

# C-6 BSAI HALIBUT ABM DEIS

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IPHC: Allan Hicks

# SSC REVIEW AT THIS MEETING

- Review changes since preliminary review in October 2019
- Changes are focused on the following:
  - Changes to alternatives (A80 only) and associated assumptions
  - Operating model changes as a result of SSC and Council requests
  - Revenue analysis
  - Modifications to Social Impact Analysis (SIA)



# OUTLINE OF PRESENTATION

1. Purpose and Need
2. Current suite of alternatives for Amendment 80
3. Operating model changes to address SSC and Council requests
4. Results of modeling
5. Groundfish and halibut fishery background and revenue analysis
6. Social Impact Assessment –changes from previous review
7. Wrap up



## PURPOSE AND NEED SECTION 1.1 P42

*The current fixed yield-based halibut PSC caps are inconsistent with management of the directed halibut fisheries and Council management of groundfish fisheries, which are managed based on abundance. When halibut abundance declines, PSC becomes a larger proportion of total halibut removals and thereby further reduces the proportion and amount of halibut available for harvest in directed halibut fisheries. Conversely, if halibut abundance increases, halibut PSC limits could be unnecessarily constraining. The Council is considering linking PSC limits to halibut abundance to provide a responsive management approach at varying levels of halibut abundance. The Council is considering abundance-based PSC limits to control total halibut mortality, particularly at low levels of abundance. Abundance based PSC limits also could provide an opportunity for the directed-halibut fishery and protect the halibut spawning stock biomass. The Council recognizes that abundance-based halibut PSC limits may increase and decrease with changes in halibut abundance.*

- 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



# ALTERNATIVES OVERARCHING ELEMENTS AND OPTIONS

SOME CONSIDERATIONS BY ANALYSTS IN RED: PROPORTIONAL REDUCTION OF FLOOR TO A80 IN E3 AND UNDERSTANDING OF E8 IN CONJUNCTION WITH E3 [SEE FOOTNOTES P61 AND P64]

Element	Description	Range	Optional?
1	Starting Point	1,167-1,745 mt	N
2	Ceiling	1,745-2,325 mt	N
3	Floor	664-1,412 mt	N
4	Breakpoint	< or > -25% average -average	Y
5	Response	1:1 >1:1 <1:1	N (unless Element 7 selected)
6	Constraint	5-25%	Y
7	Look up Table	Up to 12 breakpoints; standard to mean or 2019	Y
8	SSB at low levels of abundance	PSC limit declines proportional to biomass when SSB, $B_{30\%}$	Y

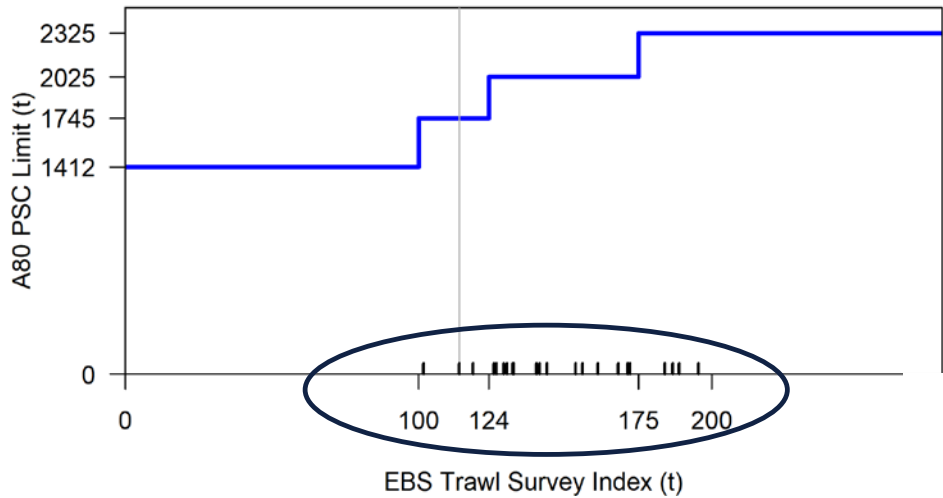
# ALTERNATIVES 2-4 PROPOSED BY STAKEHOLDER AND MODIFIED BY COUNCIL

Alternative	Previously numbered (Oct 2019)	Source	Survey Index	E 1 Starting point	E 2 Ceiling	E 3 Floor	E 4 Breakpoint	E 5 Magnitude	E 6 Constraint	E 7 Look-up Table	E 8 SSB low levels of abundance
1	1	Status Quo	NA					1,745 fixed PSC limit			
2	2-2	A80	Trawl	1,745	2,325	1,412	3 specified	Stairsteps	2 yr avg	NA	NA
3	2-4	FVOA	Setline	1,255	1,745	664	1,255	1:1 above 2:1 below	15% max	NA	NA
4	3-3a_update	Directed halibut users	Setline	1,167	1,745	664	NA	1:1	20% max	NA	Yes

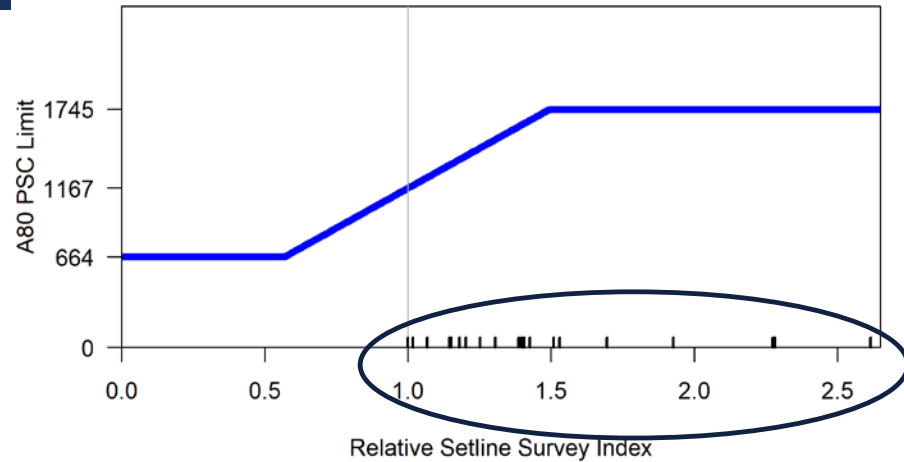


# ACTION ALTERNATIVES

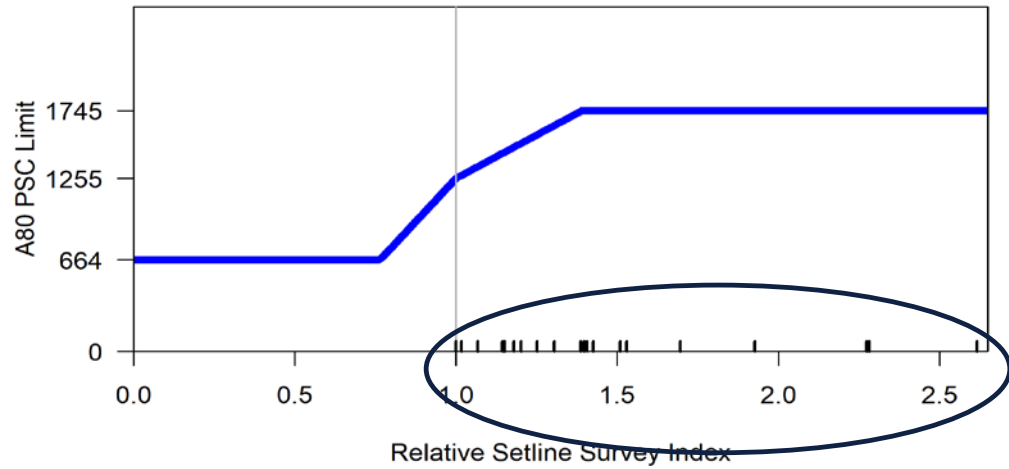
**Alternative 2**



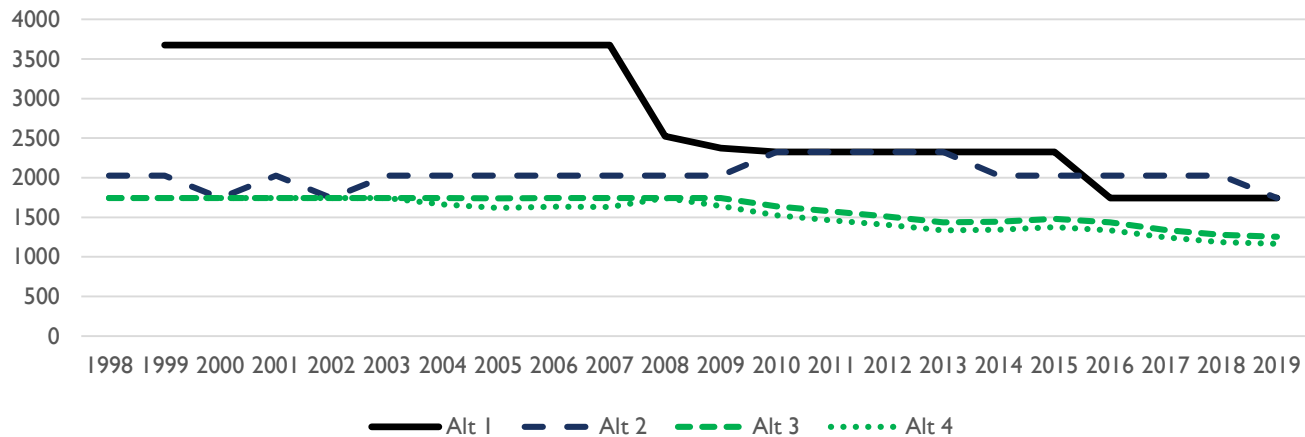
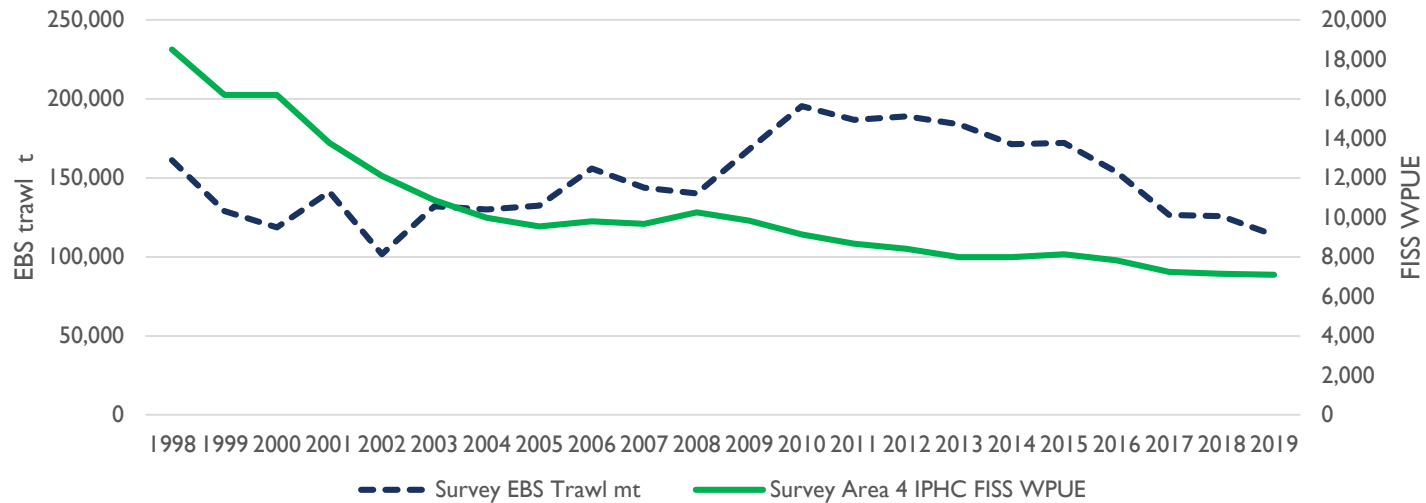
**Alternative 4**



**Alternative 3**



# COMPARISON OF ALTERNATIVES (EXECUTIVE SUMMARY P21)





# CLARIFYING ISSUES FOR COUNCIL ON ALTERNATIVES

How to implement  
Element 8 on an  
annual basis in  
conjunction with the  
IPHC process

What data to use in a  
year (as with 2020) in  
which there was no  
survey



# OVERVIEW OF DISCUSSION PAPER TOPICS (NOT SCHEDULED FOR SSC REVIEW)

		EBS shelf trawl survey index (t)	
		Low < 130,000	High ≥ 130,000
IPHC setline survey index in Area 4ABCDE (WPUE)	High ≥ 11,000	Medium 1,745 mt  (current limit)	High 2,207 – 2,325 mt  (15% above current limit or 2015 limit)
	Medium 8,000 – 10,999	Low 1,309 – 1,483 mt  (15-25% below current)	Medium 1,745 mt  (current limit)
	Low < 8,000	Very Low 1,047 – 1,222 mt  (30-40% below current)	Low 1,309 – 1,483 mt  (15-25% below current)

- 3 items requested by Council (February 2020)
- Evaluation of lookup table for setting PSC limits
- Consideration of performance standard tied to status quo limit
- Adjustment of halibut PSC limit in years when catch limits in 4CDE are below 1 million net pounds



# OUTLINE FOR MODELING DISCUSSION

- Review of model and changes to model
- Conversion error, impacts, what was not impacted
- Quick review of model validation
- Model results



# NEW THIS YEAR (ALL SSC MODEL RECOMMENDATIONS ADDRESSED)

- Alternatives apply only to A80
- Ran the model for 100 years
- Previous control rule for directed halibut fishery is still based on historical estimated SSB:total mortality estimates, but:
  - some runs also including a 30:20 control rule
  - historical relationship focuses on recent history (shallower slope)
- PSC use:limit relationship incorporates uncertainty



# NEW THIS YEAR (ALL SSC MODEL RECOMMENDATIONS ADDRESSED)

- Model shifted definition of B0 to dynamic B0
  - consistent with shift in IPHC management
- Updated model validation process to account for changes in IPHC assessments
  - Sex ratio data changed selex curves, for instance

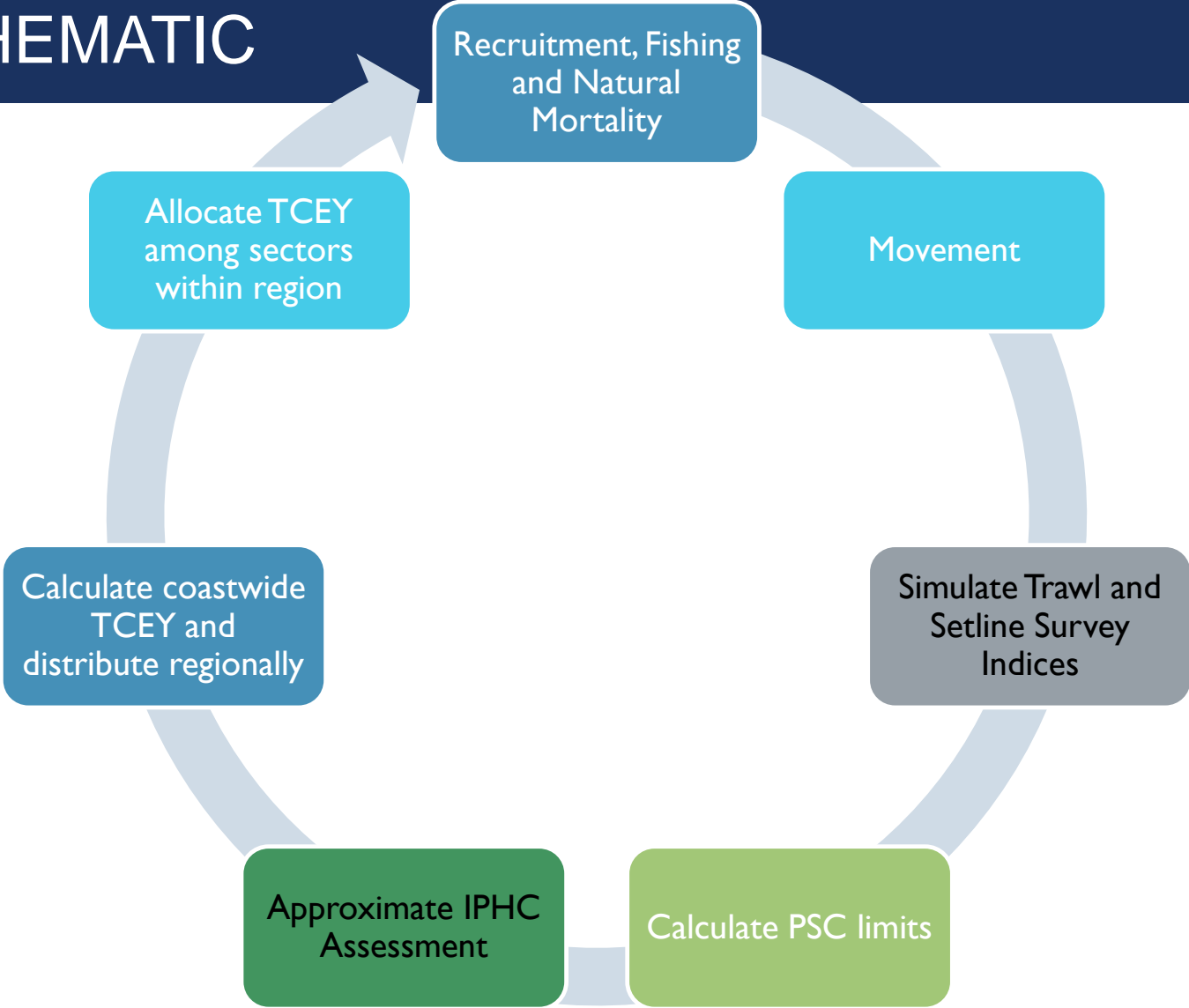


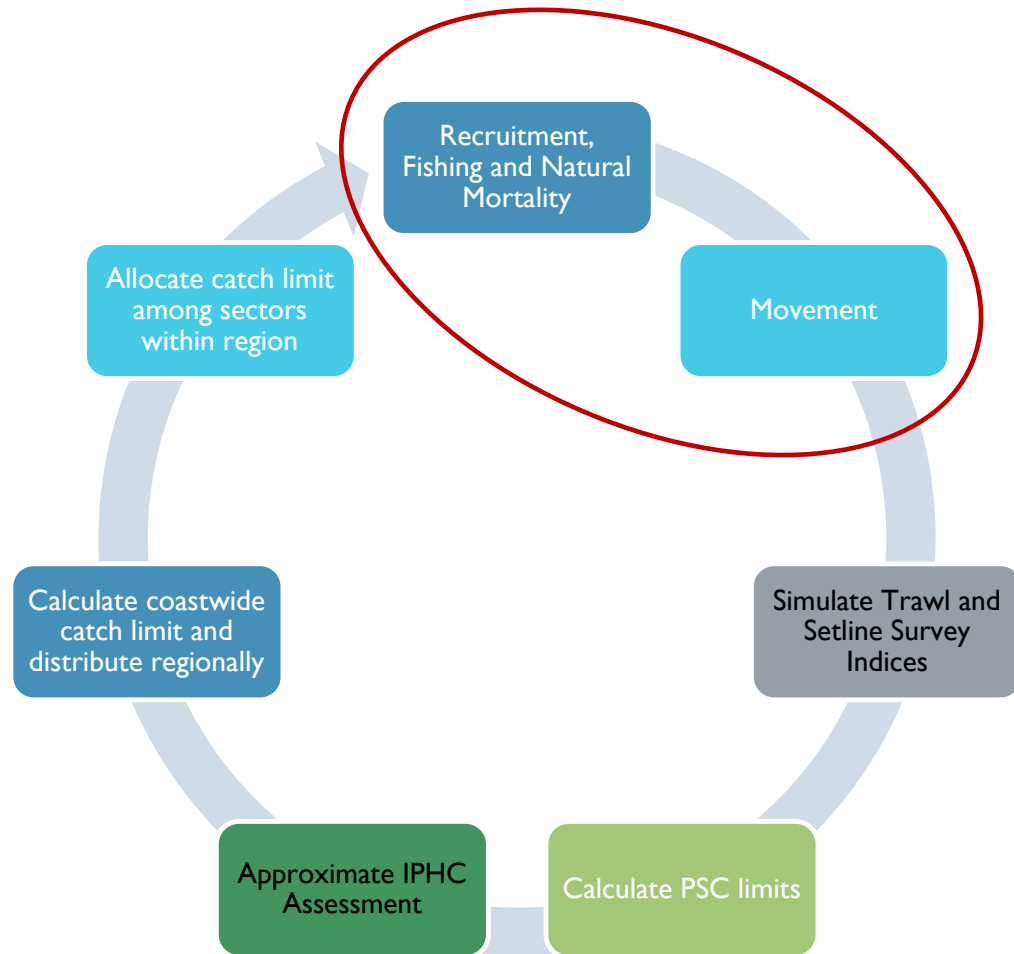
# NEW THIS YEAR

- Sensitivity analyses:
  - Low recruitment scenario,
  - Extreme low recruitment robustness test
  - Temporal autocorrelation in simulated “assessment” step
  - PSC use:limit relationship where use closer to limit as limit becomes low (also stochastic)
  - Two alternative trawl PSC selectivity curves



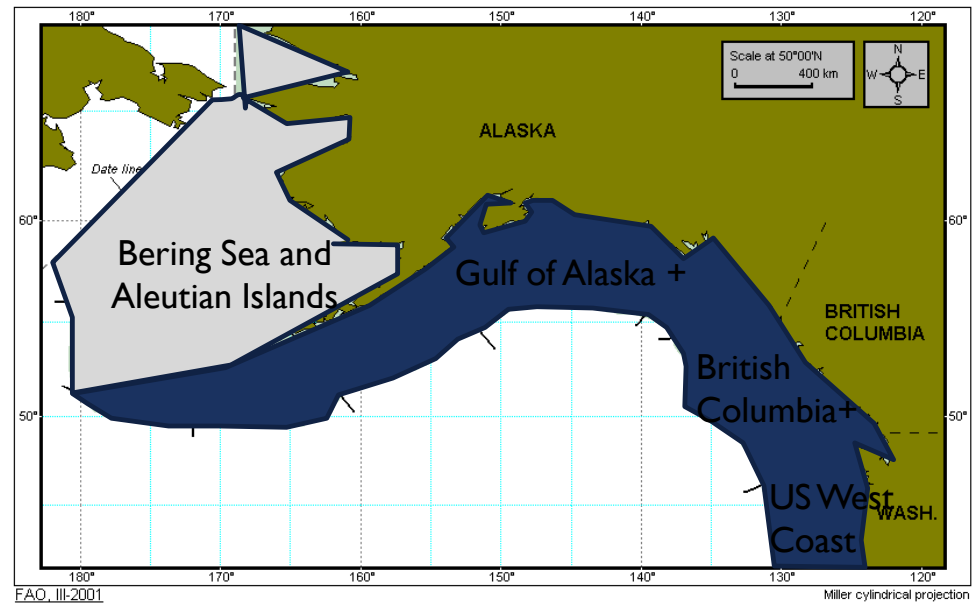
# CLOSED-LOOP SIMULATION MODEL SCHEMATIC

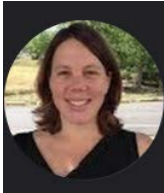
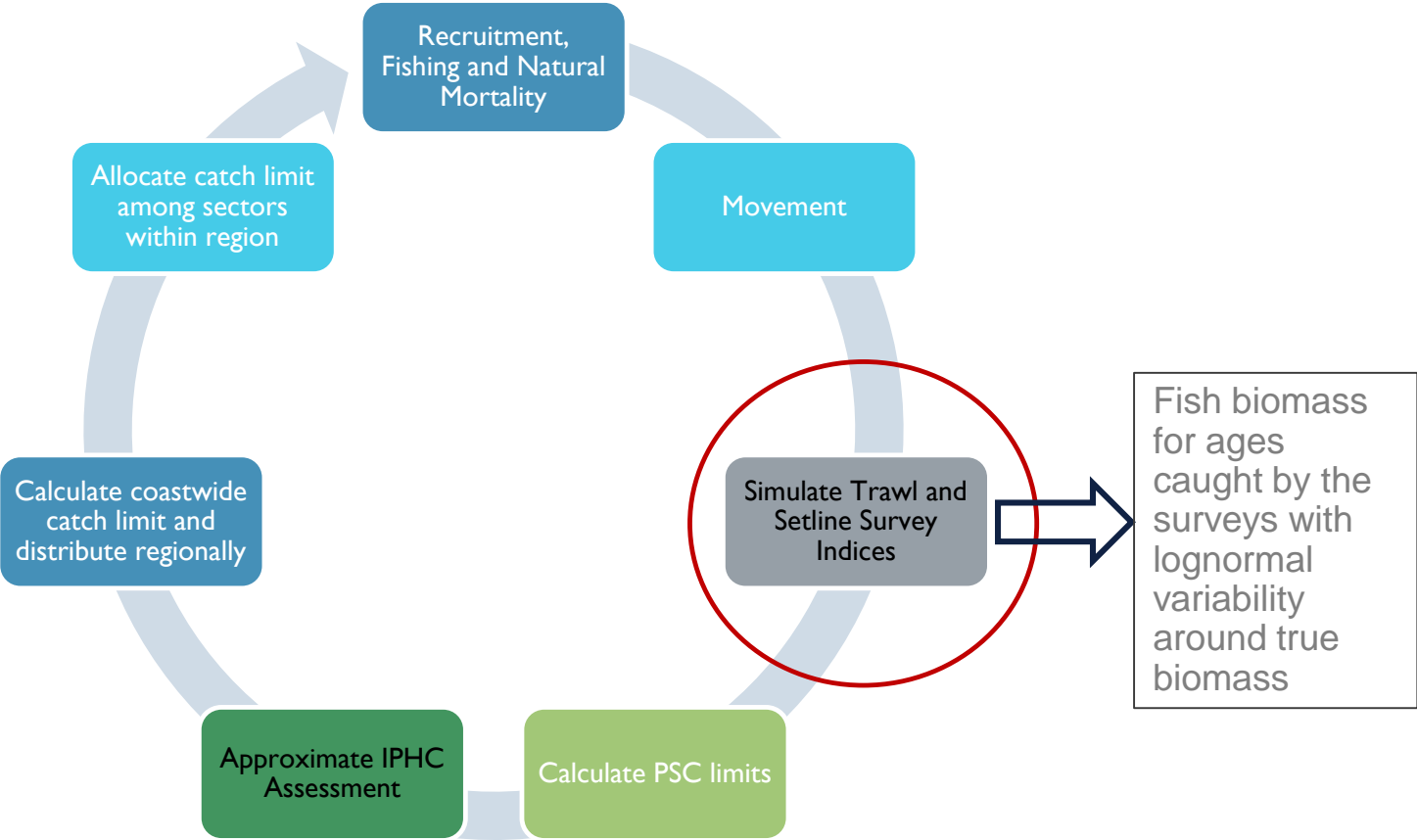




