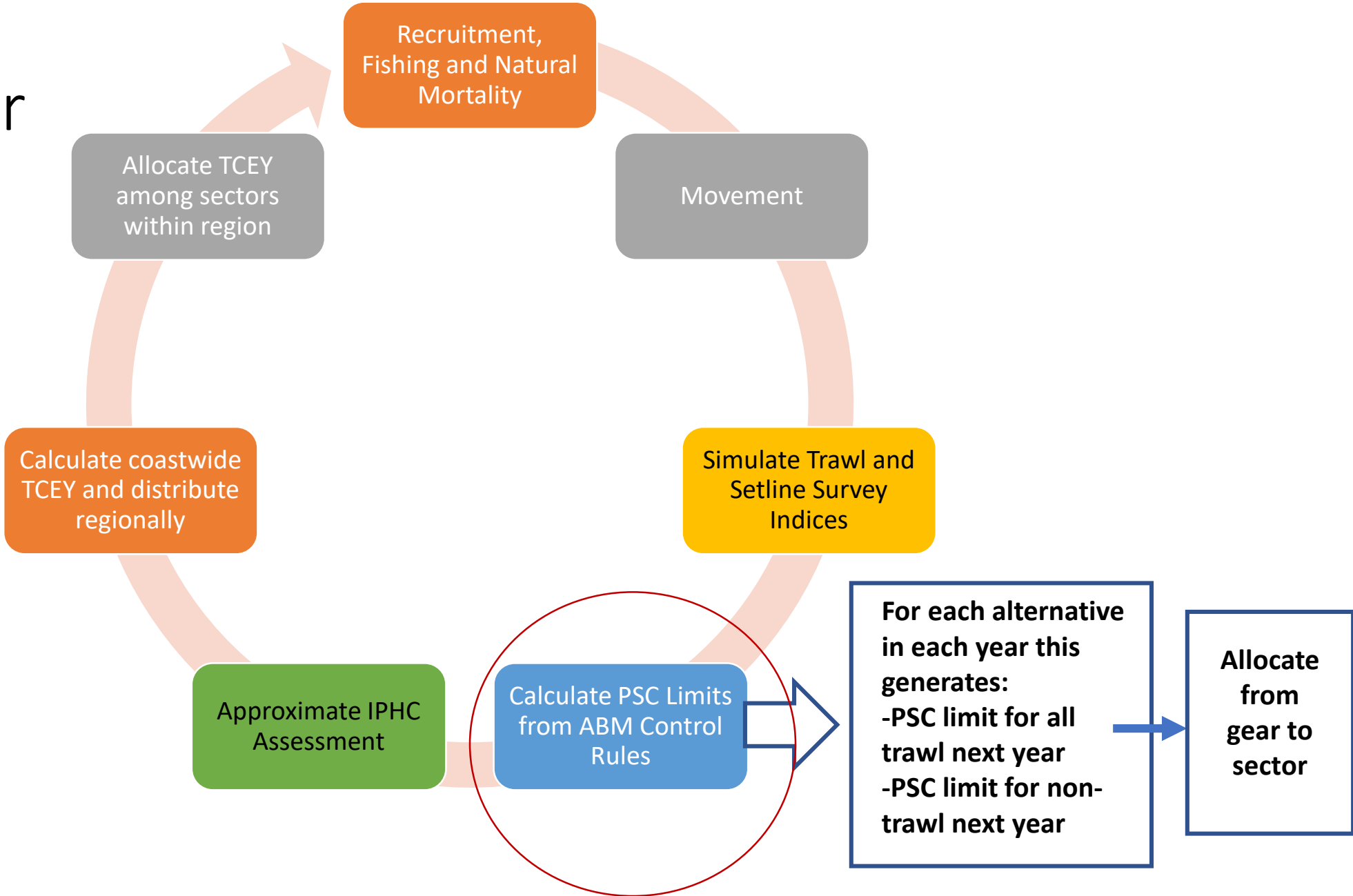
Movement **Into** BSAI



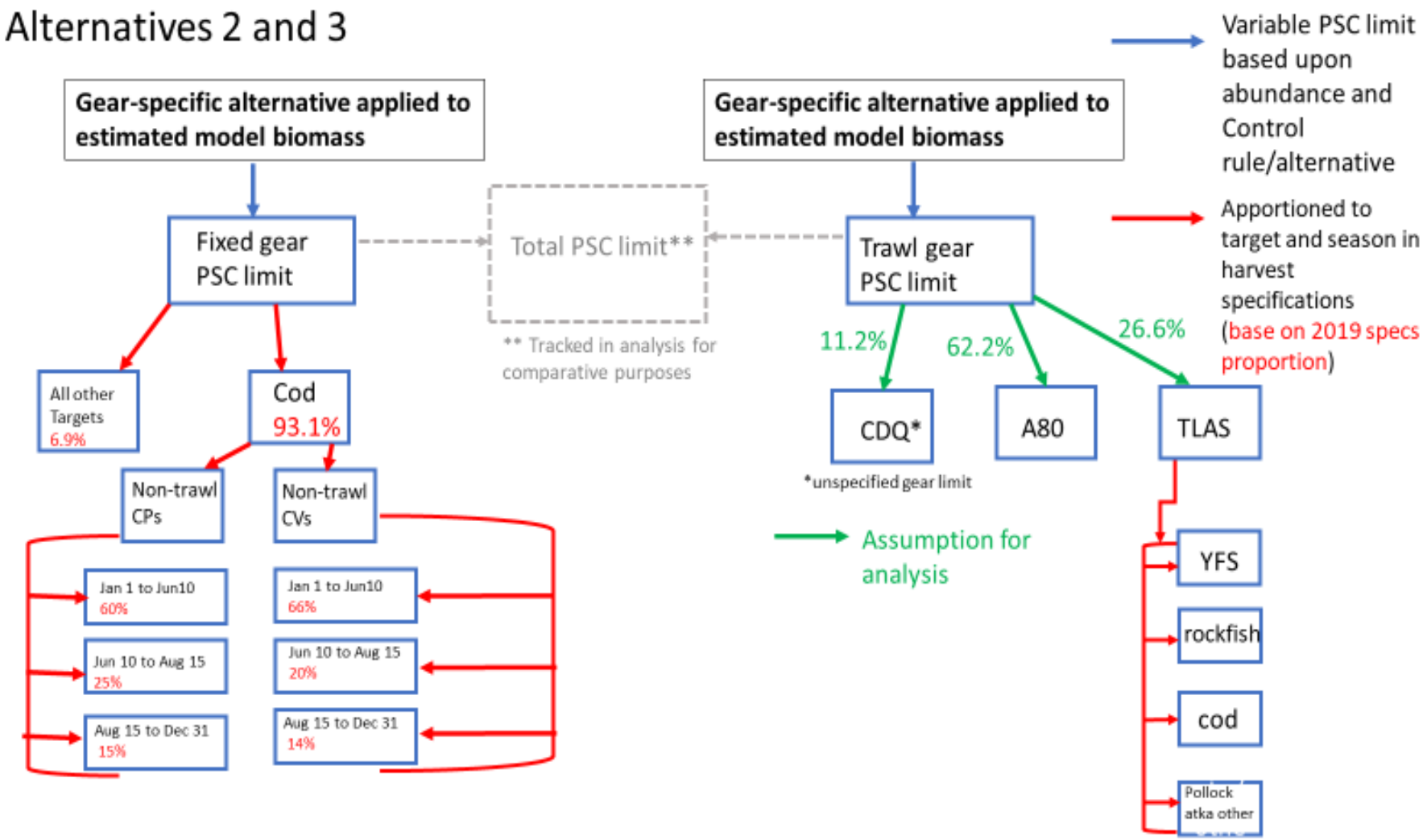
Model Schematic



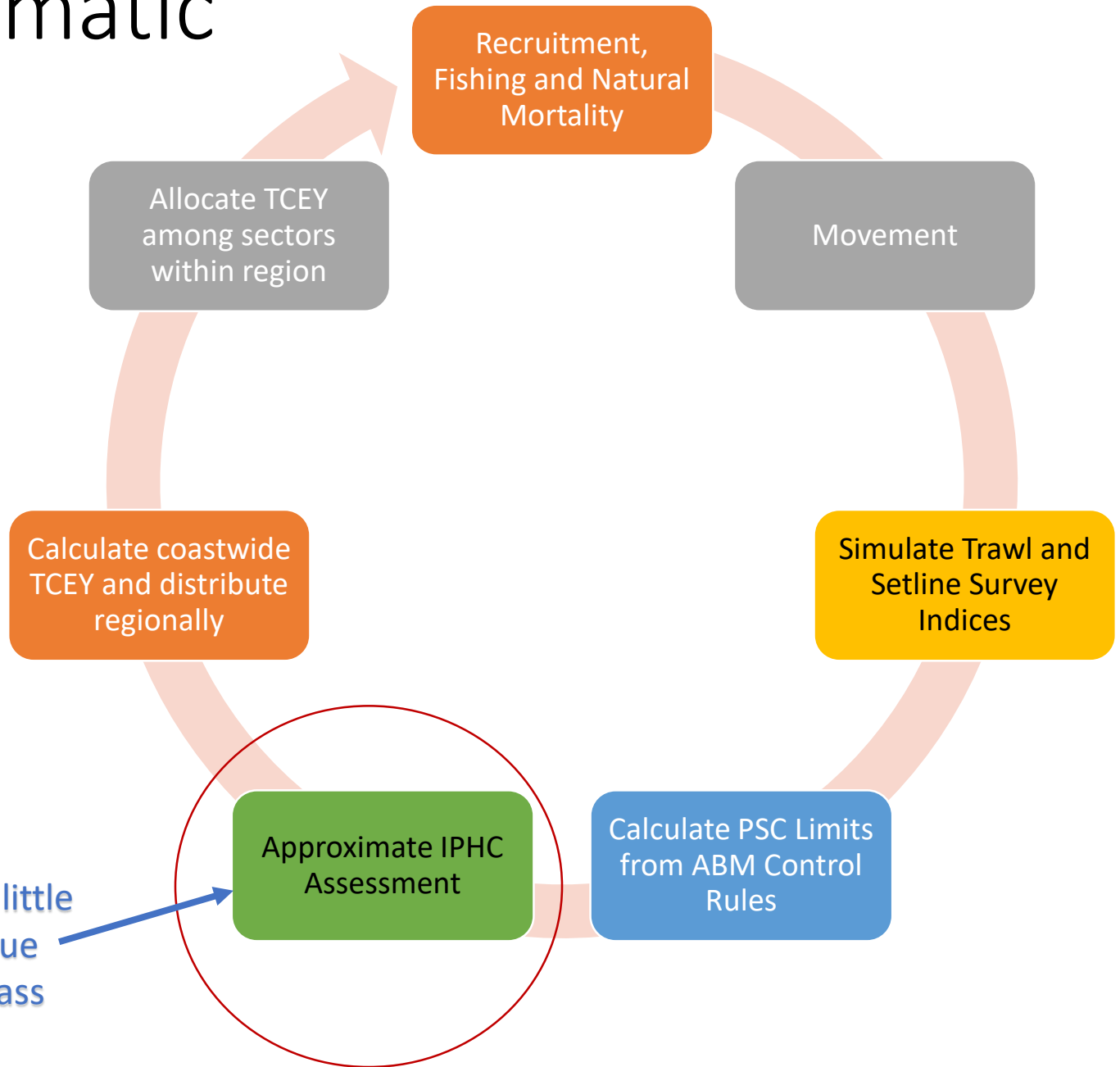
Calculating PSC Limits for the following year



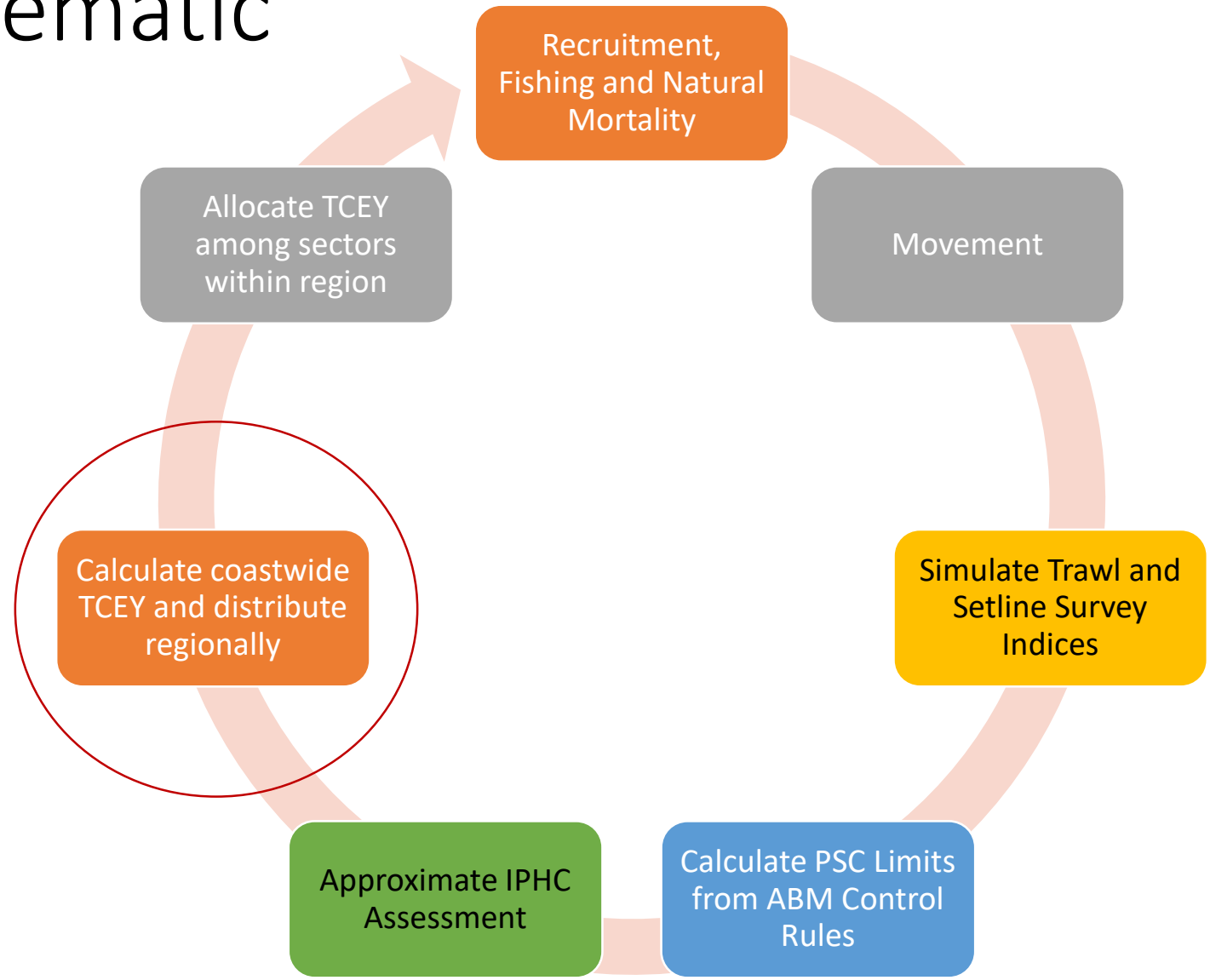
Sector allocation assumptions

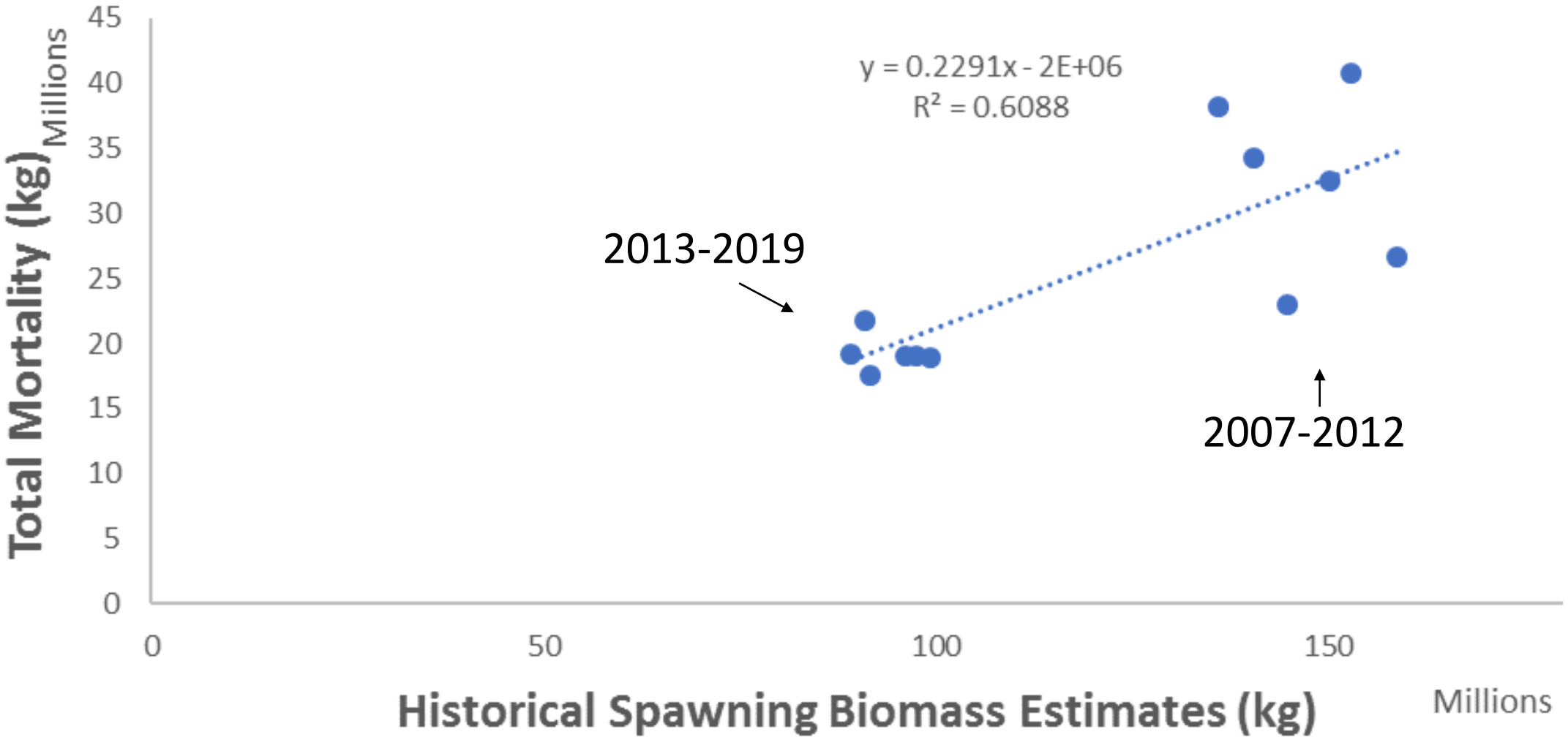


Model Schematic



Model Schematic



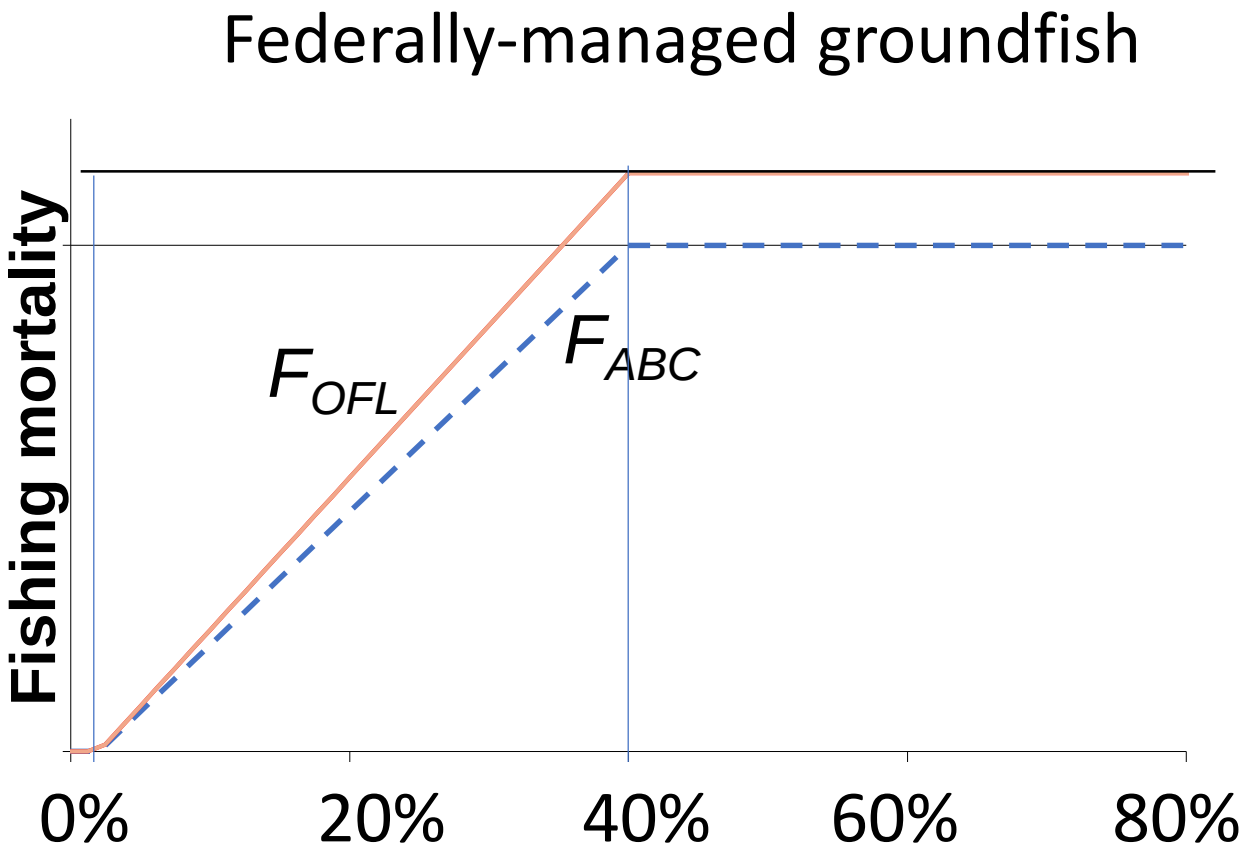

Total Mortality (kg) Millions
45
40
35
30
25
20
15
10
5
0
y = 0.2291x - 2E+06
R² = 0.6088
2013-2019
2007-2012
0
50
100
150
Historical Spawning Biomass Estimates (kg)
Millions

How would a 30:20 rule (or approximation) in TCEY determination influence the results?

- Not currently modeled
- The IPHC's 30:20 rule has never been invoked
- IPHC harvest strategy policy is not binding

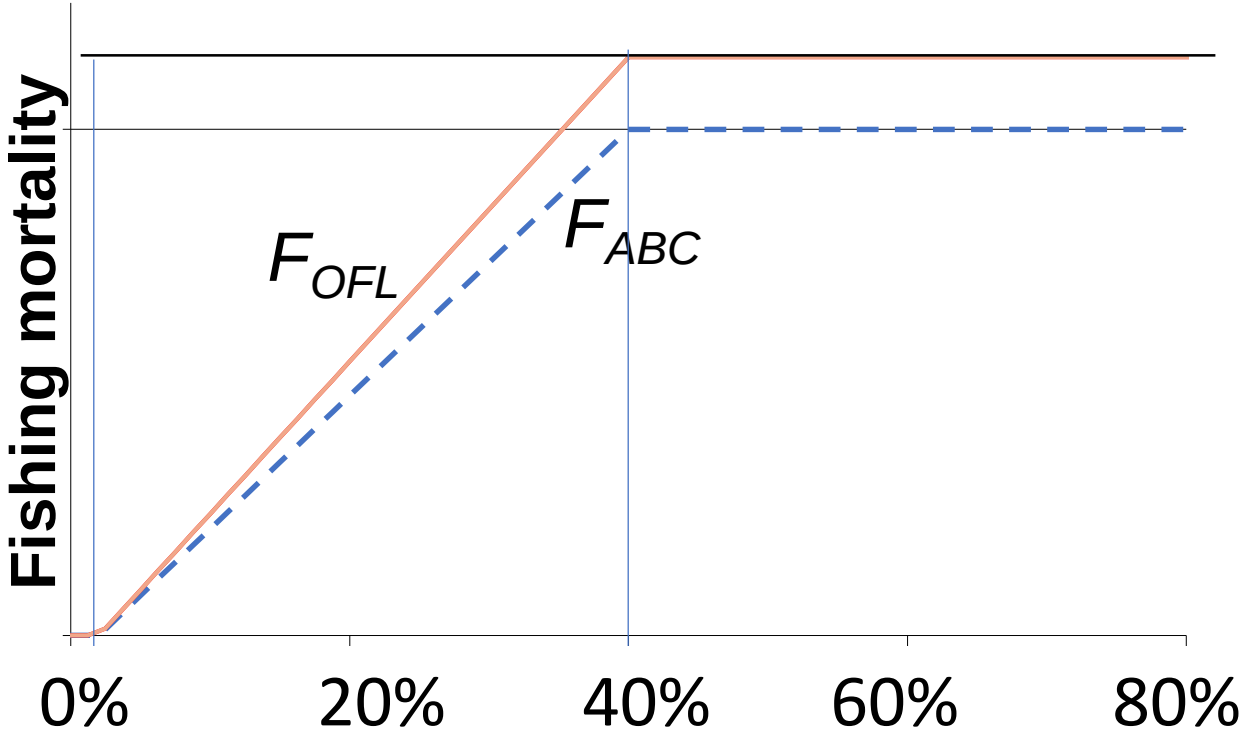
- Under low spawning biomass scenarios:
  - Coastwide TCEY would be reduced drastically
  - Increases the likelihood of PSC use > TCEY in BSAI
  - Increases likelihood of closed directed halibut fishery

The 30:20 rule is very steep

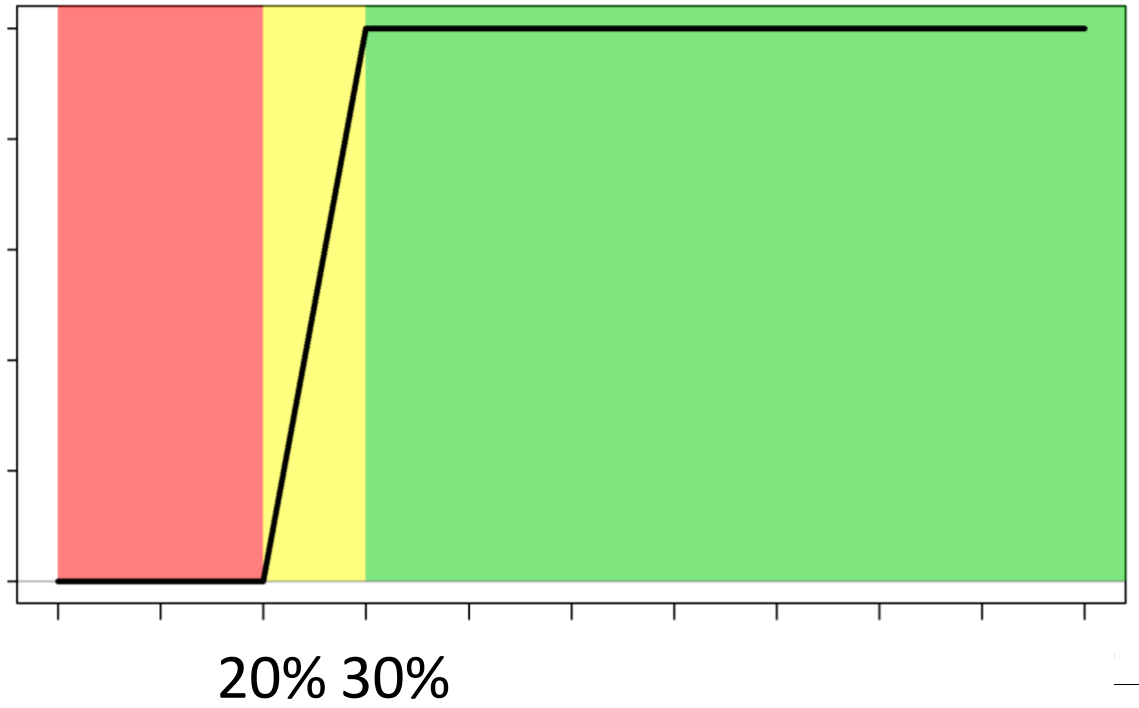


The 30:20 rule is very steep

Federally-managed groundfish



Halibut



Relative spawning biomass

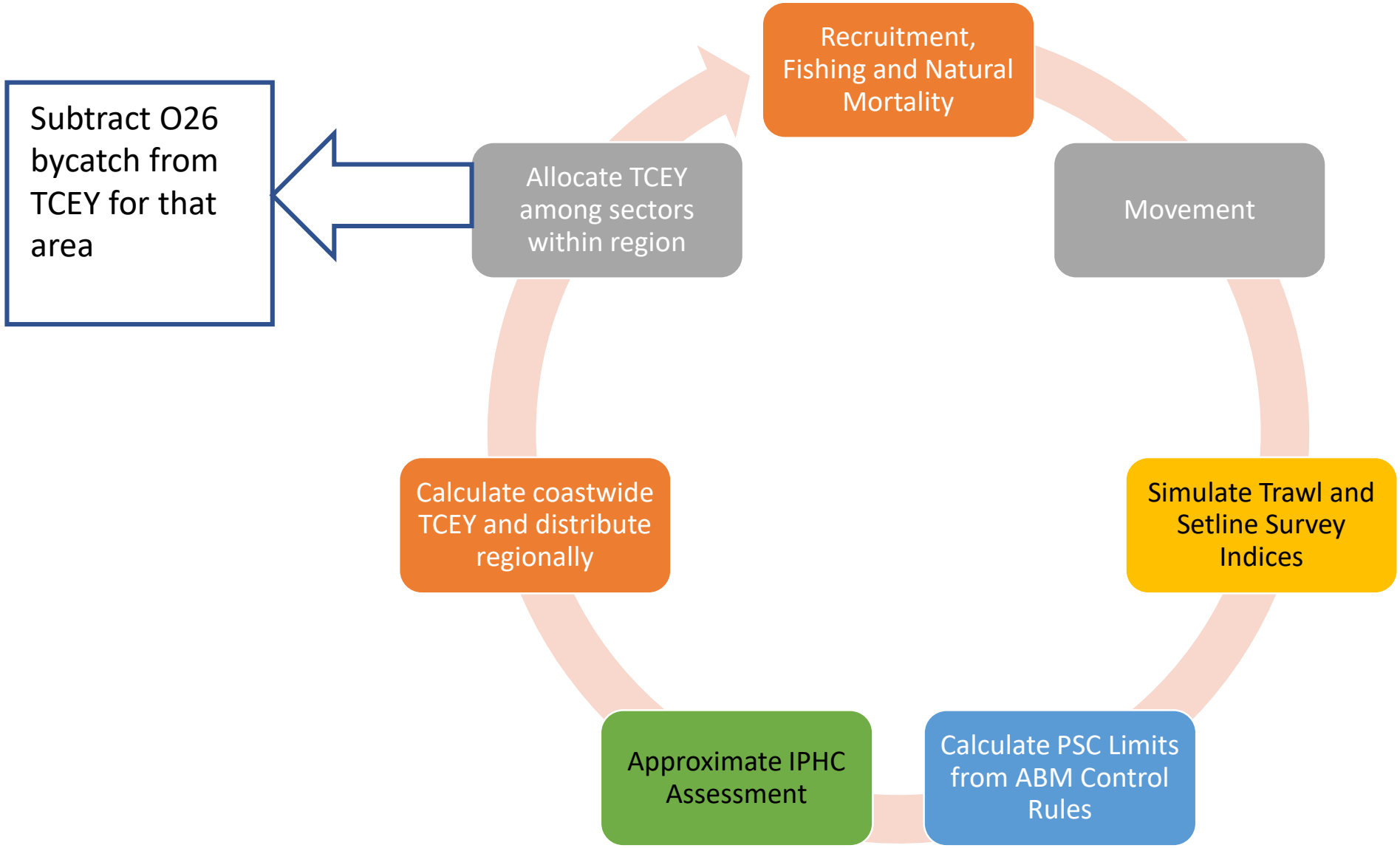
Model distribution of TCEY proxy between BSAI and the other area

- 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

Typo on Page 210!

