Abundance-based management for Pacific halibut PSC

October 2017 Council meeting
C-9

Background

History

Table 1. Information contained in previous materials provided April 2016-June 2017

Information	Date and document available	Link
Data sources from which to derive indices including strengths and weaknesses of each	April 2016 discussion paper	April 2016
Fishery characteristics (halibut PSC by target; observed trawl and longline effort, CPUE, PSC rates)	Supplement to April 2016 discussion paper	Supplement April 2016
Description of potential abundance indices IPHC assessment; EBS trawl survey; combined and applied in a control rule	April 2016 discussion paper and attachment	April 2016
Control rule background	April 2016 discussion paper; October 2016 Discussion paper; April 2017 Discussion paper	April 2016 October 2016 April 2017
Control rule features	April 2016 discussion paper; October 2016 Discussion paper; April 2017 Discussion paper	April 2016 October 2016 April 2017
Control rule examples already in use	April 2016 discussion paper; April 2017 Discussion paper	April 2016 April 2017
Performance metrics	February Workshop materials; April 2017 discussion paper	February 2017 April 2017
	June 2017 Discussion paper	June 2017
Incentives	April 2017 Discussion paper	April 2017
Example ABM alternatives	April 2016 discussion paper; October 2016 Discussion paper; April 2017 Discussion paper; Supplement April 2017 Disc paper	April 2016 October 2016 April 2017 Supplmnt Apr 17
Management issues	October 2016 Discussion paper	October 2016
Analytical considerations and example scenarios	April 2016 Discussion paper Supplemental presentation on model October 2016 Discussion paper April 2017 Discussion paper Supplement to April 2017 Discussion paper (example calculations)	April 2016 Supplement ppt October2016 April2017 SupplmntApr17

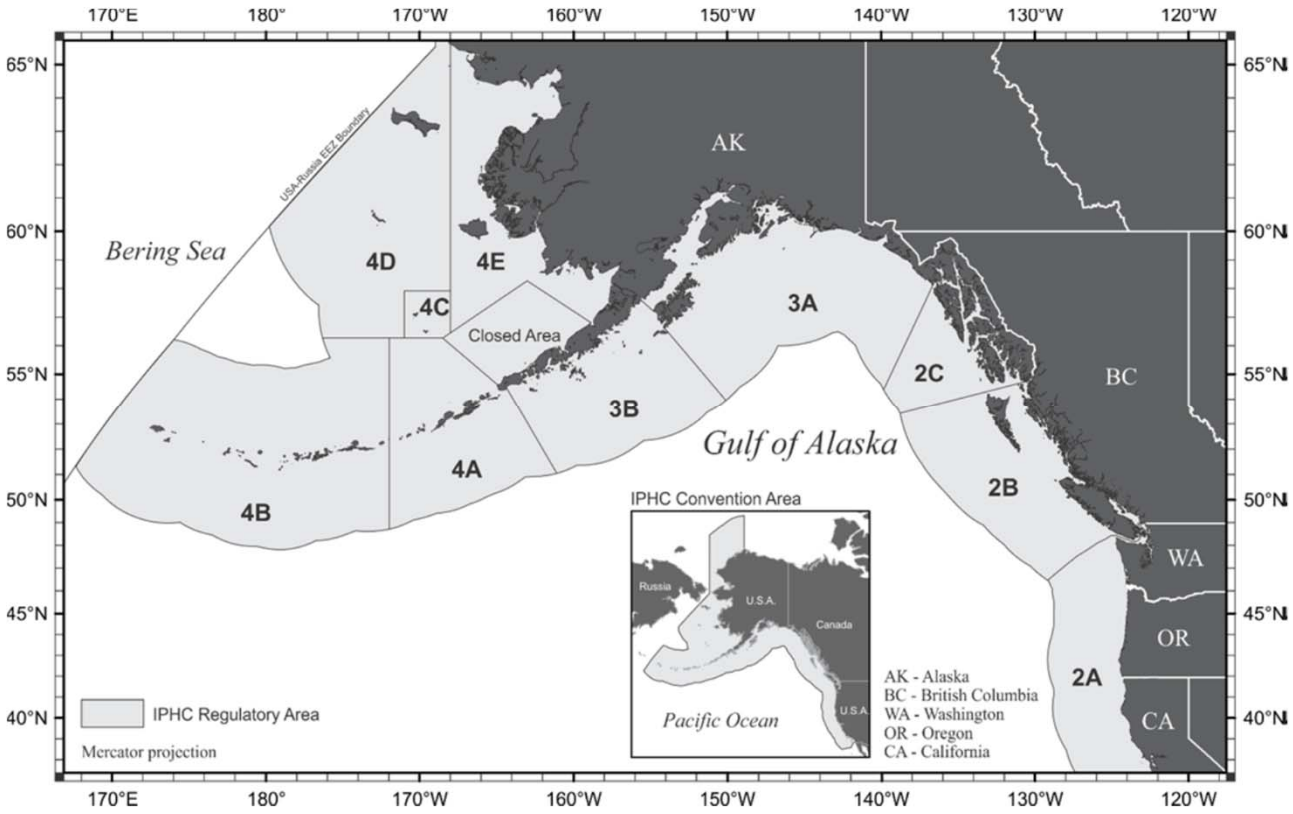
Requests of Analysts: Motions (April, June 2017)

- Feedback on indices:
  - Reflect 1) Halibut Abundance in Bering Sea; 2) Halibut encountered by the groundfish fishery in the Bering Sea
  - How indices represent population segment of halibut and fishery encounters
  - Refinements from SSC on which indices should be eliminated and justifications for moving forward with a sub-set
- Discussion of control rules
  - Features and additional control rules (non-linear; decision table; IPHC stock status)
- Include section on incentives
- Remove GOA from consideration within package
- Develop additional ABM examples using simplified continuous CRs, starting point 2016 PSC limit (+/- 50%)

Relative authorities

- Magnuson Stevens Act
- Halibut Act

Halibut stock assessment and management in the BSAI



IPHC stock assessment

- Coastwide assessment
- Ensemble of four assessment models
  - Robust method with an appropriate estimate of uncertainty

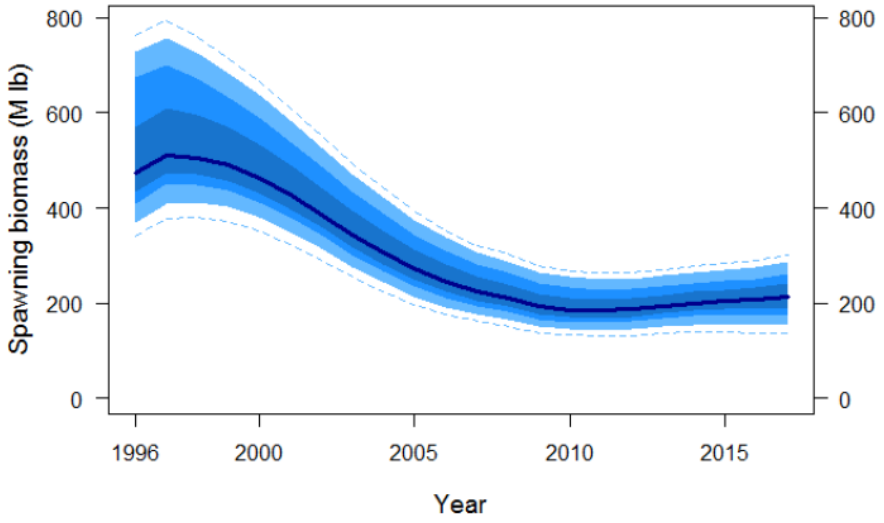
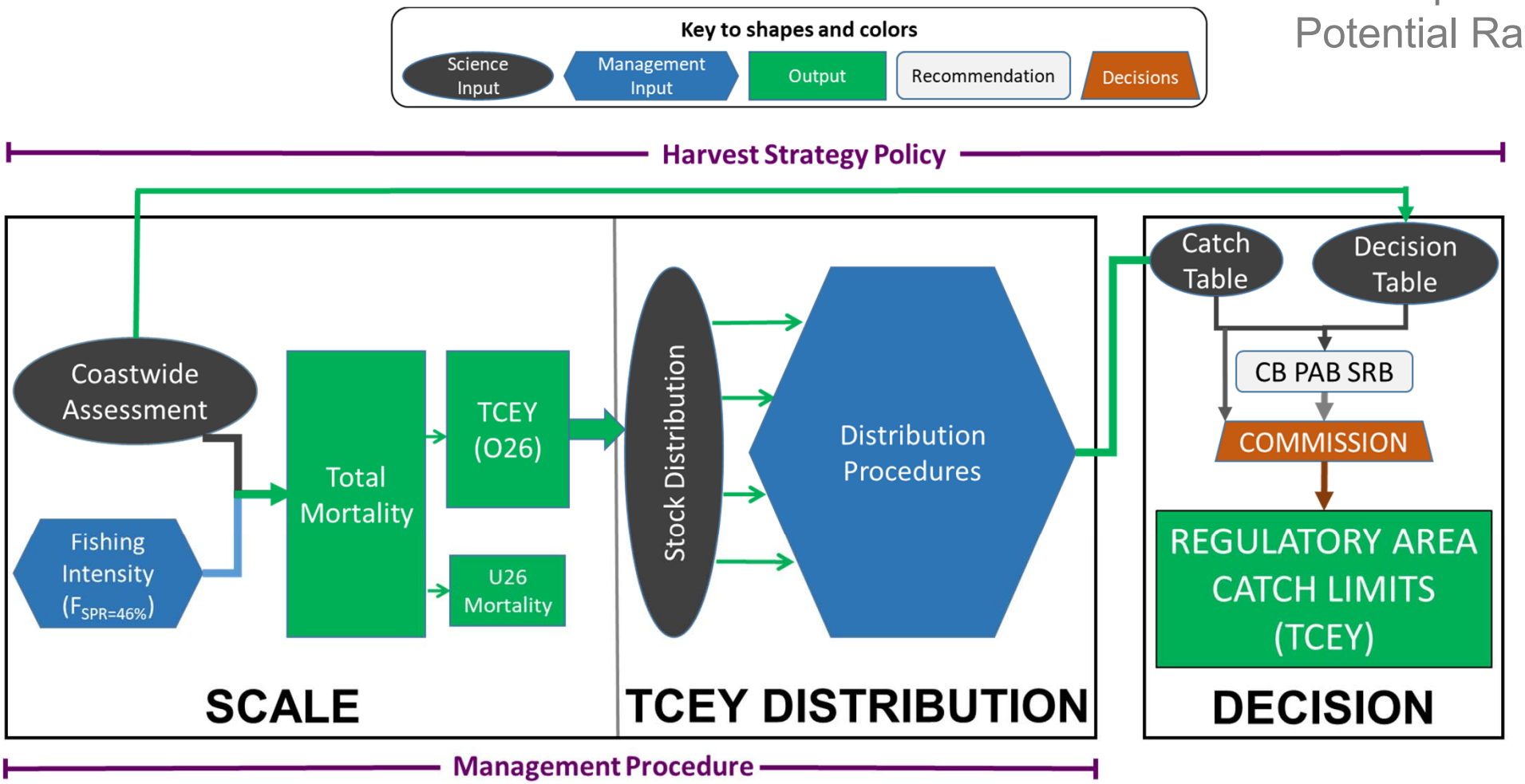


Figure 4. Estimated spawning biomass for the 2016 stock assessment ensemble.

IPHC SPR-based Harvest Policy

SPR: Spawning Potential Ratio

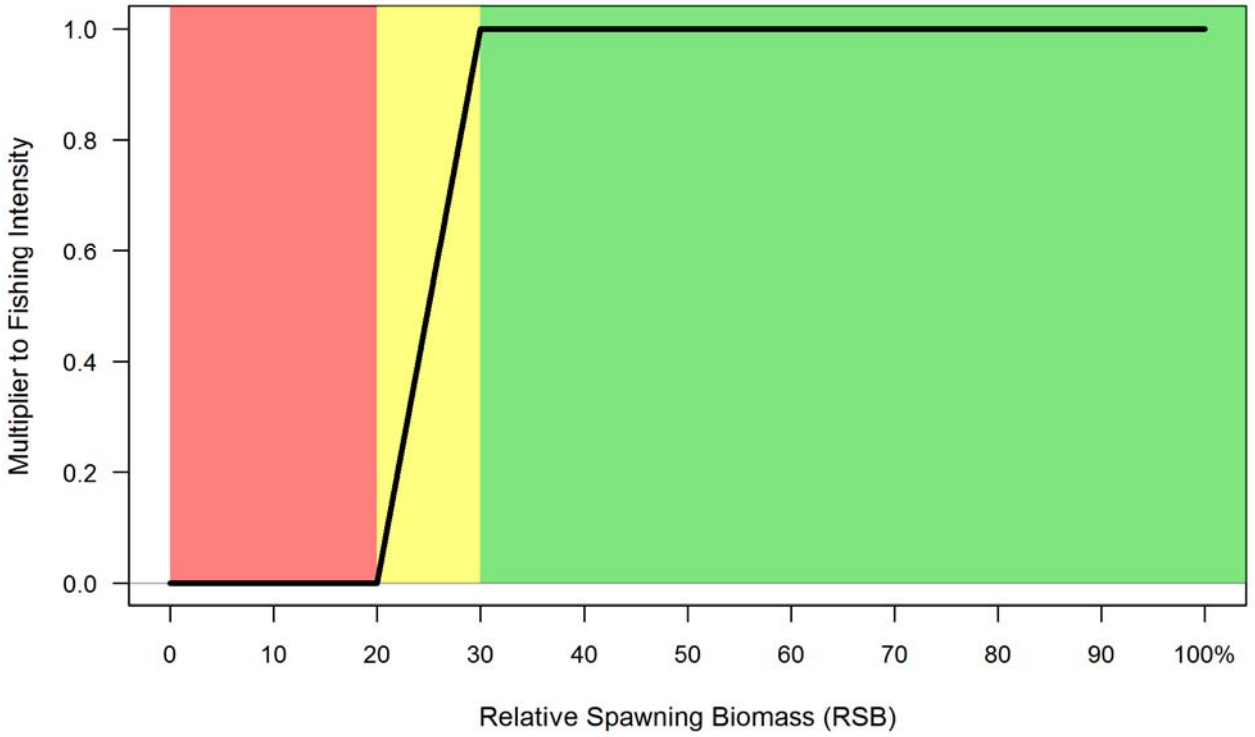


Highlights of IPHC harvest policy

- 32” size limit
  - Fisheries encounter a small percentage of fish less than 26”
    - **1.1%** less than 26” in 4CDE; **13.2%** less than 32” in 4CDE
- Interim SPR of 46%
  - Average of last three years that saw a stable or slightly increasing population
  - SPR accounts for mortality of all sizes and from all sources
- 30:20 control rule
  - Directed fishery catch limits equal to zero when status is less than 20%
- Distribute O26 TCEY (catch/mortality limits) to Reg Areas
  - Use the IPHC setline survey biomass
  - Lower harvest rates in western areas

IPHC 30:20 control rule

- Fishing Intensity is reduced when stock status is less than 30% of B0
- Fishing intensity is zero when stock status is less than 20% of B0



Catch Table

Other Fisheries

Directed Fishery

Under 26”

CATCH TABLE PROJECTED FOR THE 2017 ADOPTED CATCH LIMITS

Catch table projected for the 2017 adopted catch limits (grey) and the resultant values based on the Commission’s previously adopted formula for calculating TCEY. All values reported in millions of net pounds.