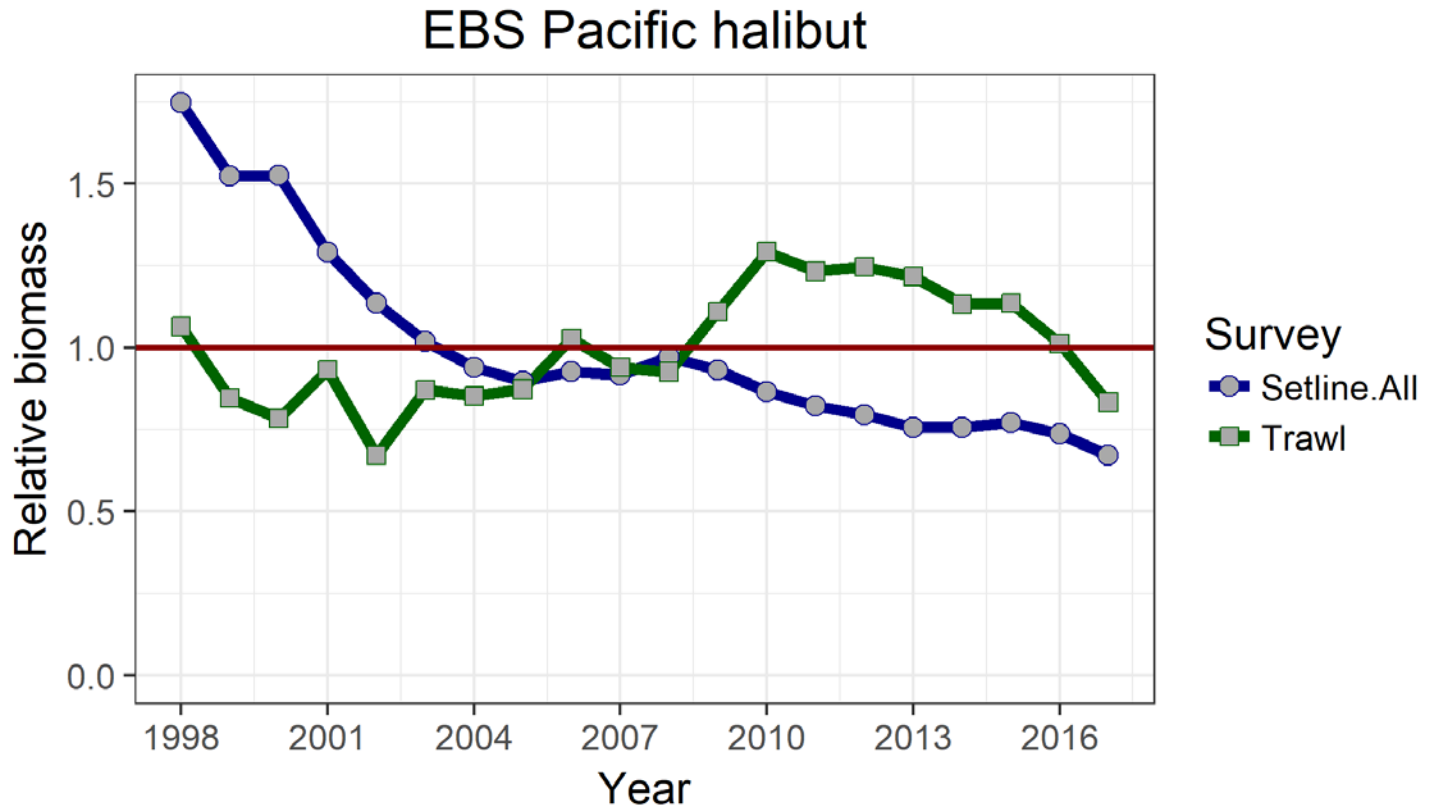


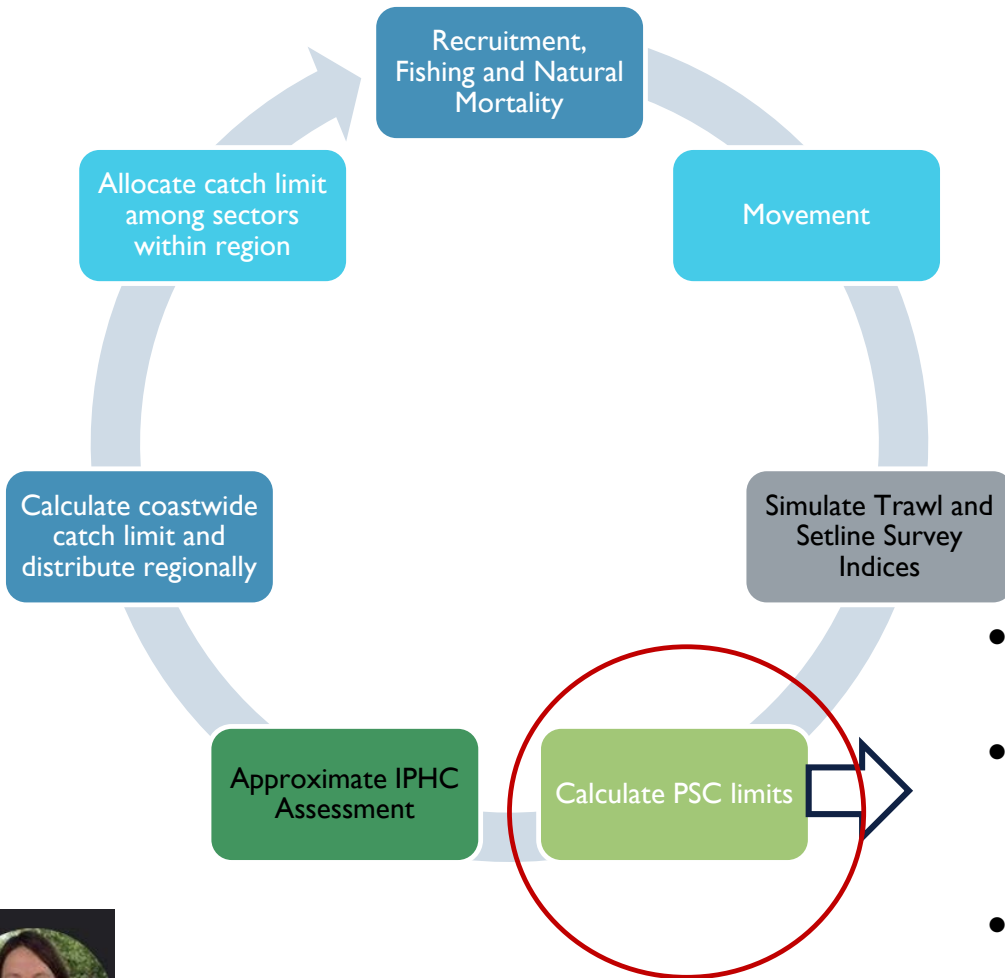
- 2 Area Model
  1. Bering Sea-Aleutian Islands
  2. Gulf of Alaska, British Columbia, US West Coast
- Recruitment of halibut
  - Allocated among areas, time-varying
  - Function of example Pacific Decadal Oscillation index
- Adult movement unchanged
- Fleet structure unchanged, but selectivity updated according to new IPHC assessment results (trawl PSC fleet is still in aggregate)





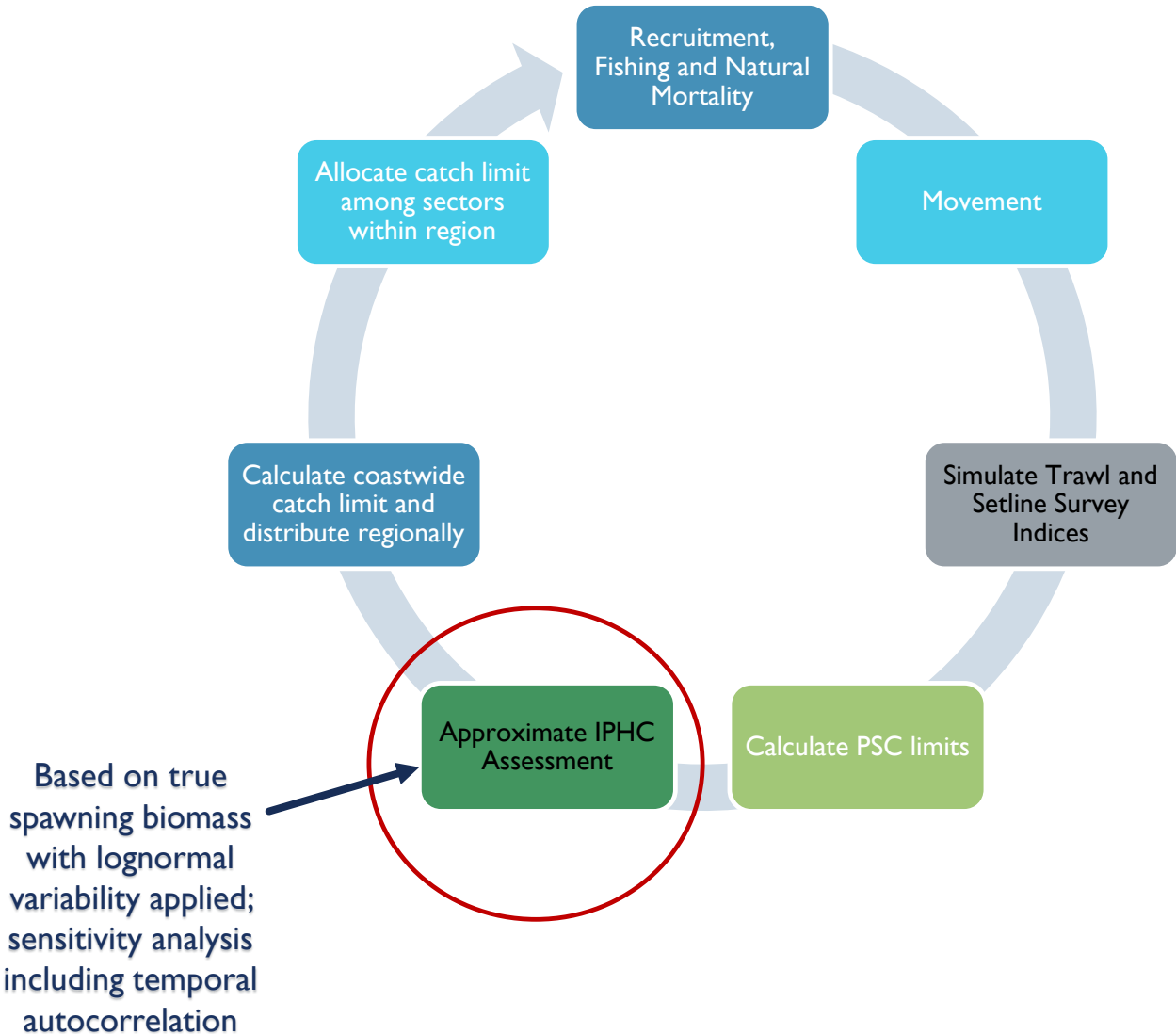
# Surveys in the Eastern Bering Sea

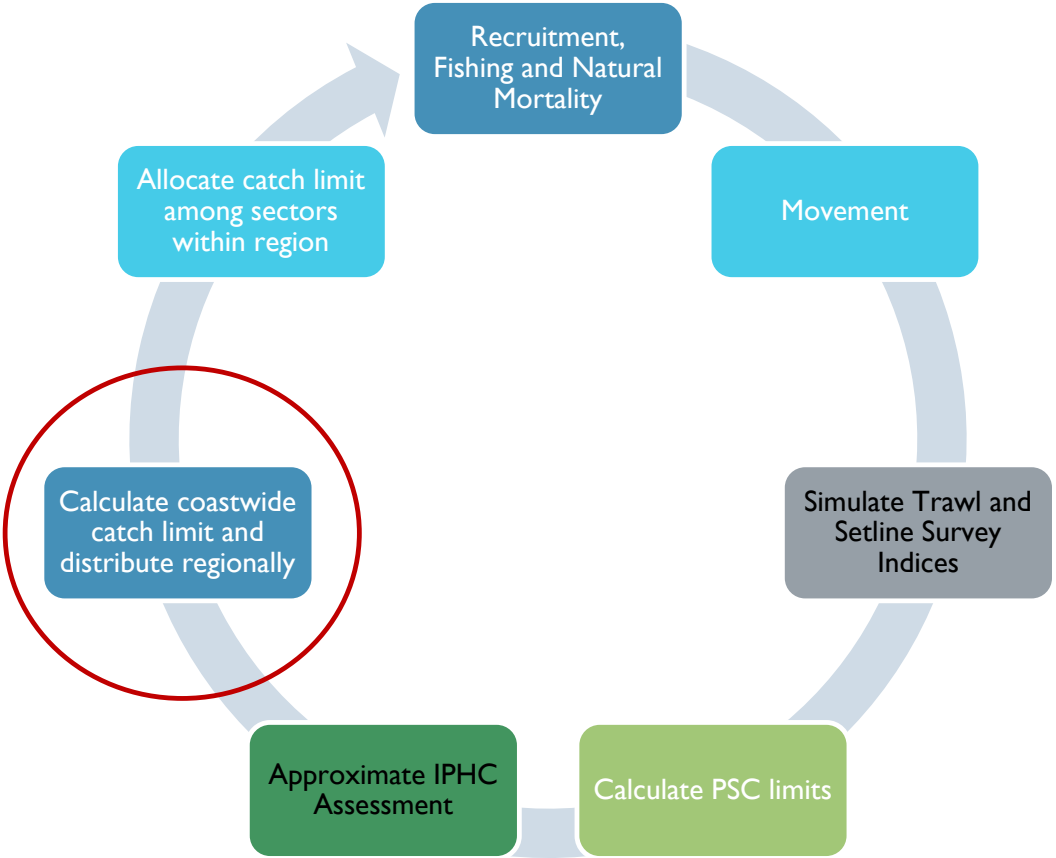




- A80 PSC limit calculated from alternatives
- Non-A80 static PSC added to A80 PSC limit to calculate aggregate BSAI trawl PSC limit
- Longline PSC limit static

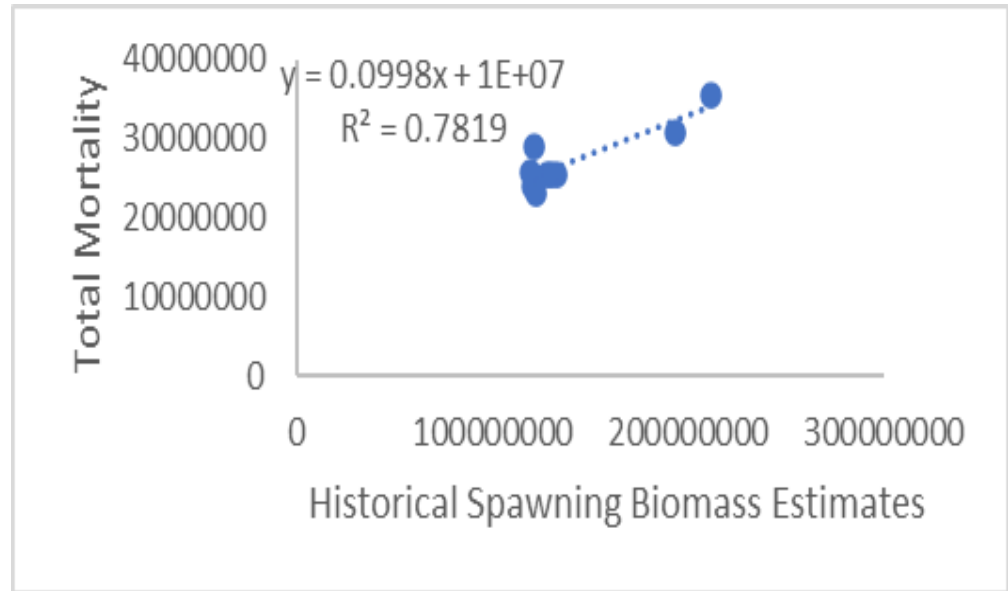




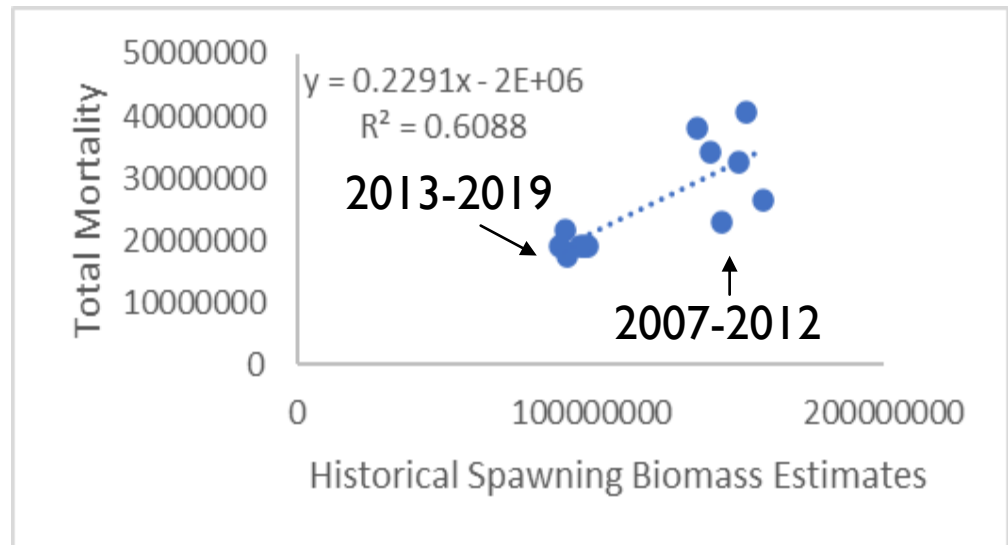


## This year's control rule for TCEY determination

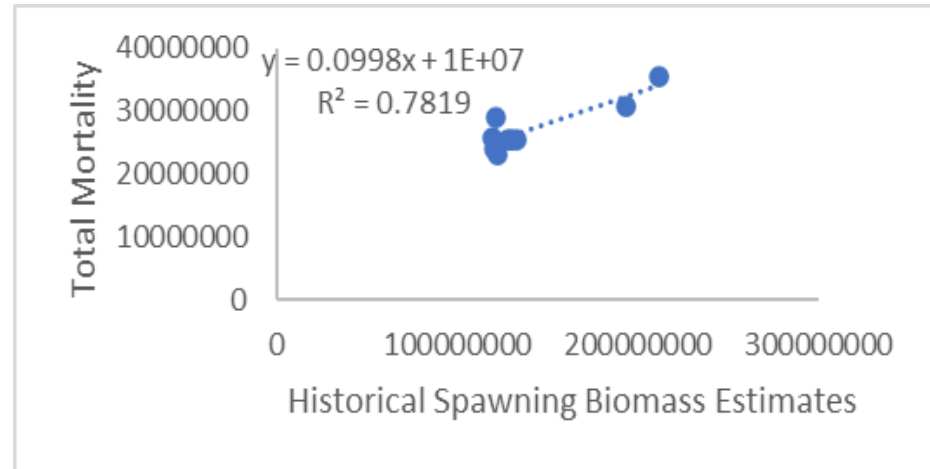
- Note shallower slope than for last year; SSC requested not including or downweighting some of the earlier years



## Last year's control rule for TCEY determination

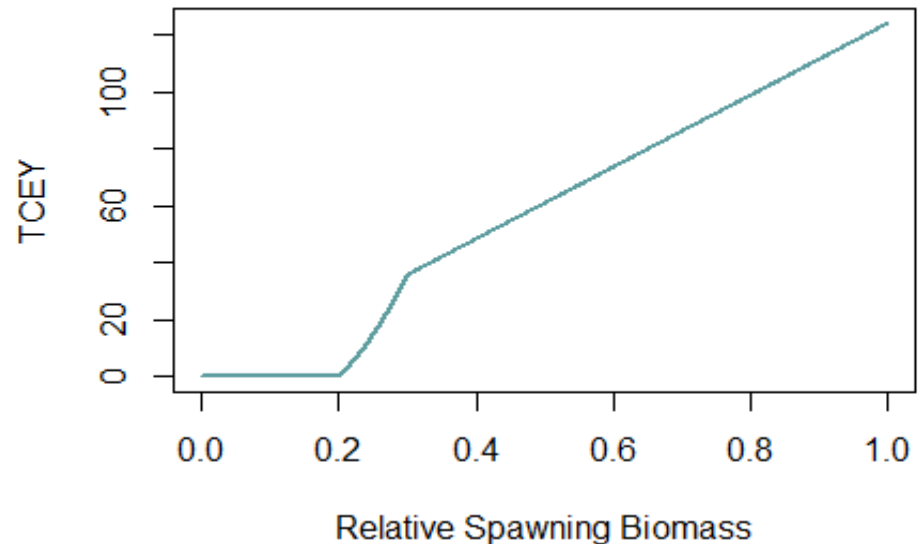


This year's control rule for TCEY determination before 30:20 rule applied



Application of 30:20 harvest control rule for TCEY determination:

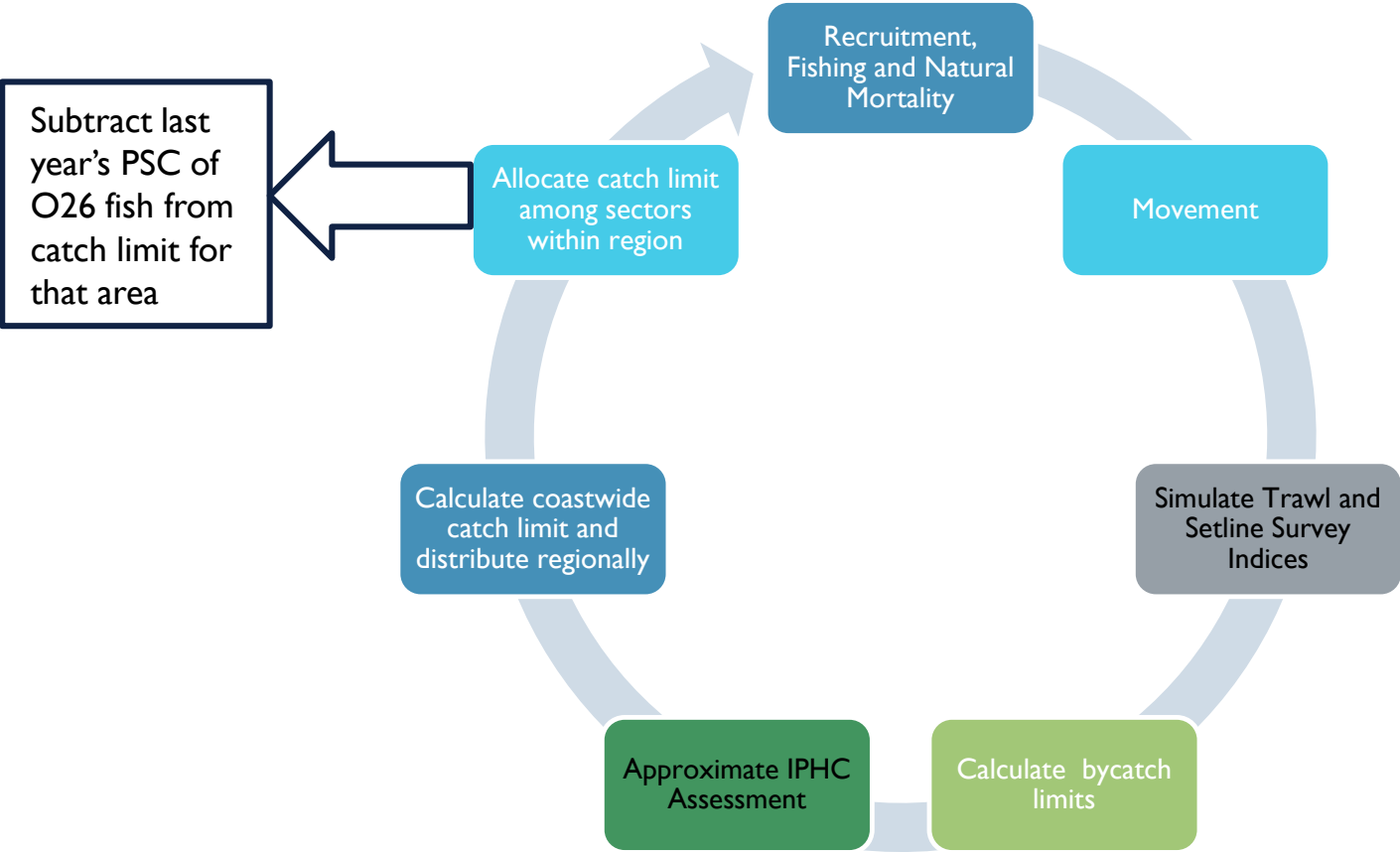
- Dynamic relative unfished spawning biomass definition

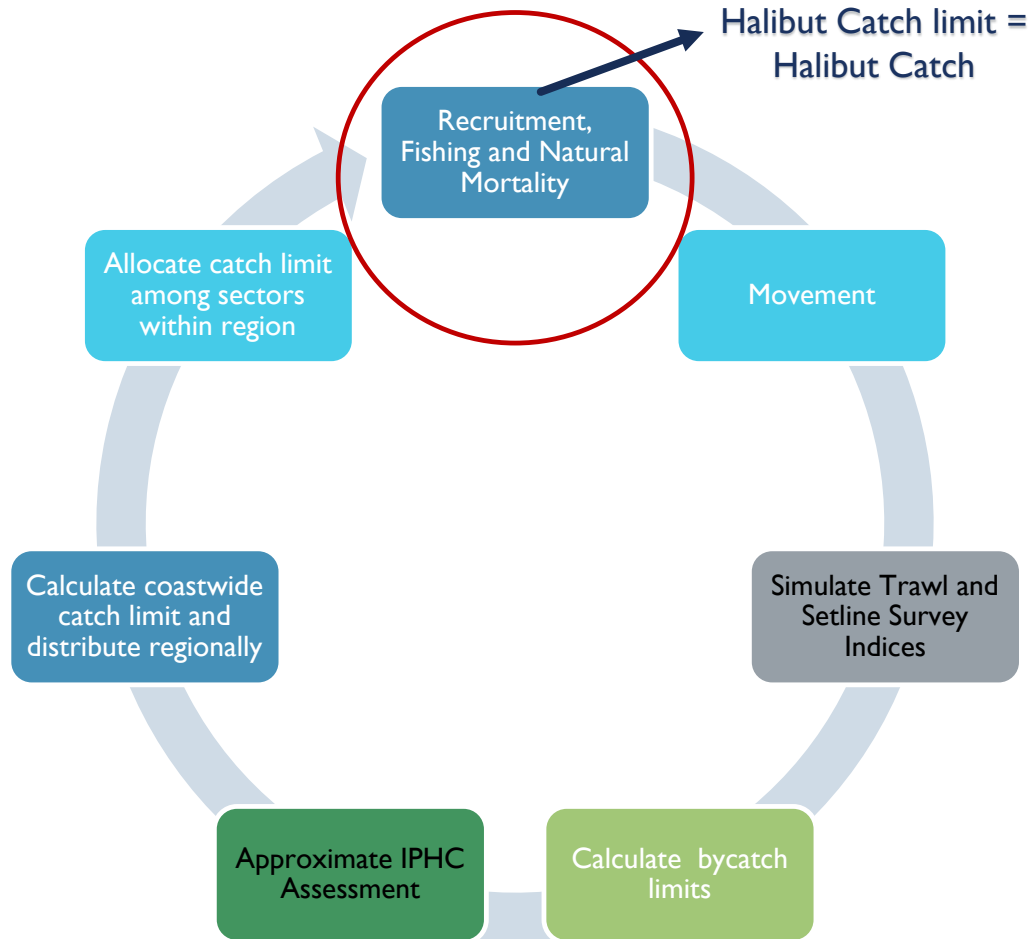


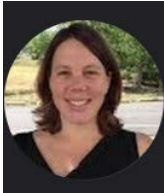
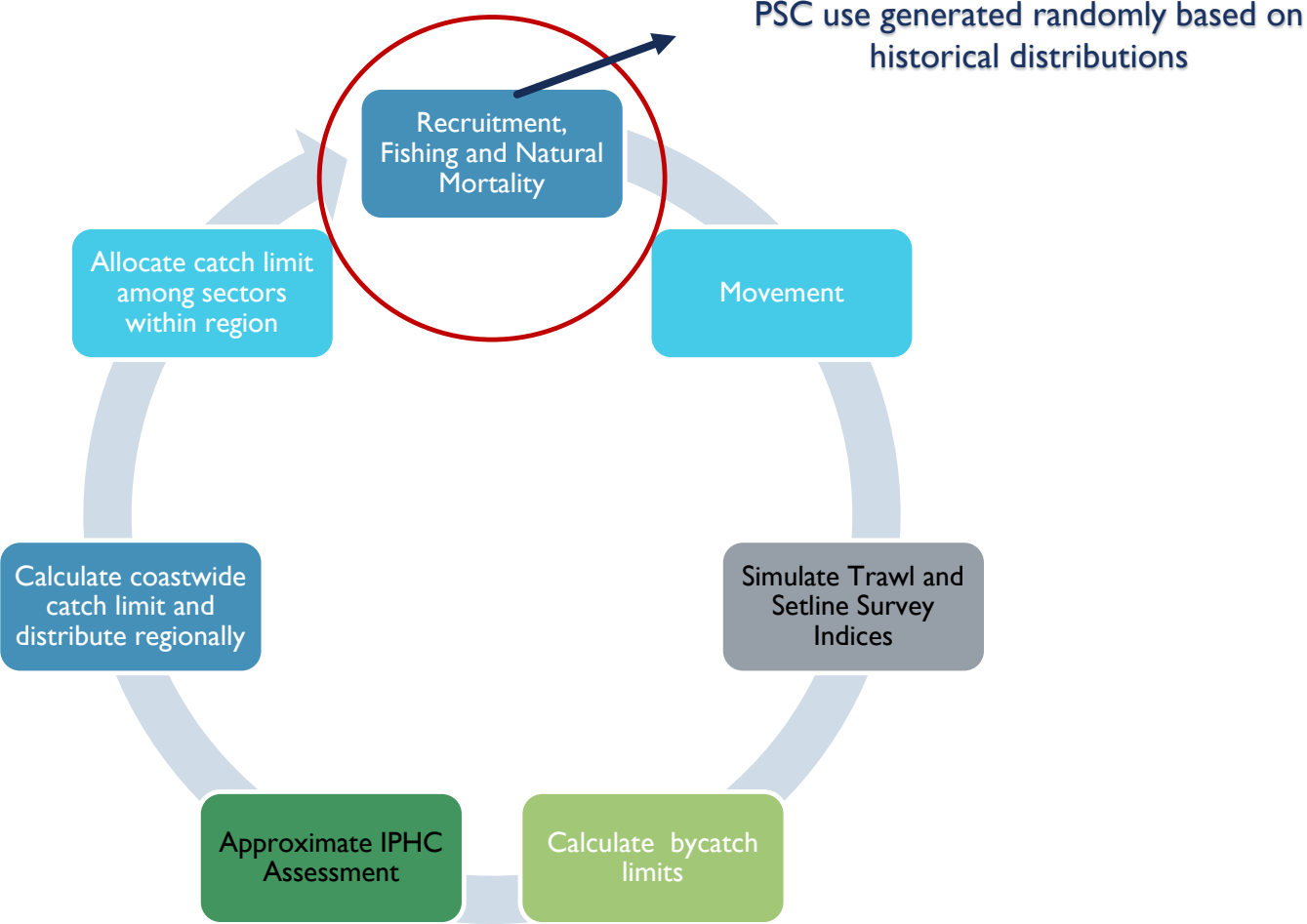


- Catch limit in the Bering Sea-Aleutian Islands = that year's proportion of modeled setline survey biomass in the BSAI
- Allows for responsiveness of catch limit by area to changes in the distribution of biomass over time

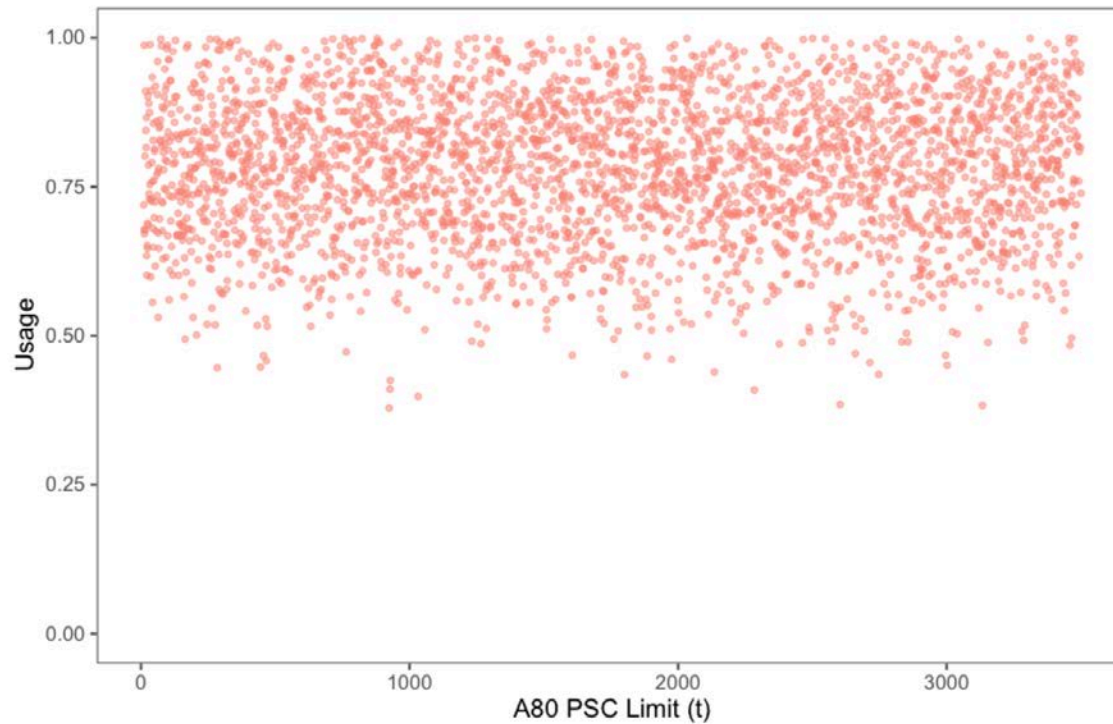




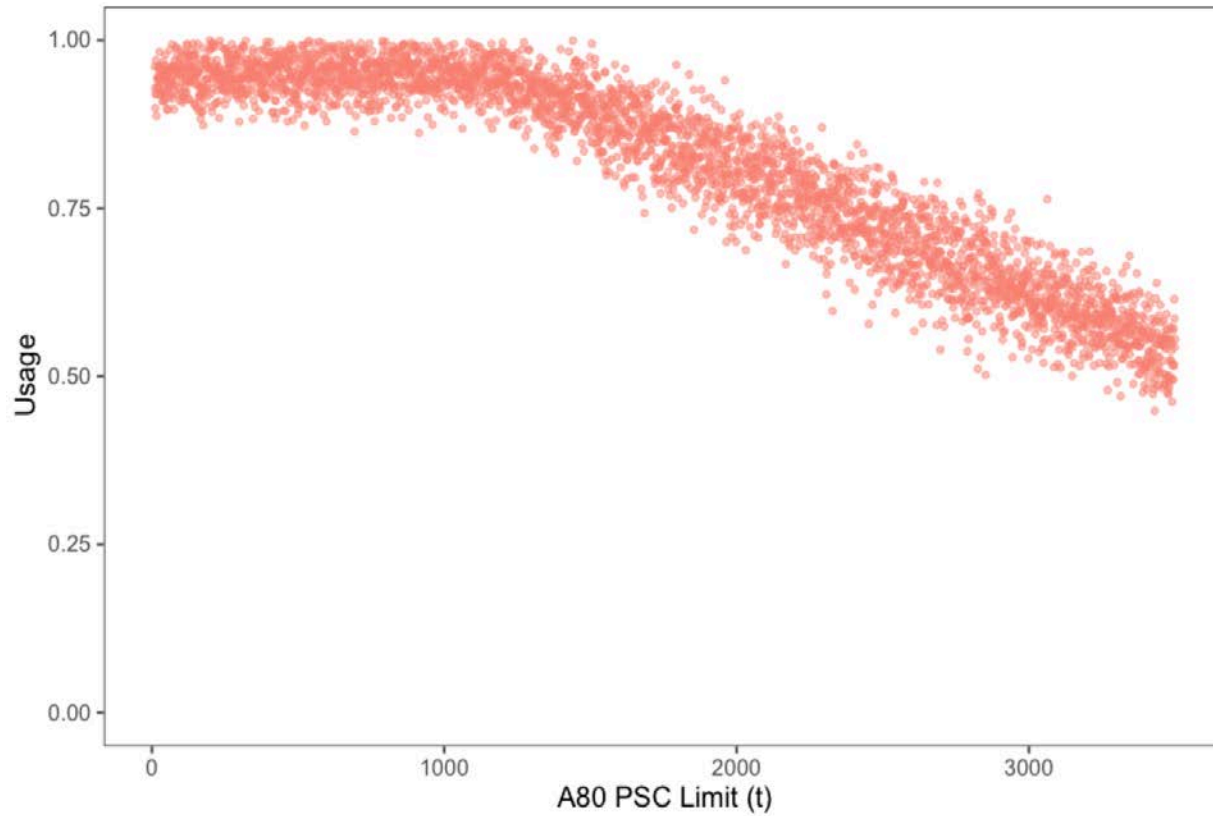




## PSC use: limit relationship generated randomly based on historical distributions



# Sensitivity analysis explored alternative PSC use: limit relationship



# ERRATA TO ADDRESS CONVERSION ERROR

- The original DEIS posted to the Council website for this meeting presented results that contained conversion error that affected historical catches, including 2019 catch
- We corrected the error and re-ran the model, including all sensitivity analyses.
- The tables and figures from the original DEIS are presented in a side-by-side comparison with corrected tables and figures in the following slides for reference and discussion purposes.
- The conversion error impacted any calculation that was done to show results relative to 2019 halibut catches, in particular calculations involving directed halibut fishery catches relative to 2019.



# IMPACT ANALYSES **UNCHANGED** BY CONVERSION ERROR

- Impact analysis on groundfish
- Comparison across alternatives in figures and tables
- Ranking of alternatives according to performance metrics
- Modeled values and trends over time
  - Simulated halibut fishery catches in absolute terms
  - Spawning and total biomass
  - Indices
  - PSC limits and usage
- Social Impact Analysis





# Differences in SSB in model demonstrations are undetectable

## DEIS version (p.189)

## Updated version

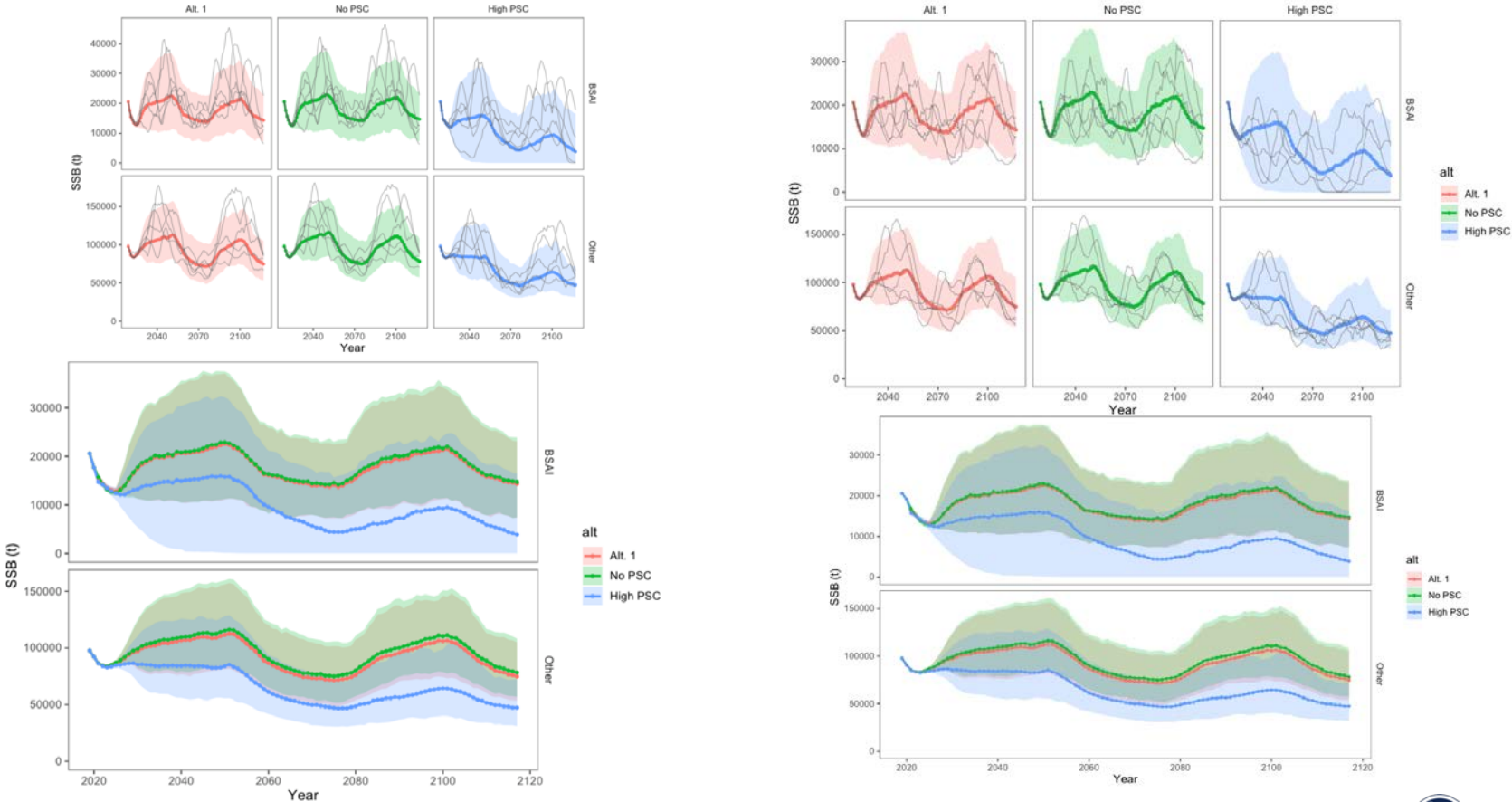


Figure 6-1 Demonstration of patterns in Pacific halibut SSB by region (note different vertical scales) over time for status quo, zero PSC Pacific halibut mortality, and 10,000 t of mortality. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. The top and bottom panels show the same results, but the bottom panel shows the three demonstrations on the same scale. All results for the three demonstrations are identical when conducted with and without a 30:20 harvest control rule implemented for coastwide TCEY determination.



# Directed halibut fishery catches relative to 2019 are higher in demonstrations (because 2019 catch is lower); trends and behavior across alternatives are unchanged

DEIS version (p.190)

Updated version

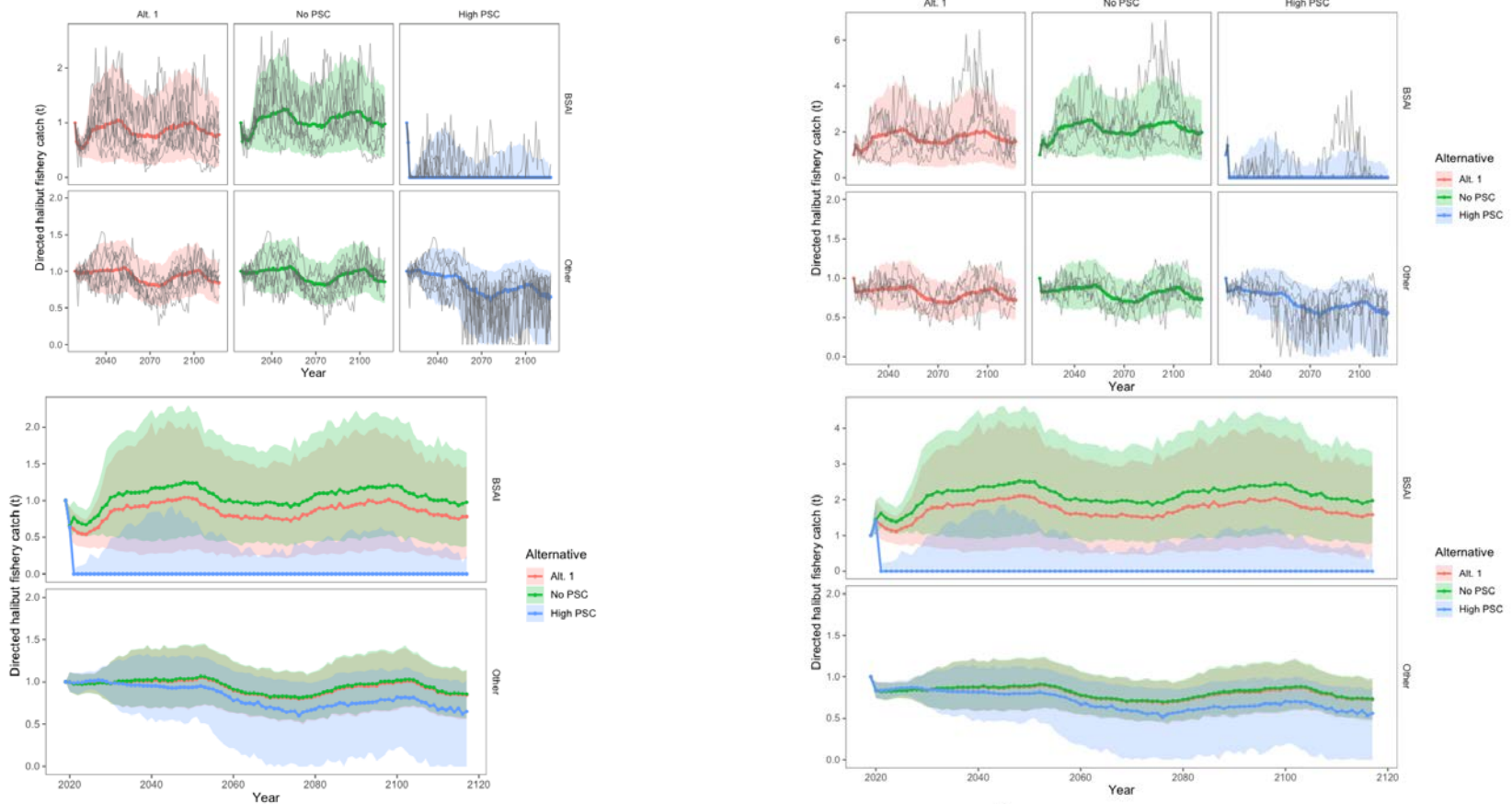
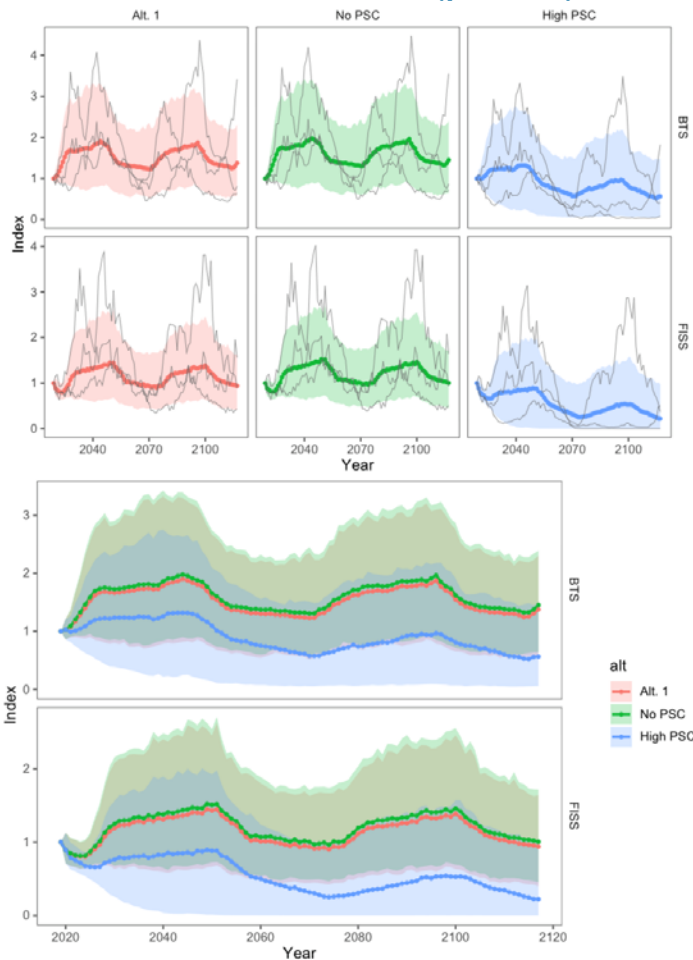


Figure 6-2 Demonstration of patterns in Pacific halibut directed fishery catch (by region and relative to 2019 values) over time for status quo, zero PSC Pacific halibut mortality, and 10,000 t of mortality. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. The top and bottom panels show the same results, but the bottom panel shows the three demonstrations on the same scale. All results for the three demonstrations are identical when conducted with and without a 30:20 harvest control rule implemented for coastwide TCEY determination.

