NOAA FISHERIES

Alaska Fisheries Science Center

BSAI Plan Team report

Grant Thompson, chair

Diana Stram, coordinator

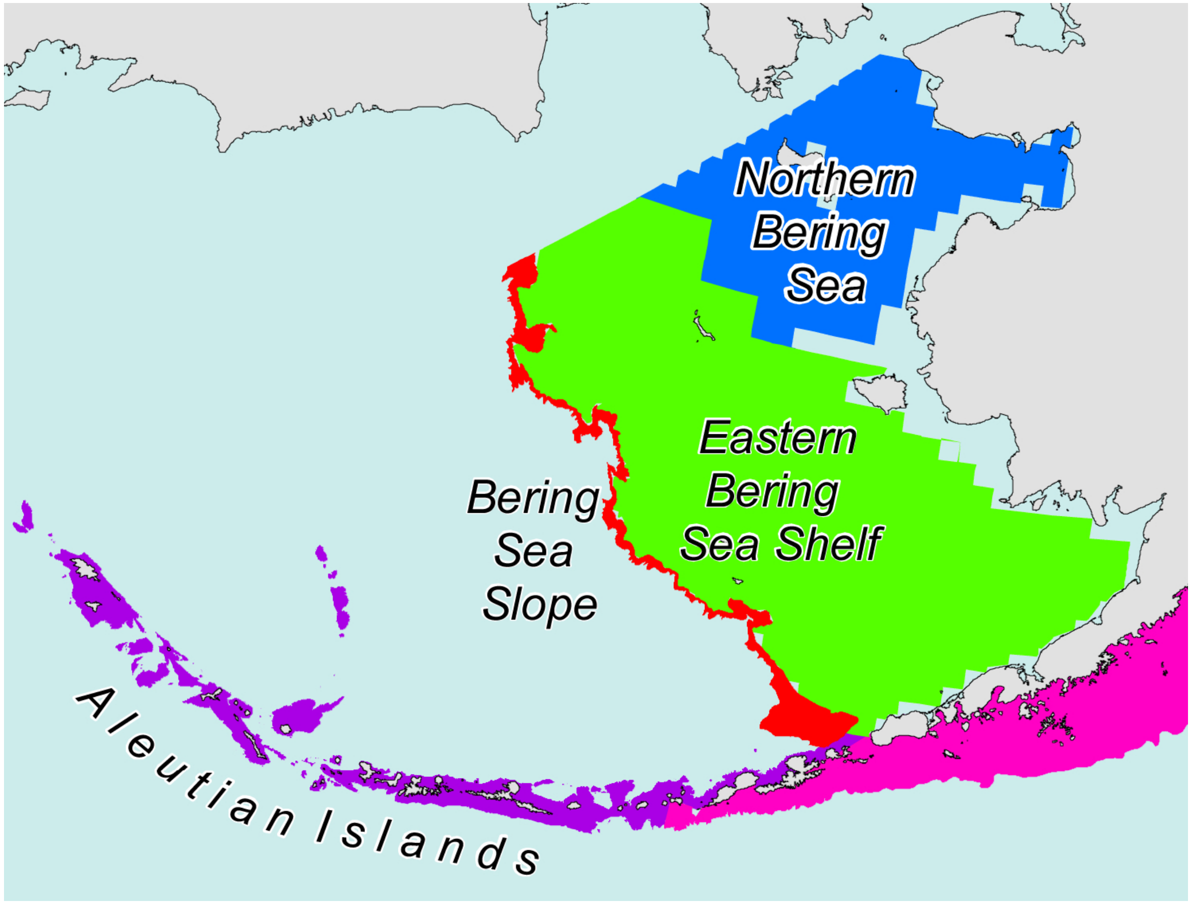
December 4, 2018

Team members

- Grant Thompson, chair (AFSC REFM)
- Diana Stram, coordinator (NPFMC)
- Steve Barbeaux (AFSC REFM)
- Mary Furuness (NMFS AKRO)
- Alan Haynie (AFSC REFM)
- Allan Hicks (IPHC)
- Lisa Hillier (WDFW)
- Kirstin Holsman (AFSC REFM)
- Andy Kingham (AFSC FMA, unofficial)
- Brenda Norcross (UAF)
- Kalei Shotwell (AFSC ABL)
- Chris Siddon (ADF&G)
- Jane Sullivan (ADF&G)
- Cindy Tribuzio (AFSC ABL)

“Big picture” overview

BSAI bottom trawl survey areas



Changes in EBS shelf biomass, 1999-2018

- Not included: sablefish, rockfish, Atka mackerel, shark, octopus
- Color gradients are row-specific

Species/complex	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Alaska plaice	0.05	-0.07	0.22	-0.22	0.09	0.04	0.06	0.26	-0.34	0.20	0.04	-0.06	0.04	0.12	-0.13	-0.11	-0.21	0.20	0.15	-0.15
arrowtooth flounder	-0.31	0.31	0.20	-0.17	0.59	0.04	0.28	-0.08	-0.21	0.10	-0.23	0.30	-0.01	-0.23	0.01	0.15	-0.12	0.16	-0.11	0.21
flathead sole	-0.41	-0.04	0.32	0.07	-0.06	0.20	0.04	-0.03	-0.10	-0.04	-0.24	0.19	0.19	-0.34	0.28	0.07	-0.23	0.16	0.19	-0.11
Greenland turbot	-0.38	0.08	0.18	-0.12	0.29	-0.09	-0.25	-0.02	-0.20	-0.19	-0.19	1.14	0.12	-0.17	0.14	0.13	-0.10	-0.11	-0.04	-0.16
Kamchatka flounder	-0.20	0.12	0.45	-0.24	0.17	0.09	0.54	0.33	0.06	-0.11	-0.15	0.18	-0.21	-0.07	0.08	0.25	0.04	-0.08	-0.13	-0.08
other flatfish	-0.06	0.00	0.12	0.24	-0.09	0.44	-0.16	0.39	-0.11	-0.22	-0.01	0.10	-0.18	-0.09	-0.11	0.70	-0.46	0.40	1.17	-0.45
Pacific cod	0.12	-0.13	0.54	-0.28	0.05	-0.08	0.11	-0.15	-0.17	-0.05	0.01	1.02	0.05	-0.02	-0.09	0.35	0.01	-0.11	-0.35	-0.21
rock soles	-0.25	0.26	0.13	-0.20	0.12	0.04	-0.03	0.05	-0.08	0.00	-0.24	0.34	-0.04	-0.03	-0.09	0.06	-0.24	0.03	-0.08	-0.21
sculpin	-0.19	0.09	-0.12	0.22	0.10	0.09	0.08	-0.07	0.02	-0.04	-0.28	0.16	0.03	-0.13	-0.22	0.29	0.08	0.14	-0.12	0.01
skate	-0.06	-0.01	0.28	-0.11	0.06	0.09	0.16	-0.10	0.09	-0.23	-0.03	0.04	0.11	-0.10	0.07	0.04	0.14	0.21	0.04	0.00
walleye pollock	0.41	0.34	-0.18	0.18	0.69	-0.54	0.26	-0.37	0.42	-0.30	-0.25	0.64	-0.17	0.12	0.31	0.62	-0.14	-0.23	-0.02	-0.35
yellowfin sole	-0.43	0.26	0.06	0.14	0.13	0.18	0.11	-0.24	0.01	-0.02	-0.17	0.36	0.01	-0.19	0.17	0.10	-0.23	0.48	-0.03	-0.32

Changes in AI biomass, 1994-2018

- Not included: sablefish, yellowfin, turbot, shortraker, shark, octopus
- Color gradients are row-specific
- Changes are expressed as discrete annual rates

Species/complex	1994	1997	2000	2002	2004	2006	2010	2012	2014	2016	2018
arrowtooth flounder	0.46	0.04	0.01	0.19	0.01	0.37	-0.17	-0.10	0.06	-0.08	-0.13
Atka mackerel	-0.04	-0.16	0.12	0.23	0.07	-0.09	0.03	-0.42	0.62	-0.21	-0.14
blackspotted/rougheye	0.08	-0.07	0.09	-0.23	0.31	-0.24	0.01	0.20	-0.40	0.46	0.00
flathead sole	-0.01	0.05	-0.02	0.06	0.14	-0.10	0.13	-0.32	0.49	-0.33	0.11
Kamchatka flounder	0.41	-0.05	-0.10	0.28	-0.10	-0.03	0.10	-0.16	0.13	-0.24	-0.02
northern rockfish	-0.26	0.00	0.33	-0.07	0.01	0.03	0.03	0.14	0.29	-0.27	-0.16
other flatfish	0.30	0.13	0.06	-0.06	0.32	0.07	0.00	-0.01	0.08	-0.05	-0.07
other rockfish	-0.01	0.16	0.06	0.12	0.12	0.15	-0.06	-0.12	0.27	-0.11	-0.11
Pacific cod	-0.05	-0.22	0.20	-0.24	0.06	0.02	-0.10	0.03	0.12	0.07	-0.02
Pacific ocean perch	0.03	0.15	-0.04	-0.05	0.06	0.13	0.08	-0.01	0.01	0.00	0.00
pollock	-0.17	0.06	0.04	0.29	-0.14	-0.15	0.10	-0.44	0.39	-0.01	0.41
rock soles	0.16	0.00	-0.06	0.14	-0.06	0.27	-0.08	0.14	-0.16	-0.15	0.09
sculpin	0.05	-0.06	-0.05	0.08	0.16	0.04	0.05	-0.01	-0.10	-0.11	0.03
skate	0.28	0.06	-0.01	0.12	0.23	0.00	-0.01	-0.16	0.09	-0.22	0.02

NBS biomass and changes, 2010-2018

- Not included: species/complexes accounting for <1% of biomass
- Color scales are for the entire respective matrix
- Changes are expressed as discrete annual rates
- Values are standardized to the 2018 “truncated” area

	Biomass			Rate of change	
Species/complex	2010	2017	2018	2017	2018
Alaska plaice	306,750	336,841	274,543	0.01	-0.18
Pacific cod	26,140	289,264	564,684	0.41	0.95
rock soles	18,368	55,294	117,639	0.17	1.13
sculpin	61,612	143,985	85,893	0.13	-0.40
skate	48,929	82,399	116,835	0.08	0.42
walleye pollock	19,975	1,338,925	1,146,515	0.82	-0.14
yellowfin sole	310,617	368,156	373,373	0.02	0.01

Big picture, small font

Ch.	Assessment	Lead author	Tier (2018)	Freq.	Year in cycle	Type	Numbered models (or Tier 5, 6)	Tier change? From 2018	Tier change? From proj.	ABC<maxABC? Author(s)	ABC<maxABC? Team
1	EBS pollock	Ianelli	1	1	n/a	Full	16.1 (base)	none	none	yes	yes
1A	AI pollock	Barbeaux	3	2	1	Full	15.1 (base), 15.2	3b to 3a	3b to 3a	no	no
1B	Bogoslof pollock	Ianelli	5	2	1	Full	Tier 5	none	none	no	no
2	EBS Pacific cod	Thompson	3	1	n/a	Full	16.6 (base), 16.6i, 16.6j, 16.6k, 17.2, 18.6, 18.7, 18.8	none	none	no	yes
2A	AI Pacific cod	Thompson	5	1	n/a	Full	Tier 5	none	none	no	no
3	Sablefish	Hanselman	3	1	n/a	Full	16.5 (base)	none	3a to 3b	yes	yes
4	Yellowfin sole	Wilderbuer	1	1	n/a	Full	14.1 (base), 14.2, 18.1	none	none	no	no
5	Greenland turbot	Bryan	3	2	1	Full	16.1b ("same" as base), 16.1c	none	none	no	no
6	Arrowtooth flounder	Spies	3	2	1	Full	15.1b (base), 15.1c, 18.3, 18.6, 18.9	none	none	no	no
7	Kamchatka flounder	Bryan	3	2	1	Full	16.0a (base), 16.0b	none	none	no	no
8	Northern rock sole	Wilderbuer	1	2	1	Full	15.1 (base), 18.1, 18.2, 18.3, 18.4	none	none	no	no
9	Flathead sole	McGilliard	3	2	1	Full	16.0 (base), 18.0, 18.0b, 18.1, 18.1b, 18.2, 18.2b, 18.2c	none	none	no	no
10	Alaska plaice	Wilderbuer	3	2	2	Partial	11.1 (base)	none	none	no	no
11	Other flatfish	Wilderbuer	5	4	3	Partial	Tier 5	none	none	no	no
12	Pacific ocean perch	Spencer	3	2	1	Full	16.3 (base), 16.3a	none	none	no	no
13	Northern rockfish	Spencer	3	2	2	Partial	16.1 (base)	none	none	no	no
14	Blackspotted/ rougheye rockfish	Spencer	3	2	1	Full	16.5 (base), 18.1, 18.2 (author), (18.1+18.2)/2 (Team)	none	3a to 3b	no	no
15	Shortraker rockfish	Spies	5	2	1	Full	Tier 5	none	none	no	no
16	Other rockfish	Spies	5	2	1	Full	Tier 5	none	none	no	no
17	Atka mackerel	Lowe	3	1	n/a	Full	16.0b (base)	3a to 3b	3a to 3b	no	no
18	Skates	Ormseth	3/5	2	1	Full	14.2 (base)	none	none	no	no
19	Sculpins	Spies	5	4	4	None	n/a	n/a	n/a	n/a	n/a
20	Sharks	Tribuzio	5	2	1	Full	Tier 6	none	none	no	no
22	Octopus	Ormseth	6	2	1	Full	Tier 6	none	none	no	no

Reference point comparisons (all chapters)

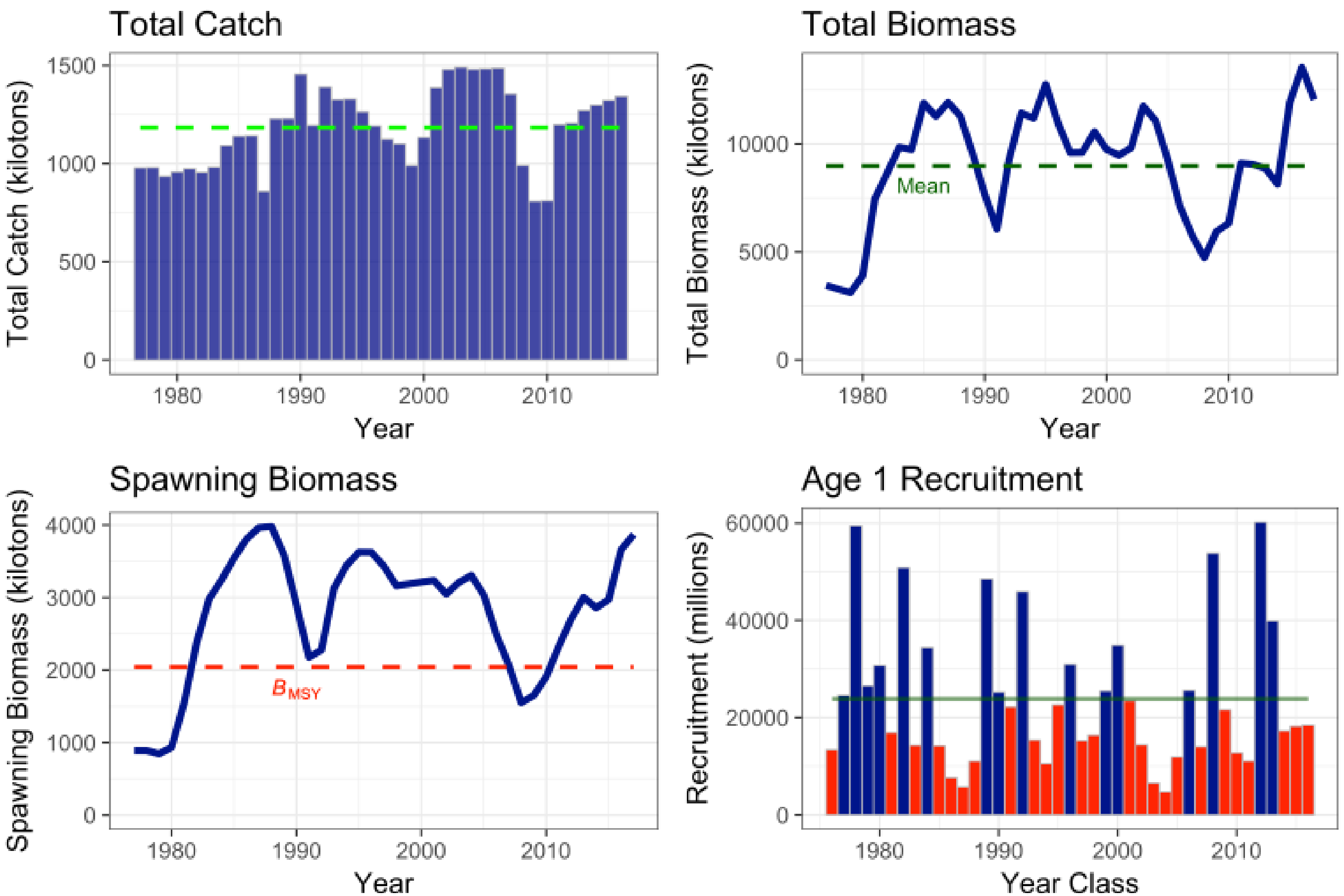
Quantity	Last asmt.	This asmt.	Change
M	0.097	0.097	0.00
2018 tier	3b	n/a	none
2019 tier	3a	3b	↓
2018 age+ biomass	330,655	n/a	0.48
2019 age+ biomass	350,850	488,273	0.39
2018 spawning biomass	88,928	n/a	0.09
2019 spawning biomass	110,974	96,687	-0.13
B100%	245,829	291,845	0.19
B40%	98,332	116,738	0.19
B35%	86,040	102,146	0.19
2019 FOFL	0.114	0.096	-0.16
2019 FABC	0.085	0.044	-0.48
2018 OFL	29,507	n/a	0.11
2019 OFL	46,775	32,798	-0.30
2018 ABC	14,957	n/a	0.01
2019 ABC	21,053	15,068	-0.28

Except where "quantity" is shaded, "change" represents the relative difference between *this assessment's value* and *last assessment's value* for the same quantity.

Where "quantity" is shaded, "change" represents the relative difference between *this assessment's value for 2019* and *last assessment's value for 2018*.

Graphs for Tiers 1-3 “full” assessments

- Courtesy of Jim Ianelli (thank you!)



Changes in reference points (Tier 1)

Quantity	EBS pollock	Yellowfin	Rock sole
M	0.00	0.00	0.00
2018 age+ biomass	-0.17	-0.04	-0.10
2019 age+ biomass	-0.10	0.00	-0.03
2018 spawning biomass	-0.16	-0.05	-0.12
2019 spawning biomass	-0.08	-0.04	0.01
B0	0.09	0.03	-0.24
Bmsy	0.12	0.01	-0.28
2019 FOFL	0.04	-0.02	-0.08
2019 FABC	0.06	-0.02	-0.07
2018 OFL	-0.18	-0.05	-0.17
2019 OFL	-0.15	-0.02	-0.10
2018 ABC	-0.17	-0.05	-0.17
2019 ABC	-0.12	-0.02	-0.10

Changes in reference points (Tier 3)

Quantity	AI pollock	EBS P. cod	Sablefish	G. turbot	Arrowtooth	Kamchatka	Flathead	AK plaice	POP	No. rockfish	Blackspot.	Atka mack.	AK skate
M	0.05	-0.06	0.00	0.00	0.00	0.00	0.00	0.00	-0.03	0.00	-0.03	0.00	0.00
2018 age+ biomass	0.17	-0.10	0.48	-0.16	0.14	-0.18	-0.12	-0.04	0.25	-0.01	-0.13	-0.17	0.05
2019 age+ biomass	0.22	0.08	0.39	-0.17	0.14	-0.22	-0.13	-0.03	0.27	0.00	-0.17	-0.17	0.12
2018 spawning biomass	0.22	-0.01	0.09	-0.07	-0.02	-0.14	-0.28	-0.03	0.30	-0.02	-0.16	-0.23	0.08
2019 spawning biomass	0.41	0.11	-0.13	-0.12	0.02	-0.19	-0.25	0.02	0.35	0.00	-0.25	-0.15	0.12
B100%	0.00	0.11	0.19	-0.12	0.14	-0.15	-0.34	0.00	0.20	0.00	0.04	-0.08	-0.02
B40%	0.00	0.11	0.19	-0.12	0.14	-0.15	-0.34	0.00	0.20	0.00	0.04	-0.08	-0.02
B35%	0.00	0.11	0.19	-0.12	0.14	-0.15	-0.34	0.00	0.20	0.00	0.04	-0.08	-0.02
2019 FOFL	0.22	0.00	-0.16	-0.05	0.07	0.44	0.15	0.00	-0.06	0.00	-0.40	0.15	0.02
2019 FABC	0.21	-0.23	-0.48	0.00	0.05	0.41	0.12	0.00	-0.04	0.00	-0.39	0.16	0.03
2018 OFL	0.30	-0.09	0.11	-0.14	0.08	-0.03	0.01	-0.03	0.18	-0.02	-0.33	-0.27	0.07
2019 OFL	0.72	0.07	-0.30	-0.16	0.10	-0.09	0.04	0.03	0.22	0.00	-0.39	-0.19	0.15
2018 ABC	0.30	-0.28	0.01	-0.13	0.07	-0.05	0.00	-0.03	0.19	-0.02	-0.32	-0.26	0.07
2019 ABC	0.72	-0.15	-0.28	-0.16	0.10	-0.10	0.02	0.03	0.23	0.00	-0.38	-0.19	0.15

- For blackspotted/rougheye, M, age+ biomass, OFL, and ABC are BSAI; other quantities are AI

Changes in reference points (Tier 5)

Quantity	Bog. pollock	AI P. cod	O. flatfish	Shortraker	O. rockfish	O. skates	Sculpins
M	0.00	-0.06	0.00	0.00	0.02	0.00	0.00
Biomass	0.40	0.01	0.25	0.08	-0.04	0.20	0.00
2019 FOFL	0.00	-0.06	0.00	0.00	0.02	0.00	0.00
2019 FABC	0.61	-0.06	0.00	0.00	0.02	0.00	0.00
2018 OFL	0.40	-0.05	0.24	0.08	-0.01	0.20	0.00
2019 OFL	0.40	-0.05	0.24	0.08	-0.01	0.20	0.00
2018 ABC	1.26	-0.04	0.24	0.08	-0.01	0.20	0.00
2019 ABC	1.26	-0.04	0.24	0.08	-0.01	0.20	0.00

