

St. Matthew Island blue king crab
September 2024 SAFE

Caitlin Stern and Katie Palof

Stock overview

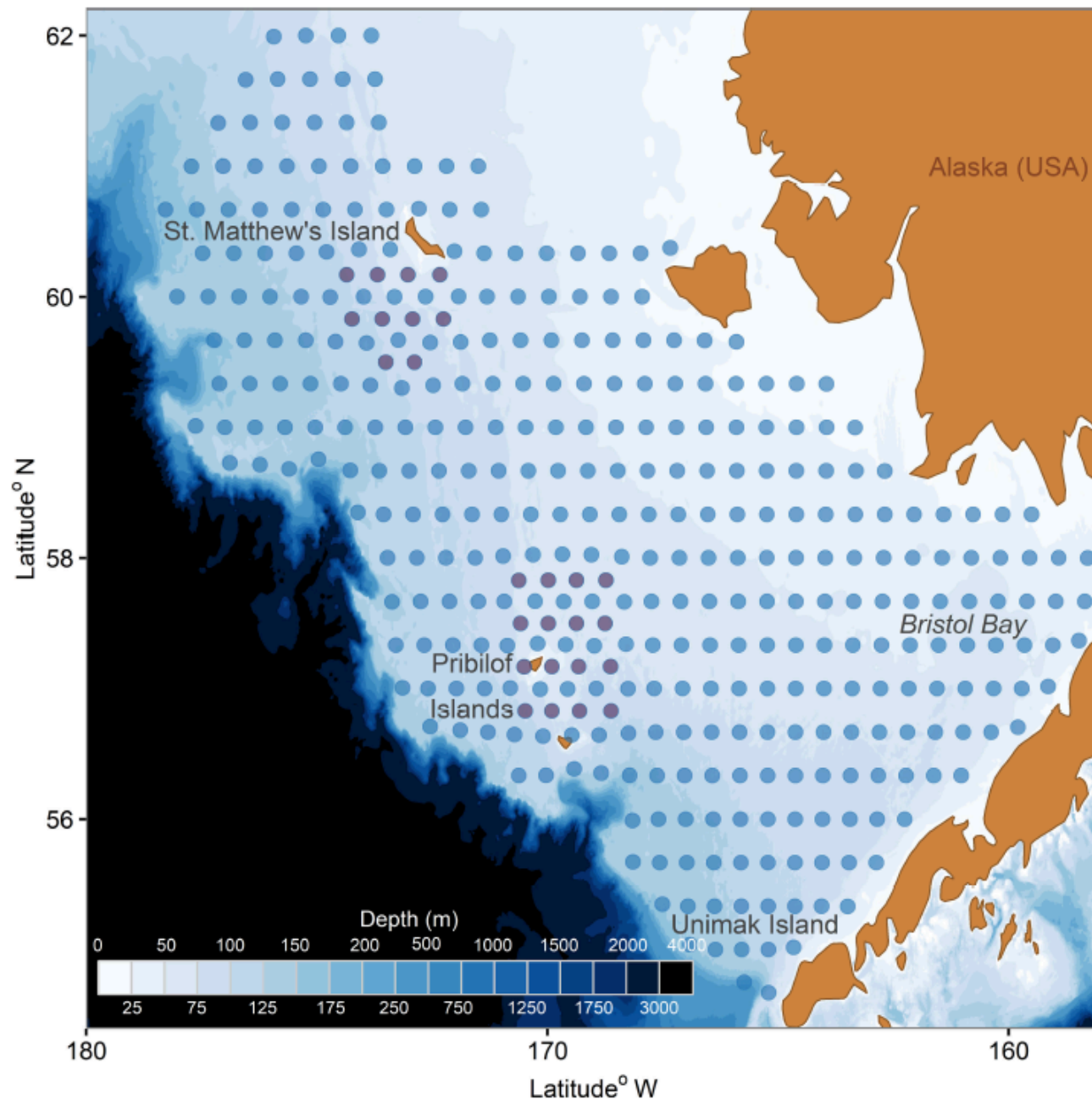
- Last full assessment: September 2022
- Declared overfished in 2018; no directed fishery since 2015/2016
- Under a rebuilding plan since 2020
 - No changes to fishing regulations
 - No further bycatch restrictions
 - Focused on recruitment expectations



Key model issues

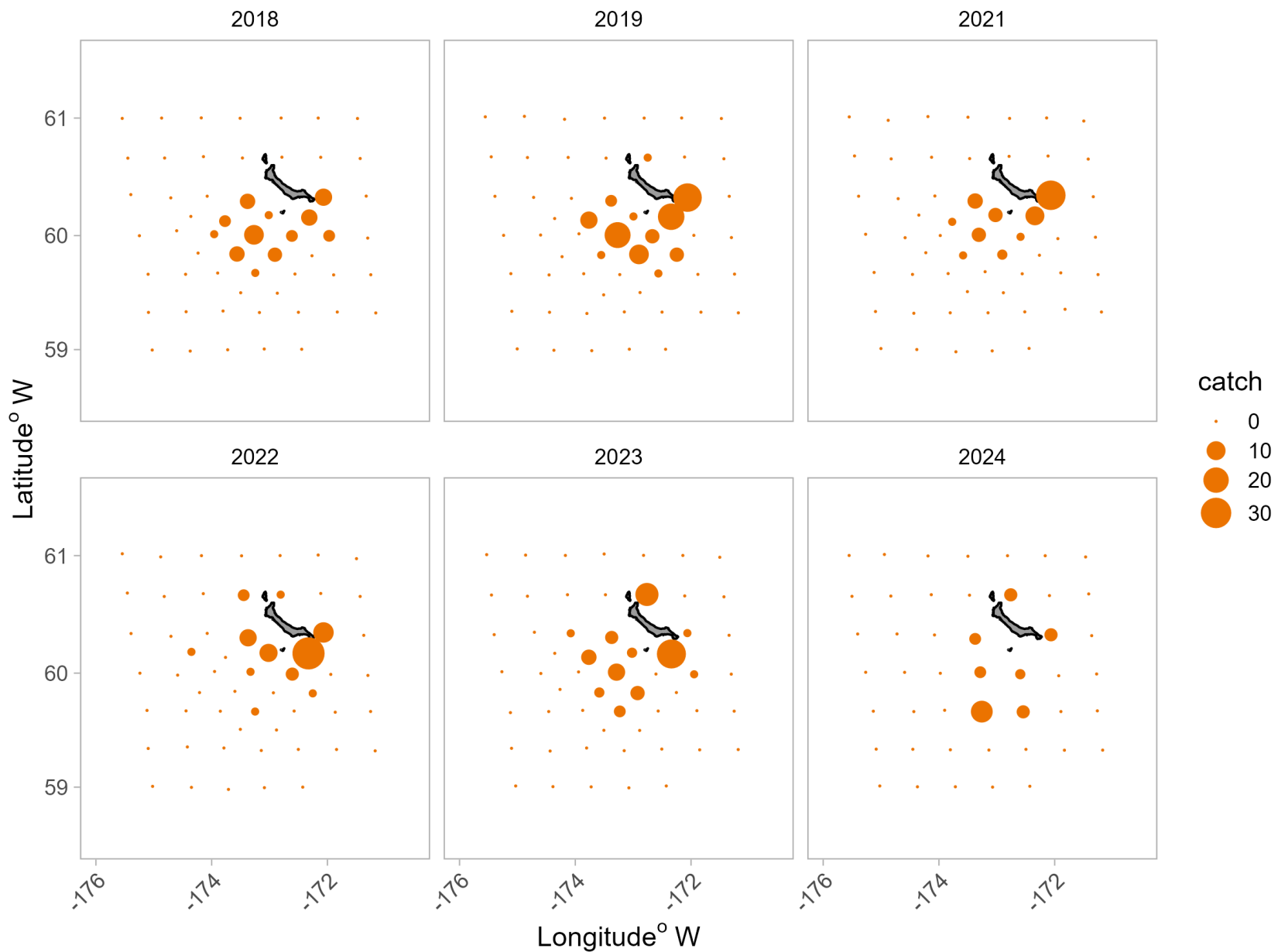
- Differences between the pot and trawl surveys
- Poor fit of models to recent years' survey data (2010+)
- Changes in NMFS Eastern Bering Sea bottom trawl survey
 - Corner stations not sampled in 2024

Corner stations: sampling density



Source:
DePhilipo et al. (2023)
Front. Mar. Sci.
10:1219283

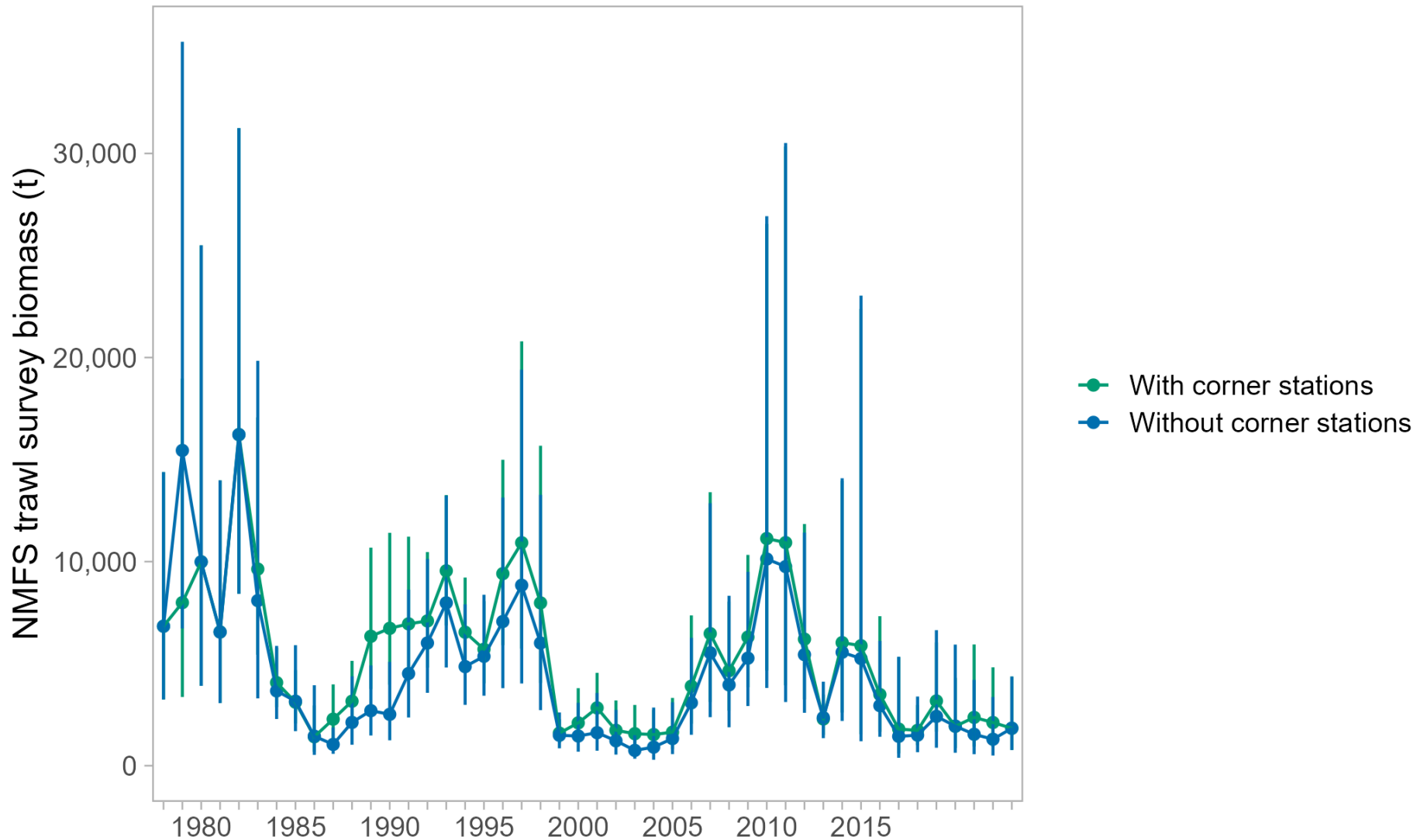
Trawl survey catch in corner stations



Biomass estimates lower without corner stations

- Mean biomass for 1983-2023 with corner stations excluded is 79% of the mean biomass for the same time period with corner stations included.

