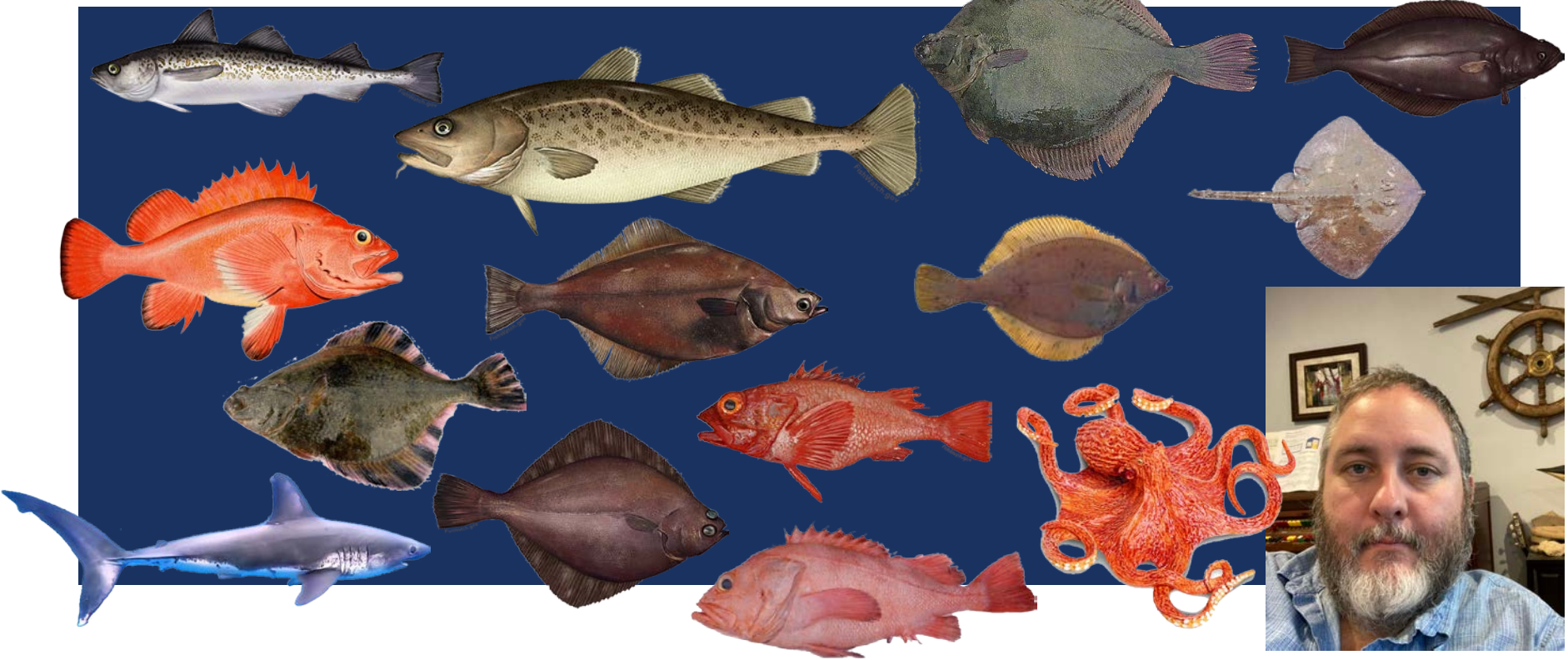




REPORT OF THE NOVEMBER 2020 BSAI GROUNDFISH PLAN TEAM MEETING

STEVE BARBEAUX (CO-CHAIR), GRANT THOMPSON (CO-CHAIR), STEVE MACLEAN (COORDINATOR)
DECEMBER 3, 2020





BSAI PLAN TEAM MEETING OVERVIEW

- Dates: November 17-20
- Place: Cyberspace
- Leaders: Grant Thompson, Steve Barbeaux (co-chairs); Steve MacLean (coordinator)
- Participation:
 - Mary Furuness (NMFS AKRO)
 - Alan Haynie (AFSC REFM)
 - Allan Hicks (IPHC)
 - Lisa Hillier (WDFW)
 - Kirstin Holsman (AFSC REFM)
 - Andy Kingham (AFSC FMA)
 - Kalei Shotwell (AFSC ABL)
 - Chris Siddon (ADF&G)
 - Cindy Tribuzio (AFSC ABL)
 - AFSC and AKRO staff and members of the public





BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE

- Assessments of 23 stocks/complexes (21 full, 2 partial, 0 “none”)
 - New lead author for 9 assessments
- Lots of models (including Tier 5 and 6 methods):
 - 25 base models/methods (2 chapters include models for 2 areas)
 - 28 additional models/methods
- The Team agreed with authors’ recommendations regarding preferred models and harvest specifications in all but 1 case
- Change from current base model/method recommended in 7 cases
- Reductions from maxABC recommended in only 2 cases
- Of the 16 stocks/complexes in Tiers 1 or 3, only 3 are in sub-tier “b”
- No stocks/complexes were subjected to overfishing in 2019, and no Tier 1 or 3 stocks/complexes are overfished/approaching as of 2020

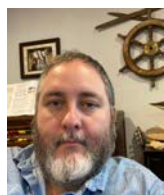
3





BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE (TINY FONT)

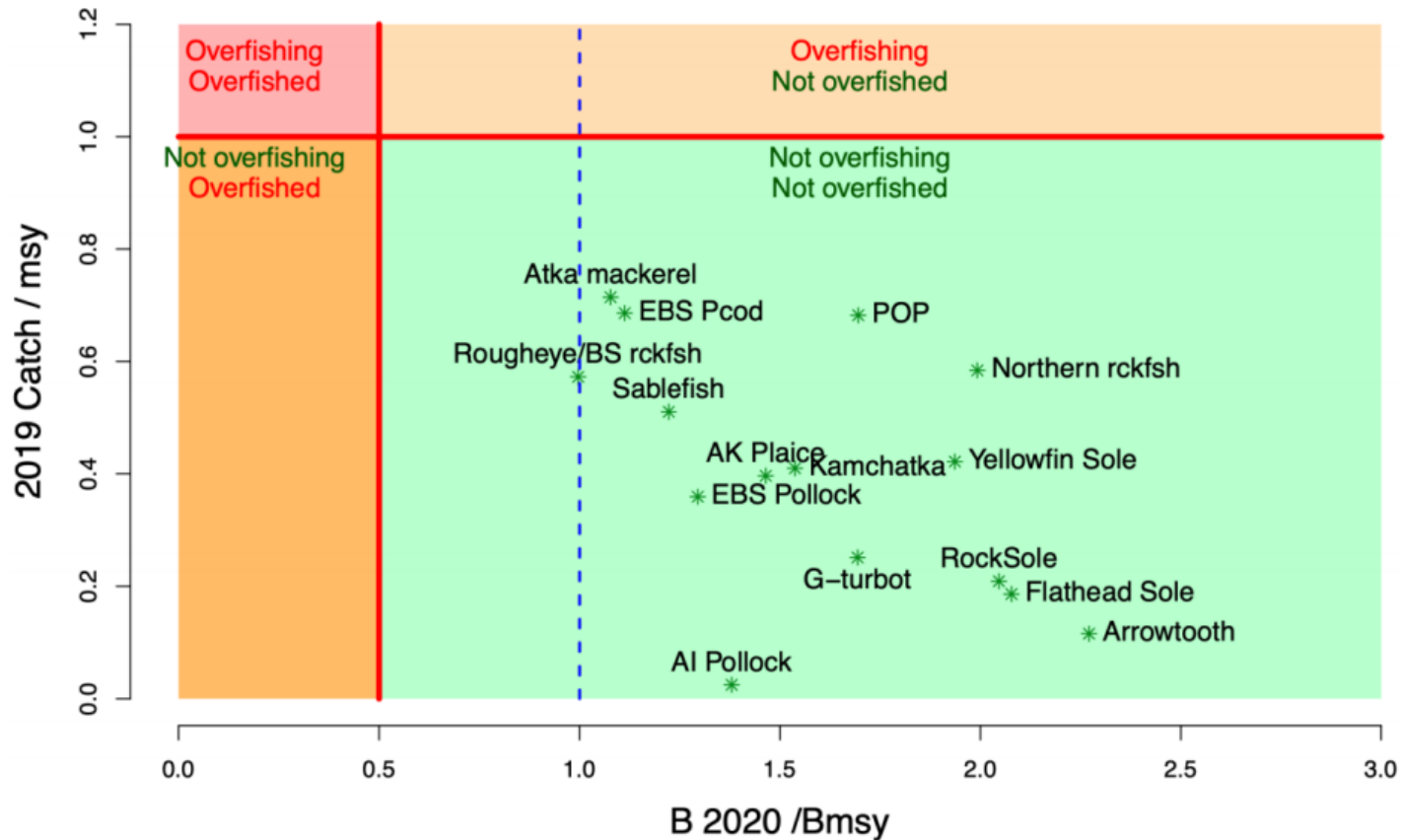
Ch. Assessment	Lead author	Tier	Type	Numbered models (or Tier 5, 6)	Risk
1 EBS pollock	Ianelli	1a	Full	16.2 (base), 20.0, 20.1, 20.0a	1.50
1A AI pollock	Barbeaux	3a	Full	15.1 (base) , 15.2	1.00
1B Bogoslof pollock	Ianelli	5	Full	Tier 5 RE (base) , age-structured model	1.00
2 EBS Pacific cod	Thompson	3b	Full	20.4, 19.12a, 19.15, 19.12 (base), 20.8, 20.9, 20.10; Ens. A {20.4, 19.12a, 19.15, 19.12}, Ens. C {Ens. A, 20.8}, Ens. AB {Ens. C, 20.9, 20.10}	1.25
2A AI Pacific cod	Spies	5	Full	Tier 5 RE (base)	1.25
3 Sablefish	Goethel	3a	Full	16.5 (base)	2.75
4 Yellowfin sole	Spies	1a	Full	18.1 (base), 18.2 , 18.3, 18.4	1.00
5 Greenland turbot	Bryan	3a	Full	16.4 (base), 16.4a	1.25
6 Arrowtooth flounder	Shotwell	3a	Full	18.9 (base)	1.00
7 Kamchatka flounder	Bryan	3a	Full	16.0a (base), 16.0b (same as base, with updated data)	1.00
8 Northern rock sole	McGilliard	1a	Full	15.1 (base), 18.3 , 18.3 (exploratory)	1.25
9 Flathead sole	Monnahan	3a	Full	18.2c (base)	1.00
10 Alaska plaice	Ormseth	3a	Partial	11.1 (base)	n/a
11 Other flatfish	Monnahan	5	Full	Tier 5 RE (base)	1.00
12 Pacific ocean perch	Spencer	3a	Full	16.3a (base)	1.25
13 Northern rockfish	Spencer	3a	Partial	16.1a (base)	n/a
14 Blackspot/rougheye	Spencer	3b/5	Full	AI: 18.1 (base), 20 , 20a, 20b, 20c; EBS: Tier 5 RE (base)	2.00
15 Shortraker rockfish	Shotwell	5	Full	Tier 5 RE (base)	1.00
16 Other rockfish	Sullivan	5	Full	Tier 5 RE (base)	1.25
17 Atka mackerel	Lowe	3b	Full	16.0b (base)	1.00
18 Skates	Ormseth	3a/5	Full	Alaska skate: 14.2 (base); other skates: Tier 5 RE (base)	1.00
19 Sharks	Tribuzio	6	Full	Tier 6: 16.0 (base) , 20.0, 20.1, 20.2	1.50
22 Octopus	Ormseth	6	Full	Tier 6: cod consumption (base)	1.00





BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – STOCK STATUS

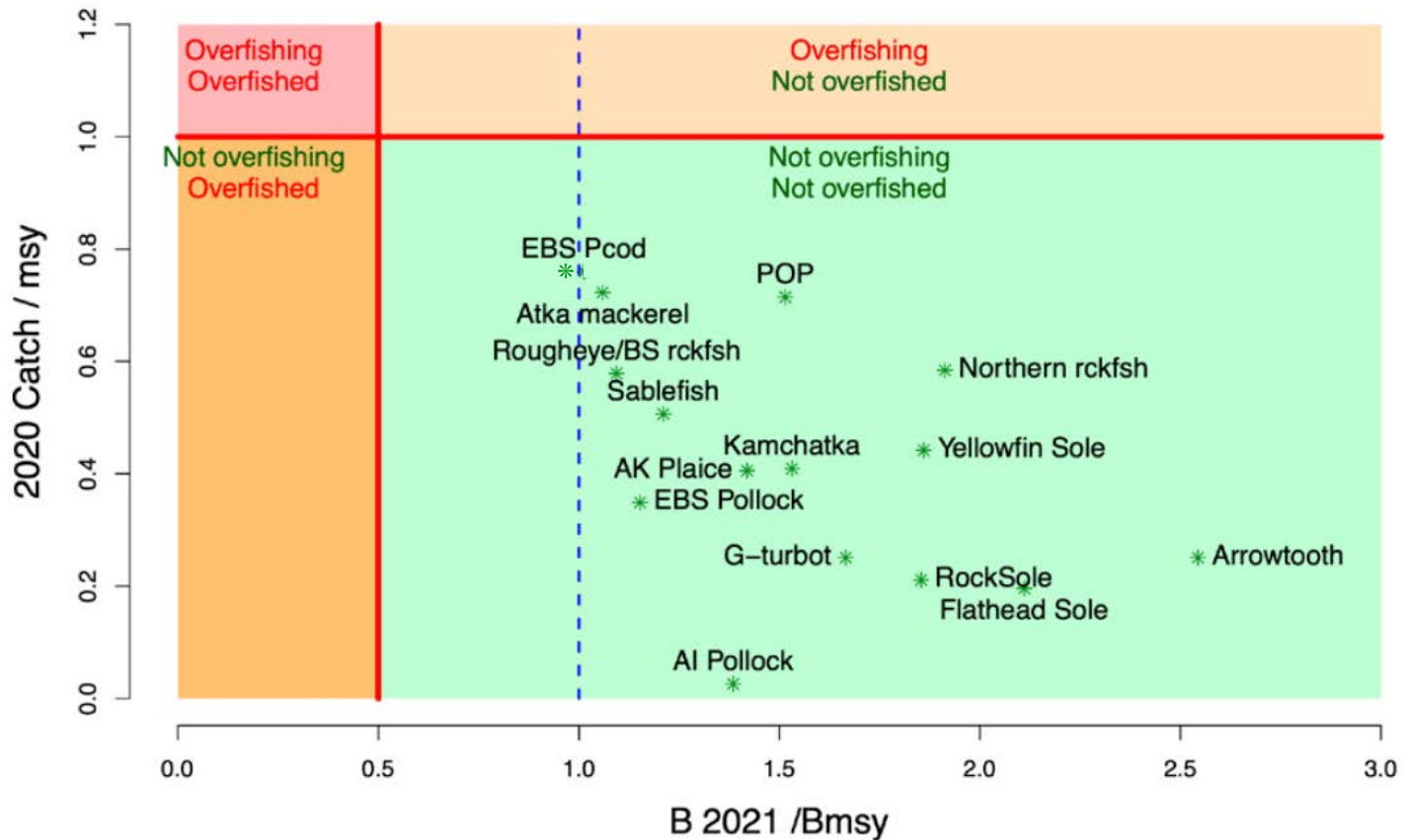
Bering Sea and Aleutian Islands





BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – STOCK STATUS

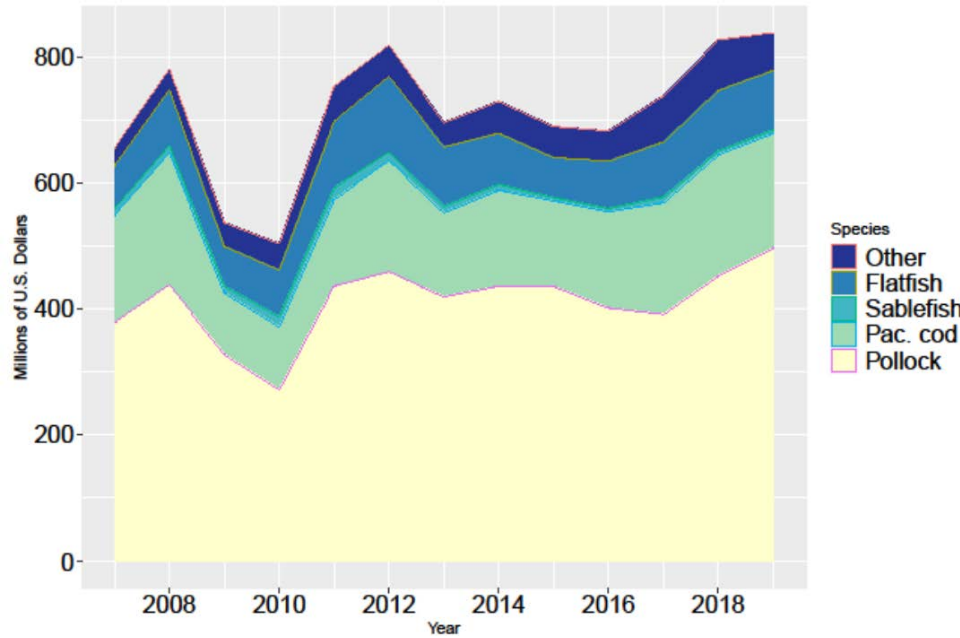
Bering Sea and Aleutian Islands



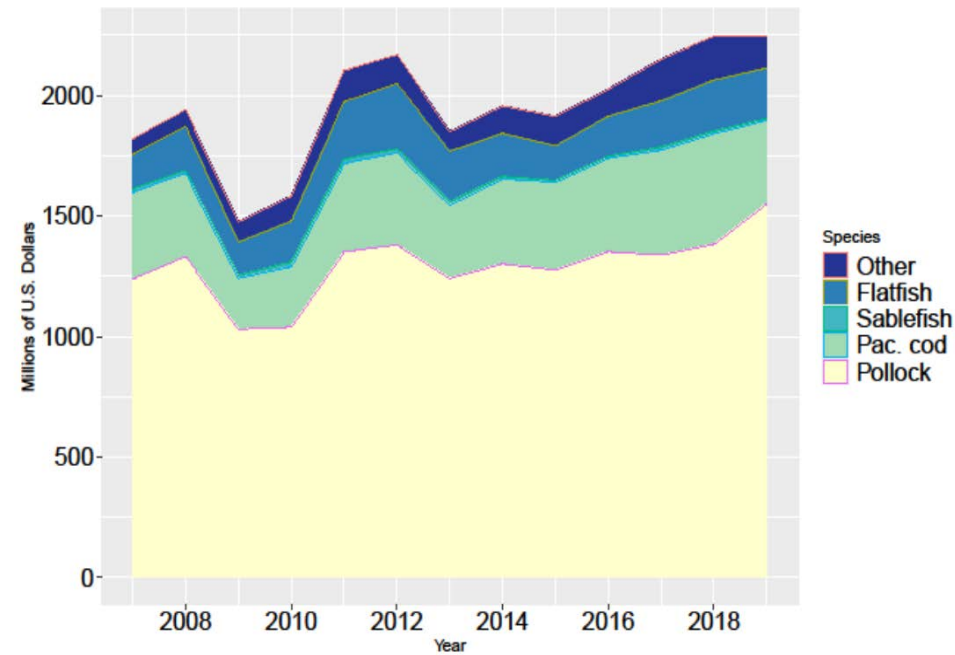


BERING SEA AND ALEUTIAN ISLANDS BIG PICTURE – ECONOMICS

Real ex-vessel value

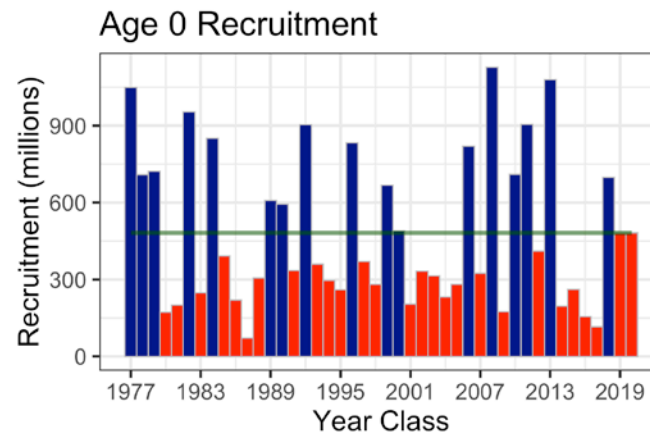
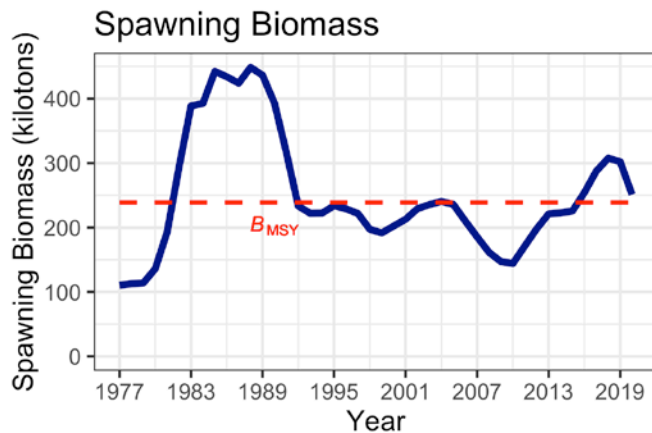
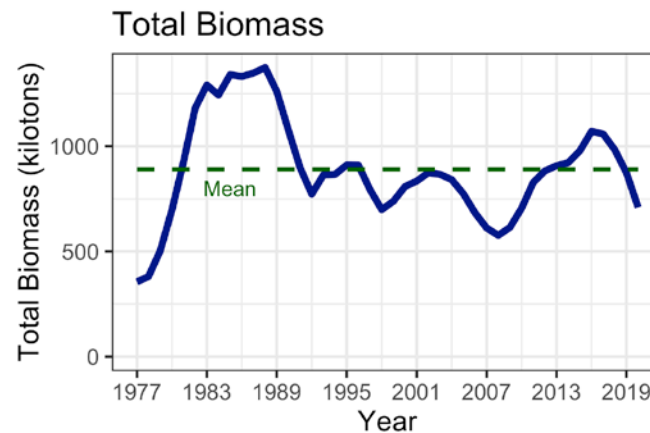
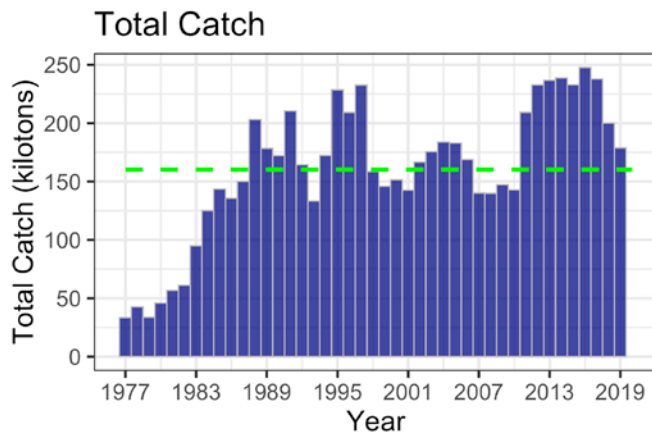


Real gross product value





REFERENCE POINT COMPARISONS (GRAPHS FOR TIERS 1-3 ASSESSMENTS)





REFERENCE POINT COMPARISONS (ALL SPECIES)

Quantity	Last asmt.	This asmt.	Change
M	0.105	0.098	-0.07
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	704,683	n/a	0.07
2021 age+ biomass	741,029	753,110	0.02
2020 spawning biomass	113,368	n/a	0.19
2021 spawning biomass	156,854	134,401	-0.14
B100%	264,940	317,096	0.20
B40%	105,976	126,389	0.19
B35%	92,729	110,984	0.20
2021 FOFL	0.121	0.117	-0.03
2021 FABC	0.041	0.042	0.02
2020 OFL	50,481	n/a	0.20
2021 OFL	64,765	60,426	-0.07
2020 ABC	22,009	n/a	0.01
2021 ABC	29,008	22,237	-0.23

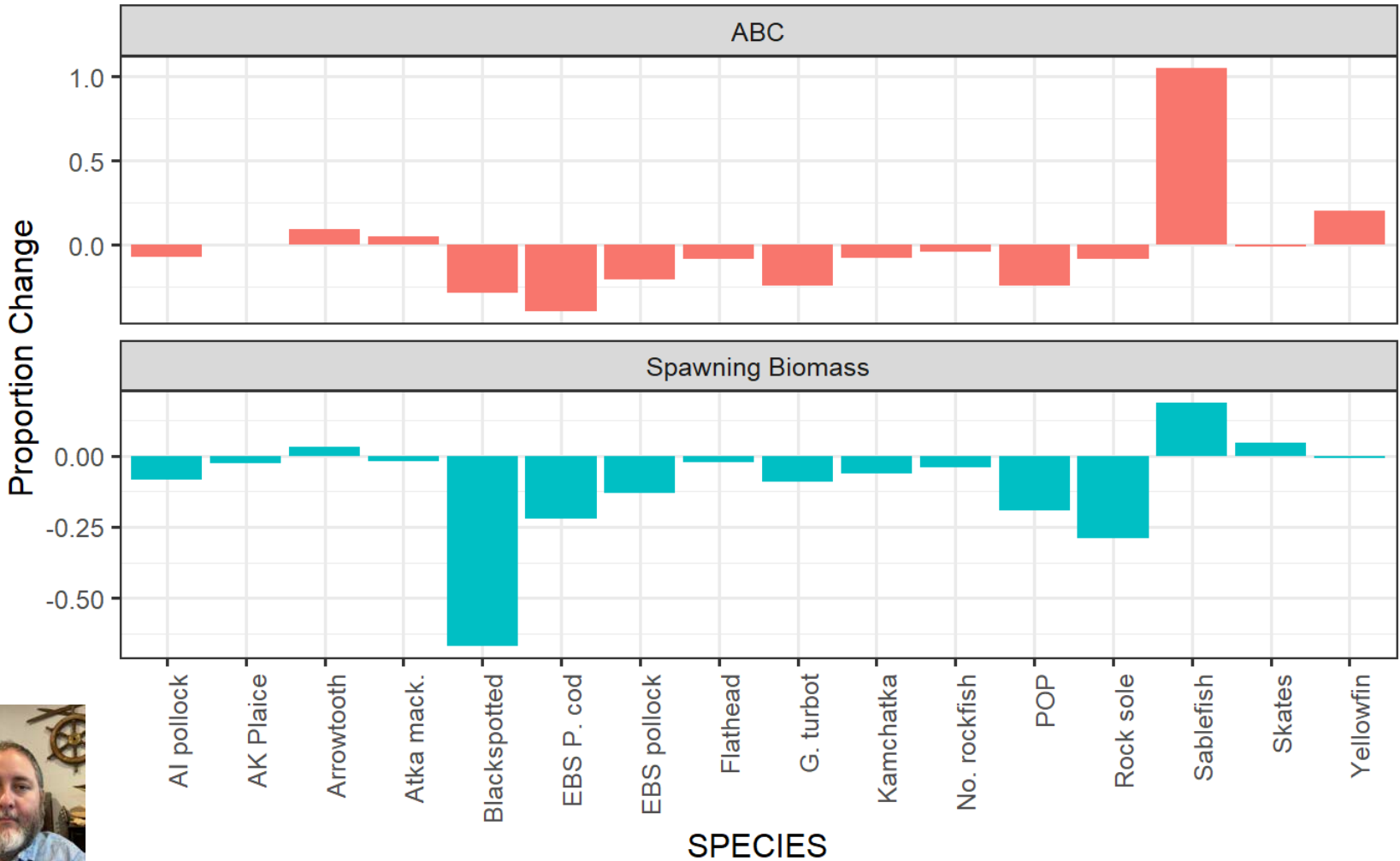
Except where “quantity” is shaded, “change” represents the relative difference between *this assessment’s value* and *last assessment’s value* for the same quantity.

Where “quantity” is shaded, “change” represents the relative difference between *this assessment’s value for 2021* and *last assessment’s value for 2020*.





BSAI TIER 1 AND TIER 3 SPECIES 2020-2021





RISK TABLES (INCLUDED FOR ALL FULL ASSESSMENTS)

- Authors and the Team continued to struggle with:
 1. Assignment of levels; especially, is “increased” concern relative to:
 - Previous assessments of the same stock/complex, or
 - Typical assessments; and if this is the case, then is it relative to:
 - Typical assessments within the same tier, or
 - Typical assessments across all tiers?
 2. Conditions under which levels >1 should result in ABC $<$ maxABC
 3. Magnitude of reduction in cases where reduction is warranted
- The Team accepted the authors’ risk levels in all cases, but this should be interpreted more as the Team’s acknowledgment that each author identified reasonable rationales in assigning levels than an assertion that the criteria used to assign levels were consistent across authors





GENERAL ISSUES

EBS SLOPE AND AI SURVEYS

- The Team noted that the continued lack of surveys in the eastern Bering Sea slope and the Aleutian Islands region is a concern for many flatfish and rockfish stocks that rely upon this data
- The recent uncertainty analysis by Bryan *et al.*, 2020 notes that stocks that rely on the biennial survey update are more impacted by the loss of one survey
- A large number of stocks will have increased uncertainty in the biomass estimates, if future surveys in the Bering Sea slope and Aleutian Islands are not prioritized
- This may result in increased risk levels in the assessment category





GENERAL ISSUES EBS AND AI ECOSYSTEM REPORTS

- See separate presentations by Elizabeth Siddon and Ivonne Ortiz
- **The Team encourages continuation, to the extent possible, of the contributions on seabirds and plastics, ROMSNPZ-based cold pool index and hindcast, and standardized marine heatwave index**



CHAPTER SUMMARIES

22 TOTAL (TIER 1, TIER 3, TIER 5, TIER 6)

- **EBS Pollock**

- **AI pollock**

- **Bogoslof pollock**

- **EBS Pacific cod**

- **AI Pacific cod**

- **Yellowfin sole**

- **Greenland turbot**

- **Arrowtooth flounder**

- **Kamchatka flounder**

- **Northern Rock sole**

- **Flathead sole**



- **Alaska plaice**

- **Other Flatfish**

- **Pacific ocean perch**

- **Northern rockfish**

- **Blackspotted/rougeye rockfish**

- **Shortraker rockfish**

- **Other rockfish**

- **Atka mackerel**

- **Skates**

- **Sharks**

- **Octopus**





TYPICAL SUMMARY FORMAT FOR FULL ASSESSMENTS

- Answers (yes, no, or n/a) to the following questions:
 - New author?; >1 model?; change from base?; risk>1?
- New data, if any (updated catch data omitted for brevity)
- Model changes/alternatives, if any
- Stock status or trend:
 - 2021 spawning biomass relative to B_0 or $B_{100\%}$ (Tiers 1-3 only)
 - Recent survey biomass trend (Tier 5)
- Mohn's r (Tiers 1-3 only)
- Risk levels (assessments with at least one level>1 only)
- Some representative figures from the assessment
- For stocks with separate presentations by the author, skip the above
- Team recommendations
- See SAFE Intro for 2022 specs and area allocations (mostly)



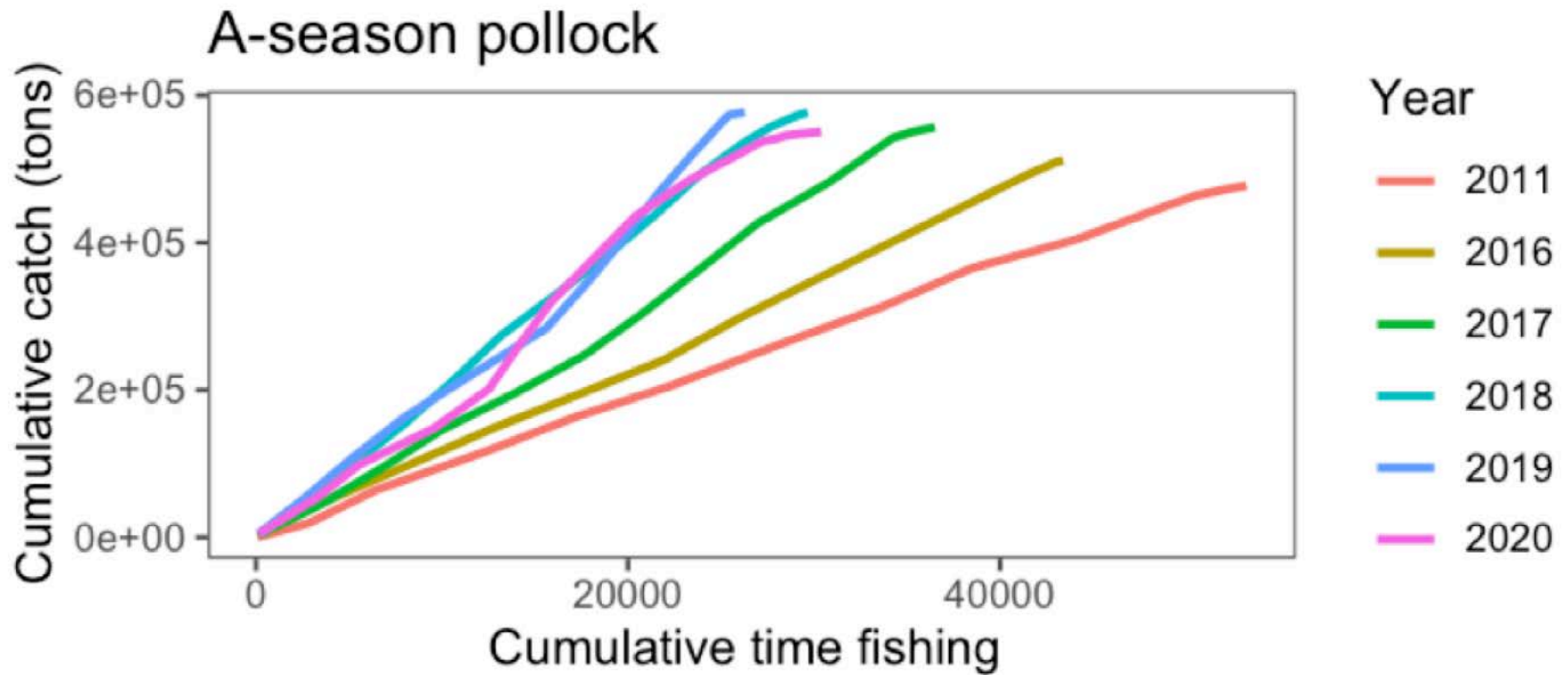


EBS WALLEYE POLLOCK

- New author: **no**; >1 model: **yes**; change from base: **yes**; risk>1: **yes**
- New data:
 - Updated catch and composition data
 - USV (saildrone survey)
- Four new models:
 - Model 16.2, model selected by the SSC in 2019.
 - Model 20.0, same as Model 16.2, but includes 2020 USV data as an extension of the ATS time series.
 - Model 20.1, same as Model 16.2, except substitutes a VAST-based time series derived from the RV Oscar Dyson backscatter data from 1994-2018 and the USV backscatter data from 2020.
 - Model 20.0a, same as Model 20.0, except estimates stock recruitment relationship without 1978 year class.

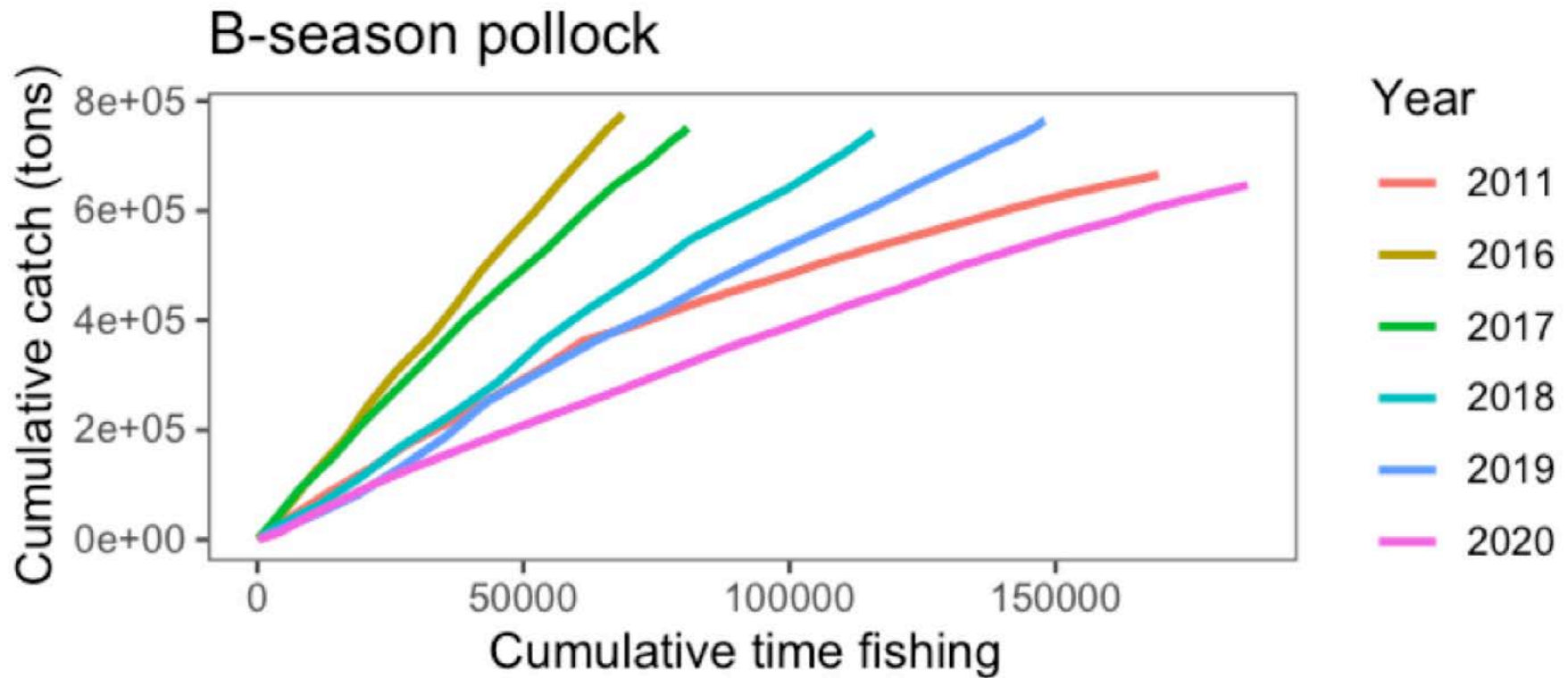


EBS WALLEYE POLLOCK FISHING CONDITIONS





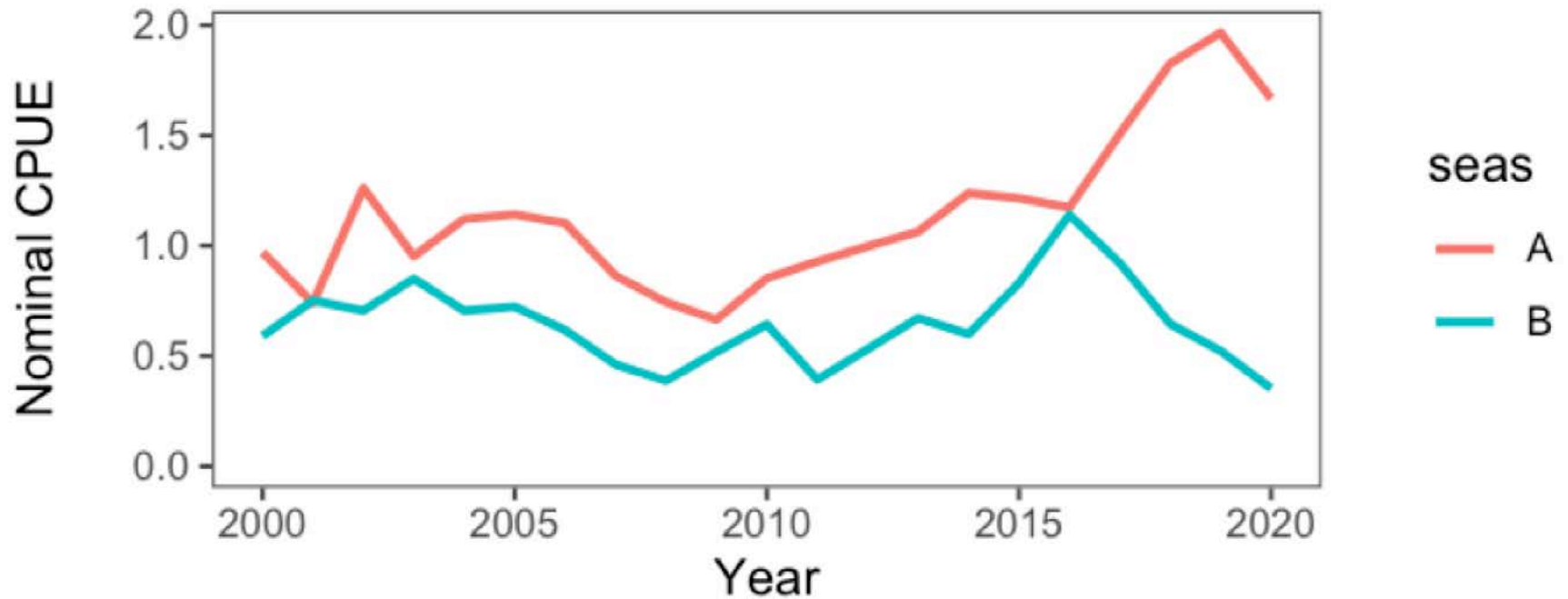
EBS WALLEYE POLLOCK FISHING CONDITIONS



EBS WALLEYE POLLOCK FISHING CONDITIONS



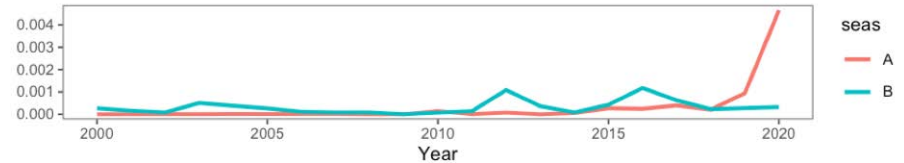
Pollock CPUE (by weight)



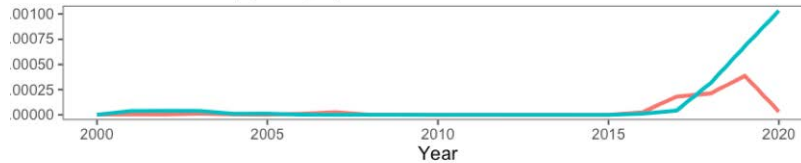
EBS WALLEYE POLLOCK CPUE



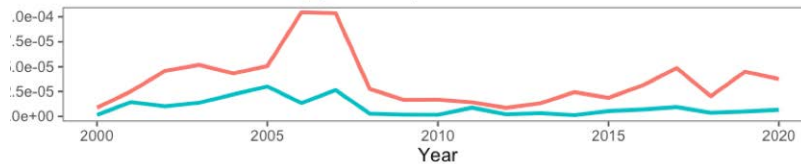
Herring CPUE (by weight)



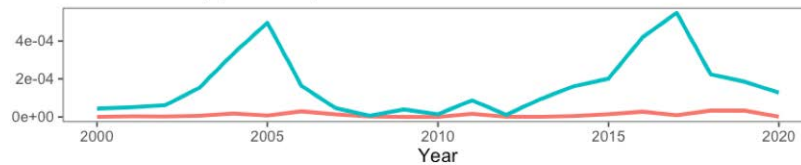
Sablefish CPUE (by weight)



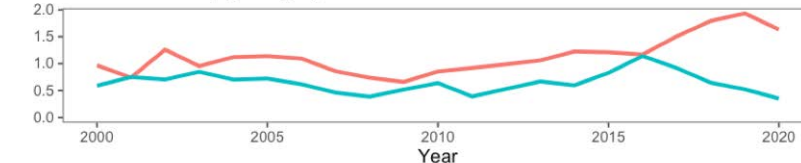
Chinook salmon CPUE (by number)



Chum CPUE (by number)



Pollock CPUE (by weight)



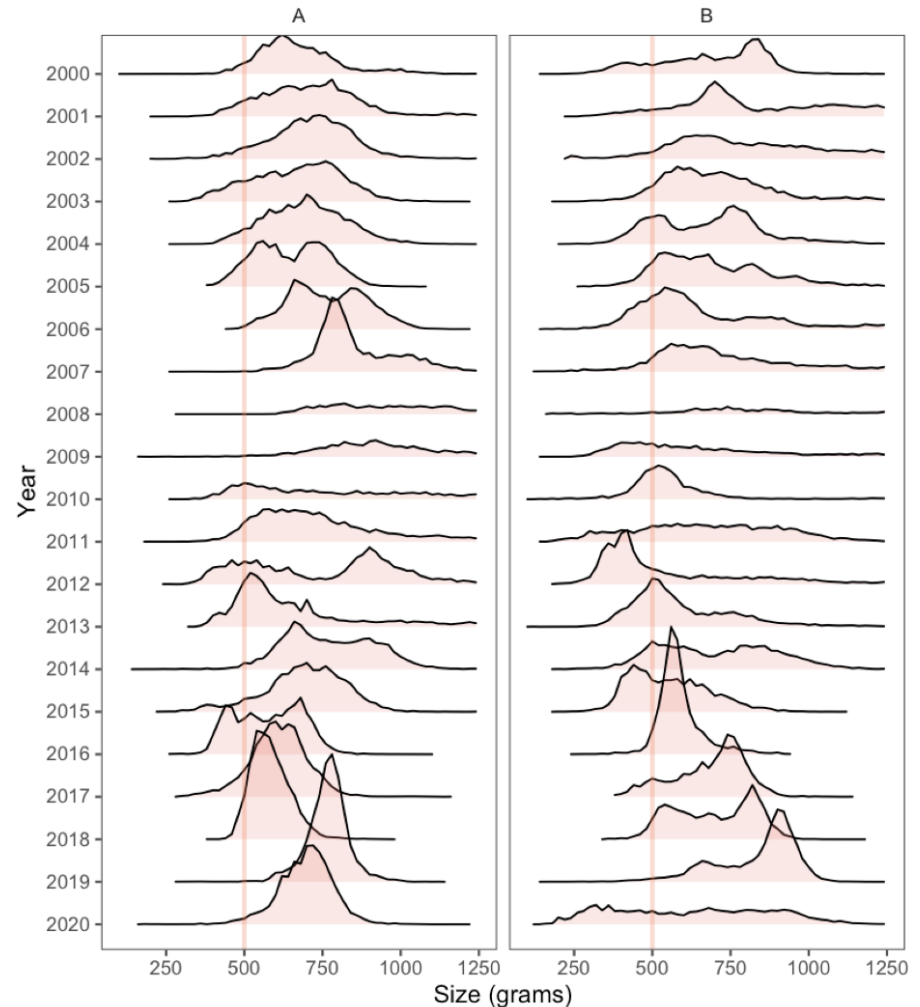


EBS WALLEYE POLLOCK FISHERY SIZE DISTRIBUTION

Size distributions by sample mean weight in tows...

