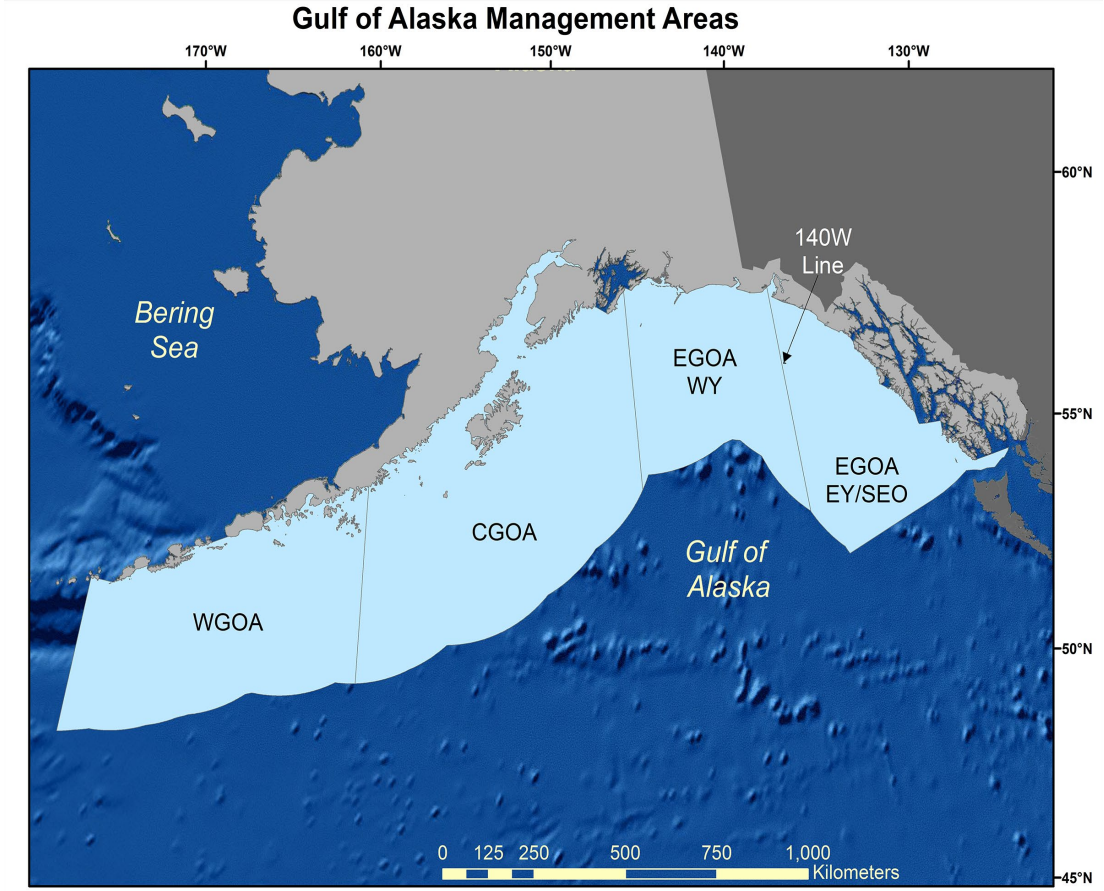
Gulf of Alaska Other Rockfish stock complex updates

Kristen Omori, Chris Lunsford, and Cindy Tribuzio

September, 2023

NOAA FISHERIES

GOA Other Rockfish stock complex background



WGOA & CGOA	EGOA: W Yakutat	EGOA: Southeast
Aurora Rockfish	Aurora Rockfish	Aurora Rockfish
Blackgill Rockfish	Blackgill Rockfish	Blackgill Rockfish
Bocaccio	Bocaccio	Bocaccio
Canary Rockfish	Canary Rockfish	
Chilipepper Rockfish	Chilipepper Rockfish	Chilipepper Rockfish
China Rockfish	China Rockfish	
Copper Rockfish	Copper Rockfish	
Darkblotched Rockfish	Darkblotched Rockfish	Darkblotched Rockfish
Greenstriped Rockfish	Greenstriped Rockfish	Greenstriped Rockfish
Harlequin Rockfish	Harlequin Rockfish	Harlequin Rockfish
	Northern Rockfish	Northern Rockfish
Pygmy Rockfish	Pygmy Rockfish	Pygmy Rockfish
Quillback Rockfish	Quillback Rockfish	
Redbanded Rockfish	Redbanded Rockfish	Redbanded Rockfish
Redstripe Rockfish	Redstripe Rockfish	Redstripe Rockfish
Rosethorn Rockfish	Rosethorn Rockfish	
Sharpchin Rockfish	Sharpchin Rockfish	Sharpchin Rockfish
Shortbelly Rockfish	Shortbelly Rockfish	Shortbelly Rockfish
Silvergray Rockfish	Silvergray Rockfish	Silvergray Rockfish
Splitnose Rockfish	Splitnose Rockfish	Splitnose Rockfish
Stripetail Rockfish	Stripetail Rockfish	Stripetail Rockfish
Tiger Rockfish	Tiger Rockfish	
Vermillion Rockfish	Vermillion Rockfish	Vermillion Rockfish
Widow Rockfish	Widow Rockfish	Widow Rockfish
Yelloweye Rockfish	Yelloweye Rockfish	
Yellowmouth Rockfish	Yellowmouth Rockfish	Yellowmouth Rockfish
Yellowtail Rockfish	Yellowtail Rockfish	Yellowtail Rockfish

GOA Other Rockfish stock complex background

Tiers (total 27 species)	Data Input	Assessment method	OFL method
Tier 4: 1 species	GOA bottom trawl survey	RE/ REMA	Biomass x $F_{35\%}$
Tier 5: 17 species	GOA bottom trawl survey	RE/REMA	Biomass x Wt M
Tier 6: 9 species	Fishery catch	Catch history	Maximum catch (2013-2016)

Comments from SSC/ PT

General

"*The Teams recommended that stock assessment authors transition from the ADMB random-effects survey smoother to this package [REMA] which implements the same model with several improvements.*"- (NPFMC Joint Groundfish PT, September 2022)

Specifics

"the Team recommended rolling over harvest recommendations from 2021 due to the discrepancy between catch and survey biomass and the estimation of weighted M being influenced by a few species that have patchy distributions and survey catchability/availability issues.

The Team recommends the author further explore issues with using the current method of weighted M biomass estimates." – (NPFMC Joint Groundfish PT, November 2021)

"The SSC concurs with the GOA GPT and recommends that the Council consider taking up this issue of separating DSR from OR GOA-wide – thus moving to Step 2 of the Spatial Management Policy." – SSC Oct 2021