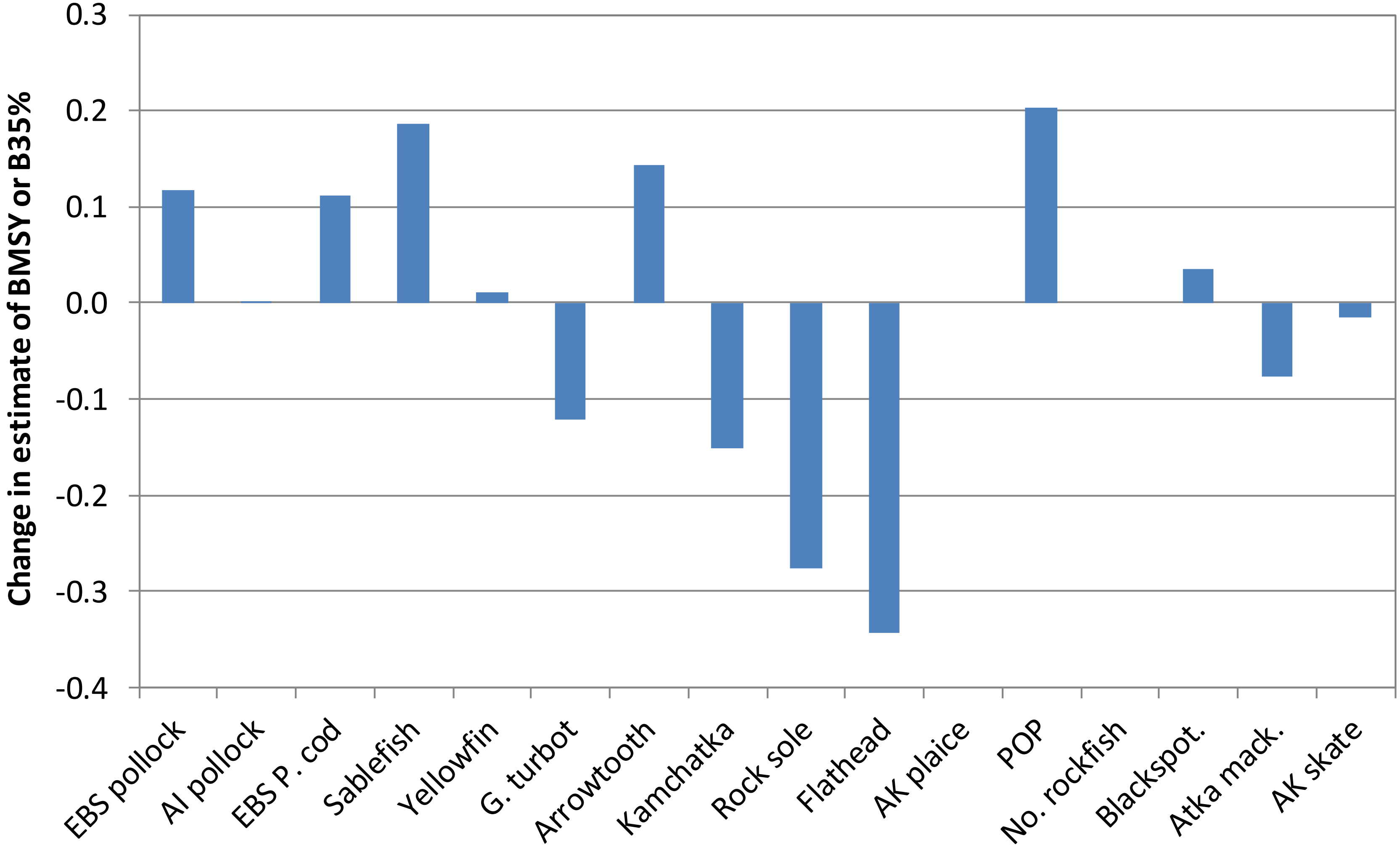
- Note that there was no sculpin assessment this year

Changes in reference points (Tier 6)

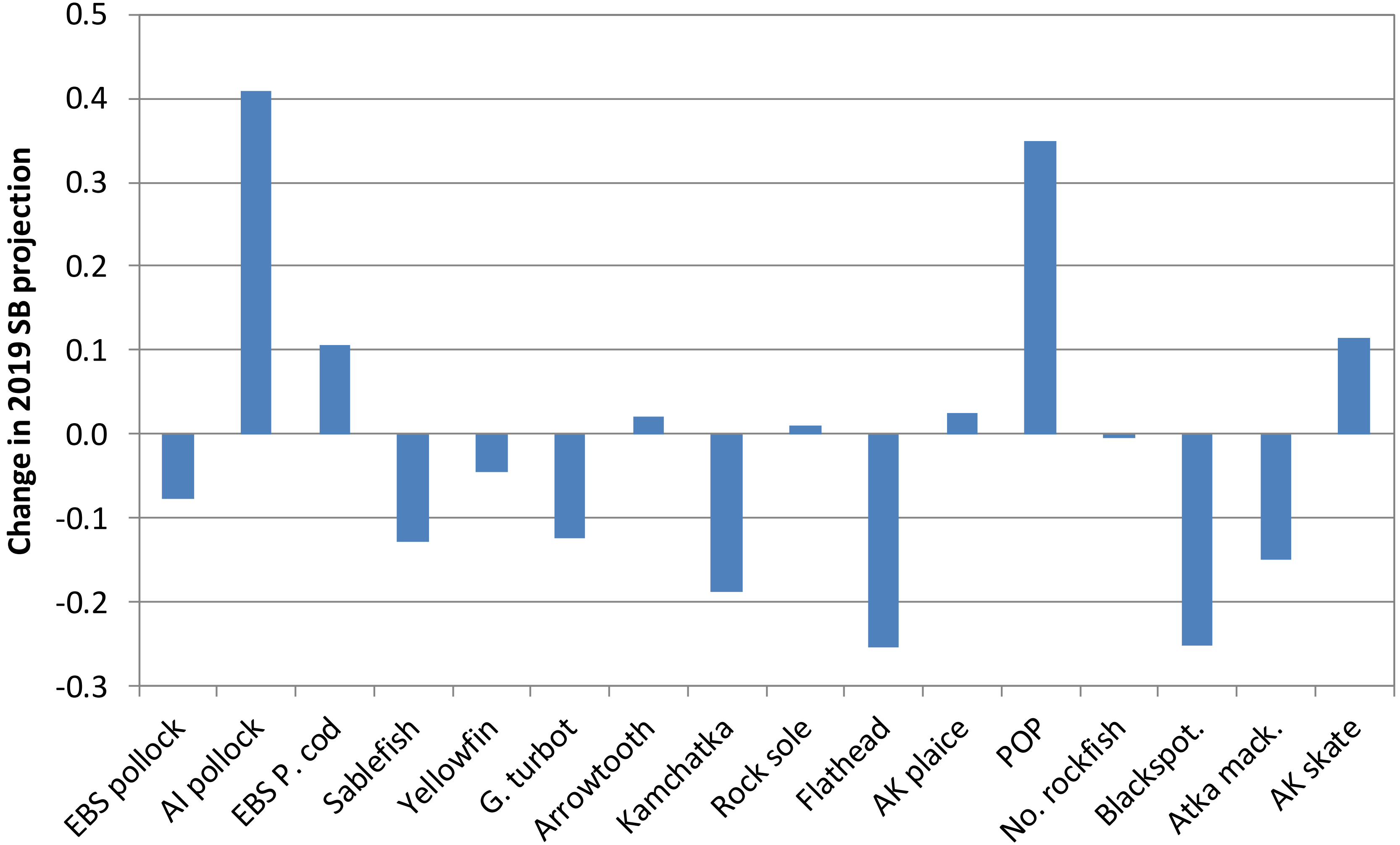
Quantity	Sharks	Octopus
2018 OFL	0.00	0.00
2019 OFL	0.00	0.00
2018 ABC	0.00	0.00
2019 ABC	0.00	0.00

- Note that squid has been moved to the "ecosystem component"

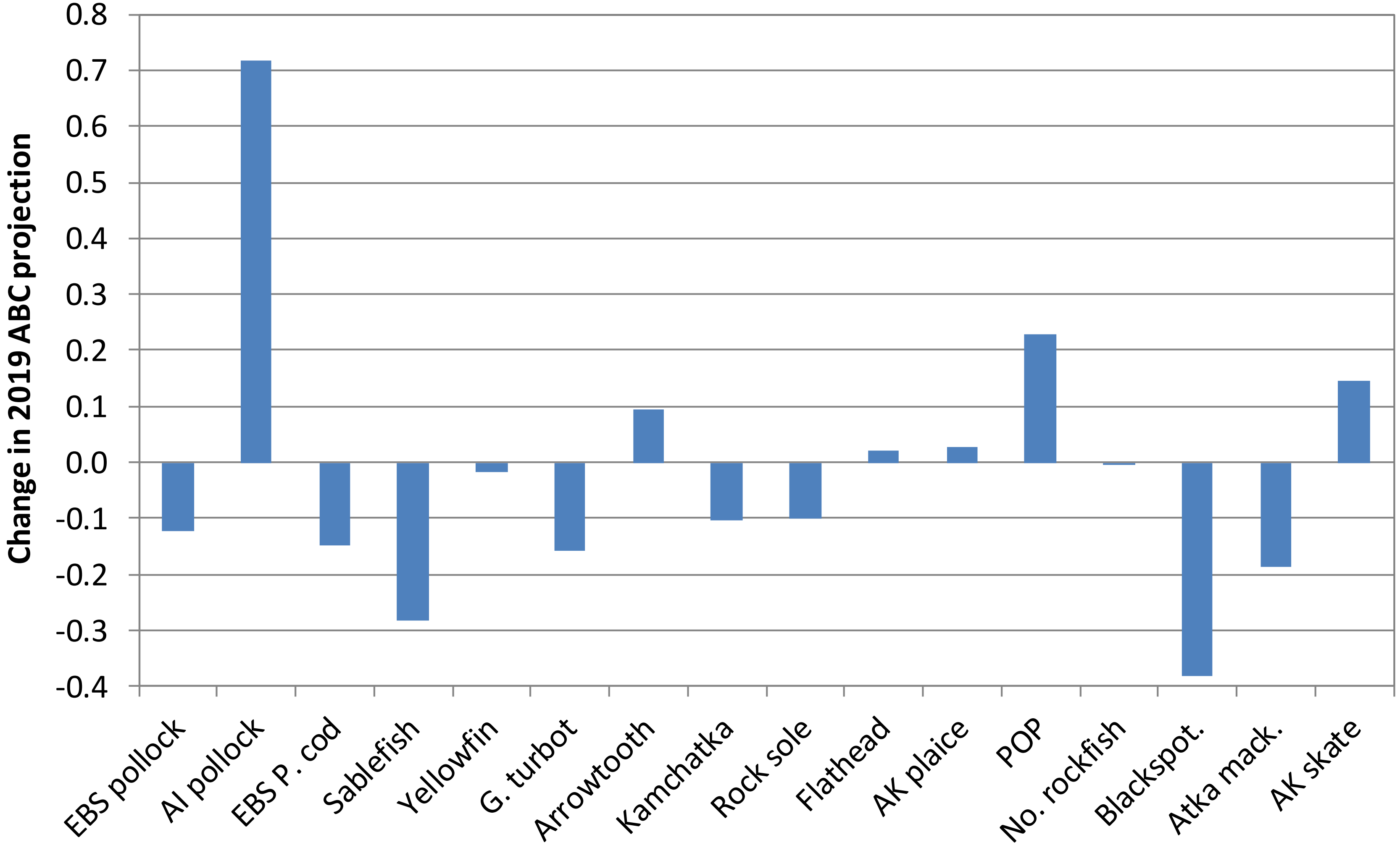
Change in estimate of B_{MSY} or $B_{35\%}$



Change in 2019 spawning biomass projection



Change in 2019 ABC projection



Typical summary format

- New data, if any (updated catch data omitted for brevity)
- Model changes/alternatives, if any
- Stock status and trend
  - Recruitment strengths (Tiers 1-3 only)
  - Spawning or survey biomass trend (Tiers 1-5 only)
  - 2019 biomass relative to B_0 or $B_{100\%}$ (Tiers 1-3 only)
- Mohn's ρ (Tiers 1-3 only)
- For stocks with separate presentations by the author, skip the above
- Figures: catch, total and spawning biomass, recruitment (Tiers 1-3 only)
- Not covered in presentation (see SAFE Intro instead):
  - Specs for 2020
  - Area allocations (except: AI Pcod, AI BS/RE, and AI Atka mackerel)

General Team recommendations

Policy on acceptance of non-previewed models

- The Team rescinded the policy on acceptance of non-previewed models that it adopted near the conclusion of the November 2018 meeting, and instead decided to adopt the following substitute:
- The Team reminds authors that, for each assessment year, models introduced in that year should ideally be previewed in September or at least requested by the Team/SSC by September/October, and that the standard for acceptance of models that do not meet at least one of these criteria will be higher than for models that do

Northern Bering Sea surveys

- The Team recommends that the NBS survey currently planned for 2019 be given very high priority

Recommended models and specifications

- The Team agreed with the authors' recommendations regarding preferred models and harvest specifications for all assessments except EBS Pacific cod and AI blackspotted/rougheye rockfish
- The Team's recommended models and harvest specifications for those two assessments are identified with stand-alone paragraphs and bold font in their respective sections....
- Recommended models and specifications for all other assessments are displayed in regular font, because:
  1. Special notation is not necessary, as it is generally understood that such recommendations will be made in each case
  2. The Team does not want to give the impression that authors need to respond to such recommendations in the next assessment

EBS and AI Ecosystem Status Reports (1 of 2)

- The Team commends the authors on the broad synthesis of a substantial amount of information and continued distillation of that information into concise and management-relevant points
- In this, the Team recommends that the authors continue to refine, condense, and clarify the executive summary with particular attention to lagged ecosystem outcomes of warm or unusual events and identification of a few key management relevant points
- The Team commends and encourages continued inclusion of LEK and LTK in the report
- The Team also recommends that the authors continue to include the NEBS and SEBS information and synthesis in the report
- In this, the Team suggests that the authors align the definition of NEBS to be parsimonious with definitions used by other assessment authors and add synthesis about similar and divergent trends in the NEBS and SEBS

EBS and AI Ecosystem Status Reports (2 of 2)

- The Team would also like to see development of indicators of shipping activity in the region as well as information (or need for information) regarding novel and/or invasive species in the region
- The Team encourages continued reporting on harmful algal blooms and encourages work to validate and evaluate the skill of short-term forecasts
- The Team supports continued refinement and development of ecosystem indicators across physical, biological, and socio-economic categories

Chapter summaries

Chapter 1: EBS walleye pollock (full)

- Switch to author’s presentation (Team comments will follow)

EBS walleye pollock, continued

- Although this stock has been determined to qualify for management under Tier 1a, the authors recommend setting ABC at the Tier 3a level, as has been done for the last four years
  - See “risk matrix” in chapter (concern level 2)
  - Lots of discussion (but no consensus) about the tier system and the risk matrix, including the following comments/questions:
    - Is this really a Tier 1 assessment?
    - Should a “tier concerns” column be added to the risk matrix?
    - Should the “assessment” and “pop dy” concern levels be higher?
    - Concerns about the tier system in general
    - Tier 1 control rule is fine; the point estimates are the concern
- Team accepted authors’ choice of model and harvest specifications
  - Not a change in tier classification; just borrowing the control rule

EBS walleye pollock, continued

- Recommendations for next year's assessment:
  - If the survey index is going to include the NBS, then inclusion of the NBS in compositional data should also be explored (although this should not make much of a difference since the size compositions in the EBS and NBS are sufficiently similar)
  - Conduct a sensitivity test of the VAST index, with environmental covariates, by omitting one or two years of NBS data at a time
  - Compare and contrast other model-based index estimates with the VAST approach
  - Regarding the apparent shift in year class dominance between 2012 and 2013, the possibility of a shift in mean length at age should be explored, as should the possible influence of ageing error
  - (continued on next slide)

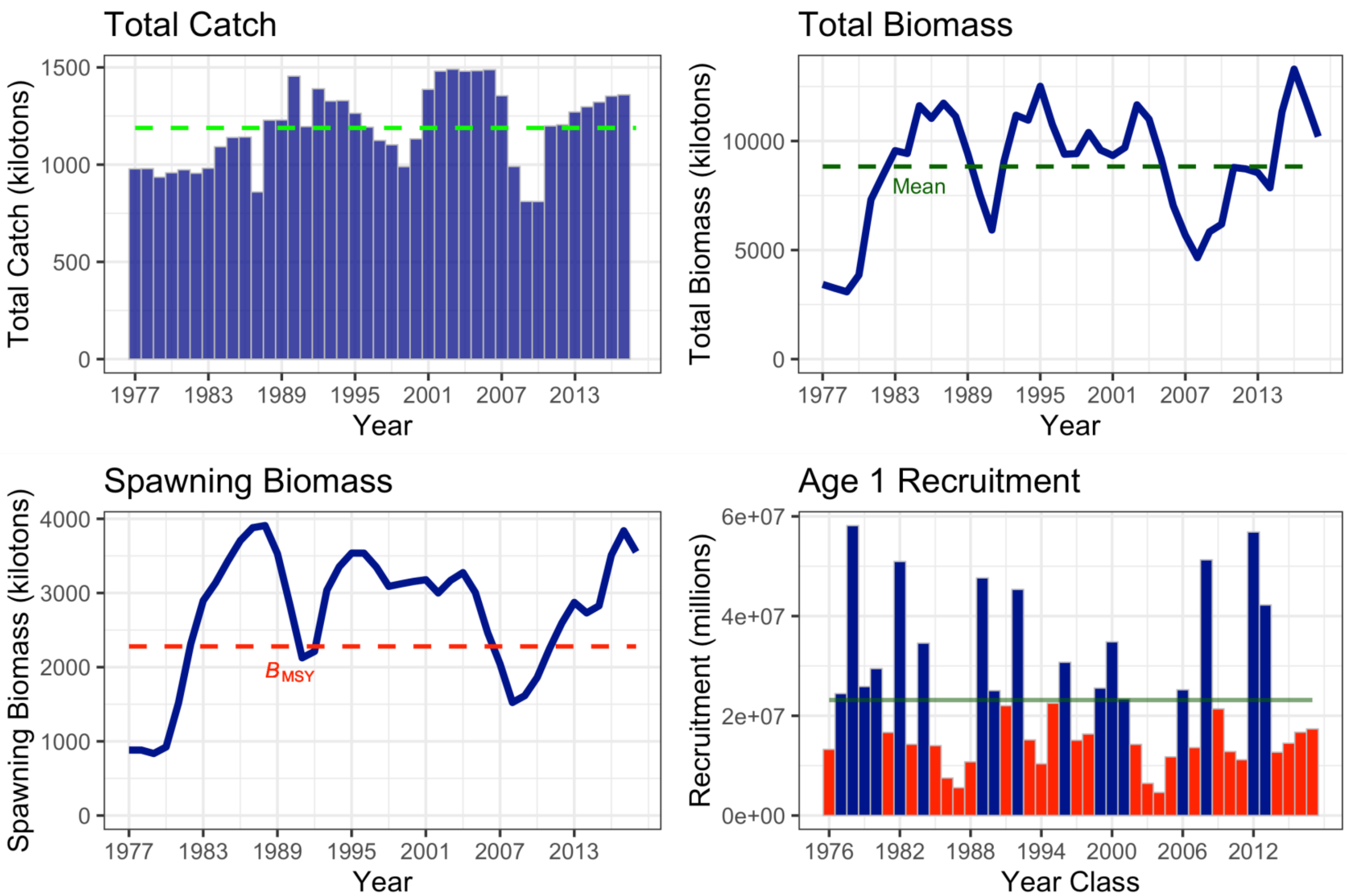
EBS walleye pollock, continued

- Recommendations for next year's assessment (continued):
  - Full treatment of both the existing model and models with alternative treatments of the data should continue to be provided, along with maxABC values under Tier 3 for all models
  - Re-examine the geographic subset of data currently used to develop the AVO index, specifically to see if including Bristol Bay data improves the correlation
  - Explore "A" season trends in mean weight at length with a GAM or similar technique, to determine if the trends are either predominantly environmental or predominantly fishery-driven
  - Regarding σ_R, explore alternative fixed values or estimation methods

EBS walleye pollock, continued

- The Team also received presentations on CEATTLE, ACLIM, and the Bering ROMS/NPZ model
- Recommendations for next year's CEATTLE appendix:
  - The Team recommends that the authors consider projecting pollock abundance with climate-specific recruitment based on hindcast estimates of ROMS/NPZ for the current year and 9-month forecasts for the current year + 1, and also consider comparing forecast skill against an AR process
  - The Team also recommends including results from the respective individual assessment chapters along with CEATTLE results in both single-species and multi-species mode where feasible

