

Summary of the 2014 stock assessment, apportionment, and catch tables

IPHC Interim Meeting
2 December, 2014

Summary

- Coastwide survey and fishery trends continue to be stable
 - But there are important differences among areas
- Improved ensemble of models for 2014
 - Some new perspective on historical and recent trends
- 2014 results somewhat more optimistic than recent assessments

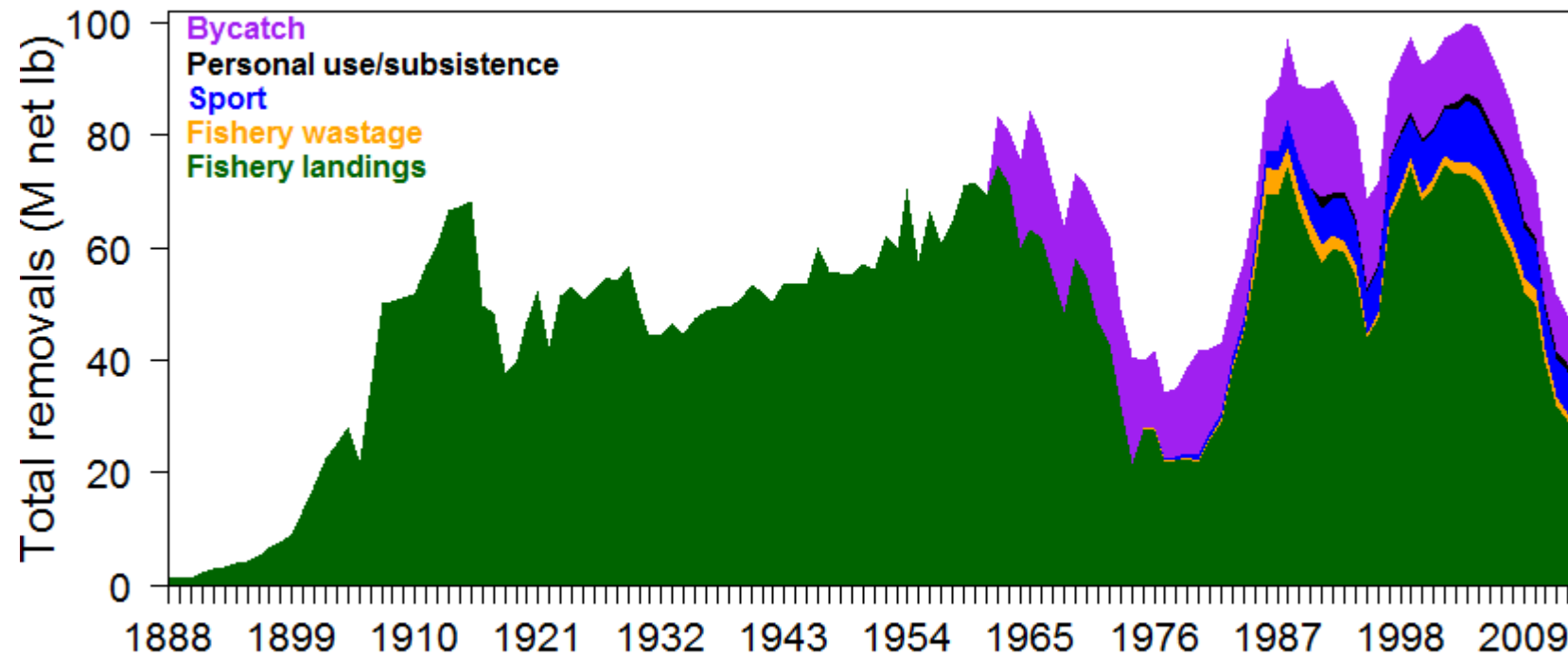


Outline

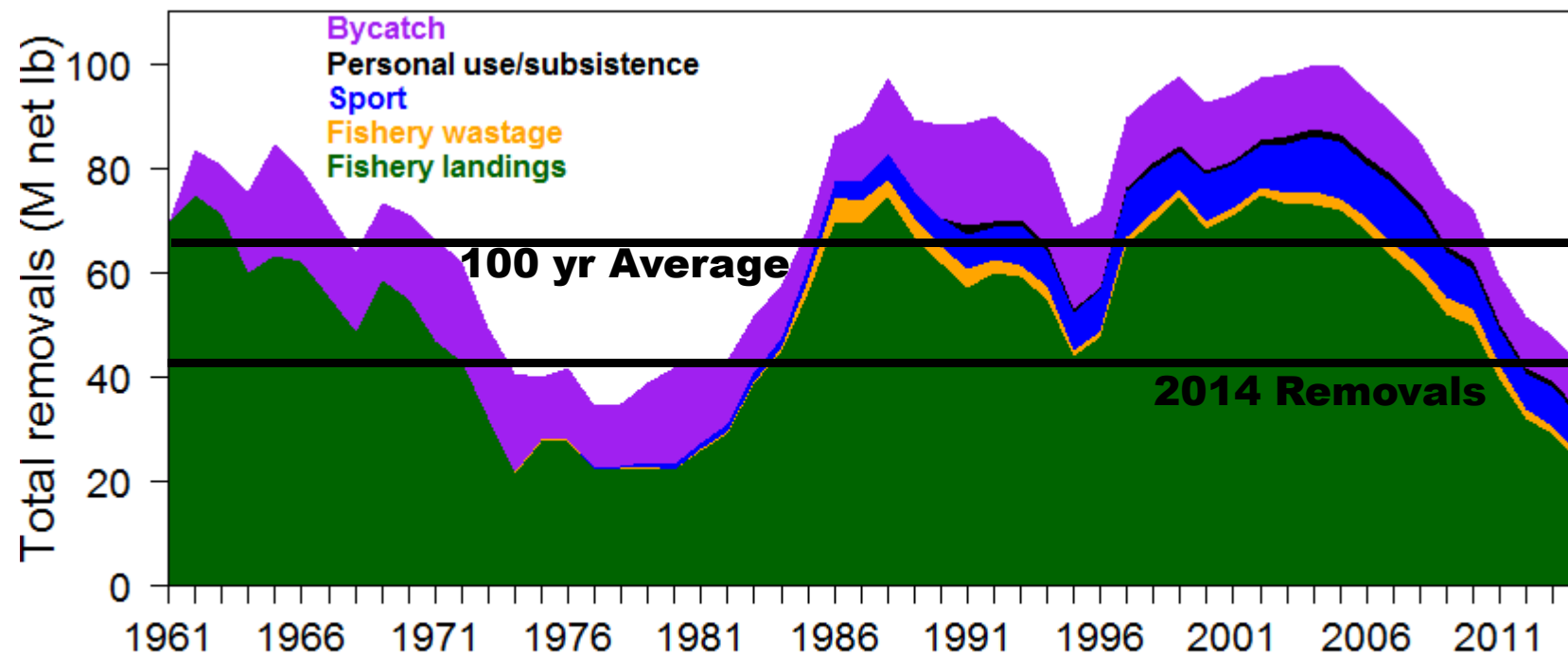
- Data
 - Trends
 - Biology
- Assessment modelling
 - The 2014 ensemble
 - Results
 - Decision table
- Apportionment
- Harvest policy and catch tables



Historical removals



Recent removals



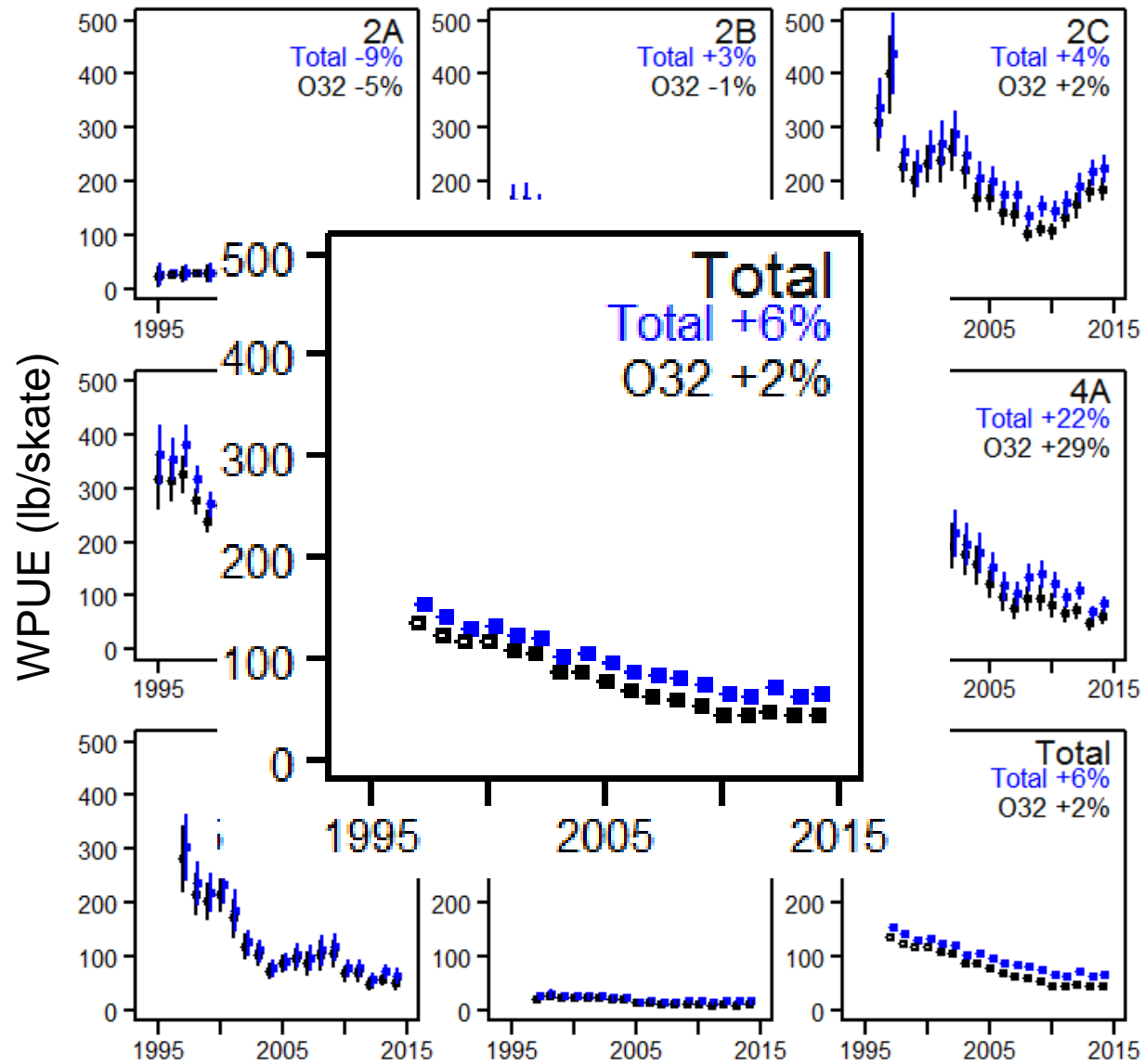
Recent removals (M lb)

Year	Landings	Wastage	Sport	Pers./ Sub.	Bycatch	Total
2010	49.72	3.21	7.85	1.24	10.30	72.36
2011	39.51	2.46	7.10	1.14	9.42	59.64
2012	31.99	1.67	6.77	1.14	10.10	51.67
2013	29.04	1.43	7.59	1.14	8.84	48.04
2014	23.69	1.29	7.08	1.14	9.32	42.51

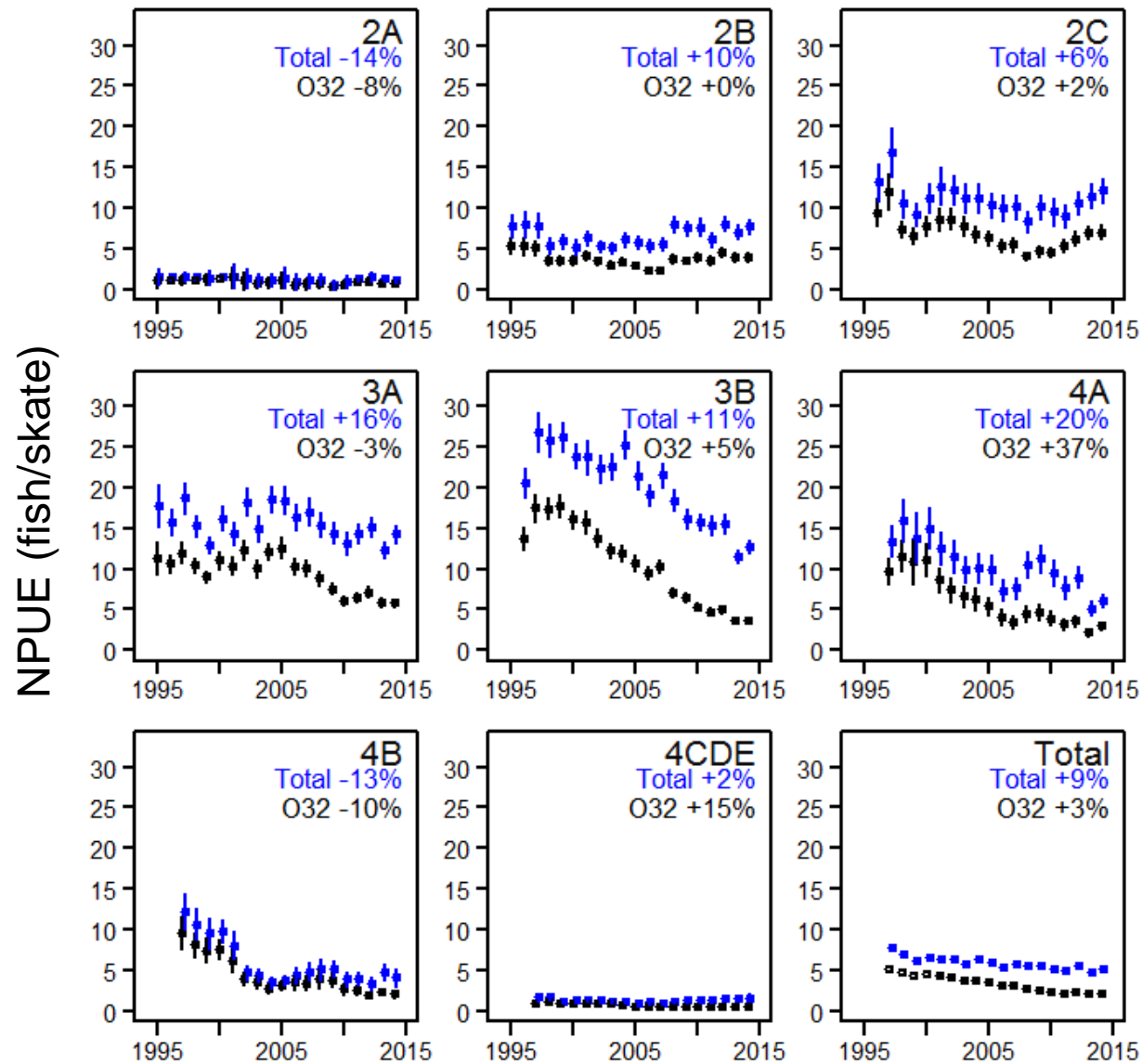
5-yr change: **-52%** **-60%** **-10%** **-8%** **-10%** **-41%**