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
O26 Non-FCEY									
Comm. wastage	0.05	0.23	NA	NA	0.23	**0.05**	**0.06**	**0.08**	0.69
Bycatch	0.10	0.24	0.03	1.17	0.58	**0.34**	**0.14**	**1.98**	4.57
Sport (+ wastage)	NA	NA	1.33	1.56	0.01	**0.01**	**0.00**	**0.00**	2.91
Pers./Subs.	NA	0.41	0.43	0.23	0.02	**0.01**	**0.00**	**0.08**	1.17
Total Non-FCEY	0.14	0.87	1.79	2.96	0.84	**0.41**	**0.20**	**2.14**	9.34
O26 FCEY									
Comm. wastage	NA	NA	0.12	0.37	NA	**NA**	**NA**	**NA**	0.49
CSP Sport (+wastage)	0.53	1.15	0.92	1.89	NA	**NA**	**NA**	**NA**	4.49
Pers./Subs.	0.03	NA	NA	NA	NA	**NA**	**NA**	**NA**	0.03
Comm. Landings	0.77	6.30	4.21	7.74	3.14	**1.39**	**1.14**	**1.70**	26.39
Total FCEY	1.33	7.45	5.25	10.00	3.14	**1.39**	**1.14**	**1.70**	31.40
TCEY	1.47	8.32	7.04	12.96	3.98	**1.80**	**1.34**	**3.84**	40.74
U26									
Comm. wastage	0.00	0.00	0.00	0.01	0.03	**0.01**	**0.00**	**0.00**	0.07
Bycatch	0.00	0.02	0.00	0.62	0.29	**0.23**	**0.01**	**1.27**	2.44
Total U26	0.00	0.02	0.00	0.63	0.33	**0.24**	**0.01**	**1.27**	2.51
Total Mortality	1.48	8.35	7.04	13.60	4.30	**2.04**	**1.35**	**5.11**	43.25

Management Strategy Evaluation

- Management Strategy Advisory Board (MSAB) is evaluating alternative management procedures
- Currently focusing on “Scale”
  - Fishing Intensity (Spawning Potential Ratio, SPR)
  - Control Rule (40:20 vs 30:20)
- Additionally looking at sensitivities
  - Shift in bycatch selectivity to smaller fish (coastwide)
  - Coastwide bycatch at higher levels

http://www.iphc.info/msab

Other/Future work at IPHC related to ABM

- Size limits
  - Another investigation on effect of different size limits
  - Will be presented at Annual Meeting
  - The SPR-based harvest policy balances mortality to constant spawning potential
- Future evaluations in the MSE
  - Distribution of TCEY
- Fisheries Footprint
  - Looking at the impacts of each fishery/sector/area

Halibut PSC management and usage in BSAI groundfish fisheries

1) halibut PSC limits for trawl and non-trawl fisheries;

2) halibut PSC limits apportioned to groundfish sectors in the FMP;

- by fishery categories, and seasons in annual specifications process

3) in-season management of groundfish fisheries to prevent PSC from exceeding the established limits.

Changes to PSC limit by sector (Amendment 111, June 2015)

	Current PSC limit	PSC limit reduction	New PSC limit
Amendment 80 cooperatives	2,325 t	-25%	1,745 t
BSAI trawl limited access fisheries	875 t	-15%	745 t
Longline fisheries	833 t	-15%	710 t
CDQ fisheries	393 t	-20%	315 t
TOTAL	4,426 t	-21%	3,515 t

History, PSC limits since 2008

Table 3. Evolution of Pacific halibut PSC limits by main sectors in the BSAI region, 2008-2016.

	Am80	BSAI TLA	Longline fisheries	CDQ	Total PSC limit
2008	2,525	875	833	343	4,576
2009	2,475	875	833	343	4,526
2010	2,425	875	833	393	4,526
2011	2,375	875	833	393	4,476
2012	2,325	875	833	393	4,426
2013	2,325	875	833	393	4,426
2014	2,325	875	833	393	4,426
2015	2,325	875	833	393	4,426
2016	2,325	875	833	393	4,426
2016*	1,745	745	710	315	3,515
2017	1,745	745	710	315	3,515

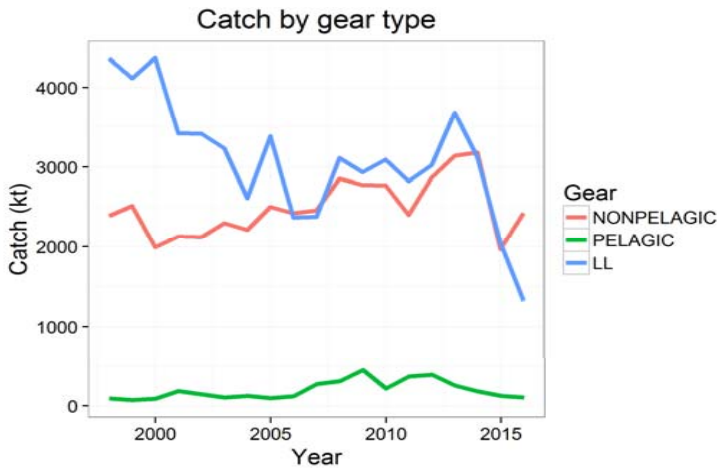
*mid-year implementation of new PSC caps in 2016

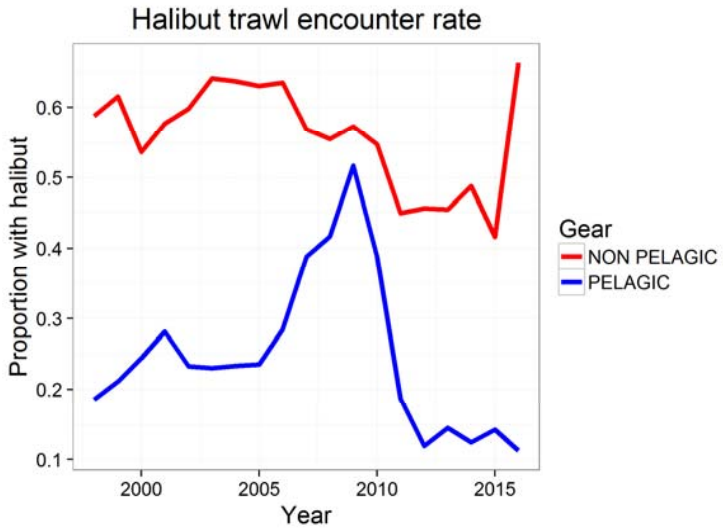
History, PSC usage since 2008

	Am80	BSAI TLA	Longline fisheries	CDQ	% of Total PSC limit
2008	74%	96%	71%	63%	77%
2009	80%	93%	72%	45%	78%
2010	89%	67%	63%	41%	76%
2011	72%	82%	60%	62%	71%
2012	81%	116%	68%	69%	85%
2013	90%	90%	57%	68%	82%
2014	91%	82%	49%	63%	79%
2015	59%	60%	36%	33%	52%
2016	76%	87%	28%	55%	67%
2017*	40%	70%	17%	29%	41%

* Halibut mortality to date week of 8/14/2017

Encounters by gear type (no DMRs applied)





Efforts by groundfish fleet to avoid halibut

- Section 1.4.4 Page 24 Description by Sector

- Longline C/Ps (FLC)
- Trawl C/Ps (A80)
- Trawl Limited Access (TLAS)

Council Purpose and Need (page 28) and overarching goals

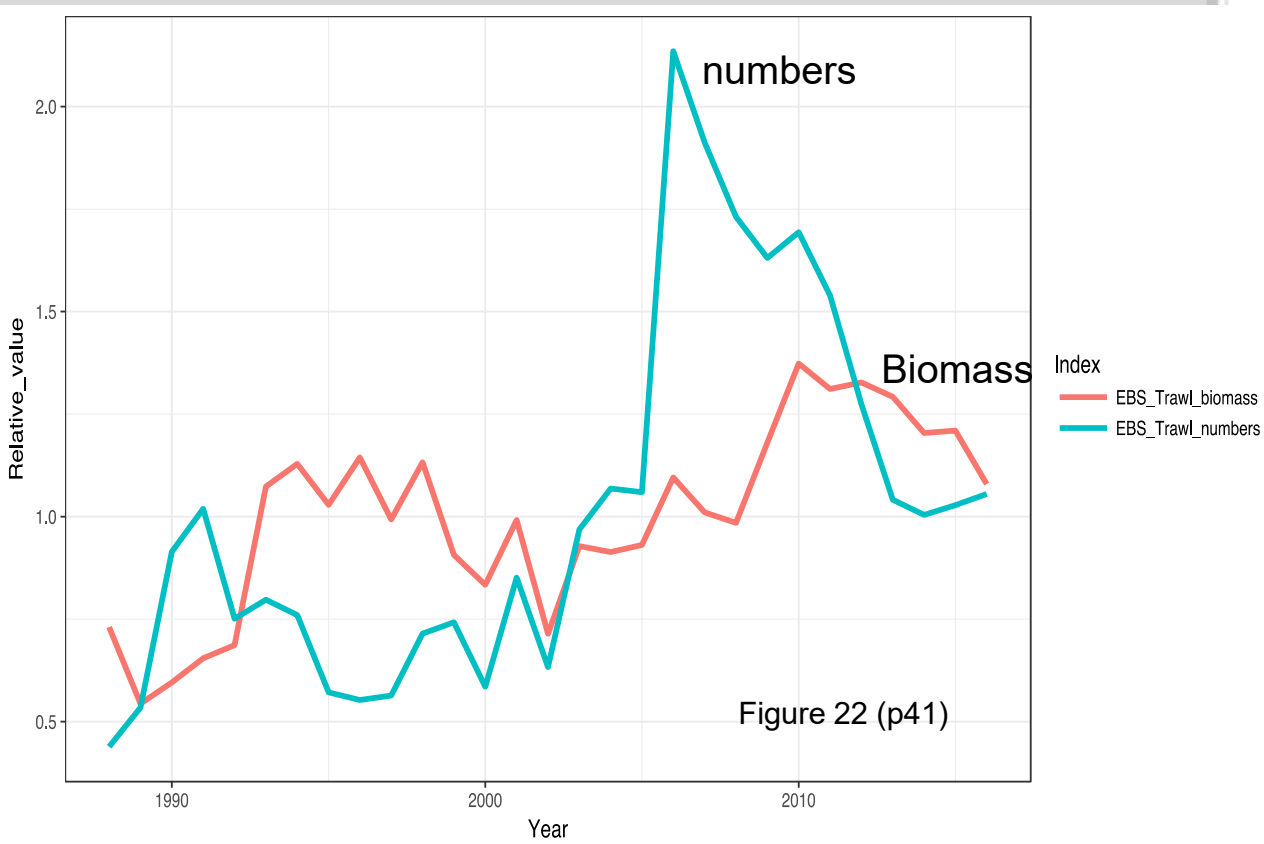
- Halibut PSC limits should be indexed to halibut abundance
- Halibut spawning stock biomass should be protected especially at lower levels of abundance
- There should be flexibility provided to avoid unnecessarily constraining the groundfish fishery particularly when halibut abundance is high
- Provide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

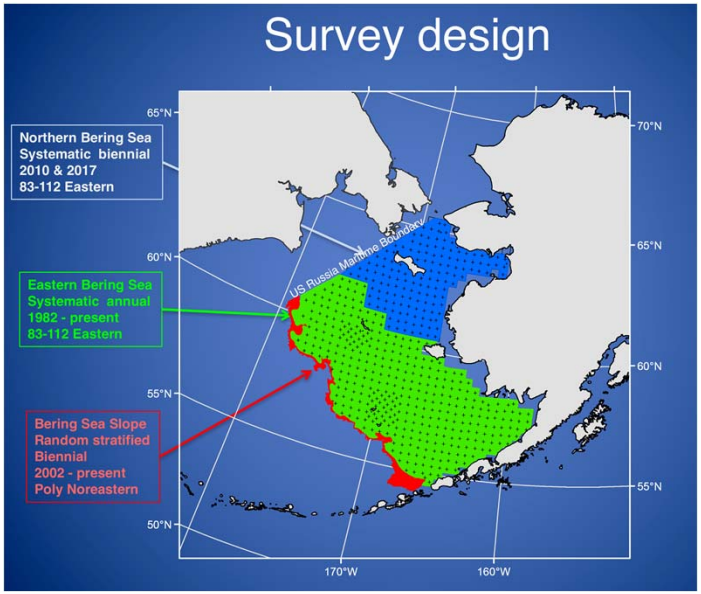
indices

Organization of index sections

- Primary and Secondary fishery independent indices
- For each sections describe:
  - Description of methodology
  - Data Availability
  - Segment of halibut population represented by the index
  - Segment of index population encountered in directed halibut and groundfish fisheries (trawl and LL)