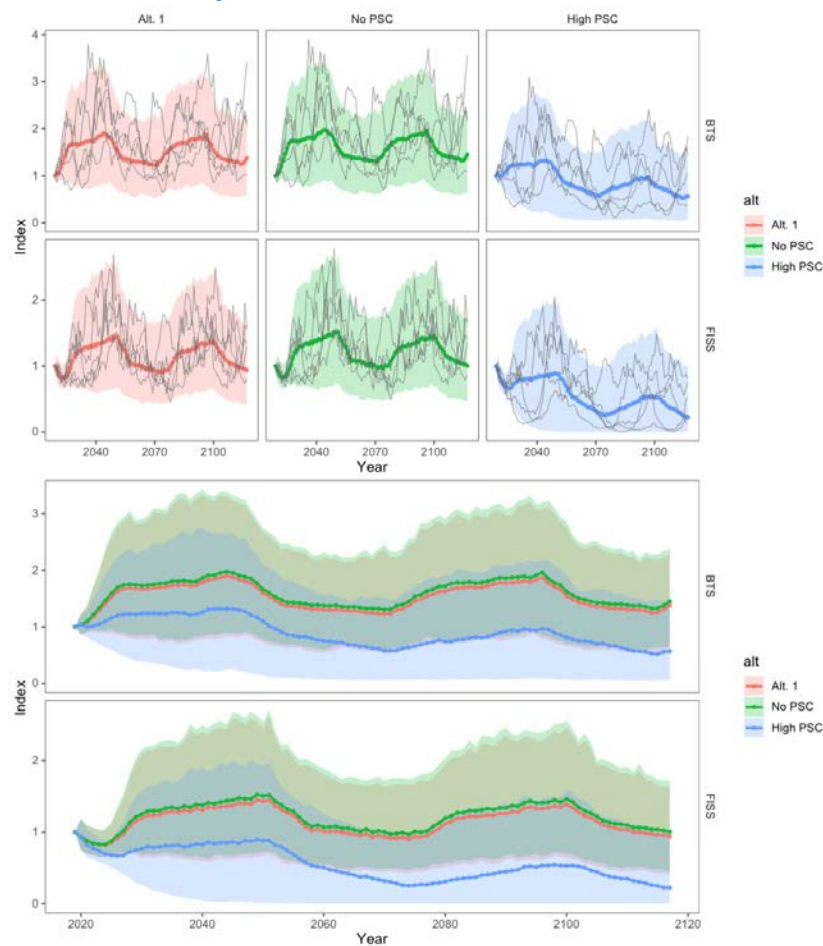


# Indices for demonstrations are unchanged

## DEIS version (p.191)



## Updated version

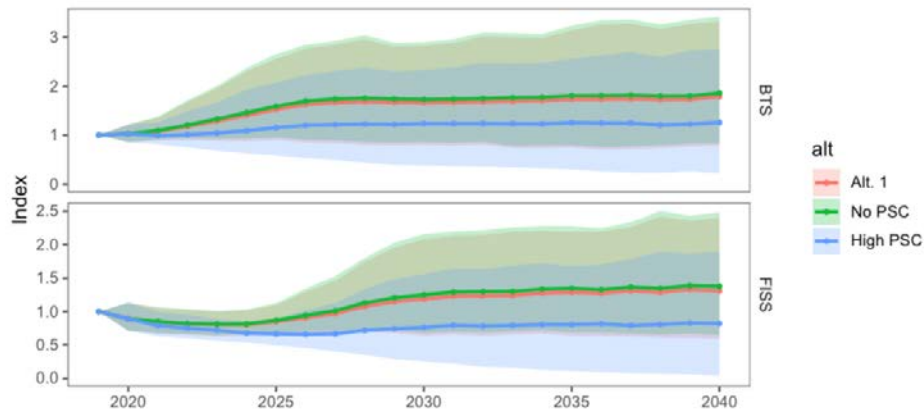


**Figure 6-3** Demonstration of patterns in Pacific halibut indices (BTS and FISS and relative to 2019 values) over time for status quo, zero PSC Pacific halibut mortality, and 10,000 t of mortality. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. The top and bottom panels show the same results, but the bottom panel shows the three demonstrations on the same scale. All results for the three demonstrations are identical when conducted with and without a 30:20 harvest control rule implemented for coastwide TCEY determination.



# Indices for demonstrations are unchanged

## DEIS version (p.192)



## Updated version

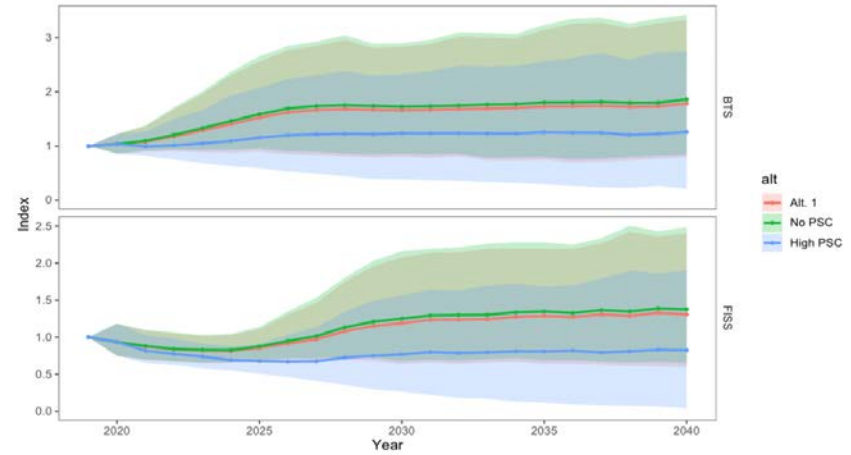


Figure 6-4 As for Figure 6-3, but showing results in more detail for initial years of simulation (2020-2040)



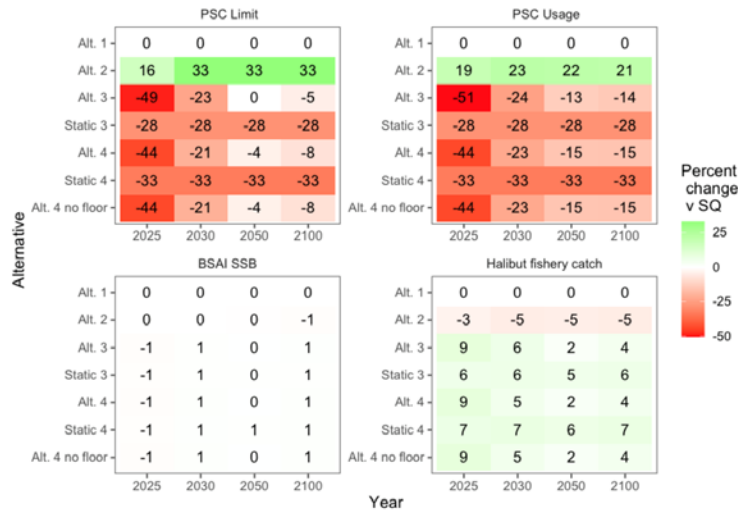
# No changes greater than two percent in PSC limits, usage, BSAI SSB, and halibut fishery catch relative to the status quo (Shown here for runs without a 30:20 rule for TCEY determination; CR = 0)

## DEIS version (p.194)

## Updated version

**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. Rows labeled "Static 3" and "Static 4" are runs with PSC Limits fixed at their starting point values for alternatives 3 and 4, respectively (as requested by the SSC). "Alt. 4 no floor" is the same as Alt. 4 but with the floor removed. This first set of tables shows results for base case (B1) model runs without a 30:20 harvest control rule for TCEY determination (CR 0).

Scenario B1, CR 0





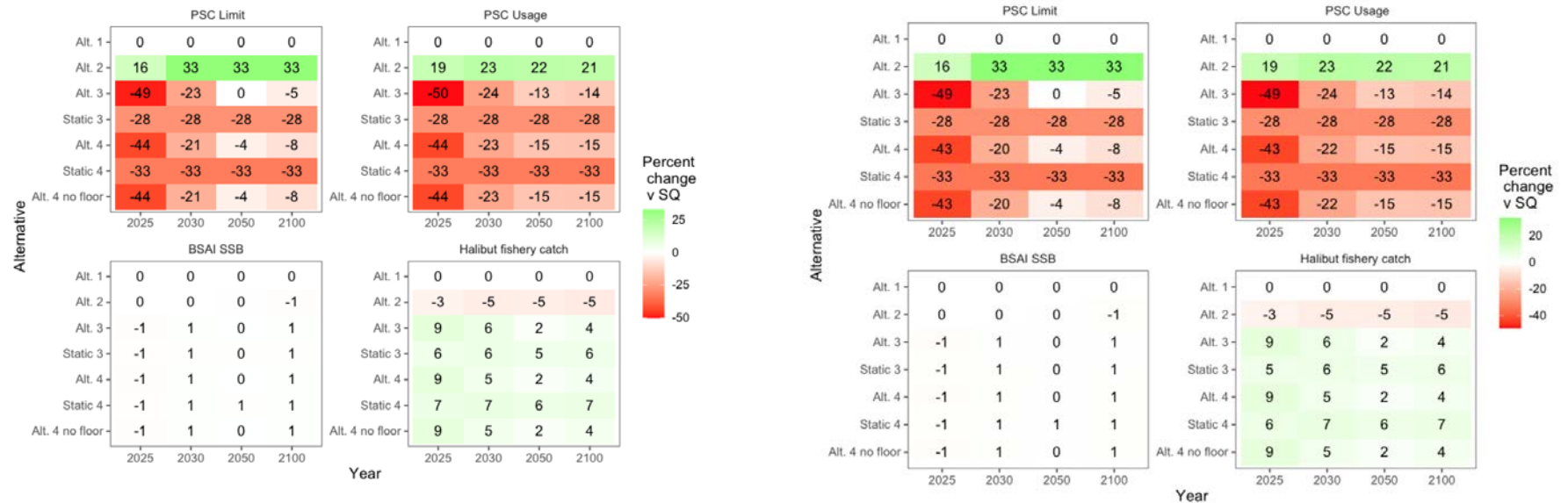
# No changes greater than one percent in PSC limits, usage, BSAI SSB, and halibut fishery catch relative to the status quo (Shown here for runs with a 30:20 rule for TCEY determination; CR = 1)

DEIS version (p.195)

Updated version

**Table 6-1** (continued) 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 (base case B1) with the 30:20 control included (CR 1). Values are expressed relative to status quo (Alternative 1 in row 1). Red shading indicates a lower relative value within each measure. Rows labeled "Static 3" and "Static 4" are runs with PSC Limits fixed at their starting point values for alternatives 3 and 4, respectively (as requested by the SSC). "Alt. 4 no floor" is the same as Alt. 4 but with the floor removed.

Scenario B1, CR 1



Changes from the conversion correction in model simulation results over time are undetectable, except that directed halibut fishery catch relative to 2019 is larger because 2019 catch is lower.

### DEIS version (p.196)

### Updated version

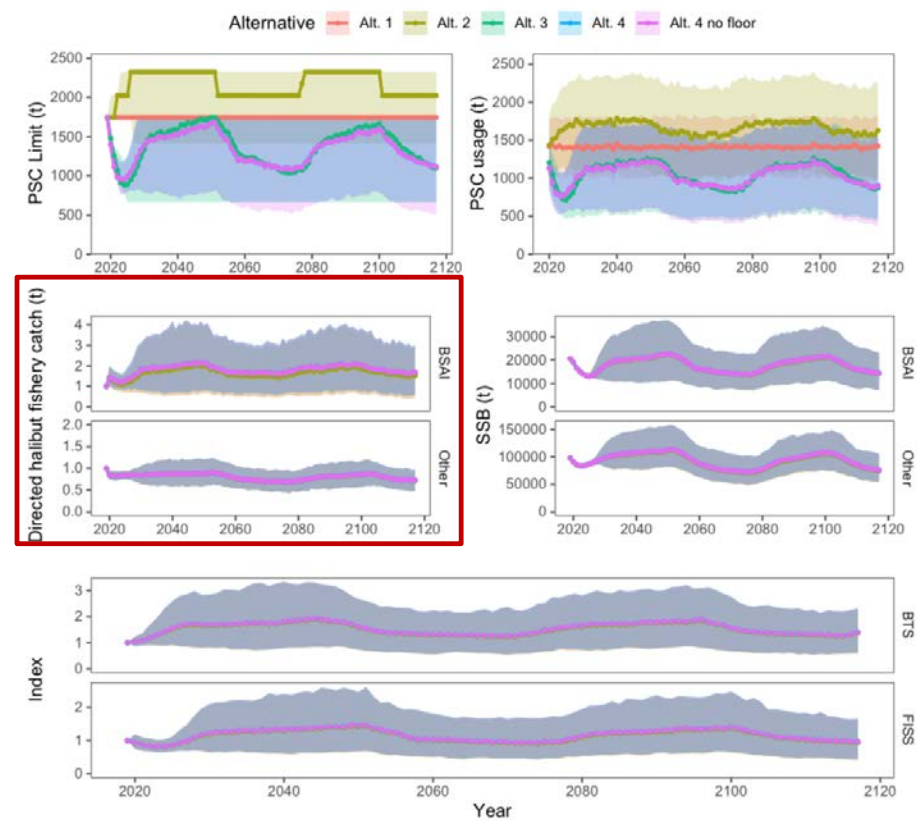
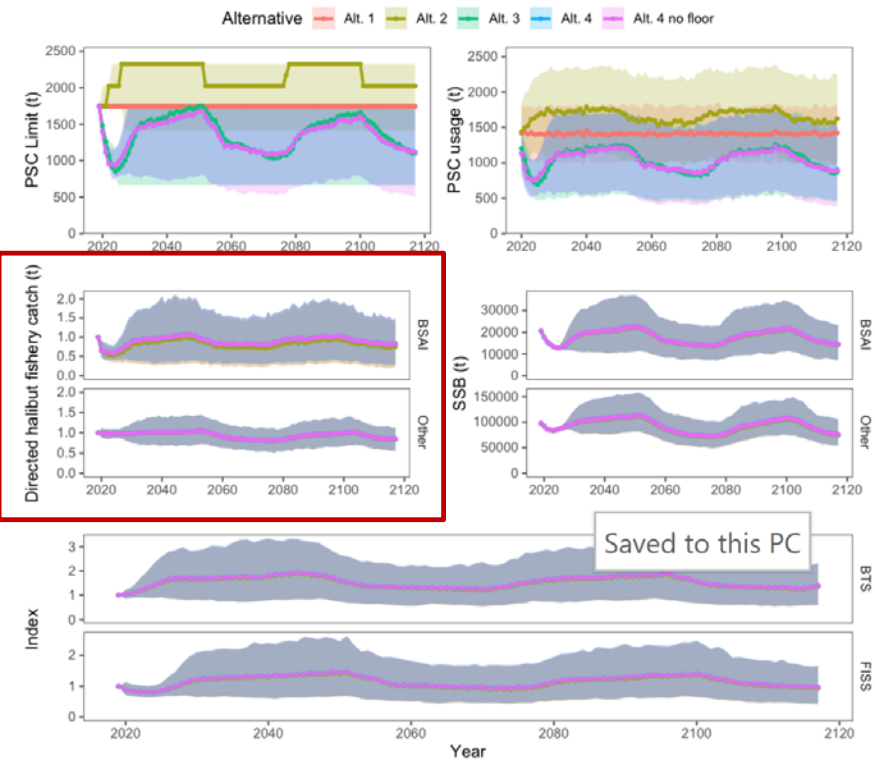


Figure 6-5 A comparison of projected PSC limits, usage, spawning biomass (SSB), and halibut fishery catch for the status quo (Alternative 1), and the 3 other alternatives, with uncertainty bounds. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. In nearly all presentations the shades and lines are overlapped.



Changes from the conversion correction in model simulation results over time are undetectable, except that directed halibut fishery catch relative to 2019 is larger because 2019 catch is lower.

### DEIS version (p.197)

### Updated version

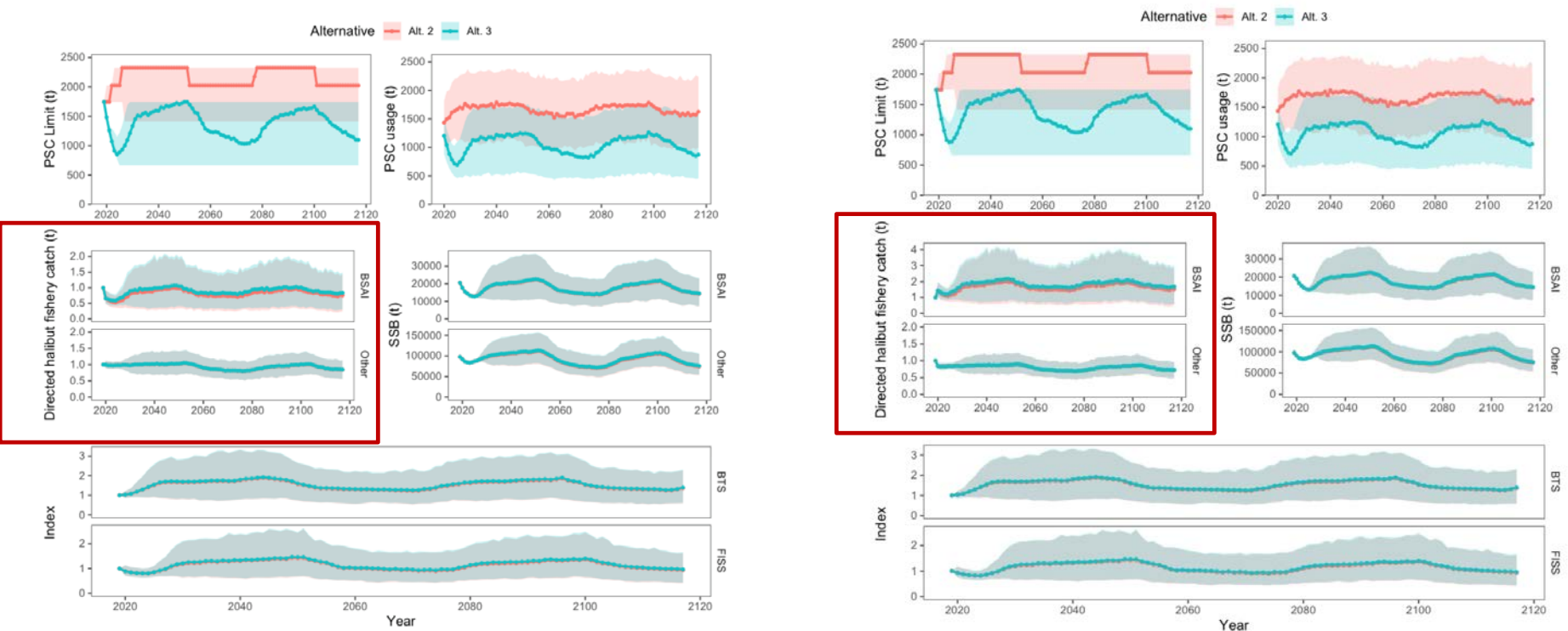


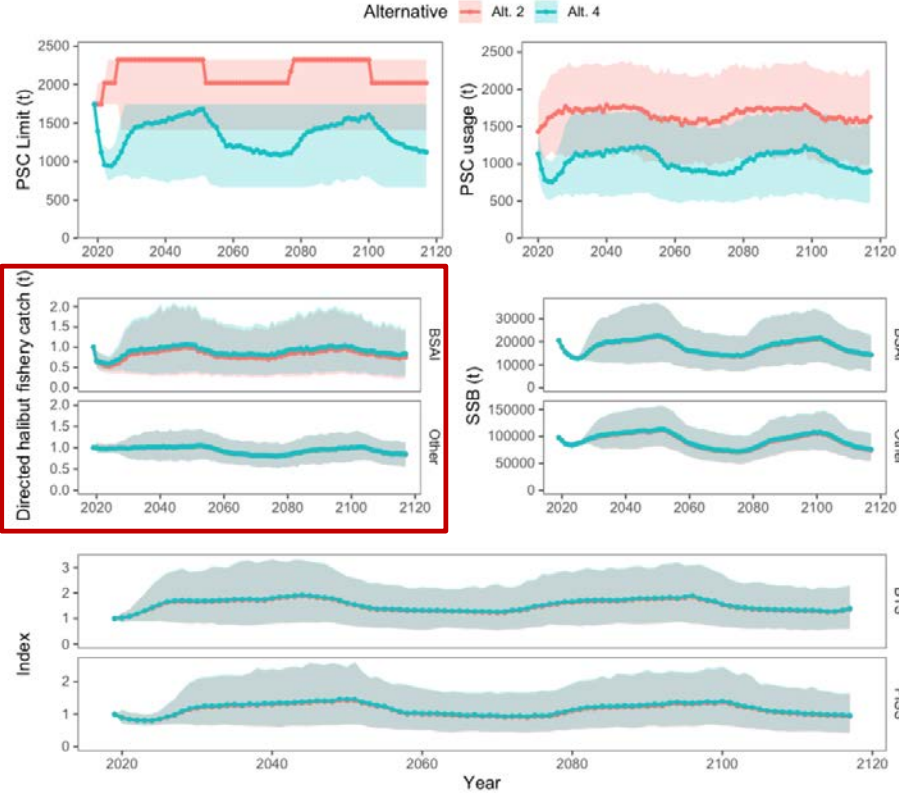
Figure 6-6 A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch over time for Alternatives 2 and 3, with uncertainty bounds. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. In nearly all presentations the shades and lines are overplotted.





Changes from the conversion correction in model simulation results over time are undetectable, except that directed halibut fishery catch relative to 2019 is larger because 2019 catch is lower.