EBS walleye pollock, continued



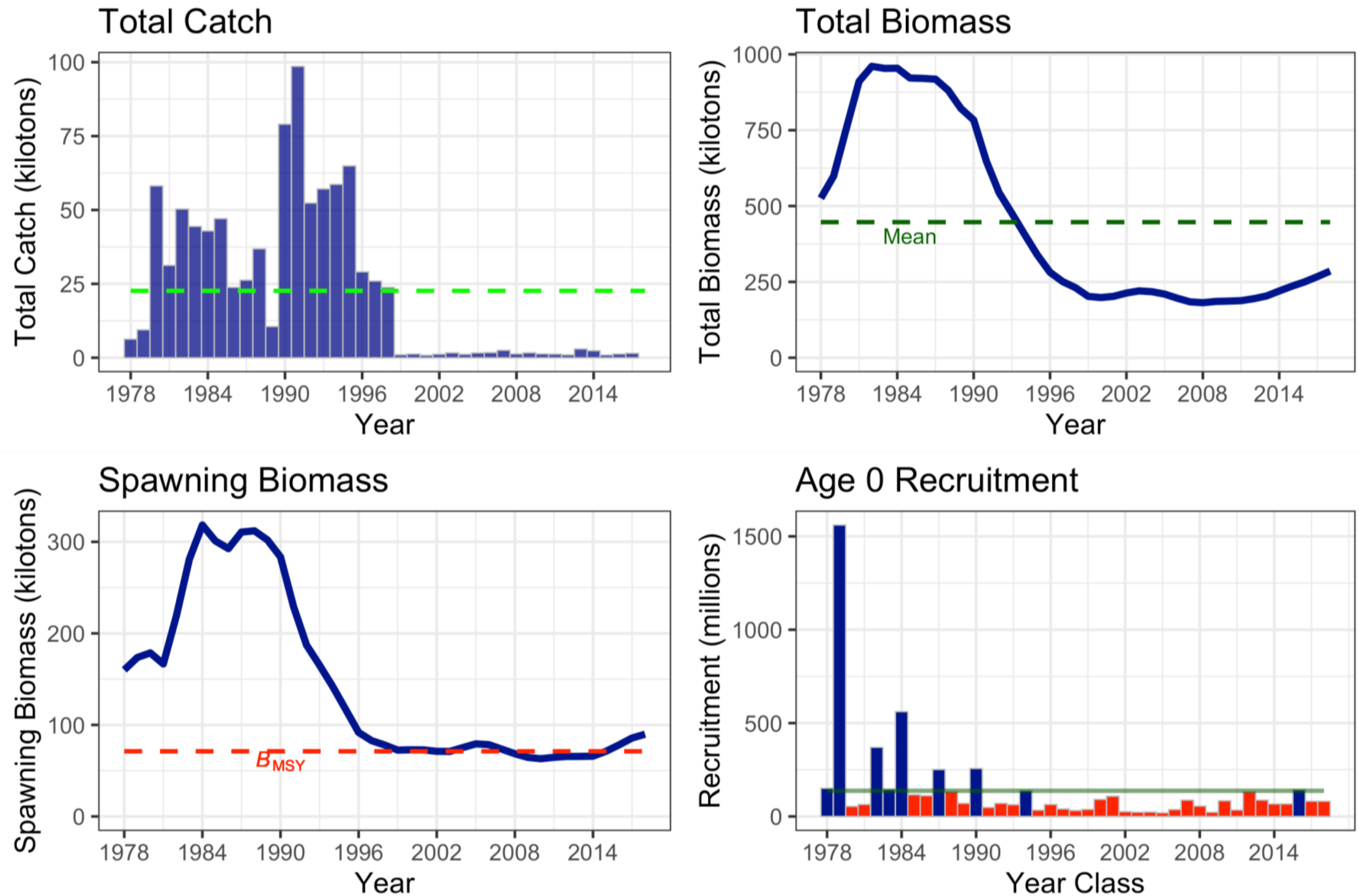
EBS walleye pollock, continued

Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2018 tier	1a	n/a	none
2019 tier	1a	1a	none
2018 age+ biomass	10,965,000	n/a	-0.17
2019 age+ biomass	10,117,000	9,110,000	-0.10
2018 spawning biomass	3,678,000	n/a	-0.16
2019 spawning biomass	3,365,000	3,107,000	-0.08
B0	5,394,000	5,866,000	0.09
Bmsy	2,042,000	2,280,000	0.12
2019 FOFL	0.621	0.645	0.04
2019 FABC	0.336	0.356	0.06
2018 OFL	4,797,000	n/a	-0.18
2019 OFL	4,592,000	3,914,000	-0.15
2018 ABC	2,592,000	n/a	-0.17
2019 ABC	2,467,000	2,163,000	-0.12

Chapter 1A: AI walleye pollock (full)

- New data:
  - 2018 AI survey biomass estimate (up 100% from 2016)
  - 2016 AI survey age composition
- Model changes/alternatives:
  - Models 15.1 (base) and 15.2 presented again
    - Model 15.2 features differential M at ages 1, 2, and 15
  - Authors and Team recommend staying with base model
- Stock status and trend
  - 2015 cohort is the first since 1989 to exceed the 1977-2015 average
  - Spawning biomass reached a minimum of $B_{35\%}$ in 2003 and has generally increased since then, primarily as a result of very low F
    - Projected to reach 47% of $B_{100\%}$ in 2019
- Mohn's ρ = 0.08

AI walleye pollock, continued



AI walleye pollock (continued)

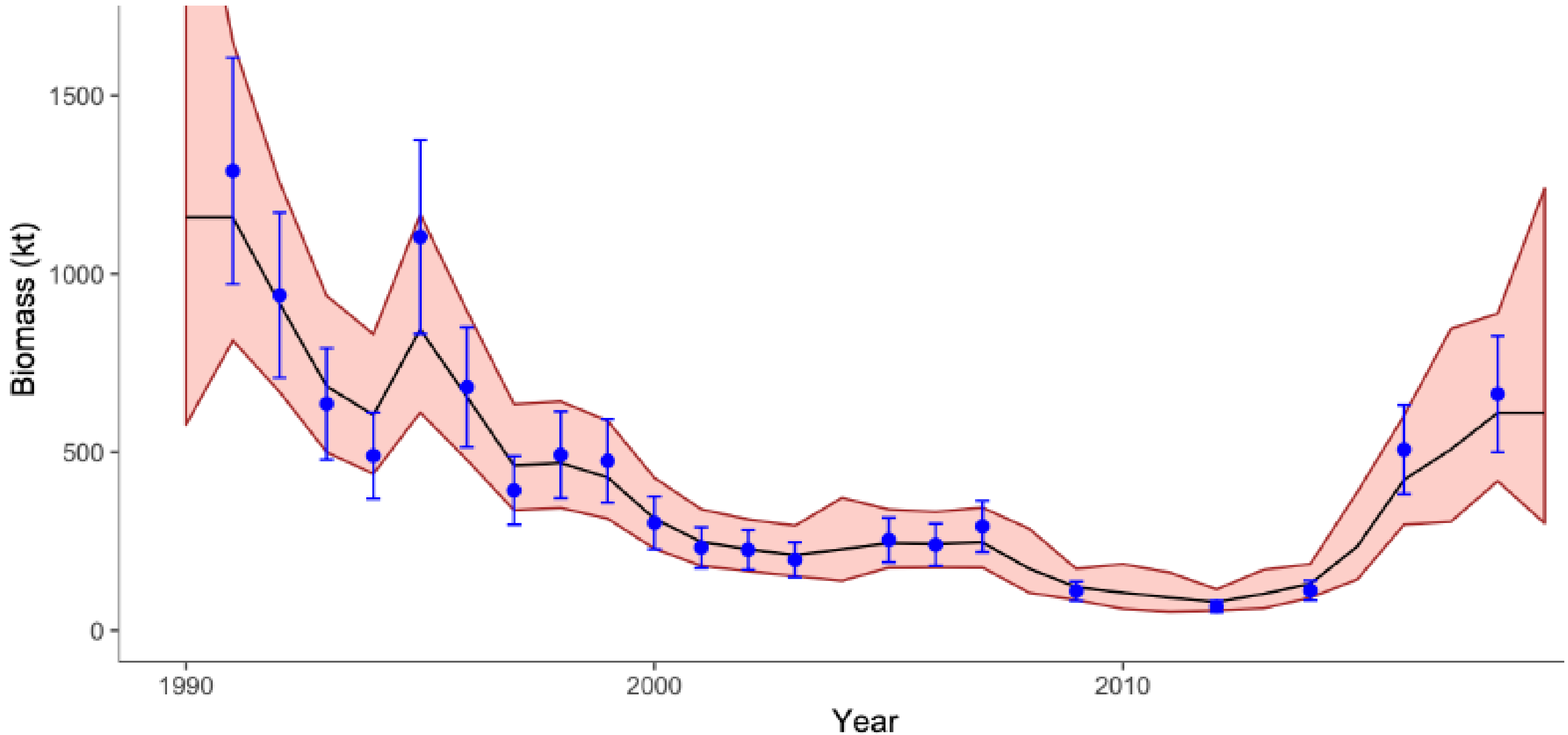
Quantity	Last asmt.	This asmt.	Change
M	0.19	0.20	0.05
2018 tier	3b	n/a	↑
2019 tier	3b	3a	↑
2018 age+ biomass	272,675	n/a	0.17
2019 age+ biomass	262,010	319,892	0.22
2018 spawning biomass	78,305	n/a	0.22
2019 spawning biomass	67,627	95,253	0.41
B100%	203,100	203,279	0.00
B40%	81,240	81,312	0.00
B35%	71,085	71,147	0.00
2019 FOFL	0.341	0.415	0.22
2019 FABC	0.273	0.331	0.21
2018 OFL	49,289	n/a	0.30
2019 OFL	37,431	64,240	0.72
2018 ABC	40,788	n/a	0.30
2019 ABC	30,803	52,887	0.72

Chapter 1B: Bogoslof walleye pollock (full)

- New data:
  - 2018 AT survey biomass estimate (up 31% from 2016)
  - 2018 AT survey age composition
- Model changes/alternatives:
  - Tier 5 random effects, plus updated age-structured model to check M
- Stock status and trend
  - AT survey biomass increasing steadily since all-time low in 2012
    - Now at highest level since 1996

Bogoslof walleye pollock (continue)

- Survey biomass data with random effects model fit



Bogoslof walleye pollock (continued)

Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	434,760	610,267	0.40
2019 FOFL	0.300	0.300	0.00
2019 FABC	0.140	0.225	0.61
2018 OFL	130,428	n/a	0.40
2019 OFL	130,428	183,080	0.40
2018 ABC	60,800	n/a	1.26
2019 ABC	60,800	137,310	1.26

- SSC embarked on a 2-year “stair-step” approach for ABC in 2016, with the first step scheduled for 2017 and the second step for 2018, but the second step (to an ABC of 97,428 t) was not taken

Chapter 2: EBS Pacific cod (full)

- Switch to author's presentation (Team comments will follow)

EBS Pacific cod, continued

- The Team discussed the NBS survey results, what they imply about the population, and how it should be used in the assessment model, leading to identification of three hypotheses:
  1. Pacific cod in the NBS are insignificant to the stock and should not be considered in management
  2. Pacific cod have the capability to migrate from the EBS to the NBS each year, and the stock extends over these two areas
  3. The population in the EBS and the NBS may simply be a mixture of the same stock, or the fish in these two areas are sub-populations of the same stock with different life-history characteristics
- More observations (e.g., genetic studies, tagging) are needed to reject any of these hypotheses

EBS Pacific cod, continued

- If Pacific cod are undertaking an annual migration, that migration may occur at the same time as the survey, and there is a possibility that the survey is double-counting some fish, making catchability greater than 1
- Catchability could be affected by the truncated area surveyed in 2018
    - Pacific cod were observed by other surveys outside of the truncated area in 2018, and a bias in the 2018 estimate may be present
- Furthermore, NBS surveys were conducted in only three years, and if a single summed index is considered in the assessment model, this implies that years without NBS survey estimates have zero biomass in that area
- Models with time-varying catchability may have captured some of these concerns, but a spatial analysis of the survey data with temporal and spatial correlation may provide a useful index

EBS Pacific cod, continued

- Investigating fishery CPUE data throughout the year at specific locations may help understand migration patterns and the intersection of a migrating population with the survey
- The longline fleet has recently started fishing on the population in the NBS, which suggests that the population has expanded in the NBS
- There is a sense that the fishery follows the fish northward, but the break between A and B seasons makes it difficult to tell
    - Industry participants reported that when they arrive on the grounds in the north for B-season, the fish are already there
- Industry participants reported that they also follow fish south at the end of the season
- Additionally, connections may occur with GOA (e.g., Unimak Pass), but the implications of these connections are unknown

EBS Pacific cod, continued

- Models 16.6, 16.6i, 16.6j, and 16.6k capture the three hypotheses:
  - *Model 16.6* is a strong bookend and assumes either that the fish in the NBS are insignificant to management of the stock, or that the fish in that area are unlikely to contribute reproductively to the population
    - e.g., they could die if the climate quickly shifted back to cold years with quick formation of ice or were harvested in Russian waters
  - *Model 16.6i* assumes that the fish in the NBS and EBS are all from the same population and should be modeled as one, with no fish in the NBS in years without a NBS survey
  - *Model 16.6j* incorporates time-varying catchability that may compensate for assuming zero NBS fish in years with no survey
  - *Model 16.6k* models the observations in the two areas separately but as a single population

EBS Pacific cod, continued

- After considering many options for a management model, including averaging various models, the Team recommended that Model 16.6i be used for management because it is the author recommended model and the author clearly itemized the justifications for selecting this model as the preferred model
- In particular, the Team noted:
  - Model 16.6i is an incremental change that includes the NBS survey data without introducing too much complexity
  - While all of the models exhibit positive retrospective bias, Model 16.6i had the lowest retrospective bias of the models presented
  - Model 16.6i satisfies many SSC requests
- Although the Team accepted Model 16.6i, other models, such as 16.6j and 16.6k, may more appropriately handle years where there are no survey data from the NBS as well as capture changes in distribution

EBS Pacific cod, continued

- Moreover, the Team identified the following concerns with Model 16.6i:
  - Years without an NBS survey implicitly assume that the biomass in the NBS was zero, which may result in a conservative view of the decline in recent years (e.g., 2014-2018) of the survey index
  - Larger fish were observed in the NBS, but the composition data were simply summed, which may not accurately reflect selectivity of the combined survey
  - This simple summation of the survey abundances assumes a survey of a population at a particular moment in time, but the timing of the north-south migration is not completely understood, and the survey may be following and interacting with migrating fish, possibly resulting in double-counting and a bias at the EBS/NBS boundary
  - (continued on the next slide)

EBS Pacific cod, continued

- Concerns with Model 16.6i (continued):
  - The EBS and NBS survey observations are based on slightly different grids and occur in slightly different time periods and therefore may have different selectivity patterns and availability, warranting the separate treatment of the two indices
  - Although the summed EBS-NBS biomass index has remained somewhat constant over the last 5 years, this may reflect a bias resulting from the larger fish in the NBS agecomps relative to EBS
  - It is uncertain if the fish in the NBS will contribute to current and future spawning biomass
  - Given the unprecedented shift in distribution and uncertain future climate conditions, there could be additional natural mortality in the NBS that is not accounted for in the present model

EBS Pacific cod, continued

- Alternative to a single model, the Team discussed and seriously considered averaging some or all of the 16.x models to characterize structural uncertainty related to the three hypotheses stated earlier
- In the end, the Team did not average models, largely because:
  - Additional work would be needed to clean up major concerns with all models (of which 16.6i had the fewest):
    - strong retrospective patterns
    - use of options not common for surveys (time-varying catchability)
    - omission of observations (NBS survey)
  - Model 16.6i was the most parsimonious and satisfied the principle of Occam's Razor
  - (continued on next slide)

EBS Pacific cod, continued

- Reasons why the Team did not average models (continued):
  - After much discussion (until 6:30 pm Wednesday), Model 16.6i was the model that the Team felt most comfortable with
    - The Team made the rounds attempting to justify each model and always came back to Model 16.6i
  - The author did not put forward any support for an ensemble
  - The Team did not have time to adequately discuss, choose, and defend an ensemble
  - The Team discussed this again on Friday afternoon per the schedule adopted Wednesday evening upon adjourning, revisiting minutes to confirm the notes
    - With additional time, the Team might have revisited the decision not to create an ensemble

EBS Pacific cod, continued

- The Team developed a risk matrix for this assessment/stock, and determined that the level of concern for each of the three categories was at least 2 (substantially increased concern) and possibly 3 (major concern), either of which would warrant a reduction from maxABC
  - Assessment:
    - Age compositions: potentially significant problems, as in GOA
    - How to treat NBS survey (e.g., ignore, separate Q and selectivity)
    - Competing hypotheses that are not addressed in a single model
    - Differences in stock status (44% to 23% of $B_{100\%}$ across models)
    - Retrospective patterns suggest overestimation of spawning biomass (potentially due to constant M across ages)
    - (continued on next slide)

EBS Pacific cod, continued

- Risk matrix (continued):
  - Assessment (continued):
    - When comparing Mohn's rho for the different models presented, the author and Team were both unsure how the missing data for the NBS impacts the interpretation
    - Uncertainty in the levels of current and historical fishery effort in Russia, especially given industry reports of many cod vessels across the border
    - Uncertainty in stock definition overall, given recent information regarding genetic similarities between GOA, EBS, and NBS fish; also given the poorly understood migration patterns between EBS/NBS areas and Shumagins/EBS areas
  - (continued on next slide)

EBS Pacific cod, continued

- Risk matrix (continued):
  - Population dynamics:
    - Recent low recruitments, and recent lowest observed
      - There may be a risk to assuming that average recruitment may occur in immediate future years
    - Continued decline in survey abundance (numbers), even summing EBS and NBS
    - Uncertainty in migration between EBS, NBS, and GOA, as well into areas outside of the U.S.A.
    - Current distribution is unprecedented
    - Uncertainty in mortality in the EBS and NBS areas, with recent environmental trends
  - (continued on next slide)

EBS Pacific cod, continued

- Risk matrix (continued):
  - Environmental/ecosystem considerations:
    - Unprecedented lack of sea ice in the EBS and associated virtually absent cold pool (not seen before in the 37-year series)
    - Delayed ice melt and spring bloom (1 month)
    - Reduced primary and secondary production; lack of large copepods and Euphausiids
    - Indications of continued poor conditions for recruitment and growth: starving birds, low forage in south Bering, exceedingly warm temperatures, transport of productivity and delay of bloom due to wind changes, continued warm conditions
    - (continued on next slide)

EBS Pacific cod, continued

- Risk matrix (continued):
  - Environmental/ecosystem considerations (continued):
    - Reduced energetic value and lipid content in lower trophic species that indicate poor food quality for 2019-2020
    - Forecasts of continued warm conditions in SEBS (small cold pool forecast for summer 2019) and continued marine heatwave (NEBS)
    - Multiple signs that the system is not productive
    - Unprecedented extent and duration of sea bird die off and indications of insufficient prey resources
    - Although NEBS is more favorable than SEBS in terms of these indicators, the trends in NEBS are also deteriorating

EBS Pacific cod, continued

- 2019 ABC:
  - The Team recommends a 20% reduction in the 2019 ABC from the 2019 maxABC, resulting in a reduced ABC of 144,800 t
  - This is because of the assessment, population dynamics, and ecosystem/environmental concerns listed in the risk table above
  - A value of 20% was chosen because some risk table elements should be classified stronger than Level 2 and a meta-analysis of past reductions with level 2 concerns were typically in the 15-35% range
  - Additionally, models, 16.6, 16.6i, 16.6j, and 16.6k were all extensively discussed and considered for management, and the 20% reduction is similar to the average ABC from these four models

EBS Pacific cod, continued

- 2020 ABC:
  - The Team recommends a 20% reduction in the 2020 ABC from the 2020 maxABC, as projected from the reduced 2019 ABC, resulting in a 2020 reduced ABC of 123,200 t
  - This is because similar concerns for the assessment model and population dynamics remain for the 2020 prediction, and anomalous environmental conditions are likely to persist

EBS Pacific cod, continued

- For next year's assessment, the Team recommended that:
  - the EBS Pacific cod ages be examined for potential biases and reader effects as seen with GOA Pacific cod (i.e., Barbeaux et al. 2018 and Kastelle et al. 2017)
  - fisheries data be examined to determine if there are within-year patterns that may indicate seasonal movement, and if the survey timing may intersect with that seasonal migration
  - a model-based survey time-series be developed that can predict combined abundance of the expanded EBS survey area and the Northern Bering Sea survey area for all years
    - Length and age compositions should also be created that account for and are appropriately weighted by these model-based estimates
    - (continued on next slide)

EBS Pacific cod, continued

- For next year's assessment, the Team recommended that:
  - a model-based survey time-series be developed (continued)
    - Validate the predictions using various methods as well as consistency with observations from other external surveys....
  - the NEBS survey be conducted again in 2019 to provide data for the Pacific cod assessment
  - Pacific cod fishery catches and Pacific cod survey data in Russia be researched and summarized
  - the significance of retrospective patterns when using a time-series with data mainly in recent years ... be investigated and explained; for example, are the Mohn's ρ estimates useful to compare across models?
  - (continued on next slide)

EBS Pacific cod, continued

- For next year's assessment, the Team recommended that:
  - the author considers an ensemble of models using the three hypotheses discussed above to address the structural uncertainty resulting from these hypotheses, as well as additional uncertainties captured by various models....
  - the author considers bringing forward an ensemble of models to capture structural uncertainty with a justifiable weighting as well as a "null" approach with equal weights
    - The Plan Team may also consider an ensemble even if not recommended by the author
    - (continued on next slide)