Survey Weight-Per-Unit-Effort

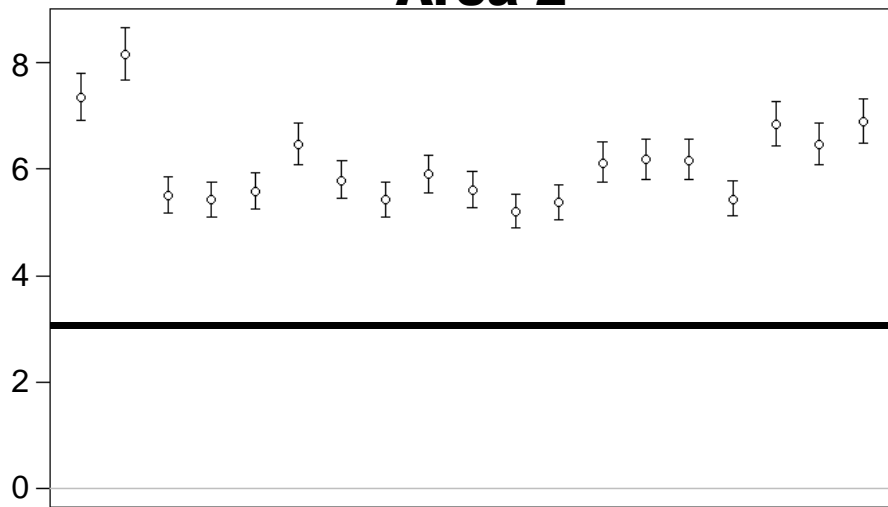


Survey Numbers-Per-Unit-Effort

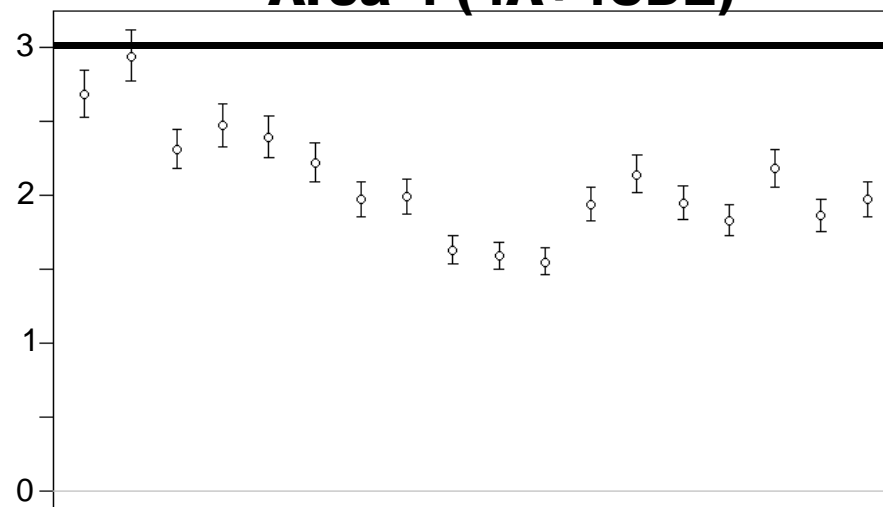


Survey total Numbers-Per-Unit-Effort

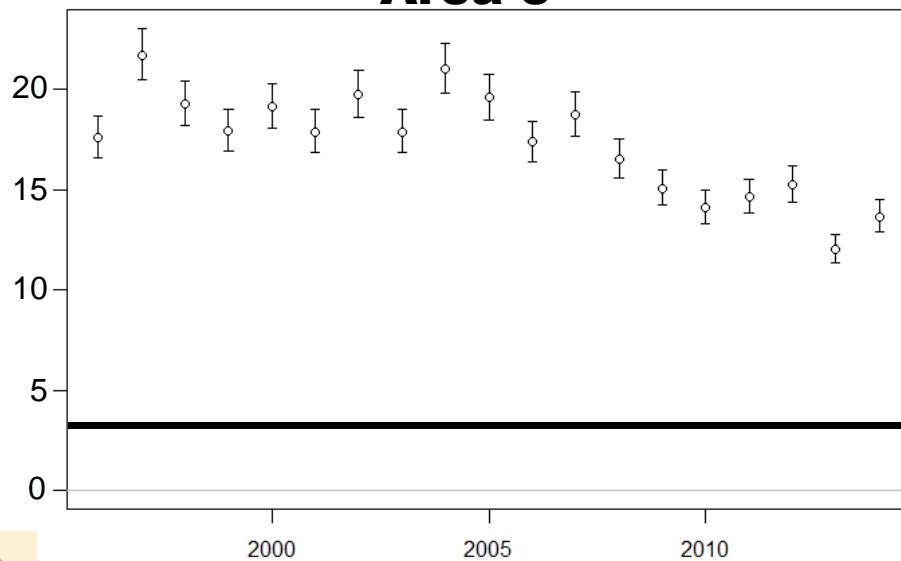
Area 2



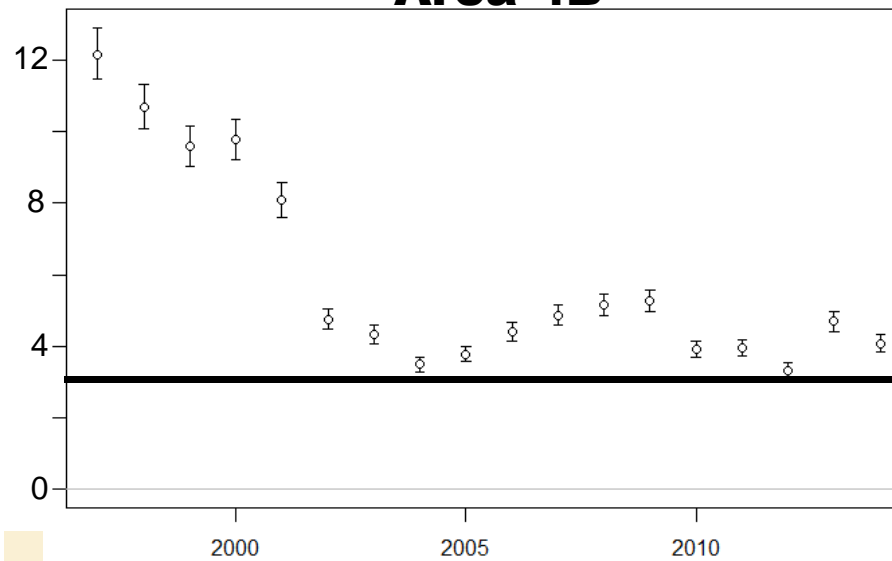
Area 4 (4A+4CDE)



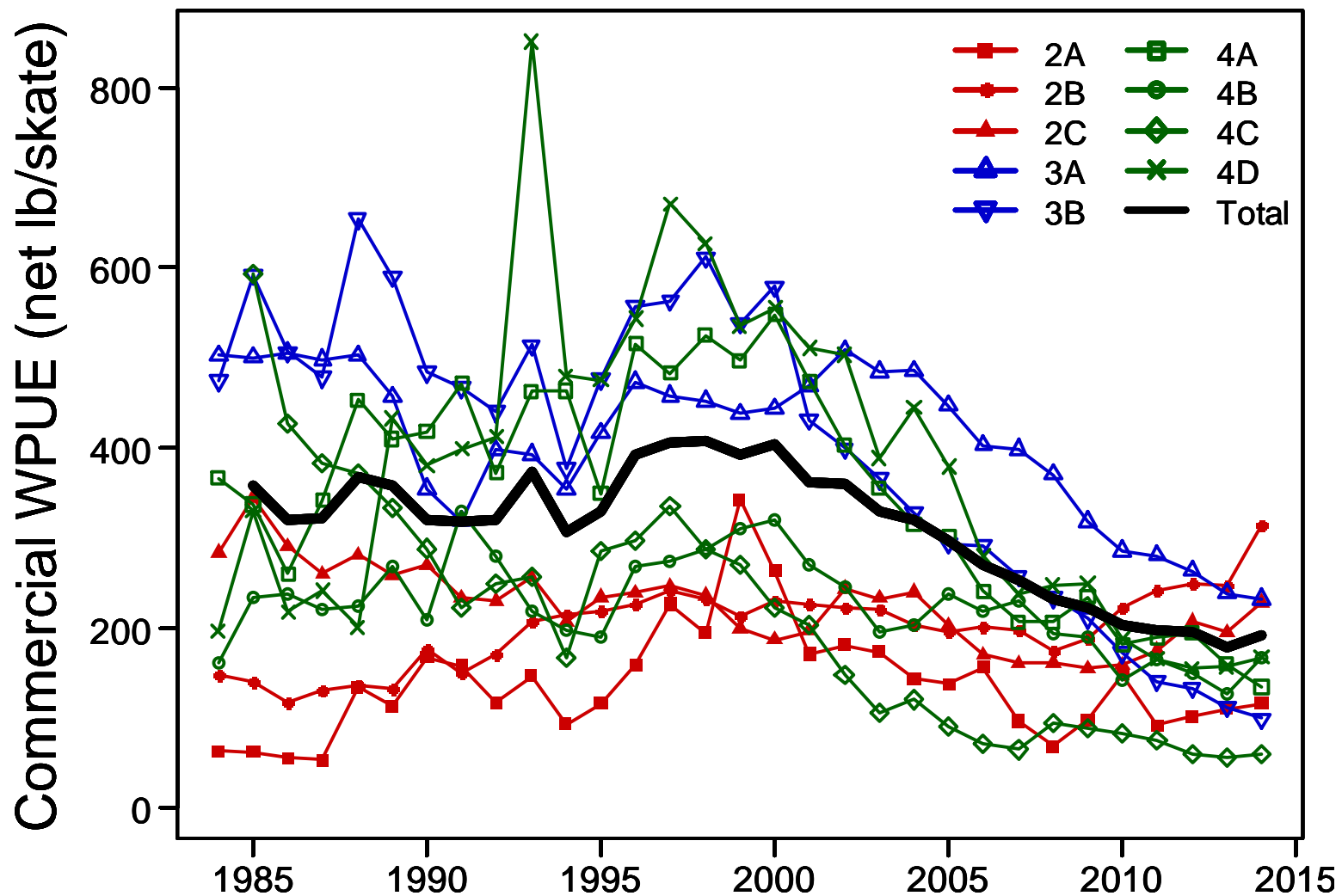
Area 3



Area 4B

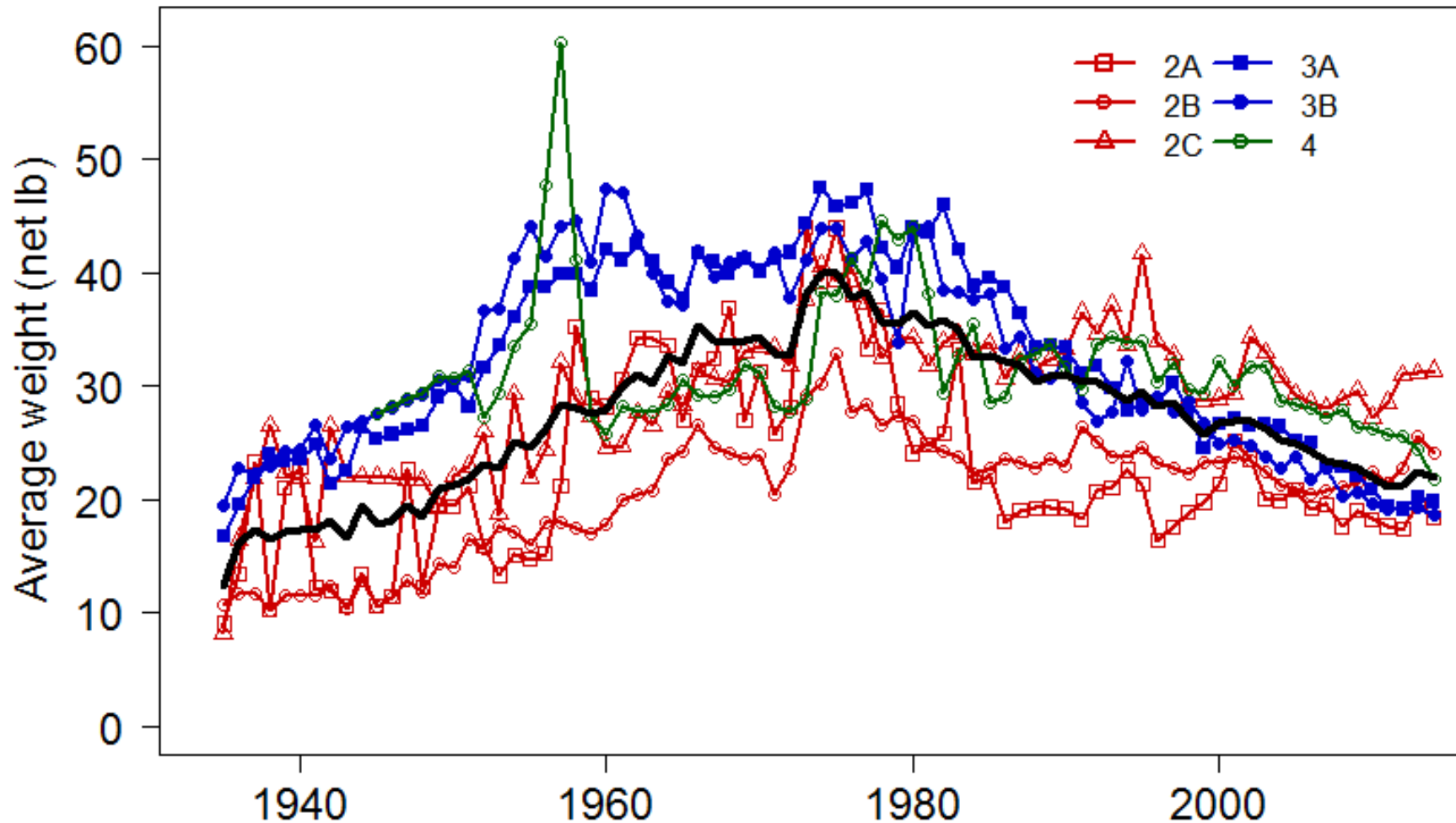


Commercial fishery logbooks

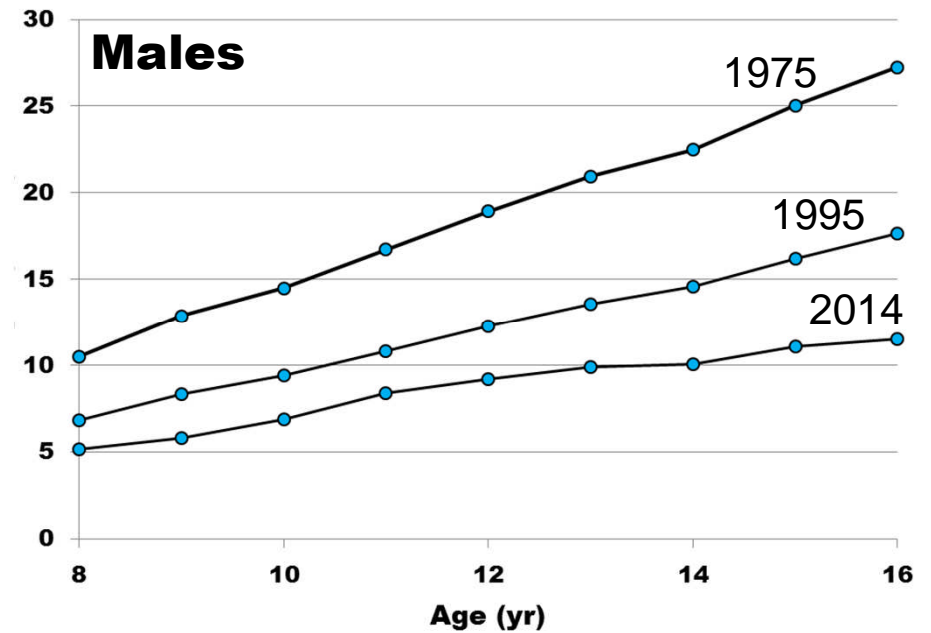
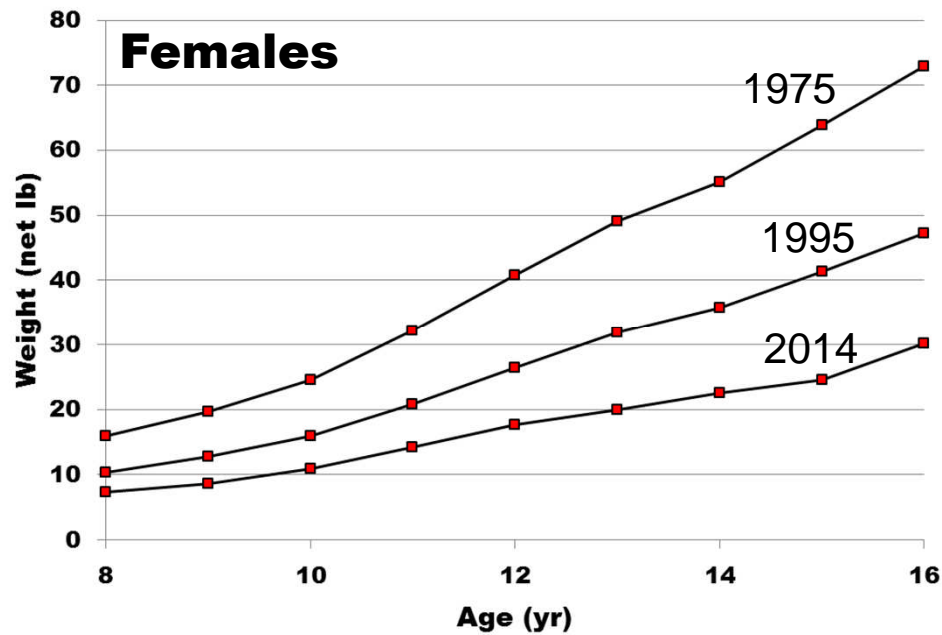


2014 logs are still incomplete and unverified.