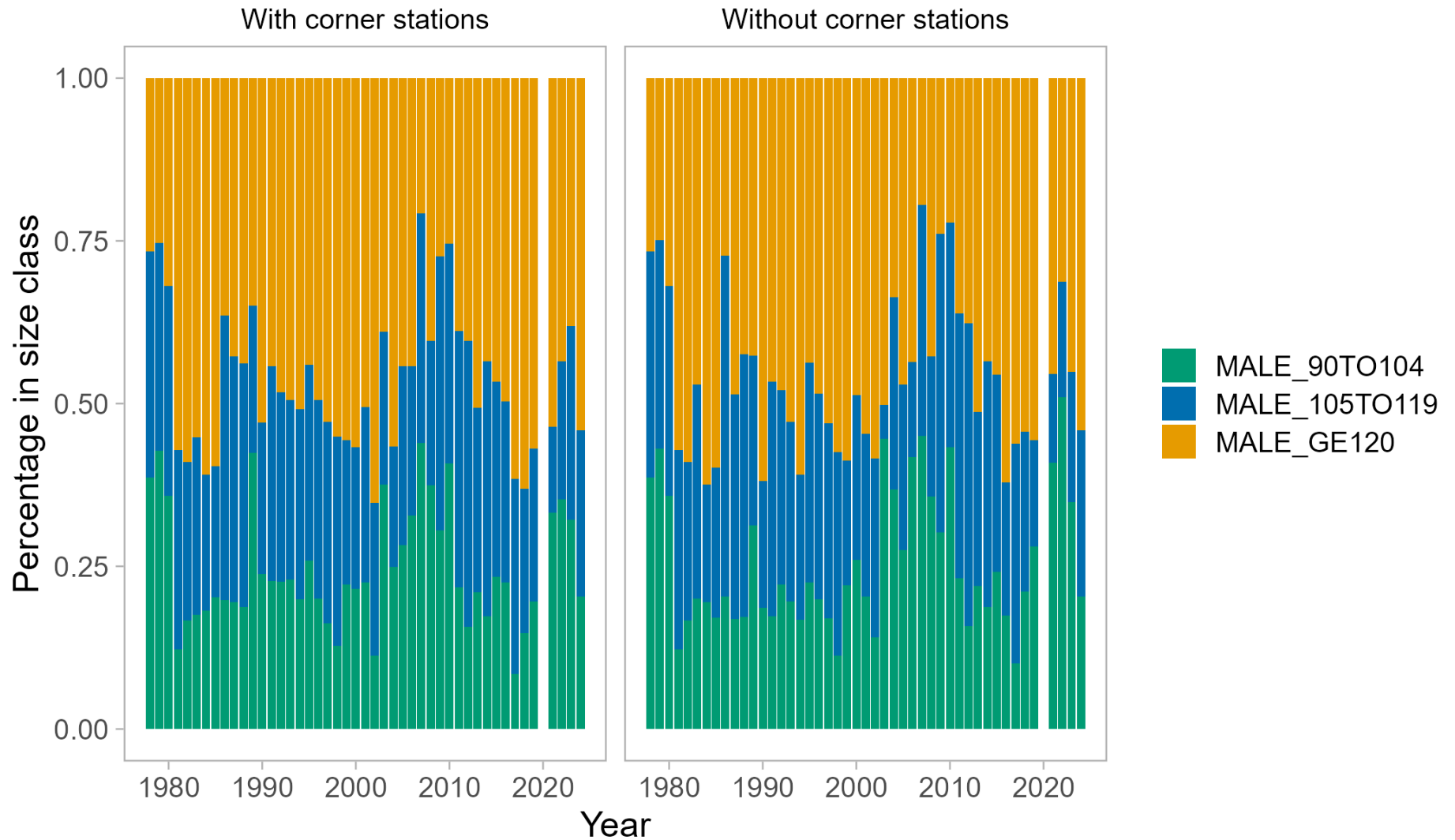
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Differences in size compositions

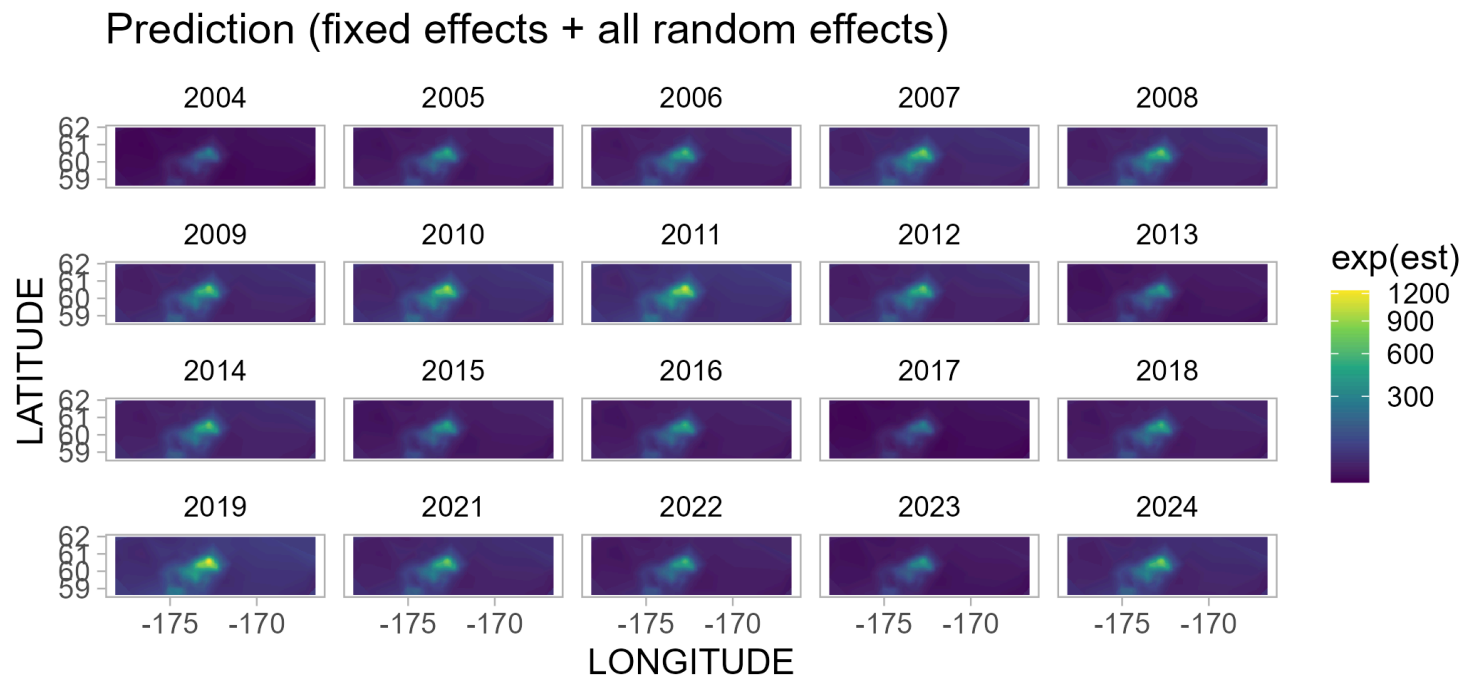
- Mean % in stage 1 (90-104 mm) for 1983-2023
 - with corner stations: 25.0%
 - without corner stations: 25.2%
- Mean % in stage 2 (105-115 mm) for 1983-2023
 - with corner stations: 30.5%
 - without corner stations: 31.2%
- Mean % in stage 3 (120+ mm) for 1983-2023
 - with corner stations: 44.5%
 - without corner stations: 43.6%

Differences in size compositions



Survey index standardization

- Need for standardization to account for changes in sampling
- Biomass index using sdmTMB in development (Jan. 2025)
- Approach for size comps also in development
- Increased importance of ADF&G pot survey



Models

Models

16.1 - May:

- May 2024 CPT- and SSC-recommended model
 - GMACS version 2.01.M.10
- Fixed $M = 0.18$ for all years except 1998 time block
- SSB estimated in season 5; corrected pot survey data
- New data:
 - 2022/23 groundfish bycatch
 - 2023 NMFS trawl survey
 - 2022 ADF&G pot survey