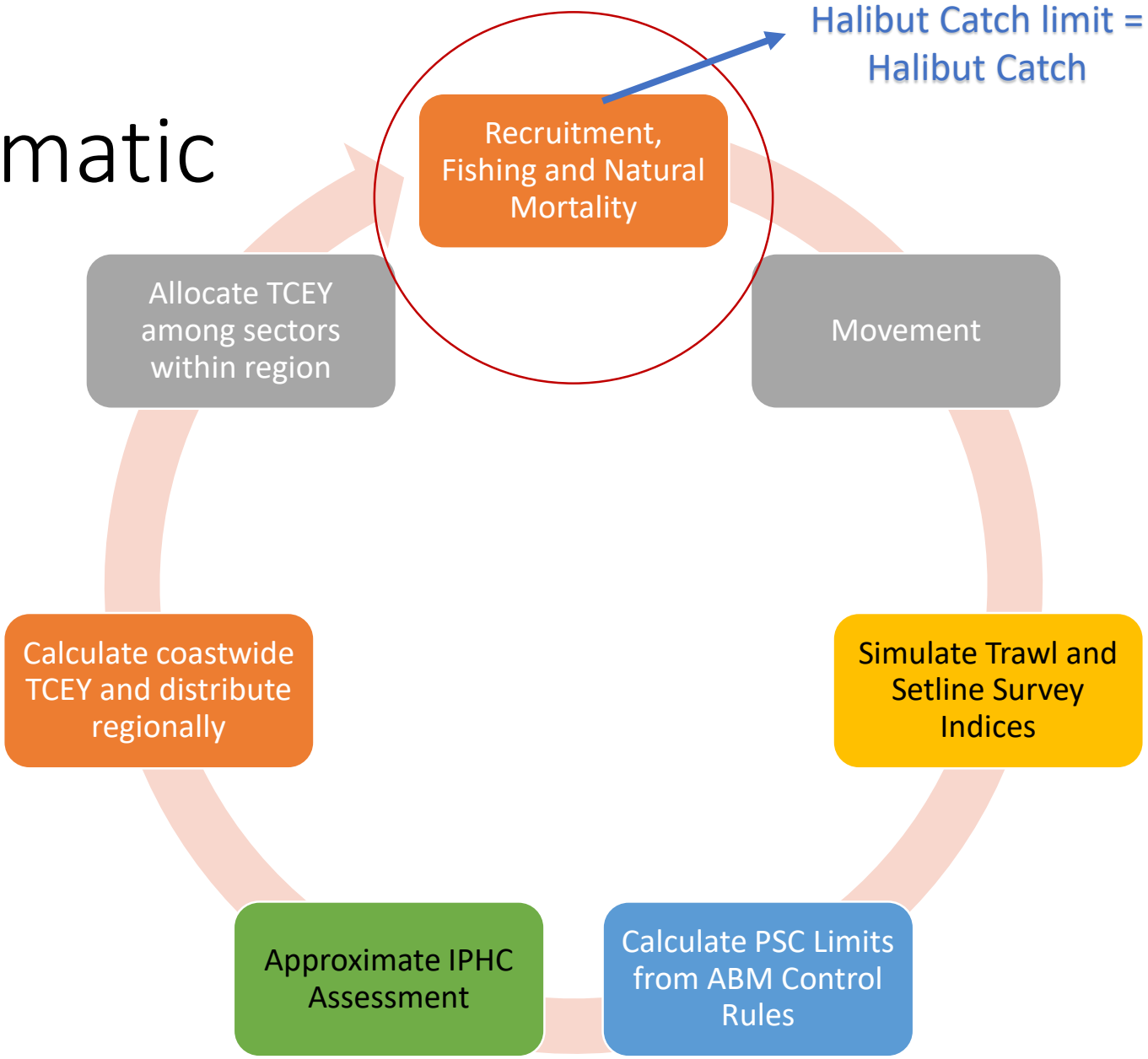
In the model the proportion of TCEY allocated to the BSAI changes with distribution of survey biomass


Recruitment, Fishing and Natural Mortality
Movement
Simulate Trawl and Setline Survey Indices
Calculate PSC Limits from ABM Control Rules
Approximate IPHC Assessment
Calculate coastwide TCEY and distribute regionally
Allocate TCEY among sectors within region
Subtract O26 bycatch from TCEY for that area

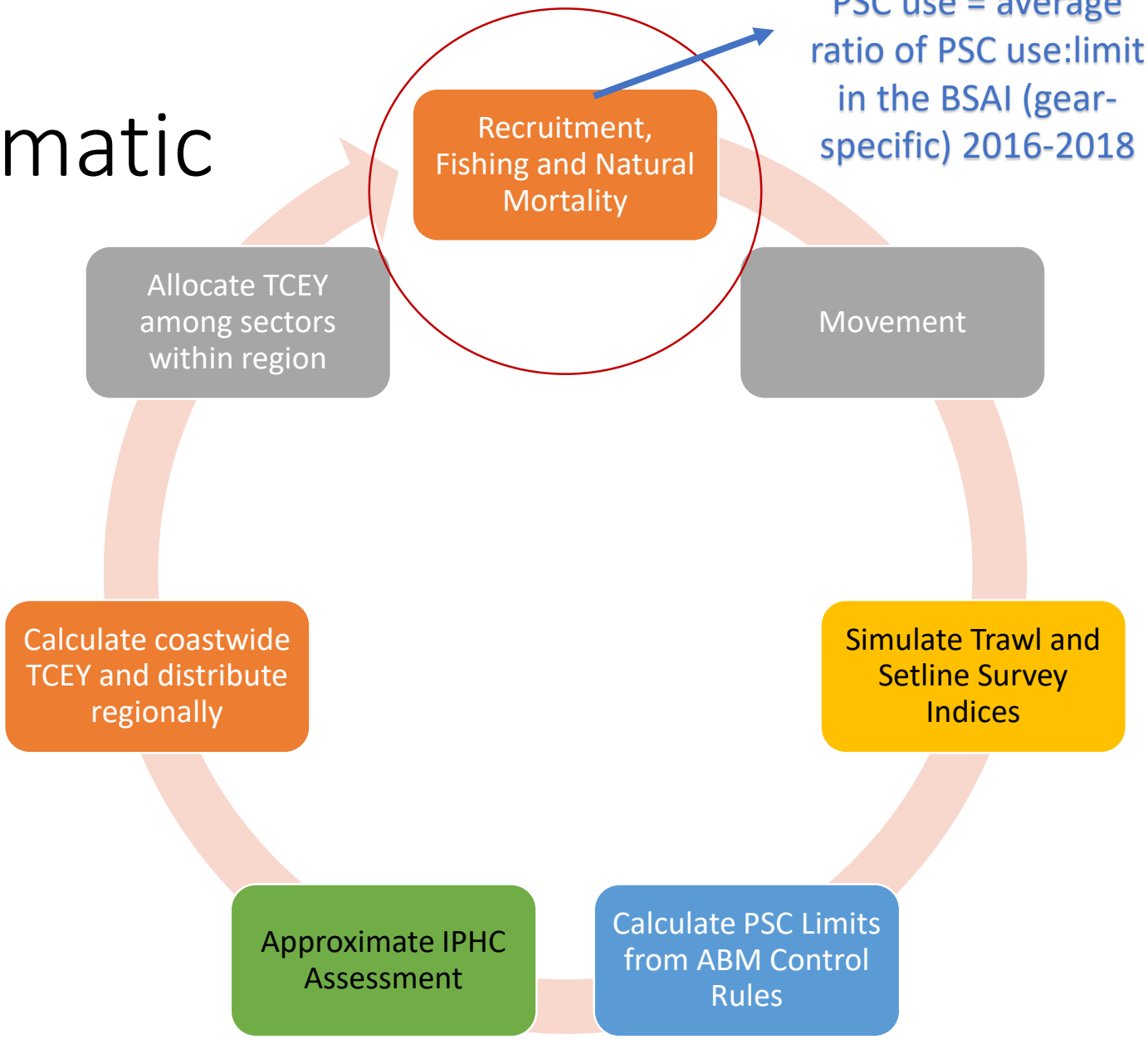
Calculating halibut fishery catch from TCEY

- 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



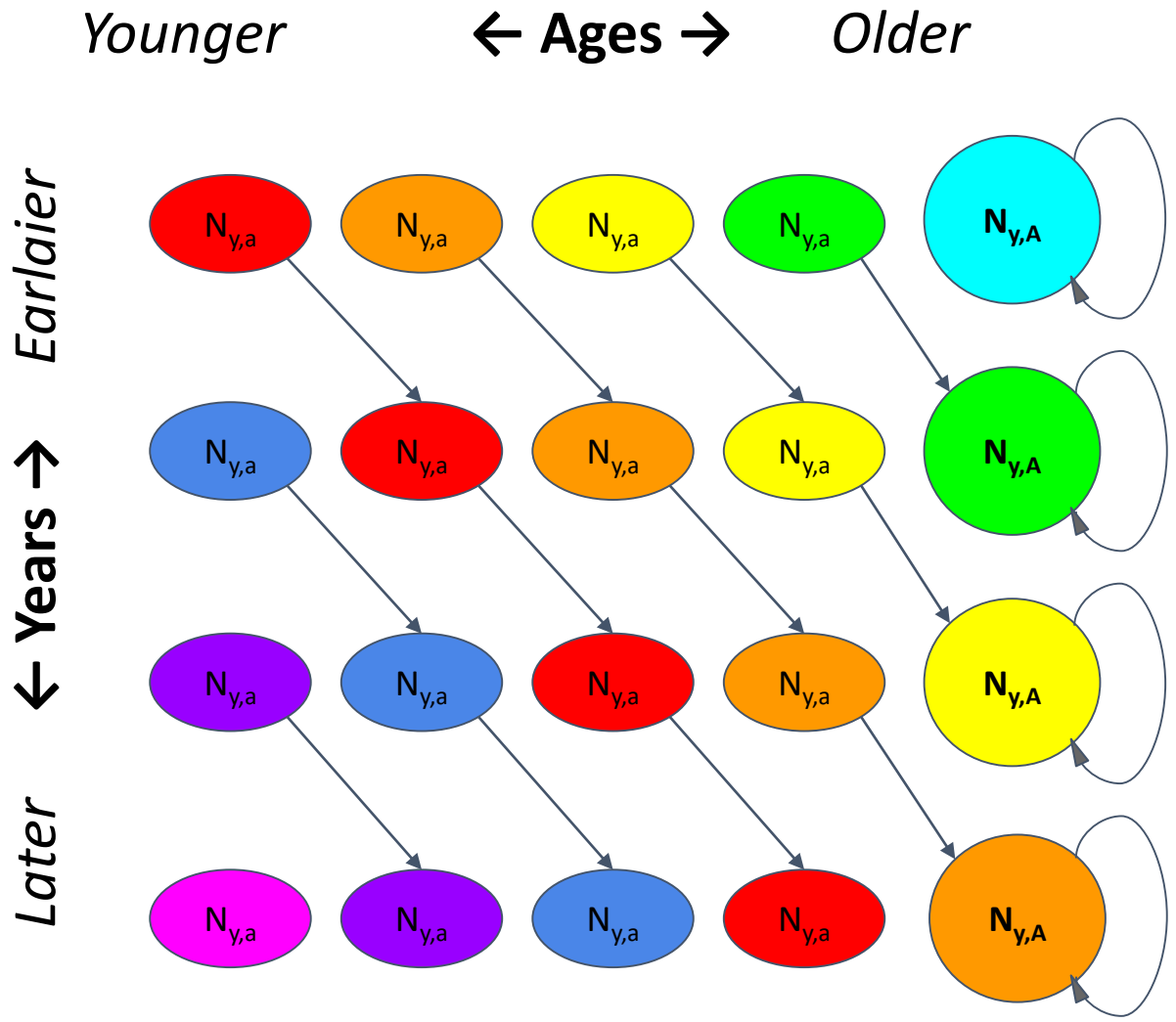
PSC usage relative to the limit

- Used the 3-year average proportion of the PSC usage:PSC limit

- In the future:
  - Better characterize uncertainty about PSC use:limit relationship

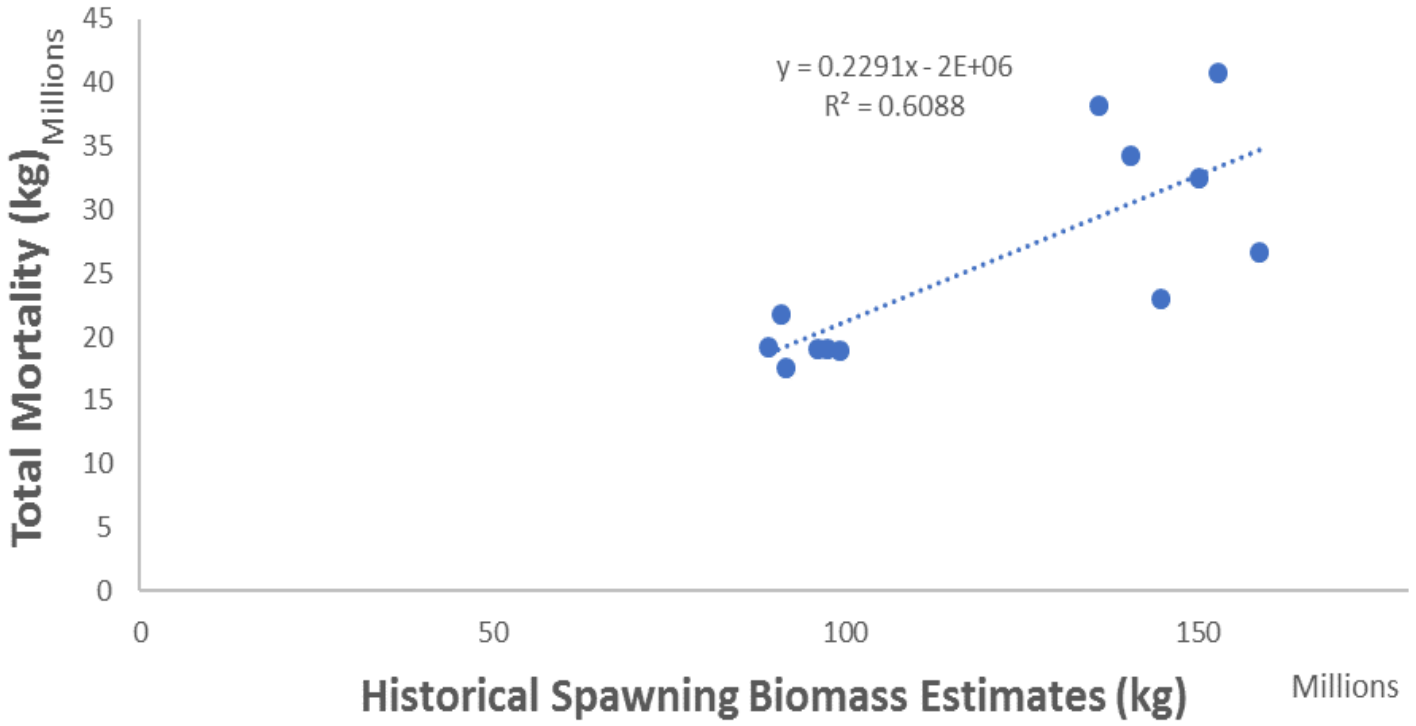
How and where are U26 fish taken into account?

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?

- BSAI TCEY - Previous year's O26 realized PSC usage =BSAI directed halibut fishery catch limit (IPHC practice)
- Average length-at-age relationship to define age of 26 inch fish
- 26-inch fish is on average a 7 year old

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.

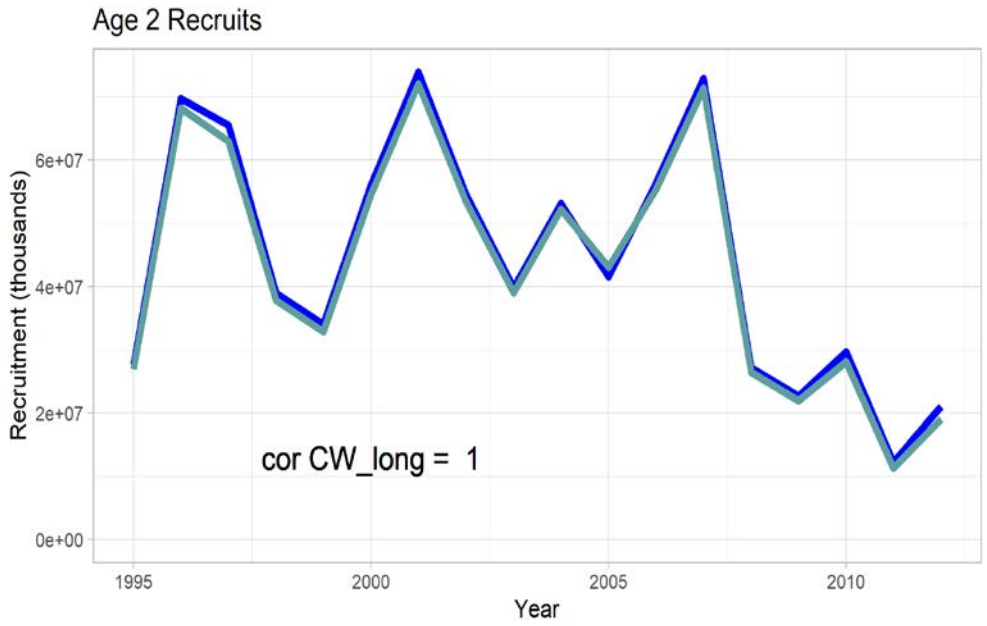
- Application of an SPR-based fishing intensity would take into account yearly fluctuations in U26 fish

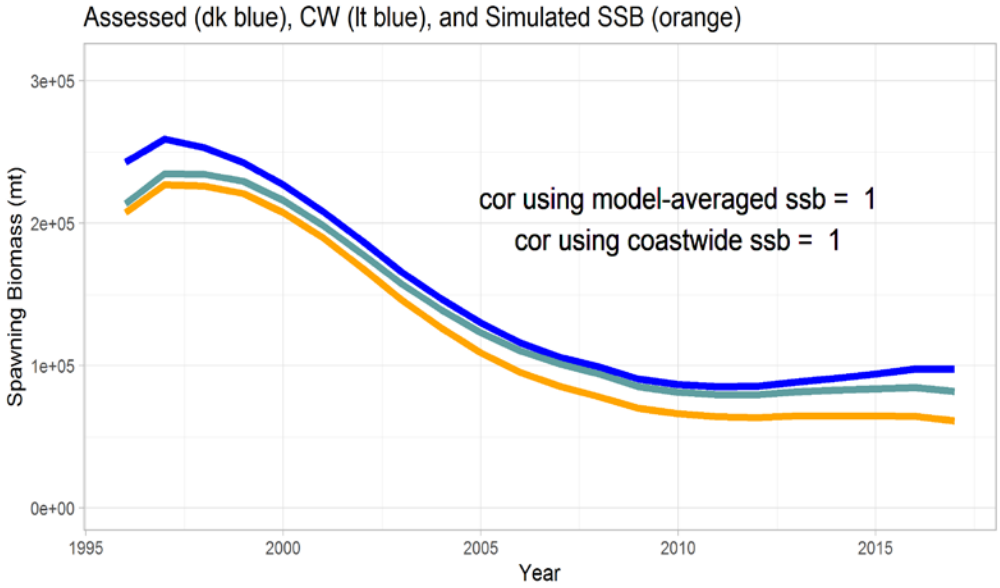
Model validation

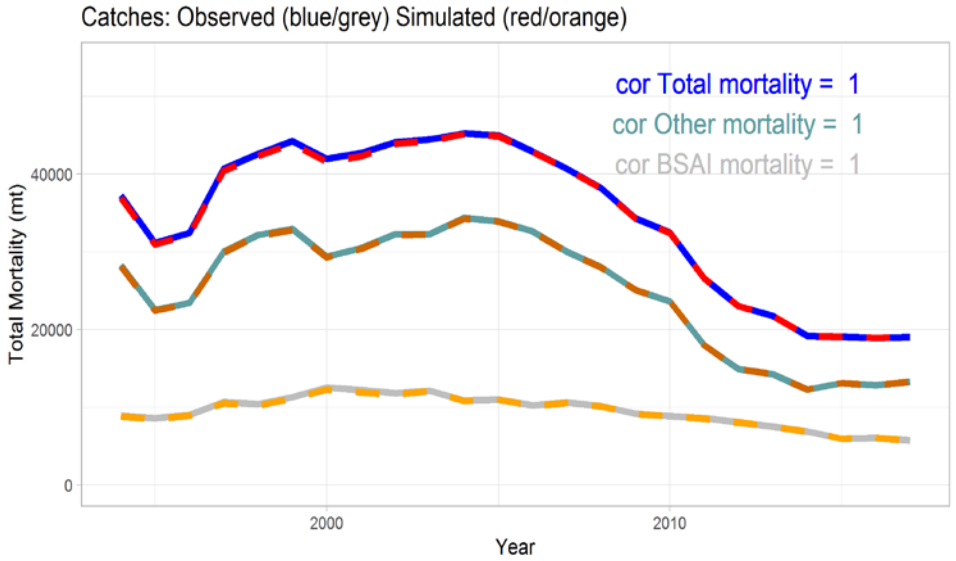
Can the model mimic halibut population dynamics?

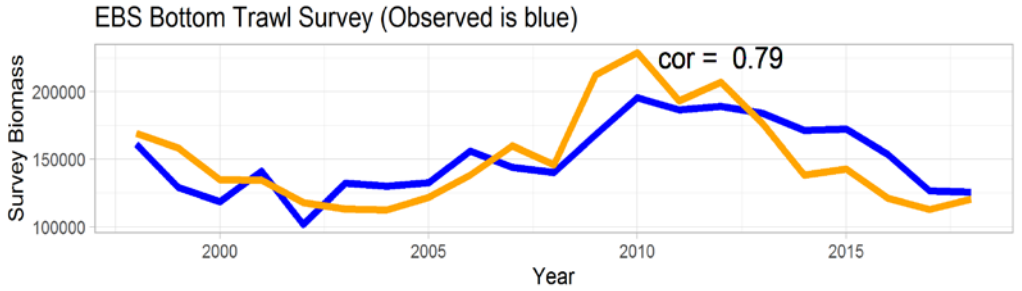
Test using past catches and recruitments

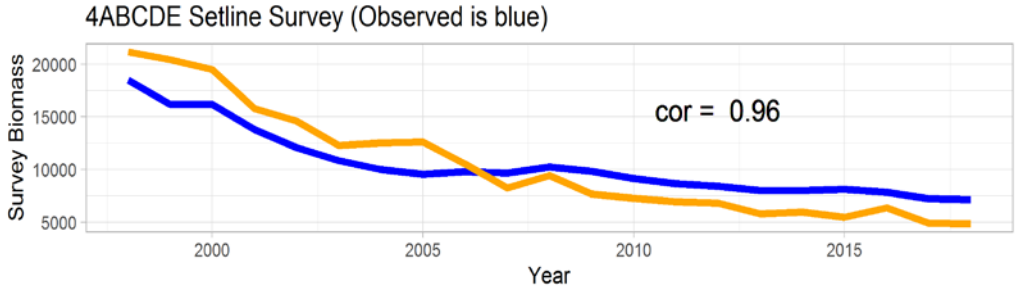
- Age-2 recruitment from BSAI
- "Other" area recruitment = coastwide – BSAI
- **Matches both survey indices:** *proportion of recruitment to the BSAI varies over time*











Overview of Alternative results

General Trends

Conclusions on major features of control rules

Effects of Elements and options

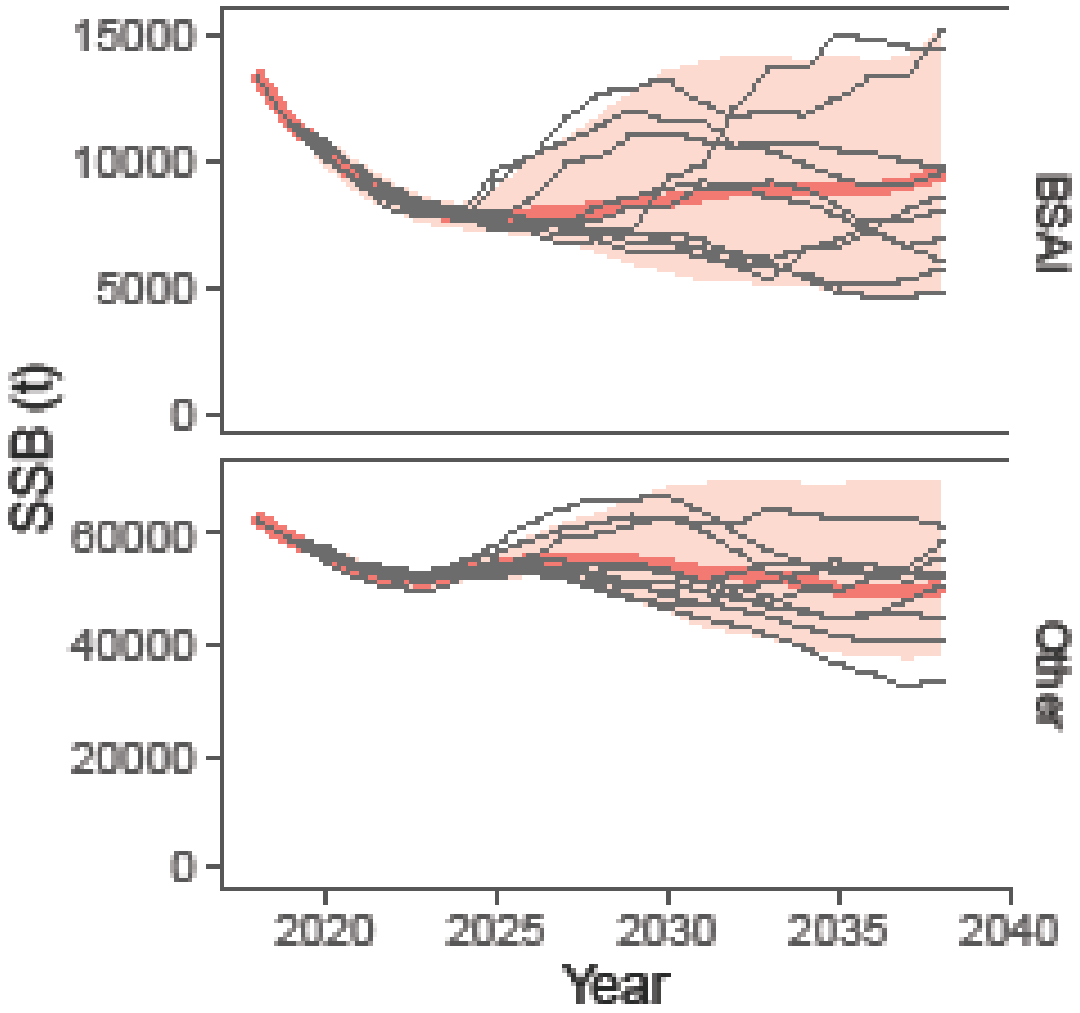
Sector specific PSC limits under Alternatives

Performance metrics

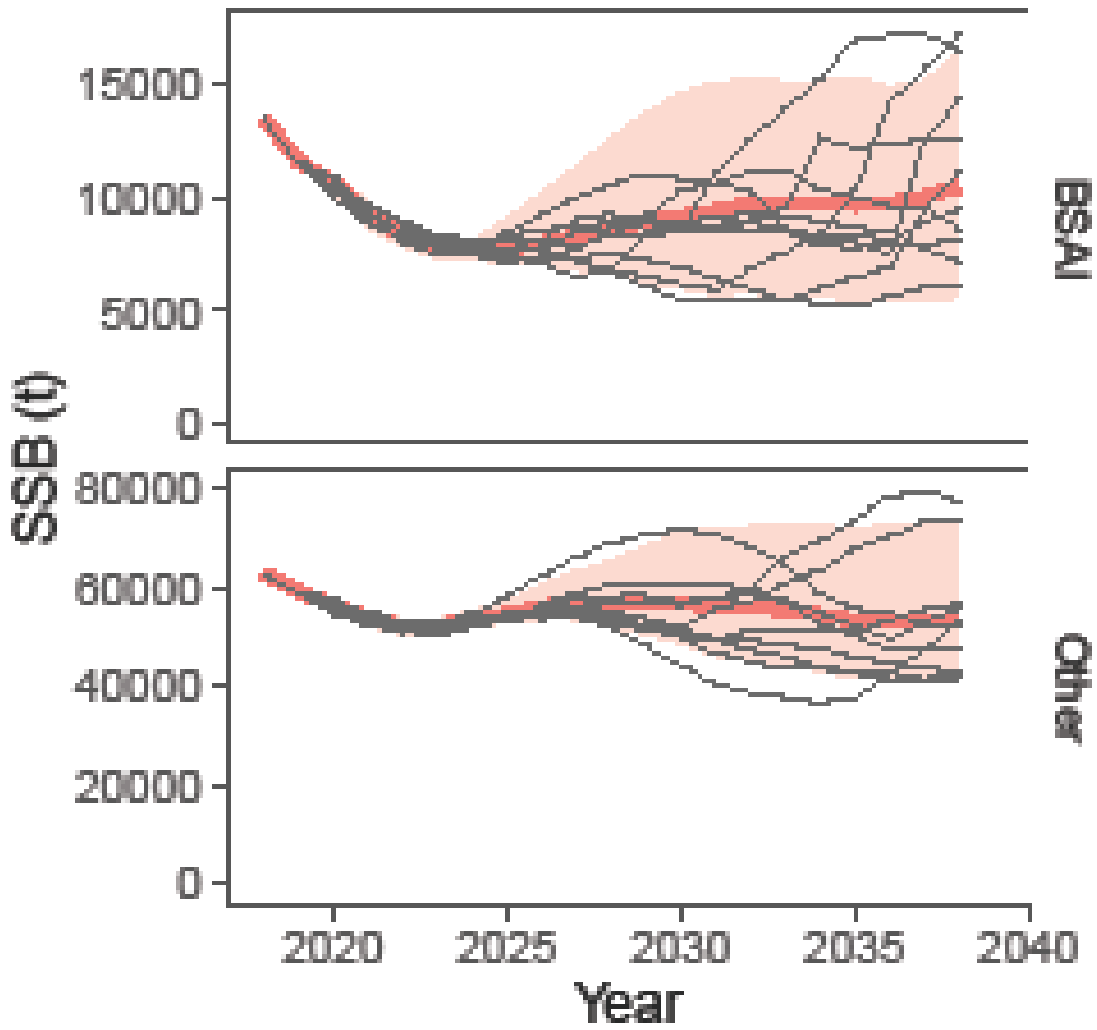
General trends

Demonstrations

Status Quo (Alt 1)