AFSC EBS trawl survey





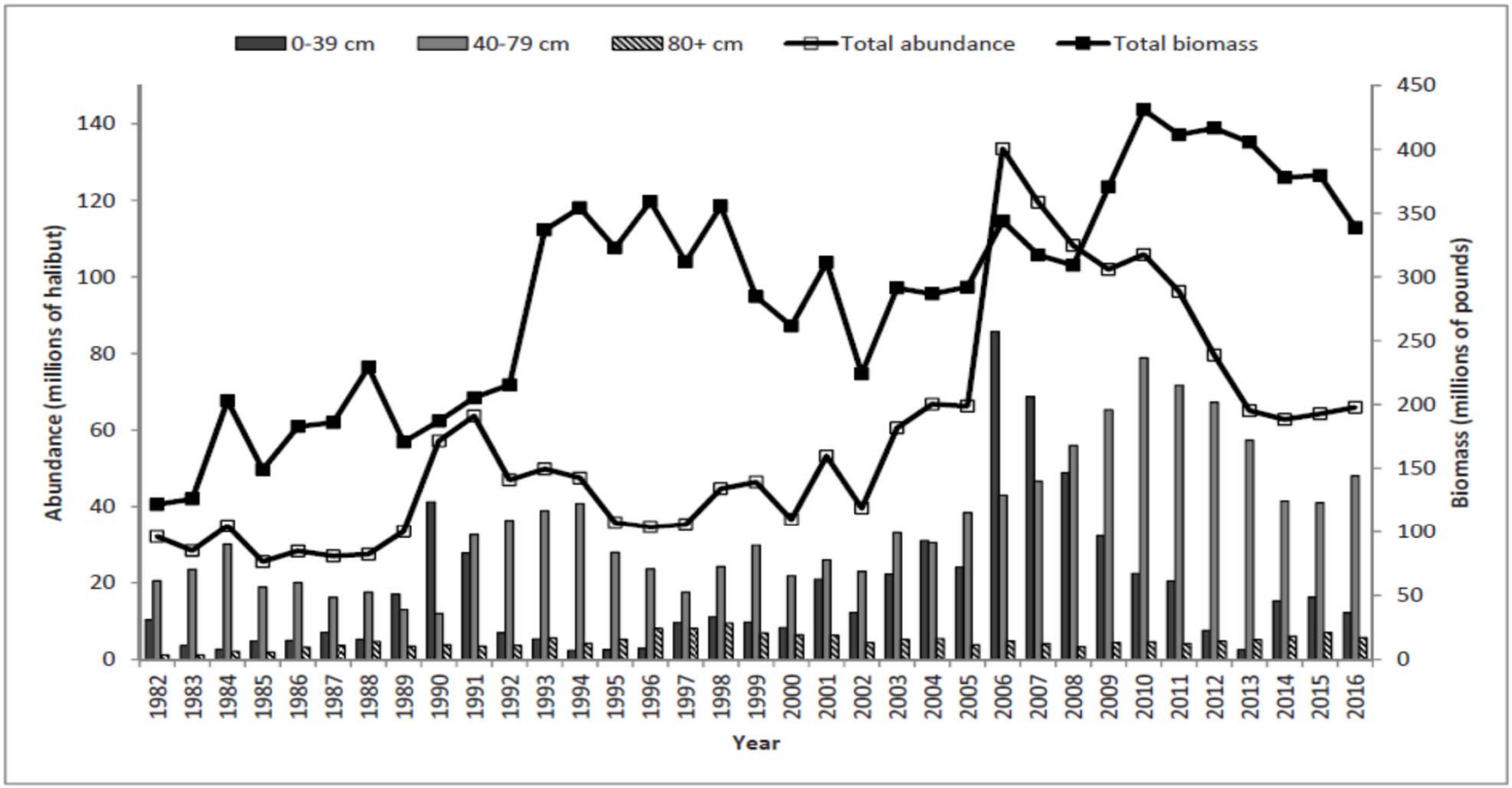

0-39 cm
40-79 cm
80+ cm
Total abundance
Total biomass
Abundance (millions of halibut)
Biomass (millions of pounds)
Year
0
20
40
60
80
100
120
140
0
50
100
150
200
250
300
350
400
450
1982
1983
1984
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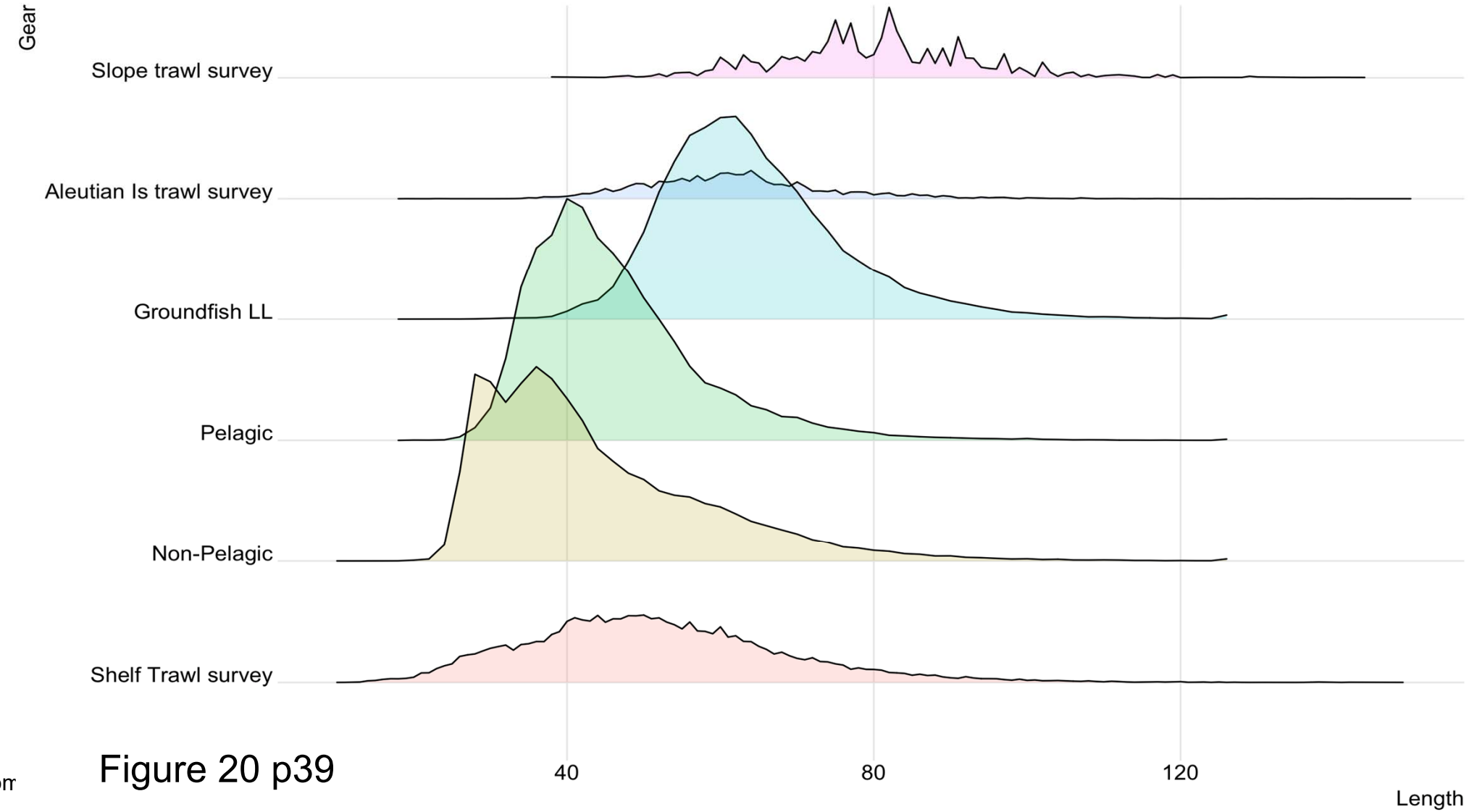
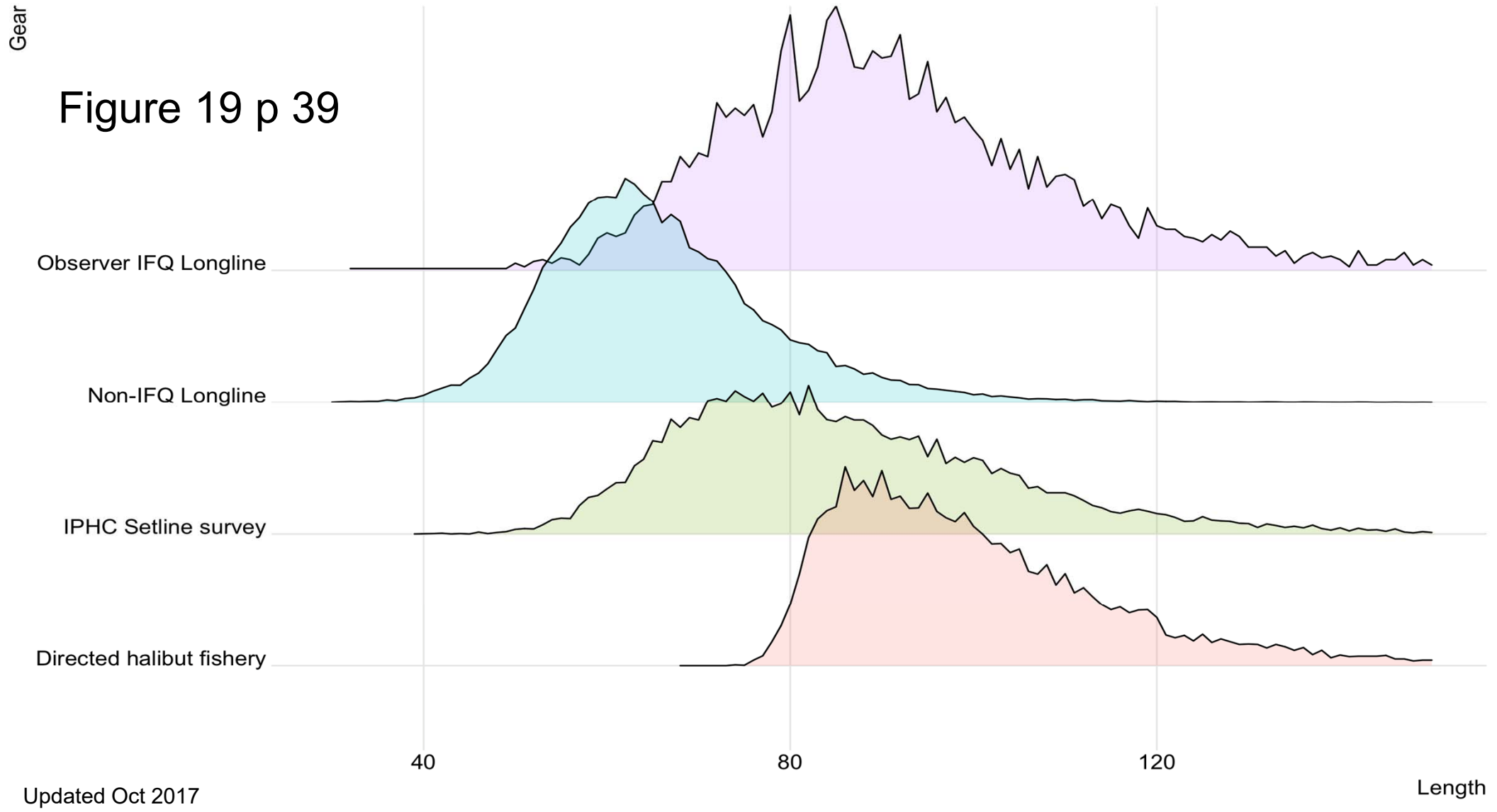
Figure 17



From

Figure 20 p39

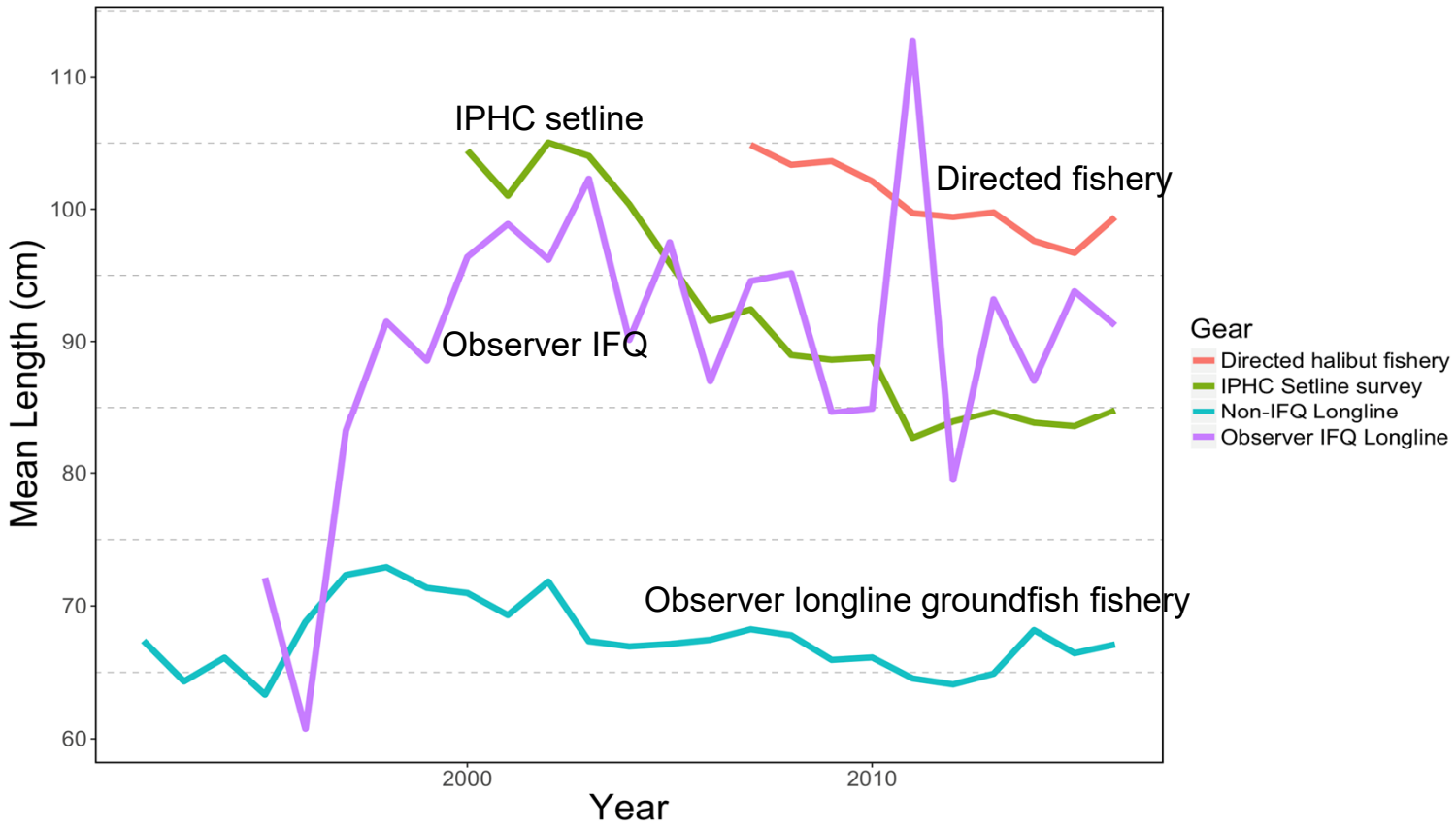
Figure 19 p 39



Updated Oct 2017

Figure 18 p36

Mean length
Pacific halibut
Longline gear



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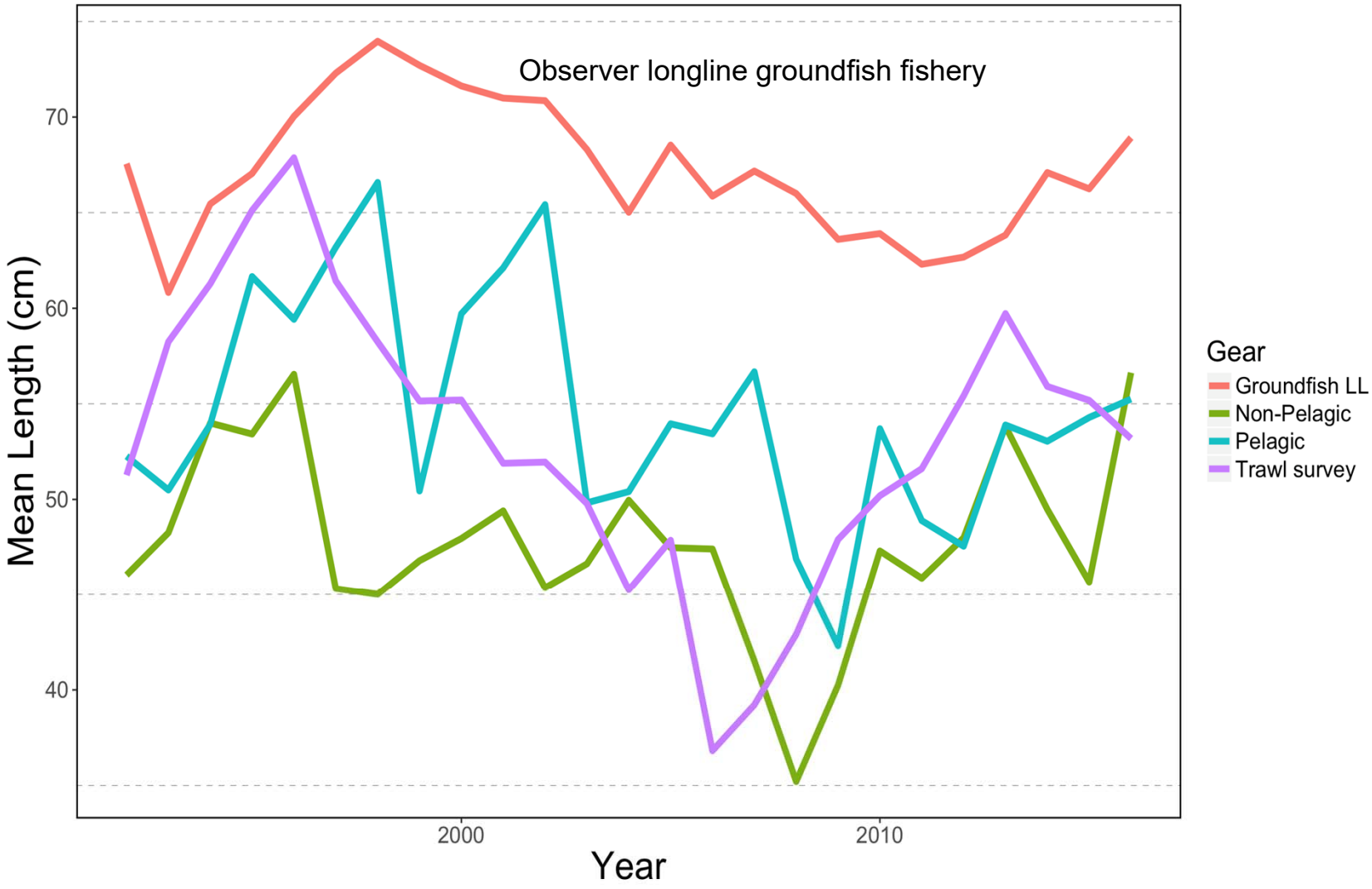