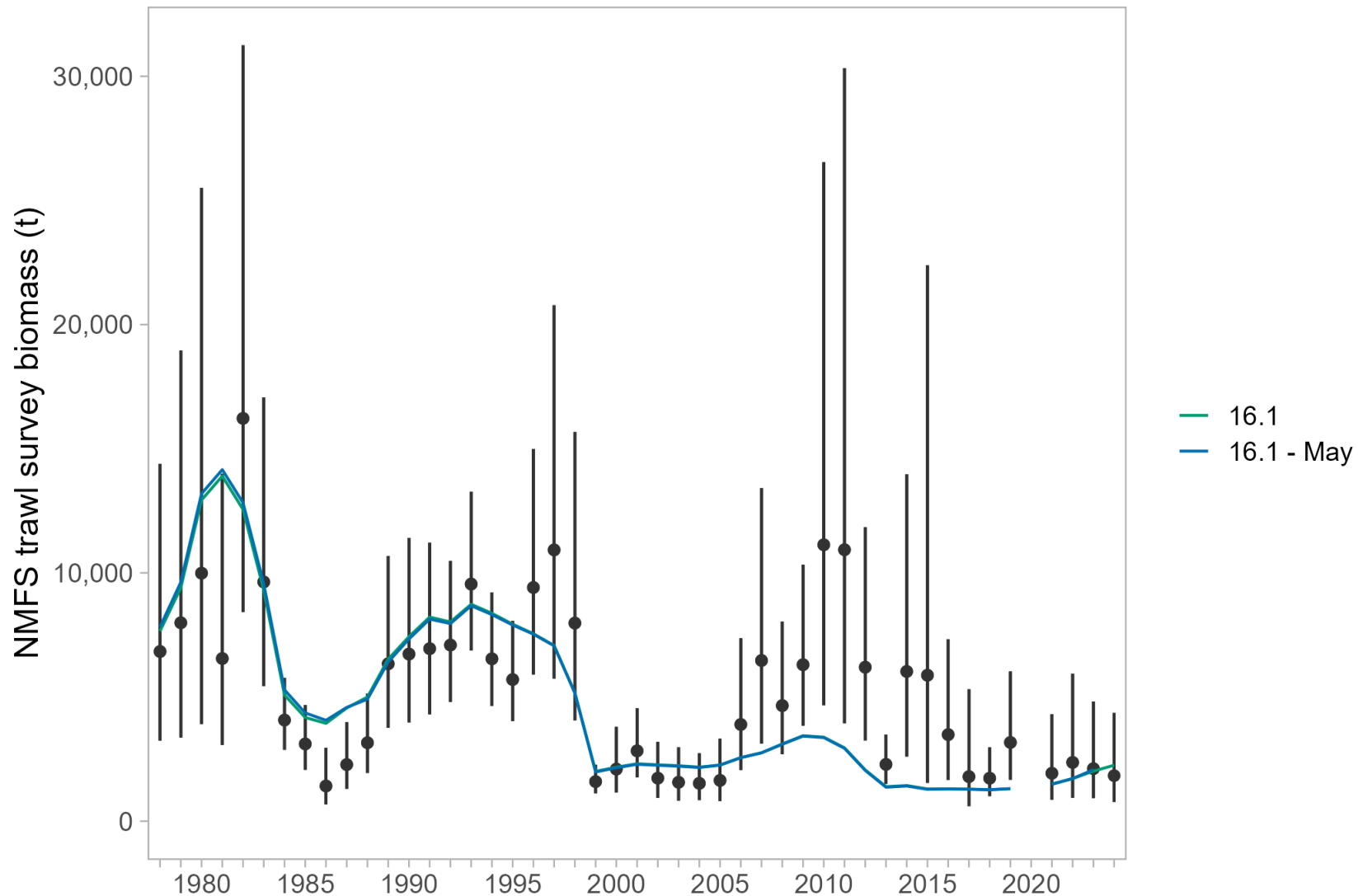
Models

16.1 - May: May 2024 recommended model

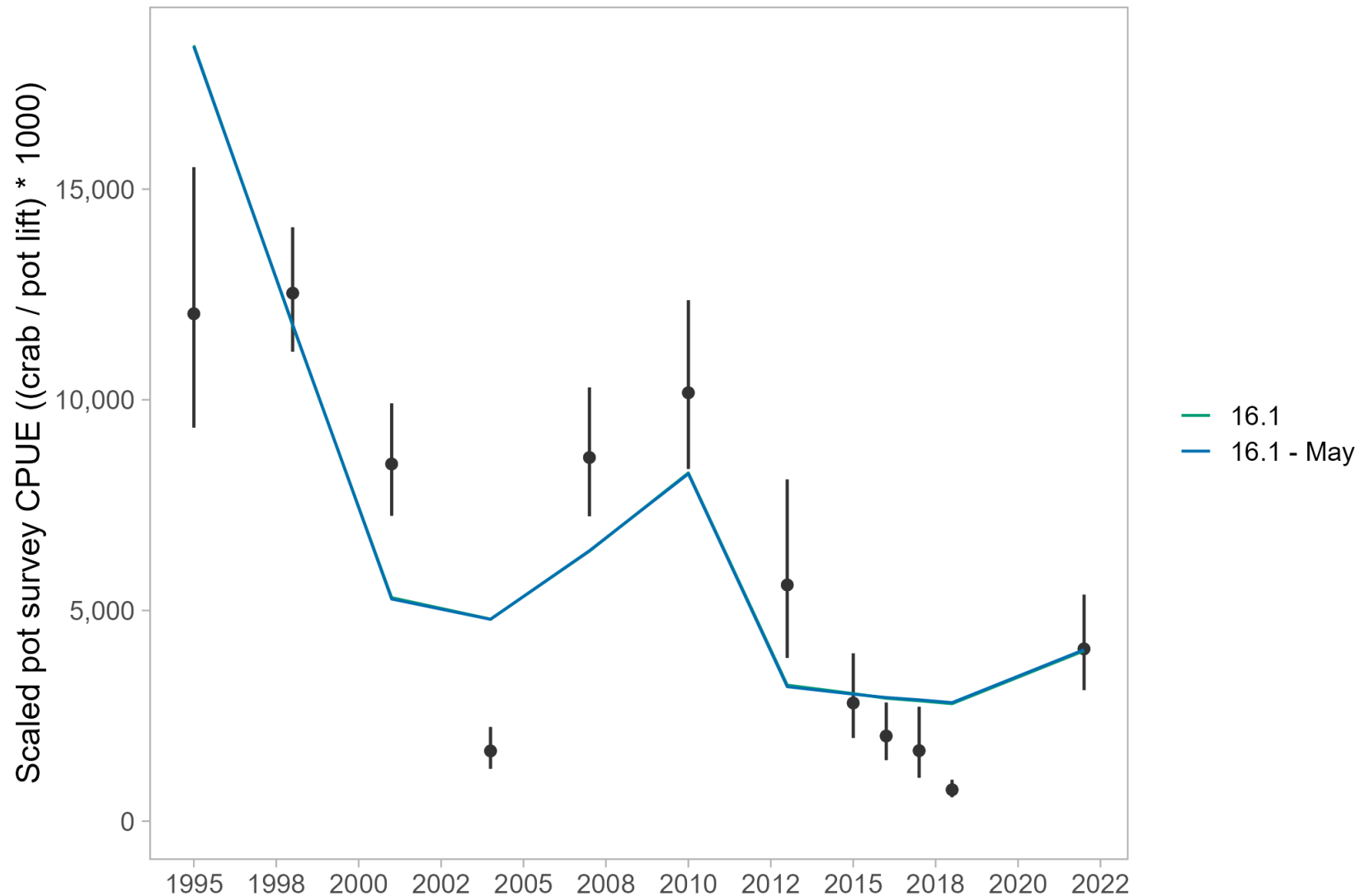
16.1:

- GMACS version 2.20.14
- New data:
 - 2023/24 groundfish bycatch
 - 2024 NMFS trawl survey

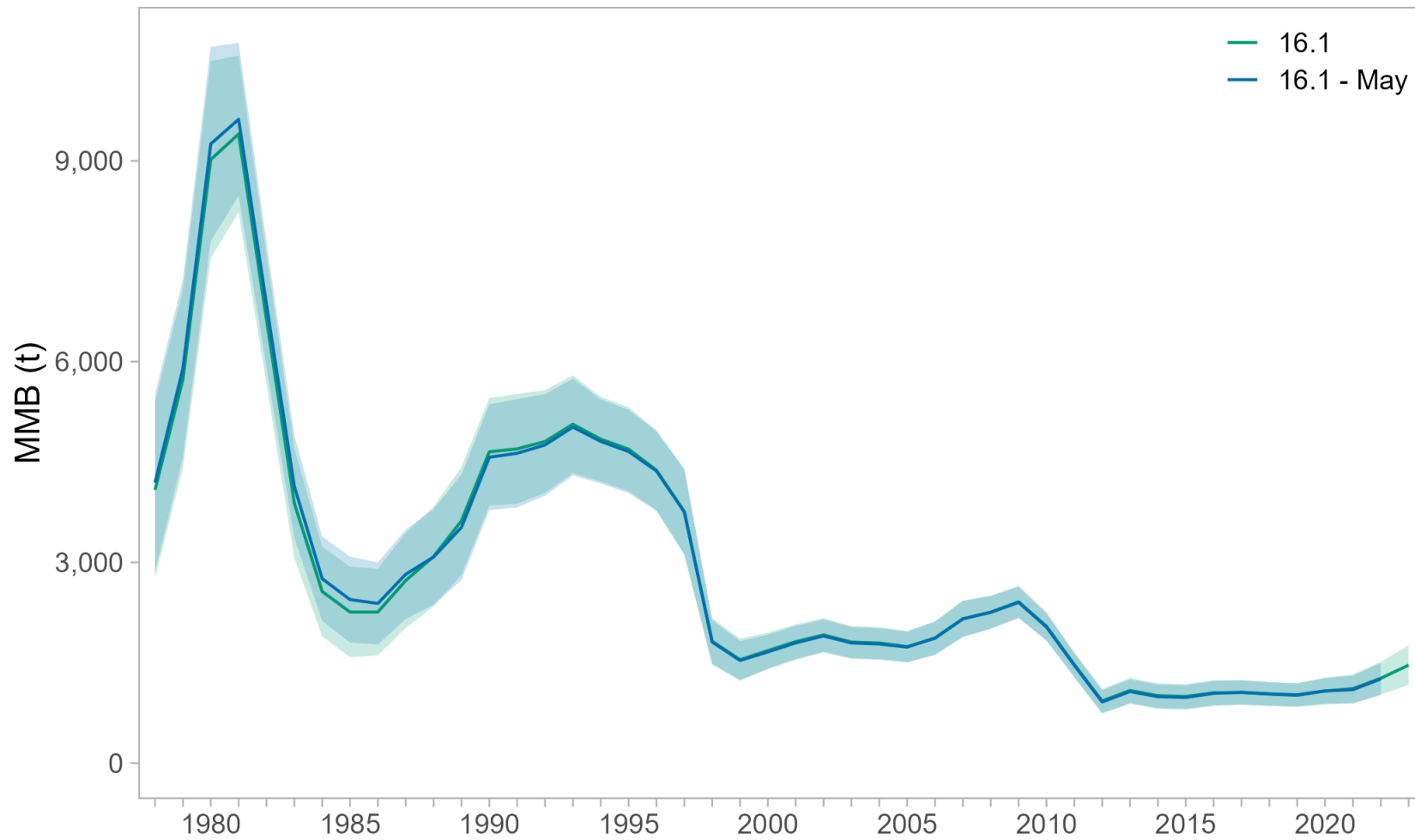
16.1 - May vs. 16.1: model fits to NMFS trawl survey data



16.1 - May vs. 16.1: model fits to ADF&G pot survey data



16.1 - May vs. 16.1: MMB



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16.1: updated data and GMACS

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24.1: 16.1 with $M = 0.23$ (from BBRKC 2023 SAFE)

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16.1a: 16.1 with corner stations removed from trawl survey

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16.1a: 16.1 with corner stations removed from trawl survey

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Management quantities 2024/2025

	16.1	16.1a	24.1	24.1a
MMB_{2024}	1620.85	1381.70	1529.77	1383.47
B_{MSY}	2860.30	2456.08	2934.66	2502.28
MMB/B_{MSY}	0.57	0.56	0.52	0.55
F_{OFL}	0.09	0.09	0.11	0.12
OFL_{2024}	121.46	102.91	129.46	126.02
ABC_{2024}	91.09	77.18	97.09	94.52

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Model comparison: trawl survey

- 24.1 ($M = 0.23$) fits trawl survey better than 16.1 ($M = 0.18$)
- 16.1a and 24.1a (no corner stations): poorer fits to trawl survey
 - fitting a different data set

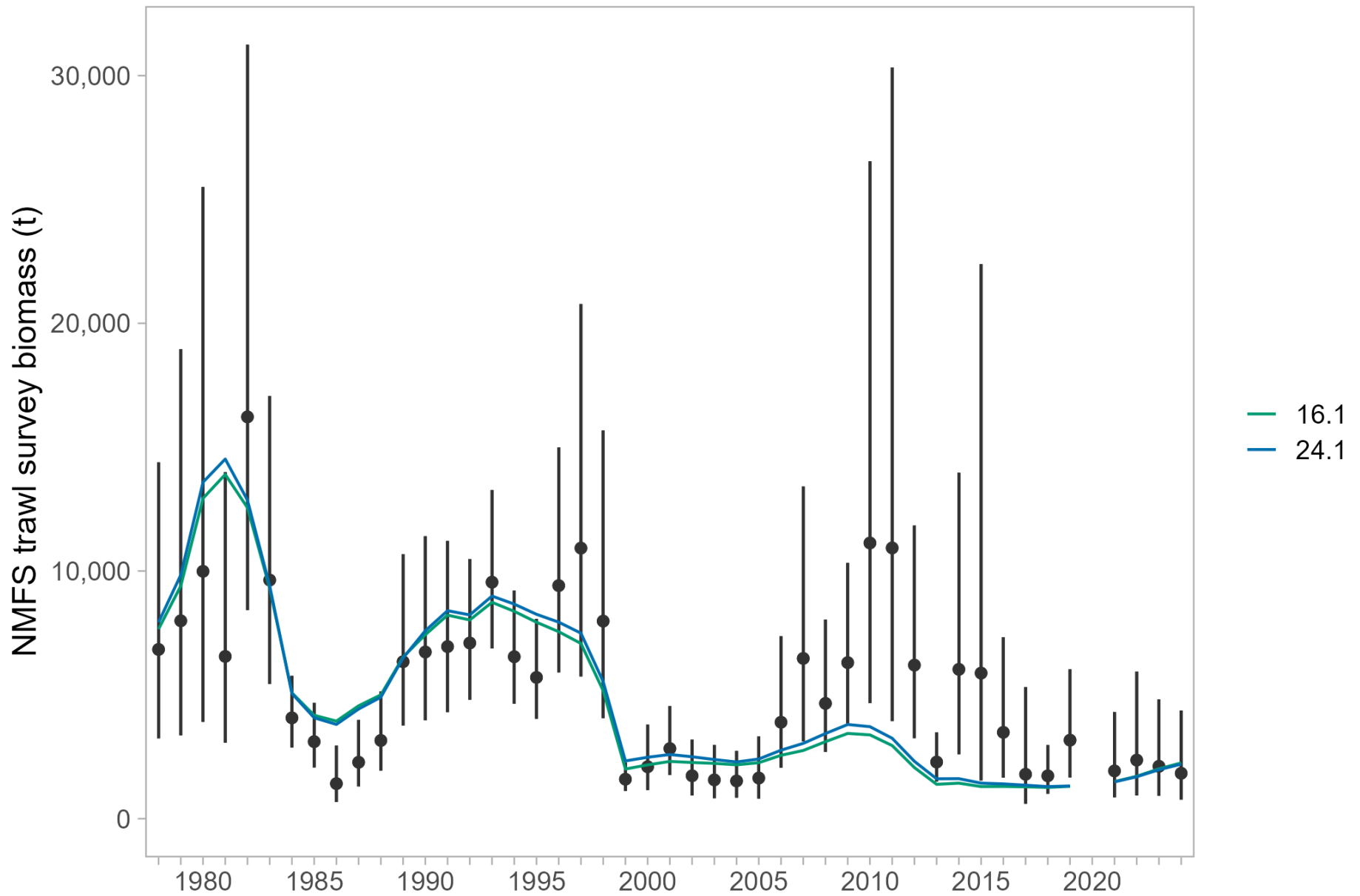
Negative log-likelihood values

Component	16.1	16.1a	24.1	24.1a
Pot retained catch	-68.3	-68.9	-69.0	-69.3
Pot discarded catch	5.9	5.3	4.5	4.1
Trawl bycatch discarded catch	-9.1	-9.1	-9.1	-9.1
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Directed pot LF	-105.1	-104.6	-105.1	-104.4
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ADF&G pot LF	-100.0	-97.8	-99.9	-97.5
Recruitment deviations	64.9	67.1	64.1	66.0
Total	-391.0	-347.9	-410.3	-363.2
Total estimated parameters	159.0	159.0	159.0	159.0