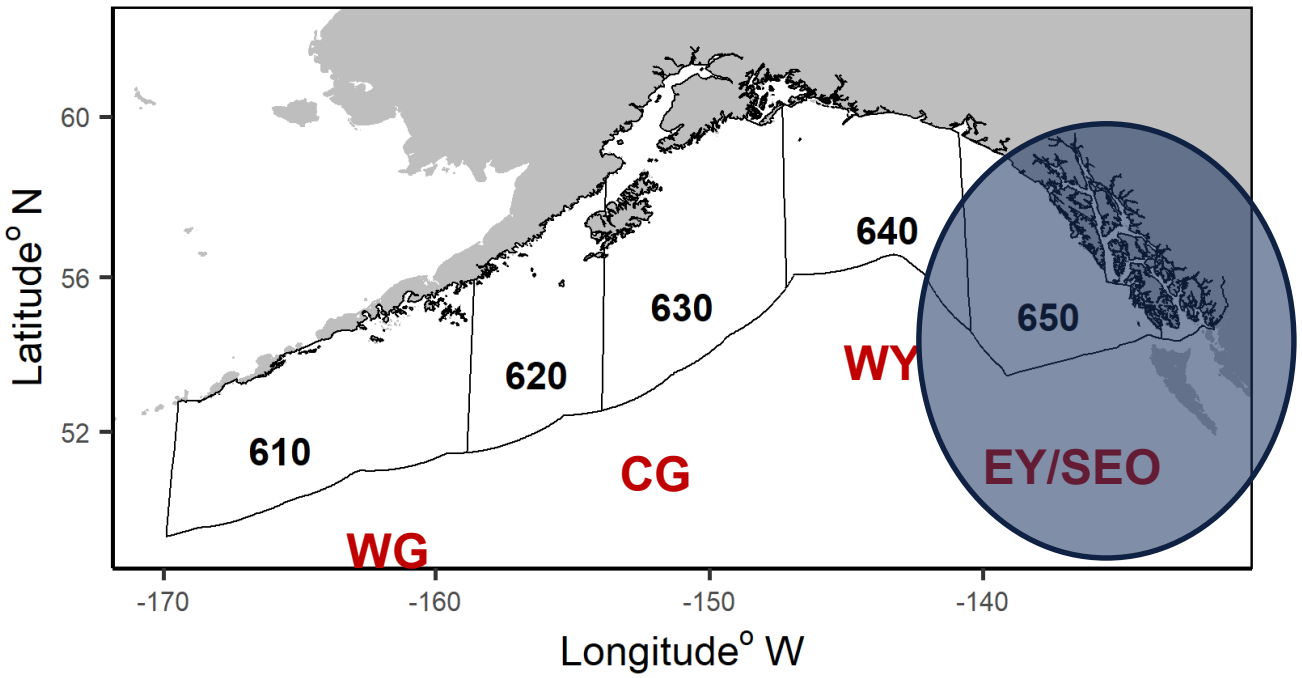
"The Team continues to support an earlier recommendation that the DSR subgroup be moved into the DSR assessment and make the DSR assessment GOA-wide pending a Council analysis on spatial management implications." – GOA PT Nov 2021

Updates for GOA Other Rockfish (OR) assessment

(0). Moving Demersal Shelf Rockfish subgroup out of OR assessment

1. Updating the Random Effects model using the REMA model
2. Expanding maximum catch time series for Tier 6 GOA OR species
3. Determining ‘reliable survey biomass’ for Tier 4/5 GOA OR species
4. Updating weighed natural mortality for Tier 5 GOA OR species

(0). Spatial management of Demersal Shelf Rockfish species



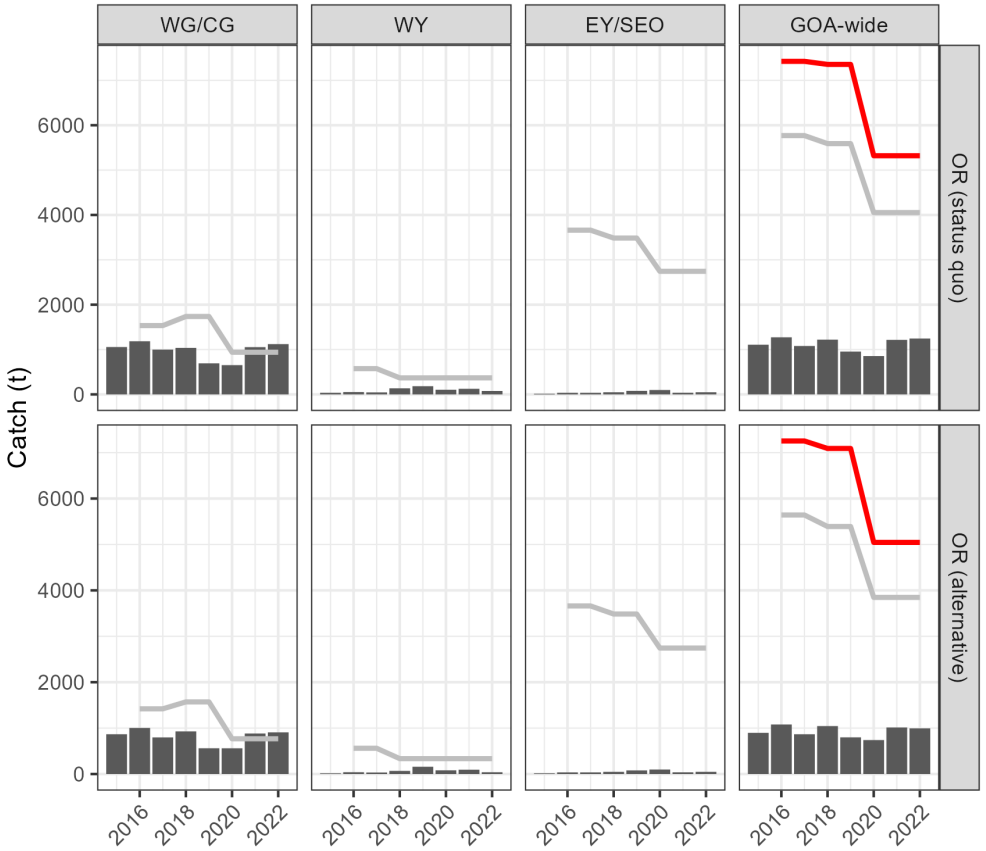
Demersal Shelf Rockfish:
canary, China, copper, quillback, rosethorn, tiger, and yelloweye

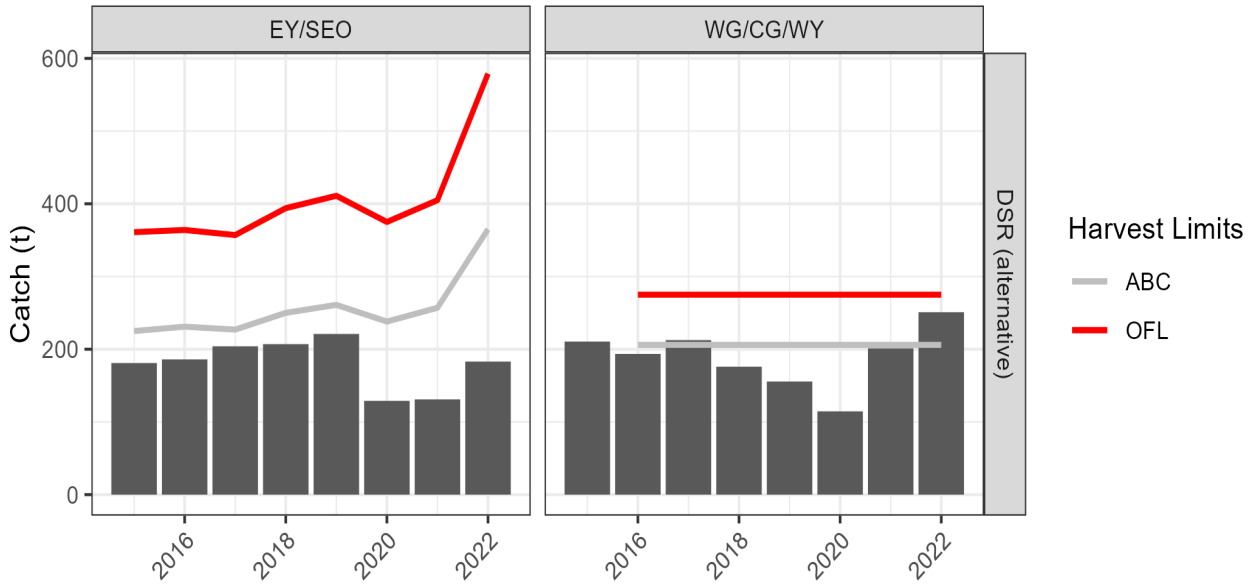
Prior support: PT Sept 2017, SSC Oct 2017, PT Nov 2019, SSC Dec 2019, PT Sept 2021, SSC Oct 2021