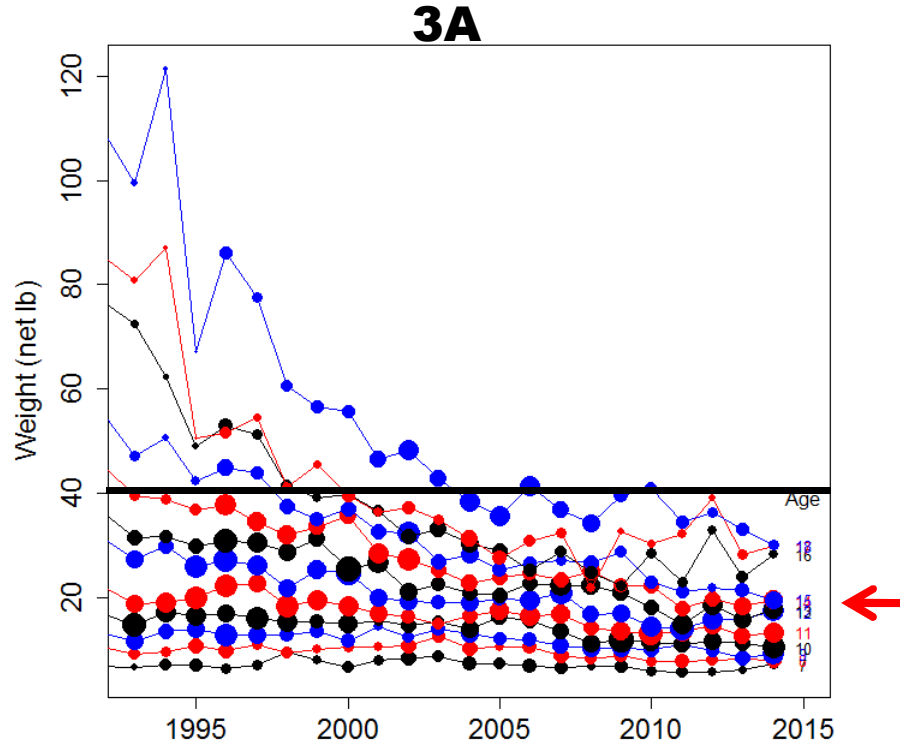
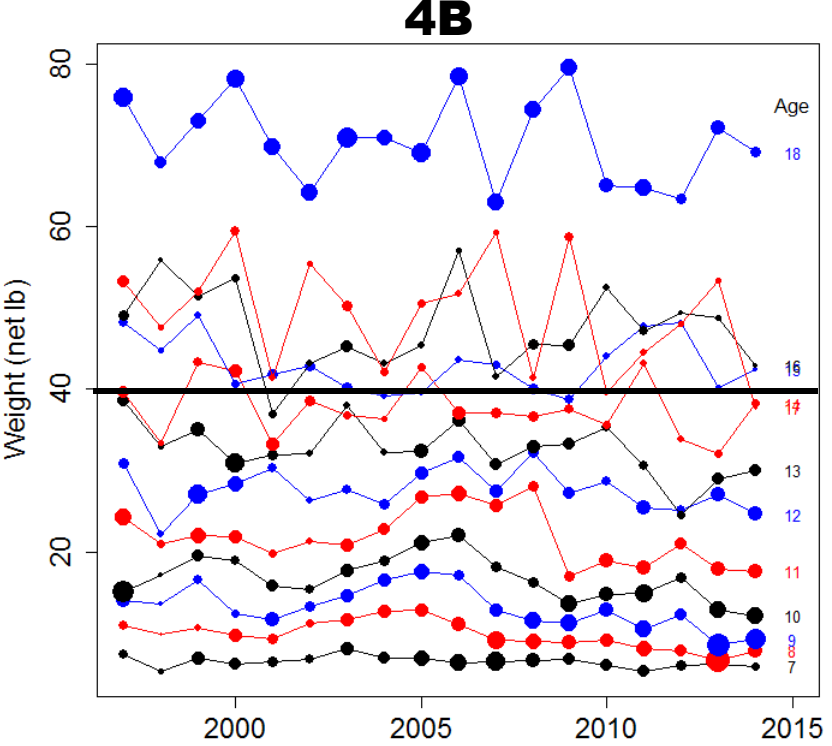
Mean weight in the landings



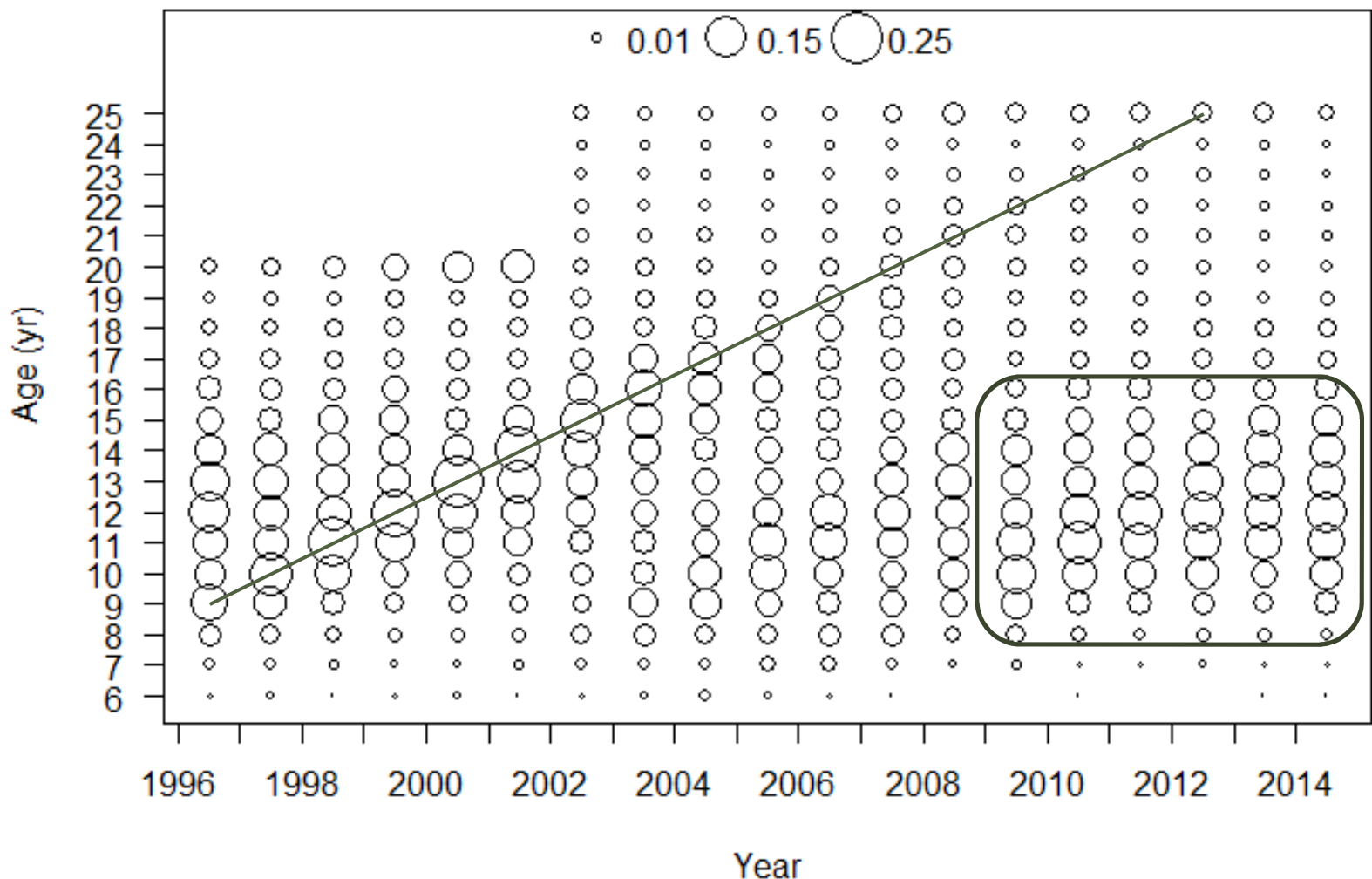
Coastwide mean weight-at-age



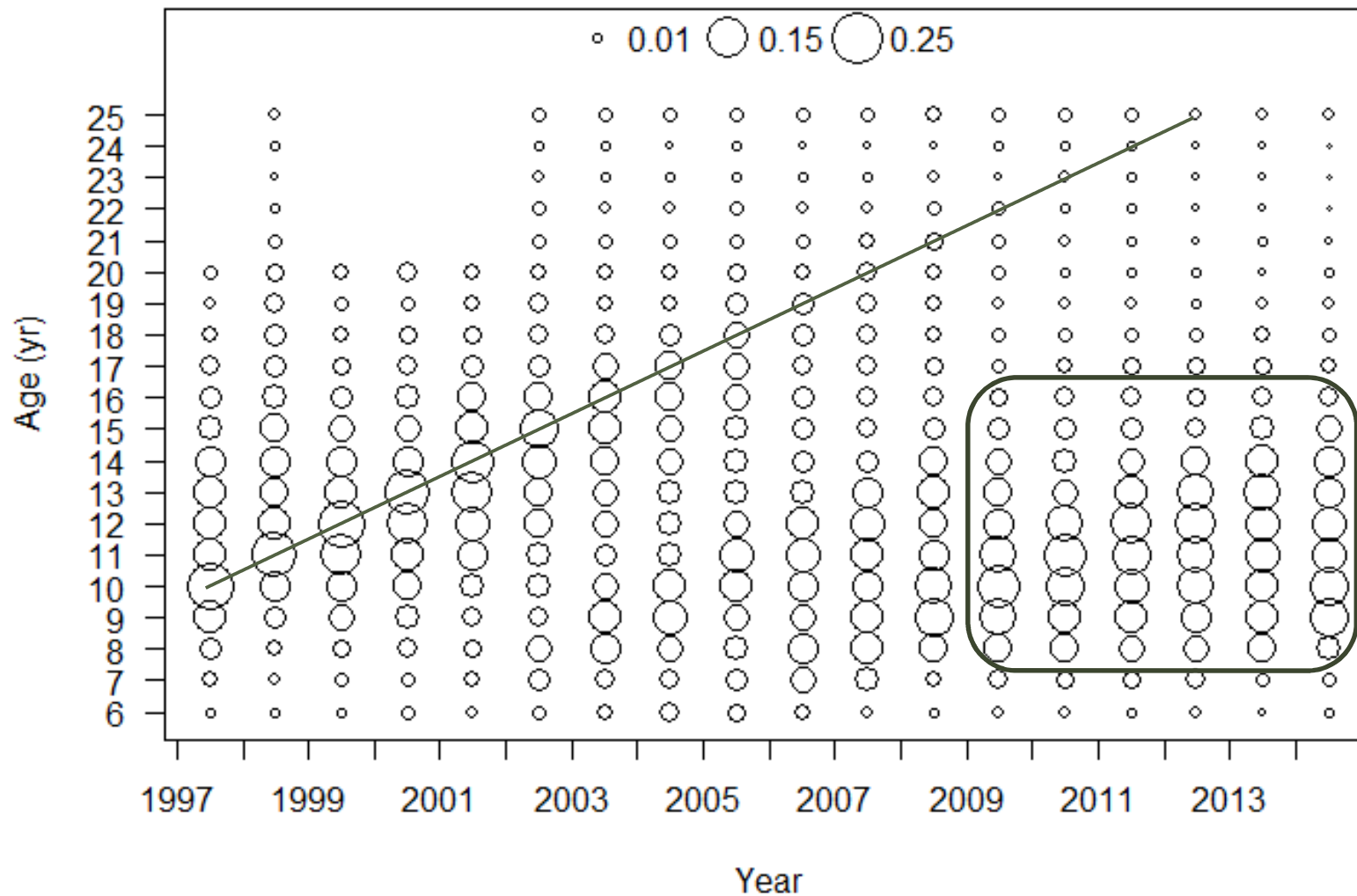
Female weight-at-age trends (survey)



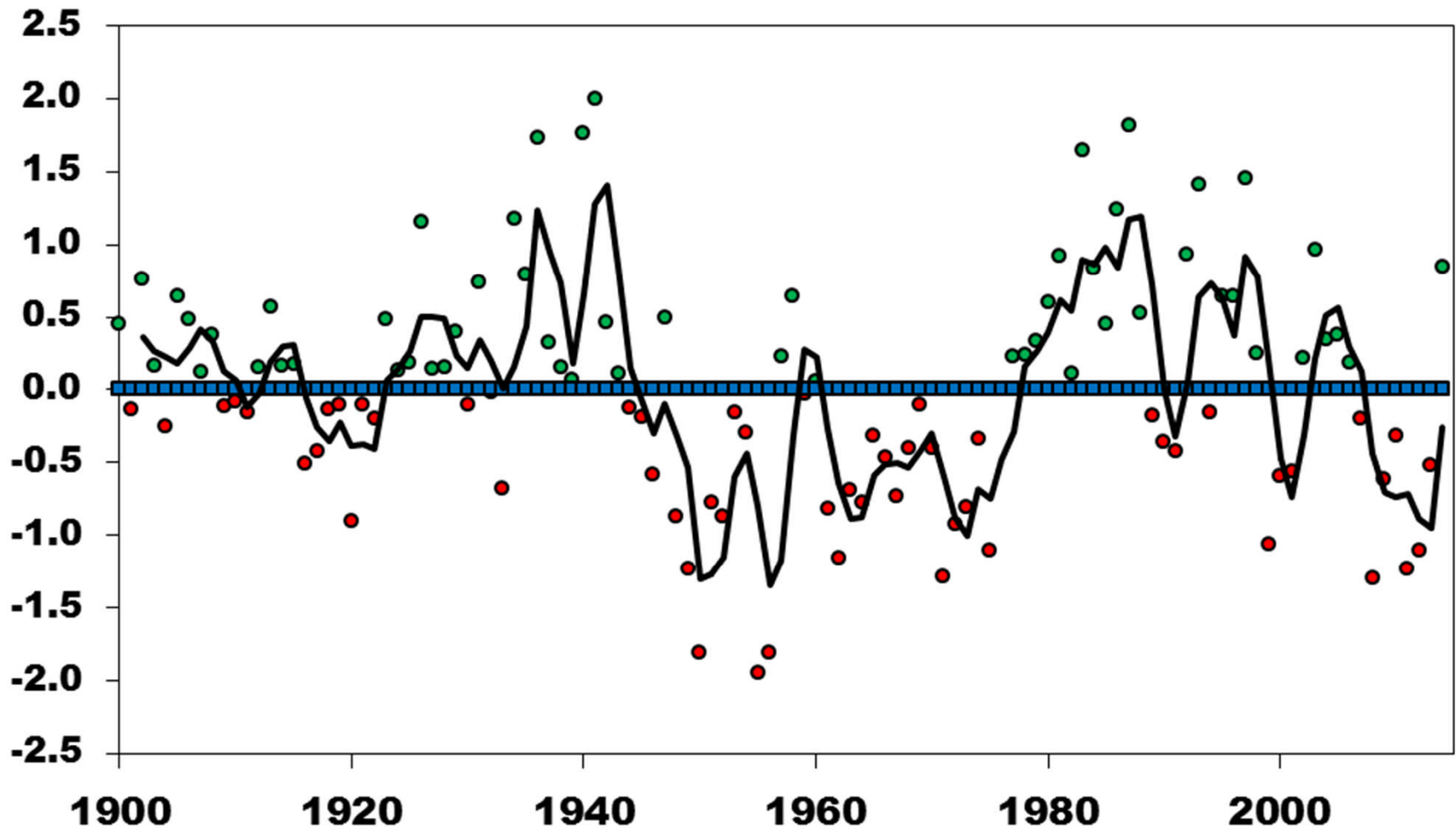
Coastwide fishery ages



Coastwide survey ages



Pacific Decadal Oscillation (PDO) trends



→ 2014 looked productive, but all of the environmental indicators were highly anomalous.



Outline

- Data
 - Trends
 - Biology
- Assessment modelling
 - The 2014 ensemble
 - Results
 - Decision table
- Apportionment
- Harvest policy and catch tables



Ensemble model development

- 2012: Short time-series historical IPHC models with 3 natural mortality levels
- 2013: Long time-series, short time-series (new and old)
 - also included alternative values for natural mortality
- Evaluated during 2014:
 - Long and short time-series models from 2013
 - Virtual Population Analysis (VPA): simple traditional model, many assumptions
 - Simple surplus production model
 - Areas-As-Fleets models: separating fishery and survey data by area (2,3,4,4B)
- Alternatives reviewed by the SRB in October



The 2014 Ensemble: 4 models

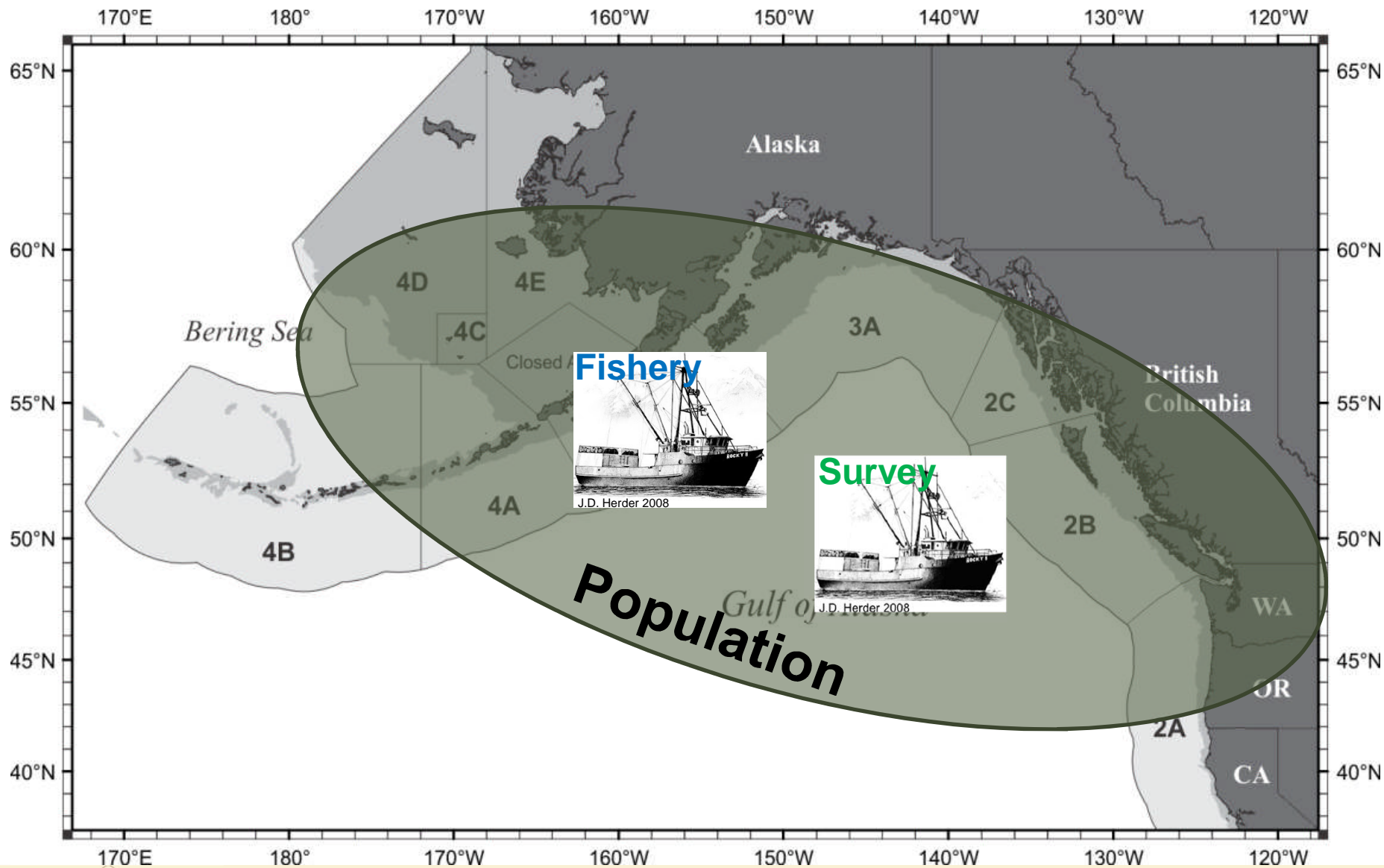
	Coastwide	Areas-As-Fleets
Short time-series (1996+)	X	X
Long time-series	X	X