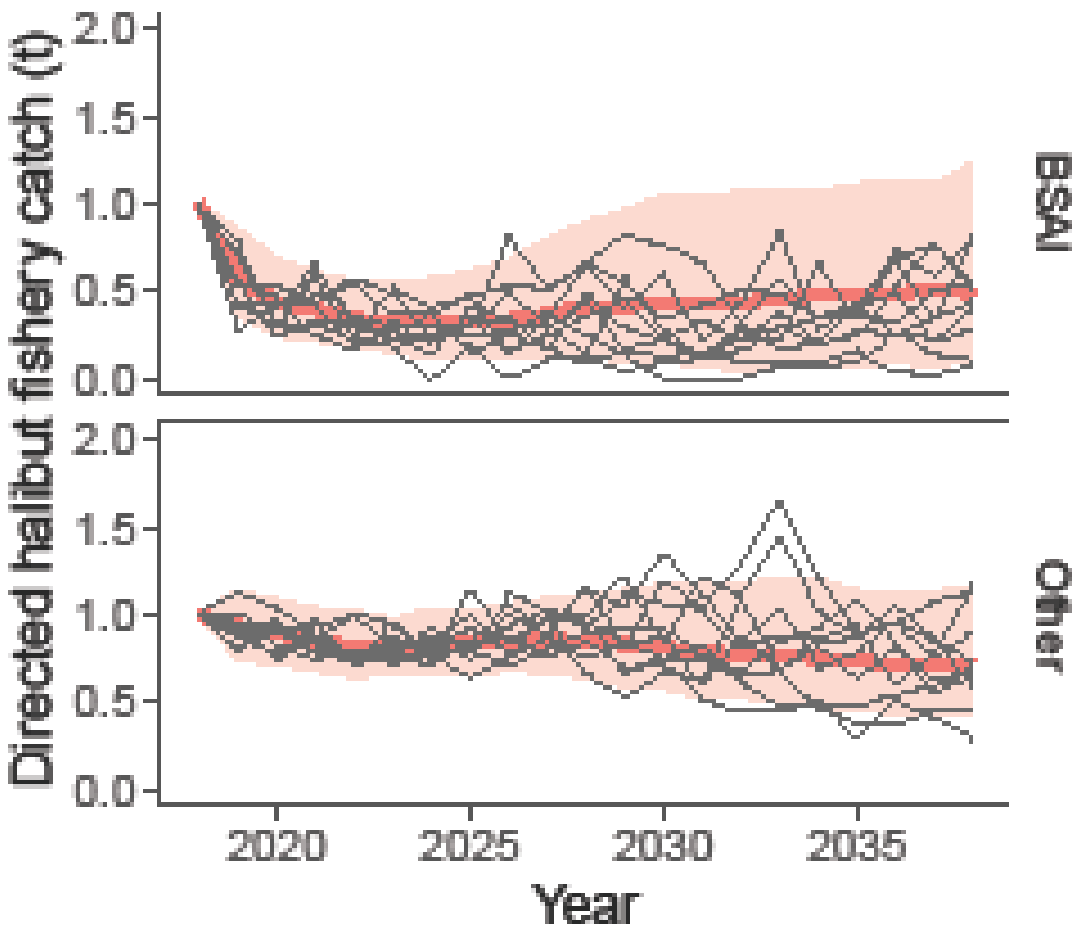


No PSC (Alt 1c)

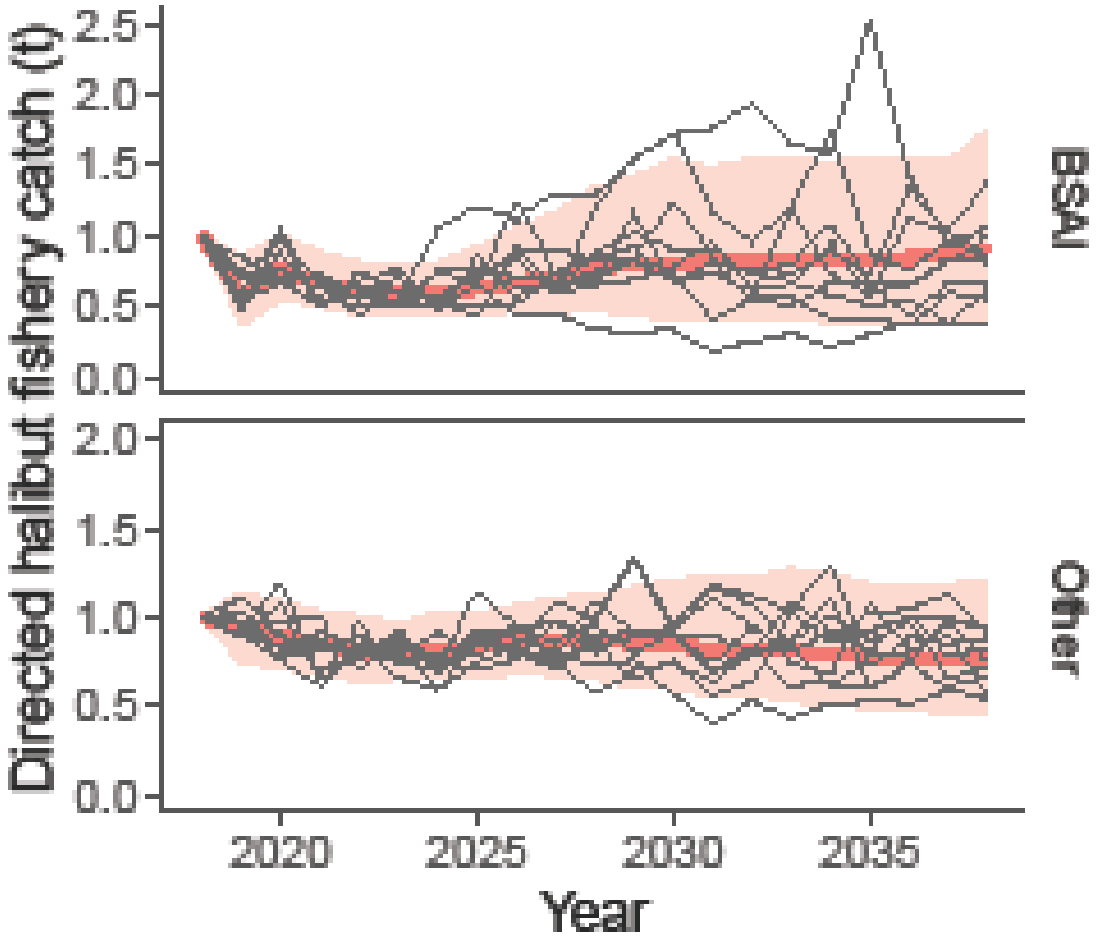


Demonstrations

Status Quo (Alt 1)

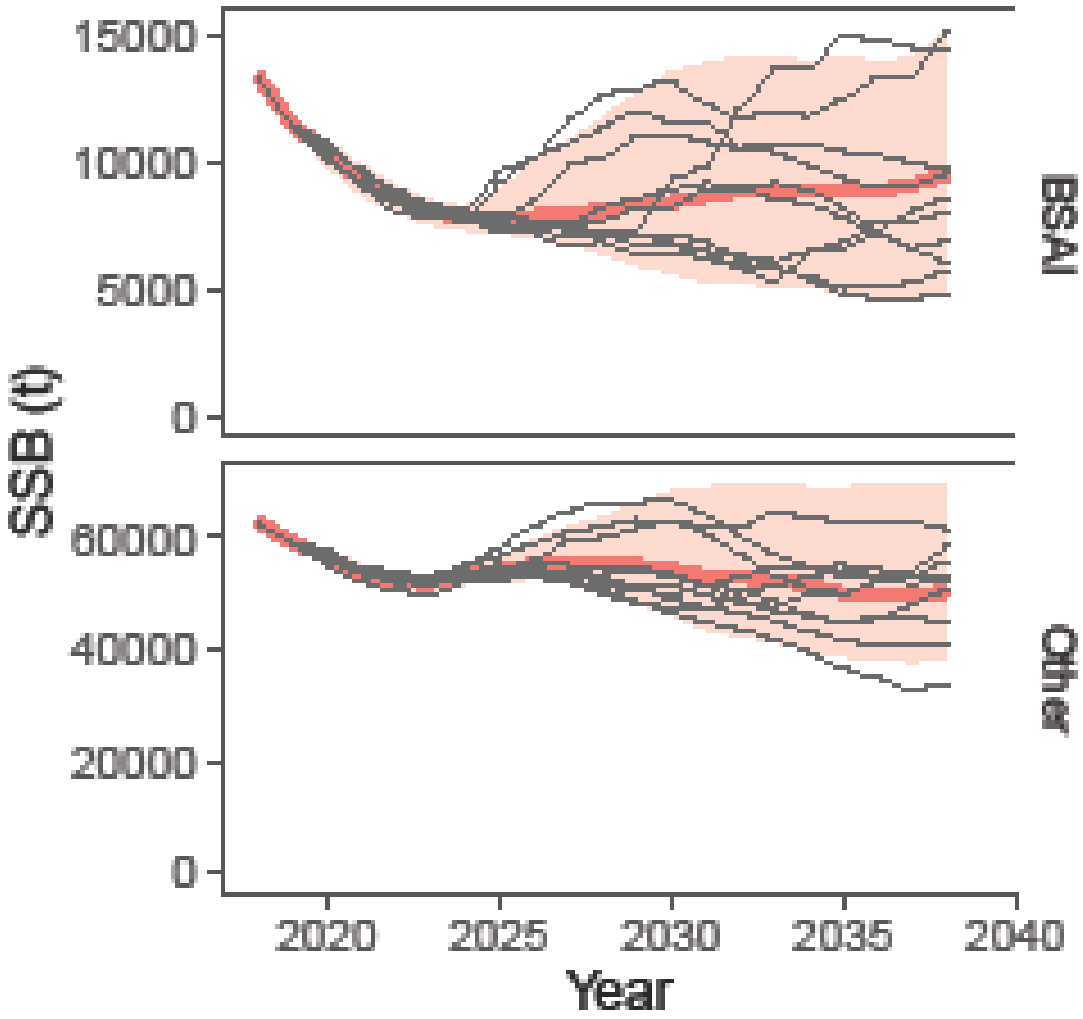


No PSC (Alt 1c)

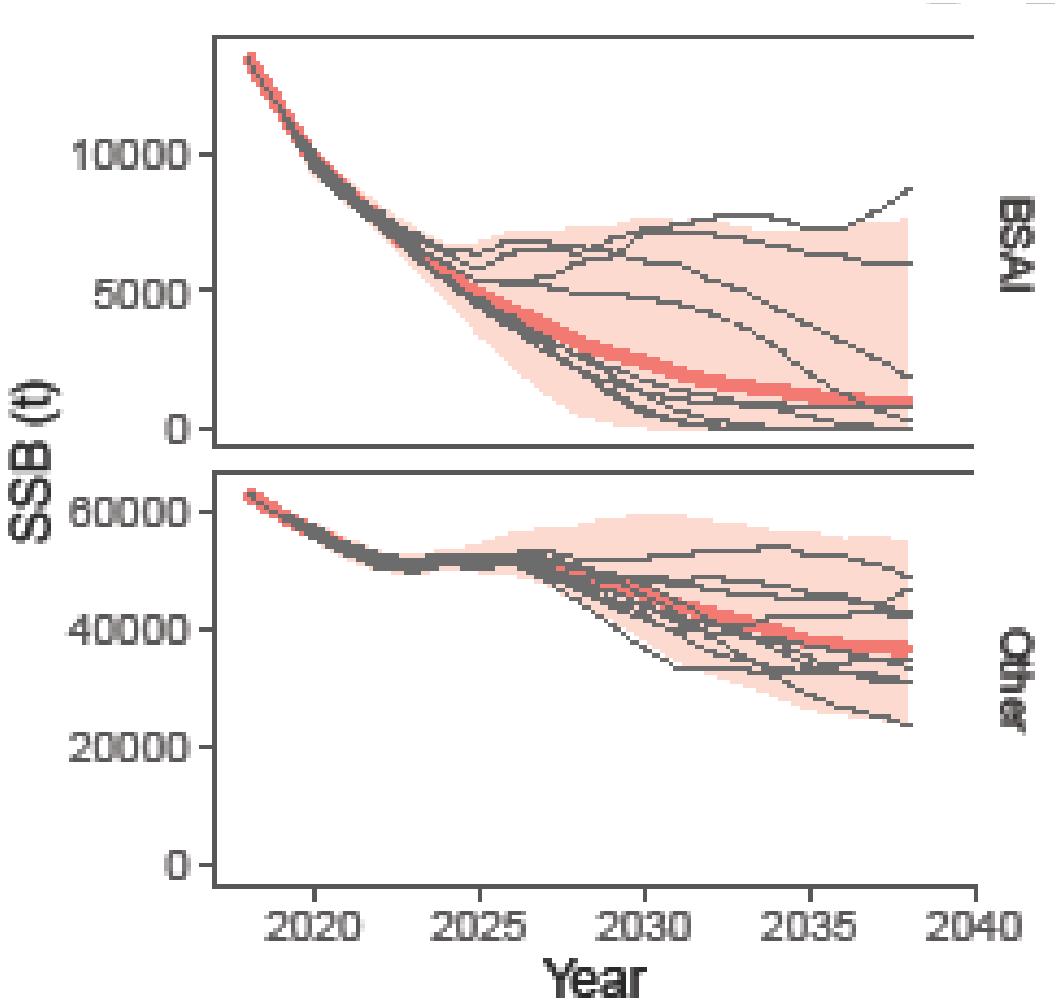


Demonstrations

Status Quo (Alt 1)

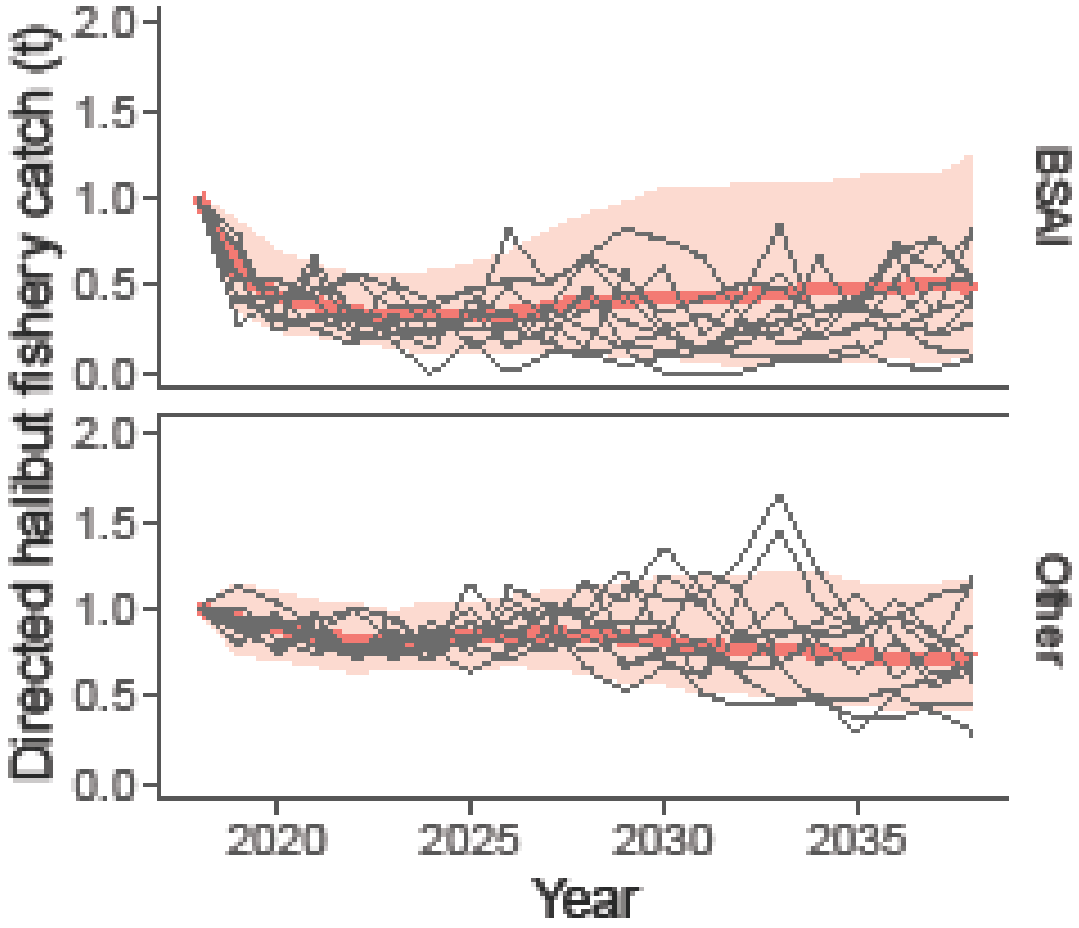


Extreme PSC (Alt 1d)

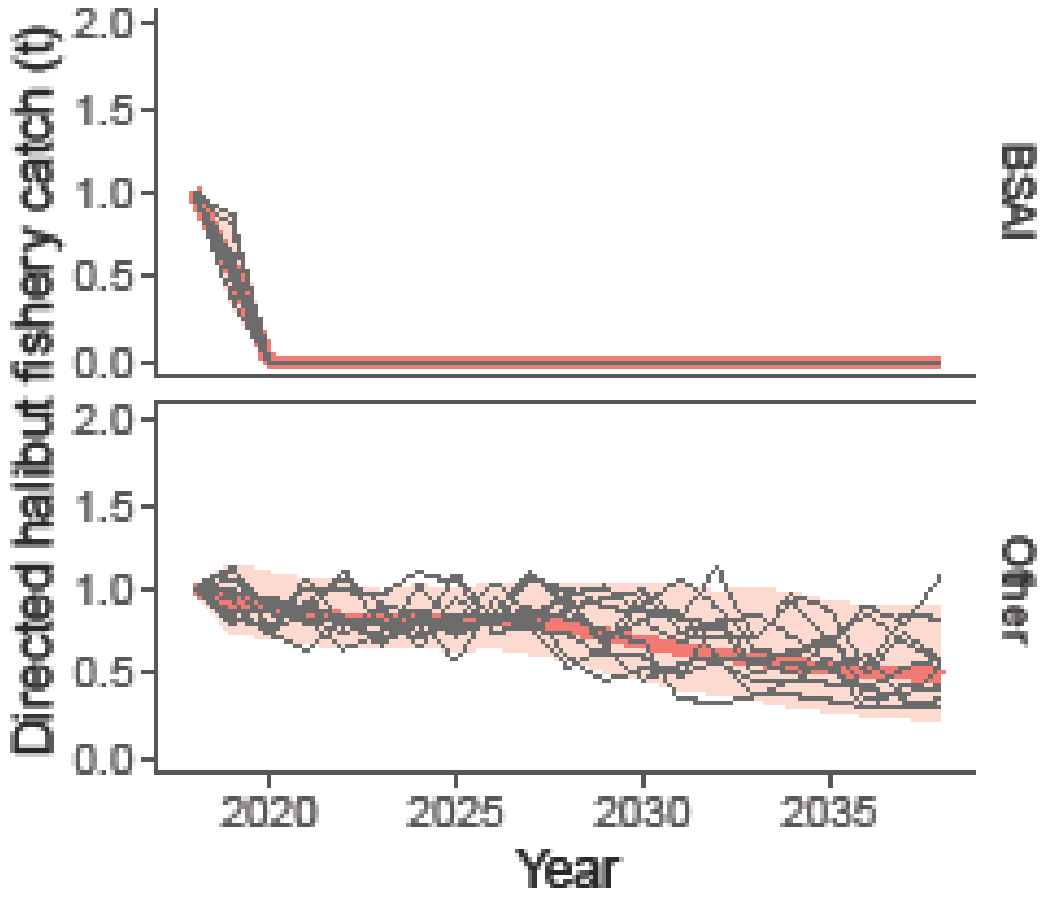


Demonstrations

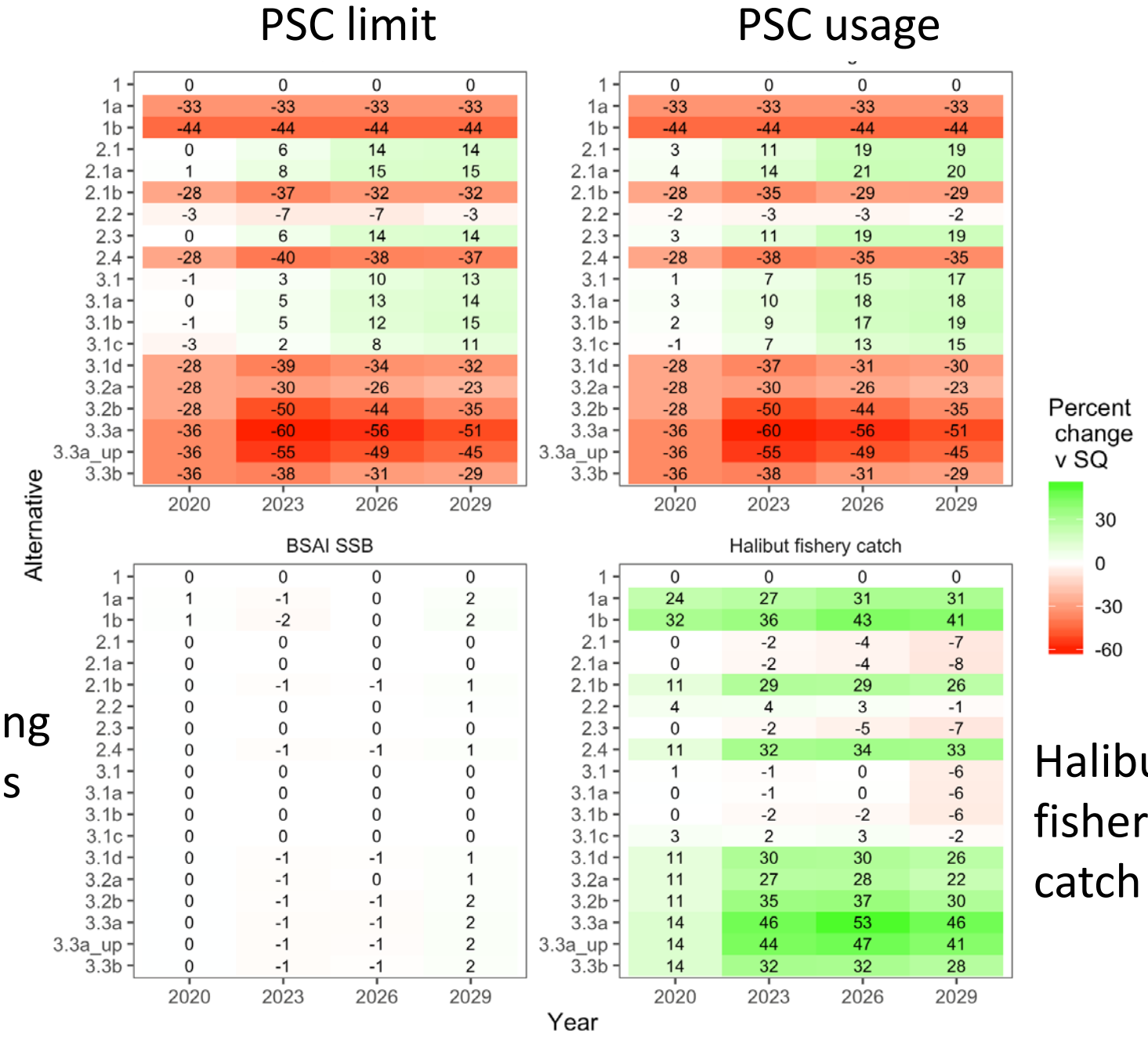
Status Quo (Alt 1)



Extreme PSC (Alt 1d)



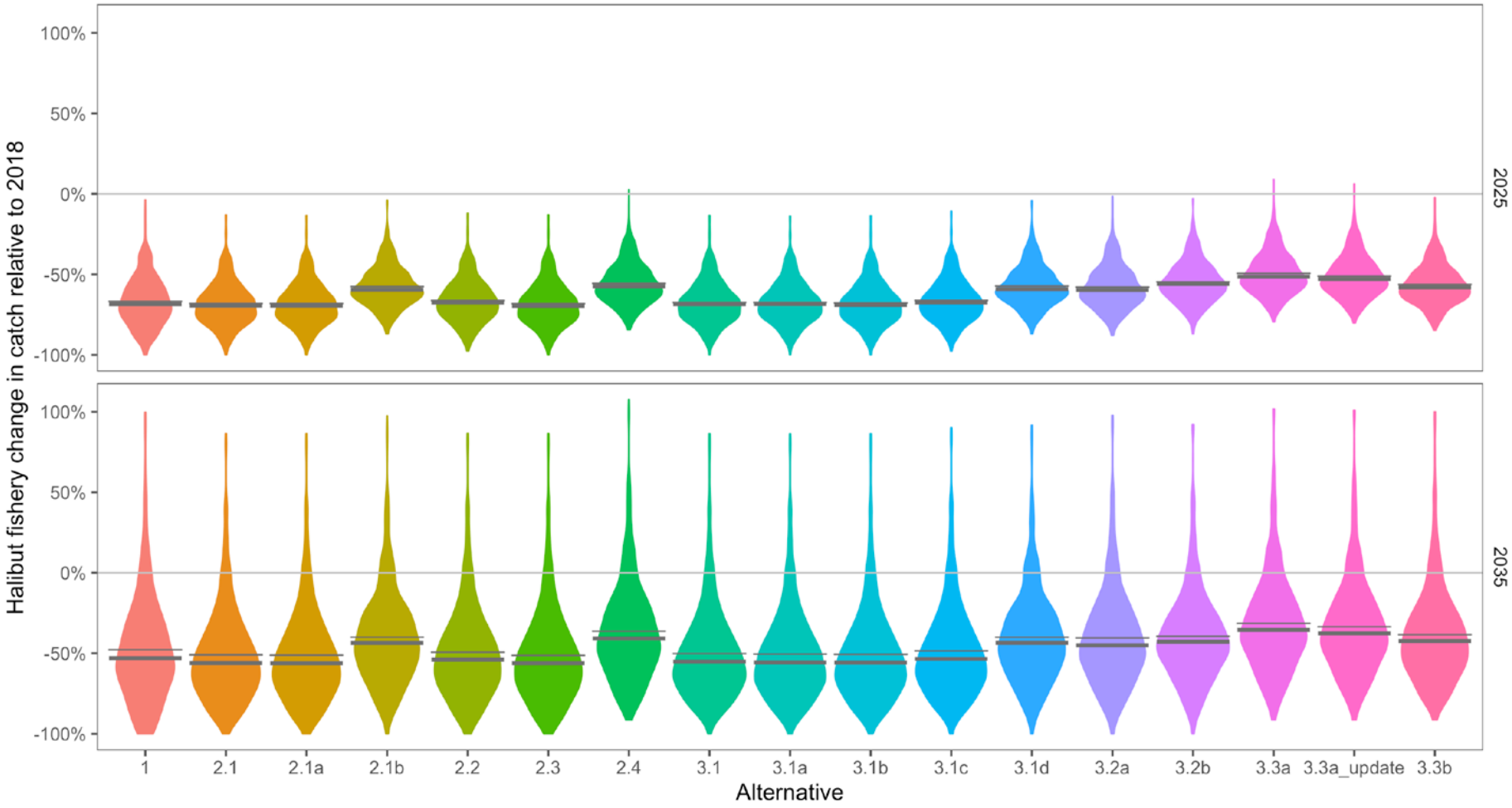
- Revised Table 6-1
- Projected median % change from status quo alternative



Spawning biomass

Halibut fishery catch

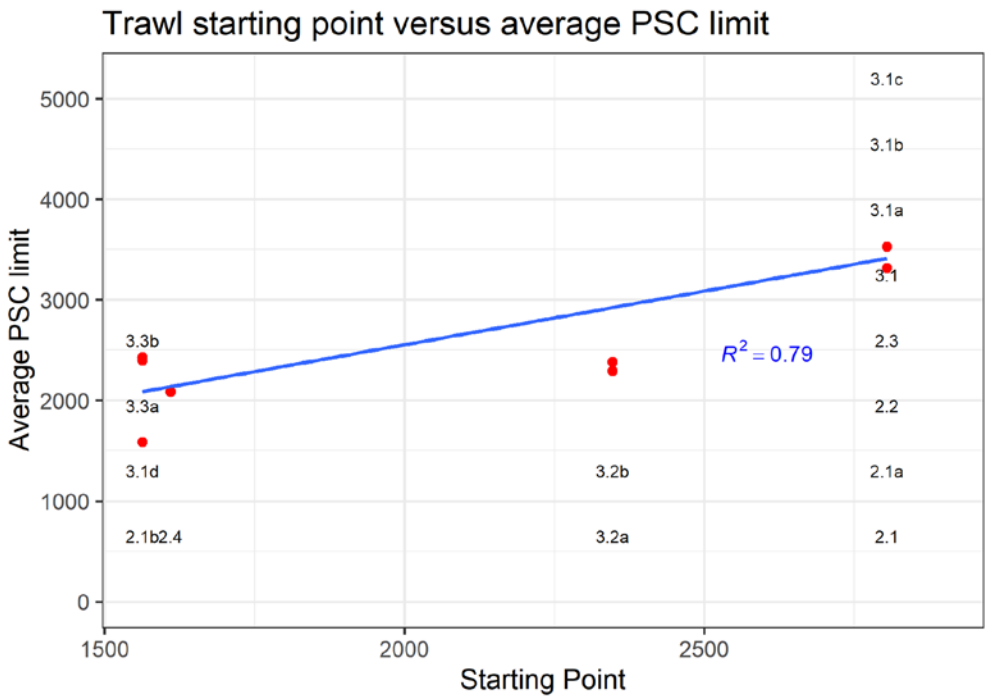
- Halibut fishery catch relative to 2018 value in 2025 and 2035
- **Compare across alternatives**
- Thick and thin horizontal bars: median and mean
- Thickness of vertical lines show number of simulations at a particular % change