Figure 18 p36

EBS trawl survey

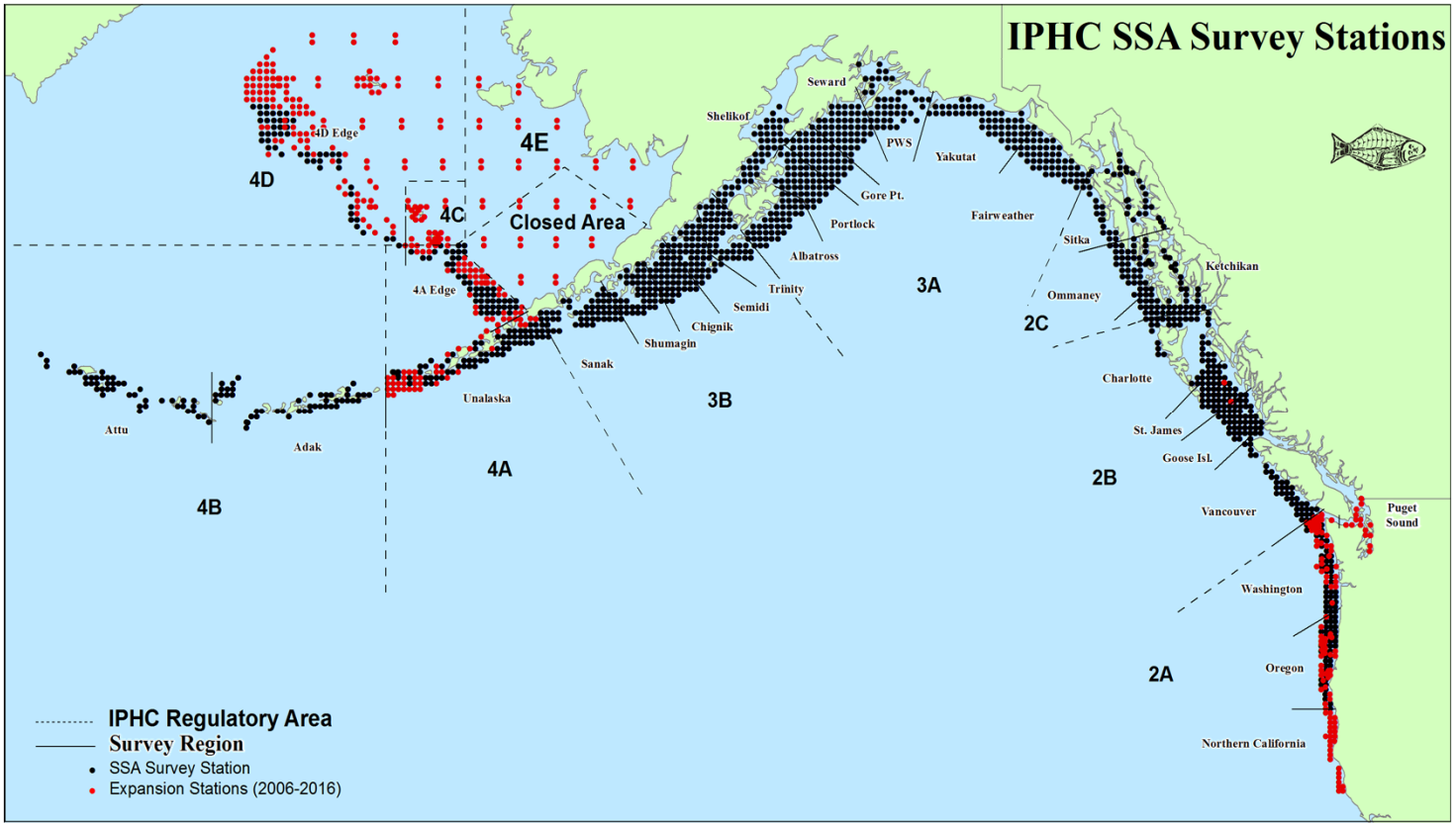
Inappropriate index for commercial directed halibut as catches smaller sizes of fish

Good proxy for size composition of bycatch of halibut in the groundfish trawl fisheries in the Bering Sea

Potentially good proxy for groundfish longline fisheries in the Bering sea

Good index for halibut abundance in the Bering Sea

IPHC Setline survey



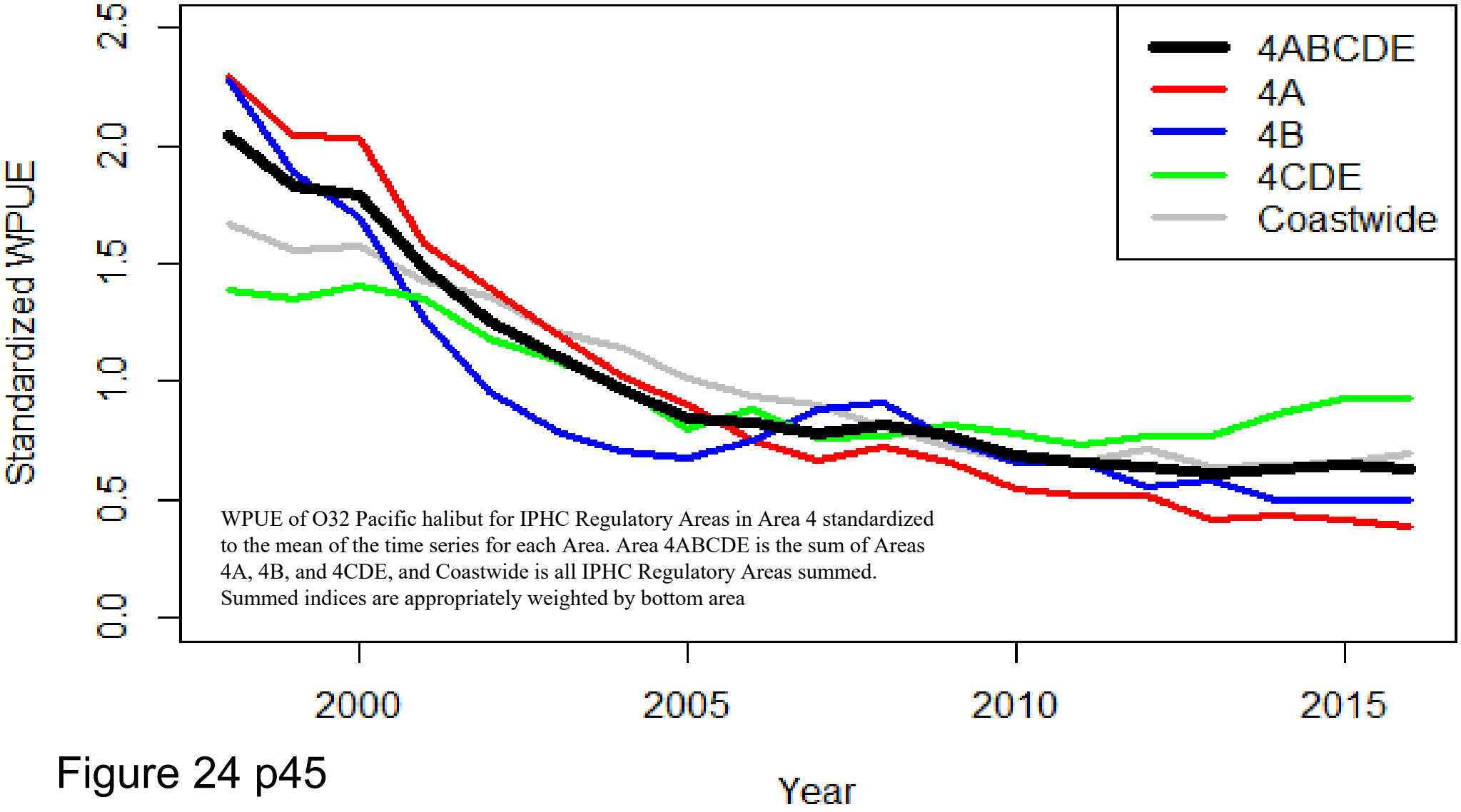


Figure 24 p45

Age compositions

Area 4CDE, 4A

Directed Commercial Fishery

Age	2008	2009	2010	2011	2012	2013	2014	2015	2016
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
6	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
7	0.1	0.2	0.3	0.2	0.2	0.0	0.1	0.1	0.3
8	2.8	2.5	1.7	1.2	1.0	0.9	0.6	0.6	2.1
9	7.2	7.7	4.8	4.5	4.8	3.2	4.3	3.3	3.8
10	13.2	13.3	13.0	8.8	11.1	9.4	11.7	10.2	7.7
11	9.7	15.3	17.7	14.9	12.7	18.4	20.6	17.4	16.1
12	9.2	8.5	15.4	17.0	14.0	14.5	21.3	22.3	18.0
13	8.5	6.0	7.8	12.8	12.3	12.0	13.3	15.2	16.3
14	7.7	7.3	5.7	7.1	8.9	9.8	7.2	9.1	11.5
15	5.1	4.2	4.9	4.7	4.2	7.6	4.6	5.0	7.7
16	3.4	2.8	3.9	3.2	3.5	3.9	3.9	3.1	3.9
17	2.8	2.8	2.5	2.6	3.0	2.5	1.4	2.7	2.8
18	3.3	2.6	1.9	2.3	2.2	2.4	1.5	1.7	1.7
19	3.6	3.8	1.9	1.8	1.9	1.1	1.2	1.4	1.5
20	4.5	4.5	2.7	2.1	2.0	1.3	1.0	0.9	0.8
21	4.3	4.5	2.3	2.3	2.2	0.9	0.6	0.7	0.7
22	3.3	3.7	3.0	2.2	2.6	1.1	0.7	0.4	0.8
23	1.6	1.9	2.8	2.9	2.8	1.4	0.6	0.7	0.3
24	1.1	1.4	1.7	3.5	2.6	1.6	0.8	0.7	0.4
25+	8.7	7.0	5.9	5.9	8.2	8.0	4.7	4.7	4.0

IPHC setline survey

	2008	2009	2010	2011	2012	2013	2014	2015	2016
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.1	0.3	0.2	0.2	0.0	0.2	0.1	0.1	0.4
6	1.8	2.0	1.3	1.0	1.3	0.5	0.7	0.9	0.6
7	4.7	7.2	4.5	2.8	4.1	1.3	1.7	3.1	1.5
8	11.7	10.2	11.0	7.9	8.3	6.1	4.9	5.0	5.7
9	13.8	13.6	10.9	16.3	13.2	10.6	11.2	10.5	6.9
10	14.2	14.3	14.6	15.6	18.6	16.4	14.6	16.4	10.1
11	9.1	11.9	14.3	14.1	12.6	18.9	18.2	16.7	15.7
12	6.9	5.7	11.4	11.3	11.1	11.0	15.7	16.0	16.3
13	6.6	4.9	4.0	8.3	8.5	9.3	9.0	10.0	12.4
14	4.6	4.5	4.0	4.1	5.1	5.5	6.1	4.9	9.4
15	2.9	3.2	3.6	2.7	2.5	4.5	4.6	3.7	6.5
16	2.6	2.2	3.1	2.5	2.3	2.7	3.3	2.6	3.1
17	2.2	2.3	1.7	1.8	1.8	1.9	1.9	1.7	2.3
18	2.0	1.8	1.3	1.3	1.0	1.4	1.5	1.5	1.4
19	2.5	2.2	1.3	0.9	1.0	1.3	0.7	0.9	0.8
20	3.0	2.6	1.2	0.9	1.0	1.2	1.0	0.6	0.6
21	2.7	2.6	1.7	0.8	1.2	0.8	0.6	0.6	0.9
22	2.2	2.2	1.9	1.3	1.1	1.1	0.3	0.2	0.5
23	1.3	1.3	1.7	1.2	0.9	0.7	0.4	0.6	0.4
24	0.9	1.0	1.5	1.3	1.0	0.9	0.4	0.9	0.7
25+	4.4	3.9	5.0	3.7	3.5	3.7	3.5	3.0	3.9

IPHC setline survey

Good proxy for directed fishery encounters

Poor proxy for trawl bycatch in groundfish fisheries

Possibly good proxy for size composition of halibut bycatch in the groundfish longline fisheries

Good index for halibut abundance in the Bering Sea (Area 4ABCDE)

Secondary fishery independent indices (3.2) and Fishery dependent information (3.3)

Extent to which indices meet recommended principles (3.4 p65)

- Principles (p65)
- The ABM index should be independent of management decisions.
- The ABM index should be parsimonious, easy to understand, and easy to implement in a timely manner.
- The ABM index should be free of as many assumptions as possible.
- The ABM index should reflect halibut abundance in the Bering Sea.
- The ABM index should reflect groundfish fishery encounters in the Bering Sea.