Corroboration from:

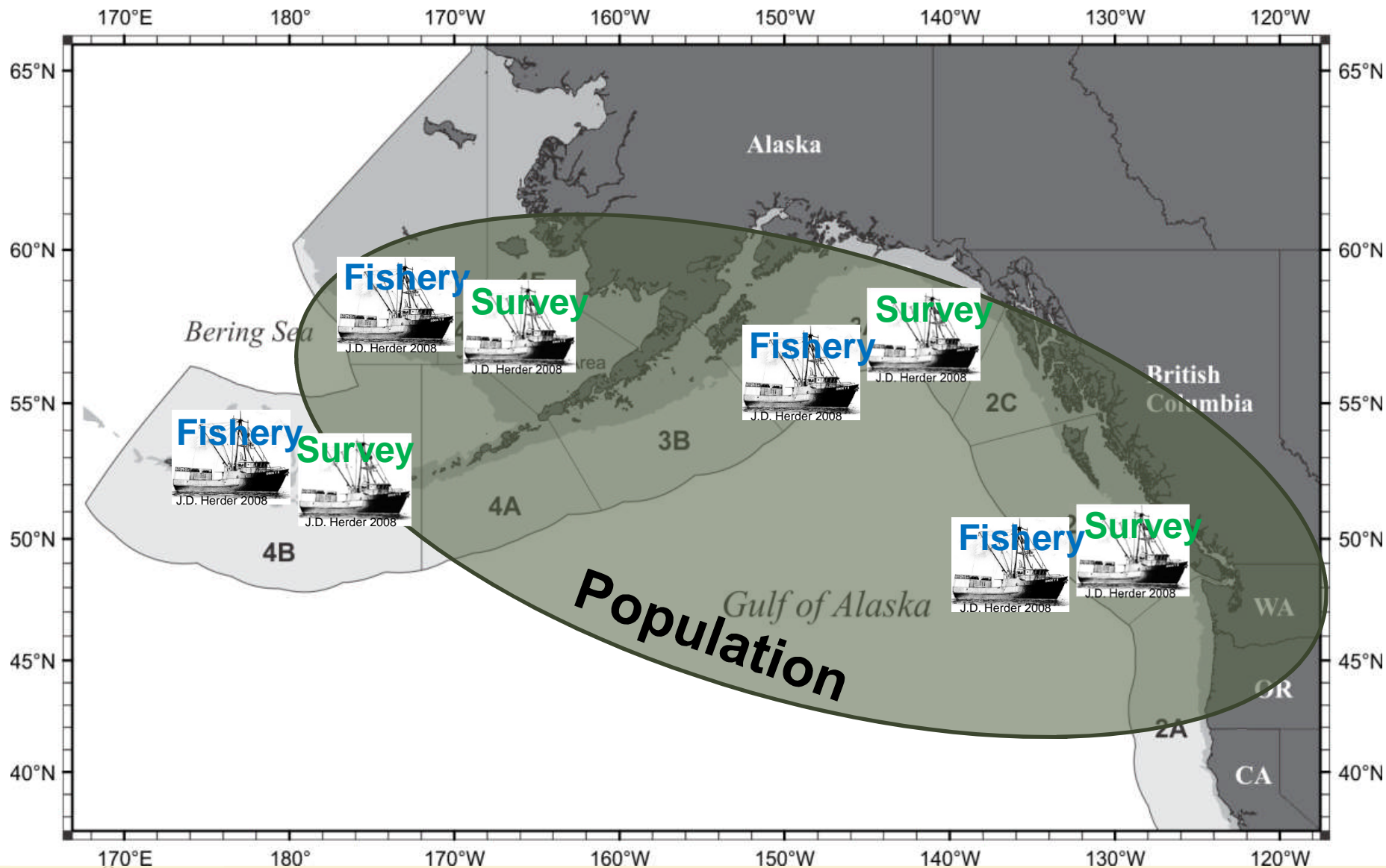
- VPA: similar trends to coastwide models
- Simple surplus production: similar estimate of recent available yield (40-45 Mlb)