Binned weight frequency

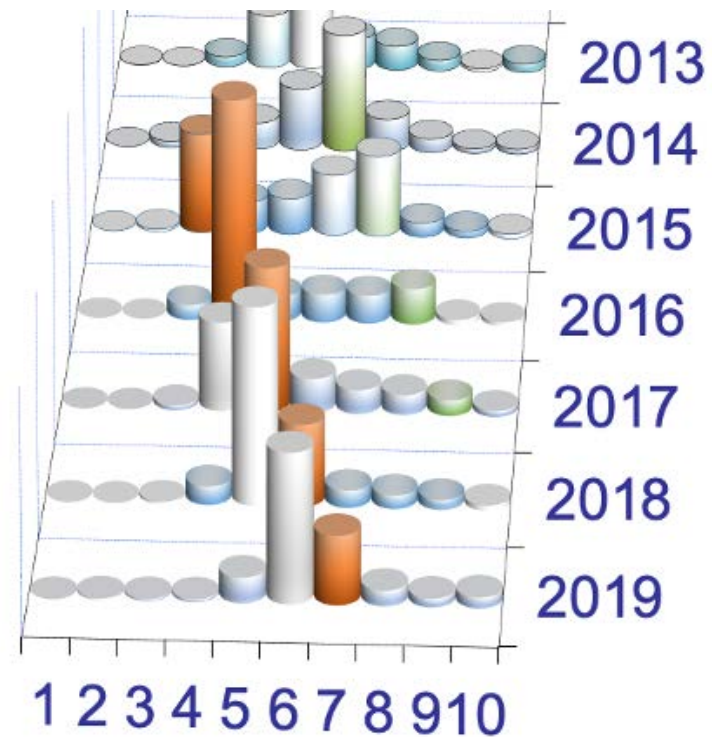
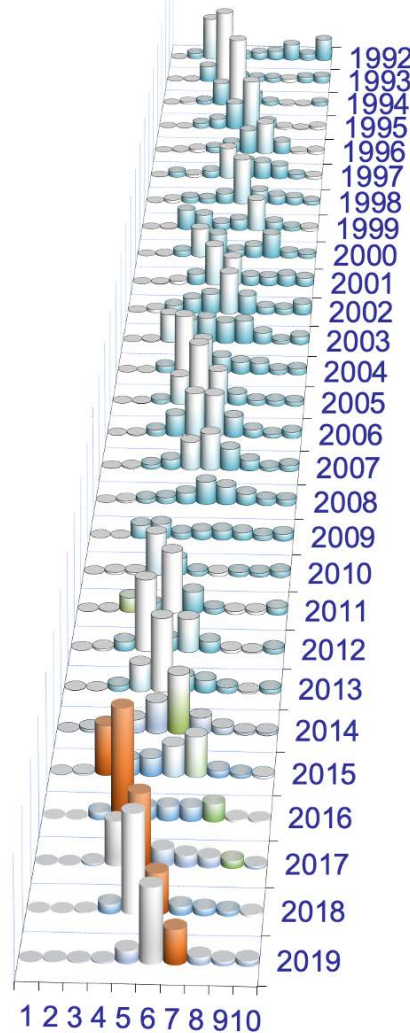
Tow sample mass
divided by
Tow sample N



EBS WALLEYE POLLOCK FISHERY CATCH-AT-AGE



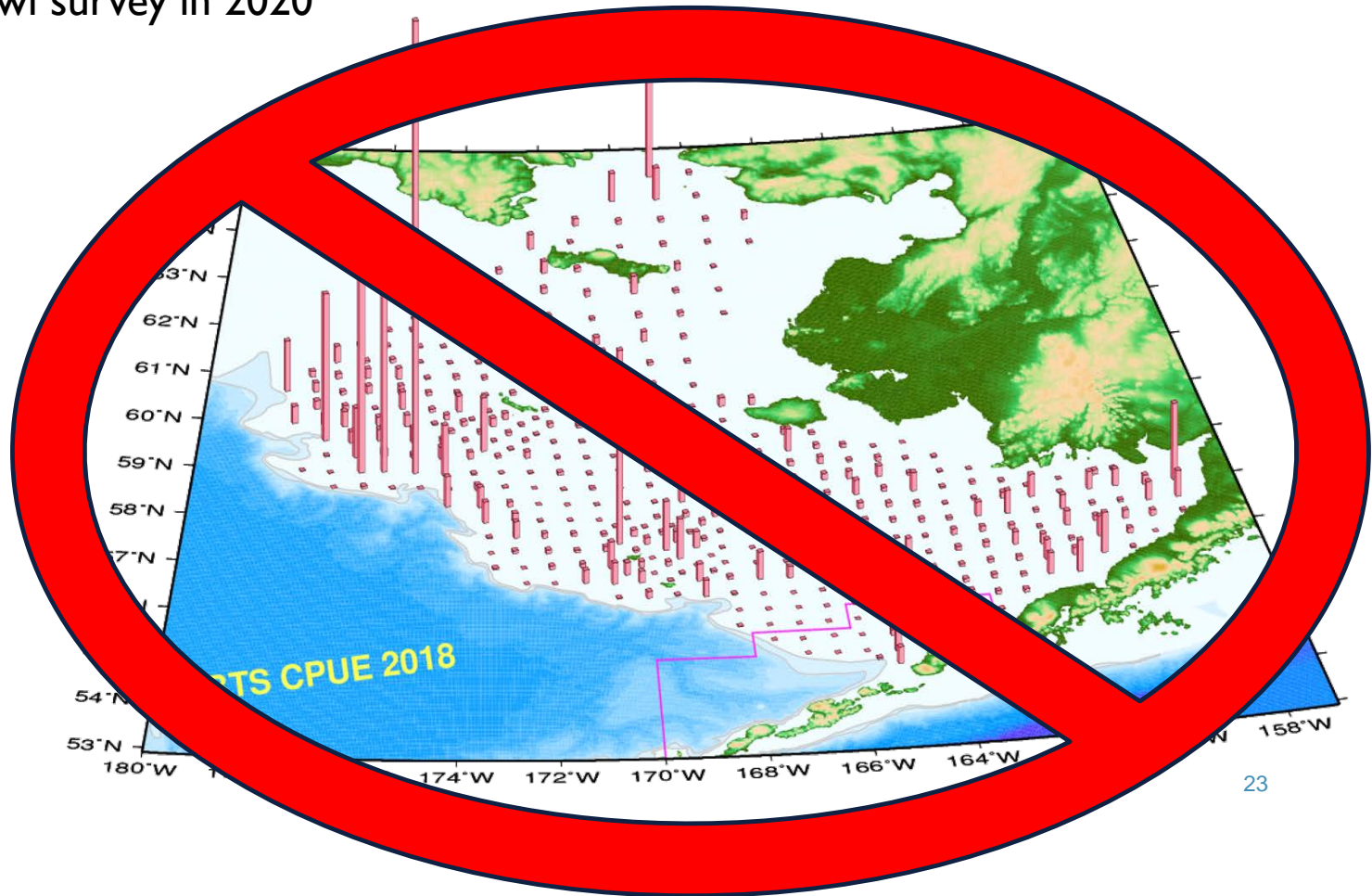
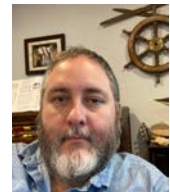
Fishery catch-at-age



EBS WALLEYE POLLOCK SCIENTIFIC RESEARCH SURVEY



No bottom trawl survey in 2020

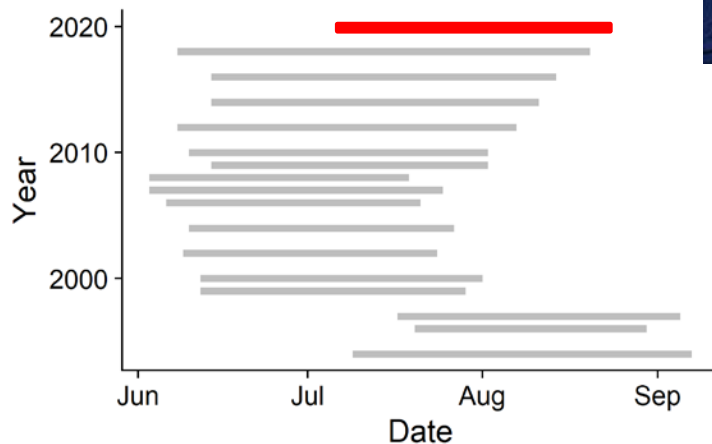
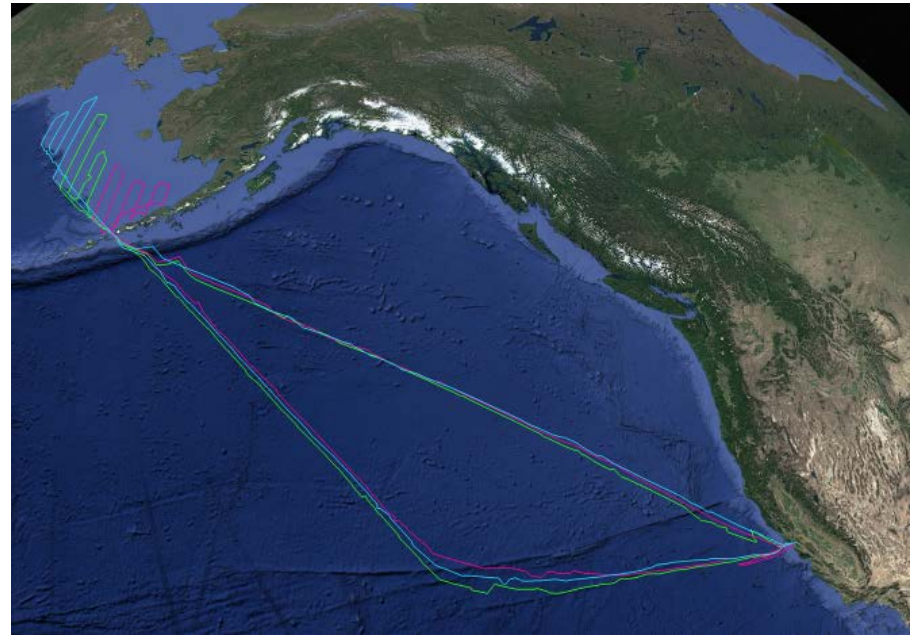


EBS WALLEYE POLLOCK 2020 SAILDRONE SURVEY (USV)



Approach

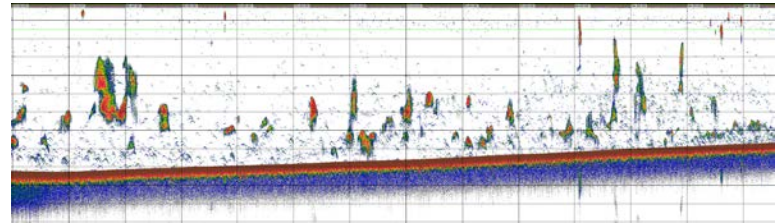
- Sail to/from Alaska
- 3 saildrones
- 40 nmi spacing
- Survey July 4-20 Aug
- Survey during daylight
- Pause at >25 knots
- Assume midwater backscatter minus jellyfish is pollock



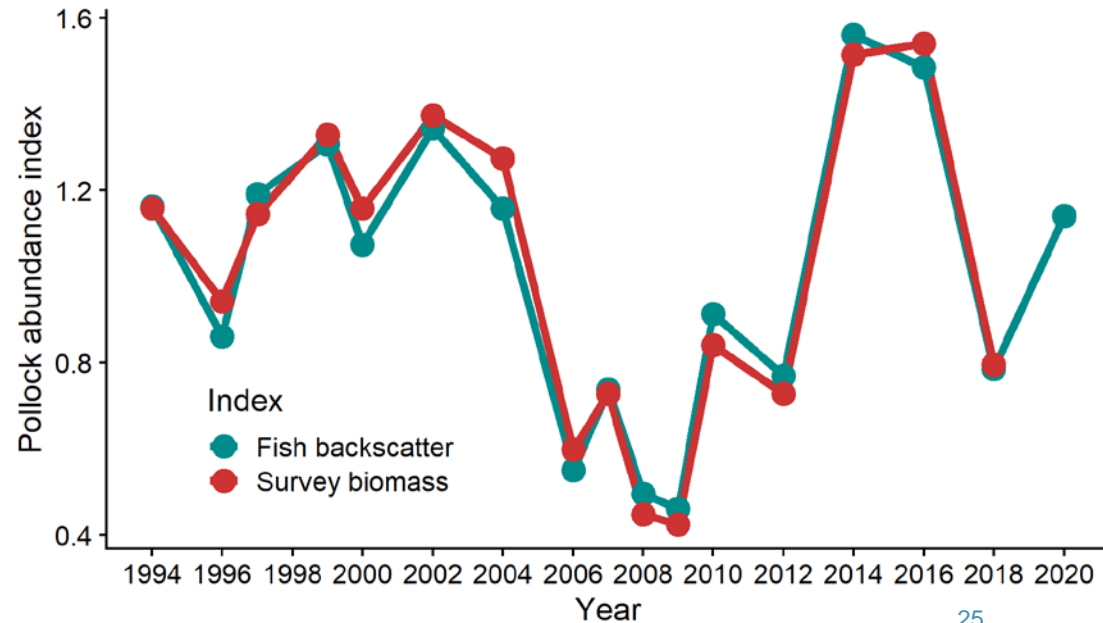
EBS WALLEYE POLLOCK 2020 SAILDRONE SURVEY (USV)



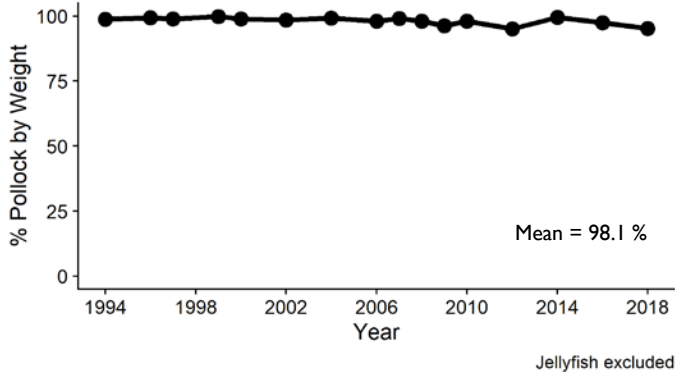
- Pollock dominate midwater biomass
- Backscatter is proportional to biomass



Acoustic survey (normalized)



Midwater survey biomass





EBS WALLEYE POLLOCK 2020 SAILDRONE SURVEY (USV)

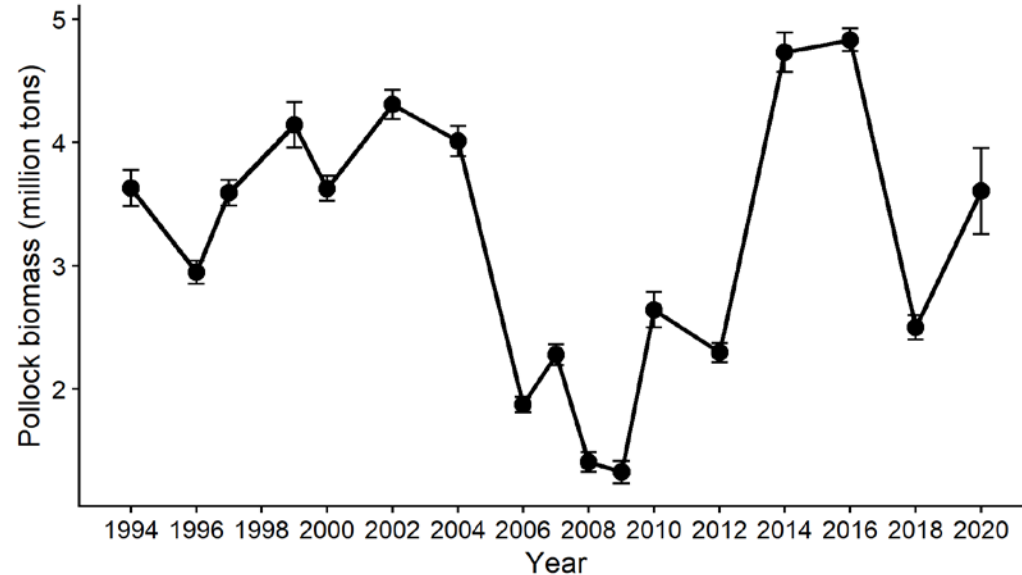
2020 USV estimate

- 3.6 million tons
- 44.5 % increase from 2018

Summary

- Contingency plan in case surveys were cancelled
- Things went as well as they could have
- Data processed in a similar way to traditional acoustic-trawl survey data
- Reduced sampling effort and conversion to biomass accounted for in increased uncertainty associated with the estimate.

Acoustic survey biomass to 0.5m





EBS WALLEYE POLLOCK MODELS CONSIDERED

- Base (as in 2019)
Model 16.2
- Extend acoustic time series with drone data
 - As biomass converted from 2020 back-scatter
 - (Model 20.0a - **Author recommended**)
- Analyze all historical data from research vessels combined with the 2020 USV data
 - All data treated as acoustic back-scatter
 - Uses VAST model for modeling unbalanced data (spatio-temporal aspects)
 - (Model 20.1)

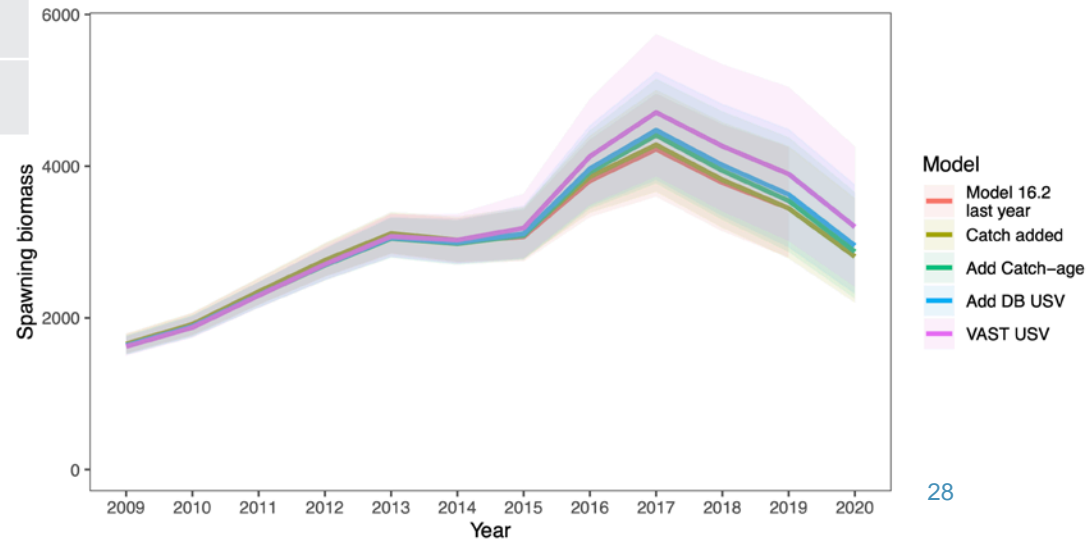




EBS WALLEYE POLLOCK MODELS - DATA CONSIDERATION

Data considerations

Name	Updated catch to 2020	2019 fishery age data	2020 Drone biomass (design based)	2020 Drone backscatter (VAST)
Catch	X			
+ Age Fishery	X	X		
+ Drone (DB)	X	X	X	
+ Drone (VAST)	X	X		X

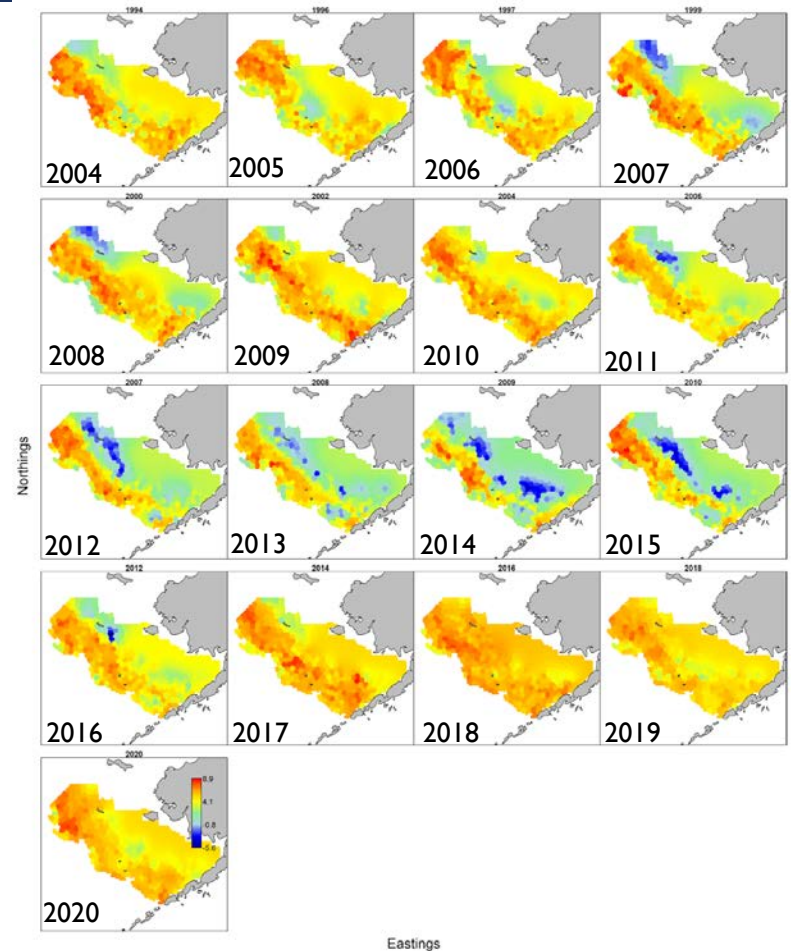


EBS WALLEYE POLLOCK MODEL - SELECTION



Selected model with USV data for management advice (Model 20.0a)

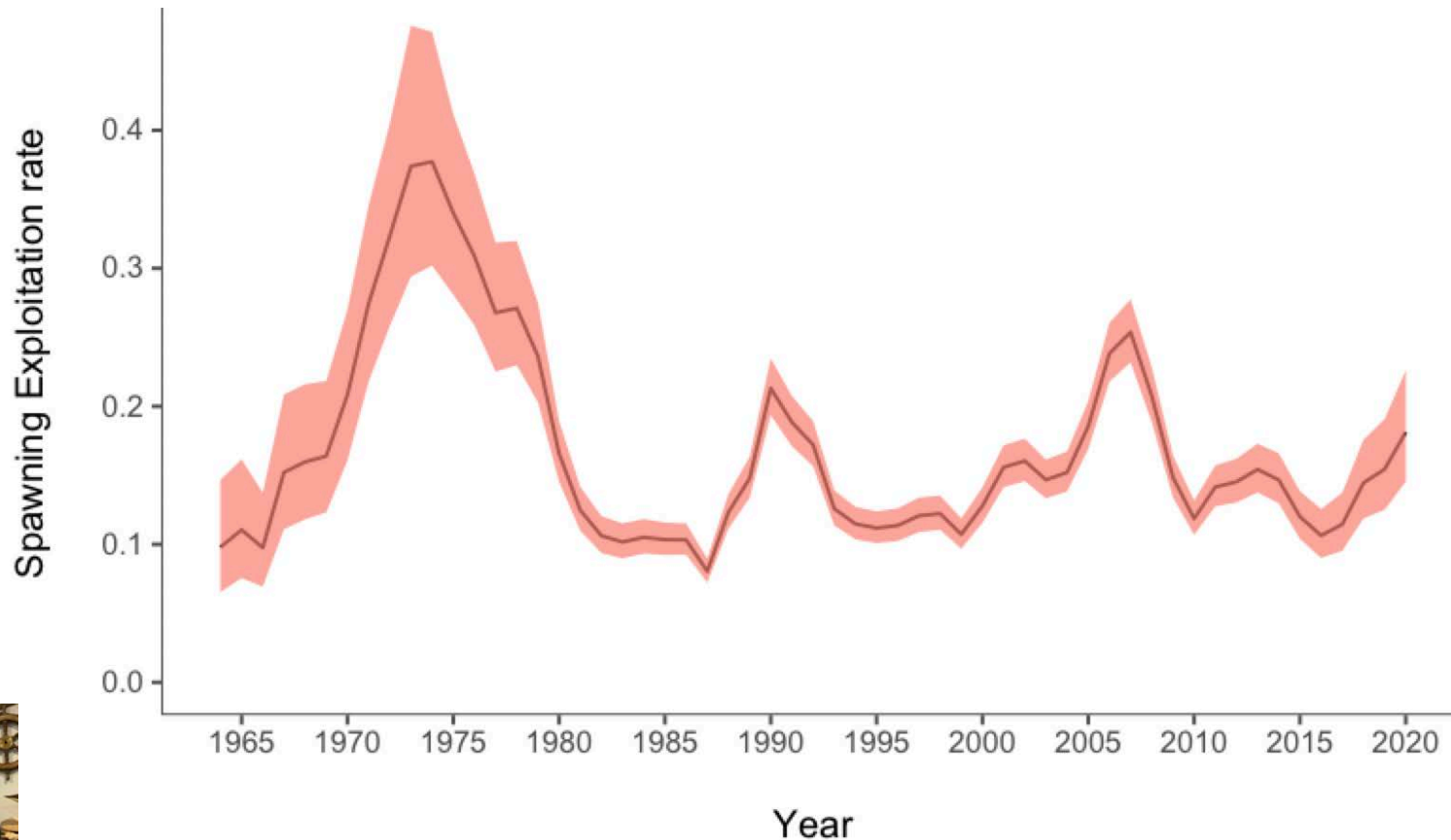
- Converted to biomass (in 2020)
- Similar to results from VAST
 - Was only backscatter



EBS WALLEYE POLLOCK MODEL 20.0A



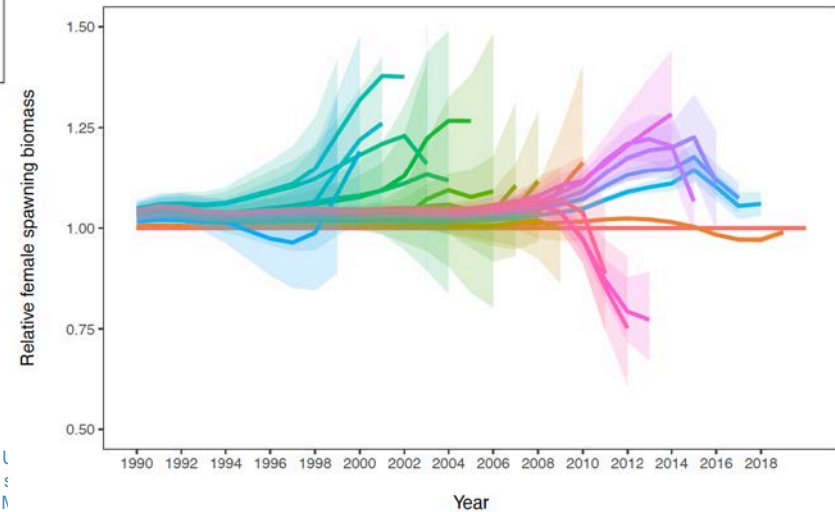
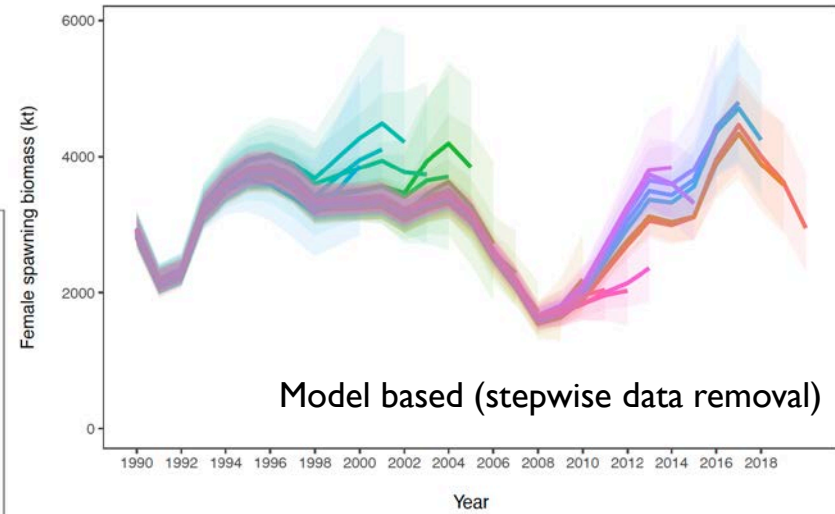
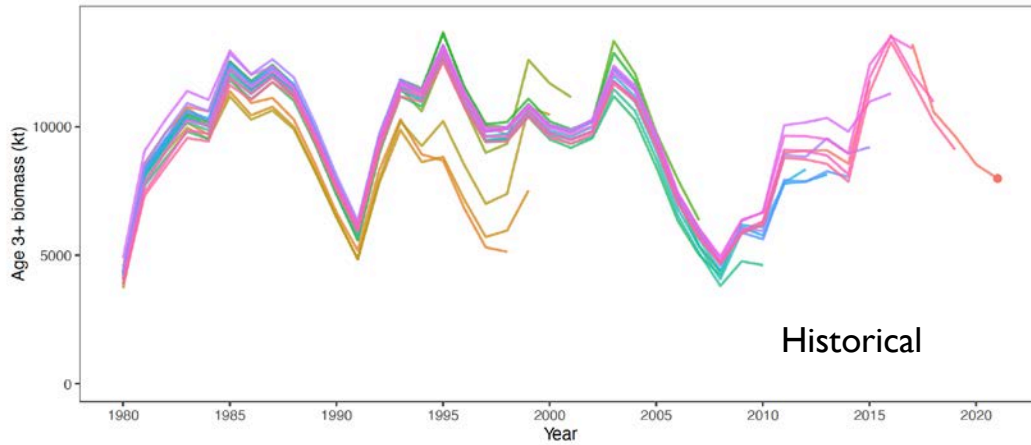
Spawning exploitation rate





EBS WALLEYE POLLOCK MODEL 20.0A

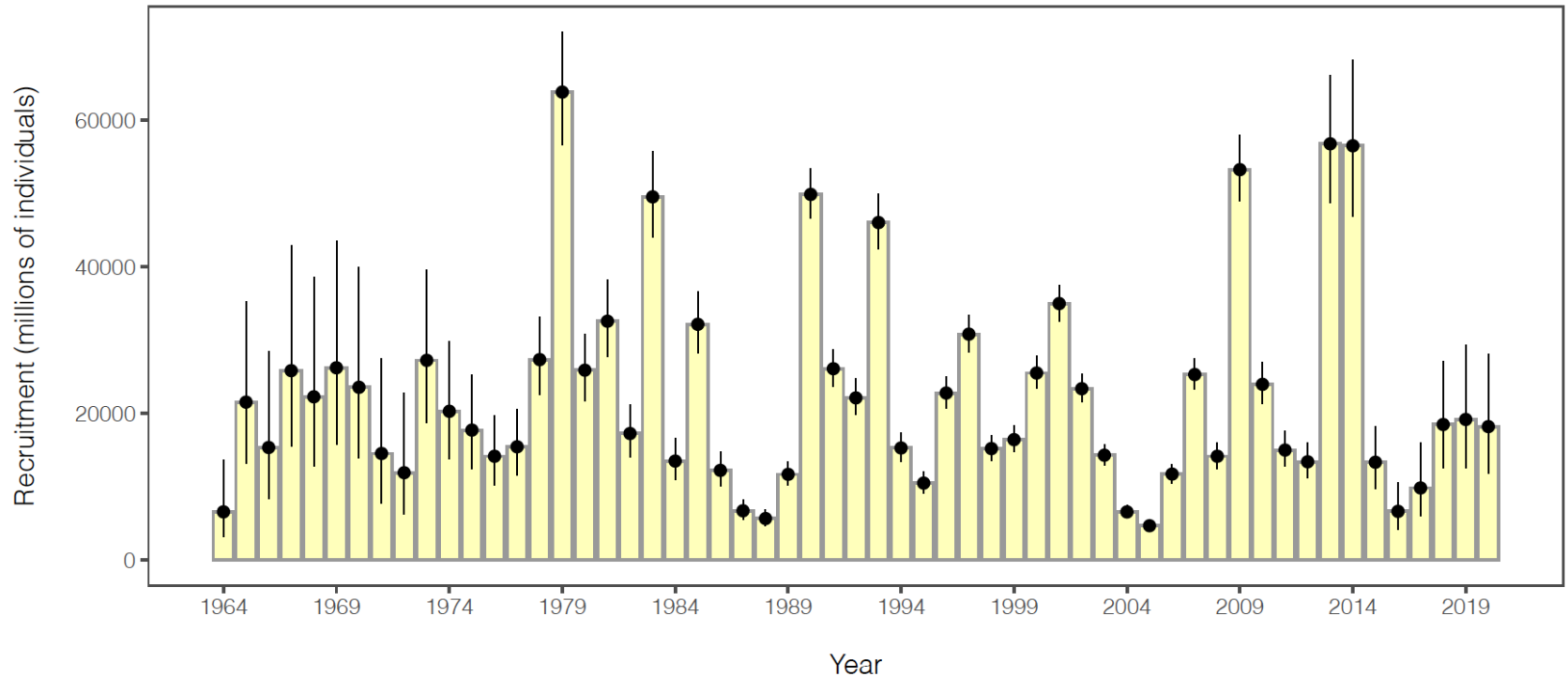
Retrospectives





EBS WALLEYE POLLOCK MODEL 20.0A

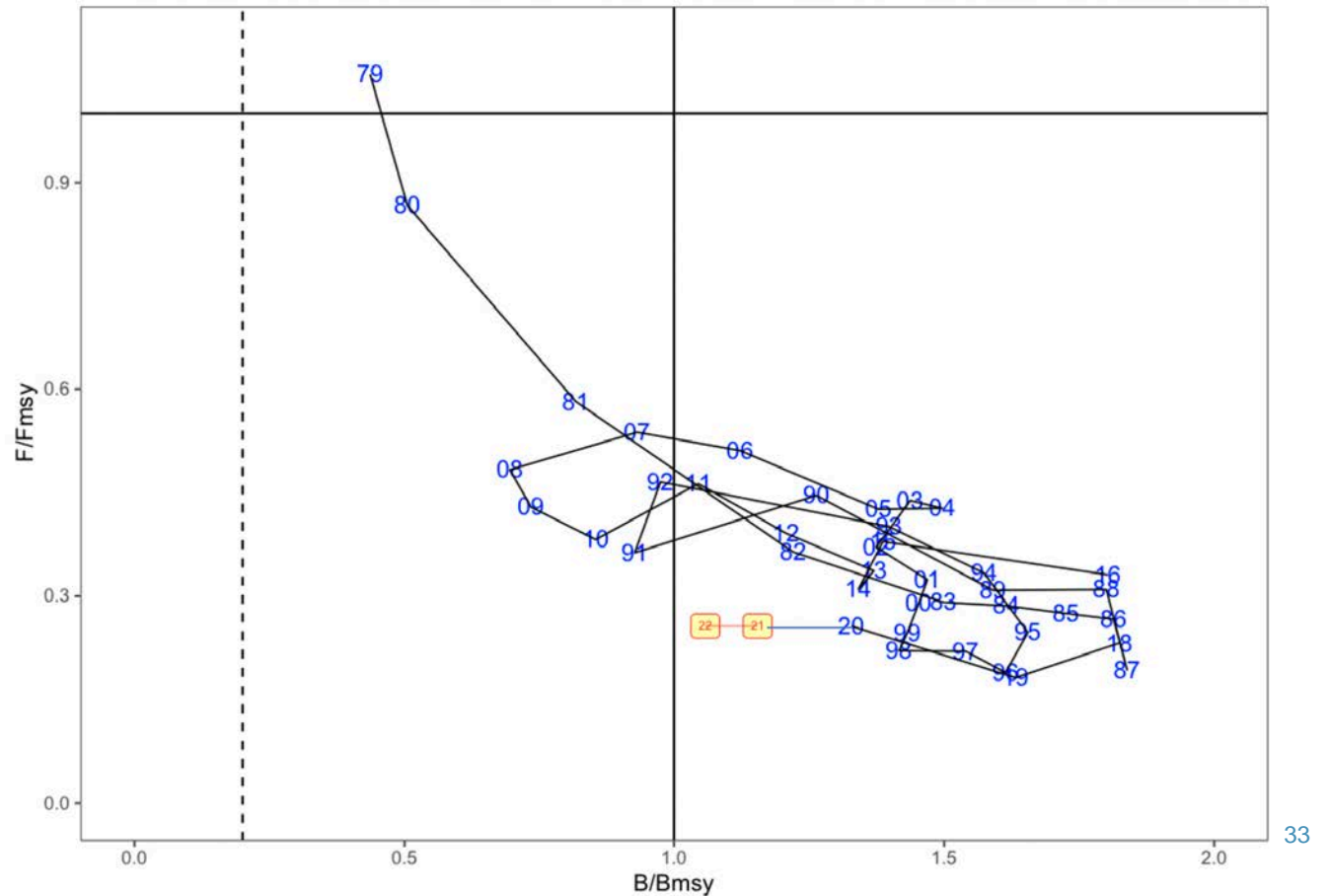
Estimated recruitment (age-I)





EBS WALLEYE POLLOCK MODEL 20.0A

Approaching B_{msy}



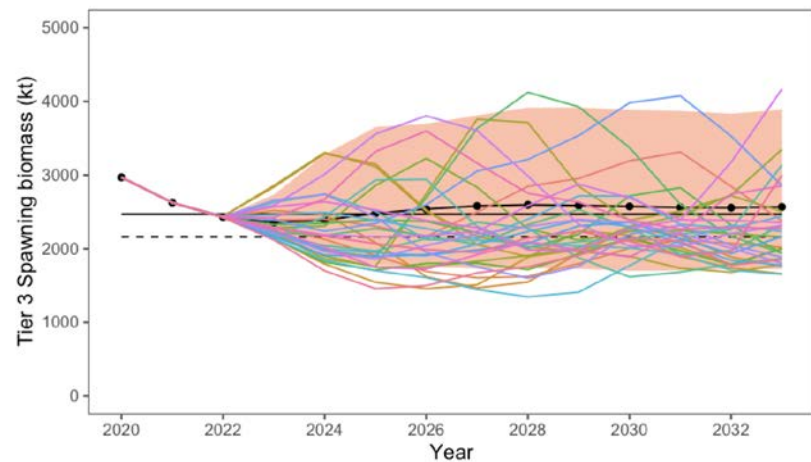
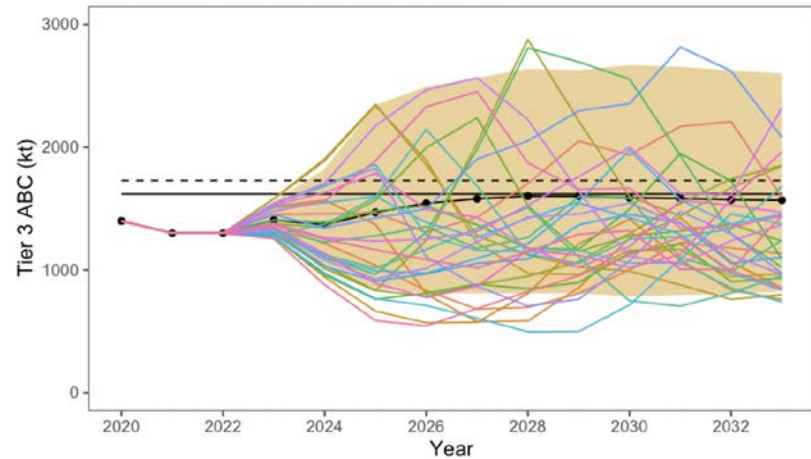


EBS WALLEYE POLLOCK MODEL 20.0A

Projections

Cautions:

- Current absolute biomass uncertain
- Future weight-at-age may add uncertainty
- Actual year-year fluctuations in catch unrealistic



EBS WALLEYE POLLOCK SUMMARY



- Outlook
 - Spawning biomass declining
 - From high levels
 - Unusual fishing challenges
 - Recommend stabilization of effort
 - ***TAC > 1.2 million t means likely more effort than 2020***
 - Stock projected drop below B_{msy} by 2021
 - could affect 2022 ABC (and TAC)





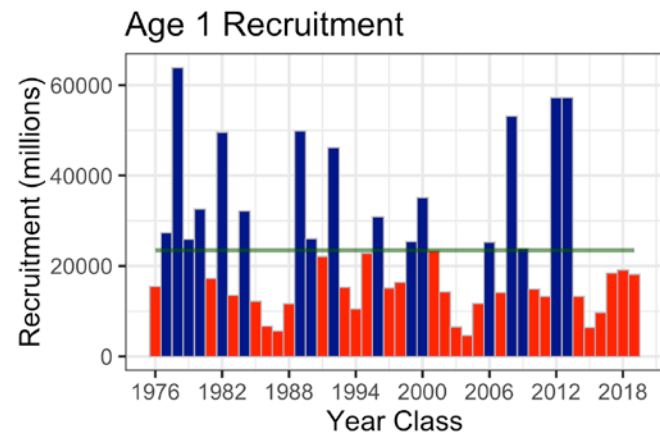
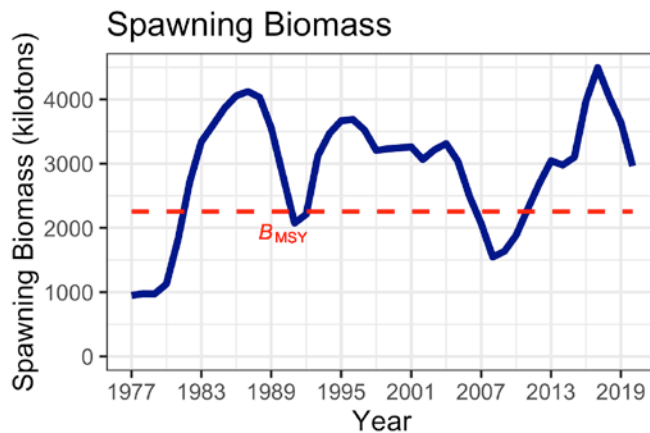
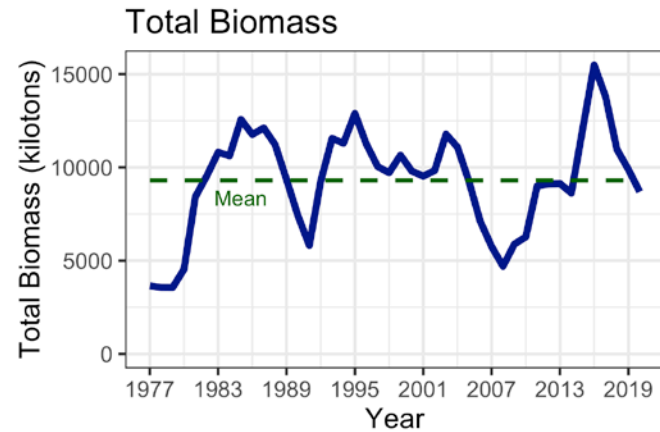
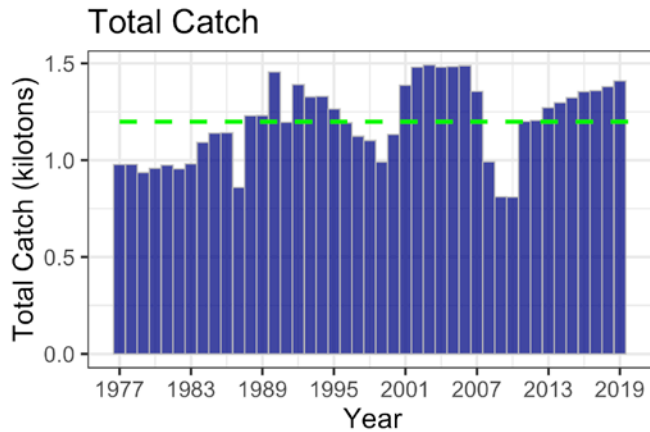
BSAI PLAN TEAM

EBS WALLEYE POLLOCK

- The Team agreed with all of the authors' recommendations:
 - Model 20.0a is the recommended model
 - ABCs to be reduced by 30% from Tier 1 maxABC in 2021 and 2022, following the Tier 3 maxABC control rule
 - No recommendation regarding a change in tier designation
- The Team and author discussed the impact of electronic monitoring (EM) in some segments of the fishery on data availability
 - Overall weight composition is still available from shoreside sampling, but tow-by-tow weight frequencies are not
- **The Team recommended that the AFSC stock assessment groups evaluate the impact of data loss associated with the fixed gear EM program and the trawl EM Exempted Fishing Permit**



EBS WALLEYE POLLOCK SUMMARY



EBS WALLEYE POLLOCK SUMMARY



Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2020 tier	1a	n/a	none
2021 tier	1a	1a	none
2020 age+ biomass	9,128,000	n/a	-0.11
2021 age+ biomass	8,494,000	8,145,000	-0.04
2020 spawning biomass	2,991,000	n/a	-0.13
2021 spawning biomass	2,674,000	2,602,000	-0.03
B0	5,777,000	5,792,000	0.00
Bmsy	2,148,000	2,257,000	0.05
2021 FOFL	0.449	0.341	-0.24
2021 FABC	0.225	0.214	-0.05
2020 OFL	4,085,000	n/a	-0.36
2021 OFL	3,385,000	2,594,000	-0.23
2020 ABC	2,043,000	n/a	-0.20
2021 ABC	1,767,000	1,626,000	-0.08



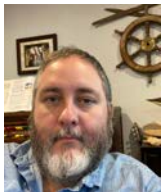
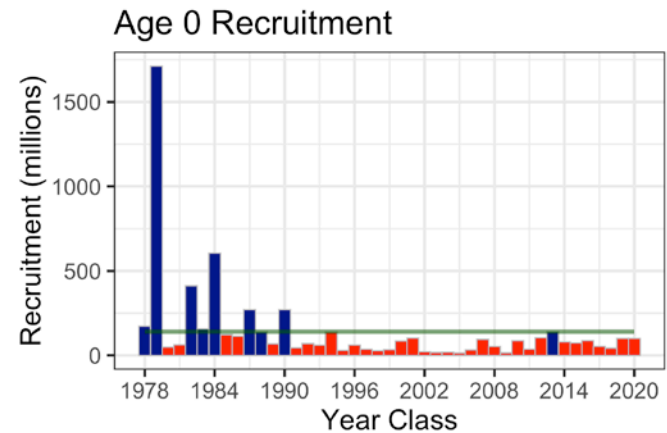
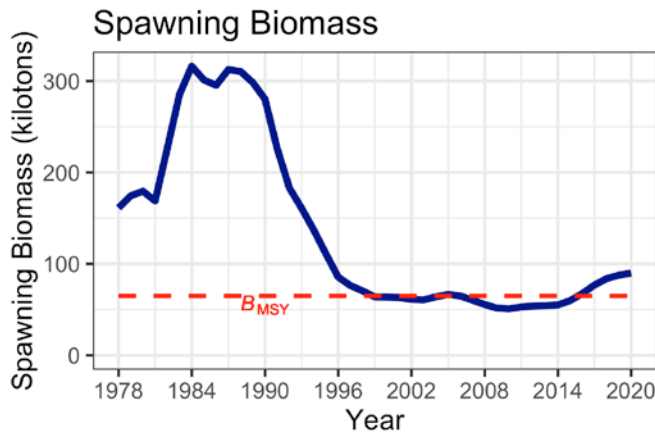
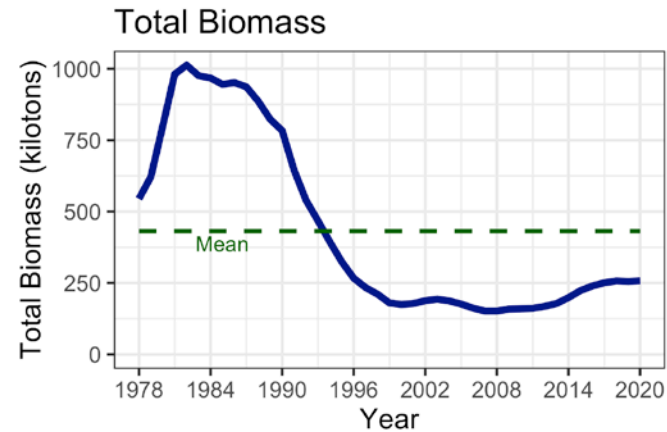
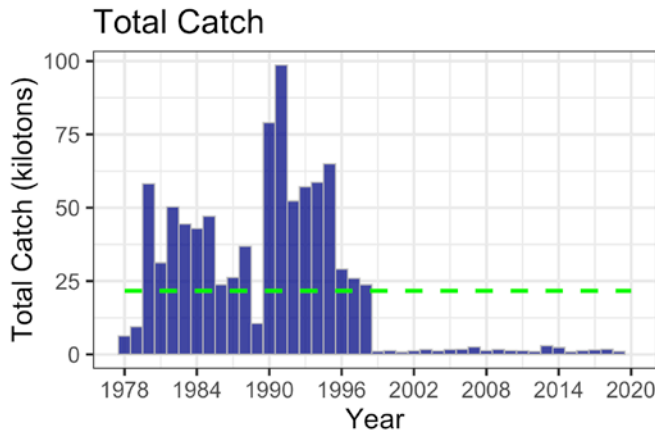