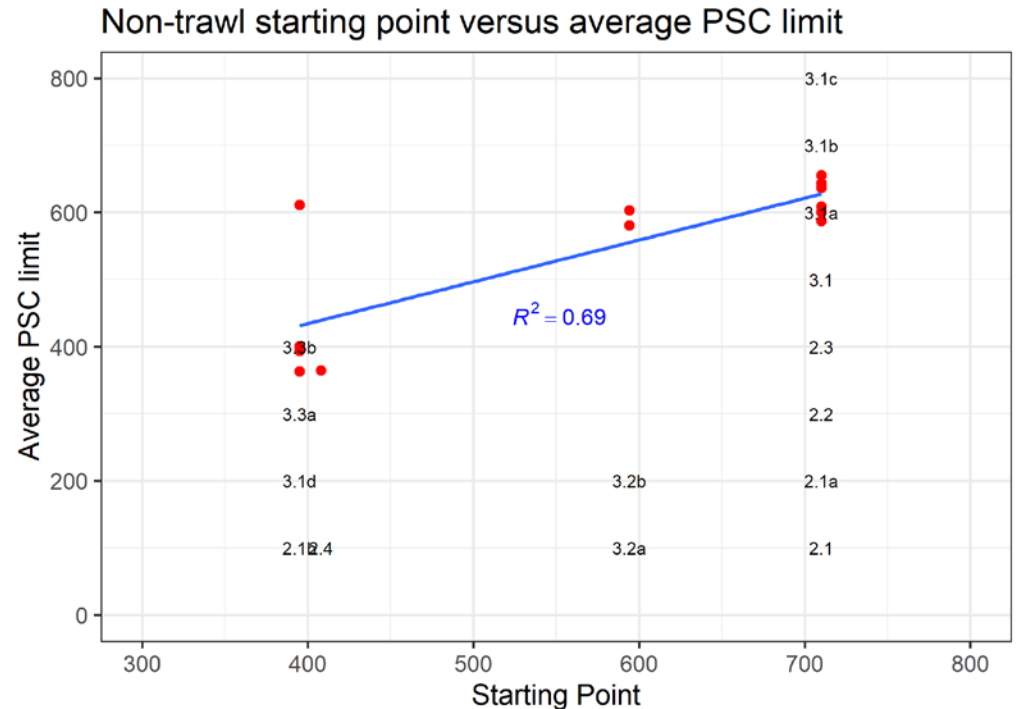


Conclusions on major features of control rules

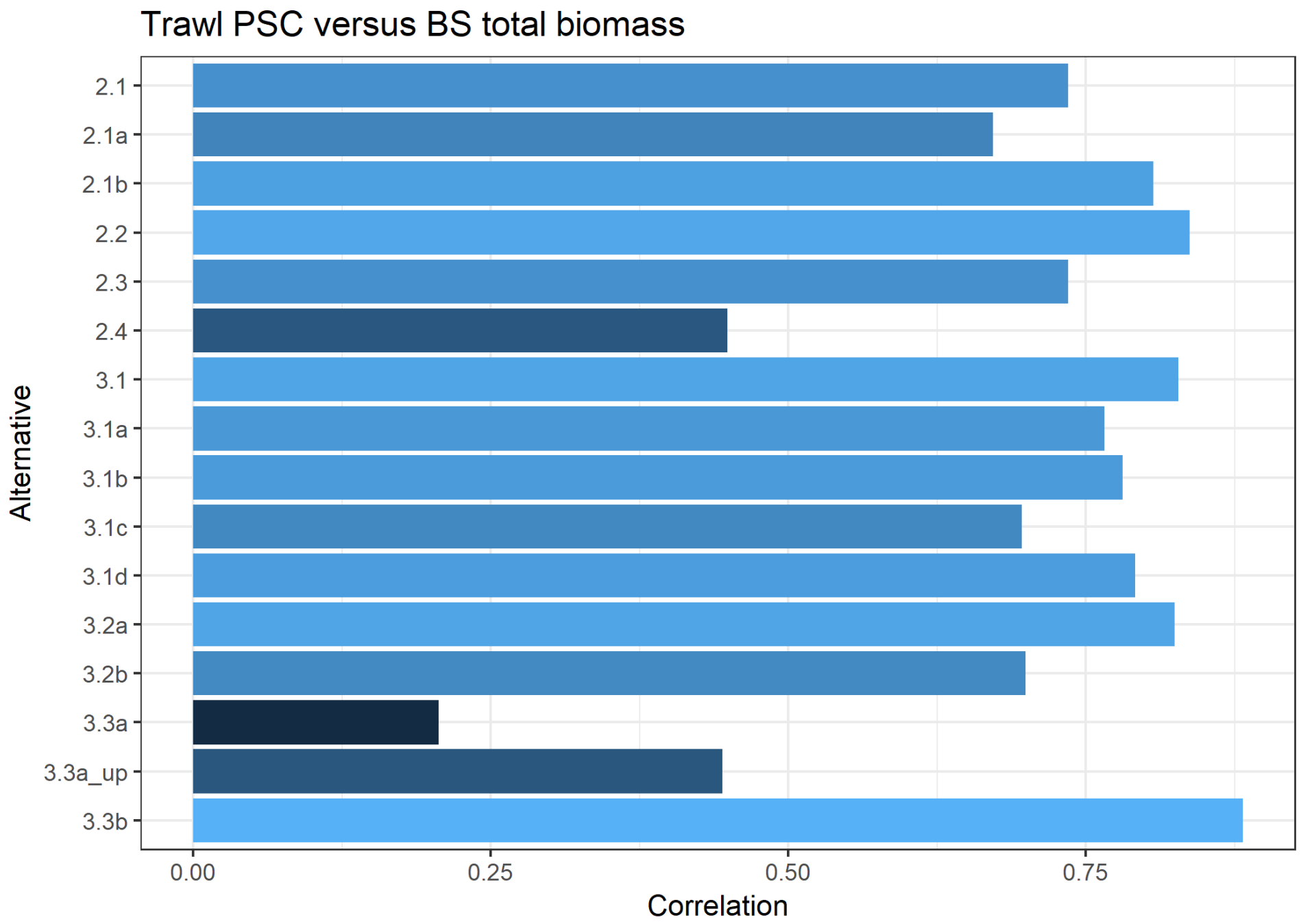
PSC limit most sensitive to starting point

Average = last 5 year's average PSC limit

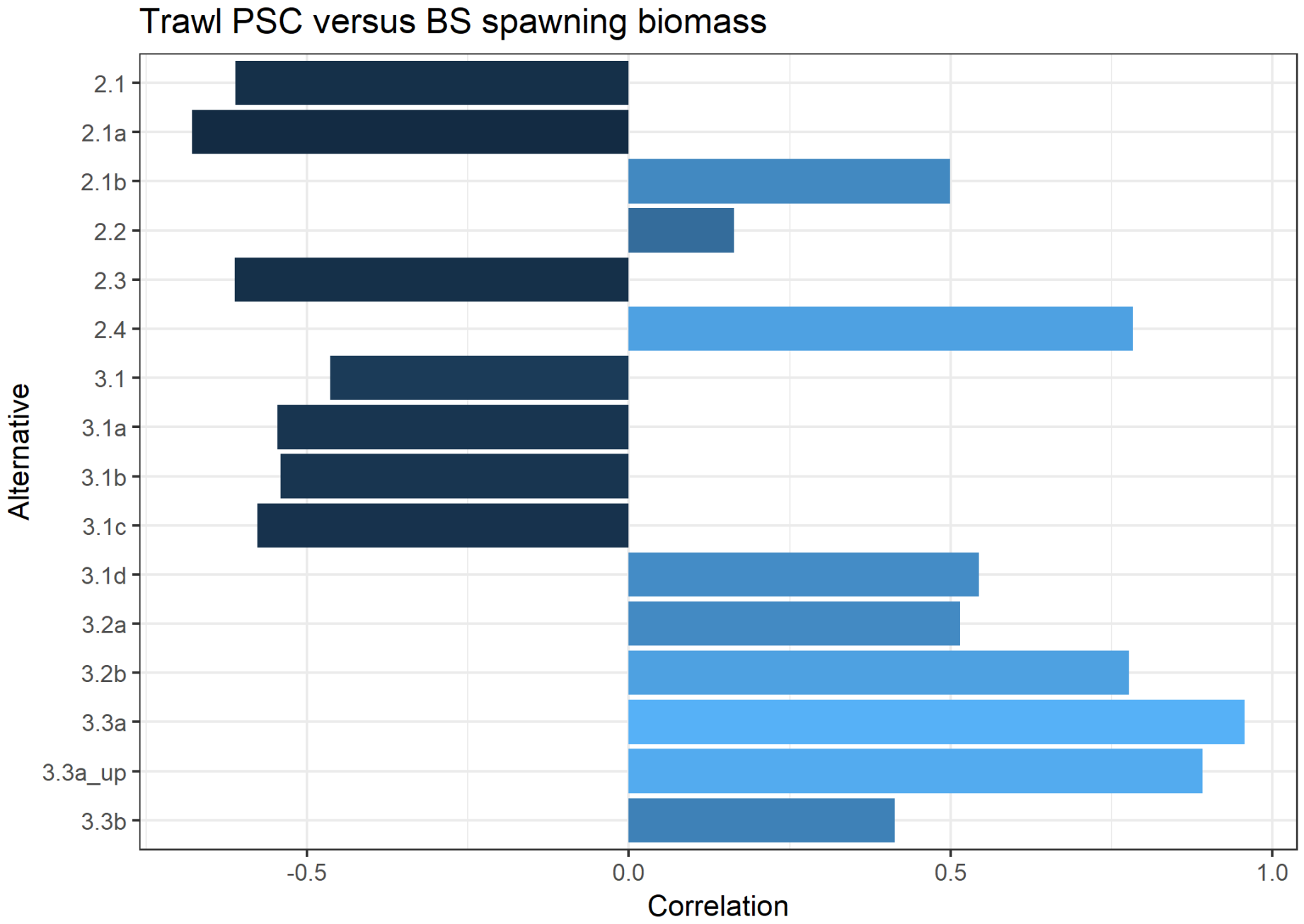




PSC limits are (mostly) correlated to halibut biomass



Correlations to non-matching biomass measure



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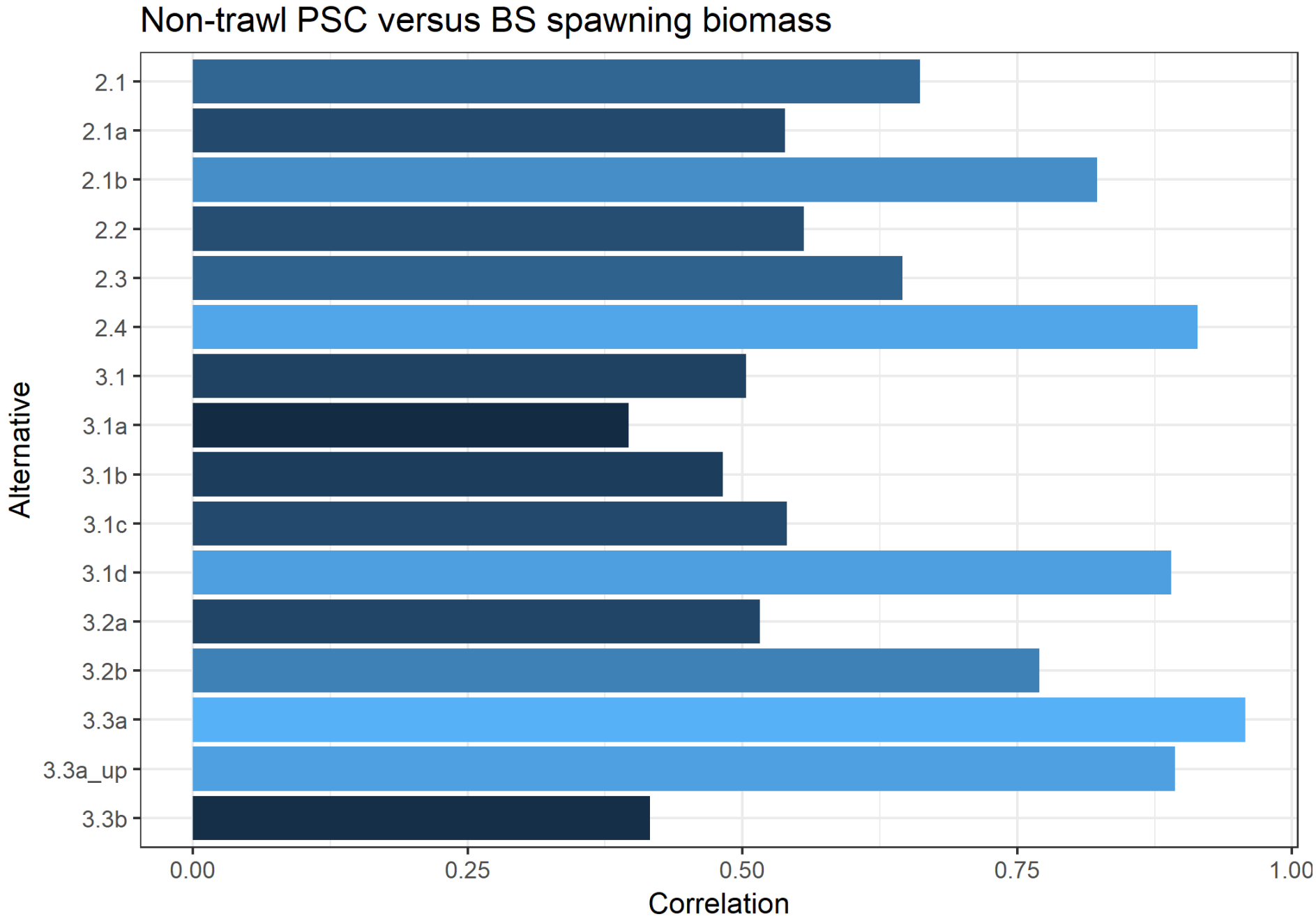
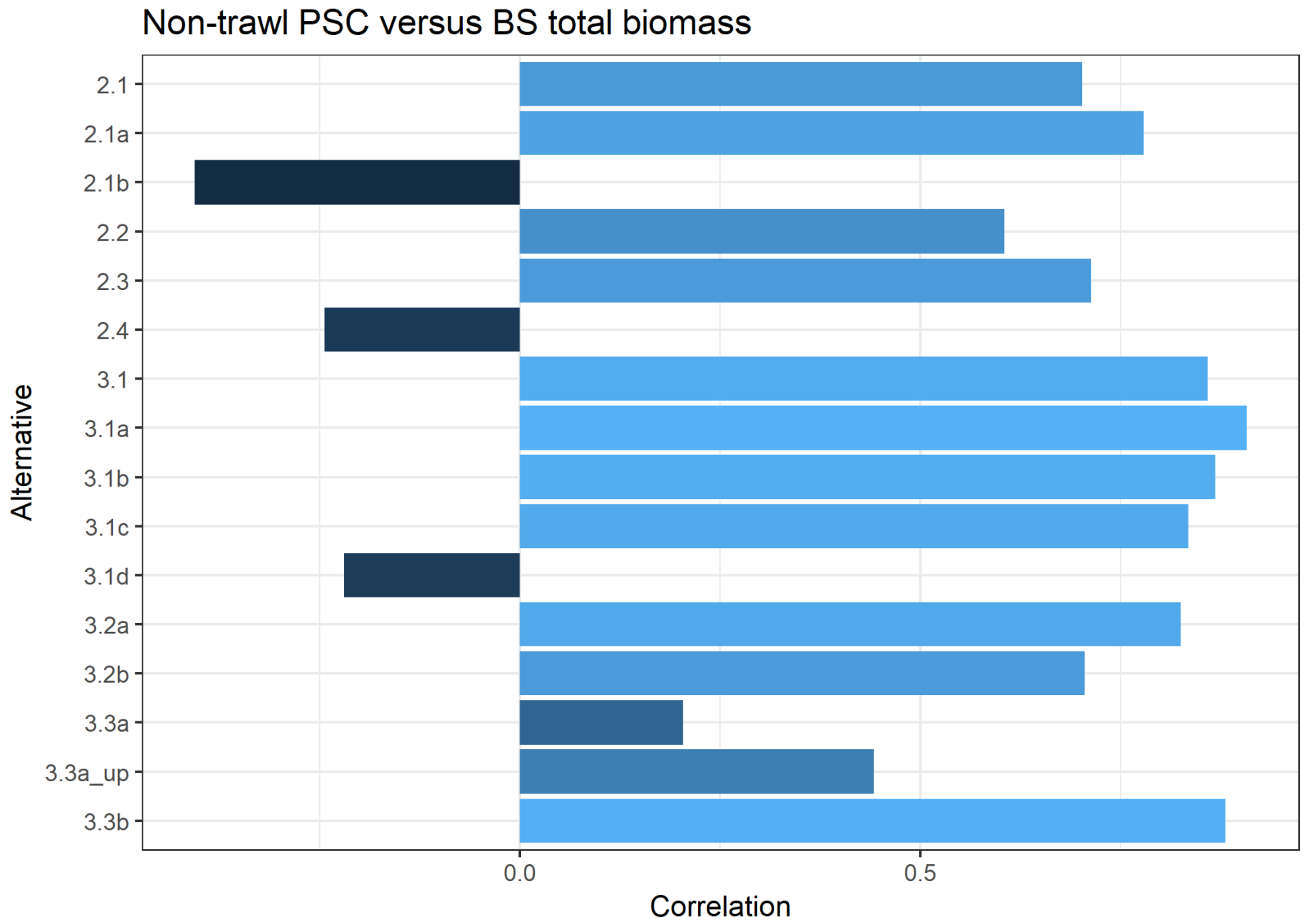


Correlations to non-matching biomass measure



Some alternative PSC limits often stuck on floors and ceilings

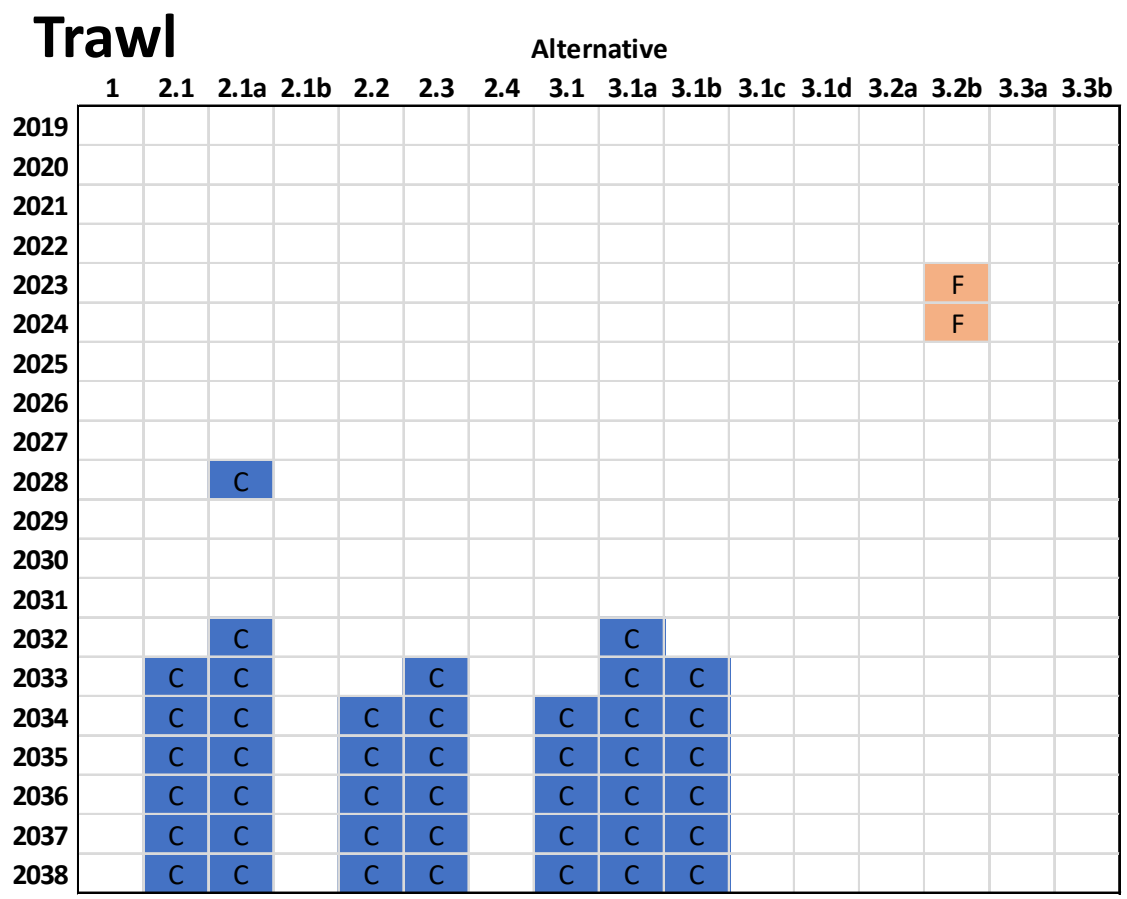


Figure 6-11. Occurrence of median trawl PSC limits reaching a floor (F, pink) or a ceiling (C, blue) for each alternative and year in the simulation.

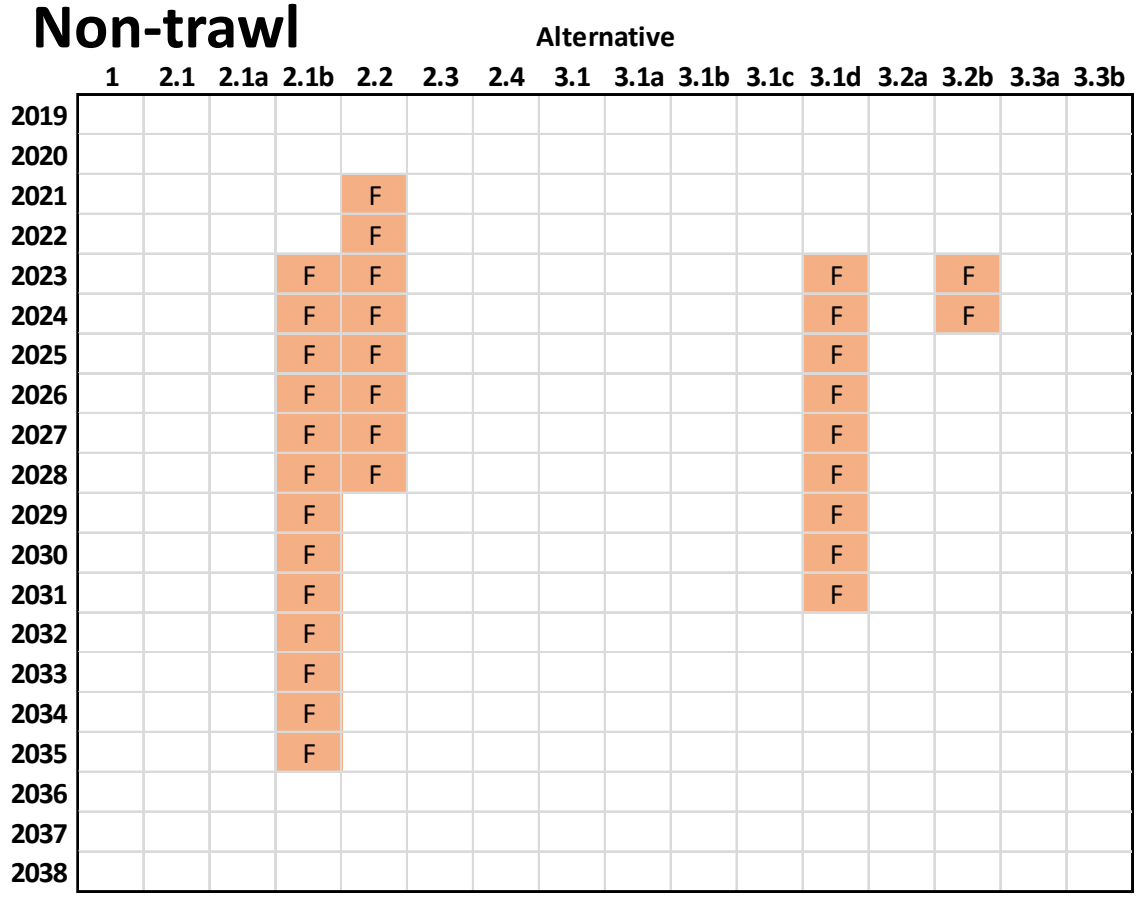
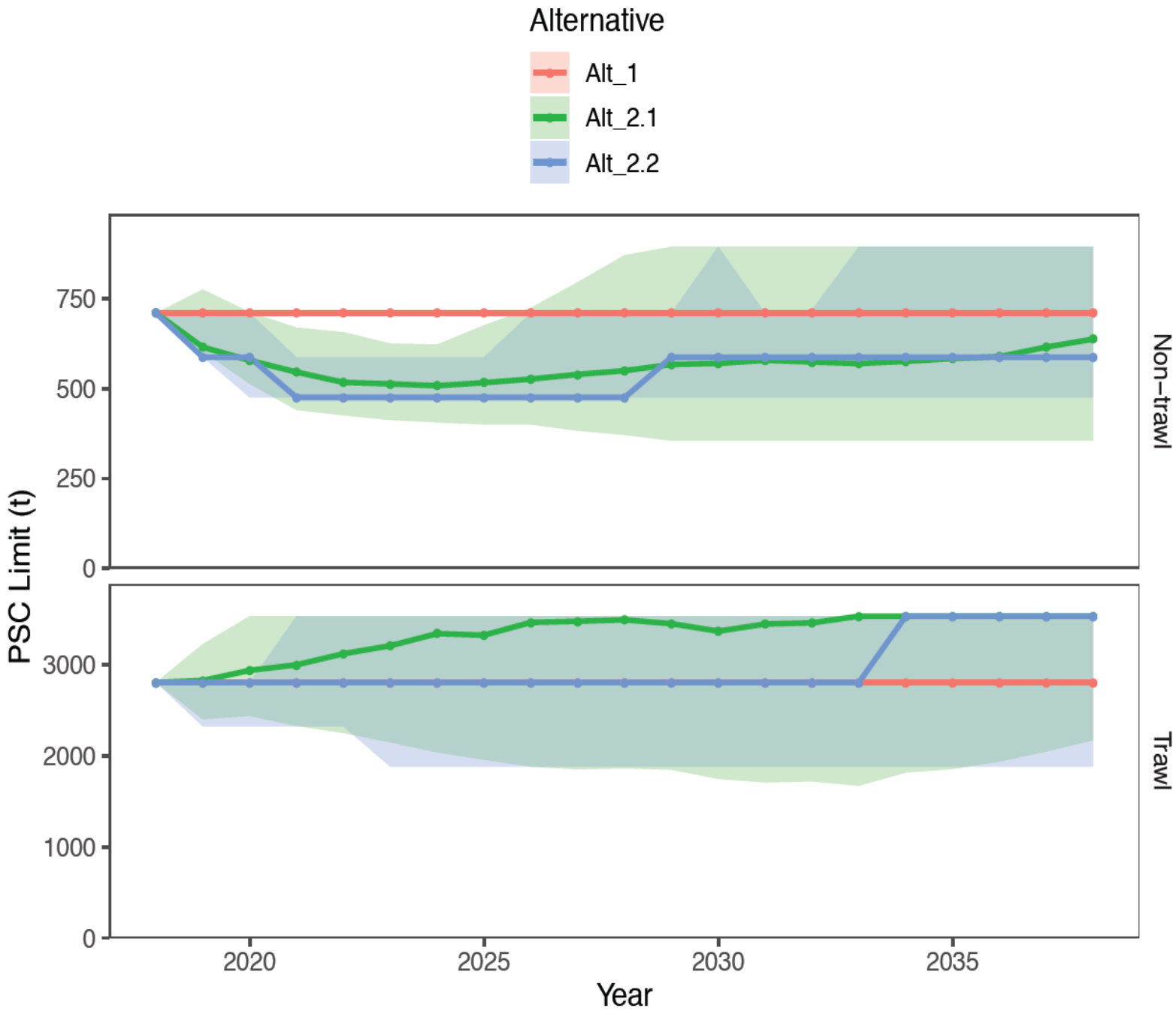


Figure 6-12. Occurrence of median non-trawl PSC limits reaching a floor (F, pink) or a ceiling (C, blue) for each alternative and year in the simulation.