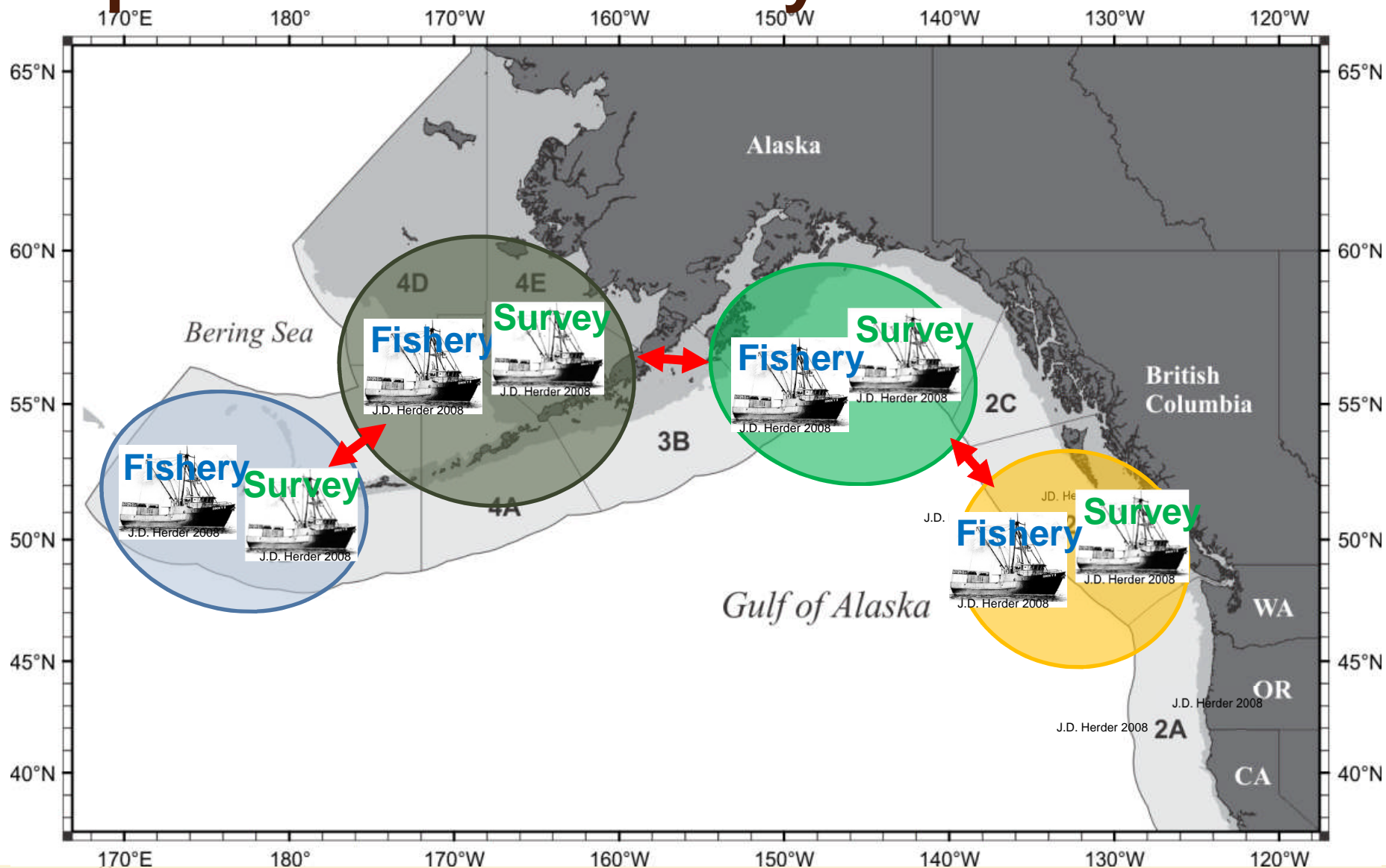
Coastwide models



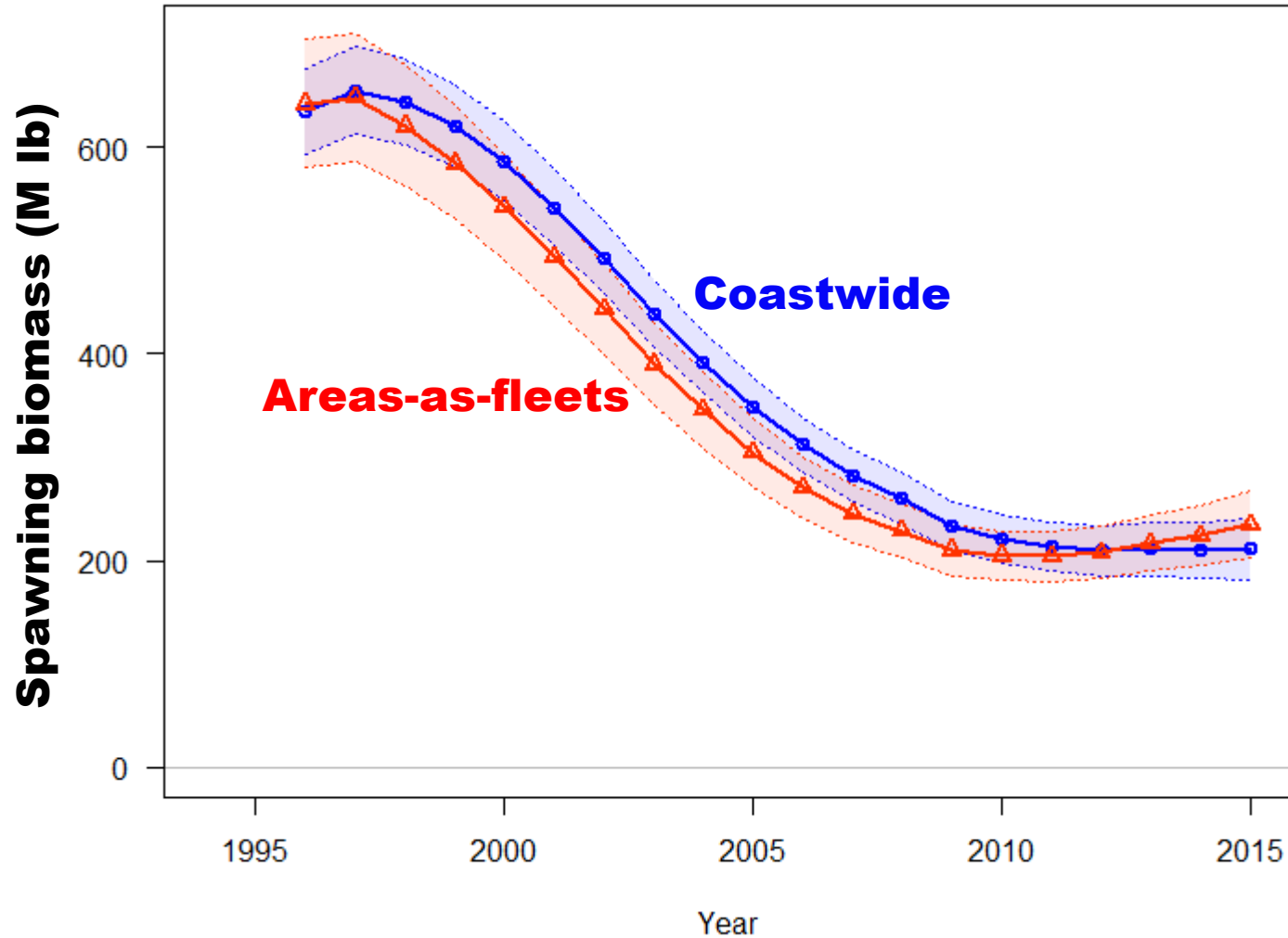
Areas-as-fleets models



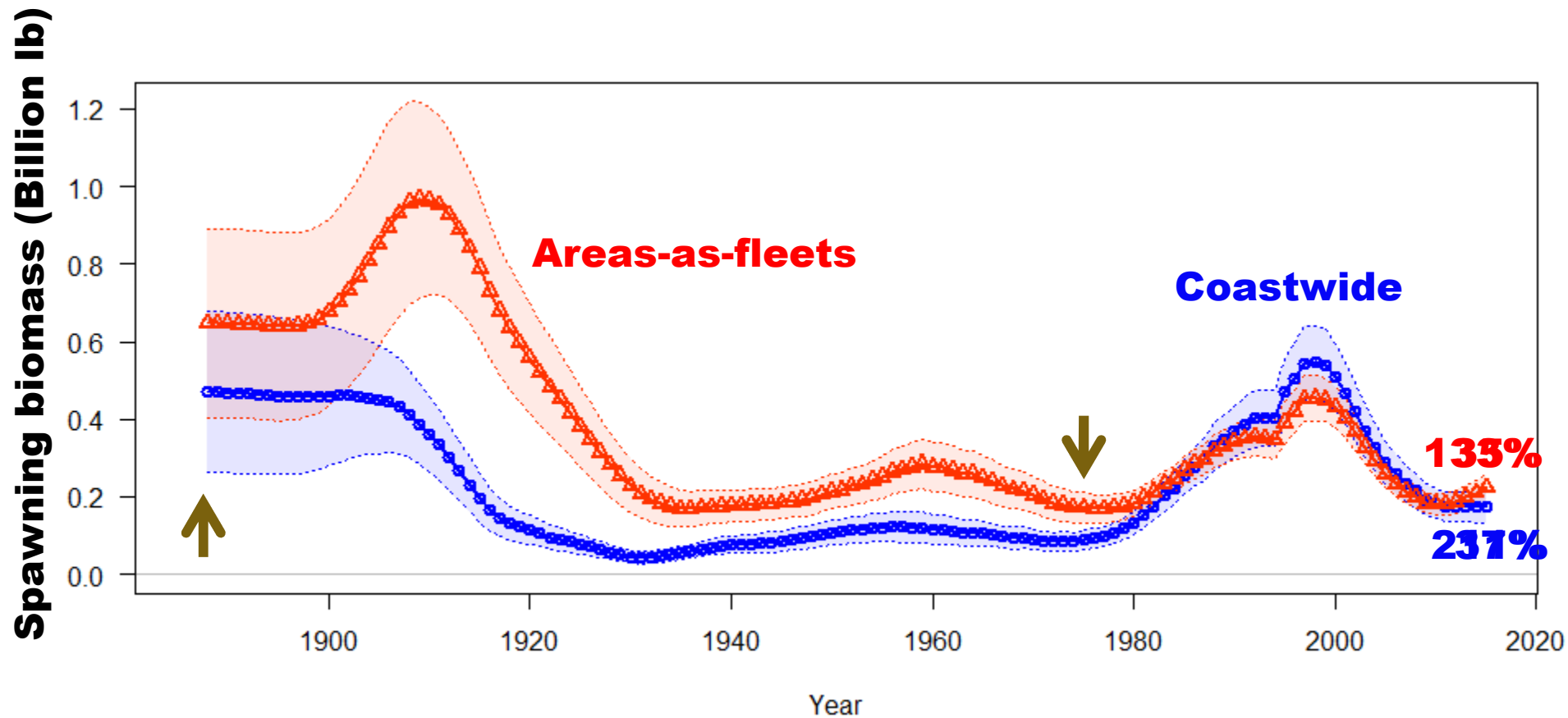
Spatial models – Not yet



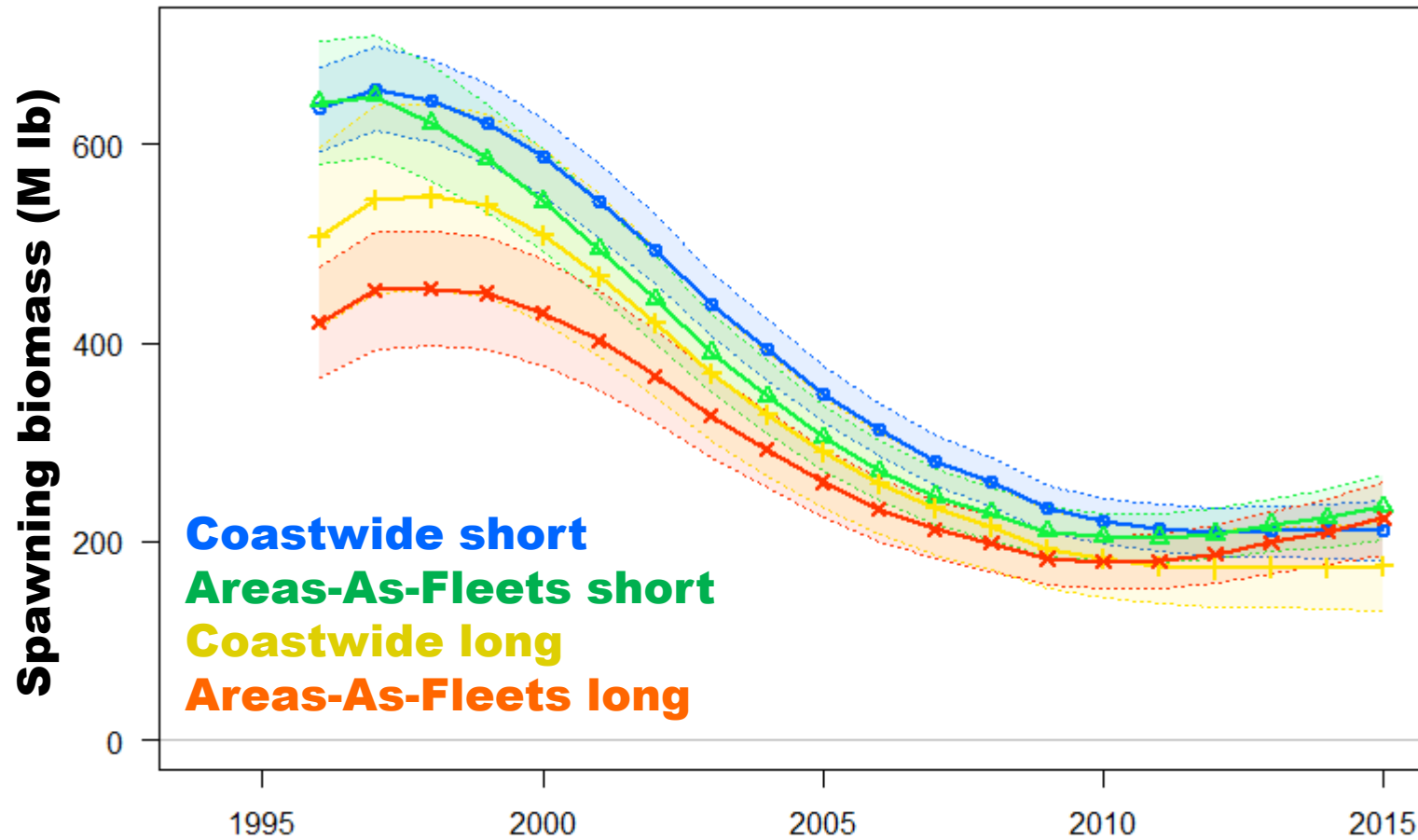
Short time-series comparisons



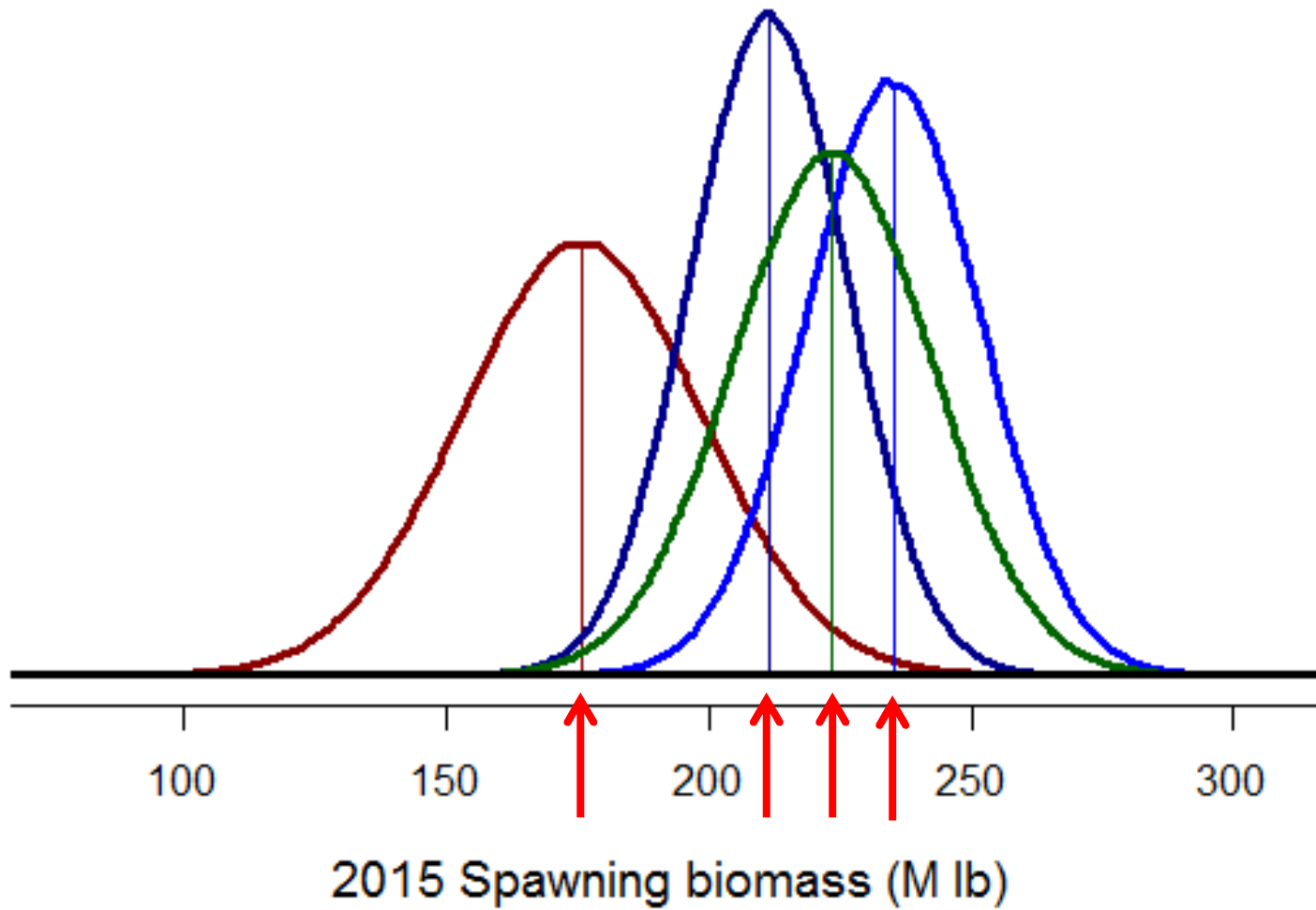
Long time-series comparisons



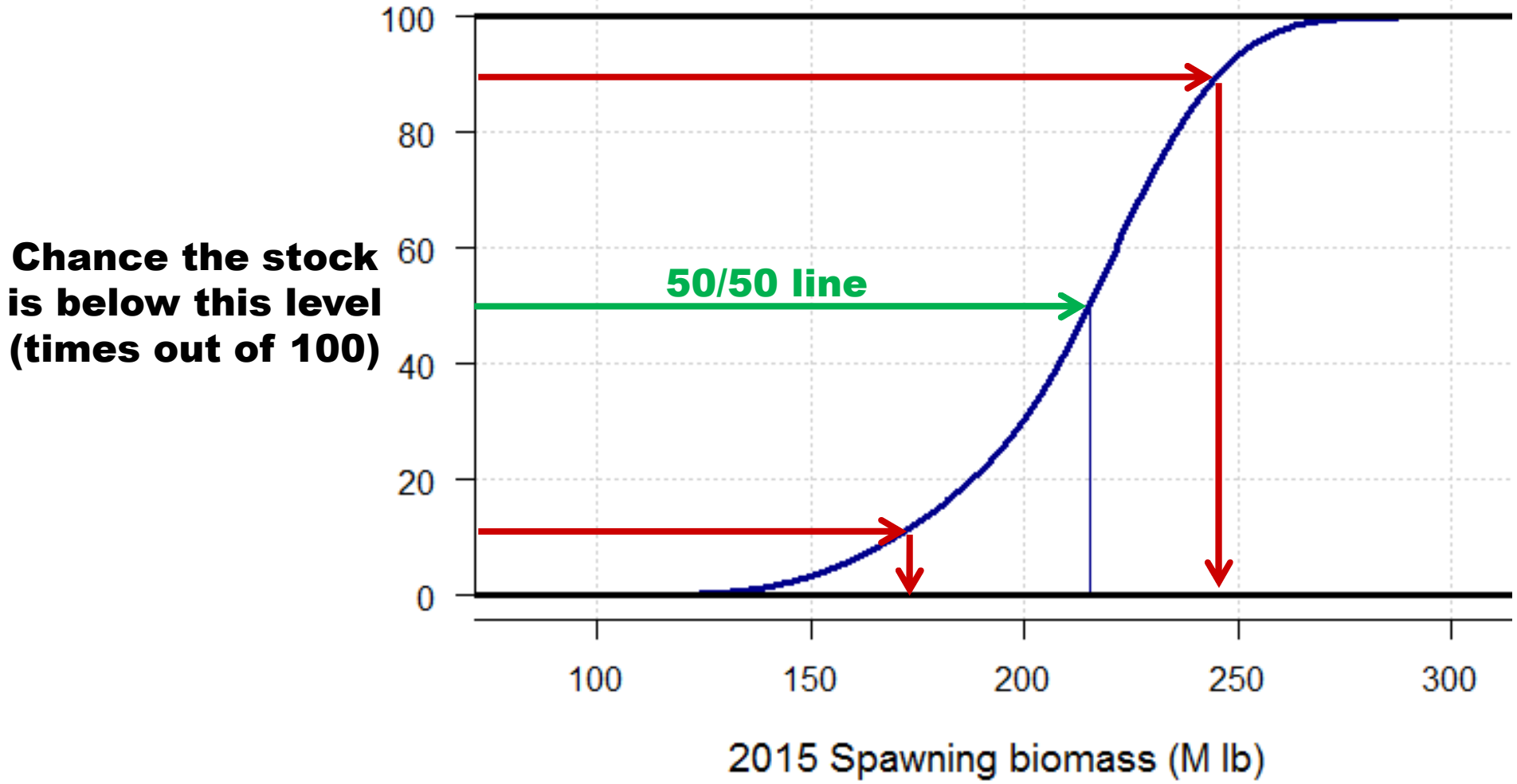
All four models



Why we are using an ensemble



Uncertainty in current stock size

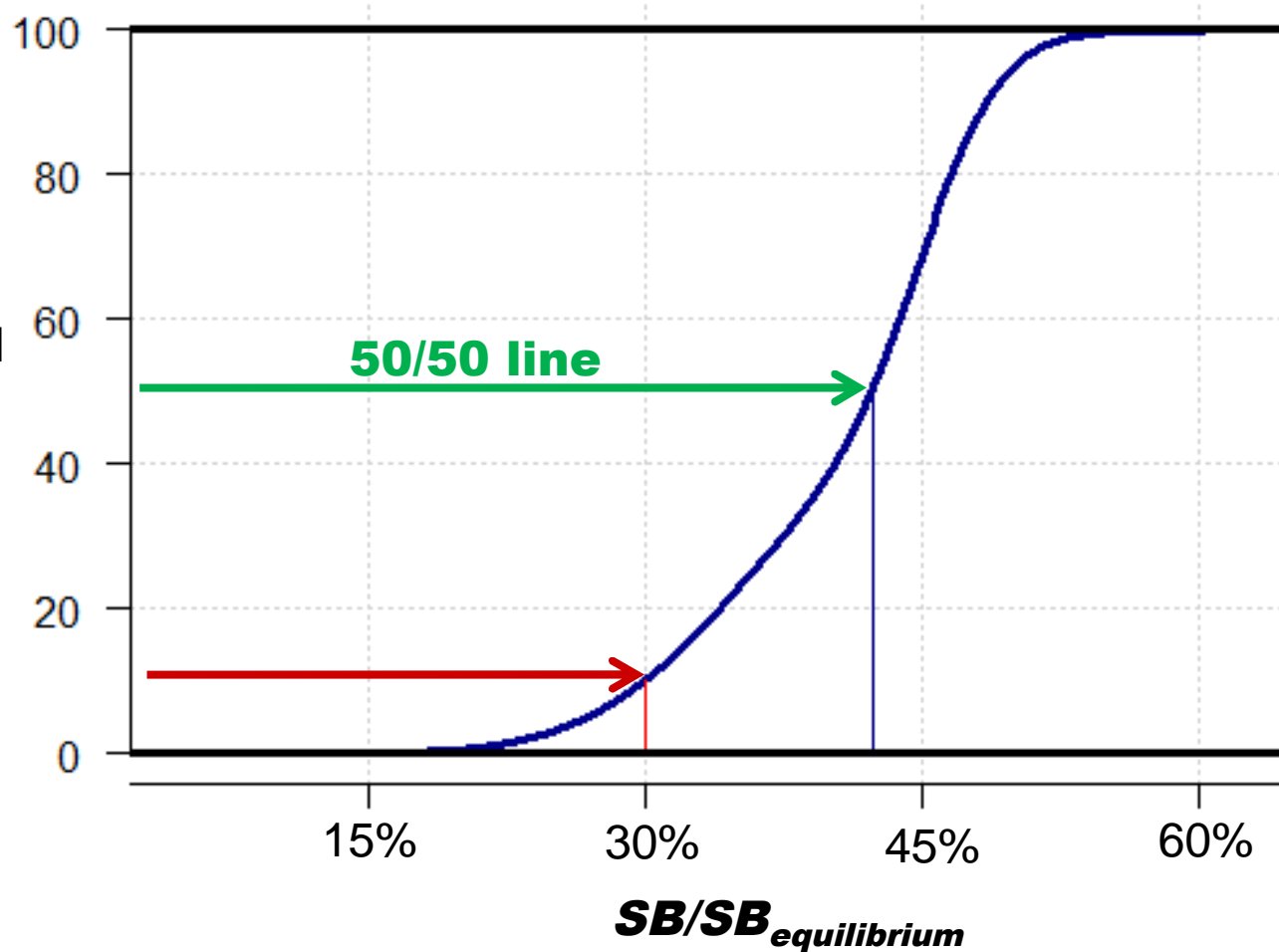


	Last year	This year
2014 Spawning biomass	197 Mlb	209 Mlb



Uncertainty in current stock status

Chance the stock is below this level (times out of 100)



Projections and decision table

- 3 year projections
- Assumes constant catch level
- Alternatives for comparison:
 - No removals
 - FCEY=0
 - 10-60 Mlb, in 10 Mlb increments
 - 2015 Blue Line
 - 2014 *status quo* FCEYs
 - Maintaining 2014 total fishing intensity (SPR)

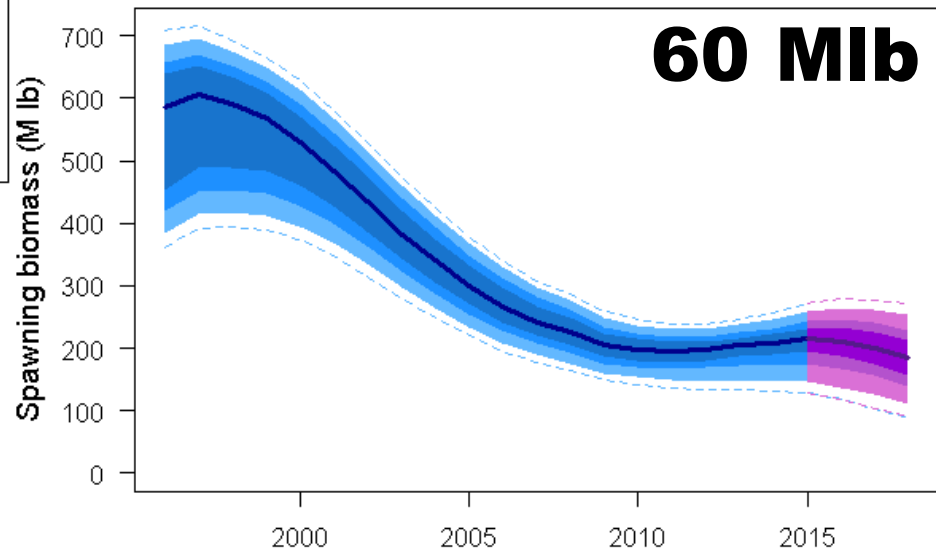
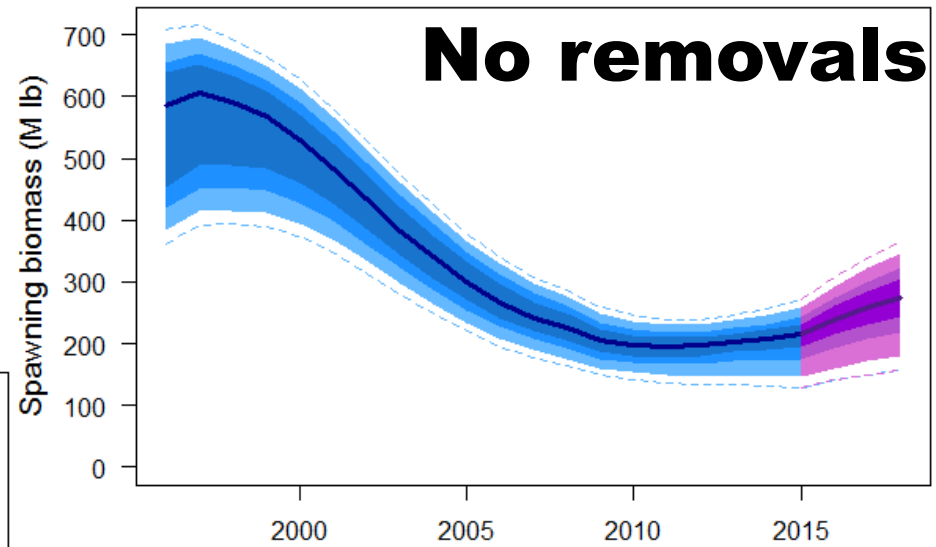
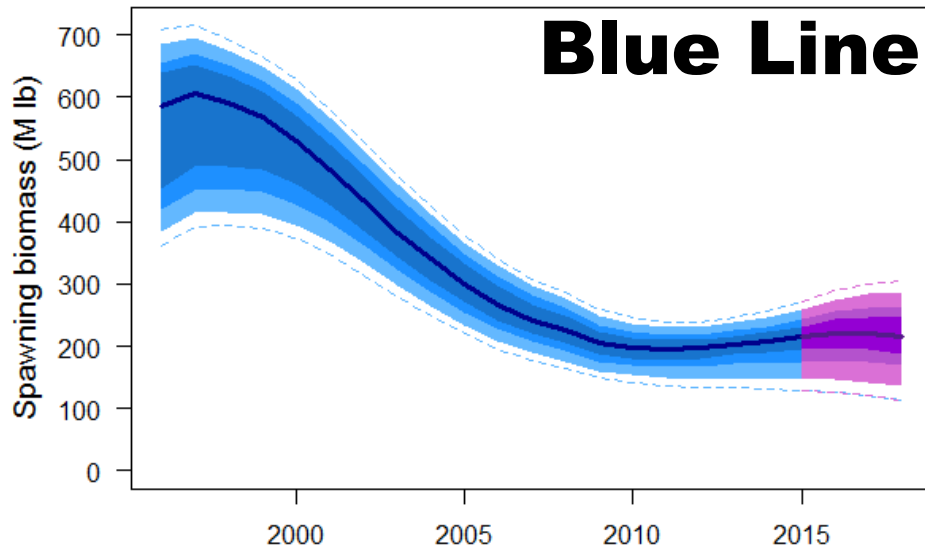