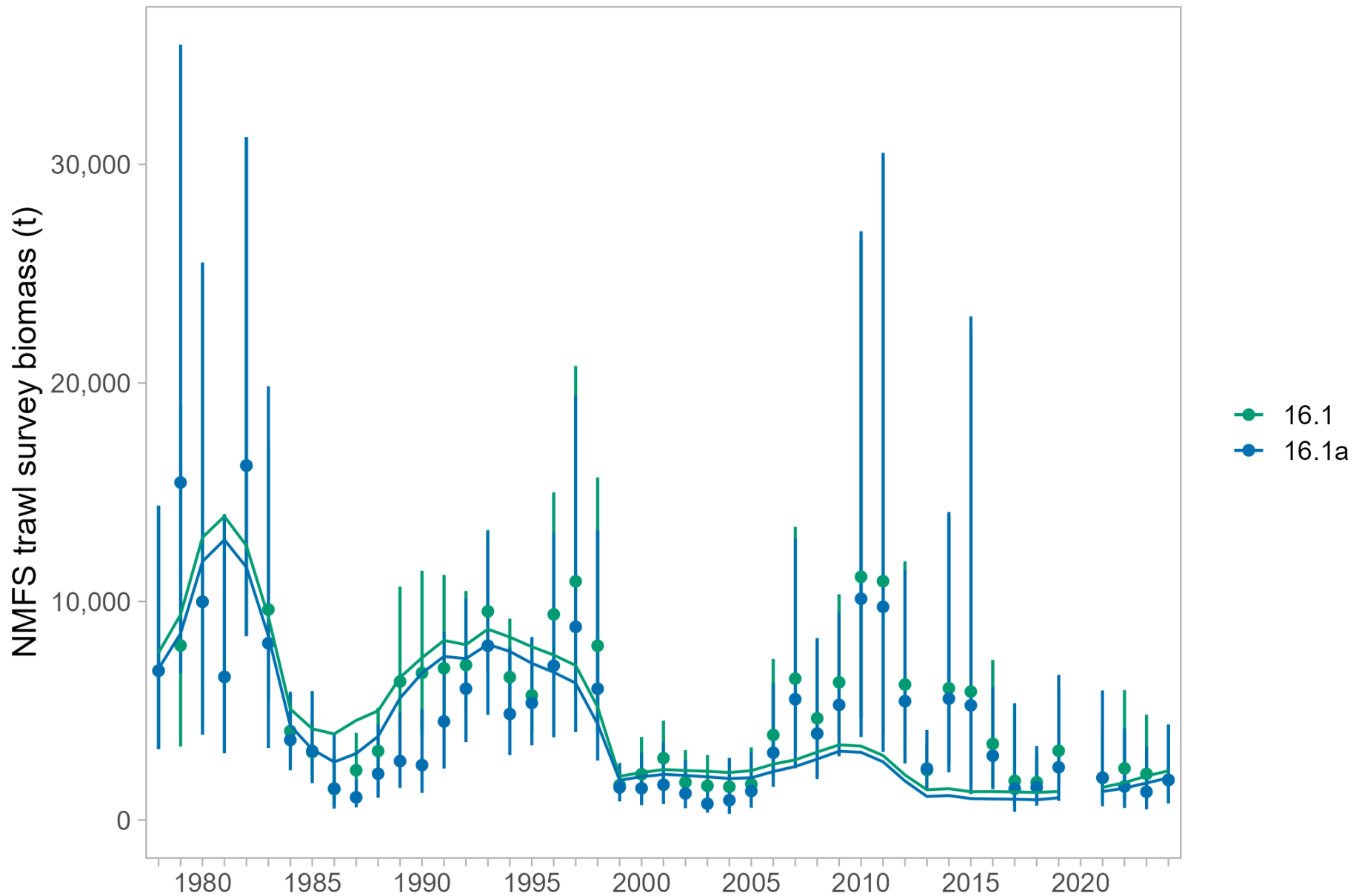
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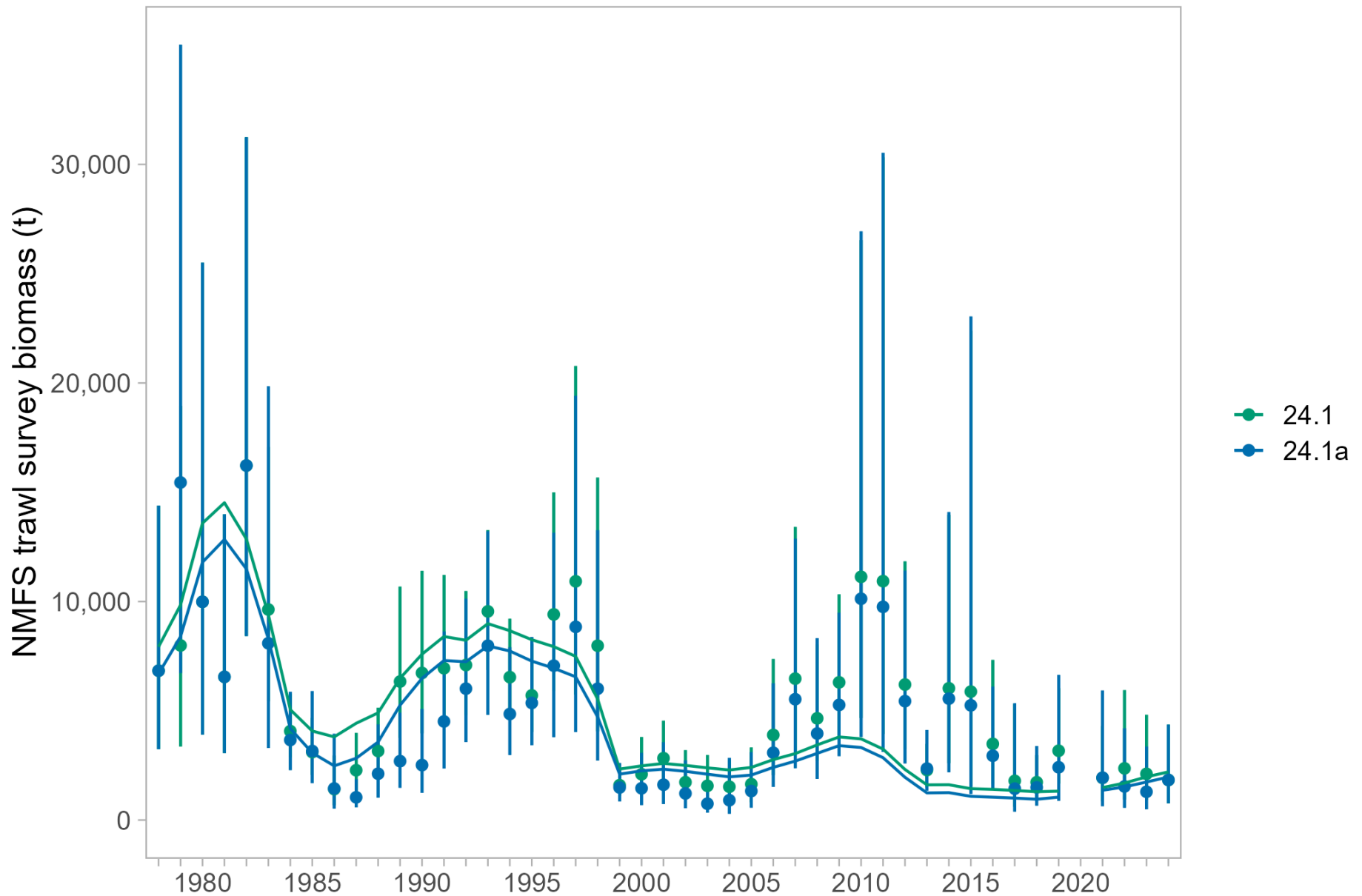
16.1 vs. 24.1 fits to trawl survey data



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24.1 vs. 24.1a fits to trawl survey data



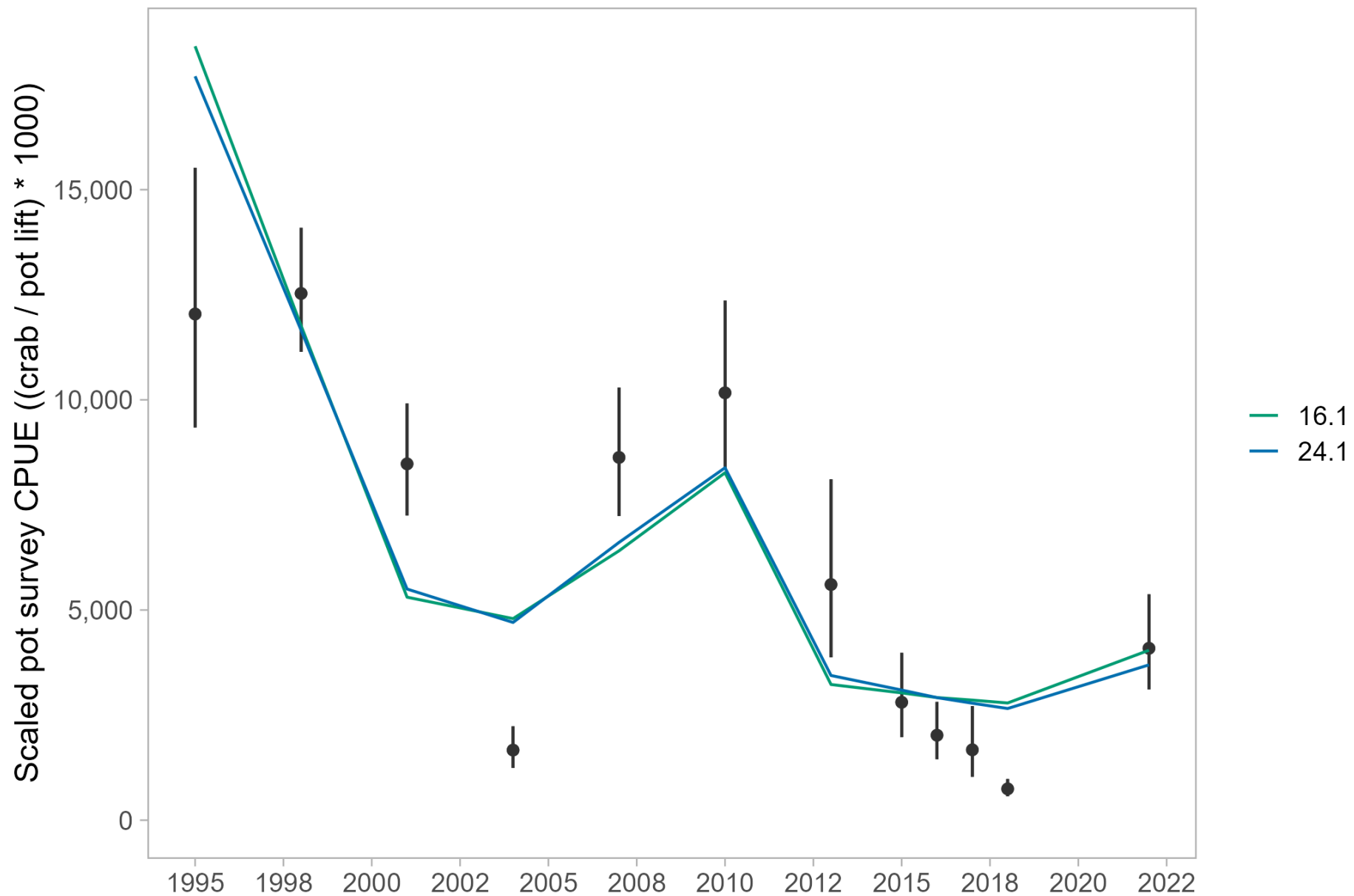
Model comparison: pot survey

- 24.1 ($M = 0.23$) fits pot survey data better than 16.1 ($M = 0.18$)
- 16.1a and 24.1a (no corner stations) show better fits to pot survey