Examples

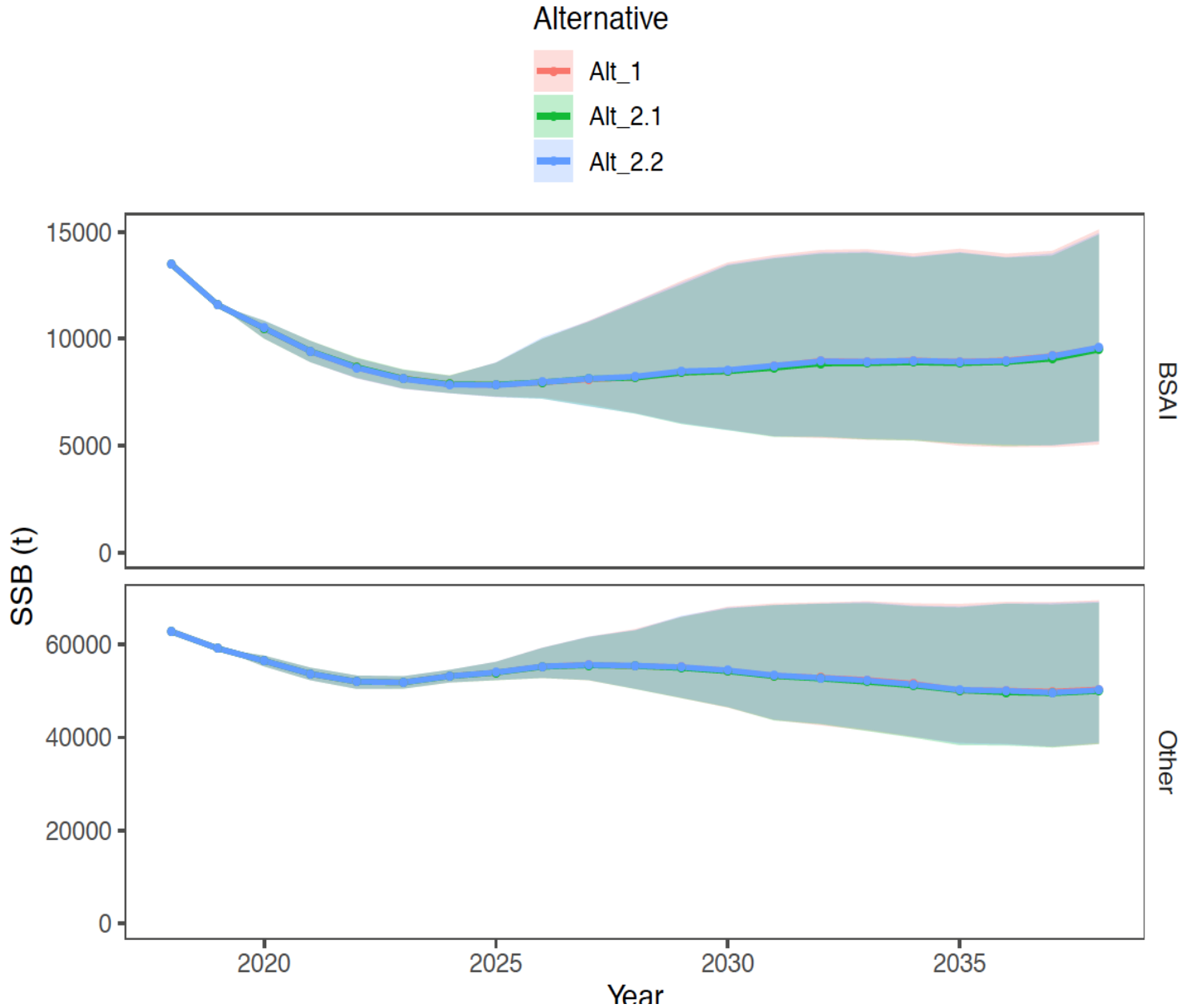
Examining effects of Elements and options:

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



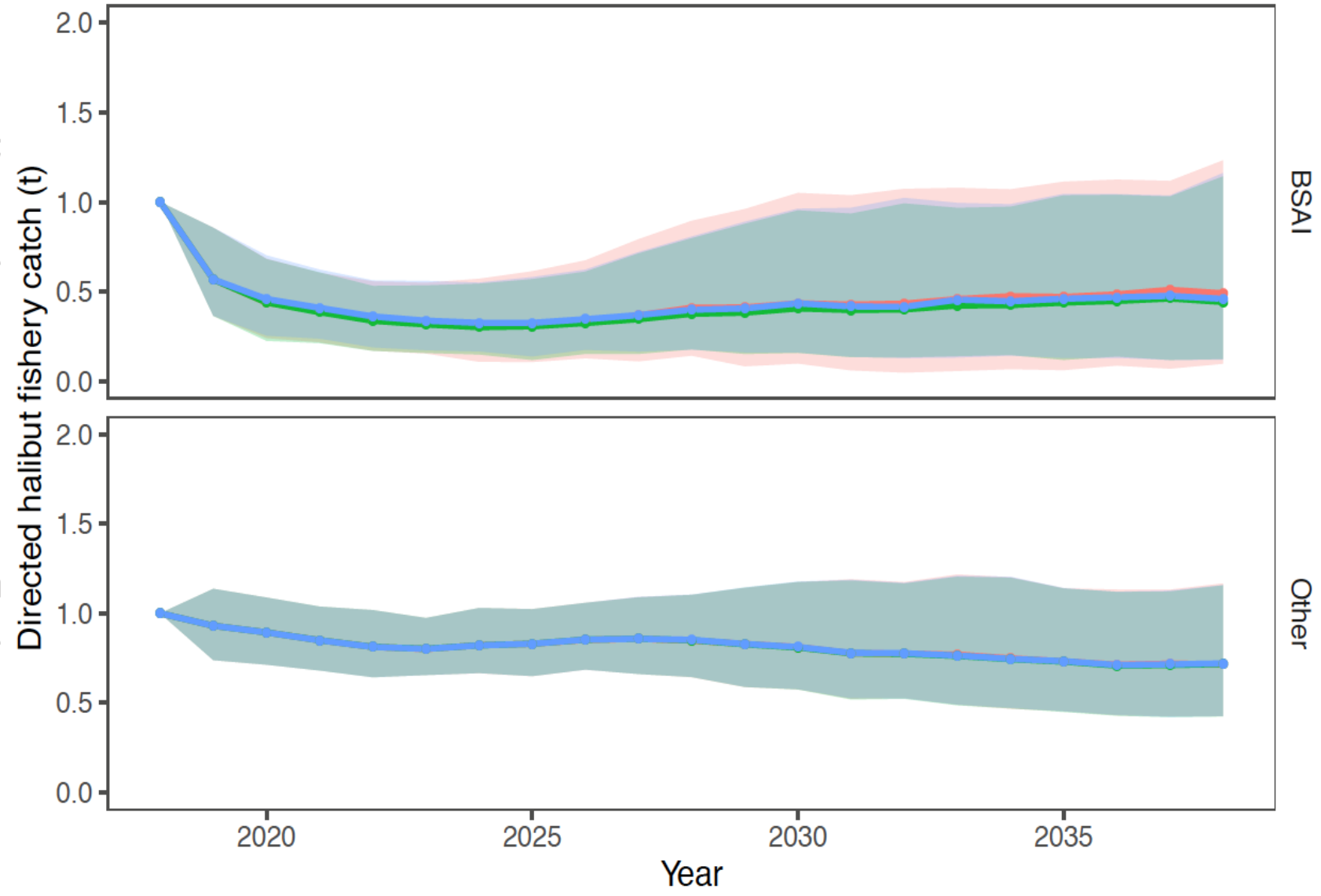
Examining effects of Elements and options:

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

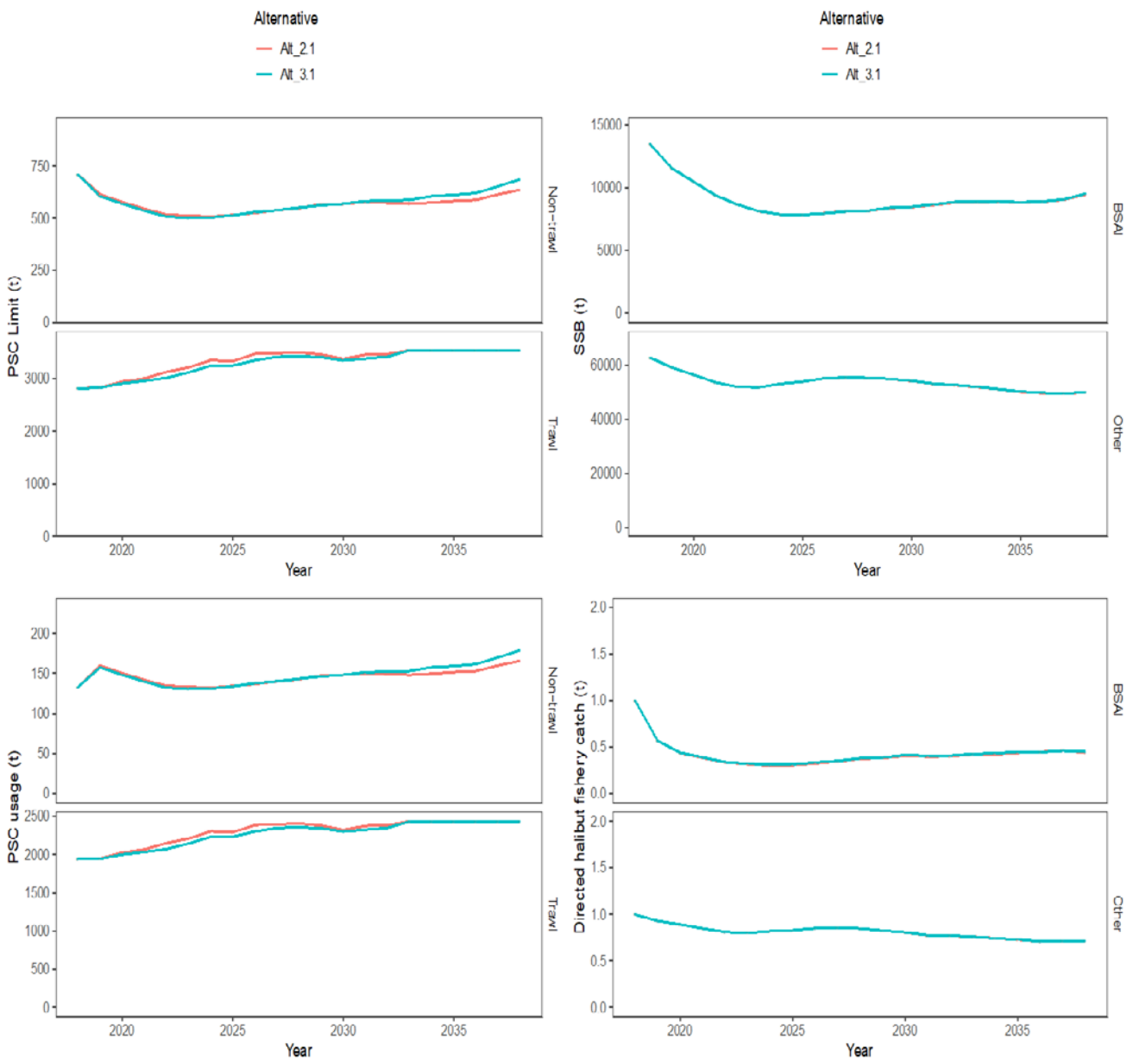


Figure 6-17. A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch for Alternative 2.1 and Alternative 3.1.

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

Change in responsiveness

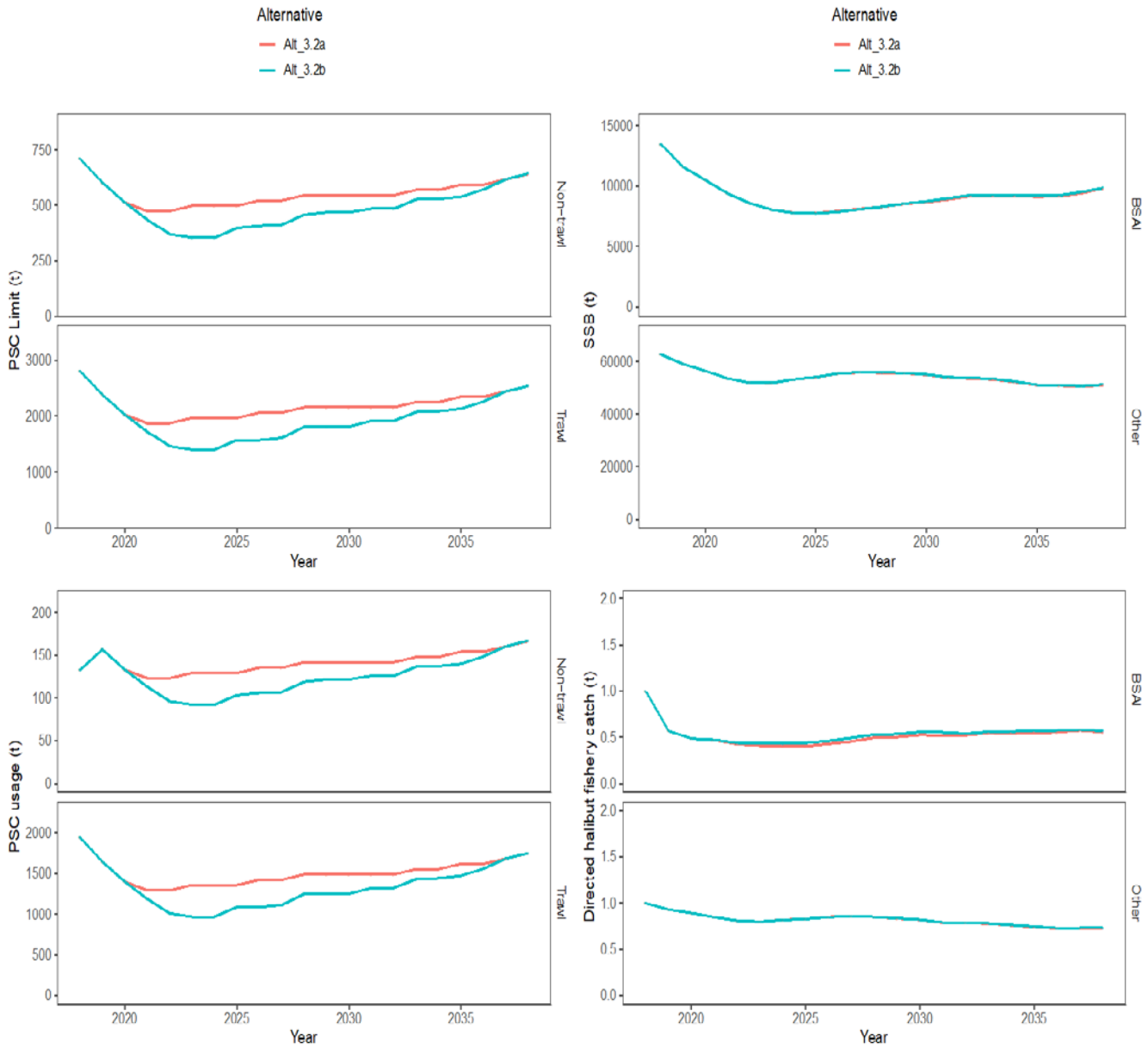
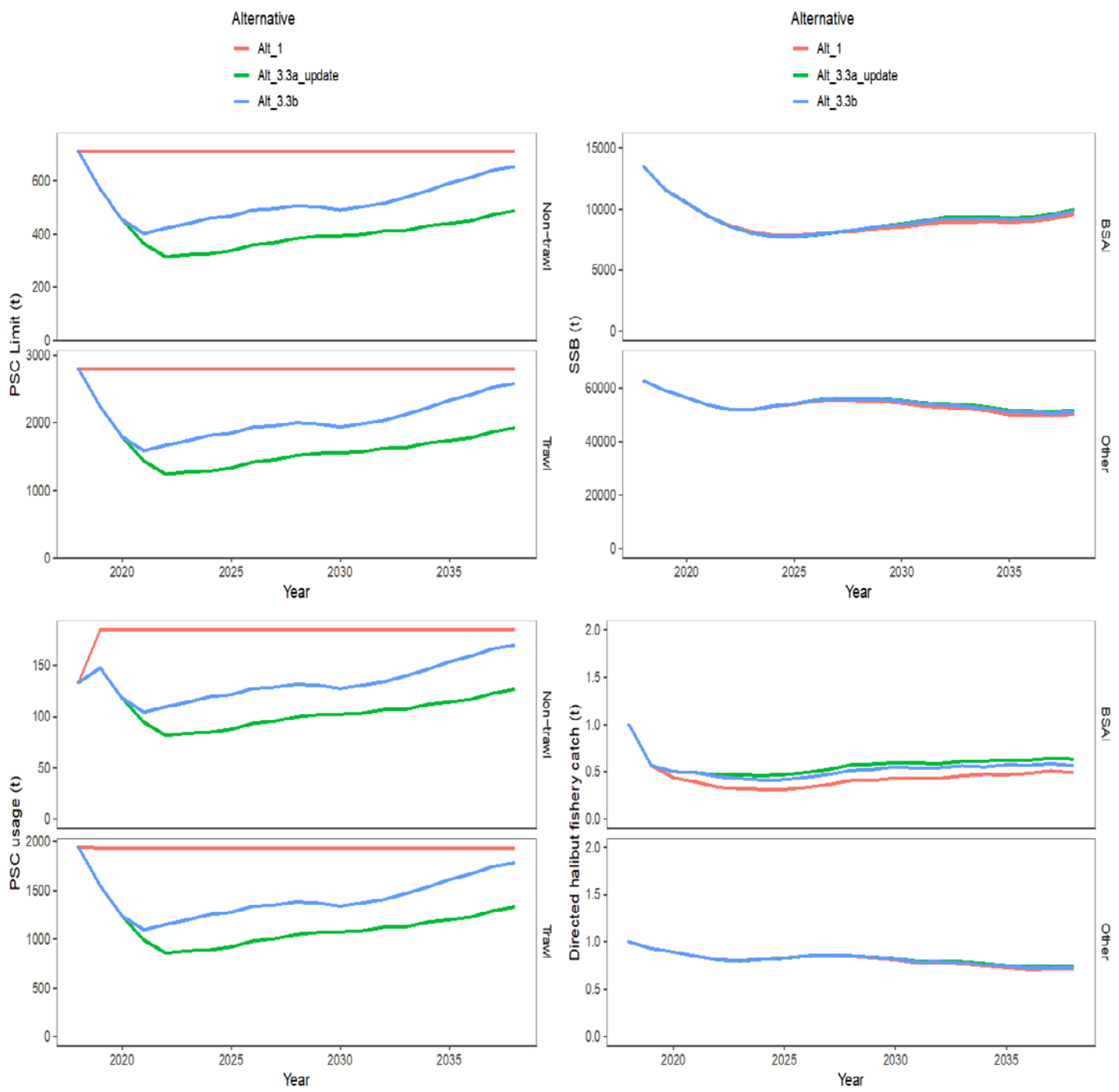


Figure 6-18. A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch for Alternatives 3.2a and 3.2b.

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

Using the same primary index for both gear types



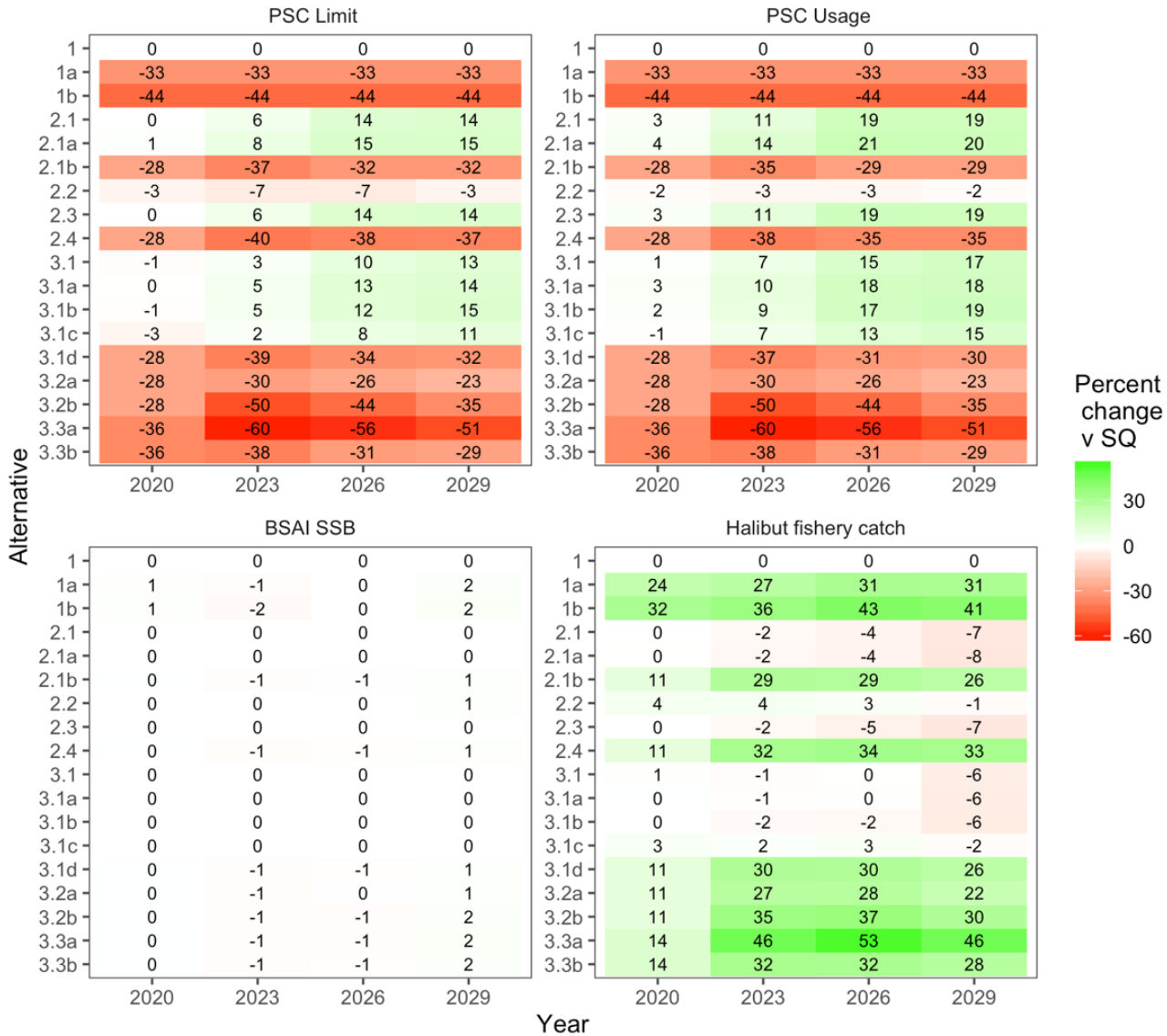
Fishery Impacts

Model Interpretation

- The ABM alternatives result in allocation rather than conservation
- Changes in PSC limits and halibut fishery catches are consistently in opposite directions but not in equal amounts
- No Action (Alt. 1) versus Status Quo
- Different expected constraints for Trawl and Non-Trawl

Table 6-1. Projected relative median values of PSC usage, Pacific halibut spawning biomass, and Pacific halibut directed fishery catch, and PSC limit as estimated from the simulation model. Values are expressed relative to status quo (Alternative 1 in row 1). Red shading indicates a lower relative value within each measure. Note that PSC Limit is identical (in relative terms) to PSC usage because it is in relative terms.

Table 6-1, p.224



Model Interpretation

- The ABM alternatives result in allocation rather than conservation
- Changes in PSC limits and halibut fishery catches are consistently in opposite directions but not in equal amounts
- No Action (Alt. 1) versus Status Quo
- Different expected constraints for Trawl and Non-Trawl

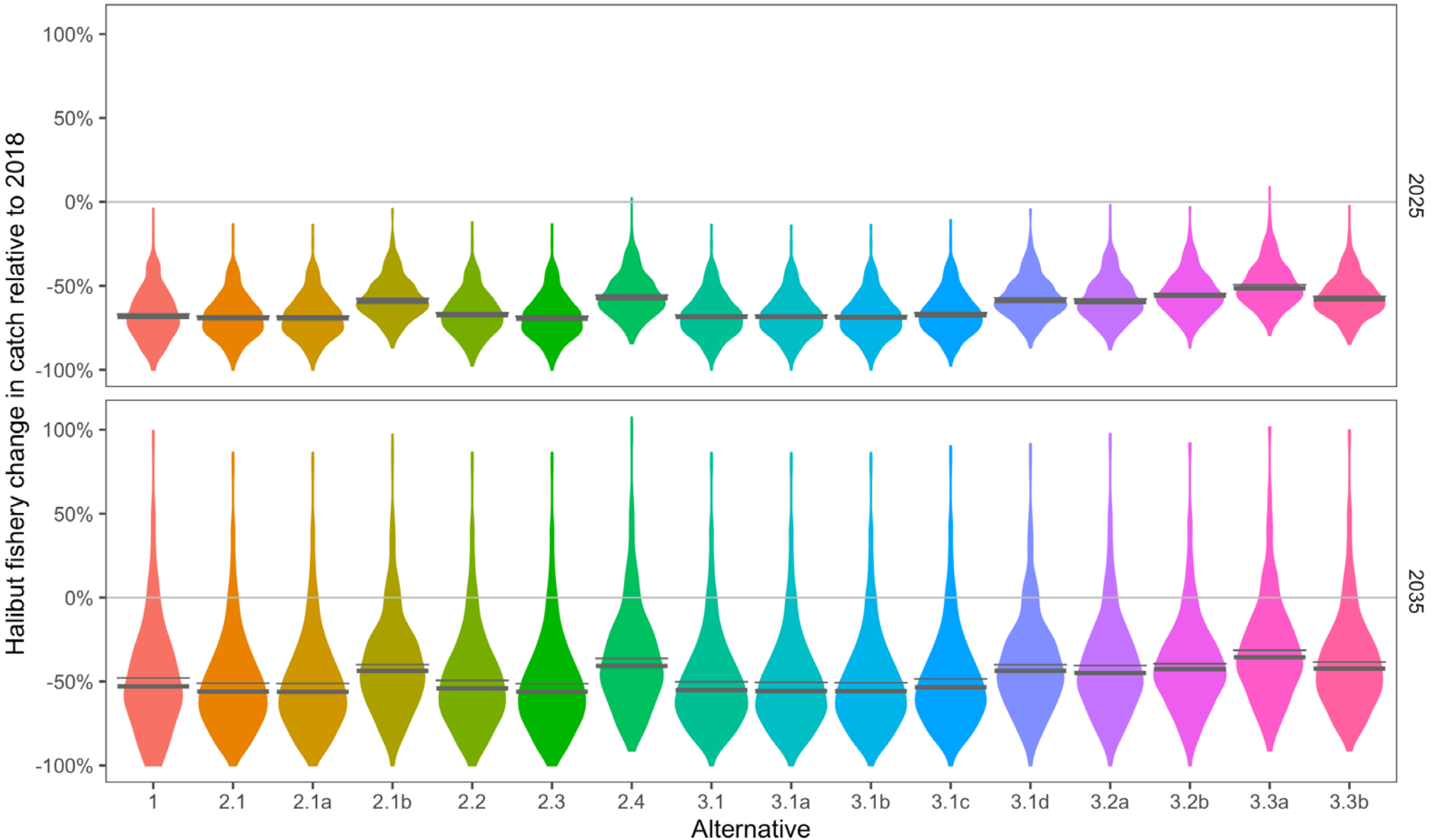


Figure 6-4, p.227

Model Interpretation

- The ABM alternatives result in allocation rather than conservation
- Changes in PSC limits and halibut fishery catches are consistently in opposite directions but not in equal amounts
- No Action (Alt. 1) versus Status Quo
- Different expected constraints for Trawl and Non-Trawl

Less than status quo limit

	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

Table 6-8, p.251

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

Factors affecting PSC encounter & use

Environmental

- Halibut abundance
- Co-location
- Spatial distribution

Regulatory

- GF TACs & 2M mt cap
- Sector and intra-sector target portfolios
- Spatial/temporal constraints
- DMR

Operational

- Avoidance measures
- Catch handling
- Species targeting and timing (A80)
- Vertical integration

Operational decisions have costs

- Search time looking for grounds with lower halibut bycatch
- Fishing lower CPUE areas because there are fewer halibut
- Changing catch handling techniques (deck sorting)
- Any change from standard fishing operations imposed to reduce halibut PSC

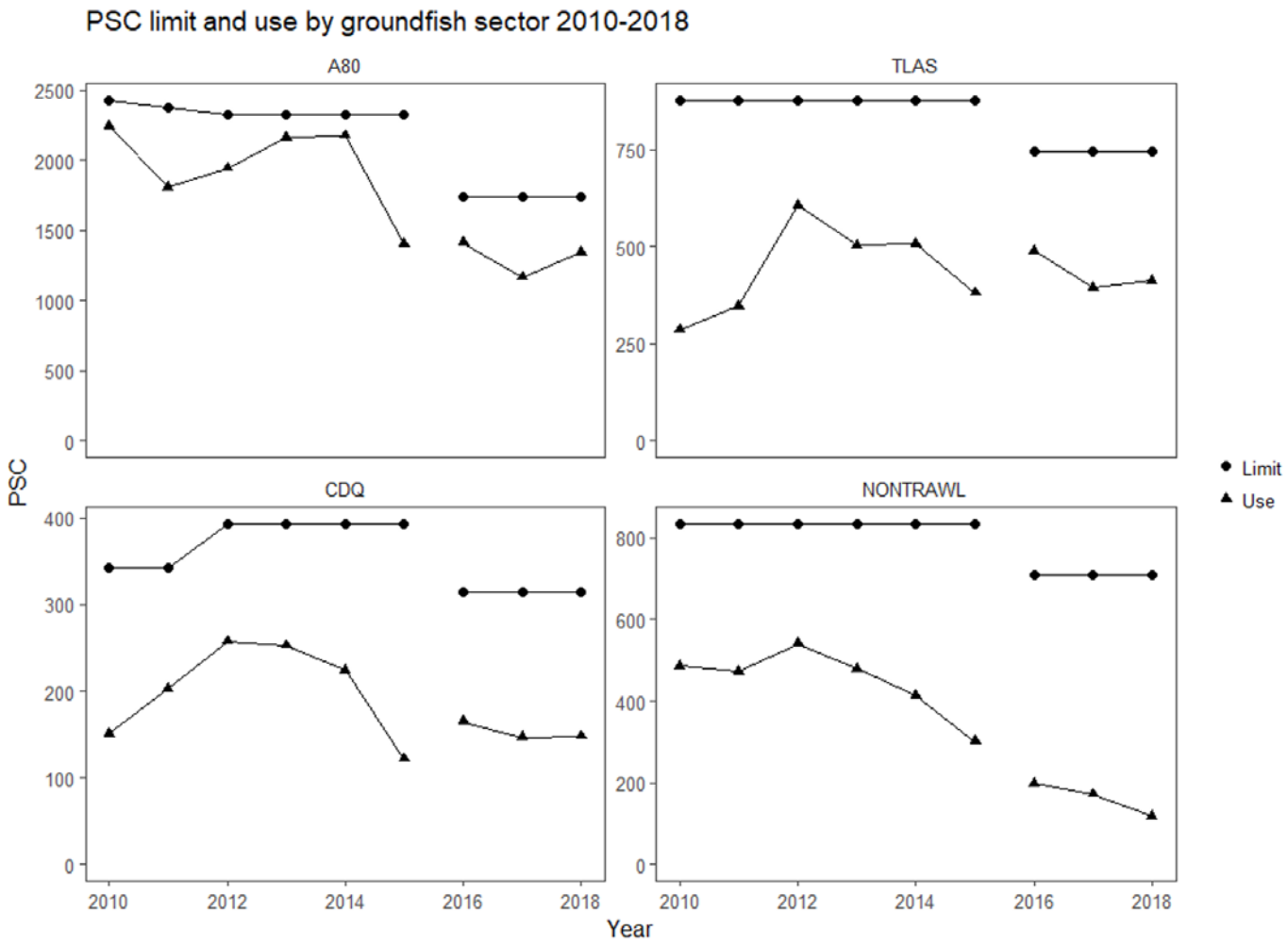


Figure 6-20. PSC limits and PSC use by groundfish sector 2010-2018. Gap in x-axis represents implementation of Amendment 111 and related PSC limit reductions. Note y-axis differs in each panel.