### DEIS version (p.198)



### Updated version

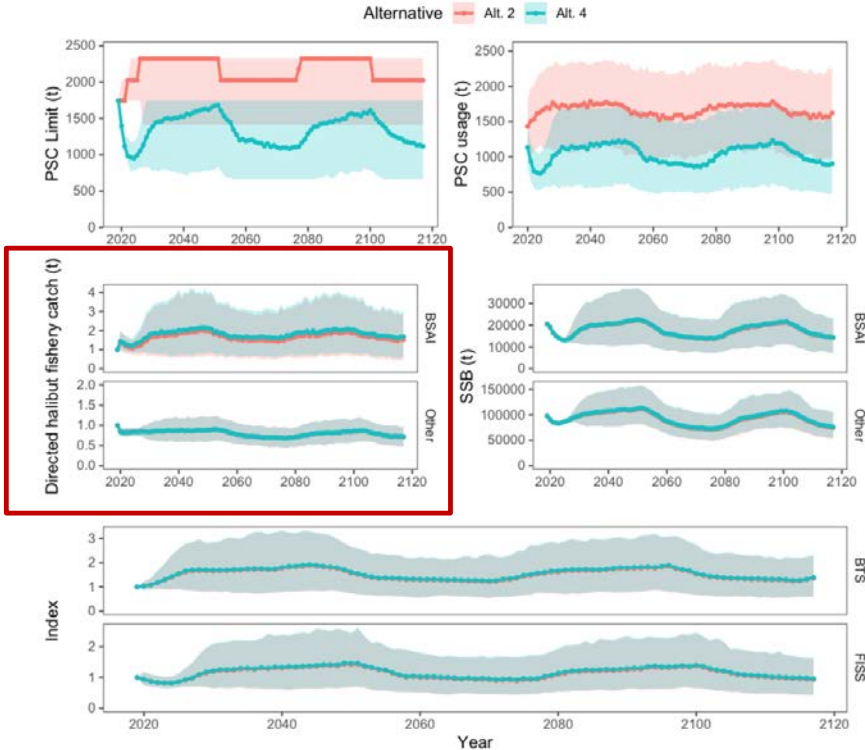


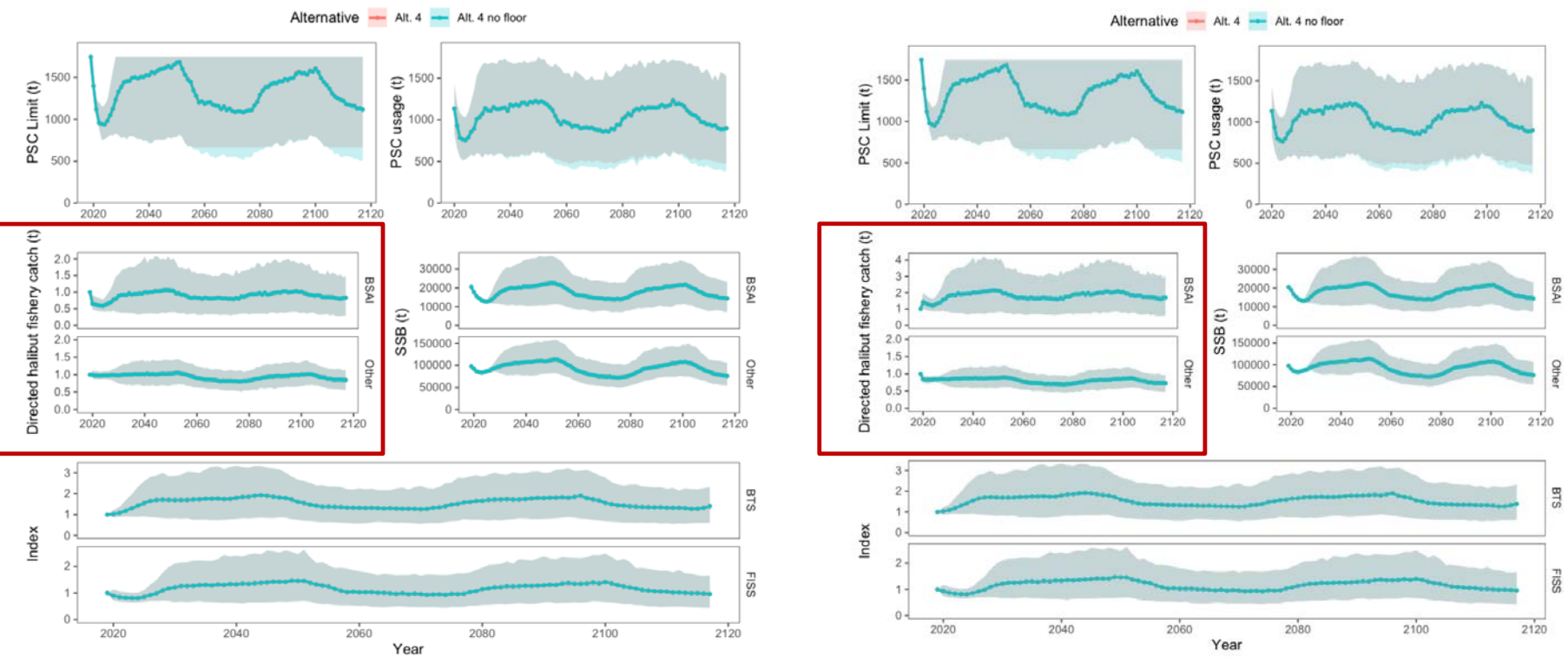
Figure 6-7 A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch over time for Alternatives 2 and 4, with uncertainty bounds. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. In nearly all presentations the shades and lines are overplotted.



Changes from the conversion correction in model simulation results over time are undetectable, except that directed halibut fishery catch relative to 2019 is larger because 2019 catch is lower.

### DEIS version (p.199)

### Updated version



**Figure 6-8** A comparison of projected PSC limits, usage, spawning biomass (SSB), and directed halibut fishery catch over time for Alternative 4 with Alternative 4 without a floor, with uncertainty bounds. Solid lines are median values and 90 out of 100 model realizations fall within the shaded areas. In nearly all presentations the shades and lines are overplotted.



2019 halibut catch changed to be lower, therefore halibut fishery change in catch relative to 2019 increased, but uncertainty and relative change across alternatives remained the same.

### DEIS version (p.215)

### Updated version

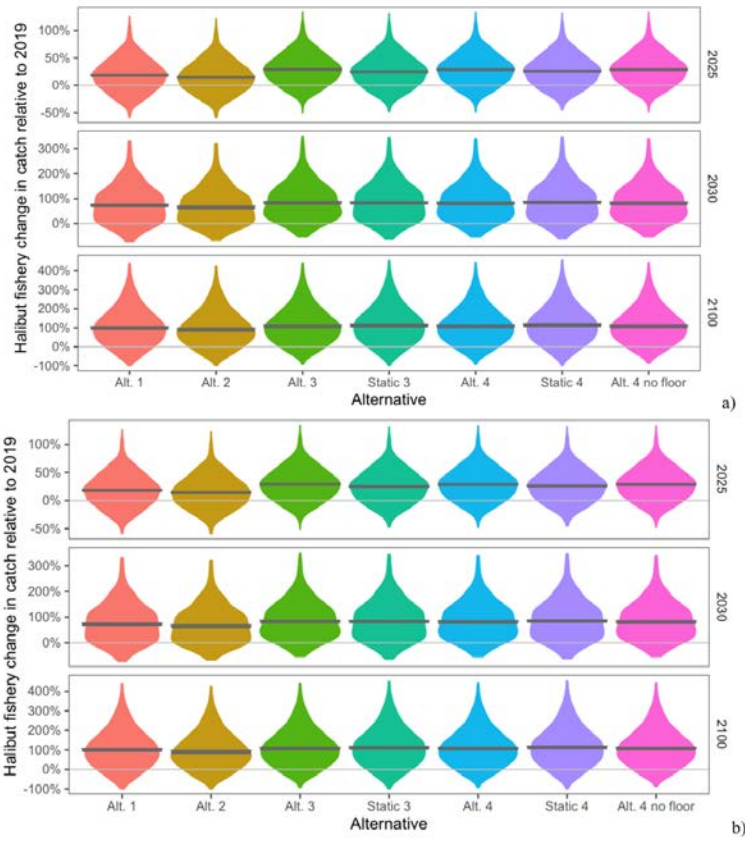
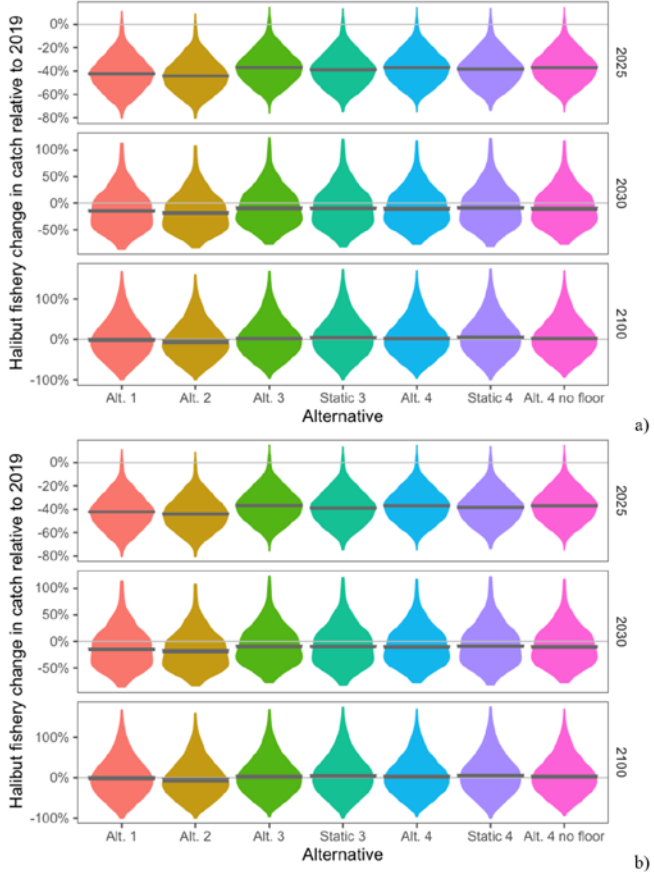


Figure 6-16 Comparison of changes in BSAI Pacific halibut fishery catch relative to the 2019 value by alternative (colors and x-axis within panels) and years (rows). The top set are for runs without the 30:20 harvest control rule and the lower set included the 30:20 rule in TCEY determination. Columns labeled "Static 3" and "Static 4" are runs with PSC limits fixed at their starting point values for Alternatives 3 and 4, respectively (as requested by the SSC). "Ait. 4 no floor" is the same as Ait. 4 but with the floor removed. Horizontal bars are median and mean values from the simulations.



## DEIS version (p.232)

**Table 6-14** Median projected BSAI halibut TCEY (millions of pounds, net weight) and percent change relative to 2019. Columns labeled "Static 3" and "Static 4" are runs with PSC Limits fixed at their starting point values for Alternatives 3 and 4, respectively (as requested by the SSC). "Alt. 4 without floor" is the same as Alternative 4 but with the floor removed. The starting point for Alternative 2 is the same as status quo.

BSAI Pacific halibut fishery TCEY (net wt. million pounds)							
Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2021	5.03	5.01	5.20	5.35	5.26	5.41	5.26
2022	4.68	4.64	4.96	4.97	5.04	5.01	5.04
2023	4.52	4.45	4.87	4.78	4.93	4.83	4.93
2024	4.46	4.35	4.84	4.71	4.86	4.76	4.86
2025	4.77	4.61	5.21	5.04	5.20	5.09	5.20
2026	5.03	4.82	5.53	5.34	5.48	5.38	5.48
2027	5.25	5.01	5.76	5.59	5.73	5.65	5.73
2028	5.96	5.66	6.42	6.30	6.39	6.36	6.39
2029	6.25	5.93	6.67	6.58	6.64	6.65	6.64
2030	6.99	6.64	7.40	7.42	7.32	7.50	7.32

Percent change relative to Status Quo (Alt. 1)							
Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	100%	0%	0%	0%	0%	0%	0%
2020	68%	0%	0%	0%	0%	0%	0%
2021	62%	0%	2%	4%	3%	4%	3%
2022	58%	-1%	3%	3%	4%	4%	4%
2023	56%	-1%	4%	3%	5%	3%	5%
2024	55%	-2%	5%	3%	5%	4%	5%
2025	58%	-2%	5%	3%	5%	4%	5%
2026	62%	-2%	6%	4%	6%	5%	6%
2027	65%	-2%	7%	5%	6%	5%	6%
2028	75%	-3%	7%	5%	6%	6%	6%
2029	82%	-4%	5%	4%	5%	5%	5%
2030	88%	-4%	5%	4%	4%	5%	4%

## Updated version

**Table 6-14** Median projected BSAI directed halibut catch limits (millions of pounds, net weight; top panel) and percent change relative to the status quo (Alternative 1) projection; bottom panel. Columns labeled "Static 3" and "Static 4" are runs with PSC limits fixed at their starting point values for Alternatives 3 and 4, respectively. "Alt. 4 without floor" is the same as Alternative 4 but with the floor removed. The starting point for Alternative 2 is the same as status quo.

BSAI Pacific halibut fishery catch limit (net wt. million pounds)							
Year	Status Quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	4.09	4.09	4.09	4.09	4.09	4.09	4.09
2020	5.83	5.83	5.83	5.83	5.83	5.83	5.83
2021	5.20	5.28	5.47	5.62	5.53	5.68	5.53
2022	4.85	4.81	5.12	5.13	5.21	5.19	5.21
2023	4.65	4.58	5.00	4.90	5.05	4.96	5.05
2024	4.54	4.44	4.91	4.79	4.93	4.84	4.93
2025	4.84	4.68	5.27	5.10	5.25	5.15	5.25
2026	5.08	4.85	5.57	5.38	5.52	5.43	5.52
2027	5.29	5.05	5.79	5.62	5.76	5.68	5.76
2028	5.98	5.69	6.45	6.33	6.42	6.39	6.42
2029	6.27	5.95	6.68	6.60	6.65	6.66	6.65
2030	7.00	6.65	7.41	7.44	7.33	7.52	7.33

Projected directed fishery catch limit change relative to status quo (Alt. 1)							
Year	Status Quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	0%	0%	0%	0%	0%	0%	0%
2020	0%	0%	0%	0%	0%	0%	0%
2021	0%	0%	3%	6%	4%	7%	4%
2022	0%	-1%	6%	6%	7%	7%	7%
2023	0%	-1%	7%	5%	9%	7%	9%
2024	0%	-2%	8%	6%	8%	7%	8%
2025	0%	-3%	9%	5%	9%	6%	9%
2026	0%	-5%	10%	6%	9%	7%	9%
2027	0%	-5%	9%	6%	9%	7%	9%
2028	0%	-5%	8%	6%	7%	7%	7%
2029	0%	-5%	7%	5%	6%	6%	6%
2030	0%	-5%	6%	6%	5%	7%	5%

### Updated version:

- Corrects the mislabeling of directed catch limits as TCEY (yellow highlight)
- Revises the table based on correct 2019 catch limits and model projections from that point





## Errata version (posted 9/25/20)

Table 6\* Projected gross ex-vessel value (\$million) of BSAI directed halibut based on 2019 average IPHC Area 4 unit values adjusted to 2018 dollars, assuming 100% utilization.

Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2021	22.3	22.2	23.0	23.7	23.3	24.0	23.3
2022	20.7	20.6	22.0	22.0	22.3	22.2	22.3
2023	20.0	19.7	21.6	21.2	21.8	21.4	21.8
2024	19.8	19.3	21.4	20.9	21.5	21.1	21.5
2025	21.1	20.4	23.1	22.3	23.0	22.5	23.0
2026	22.3	21.4	24.5	23.7	24.3	23.8	24.3
2027	23.3	22.2	25.5	24.8	25.4	25.0	25.4
2028	26.4	25.1	28.4	27.9	28.3	28.2	28.3
2029	27.7	26.3	29.5	29.1	29.4	29.5	29.4
2030	31.0	29.4	32.8	32.9	32.4	33.2	32.4

Table 6\*\* Projected gross ex-vessel value (\$million) of BSAI directed halibut based on 2015-2019 average IPHC Area 4 unit values adjusted to 2018 dollars, assuming 100% utilization.

Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2021	28.0	27.9	29.0	29.8	29.3	30.1	29.3
2022	26.1	25.8	27.6	27.7	28.1	27.9	28.1
2023	25.2	24.8	27.1	26.6	27.5	26.9	27.5
2024	24.8	24.2	27.0	26.2	27.1	26.5	27.1
2025	26.6	25.7	29.0	28.1	29.0	28.4	29.0
2026	28.0	26.8	30.8	29.7	30.5	30.0	30.5
2027	29.2	27.9	32.1	31.1	31.9	31.5	31.9
2028	33.2	31.5	35.8	35.1	35.6	35.4	35.6
2029	34.8	33.0	37.2	36.7	37.0	37.0	37.0
2030	38.9	37.0	41.2	41.3	40.8	41.8	40.8

## Updated version (posted 9/30/20)

Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	18.12	18.12	18.12	18.12	18.12	18.12	18.12
2020	25.83	25.83	25.84	25.85	25.84	25.85	25.84
2021	23.49	23.41	24.22	24.90	24.49	25.16	24.49
2022	21.49	21.30	22.70	22.73	23.07	22.97	23.07
2023	20.59	20.29	22.13	21.71	22.37	21.95	22.37
2024	20.12	19.65	21.77	21.23	21.82	21.44	21.82
2025	21.44	20.72	23.34	22.61	23.26	22.82	23.26
2026	22.49	21.47	24.66	23.84	24.46	24.06	24.46
2027	23.42	22.35	25.63	24.88	25.52	25.15	25.52
2028	26.50	25.20	28.56	28.05	28.42	28.30	28.42
2029	27.77	26.35	29.59	29.24	29.47	29.52	29.47
2030	31.01	29.47	32.84	32.94	32.46	33.30	32.46

Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	22.78	22.78	22.78	22.78	22.78	22.78	22.78
2020	32.48	32.48	32.49	32.50	32.49	32.50	32.49
2021	29.53	29.43	30.45	31.31	30.79	31.63	30.79
2022	27.03	26.78	28.55	28.58	29.01	28.88	29.01
2023	25.88	25.52	27.82	27.30	28.13	27.60	28.13
2024	25.29	24.71	27.37	26.69	27.44	26.95	27.44
2025	26.95	26.05	29.35	28.43	29.25	28.69	29.25
2026	28.27	26.99	31.00	29.98	30.75	30.25	30.75
2027	29.45	28.11	32.23	31.29	32.09	31.63	32.09
2028	33.32	31.68	35.91	35.26	35.73	35.58	35.73
2029	34.91	33.13	37.21	36.76	37.06	37.12	37.06
2030	38.99	37.05	41.29	41.42	40.81	41.86	40.81

### Updated version:

- Recalculates the table based on correct 2019 catch limits and model projections from that point



# QUICK REVIEW OF MODEL VALIDATION

## APPENDIX 3

- Purpose: match closed-loop simulation model over historical years to IPHC stock assessment
- IPHC stock assessment models changed since last October:
  - Commercial sex ratio data showed higher proportion of older fish (mostly female)
  - Definition of unfished spawning biomass changed to be dynamic
- Closed-loop simulation model updated to reflect IPHC assessment changes



# QUICK REVIEW OF MODEL VALIDATION

## APPENDIX 3

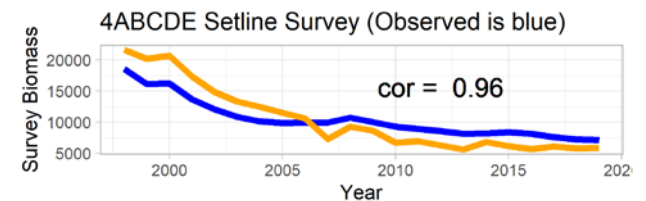
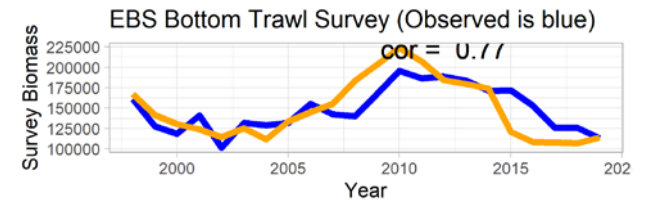
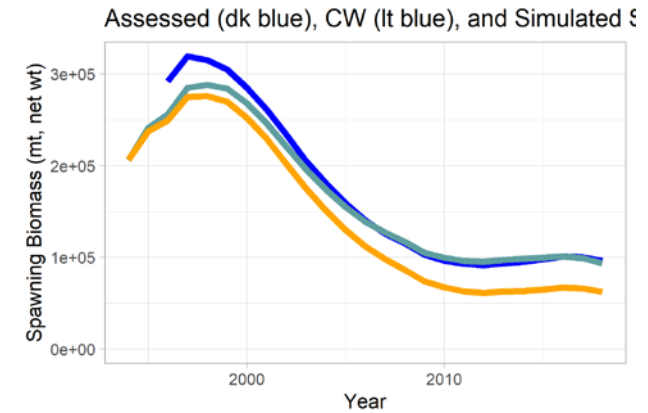
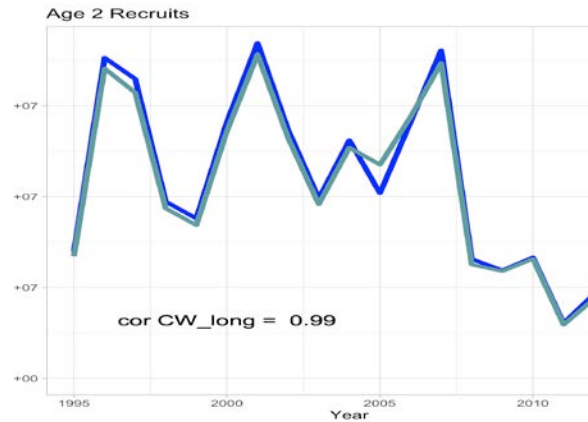
- Re-ran model validation after conversion error fix
  - Results were unchanged
  - Total historical catches in the model were always correct.
- No changes to movement parameters or average recruitment allocation
- Some fundamental differences occur between models
  - Addressed with sensitivity analyses



# QUICK REVIEW OF MODEL VALIDATION

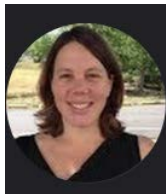
## APPENDIX 3

- Incorporating time-varying spatial allocation of recruitment into model important for mimicking trawl survey