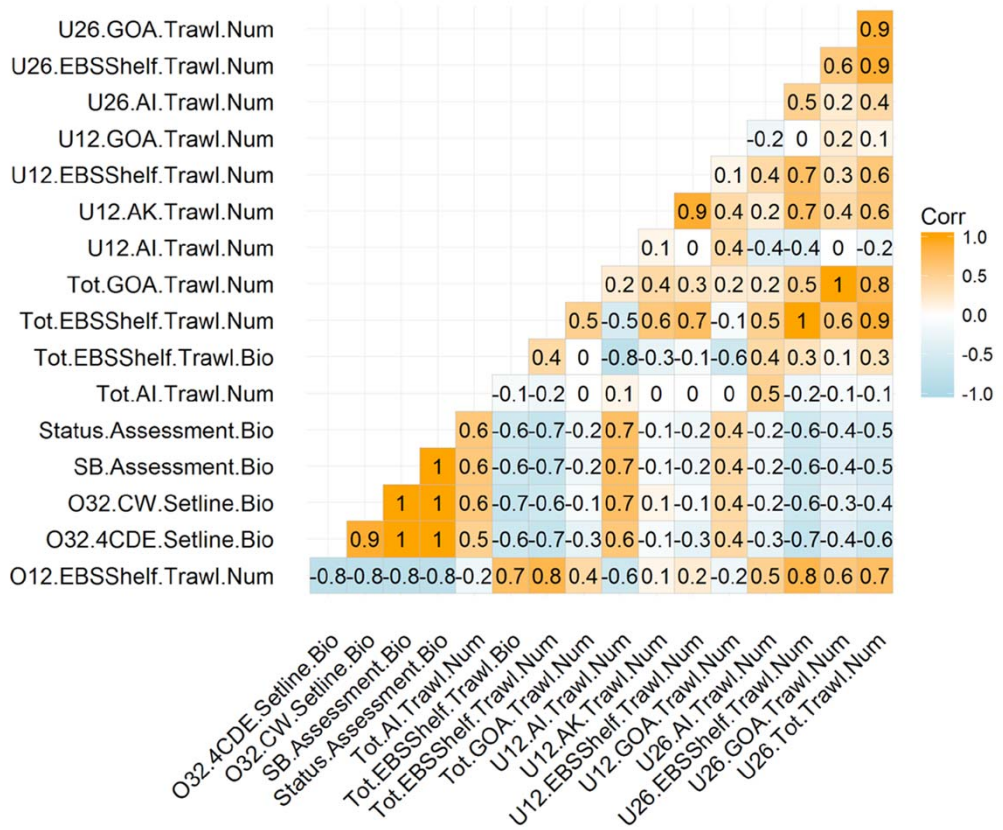
Table 12 page 67

Index Qualities and correlations amongst indices

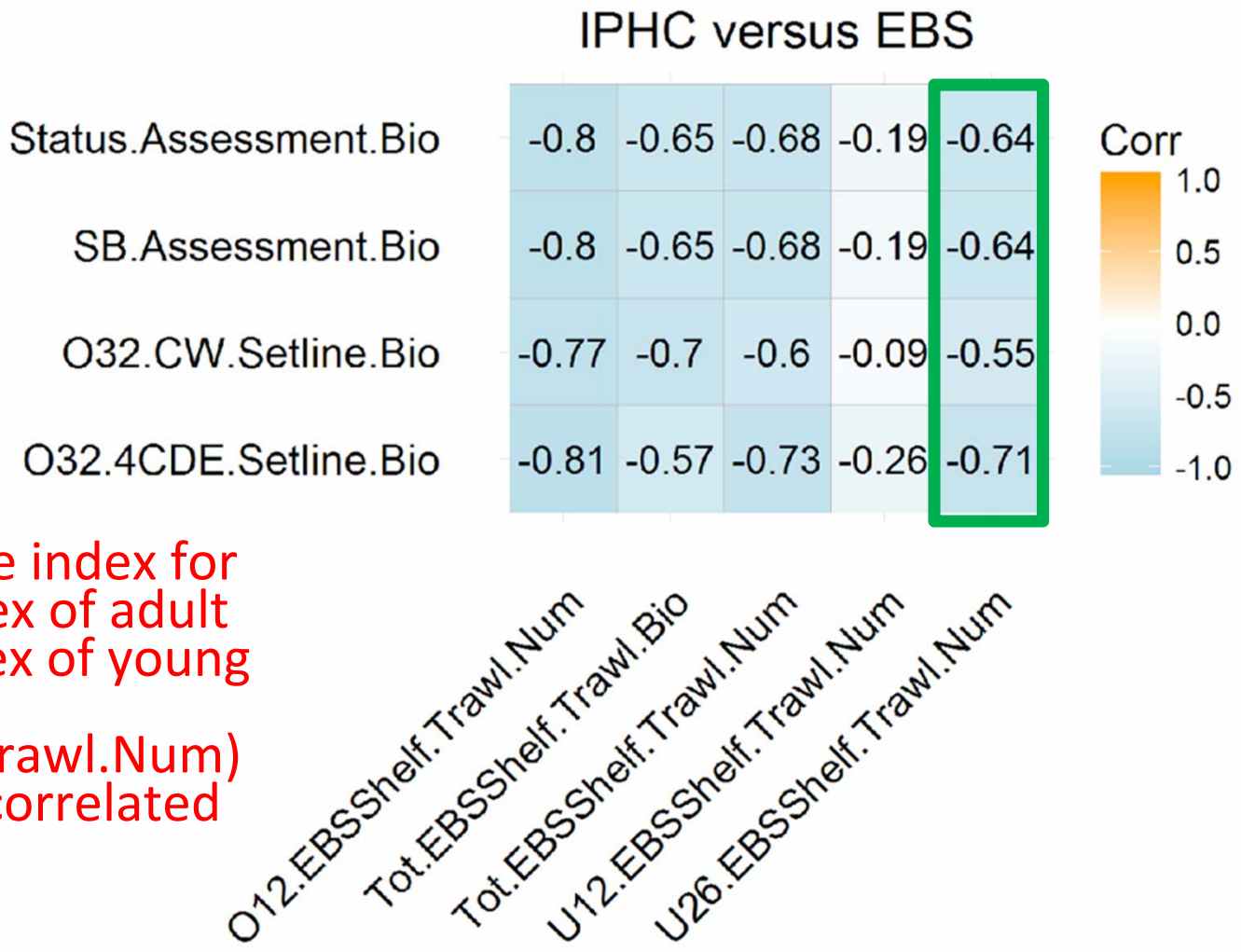
- Qualities of indices, description and segment of population shown in Tables 13-14 p69

Index Combination Summary

- Combining uncorrelated or negatively correlated indices may help in explaining different dynamics of the population
- Selecting highly positively correlated would add emphasis to that population component
  - For simplicity, better to use just one



Correlation between indices



The IPHC setline index for 4CDE as an index of adult fish and an index of young fish in the EBS (U26.EBSShelfTrawl.Num) are negatively correlated (Table 3, -0.71).

Correlation between indices

- Coastwide stock status best tracked with IPHC indices
- IPHC Stock assessment model and IPHC setline survey interchangeable
  - High **positive correlations**
- EBS trawl-survey indices negatively correlated with IPHC indices
  - **EBS trawl survey indices unsuitable for Pacific halibut stock status**

Summary of indices and conclusions/recommendations Section 3.7 pages 78-79

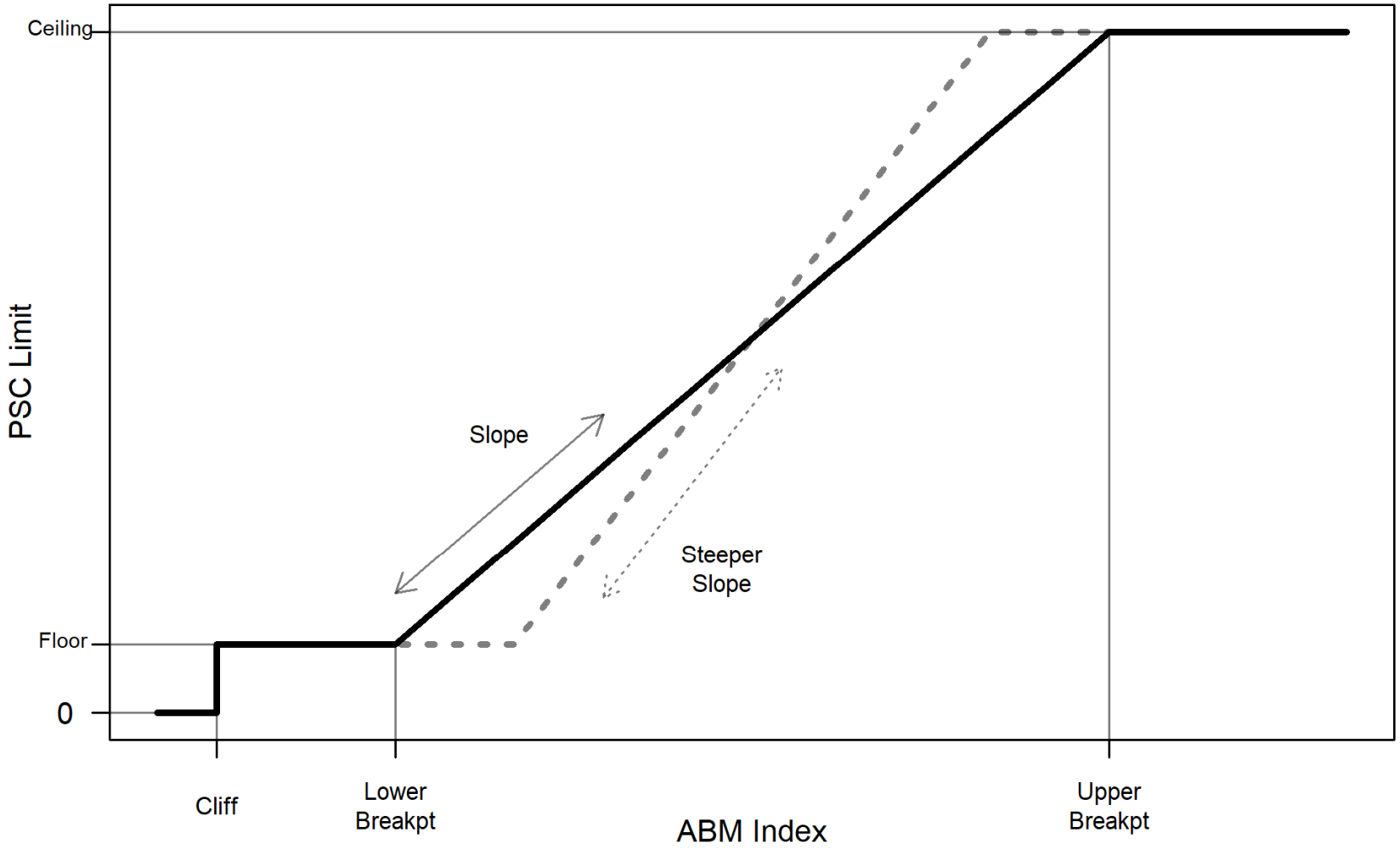
- EBS shelf survey is a useful index:
  - Correlated with Pacific halibut bycatch in the Bering Sea trawl groundfish fisheries
  - Size composition similar to Bering Sea trawl groundifsh fisheries
  - Some overlap in size composition for halibut encountered by the groundfish longline fishery
- IPHC 4ABCDE setline index is a useful index:
  - Highly correlated and catch size composition similar to longline groundfish fishery
  - Stronger correlation to the EBS longline fishery halibut bycatch than the 4CDE index

Index Recommendations

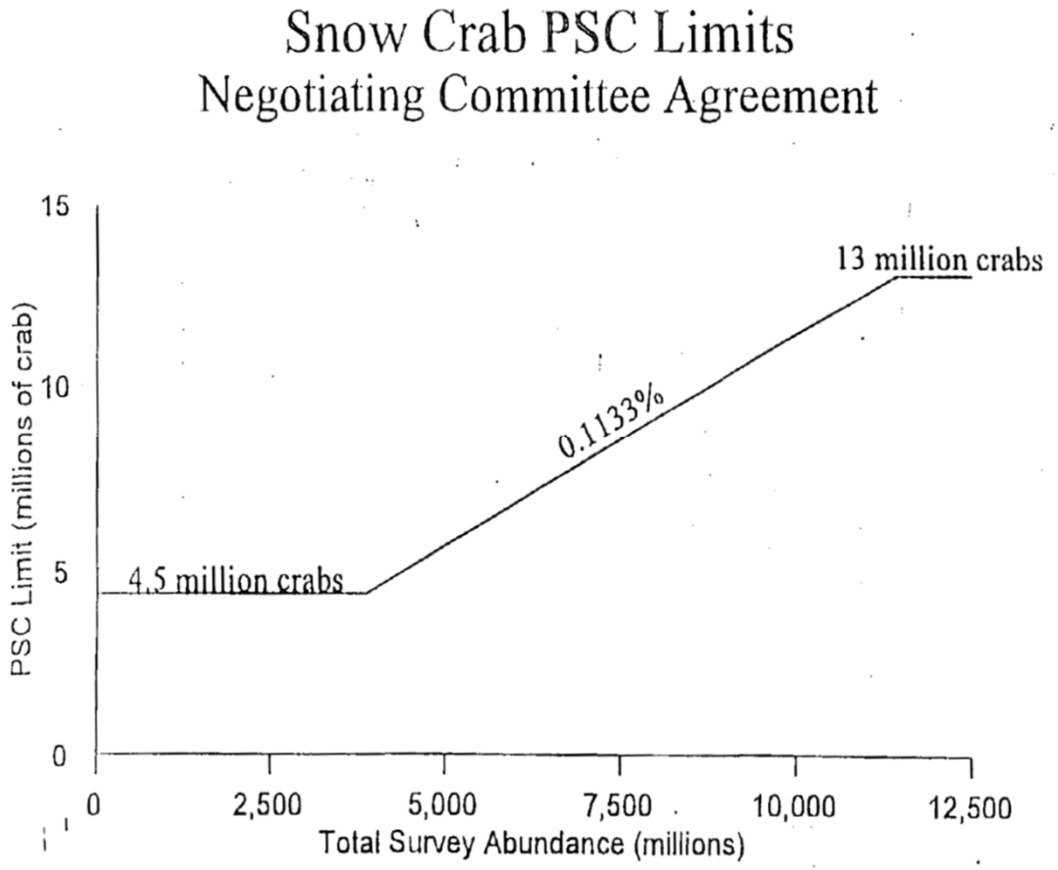
- **EBS shelf bottom trawl survey**
- **IPHC Area 4ABCCDE setline survey (SLS)**
- **Include separately and/or in combination along with a control rule.**

control rules

Control rule overview



Examples


Snow Crab PSC Limits
Negotiating Committee Agreement
PSC Limit (millions of crab)
15
10
5
0
13 million crabs
0.1133%
4.5 million crabs
0
2,500
5,000
7,500
10,000
12,500
Total Survey Abundance (millions)

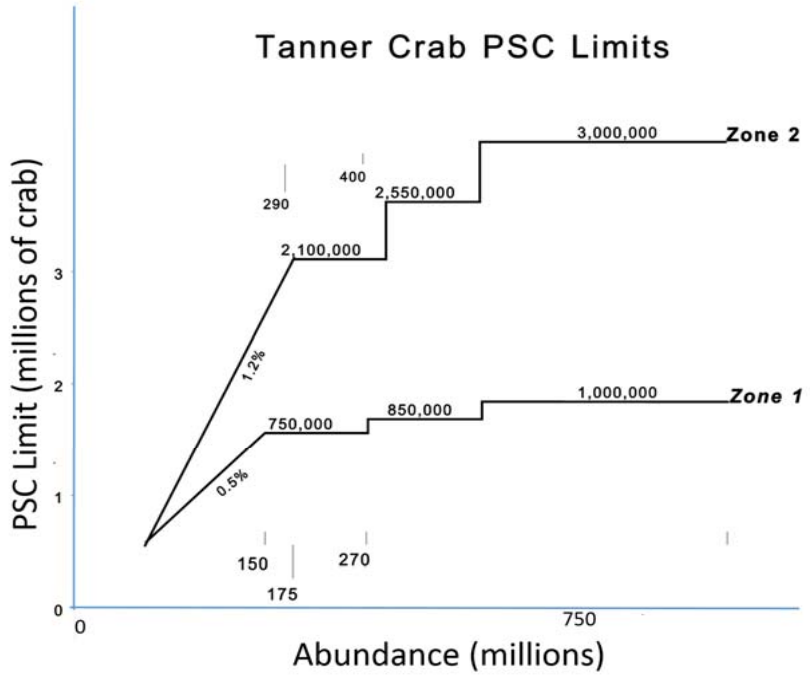

Tanner Crab PSC Limits
PSC Limit (millions of crab)
3
2
1
0
3,000,000
Zone 2
400
290
2,550,000
2,100,000
1.2%
1,000,000
Zone 1
850,000
750,000
0.5%
150
270
175
0
750
Abundance (millions)

Table 21 Example decision table to set PSC based on the level of two indices. PSC is set at the level of the index that is most constraining. Here example PSC values are shown corresponding to levels of abundance as in Table 20. These example PSC levels use the current PSC as the level for 'medium' and 50% below that for 'low' with 50% above that for 'high'.

		EBS exploitable biomass index		
		Low	***Medium***	***High***
IPHC Setline abundance in Area 4ABCDE	***High***	1,758	3,515	5,273
	Medium	1,758	3,515	3,515
	Low	1,758	1,758	1,758

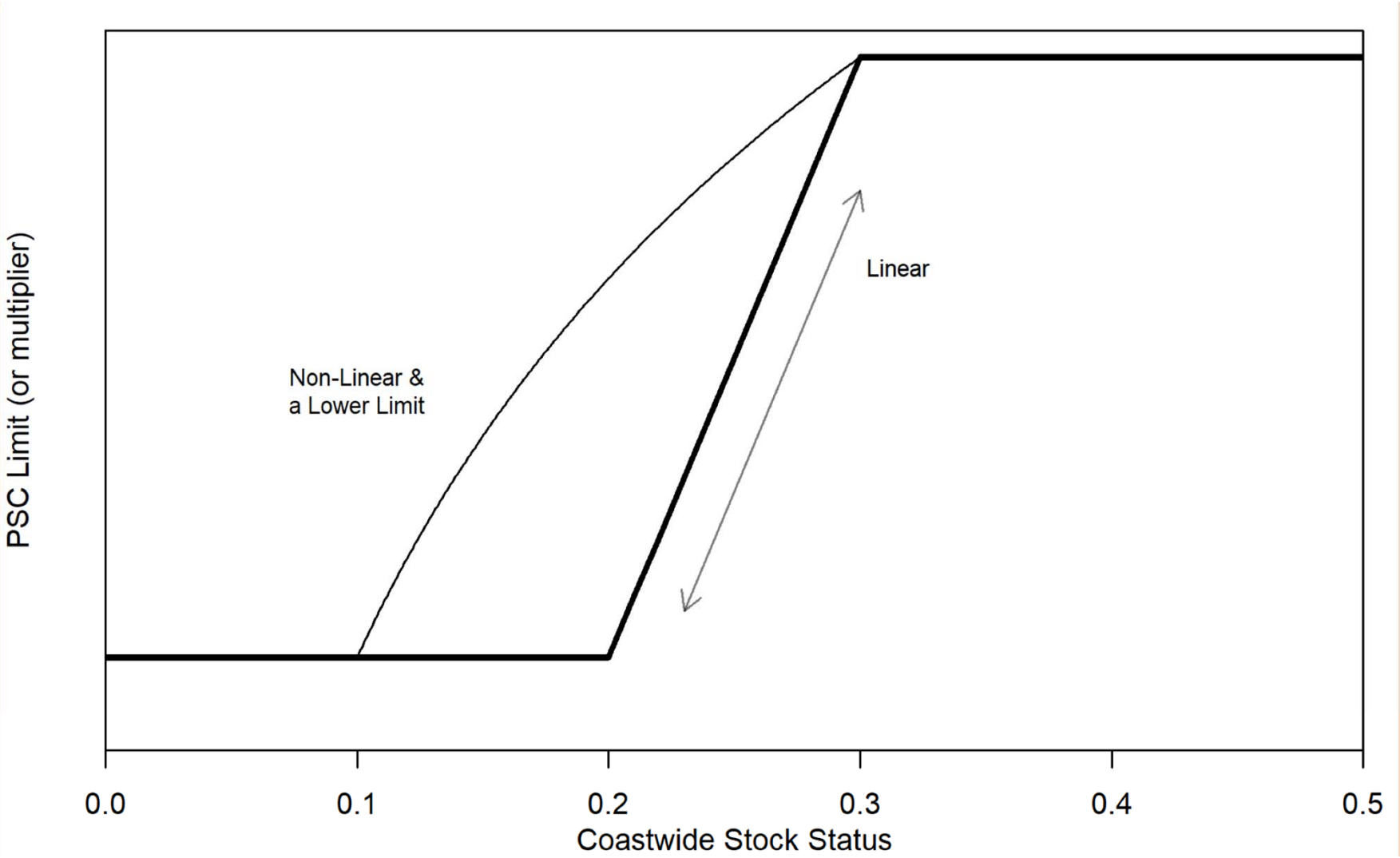


Figure 42. Examples of a linear control rule with stock status reference points at 30% and 20% stock status, and a non-linear control rule with stock status reference points at 30% and 10%.