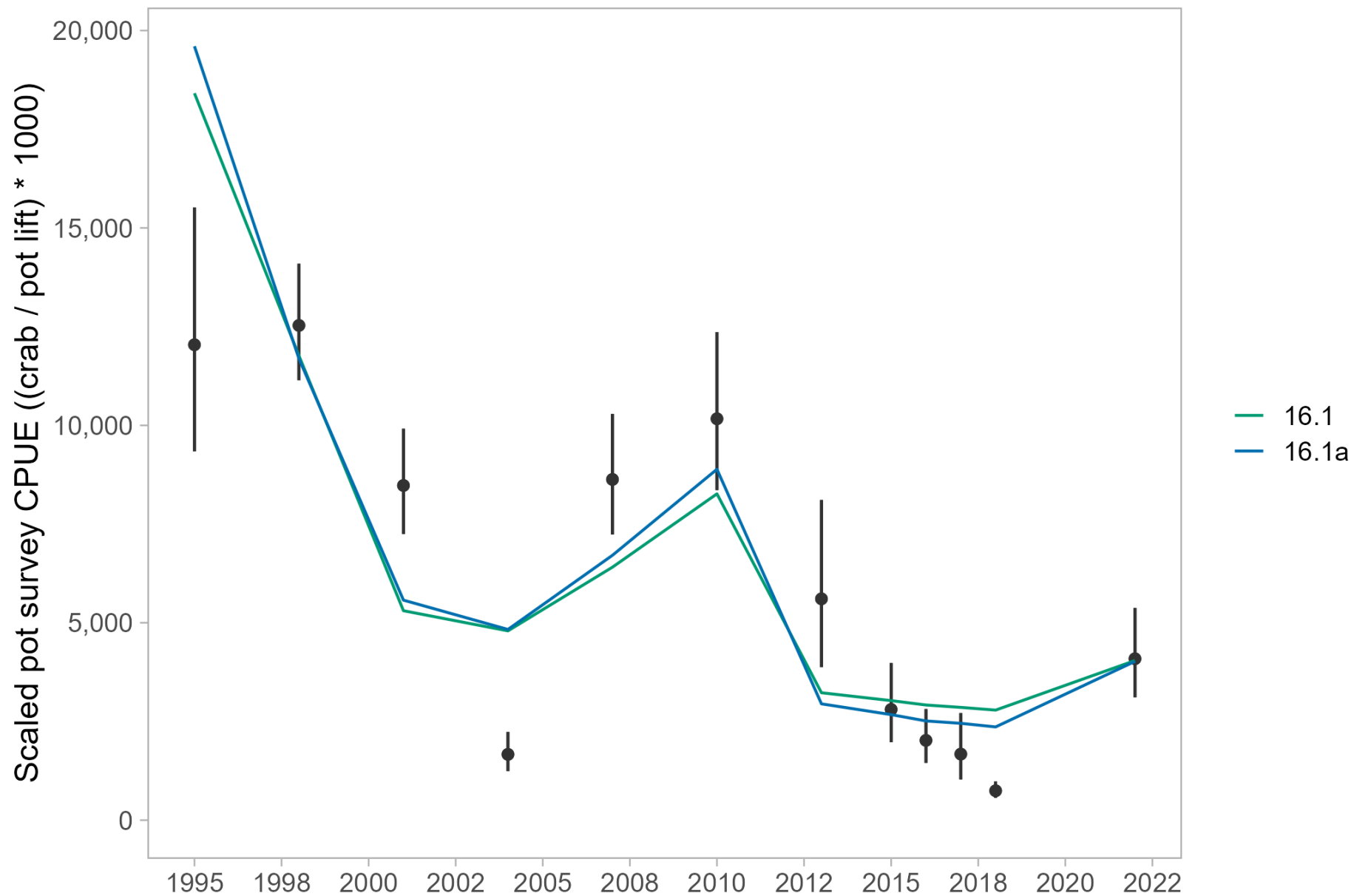
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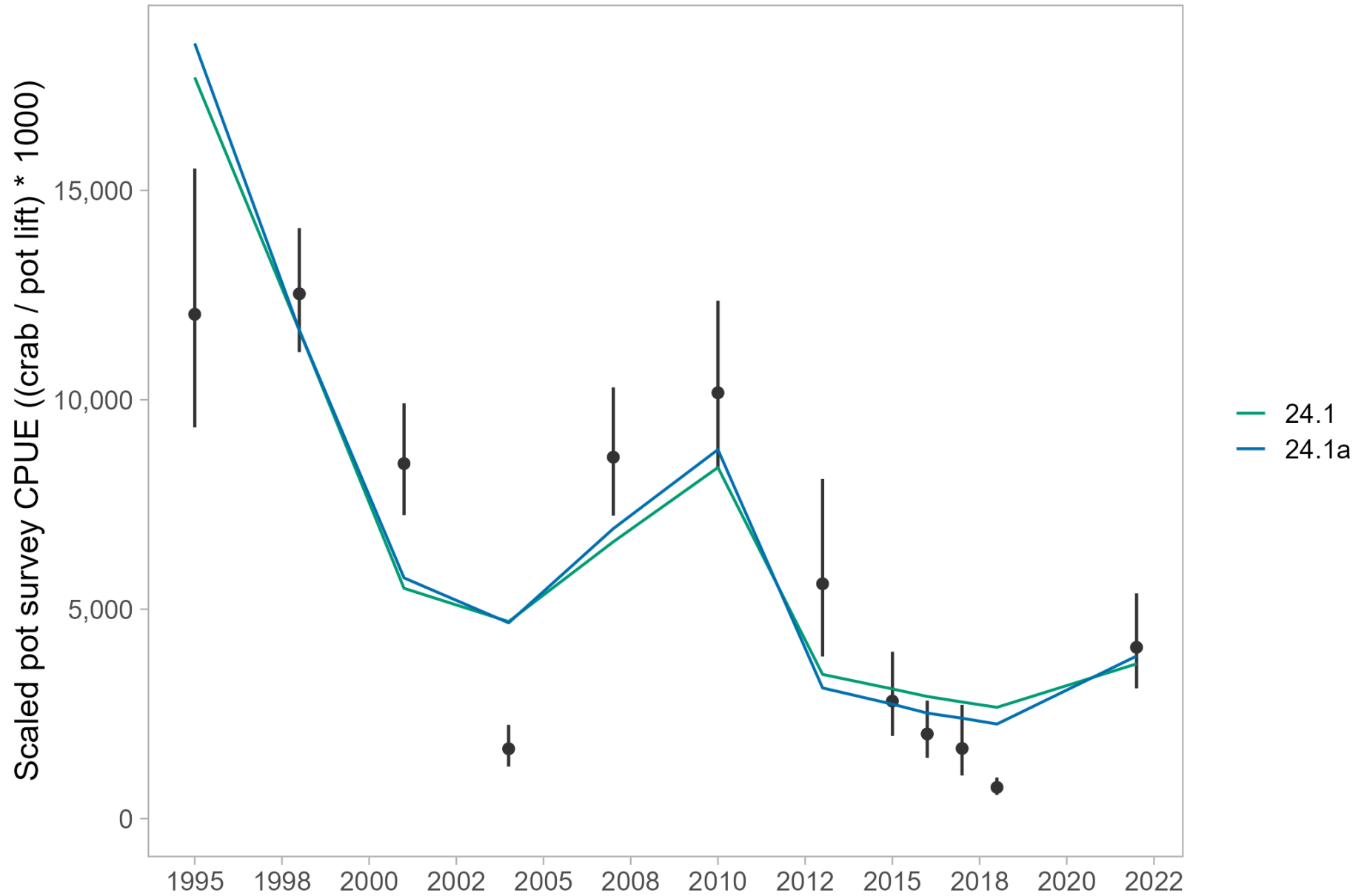
16.1 vs. 24.1 fits to pot survey data



16.1 vs. 16.1a fits to pot survey data



24.1 vs. 24.1a fits to pot survey data



Model comparison: size compositions

- Very similar fits to size compositions for models 16.1 and 24.1
- Poorer fits to trawl survey size compositions for 16.1a and 24.1a
 - fitting different data set

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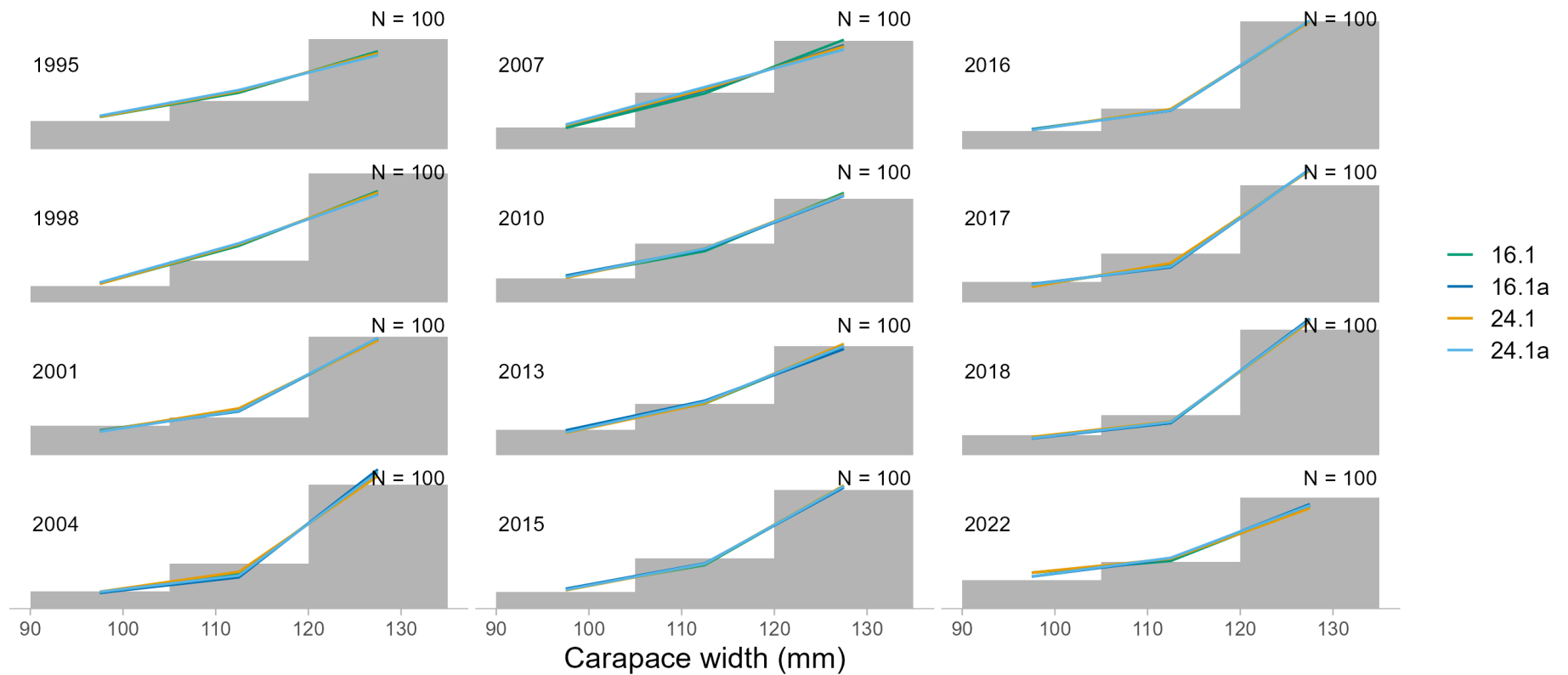
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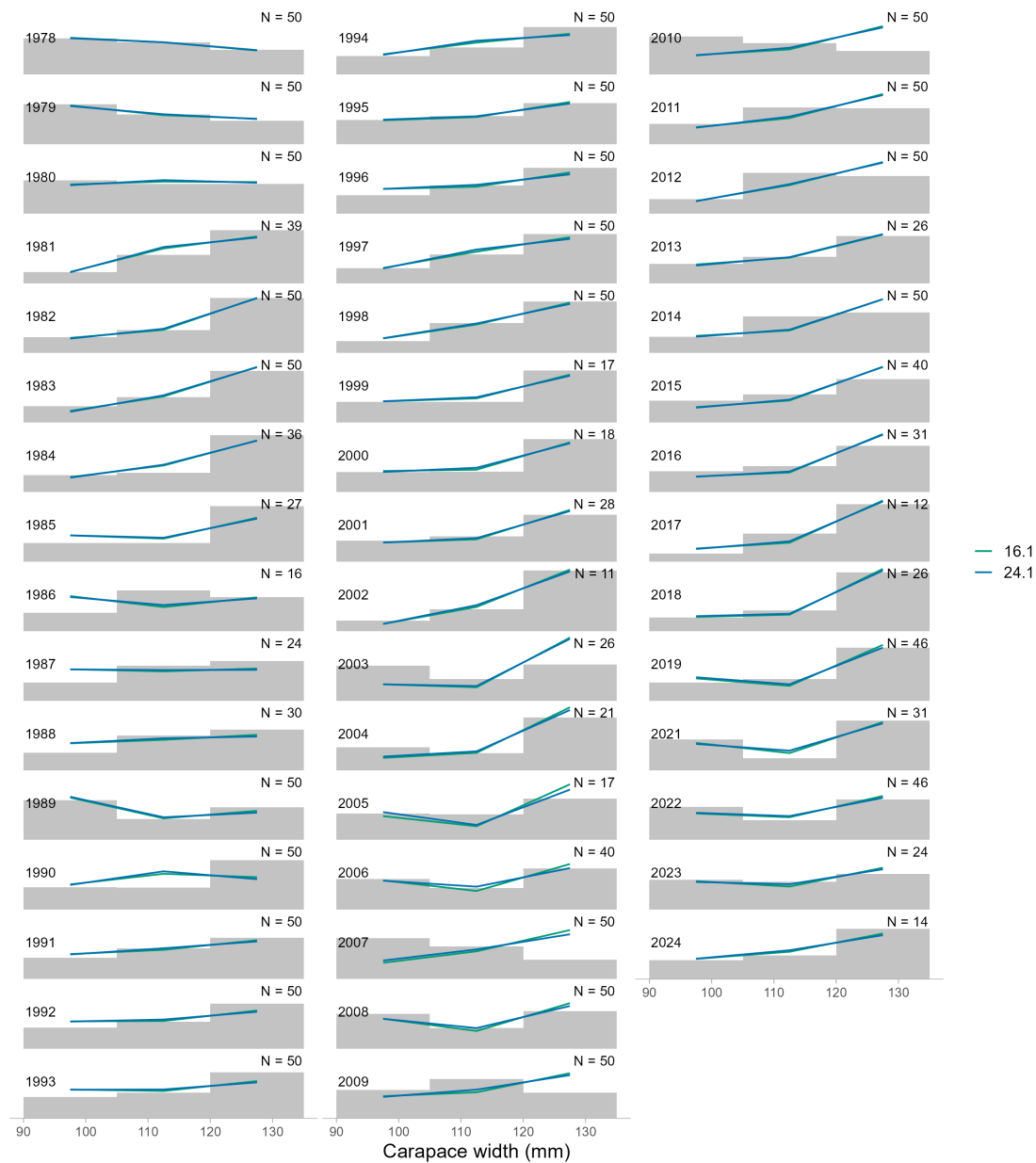
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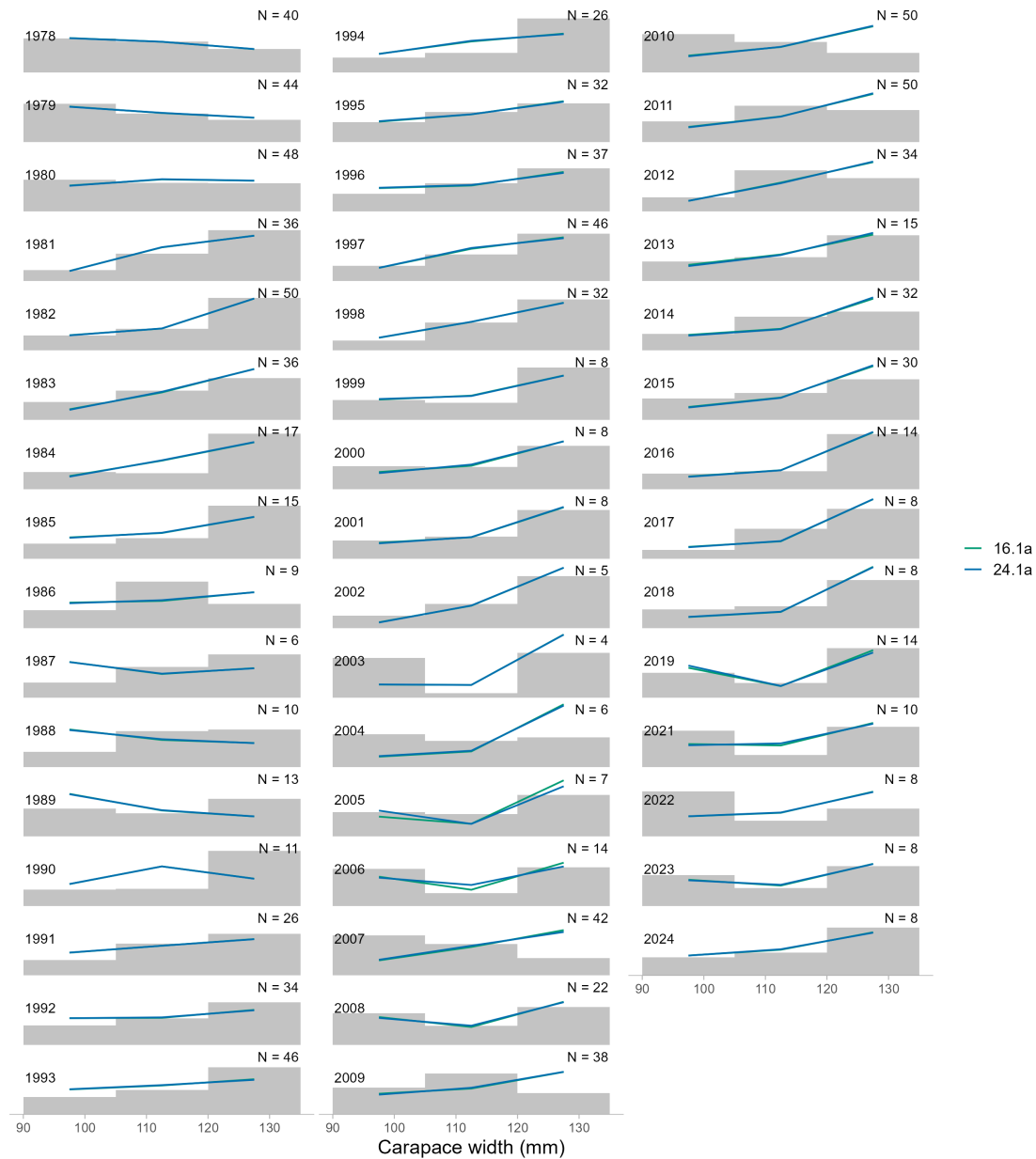
Model fits to pot survey size compositions