CHAPTER 1A: AI WALLEYE POLLOCK

- New author: **no**; >1 model: **yes**; change from base: **no**; risk>1: **no**
- New data: 2018 fishery age composition
- Model changes/alternatives:
 - Models 15.1 (recommended), the current base model
 - Model 15.2, the same as 15.1, but with differential M at ages 1, 2, and 15
- Stock status: 2021 spawning biomass = 48% of $B_{100\%}$
- Mohn's $\rho = 0.03$



AI WALLEYE POLLOCK SUMMARY



AI WALLEYE POLLOCK SUMMARY



Quantity	Last asmt.	This asmt.	Change
M	0.20	0.21	0.05
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	340,680	n/a	-0.14
2021 age+ biomass	367,017	292,967	-0.20
2020 spawning biomass	98,172	n/a	-0.08
2021 spawning biomass	102,413	89,906	-0.12
B100%	203,279	185,475	-0.09
B40%	81,312	74,190	-0.09
B35%	71,147	64,916	-0.09
2021 FOFL	0.415	0.390	-0.06
2021 FABC	0.331	0.313	-0.05
2020 OFL	66,973	n/a	-0.08
2021 OFL	70,970	61,856	-0.13
2020 ABC	55,120	n/a	-0.07
2021 ABC	58,384	51,241	-0.12



CHAPTER 1B: BOGOSLOF WALLEYE POLLOCK



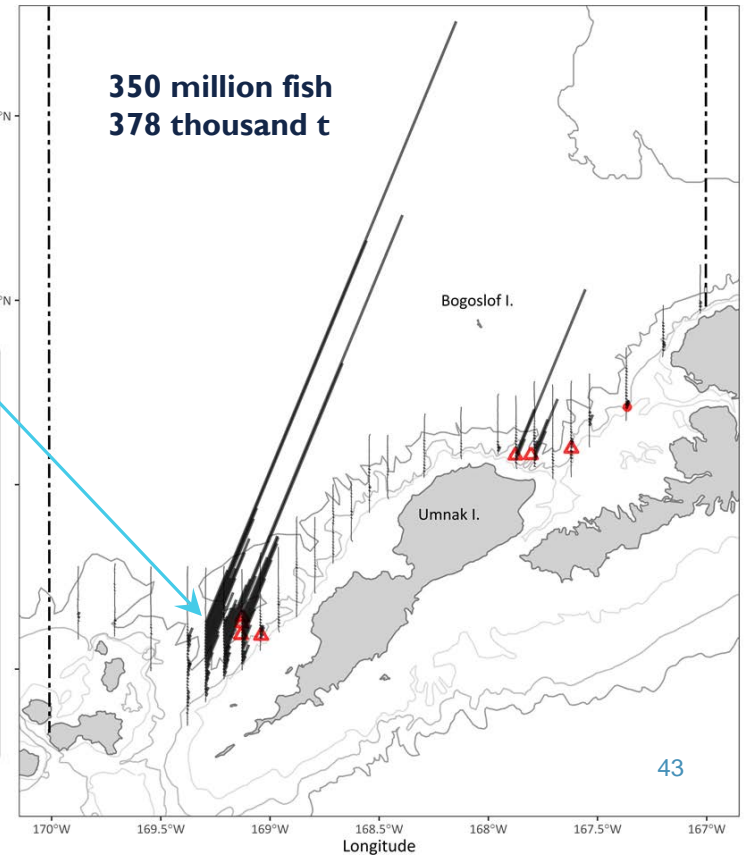
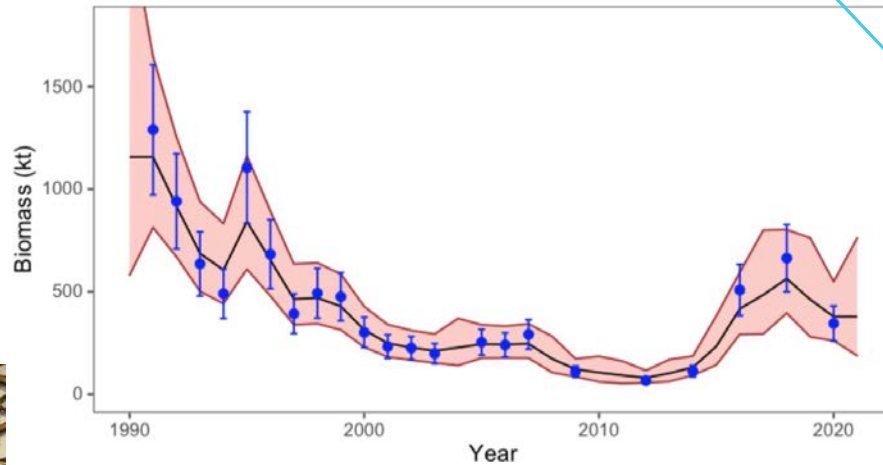
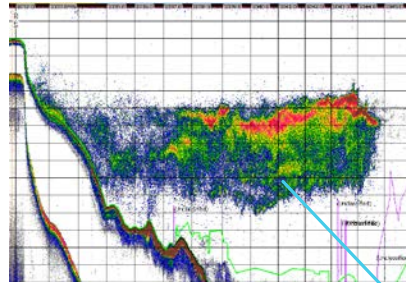
- New author: **no**; >1 model: **yes**; change from base: **no**; risk>1: **no**
- New data:
 - 2020 AT survey biomass estimate (down 48% from 2018)
 - 2020 AT survey age composition
- Model changes/alternatives:
 - Tier 5 RE model (recommended), the current base model
 - An age-structured model, used to check the value of M
- Stock trend: Although 2020 AT biomass estimate was down from 2018, biomass estimates from the last 3 AT surveys have all been higher than at any time between 2000 and 2014



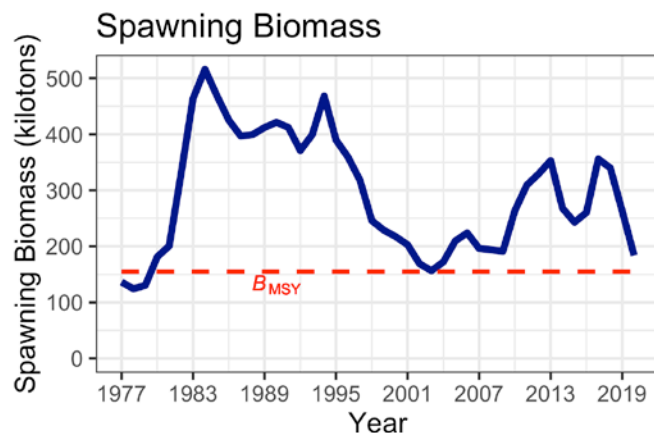
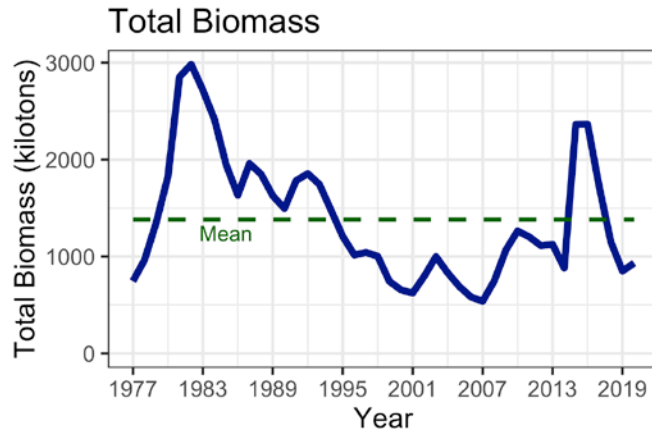
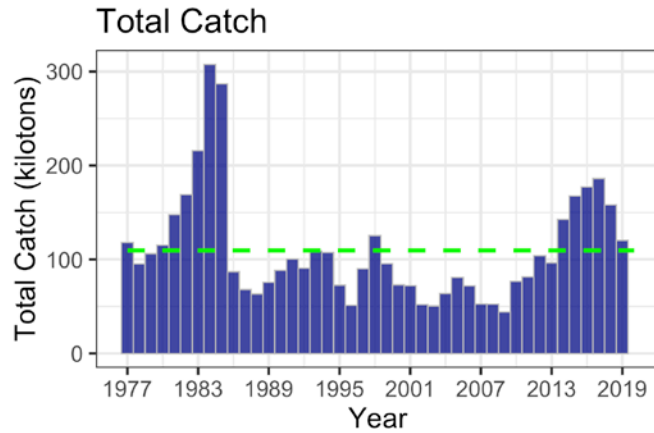


BOGOSLOF WALLEYE POLLOCK ACOUSTIC TRAWL SURVEY

- 2020 Bogoslof Island winter acoustic trawl survey



BOGOSLOF WALLEYE POLLOCK SUMMARY



BOGOSLOF WALLEYE POLLOCK SUMMARY



Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	610,267	378,262	-0.38
2021 FOFL	0.300	0.300	0.00
2021 FABC	0.225	0.225	0.00
2020 OFL	183,080	n/a	-0.38
2021 OFL	183,080	113,479	-0.38
2020 ABC	137,310	n/a	-0.38
2021 ABC	137,310	85,109	-0.38





CHAPTER 2: EBS PACIFIC COD

- New author: **no**; >1 model: **yes**; change from base: **yes**; risk>1: **yes**
- ESP developed and presented this year.
- New data:
 - Catches for 1991-2019 were updated, and a preliminary catch estimate for 2020.
 - Updated fishery size compositions for 1991-2019 and a preliminary size composition from the 2020 fishery.
 - VAST age compositions from the EBS, NBS, and combined EBS+NBS survey time-series were updated
 - Long-term average weight-length parameters, and the time-series of annual deviations there from, were re-estimated.
 - For new models, CPUE time series for the commercial fishery
- Model changes/alternatives

Factor A1: Allow Q to vary?	no		yes		(yes)		
Factor A2: Combine surveys?	no	yes	no	yes			
Factor B1: Use fishery CPUE?	(no)			no		yes	
Factor B2: Allow domed selex?				no	yes	no	yes
Model:	20.4	19.12a	19.15	19.12	20.8	20.9	20.10

- Stock status: 2021 spawning biomass = 30.6% of $B_{100\%}$ for Scenario C

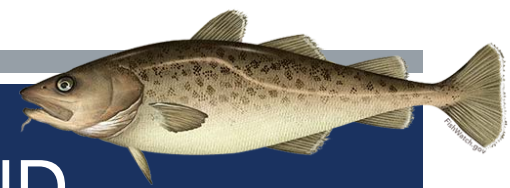


EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)



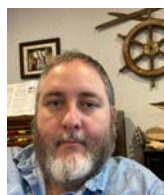
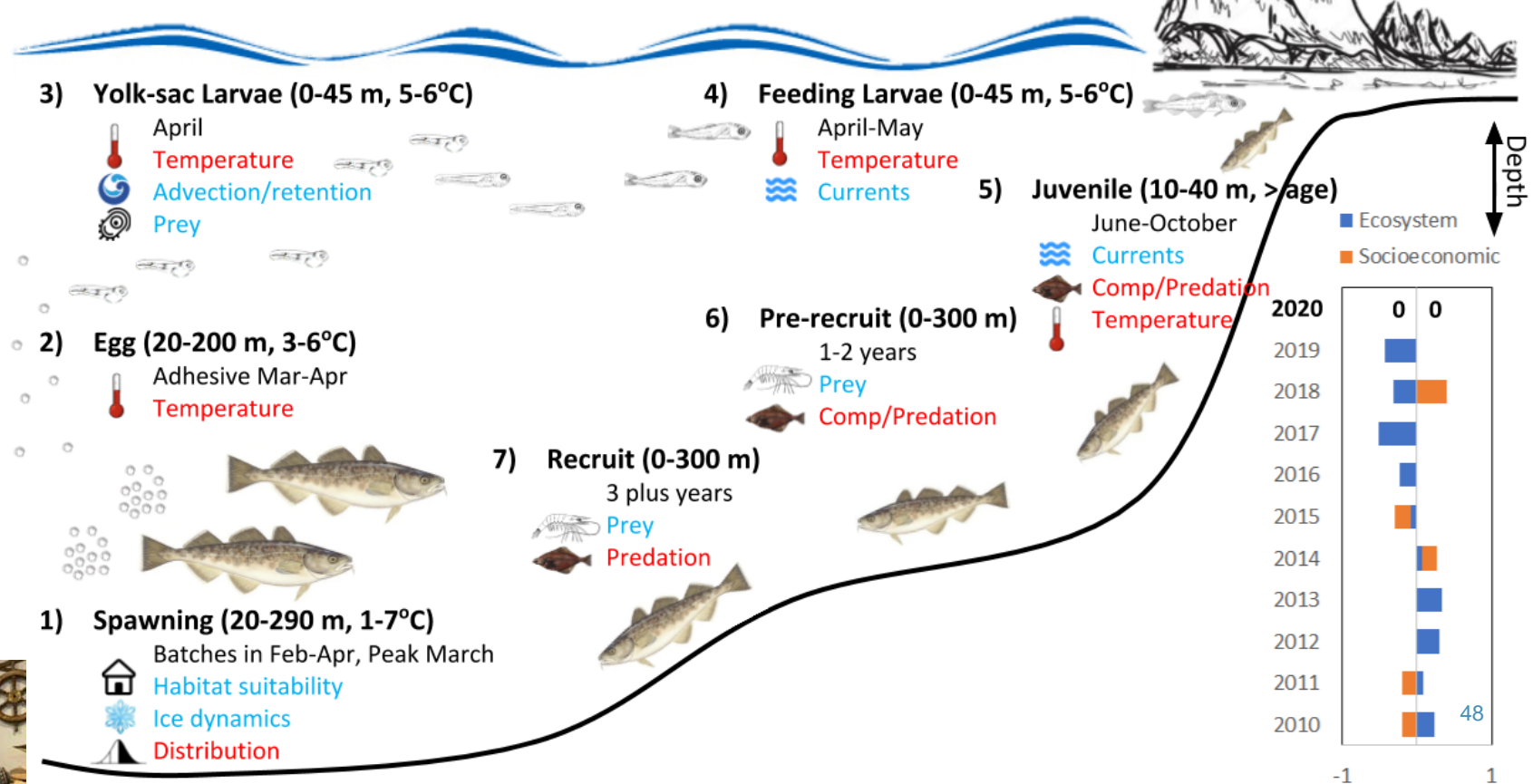
- ESP appears as Appendix 2.2 of the SAFE chapter
- Still in draft form; final draft will be included in the 2021 assessment
 - Investigation of movement between EBS and NBS will be a priority
 - More description of multispecies model
 - Additional work on recruitment (stage 3) and ROMS model output
- 7 editors, 17 contributors
- Data Sources
 - RACE, REFM, ABL, EcoFOCI, RPA, MML, FMA, PMEL
 - CoastWatch (satellite), BEST-BSIERP, EFH, ISRC (seabirds)
 - Many contributions derived from ESR contributions
 - AKRO, ADF&G, FAO via AKFIN (thank you Jean Lee)





EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

Ecosystem processes

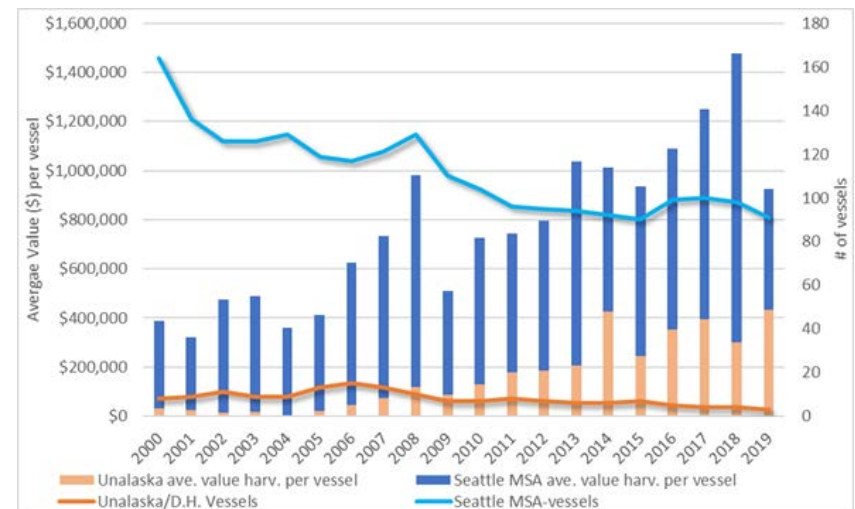
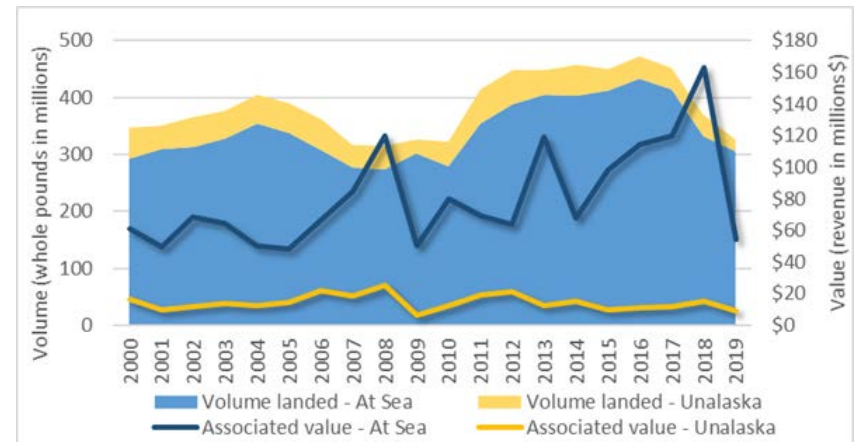




EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

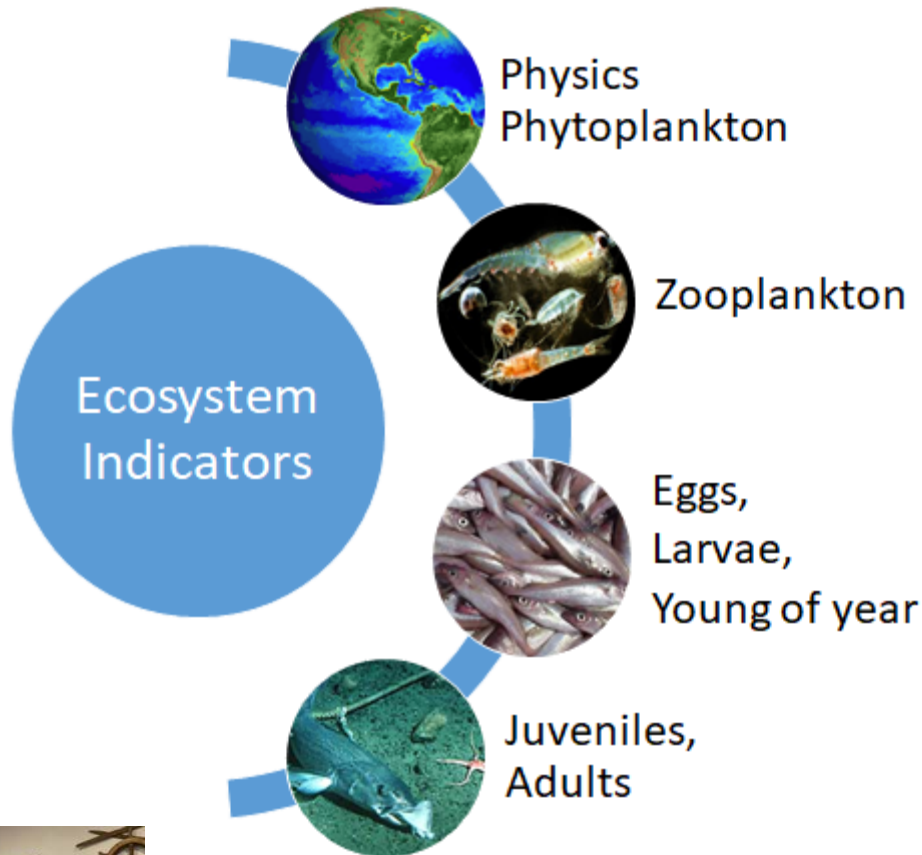
Socioeconomic processes

- Communities
 - At-sea processing accounts for 73% of landed volume
 - Seattle accounts for 63% of harvest value
 - Moderate/high engagement for Unalaska/Dutch
- Engagement metrics
 - Regional quotient for processing and harvesting





EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)



1. North Pacific Index
2. Sea ice extent (DJF)
3. Sea ice advance (MAM)
4. Sea surface temperature (satellite)
5. Summer bottom temperature (ROMS)
6. Spring bloom peak timing (satellite)
7. Euphausiids (acoustic backscatter)
8. Juvenile condition, bottom trawl survey
9. Adult condition, bottom trawl survey
10. Center of gravity, eastings (VAST)
11. Center of gravity, northings (VAST)
12. Area occupied (VAST)
13. Predator biomass, arrowtooth





EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

Socio-economic Indicators



~~Fishery Performance~~



Economic



Community

1. Ex-vessel value
2. Ex-vessel price per pound
3. Revenue per unit effort
4. Processing regional quotient for Unalaska/Dutch Harbor
5. Harvesting regional quotient for Unalaska/Dutch Harbor

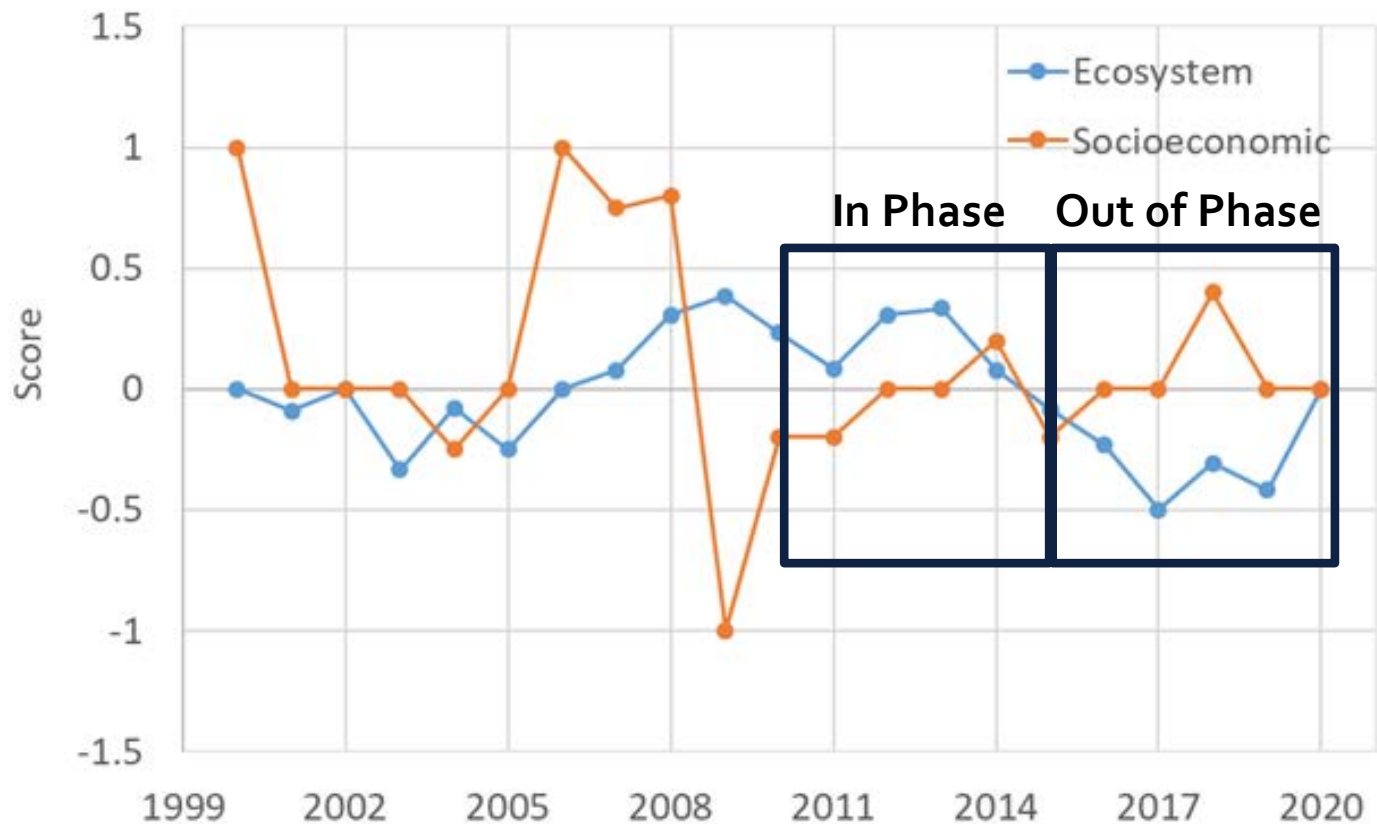
Fishery performance is currently handled in the main text of the chapter, but may be moved to the ESP in the future





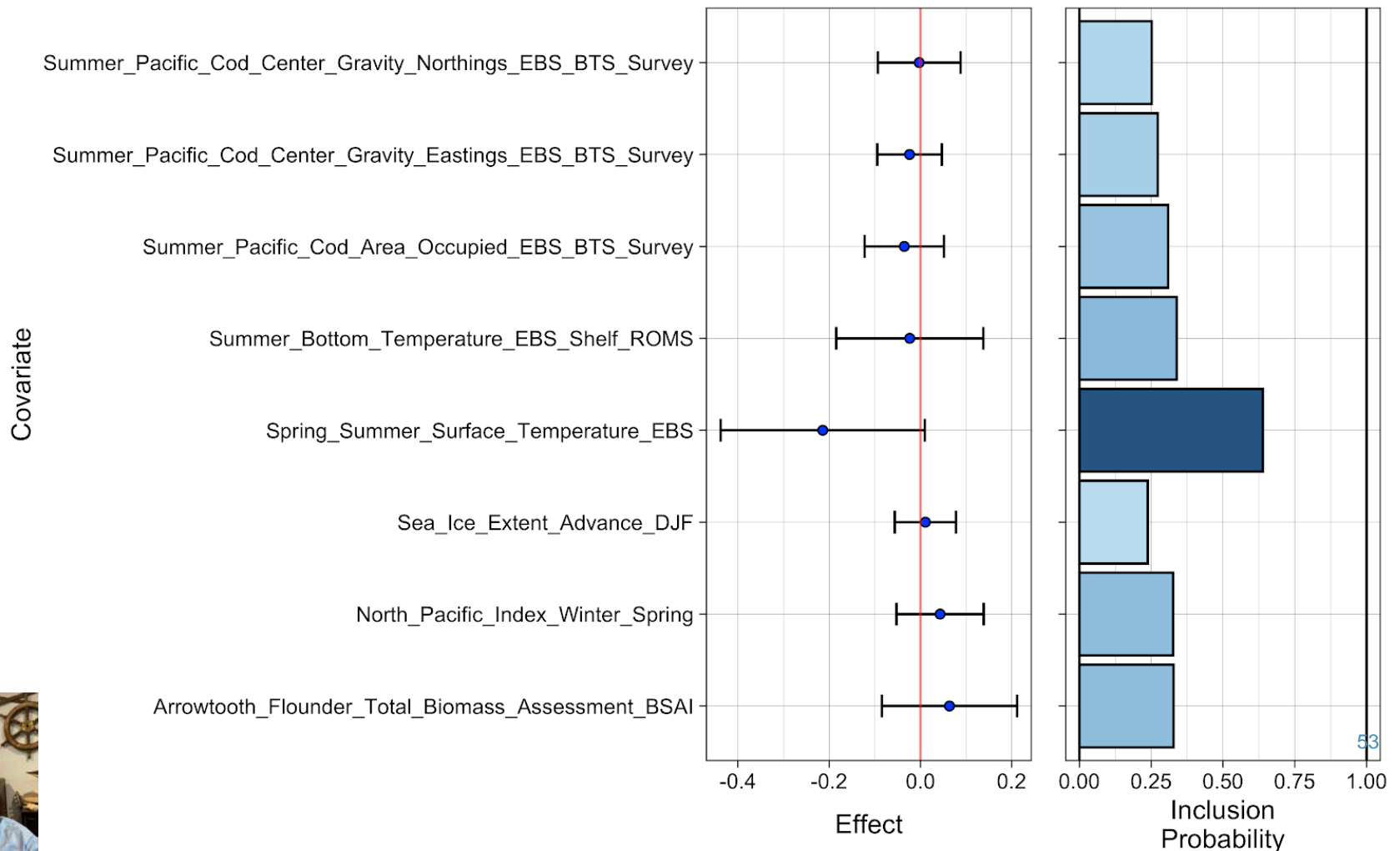
EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

Overall Stage 1 Score for EBS Pacific Cod





EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)





EBS PACIFIC COD: ECOSYSTEM AND SOCIOECONOMIC PROFILE (ESP)

■ Ecosystem Summary

- Hatch success temp dependent, impacts spawning habitat
- Population center moved northwest with sea ice retreat
- Condition moderate to below avg in SEBS, \uparrow in NBS
- Physical \uparrow \uparrow , lower and upper stable, out of phase w/ SE

■ Socioeconomic Summary

- Ex-vessel value, price/pound, revenue/effort \uparrow 2015-19
- Unalaska/Dutch Harbor processing RQ \downarrow , harvesting \uparrow

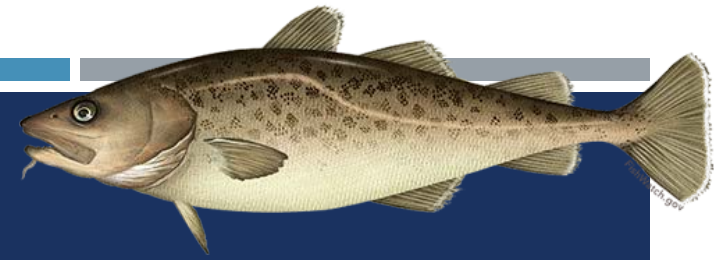




EBS PACIFIC COD

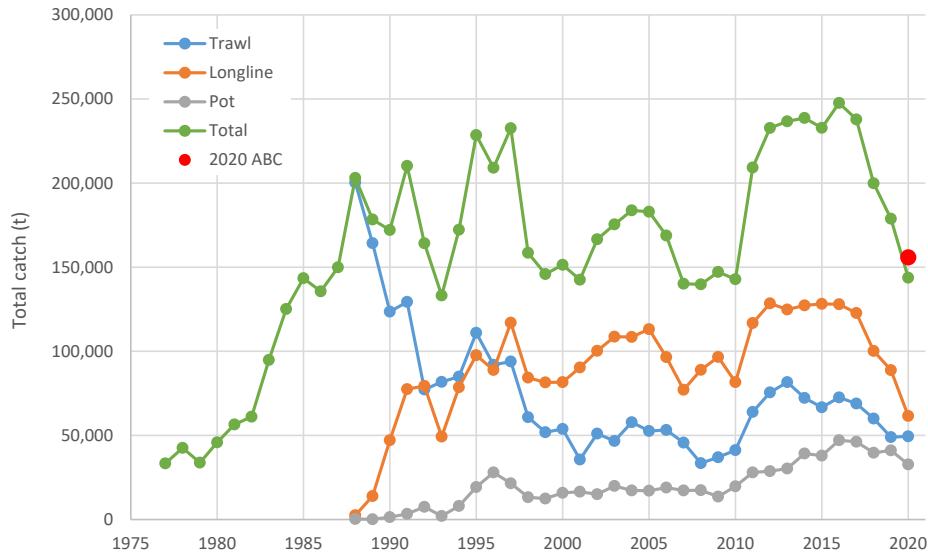
Assessment



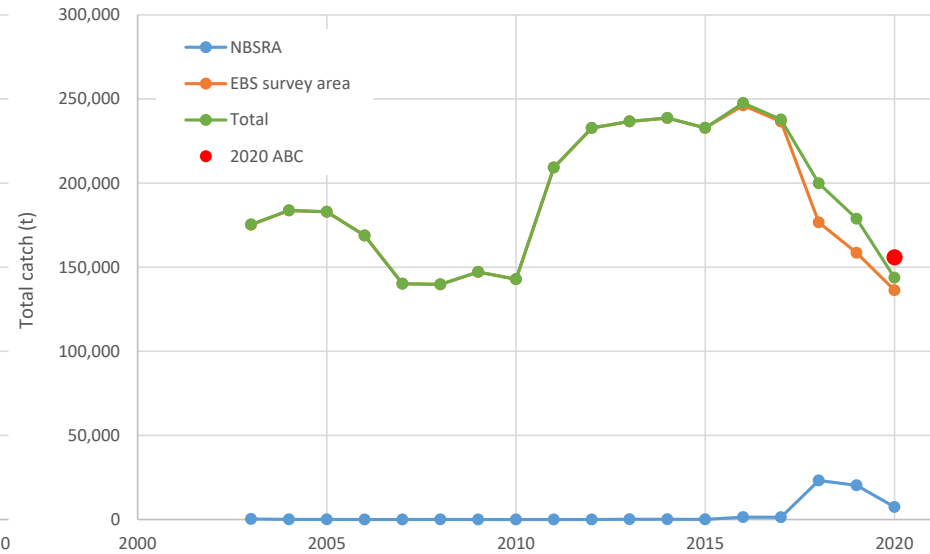


EBS PACIFIC COD CATCH TIME SERIES

Eastern Bering Sea (EBS) 1977-2020



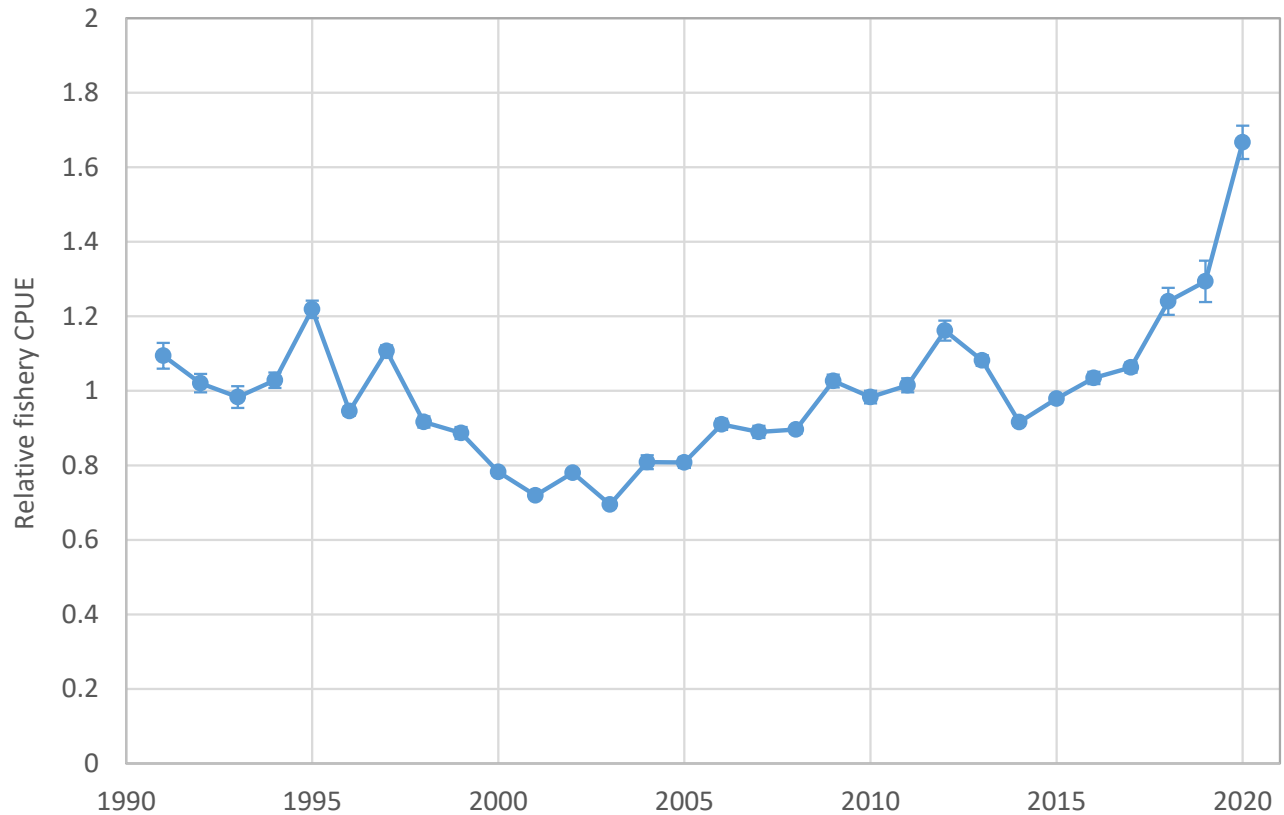
EBS and Northern Bering Sea 2003-2020





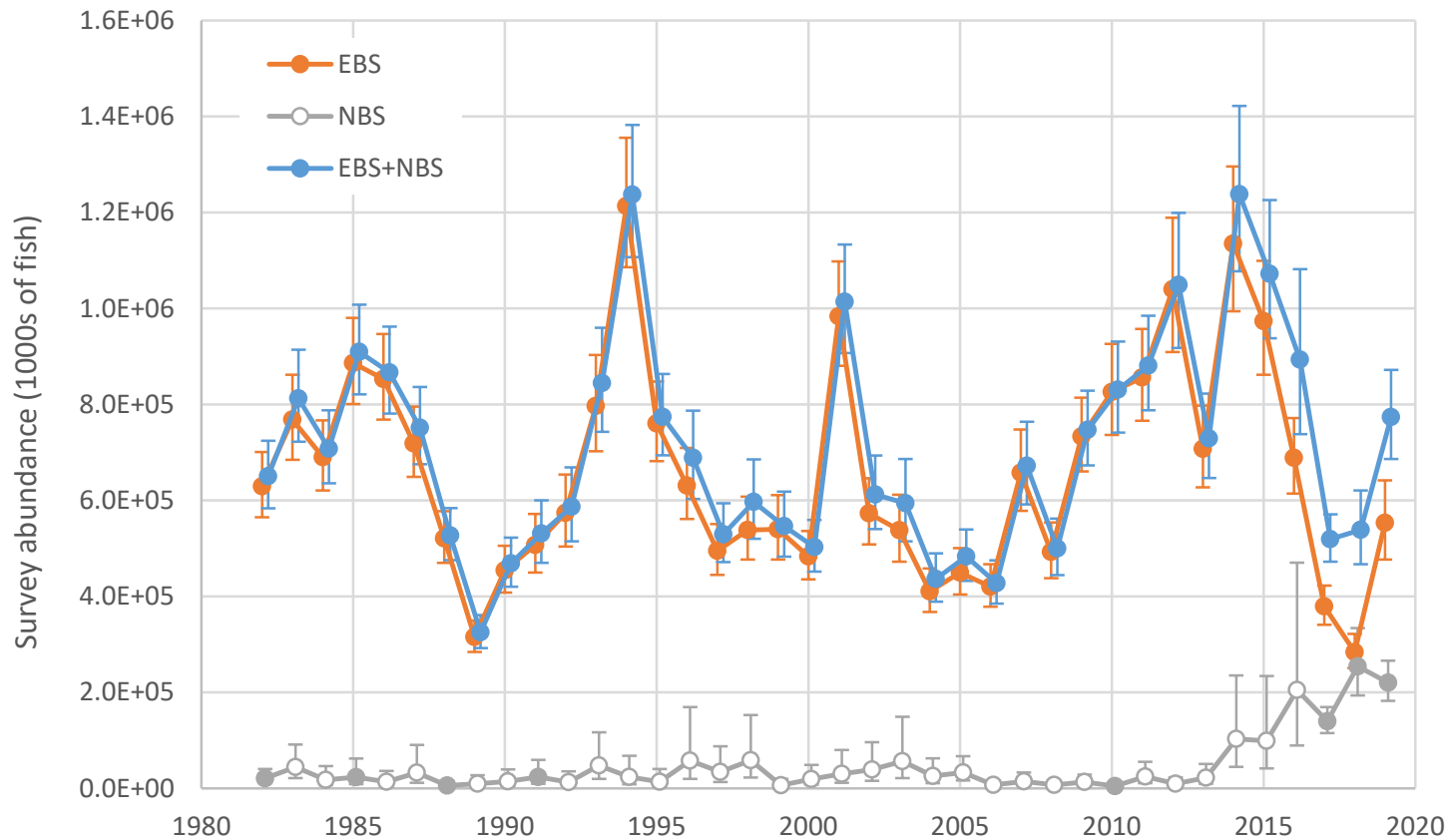
EBS PACIFIC COD CPUE INDEX

- Catch-weighted, all-gear, annual mean CPUE by weight





EBS PACIFIC COD AFSC SURVEY ABUNDANCE (VAST)

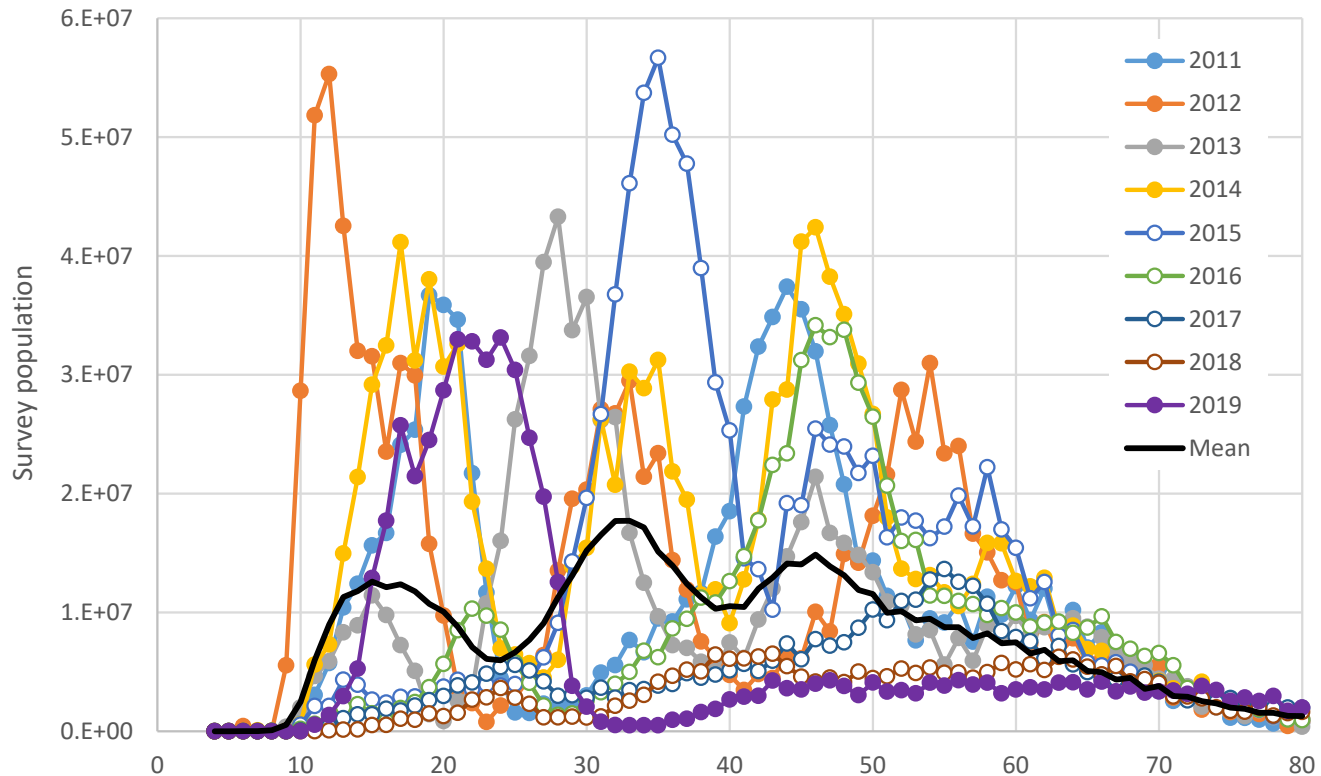


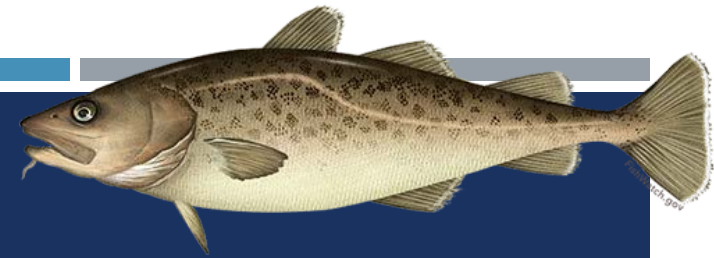


EBS PACIFIC COD SIZE COMPOSITION

- **Recent survey size comps (EBS)**

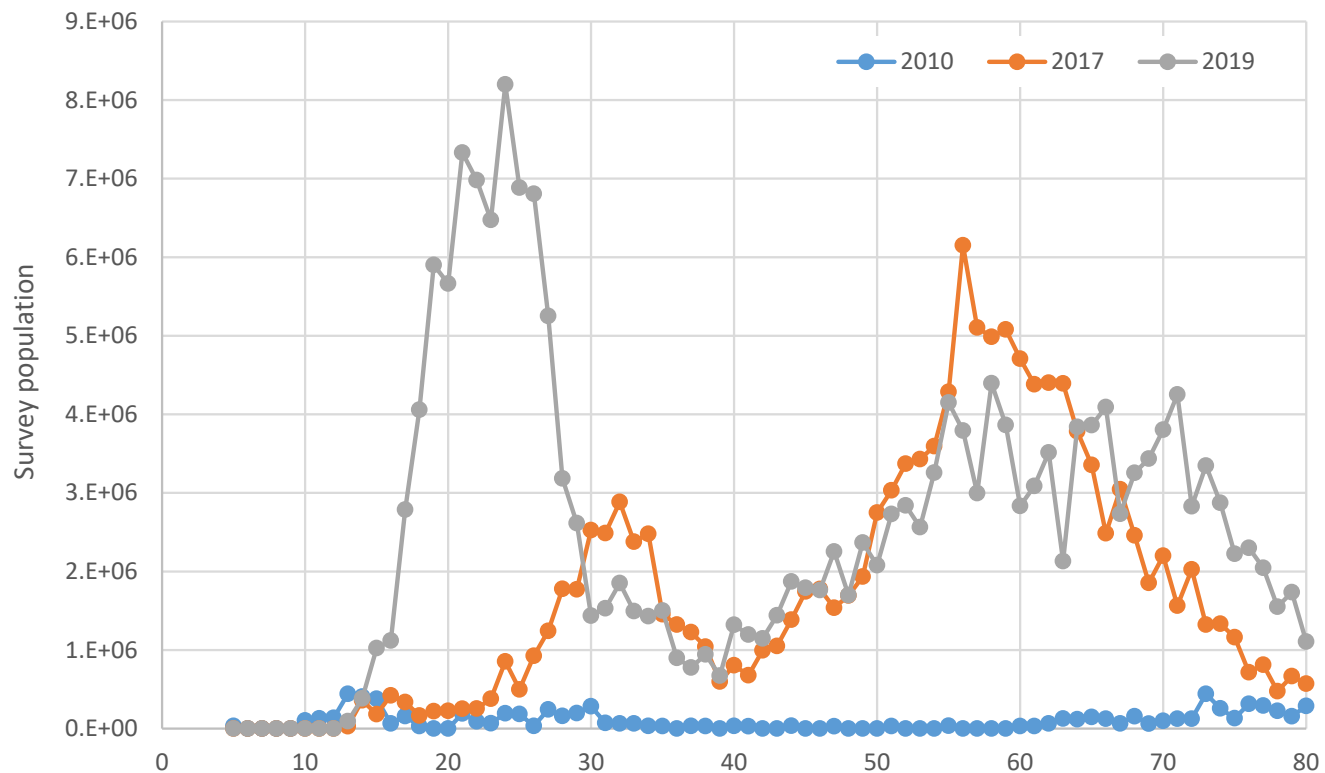
- 2011-14: strong age 1; 2015-18: Weak age 1; 2019: strong age 1

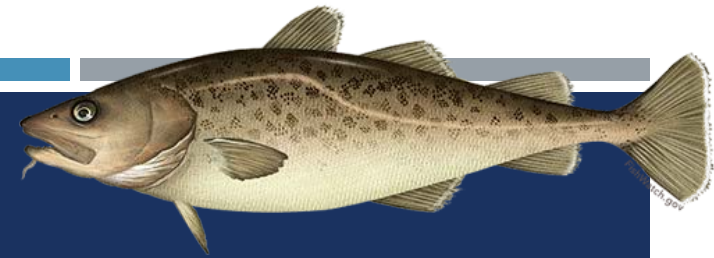




EBS PACIFIC COD SIZE COMPOSITION

- **Recent survey sizecomps (NBS)**
 - 2018 looks strong here, too (the result of NBS spawning?)