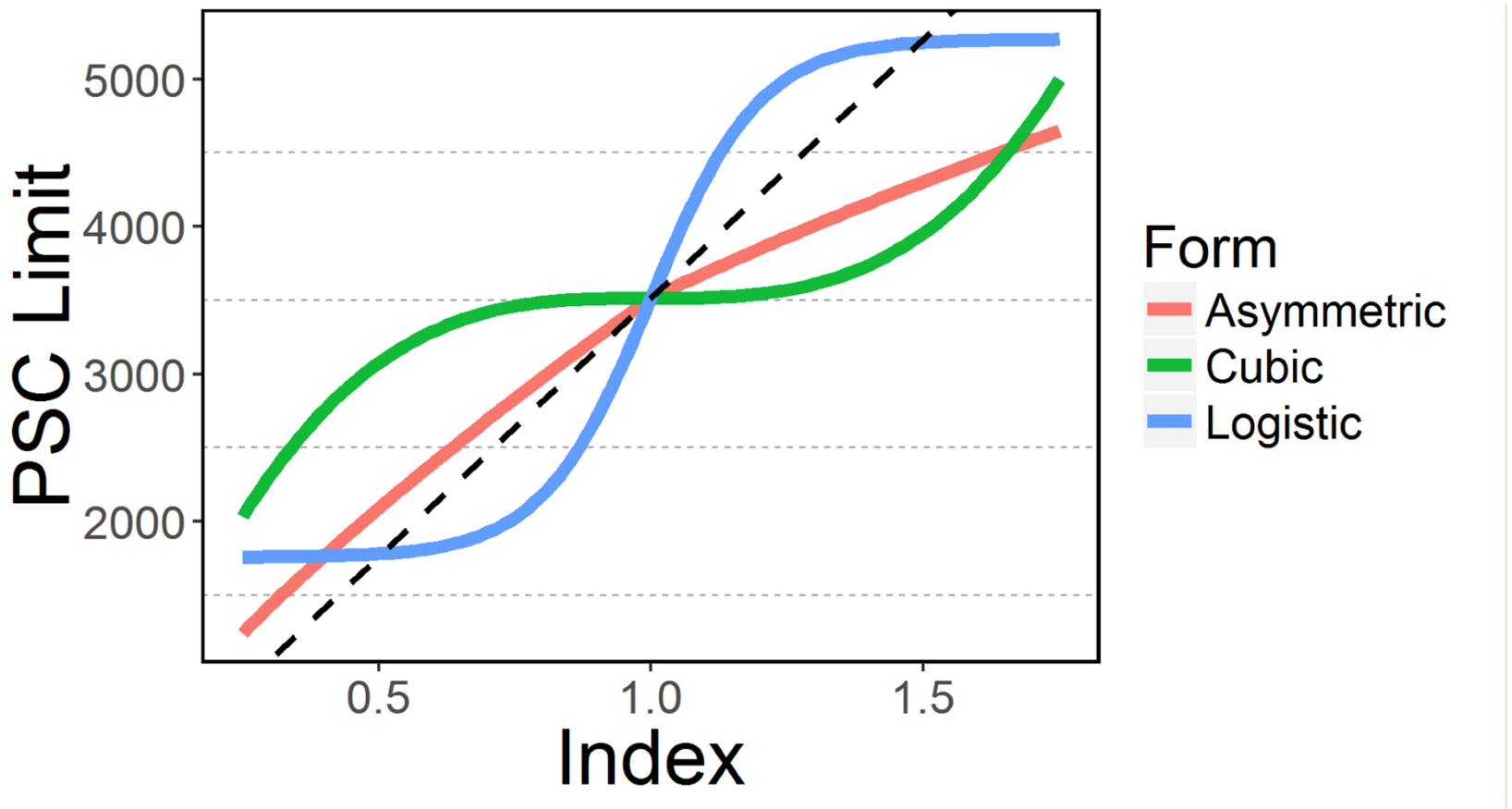


Figure 43. Three example control rules where the index has a non-linear effect on the PSC (vertical axis). Asymmetric shows a control rule that has different responses when above and below average abundance. Cubic shows a relationship that is stable near average abundance but is responsive with large departures from average. Logistic is more responsive than linear when abundance departs from average but responds slower when far from average abundance. Dashed line is a linear control rule for context.

Developing alternatives

Table 22. Draft Alternative elements and options for establishing ABM PSC management alternative sets for analysis. Note most elements and options are not mutually exclusive nor are all elements necessary to construct alternatives (* = mandatory selections)

Element 1* – Abundance index

Option 1. EBS trawl survey
- Suboption 1: index in biomass
- Suboption 2: index in numbers

Option 2. IPHC setline survey (O32) in Area 4ABCDE

Option 3. EBS trawl survey and IPHC setline survey (biomass)
- Suboptions (to Option 3 only):
  - Suboption 1: Equal weighting
  - Suboption 2: EBS trawl survey weighted higher

Option 4. Index trawl gear to EBS survey, index fixed gear to IPHC setline survey

Element 2* – PSC limit responsiveness to abundance changes

Option 1. PSC limit varies proportionally with change in abundance index
- Suboptions (to Option 1 only):
  - Suboption 1: varies 1:1 with abundance
  - Suboption 2: varies X:X with abundance
  - Suboption 3: varies non-linearly with abundance

Option 2. Limit PSC change to a maximum percentage

Option 3. Change PSC only every x number of years

Option 4. Threshold values(breakpoints) to modify PSC limit (e.g., IPHC stock status, other)

Element 3* – Starting point for PSC limit

Option 1. 2016 PSC limit (3,515 t)

Option 2. 50% of 2016 PSC limit = (1,758)

Option 3. 150% of 2016 PSC limit (= 5,273)

Option 4. Additional value within range of Options 1-3

Table 23. ABM choices for Element 1 **abundance index selection** of Table 22. Note that selection of the abundance indices is the first step for construction of strawmen alternatives (labeled as ABM1, ABM2, ABM3, ABM4)

Corresponding abundance estimate	**Option / suboption**	**Alternative**
EBS trawl survey (biomass)	Option 1, suboption 1	ABM1
IPHC setline survey (O32) in Area 4ABCDE	Option 2	ABM2
EBS trawl survey and IPHC setline survey (O32) in Area 4ABCDE (biomass). Equal weighting on both indices	Option 3, suboption 1	ABM3
EBS trawl survey and IPHC setline survey (O32) in Area 4ABCDE (biomass). Indices considered separately for trawl gear (EBS trawl survey) and fixed gear (IPHC survey)	Option 4	ABM4

Table 24. ABM choices for Elements 2 and 3 (Table 22) **shape and features of the Control Rule** as the second step in constructing strawmen alternatives. These ABM alternatives build upon the selection of abundance indices as defined in Table 23.

Features of control rules (Elements 2 and 3 in Table 22)	**Element/Option/[suboption]**	**Alternative**
PSC varies proportion to abundance (1:1)	Element 2: Option 1, suboption 1	ABM1
Starting point is the current PSC limit (3,515)	Element 3, Option 1	
PSC varies proportion to abundance (1:1)	Element 2: Option 1, suboption 1	ABM2
Starting point is the current PSC limit (3,515)	Element 3, Option 1	
PSC varies proportion to abundance (1:1)	Element 2: Option 1, suboption 1	ABM3
Starting point is the current PSC limit (3,515)	Element 3, Option 1	
PSC varies proportion to abundance (1:1)	Element 2: Option 1, suboption 1	ABM4
Starting point is the current PSC limit (3,515)	Element 3, Option 1	

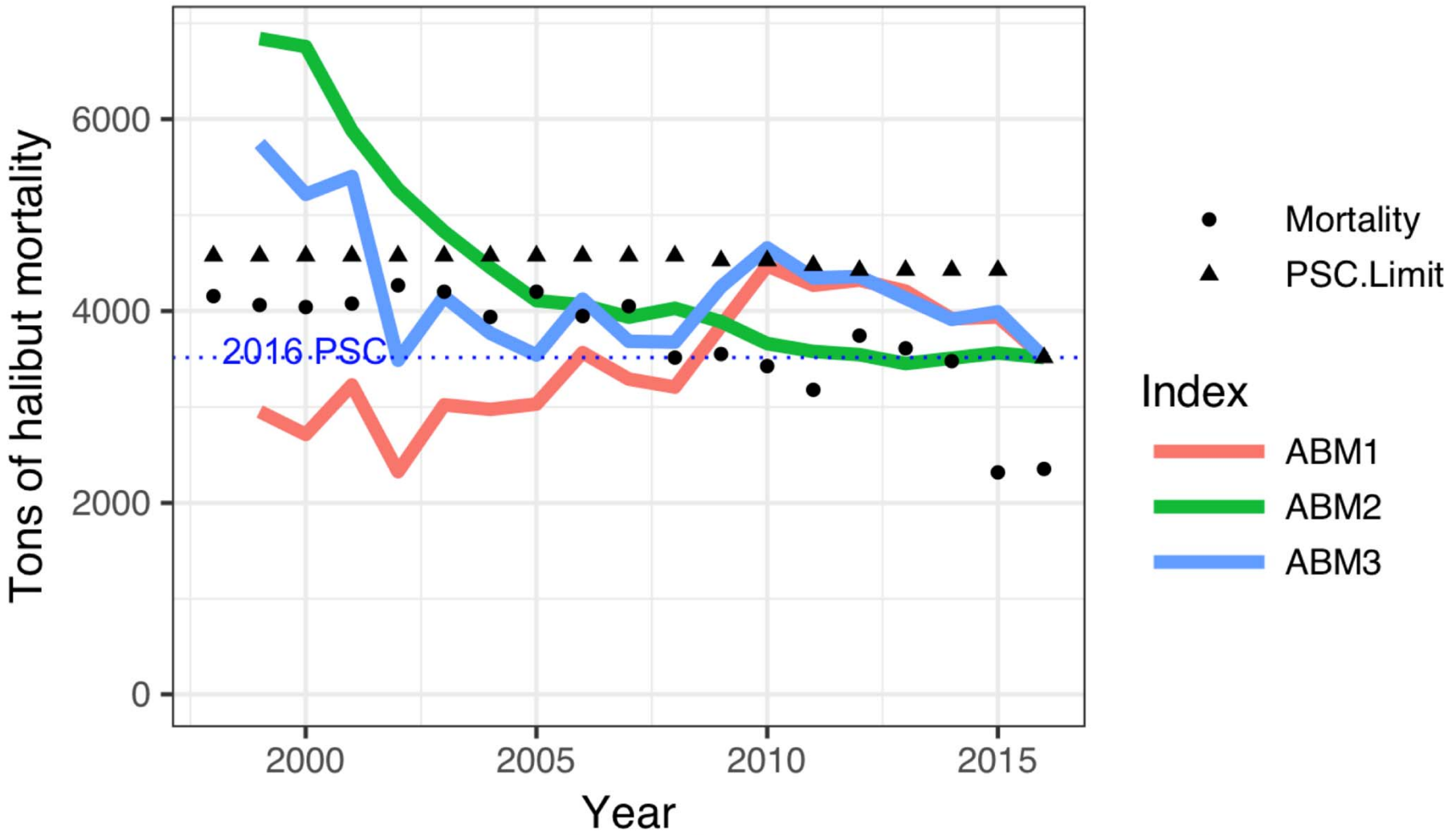


Figure 44. PSC limits using selected indices (Table 24) compared to historical actual limits (triangles) and Pacific halibut mortality estimates (solid dots).

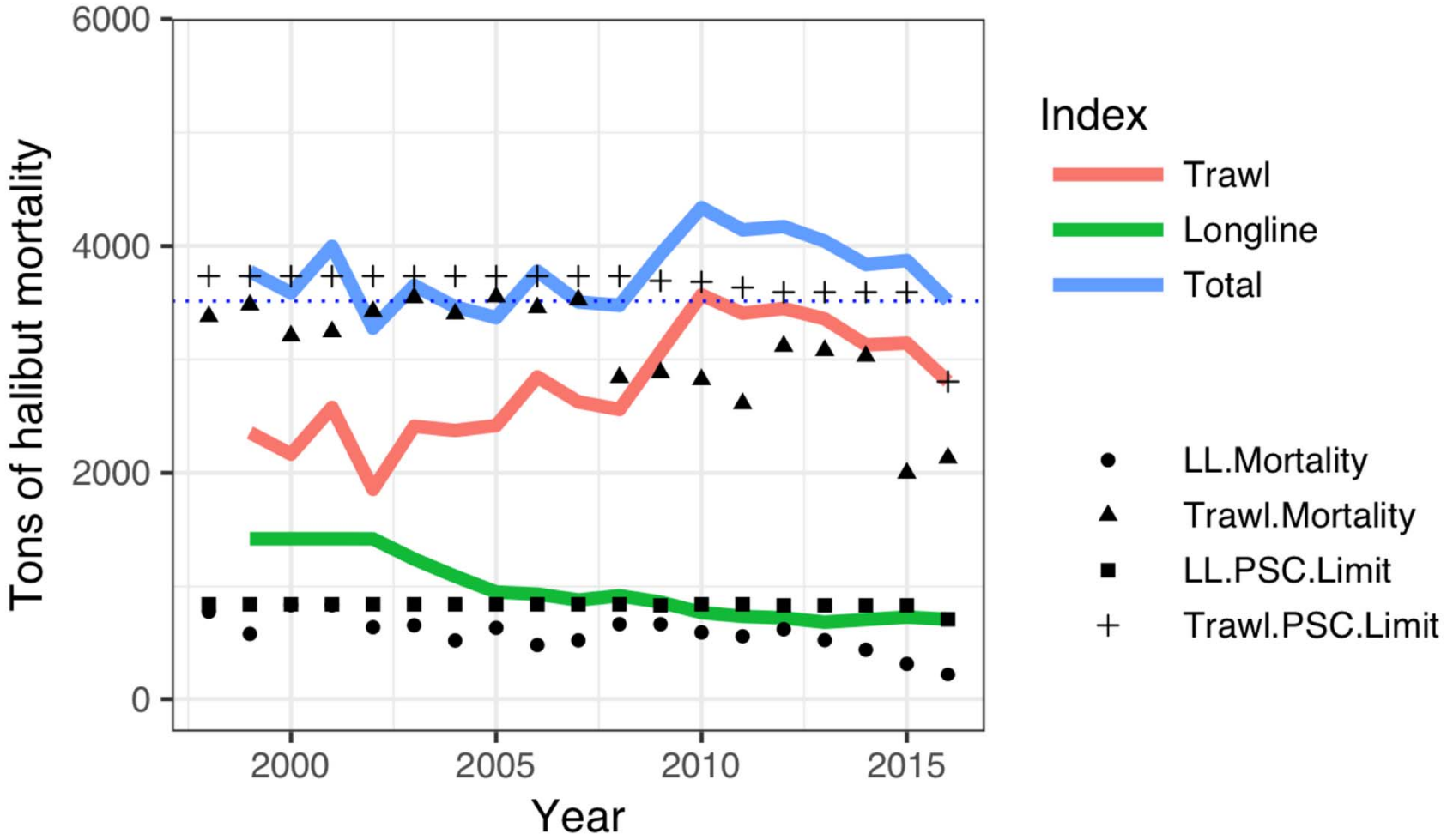


Figure 45. PSC limits using selected indices (Table 24) for ABM4 compared to historical actual limits and Pacific halibut mortality estimates by main gear types. Note that for exposition purposes, PSC "allocations" include CDQ as part of the Trawl PSC limit (which results in 2016 values of 2,805 t for trawl and 710 t of mortality for longline).