Measuring total fishing intensity

- Spawning Potential Ratio (SPR) measures the equilibrium reduction in spawning biomass per fish for any level of fishing
- Includes all sizes and sources of mortality (not just O26)
- Often reported as $F_{xx\%}$
 - e.g., $F_{35\%}$ is the North Pacific Fishery Management Council's overfishing limit



Projections



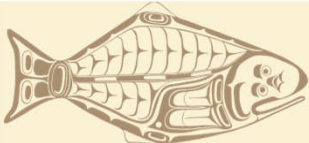
Decision table: Stock trend

	Stock Trend			
	Spawning biomass			
	in 2016		in 2018	
	is less than 2015	is 5% less than 2015	is less than 2015	is 5% less than 2015
Total removals (M lb)	a	b	c	d
0.0	<1/100	<1/100	<1/100	<1/100
13.1	<1/100	<1/100	<1/100	<1/100
20.0	<1/100	<1/100	1/100	<1/100
30.0	3/100	<1/100	17/100	4/100
38.7	19/100	<1/100	40/100	23/100
41.4	26/100	1/100	47/100	30/100
43.3	31/100	1/100	56/100	36/100
50.0	44/100	5/100	75/100	51/100
60.0	65/100	22/100	96/100	82/100



Decision table: Harvest policy

2015 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	Stock Status				Fishery Trend				Fishery Status	
				Spawning biomass				Fishery CEY from the harvest policy				Harvest rate	
				in 2016		in 2018		in 2016		in 2018		in 2015	
				is less than 30%	is less than 20%	is less than 30%	is less than 20%	is less than 2015	is 10% less than 2015	is less than 2015	is 10% less than 2015	is above target	
No removals	0.0	0.0	F _{100%}	5/100	<1/100	1/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100	0/100
FCEY = 0	13.1	0.0	F _{73%}	5/100	<1/100	2/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	20.0	7.7	F _{64%}	6/100	<1/100	3/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	30.0	16.5	F _{54%}	7/100	<1/100	5/100	<1/100	3/100	2/100	3/100	2/100	4/100	4/100
Blue Line	38.7	25.0	F _{46%}	8/100	<1/100	8/100	<1/100	37/100	22/100	36/100	23/100	50/100	50/100
status quo	41.4	27.5	F _{45%}	8/100	<1/100	9/100	1/100	57/100	37/100	51/100	38/100	50/100	50/100
Maintain 2014 SPR	43.3	29.5	F _{43%}	8/100	<1/100	10/100	1/100	73/100	51/100	63/100	49/100	88/100	88/100
	50.0	36.0	F _{39%}	9/100	1/100	13/100	1/100	99/100	91/100	95/100	84/100	>99/100	>99/100
	60.0	45.8	F _{34%}	11/100	1/100	23/100	2/100	>99/100	>99/100	>99/100	>99/100	>99/100	>99/100
				e	f	g	h	i	j	k	l	m	



Uncertainty

- None of these models is perfect (or “true”!)
- Spatial, growth, and other dynamics are complicated and likely changing over time
- All of these analyses are conditioned on estimated removals



Conclusions: Data and assessment

- Much of the story can be seen right in the data
- Trend estimates are somewhat more optimistic
- Projections are more sensitive to management action than in previous years



Outline

- Data
 - Trends
 - Biology
- Assessment modelling
 - The 2014 ensemble
 - Results
 - Decision table
- Apportionment
- Harvest policy and catch tables

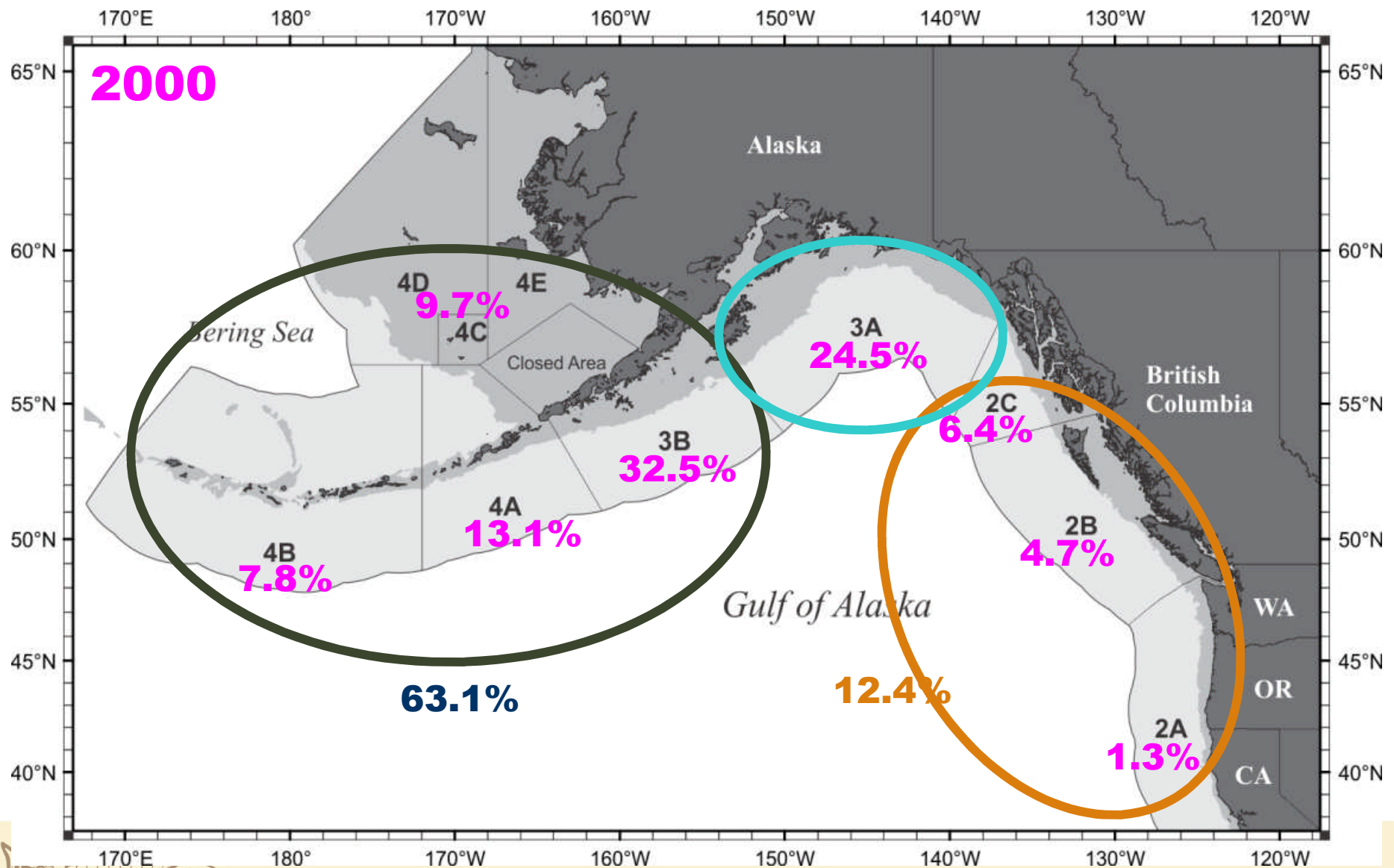


Apportionment

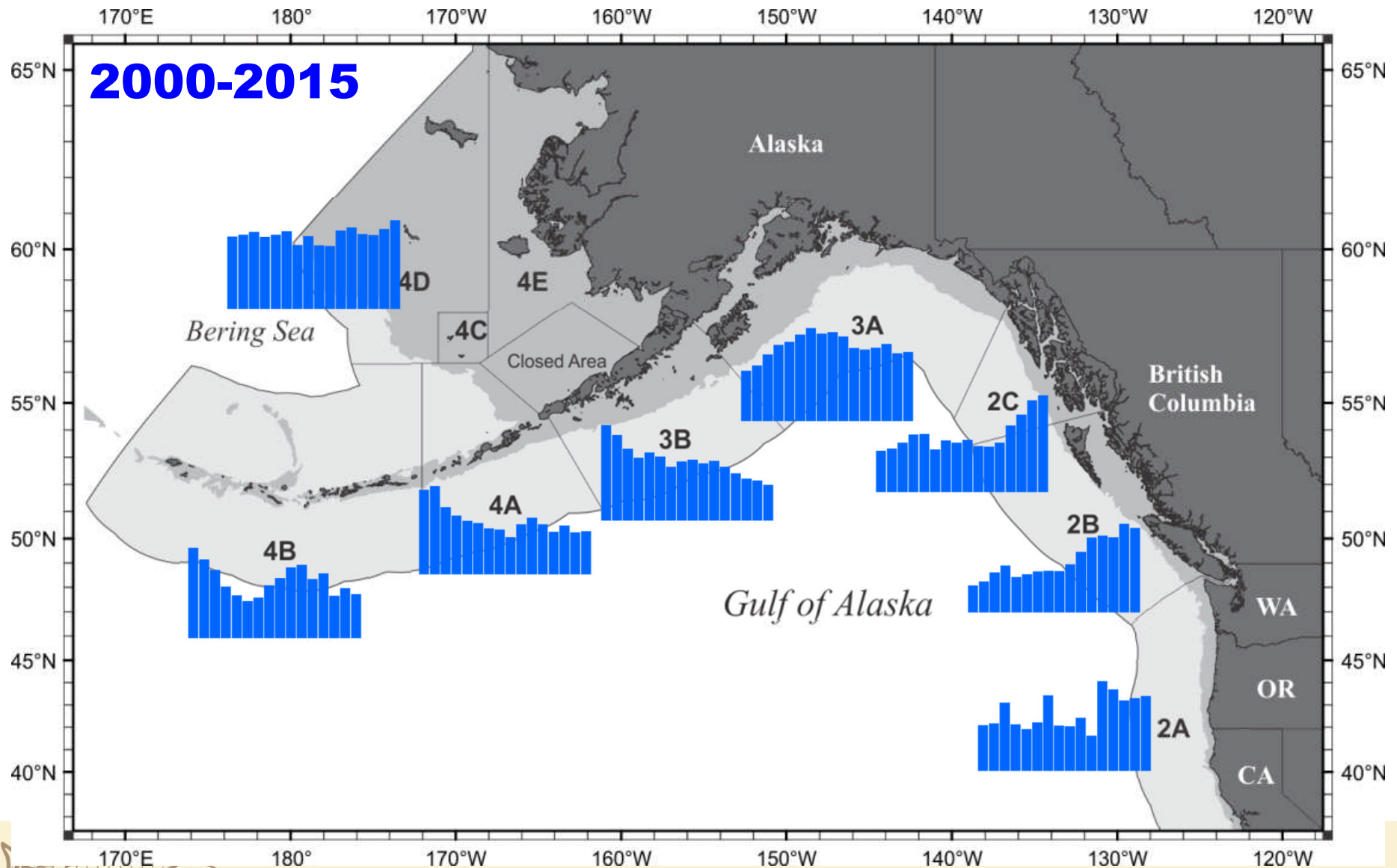
- O32 Survey WPUE adjusted to account for:
 - Fishery timing
 - Hook competition
 - Interannual variability (3-year smoother)
 - Areas not sampled annually (e.g., Salish Sea)
 - Calibration to other surveys (e.g., NMFS Bering Sea trawl)
 - Improved in 2014: survey expansion areas, calibration to deep water estimates from the NMFS sablefish survey



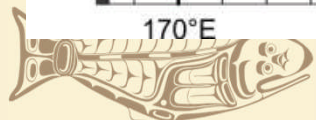
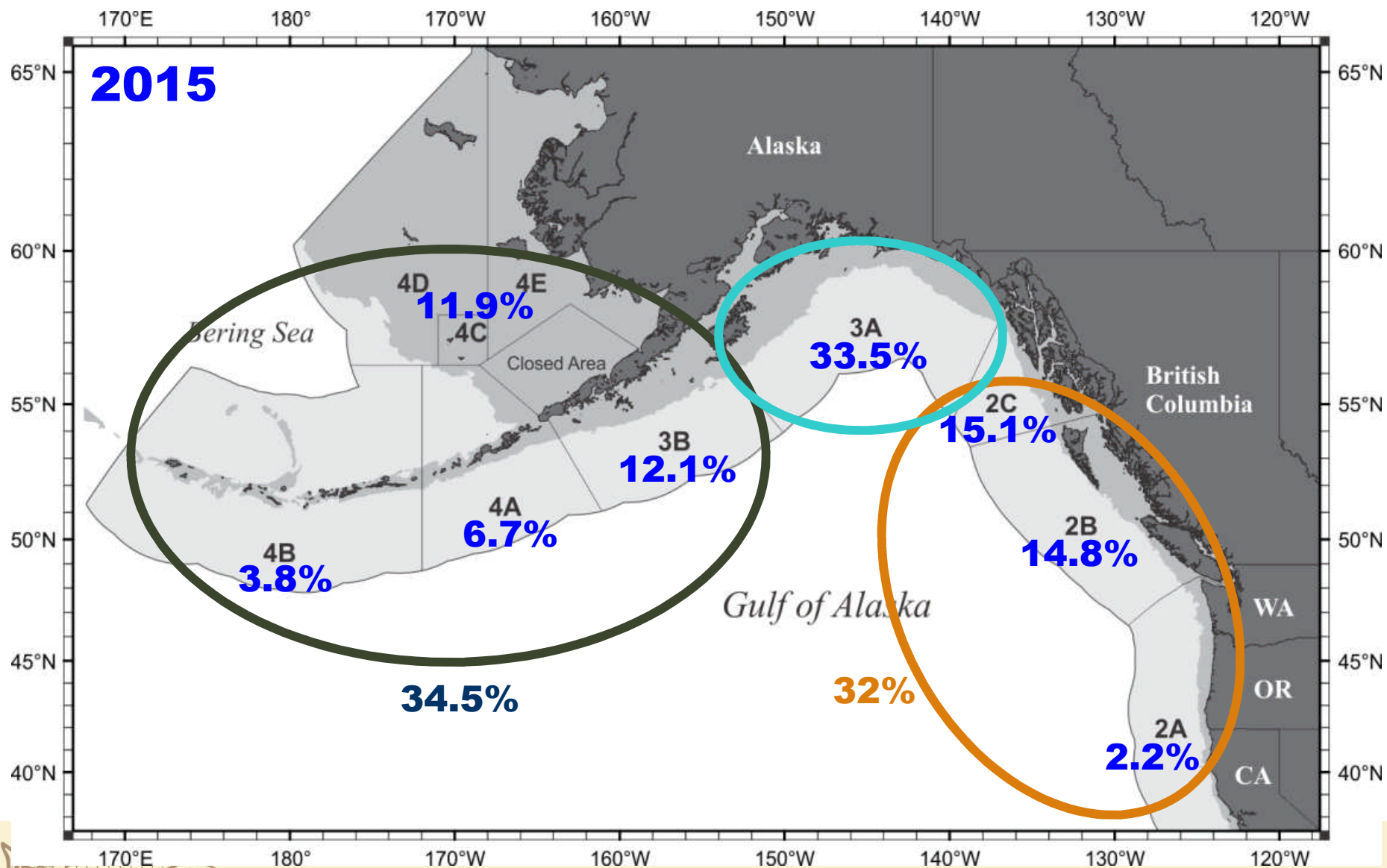
Apportionment: O32 survey biomass