EBS PACIFIC COD OVERVIEW OF MODELS

- A pair of 2x2 factorial designs
 - Ensemble A (requested by SSC; previewed in September)
 - Factor A1: Allow Q to vary?
 - Factor A2: Combine EBS and NBS surveys?
 - Ensemble B (prompted by industry review and comments)
 - Factor B1: Use fishery CPUE?
 - Factor B2: Allow domed survey selectivity?
- AB = union of A (blue) and B (yellow); base model = intersection (green)

Factor A1: Allow Q to vary?	no		yes		(yes)		
Factor A2: Combine surveys?	no	yes	no	yes			
Factor B1: Use fishery CPUE?	(no)			no		yes	
Factor B2: Allow domed selex?				no	yes	no	yes
Model:	20.4	19.12a	19.15	19.12	20.8	20.9	20.10

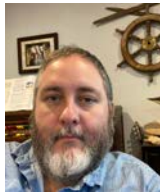
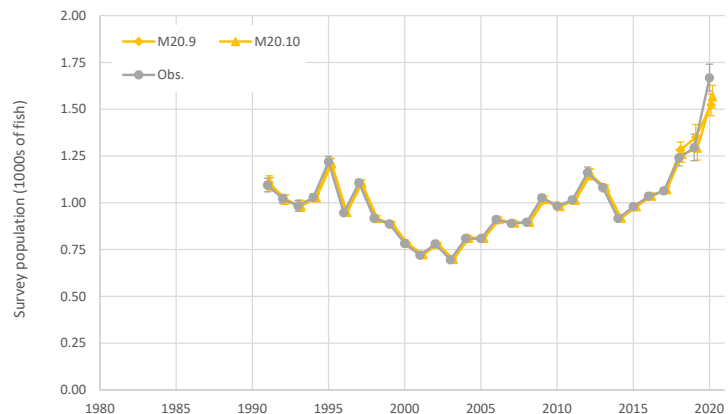
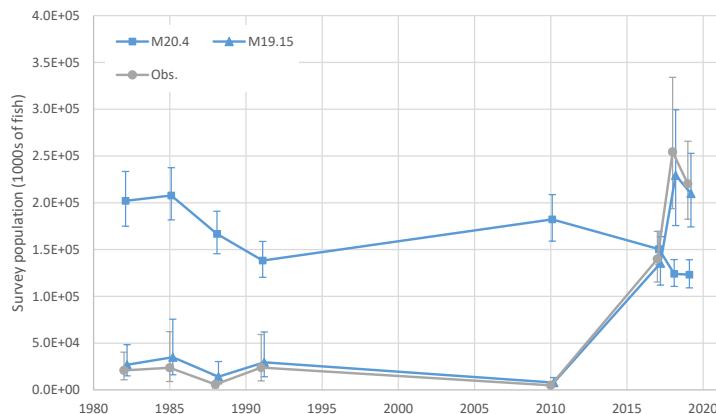
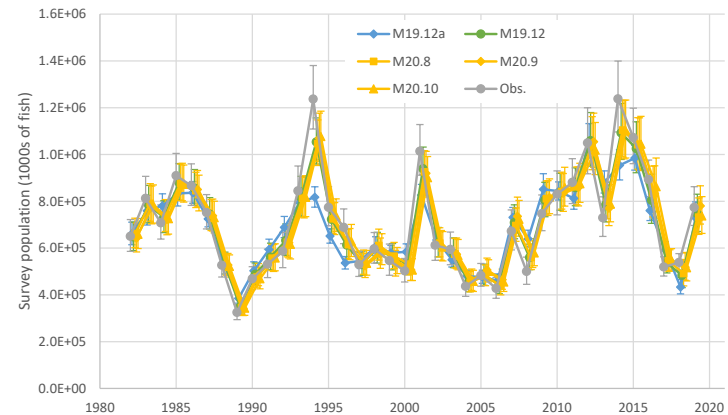
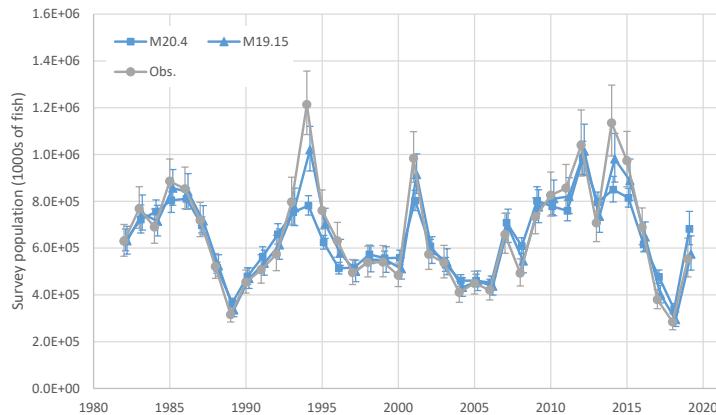


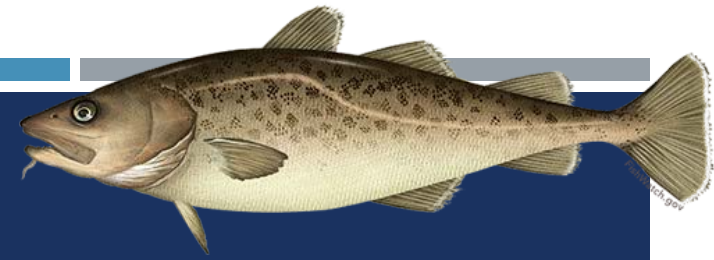


EBS PACIFIC COD MODELS

■ Goodness of fits: abundance indices

- Top left: EBS; top right: EBS+NBS; bottom left: NBS; bottom right: fishery





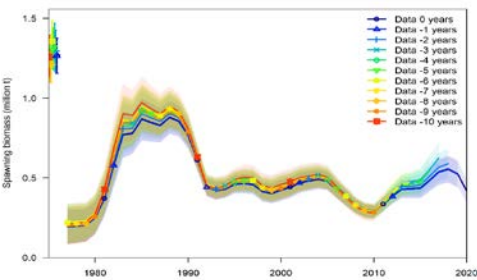
EBS PACIFIC COD RETROSPECTIVE

Retrospective analysis (-0.02 to 0.15)

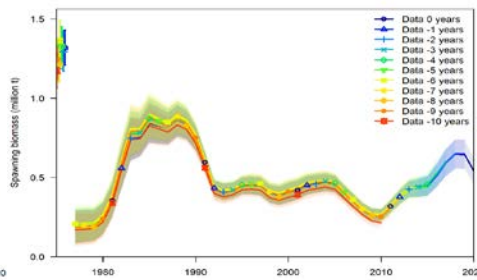
Ensemble A models

Ensemble B models

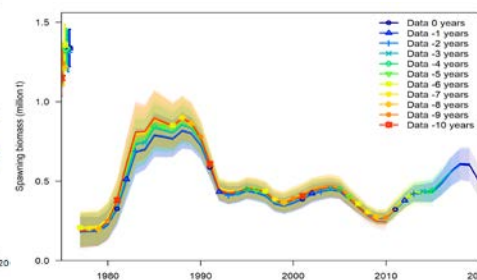
Model 20.4 ($\rho = 0.0601$)



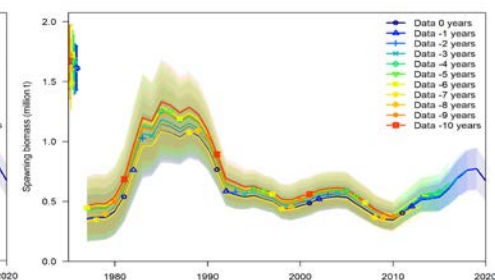
Model 19.12a ($\rho = -0.0211$)



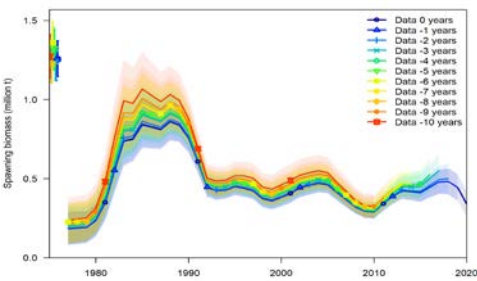
Model 19.12 ($\rho = -0.0028$)



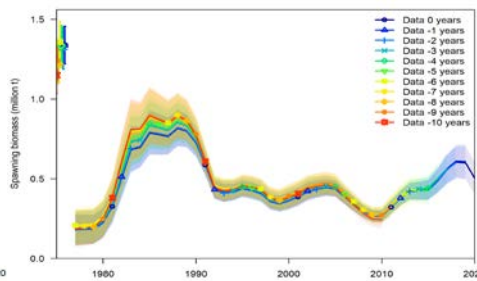
Model 20.8 ($\rho = 0.0076$)



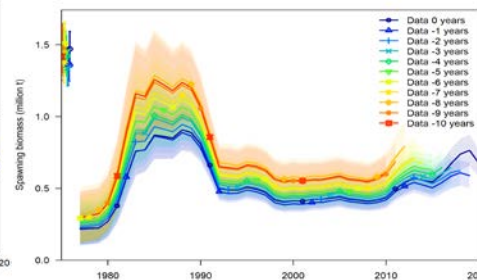
Model 19.15 ($\rho = 0.1046$)



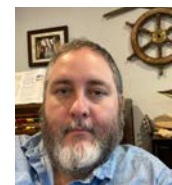
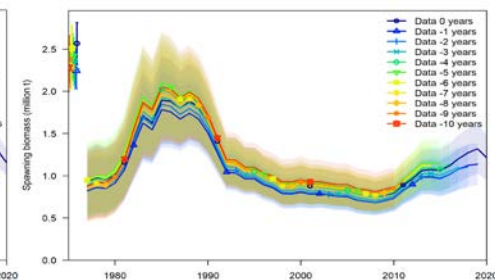
Model 19.12 ($\rho = -0.0028$)

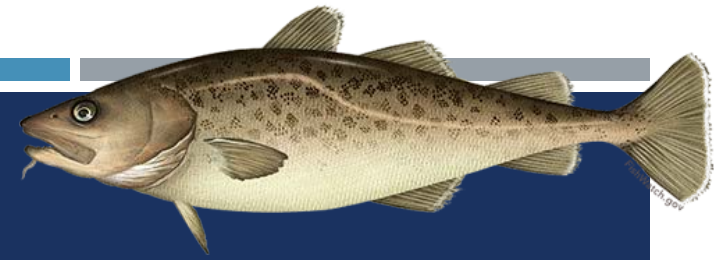


Model 20.9 ($\rho = 0.1533$)



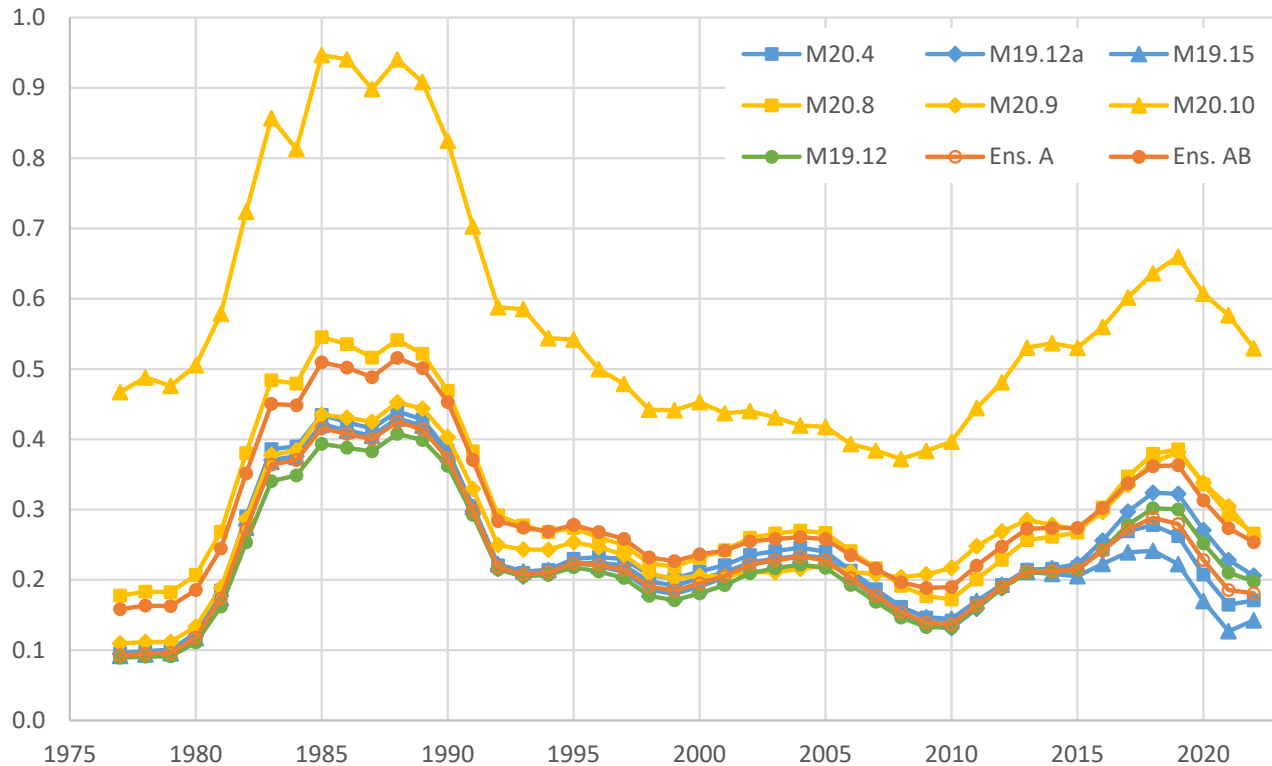
Model 20.10 ($\rho = 0.0071$)





EBS PACIFIC COD TIME SERIES

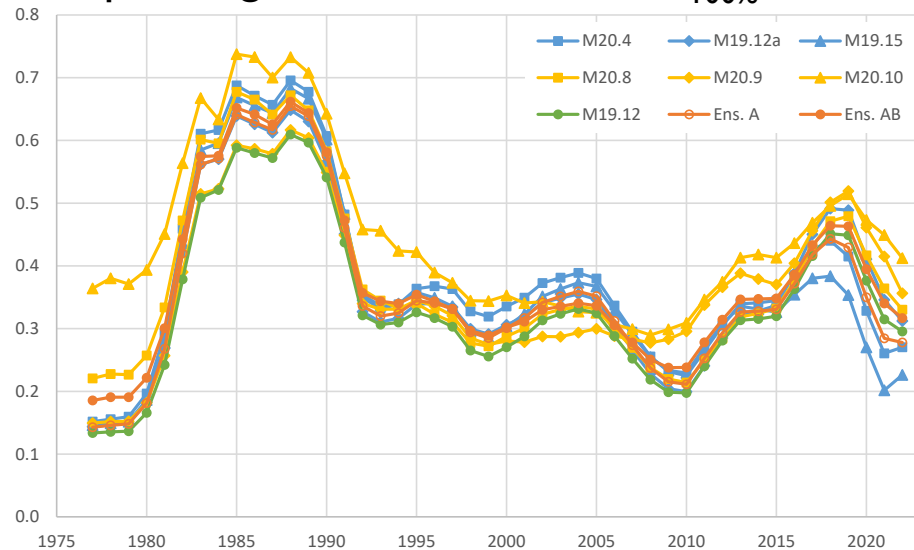
- Time series: female spawning biomass
 - Values in millions of tons



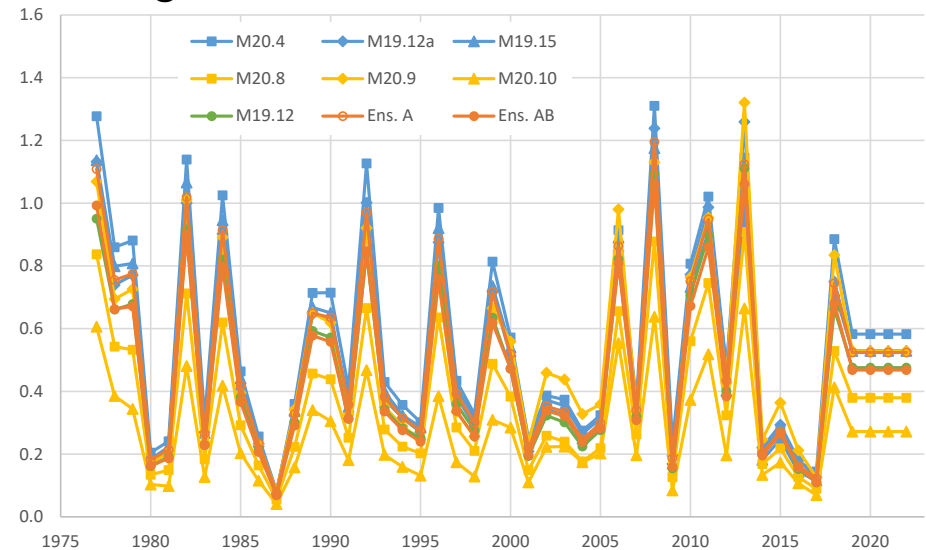


EBS PACIFIC COD TIME SERIES

Spawning Biomass: relative to $B_{100\%}$



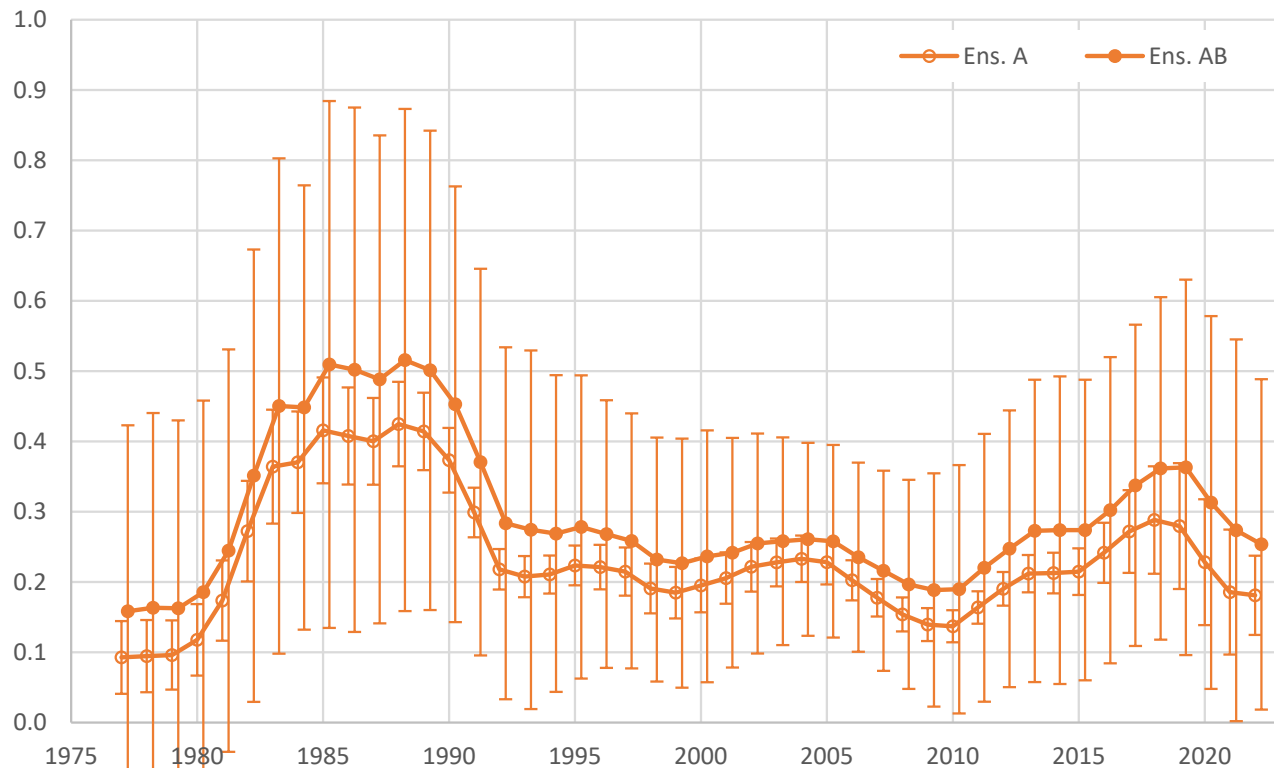
Age 0 Recruitment: billions of fish





EBS PACIFIC COD ENSEMBLE TIME SERIES

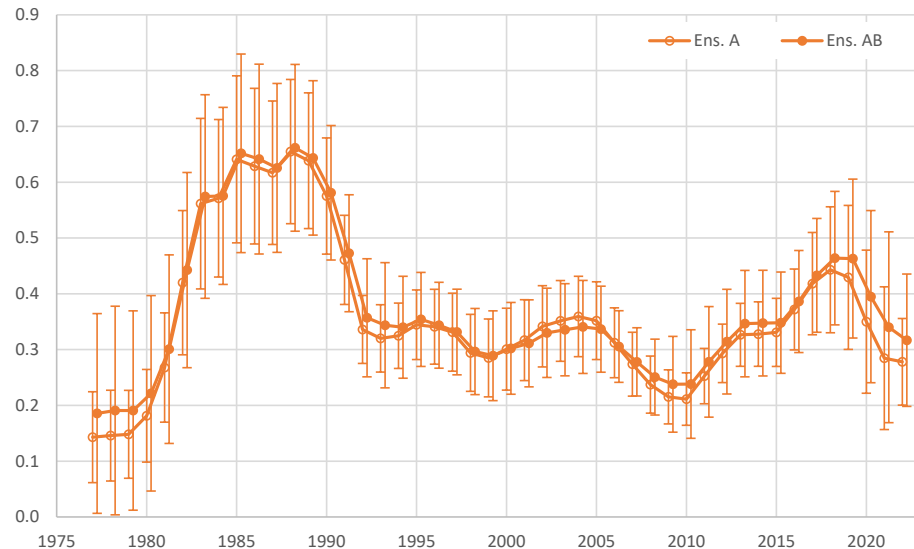
- **Female spawning biomass**
 - Values are in millions of t



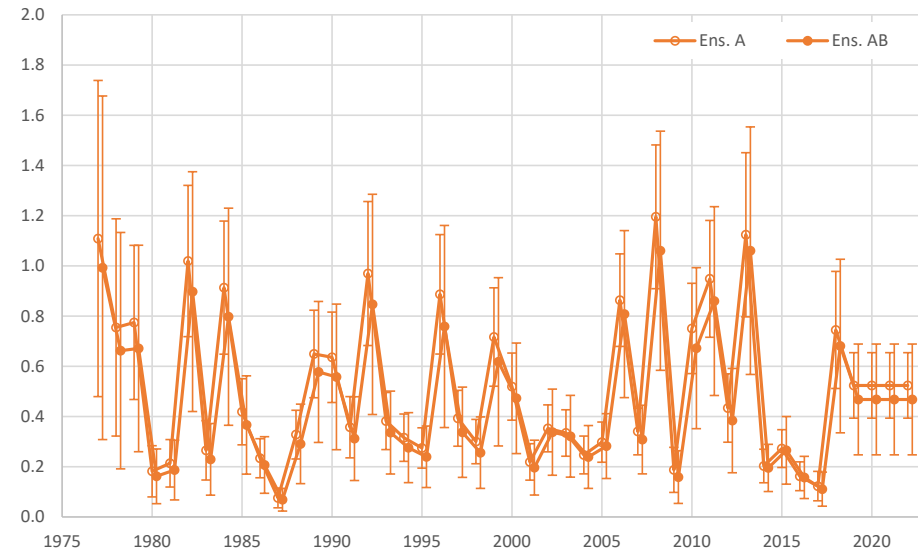


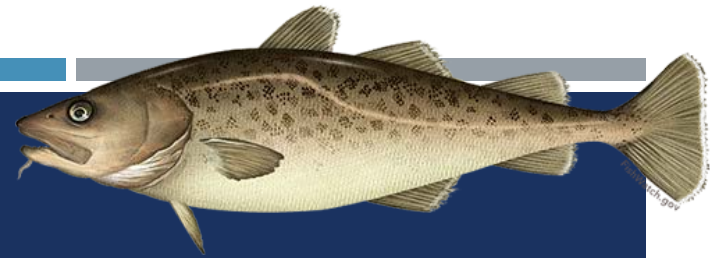
EBS PACIFIC COD ENSEMBLE TIME SERIES

Spawning Biomass: Relative to $B_{100\%}$



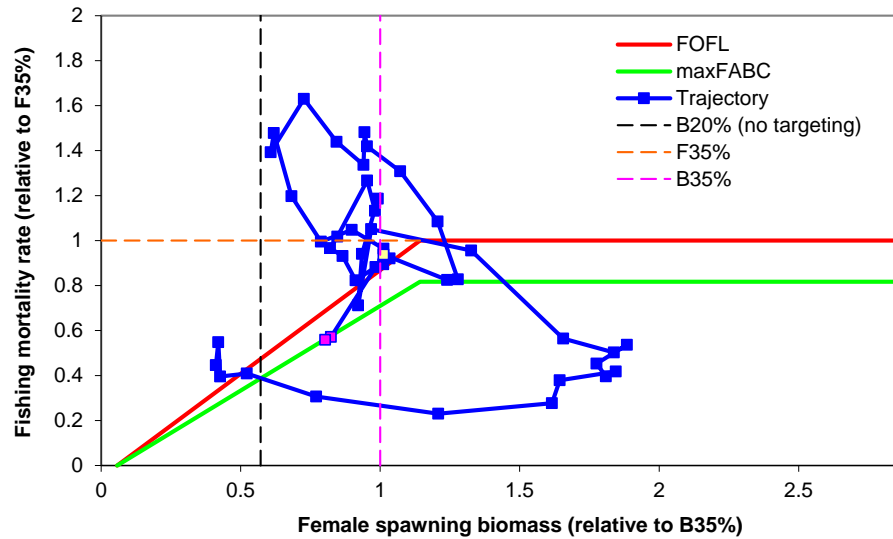
Age 0 Recruitment: billions of fish



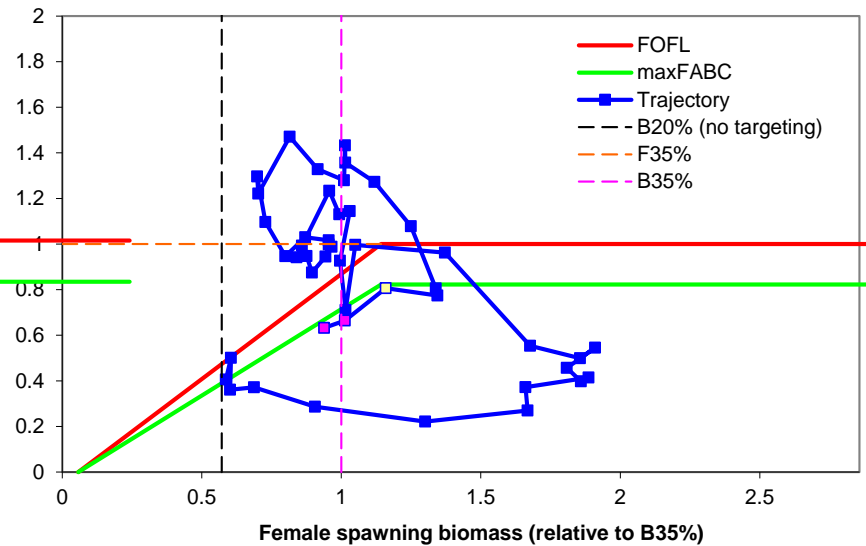


EBS PACIFIC COD PHASE PLANE

Ensemble A



Ensemble AB

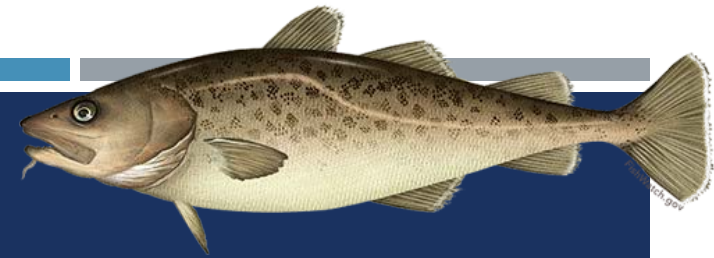




EBS PACIFIC COD

Plan Team Recommendations





EBS PACIFIC COD RECOMMENDATIONS

- The Team recommended omitting the models containing fishery CPUE from the ensemble and including the additional model with dome-shaped selectivity along with the four models representing ensemble A.

Factor A1: Allow Q to vary?	no	yes			X
Factor A2: Combine surveys?	no	yes	no	yes	
Factor B1: Use fishery CPUE?	(no)		no		
Factor B2: Allow domed selex?			no	yes	
Model:	20.4	19.12a	19.15	19.12	





EBS PACIFIC COD CPUE DISCUSSION

- The Team noted that this CPUE index and method for deriving the index was new for the EBS Pacific cod assessment and has not been reviewed previously
- A large amount of data is used to create this index and the resulting uncertainty is low;
- Because the fishery CPUE data have much smaller variances than the survey index data, Models 20.9 and 20.10 tend to fit the CPUE index much more closely than the survey
- In agreement with written public comment, it would be worthwhile to investigate statistical standardizing methods for CPUE, especially at the upcoming CIE review
- The fishery CPUE time-series was fit with time-varying selectivity (Models 20.9 and 20.10) and time-varying catchability (20.9), which are confounded





EBS PACIFIC COD RECOMMENDATIONS

- The Team recommended retaining only the following weighting criteria: those with an emphasis factor of 3; the fits consistent with variances; and new criteria of whether asymptotic survey selectivity is used and whether the model was previewed in September, both with an emphasis factor of 1.

Factor A1: Allow Q to vary?		no		yes			
Factor A2: Combine surveys?		no	yes	no	yes		
Factor B2: Allow domed selex?		no				yes	
Criterion	Emph.	20.4	19.12a	19.15	19.12	20.8	Ensemble C
Plausible hypothesis	3	1	1	1	1	1	
Plausible catchability	3	0	1	0	1	1	
Acceptable retrospective bias	3	1	1	1	1	1	
Fits consistent with variances	2	0	0	1	1	1	
Asymptotic survey selectivity	1	1	1	1	1	0	
Model reviewed in September	1	1	1	1	1	0	
Model Weight Ensemble C		0.1509	0.2075	0.1887	0.2453	0.2075	
2021 OFL		87,678	147,949	50,770	118,895	145,354	112,851
2021 max ABC		72,848	123,805	42,029	99,310	123,210	94,552
2022 OFL		101,682	128,340	68,639	110,353	128,447	108,662
2022 max ABC		84,295	106,852	56,788	91,845	108,512	90,665





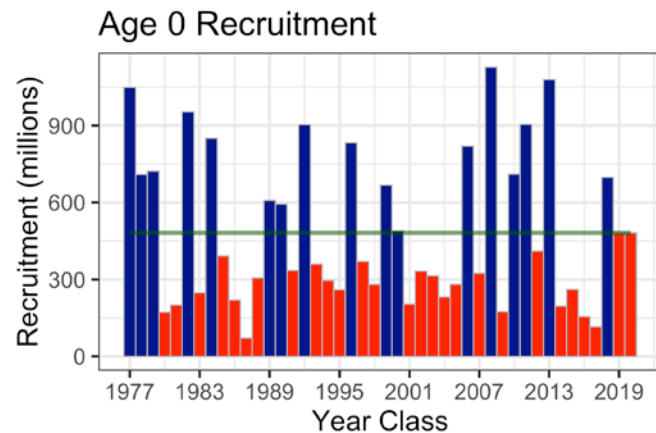
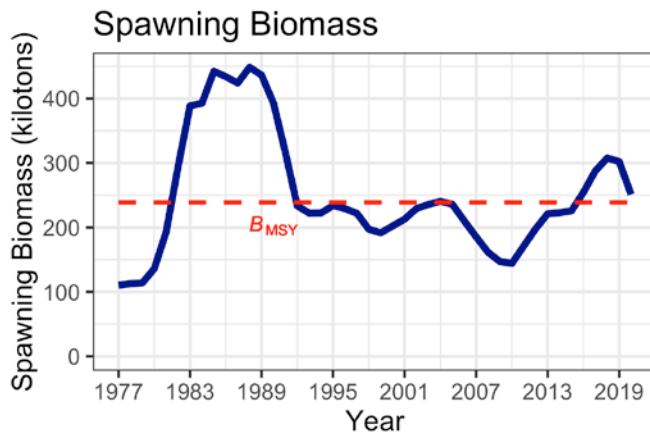
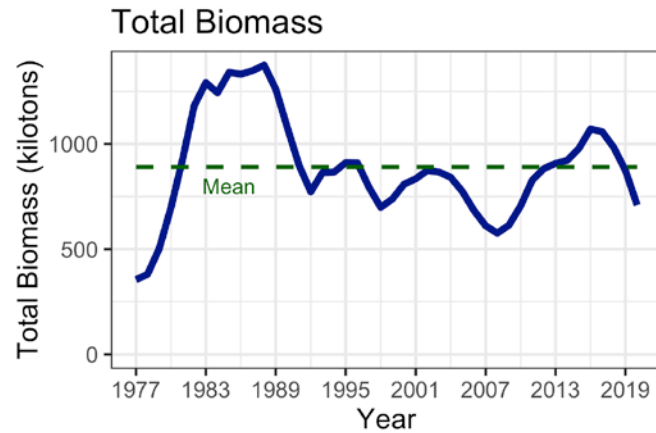
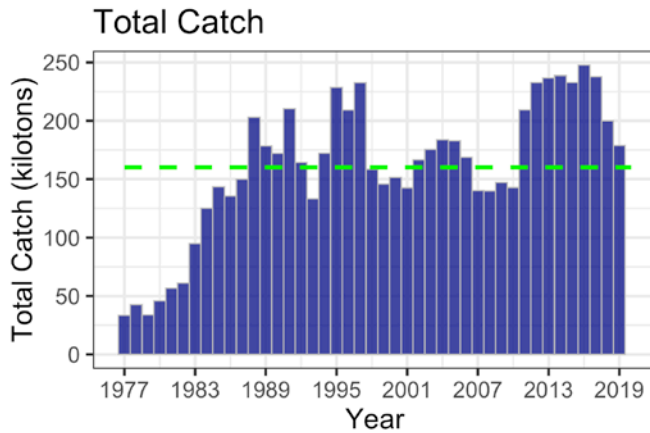
EBS PACIFIC COD RECOMMENDATIONS

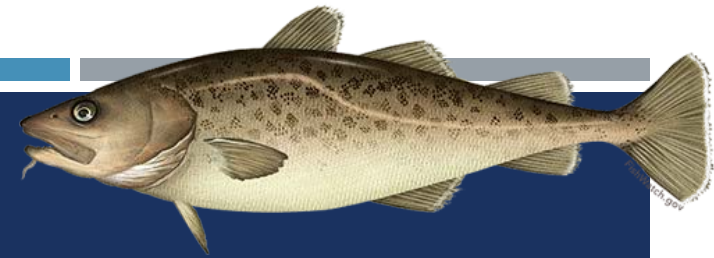
- The Team recommended that the fishery CPUE be standardized using alternative statistical methods and that it be discussed at the CIE review in 2021.
- The Team recommended collating fishery information in the ESP.
- The Team recommended the following topics for the 2021 CIE review:
 - Development of a fishery CPUE index,
 - Incorporation of dome-shaped survey selectivity,
 - Which models to include in an ensemble,
 - Whether to apply the sloping HCR before or after ensemble averaging, and
 - Development of movement models.





EBS PACIFIC COD SUMMARY





EBS PACIFIC COD SUMMARY

Quantity	Last asmt.	This asmt.*	Change
M	0.35	0.34	-0.03
2020 tier	3b	n/a	none
2021 tier	3b	3b	none
2020 age+ biomass	756,811	n/a	-0.08
2021 age+ biomass	702,235	694,707	-0.01
2020 spawning biomass	267,333	n/a	-0.22
2021 spawning biomass	216,255	208,640	-0.04
B100%	672,795	682,270	0.01
B40%	269,118	272,908	0.01
B35%	235,478	238,795	0.01
2021 FOFL	0.33	0.30	-0.09
2021 FABC	0.26	0.25	-0.04
2020 OFL	191,386	n/a	-0.41
2021 OFL	125,734	112,851	-0.10
2020 ABC	155,873	n/a	-0.39
2021 ABC	102,975	94,552	-0.08

*"This asmt." column based on Ensemble C.





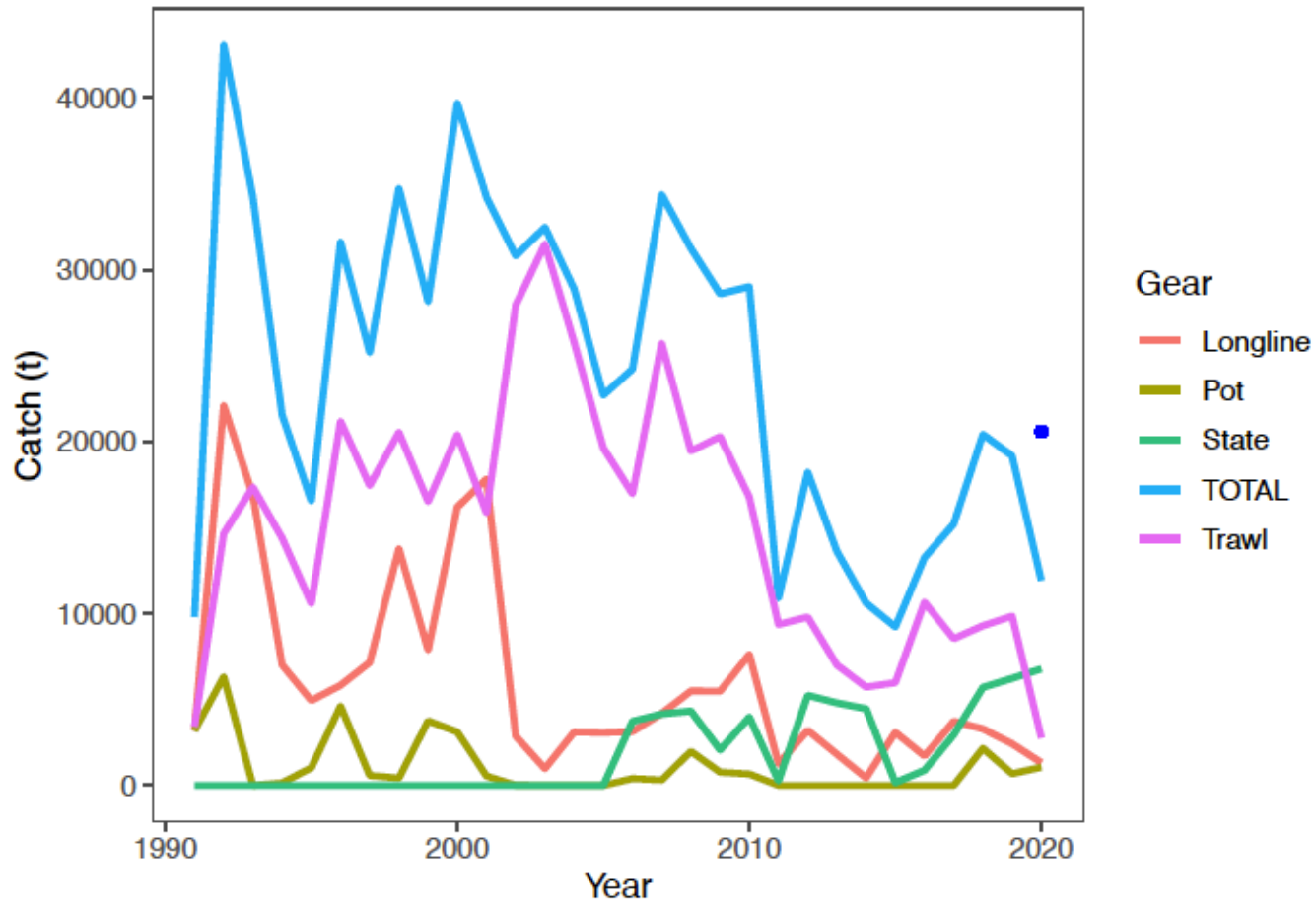
CHAPTER 2A: ALEUTIAN ISLANDS PACIFIC COD

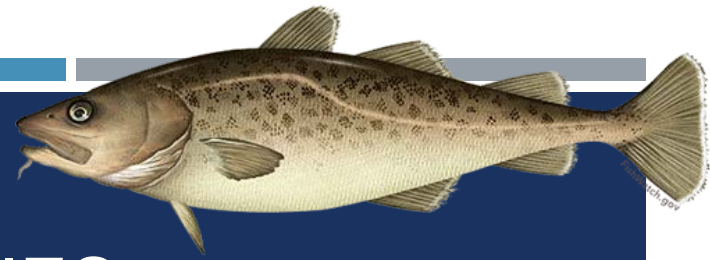
- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **yes**
- New data: none
- Model changes/alternatives: none (standard Tier 5 RE model)
- Stock trend: Tier 5 RE model estimates that survey biomass has increased continuously since the all-time low observed in 2010
 - 2018 estimate is 32% higher than 2010 estimate
 - 2018 estimate is 11% lower than time series average
- Risk levels: assess. = 1, pop. dy. = 1, **env./eco. = 2**, fishery = 1
 - Temperatures and heatwave days above average since 2013-2016
 - Increased bioenergetics costs
 - Since 2014, diet has been changing to potentially lower quality prey
 - Pelagic predator assemblage now dominated by rockfish
 - Fish condition has been below average since 2012



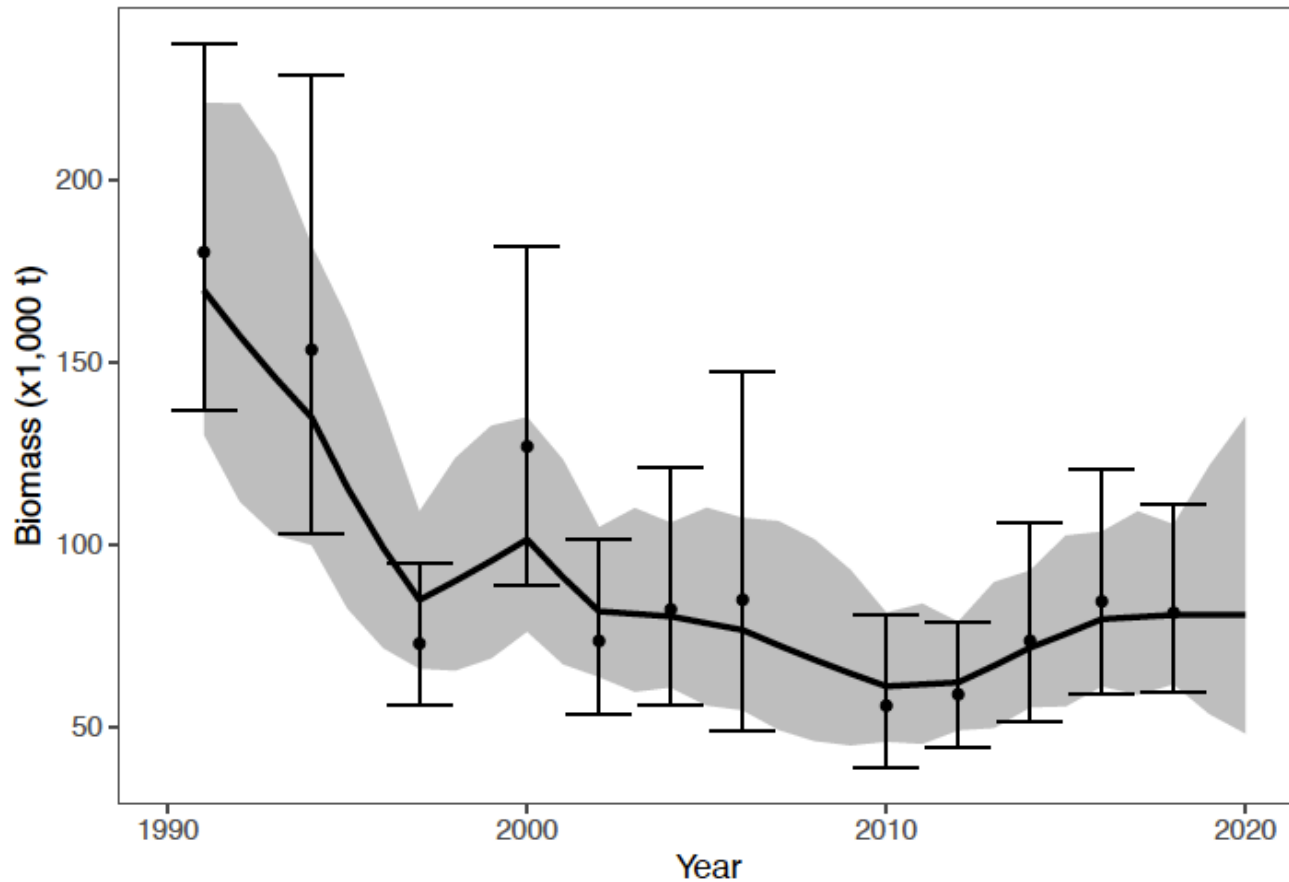


AI PACIFIC COD CATCH TIME SERIES





AI PACIFIC COD SURVEY BIOMASS TIME SERIES





AI PACIFIC COD

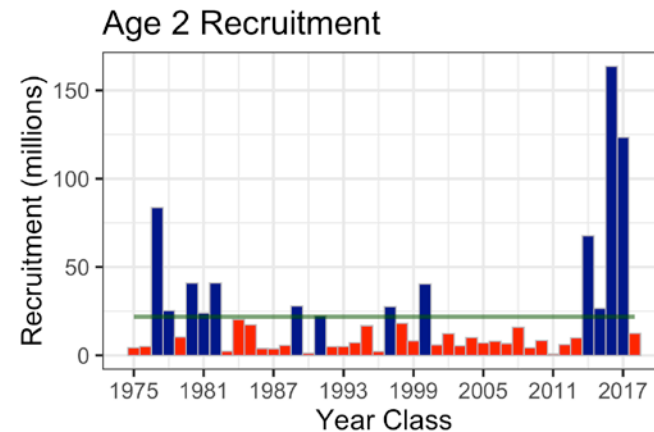
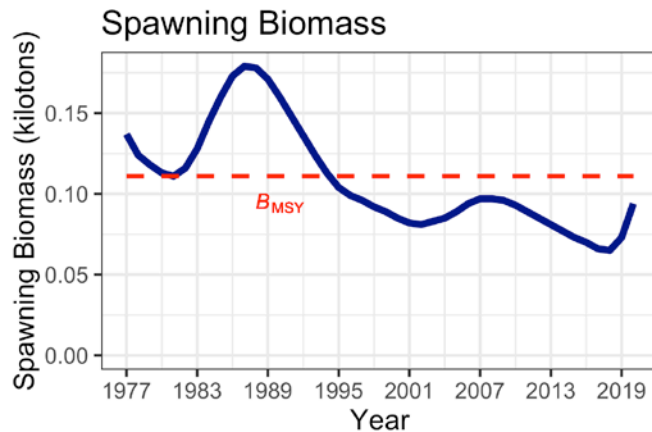
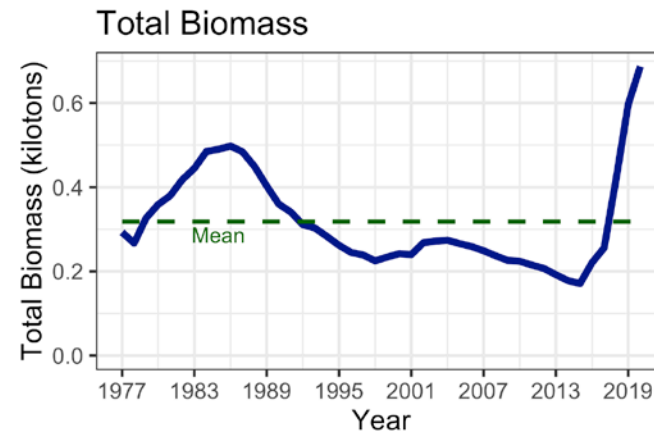
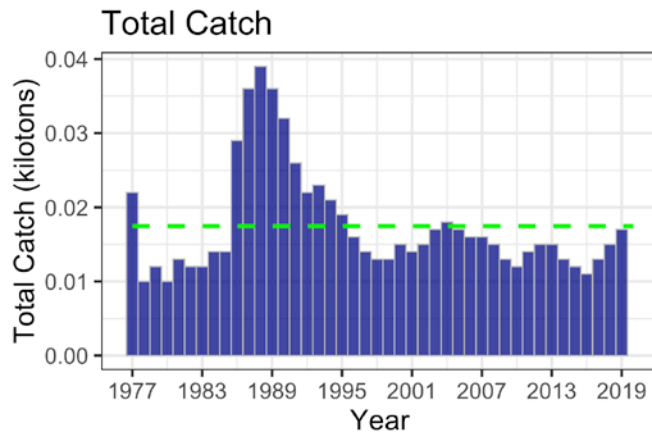
- The Team recommended that an age-structured assessment be presented to the Team in September 2021.