16.1 vs. 24.1 fits to trawl size comps



16.1a vs. 24.1a fits to trawl size comps



Model comparison: total NLL

- 24.1 ($M = 0.23$) has lower total negative log likelihood than 16.1 ($M = 0.18$)
- 24.1a ($M = 0.23$) has lower total negative log likelihood than 16.1a ($M = 0.18$)
 - no corner stations

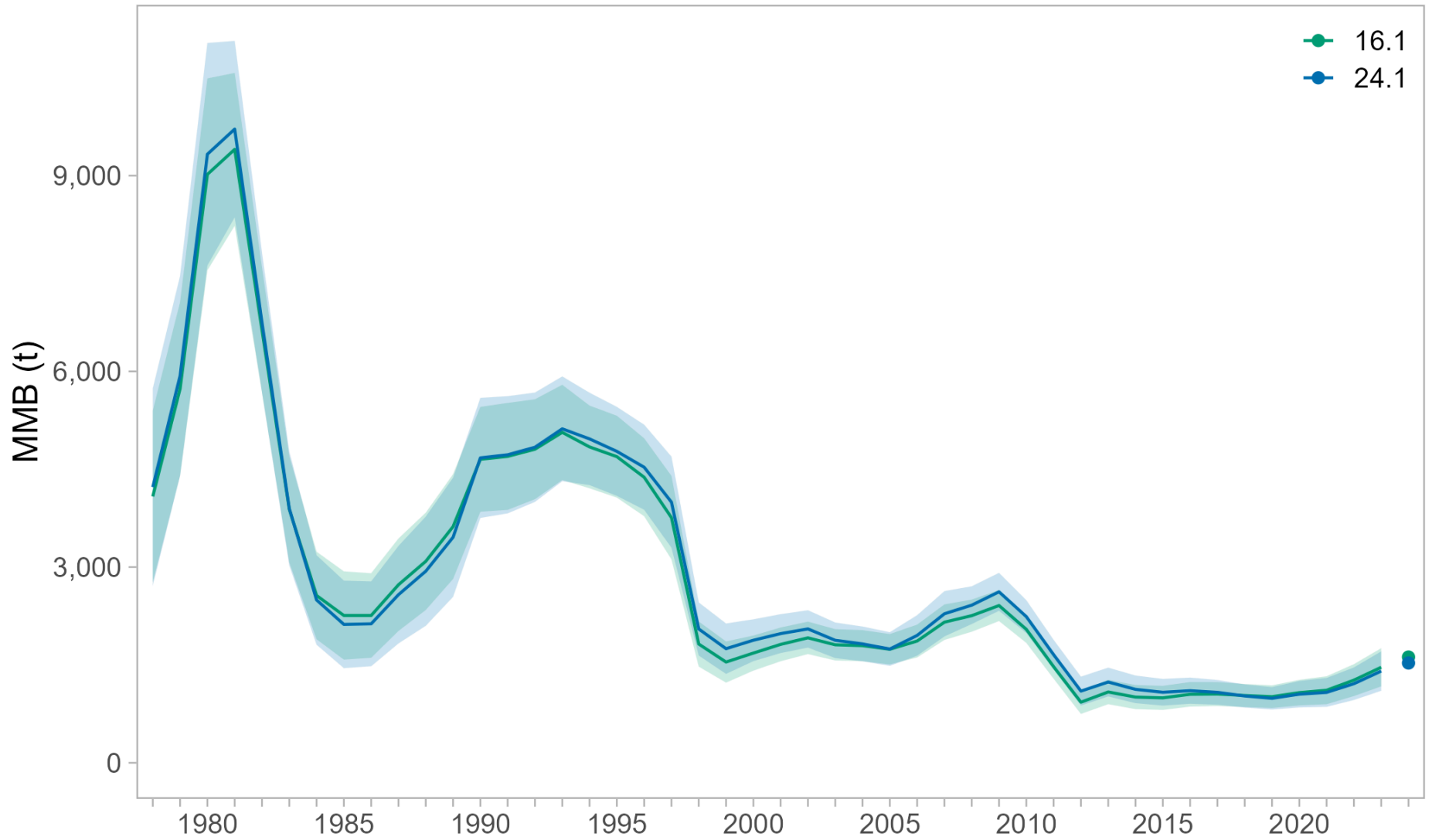
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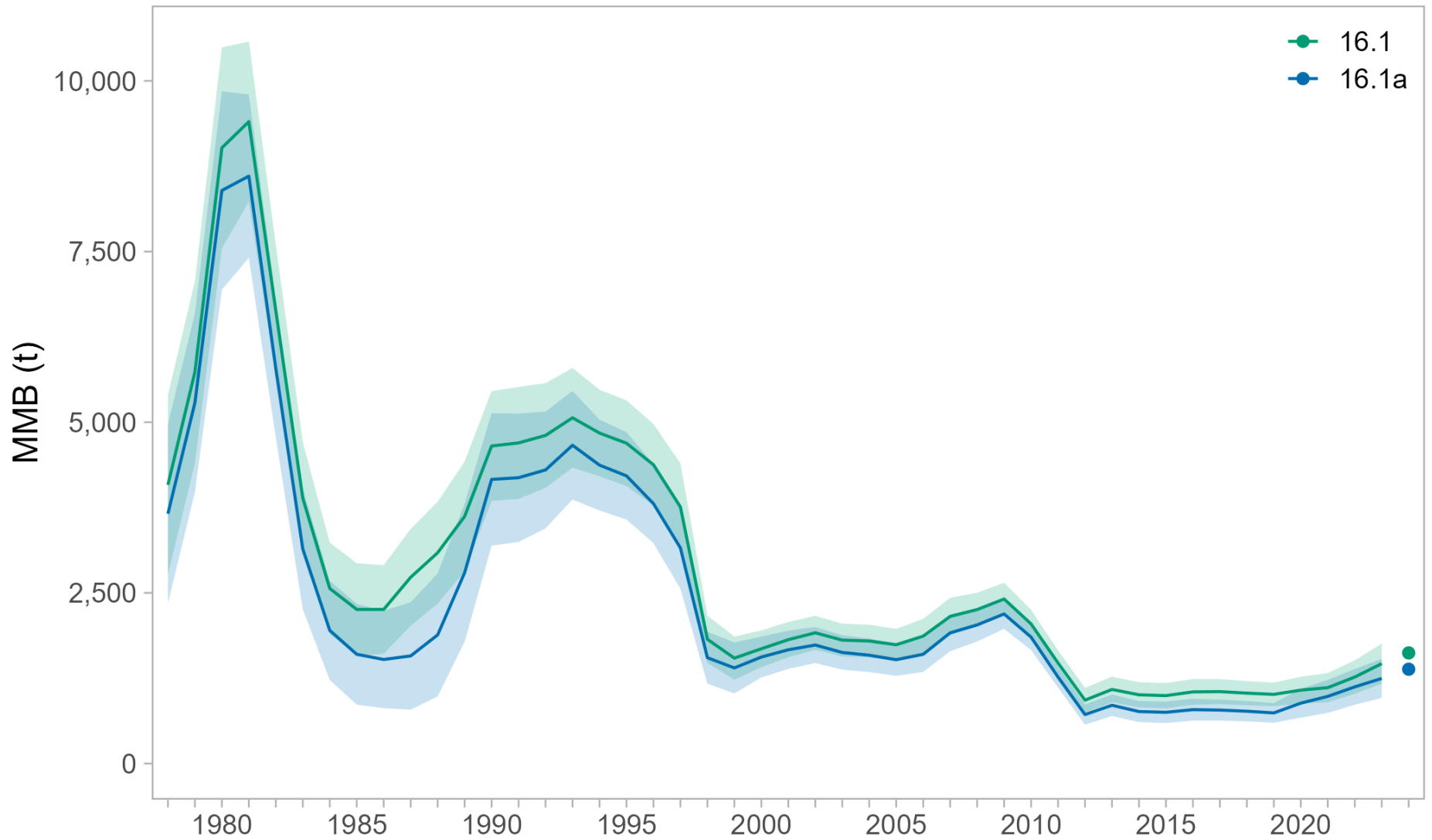
Model comparison: estimated MMB

- MMB trajectory similar for 16.1 and 24.1
 - projected 2024/2025 MMB for 16.1: 1621 t
 - projected 2024/2025 MMB for 24.1: 1530 t
- MMB lower for models without corner stations
 - mean difference in MMB, 16.1 vs. 16.1a: 404 t (SE = 40 t)
 - mean difference in MMB, 24.1 vs. 24.1a: 432 t (SE = 45 t).