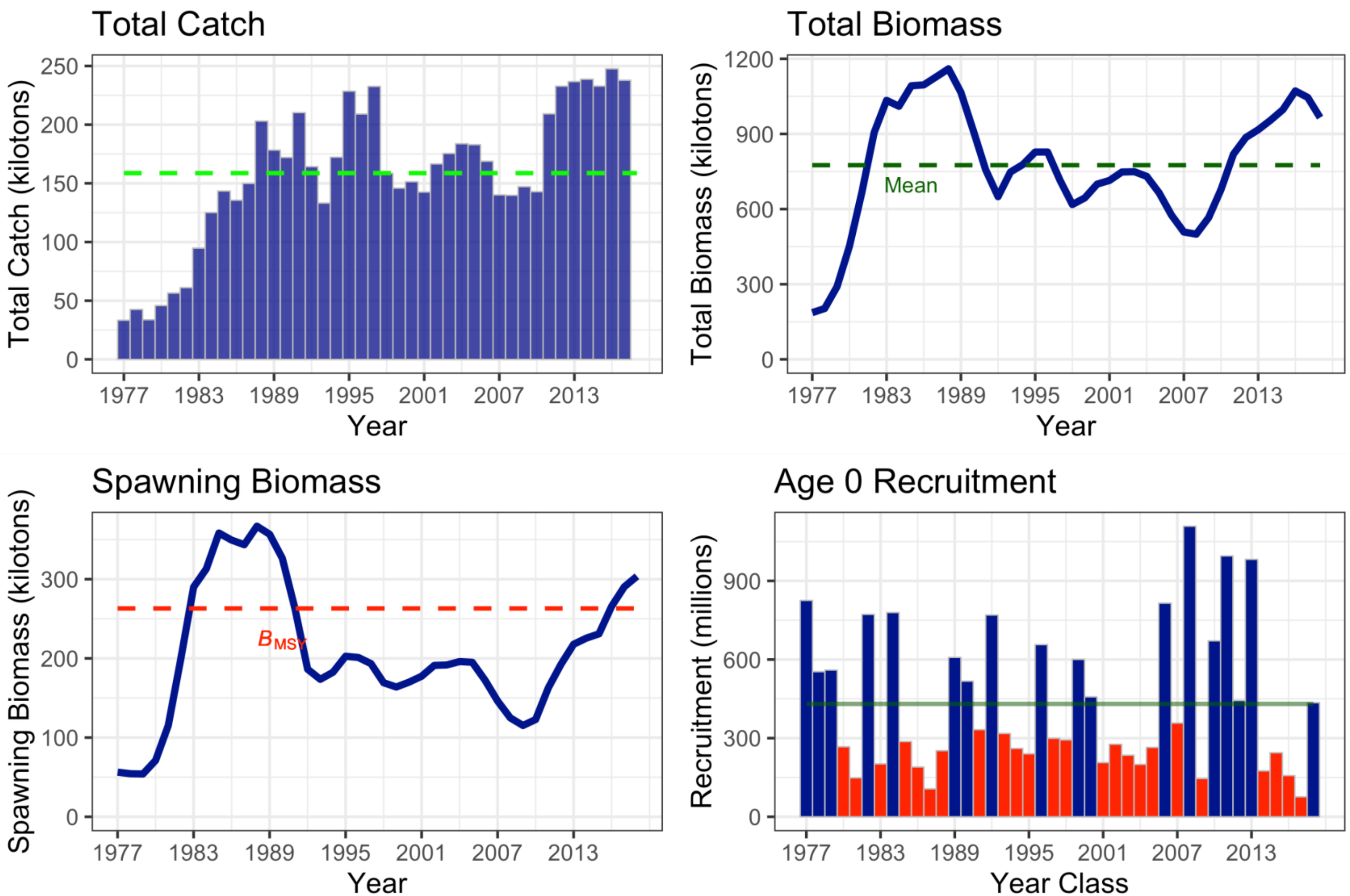
EBS Pacific cod, continued

- For next year's assessment, the Team recommended that:
  - ensemble modeling (continued):
    - If an ensemble is used, all model outputs in the ensemble that are management related should be averaged, and the ABC should be determined from those averaged outputs
      - i.e., the application of the control rule to averaged biological reference values
      - The Team would appreciate feedback from the SSC on appropriate methods to average model outputs to determine an ABC
  - (continued on next slide)

EBS Pacific cod, continued

- For next year's assessment, the Team recommended that:
  - the authors coordinate with Council staff to augment the fishery information section of the assessment for next year
    - Council staff will be providing a cod allocation review in 2019 and will work with the author to provide pertinent summary sections over the summer
  - the authors coordinate with Alaska Department of Fish and Game on assessment data needs from the state managed Area O Pacific cod fishery as the fishery GHL is expanded under new allocation rules from 6.4% to a maximum 15% of the Bering Sea Pacific cod ABC

EBS Pacific cod, continued



EBS Pacific cod, continued

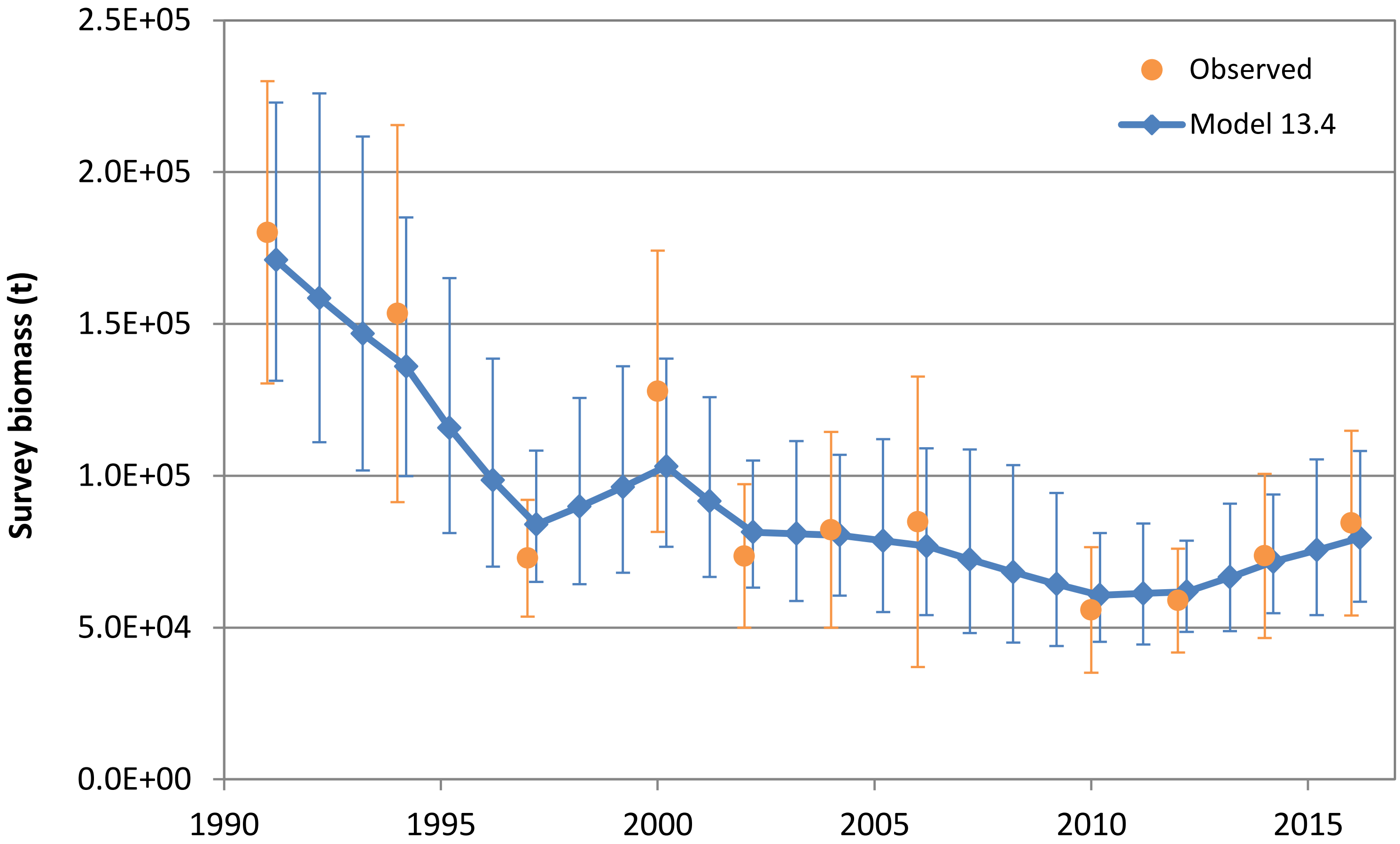
Quantity	Last asmt.	This asmt.	Change
M	0.36	0.34	-0.06
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	918,000	n/a	-0.10
2019 age+ biomass	762,000	824,000	0.08
2018 spawning biomass	292,000	n/a	-0.01
2019 spawning biomass	262,000	290,000	0.11
B100%	593,000	658,000	0.11
B40%	237,000	263,000	0.11
B35%	207,000	230,000	0.11
2019 FOFL	0.38	0.38	0.00
2019 FABC	0.31	0.24	-0.23
2018 OFL	238,000	n/a	-0.09
2019 OFL	201,000	216,000	0.07
2018 ABC	201,000	n/a	-0.28
2019 ABC	170,000	144,800	-0.15

Chapter 2A: AI Pacific cod (full)

- New data:
  - 2018 AI survey biomass estimate (down 4% from 2016)
- Model changes/alternatives: none
  - Standard Tier 5 random effects model
- Stock status and trend:
  - Tier 5 RE model estimates that survey biomass has increased continuously since the all-time low observed in 2010
    - 2018 estimate is 32% higher than 2010 estimate
    - 2018 estimate is 11% lower than time series average

AI Pacific cod, continued

- Survey biomass



AI Pacific cod, continued

- Biomass apportionment
  - “Harvest limit” for the WAI is computed by subtracting State GHL from AI ABC, then multiplying by proportion of biomass in WAI
  - Proportion “determined by the annual stock assessment process”
  - Based on 2019 estimate from RE model, proportion = 15.7%
    - Down from 25.6% estimated in 2016-2017 assessments
  - GHL has been 27% of ABC since 2016; increasing to 31% in 2019
  - Recommended 2019 ABC is 20,600 t, implying a 2019 WAI harvest limit of 20,600 t × (1.00–0.31) × 0.157 = 2,232 t
    - 2018 WAI catch through 11/24 = 2,694 t
  - (continued on next 3 slides)

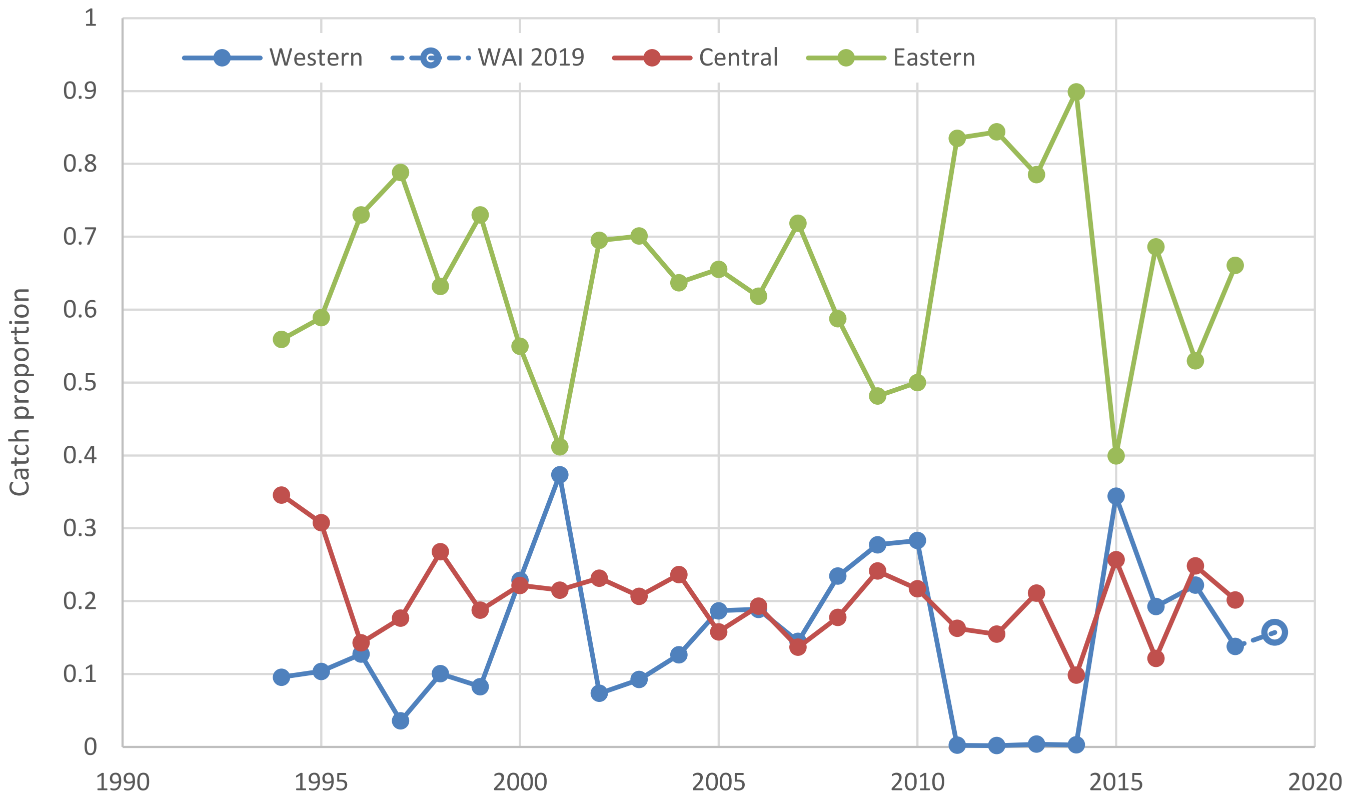
AI Pacific cod, continued

- Biomass proportions

	Observed			Estimated		
Year	WAI	CAI	EAI	WAI	CAI	EAI
1991	0.419	0.221	0.360	0.432	0.231	0.337
1994	0.155	0.336	0.509	0.225	0.320	0.454
1997	0.197	0.415	0.388	0.194	0.368	0.438
2000	0.341	0.287	0.371	0.287	0.303	0.410
2002	0.321	0.336	0.343	0.257	0.304	0.439
2004	0.117	0.252	0.631	0.152	0.305	0.543
2006	0.230	0.260	0.511	0.237	0.273	0.489
2010	0.382	0.201	0.417	0.296	0.229	0.475
2012	0.229	0.251	0.519	0.239	0.225	0.535
2014	0.246	0.115	0.639	0.246	0.185	0.568
2016	0.234	0.231	0.535	0.221	0.205	0.574
2018	0.141	0.253	0.606	0.157	0.235	0.607

AI Pacific cod, continued

- Note that WAI was closed from 2011-2014
- 2019 value is based on most recent model biomass proportion



AI Pacific cod, continued

- Biomass apportionment, continued
  - Team discussion:
    - Options include basing the proportion on:
      - the raw survey data or the RE model estimates
      - the most recent estimate or an average over recent years
    - Using the model-based estimate intrinsically introduces some level of smoothing compared to the survey observations
    - Team ultimately agreed that 15.7% is the appropriate proportion

AI Pacific cod, continued

- Recommendations for next year's assessment:
  - The Team recommends investigating natural mortality to determine if there is a more appropriate value of M for this Tier 5 stock assessment
    - Potential sources of information are the GOA P. cod assessment, the prior for M currently developed for P. cod, and a prior for M using various approaches for estimating M (i.e., http://barefootecologist.com.au/shiny_m.html)
  - Given the continued concerns of the EBS P. cod assessment, the Team recommends continued focus on the EBS P. cod assessment and giving a lower priority to developing an age-structured AI P. cod model
    - Progress on the EBS and GOA P. cod assessments may provide useful insights into developing an age-structured assessment for AI P. cod

AI Pacific cod, continued

- Following past practice, the value of M used in the Tier 5 harvest control rule is borrowed from the EBS assessment, resulting in a change from 0.36 to 0.34 this year

Quantity	Last asmt.	This asmt.	Change
M	0.36	0.34	-0.06
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	79,600	80,700	0.01
2019 FOFL	0.36	0.34	-0.06
2019 FABC	0.27	0.255	-0.06
2018 OFL	28,700	n/a	-0.05
2019 OFL	28,700	27,400	-0.05
2018 ABC	21,500	n/a	-0.04
2019 ABC	21,500	20,600	-0.04

Chapter 3: sablefish (full)

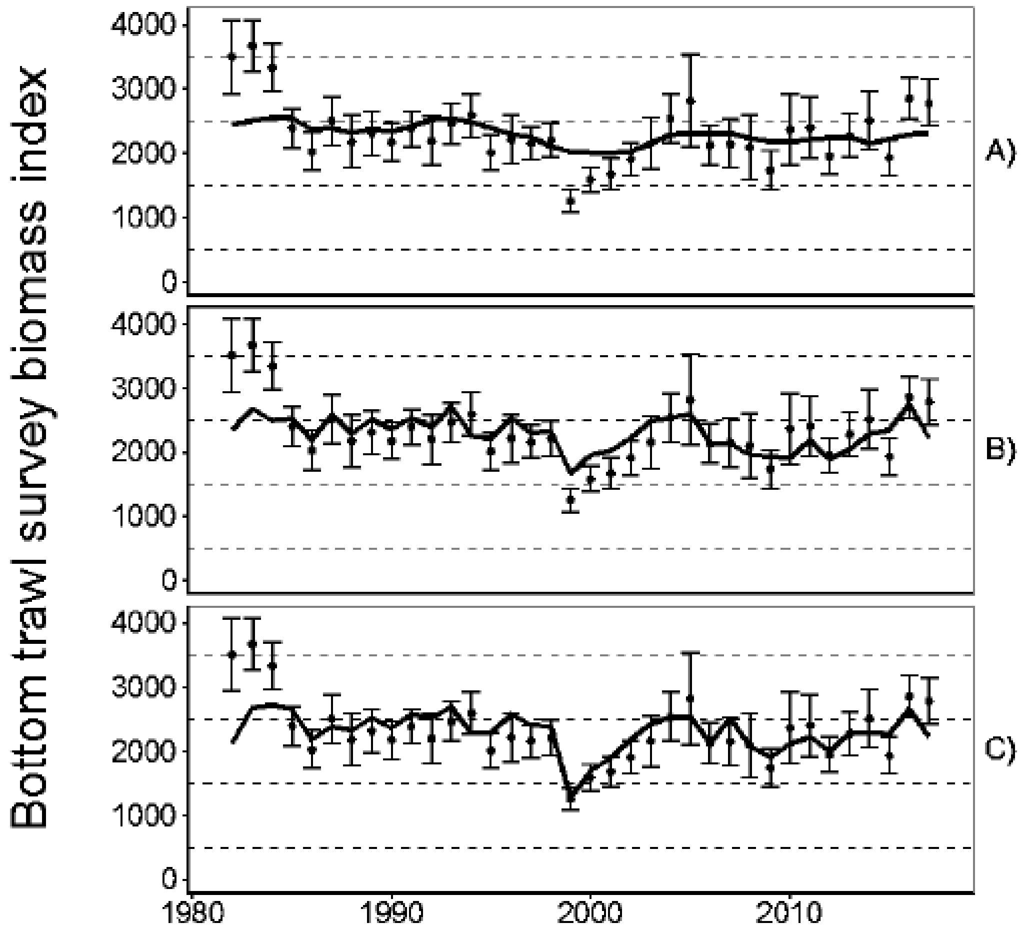
- Covered in GOA Team presentation (Thanks, GOA colleagues!)

Chapter 4: yellowfin sole (full)

- New data:
  - Fishery and survey agecomps for 2017
  - EBS shelf survey biomass estimate for 2018 down 32% from 2017
- Model changes/alternatives:
  - Model 14.1 is the base model (nearly unchanged since about 2010)
  - Model 14.2 uses a different period to estimate the SRR
    - Model 14.1 uses 1978-2012; Model 14.2 uses 1955-2012
    - F_{MSY} is higher, B_{MSY} is lower under Model 14.2
  - Model 18.1 augments the temperature:catchability relationship in the base model by including survey start date and an interaction term
    - Paper by Nichol et al. to appear in *Fisheries Research*
  - Authors and Team recommend Model 18.1

Yellowfin sole, continued

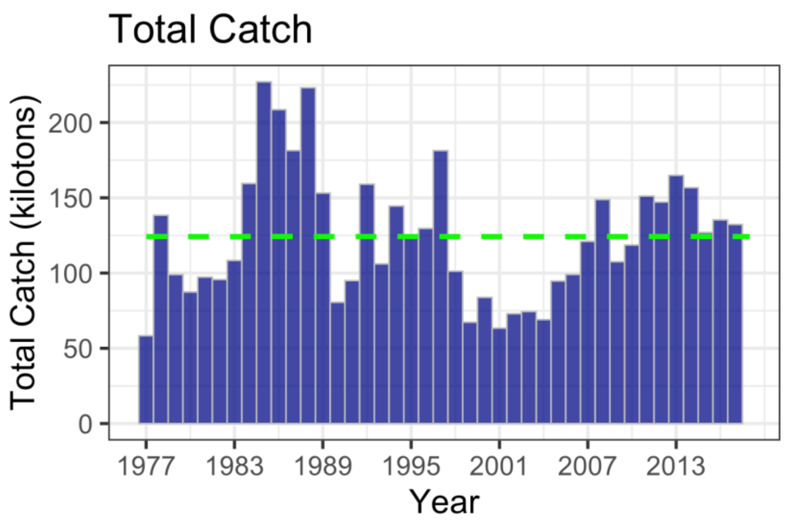
- A: constant Q; B: temperature only; C: temp., start date, and interaction

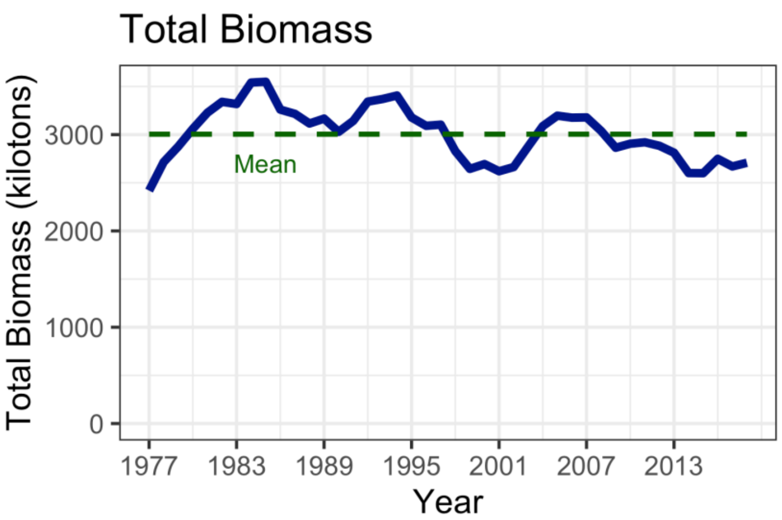


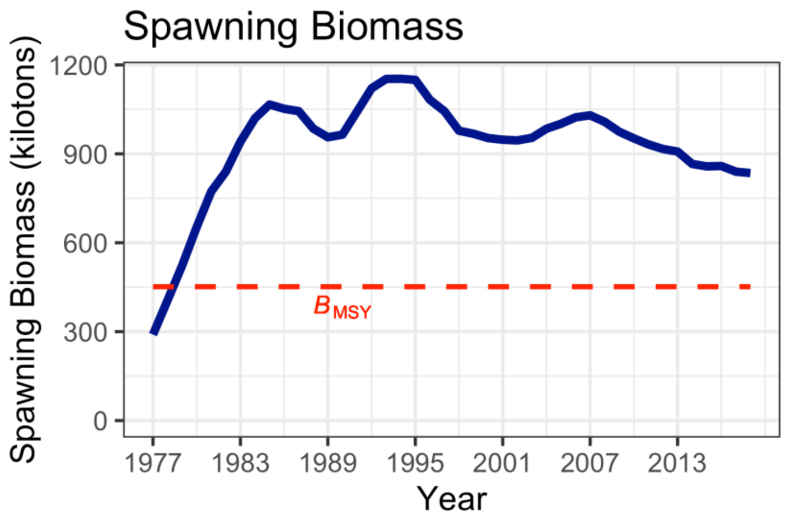
Yellowfin sole, continued

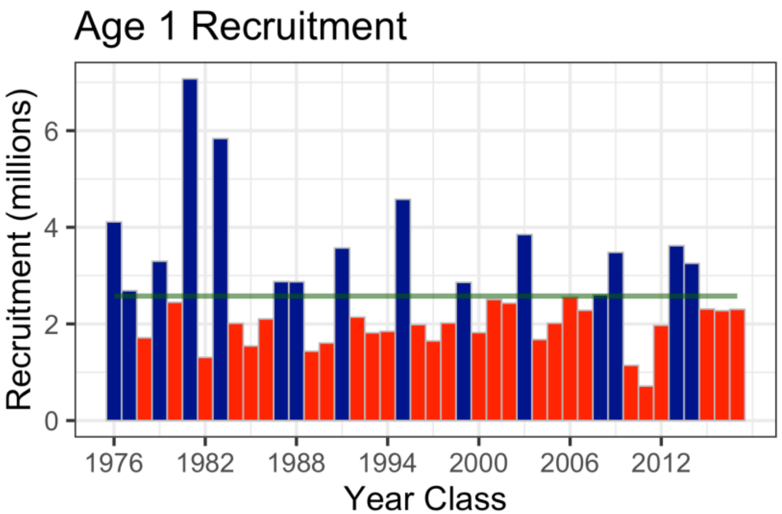
- Stock status and trend:
  - 2003 and 2009 cohorts are 49% and 21% above average
    - However, 9 of the last 12 cohorts are below average
  - Spawning biomass has declined almost continuously since 2007
  - 2019 spawning biomass is 68% of B_0 and 85% above B_{MSY}
- Mohn's ρ = 0.12
- The Team made no recommendations for next year, but discussed:
  - the drop in survey biomass despite the increase in temperature
  - the authors' choice not to include the NBS survey data in a model despite the high abundance of yellowfin sole in that region
    - The author did not think that the 2018 NBS survey was fully appropriate for this stock as it did not include shallow stations that would have been informative for yellowfin sole