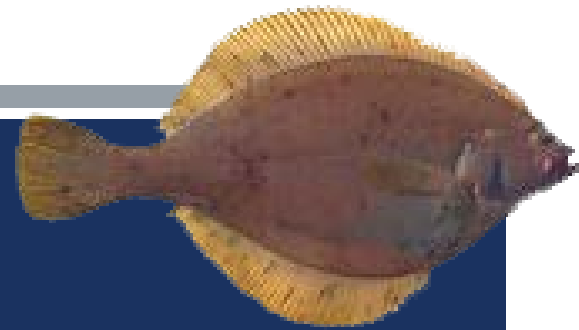
Quantity	Last asmt.	This asmt.	Change
M	0.34	0.34	0.00
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	80,700	80,700	0.00
2021 FOFL	0.34	0.34	0.00
2021 FABC	0.255	0.255	0.00
2020 OFL	27,400	n/a	0.00
2021 OFL	27,400	27,400	0.00
2020 ABC	20,600	n/a	0.00
2021 ABC	20,600	20,600	0.00



CHAPTER 3: SABLEFISH

- Covered in Joint Plan Team presentation (thanks Jim!)

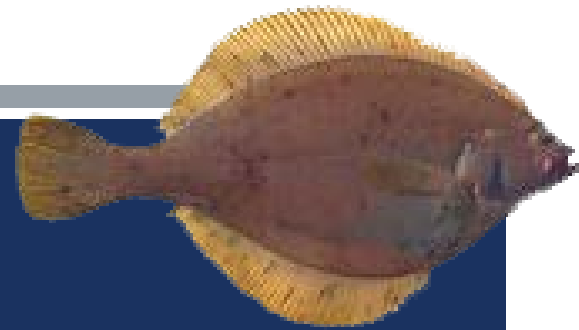




CHAPTER 4: YELLOWFIN SOLE

- New author: **no**; >1 model: **yes**; change from base: **yes**; risk>1: **no**
- New data:
 - Fishery and survey agecomps for 2019
 - Fishery weight at age was re-estimated
- Model changes/alternatives:
 - Model 18.1 is the base model, with $M=0.12$ for both sexes
 - Model 18.2 (recommended) fixes female $M=0.12$, but estimates male $M=0.135$
 - Exploratory Model 18.3 is the same as Model 18.2, except with VAST estimates of the EBS survey biomass
 - Exploratory Model 18.4 is the same as Model 18.2, except with VAST estimates of the combined EBS and NBS survey biomass



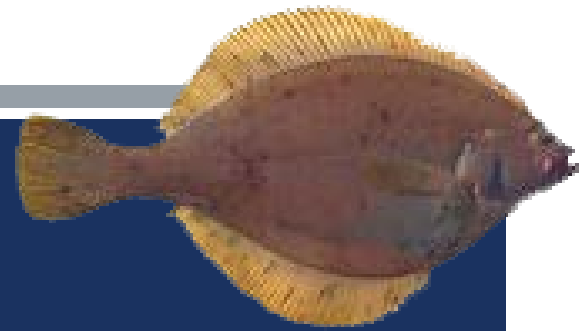


YELLOWFIN SOLE MODEL SELECTION

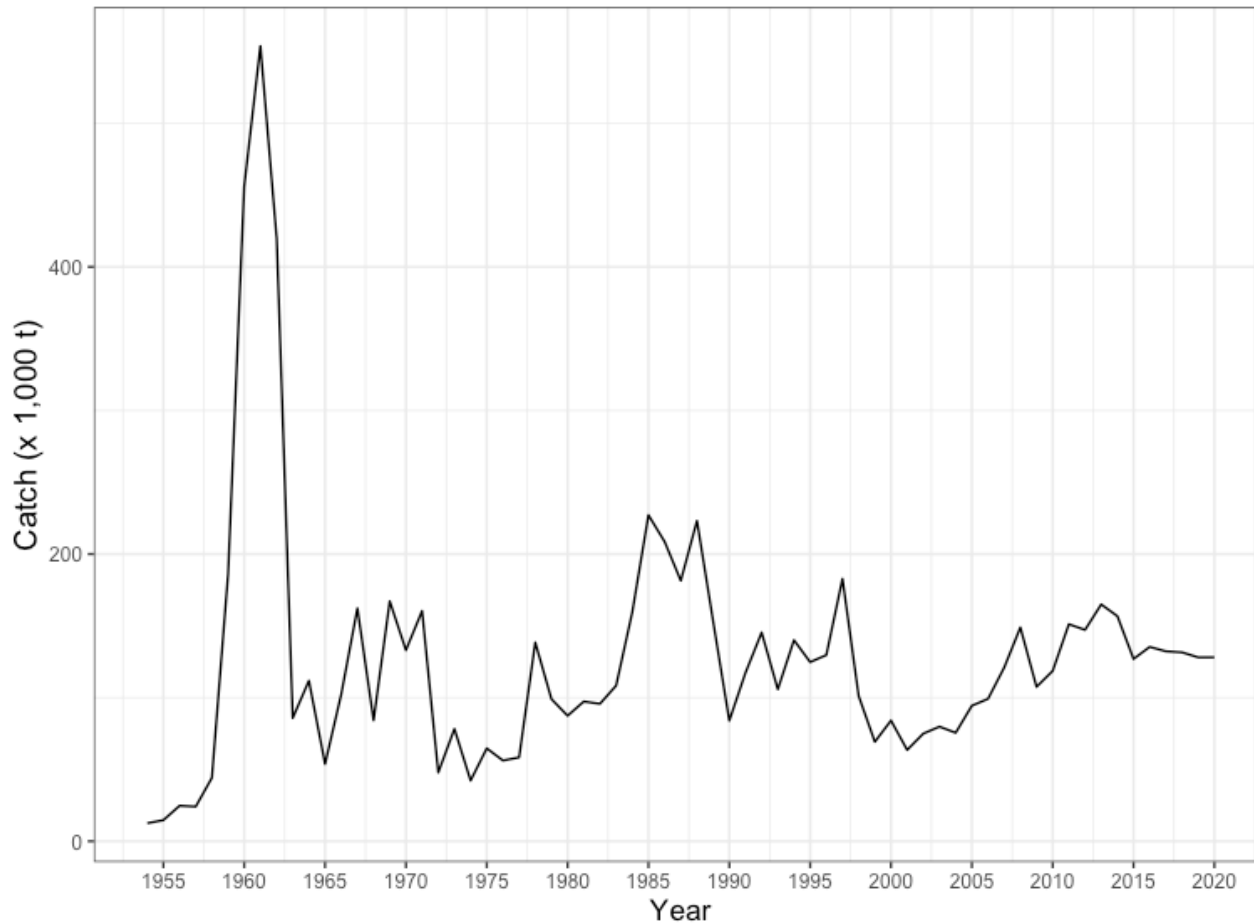
- Stock status:
 - 2021 spawning biomass is 68% of B_0 and 86% above B_{MSY}
- Mohn's $\rho = -0.18$
- Negative log likelihoods for Models 18.1 and 18.2:

Likelihood component	Model 18.1	Model 18.2
Survey age	604.51	575.56
Fishery age	658.01	620.17
Selectivity	61.41	61.16
Survey biomass	93.23	96.41
Recruitment	28.88	29.67
Catchability	0.0084	0.007
Total	1446.05	1382.98

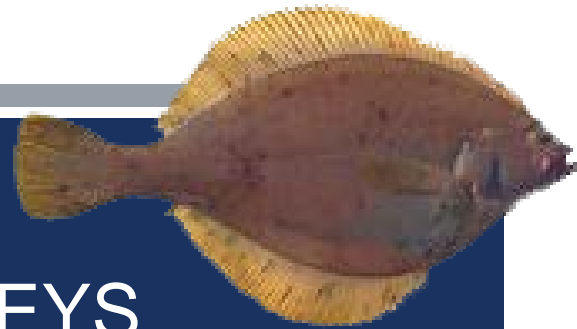




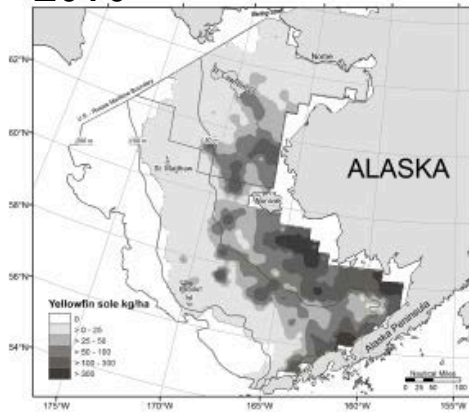
YELLOWFIN SOLE CATCH TIME SERIES



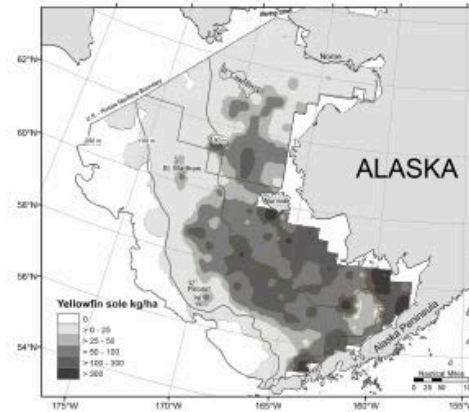
YELLOWFIN SOLE SURVEY CATCHES IN NBS SURVEYS



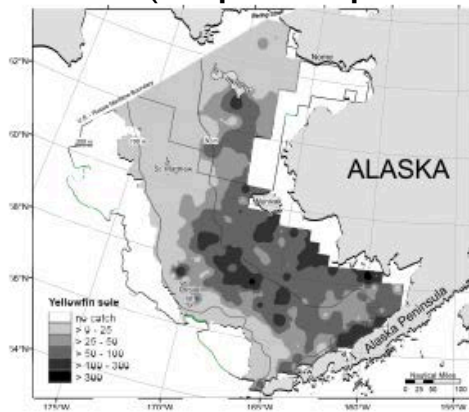
2010



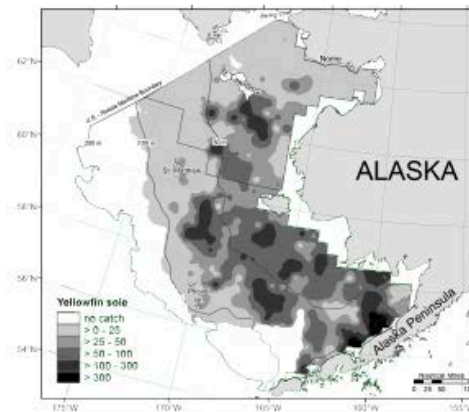
2017



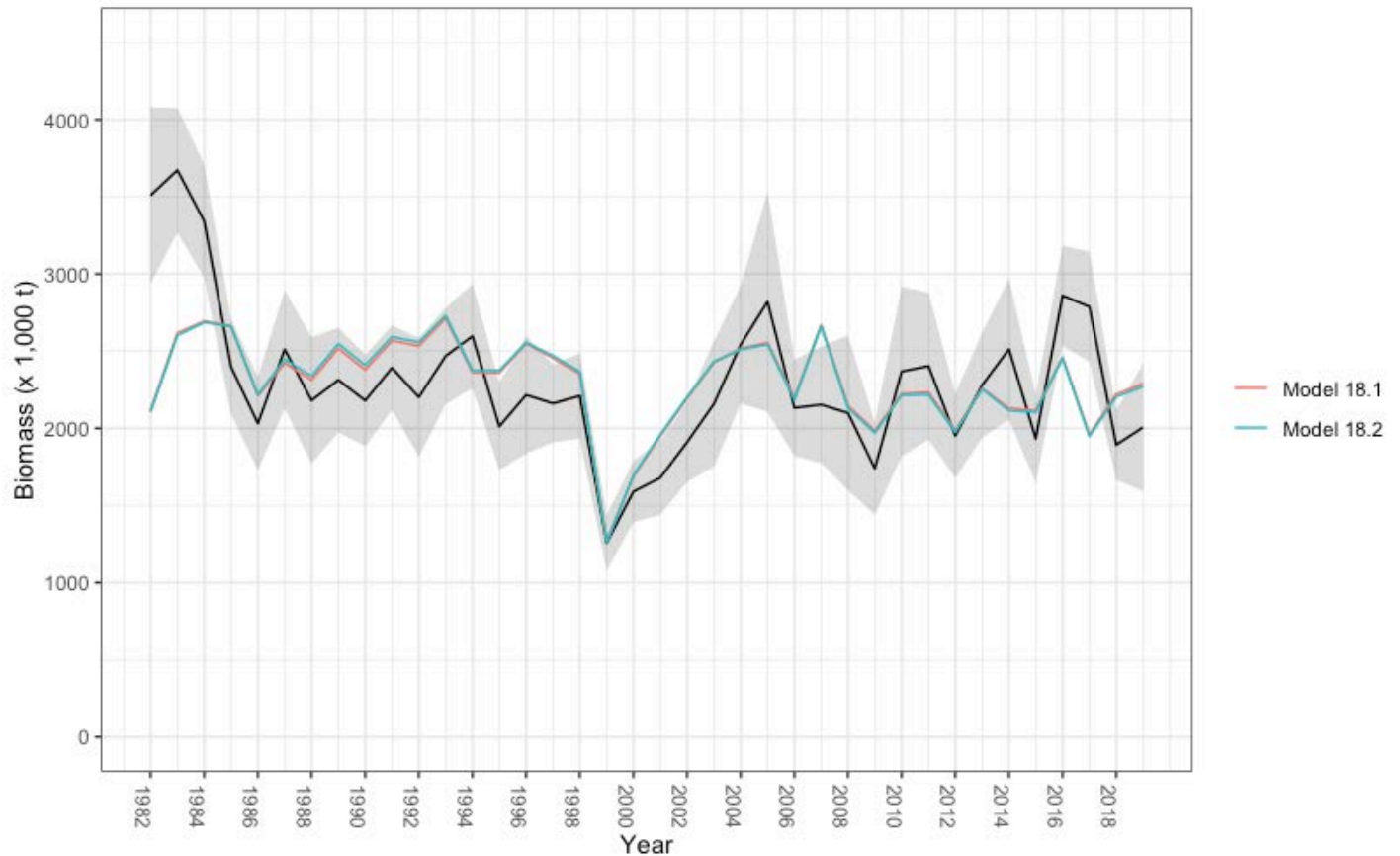
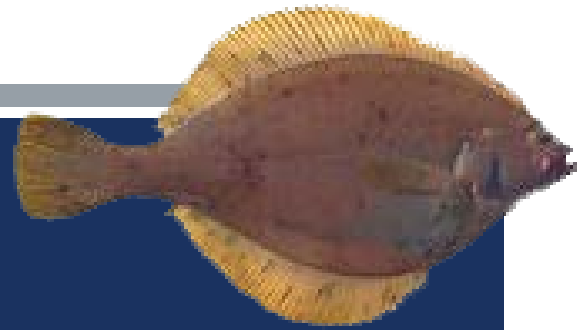
2018 (“rapid response”)

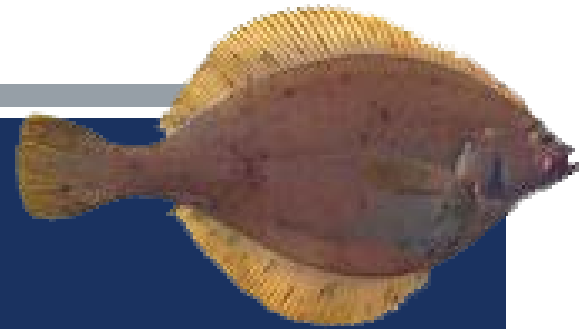


2019



YELLOWFIN SOLE SURVEY BIOMASS TIME SERIES



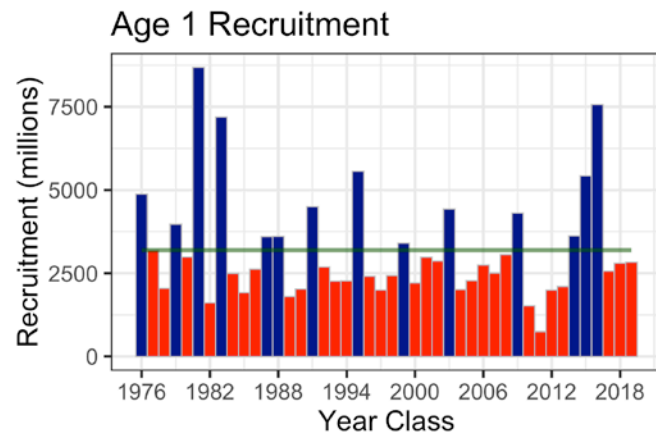
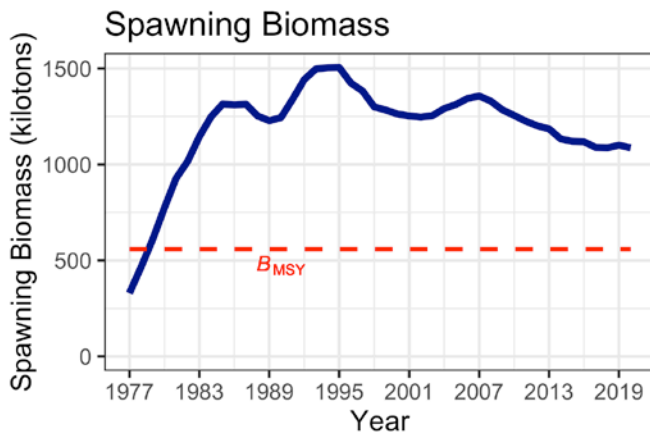
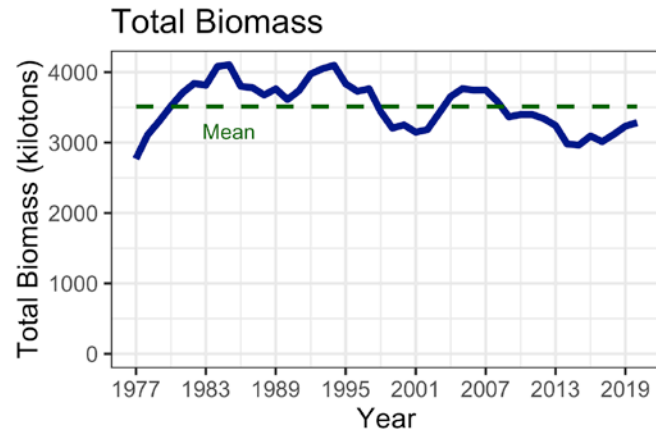
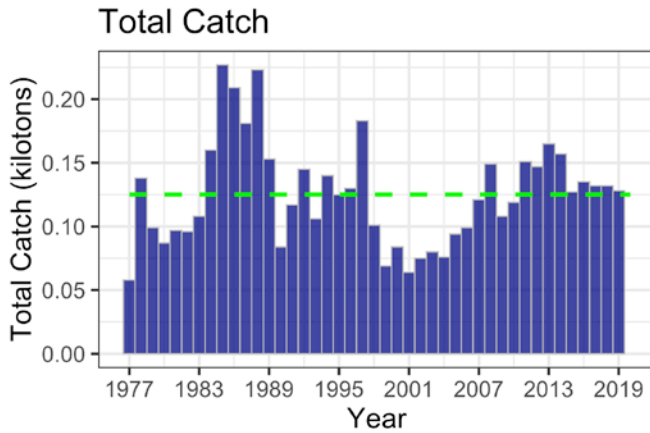
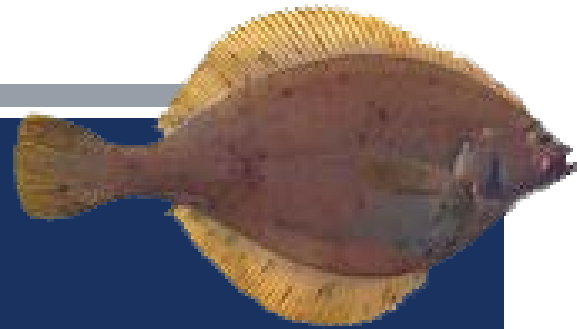


YELLOWFIN SOLE SUMMARY

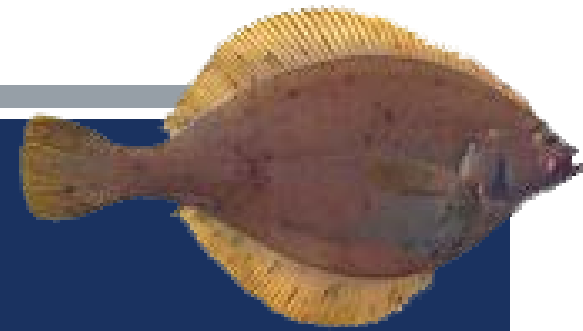
- Public comment:
 - YFS fishers struggled to find areas of low halibut bycatch in 2019
 - In 2020 bottom temperatures were cooler and fishing was better
 - Market issues drove the differences in the fishery this year
 - The YFS market had issues in 2020 with the pandemic affecting European/US “white table cloth” markets and tariffs affecting product reprocessed in China; however, these circumstances had normalized towards the end of the year
- **The Team recommended that the authors investigate decreased female natural mortality and weight at age next year to help address the issue of a negative retrospective bias in the recommended model**
 - In addition to the Team’s September recommendation on estimating sex-specific M , one suggestion was to fix the male M at the current value in model 18.2 and fit the female M



YELLOWFIN SOLE SUMMARY



YELLOWFIN SOLE SUMMARY



Quantity	Last asmt.	This asmt.	Change
M (female/male)	0.12	0.12/0.135	0/0.13
2020 tier	1a	n/a	none
2021 tier	1a	1a	none
2020 age+ biomass	2,486,700	n/a	0.11
2021 age+ biomass	2,733,340	2,755,870	0.01
2020 spawning biomass	847,101	n/a	0.23
2021 spawning biomass	809,813	1,040,900	0.29
B0	1,275,940	1,528,700	0.20
Bmsy	477,288	559,704	0.17
2021 FOFL	0.123	0.124	0.01
2021 FABC	0.112	0.114	0.02
2020 OFL	306,410	n/a	0.11
2021 OFL	336,801	341,571	0.01
2020 ABC	278,370	n/a	0.13
2021 ABC	305,980	313,477	0.02



CHAPTER 5: GREENLAND TURBOT



- New author: **no**; >1 model: **yes**; change from base: **yes**; risk>1: **yes**
- New data:
 - 2019 EBS trawl survey biomass and size composition
 - 2019 and 2020 AFSC longline survey relative biomass
 - 2018 and 2019 EBS trawl survey size at age
 - 2019 and 2020 fishery size composition
- Model changes/alternatives:
 - Model 16.4, the current base model
 - Model 16.4a (recommended), the same as 16.4, except that an error in the units specified for the AFSC longline index has been corrected
- Stock status: projected 2021 spawning biomass is 58% of $B_{100\%}$
- Mohn's $\rho = 0.04$



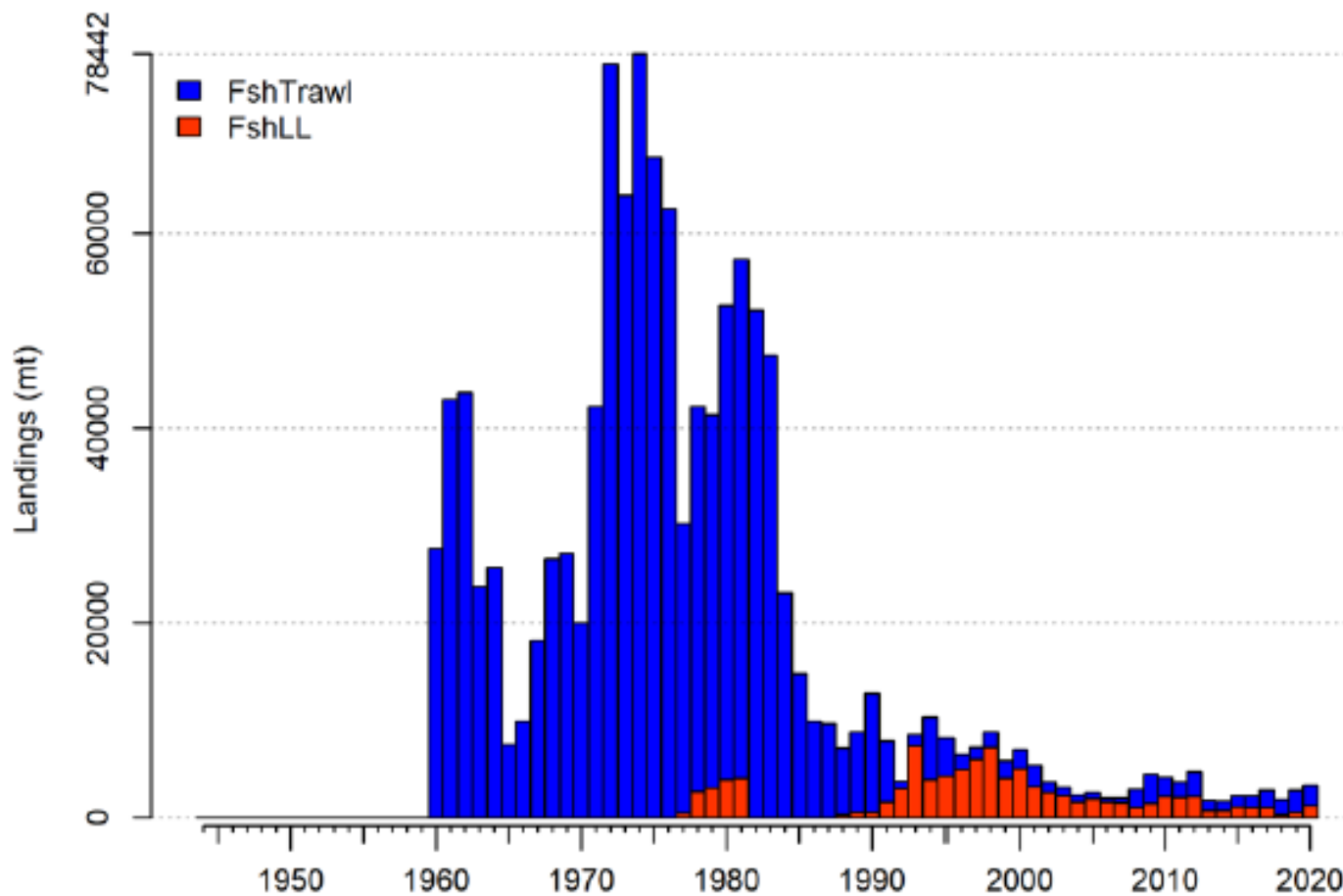
GREENLAND TURBOT



- Risk levels: assess. = 1, pop. dy. = 1, env./eco. = 2, fishery = 1
 - Recent EBS shelf survey data indicate that the length distribution is truncating, with few to no young recruits in 2019
 - Although 2020 has an average cold pool extent, there is concern that with increased frequency of years with little to no cold pool there will be a continued lack of recruitment in the future
 - Few clear concerns about prey abundance
 - Arrowtooth flounder, Kamchatka flounder, and Pacific halibut can be considered competitors based on overlap in their ecological niches, and these are largely abundant or increasing
 - Trends in predator abundances that would indicate a change in predation impact on turbot are unknown
 - Environmental impacts on future recruitment are uncertain



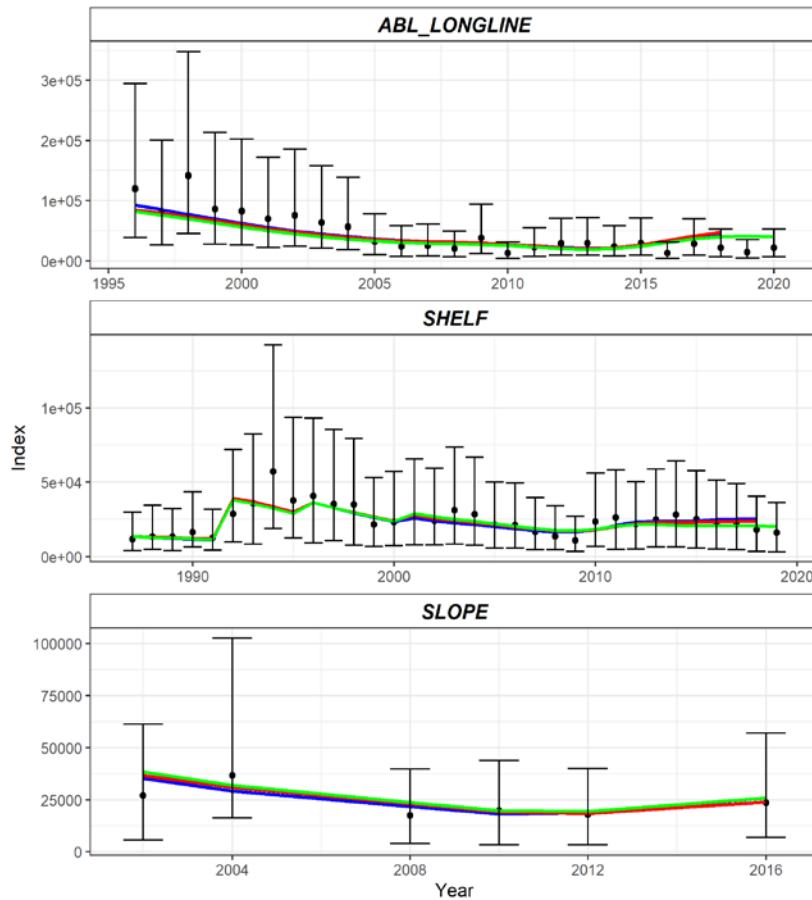
GREENLAND TURBOT CATCH TIME SERIES



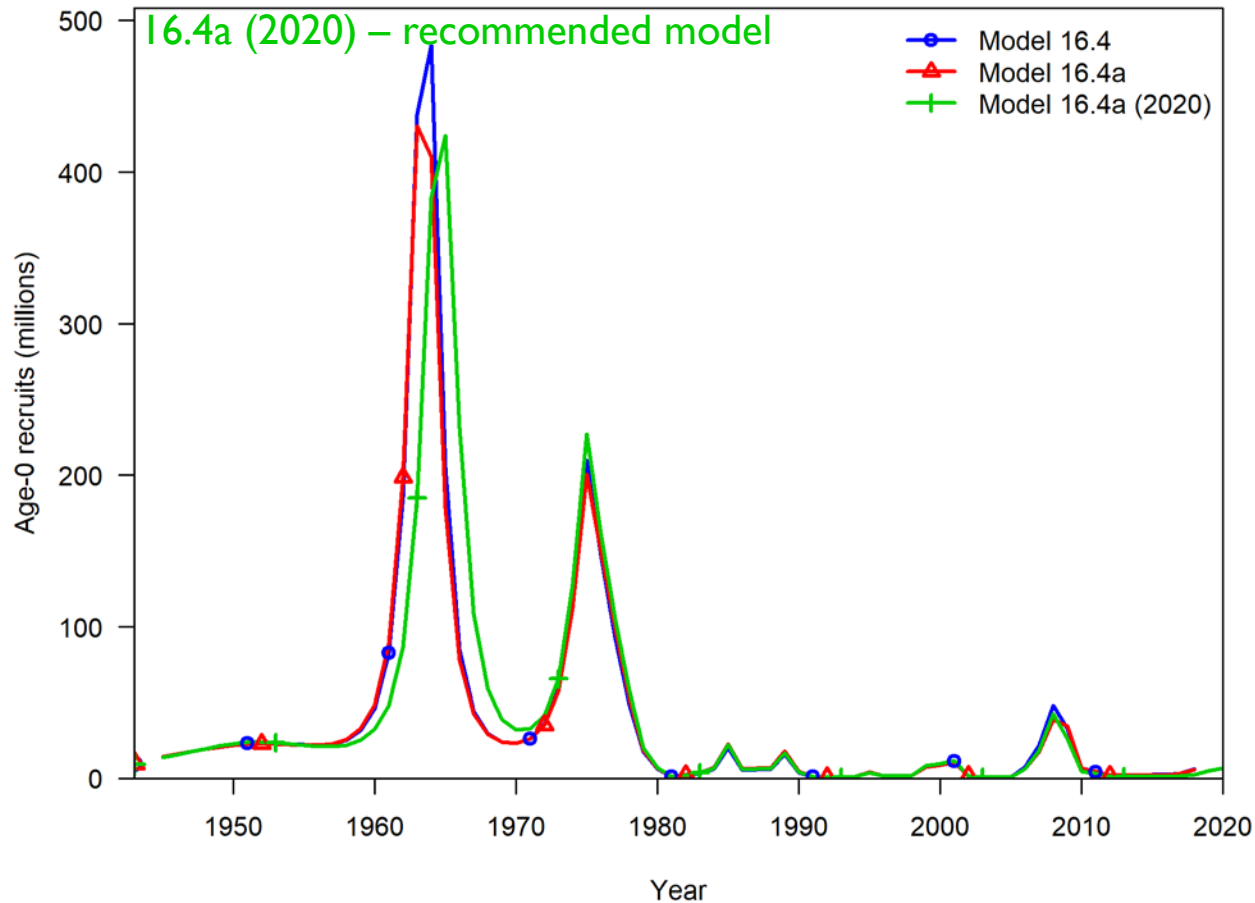
GREENLAND TURBOT SURVEYS



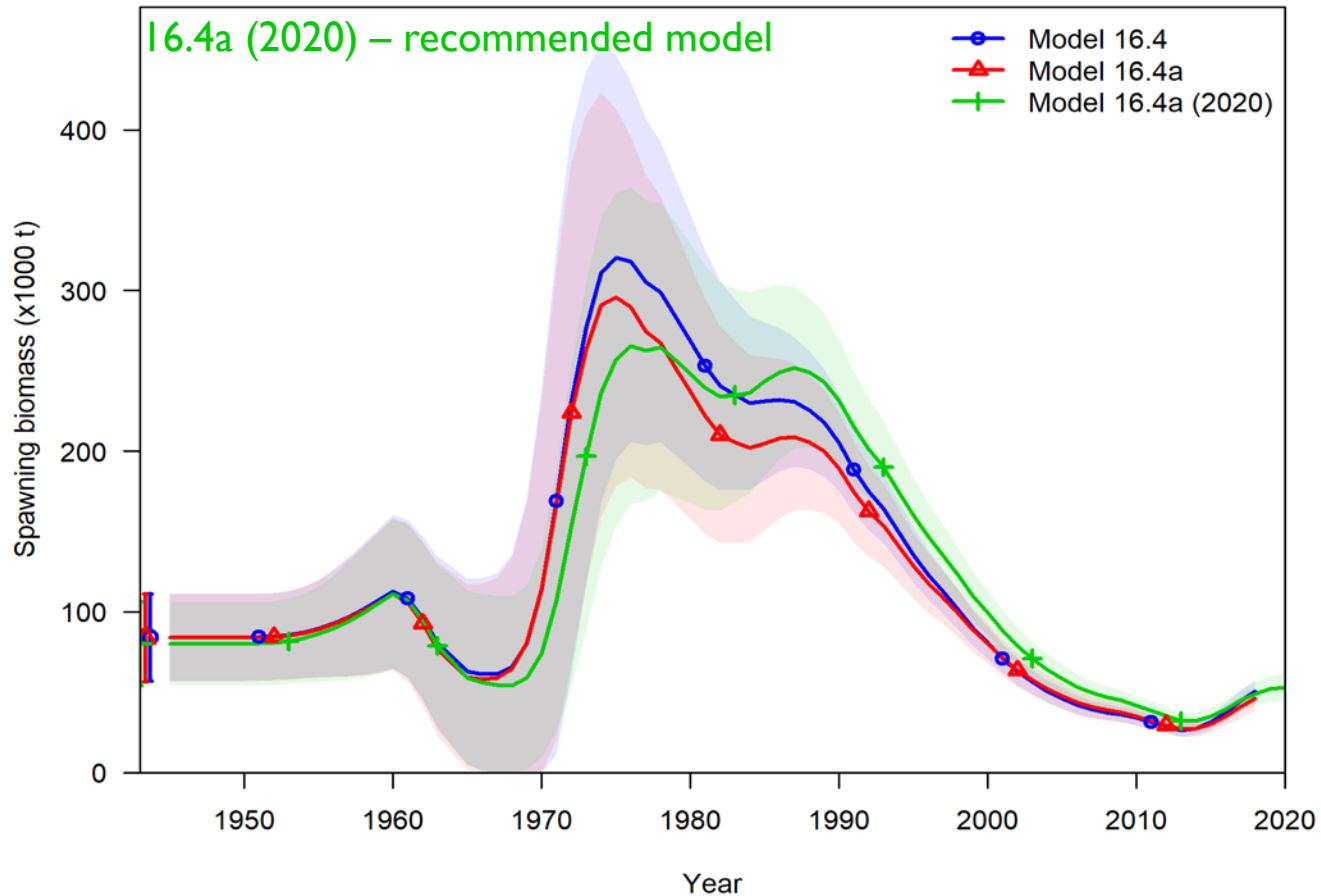
Model — Model 16.4 — Model 16.4a — Model 16.4a (2020)



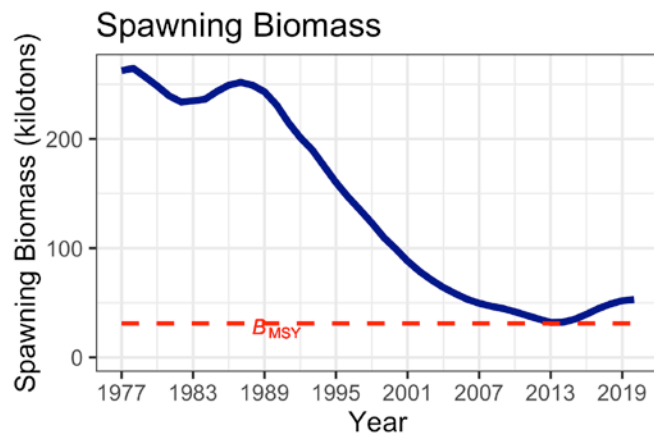
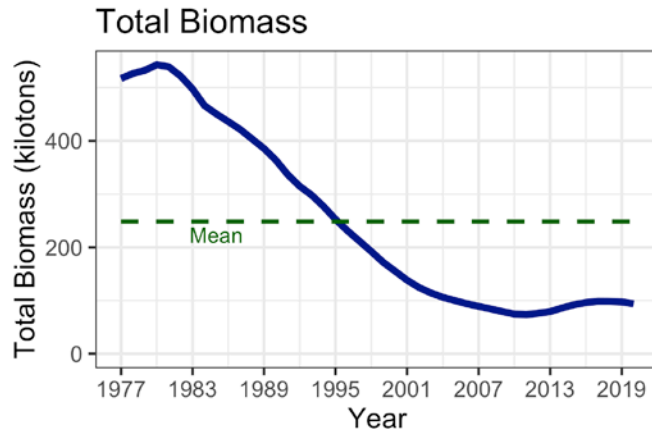
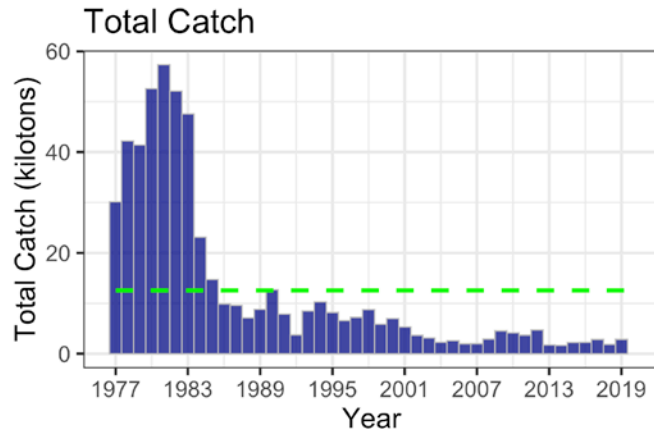
GREENLAND TURBOT RECRUITMENT TIME SERIES



GREENLAND TURBOT SPAWNING BIOMASS TIME SERIES



GREENLAND TURBOT SUMMARY



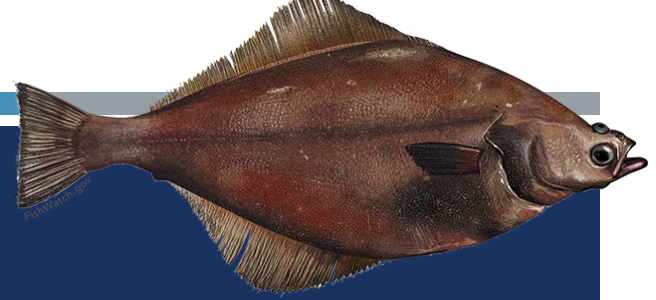
GREENLAND TURBOT SUMMARY



- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.112	0.112	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	106,101	n/a	-0.17
2021 age+ biomass	98,532	87,849	-0.11
2020 spawning biomass	57,094	n/a	-0.09
2021 spawning biomass	53,617	51,914	-0.03
B100%	90,534	89,054	-0.02
B40%	36,213	35,622	-0.02
B35%	31,687	31,169	-0.02
2021 FOFL	0.21	0.22	0.05
2021 FABC	0.18	0.18	0.00
2020 OFL	11,319	n/a	-0.24
2021 OFL	10,006	8,568	-0.14
2020 ABC	9,625	n/a	-0.24
2021 ABC	8,510	7,326	-0.14

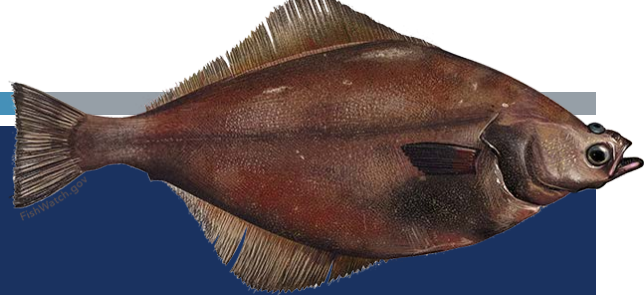




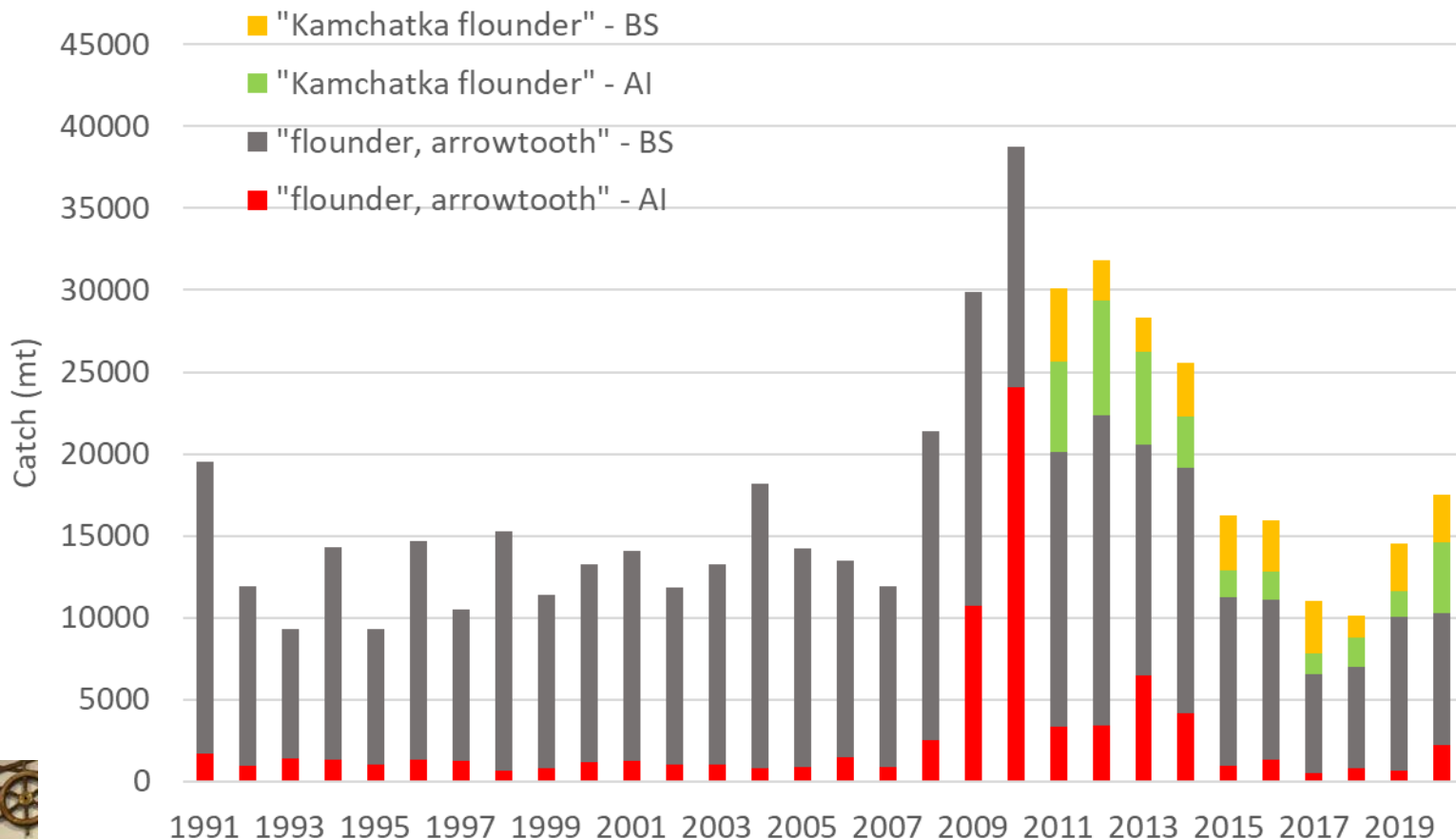
CHAPTER 6: ARROWTOOTH FLOUNDER

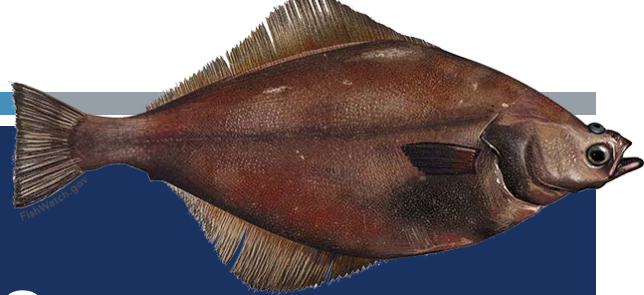
- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data:
 - Size composition from the 2018 (updated) and 2019 fisheries
 - Biomass estimate from 2019 EBS shelf survey
 - Age composition from 2018-19 EBS shelf and 2018 AI surveys
 - Size composition from the 2019 EBS shelf survey
 - Minor corrections based on species ID (arrowtooth vs. Kamchatka):
 - Shelf survey index
 - 2008-2010 catch
- Model changes/alternatives: none
- Stock status: 2021 spawning biomass is 89% of $B_{100\%}$
- Mohn's $\rho = 0.07$