- Council motion to consider the proposed change and asked for impacts of change
  → Coming up at October Council meeting

Kristen Omori (AFSC), Cindy Tribuzio (AFSC), and Sara Cleaver (NPFMC) with contributions by Mary Furuness (NMFS AKR), Abby Jahn (NMFS AKR), Molly Watson (NOAA GC), Andrew Olson (previously ADFG), Phil Joy (ADFG), Rhea Ehresmann (ADFG), and Laura Coleman (ADFG)

(0). Spatial management of Demersal Shelf Rockfish species





- We recommend to make this change for the 2024 SAFE reports and action implemented for the 2025 fisheries

Updates for GOA Other Rockfish (OR) assessment

~~(0). Moving Demersal Shelf Rockfish subgroup out of OR assessment~~

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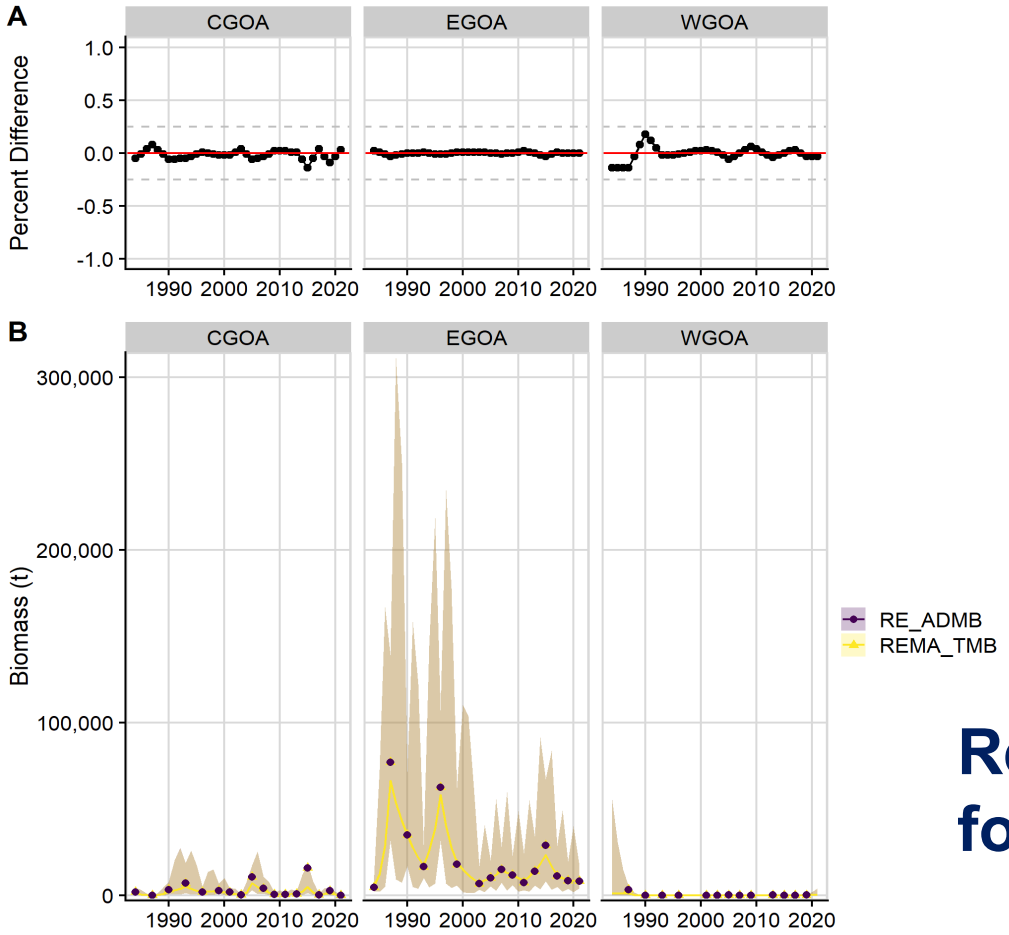
1. Random effects → REMA

"*The Teams recommended that stock assessment authors transition from the ADMB random-effects survey smoother to this package [REMA] which implements the same model with several improvements.*"- (NPFMC Joint Groundfish PT, September 2022)

- Methods:
  - Compared biomass estimates from the random effects model (RE; ADMB) with the REMA model (TMB) from 2021 assessment with:
    - Tier 4: Sharpchin
    - Tier 5: Aggregate of all 17 Tier 5 Other Rockfish species
    - Tier 5: Natural mortality groupings (used to determine a Tier 5 group Weighted M

1. Random effects → REMA

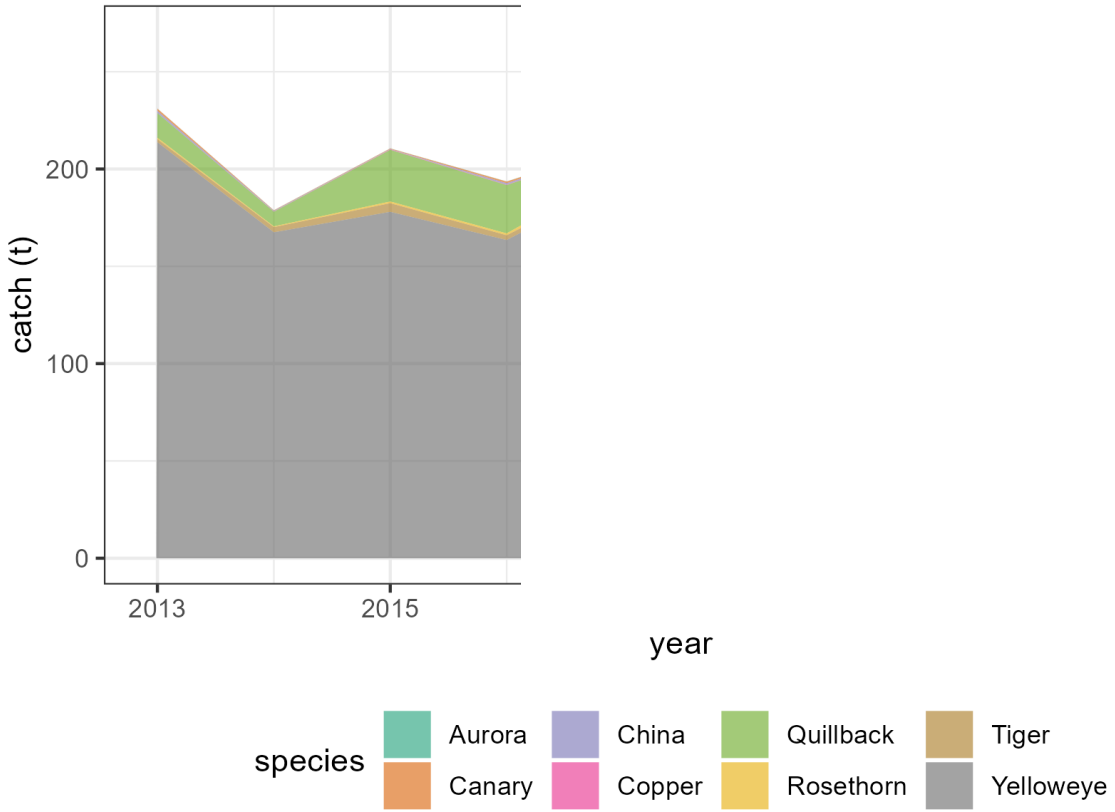
Tier 4: Sharpchin example



Group	Average Difference (t)	No. of years with > 0.5% difference
Tier 4: Sharpchin	-0.007	0
Tier 5: All species	-0.008	0
Tier 5: M=0.1	-0.003	0
Tier 5: M=0.05	-0.007	0
Tier 5: M=0.06	-0.003	0
Tier 5: M=0.07	-0.001	0
Tier 5: M=0.092	-0.006	0