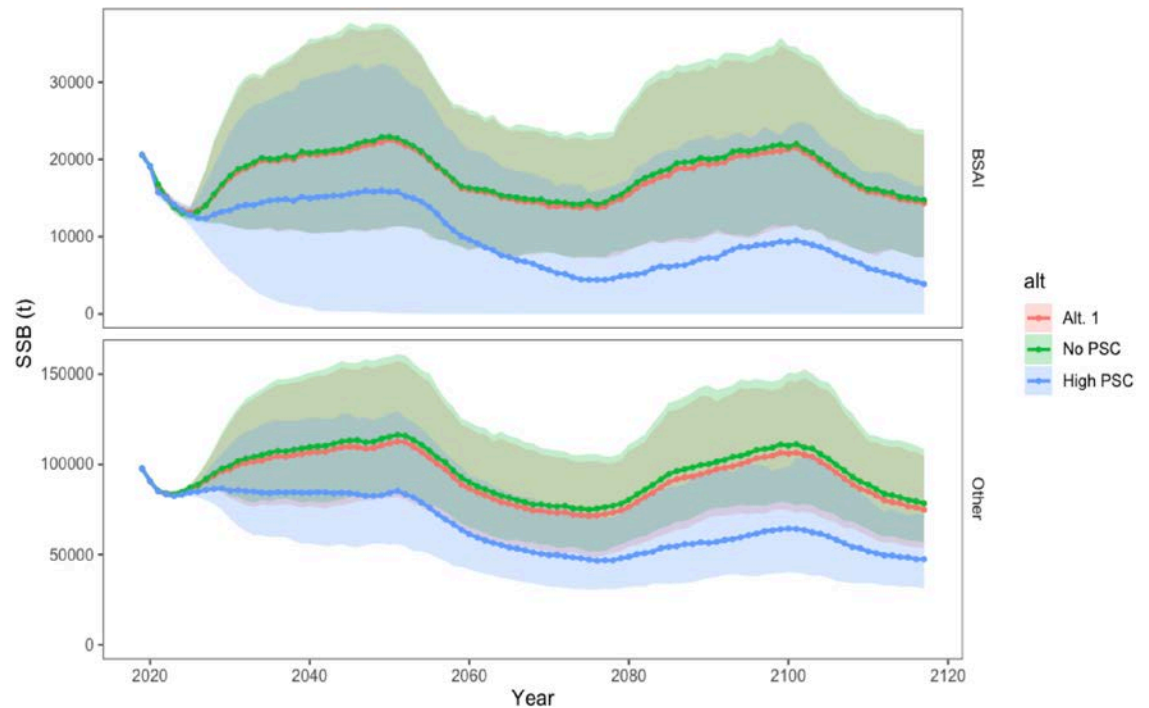


# MODEL RESULTS



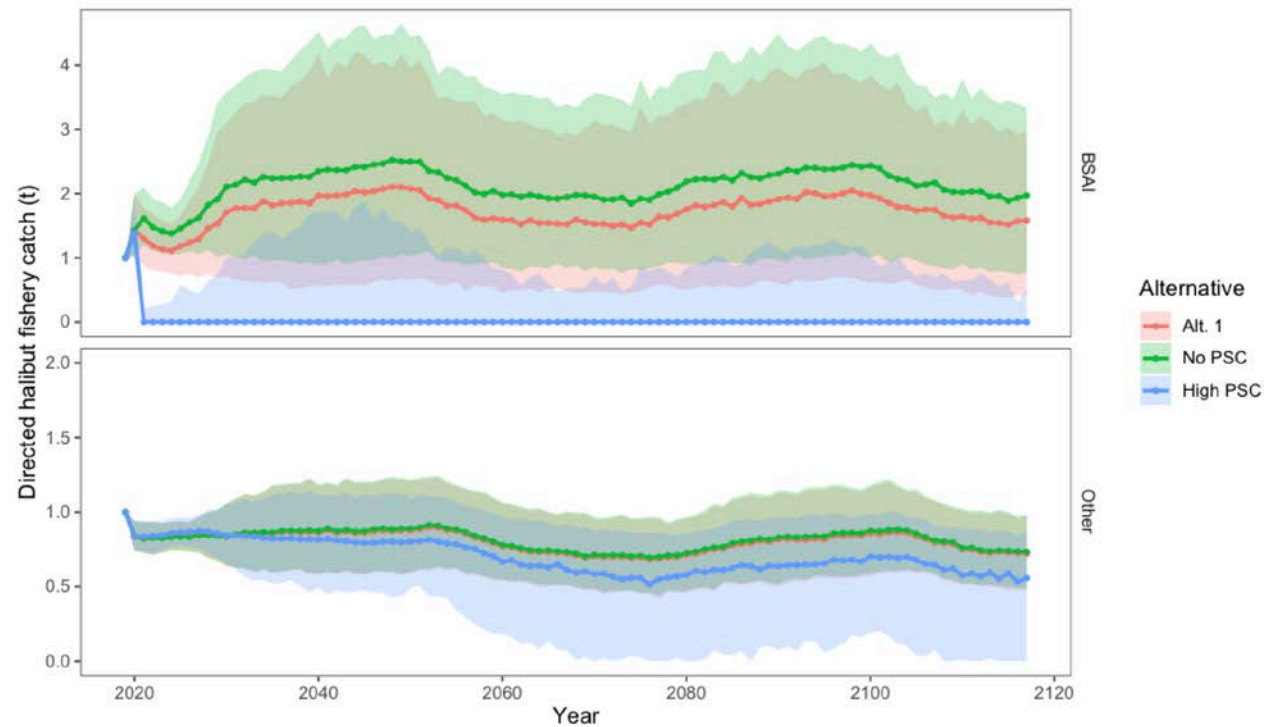
# DEMONSTRATIONS

- SSB similar with or without PSC
- SSB declines in both areas with extreme high PSC (outside of range of alternatives)



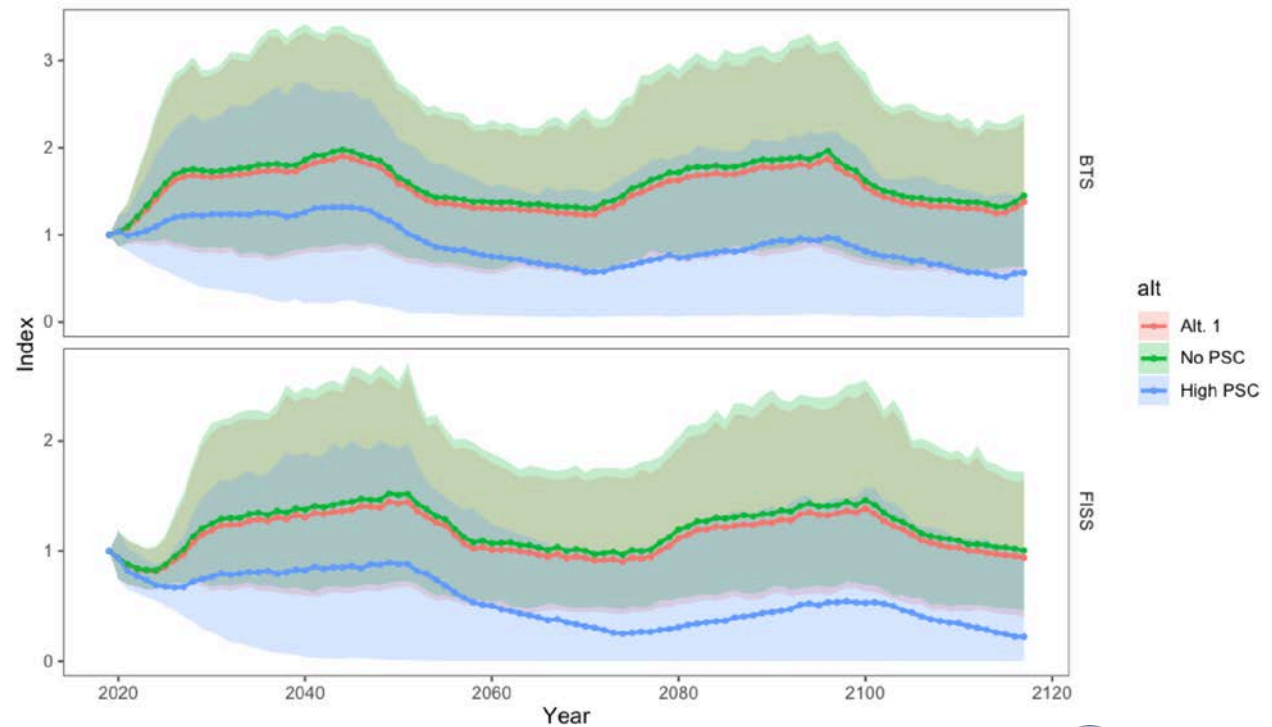
# DEMONSTRATIONS

- Halibut fishery catches a little larger with no PSC
- Halibut catches in the BSAI are 0 if PSC limits are very high



# DEMONSTRATIONS

- Indices for no PSC and Alt 1 are similar
- Indices for high PSC are lower



# COMPARING ALTERNATIVES

- Alt 2 leads to higher PSC limits and lower halibut catches than for the status quo and other Alts
- Alts 3 & 4 lead to lower PSC limits and slightly higher halibut catches
- No meaningful differences in SSB among alternatives
- PSC limits and use inversely correlated to halibut fishery catches
- Changes in PSC limits are larger than changes in halibut catches
- No effect of implementing a 30:20 control rule for halibut catch limit determination for current alternatives (not shown here)



# COMPARING ALTERNATIVES

## Without a 30:20 control rule for TCEY

## With a 30:20 control rule for TCEY



# SENSITIVITY ANALYSES APPX 2

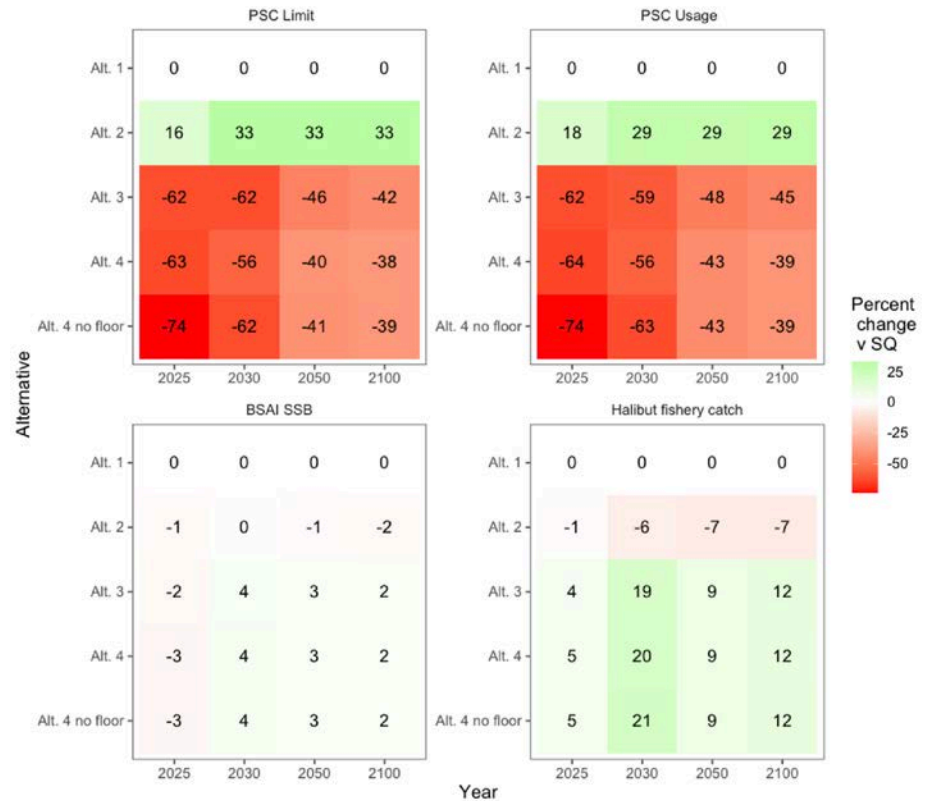
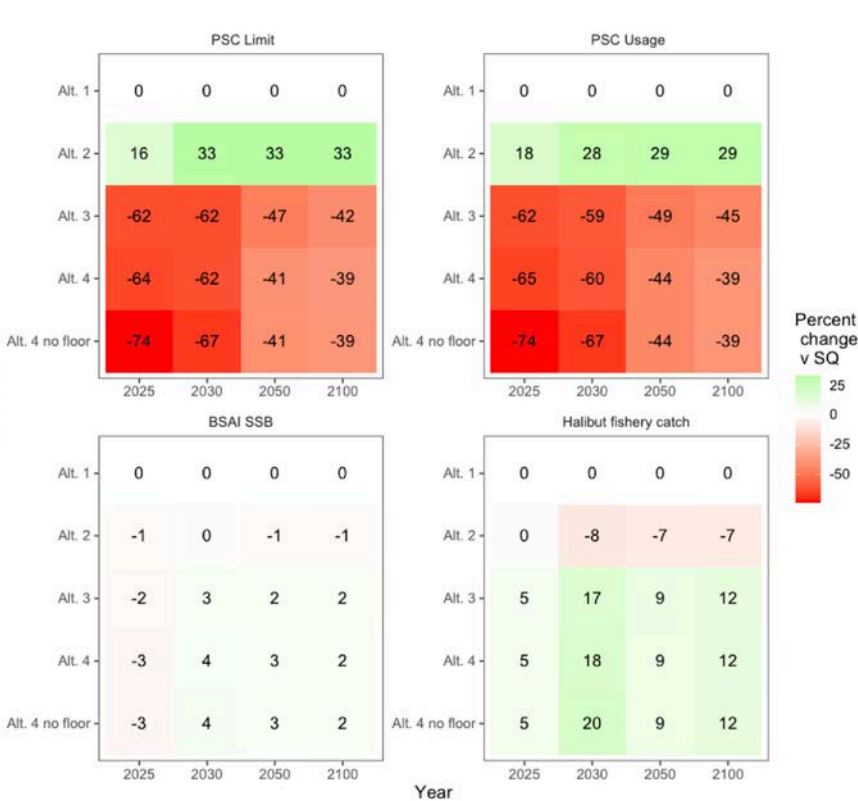
- Low recruitment scenario:
- Extreme low recruitment scenario (recruitment 50% of expected every year)
- PSC use: limit increases at low PSC limits
- Trawl selectivity shifted towards younger or older fish
- Temporal autocorrelation in estimated SSB



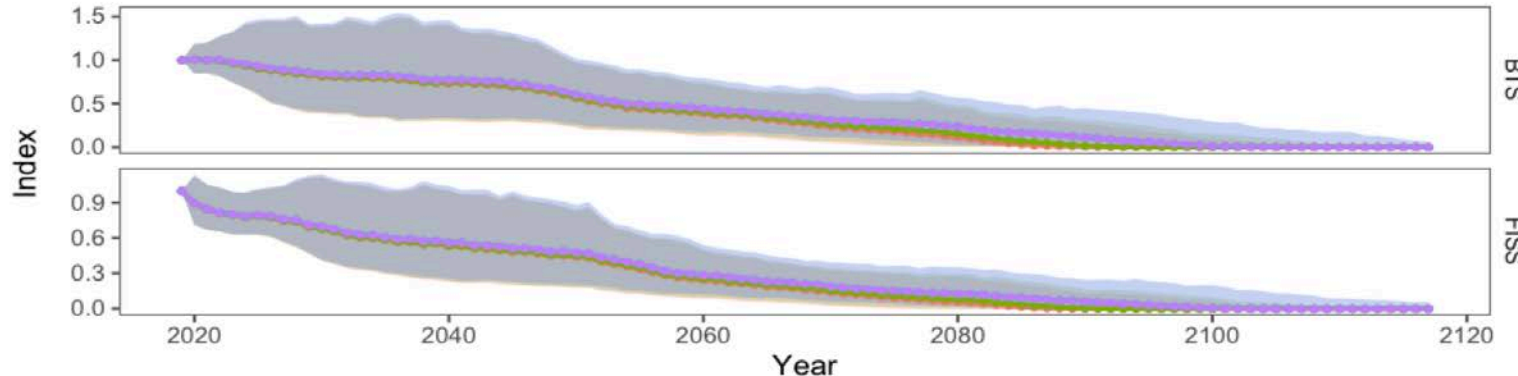
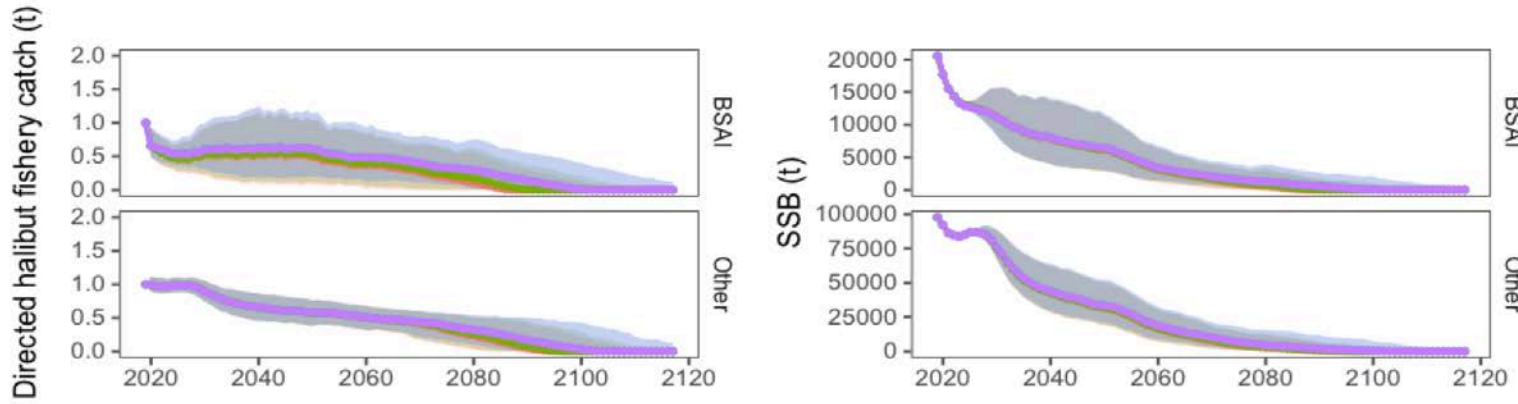
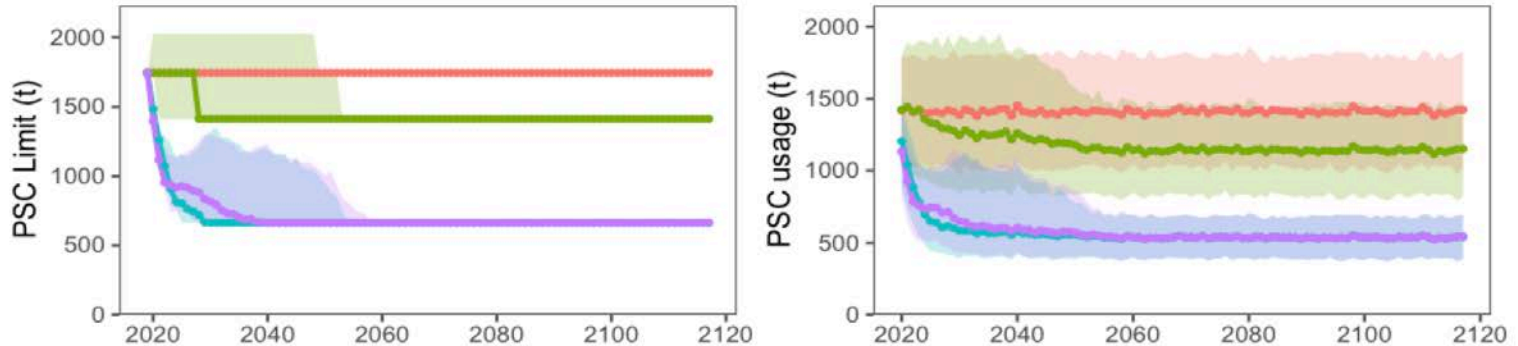
# LOW RECRUITMENT NO RECRUITMENT FOR 6 YEARS, FOLLOWED BY ALWAYS LOW PDO

Without a 30:20 control rule for TCEY

With a 30:20 control rule for TCEY







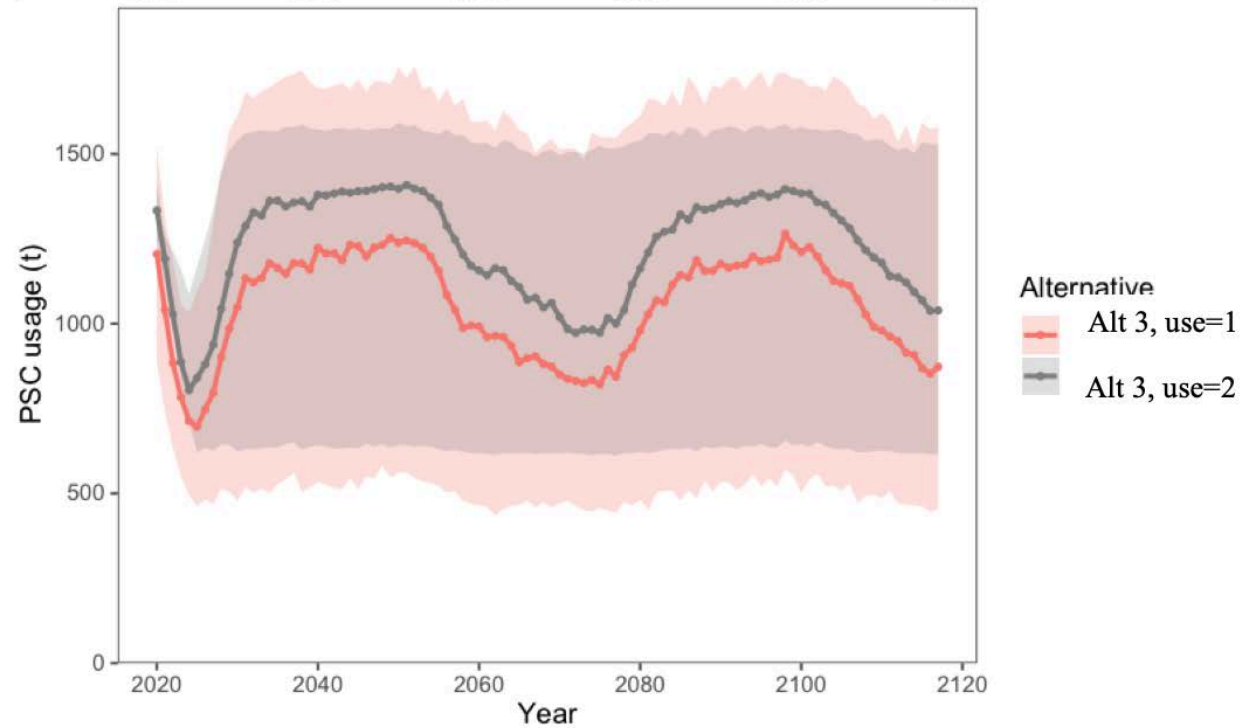
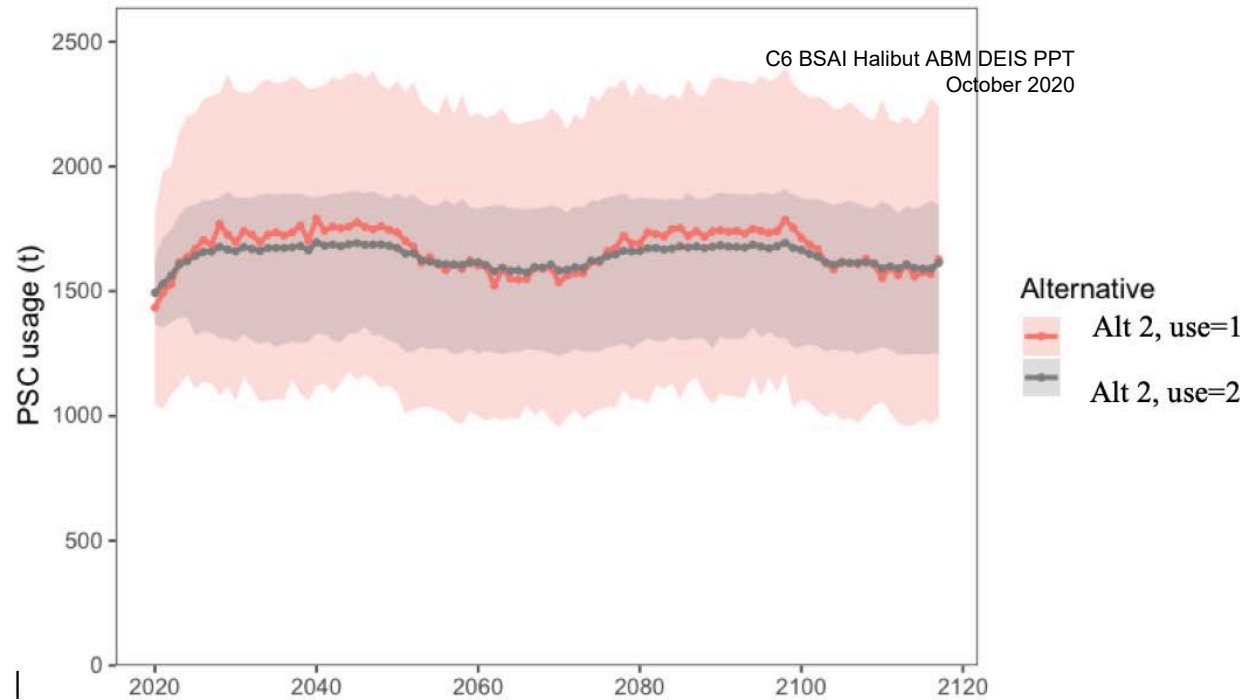
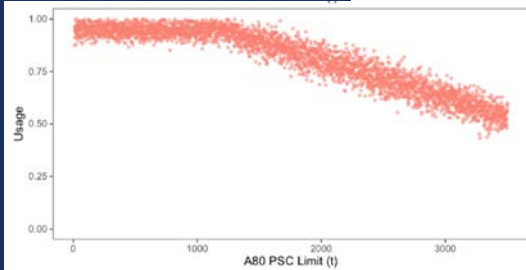
Extreme Low Recruitment 50% of expected recruitment in each year