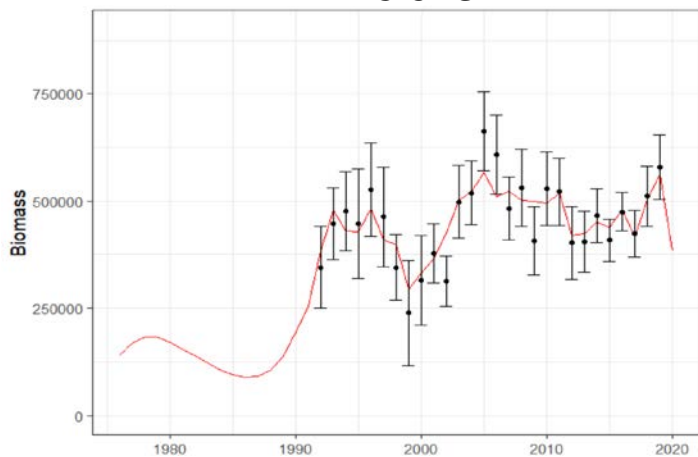
ARROWTOOTH FLOUNDER CATCH TIME SERIES



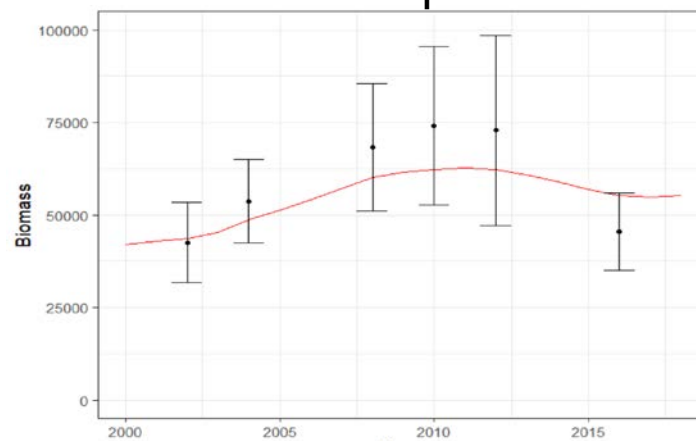


ARROWTOOTH FLOUNDER SURVEY BIOMASS TIMESERIES

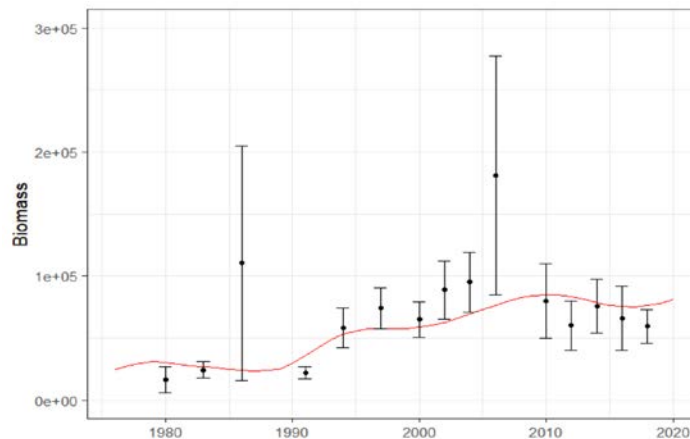
EBS shelf

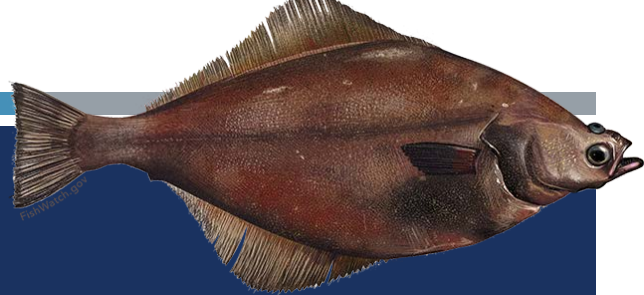


EBS slope

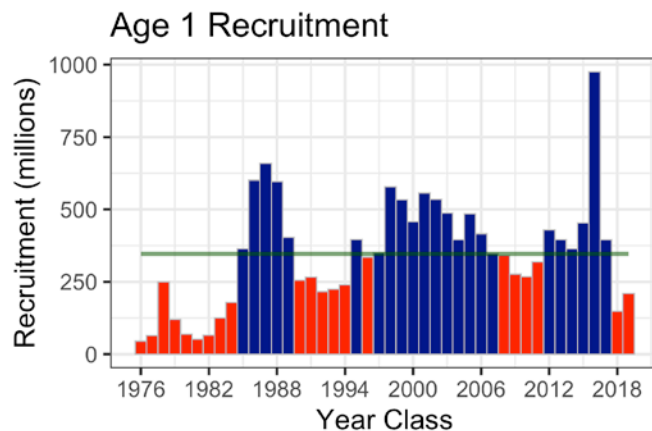
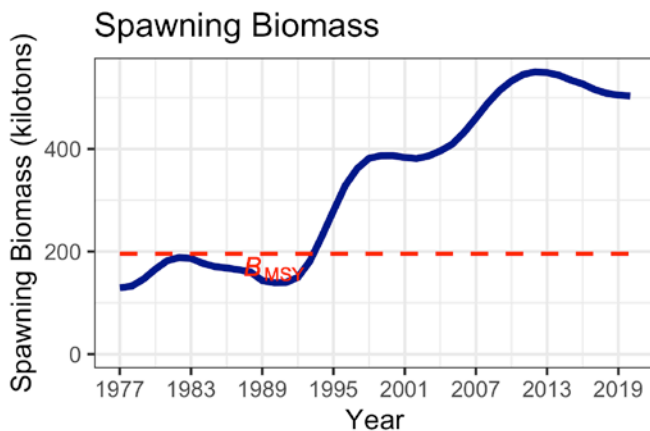
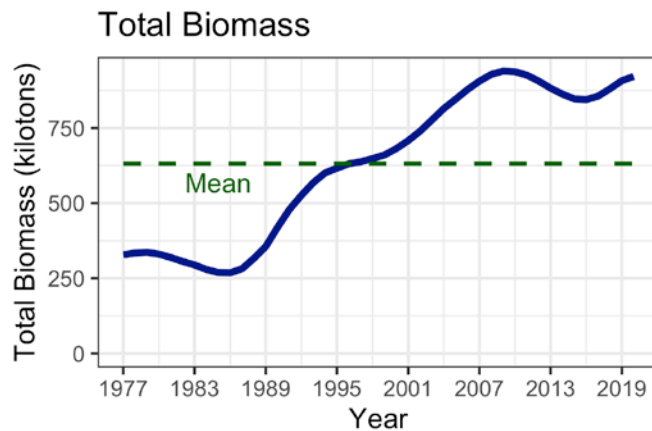
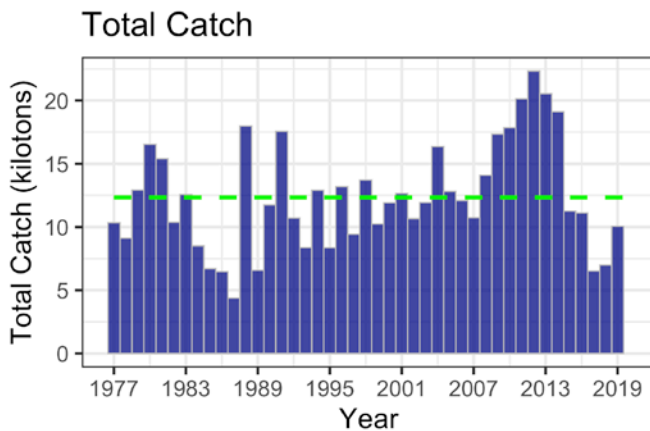


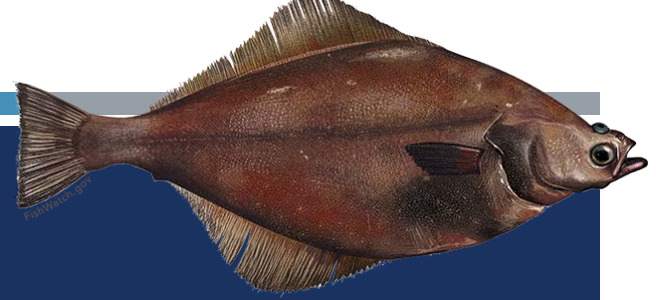
Aleutians





ARROWTOOTH FLOUNDER SUMMARY





ARROWTOOTH FLOUNDER SUMMARY

- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M (female/male)	0.20/0.35	0.20/0.35	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	891,959	n/a	0.04
2021 age+ biomass	934,008	923,646	-0.01
2020 spawning biomass	481,845	n/a	0.03
2021 spawning biomass	478,260	497,556	0.04
B100%	606,237	558,826	-0.08
B40%	242,495	223,530	-0.08
B35%	212,183	195,589	-0.08
2021 FOFL	0.161	0.160	-0.01
2021 FABC	0.136	0.135	-0.01
2020 OFL	82,860	n/a	0.10
2021 OFL	84,057	90,873	0.08
2020 ABC	70,606	n/a	0.10
2021 ABC	71,618	77,349	0.08



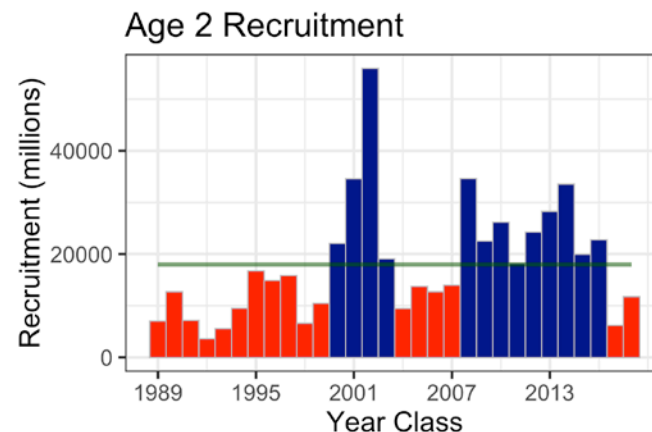
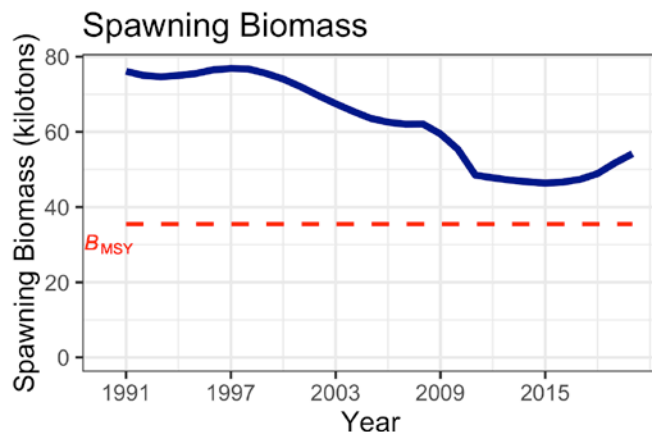
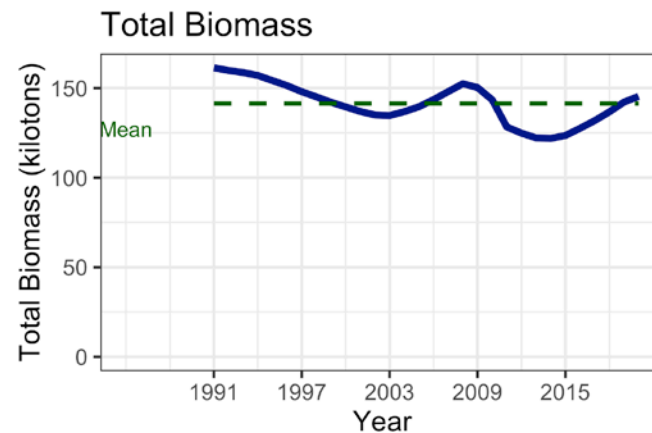
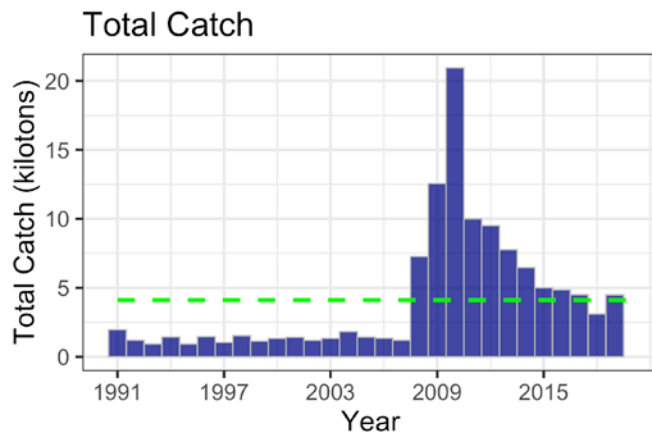
CHAPTER 7: KAMCHATKA FLOUNDER



- New author: **no**; >1 model: **yes***; change from base: **yes***; risk>1: **no**
- New data:
 - 2019 and 2020 fishery size composition
 - 2019 EBS shelf survey biomass
 - 2016 EBS slope survey age composition
 - 2016 and 2018 AI survey age composition
 - Minor corrections based on species ID (complementing arrowtooth)
- Model changes/alternatives:
 - Model 16.0a, the current base model
 - Model 16.0b (recommended), the same as 16.0a, but with updated externally estimated parameters (growth, age-length conversion)
- Stock status: projected 2021 spawning biomass is 54% of $B_{100\%}$
- Mohn's $\rho = 0.02$



KAMCHATKA FLOUNDER SUMMARY



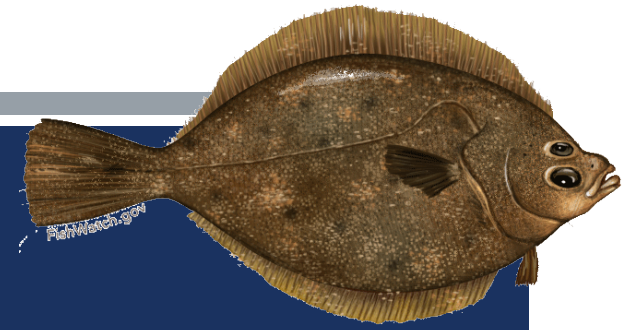
KAMCHATKA FLOUNDER SUMMARY



- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.11	0.11	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	162,709	n/a	-0.11
2021 age+ biomass	163,158	144,671	-0.11
2020 spawning biomass	57,948	n/a	-0.06
2021 spawning biomass	57,892	54,341	-0.06
B100%	107,673	101,376	-0.06
B40%	43,069	40,550	-0.06
B35%	37,685	35,482	-0.06
2021 FOFL	0.108	0.108	0.00
2021 FABC	0.090	0.090	0.00
2020 OFL	11,495	n/a	-0.08
2021 OFL	11,472	10,630	-0.07
2020 ABC	9,708	n/a	-0.07
2021 ABC	9,688	8,982	-0.07

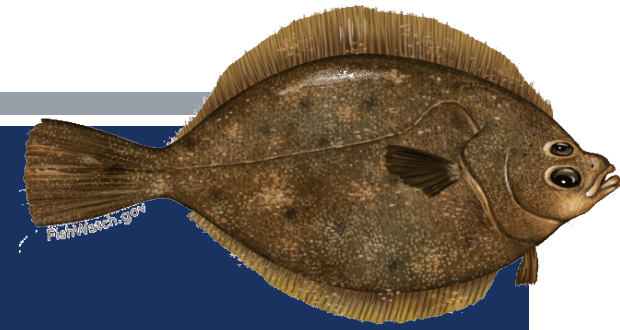




CHAPTER 8: NORTHERN ROCK SOLE

- New author: **yes**; >1 model: **yes**; change from base: **yes**; risk>1: **yes**
- New data:
 - 2018-2019 fishery age composition
 - 2018-2019 survey age composition
 - 2019 EBS survey biomass
- Model changes/alternatives:
 - Model 15.1, the current base model
 - Model 18.3 (recommended), the same as 15.1, but with estimated male M , survey Q , and male selectivity offset
 - Model 18.3 (exploratory), the same as 18.3, but with 75% reduction in age composition sample sizes
- Stock status: projected 2021 spawning biomass is 62% of $B_{100\%}$
- Mohn's $\rho = 0.12$



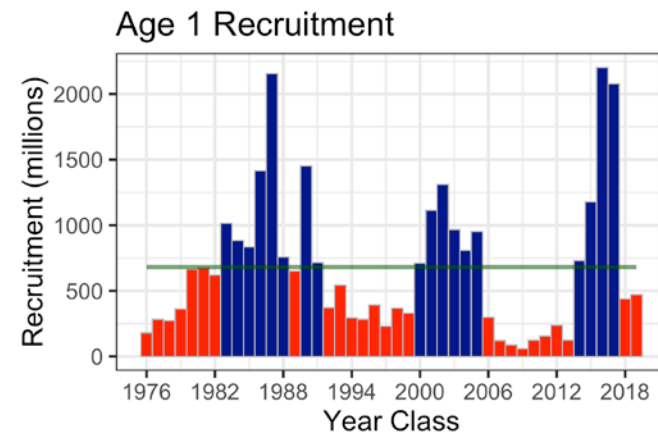
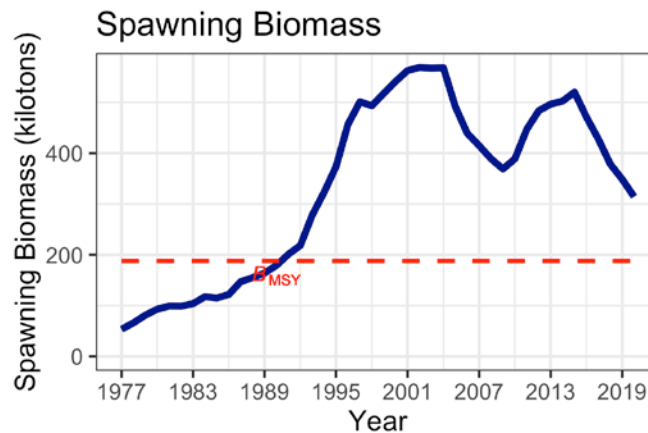
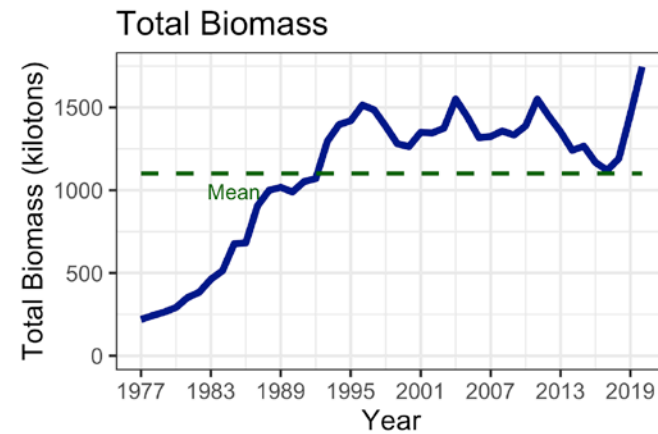
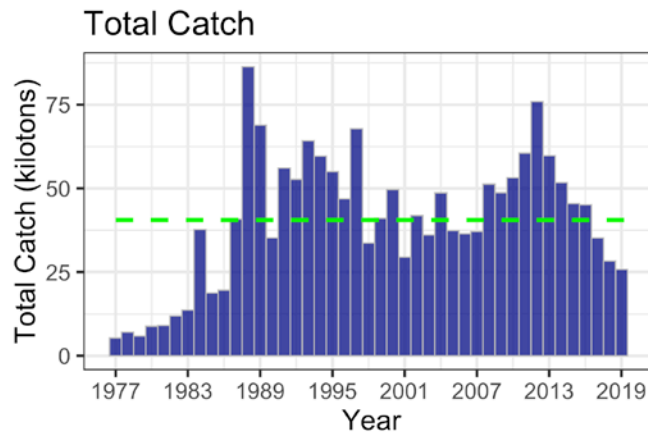
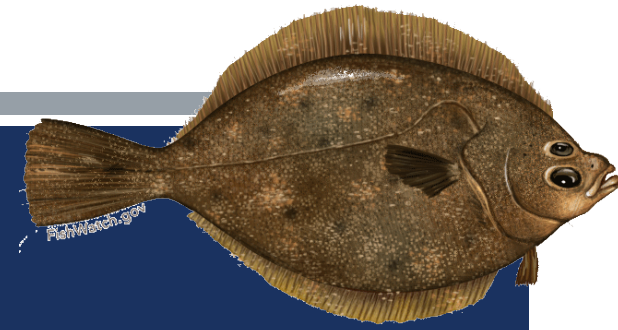


NORTHERN ROCK SOLE

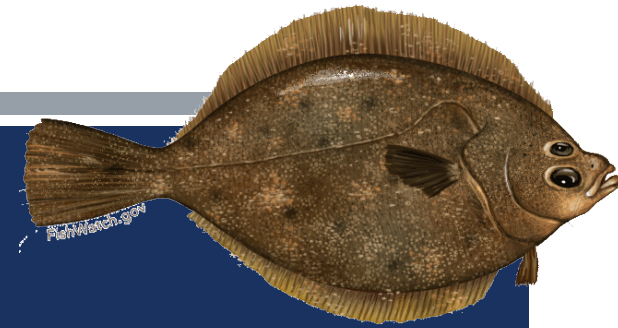
- Risk levels: **assess. = 2**, pop. dy. = 1, env./eco. = 1, fishery = 1
 - Data inputs are generally adequate
 - In the 2018 and 2019 data there appears to be a conflict between the fit to survey biomass and fits to survey and fishery agecomps
 - In particular, the agecomp data showed large recruitments of age 1 fish in 2017 and 2018; this led to an increase in model predicted survey biomass but the observed values declined
 - It is possible that availability of young fish has shifted, perhaps due to changes in habitat conditions for young fish
 - Lack of a 2020 EBS bottom trawl survey meant no confirmation of either the positive recruitment pattern or the biomass decline
 - The retrospective pattern is modest



NORTHERN ROCK SOLE SUMMARY



NORTHERN ROCK SOLE SUMMARY

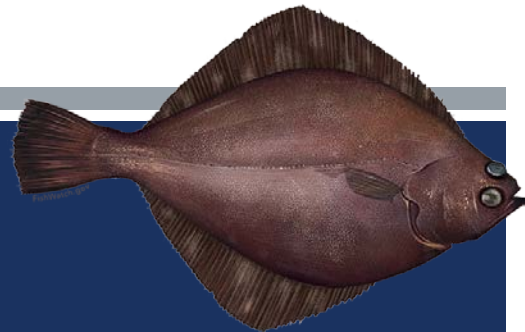


- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.*	This asmt.	Change
M	0.15	0.15/0.17	0/0.13
2020 tier	1a	n/a	none
2021 tier	1a	1a	none
2020 age+ biomass	1,154,000	n/a	-0.20
2021 age+ biomass	1,729,000	923,197	-0.47
2020 spawning biomass	415,000	n/a	-0.29
2021 spawning biomass	389,000	294,627	-0.24
B0	546,800	476,820	-0.13
Bmsy	197,400	158,972	-0.19
2021 FOFL	0.147	0.157	0.07
2021 FABC	0.142	0.152	0.07
2020 OFL	168,000	n/a	-0.14
2021 OFL	251,800	145,180	-0.42
2020 ABC	163,700	n/a	-0.14
2021 ABC	245,400	140,306	-0.43

*"Last asmt." column as shown **this** year



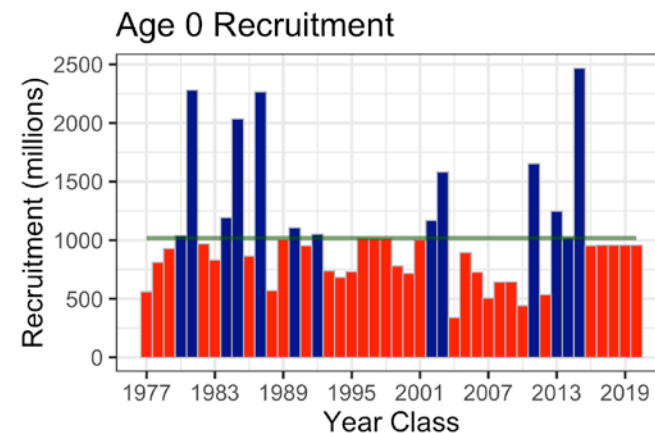
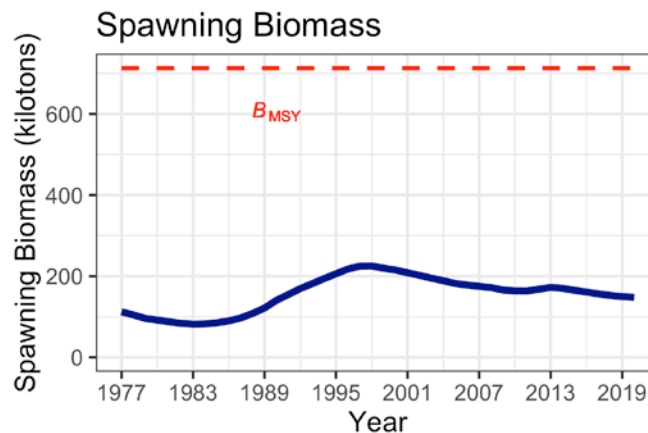
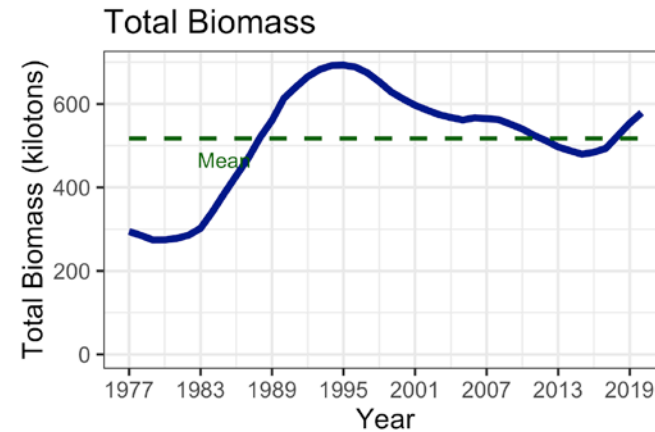
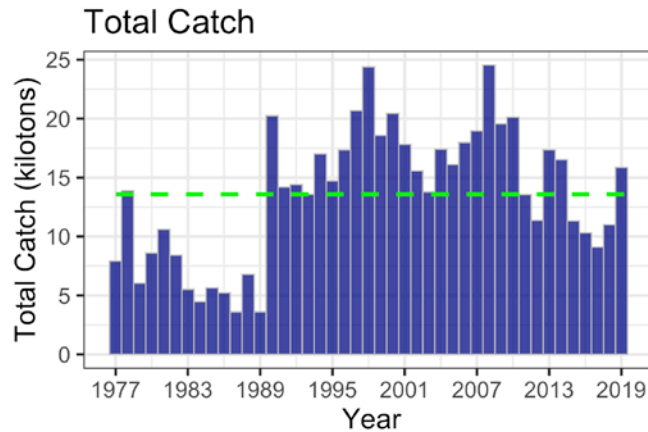
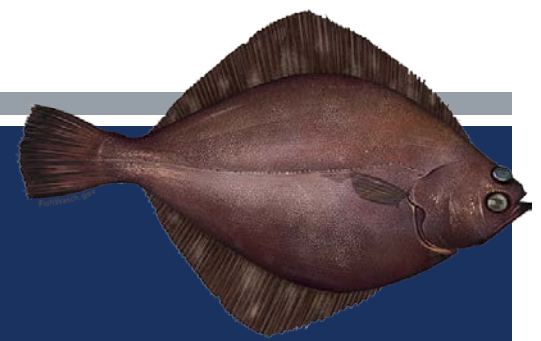


CHAPTER 9: FLATHEAD SOLE

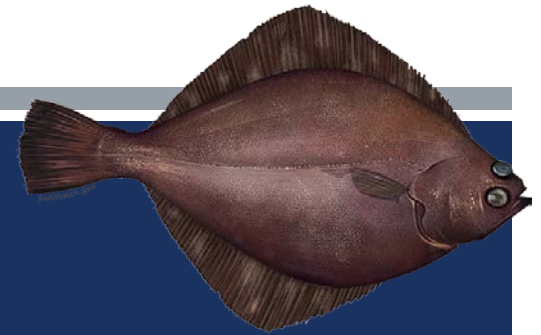
- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data:
 - 2018-2019 fishery age composition
 - 2020 fishery size composition
 - 2019 EBS survey biomass (also used to estimate AI biomass)
 - 1999 and 2018-2019 survey age composition (conditional A at L)
 - 2019 EBS survey size composition
 - Survey ages 1-2 added to model; Bering flounder age data removed
- Model changes/alternative: none
- Stock status: projected 2021 spawning biomass is 74% of $B_{100\%}$
- Mohn's $\rho = -0.05$



FLATHEAD SOLE SUMMARY



FLATHEAD SOLE SUMMARY

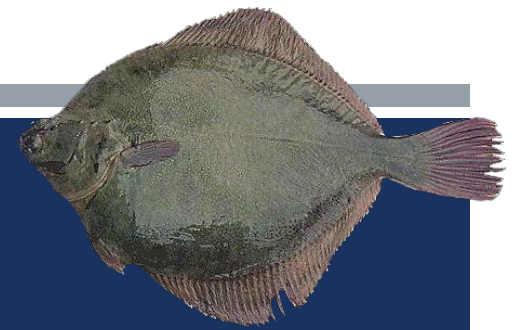


- The Team agreed with all of the authors' recommendations

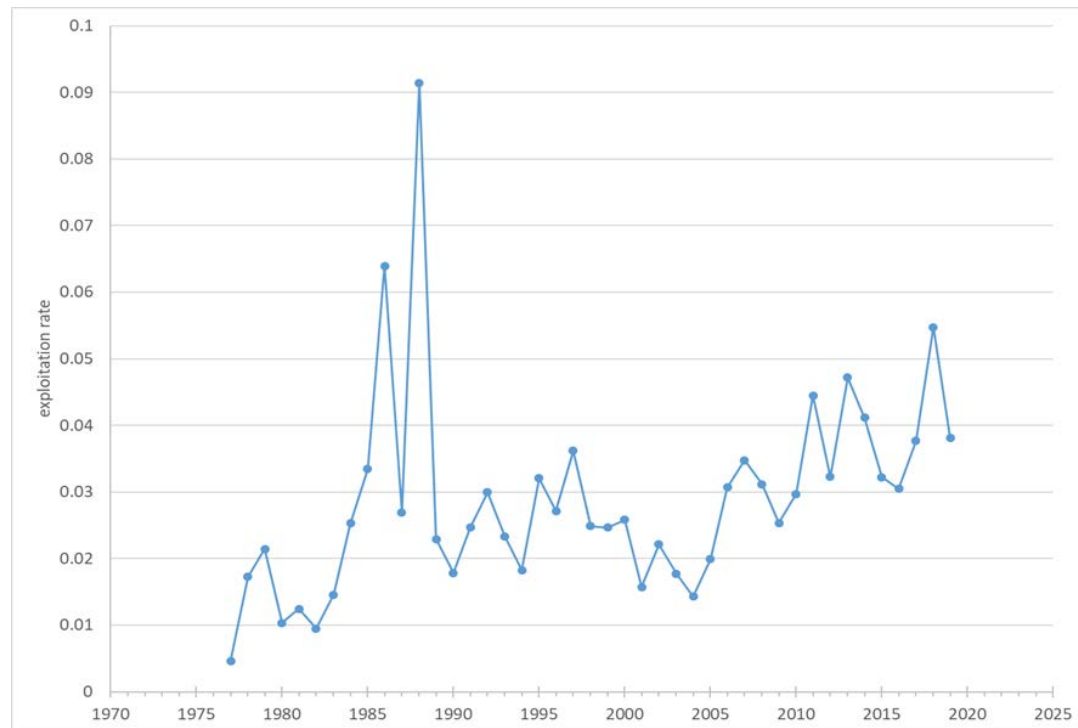
Quantity	Last asmt.	This asmt.	Change
M	0.20	0.20	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	684,768	n/a	-0.12
2021 age+ biomass	692,915	602,497	-0.13
2020 spawning biomass	154,195	n/a	-0.02
2021 spawning biomass	160,864	150,433	-0.06
B100%	212,060	203,658	-0.04
B40%	84,824	81,463	-0.04
B35%	74,221	71,280	-0.04
2021 FOFL	0.47	0.46	-0.02
2021 FABC	0.38	0.37	-0.03
2020 OFL	82,810	n/a	-0.08
2021 OFL	86,432	75,863	-0.12
2020 ABC	68,134	n/a	-0.08
2021 ABC	71,079	62,567	-0.12



CHAPTER 10: ALASKA PLAICE (PARTIAL)



- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **n/a**
- Stock status: projected 2021 spawning biomass is 50% of $B_{100\%}$
- Catch/biomass time series:



ALASKA PLAICE (PARTIAL) SUMMARY



- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.13	0.13	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	428,800	n/a	0.00
2021 age+ biomass	435,700	427,587	-0.02
2020 spawning biomass	170,800	n/a	-0.03
2021 spawning biomass	161,000	166,528	0.03
B100%	333,300	335,172	0.01
B40%	133,300	134,069	0.01
B35%	116,600	117,310	0.01
2021 FOFL	0.150	0.160	0.07
2021 FABC	0.125	0.132	0.06
2020 OFL	37,600	n/a	0.01
2021 OFL	36,500	37,924	0.04
2020 ABC	31,600	n/a	0.00
2021 ABC	30,700	31,657	0.03





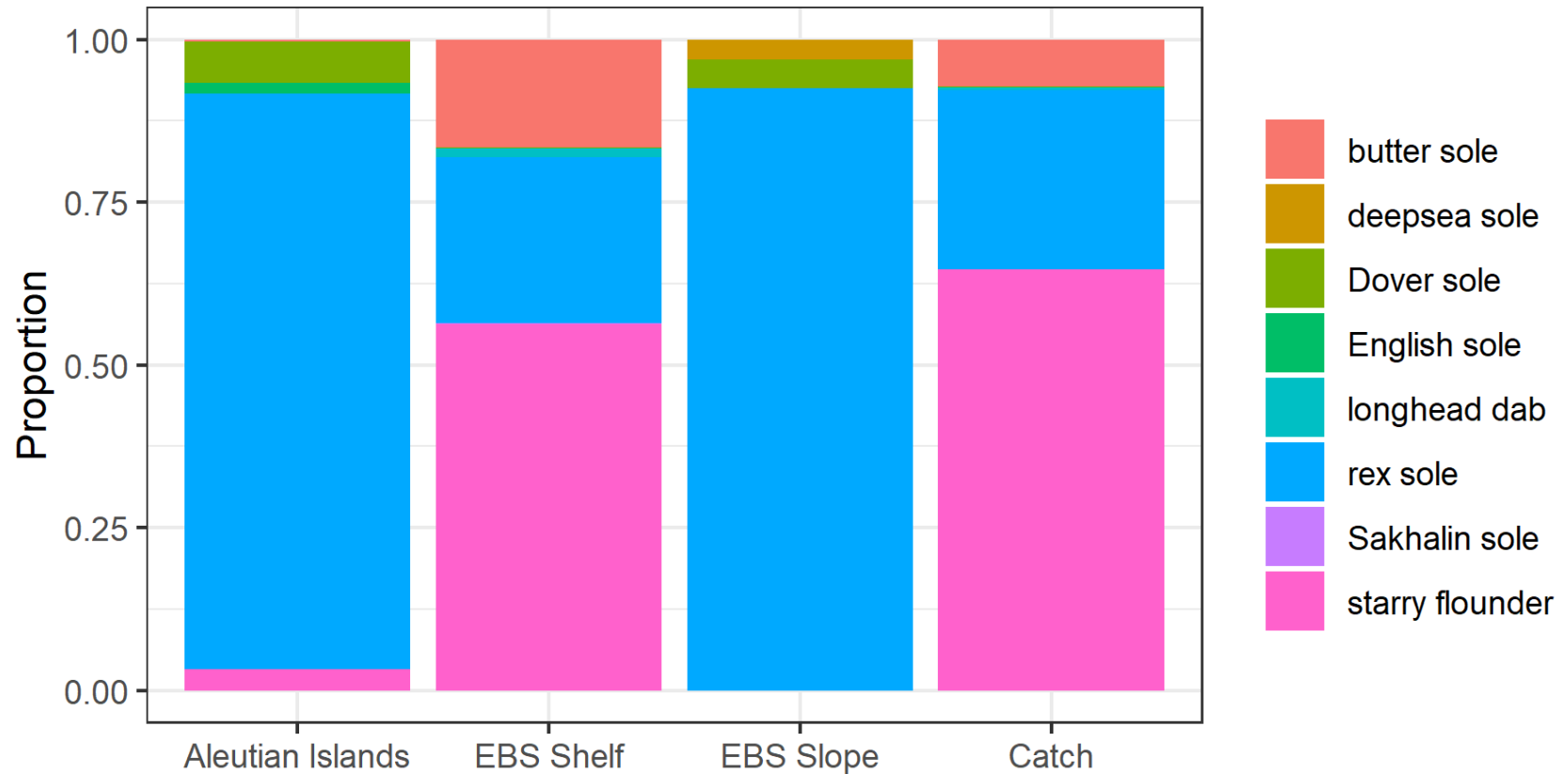
CHAPTER 11: OTHER FLATFISH

- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data:
 - 2016 updated catch, 2017 through 2020 (preliminary) catch
 - 2017, 2018, 2019 EBS survey biomass
 - 2018 AI survey biomass
- Model changes/alternatives: none (standard Tier 5 RE model)
- Stock trends, since 2010:
 - Dover sole down by a discrete annual rate of -2.8%, to 1,790 t
 - Rex sole up by a discrete annual rate of 2.7%, to 51,660 t
 - Starry flounder up by a discrete annual rate of 0.2%, to 76,429 t





OTHER FLATFISH SPECIES COMPOSITION



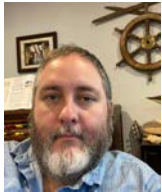
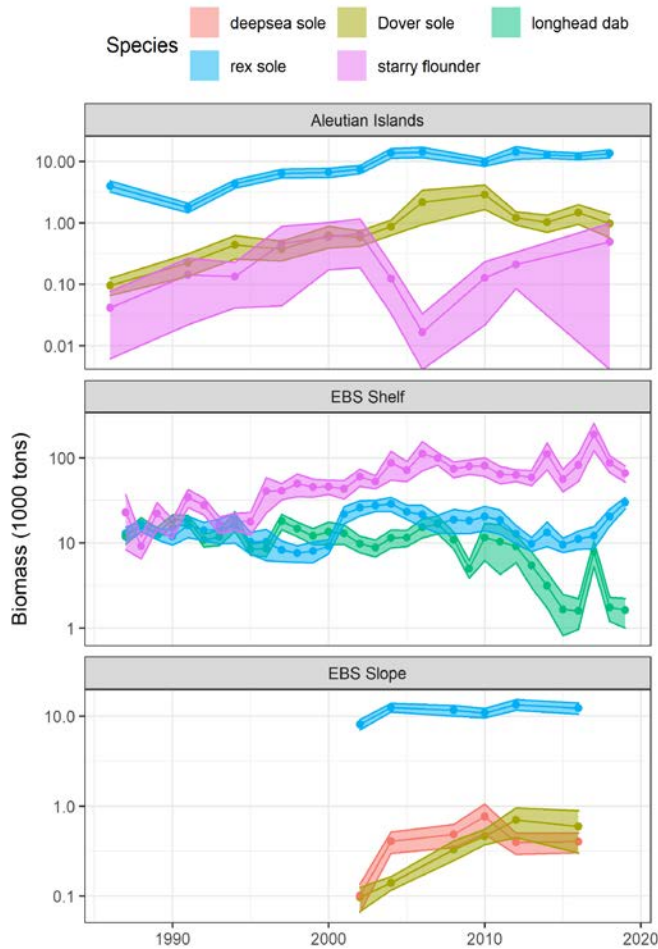


OTHER FLATFISH EXAMPLE FITS TO SURVEY BIOMASS





OTHER FLATFISH EXAMPLE FITS TO SURVEYS





OTHER FLATFISH SUMMARY

- The Team recommends that the author consider adding a secondary table, by species, to the risk table. This breakdown will highlight species specific concerns that can be tracked over time.