Recommend moving to the REMA model for GOA Other Rockfish assessment

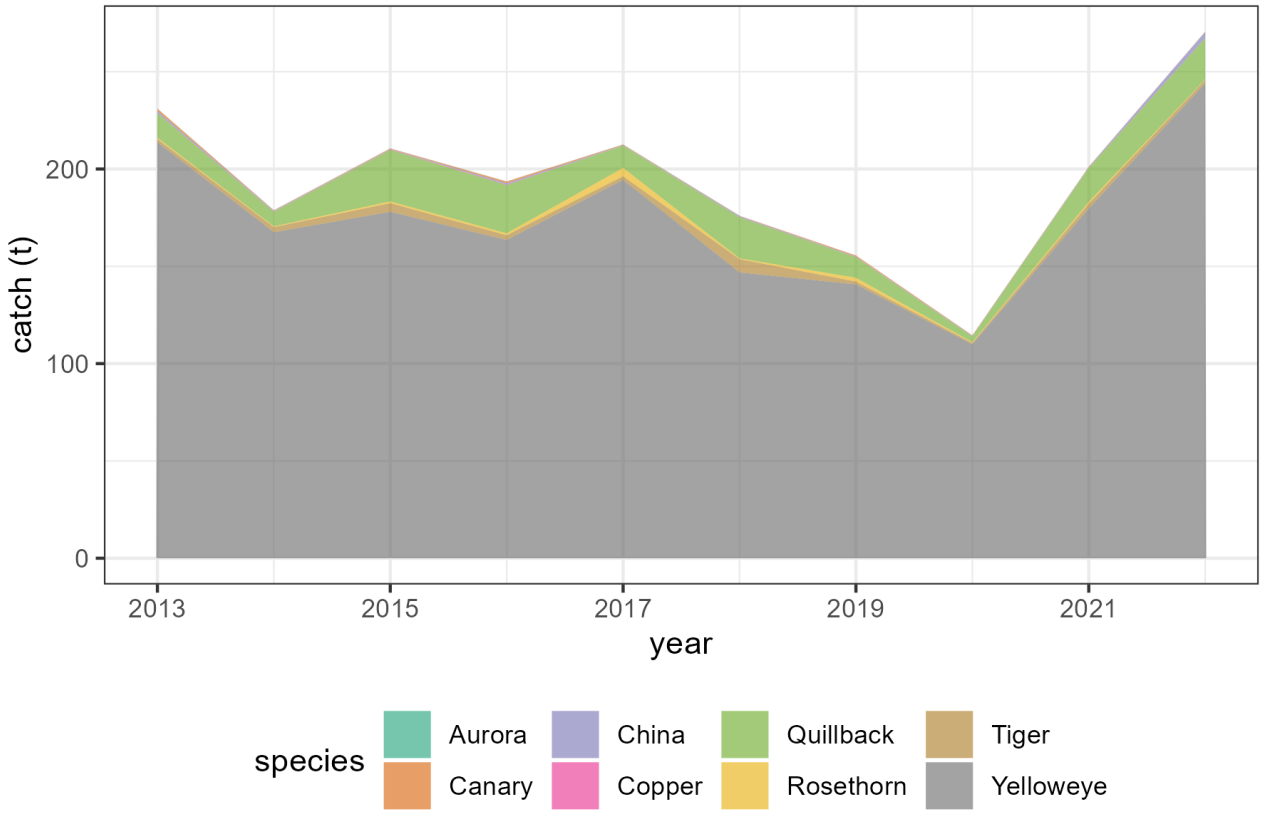
2. Expanding Tier 6 maximum catch time series



- Current Tier 6 ‘reliable catch time series’ =

  2013-2016 (4 years)

2. Expanding Tier 6 maximum catch time series



- Current Tier 6 ‘reliable catch time series’ =
  - 2013-2016 (4 years)
- Propose Tier 6 catch history= 2013-2022 (10 years)
  - Represents more current catch in the fishery (and fuller time series)
  - Fishing pattern shifts

2. Expanding Tier 6 maximum catch time series

	Maximum Catch (t)							
	2013-2016				2013-2022			
Tier 6	WGOA	CGOA	WY	Total 2013-2016	WGOA	CGOA	WY	Total 2013-2022
aurora	0	<1	0	0	0	<1	<1	0
[1]canary	<1	1	<1	1	<1	1	<1	2
[1]china	<1	1	<1	1	<1	3	<1	3
[1]copper	<1	<1	<1	0	<1	<1	<1	0
[1]quillback	1	25	1	27	1	25	14	40
[1]rosethorn	<1	1	1	2	<1	2	2	5
shortbelly	0	0	0	0	0	0	0	0
[1]tiger	1	4	<1	5	1	6	1	7
[1]yelloweye	57	124	40	221	82	155	53	290
Total OFL				257				347

[1] Stocks that belong to the Demersal Shelf Rockfish (DSR) sub-group

2. Expanding Tier 6 maximum catch time series

	Maximum Catch (t)							
	2013-2016				2013-2022			
Tier 6	WGOA	CGOA	WY	Total 2013-2016	WGOA	CGOA	WY	Total 2013-2022
aurora	0	<1	0	0	0	<1	<1	0
[illegible]	<1	1	<1	1	<1	1	<1	2
[illegible]	<1	1	<1	1	<1	3	<1	3
[illegible]copper	<1	<1	<1	0	<1	<1	<1	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]rosethorn	<1	1	1	2	<1	2	2	5
shortbelly	0	0	0	0	0	0	0	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1	7
[illegible]yelloweye	57	124	40	221	82	155	53	290
Total OFL				257				347

- No single area changes; no major increases for most Tier 6 species
- **90 t** (35%) Tier 6 OFL increase using 2013-2022 catch time series
- ~2% increase in total GOA OR complex OFL

Recommend using the 2013-2022 as the Tier 6 catch time series

3. What is a reliable survey biomass?

"the Team recommended rolling over harvest recommendations from 2021 due to the discrepancy between catch and survey biomass and the estimation of weighted M being influenced by a few species that have patchy distributions and survey catchability/availability issues." (NPFMC Joint Groundfish PT, November 2021)