# Alternative PSC “use” to limit relationship increases at low PSC Limits

Smoothing effect at higher PSC limits

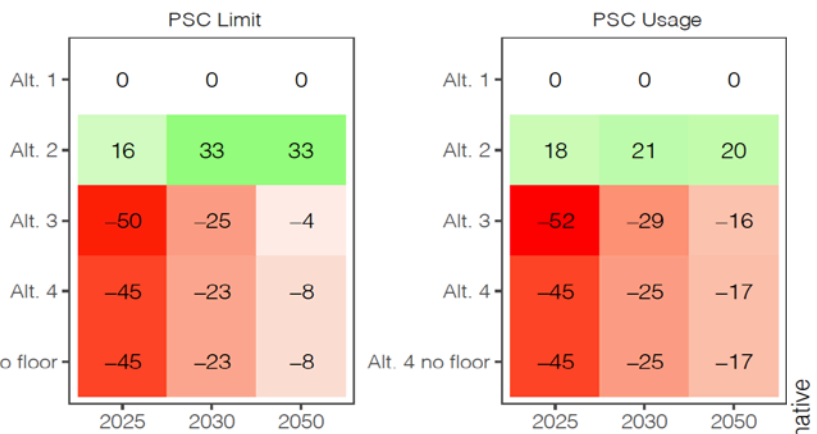
Different behavior at lower PSC limits



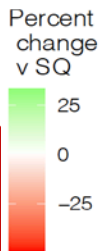
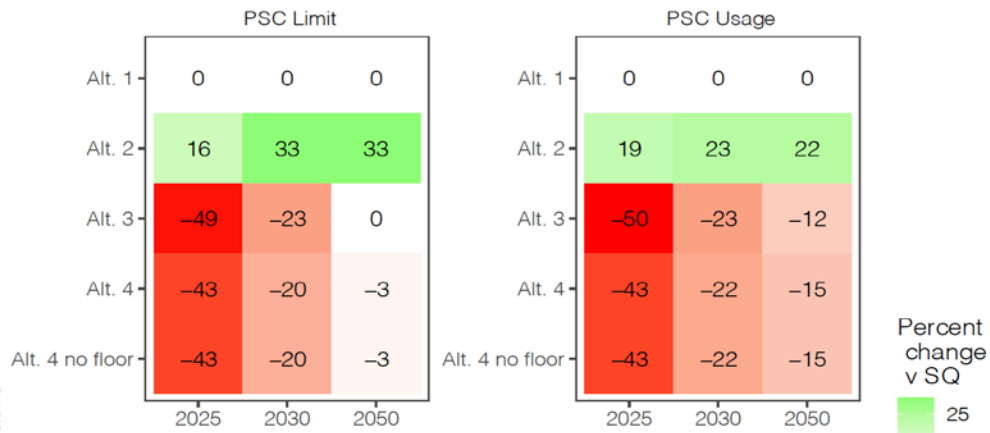
# ALTERNATIVE TRAWL PSC SELECTIVITY

## TWO SCENARIOS: TRAWL CATCHES YOUNGER OR OLDER FISH THAN FOR BASE CASE

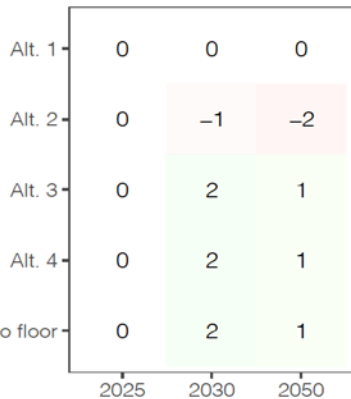
Scenario T0, CR 1



Scenario T2, CR 1



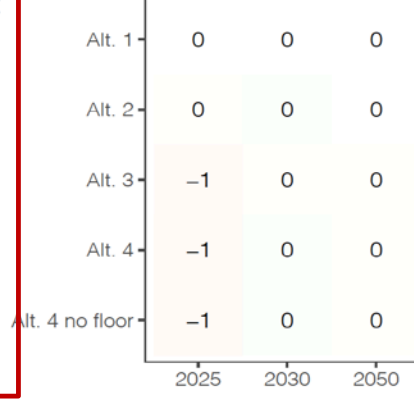
BSAI SSB



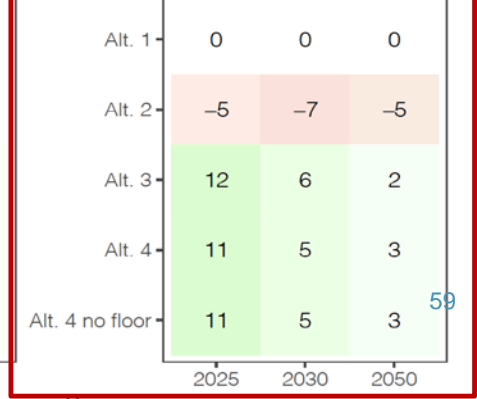
Halibut fishery catch



BSAI SSB



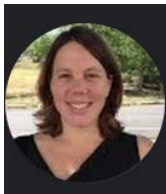
Halibut fishery catch



59

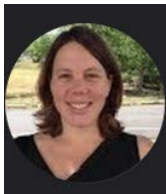
# MAIN POINTS FROM MODELING ANALYSIS

- PSC limits are lowest and directed halibut fishery catches are highest for Alternatives 3 and 4.
- No meaningful differences in SSB trajectories between alternatives for the range of alternatives and expected population dynamics
- Changes from status quo are larger for PSC limits than for directed halibut fishery limits
- Trawl PSC selectivity impacts how much larger changes in PSC limits are in relation to changes in directed halibut fishery limits
- Effects of 30:20 harvest control rules cannot be seen unless the population dynamics are pushed outside of expectations
- Use of dynamic unfished spawning biomass lowers the probability of falling below 30% of unfished due to low recruitment



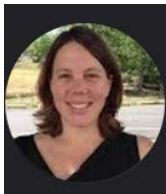
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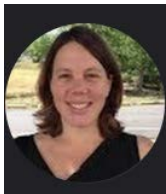
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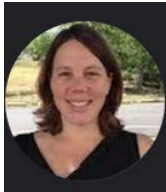
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# MAIN POINTS FROM MODELING ANALYSIS

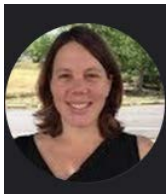
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# MAIN POINTS FROM MODELING ANALYSIS

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# BSAI GROUND FISH MGMT (3.1 & 3.2)

- Minor changes to groundfish mgmt. background
  - Relationship between A80 species TACs and pollock (Figs 3-2 & 3-6)
  - Trends in key A80 flatfish species (YFS; NRS; FHS); Flatfish Flexibility Exchange
  - PCod as a constraining species apportioned across sectors (Figure 3-9, p.85)
- Updated DMR information; focus on A80 (i.e. Deck Sorting) – Section 3.2.2

Table 3-7, p.91

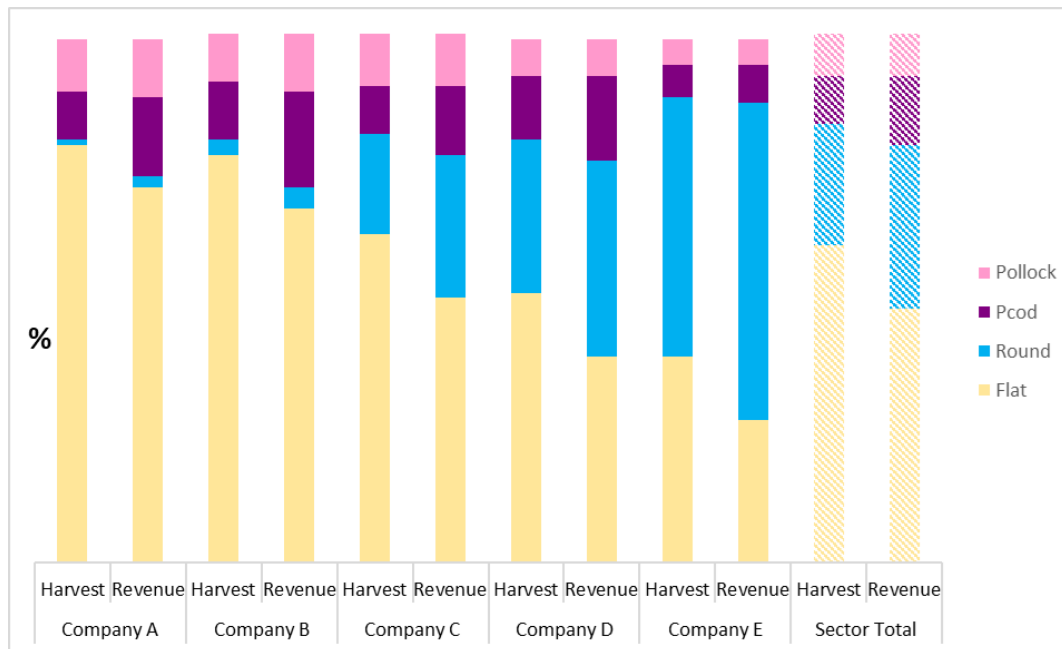
Gear	Fishery/Sector	2010-13	2013-16	2016-17	2017-18	2018-19	2019-20	2020-21
Non-CDQ trawl	Alaska plaice		71	66				
	Arrowtooth flounder <sup>1</sup>	76	76	84				
	Atka mackerel	76	77	82				
	Flathead sole	74	73	72				
	Greenland turbot	67	64	82				
	Kamchatka flounder			84				
	Non-pelagic pollock	73	77	81				
	Pelagic pollock	89	88	88				
	Other flatfish <sup>2</sup>	72	71	63				
	Other species <sup>3</sup>	71	71	66				
	Pacific cod	71	71	66				
	Rockfish	81	79	83				
	Rock sole	82	85	86				
	Sablefish	75	75	66				
	Yellowfin sole	81	83	84				
	Non-pelagic trawl	Mothership and catcher/processor				85	84	78



# AMENDMENT 80 FISHERY (3.3)

- Five companies (2020); ownership transition in 2017 (Fig 3-16, p.103)
- Sector varies in reliance on flatfish → different exposure to PSC limit (Fig 3-15, p.102)
- Sector varies in reliance on mothershipping and CDQ revenues, by company (Table 3-14 & Fig 3-19, p.107)
- CDQ Groups are stakeholders in A80, though A80 is a relatively small portion of total CDQ revenues (Fig 3-21, p.122)

Figure 3-15,  
p.102



# AMENDMENT 80 HALIBUT PSC (3.4)

- Absolute and Effective PSC mortality declines post-2015
  - Table 3-19 (p.125) & Fig 3-25 (p.126)
  - $\text{Effective mortality} = \text{PSC mortality} / \text{Halibut Catch}$
- Deck sorting has become pervasive since 2018 (Table 3-22 & Fig 3-39, p.140-141)
- More hauls made to catch same or fewer groundfish (Table 3-21, p.139; Table 3-13, p.104)
- Groundfish catch/halibut and revenue/halibut diverge by flatfish v. roundfish

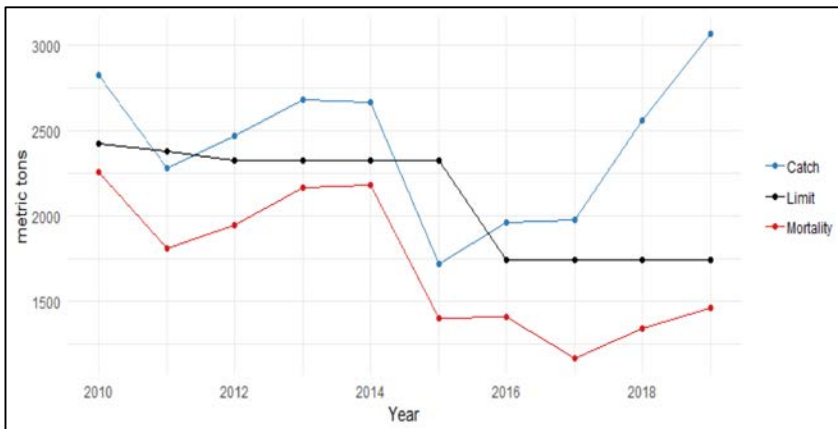


Fig. 3-24, p.125

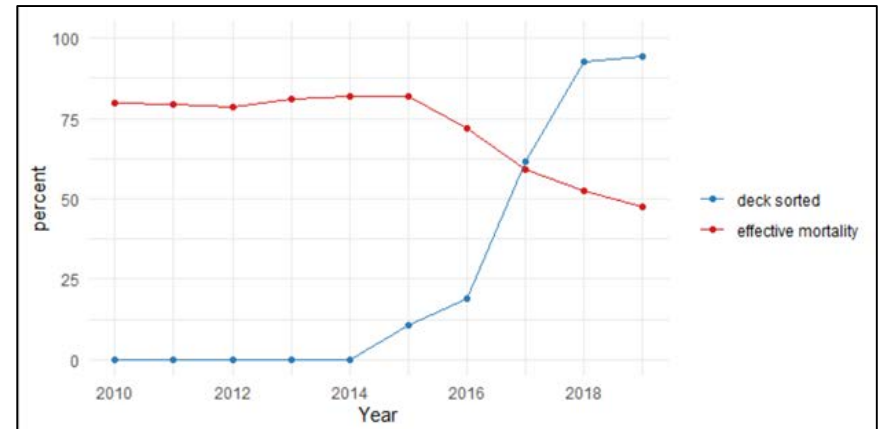


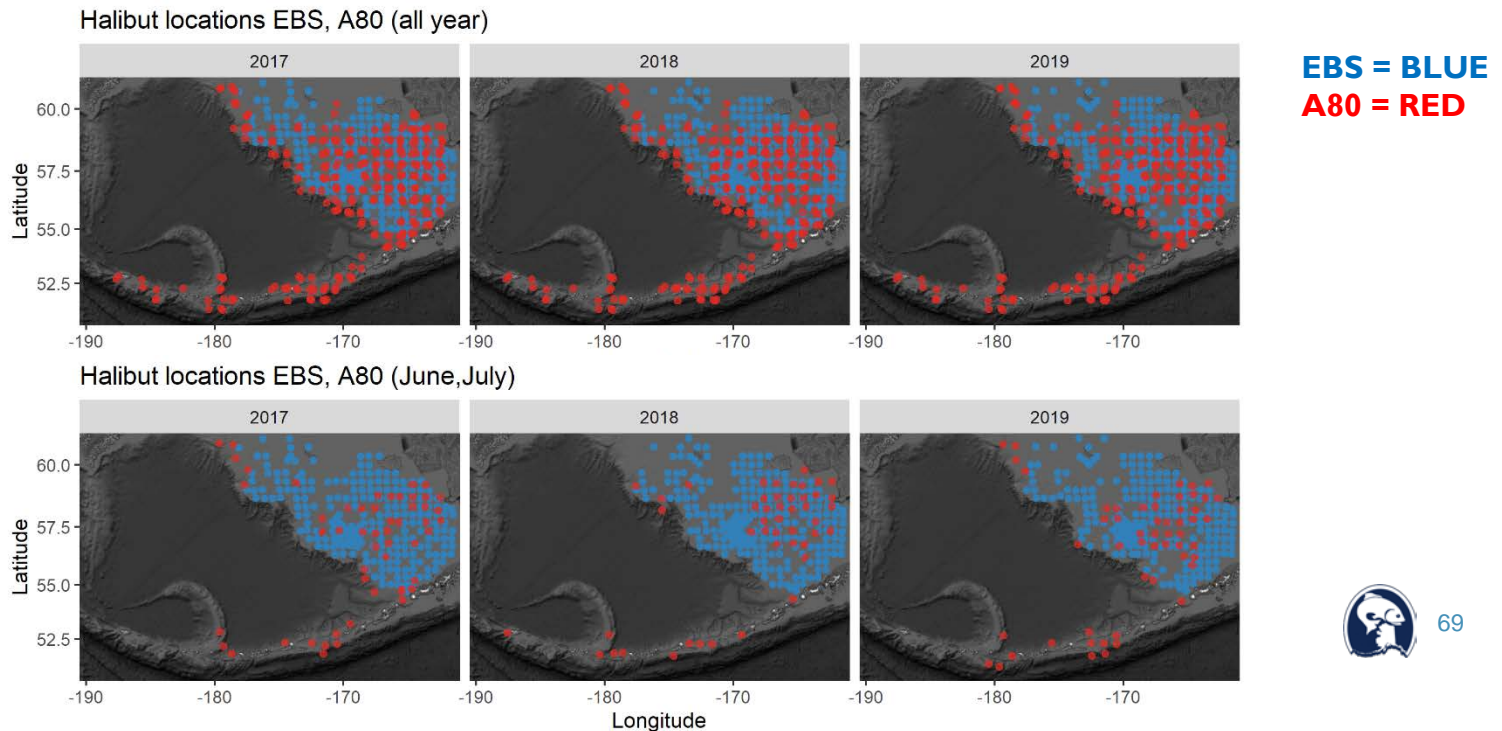
Fig. 3-26, p.126



# AMENDMENT 80 HALIBUT PSC (3.4)

- Generally, the EBS Trawl Survey covers the areas where A80 encounters halibut throughout the year (Fig 3-37, p.137), excepting roundfish species (Fig 3-34, p.134)

Figure 3-37,  
p.137



# MODEL ESTIMATION OF HALIBUT CATCH SHOWN AS GROSS REVENUE

**Table 6-14,  
Section 6.4.4 errata**

Median projected BSAI directed halibut catch limits (millions of pounds, net weight; top panel) and percent change relative to the status quo (Alternative 1) projection; bottom panel. Columns labeled "Static 3" and "Static 4" are runs with PSC limits fixed at their starting point values for Alternatives 3 and 4, respectively. "Alt. 4 without floor" is the same as Alternative 4 but with the floor removed. The starting point for Alternative 2 is the same as status quo.

BSAI Pacific halibut fishery catch limit (net wt. million pounds)							
Year	Status Quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	4.09	4.09	4.09	4.09	4.09	4.09	4.09
2020	5.83	5.83	5.83	5.83	5.83	5.83	5.83
2021	5.30	5.28	5.47	5.62	5.53	5.68	5.53
2022	4.85	4.81	5.12	5.13	5.21	5.19	5.21
2023	4.65	4.58	5.00	4.90	5.05	4.96	5.05
2024	4.54	4.44	4.91	4.79	4.93	4.84	4.93
2025	4.84	4.68	5.27	5.10	5.25	5.15	5.25
2026	5.08	4.85	5.57	5.38	5.52	5.43	5.52
2027	5.29	5.05	5.79	5.62	5.76	5.68	5.76
2028	5.98	5.69	6.45	6.33	6.42	6.39	6.42
2029	6.27	5.95	6.68	6.60	6.65	6.66	6.65
2030	7.00	6.65	7.41	7.44	7.33	7.52	7.33

**Table 6\*,  
Section 6.4.4 errata**

Projected gross ex-vessel value (\$million) of BSAI directed halibut based on 2019 average IPHC Area 4 unit values adjusted to 2018 dollars, assuming 100% utilization.

Year	Status quo	Alt. 2	Alt. 3	Static 3	Alt. 4	Static 4	Alt. 4 w/o floor
2019	18.12	18.12	18.12	18.12	18.12	18.12	18.12
2020	25.83	25.83	25.84	25.85	25.84	25.85	25.84
2021	23.49	23.41	24.22	24.90	24.49	25.16	24.49
2022	21.49	21.30	22.70	22.73	23.07	22.97	23.07
2023	20.59	20.29	22.13	21.71	22.37	21.95	22.37
2024	20.12	19.65	21.77	21.23	21.82	21.44	21.82
2025	21.44	20.72	23.34	22.61	23.26	22.82	23.26
2026	22.49	21.47	24.66	23.84	24.46	24.06	24.46
2027	23.42	22.35	25.63	24.88	25.52	25.15	25.52
2028	26.50	25.20	28.56	28.05	28.42	28.30	28.42
2029	27.77	26.35	29.59	29.24	29.47	29.52	29.47
2030	31.01	29.47	32.84	32.94	32.46	33.30	32.46

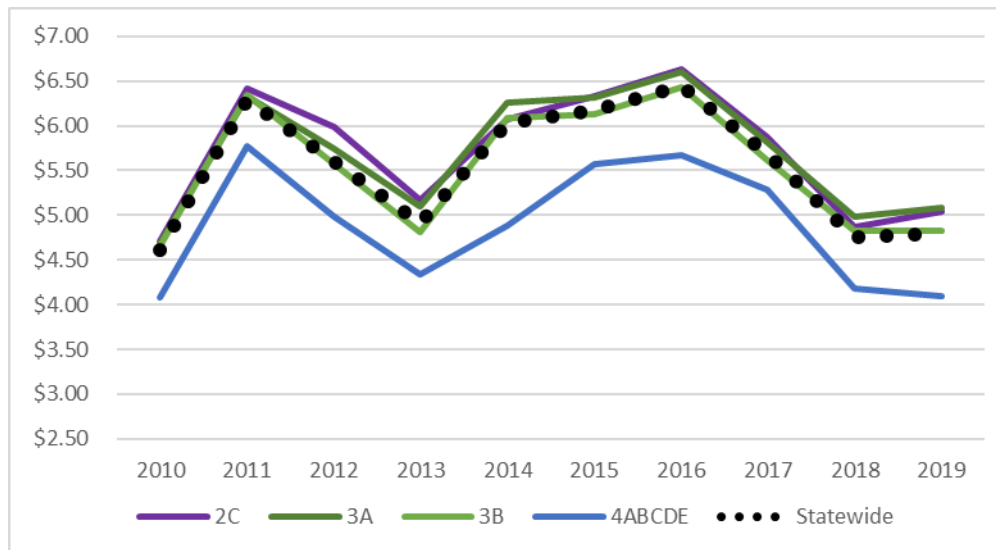


# AREA 4 HALIBUT FISHERY (4.4)

- High utilization of catch limit – 2012-2019 Avg. = IFQ: 91%, CDQ 90%
- Annual ex-vessel value (IFQ+CDQ; 2018\$) between \$16.9M and \$24.9M since 2013... 2018 & 2019 lowest (Table 4-3, p.157)
- Ex-vessel unit value has declined since 2016 and is lowest in Area 4 (Figure 4-8)
- High likelihood of continued low or decreasing \$/lb. in the near term

Commercial ex-vessel value per IFQ pound (nominal dollars)

Figure 4-8,  
p.158



# GROUND FISH REVENUE IMPACT ESTIMATION (P. 216-231 DEIS)

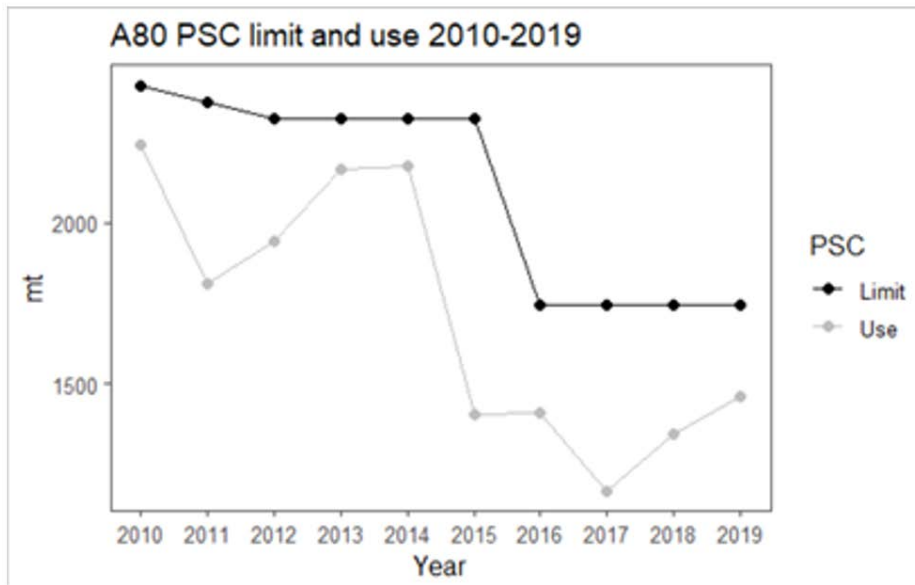
## General approach

- A80 haul level data (PSC, groundfish catch, wholesale value)
- Randomly resample hauls without replacement until reaching PSC limit or groundfish catch limit
- Sum wholesale values to estimate annual revenue
- 500 runs of 6 separate “scenarios” for each PSC limit specified in alternatives





# GROUND FISH REVENUE IMPACT ESTIMATION



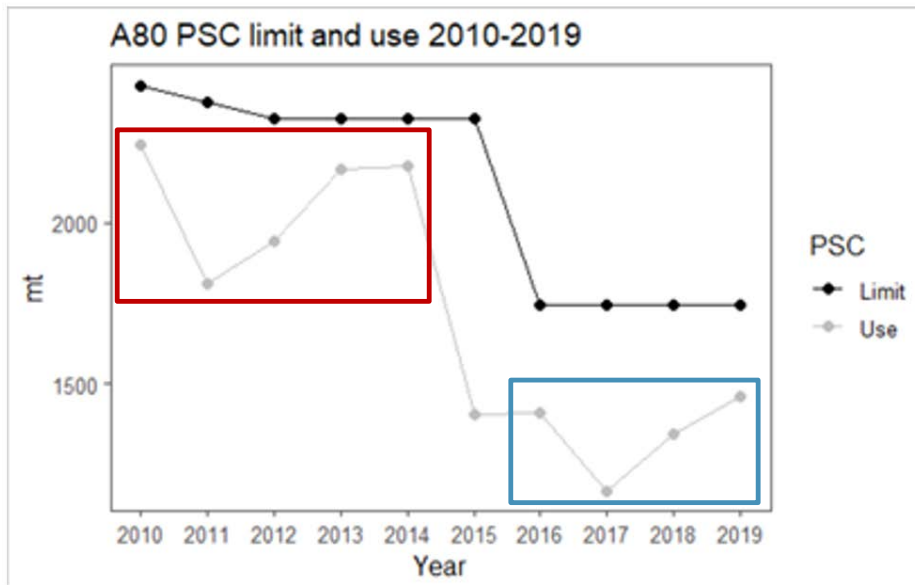
PSC limits and use varied over the last 10 years

PSC limits and PSC use (in metric tons) for the A80 sector 2010-2019.