Apportionment: O32 survey biomass



Apportionment: O32 survey biomass

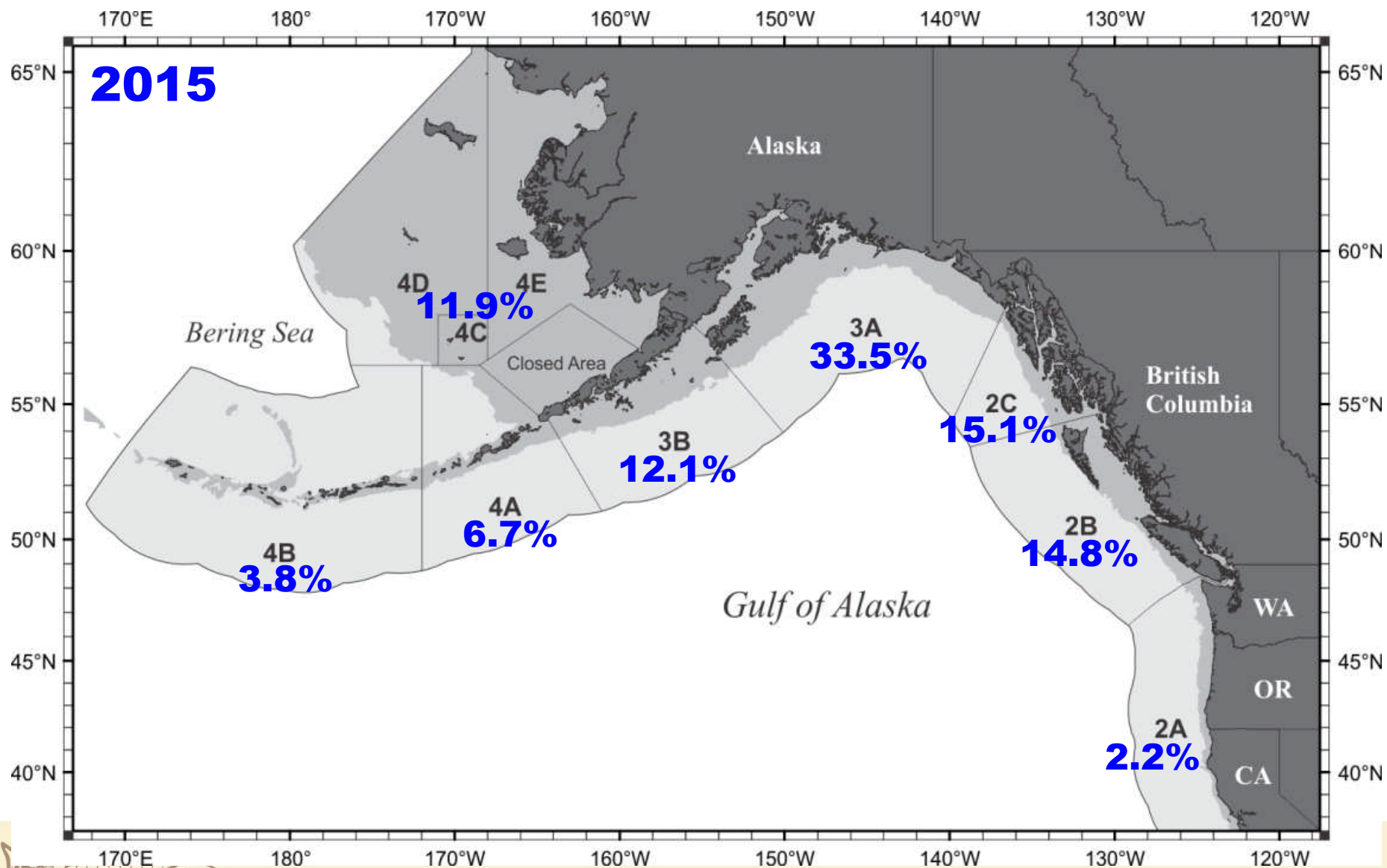


Harvest policy

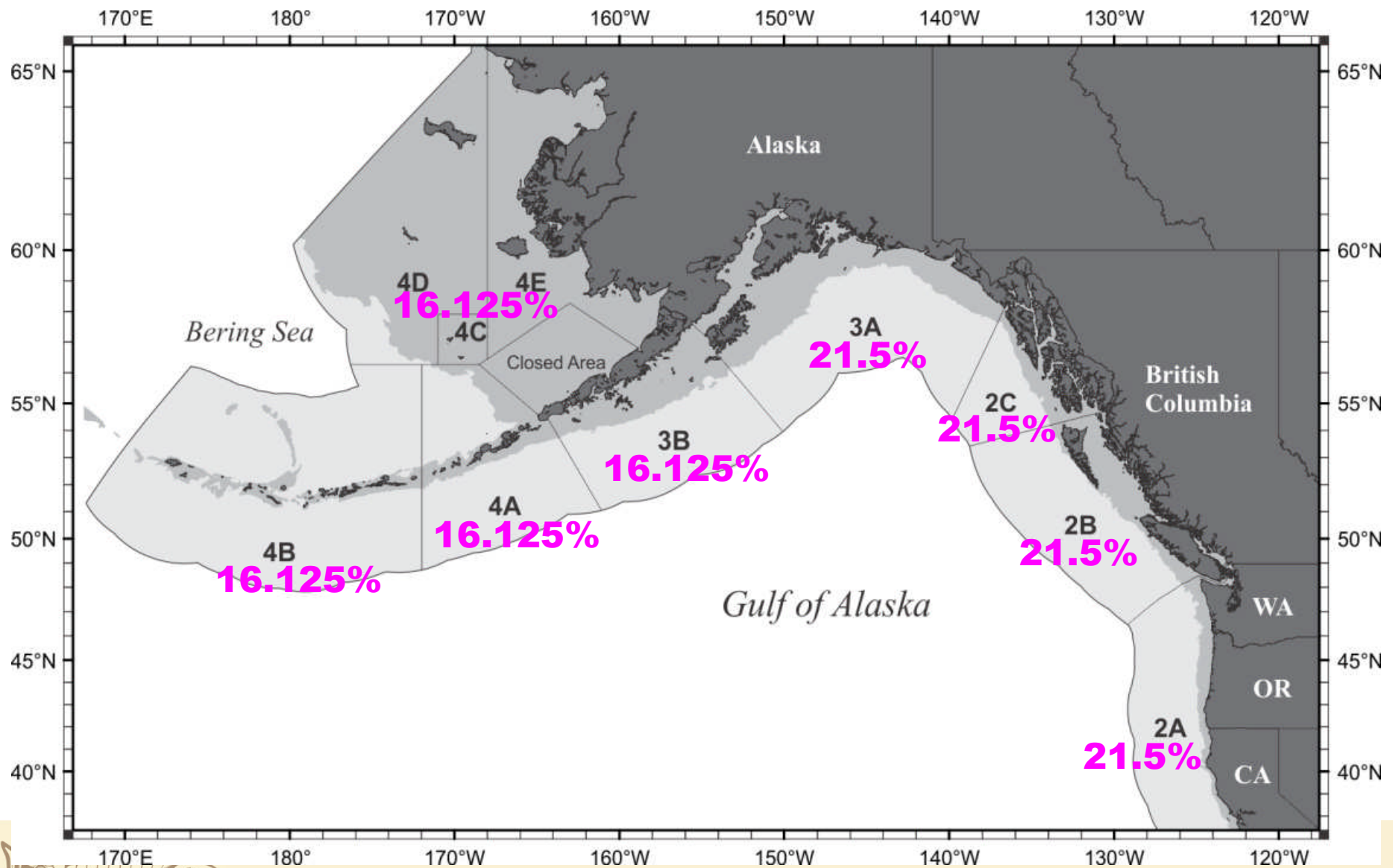
- Two targets:
 - The TCEY distribution
 - From apportionment and target rates by area
 - The scale of the TCEY
 - From historical simulation analysis



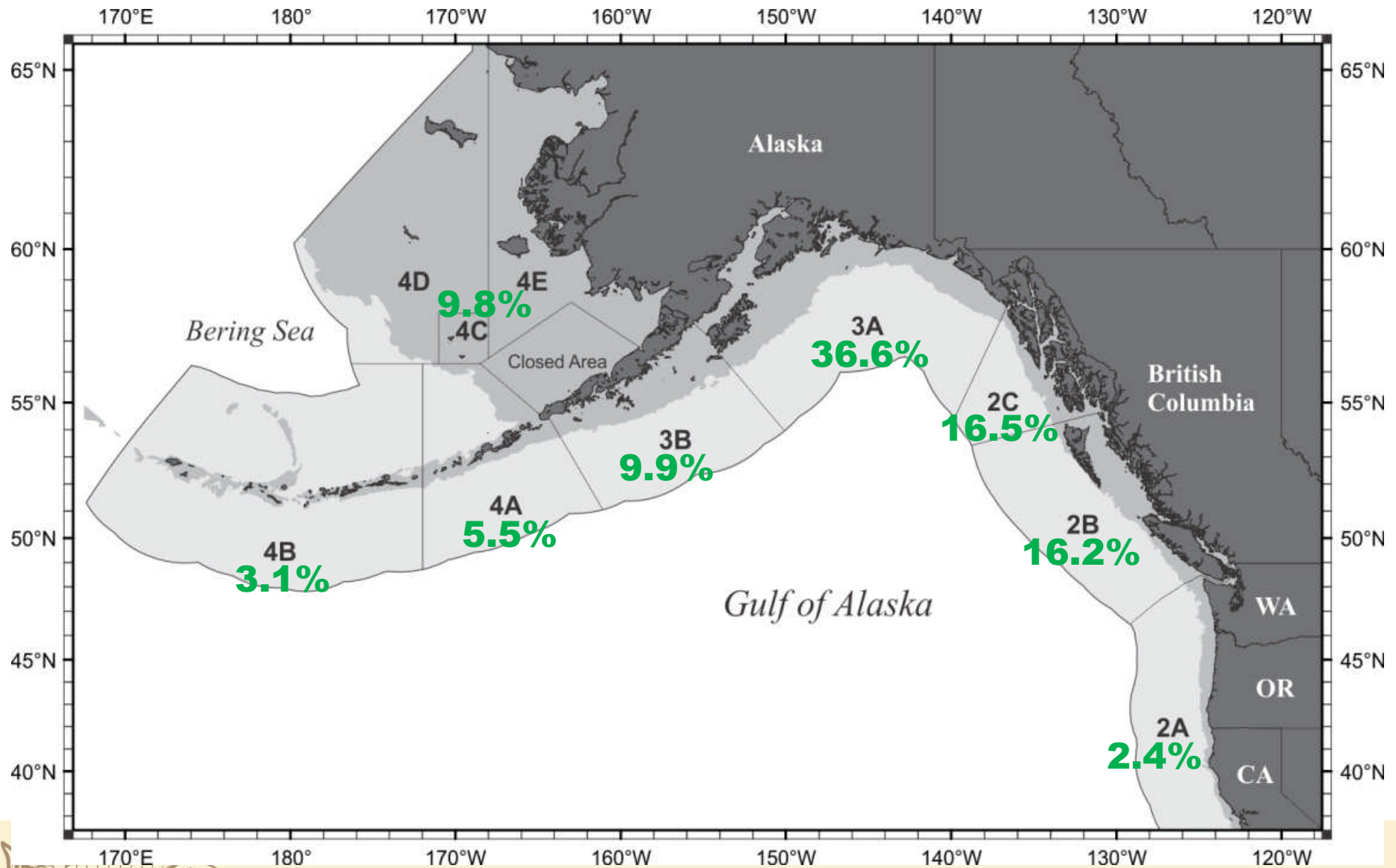
Apportionment: O32 survey biomass



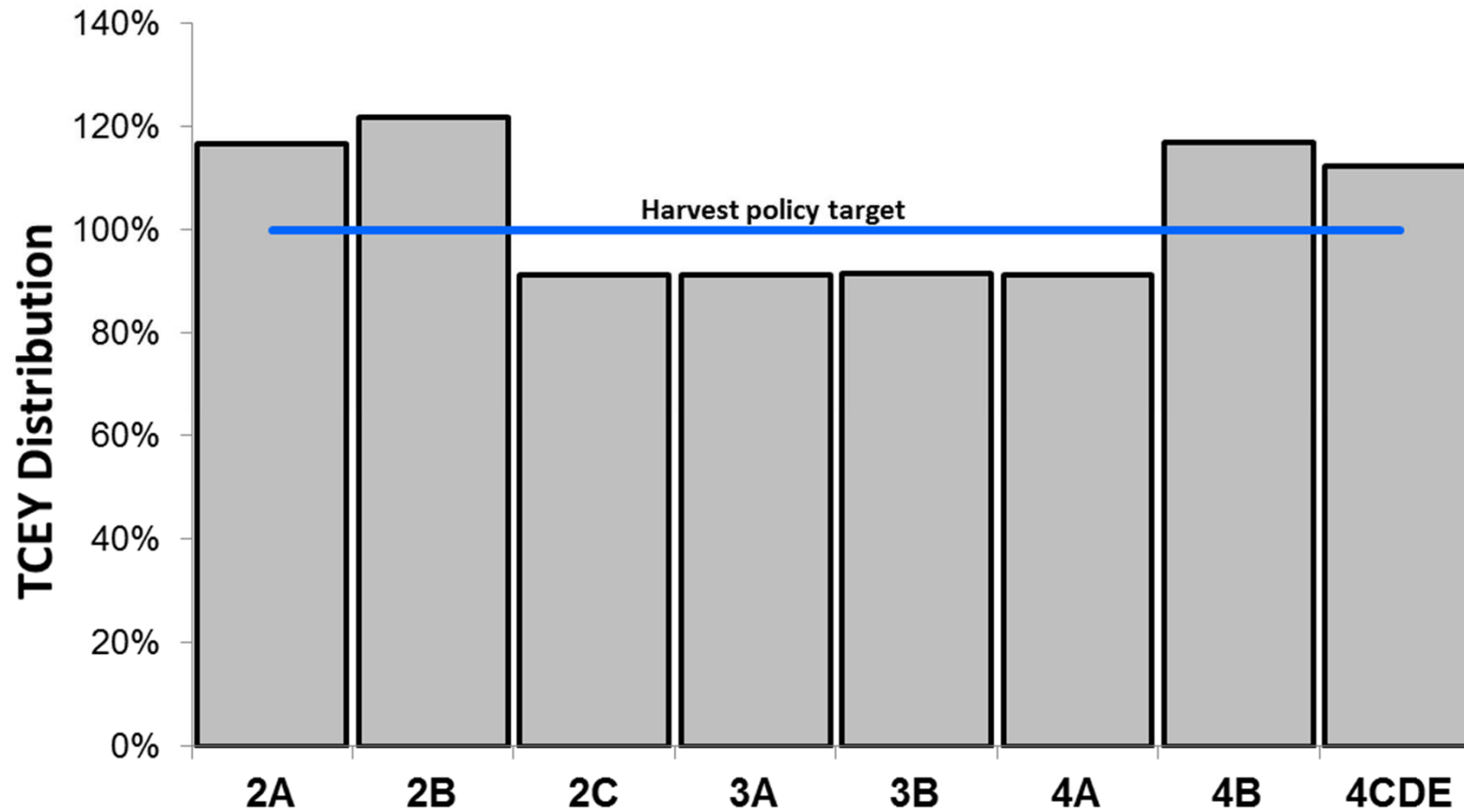
Target harvest rates



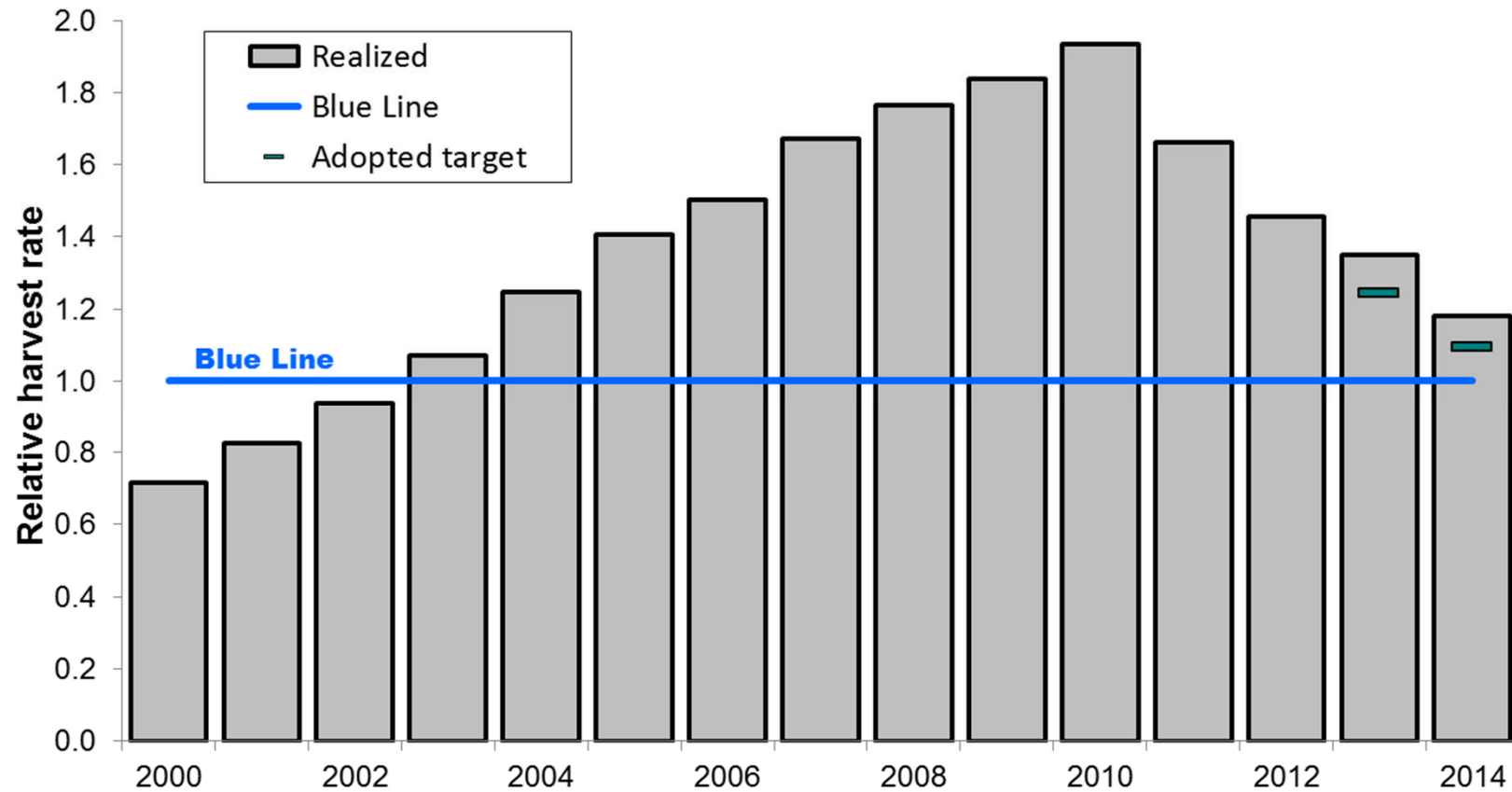
2015 Target TCEY distribution



TCEY distribution: 2014 Adopted catch limits



TCEY scale: current harvest policy



Catch tables

- Apply the harvest policy (both targets)
 - The TCEY distribution
 - The scale of the TCEY
 - Project the removals
- Remember, these are point estimates
- Uncertainty not explicitly included in current harvest policy



Full removals accounting: 2014 adopted

2A 2B 2C 3A 3B 4A 4B 4CDE Total

O26 Non-FCEY

“Other removals”

3.07

Total Non-FCEY	0.15	0.79	1.31	2.63	0.90	0.71	0.35	2.29	9.13
-----------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------

O26 FCEY

FCEY

2.18

Total FCEY	0.96	6.85	4.16	9.43	2.84	0.85	1.14	1.29	27.52
-------------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	-------------	--------------

TCEY	1.11	7.64	5.47	12.06	3.74	1.56	1.49	3.58	36.65
-------------	-------------	-------------	-------------	--------------	-------------	-------------	-------------	-------------	--------------