Tier 6 Tier 4/5

1991: Other Slope

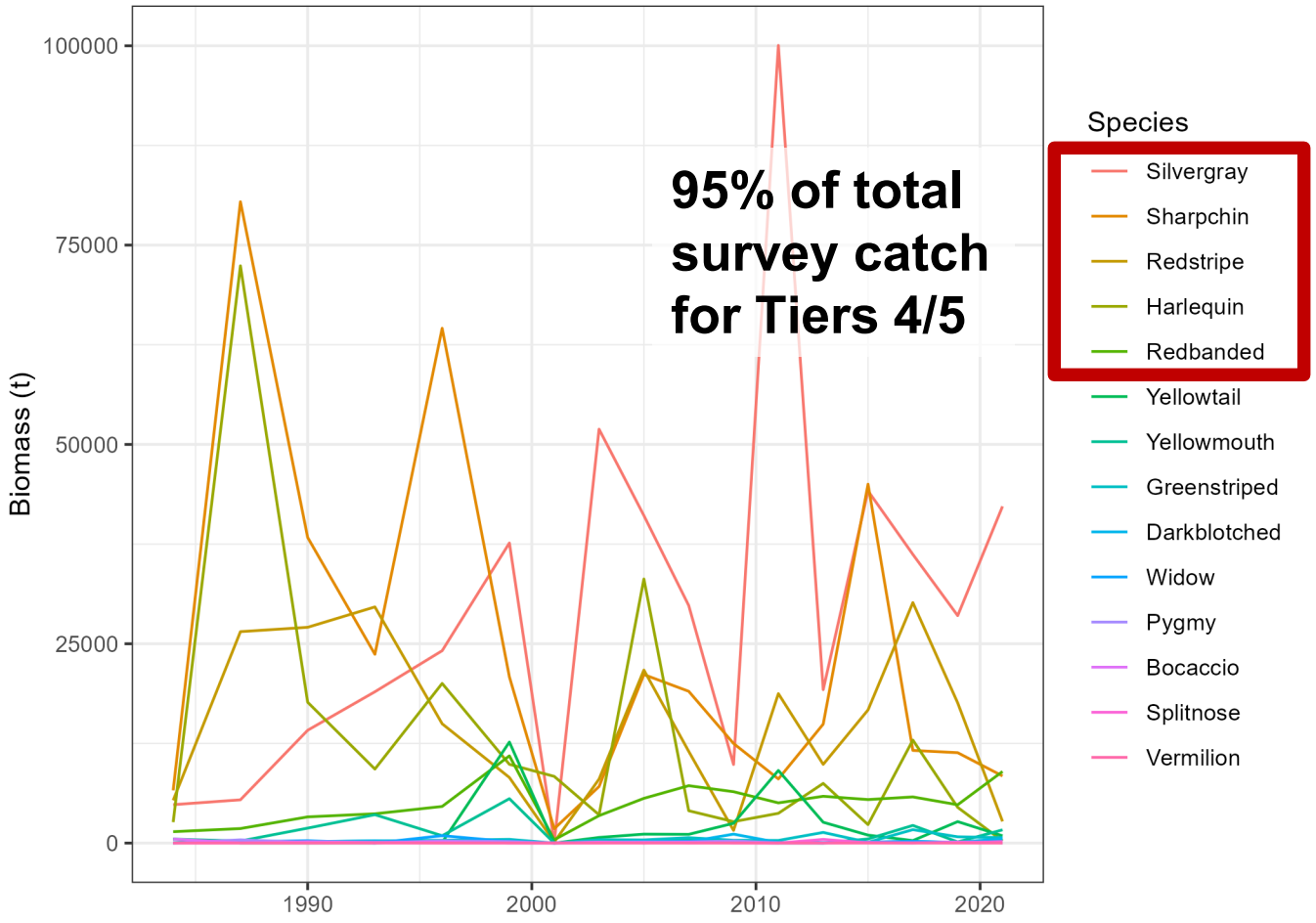
2012: Other Slope + Pelagic Shelf

2013: Demersal Shelf

Tier 4/5 Other Rockfish species:

- NPFMC OFL Control Rule System: Tier 4/5 need a reliable point estimate of biomass
- Uses GOA bottom trawl survey for biomass estimates from RE/ REMA model
  - Patchy distributions
  - Trawlable/ untrawlable habitat
  - Some are rare/ difficult to survey

3. What is a reliable survey biomass?



Questions:

- Does the trawl survey sufficiently represent the Tier 4 and 5 GOA Other Rockfish?
- Should the trawl survey biomass be used in the REMA models?

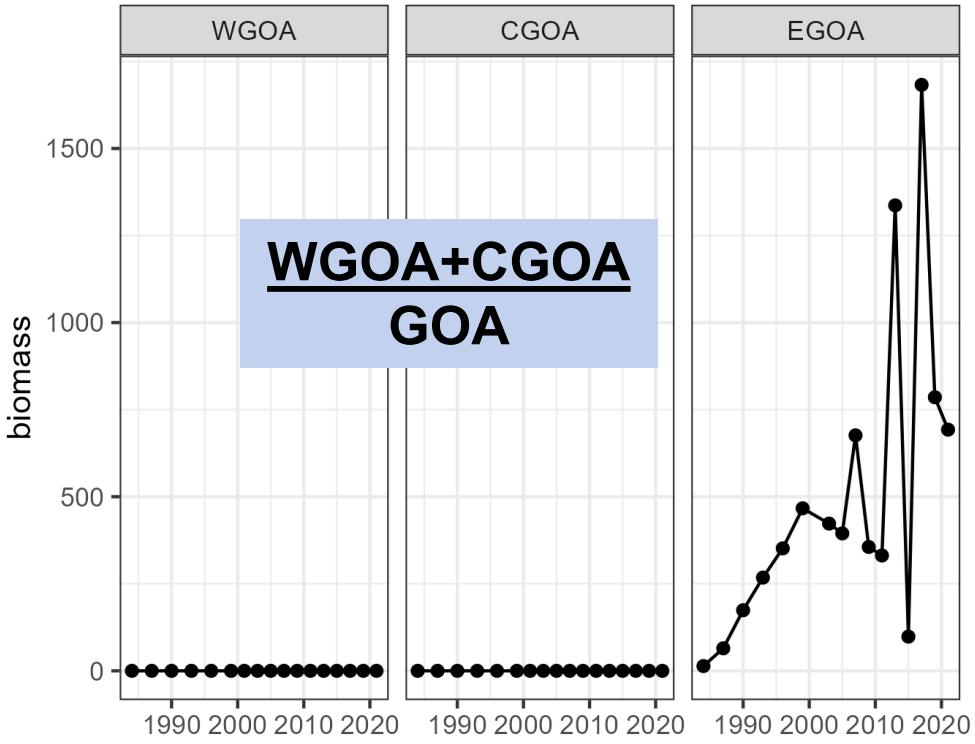
→ What is considered as a "reliable survey biomass"?

3. Reliable survey biomass metrics

Metrics:

- **REMA model diagnostic**
  - Process error/ biomass estimates (**REMA**)
- **Proportion of hauls with positive catch**
  - Proportion of years with positive survey catch (**propyrs**)
  - Average annual proportion of hauls with positive catch (**avg_pos**)
  - Proportion of years that have above 5% and 1% positive hauls (above.05, above.01)
  - Time series of proportion of hauls with positive catch
- **CV**
  - Average CV (**avg**)
  - Proportion of years that have a CV below 0.5 (below.5)
  - Time series of CV