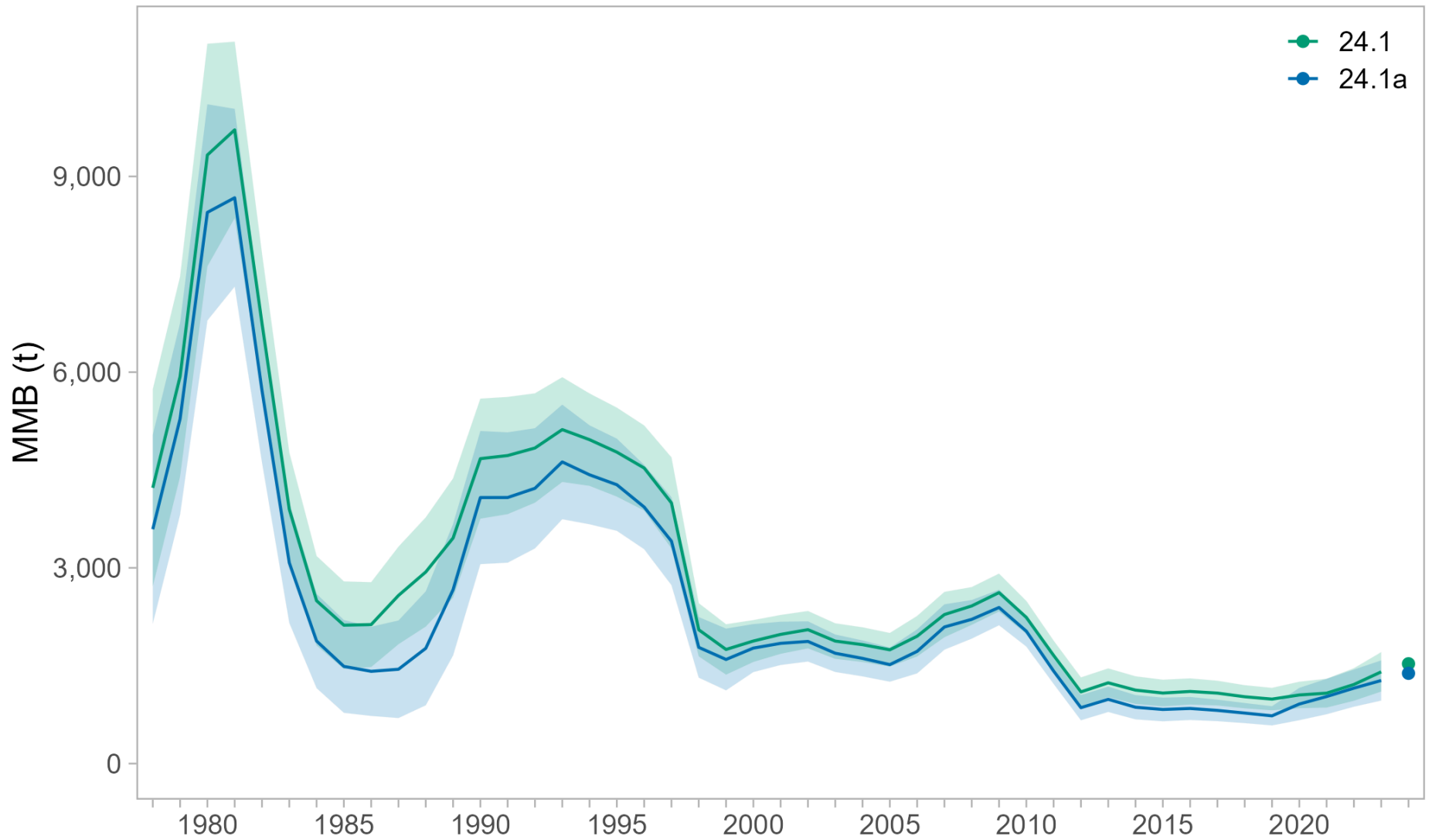
16.1 ($M = 0.18$) vs. 24.1 ($M = 0.23$)



With (16.1) vs. without (16.1a) corner stations



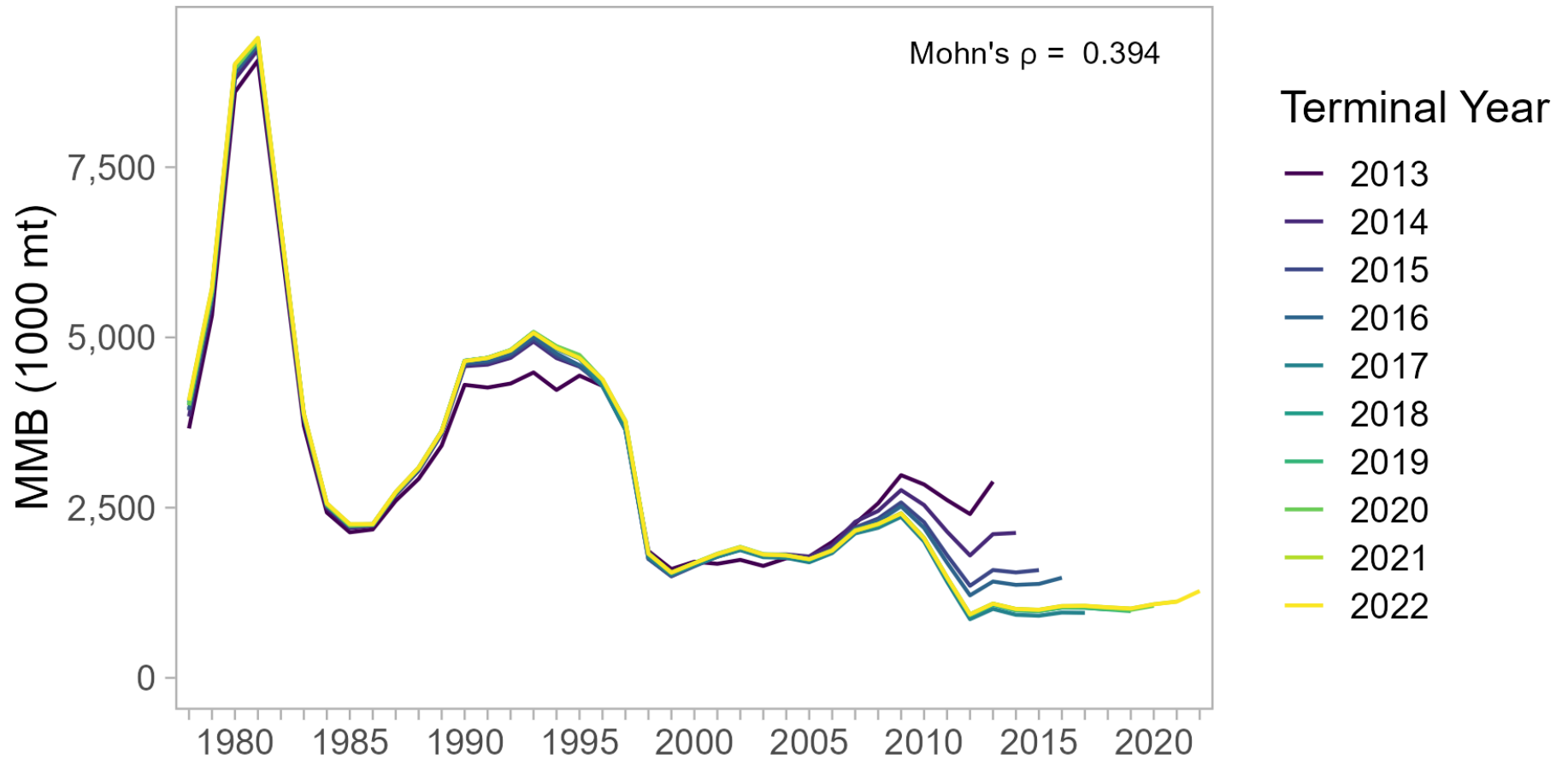
With (24.1) vs. without (24.1a) corner stations



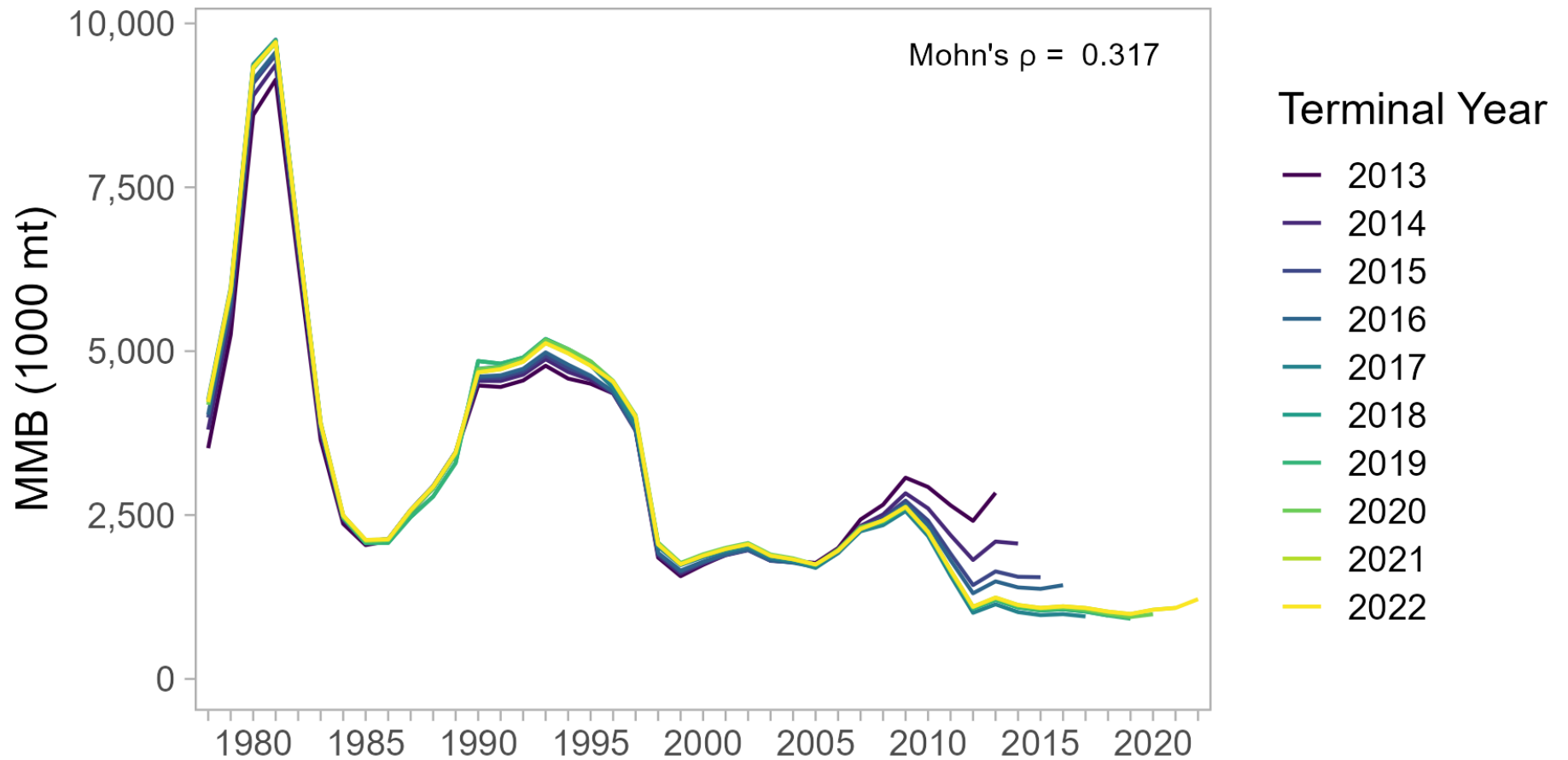
Retrospective analysis

- Both 16.1 and 24.1 show retrospective pattern starting with 2016 peel
- Likely due to high variation in survey results