Yellowfin sole, continued









Yellowfin sole, continued

Quantity	Last asmt.	This asmt.	Change
M	0.12	0.12	0.00
2018 tier	1a	n/a	none
2019 tier	1a	1a	none
2018 age+ biomass	2,553,100	n/a	-0.04
2019 age+ biomass	2,460,700	2,462,400	0.00
2018 spawning biomass	895,600	n/a	-0.05
2019 spawning biomass	890,000	850,600	-0.04
B0	1,204,000	1,245,400	0.03
Bmsy	456,000	460,800	0.01
2019 FOFL	0.12	0.118	-0.02
2019 FABC	0.109	0.107	-0.02
2018 OFL	306,700	n/a	-0.05
2019 OFL	295,600	290,000	-0.02
2018 ABC	277,500	n/a	-0.05
2019 ABC	267,500	263,200	-0.02

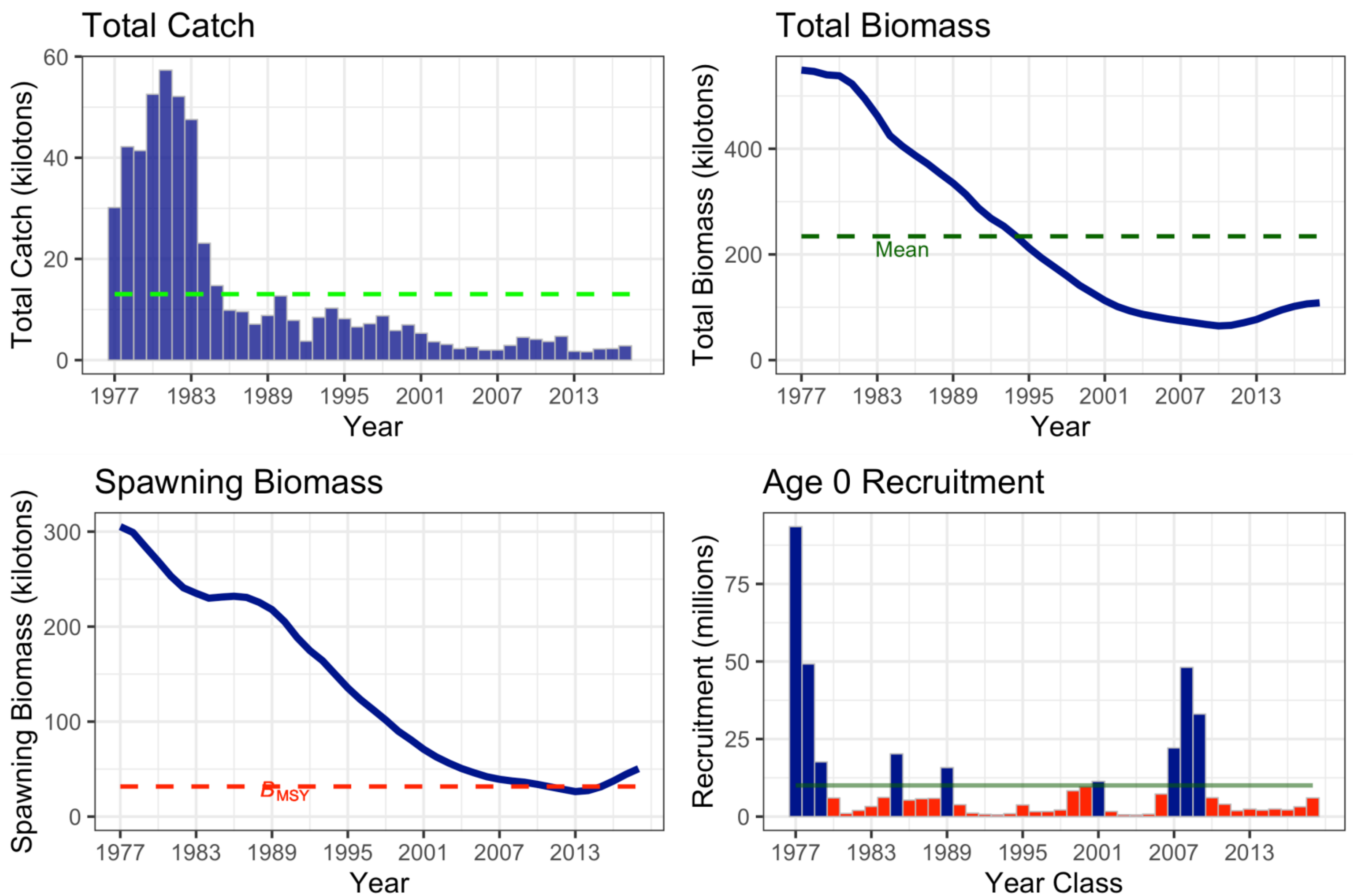
Chapter 5: Greenland turbot (full)

- New data:
  - 2017 EBS shelf survey agecomps and size-at-age data
  - 2018 fishery, EBS shelf survey, and ABL longline survey sizecomps
  - 2018 EBS shelf survey biomass (down 16% from 2017)
  - 2018 ABL longline survey RPN (down 24% from 2017)
- Model changes/alternatives
  - Model 16.1b is treated as the base model (although it includes a minor technical change, it gives the same results as the base model)
  - Model 16.1c includes a link between warm/cold years and R_0
    - Although it performed well statistically, authors/Team did not recommend it, as implications have not been fully considered and newer SS options that allow environmental impacts on recruitment without changing R_0 should be explored first

Chapter 5: Greenland turbot (full)

- Stock status and trend
  - The 2007, 2008, and 2009 cohorts are estimated to be 120%, 379%, and 229% above the 1977-2018 average
  - Spawning biomass declined almost continuously from 1975 to 2013 (a total decline of 92%)
  - However, it has been increasing steadily since 2013, and is projected to have more than doubled by 2019
  - 2019 spawning biomass is 60% of $B_{100\%}$
- Mohn's ρ = 0.097
- The Team made no recommendations for next year, but discussed:
  - the Team's continued interest in a model similar to 16.1c
  - integrating a spatial model that explores Russian connections
  - investigating time blocks to improve selectivity estimation

Greenland turbot, continued



Greenland turbot, continued

Quantity	Last asmt.	This asmt.	Change
M	0.112	0.112	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	126,417	n/a	-0.16
2019 age+ biomass	127,021	105,930	-0.17
2018 spawning biomass	58,035	n/a	-0.07
2019 spawning biomass	61,878	54,244	-0.12
B100%	103,097	90,534	-0.12
B40%	41,239	36,213	-0.12
B35%	36,084	31,687	-0.12
2019 FOFL	0.22	0.21	-0.05
2019 FABC	0.18	0.18	0.00
2018 OFL	13,148	n/a	-0.14
2019 OFL	13,540	11,362	-0.16
2018 ABC	11,132	n/a	-0.13
2019 ABC	11,473	9,658	-0.16

Chapter 6: arrowtooth flounder (full)

- New data:
  - 2017 & 2018 EBS shelf survey and 2018 AI survey sizecomps
  - 2017 EBS shelf survey biomass (down 11% from 2016)
  - 2018 EBS shelf survey biomass (up 21% from 2017)
  - 2018 AI survey biomass (down 10% from 2016)
  - Fishery size compositions for 2017 and 2018
  - 2016 and 2017 EBS shelf survey agecomps
  - 2012 and 2016 AI survey agecomps

Arrowtooth flounder, continued

- Model alternatives (first four previewed in September/October):
  - Model 15.1b: base model
  - Model 15.1c: same as 15.1b, but with a smoothed length-age conversion matrix and updated weight at age
  - Model 18.3: same as 15.1c, but with an ageing error matrix
  - Model 18.6: same as 15.1c, but with length-based survey selectivity
  - Model 18.9: same as 18.3, but with slope survey thru 1991 removed
  - Author and Team recommend Model 18.9
    - Smooth length-age conversion matrix, updated weight at age, and inclusion of ageing error matrix seem advisable in general
    - Length-based selectivity resulted in too many males on shelf
    - Dropping slope data through 1991 conforms to general practice
    - Model 18.9 fit data "better," but fits are not truly comparable

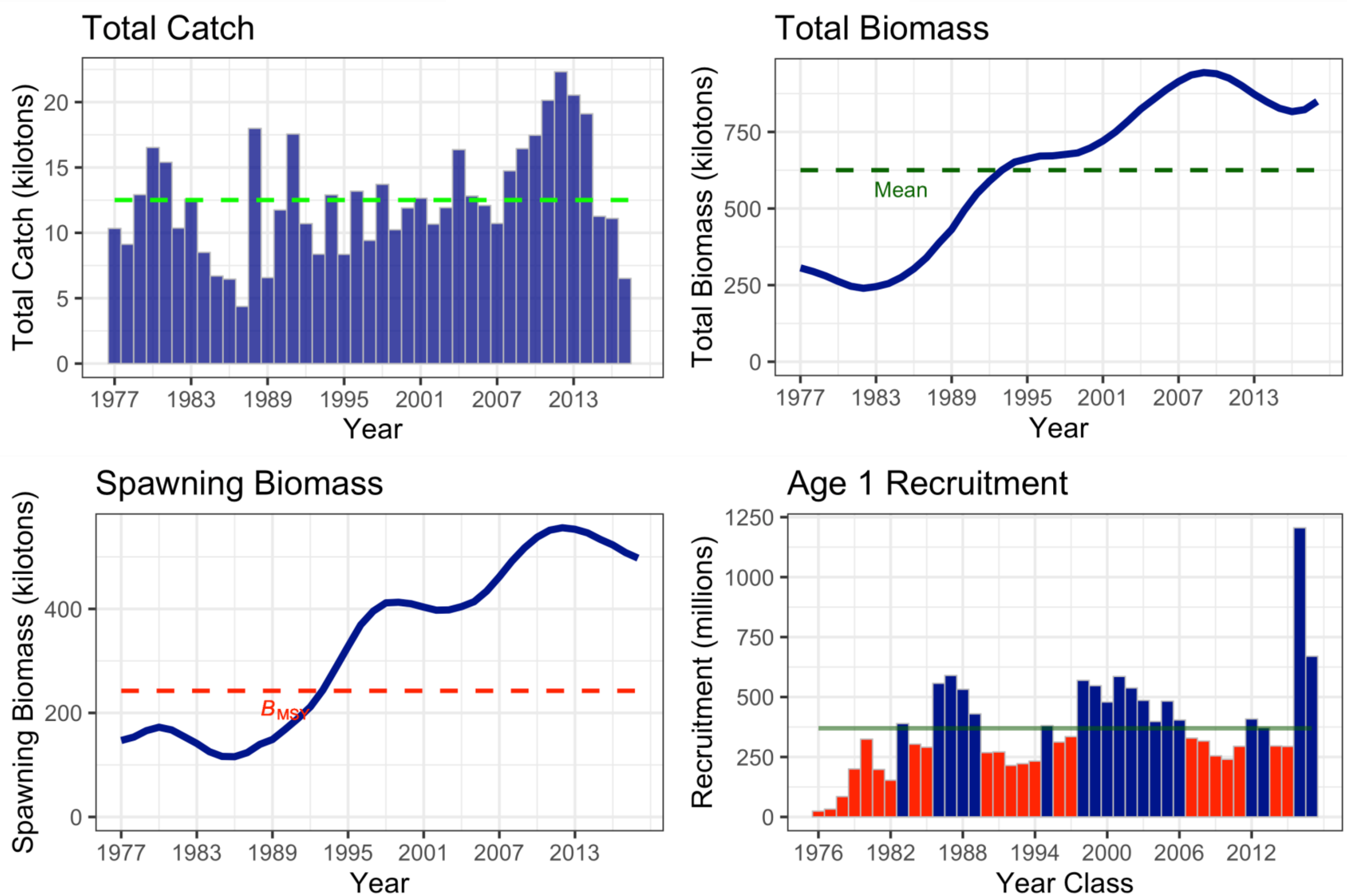
Arrowtooth flounder, continued

- Stock status and trend
  - 1999-2007 cohorts were all above average, and 2016 cohort is 240% above average (cohorts mislabeled in chapter)
  - Spawning biomass increased almost continuously from 1986-2012
  - However, it has declined almost continuously since then
    - Overall decline = 13%
  - 2019 biomass is 80% of $B_{100\%}$
- Mohn's ρ = 0.029

Arrowtooth flounder, continued

- The Team re-iterated a previous recommendation that Models 18.7 and 18.8 from this year's September document be evaluated in a future year
  - These represent separating the BSAI model into individual BS and AI models

Arrowtooth flounder, continued



Arrowtooth flounder, continued

Quantity	Last asmt.	This asmt.	Change
M	0.35/0.20	0.35/0.20	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	785,141	n/a	0.14
2019 age+ biomass	782,840	892,591	0.14
2018 spawning biomass	490,663	n/a	-0.02
2019 spawning biomass	472,562	482,174	0.02
B100%	530,135	606,237	0.14
B40%	212,054	242,495	0.14
B35%	185,547	212,183	0.14
2019 FOFL	0.151	0.161	0.07
2019 FABC	0.129	0.136	0.05
2018 OFL	76,757	n/a	0.08
2019 OFL	75,084	82,939	0.10
2018 ABC	65,932	n/a	0.07
2019 ABC	64,494	70,673	0.10

Chapter 7: Kamchatka flounder (full)

- New data:
  - Fishery and AI survey sizecomp time series recompiled
    - Some misidentification in previous assessments
  - 2017 and 2018 shelf survey sizecomps
  - EBS shelf survey biomass time series recompiled
    - 2018 biomass down 8% from 2017
  - 2018 AI survey biomass up 5% from 2016
- Model alternatives:
  - Model 16.0a: base model (= Model 16.0 with updated data)
  - Model 16.0b: same as Model 16.0a but with updated age-length conversion matrix (CV declines w.r.t. age)
  - Author and Team recommend Model 16.0a, based on better fits and lower retrospective bias

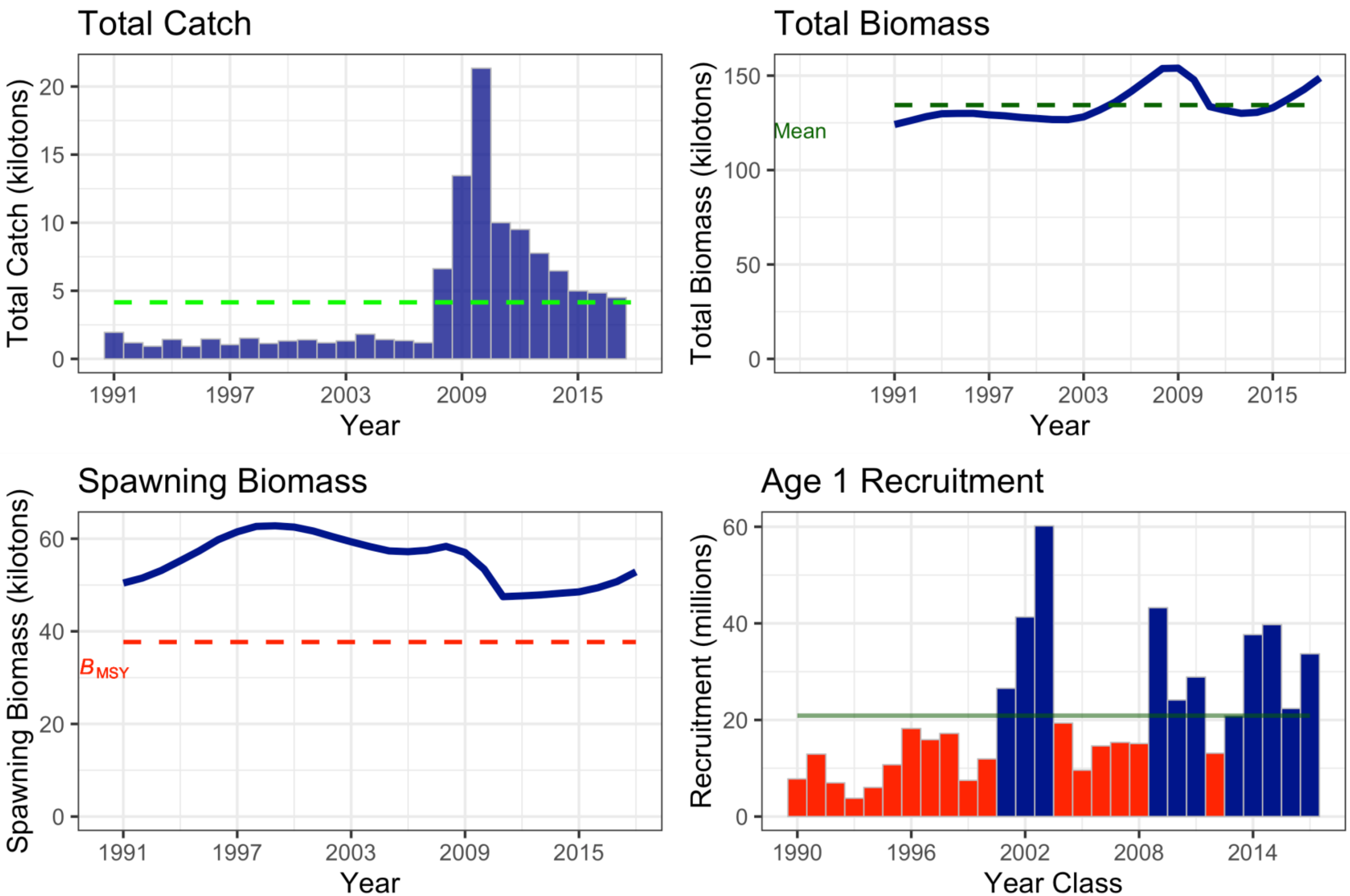
Kamchatka flounder, continued

- Stock status and trend
  - 2001, 2002, 2008, 2013, and 2014 cohorts all >80% above average
  - Spawning biomass declined by 24% from 1999-2011, but has increased by 11% since then
  - 2019 spawning biomass is 51% of $B_{100\%}$
- Mohn's ρ = 0.10
- Author's proposed area for future research:
  - More length (or age) data from the fishery are needed
  - Update conversion matrix with all data available

Kamchatka flounder, continued

- The Team recommends:
  - Examining data weighting to deal with underfitting the data
  - Investigating whether the slope survey catchability could be estimated inside the model instead of fixed at 0.18
  - Re-evaluating historical estimates of species composition, in particular the assumption that Kamchatka flounder comprised 10% of the catch of combined arrowtooth/Kamchatka catch from 1991-2007
    - Maybe look at proportions for years in which data do exist and compare to survey proportions to see if there is any correlation
    - Or maybe conduct sensitivity runs to determine if changing that rate impacts the model significantly