- Relationship between PSC limit and use varies
- How would use change under different PSC limits?
- Past groundfish value per PSC ton is not predictive of future

Figure 6-20, p.252

Forgone groundfish revenue

Relationship between groundfish revenue and PSC is unclear and unpredictable

Revenue factors can be independent of PSC use

- Catch composition
- Markets
- Season
- TAC

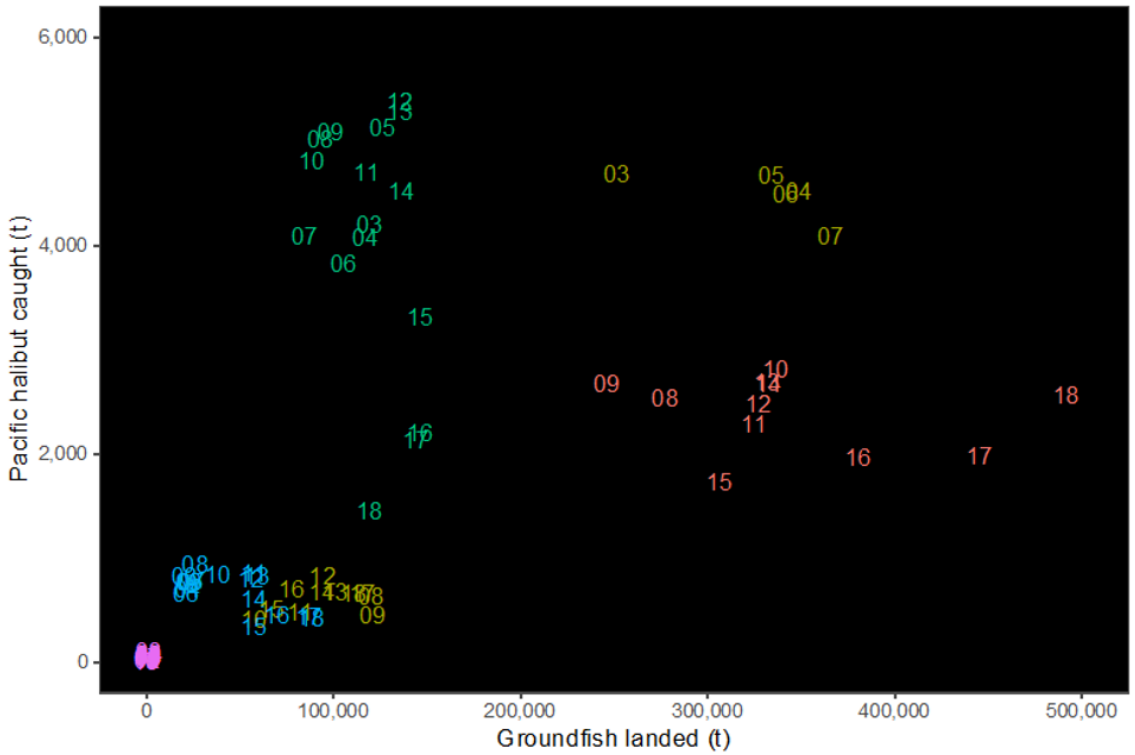
Environmental and regulatory factors influence PSC encounter & use

Table 6-9. PSC limits, annual averages of PSC use, groundfish revenue per ton of PSC use and gross non-pollock groundfish revenue before and after A111 and the differences between these periods.

			Average annual…			
	Sector	**PSC Limit**	**PSC Use**	**PSC Use:Limit**	**Groundfish $/ t PSC use**	**Non-pollock groundfish revenue**
Pre A111 (2012-2015)	A80	2,325	1,923	0.83	155,398	298,869,286
	TLAS	875	500	0.57	195,375	97,590,011
	CDQ	393	214	0.55	324,076	69,433,362
	NON TRAWL	833	434	0.52	403,020	174,809,718
Post A111 (2016-2018)	A80	1,745	1,307	0.75	244,624	319,805,750
	TLAS	745	431	0.58	252,708	109,001,276
	CDQ	315	153	0.49	506,379	77,644,765
	NON TRAWL	710	163	0.23	1,151,011	187,614,773
Difference (post - pre)	A80	-580	-616	-0.08	89,226	20,936,464
	TLAS	-130	-68	0.01	57,332	11,411,265
	CDQ	-78	-61	-0.06	182,303	8,211,403
	NON TRAWL	-123	-271	-0.29	747,991	12,805,055

Table 6-9, p.255

Figure 3-47, p.147



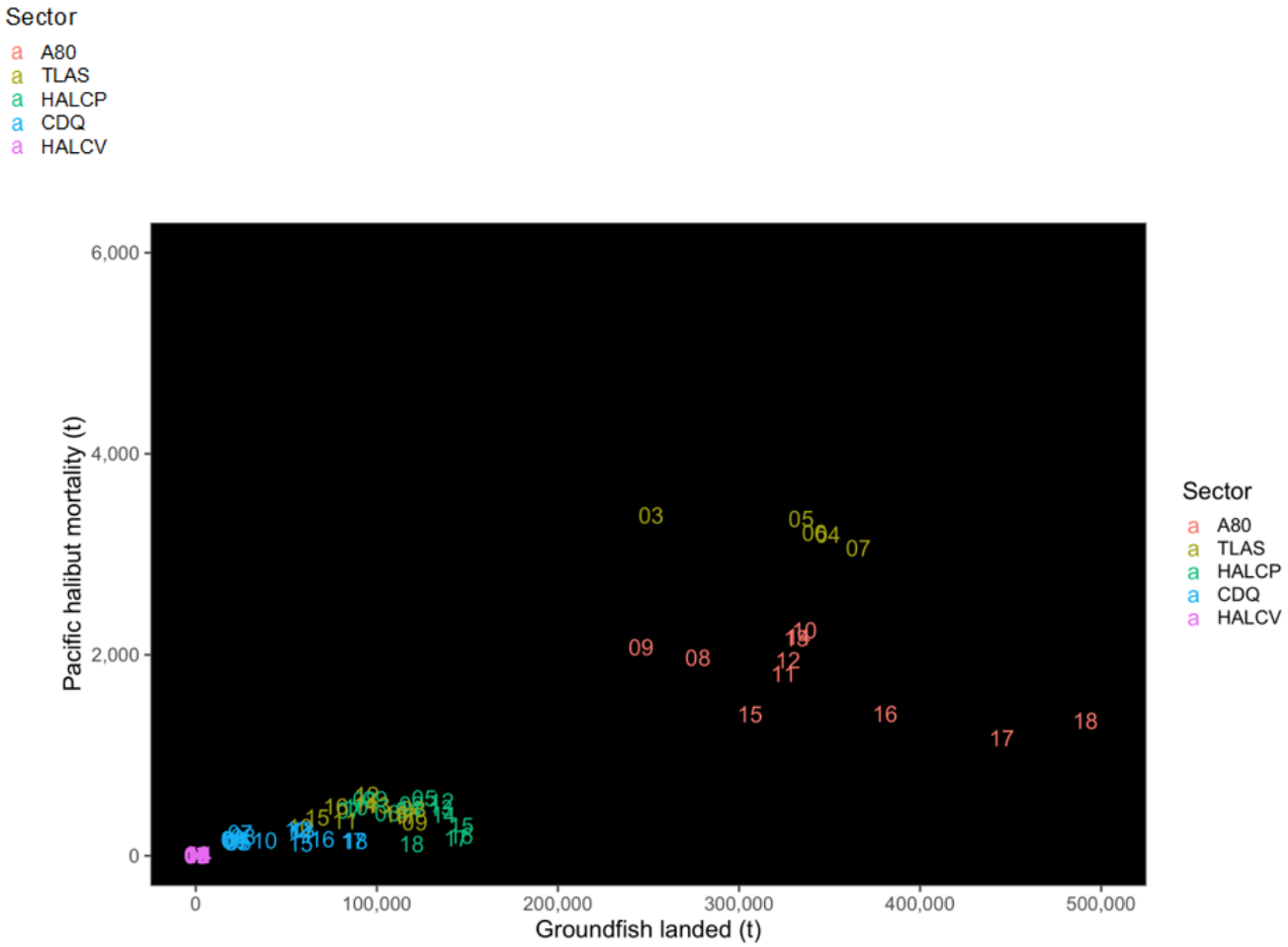


Figure 3-47. Bycatch of Pacific halibut (t) versus groundfish catch (horizontal axis) by sector (colors) and year (labels) for catch (top) and mortality (bottom). Note that data are from 2003-2018 (hence A80 pooled with TLAS prior to 2008).

Figure 3-77, p.177

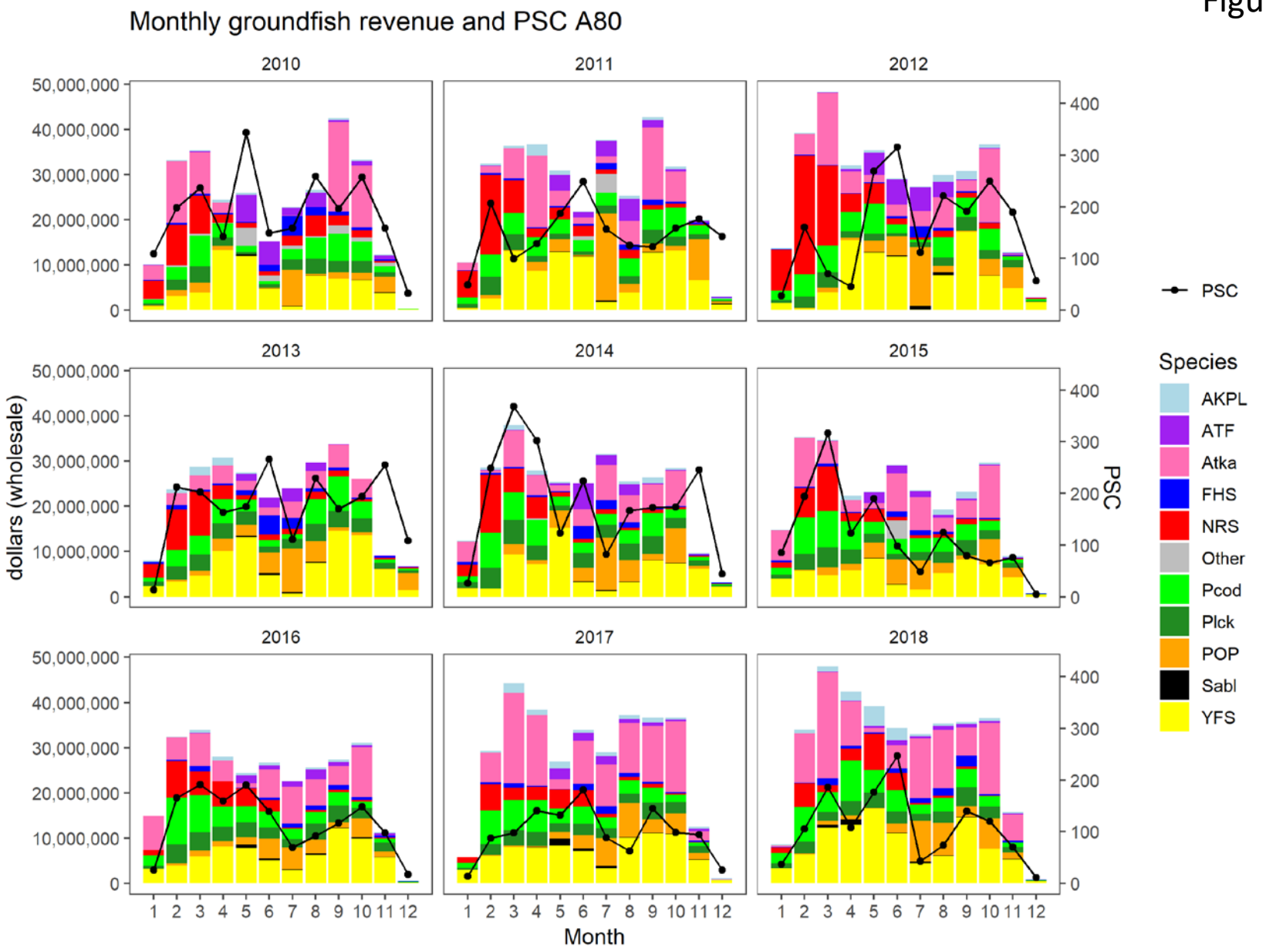


Figure 3-48, p.148

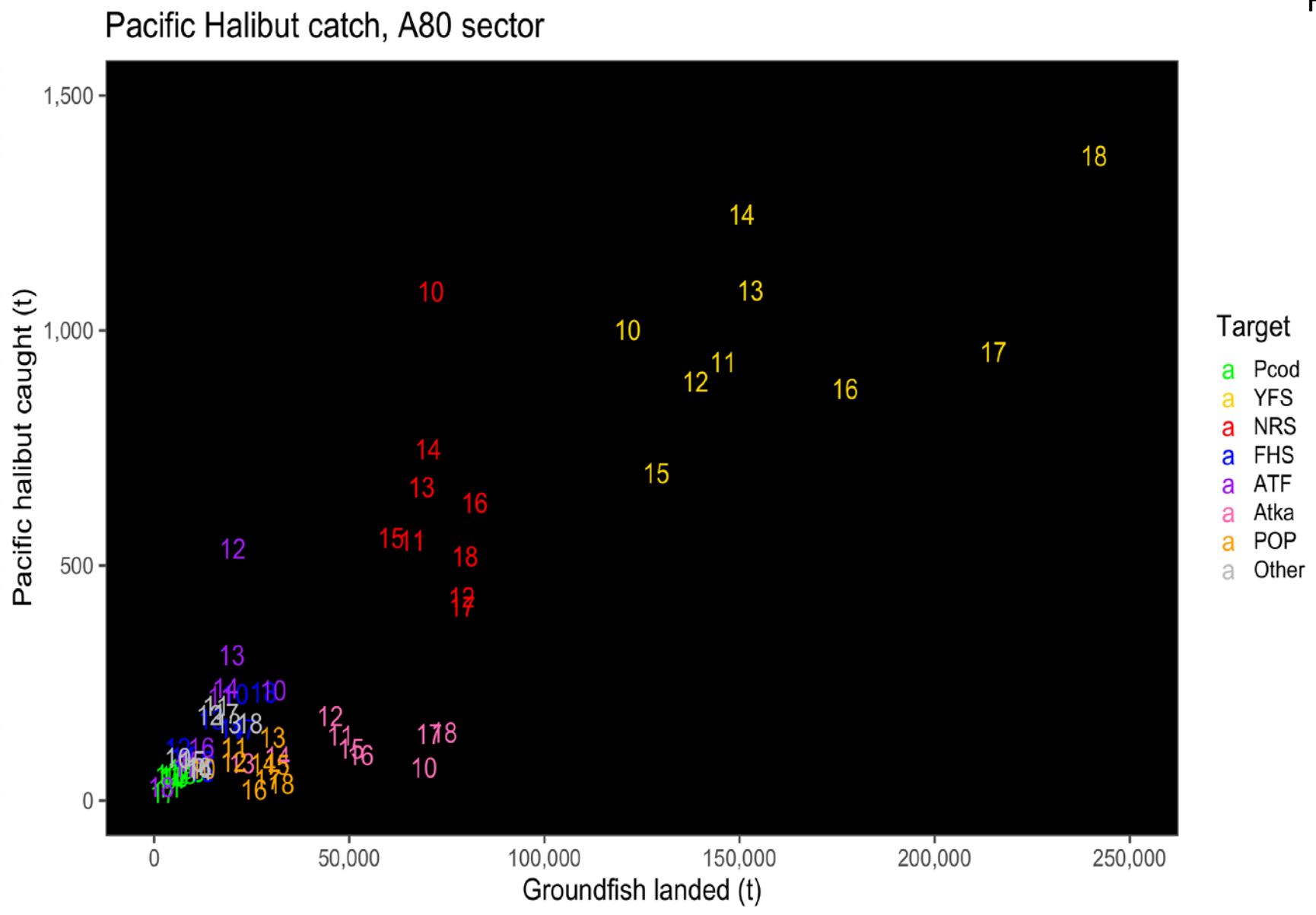


Figure 3-77, p.177

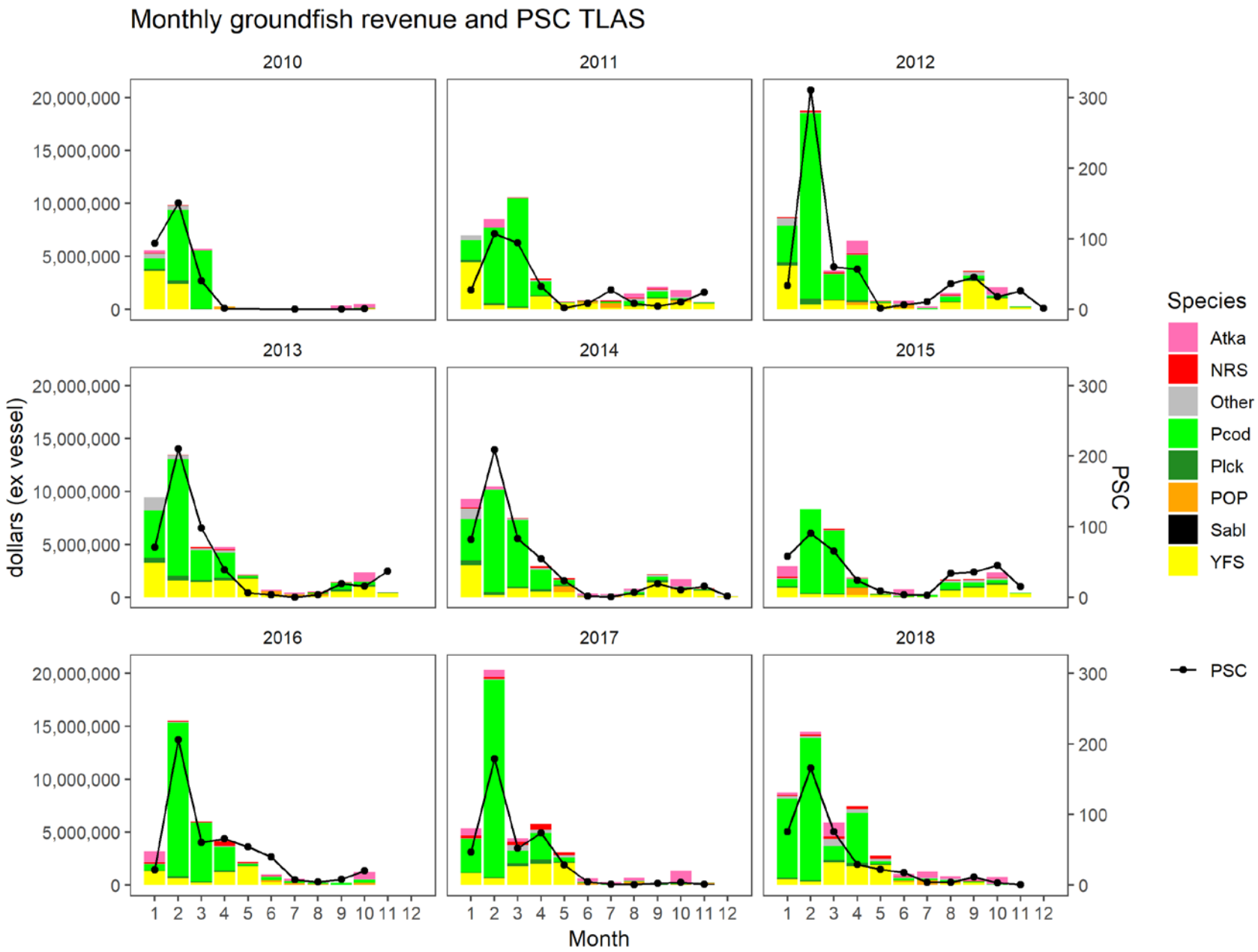


Figure 3-48, p.148

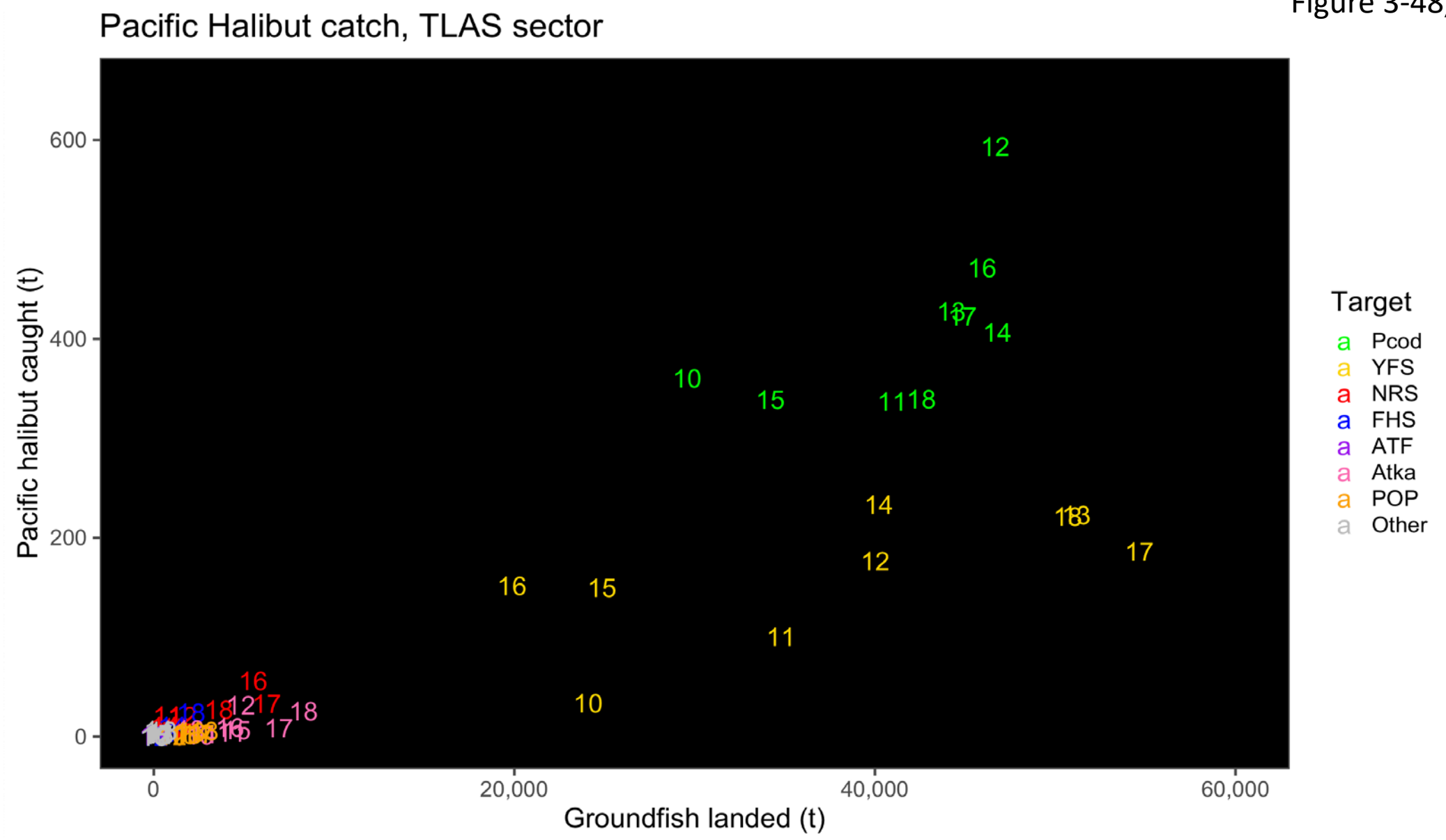


Figure 3-77, p.177

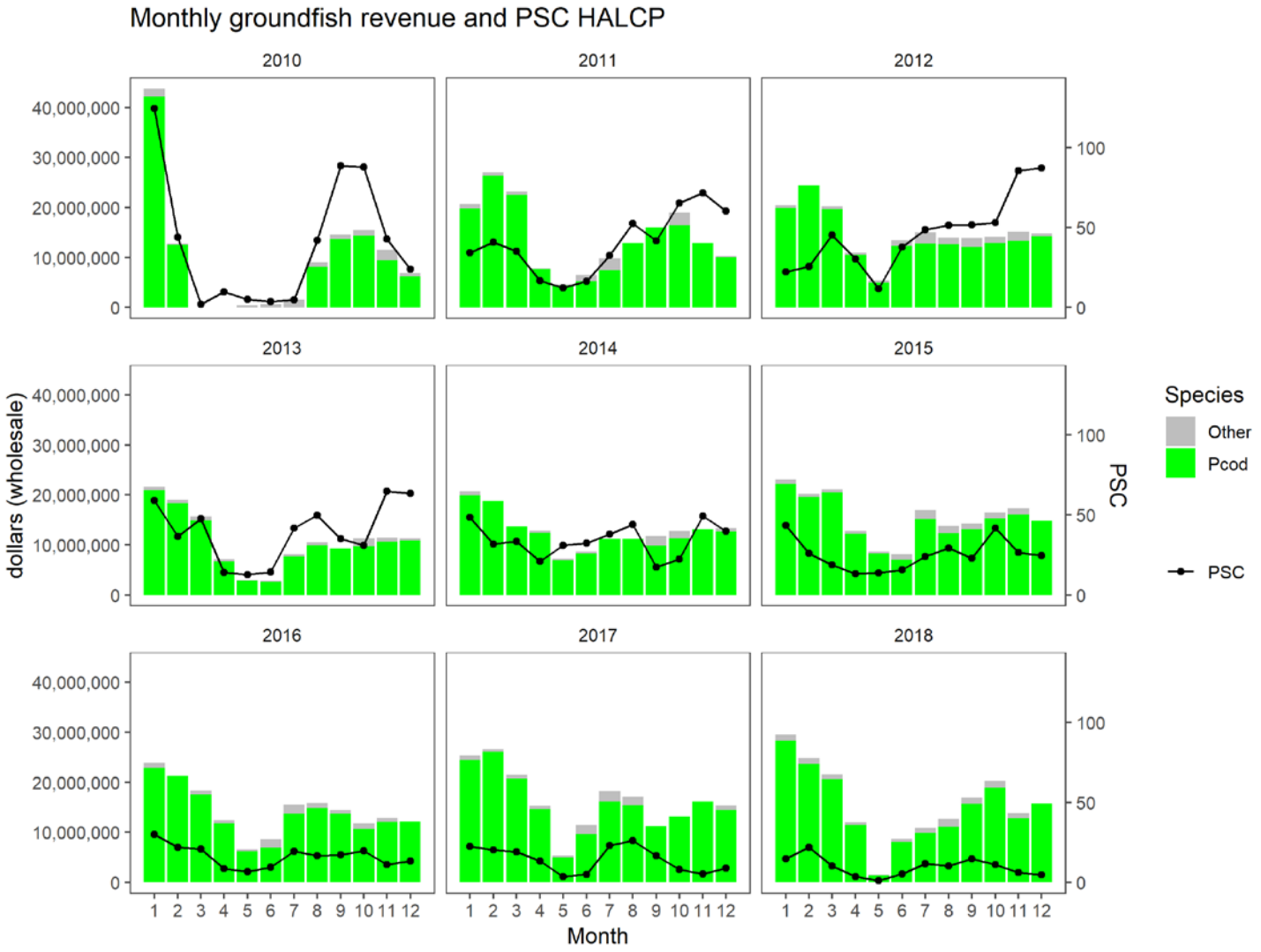
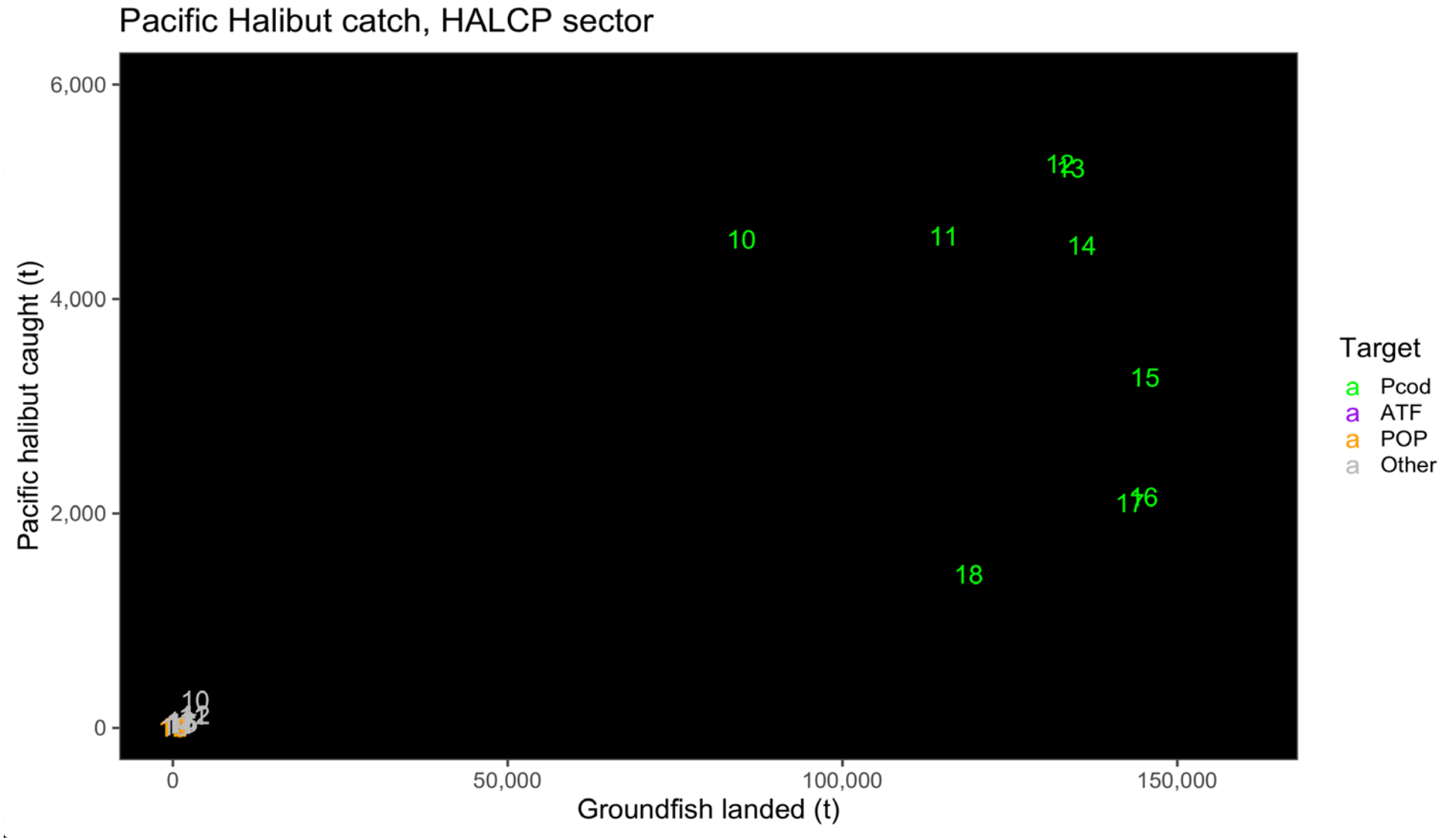