16.1 retrospective analysis



24.1 retrospective analysis



Rebuilding update

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- Stock status:

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 - 2023/2024 MMB above MSST for 16.1, below for 24.1
 - 2024/2025 MMB above MSST for both 16.1 and 24.1

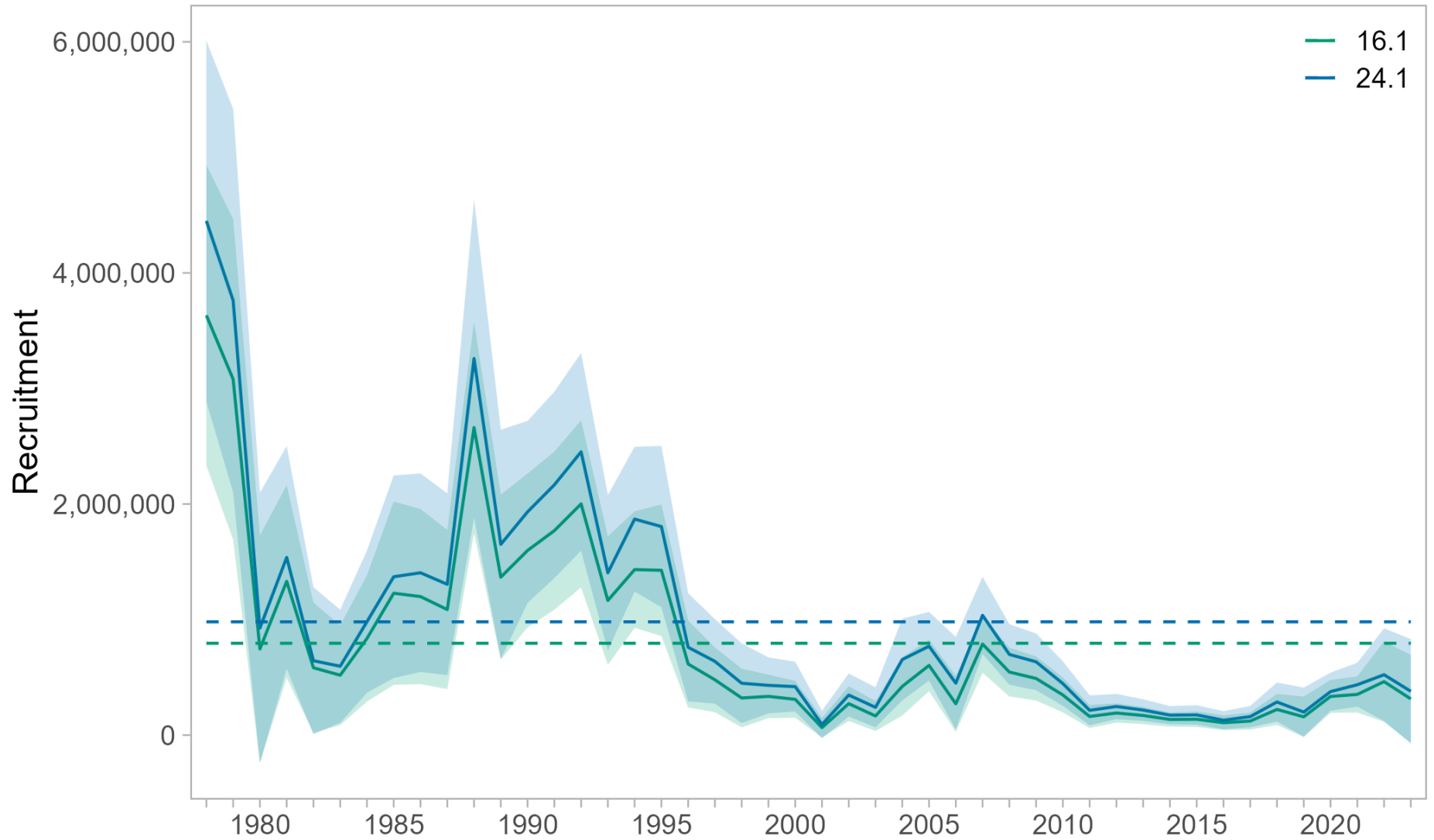
Rebuilding update

- Stock status:
 - 2023/2024 MMB above MSST for 16.1, below for 24.1
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 - when MMB below MSST, stock is considered overfished

Rebuilding update

- Stock status:
 - 2023/2024 MMB above MSST for 16.1, below for 24.1
 - 2024/2025 MMB above MSST for both 16.1 and 24.1
- Recruitment: remains low compared to 1978-2023 mean

Rebuilding update

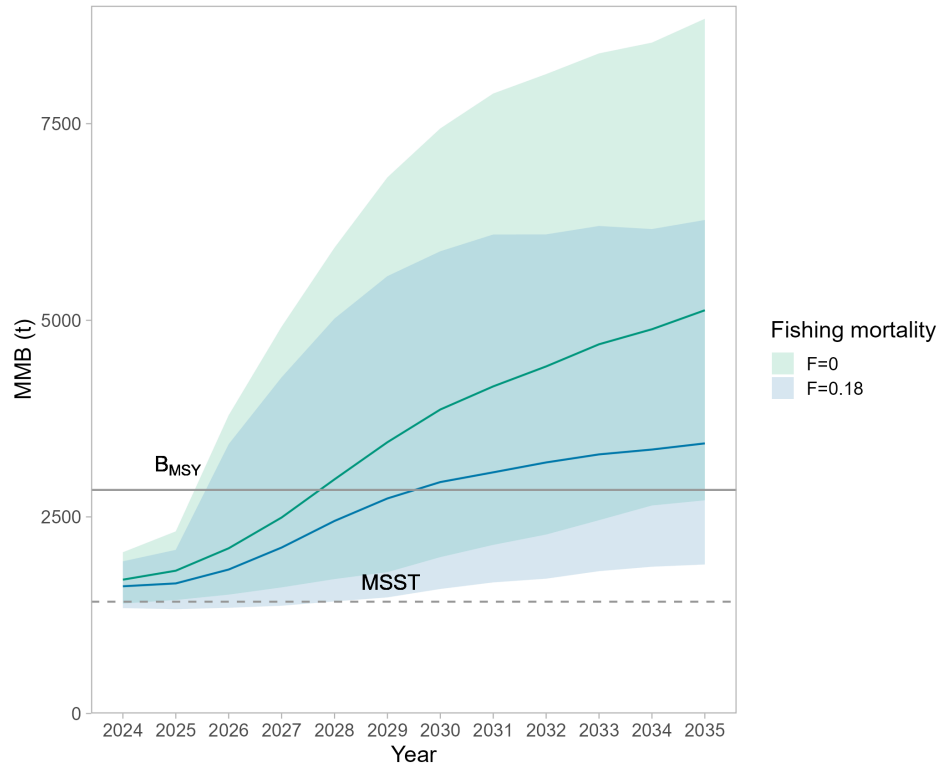


Rebuilding update

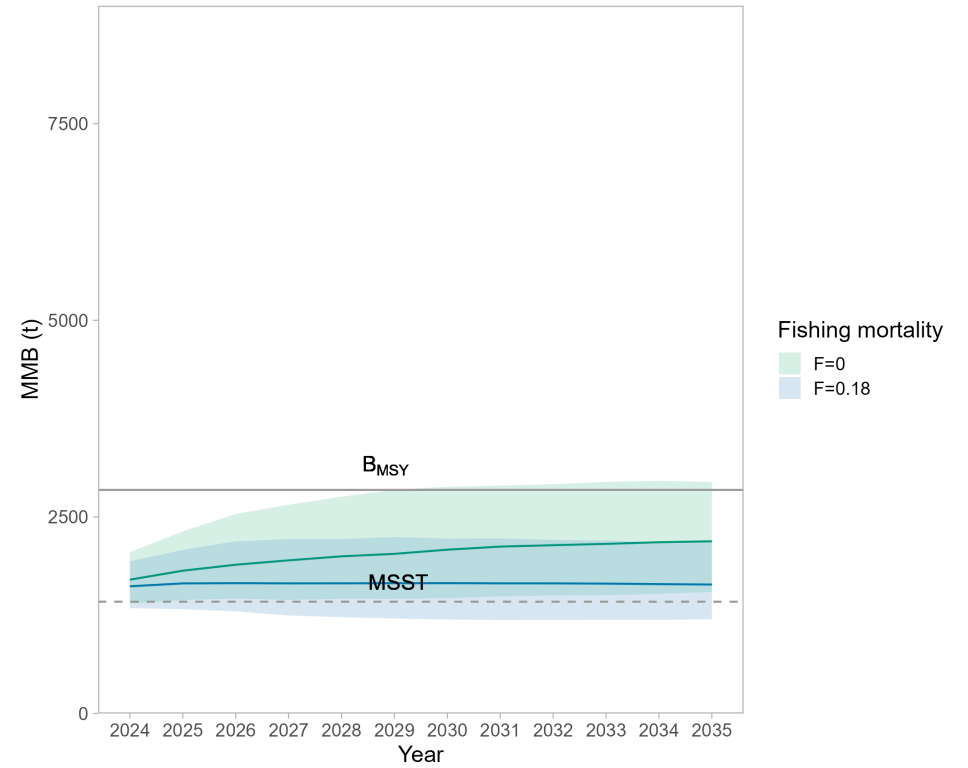
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- Recruitment: remains low compared to 1978-2023 mean
- Projections: dependent on assumptions about recruitment
 - 1978-2023 mean recruitment: recovery to B_{MSY}
 - 1999-2023 mean recruitment: remain below B_{MSY}

Rebuilding update

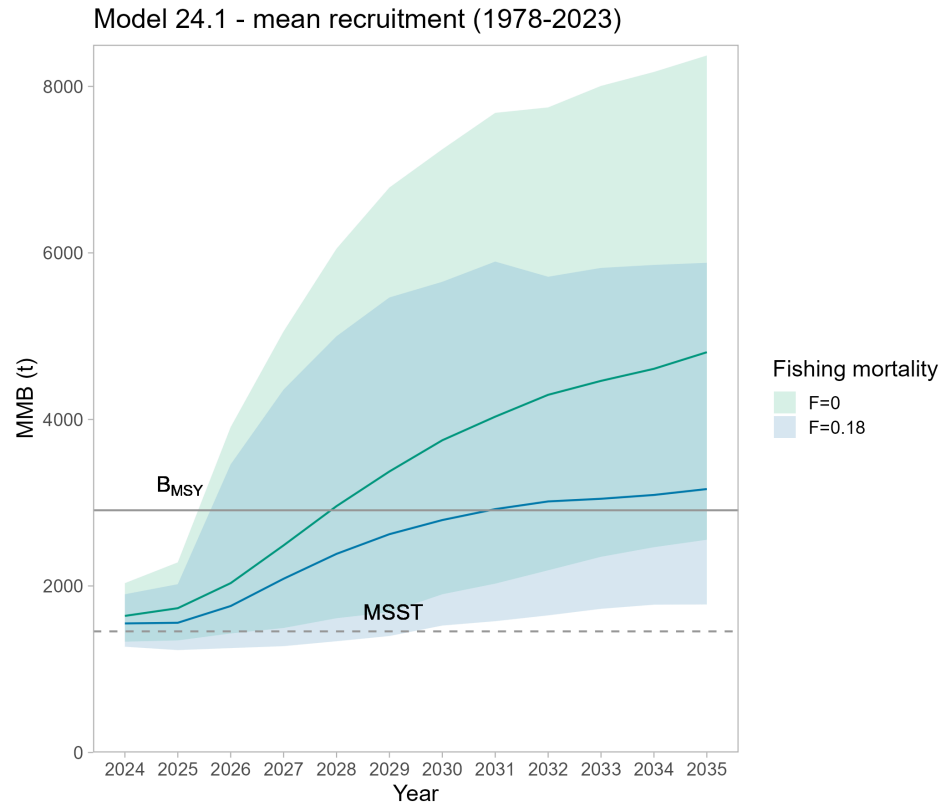
Model 16.1 - mean recruitment (1978-2023)



Model 16.1 - recent recruitment (1999-2023)



Rebuilding update



Summary 1

- Model 24.1 recommended for specifications
 - better fit, M consistent with BBRKC
 - model 16.1 also acceptable
- 25% buffer recommended to set ABC
 - significant retrospective pattern on MMB estimates
 - pot and trawl survey data show contradictory trends
 - corner station removal adds uncertainty to biomass estimates
- Stock appears to be nearing MSST
 - recruitment still low
 - reaching B_{MSY} in near future unlikely

Summary 2

- Standardization of trawl survey data needed
 - developing biomass index using sdmTMB for Jan. 2025
- Increased importance of ADF&G pot survey
 - next survey in fall 2025

Thanks!



Dan Urban