Kamchatka flounder, continued



Kamchatka flounder, continued

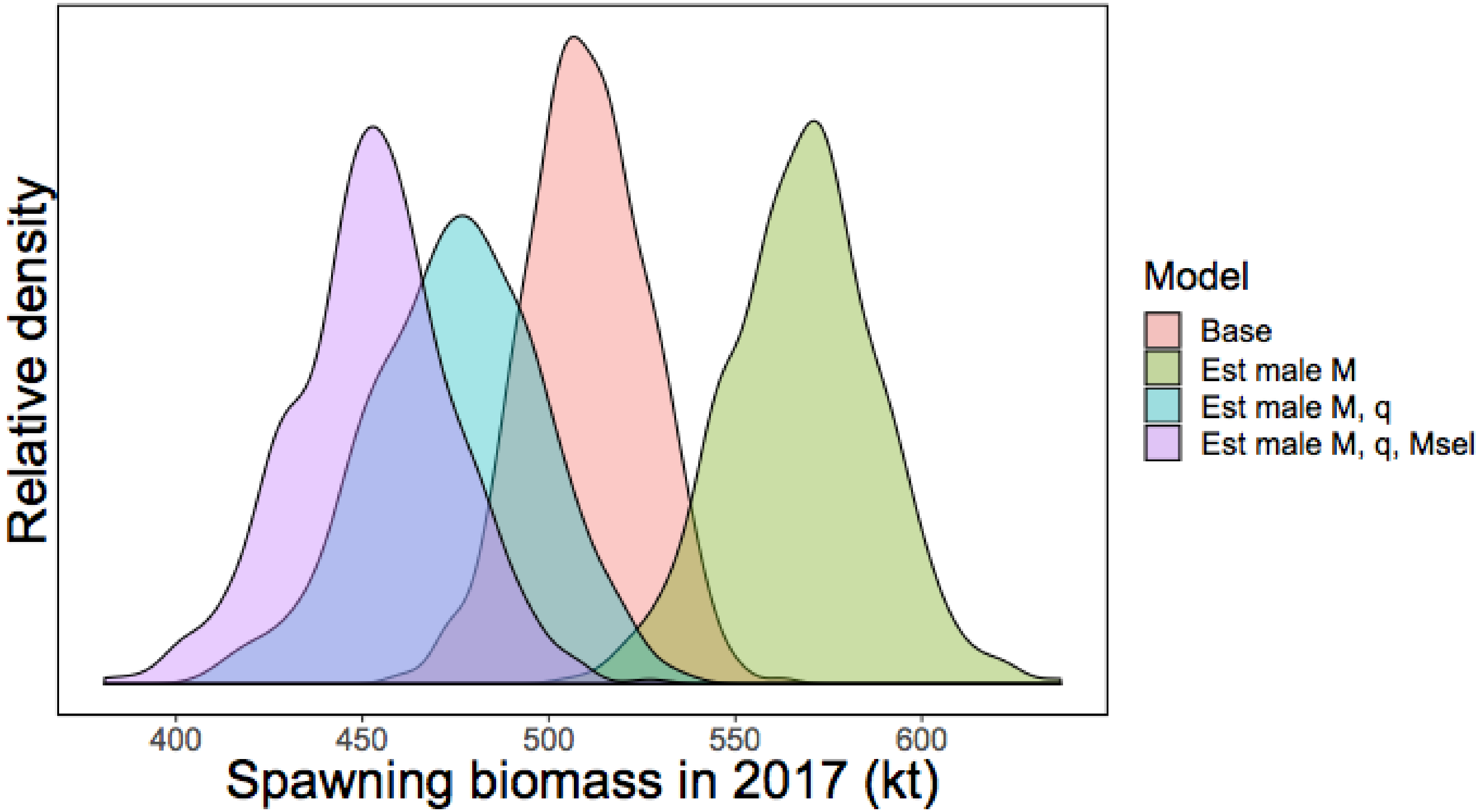
Quantity	Last asmt.	This asmt.	Change
M	0.11	0.11	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	189,868	n/a	-0.18
2019 age+ biomass	199,223	155,251	-0.22
2018 spawning biomass	63,718	n/a	-0.14
2019 spawning biomass	67,390	54,779	-0.19
B100%	126,954	107,673	-0.15
B40%	50,782	43,069	-0.15
B35%	44,434	37,685	-0.15
2019 FOFL	0.075	0.108	0.44
2019 FABC	0.064	0.090	0.41
2018 OFL	11,347	n/a	-0.03
2019 OFL	12,022	10,965	-0.09
2018 ABC	9,737	n/a	-0.05
2019 ABC	10,317	9,260	-0.10

Chapter 8: northern rock sole (full)

- New data:
  - 2016 and 2017 fishery agecomps
  - 2016 and 2017 survey agecomps
  - 2017 EBS shelf survey biomass (down 9% from 2016)
  - 2018 EBS shelf survey biomass (down 21% from 2017)
- Model alternatives (all but 18.3 previewed in September/October):
  - Model 15.1: base model (essentially unchanged since 2006)
  - Model 18.1: same as Model 15.1, but with male M estimated
  - Model 18.2: same as Model 18.1, but with more diffuse Q prior
  - Model 18.3: same as Model 18.2, but with male selectivity offset
  - Model 18.4: equally weighted average of Models 15.1 and 18.1-18.3
  - Authors and Team recommend Model 15.1, based on best fit to sex ratio and overall similarity of management results among models

Northern rock sole, continued

- Comparison of spawning biomass distributions across models



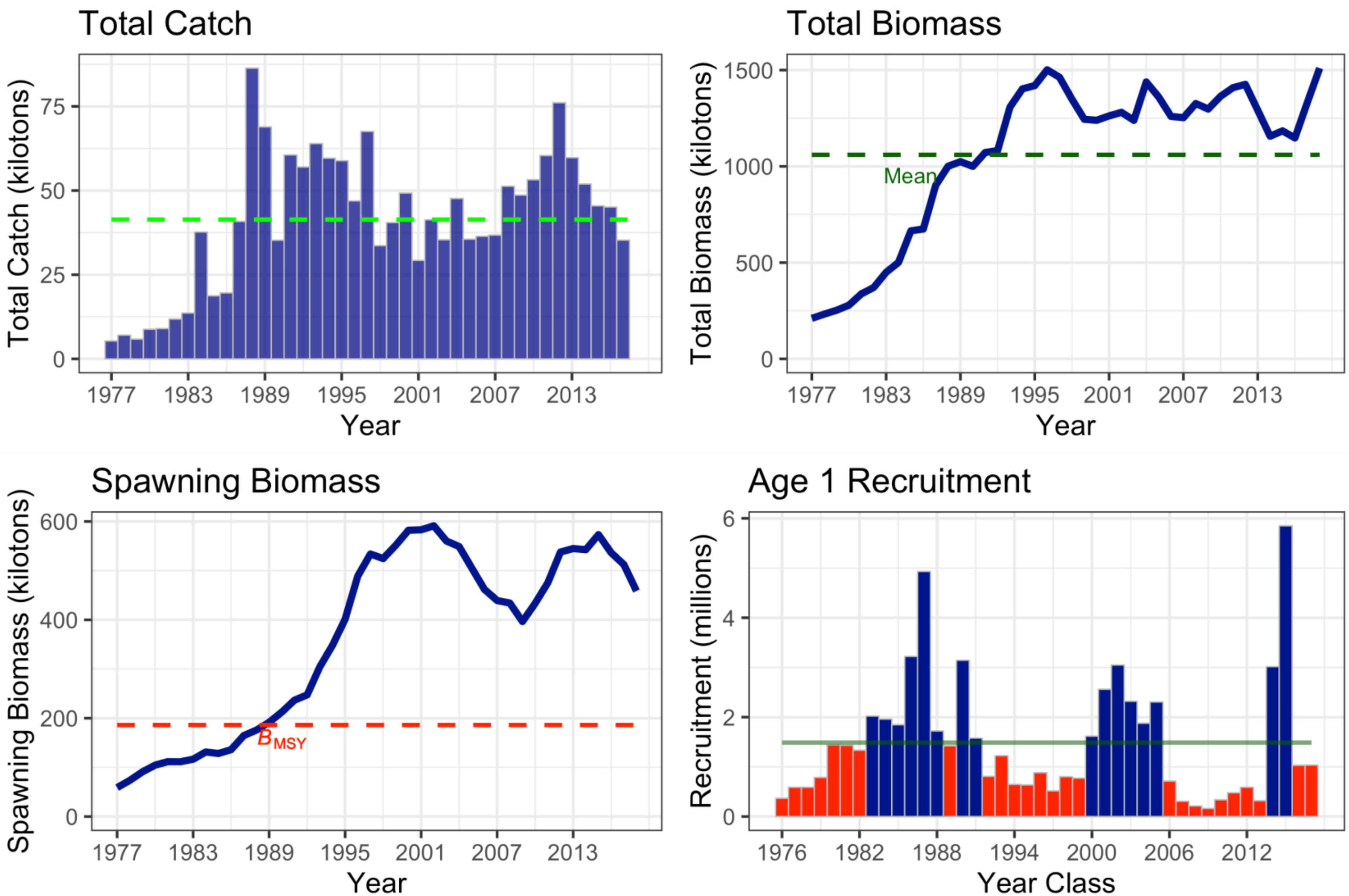
Northern rock sole, continued

- Stock status and trend:
  - The 2001, 2002, 2003, 2005, and 2014 year classes are all estimated to be at least 60% above average.
  - Spawning biomass steadily increased from 2009 until 2015, but has since decreased
    - The two most recent EBS shelf survey biomass estimates are the lowest since 1987
  - 2019 spawning biomass is 81% of B_0
- Mohn's ρ = -0.04

Northern rock sole, continued

- The Team thanks the authors for volunteering to examine a model averaging approach
- The Team recommends that the authors consider alternative weightings if they decide to pursue model averaging further; noting that, if the ensemble consists of nested models, the choice of weighting approach may be simplified somewhat
- The Team also encourages the authors to consider whether the present ensemble might usefully be expanded by including models that span a greater range of structural uncertainty
- Finally, the Team recommends that the authors further investigate Model 18.3, which may be the most biologically plausible model in the present ensemble

Northern rock sole, continued



Northern rock sole, continued

Quantity	Last asmt.	This asmt.	Change
M	0.15	0.15	0.00
2018 tier	1a	n/a	none
2019 tier	1a	1a	none
2018 age+ biomass	923,200	n/a	-0.10
2019 age+ biomass	852,000	828,000	-0.03
2018 spawning biomass	472,200	n/a	-0.12
2019 spawning biomass	413,300	417,800	0.01
B0	678,310	515,680	-0.24
Bmsy	257,000	186,000	-0.28
2019 FOFL	0.160	0.147	-0.08
2019 FABC	0.155	0.144	-0.07
2018 OFL	147,300	n/a	-0.17
2019 OFL	136,000	122,000	-0.10
2018 ABC	143,100	n/a	-0.17
2019 ABC	132,000	118,900	-0.10

Chapter 9: flathead sole (full)

- New data:
  - 1964-1976 catch biomass
  - Historical catch prior to 1964 was set equal to the 1964-1977 mean
  - 2015-2017 fishery agecomps
  - 2016-2018 fishery sizecomps
  - 2016-2017 survey agecomps
  - 2017-2018 survey sizecomps
  - 2017 EBS shelf survey biomass
  - 2018 EBS shelf survey biomass
  - 2018 AI survey biomass
  - 2017-2018 survey bottom temperatures
  - Fishery and survey sizecomp data for lengths less than 6 cm
  - Fishery and survey agecomp data for ages 0-2

Flathead sole, continued

- Model alternatives:
  - Model 16.0: base model
  - Model 18.0 (previewed Sept/Oct): best SS match to 16.0, but with:
    - Catch data extended back to 1964
    - Sum-to-zero constraint on log recruitment deviations
    - Recruitment in 4 most recent years fixed at time series average
    - Log recruitment deviations estimated back to 1961
    - Age-based selectivity
    - “Francis weighting” of compositional data
  - Model 18.0b (previewed Sept/Oct): same as Model 18.0, but with 3 time blocks for fishery selectivity
  - (continued on next slide)

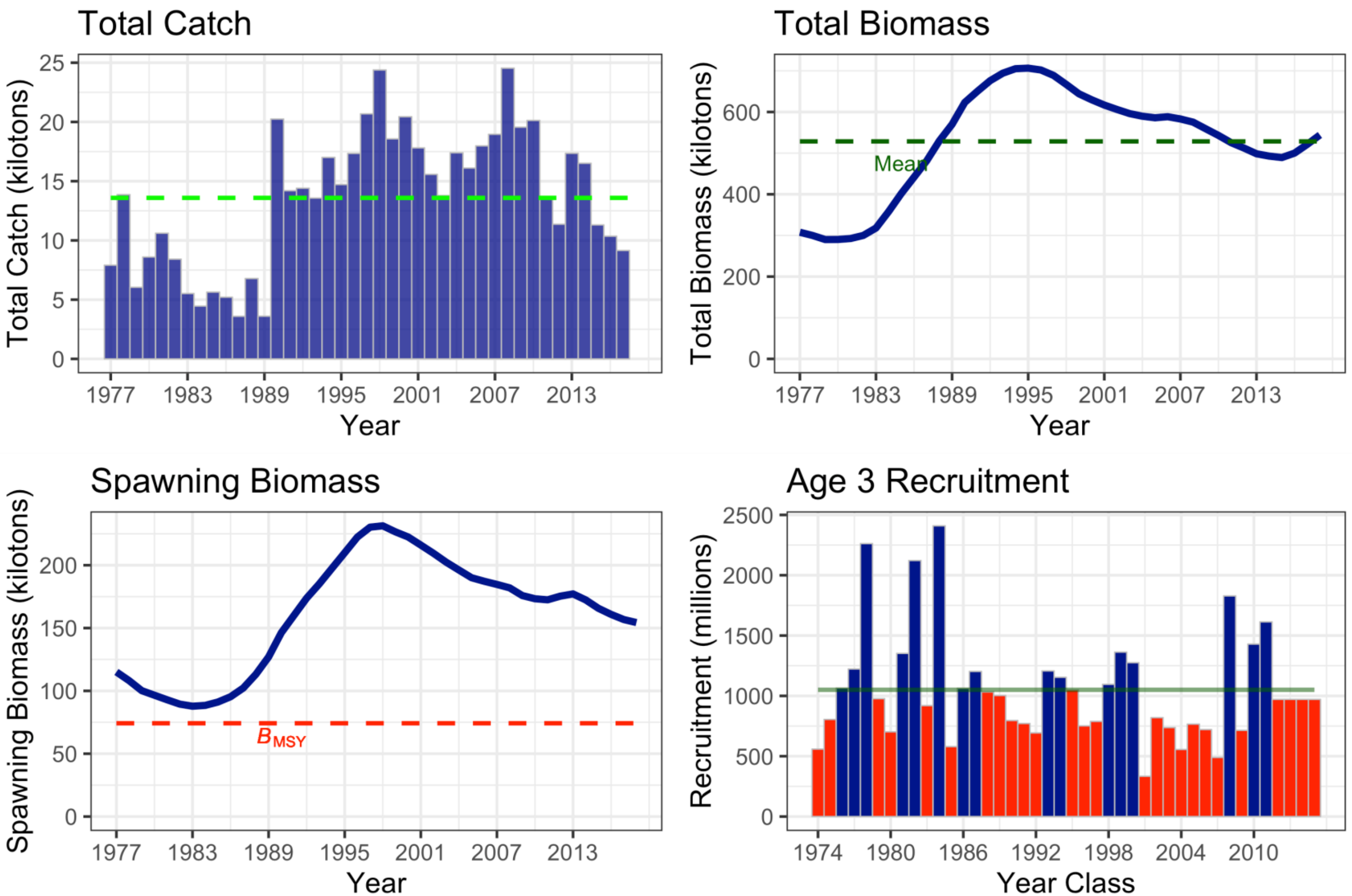
Flathead sole, continued

- Model alternatives, continued:
  - Models 18.1 and 18.1b: same as Models 18.0 and 18.0b, but with internal growth estimation (using conditional age at length data)
  - Models 18.2 and 18.2b: same as Models 18.1 and 18.1b, but with initial N for comp data set equal to number of sampled hauls
  - Model 18.2c: same as Model 18.2b, but with 2 fishery time blocks
  - Author and Team recommend Model 18.2c:
    - Updating the model to estimate growth internally and changing initial N to number of sampled hauls are preferable on general principles, and have little impact in this case
    - Inclusion of time blocks resolved residual pattern from early years, but 2-point improvement in lnL from inclusion of a third time block did not justify adding 4 parameters (weights were =)

Flathead sole, continued

- Stock status and trend
  - 2002, 2011, and 2014 cohorts are all at least 40% above average
  - Spawning biomass has declined consistently since 1998 (a 33% decrease as of 2018), but is projected to begin increasing in 2020
  - 2019 spawning biomass is 72% of $B_{100\%}$
- Mohn's ρ = -0.05
- The Team commended the author for a clearly presented assessment along with a well-written and thorough SAFE report chapter

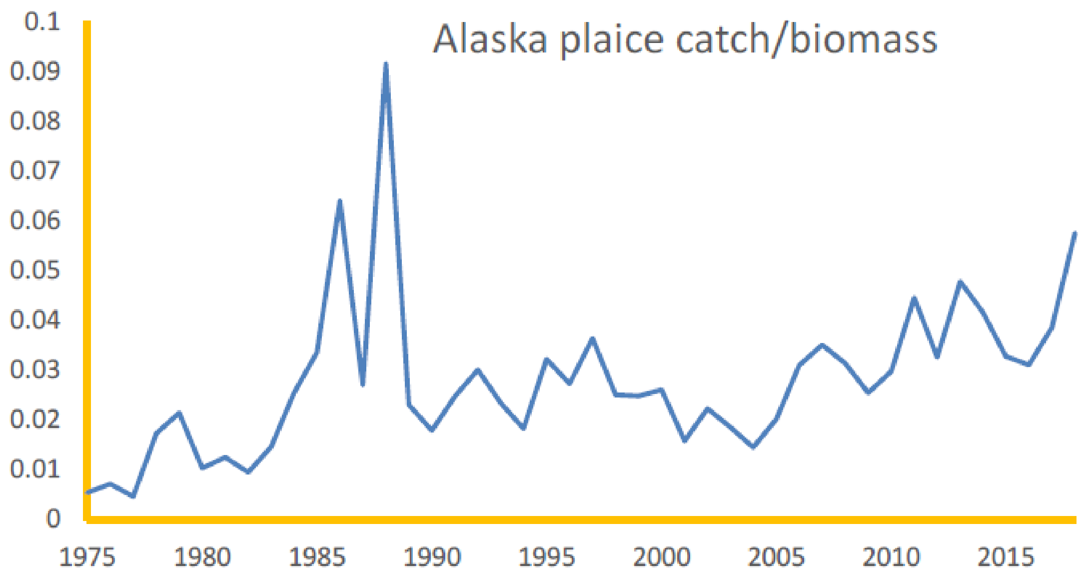
Flathead sole, continued



Flathead sole, continued

Quantity	Last asmt.	This asmt.	Change
M	0.20	0.20	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	762,513	n/a	-0.12
2019 age+ biomass	777,961	673,718	-0.13
2018 spawning biomass	214,124	n/a	-0.28
2019 spawning biomass	205,156	153,203	-0.25
B100%	322,938	212,060	-0.34
B40%	129,175	84,824	-0.34
B35%	113,028	74,221	-0.34
2019 FOFL	0.41	0.47	0.15
2019 FABC	0.34	0.38	0.12
2018 OFL	79,862	n/a	0.01
2019 OFL	78,036	80,918	0.04
2018 ABC	66,773	n/a	0.00
2019 ABC	65,227	66,625	0.02

Chapter 10: Alaska plaice (partial)

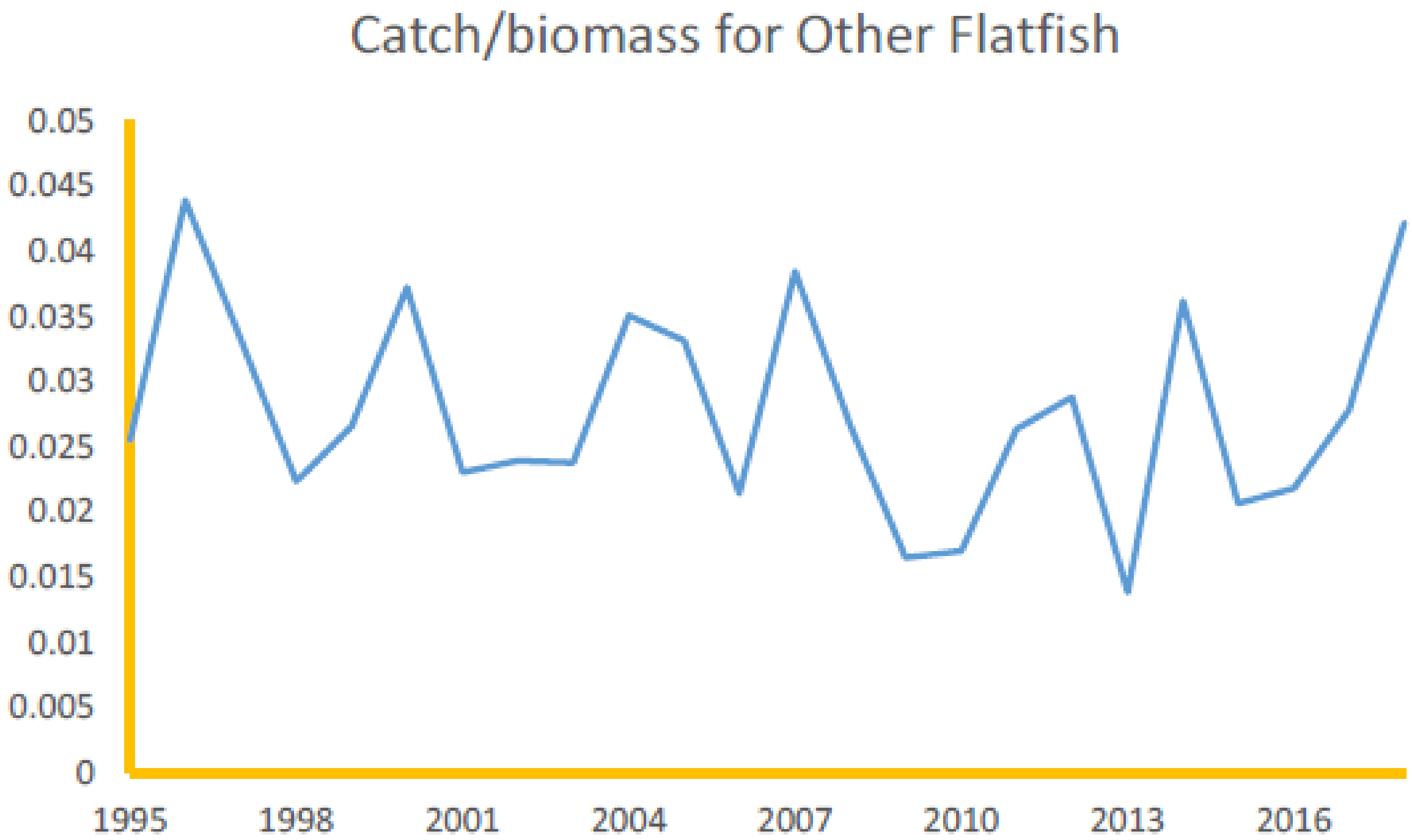


- 2019 spawning biomass is 59% of $B_{100\%}$
- Team recommendation from last year:
  - Because 38 and 40% of Alaska plaice were in the Northern Bering Sea in 2010 and 2017, respectively, the Team recommends that the authors examine how to include surveys of that area in the model