Quantity*	Last asmt.	This asmt.	Change
M	0.154	0.156	0.01
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	141,325	146,679	0.04
2021 FOFL	0.154	0.156	0.01
2021 FABC	0.116	0.117	0.01
2020 OFL	21,824	n/a	0.05
2021 OFL	21,824	22,919	0.05
2020 ABC	16,368	n/a	0.05
2021 ABC	16,368	17,189	0.05

*Instantaneous rates are biomass-weighted averages





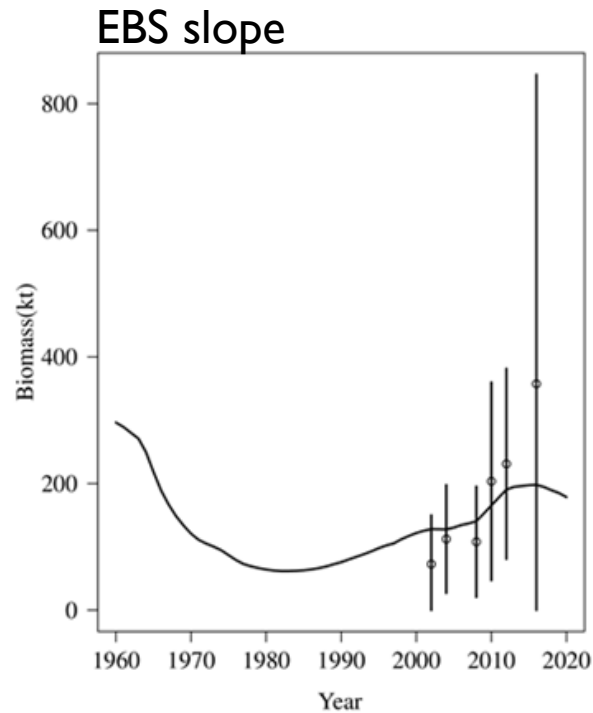
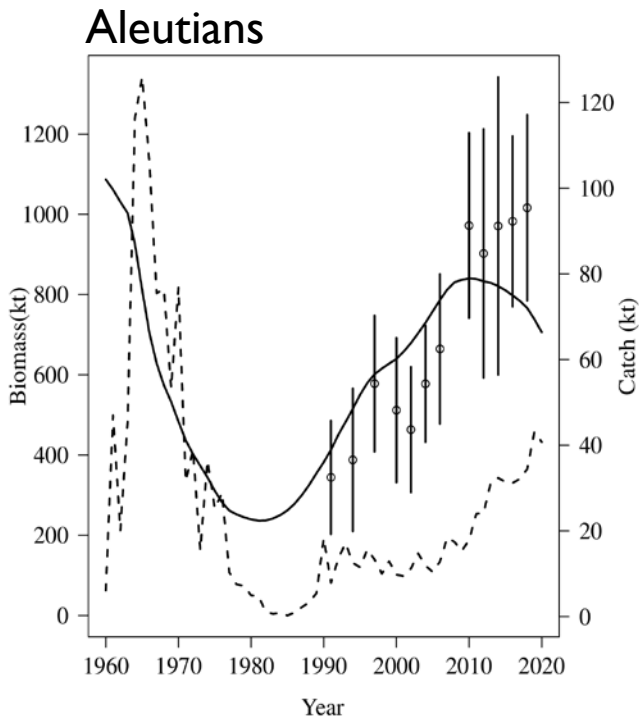
CHAPTER 12: PACIFIC OCEAN PERCH

- New author: **no**; >1 model: **no**; change from base: **no**; risk>1: **yes**
- New data:
 - 2018 AI survey age composition
 - 2018 fishery size composition
 - 2019 fishery age composition
 - Length-at-age, age-at-length matrix, weight-at-age updated
- Model changes/alternatives: none (Model 16.3a)
- Stock status: projected 2021 spawning biomass is 53% of $B_{100\%}$
- Mohn's $\rho = -0.24$ (compare to -0.45 in 2018 assessment)
- Risk levels: **assess. = 2**, pop. dy. = 1, env./eco. = 1, fishery = 1
 - Large Mohn's ρ
 - Residual pattern in AI survey biomass estimates (see next slide)
 - Estimate of M is strongly constrained





PACIFIC OCEAN PERCH FITS TO SURVEY BIOMASS INDICES

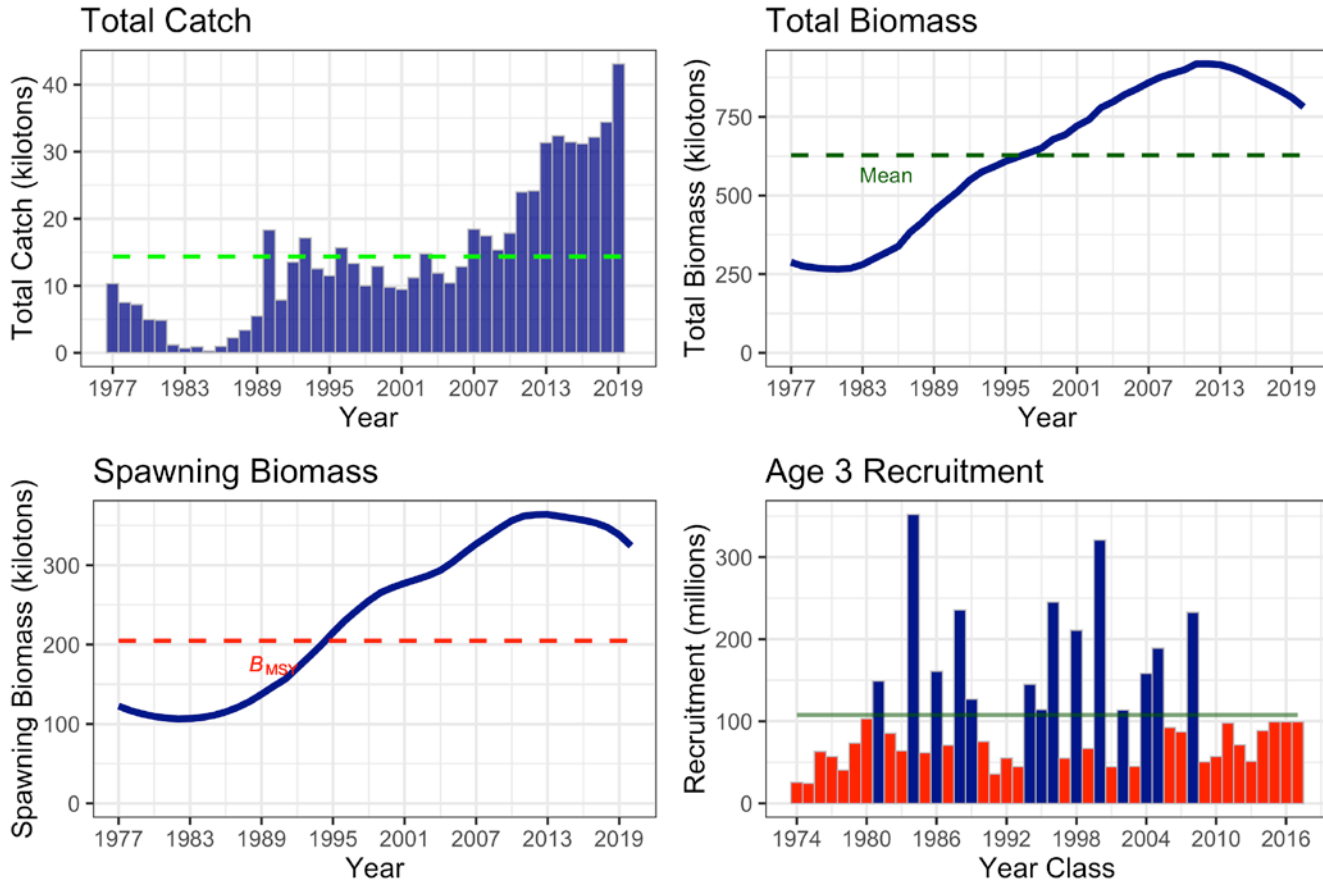


- The Team recommended investigating Francis weighting and trying different time blocks of natural mortality to help improve the fit to the Aleutian Islands survey index





PACIFIC OCEAN PERCH SUMMARY





PACIFIC OCEAN PERCH SUMMARY

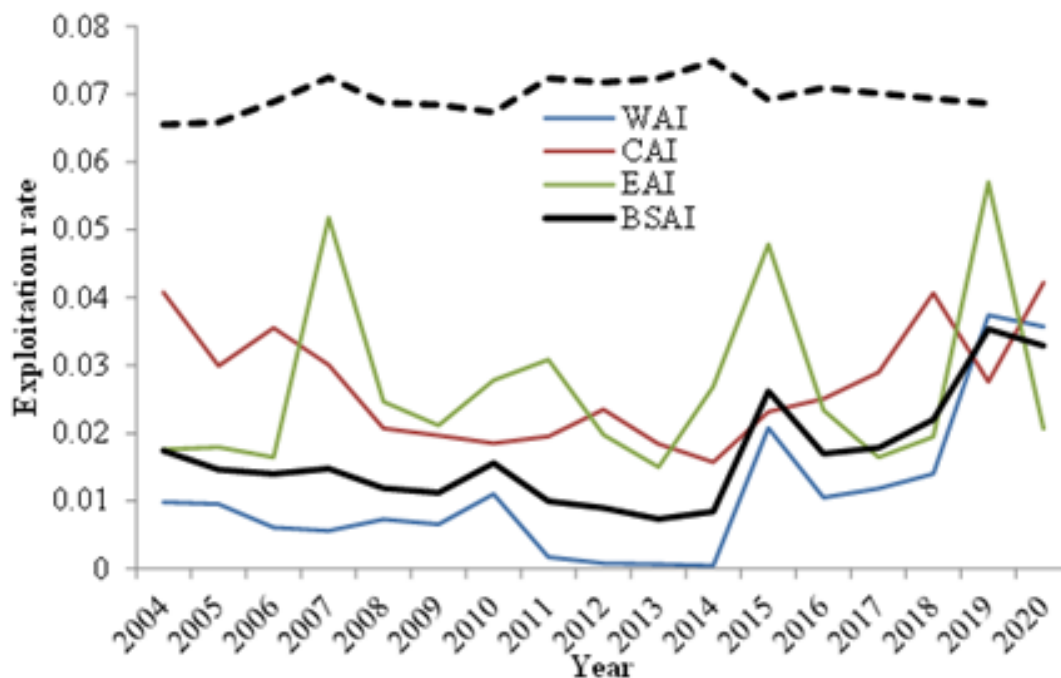
Quantity	Last asmt.	This asmt.	Change
M	0.056	0.056	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	908,529	n/a	-0.17
2021 age+ biomass	885,439	756,011	-0.15
2020 spawning biomass	383,178	n/a	-0.19
2021 spawning biomass	367,062	310,036	-0.16
B100%	645,738	584,747	-0.09
B40%	258,295	233,899	-0.09
B35%	226,008	204,661	-0.09
2021 FOFL	0.095	0.089	-0.06
2021 FABC	0.079	0.073	-0.08
2020 OFL	58,956	n/a	-0.25
2021 OFL	56,589	44,376	-0.22
2020 ABC	48,846	n/a	-0.24
2021 ABC	46,885	37,173	-0.21





CHAPTER 13: NORTHERN ROCKFISH (PARTIAL)

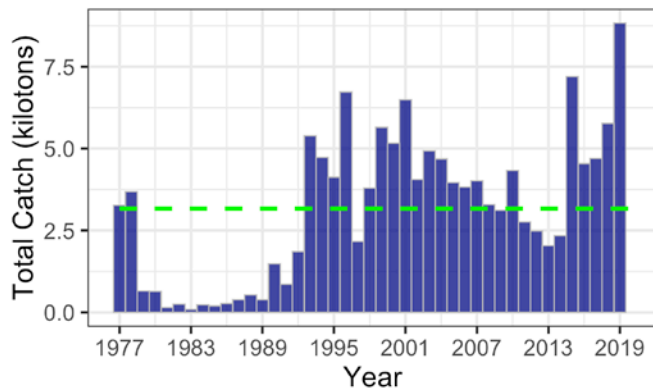
- New author: **no**; >1 model: **no**; change from base: **no**; risk>1: **n/a**
- Stock status: projected 2021 spawning biomass is 67% of $B_{100\%}$
- Catch/biomass time series (dashed line corresponds to $F_{40\%}$ ratio):



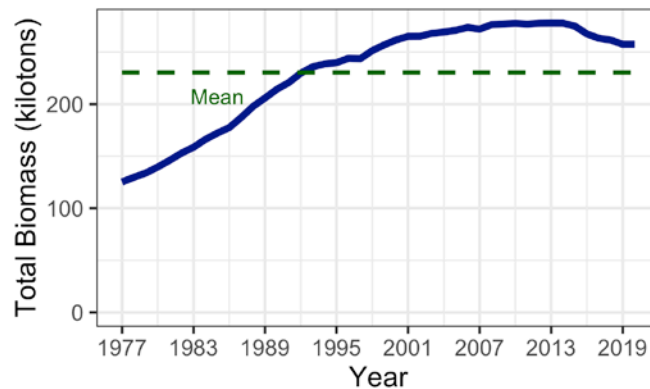


NORTHERN ROCKFISH SUMMARY

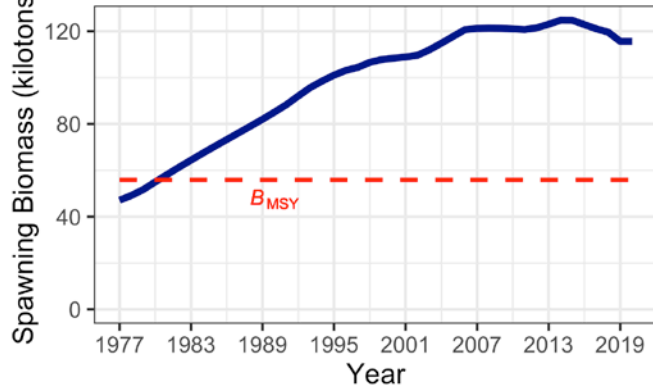
Total Catch



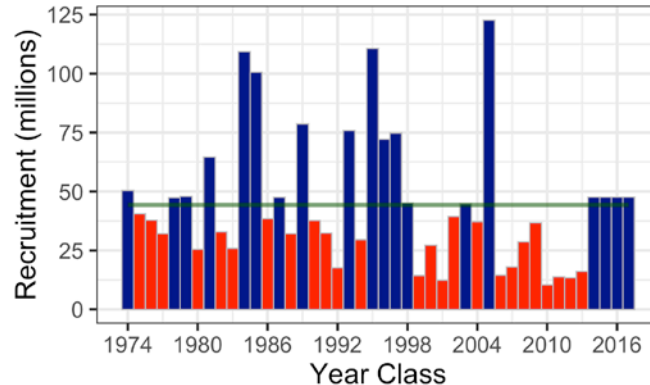
Total Biomass



Spawning Biomass



Age 3 Recruitment





NORTHERN ROCKFISH SUMMARY

- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.048	0.048	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	250,235	n/a	-0.02
2021 age+ biomass	246,384	244,600	-0.01
2020 spawning biomass	111,476	n/a	-0.04
2021 spawning biomass	108,063	107,003	-0.01
B100%	159,850	159,850	0.00
B40%	63,940	63,940	0.00
B35%	55,947	55,947	0.00
2021 FOFL	0.075	0.075	0.00
2021 FABC	0.061	0.061	0.00
2020 OFL	19,751	n/a	-0.04
2021 OFL	19,070	18,917	-0.01
2020 ABC	16,243	n/a	-0.04
2021 ABC	15,683	15,557	-0.01





CHAPTER 14: BLACKSPOTTED/ROUGHEYE ROCKFISH

- New author: **no**; >1 model: **yes**; change from base: **yes**; risk>1: **yes**
- New data:
 - 2018 AI survey age composition
 - 2018 and 2019 AI fishery size composition
 - Length-at-age, age-at-length matrix, weight-at-age updated
- Model changes/alternatives:
 - Model 18.1, the current base model
 - Model 20 (recommended), same as 18.1, but with additional updated data (ageing error, maturity) and use of Francis weighting
 - Model 20a, same as 20, but with McAllister-Ianelli weighting
 - Model 20b, same as 20, but with fishery sizecomps removed
 - Model 20c, same as 20a, but with fishery sizecomps removed





BLACKSPOTTED/ROUGHEYE ROCKFISH

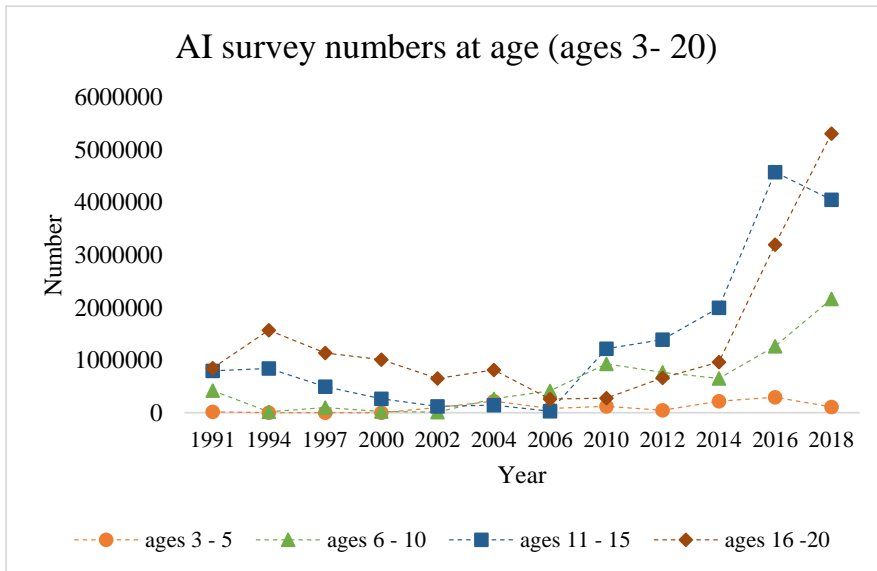
- Stock status/trend:
 - AI: projected 2021 spawning biomass is 38% of $B_{100\%}$
 - EBS: Slope survey shows upward trend through 2012
 - 2016 slope estimate may be unreliable (29% of stations failed)
- Mohn's $\rho = 0.30$ (compare to 0.55 from Model 18.1)
- Risk levels: **assess. = 3**, **pop. dy. = 2**, env./eco. = 1, **fishery = 2**
 - These will be summarized later in the presentation



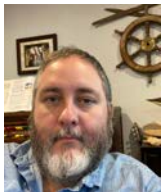
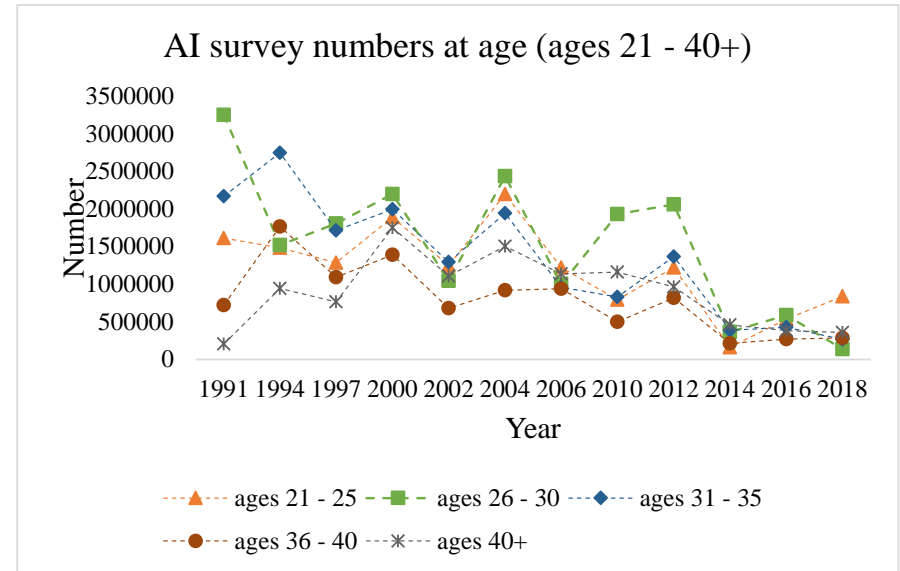


BLACKSPOTTED/ROUGHEYE ROCKFISH OLDER FISH DECLINE

Increasing numbers of young fish



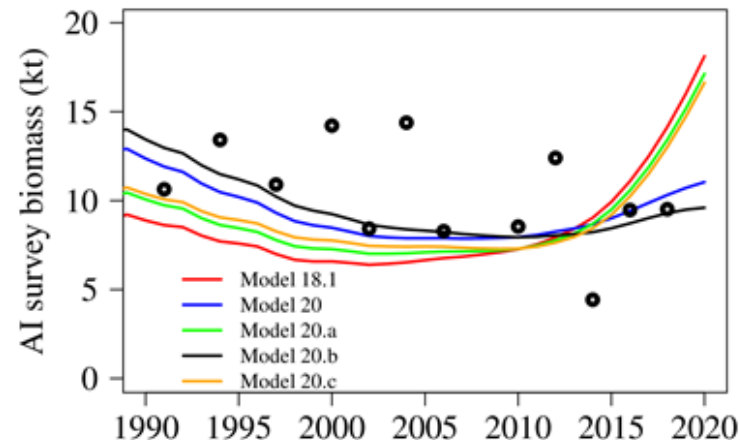
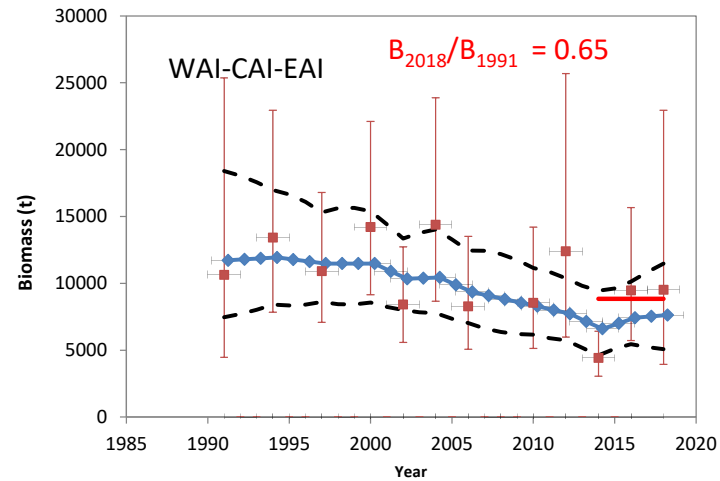
Decreasing numbers of older fish





BLACKSPOTTED/ROUGHEYE ROCKFISH DATA CONFLICT

- Data conflict
 - By themselves, index data suggest a biomass decrease
 - Tier 5 RE model fit
 - When compositional data are added, recent trend reverses
 - Note ABC implications
 - Models 20 and 20.b are the two that use Francis
 - These give better fits





BLACKSPOTTED/ROUGHEYE ROCKFISH DATA CONFLICT

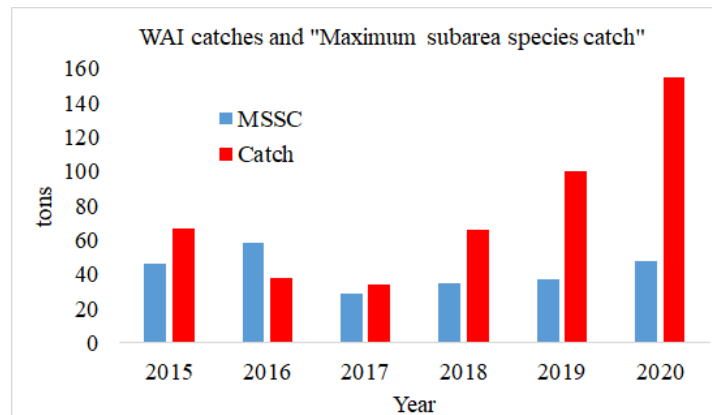
- Author recommends Model 20; compared to M18.1, it gives:
 - Decreased retrospective bias ($\rho=0.55$ in M18.1, $\rho=0.30$ in M20)
 - Decreased recruitment variability
 - Improved fit to AI survey index overall
 - Recent biomass trend more consistent with recent AI survey index
 - Greater stability in inter-assessment ABC advice
 - M18.1 projects dramatic increases, but these will likely later be shown to be high due to retrospective bias



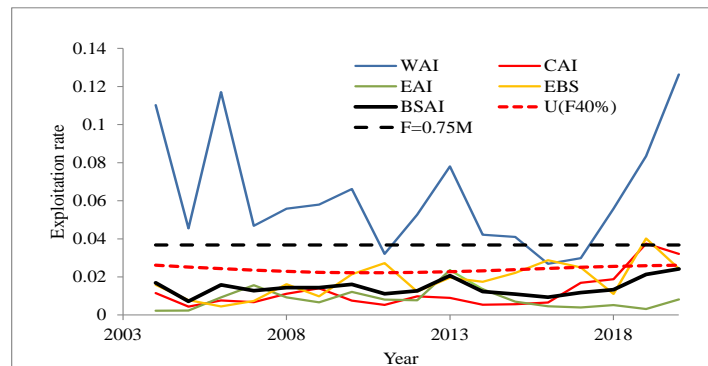


BLACKSPOTTED/ROUGHEYE ROCKFISH MSSC EXCEECEANCE

- Catches continue to exceed MSSC in WAI:



- In terms of exploitation rate:





BLACKSPOTTED/ROUGHEYE ROCKFISH RISK TABLE

- Assessment (Level 3):
 - Very poor fits to data (data conflict)
 - High level of uncertainty
 - Inability of model to explain decline in abundance of older fish
 - Highly constrained estimate of M
 - Strong retrospective bias
- Population dynamics (Level 2):
 - Abundance (particularly older fish) decreasing faster than usual
 - Unusual pattern of recent strong recruitments
 - Existing spatial management structure is inadequate





BLACKSPOTTED/ROUGHEYE ROCKFISH RISK TABLE

- Environmental/ecosystem (Level 1)
- Fishery performance (Level 2):
 - For a bycatch stock, fishery performance can be evaluated with respect to how well the target fishery can avoid bycatch
 - Fishery CPUE in the WAI is higher than would be expected based on the spatial distribution of survey biomass estimates
 - The WAI catches have consistently exceeded the MSSC, and these overages have increased over time
 - The catches in the WAI/CAI subarea have also exceeded the subarea ABC in 2019 and 2020
- Author does not recommend a reduction from maxABC





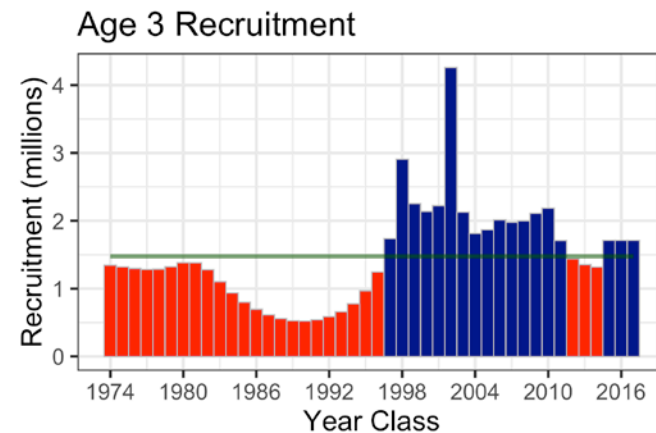
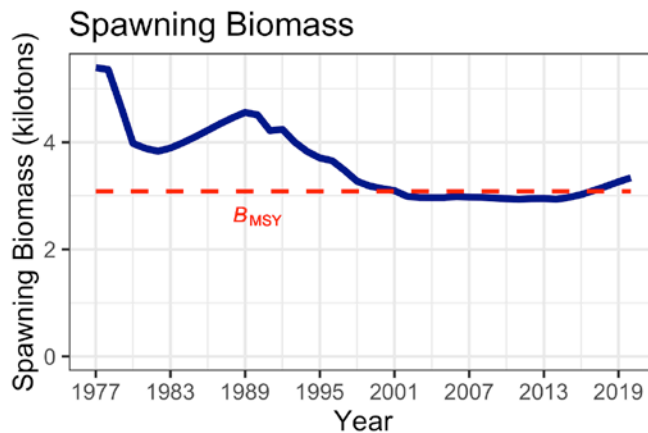
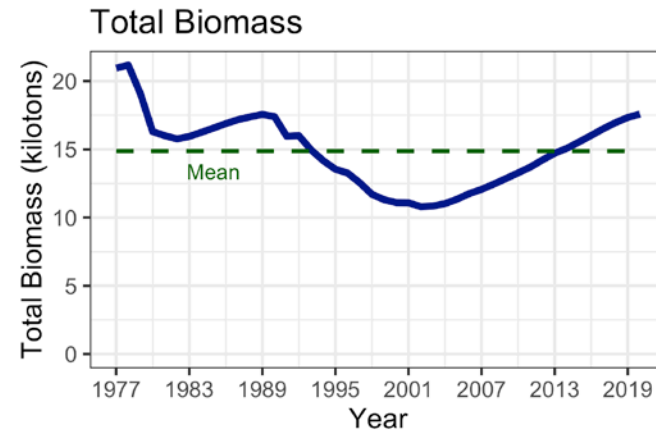
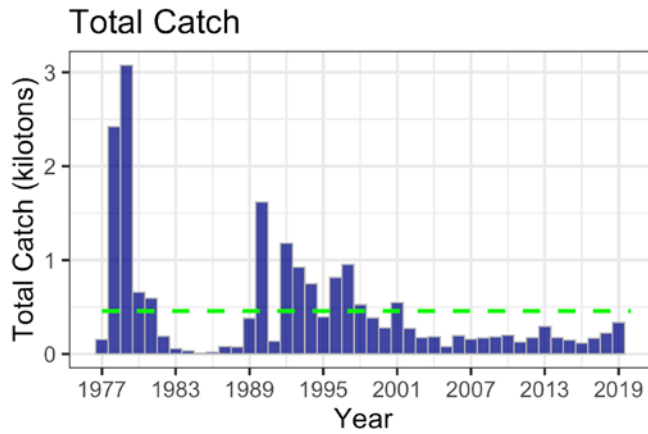
BLACKSPOTTED/ROUGHEYE ROCKFISH SUMMARY

- The Team requests guidance from the SSC and Council on how to reduce incidental catch in areas with disproportionate spatial exploitation because the MSSC tool has not provided enough protection.
- The Team recommends that the author assess the depth distribution of the survey samples to evaluate trends by depth, to help determine risk considerations and potentially help inform the industry on how to reduce incidental catch.





BLACKSPOTTED/ROUGHEYE ROCKFISH SUMMARY AI PORTION





BLACKSPOTTED/ROUGHEYE ROCKFISH SUMMARY

Quantity (AI portion)	Last asmt	This asmt	Change
M	0.032	0.049	0.53
2020 tier	3b	n/a	none
2021 tier	3b	3b	none
2020 age+ biomass	49,005	n/a	-0.64
2021 age+ biomass	51,451	17,632	-0.66
2020 spawning biomass	10,213	n/a	-0.67
2021 spawning biomass	11,551	3,372	-0.71
B100%	29,287	8,811	-0.70
B40%	11,715	3,524	-0.70
B35%	10,250	3,083	-0.70
2021 FOFL	0.047	0.038	-0.19
2021 FABC	0.039	0.032	-0.18
2020 OFL	817	n/a	-0.38
2021 OFL	1,046	509	-0.51
2020 ABC	675	n/a	-0.36
2021 ABC	866	432	-0.50

* Note that the WAI MSSC was exceeded again in 2020





BLACKSPOTTED/ROUGHEYE ROCKFISH SUMMARY

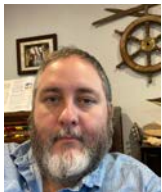
Quantity (EBS portion)	Last asmt.	This asmt.	Change
M	0.032	0.049	0.53
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	1,371	1,371	0.00
2021 FOFL	0.032	0.049	0.53
2021 FABC	0.024	0.037	0.54
2020 OFL	44	n/a	0.53
2021 OFL	44	67	0.53
2020 ABC	33	n/a	0.53
2021 ABC	33	50	0.53





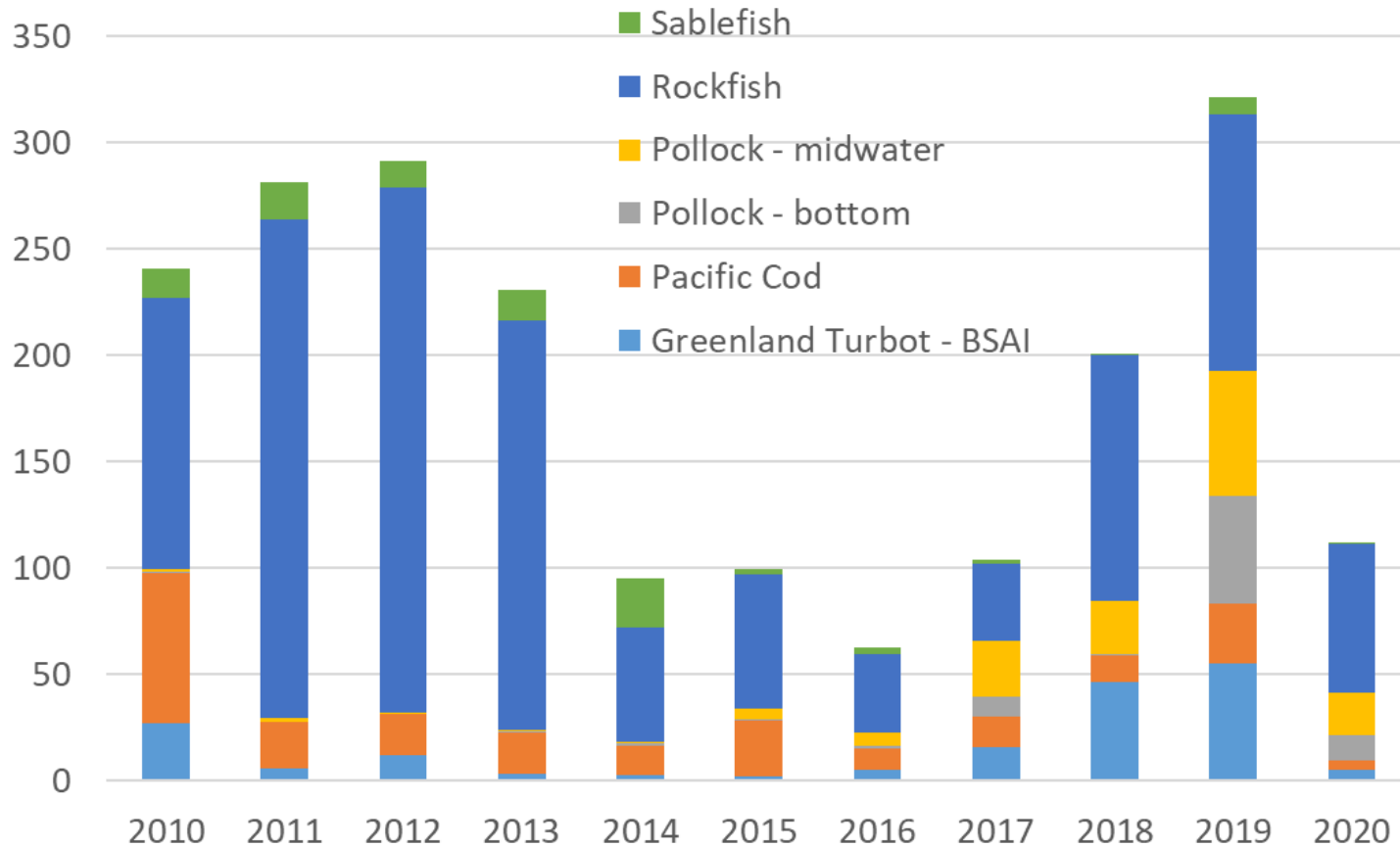
CHAPTER 15: SHORTRAKER ROCKFISH

- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data: none
- Model changes/alternatives: none (Tier 5 RE model)
- Stock trend:
 - Aggregate is very stable since 2002 (low = 20,932 t, high = 24,055 t)
 - Although subareas of AI, EBS slope show variability (with large CVs)





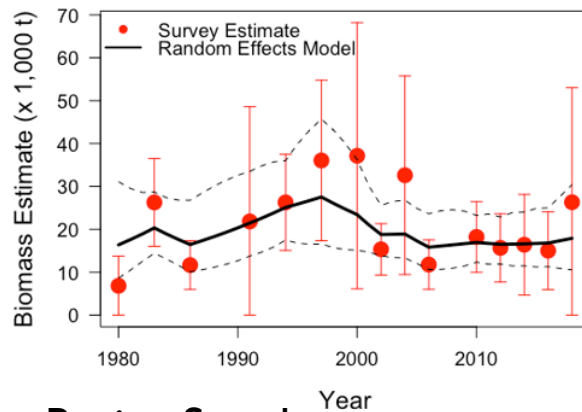
SHORTRAKER ROCKFISH CATCH TIME SERIES (TARGET FISHERY)



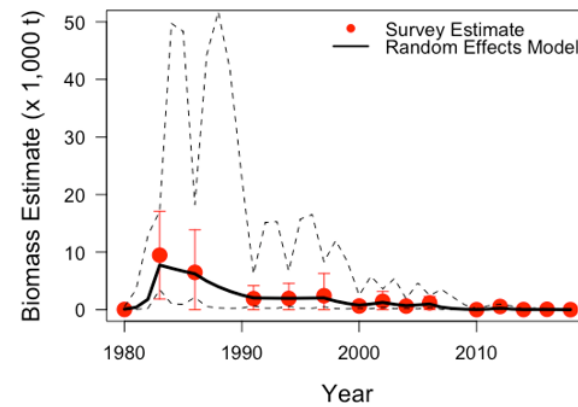


SHORTRAKER ROCKFISH SURVEY BIOMASS TIME SERIES

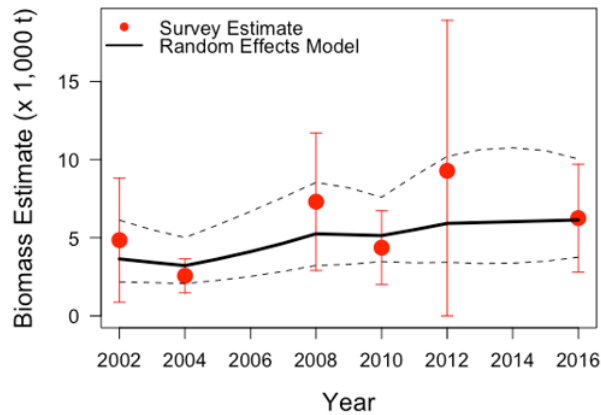
Aleutian Islands



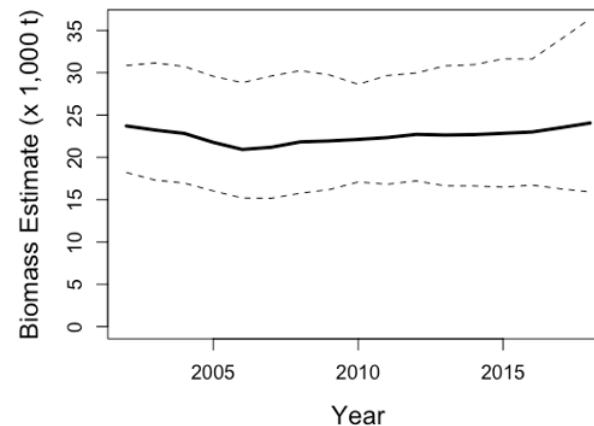
Southern Bering Sea



Bering Sea slope



BSAI total



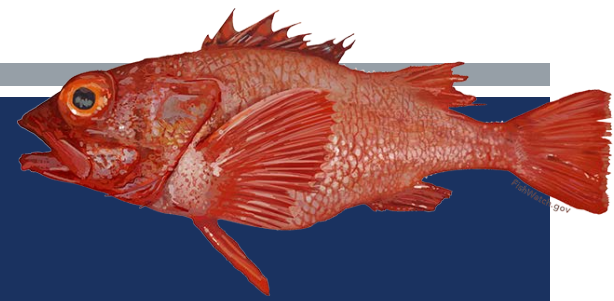


SHORTRAKER ROCKFISH SUMMARY

- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.030	0.030	0.00
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	24,055	24,055	0.00
2021 FOFL	0.030	0.030	0.00
2021 FABC	0.0225	0.0225	0.00
2020 OFL	722	n/a	0.00
2021 OFL	722	722	0.00
2020 ABC	541	n/a	0.00
2021 ABC	541	541	0.00



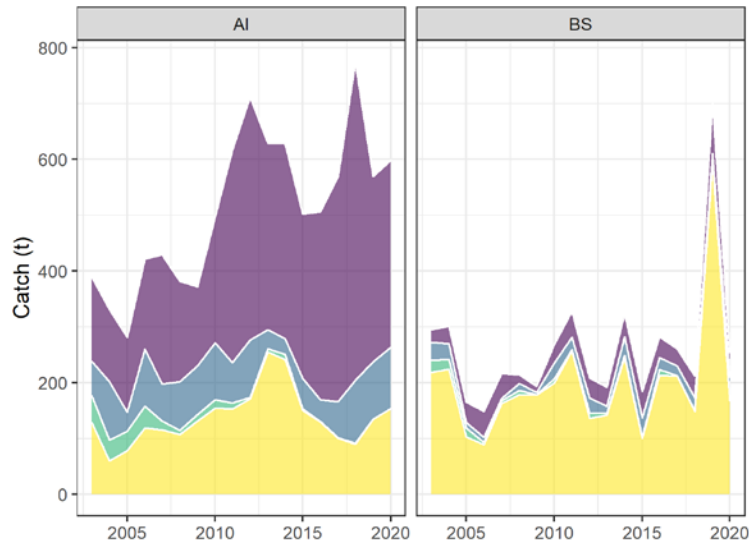
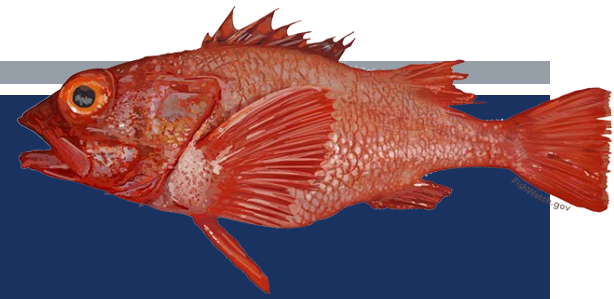


CHAPTER 16: OTHER ROCKFISH

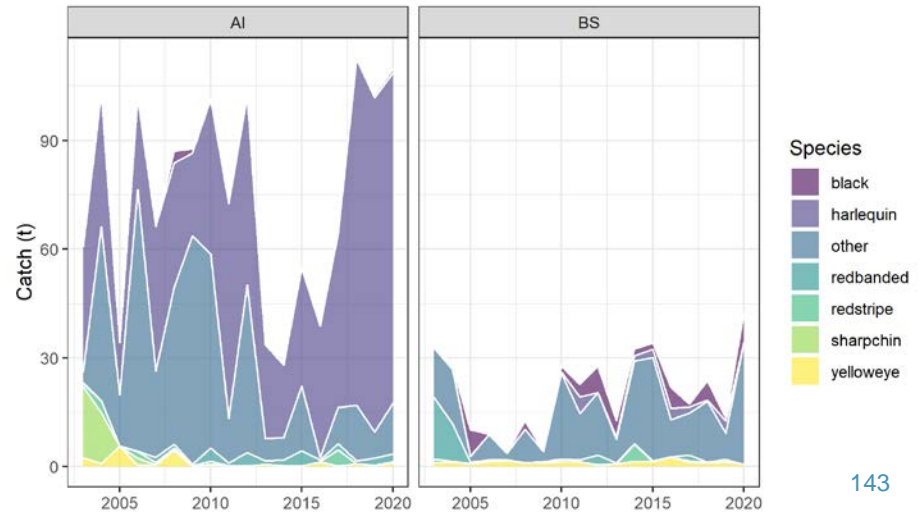
- New author: **yes**; >1 model: **no**; change from base: **no**; risk>1: **yes**
- New data:
- Model changes/alternatives: none (Tier 5 RE model)
- Stock trend:
- Risk levels: **assess. = 2**, pop. dy. = 1, env./eco. = 1, fishery = 1
 - SST comprises 95% of the total biomass and the RE model fits the data well, but the area (EBS slope) with the largest SST biomass has not been surveyed since 2016
 - Use of the RE model for the non-SST species is problematic in that the data include many zero (or close to zero) values with very tight CIs, interspersed with high values accompanied by very large CIs
 - Catch often exceeds biomass, or at least tacit ABCs and OFLs, for non-SST species, casting doubt on the reliability of those estimates

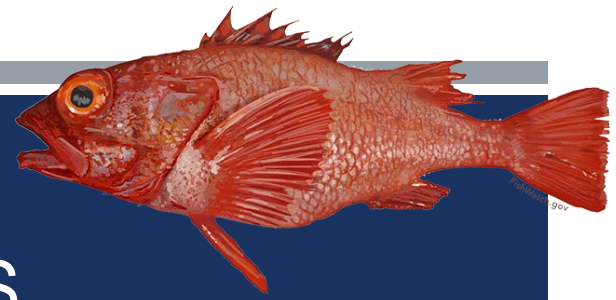


OTHER ROCKFISH CATCH TIME SERIES



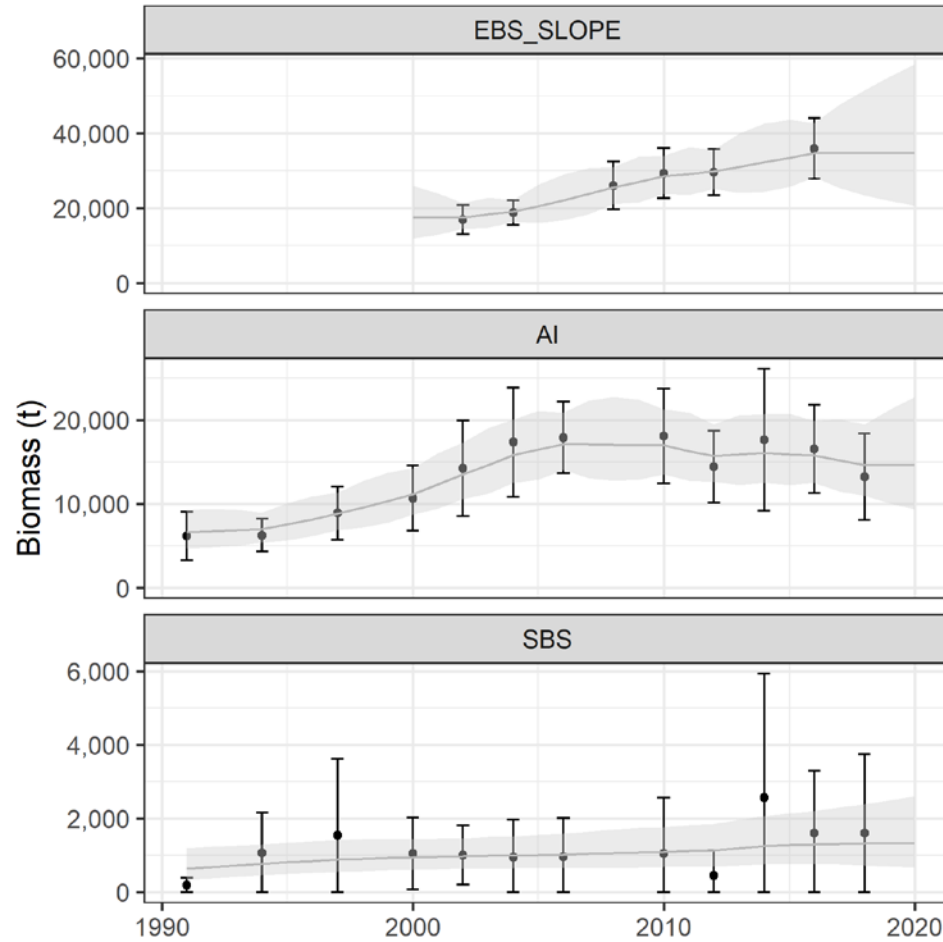
The other, other rockfish



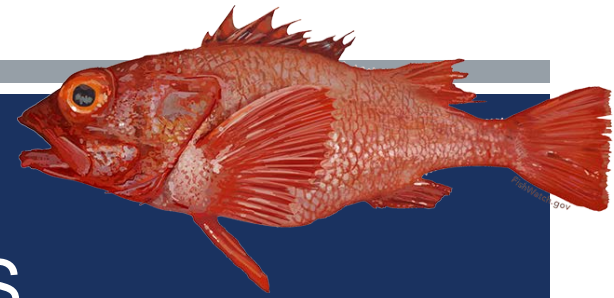


OTHER ROCKFISH SURVEY BIOMASS TIME SERIES

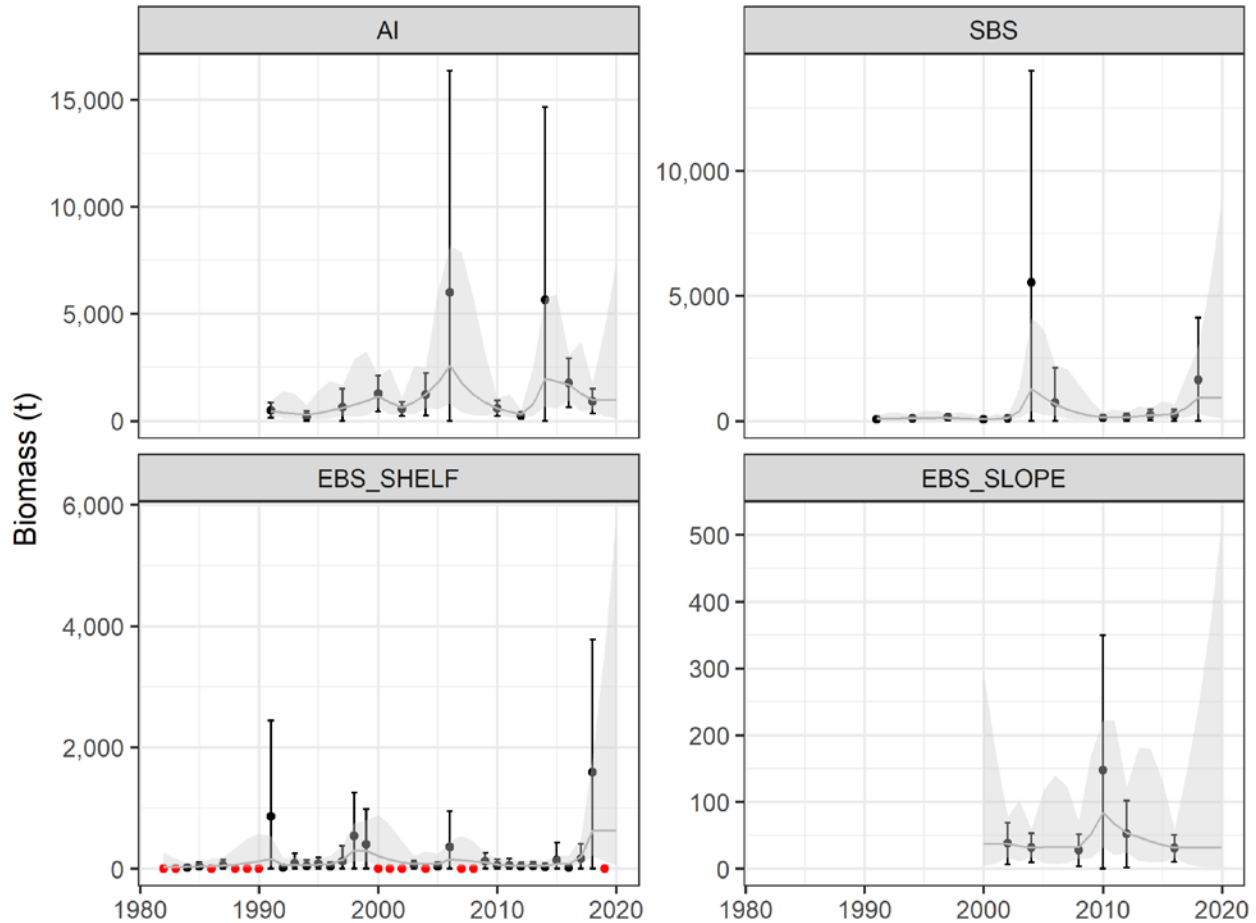
Shortspine thornyhead

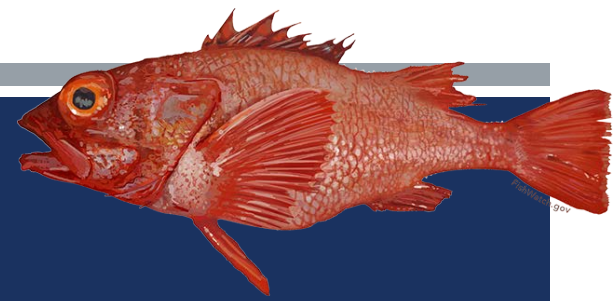


OTHER ROCKFISH SURVEY BIOMASS TIME SERIES



Other rockfish besides shortspined thornyhead



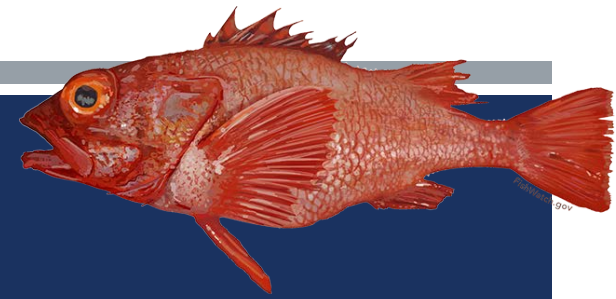


OTHER ROCKFISH SUMMARY

- The Team recommends that the author pursue the planned work in collaboration with other authors to consider issues with the Tier 5 model process for stocks with variable, and at times sparse or missing, survey observations. Specifically, the manner in which biomass estimates of 0 are handled (i.e., currently ignored) should be revisited.
- The Team recommends that the author consult with other rockfish assessment authors to consider revising M for the non-SST portion of the population in future assessments, noting that recent assessments reported to have based the $M=0.09$ assumption on GOA dusky rockfish, when in fact $M=0.07$ has been the GOA dusky rockfish value used since 2006.
- The Team recommends that the author do more spatial analysis of AI catch of non-SST rockfish. The Team recommends the author explore the locations, depths, seasons, the encounter rates and concentration of catch (i.e., frequent constant bycatch rates or a smaller number of highly concentrated hauls).