Table 25. Illustrative example options (sensitivities) to the strawmen ABM alternatives.

Alternative	**Control rule features**
ABM1.LOV	Less responsive to trawl survey index, $b = 0.5$
ABM1.HIV	Highly responsive to changes in trawl survey index, $b = 2.0$
ABM1.NOS	Use numbers instead of biomass
ABM1.NOS.LOV	Use numbers instead of biomass, with lower variability ($b=0.5$)
ABM3.ALL	Relative weights based on relative allocations
ABM3.HSP	$PSC_0=5,273$ *t,* high starting point
ABM3.NON	Non-linear
ABM3.SSD	Include a discontinuity in control rule at low stock status levels (from IPHC)

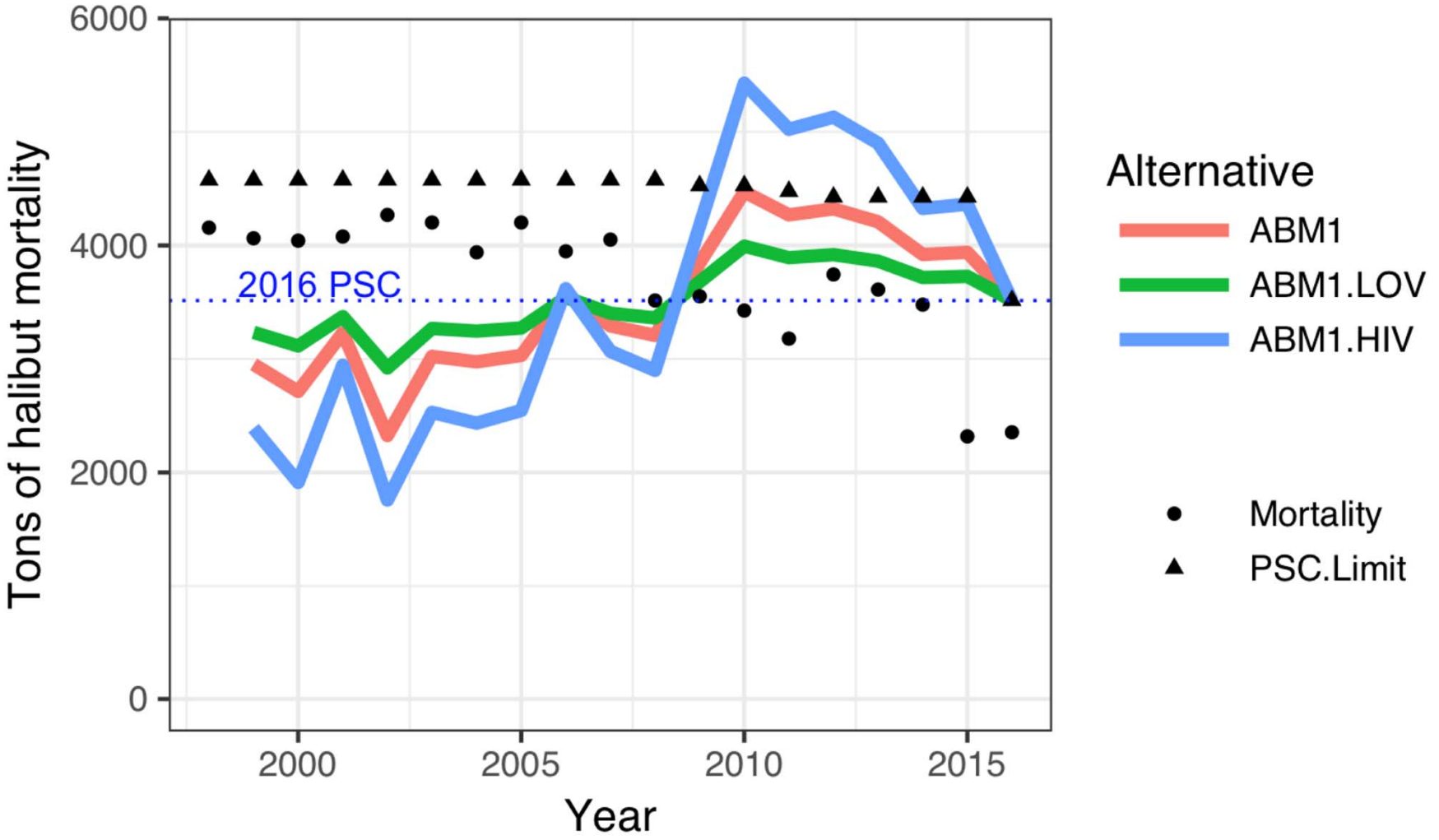
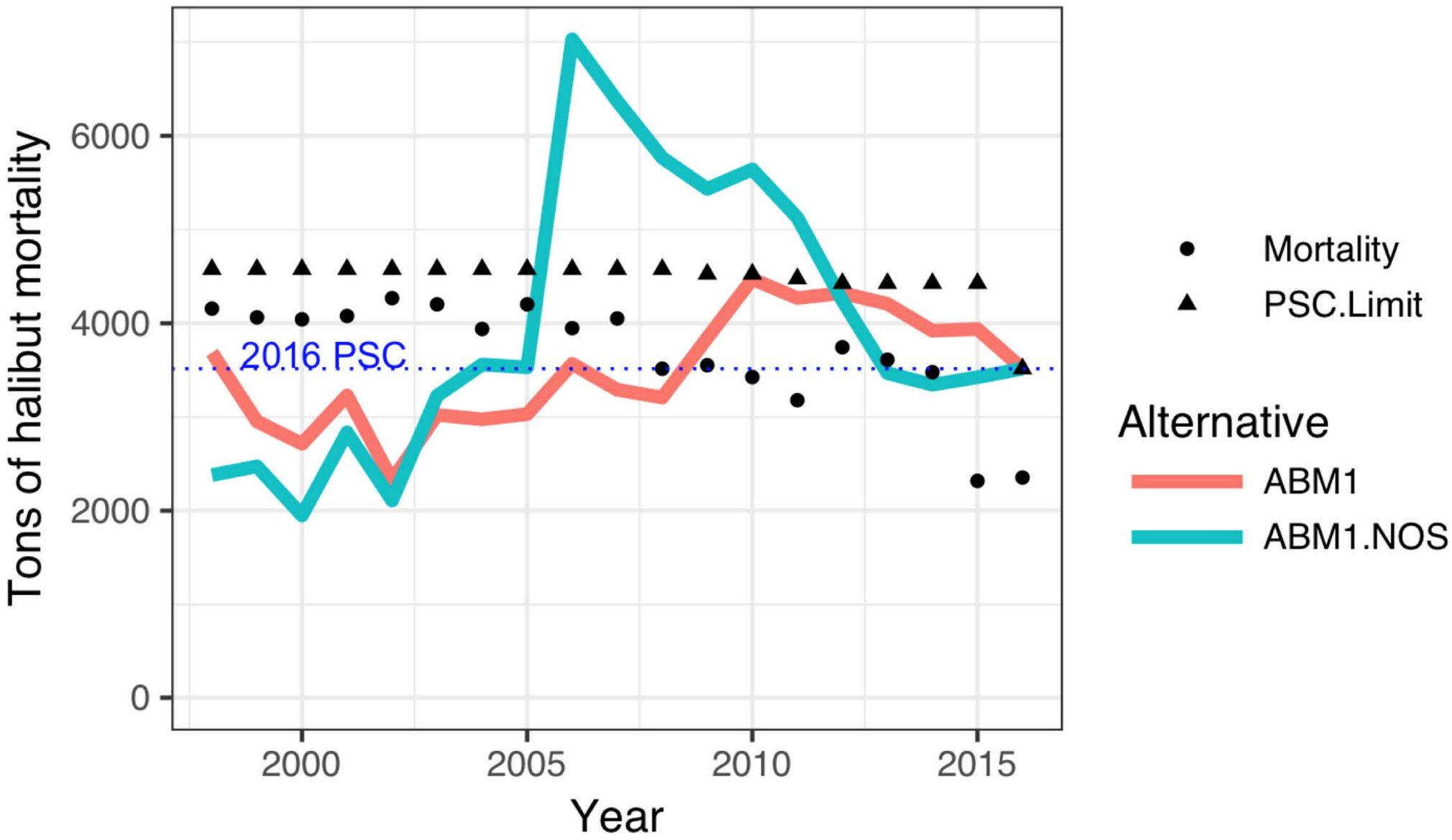
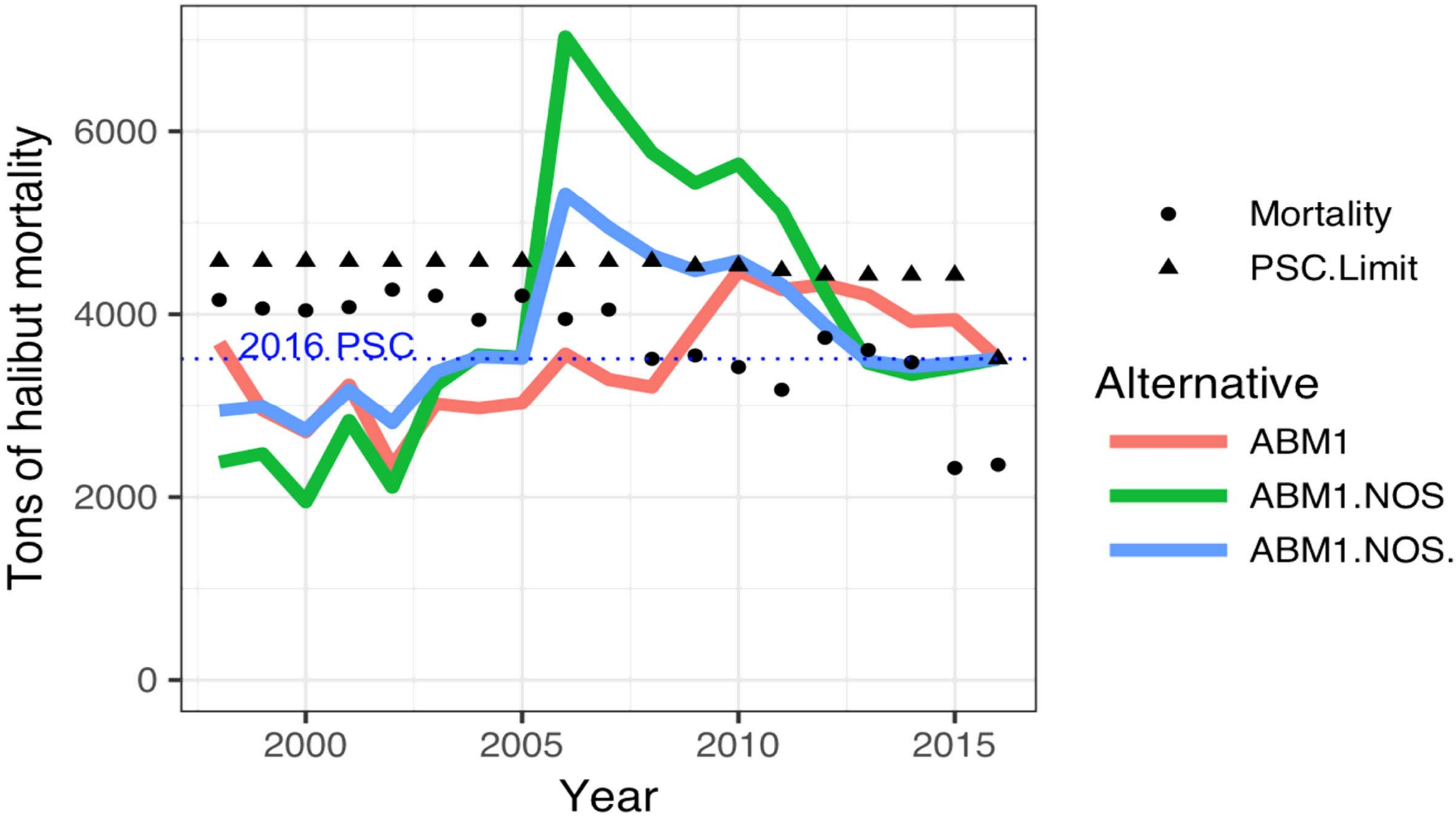


Figure 46. PSC limits from ABM1 and sensitivities as outlined in Table 25. ABM1.LOV is specified to have lower responsiveness to the index (lower variability) whereas ABM1.HIV is specified to be highly responsive to the trawl survey index.


Tons of halibut mortality
6000
4000
2000
0
2016 PSC
2000
2005
2010
2015
Year
Mortality
PSC.Limit
Alternative
ABM1
ABM1.NOS


Tons of halibut mortality
6000
4000
2000
0
2016 PSC
2000
2005
2010
2015
Year
Mortality
PSC.Limit
Alternative
ABM1
ABM1.NOS
ABM1.NOS.I

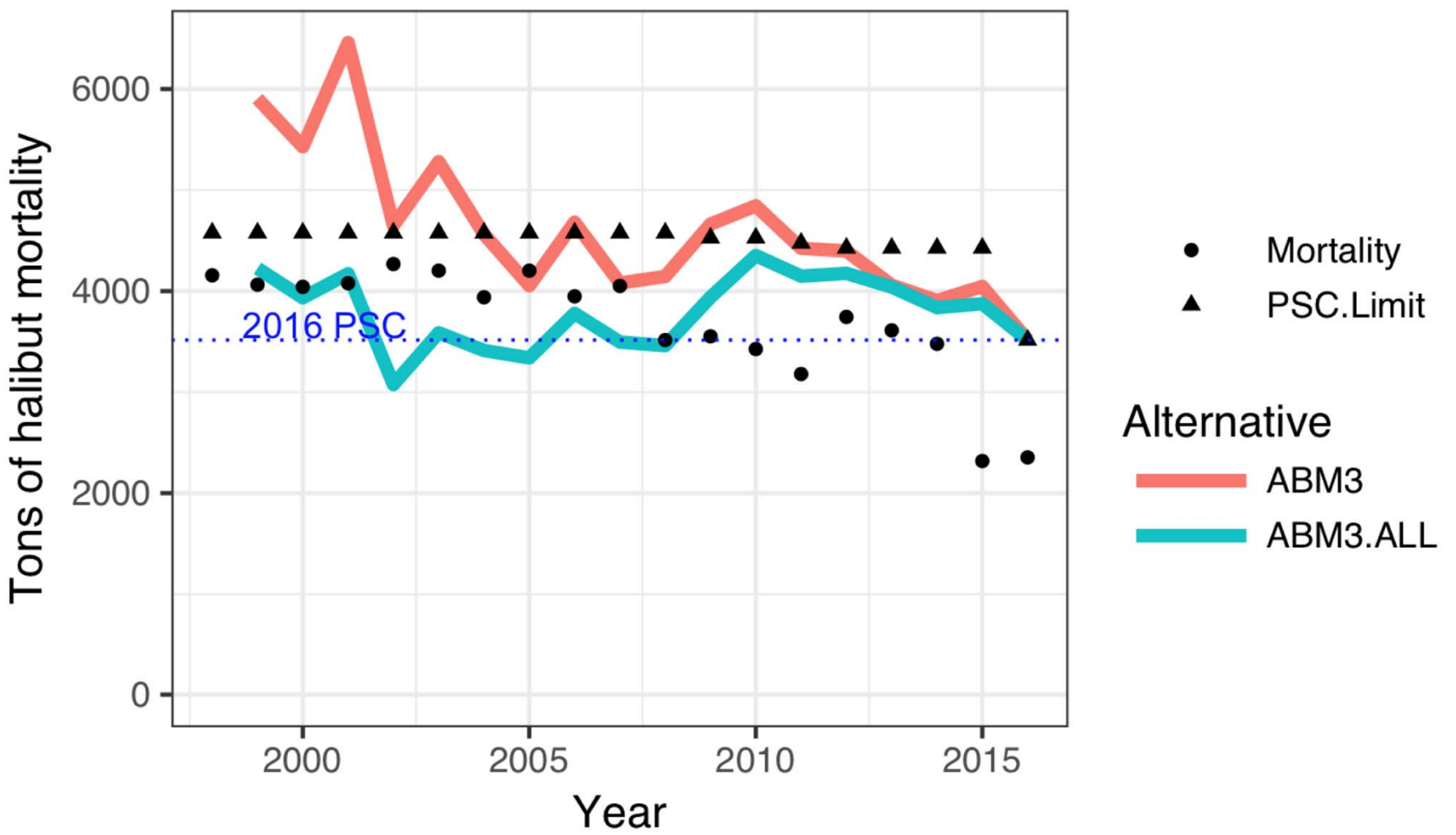


Figure 48. PSC limits from ABM3 and sensitivities as outlined in Table 25. ABM3.ALL is specified to have the same weight between the trawl and longline survey indices as the relative allocation between trawl and longline PSC (roughly 80:20).