Alaska plaice, continued

Quantity	Last asmt.	This asmt.	Change
M	0.13	0.13	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	417,300	n/a	-0.04
2019 age+ biomass	412,000	400,700	-0.03
2018 spawning biomass	191,460	n/a	-0.03
2019 spawning biomass	181,730	186,100	0.02
B100%	317,360	317,360	0.00
B40%	126,900	126,900	0.00
B35%	111,100	111,100	0.00
2019 FOFL	0.149	0.149	0.00
2019 FABC	0.124	0.124	0.00
2018 OFL	41,170	n/a	-0.03
2019 OFL	38,800	39,880	0.03
2018 ABC	34,590	n/a	-0.03
2019 ABC	32,700	33,600	0.03

Chapter 11: other flatfish (partial)



Other flatfish, continued

- Tier 5 random effects model was re-run with updated data

Quantity*	Last asmt.	This asmt.	Change
M	0.155	0.154	0.00
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	113,450	141,325	0.25
2019 FOFL	0.155	0.154	0.00
2019 FABC	0.116	0.116	0.00
2018 OFL	17,591	n/a	0.24
2019 OFL	17,591	21,824	0.24
2018 ABC	13,193	n/a	0.24
2019 ABC	13,193	16,368	0.24

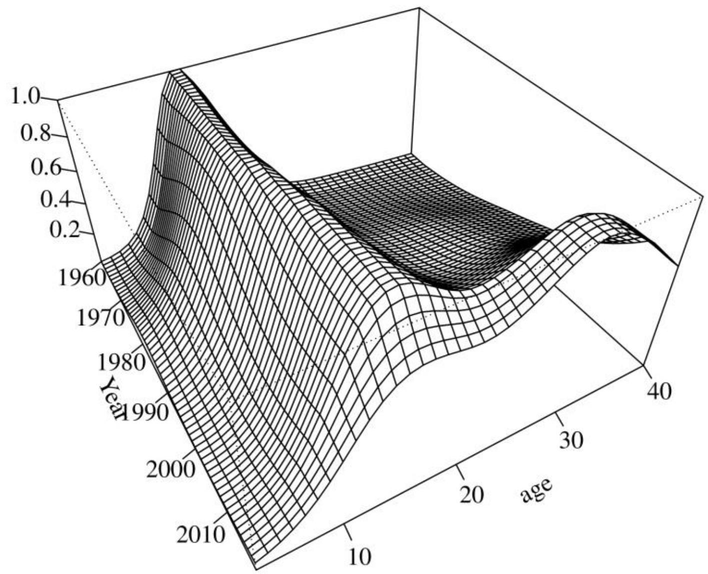
*Instantaneous rates are biomass-weighted averages

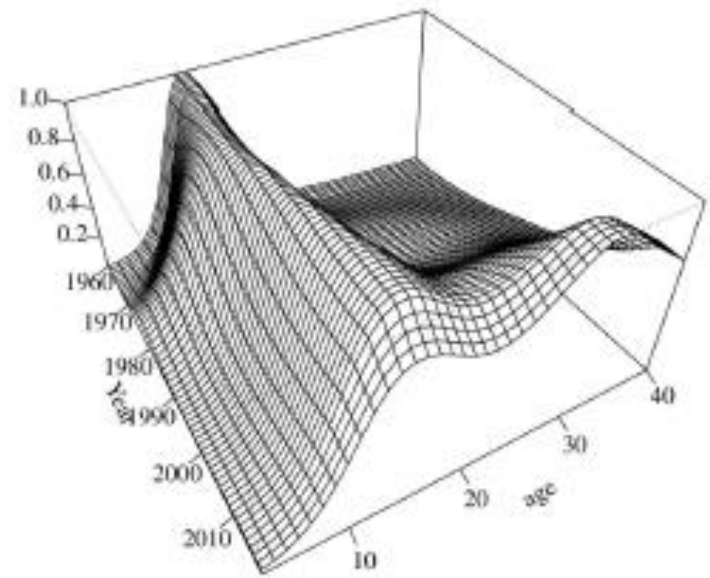
Chapter 12: Pacific ocean perch (full)

- New data:
  - 2018 AI survey biomass (up 3% from 2016; new all-time high)
  - 2018 AI survey sizecomp
  - 2016 AI and EBS slope agecomps
  - 2016 fishery sizecomps
  - 2015 and 2017 fishery agecomps
  - Length-at-age, weight-at-age, age-to-length conversion recompiled
- Model alternatives:
  - Model 16.3: base model
  - Model 16.3a: same as Model 16.3, with additional node in the spline-based fishery selectivity schedule
  - Author and Team recommend Model 16.3a because it gave a level of selectivity “smoothness” similar to that estimated in 2016

Pacific ocean perch, continued

- Spline-based fishery selectivity in Models 16.3 (left) and 16.3a (right)





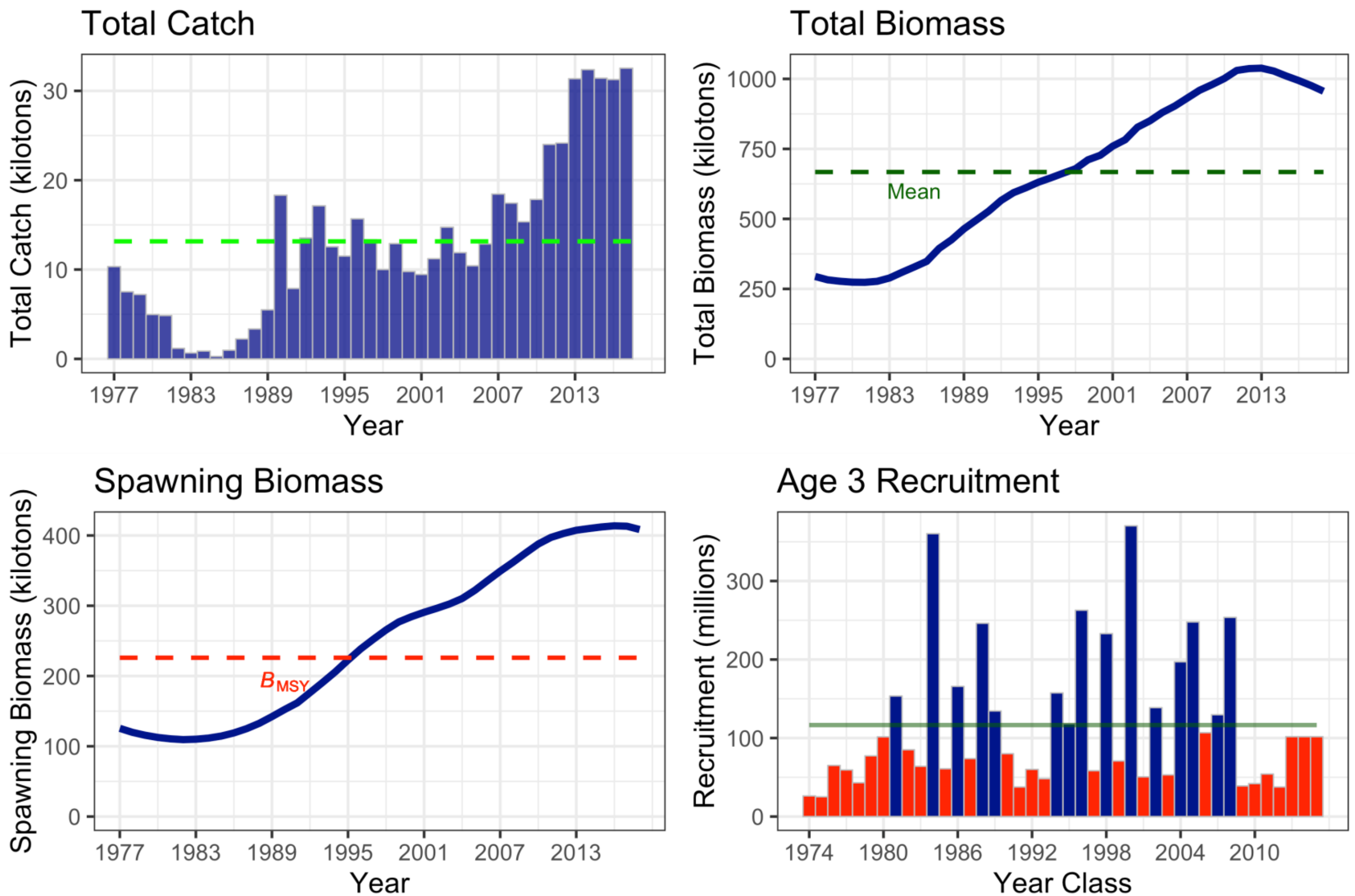
Pacific ocean perch, continued

- Stock status and trend:
  - 2000, 2005, and 2008 cohorts are 198%, 99%, and 104% above ave.
  - Spawning biomass increased continuously from 1981 to 2016, declining slowly since
  - 2019 spawning biomass is 62% of $B_{100\%}$
  - Mohn's ρ = -0.45 (see Appendix 12C)
    - Author considered why the population was increasing so rapidly over time and over many ages
    - Examined a model with catchability estimated in two time blocks
    - This model fit the data better, and improved Mohn's ρ (= -0.30)
    - Author is uncomfortable with time-varying Q for the AI survey, given that station locations vary so little from year to year

Pacific ocean perch, continued

- The Team recommends producing a squid plot (see sablefish SAFE chapter for example) for the next full assessment, to examine the retrospective pattern with respect to recruitment trends.
- The Team also recommends updating the prior on M using alternative methods for the next full assessment (e.g., Hamel method, Jason Cope online application, http://barefootecologist.com.au/shiny_m.html).

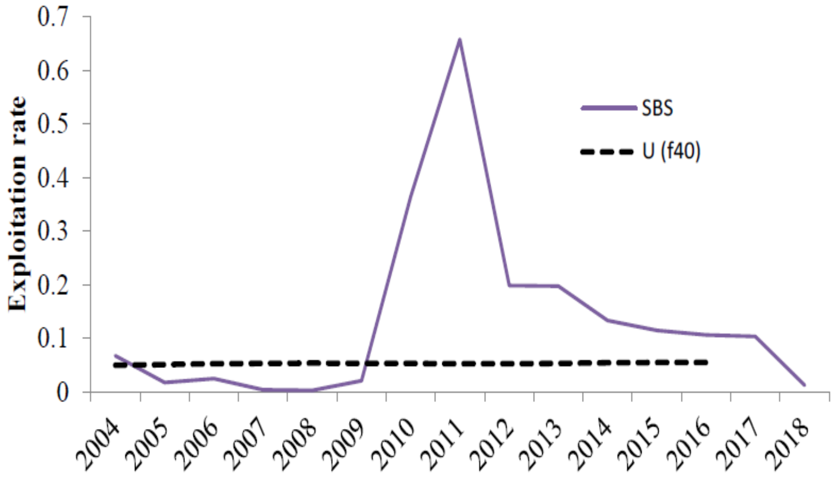
Pacific ocean perch, continued

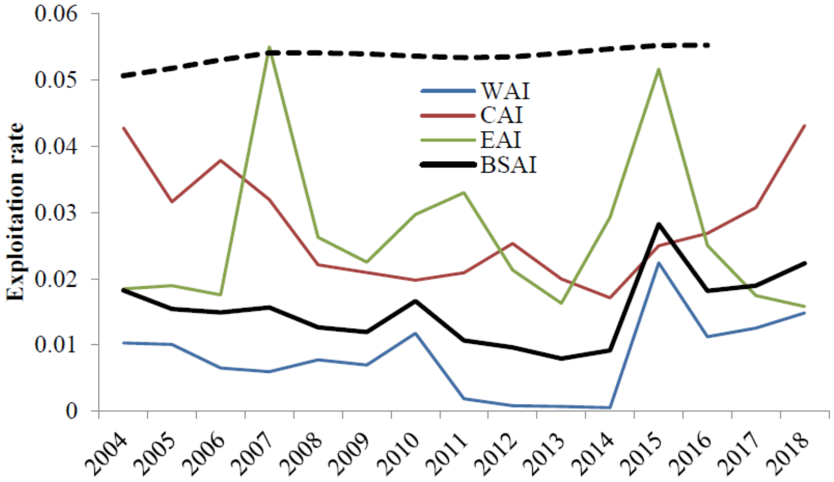


Pacific ocean perch, continued

Quantity	Last asmt.	This asmt.	Change
M	0.058	0.056	-0.03
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	749,925	n/a	0.25
2019 age+ biomass	734,431	934,293	0.27
2018 spawning biomass	305,804	n/a	0.30
2019 spawning biomass	295,593	399,024	0.35
B100%	536,713	645,738	0.20
B40%	214,685	258,295	0.20
B35%	187,849	226,008	0.20
2019 FOFL	0.101	0.095	-0.06
2019 FABC	0.082	0.079	-0.04
2018 OFL	51,675	n/a	0.18
2019 OFL	50,098	61,067	0.22
2018 ABC	42,509	n/a	0.19
2019 ABC	41,212	50,594	0.23

Chapter 13: northern rockfish (partial)





- The high exploitation rates in the southern Bering Sea (SBS) area result from high variable survey biomass estimates for this area.

Northern rockfish, continued

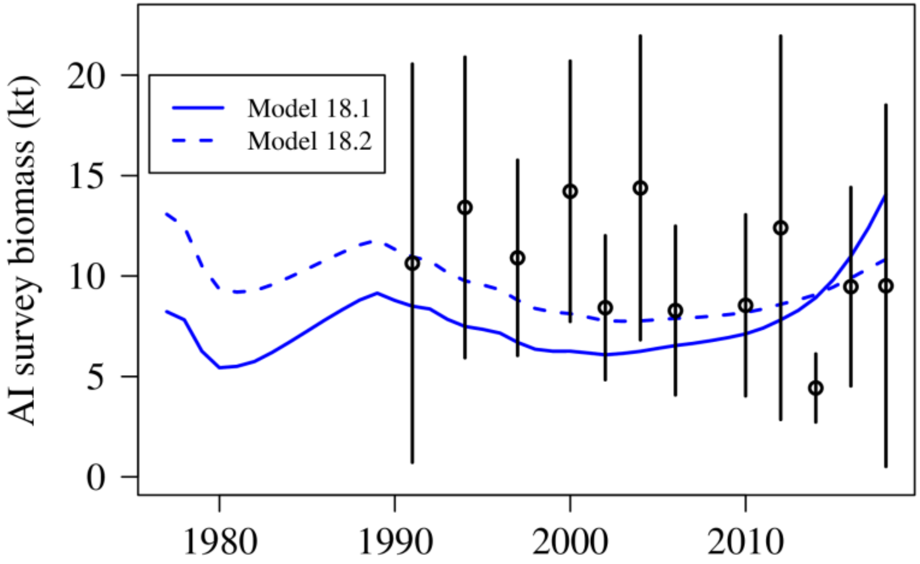
Quantity	Last asmt.	This asmt.	Change
M	0.046	0.046	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	246,160	n/a	-0.01
2019 age+ biomass	244,963	244,196	0.00
2018 spawning biomass	106,486	n/a	-0.02
2019 spawning biomass	104,699	104,201	0.00
B100%	164,674	164,674	0.00
B40%	65,870	65,870	0.00
B35%	57,636	57,636	0.00
2019 FOFL	0.080	0.080	0.00
2019 FABC	0.065	0.065	0.00
2018 OFL	15,888	n/a	-0.02
2019 OFL	15,563	15,507	0.00
2018 ABC	12,975	n/a	-0.02
2019 ABC	12,710	12,664	0.00

Chapter 14: blackspotted/rougheye (full)

- New data:
  - AI survey biomass estimates and all sizecomps and agecomps were recomputed so as to correspond to only the AI management area (i.e., excluding the SBS)
  - 2018 AI survey biomass (almost unchanged from 2016)
  - 2016 AI survey agecomp
  - 2018 AI survey sizecomp
  - 2015 and 2017 AI fishery agecomps
  - 2016 AI fishery sizecomps
  - Length-at-age, weight-at-age, age-to-length conversion recompiled

Blackspotted/rougheye, continued

- Model alternatives:
  - Model 16.5: base model
  - Model 18.1: same as Model 16.5, but configured for AI area only
  - Model 18.2: same as Model 18.1, but with "Francis weighting"
  - Author recommends Model 18.2, based on improved index fit

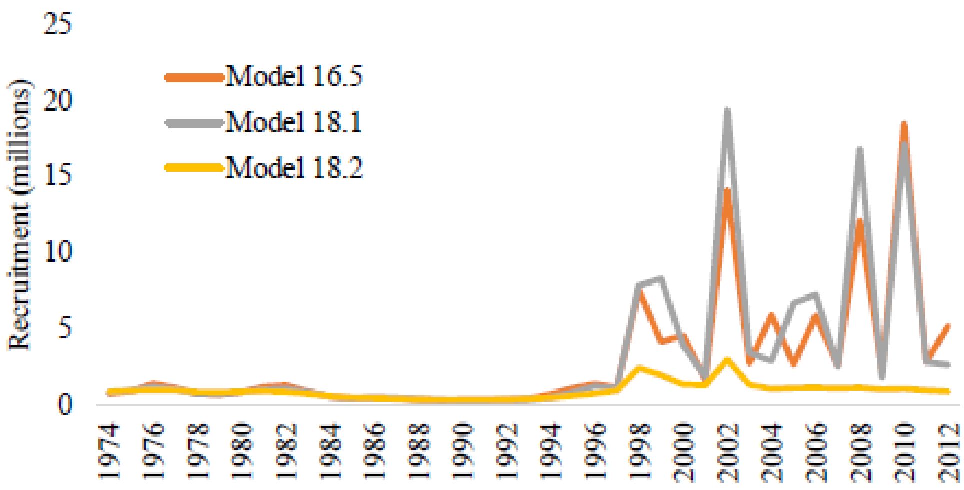


Blackspotted/rougheye, continued

- Stock status and trend (AI only, based on Model 18.2):
  - Following a string of 20 consecutive below-average cohorts, 1998-2011 cohorts are all above average
  - Spawning biomass has increased steadily since 2007 (28% by 2018)
  - 2019 spawning biomass is 32% of $B_{100\%}$
- Mohn's ρ = 0.42

Blackspotted/rougheye, continued

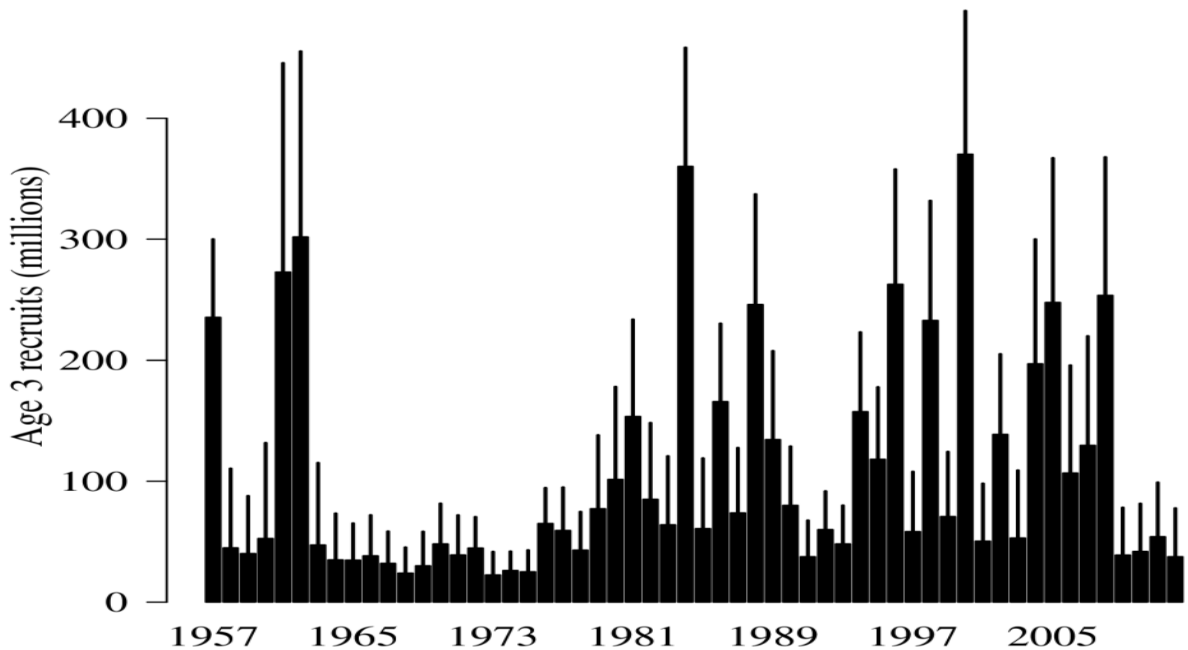
- Team discussion:
  - Nearly all Team members preferred Model 18.2 over Model 18.1
  - In addition to the improved fit to the survey biomass, Team members felt that the pattern of recruitments estimated by Model 18.1 seems uncharacteristic for a rockfish species



  - (continued on next slide)

Blackspotted/rougheye, continued

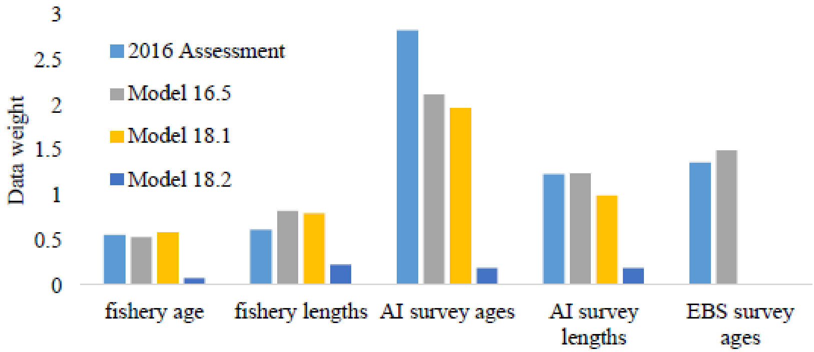
- Team discussion, continued
  - Compare to the Pacific ocean perch recruitment time series:



  - (continued on next slide)

Blackspotted/rougheye, continued

- Team discussion (continued):
  - On the other hand, Model 18.1 fits the comp data better than 18.2