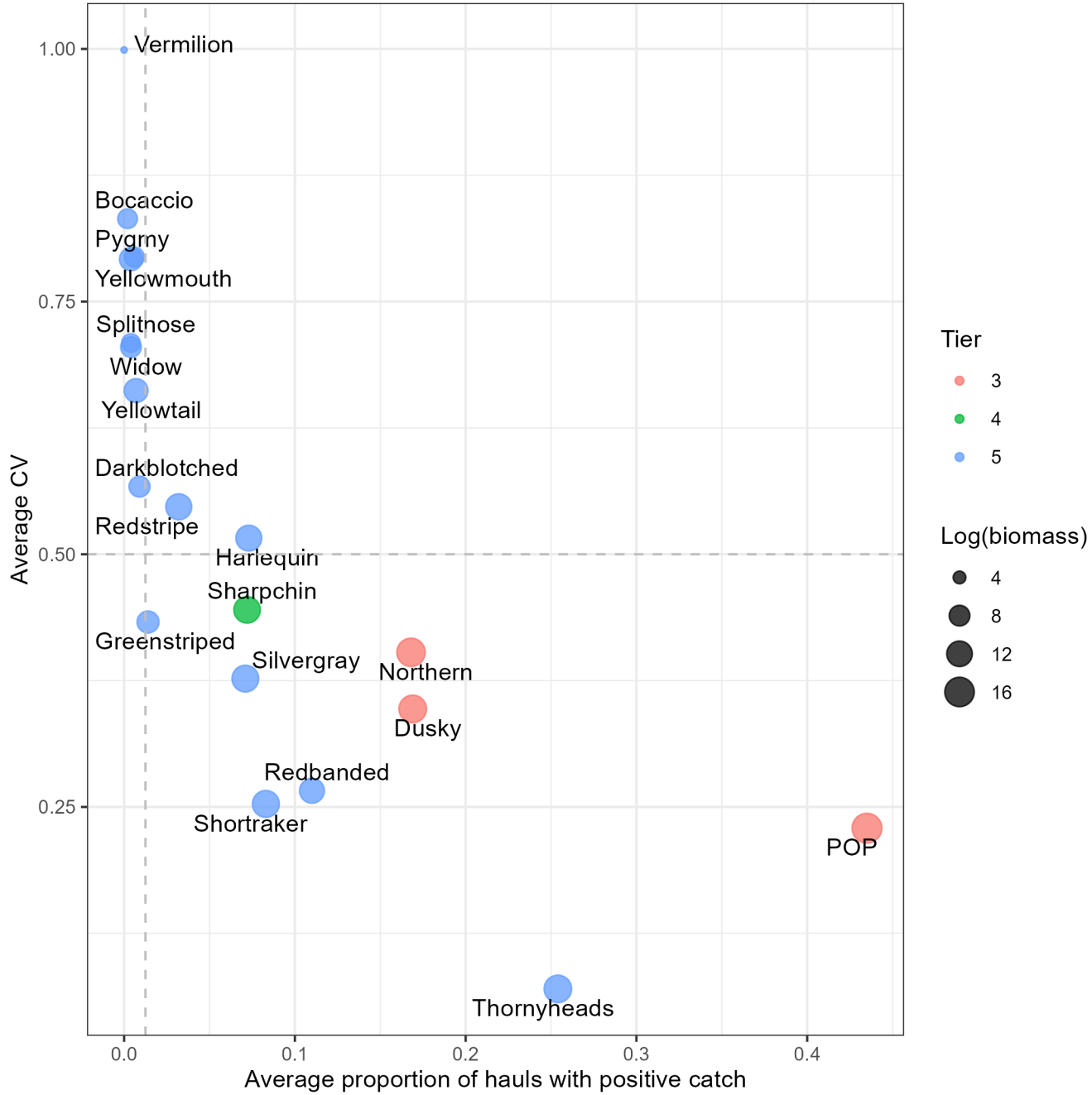
Example: Greenstriped



- Also examined other rockfish in GOA for comparison (e.g., Dusky, Northern, POP, Thornyhead, Shortraker)

3. Reliable survey biomass results

tier	species	avg annual biomass (t)	REMA	Proportion of hauls with positive catch		CV	Avg (WG+CG) GOA
				propyrs	avg_pos	avg_CV	
3	*POP*	783,138	1	1	0.44	0.23	0.75
3	*Northern*	160,574	1	1	0.17	0.4	1
3	*Dusky*	71,074	1	1	0.17	0.35	0.84
4	Sharpchin	23,258	1	1	0.07	0.45	0.21
5	*Thornyheads*	66,513	1	1	0.25	0.07	0.63
5	*Shortraker*	36,578	1	1	0.08	0.25	0.52
5	Silvergray	29,898	1	1	0.07	0.38	0.11
5	Redstripe	14,734	1	1	0.03	0.55	0.27
5	Harlequin	12,639	1	1	0.07	0.52	0.71
5	Redbanded	4,988	1	1	0.11	0.27	0.27
5	Yellowtail	2,075	1	0.77	<0.01	0.66	0.08
5	Yellowmouth	1,067	1	0.82	<0.01	0.79	0.02
5	Greenstriped	477	1	0.94	0.01	0.43	0
5	Darkblotched	213	1	0.94	<0.01	0.57	0.03
5	Widow	165	1	0.77	<0.01	0.71	0.16
5	Pygmy	106	1	0.82	<0.01	0.79	0.35
5	Bocaccio	89	1	0.65	<0.01	0.83	0.09
5	Splitnose	47	1	0.77	<0.01	0.71	0.05
5	Vermilion	1	0	0.06	0	1	1


Vermilion
Bocaccio
Pygmy
Yellowmouth
Splitnose
Widow
Yellowtail
Darkblotched
Redstripe
Harlequin
Sharpchin
Greenstriped
Silvergray
Northern
Dusky
Redbanded
Shortraker
POP
Thornyheads
1.00
0.75
0.50
0.25
Average CV
0.0
0.1
0.2
0.3
0.4
Average proportion of hauls with positive catch
Tier
3
4
5
Log(biomass)
4
8
12
16

3. Reliable survey biomass summaries and recommendations

- Metrics able to capture:
  - Data availability (frequency)
  - Consistency
  - Reliability

- "Loose Criteria":
  - REMA model ran
  - Caught every year in survey
  - Above 0.01 average proportion of positive hauls
  - Average CV < 0.5
  - GOA-wide distribution

Tier 6 catch history methods

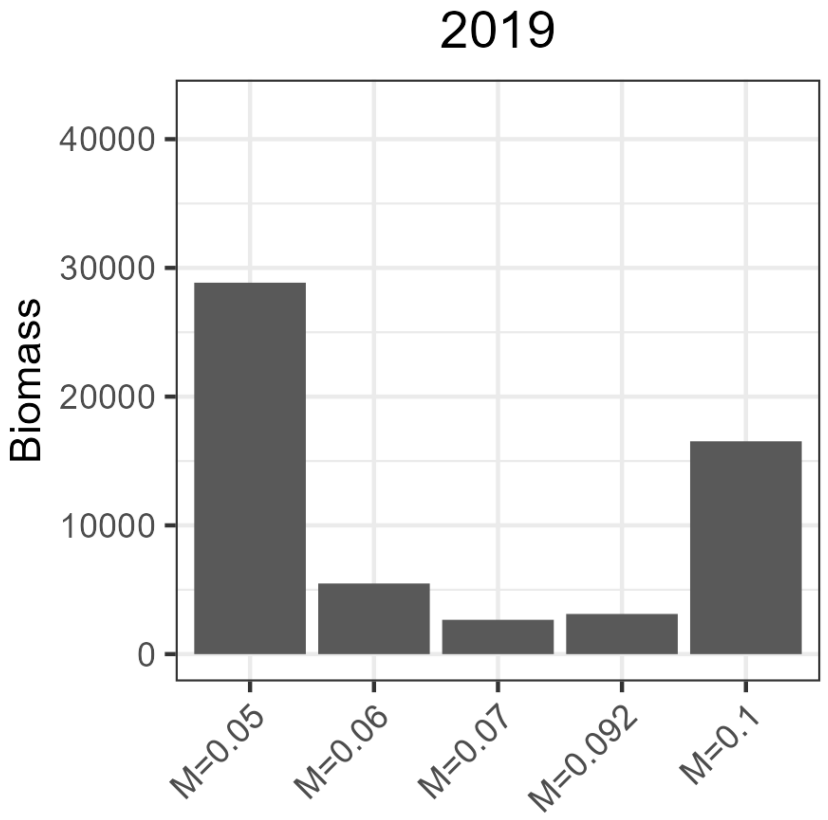
Species	Current Tier	Suggested Tier	Reason
sharpchin	4	4 (no change)	✓
harlequin	5	5 (no change)	✓ Biomass in WG/CG
redbanded	5	5 (no change)	✓
redstripe	5	5 (no change)	✓ Found GOA-wide
silvergray	5	5 (no change)	✓
greenstriped	5	6	Partially met criteria; Driven by EG
pygmy	5	6	
darkblotched	5	6	
yellowtail	5	6	
yellowmouth	5	6	
bocaccio	5	6	
splitnose	5	6	
vermillion	5	6	
widow	5	6	
stripetail	5	6	⊗ Not caught in survey
blackgill	5	6	⊗ Not caught in survey
chilipepper	5	6	⊗ Not caught in survey

4. Updating weighted natural mortality (M) for Tier 5

"the Team recommended rolling over harvest recommendations from 2021 due to the discrepancy between catch and survey biomass and the estimation of weighted M being influenced by a few species that have patchy distributions and survey catchability/availability issues.