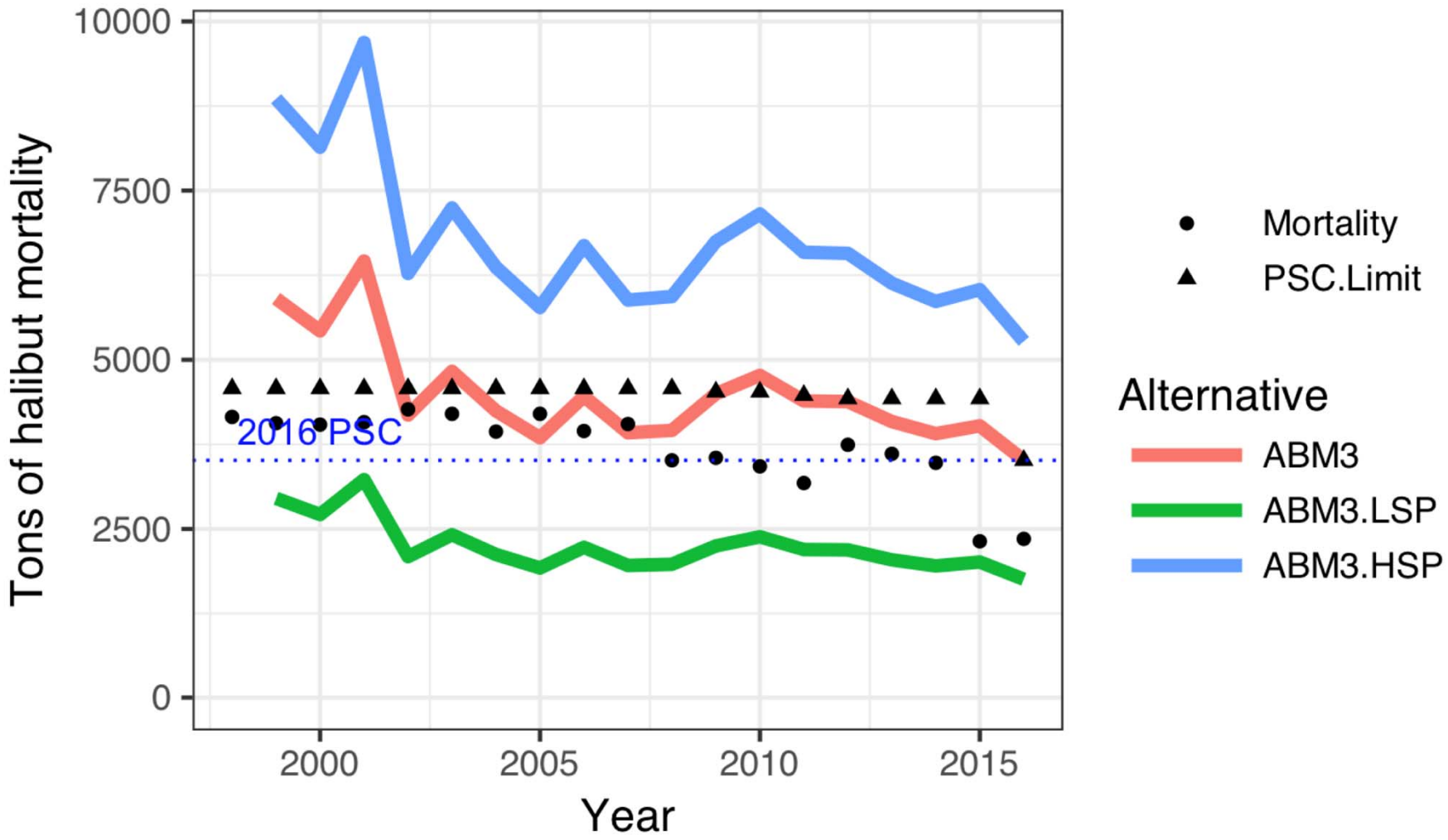


Figure 49. PSC limits from ABM3 and sensitivities as outlined in Table 25. ABM3.LSP is specified to have a low starting point (50% of the current) and ABM3.HSP has a starting point of 50% higher than the current.

Table 26. PSC limits for ABM1 (EBS trawl survey as the index) apportioned by sector given the current rates. Top section (2008-2016) is with the current PSC limit as the "starting point" whereas the middle and bottom sections are for low and high starting point values. Values in parenthesis is the percentage above (or below if negative) the putative PSC limit given current Pacific halibut mortality estimates shown in Table 3.

Current, starting point = 3,515 t	**Total**	**Am80**	**BSAI TLA**	**LL**	**CDQ**
2008	3,207 (10%)	1,592 (17%)	680 (23%)	648 (-8%)	287 (-25%)
2009	3,844 (-8%)	1,908 (4%)	815 (0%)	777 (-23%)	345 (-55%)
2010	4,472 (-23%)	2,220 (-3%)	948 (-38%)	903 (-42%)	401 (-60%)
2011	4,269 (-26%)	2,119 (-19%)	905 (-21%)	862 (-42%)	383 (-36%)
2012	4,322 (-13%)	2,146 (-12%)	916 (10%)	873 (-35%)	387 (-30%)
2013	4,208 (-14%)	2,089 (0%)	892 (-12%)	850 (-45%)	377 (-29%)
2014	3,920 (-11%)	1,946 (8%)	831 (-14%)	792 (-48%)	351 (-30%)
2015	3,939 (-41%)	1,955 (-30%)	835 (-37%)	796 (-62%)	353 (-63%)
2016	3,515 (-33%)	1,745 (-24%)	745 (-13%)	710 (-72%)	315 (-45%)

Low, starting point = 1,758 t	**Total**	**Am80**	**BSAI TLA**	**LL**	**CDQ**
2008	1,604 (119%)	796 (135%)	340 (147%)	324 (83%)	144 (50%)
2009	1,922 (85%)	954 (108%)	407 (100%)	388 (54%)	172 (-10%)
2010	2,236 (53%)	1,110 (94%)	474 (23%)	452 (16%)	200 (-19%)
2011	2,134 (49%)	1,060 (63%)	452 (58%)	431 (16%)	191 (27%)
2012	2,161 (73%)	1,073 (76%)	458 (121%)	437 (31%)	194 (40%)
2013	2,104 (72%)	1,044 (100%)	446 (76%)	425 (11%)	189 (41%)

Developing alternatives

Decision Points

Element choices

- An outline with options and possibly suboptions for each element

Element 1 Abundance Estimate: SELECT ONE PER ALTERNATIVE	
Option 1. EBS trawl survey	*Choose suboption:* *1) Index in biomass* *2) Index in numbers*
Option 2. IPHC setline survey (O32) in Area 4ABCDE (*no suboptions*)	
Option 3. EBS trawl survey and IPHC setline survey (biomass)	*Choose suboption:* *1) Equal weighting* *2) EBS trawl survey weighted 80:20*
Option 4. Index trawl gear to EBS survey, index fixed gear to IPHC setline survey (*no suboptions*)	

Coordination with IPHC

- Resulting allocation to directed and groundfish fisheries is a combination of the actions of IPHC and NPFMC
- Coordination is very important
- Synchronization of goals and objectives between agencies may also be helpful to identify when conservation measures should be prioritized

Appropriate NEPA document

1. NMFS recommends the Council consider preparing an Environmental Impact Statement (EIS) for proposed action.
2. An EIS is appropriate because:
   - the program could result in comprehensive changes to the management of groundfish fisheries in the BSAI and,
   - the effects of these changes on the human environment are likely to be uncertain and controversial.
3. Preparation of an EIS will not delay Council action on development of the halibut ABM program or its implementation.
4. First step would be publication of a Notice of Intent.

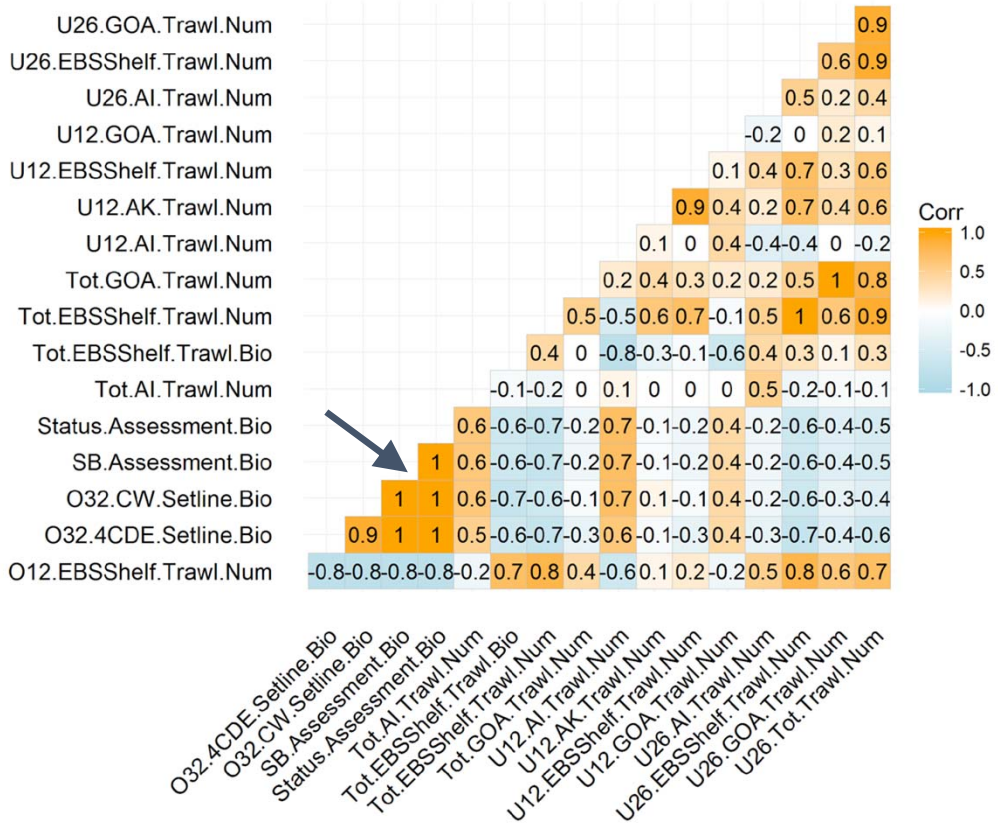
We will help put this puzzle together

http://www.cafepress.com/dd/105331934

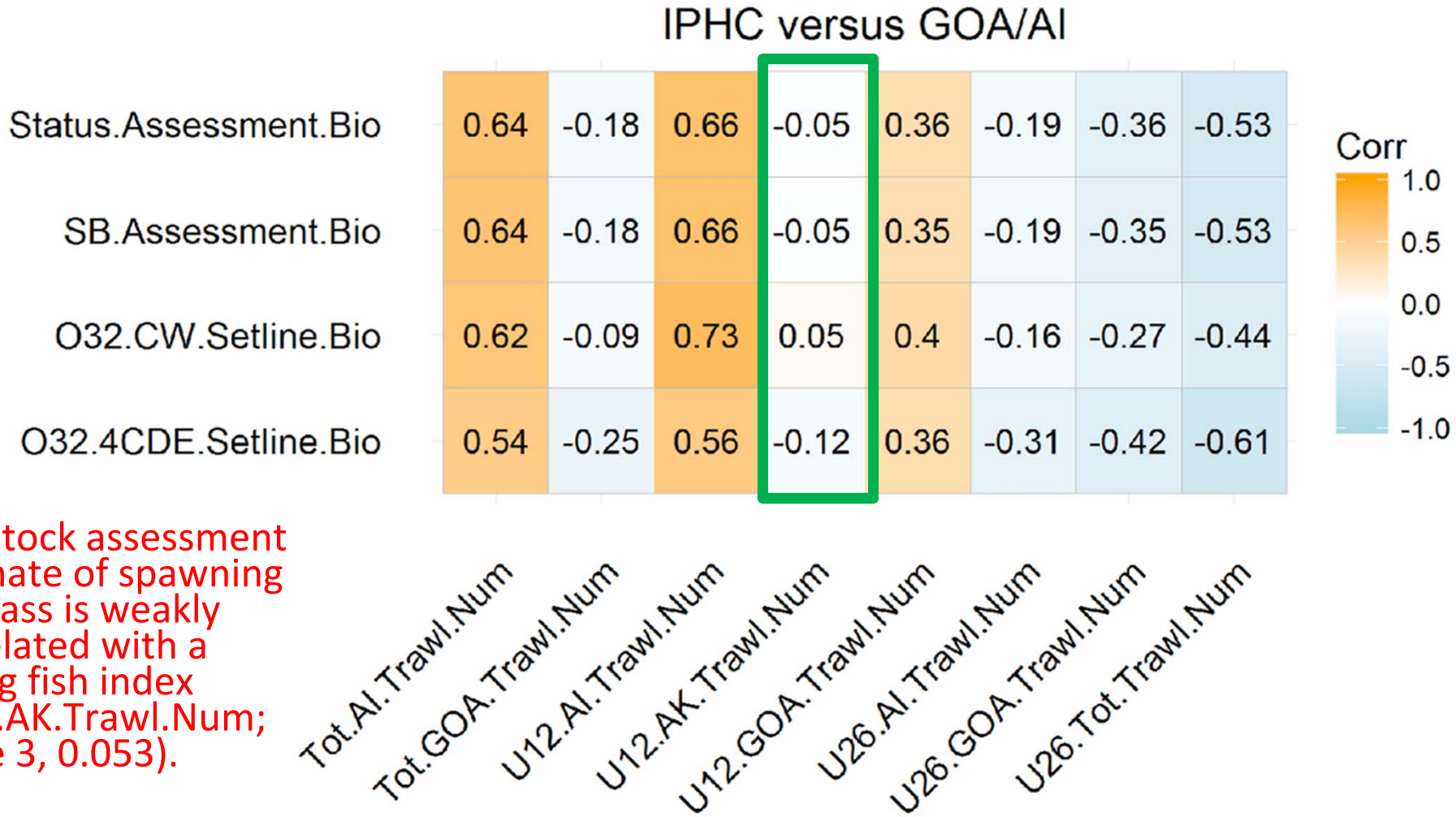
Summary

- Background of IPHC and NPFMC management provided
- Summary of Purpose & Need
- Two indices recommended
  - EBS trawl survey in biomass
  - IPHC setline survey
- Discussion of Control Rules
- Draft alternatives and historical behavior
- A discussion of Incentives
- Decision Points and further action

Correlation between all indices



Correlation between indices



The stock assessment estimate of spawning biomass is weakly correlated with a young fish index (U12.AK.Trawl.Num; Table 3, 0.053).