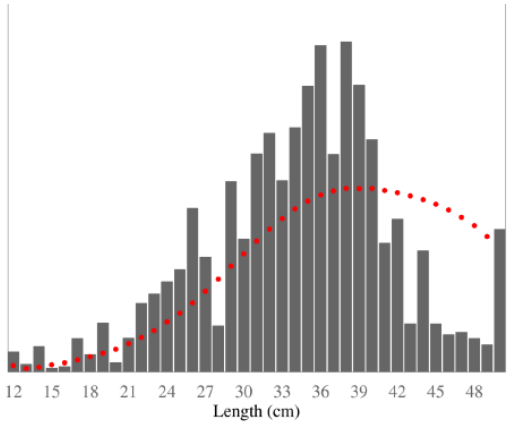


	Effective sample size	
Component	M18.1	M18.2
Fishery agecomps	75	46
Fishery sizecomps	156	122
Survey agecomps	195	66
Survey sizecomps	93	45

  - In 2016, the POP, northern rockfish, and blackspotted/rougheye assessments all compared harmonic mean weighting to Francis weighting, and harmonic mean weighting was recommended in all three cases
  - (continued on next slide)

Blackspotted/rougheye, continued

- Team discussion (continued):
  - Author noted that both models suffer from older fish disappearing at a rate greater than accounted for by mortality
    - Example: 2018 AI survey sizecomp (bars = data, dots = model)



    - Potentially, this could result from dome-shaped selectivity, which has not been explored yet
  - (continued on next slide)

Blackspotted/rougheye, continued

- Team discussion (continued):
  - The Team recommends that the results of Models 18.1 and 18.2 be averaged in order to arrive at the 2019 and 2020 harvest specs
    - Potential inconsistency with other Team recommendations noted
  - The Team also noted that multiple methods of averaging exist:
    1. Average the *management outputs* estimated by the models
       - This is what the Team did
    2. Average the *projection model inputs* estimated by the models, then use the management outputs from the projection model
       - This is what some members thought we should have done
       - Requires that all models in the ensemble be compatible
    - The Team welcomes SSC guidance on this
  - (continued on next slide)

Blackspotted/rougheye, continued

- Team discussion (continued):
  - Additionally, the utility of the MSSC as a guideline for fishery removals on a finer spatial scale was discussed
    - Industry participants generally liked having the MSSC as a guideline to work toward
    - Team opinion was mixed regarding subarea ABCs versus MSSCs
    - The Team recommended that MSSCs for 2019-2020 be set

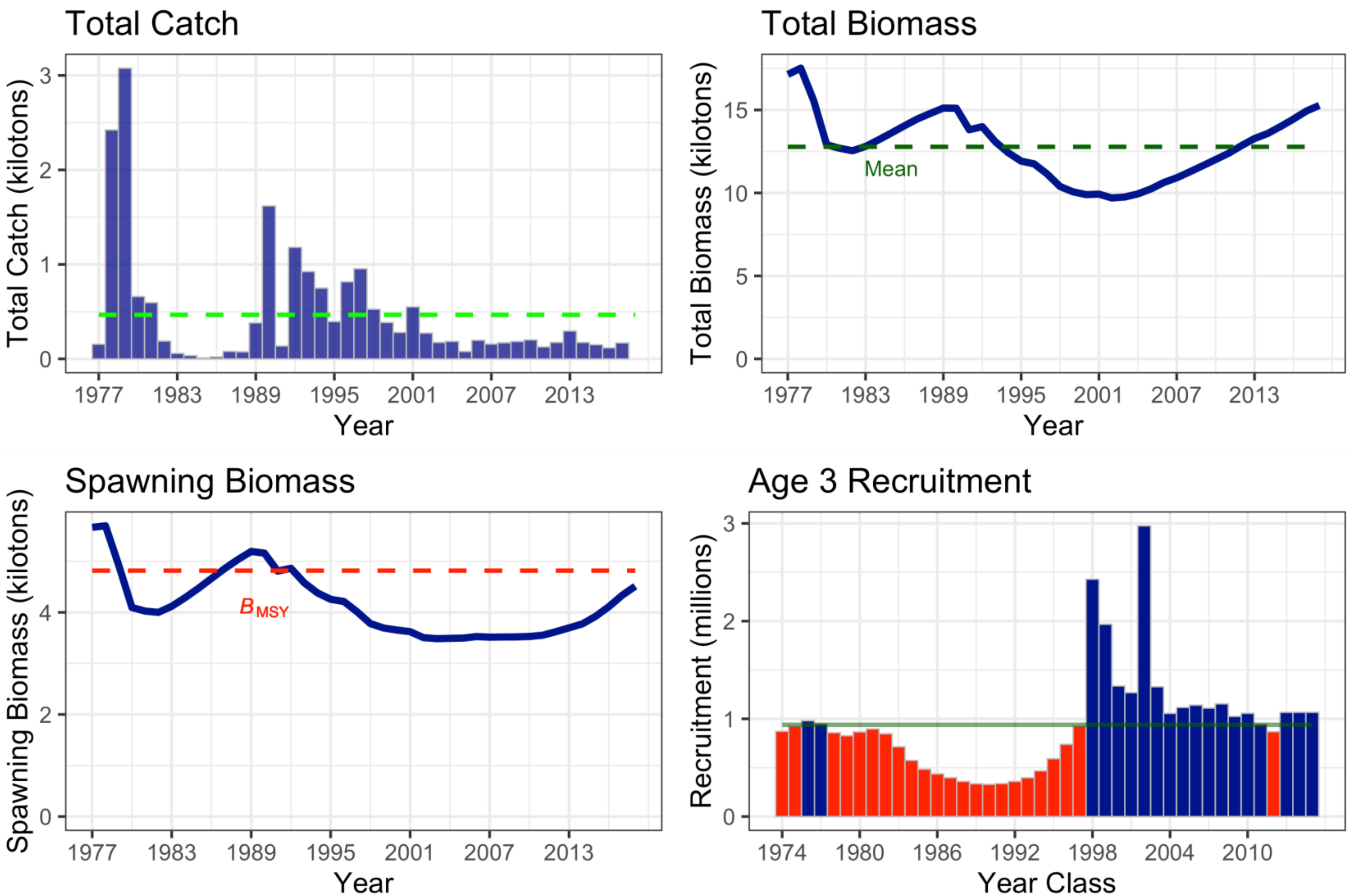
Year	WAI	CAI
2019	29 t	134 t
2020	36 t	164 t

    - The Team also recommended that Council staff provide the author's previously written analyses on subarea ABCs for discussion and Team consideration in September 2019

Blackspotted/rougheye, continued

- Team recommendations for the next assessment:
  - updating the age error matrix, as this has helped with the corresponding model in the GOA
  - evaluating dome-shaped selectivity for the survey, to better account for the survey's difficulty in sampling large/old fish accurately
  - examining larger bounds on M and investigating a profile of M and its subsequent impacts on model results
- The Team concurs with the author's research plans to evaluate the strong retrospective patterns

Blackspotted/rougheye, continued



Blackspotted/rougheye, continued

Quantity	Last asmt	This asmt*	Change
M	0.033	0.032	-0.03
2018 tier	3b	n/a	none
2019 tier	3a	3b	↓
2018 age+ biomass	37,453	n/a	-0.13
2019 age+ biomass	39,169	32,436	-0.17
2018 spawning biomass	8,208	n/a	-0.16
2019 spawning biomass	9,163	6,858	-0.25
B100%	20,777	21,527	0.04
B40%	8,311	8,611	0.04
B35%	7,272	7,534	0.04
2019 FOFL	0.054	0.0325	-0.40
2019 FABC	0.044	0.027	-0.39
2018 OFL	749	n/a	-0.33
2019 OFL	829	503	-0.39
2018 ABC	613	n/a	-0.32
2019 ABC	678	418	-0.38

* M, age+ biomass, OFL, and ABC are BSAI; others are AI

Chapter 15: shortraker rockfish (full)

- New data:
  - 2018 AI survey biomass (up 74% from 2016)
- Model alternatives:
  - Tier 5 random effects
- Stock status and trend:
  - Time series starts in 2002 (first year of modern EBS slope survey)
  - Model biomass has increased steadily since 2006 (up 15% overall)
    - 2018 estimate is all-time high
    - Trends similar in AI and BS (BS = EBS slope + SBS)

Shortraker rockfish, continued

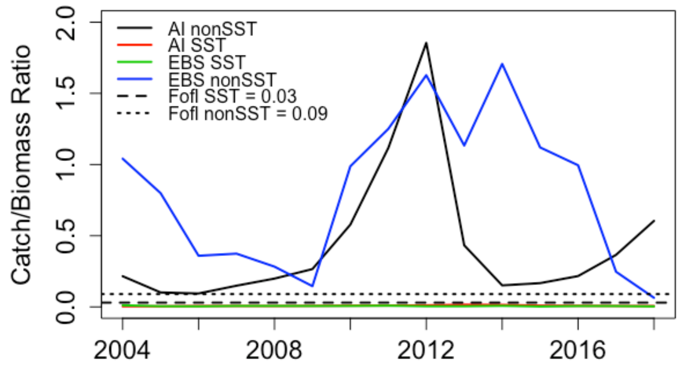
Quantity	Last asmt.	This asmt.	Change
M	0.030	0.030	0.00
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	22,191	24,055	0.08
2019 FOFL	0.030	0.030	0.00
2019 FABC	0.0225	0.0225	0.00
2018 OFL	666	n/a	0.08
2019 OFL	666	722	0.08
2018 ABC	499	n/a	0.08
2019 ABC	499	541	0.08

Chapter 16: other rockfish (full)

- New data:
  - 2018 AI survey biomass (down 14% from 2016)
- Model alternatives:
  - Tier 5 random effects
  - For non-SST species combined, EBS shelf survey yielded estimates of zero for both biomass and standard error in 12 of 37 years
  - These need to be modeled separately because of differential M
  - Author tried various ways to address the issue (Table 16.15)
  - Author and Team recommend removing "zero" years from time series
- Stock status and trend
  - Model biomass generally increasing throughout time series

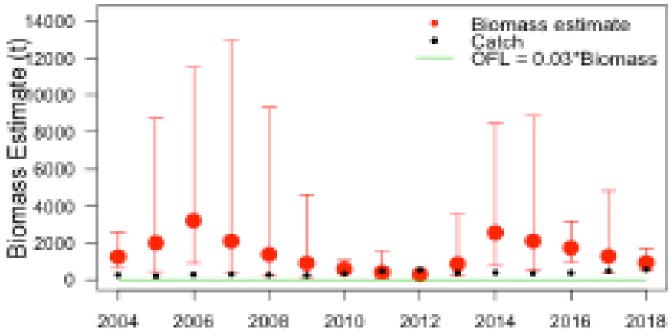
Other rockfish, continued

- Author and Team discussed potential overharvest of non-SST species



- Exploitation rates > 1 are suspect

- However, survey estimates of non-SST species are highly imprecise



- Possible mixing with GOA?

Other rockfish, continued

Quantity*	Last asmt.	This asmt.	Change
M	0.033	0.034	0.02
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	55,312	53,290	-0.04
2019 FOFL	0.033	0.034	0.02
2019 FABC	0.025	0.025	0.02
2018 OFL	1,816	n/a	-0.01
2019 OFL	1,816	1,793	-0.01
2018 ABC	1,362	n/a	-0.01
2019 ABC	1,362	1,345	-0.01

*Instantaneous rates are biomass-weighted averages

Chapter 17: Atka mackerel (full)

- New data:
  - 2017 fishery agecomp
  - 2018 AI survey biomass (down 21%)
  - 1986 survey agecomp removed
- Model alternatives:
  - Model 16.0b: base model (introduced last year)
- Stock status and trend:
  - 1998-2001 cohorts were all very strong, and the 2006 and 2007 cohorts are 56% and 33% above average
  - Spawning biomass reached all-time high in 2005; decreasing since
    - Overall decrease of 57% through 2018
  - 2019 spawning biomass is 38% of $B_{100\%}$
- Mohn's ρ = 0.16

Atka mackerel, continued

- Area apportionment:
  - The Tier 5 random effects model has been employed since 2015 to determine apportionment proportions
  - This method would result in reducing the CAI share to 10% for 2019, down from 34.78% in 2018
  - Authors conducted a thorough examination of the survey and fisheries data to determine if the survey decline reflects the stock
  - Fishery data from the CAI show no obvious differences in catch rates, locations, or fish behavior
  - Fishers reported no extraordinary or even notably different conditions in the CAI in 2018
  - Authors recommend returning, for now, to the weighted 4-year average method that was used prior to 2015
  - (continued on next slide)

Atka mackerel, continued

- Area apportionment (continued):
  - Additional discussion tended to echo some of the suggestions given in the assessment chapter, such as:
    - The RE model could potentially be adjusted to better address patchy species by constraining the process error parameter
    - Advances in spatio-temporal modeling approaches such as the VAST methods being developed for the region could potentially better address apportionment in the near future
    - More research is required, either in adapting the random effects model for patchy species, such as Atka mackerel,, or in developing and validating new methods
  - (continued on next slide)

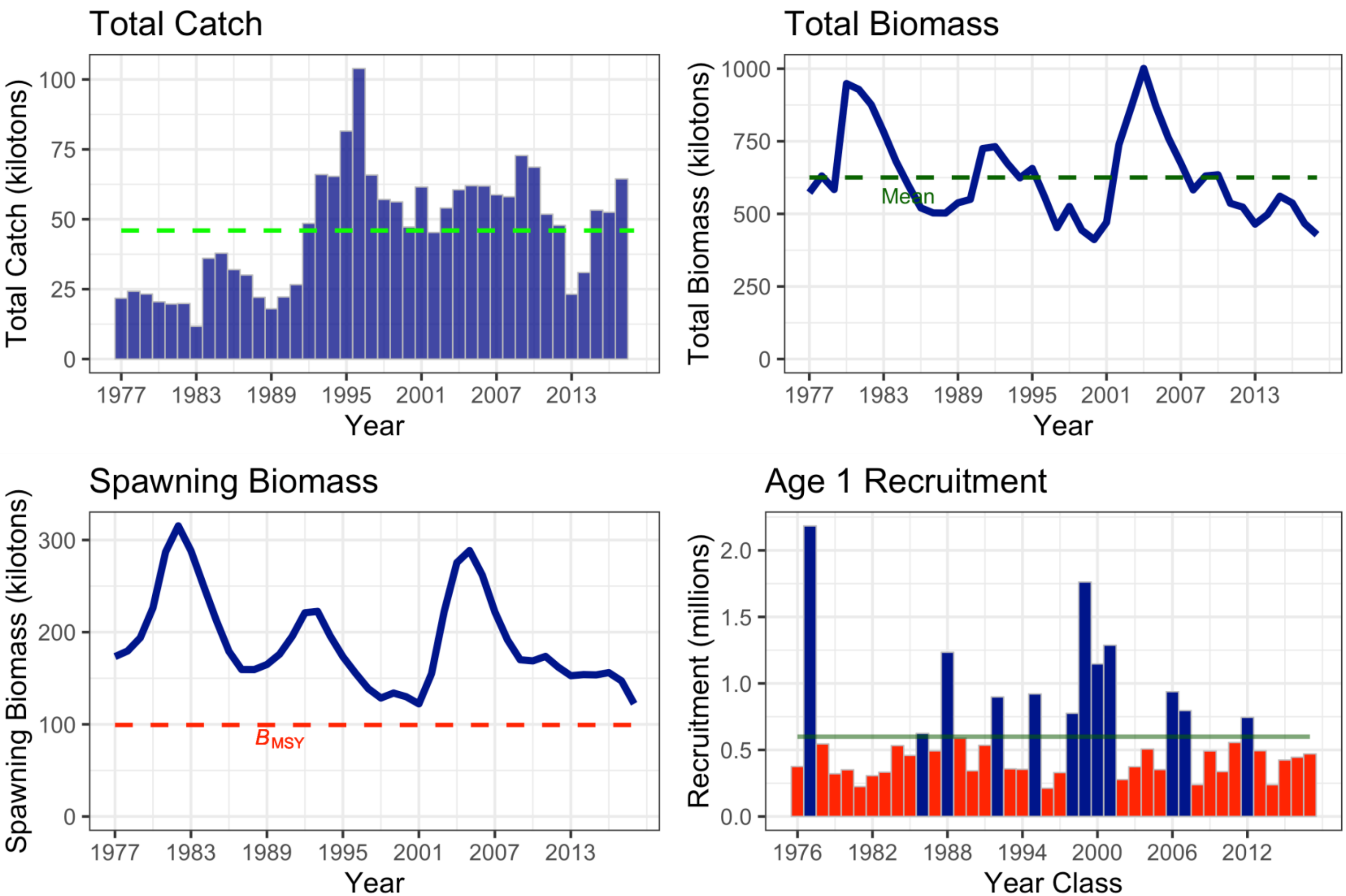
Atka mackerel, continued

- Area apportionment, continued:
  - Summary of alternatives:

Subarea	2018	2019 Most recent	2019 4-year ave.
EAI/SBS	0.4001	0.50	0.35
CAI	0.3478	0.10	0.21
WAI	0.2520	0.40	0.44

  - The Team agreed with the authors' recommendation for the 2019 apportionments
  - The Team recommends that further research be conducted on developing appropriate apportionment methods for this stock, with an emphasis on investigating the application and validation of the autoregressive spatio-temporal modeling approach developed in the VAST modeling framework for such purposes

Atka mackerel, continued



Atka mackerel, continued

Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2018 tier	3a	n/a	↓
2019 tier	3a	3b	↓
2018 age+ biomass	599,000	n/a	-0.17
2019 age+ biomass	600,440	498,320	-0.17
2018 spawning biomass	139,300	n/a	-0.23
2019 spawning biomass	125,600	106,800	-0.15
B100%	307,150	283,780	-0.08
B40%	122,860	113,510	-0.08
B35%	107,500	99,320	-0.08
2019 FOFL	0.46	0.53	0.15
2019 FABC	0.38	0.44	0.16
2018 OFL	108,600	n/a	-0.27
2019 OFL	97,200	79,200	-0.19
2018 ABC	92,000	n/a	-0.26
2019 ABC	84,400	68,500	-0.19

Chapter 18: skates (full)

- New data:
  - A new time series of skate catches by species was created for this assessment (previewed in September/October)
  - 2017 EBS shelf survey biomass
    - down 3% from 2016 (Alaska skate), up 79% (other skates)
  - 2018 EBS shelf survey biomass
    - up 2% from 2017 (Alaska skate), down 3% (other skates)
  - 2018 AI survey biomass
    - up 50% from 2016 (AK skate, minor part), up 3% (other skates)
  - 2017 and 2018 EBS shelf survey sizecomps (Alaska skate only)
  - 2017 fishery sizecomps (Alaska skate only)

Skates, continued

- Model alternatives:
  - Alaska skate: Model 14.2 (base model)
  - Other skates: Tier 5 random effects
- Stock status and trend:
  - Alaska skate:
    - 2003-2010 cohorts all above average, more recent all below
    - Spawning biomass increased continuously from 2006-2018
      - Currently at all-time high
    - 2019 spawning biomass is 65% of $B_{100\%}$
  - Other skates:
    - Survey biomass has been relatively flat or increasing, except AI whiteblotched and AI leopard (declining since 2006 and 2010)
- Mohn's ρ = 0.15

Skates, continued

- Discussion and recommendations:
  - Author noted that Bering skate exploitation rate exceeds $F=M$
  - Leopard skate exploitation rate is of concern given declining biomass
  - Team requested that the discussion of B_{MSY} proxies be moved to 9/19
  - Team suggested that author review how other Tier 5 complexes deal with species with differing life histories when running the RE model
  - Team reiterated the request from 11/16 minutes to "examine the utility of including IPHC and AFSC longline survey indices in both Model 14.2 and the random effects model for the Tier 5 species."
    - Already done for AFSC longline data, but not IPHC data
  - Team requested that the author conduct sensitivity runs to examine potential biases in ageing

Skates, continued

- Alaska skate:

Quantity	Last asmt.	This asmt.	Change
M	0.13	0.13	0.00
2018 tier	3a	n/a	none
2019 tier	3a	3a	none
2018 age+ biomass	478,306	n/a	0.05
2019 age+ biomass	452,245	504,551	0.12
2018 spawning biomass	107,136	n/a	0.08
2019 spawning biomass	103,953	115,957	0.12
B100%	180,556	177,761	-0.02
B40%	72,222	71,105	-0.02
B35%	63,195	62,217	-0.02
2019 FOFL	0.092	0.094	0.02
2019 FABC	0.079	0.081	0.03
2018 OFL	36,655	n/a	0.07
2019 OFL	34,189	39,173	0.15
2018 ABC	31,572	n/a	0.07
2019 ABC	29,447	33,730	0.15

Skates, continued

- Other skates:

Quantity	Last asmt.	This asmt.	Change
M	0.10	0.10	0.00
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	100,130	119,787	0.20
2019 FOFL	0.10	0.10	0.00
2019 FABC	0.075	0.075	0.00
2018 OFL	10,013	n/a	0.20
2019 OFL	10,013	11,979	0.20
2018 ABC	7,510	n/a	0.20
2019 ABC	7,510	8,984	0.20

Chapter 19: sculpins (none)

Quantity*	Last asmt.	This asmt.	Change
M	0.282	0.282	0.00
2018 tier	5	n/a	none
2019 tier	5	5	none
Biomass	188,656	188,656	0.00
2019 FOFL	0.282	0.282	0.00
2019 FABC	0.212	0.212	0.00
2018 OFL	53,201	n/a	0.00
2019 OFL	53,201	53,201	0.00
2018 ABC	39,995	n/a	0.00
2019 ABC	39,995	39,995	0.00

*Instantaneous rates are biomass-weighted averages

Chapter 20: sharks (full)

- Although the assessment contains lots of important information, in terms of harvest specifications, this was basically a rollover assessment
- Author plans to include a greatly expanded set of data-limited methods in the 2020 assessment (“Sharknado!”)

Quantity	Last asmt.	This asmt.	Change
2018 tier	6	n/a	none
2019 tier	6	6	none
2018 OFL	689	n/a	0.00
2019 OFL	689	689	0.00
2018 ABC	517	n/a	0.00
2019 ABC	517	517	0.00

Chapter 22: octopus (full)

- Like the shark chapter, this assessment contains lots of important information, but in terms of harvest specs, it is basically a rollover

Quantity	Last asmt.	This asmt.	Change
2018 tier	6	n/a	none
2019 tier	6	6	none
2018 OFL	4,769	n/a	0.00
2019 OFL	4,769	4,769	0.00
2018 ABC	3,576	n/a	0.00
2019 ABC	3,576	3,576	0.00