OTHER ROCKFISH SUMMARY



Quantity*	Last asmt.	This asmt.	Change
M	0.034	0.033	-0.02
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	53,290	53,248	0.00
2021 FOFL	0.034	0.033	-0.02
2021 FABC	0.025	0.025	-0.02
2020 OFL	1,793	n/a	-0.02
2021 OFL	1,793	1,751	-0.02
2020 ABC	1,344	n/a	-0.02
2021 ABC	1,344	1,313	-0.02

*Instantaneous rates are biomass-weighted averages



CHAPTER 17: ATKA MACKEREL



- New author: **no**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data: 2019 fishery age composition
- Model changes/alternatives: none (Model 16.0b)
- Stock status: projected 2021 spawning biomass is 37% of $B_{100\%}$
- Mohn's $\rho = 0.05$





ATKA MACKEREL SUMMARY

- Except for the 2016 and 2017 assessments, when area apportionments were based on the Tier 5 RE model, apportionments of Atka mackerel since the 2001 assessment have been based on a 4-survey weighted average, with weights of 8:12:18:27
- Because no AI surveys have been conducted since 2018, the relative apportionments remain the same as in 2018 and 2019

**4-Survey Weighted Average
(Recommended)**

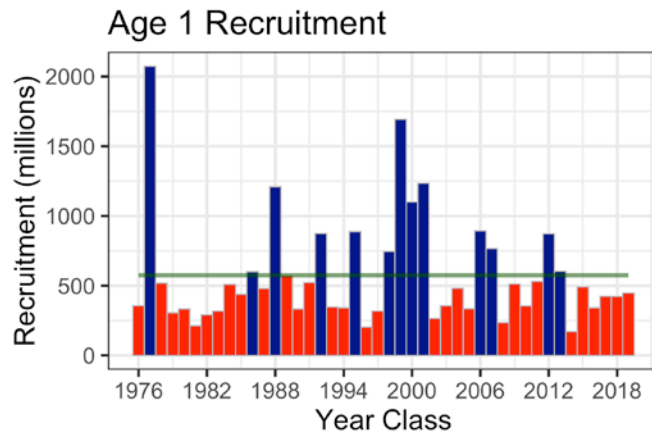
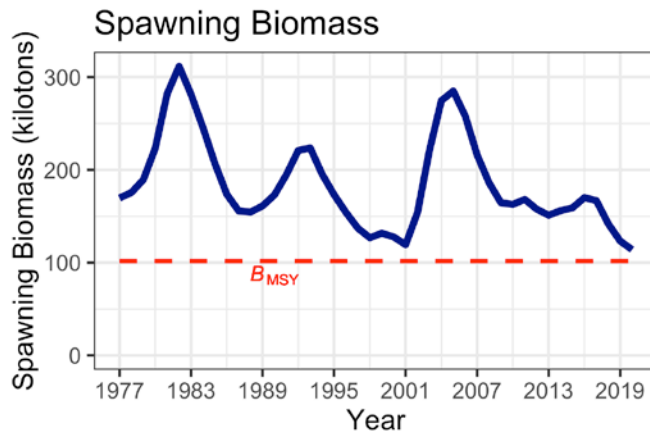
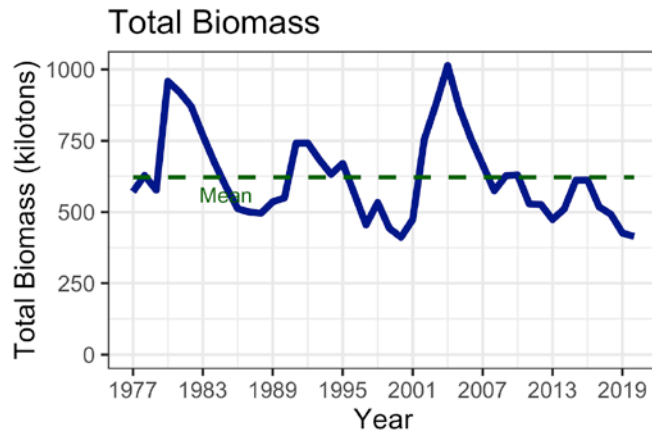
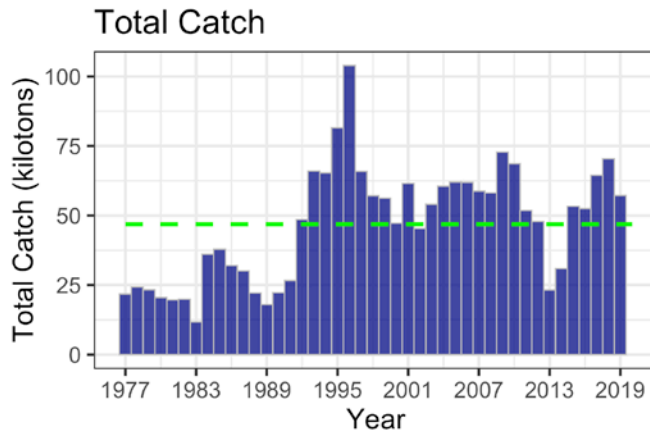
	Survey Year				2021 & 2022 Apportionment	2021 ABC	2022 ABC
	2012	2014	2016	2018			
541+SBS	12%	42%	35%	38%	0.35	25,760	23,880
542	39%	28%	30%	7%	0.21	15,450	14,330
543	48%	30%	35%	55%	0.44	32,380	30,010
Weights	8	12	18	27	1.00		
Total ABC						73,590	68,220

■ Other:

- During discussion, it was noted that the fishery was somewhat different this year, with additional catch early in the season due to low demand for yellowfin sole and the fleet switching to Atka Mackerel in the spring



ATKA MACKEREL SUMMARY



ATKA MACKEREL SUMMARY

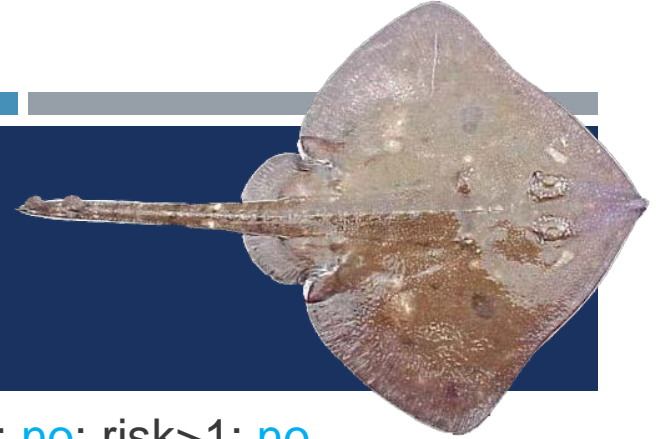


- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
M	0.30	0.30	0.00
2020 tier	3b	n/a	none
2021 tier	3b	3b	none
2020 age+ biomass	515,890	n/a	0.09
2021 age+ biomass	534,220	560,360	0.05
2020 spawning biomass	109,900	n/a	-0.02
2021 spawning biomass	104,700	107,830	0.03
B100%	291,780	290,820	0.00
B40%	116,600	116,330	0.00
B35%	102,020	101,790	0.00
2021 FOFL	0.46	0.51	0.11
2021 FABC	0.39	0.43	0.10
2020 OFL	81,200	n/a	0.05
2021 OFL	74,800	85,580	0.14
2020 ABC	70,100	n/a	0.05
2021 ABC	64,400	73,590	0.14



CHAPTER 18: SKATES

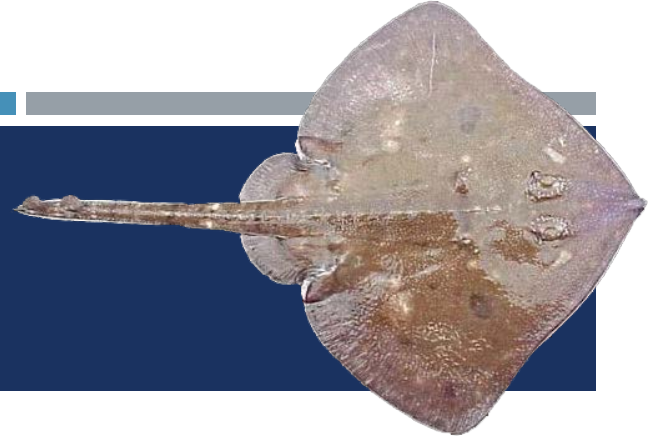


- New author: no; >1 model: no*; change from base: no; risk>1: no
- New data:
 - 2019 EBS shelf survey biomass
 - 2019 EBS shelf survey size composition
 - 2019 fishery size composition
- Model changes/alternatives: none (AK skate = M14.2, other = Tier 5)
- Stock status (AK skate): 2021 spawning biomass is 69% of $B_{100\%}$
- Stock trend (other): shelf = increasing, slope = variable, AI = declining
- Mohn's $\rho = 0.14$ (AK skate)

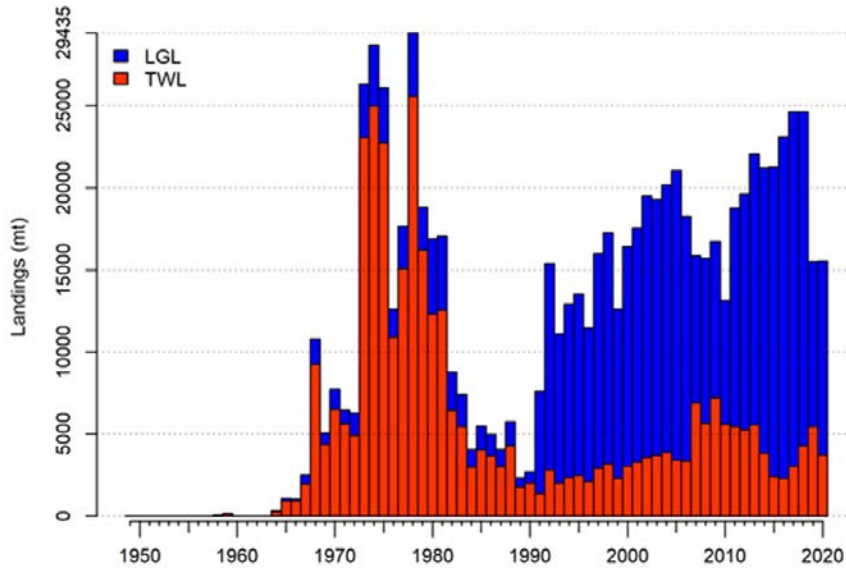


SKATES

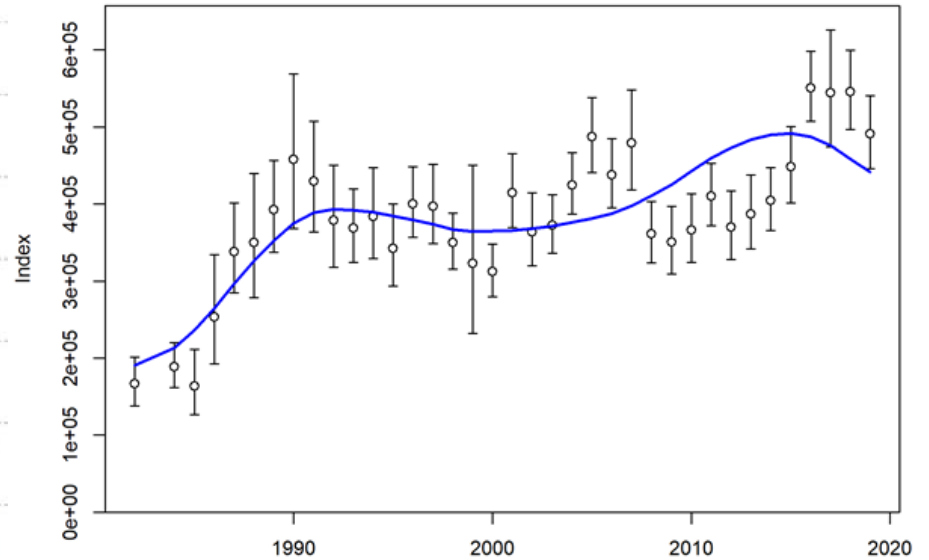
ALASKA SKATE



Catch time series

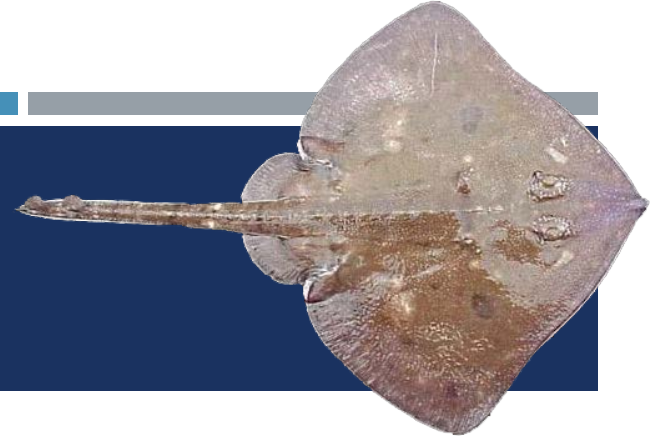


Fit to EBS shelf survey biomass data

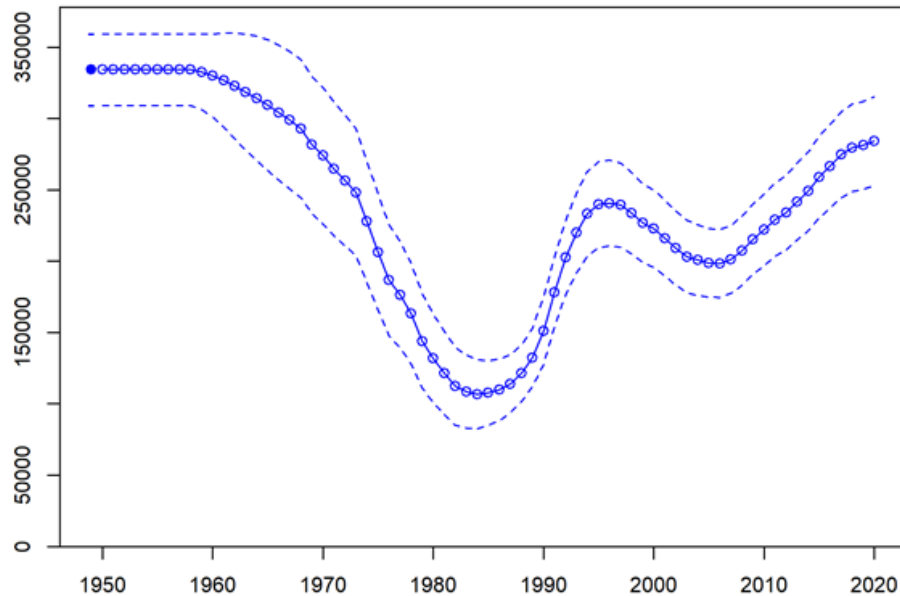


SKATES

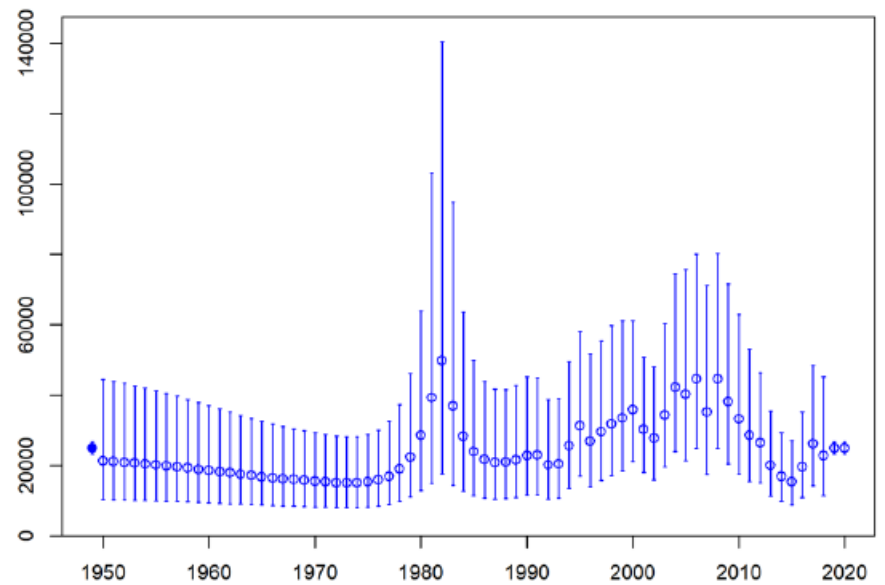
ALASKA SKATE



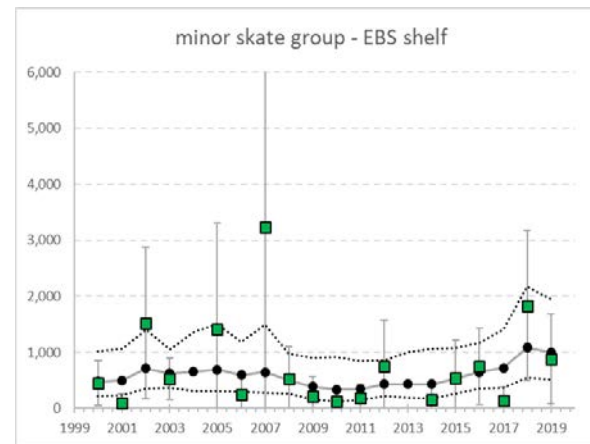
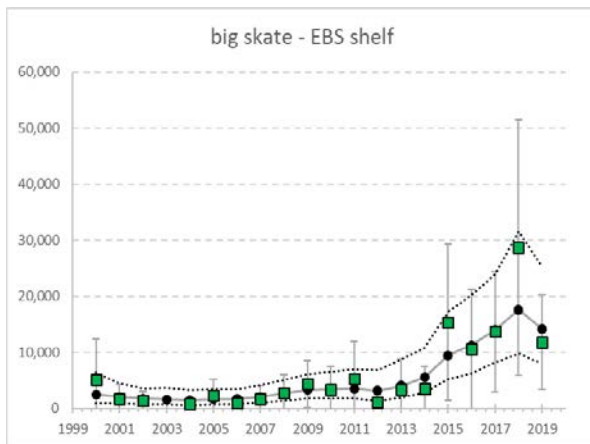
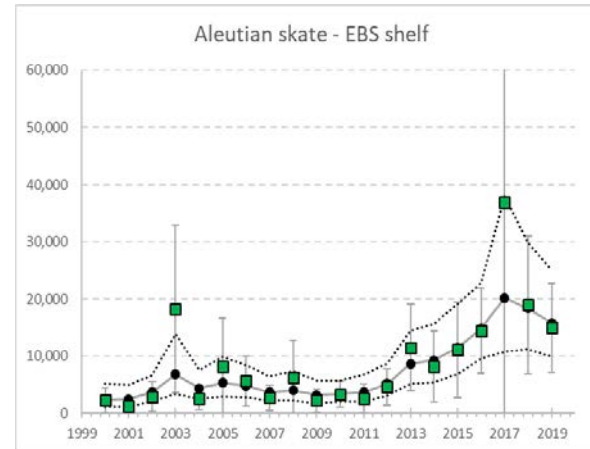
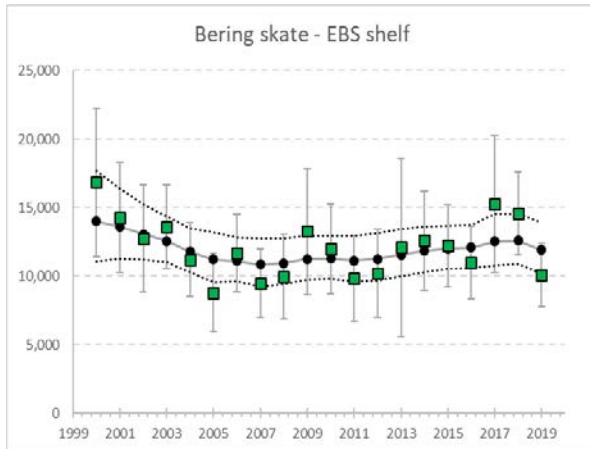
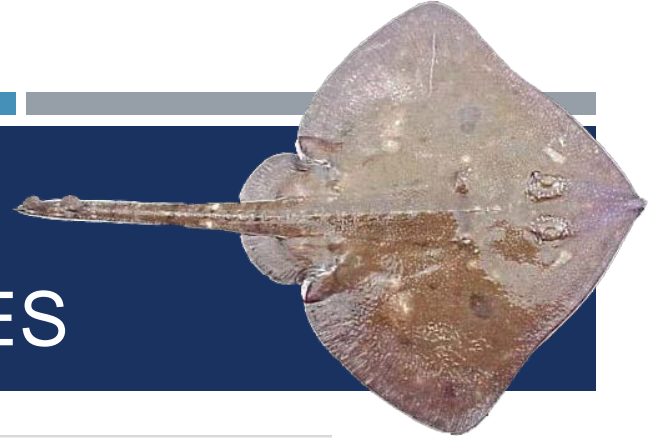
Spawning biomass time series



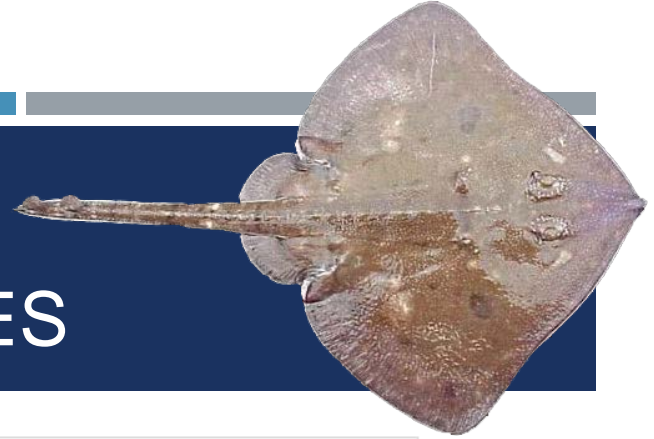
Age 0 recruitment time series



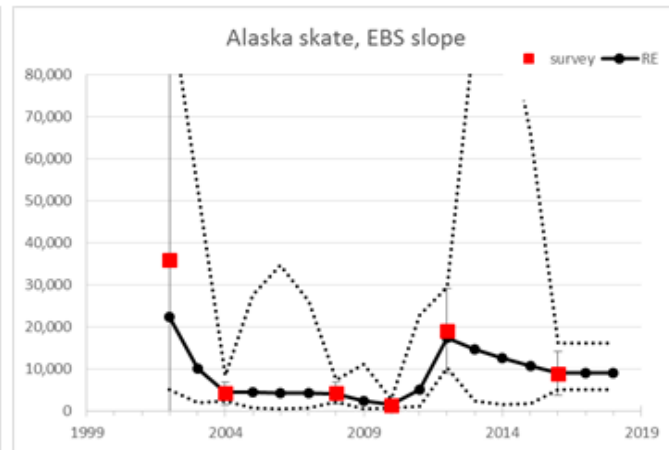
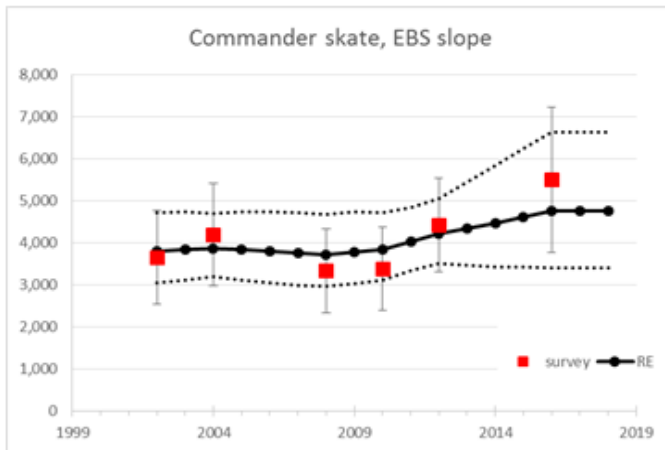
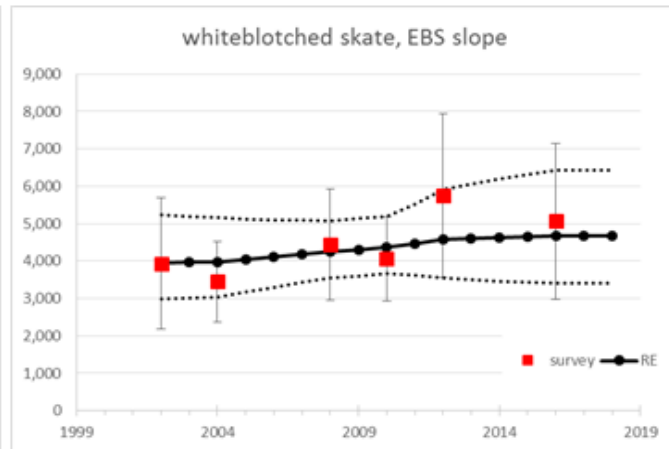
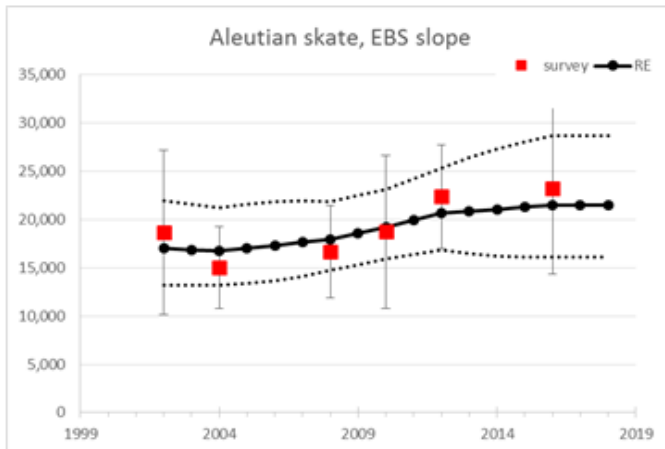
SKATES SURVEY BIOMASS TIME SERIES



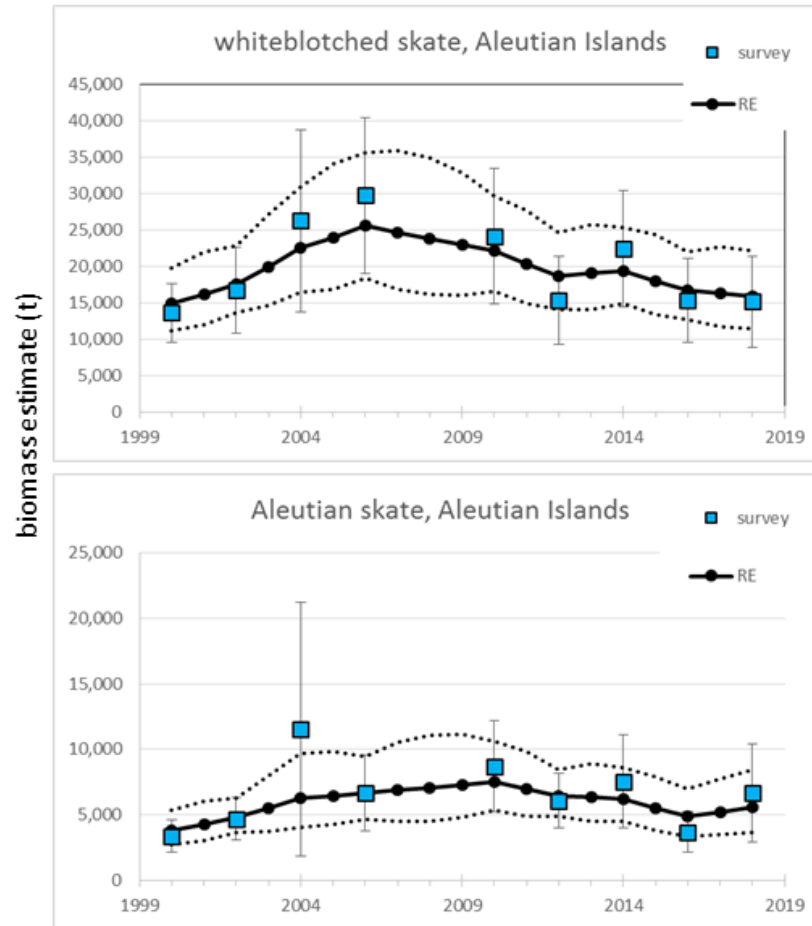
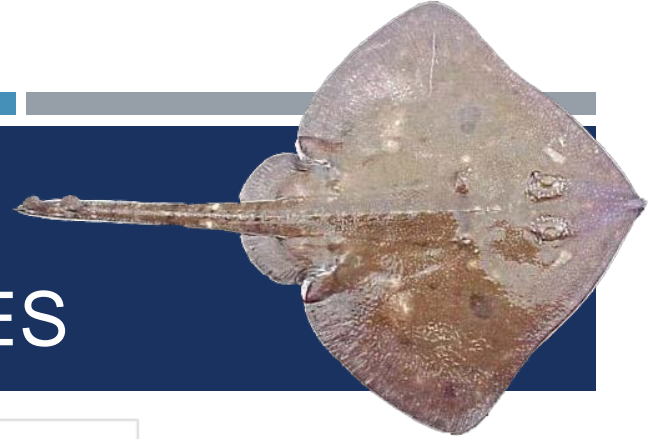
SKATES SURVEY BIOMASS TIME SERIES



biomass estimate (t)

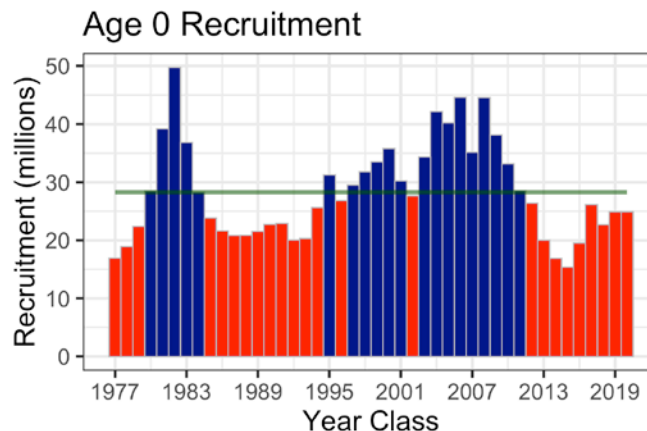
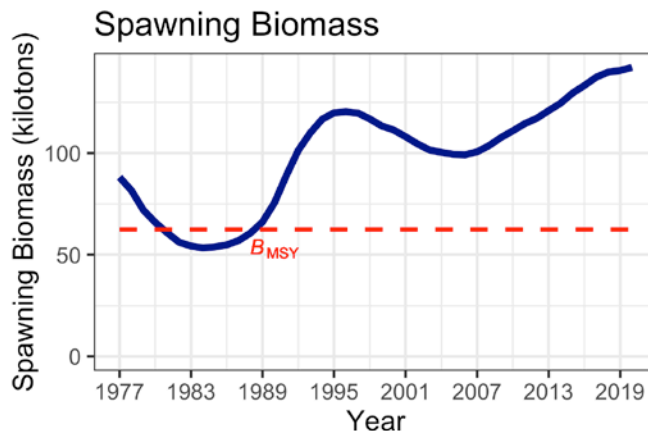
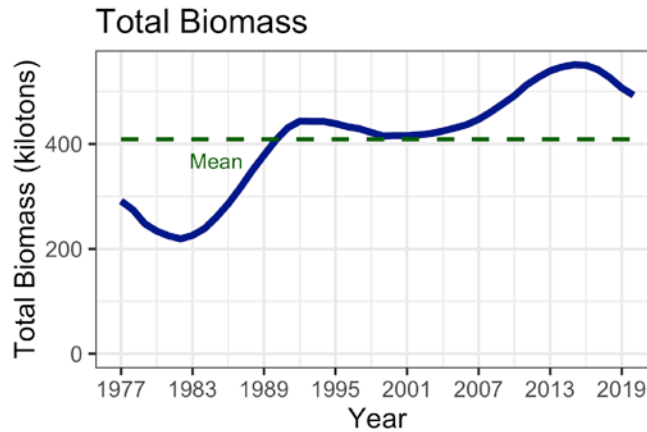
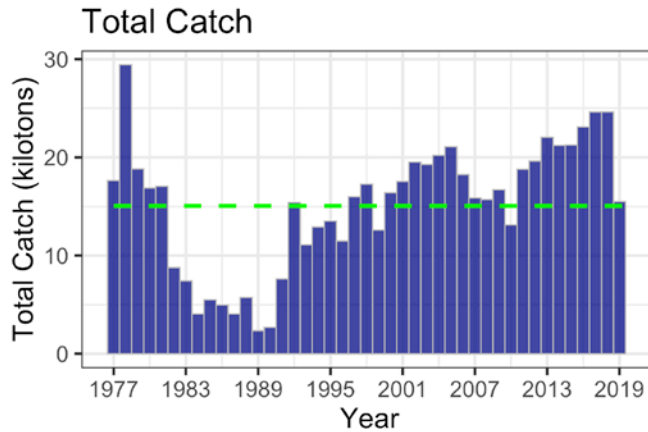
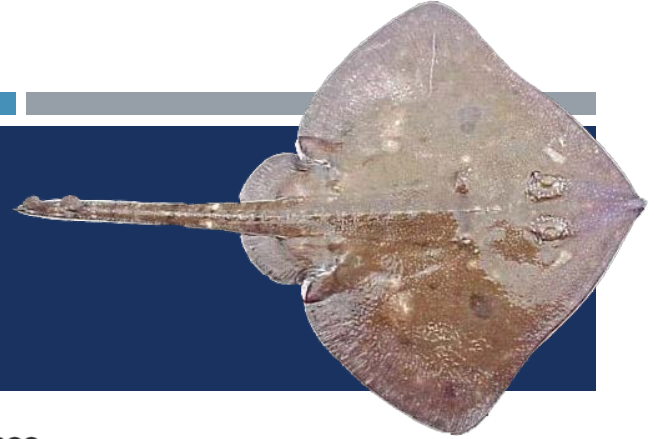


SKATES SURVEY BIOMASS TIME SERIES



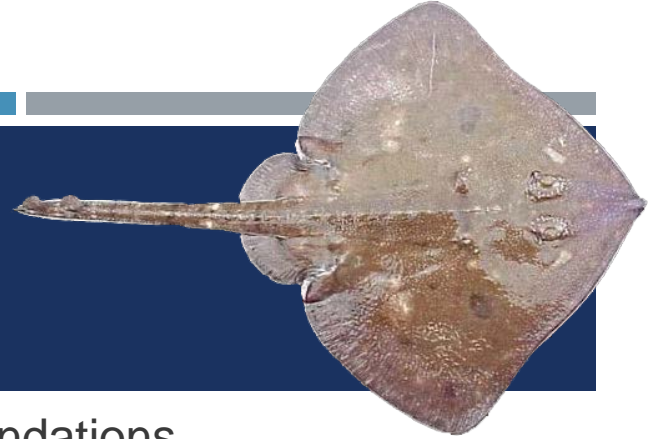
SKATES

ALASKA SKATE - SUMMARY



SKATES

ALASKA SKATE - SUMMARY



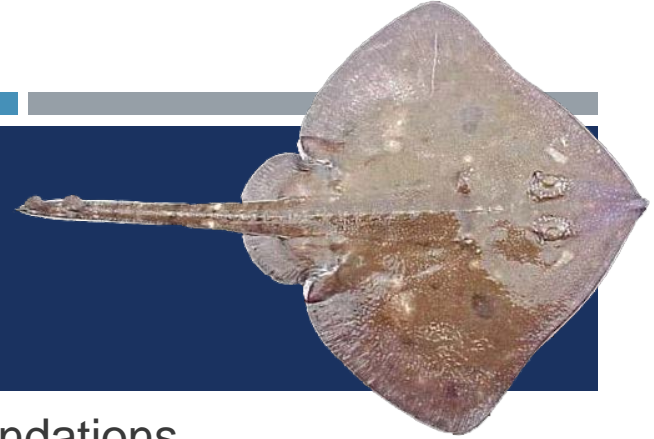
- The Team agreed with all of the authors' recommendations

Quantity (Alaska skate)	Last asmt.	This asmt.	Change
M	0.13	0.13	0.00
2020 tier	3a	n/a	none
2021 tier	3a	3a	none
2020 age+ biomass	491,974	n/a	0.03
2021 age+ biomass	478,477	504,691	0.05
2020 spawning biomass	117,973	n/a	0.05
2021 spawning biomass	114,985	123,390	0.07
B100%	177,761	178,425	0.00
B40%	71,105	71,370	0.00
B35%	62,217	62,449	0.00
2021 FOFL	0.094	0.092	-0.02
2021 FABC	0.081	0.079	-0.02
2020 OFL	37,813	n/a	0.02
2021 OFL	36,310	38,580	0.06
2020 ABC	32,559	n/a	0.02
2021 ABC	31,264	33,219	0.06



SKATES

OTHER SKATE - SUMMARY



- The Team agreed with all of the authors' recommendations

Quantity (other skates)	Last asmt.	This asmt.	Change
M	0.10	0.10	0.00
2020 tier	5	n/a	none
2021 tier	5	5	none
Biomass	119,787	107,174	-0.11
2021 FOFL	0.10	0.10	0.00
2021 FABC	0.075	0.075	0.00
2020 OFL	11,979	n/a	-0.11
2021 OFL	11,979	10,717	-0.11
2020 ABC	8,984	n/a	-0.11
2021 ABC	8,984	8,038	-0.11



CHAPTER 19: SHARKS



- New author: **no**; >1 model: **yes**; change from base: **no**; risk>1: **yes**
- New data:
 - IPHC longline survey RPN updated through 2019
 - EBS shelf trawl survey biomass updated through 2019
- Model changes/alternatives (all Tier 6):
 - Model 16.0, the current base method (max. catch 2003-2015)
 - Model 20.0, median catch 2003-2015
 - Model 20.1, 5th catch percentile 2003-2015
 - Model 20.2, 99th catch percentile 2003-2015
- Stock trend: difficult to quantify
- Risk levels: **assess. = 2**, **pop. dy. = 2**, env./eco. = 1, fishery = 1



SHARKS RISK TABLE



- Assessment considerations (Level 2):
 - As a Tier 6 complex data are severely limited, and the assessment does not incorporate life history or any other biological information in the OFL/ABC calculations
 - For non-targeted, low value (i.e., discarded) species, a catch-scalar approach may suffice if the species is sufficiently productive to be sustainably harvested at that rate
 - For Pacific sleeper sharks, it is unclear how productive the species is, and indications are that it is highly vulnerable to overfishing
 - There are concerns over the accuracy of the catch estimates due to the difficulty in sampling such large species



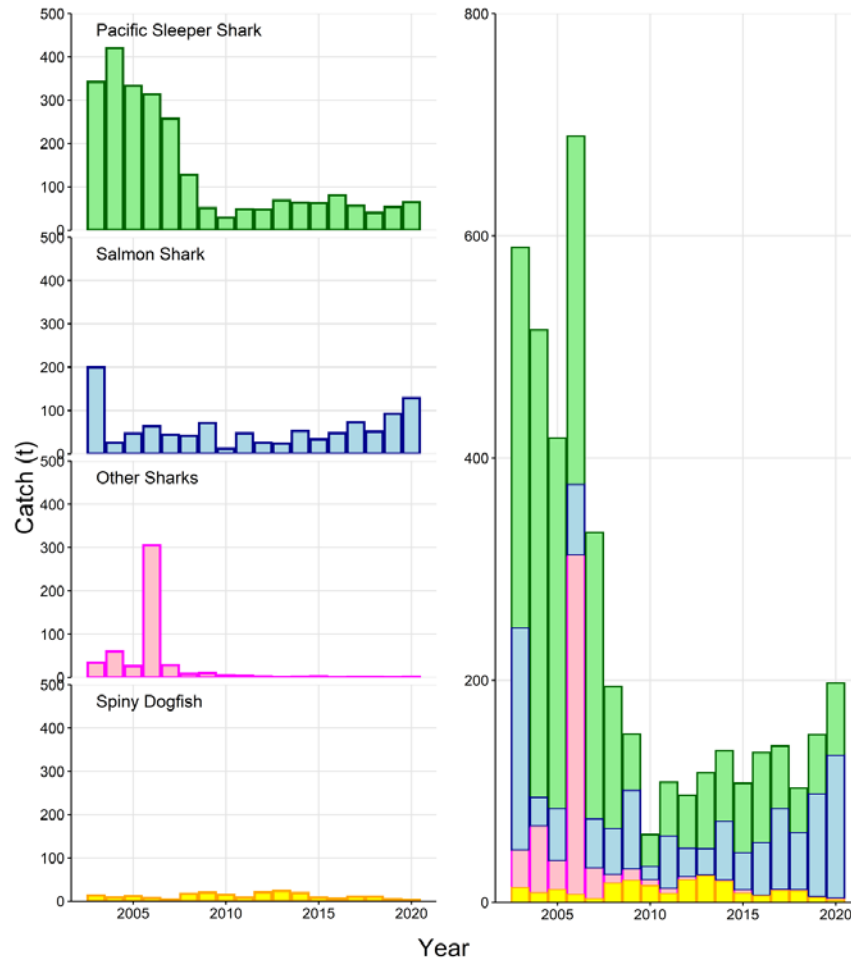
SHARKS RISK TABLE



- Population dynamics considerations (Level 2):
 - The only informative indicator of stock trends is the IPHC longline survey RPNs
 - The index is not included in considerations of OFL within this assessment
 - The Pacific sleeper shark RPNs declined from their peak at the beginning of the time series and have remained low since 2004
 - This trend is mirrored in other regions (e.g., GOA, Canada and U.S. West Coast) of the IPHC survey and in other surveys, such as the ADF&G Southeast Alaska longline survey
 - It is unclear if the peak at the beginning of the time series was unusual, or if the current low state reflects low population sizes



SHARKS CATCH TIME SERIES



CHAPTER 19: SHARKS

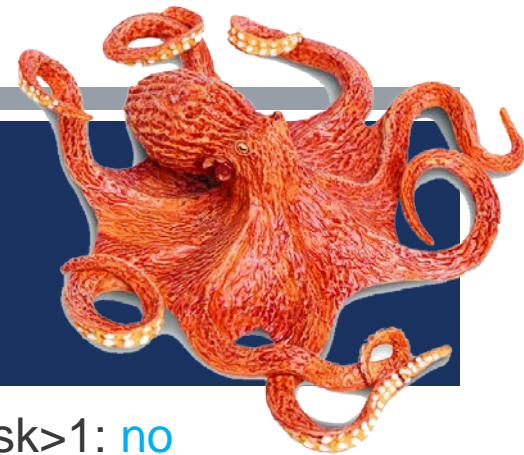


- New author: **no**; >1 model: **yes**; change from base: **no**; risk>1: **yes**
- Tier 6: No new data
- The Team agreed with all of the authors' recommendations

Quantity	Last asmt.	This asmt.	Change
2020 tier	6	n/a	none
2021 tier	6	6	none
2020 OFL	689	n/a	0.00
2021 OFL	689	689	0.00
2020 ABC	517	n/a	0.00
2021 ABC	517	517	0.00



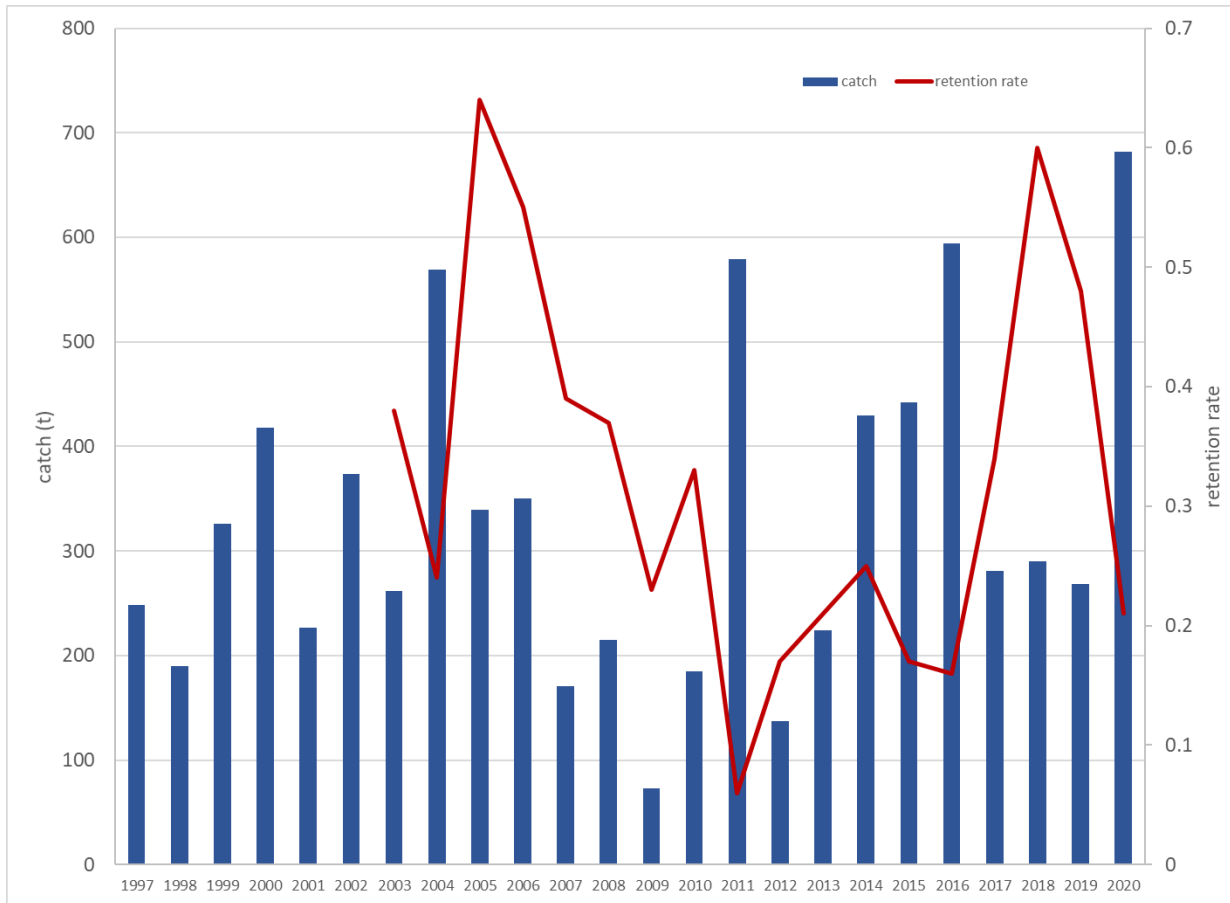
CHAPTER 22: OCTOPUS



- New author: **no**; >1 model: **no**; change from base: **no**; risk>1: **no**
- New data: None
- Model changes/alternative: none (Tier 6)
- Stock trend: unknown
- The Team agreed with all of the authors' recommendations



OCTOPUS CATCH



OCTOPUS SUMMARY



Quantity	Last asmt.	This asmt.	Change
2020 tier	6	n/a	none
2021 tier	6	6	none
2020 OFL	4,769	n/a	0.00
2021 OFL	4,769	4,769	0.00
2020 ABC	3,576	n/a	0.00
2021 ABC	3,576	3,576	0.00





QUESTIONS?