Figure 3-48, p.148



Halibut Fishery

- Model results (Table 6-1, p.224)
- Spectrum of harvest engagement (Section 4.4.1)
- Relative dependence of shore-based processors (Section 4.4.2)
- Discard mortality in the commercial halibut fishery (Table 4-11, p.205)
- Shifting distribution of benefits around a PSC limit ceiling or floor
- CDQ groups as direct participants in both groundfish and halibut, with multiple modes of use

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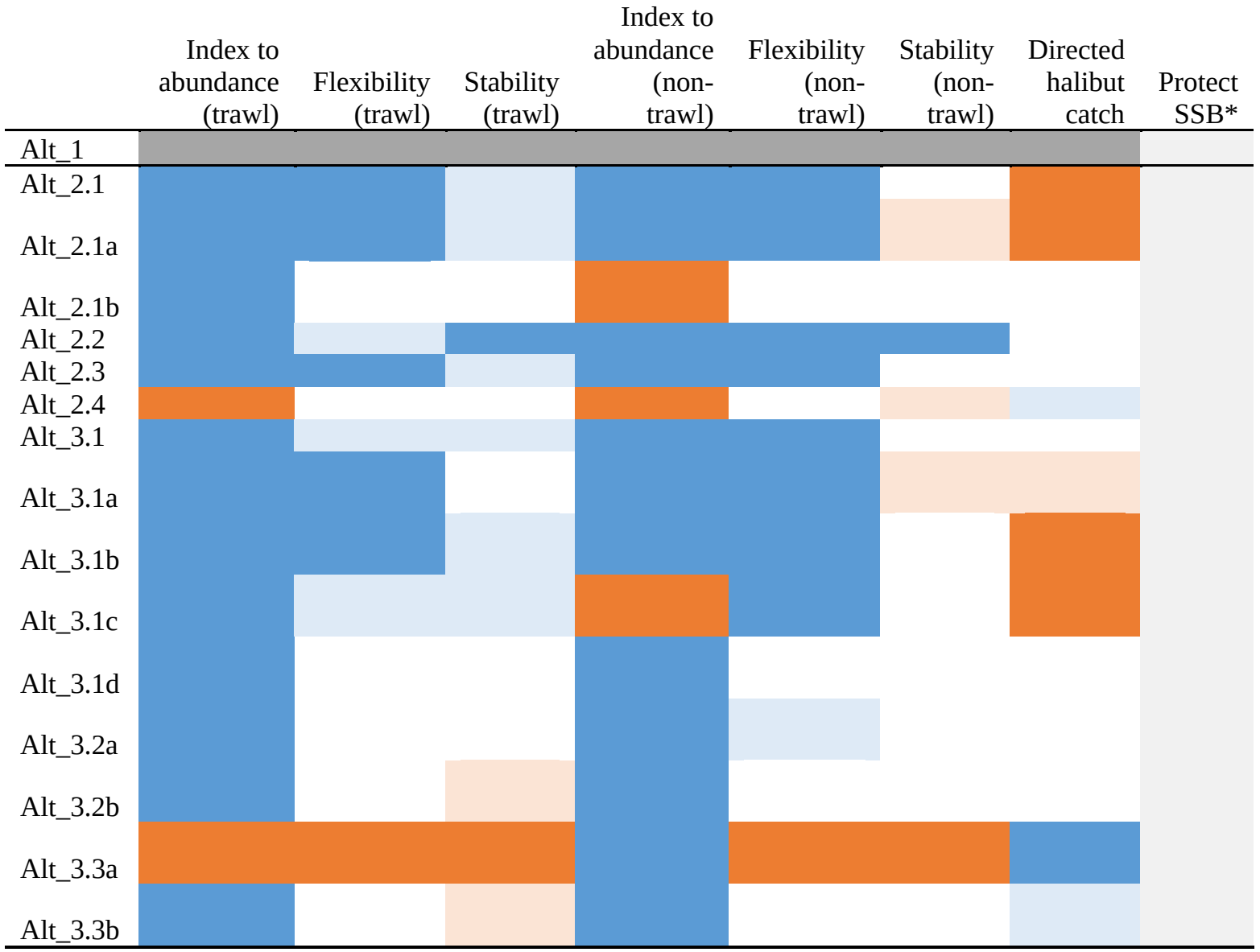
Performance metrics relative to Council objectives

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

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.

Thank you

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
- 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.

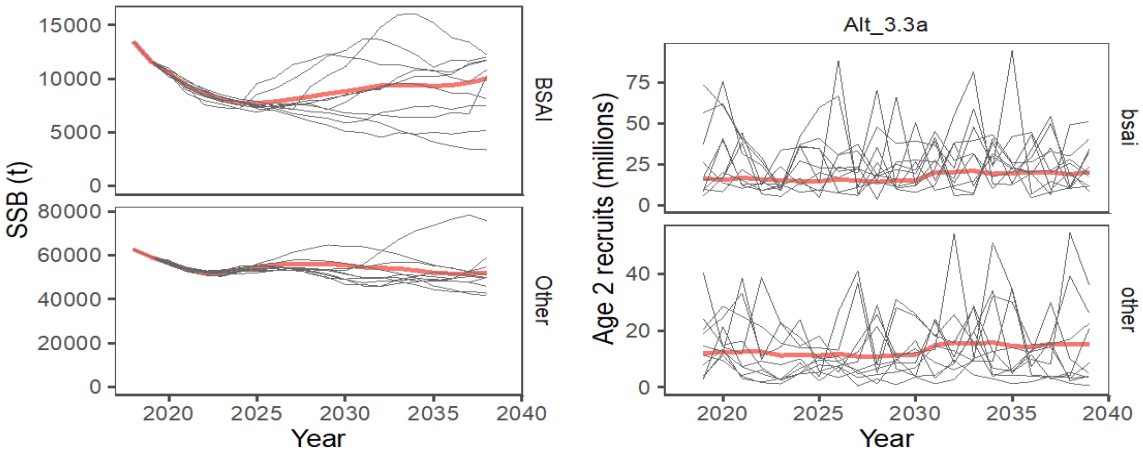
General results (ctd.)

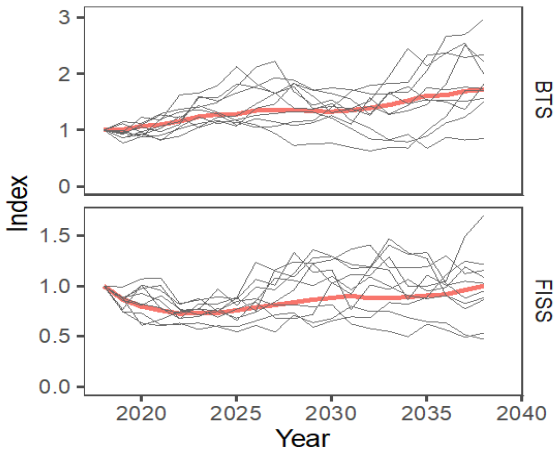
- Non-Trawl PSC limits for 2024 and 2030 are reduced from current limits
  - reductions from current PSC limits, not represent reductions from recent PSC use.
- The 2030 non-trawl PSC limits are generally larger than those in 2024
  - spawning biomass (and thus the setline trend) stabilizes in the BSAI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

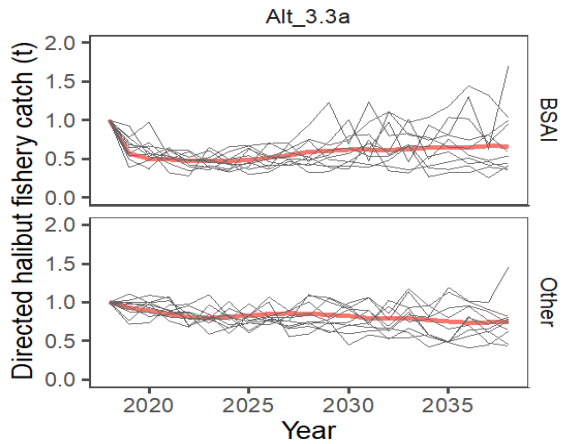
Additional questions?

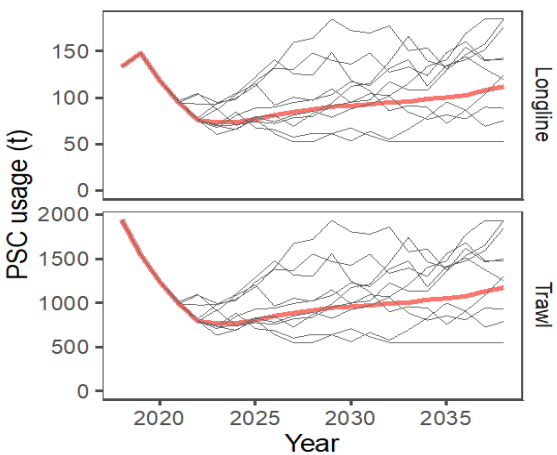
Results of simulation modeling (Appendix)

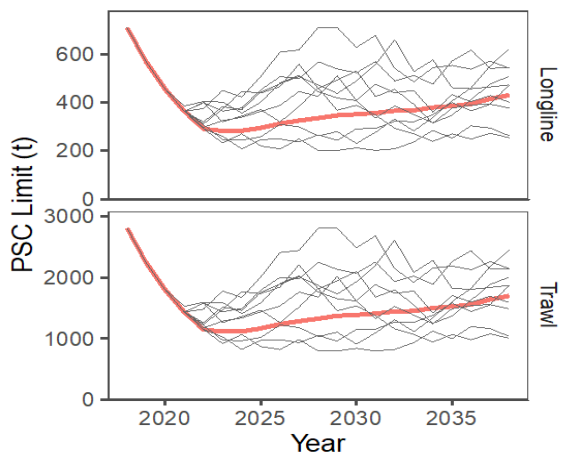
S1_Alt_3.3a_Use_1



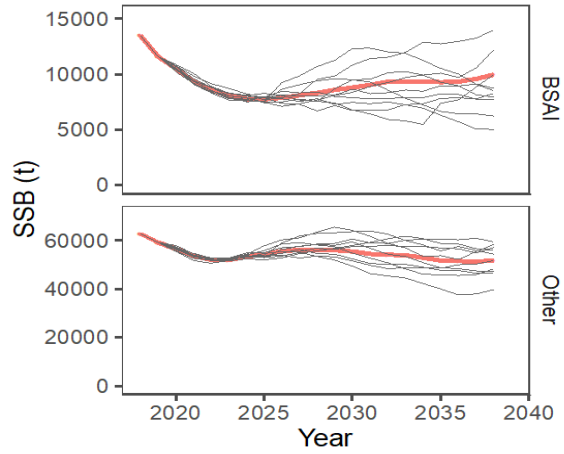


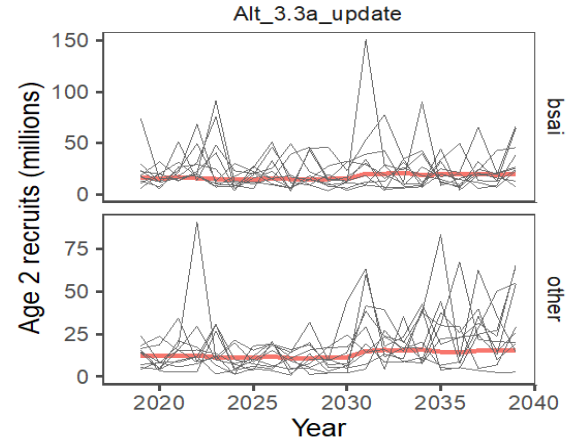


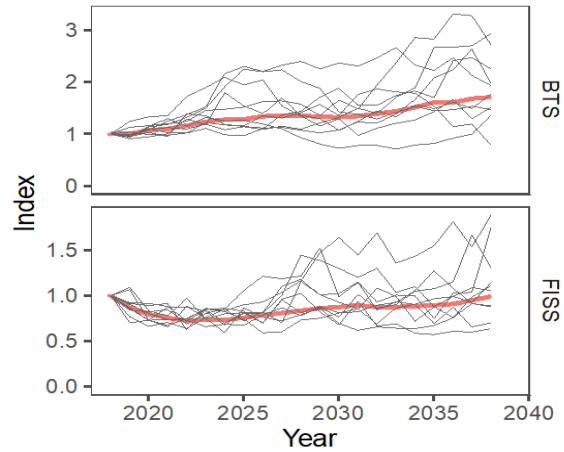


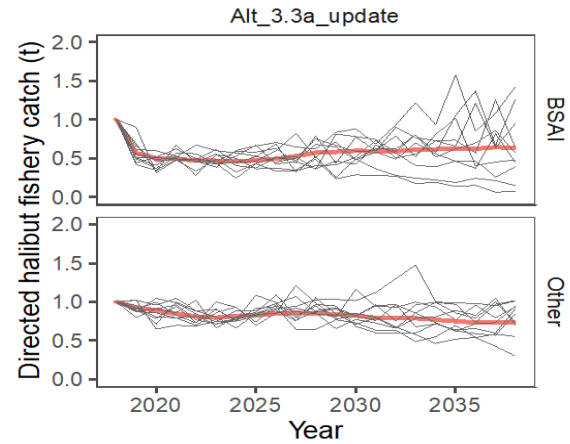


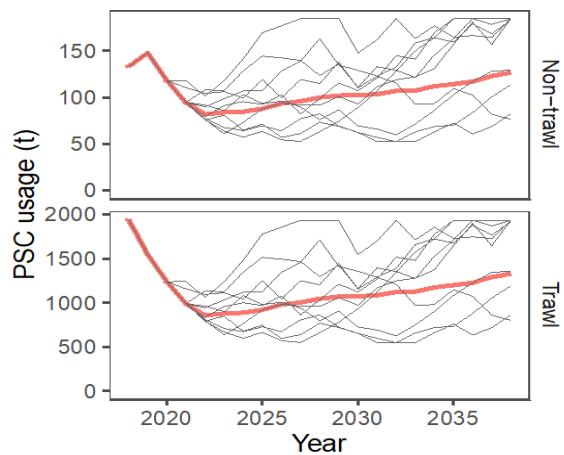
S1_Alt_3.3a_update_Use_1

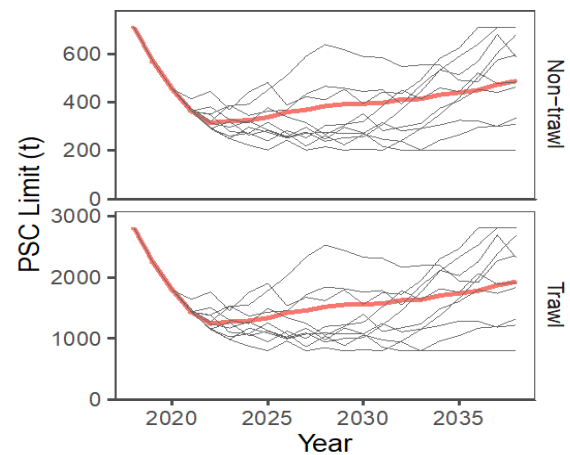












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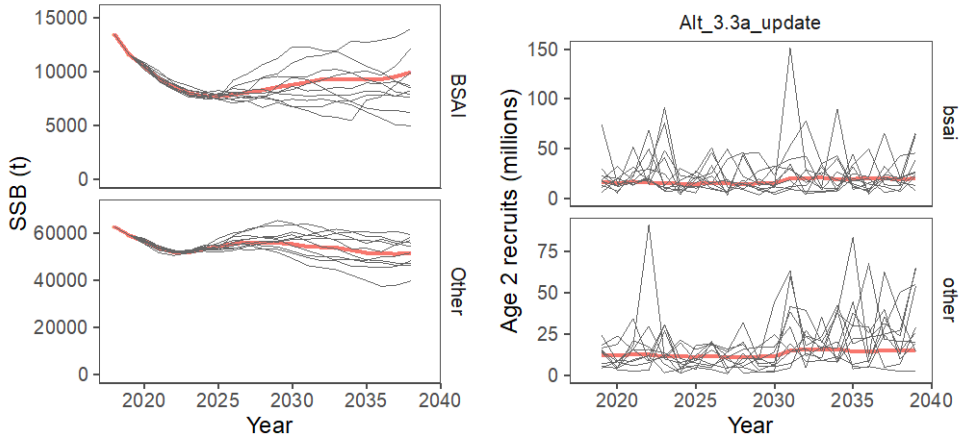

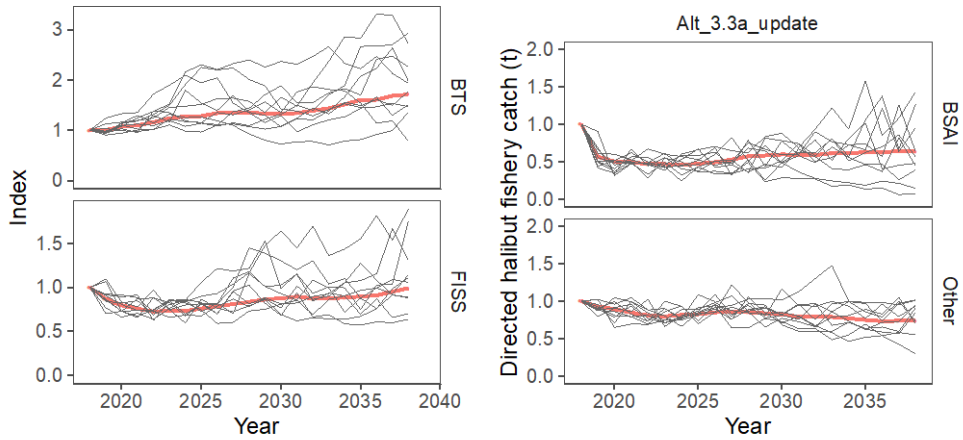

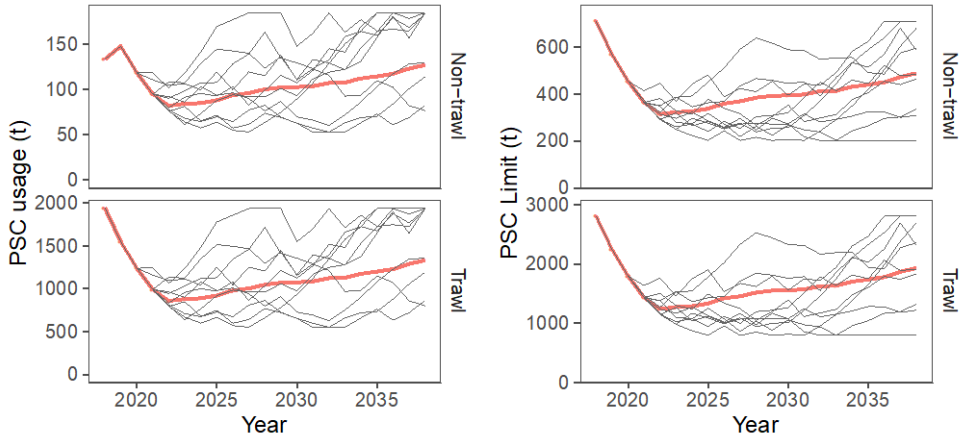

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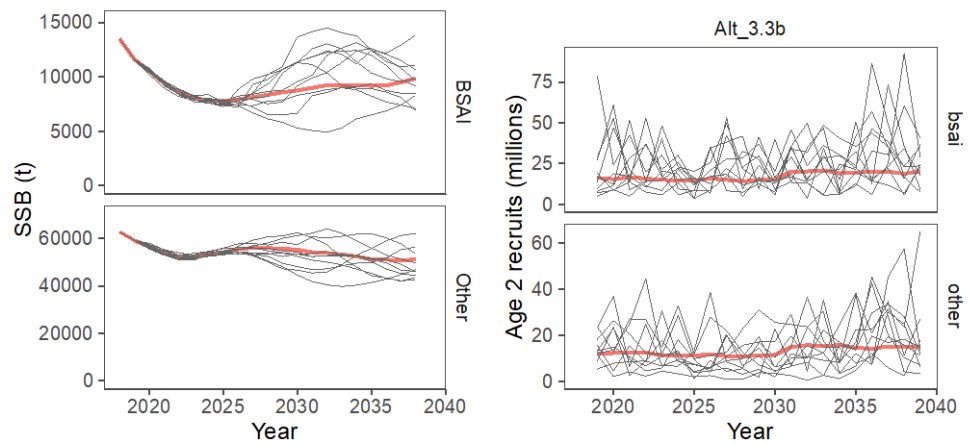
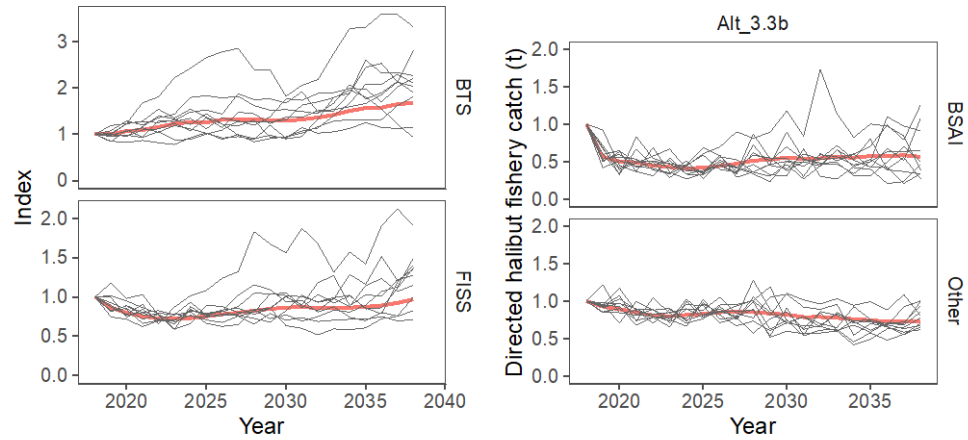
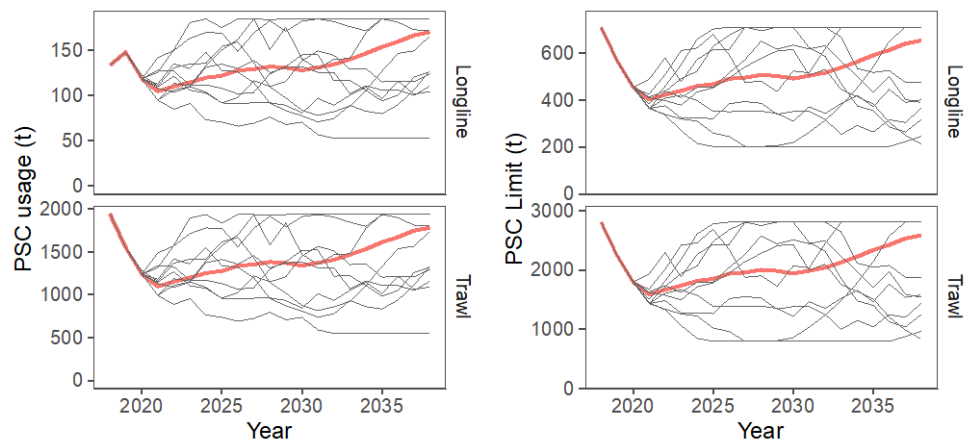






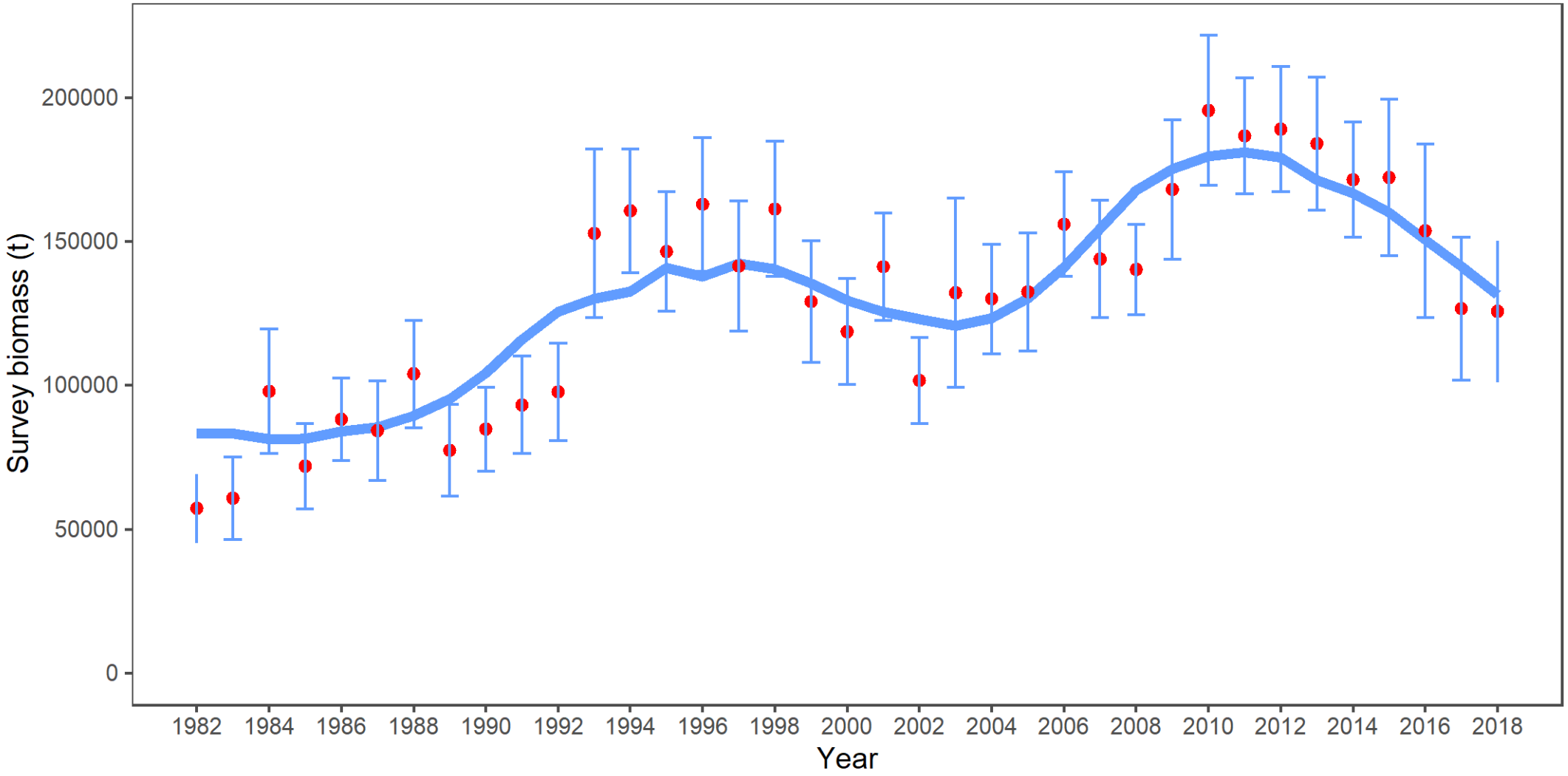


Figure A3-2. The BSAI sub-model (thick blue line) conditioned to fit to the observed BTS biomass index (red dots). Vertical lines show 95% asymptotic intervals about the observed BTS biomass index point estimates.

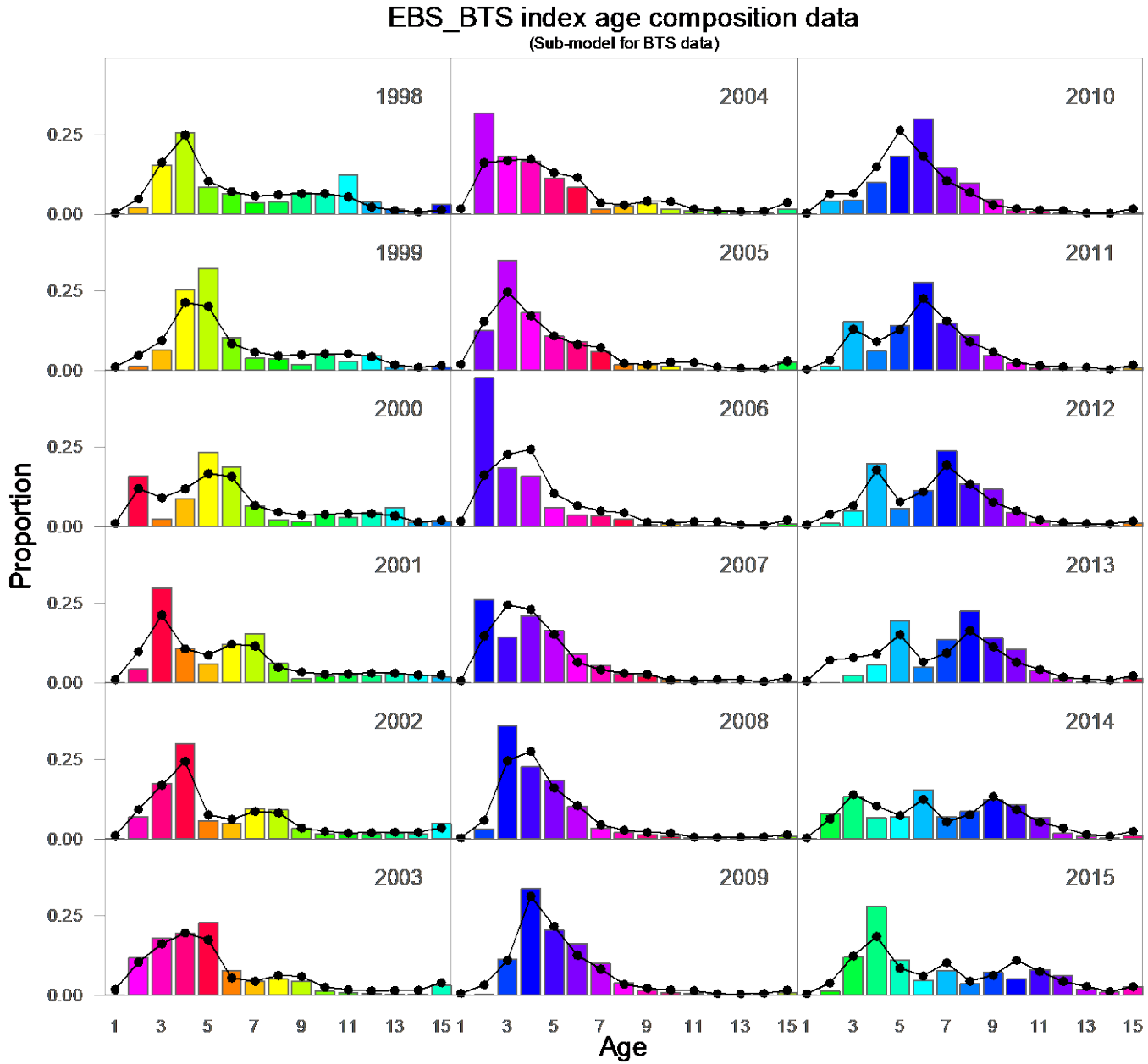


Figure A3-3. The BSAI sub-model conditioned to fit the available yearly BTS age composition data (data are shown as the multi-color frequency histogram, model fits to data are indicated by black dots and line).