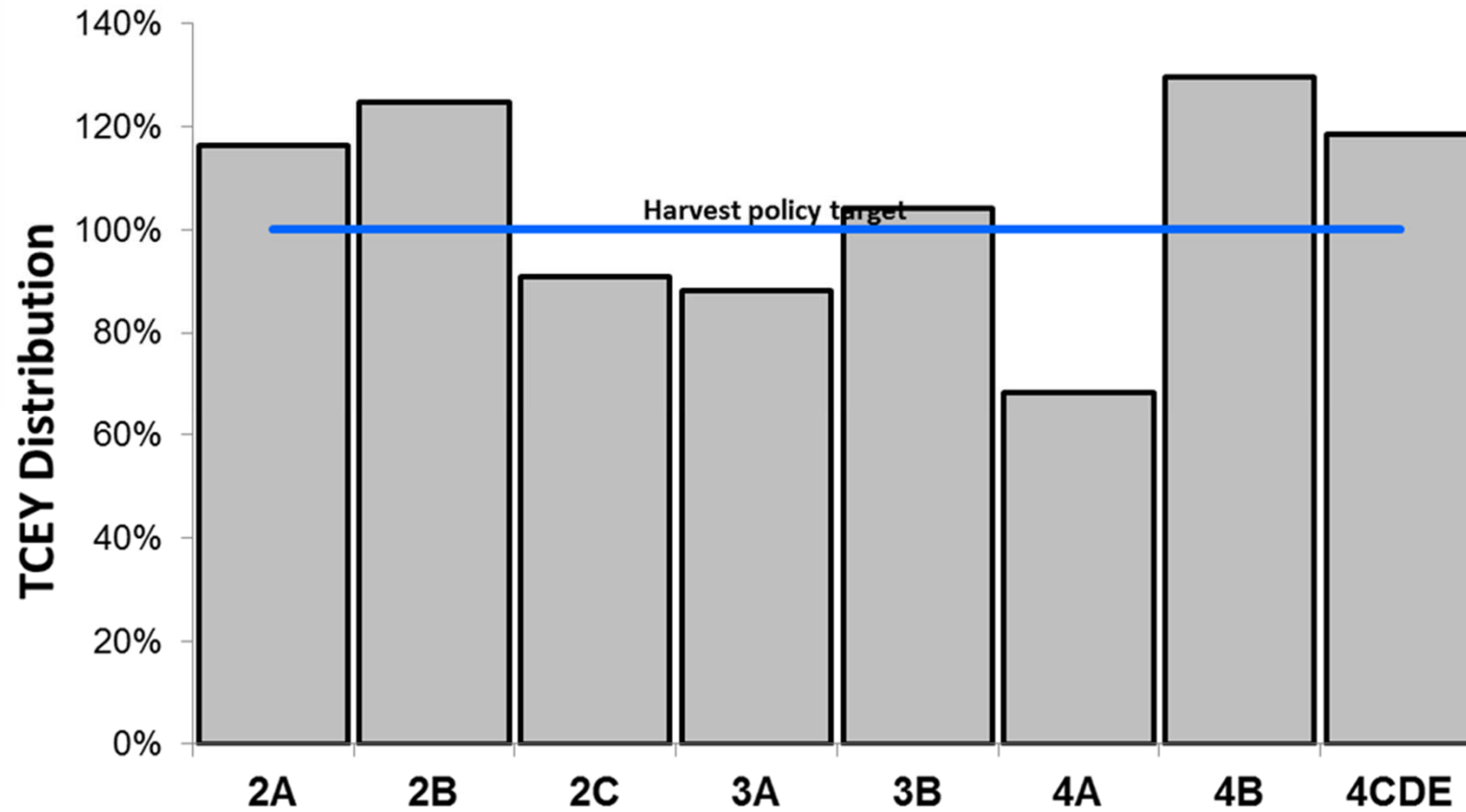
Not included

1.75

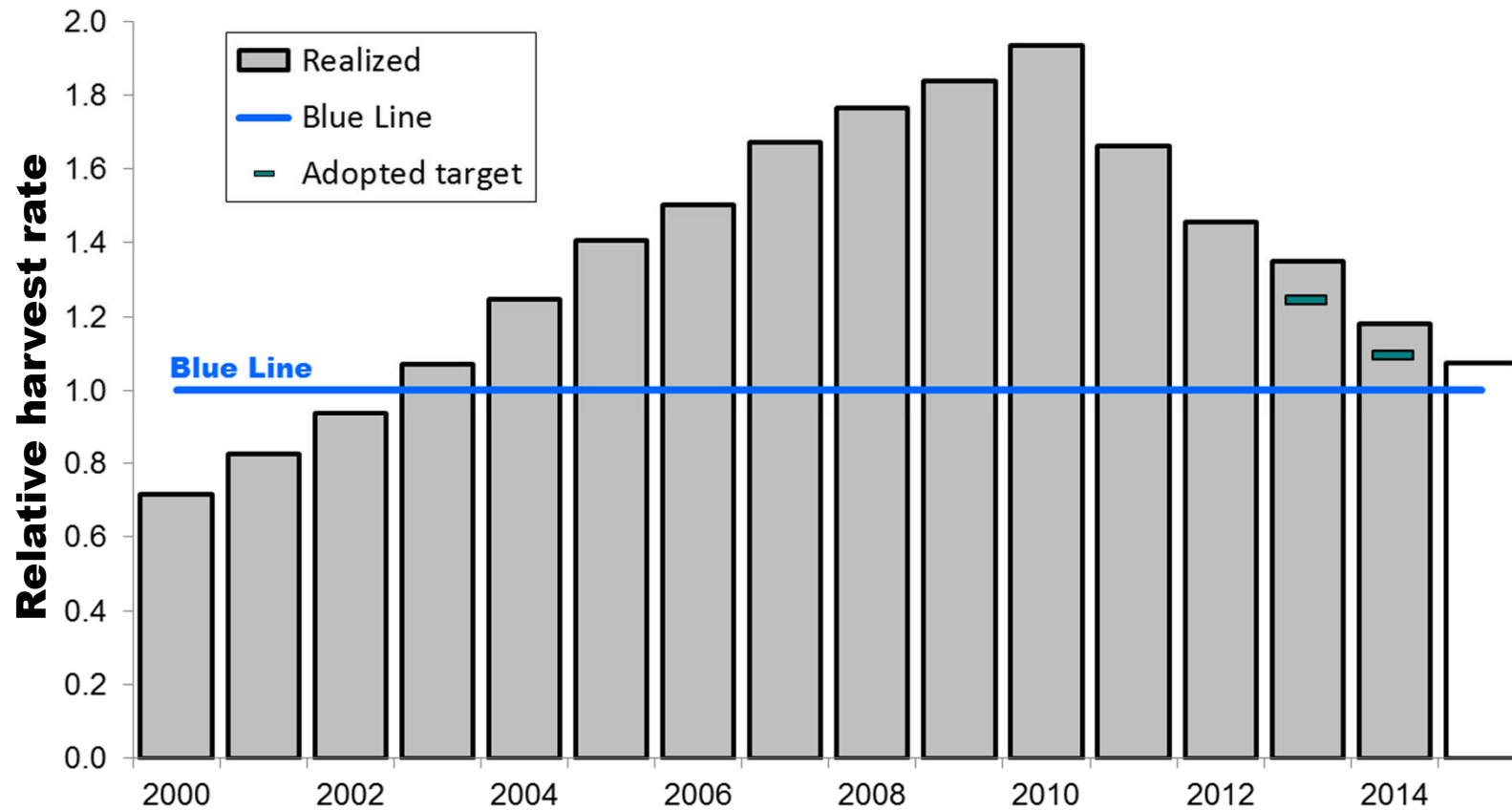
42.51



2014 *Status quo* FCEYs



2014 *Status quo* FCEYs



Full accounting: Status quo FCEYs

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
<u>O26 Non-FCEY</u>									
Comm. wastage	0.02	0.24	NA	NA	0.28	0.03	0.05	0.05	0.66
Bycatch	0.07	0.22	0.02	1.14	0.78	0.52	0.35	3.07	6.16
Sport (+ wastage)	NA	NA	1.14	1.49	0.02	0.02	0.00	0.00	2.67
Pers./Subs.	NA	0.41	0.40	0.25	0.02	0.01	0.00	0.03	1.11
Total Non-FCEY	0.09	0.86	1.55	2.88	1.09	0.58	0.40	3.15	10.60
<u>O26 FCEY</u>									
Comm. wastage	NA	NA	0.11	0.39	NA	NA	NA	NA	0.50
CSP Sport (+wastage)	0.40	0.95	0.76	1.78	NA	NA	NA	NA	3.90
Pers./Subs.	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Comm. Landings	0.53	5.90	3.29	7.26	2.84	0.85	1.14	1.29	23.10
Total FCEY	0.96	6.85	4.16	9.43	2.84	0.85	1.14	1.29	27.52
TCEY	1.05	7.71	5.71	12.31	3.93	1.43	1.54	4.44	38.12
<u>U26</u>									
Comm. wastage	0.00	0.01	0.01	0.02	0.04	0.00	0.00	0.01	0.09
Bycatch	0.00	0.02	0.00	0.47	0.46	0.39	0.05	1.75	3.15
Total U26	0.00	0.03	0.01	0.49	0.50	0.40	0.06	1.75	3.25
Total Mortality	1.05	7.74	5.72	12.81	4.44	1.83	1.59	6.19	41.37



Full accounting: 2015 Blue Line

	2A	2B	2C	3A	3B	4A	4B	4CDE	Total
<u>O26 Non-FCEY</u>									
Comm. wastage	0.02	0.17	NA	NA	0.24	0.05	0.03	0.01	0.52
Bycatch	0.07	0.22	0.02	1.14	0.78	0.52	0.35	3.07	6.16
Sport (+ wastage)	NA	NA	1.14	1.49	0.02	0.02	0.00	0.00	2.67
Pers./Subs.	NA	0.41	0.40	0.25	0.02	0.01	0.00	0.03	1.11
Total Non-FCEY	0.08	0.80	1.55	2.88	1.06	0.60	0.38	3.11	10.46
<u>O26 FCEY</u>									
Comm. wastage	NA	NA	0.11	0.42	NA	NA	NA	NA	0.53
CSP Sport (+wastage)	0.31	0.69	0.79	1.89	NA	NA	NA	NA	3.68
Pers./Subs.	0.03	NA	NA	NA	NA	NA	NA	NA	0.03
Comm. Landings	0.41	4.27	3.40	7.81	2.46	1.35	0.72	0.37	20.78
Total FCEY	0.75	4.96	4.30	10.12	2.46	1.35	0.72	0.37	25.02
TCEY	0.84	5.75	5.85	13.00	3.51	1.95	1.10	3.48	35.48
<u>U26</u>									
Comm. wastage	0.00	0.01	0.01	0.02	0.04	0.00	0.00	0.00	0.08
Bycatch	0.00	0.02	0.00	0.47	0.46	0.39	0.05	1.75	3.15
Total U26	0.00	0.03	0.01	0.50	0.50	0.40	0.06	1.75	3.24
Total Mortality	0.84	5.78	5.85	13.49	4.01	2.35	1.16	5.23	38.72



FCEY comparison

	<u>2A</u>	<u>2B</u>	<u>2C</u>	<u>3A</u>	<u>3B</u>	<u>4A</u>	<u>4B</u>	<u>4CDE</u>	<u>Total</u>
2014 Blue Line	0.72	4.98	4.16	9.43	2.84	0.85	0.82	0.64	24.45
2014 Adopted	0.96	6.85	4.16	9.43	2.84	0.85	1.14	1.29	27.52
2015 Blue Line	0.75	4.96	4.30	10.12	2.46	1.35	0.72	0.37	25.02

Increases relative to 2014 Blue Line



Alternative management actions

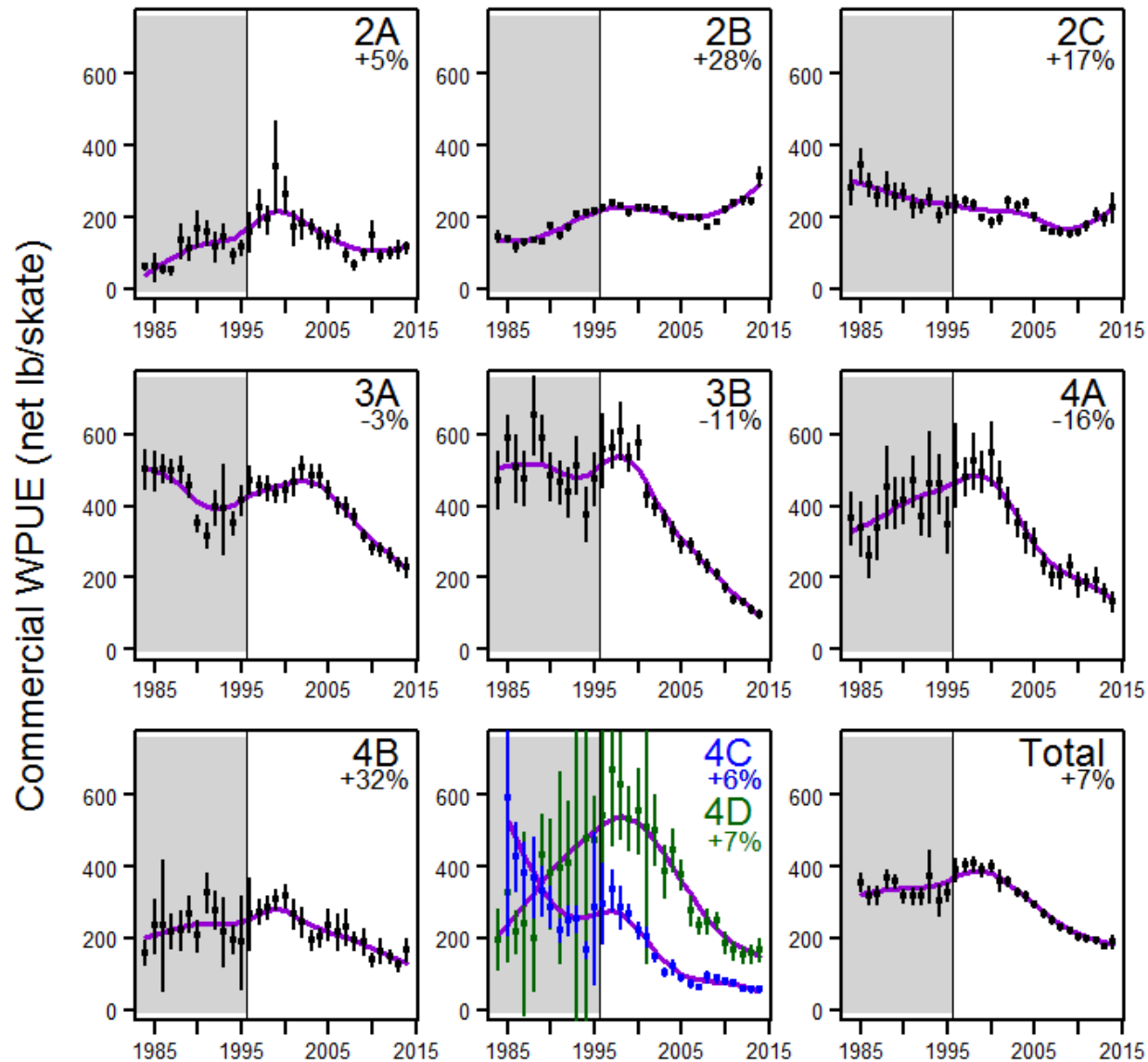
- As in previous years, as needed:
 - Additional decision table rows
 - Additional catch tables



Extra slides



Commercial fishery logbooks



2014 logs are still incomplete and unverified.

Decision table: Full table

2015 Alternative	Total removals (M lb)	Fishery CEY (M lb)	Fishing intensity	Stock Trend				Stock Status				Fishery Trend				Fishery Status
				Spawning biomass				Spawning biomass				Fishery CEY from the harvest policy				Harvest rate
				in 2016		in 2018		in 2016		in 2018		in 2016		in 2018		in 2015
				is less than 2015	is 5% less than 2015	is less than 2015	is 5% less than 2015	is less than 30%	is less than 20%	is less than 30%	is less than 20%	is less than 2015	is 10% less than 2015	is less than 2015	is 10% less than 2015	is above target
No removals	0.0	0.0	F _{100%}	<1/100	<1/100	<1/100	<1/100	5/100	<1/100	1/100	<1/100	<1/100	<1/100	<1/100	<1/100	0/100
FCEY = 0	13.1	0.0	F _{73%}	<1/100	<1/100	<1/100	<1/100	5/100	<1/100	2/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	20.0	7.7	F _{64%}	<1/100	<1/100	1/100	<1/100	6/100	<1/100	3/100	<1/100	<1/100	<1/100	<1/100	<1/100	<1/100
	30.0	16.5	F _{54%}	3/100	<1/100	17/100	4/100	7/100	<1/100	5/100	<1/100	3/100	2/100	3/100	2/100	4/100
Blue Line	38.7	25.0	F _{46%}	19/100	<1/100	40/100	23/100	8/100	<1/100	8/100	<1/100	37/100	22/100	36/100	23/100	50/100
status quo	41.4	27.5	F _{45%}	26/100	1/100	47/100	30/100	8/100	<1/100	9/100	1/100	57/100	37/100	51/100	38/100	50/100
Maintain 2014 SPR	43.3	29.5	F _{43%}	31/100	1/100	56/100	36/100	8/100	<1/100	10/100	1/100	73/100	51/100	63/100	49/100	88/100
	50.0	36.0	F _{39%}	44/100	5/100	75/100	51/100	9/100	1/100	13/100	1/100	99/100	91/100	95/100	84/100	>99/100
	60.0	45.8	F _{34%}	65/100	22/100	96/100	82/100	11/100	1/100	23/100	2/100	>99/100	>99/100	>99/100	>99/100	>99/100
				a	b	c	d	e	f	g	h	i	j	k	l	m