The Team recommends the author further explore issues with using the current method of weighted M biomass estimates." – (NPFMC Joint Groundfish PT, November 2021)

4. Updating weighted natural mortality (M) for Tier 5



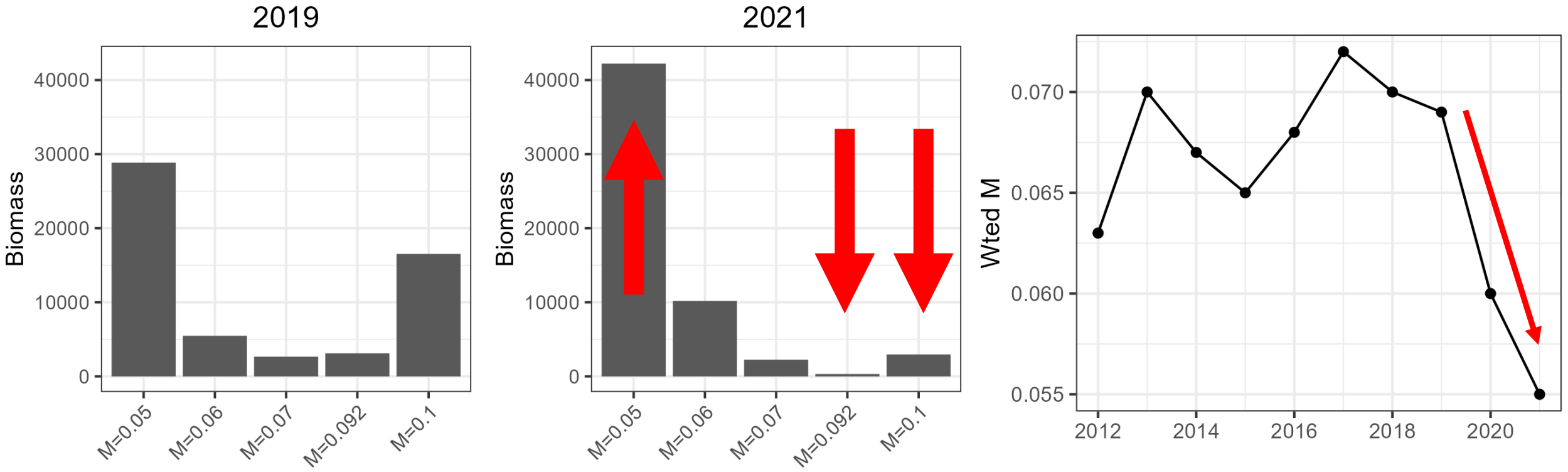
Tier 5: $OFL = Biomass_{total\ Tier\ 5} \times Wted\ M$