PSC limits are (mostly) correlated to halibut biomass

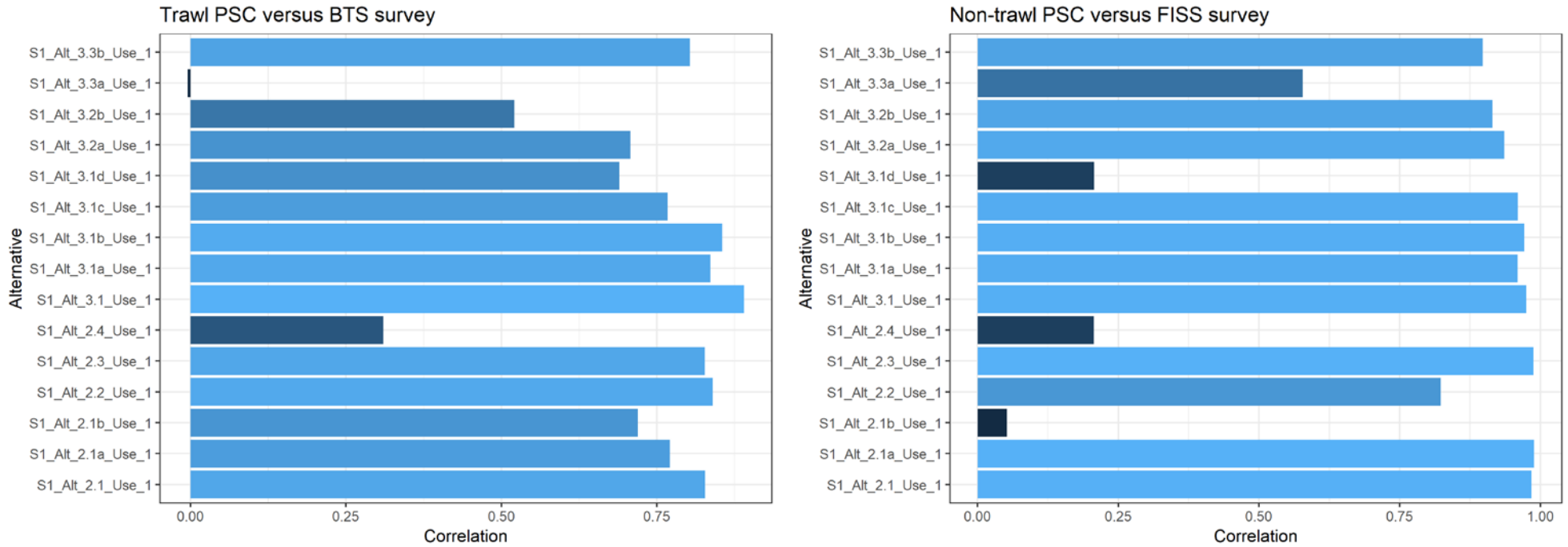
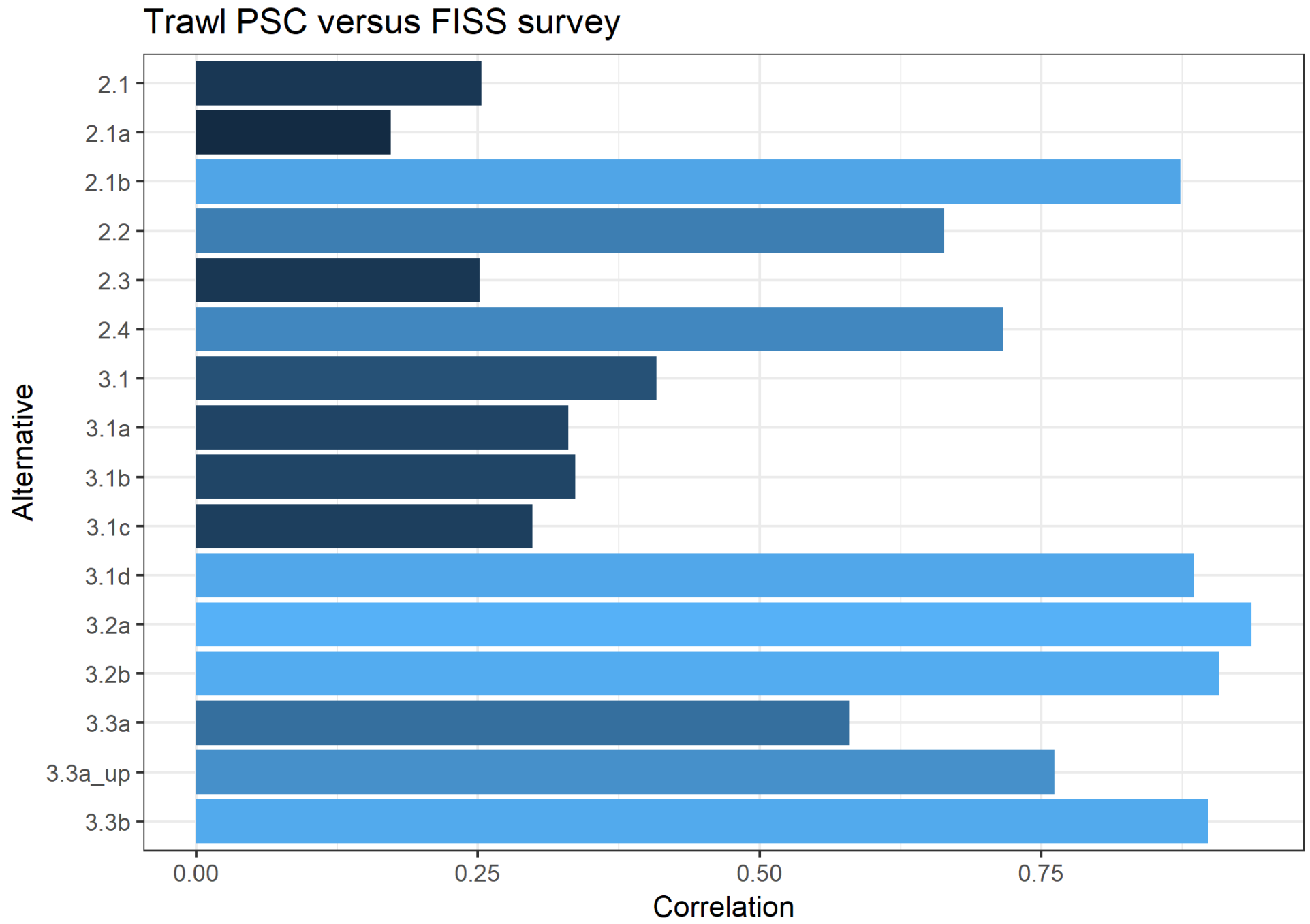
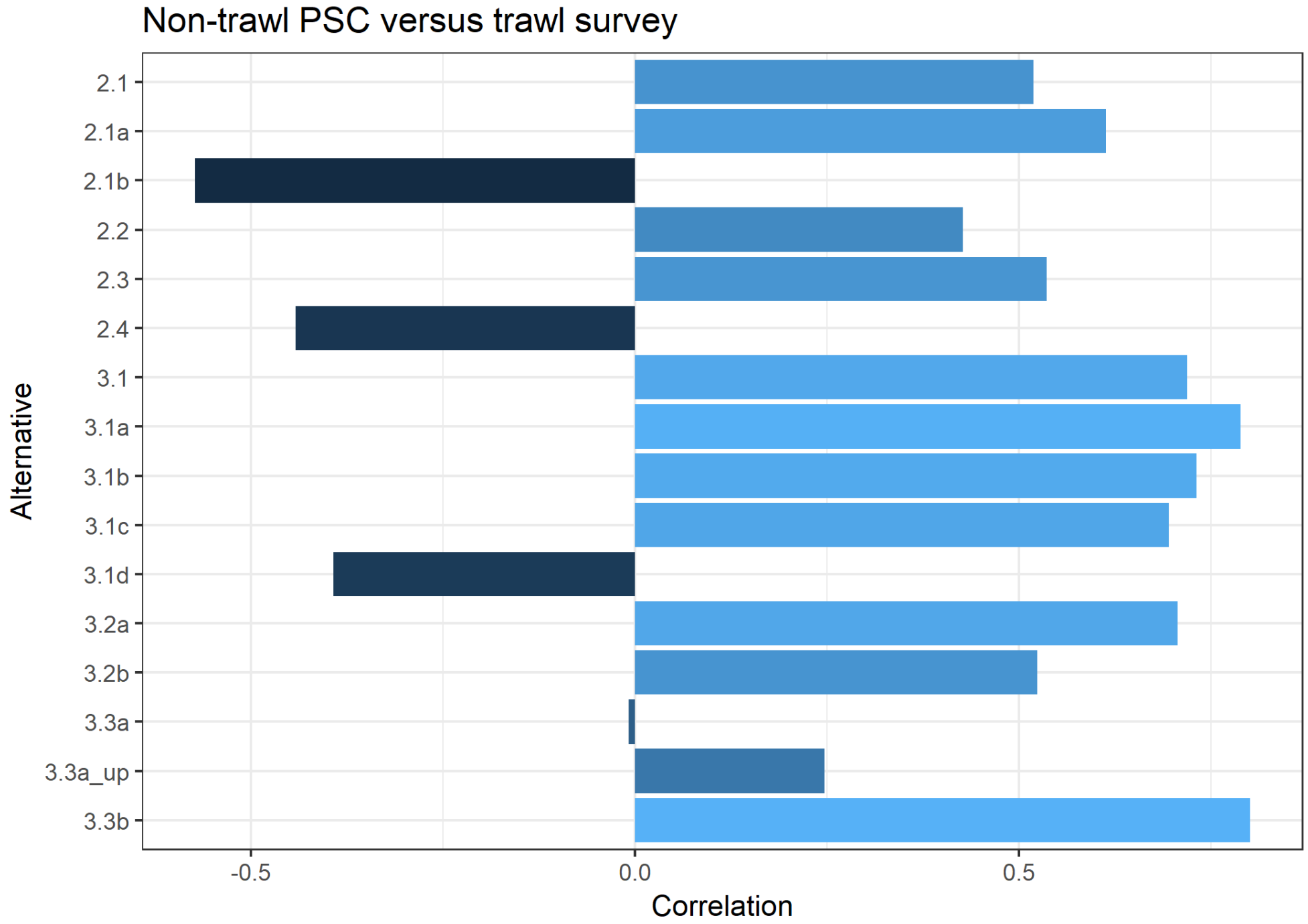


Figure 6-8. Correlations of PSC limits with their respective gear type indices across alternatives for the trawl fishery (left) and the non-trawl fishery (right).

How do they correlate to the opposite survey?



How do they correlate to the opposite survey?

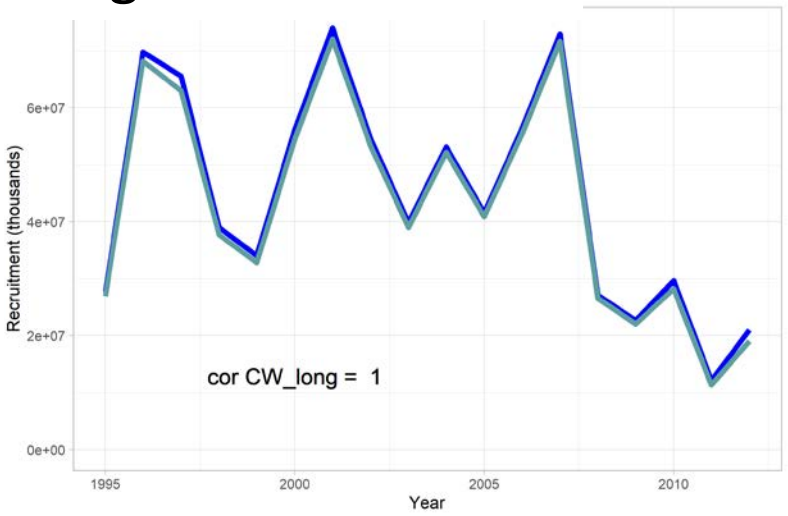


Features

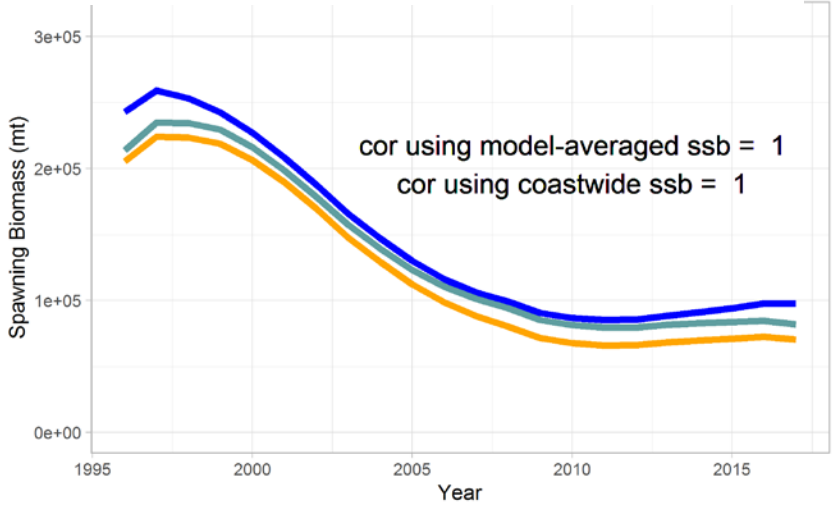
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

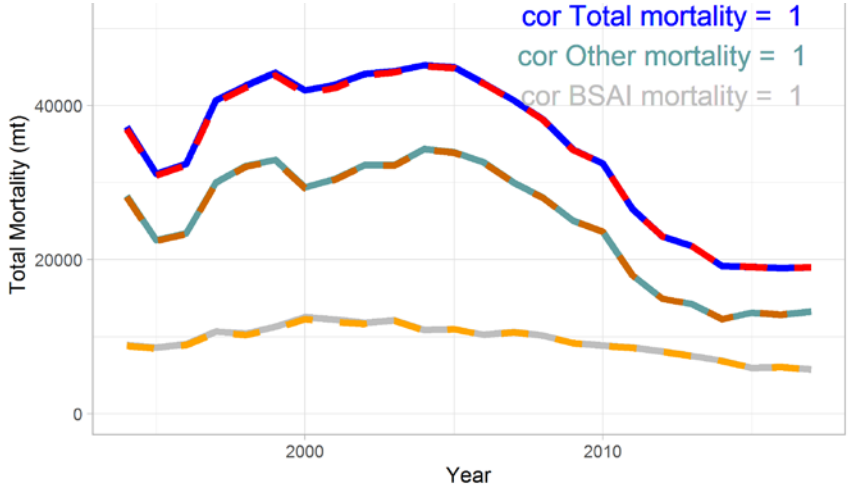
Age-2 Recruitment



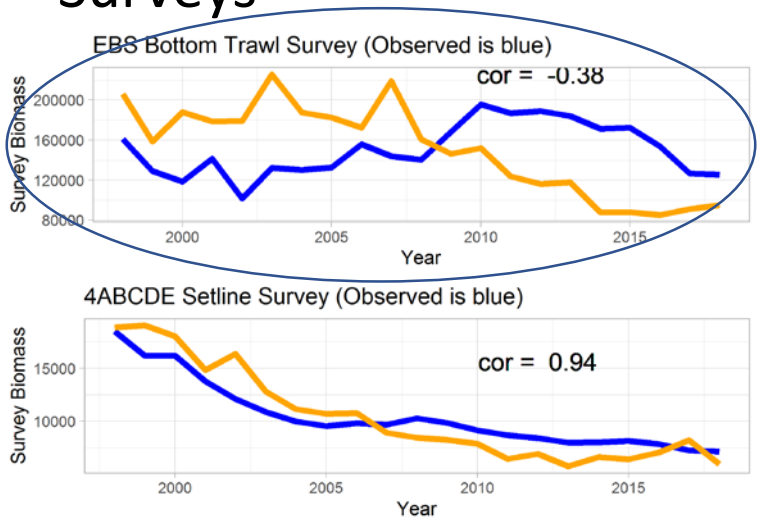
Spawning biomass



Catches (directed, PSC, other bycatch



Surveys



BSAI-specific relative recruitment estimates

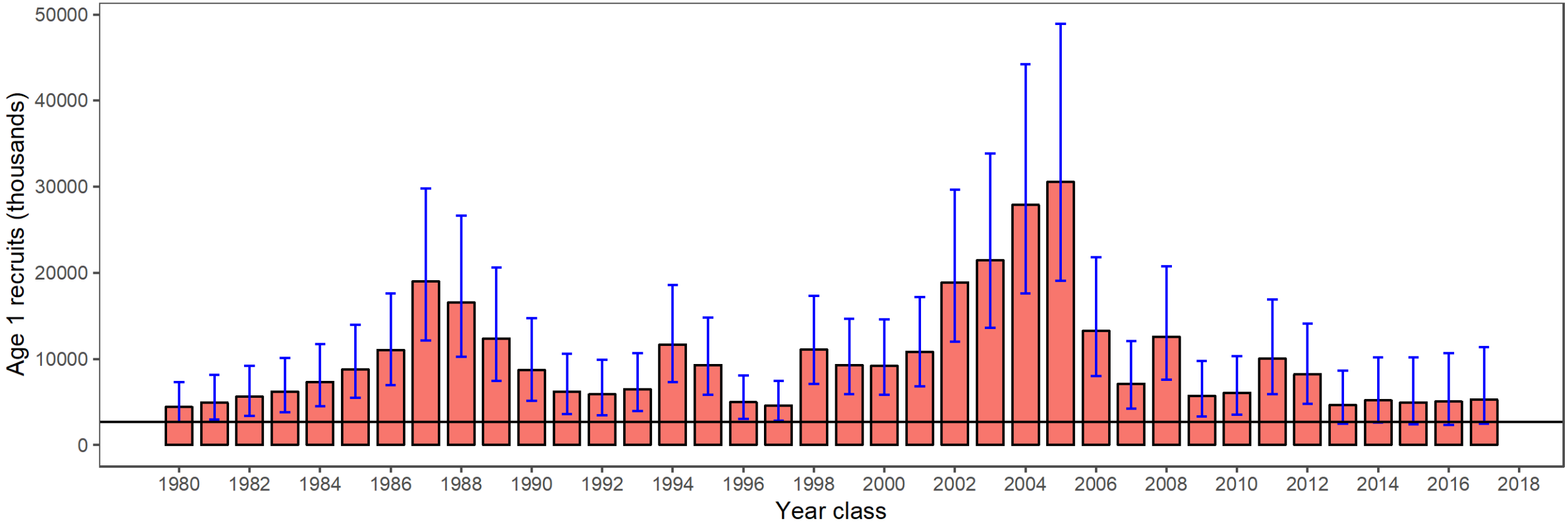


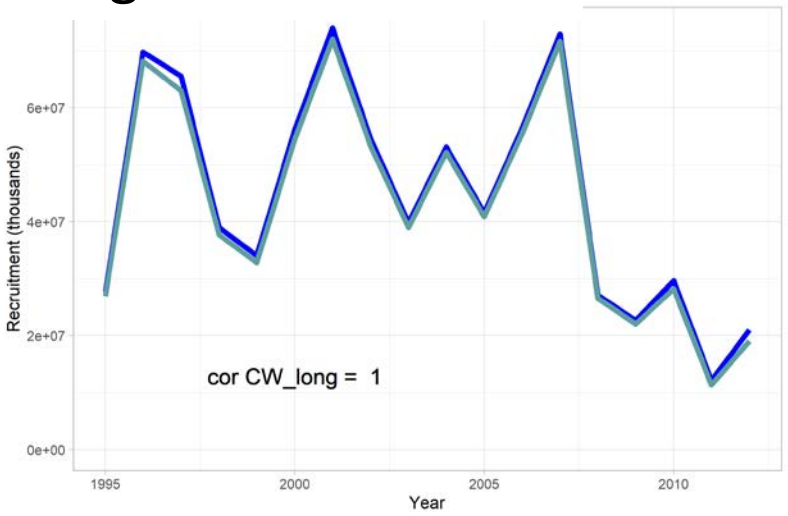
Figure A3-4. Age-1 Recruitment estimates from the BSAI sub-model. These relative values were used to evaluate the process error component of the BTS in OM projections relative to the OM conditioned to mimic the 2018 coastwide long assessment by the IPHC.

Features

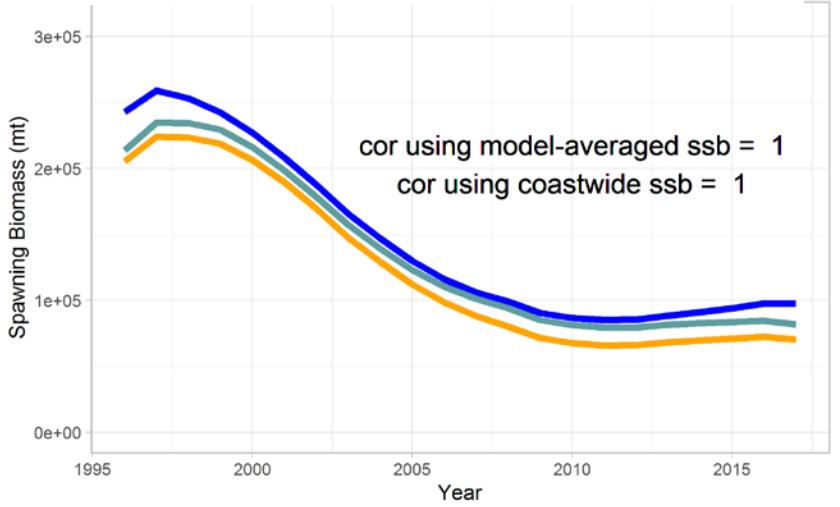
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

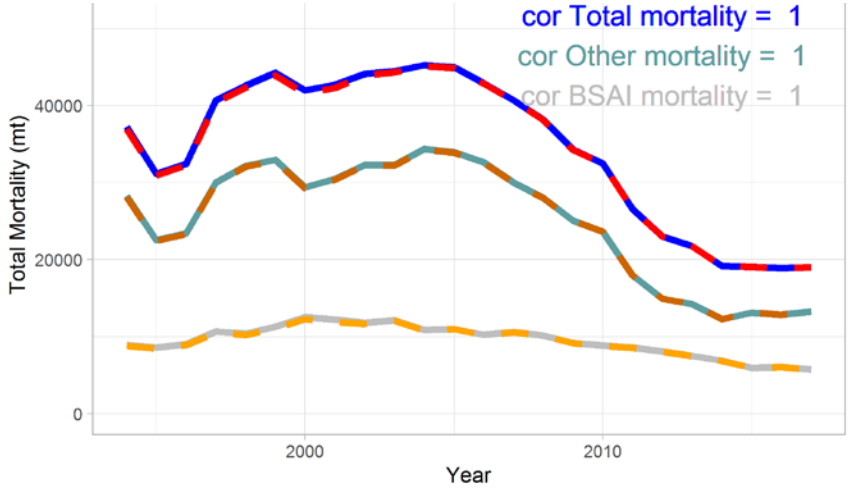
Age-2 Recruitment



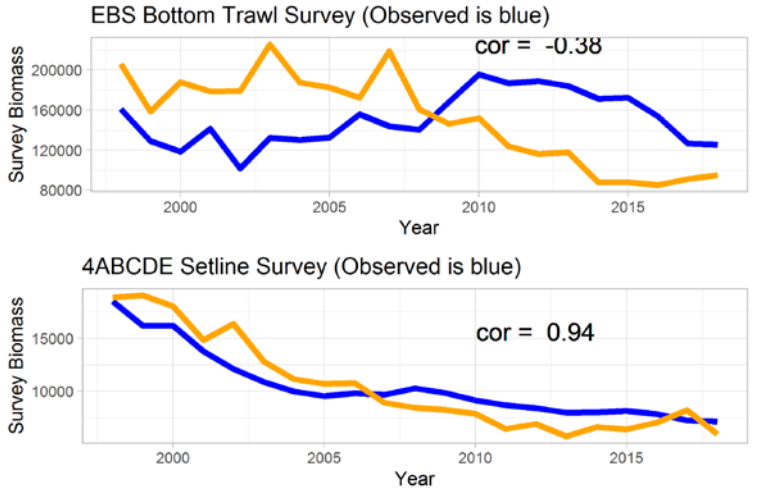
Spawning biomass



Catches (directed, PSC, other bycatch



Surveys

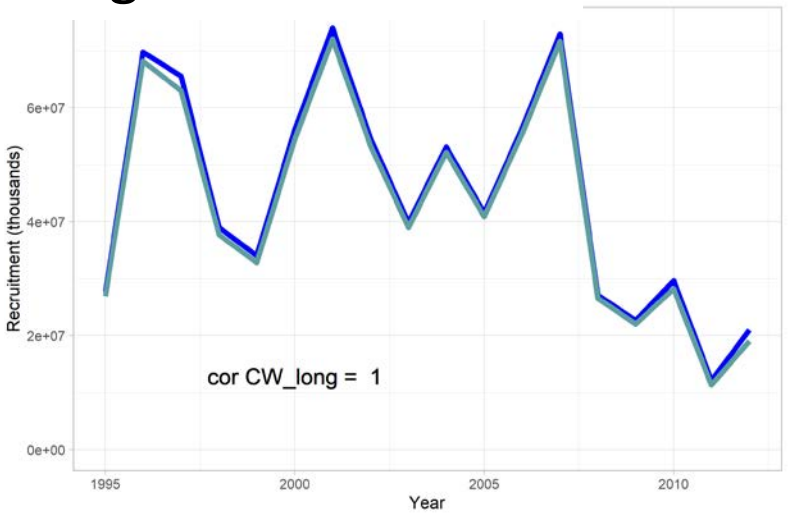


Features

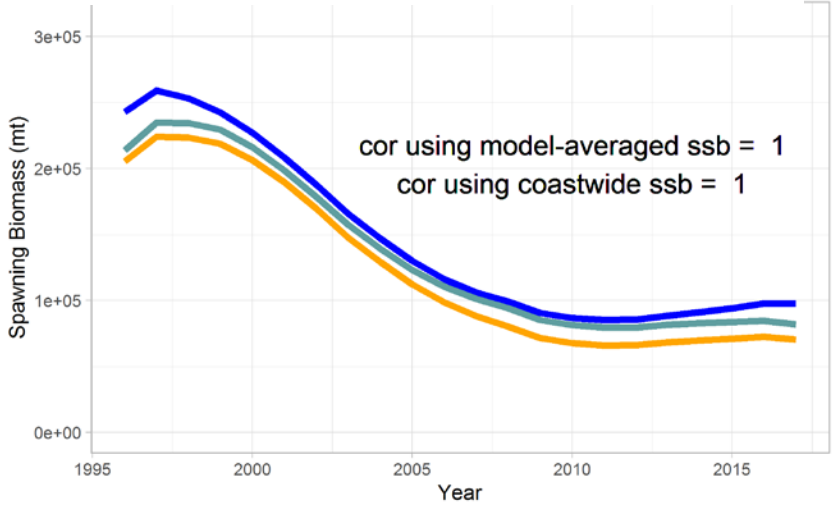
- 25 years, 1994-2018
- 5 gear types
- Recruitment deviations from IPHC
- Conditioned on coastwide IPHC assessment

Details in appendix 3

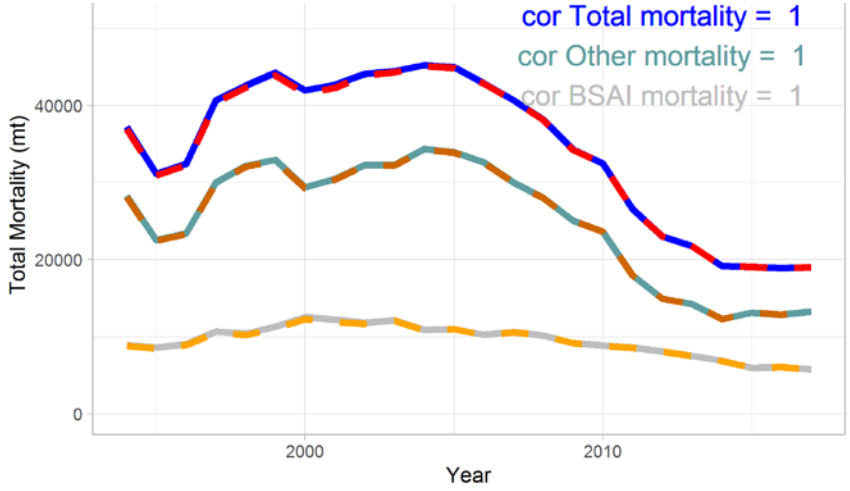
Age-2 Recruitment



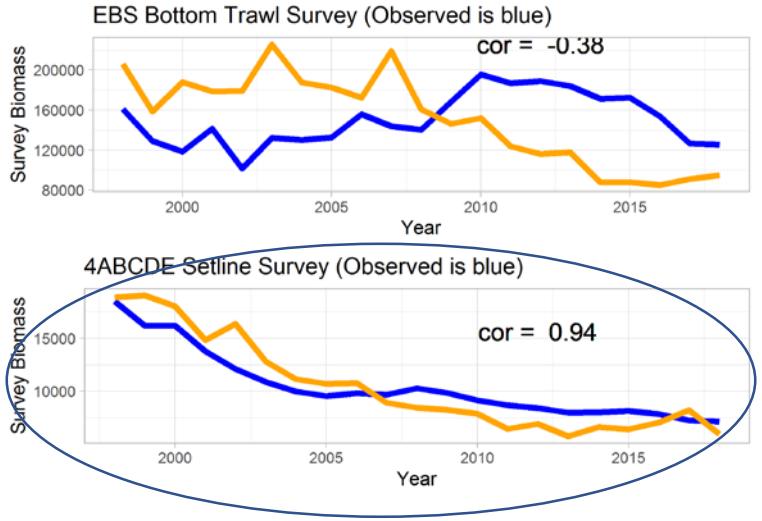
Spawning biomass



Catches (directed, PSC, other bycatch



Surveys



- BSAI 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