Figure 6-17, p. 219



# GROUNDFISH REVENUE IMPACT ESTIMATION



PSC limits and use varied over the last 10 years

Subset into three datasets

- high PSC use years (2010-2014)
- all years (2010-2019, excluding 2015)
- low PSC use years (2016-2019)

PSC limits and PSC use (in metric tons) for the A80 sector 2010-2019.

Figure 6-17, p. 219



# GROUND FISH REVENUE IMPACT ESTIMATION

- Separate runs with 2 groundfish catch limits
  - 310,000 mt (maximum all years)
  - 290,000 mt (maximum in most recent years)

**Table 6-9 Annual totals of the underlying haul-by-haul data used in the revenue estimates.**

Year	Groundfish catch (mt)	Wholesale value (\$ 2018)	PSC (mt)	Hauls
2010	305,241	323,870,339	2,254	12,507
2011	302,157	385,153,549	1,810	11,163
2012	307,406	397,530,330	1,944	10,892
2013	306,775	307,582,132	2,166	11,338
2014	308,022	316,928,372	2,178	11,702
2015	Not used due to reporting structure			
2016	298,449	306,505,259	1,412	14,167
2017	278,771	359,357,539	1,167	13,821
2018	290,173	379,443,654	1,343	15,908
2019	288,302	335,260,125	1,458	16,574

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# GROUND FISH REVENUE IMPACT ESTIMATION

- 6 “scenarios”

3 time periods or datasets x 2 catch limits

high PSC use years (2010-2014)  
all years (2010-2019, excluding 2015)  
low PSC use years (2016-2019)

310,000 mt (max catch all years)  
290,000 mt (max in most recent years)

- 7 PSC limits defined in Alternatives

**Table 6-10 PSC limits used in revenue estimates and the associated Alternatives and Elements.**

Alternative	Element	PSC limit
1	Status Quo	
2	Starting Point	1,745
3, 4	Ceiling	
2	Floor	1,412
2	Step	2,025
2	Ceiling	2,325
3	Starting Point	1,255
4	Starting Point	1,167
3, 4	Floor	664



# GROUND FISH REVENUE IMPACT ESTIMATION

Estimates from these 7 PSC limits can be cross referenced with the PSC limits estimated by the operating model to compare across alternatives

**Table 6-10 PSC limits used in revenue estimates**

Alternative	Element	PSC limit
1	Status Quo	
2	Starting Point	1,745
3, 4	Ceiling	
2	Floor	1,412
2	Step	2,025
2	Ceiling	2,325
3	Starting Point	1,255
4	Starting Point	1,167
3, 4	Floor	664

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**Table 6-8 Comparison of Pacific halibut A80 PSC limits (t) by alternative for median values of the projection simulations from 2021-2030. Grey shaded values represent the ceiling for that alternative. None of the Alternatives as projected out in median values for these years have reached their floor. Bolded values are greater than the status quo PSC limit; red indicates a PSC limit less than status quo.**

Year	Status quo (Alt. 1)	Alt. 2	Alt. 3	Alt. 4	Alt. 4 w/o floor
2021	1,745	1,745	1,261	1,117	1,117
2022	1,745	2,025	1,072	956	956
2023	1,745	2,025	911	945	945
2024	1,745	2,025	849	939	939
2025	1,745	2,025	890	982	982
2026	1,745	2,325	930	1,047	1,047
2027	1,745	2,325	1,000	1,126	1,126
2028	1,745	2,325	1,097	1,234	1,234
2029	1,745	2,325	1,214	1,329	1,329
2030	1,745	2,325	1,336	1,386	1,386

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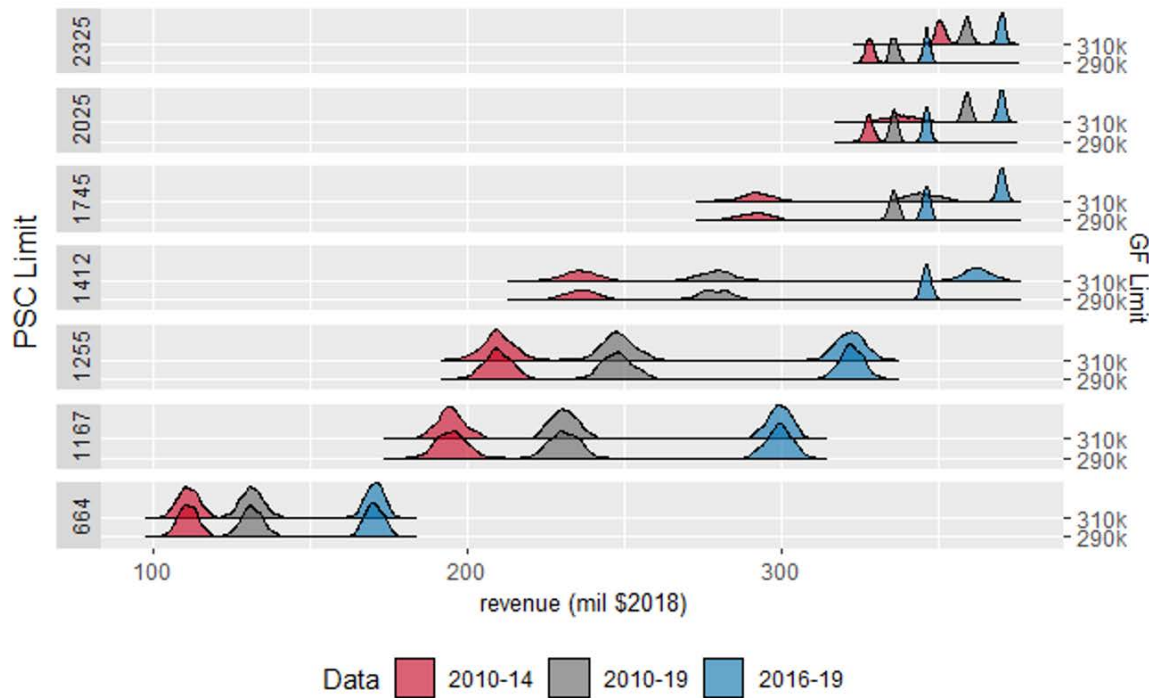


# CONTEXT FOR RESULTS

- Revenue estimates should be read for comparison across alternatives
  - Results are not stand-alone predictions of future A80 revenue under each PSC limit. Harvesters are expected to make strategic choices that are different from the randomized selection of hauls used in this analysis.
- Results are aggregated at the A80 sector level
  - The distribution of impacts across companies and vessels will differ based on many factors, most notably fishing portfolio
- Estimates are based on actual fishery data
  - Only reflects the environmental conditions and fishing behavior that occurred during the past 10 years
  - Does not estimate outcomes under a changed environment or management regime, future TACs or market conditions, or incorporate potential future fishing adaptations or operational changes
- No predetermined relationship between PSC use and PSC limit
  - Implicit assumption that 100% of PSC use is possible (and is reached unless groundfish limit is reached first)
- Random selection of hauls
  - Hauls are selected based on their prevalence in the underlying distribution
  - Less likely to include the most extreme examples such as a year in which the fleet has difficulty avoiding halibut and accumulates PSC at a more rapid rate
  - Results center around the mean
  - Does not assume specific fishing strategy or operational response



# RESULTS



- Generally, lower PSC limits tend to result in reduced groundfish revenue

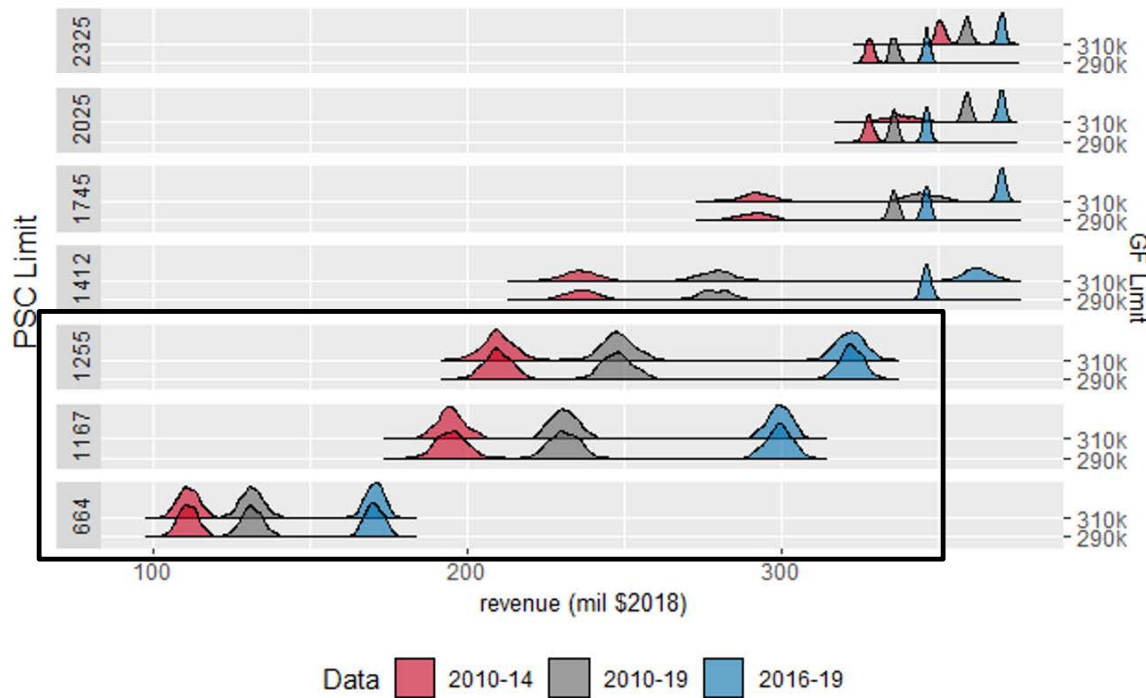
Figure 6-22 Distribution of Amendment 80 sector gross wholesale revenue estimates under various PSC Limits (2018\$)



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# RESULTS



- Revenue constrained by PSC at low PSC limits
- Similar revenue estimates under both groundfish limits

Figure 6-22 Distribution of Amendment 80 sector gross wholesale revenue estimates under various PSC Limits (2018\$)

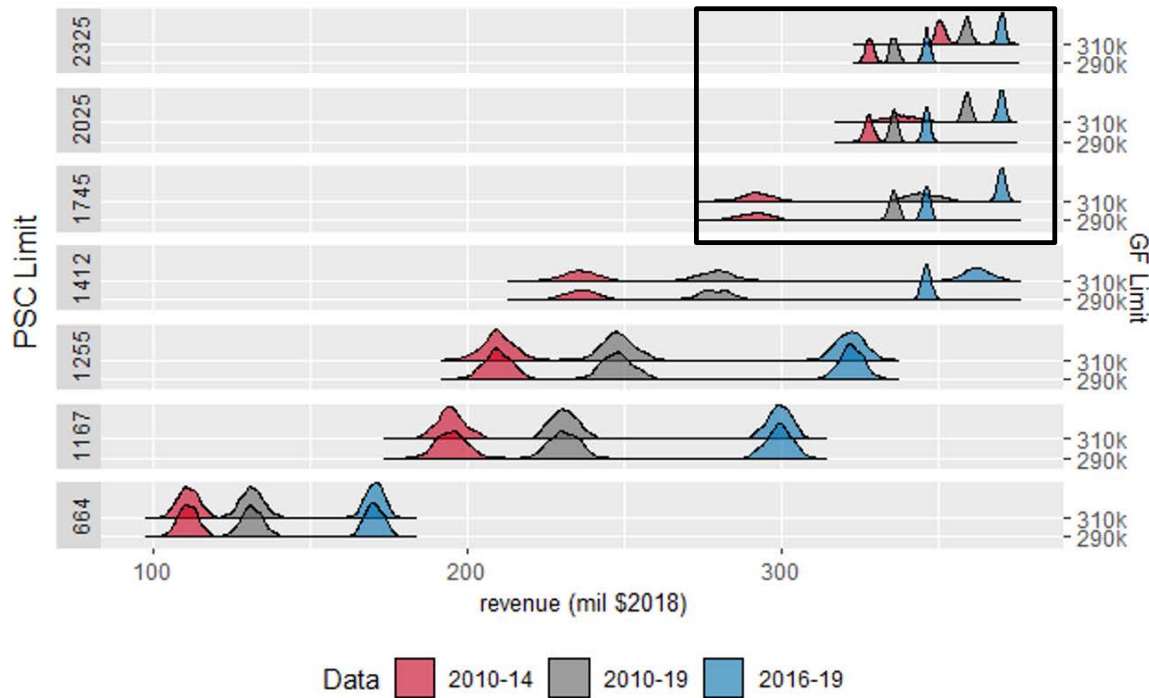


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# RESULTS



- Revenue constrained by groundfish limits at higher PSC limits
- Revenue estimates vary with groundfish limit

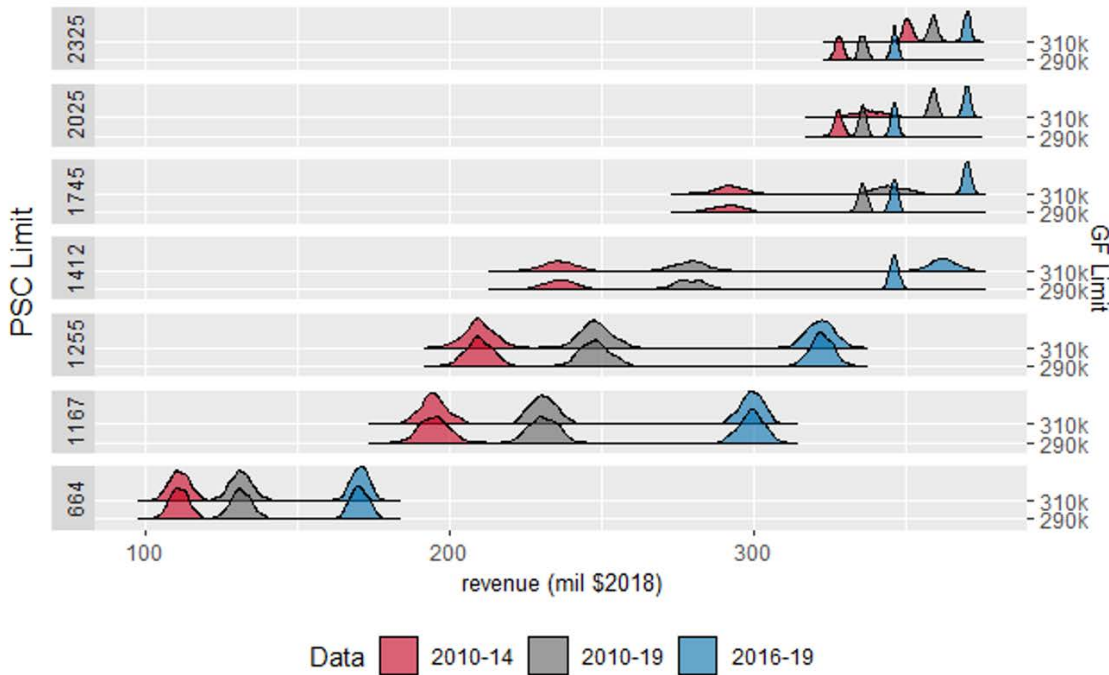
Figure 6-22 Distribution of Amendment 80 sector gross wholesale revenue estimates under various PSC Limits (2018\$)



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# RESULTS



- Revenue estimates are lower under the **high** PSC use and higher under **low** PSC use dataset
- Large range of potential revenue for each PSC limit based on **high** or **low** PSC use
- Particularly in mid range PSC limits with more variability across runs as to which constraint will bind revenue and thus a wider spread in revenue outcomes
- The range of estimates under each dataset (years sampled) should be considered when comparing alternatives

Figure 6-22 Distribution of Amendment 80 sector gross wholesale revenue estimates under various PSC Limits (2018\$)



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# RESULTS

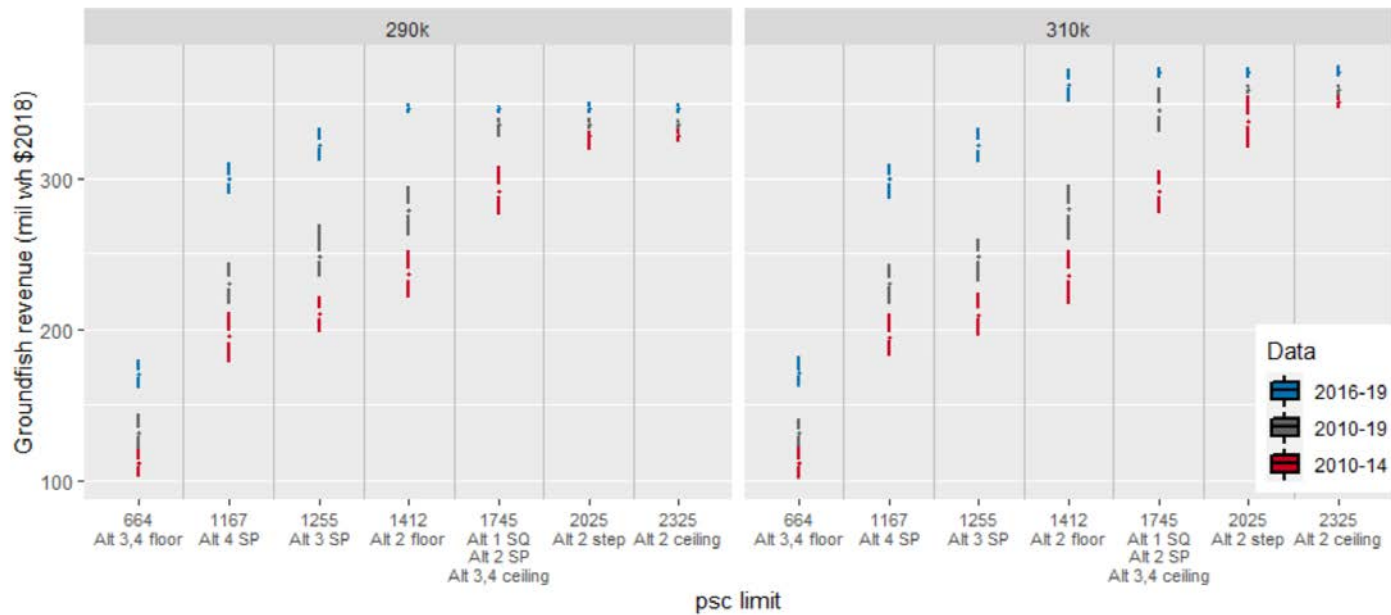


Figure 6-23 Estimated Amendment 80 sector gross wholesale revenue (2018\$) associated with PSC limits specified in Alternatives



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# SOCIAL IMPACT ASSESSMENT (APPENDIX 1)

- Changes since SSC/AP/Council reviewed October 2019 SIA version:
  - Quantitative measures of fishing engagement and dependency updated with 2019 data (multiple document sections).
  - Additional sources added to discussion of available LK and TK (Section 4.5.6).
  - Subsistence halibut harvest info updated (Section 5.4 and multiple Sections 6.x.6)..
  - Sport halibut harvest information updated (Section 5.5).
  - School enrollment data added to and income data updated in regional demographic discussions (Sections 6.x.3).
  - Fisheries tax related and general fund revenue information 2010-2019 added for Unalaska (Section 7.1.1.1) as well as Atka and Adak (Section 7.1.1.2).
  - Additional changes made due to shift in groundfish focus to Amendment 80 sector (next slide)



# SIA (APPENDIX 1) CHANGES, CONT.

- Additional changes related to focus on Amendment 80 groundfish sector:
  - Changes in screening criteria for inclusion of BSAI groundfish communities (Section 4.3.1).
    - Dropping non-Amendment 80 sectors eliminated 8 Alaska groundfish communities from analysis.
    - Addition of criterion related to CP product transfers added Togiak to the analysis.
  - Changes to section on data that would be useful but unavailable (Section 4.5)
    - Product transfer report data added as new subsection (Section 4.5.1)
    - Amendment 80 port call data added to discussion of support service sector data (Section 4.5.4)
  - Discussion of CP product transfer locations across the BSAI region and specific to the APICDA region added to Section 6.1.7, along with FBT and FRLT revenue data for identified groundfish communities. Region-specific discussions also added to CBSFA region (Section 6.2.7) and BBEDC region (Section 6.5.4) sections.



## SIA (APPENDIX 1) CHANGES, CONT.

- Additional changes related to focus on AM80 groundfish sector (continued):
  - CDQ ownership interest in Amendment 80 vessels updated (Section 6.4.8).
  - Amendment 80 vessel homeport and LLP license data (Section 6.8) and EDR-derived crew information (Sections 6.8 and 10.2) updated with 2019 data.
  - New section added containing detailed information on State of Alaska shared fishery tax revenues by tax type and fiscal year 2010-2019 (Section 10.4), broken out by program administrative entity:
    - Department of Revenue administered program (Section 10.4.1)
    - Department of Commerce, Community, and Economic Development administered program (Section 10.4.2)



# SIA (APPENDIX 1) FINDINGS

- SIA findings summarized in DEIS Section 6.5, Social and Environmental Justice
  - Alaska BSAI groundfish communities selected for inclusion in the SIA based on relative engagement in or dependency on the sector(s) of the BSAI groundfish fishery likely to were reduced from 11 to 5.
    - Unalaska/Dutch Harbor, Atka, and Adak are the communities that would be most vulnerable to adverse impacts from potential reductions in Amendment 80 activities associated with product transfers/port calls under the proposed action alternatives. These are also BSAI/Area 4 halibut communities at risk for adverse impacts under the no-action alternative under low-abundance conditions. Environmental Justice impacts would be of concern in some circumstances.
    - Impacts to Togiak or Sand Point (the other 2 selected AK communities) would likely be minor/negligible.
    - St. Paul averaged the 4<sup>th</sup> highest number of Amendment 80 port calls but adverse impacts via this pathway would likely be negligible under any of the proposed action alternatives.
    - 4 of the 6 CDQ groups typically lease multi-species groundfish quota in whole or in part to Amendment 80 industry partners. Another CDQ group holds partial ownership interest in multiple Amendment 80 vessels. Potential risks to returns from these activities under any of the proposed alternatives would depend on adaptive behaviors and business practices of the individual Amendment 80 partners.



## SIA (APPENDIX 1) FINDINGS, CONT.

- SIA findings summarized in DEIS Section 6.5, Social and Environmental Justice (continued)
  - Potential adverse impacts to the Amendment 80 sector itself under the proposed action alternatives would largely accrue to the Seattle MSA and the PNW in general. Environmental Justice potentially of concern if CP crew experience high and adverse impacts.
  - Overall findings with respect to BSAI/Area 4 halibut dependent communities remain essentially unchanged.
- More alternative-specific detail will be provided following the selection of a preliminary preferred alternative.





# PERFORMANCE METRICS

## SECTION 6.3.2 P201

- Developed through public Council/stakeholder process to evaluate how well each alternative addresses individual objectives
- Tables 6-3 through 6-7 (p202-204); summarized generally in Executive Summary
- Metrics show limited contrast across alternatives but are useful for ranking alternatives
- Alternatives 1 and 2 perform better for flexibility and stability; Alternatives 3 and 4 best for directed fishery
- All are indexed to abundance to some extent (but for Alternative 1)
- Table 6-7 too difficult to interpret to be useful



# SSC REVIEW AT THIS MEETING

- Review changes since preliminary review in October 2019
- Changes are focused on the following:
  - Changes to alternatives (A80 only) and associated assumptions
  - Operating model changes as a result of SSC and Council requests
  - Revenue analysis
  - Modifications to Social Impact Analysis (SIA)

Next steps?