$$F_{OFL} = Wted\ M = \sum p_i \times F_i$$

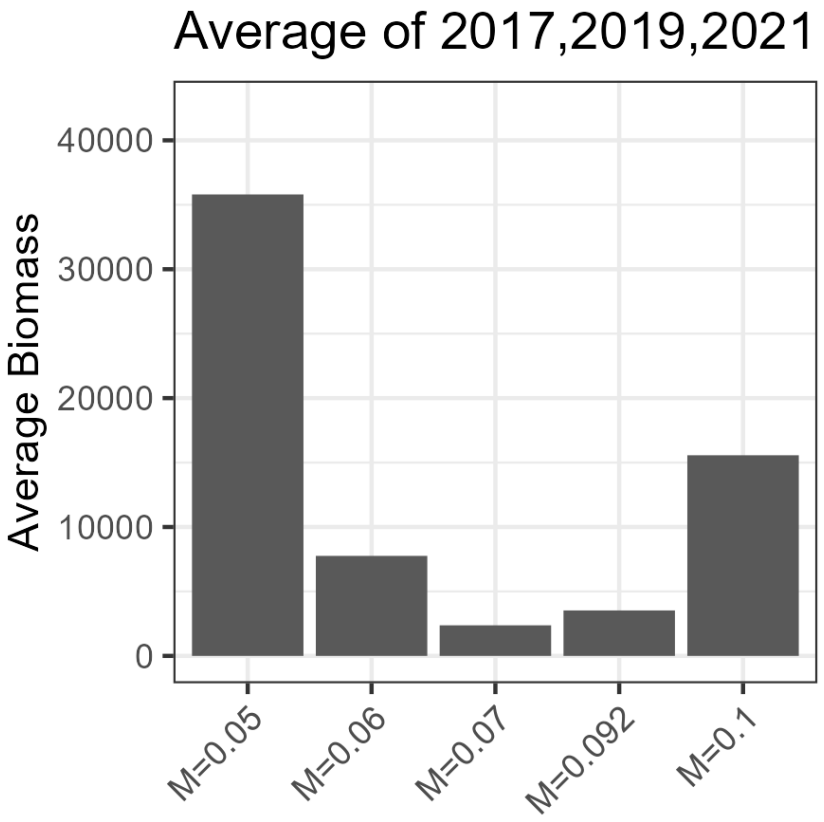
Tier 5:
$F_i \approx M_i$

$$F_{OFL} = Wted\ M = \sum p_i \times M_i$$

4. Updating weighted natural mortality (M) for Tier 5



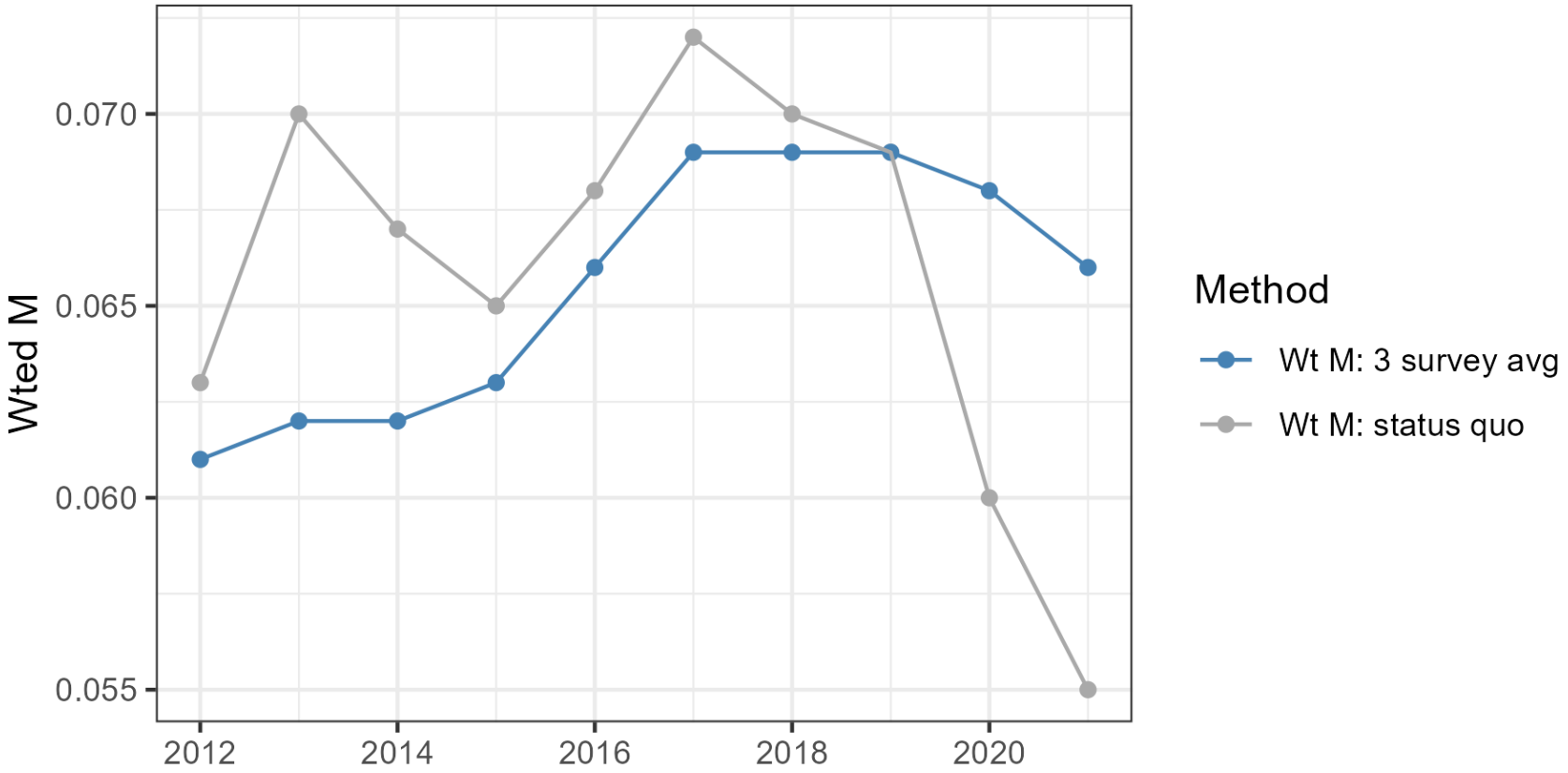
4. Alternative weighted M



$$\overline{Wt_M} = \sum \overline{p_{i,z\ survey\ years}} \times M_i$$

- Propose using average biomass estimated from past 3-surveys (~6 years) for each M sub-group.
  - Decrease sensitivity to single survey variability (particularly for poorly/ variably sampled rockfish)
  - Past assessments used 3 surveys averages for determining exploitable biomass and apportionment

4. Alternative weighted M



4. Alternative weighted M

	Year	Est. Biomass[1]	Weighted M Method	Wted M	OFL
Tier 5	2021	58,687	$Wted\ M$	0.055	3,228
Tier 5	2021	58,687	Alt. $\overline{Wt_M}$: 3 survey avg	0.066	3,873

Recommend using an alternative weighted M using a survey-average

Other Rockfish species are long-lived, later maturing species with high survey variability → averaging the last survey data points (~ 6 years) would dampen survey uncertainty, while capturing population trends and species composition

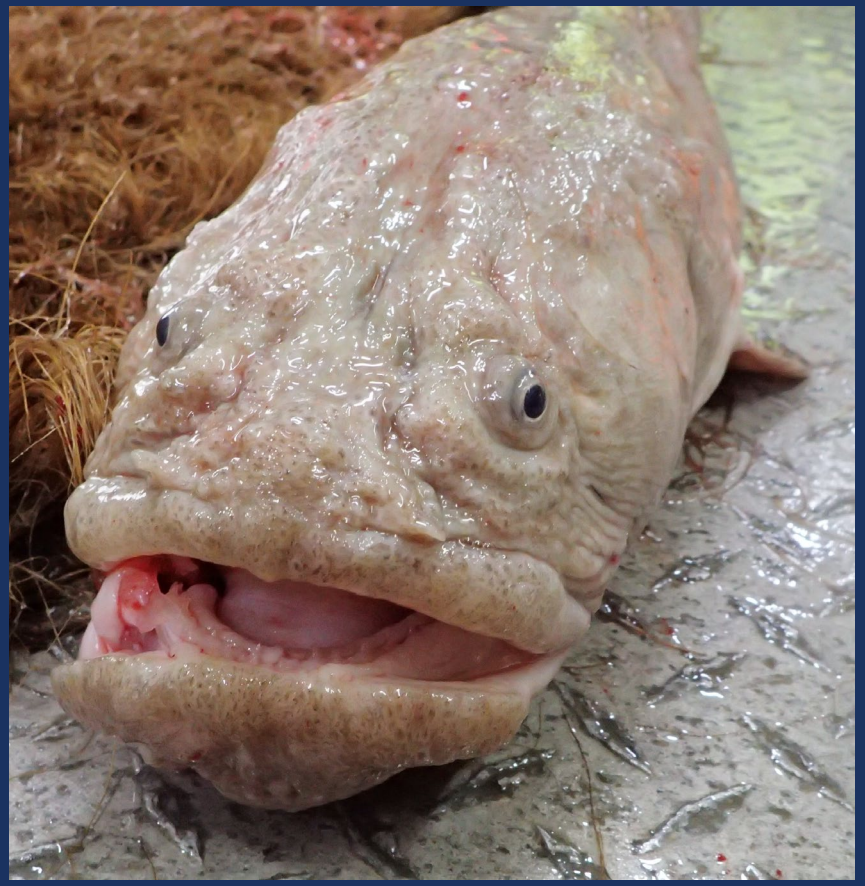
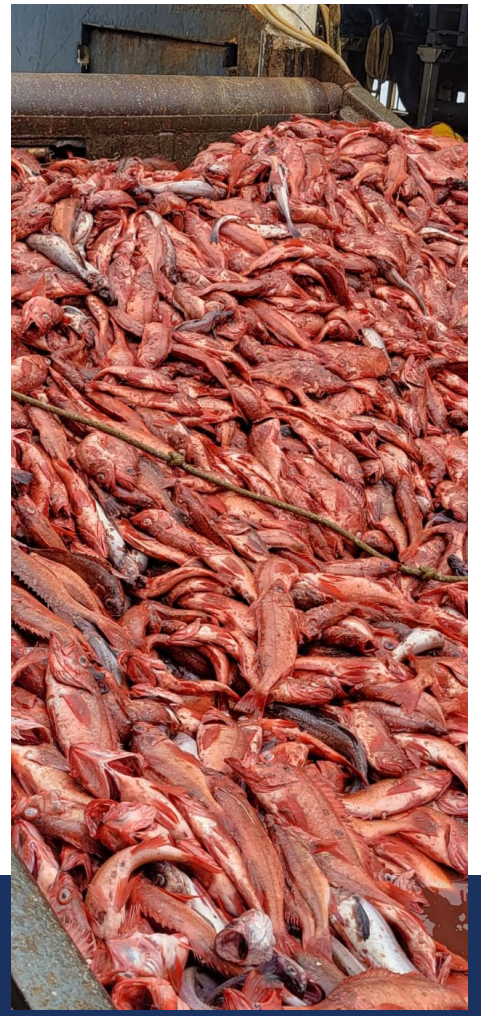
[1]Estimated biomass is from the 2021 GOA OR Assessment, Tribuzio et al., 2021

Updates for GOA Other Rockfish assessment

Tiers (total 27 species)	Data Input	Assessment method	OFL calculations
Tier 4: 1 species	GOA bottom trawl survey	**REMA**	Biomass x $F_{35\%}$
Tier 5: **5 species**	GOA bottom trawl survey	**REMA**	Biomass x $\overline{Wt\ M}_{3\ surveys}$
Tier 6: **9 + 12 species**	Fishery catch	Catch history	Maximum catch **(2013-2022)**

Action Items for GOA Other Rockfish

(0). Moving Demersal Shelf Rockfish subgroup out of OR assessment

1. Replacing RE model with the REMA model
2. Expanding maximum catch time series for Tier 6 GOA OR species from 2013-2016 to 2013-2022 (10 years).
3. Determining 'reliable survey biomass' for Tier 4/5 GOA OR species → move 12 Tier 5 species to Tier 6 because of unreliable survey biomass
4. Updating weighed natural mortality for Tier 5 GOA OR species to an average weighted M using 3 surveys

QUESTIONS?